2022-23 Annual Report of the

Mathematical Sciences Research Institute
D.B.A. Simons Laufer Mathematical Sciences Insitute (SLMath)

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Simons Laufer Mathematical Sciences Institute
Annual Report, 2022-2023

1. Overview of Activities

This annual report covers SLMath's (formerly MSRI's) projects and activities supported by the NSF core grant, DMS-1928930, during the period **June 1, 2022 to May 31, 2023**. We refer the Institute as SLMath throughout this narrative report; however, some documentation still includes the MSRI moniker. SLMath and MSRI both refer to the same entity.

1.1   New Developments

This year MSRI/SLMath marked its 40th anniversary. To celebrate this landmark event, we organized an extraordinary workshop that highlighted the Institute's impact on several areas of mathematics and previewed what is to come. The speakers, Ian Agol, David Eisenbud, Wilfrid Gangbo, Alice Guionnet, Dusa McDuff, Curtis McMullen, Andrei Okounkov, and Terrence Tao, gave exceptional talks, the details and videos of which may be found on msri.org. Tao's talk on Machine Assisted Proofs drew hundreds of listeners both in person and virtually. We should note that the majority of the in-person participants were undergraduate students from UC Berkeley. It was inspiring to see so many young mathematicians deeply interested in the future of mathematics.

The renaming of the Institute to the Simons Laufer Mathematical Sciences Institute (SLMath) has been made official and we now operate under the new name. Director Tatiana Toro took the helm of SLMath in August 2022 and has been busy formalizing the future direction of the Institute. SLMath's endowment campaign has continued unabated during Toro's first year and we are close to reaching the $100 million goal. The vast majority of the gifts are unrestricted, meaning they enhance our existing programs and contribute to the financial stability of the Institute. The pledges will be fulfilled over a period of seven years and the disbursements for each period will be based on the average value of the endowment fund over the previous eight fiscal quarters' ending values. Disbursements are expected to be approximately 1.00% per quarter.

These exciting developments leave SLMath well poised to continue successfully executing its mission of elevating, amplifying and celebrating the mathematical sciences for more than 40 years.

Despite the continued challenges of the COVID-19 pandemic, 2022–23 proved to be a productive academic year. In fall 2022, SLMath hosted the concurrent programs: *Analytic and Geometric Aspects of Gauge Theory* with lead organizer Thomas Walpuski (Humboldt-Universität) and *Floer Homotopy Theory* with lead organizer Ciprian Manolescu (Stanford University). In spring 2023, the two concurrent programs were: *Diophantine Geometry* with lead organizer Hector Pasten (Pontificia Universidad Católica de Chile), and *Algebraic Cycles, L-Values, and Euler Systems* with lead organizer Benjamin Howard (Boston College). Programs took place primarily in person, with ample precautions to protect the health of the SLMath community. During fall 2022, members in residence and staff were masked at all times, weekly COVID self-testing was required of members and staff, and there was no indoor eating except in private offices. Daily teas were served outdoors on the Strauch Lookout, where rolling blackboards were made available. Embraced by the members, this new indoor-outdoor setup has continued beyond the end of the COVID-19 pandemic.

Most of the fall COVID restrictions were lifted during spring 2023. All programs operated on a hybrid model: talks from seminars, colloquia, and workshops were available for synchronous participation by online and in person attendees, and shortly thereafter as part of SLMath's online video repository (pending permission from speakers). This improvement has been well-received by researchers, whether they attend programs in person or remotely. Members who visit the Institute for less than the duration of a semester-long program are now able to participate in activities before and after their time in Berkeley, allowing for a more sustained research experience. Additionally, members who feel unwell or test positive for COVID-19 during their visits are now able to follow lectures while quarantining in their homes. Lastly, researchers who cannot participate in SLMath's programs due to space limitations are now able to participate remotely, allowing for broader outreach into the mathematical community. This hybrid model, supported by the hiring of additional IT staff, has undoubtedly enriched SLMath's scientific offerings and will remain a part of the Institute's regular operations.

All programs in 2022-23 had stellar researchers, including four Clay Senior Scholars: Tomasz Mrowka from the *Analytic and Geometric Aspects of Gauge Theory* program, Ivan Smith from the *Floer Homotopy Theory* program, Mark Kisin of the *Diophantine Geometry* program, and Henri Darmon of the *Algebraic Cycles, L-Values, and Euler Systems* program.

Professor Mrowka is a graduate of the University of California, Berkeley, having earned his Ph.D. in Mathematics in 1988. Following professorships at Stanford University, the California Institute of Technology, and a Clay Visiting Professorship at Harvard University, Mrowka joined the faculty of MIT in 1995. During his 26-year tenure, Mrowka has chaired the Pure Mathematics Committee, received two named professorships (Simons and Singer), and served as Head of Department. Among Mrowka's numerous honors have been the Oswald Veblen Prize of the American Mathematical Society (AMS) in 2007, a Guggenheim Fellowship in 2010, and the Joseph L. Doob Prize of the AMS in 2011. He is a fellow of both the American Academy of Arts & Sciences and the National Academy of Sciences. In 2018, he gave a plenary address at International Congress of Mathematicians (ICM) in Rio de Janeiro.

Professor Smith earned his D. Phil. in Pure Mathematics in 1999 from the University of Oxford under the supervision of Sir S. K. Donaldson. After two terms as Visiting Research Scholar at Stanford University, he acted as G.H. Hardy Junior Research Fellow at New College, University of Oxford, followed by a Marie-Curie Postdoctoral Fellowship at the École Polytechnique, Paris. He began his tenure at the University of Cambridge in 2003 as College Lecturer, was appointed Professor of Geometry in 2012, and since 2020 has served as Deputy Head of Department. Among his numerous honors are the 2007 Whitehead Prize of the London Mathematical Society (LMS) "for the breadth of techniques employed, often blending ideas from algebraic geometry and topology in novel ways" and the 2013 Adams Prize of the University of Cambridge, one of the University's oldest and most prestigious awards. Smith was an invited speaker in the Topology section of the International Congress of Mathematicians (ICM) in Rio de Janeiro in 2018. He has served as a member of the LMS Prizes Committee, the Royal Society International Exchanges Panel, and in 2022 will be a Core Member of the ICM Sectional Committee in Topology (St. Petersburg).

Professor Kisin is a graduate of Princeton University, having earned his Ph.D. in 1998. After completion of his studies, he was an Australian Research Council Postdoctoral Fellow followed by another research fellowship at the Sonderforschungsbereich (Collaborative Research Center) of Westfälische Wilhelms-Universität Münster. In 2003, he joined the University of Chicago as an assistant professor, becoming a ranked professor in 2005. In 2009, he joined the faculty of the Department of Mathematics at Harvard University and has been its Director of Graduate Studies for several years. In 2008, Kisin was elected to the English Royal Society of Fellows and, in 2012, as a Fellow of the American Mathematical Society. Kisin is a world-renowned expert in Diophantine Geometry. To quote Professor Frank Calegari, "Mark belongs in the absolutely top rank mathematicians. Mark has made fundamental contributions to a number of important problems in number theory. More importantly, he has done this by introducing completely new ideas which have required both technical mastery and deep insight."

Professor Darmon earned his Ph.D. in Mathematics from Harvard University in 1991. He thereafter served as Instructor and Assistant Professor at Princeton University before joining the faculty of McGill University in 1994. In 2018, Darmon was accorded the Distinguished James McGill Professorship in recognition of his "sustained scholarship of world-class caliber and international leadership," one of 38 awardees since the establishment of the award. Throughout his extraordinary career, he has held more than 20 visiting professorships, including at the IHÉS, Institut Henri Poincaré, ETH, RIMS, and the Chinese Academy of Sciences, Beijing. Darmon has a prolific record of publications. As Professor Benedict Gross observes "Darmon has been one of the international leaders in number theory for the past twenty-five years." Gross continues, "He has proposed a fantastic conjecture on the analog of Heegner points on elliptic curves over real quadratic fields, and provided considerable evidence. His work on p-adic Lfunctions and p-adic versions of the conjectures of Birch and Swinnerton-Dyer and of Stark have motivated an entire field."

Professor Jason Lotay was the UC Berkeley Chancellor's Professor. This honor is bestowed on one member of the programs held at the Institute on any given year. The Institute provides nominations to the Department of Mathematics who then chooses one mathematician to teach a graduate course "down the hill" at UC Berkeley. Jason Lotay, Professor of Pure Mathematics and Tutorial Fellow at Balliol College, University of Oxford, an expert in differential geometry and geometric analysis as well as one of the leading figures in the study of special holonomy spaces, was the top candidate. He is regarded as one of the most active researchers in this field, has a large number of collaborators, and continuously seeks out new avenues to explore. Lotay was awarded a Leverhulme Trust Research Project Grant, a Royal Society International Exchanges grant as PI, and a Newton Mobility grant to name a few of his numerous awards. His recent research agenda touches upon many questions in gauge theory which were closely aligned with the fall 2022 program. Lotay's mentoring record was equally outstanding. He was (co-)supervising 9 PhD students and 3 post-docs and had already graduated 7 PhD students. He himself started his career as a mentee of Robert Bryant's at SLMath. Finally, Lotay is well-known for his outreach activities. He has given numerous very successful public talks giving a general audience a glimpse of recent work in differenntial geometry.

Other luminaries, including organizers listed in the program reports, were Andrew Blumberg (Columbia University), Anna Cadoret (IMJ-PRG, Sorbonne Université), Pierre Colmez (CNRS), Daniel Freed (University of Texas at Austin), Jennifer Hom (Georgia Tech), David Loeffler (University of Warwick), Michael Mandell (Indiana University), Ciprian Manolescu (Stanford University), Wieslawa Niziol (CNRS/Sorbonne University), Michael Rapoport (Mathematisches Institut Universitaet Bonn), Christopher Skinner (Princeton University), Emmanuel Ullmo (IHES), Thomas Walpuski (Humboldt-Universität), and Sarah Zerbes (ETH Zurich).

In all, SLMath awarded distinguished Chern, Eisenbud, Della Pietra, and Simons Professorships to 15 researchers.

A description of the research areas investigated during the 2022-23 academic year programs, together with a summary of the salient discoveries, can be found in the Appendix as part of the program organizers' reports. Below is a small sample that gives a glimpse into the lively research activities that took place throughout the year.

Analytic and Geometric Aspects of Gauge Theory. The evolution of gauge theory presents a compelling story about the many ways in which mathematics and physics are intertwined and influence one another. In the last century, the insights and problems suggested by physicists have provided crucial direction and motivation for mathematical developments, and the interchange between these fields continues to strengthen. The program was organized to capitalize on new ideas, to help expedite their development, and to chart out new directions for future work. In particular, careful attention was paid to ensure that the early-career participants had a welcoming entrée to the field and gained tools to understand the most compelling open problems in gauge theory.

One exciting breakthrough involved advances in the study of diffeomorphism groups of 4-manifolds and spaces of embeddings of surfaces and 3-manifolds. During the program, Daniel Ruberman and Dave Auckly finished a major paper applying Yang-Mills gauge theory to questions about diffeomorphism groups of 4-manifolds and spaces of embeddings of surfaces and 3-manifolds, capping 25 years of work (started at a conference at SLMath in 1998). Prof. Ruberman and Prof. Auckly also worked out a key step in a subsequent paper, applying Seiberg-Witten theory to related problems, which has led to further stronger results, for example showing infinite generation of various homology and homotopy groups of such spaces, and also showing infinite generation of homotopy and homology groups of spaces of metrics of positive scalar curvature. They also formed a new collaboration with postdocs Hokuto Konno, Anubhav Mukherjee, and Masaki Taniguchi, and have some preliminary results relating family Seiberg-Witten invariants to diffeomorphism groups and embedding spaces.

Floer Homotopy Theory. The aim of this program was to accelerate the cross-pollination of modern homotopy theory and Floer homology, broadly construed. There are outstanding problems in symplectic topology and the geometry of low-dimensional manifolds that require Floer homotopy theory, and new directions in homotopy theory that are motivated by new classes of examples provided by Floer homology. The point of departure for Floer homotopy theory is to answer the following question: Can the various Floer homology theories be interpreted as the homology of some space, or more generally the invariants of the stable homotopy type of some

space? Several of the postdoctoral members reported breakthroughs in their research during the program. In particular, postdoctoral member Shaoyun Bai, with Guangbo Xu, finished a proof of the Arnol'd conjecture over the integers, one of the most famous conjectures in symplectic topology. Moreover, the technical details developed there are likely to provide the necessary tools to construct a Floer homotopy type with complex cobordism coefficients for any compact symplectic manifolds. Bai and organizer Mohammed Abouzaid have made progress towards realizing that proposal during the semester.

Another example is postdoc Semon Rezchikov, who, in consultation with organizer Andrew Blumberg, gave a new construction of equivariant Morse theory, adapted to studying Floer theory and structures on the loop space. New ideas developed this semester allowed him to sidestep technical issues that have stymied the project for more than three years. He expects this will also relate to conjectures about cyclotomic structures in symplectic topology also proposed several years ago. In another direction, Rezchikov is writing a paper giving a simplified construction of Floer homotopy types which will allow more researchers to access and extend these tools.

Algebraic Cycles, L-Values, and Euler Systems. This program revolved around two intertwined and fast developing areas. The *L*-functions and Selmer groups, and special cycles on Shimura varieties. The organizers of this program stressed two important activities that were essential to the development of this field during spring 2023. The lecture series by Sarah Zerbes outlined the far reaching development of the Euler systems program that she and her collaborators have been engaged in over the last decade. Never before had these subjects been presented with such thoroughness in a lecture series.

The second activity was the unveiling of the new approach to Euler system constructions laid out by Chris Skinner and Marco Sangiovanni-Vincentelli in their lecture series. Their novel approach is to construct Euler systems by fusing together special cycles on Shimura varieties and Eisenstein cohomology classes, an idea with many potential generalizations.

The organizers anticipate that both of these lecture series will have a long-lasting impact on their community.

Diophantine Geometry. The subject of Diophantine Geometry spans a vast array of topics at the interface of number theory and algebraic geometry. This program facilitated the interaction among experts in different subjects within the field and led to many research developments. Researchers made progress on rational points on varieties, Vojta's conjecture, unlikely intersections, arithmetic of abelian varieties, Shimura varieties and local systems, Arakelov theory, and arithmetic dynamics.

The organizers list several areas where substantial progress was made during the semester. Here is an example of a deep and exciting result: Anna Cadoret and Jakob Stix proved a substantial theorem on the sparsity of toric loci for l-adic local systems arising from geometry. The distribution of CM points on Shimura varieties has been studied by many people (including many participants of the program) with fruitful outcomes such as the proof of the André–Oort conjecture. The toric locus is the analogue of the CM locus for geometric local systems. Cadoret and Stix studied rational and integer points (and more generally points of bounded degree) in the toric locus and

proved that (under mild conditions) these points are not Zariski dense for a positive density set of l.

Their work is very important as it provided a first understanding of the toric loci beyond the previously known cases for subvarieties of Shimura varieties. For the Shimura variety of Hodge type with the local system coming from the universal family of abelian varieties, their result follows from an argument using the Pila–Zannier strategy, which was the key framework of the proof of the André–Oort conjecture. In the work of Cadoret and Stix, they brought the Lawrence–Venkatesh method into the picture. The work of Lawrence–Venkatesh provided a new proof of Faltings's theorem (on the finiteness of rational points). It was thrilling for participants of the program to see a new result with deep links to both the Pila–Zannier method and the Lawrence–Venkatesh method.

Talks of every scientific activity are recorded and may be viewed on the Institute's website: msri.org/web/msri/online-videos. Reports for each of the workshops can be found in the Appendix.

Aside from the semester-long programs described above, and their associated workshops, SLMath hosted several additional short-term activities during the summer 2022.

2022 Summer Graduate Schools. Graduate students are the future leaders of mathematics, and providing opportunities for international networking and collaboration early in their careers is critical to the vitality of the profession. In summer 2022, SLMath organized a record thirteen (13) summer schools for which we received an unprecedented 680 graduate student nominations; 70% (480) were invited and nearly 60% (393) were able to participate. Eight (8) of the summer schools were joint national and international partnerships, while the other five (5) were held at SLMath or locally in the Berkeley area.

Due to the high volume of activities at SLMath, we established a partnership with the School of Science at Saint Mary's College of California to host three of the five Bay Area summer graduate schools. The bucolic setting of Saint Mary's campus (10 miles away from SLMath) enabled tightly knit collaborations between lecturers, TAs, and students, and made their experiences especially successful. This successful partnership was repeated in summer 2023, and will continue for the foreseeable future.

Eight joint schools took place in collaboration with the Australian Mathematical Sciences Institute (AMSI); the Banff International Research Station-Okanagan (BIRS, Canada); the Institute of Applied and Computational Mathematics (IACM-FORTH, Greece); Istituto Nazionale di Alta Matematica (INdAM, Italy); the National Center for Theoretical Sciences (NCTS, Taiwan); the University of Oxford (UK); the Park City Mathematics Institute (PCMI, Utah); and Séminaire de Mathématiques Supérieures (SMS, Canada).

The BIRS-Okanagan and University of Oxford schools took place in person and were extraordinarily productive; students rejoiced at the opportunity to collaborate in 3-D! We are grateful to both BIRS and Oxford for their financial and logistical contributions to the success of these schools. The Oxford school in particular featured many exceptional mathematicians, among them Mikhael Gromov who was in residence for the 2 weeks and who is reported as having greatly

enjoyed the experience. SLMath's longstanding partnerships with PCMI and SMS were their usual successes.

The newly developed collaboration with IACM-FORTH, funded by the Stavros Niarchos Foundation and SLMath, was also an astounding success. This collaboration is expected to continue in the future, we hope in continued partnership with the Stavros Niarchos Foundation.

During summer 2022, COVID-19-related travel restrictions prevented the schools with AMSI, INdAM, and NCTS from taking place in a single location. As such, SLMath improvised and implemented a satellite model for those schools wherein the U.S.-based students participated from one location in the U.S. as close as possible to the time zone of the partner country while the students of the partnering institution participated from their home countries. SLMath partnered with the University of Hawaii, Hilo to host the AMSI and NCTS schools. For the joint school with INdAM, we partnered with the Courant Institute, New York. These bicontinental summer school experiments proved to be worthwhile and allowed all students to attend lectures synchronously online; problem sessions were held in person across the various locations. While this configuration does not provide all of the advantages of in-person research sessions, it was without question an improvement over the experience of being entirely online.

The African Diaspora Joint Mathematics Workshop (ADJOINT) is a yearlong program that provides opportunities for U.S. mathematicians – especially those from the African Diaspora – to form collaborations with distinguished African-American research leaders on topics at the forefront of mathematical and statistical research.

ADJOINT begins with an intensive two-week summer session which, in 2022, took place in-person. The 14 participants (including 3 research leaders) were divided in 3 groups. All groups reported high satisfaction with ADJOINT, with participants remarking that, for the first time in their careers, they felt a strong sense of belonging in a mathematical community.

The second week of the ADJOINT 2022 two-week intensive period overlapped with the ADJOINT 2020 and 2021 reunions, which collectively brought 26 past ADJOINT participants and leaders to the Institute. SLMath leadership and support staff hosted a collective ADJOINT dinner, catered by Chef Rashad Armstead of The Black Food Collective on SLMath's terrace. The experience was memorable both for the participants and the chef. Filmmaker George Csicsery was on site and produced a short video on the ADJOINT experience. Additionally, Csicsery is working on a movie (funded by SLMath) featuring Black mathematicians' journeys; several of the ADJOINT participants were filmed for this endeavor.

In January 2023, SLMath hosted an ADJOINT special session at the annual JMM meeting of the AMS. The two-part session, organized by ADJOINT co-directors Edray Goins and Anisah Nabilah Nu'Man, featured six speakers discussing results from ADJOINT work representing a total of 11 co-authors.

More details about the ADJOINT program can be found in Section 7, and a report of ADJOINT 2022 can be found in the Appendix.

Summer Research in Mathematics (SRiM) is part of SLMath's overall activities aimed at strengthening the mathematical sciences by providing space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals, whose ongoing research may have been disproportionately affected by various obstacles including family obligations, professional isolation, or access to funding. Through this effort, SLMath aims to mitigate obstacles faced by these groups, improve the odds of research project completion, and deepen their research experience.

Responses to the exit survey reveal that the 2022 program was successful in achieving this goal; when asked about their level of professional satisfaction with SLMath, 88% of respondents gave a rating of 5 out of 5 while the remaining 12% gave a rating of 4 out of 5. The institute is also gratified to see that roughly 85% of respondents gave administrative support a 5 out of 5 rating.

SRiM 2022 was the program's first application cycle since the start of the COVID-19 pandemic. The first task of the 11 members of the SRiM selection committee, chaired by Professor Bianca Viray, was to create an application review process. The committee developed a comprehensive rubric with 9 categories to evaluate the applications. Ultimately, 11 research groups comprising 39 researchers took part in the summer 2022 program. The collaborations spanned a wide variety of research topics from *Shapes of Echoes* to *Cohomogeneity Two Manifolds of Positive Sectional Curvature.*

The positive impact of this program is evidenced, in part, by the high number of JMM special sessions organized by past SRiM participants. At the 2023 JMM, 23 researchers organized 8 SRiM special sessions featuring 64 speakers (and representing well over 150 co-authors)!

More details about the SRiM program can be found in Section 6, and a report of SRiM 2022 can be found in the Appendix.

Funding: In 2022-23, out of a total of $3.3 million in support for program members, about a third (33.3%) came from the NSF, 4% from the NSA, 12% from endowments, and 51% from private sources. SLMath's short-term scientific activities (programmatic workshops, 40th anniversary symposium, 2 program reunions, ADJOINT, and SRiM) totaled about $1 million; of this, the NSF contributed 63%, the NSA 10%, and private sources 27%. The record 13 Summer Graduate Schools totaled an additional $877,000 of which 87% came from the NSF and 13% from private sources.

These numbers demonstrate SLMath's ability to leverage the NSF's support to maximally benefit the mathematical sciences as a whole. We strongly believe that much of SLMath's success is attributable to the NSF's core support, which provides an ironclad foundation for, and endorsement of, SLMath's scientific excellence.

Postdoctoral Program: Twenty-eight (28) Postdoctoral Fellows participated in SLMath's four scientific programs. Of those, twelve (12) received stipends from this NSF grant.

Privately funded "named" postdoctoral fellows included the following: Saman Habibi Esfahani was the Berlekamp Postdoctoral Fellow; Inbar Klang was the Donoho Fellow; Stephanie Chan the

Gamelin Fellow; Maxwell Zimet the Huneke Fellow; Shaoyun Bai the McDuff Fellow; Tony Feng and Melissa Zhang the Viterbi Fellows; and Gregorio Baldi and Gabriel Dill the Della Pietra Fellows. For details on the postdoctoral program, please see Section 3.

Mathematical Sciences Institutes Diversity Initiative: This initiative, known as MSIDI, consists of a series of workshops for members of groups that have been historically underrepresented in the mathematical sciences. These workshops are sponsored by a collaborative grant involving NSF-funded US mathematical sciences institutes (IAS, ICERM, IMSI, IPAM, SLMath, and SAMSI). During the 2022-23 academic year, SLMath was responsible for organizing the Modern Math Workshop, which was held on October 26-27, 2022 in San Juan, Puerto Rico, immediately before the SACNAS conference. SLMath's activities under MSIDI are reported separately under NSF grant number DMS-1935867.

Critical Issues in Mathematics Education: The Critical Issues in Mathematics Education (CIME) series of workshops addresses key problems in education today. They are designed to engage professional mathematicians in discussions with education researchers, teachers, and policy makers to improve mathematics education. This year's topic was on *Mentoring for Equity*. Participants learned about the evidence base for effective mentoring, with a focus on culturally responsive mentoring that supports all students and faculty along their mathematical paths. The workshop included a combination of discussion of research evidence, review and adaptation of practical tools, and explicit training in effective mentoring, including how to bring these tools back to participants' home institutions. This workshop was held in a hybrid format to accommodate both in-person and virtual participation. There were 116 *identifiable registered* attendees, but 84 people signed a physical sign-in sheet, and 51 distinct individuals were present on Zoom.

Public Understanding of Mathematics: SLMath runs activities and programming each year that aim to help the public understand the power, beauty, and fun of mathematics:

Mathical Book Prize: (www.mathicalbooks.org) The Mathical Book Prize is presented in partnership with the National Council of Teachers of English and the National Council of Teachers of Mathematics, and in coordination with the Children's Book Council. Now in its 10th year, the prize aims to cultivate a love of mathematics by elevating outstanding children's books that explore the many ways that mathematics can be experienced in the world around us. SLMath partners with many organizations including the Guru Krupa Foundation, ParentChild+, School Library Journal, and the DREME Network at Stanford University to distribute Mathical titles nationally to children in need. The 2023 prize was supported by the Firedoll Foundation, Joan and Irwin Jacobs, and the Guru Krupa Foundation. Founding support for the Mathical Prize was provided by the Simons Foundation.

In conjunction with the Mathical Book Prize, SLMath presented 32 school libraries across the U.S. with Mathical Book Prize Collection Development Awards in partnership with the School Library Journal. This award provides the recipient Title I schools with $700 to be used to purchase Mathical titles with the intention of inspiring a love and appreciation of math in the everyday world.
SLMath also collaborated with the National Council of Teachers of English (NCTE) and the National Council of Teachers of Mathematics (NCTM) to present a total of 20 Title I school

classrooms nationwide with Mathical titles. Language arts and math teachers received $750 to purchase Mathical List titles for classroom integration.

The 2023 Mathical Prize winners are: **Pre-K**, *Again, Essie?*, by Jenny Lacika (Charlesbridge); **Grades K-2**, *Zero Zebras* by Bruce Goldstone (Scholastic); **Grades 3-5**, *Counting in Dog Years and Other Sassy Math Poems* by Betsy Franco (Candlewick Press); **Grades 6-8**, *Shine On, Luz Véliz* by Rebecca Balcárcel (Chronicle Books). Live online author events were held to celebrate the 2023 Mathical Book Prize announcement, featuring all winning authors and a national audience of librarians, educators, parents, and children's publishing professionals. This year's selection committee was co-chaired by Katie Hendrickson of Code.org, Chris Nho of Desmos, and Dr. John Urschel of Harvard University Department of Mathematics.

Films for Public Television: The field of Mathematics is full of figures who have overcome odds, solved unusual problems, and inspired new generations of mathematicians. As part of our commitment to making these stories accessible, MSRI has produced several films aimed at a general audience. Many of these have been directed by George Csicsery of Zala Films, whose films about mathematicians have aired on U.S. public television and featured at film festivals worldwide for nearly two decades.

Journeys of Black Mathematicians, a two-part documentary series by Director George Csicsery, currently in production, explores the contributions of pioneering African Americans in mathematics. Featuring interviews with contemporary Black American researchers and educators who discuss their experiences, struggles and accomplishments, the film surveys some innovative educational programs in math at every level from grade school through undergraduate and postdocs. The project hopes to inspire young people, particularly African-Americans, to pursue careers in the mathematical sciences by highlighting the importance of their contributions as researchers and educators in the field.

This film is SLMath's seventh documentary film project with Csicsery's Zala Films. The world premiere of Journeys of Black Mathematicians' first half is scheduled for January 2024 at the Joint Mathematics Meetings (JMM) in San Francisco, California, and part two is anticipated for release in conjunction with the 2025 JMM in Seattle, Washington. Additional interview footage featuring Black mathematicians and math educators has been recorded for a future archival project. As filming of interviews with individual mathematicians and math organizations continued through Summer 2023, two segments of interest from filming in Summer 2022 at MSRI are now available to view. Students and leaders of the MSRI-UP Research Experience for Undergraduates were interviewed regarding the program and its impact (https://vimeo.com/779419764). PhD mathematicians organizing and participating in the African Diaspora Joint Mathematics Workshop (ADJOINT) were also filmed in June 2022, as part of that year's program and reunion for participants who had participated in group research projects virtually during the pandemic (https://vimeo.com/761580270).

Secrets of the Surface: The Mathematical Vision of Maryam Mirzakhani (zalafilms.com/secrets), MSRI's 2020 feature-length documentary film, continued to be screened periodically at film festivals, at universities, and on PBS and APT stations and streaming services. Notably in 2023, the film aired on Arte (Association relative à la télévision européenne), the France-based European

public service television channel dedicated to culture. Arte has made the film available free of charge on demand online through the end of 2023 for their viewers. Many screenings continued to be accompanied by Q&A sessions featuring mathematicians as panelists in both the United States and abroad, including screenings at San Francisco State University and at Stanford University's Stanford Arts Camera as Witness Program's REFLECTIONS series, which celebrated the United Nations' International Day of Women and Girls in Science. Stanford undergraduate student reporter Mirelys Mendez-Pons, writing about the event, noted that Maryam Mirzakhani's success "has shown young women that they can pursue their passions and excel in any field, regardless of their gender." The film remains available to the public for on-demand viewing via Vimeo in English (including English Open Captions for accessibility), and subtitled in French, Italian, Japanese, Persian, Portuguese, Spanish, and Turkish.

Numberphile: (youtube.com/numberphile). SLMath continues to provide financial and intellectual support to Brady Haran's Numberphile, a popular YouTube channel and podcast started in 2014. Numberphile remains one of the most popular resources for public mathematical education on YouTube boasting millions of subscribers on their channel. Popular uploads this year included The Brick Factory Problem with James Grime, Magic Squares of Squares with Anthony Várilly-Alvarado, and The Journey to 3264 with David Eisenbud, as well as additional videos filmed with SLMath visitors in residence in Berkeley.

In 2022-23, Numberphile uploaded 36 new videos, bringing the total to 691. The channel boasts 4.33 million subscribers as of Summer 2023, with an additional 222 extended content videos and 45 podcast episodes hosted on the "extras channel" called Numberphile2 (with 247 thousand subscribers of its own).

Inspiring Voices from the Classroom, a video interview series, is designed to recognize and highlight current mathematics classroom teachers and provide a positive platform that allows their authentic voices to be heard. Teachers have the opportunity to sit-down with the host, mathematics educator and public speaker Dr. Kristopher J. Childs, to tell their personal stories of being a teacher. These stories are vital, as the responsibilities of a teacher have shifted due to the pandemic and a once in a lifetime opportunity is occurring in education to reimagine the field. Educators and other viewers can find Inspiring Voices from the Classroom Show on Facebook and YouTube. See msri.org/web/msri/education/for-k-12-educators/inspiring-voices for more detail.

***Truth Values* Play in San Francisco:** In March 2023, SLMath co-sponsored a special one-night performance of the award-winning play Truth Values at San Francisco's Théâtre Erick Moreau. The story follows writer/performer and "recovering mathematician" Gioia De Cari's adventures as a math Ph.D. student at the Massachusetts Institute of Technology. The one-woman show offers a serious, insightful, and ultimately uplifting exploration of the joys and challenges women face in STEM. The performance was followed by a post-show conversation featuring Marilyn Simons, economist and STEM philanthropist, mathematician Emille Lawrence (University of San Francisco), and SLMath Director Tatiana Toro.

Winner of a New York International Fringe Festival Overall Excellence Award for Best Solo Show, the play has been presented at more than 50 theaters and performing arts centers throughout the United States, including the Ensemble Studio Theatre in New York, the La Jolla Playhouse,

and USC's celebrated Visions and Voices Arts and Humanities Series, among many others. SLMath was joined by Friends of the Institut des Hautes Études Scientifiques, the Lycée Français de San Francisco, the Consulat Général de France à San Francisco, University of San Francisco, and the Simons Institute for the Theory of Computing at UC Berkeley in sponsoring this event, with the show originally launched via sponsorship from the Alfred P. Sloan Foundation and the Massachusetts Institute of Technology.

Art at SLMath: SLMath continued to host art exhibitions of mathematical significance or local Bay Area interest as part of our enrichment for members and visitors, with public receptions to welcome community visitors to our building. From October 2022, SLMath hosted works by Ethiopian-born contemporary artist Wosene Worke Kosrof, who has achieved international acclaim. Over the past five decades, Wosene has created an internationally recognized artistic signature in his work by being the first contemporary Ethiopian-born artist to use the script forms – fiedel – of his native Amharic as a core element in his paintings and sculptures. This recognizable 'signature' emerges from the way he elongates, distorts, dissects and reassembles Amharic symbols – not as literal words – but as images that speak for themselves in a visual language accessible to international audiences. Jazz improvisations underlie his compositions, animating them with rhythmic movements and emboldening his masterful use of color.

Beginning in April 2023, SLMath is exhibiting the photographs of Kris Lang. These improvisational abstract dioramas are made using both found elements and purpose-built sculptural elements. Photographed elements are manipulated to generate patterns and repeats, which are made into paper sculptures. The use of printed backlit film allows for disorienting manipulations of space and the picture plane. Fragile, ephemeral, barely constructed, the final work is lit and photographed — all the effects are in-camera, yielding a fluid collaboration between the digital and analog realms. No digital manipulation or 3D rendering is used in these works.

Private Fundraising: The private fundraising for SLMath continues to be a robust operation that leverages NSF support to enhance and grow both our scientific and public outreach programming. As shown by the Spendable Annual Revenue Chart below, the spendable funds from private donors (individuals, private foundations, and corporations) is increasing due to additional multi-year pledges. These funds provide us with an increased ability to plan for the future. Overall private funding remains about half of the total revenue, which fits the trend pre-2020. In addition to what is shown on the chart, over the last two years we have raised more than $95 million in pledges and gifts from private sources to benefit our endowment campaign. This campaign as a whole will greatly increase our ability to expand existing programs and launch new initiatives.

Spendable Annual Revenue FY16 - FY23*

Legend:
- NSF & NSA
- Annual Giving & First Year of Recurring Gifts
- Multi-Year Gift Pledges
- Academic Sponsors
- Endowment Distributions
- National Math Festival

Values by year:
- FY 15-16: $9.4M
- FY 16-17: $9.3M
- FY 17-18: $10.1M
- FY 18-19: $11.1M
- FY 19-20: $10M
- FY 20-21: $9.8M
- FY 21-22: $11.2M
- FY 22-23 Estimate: $11.3M
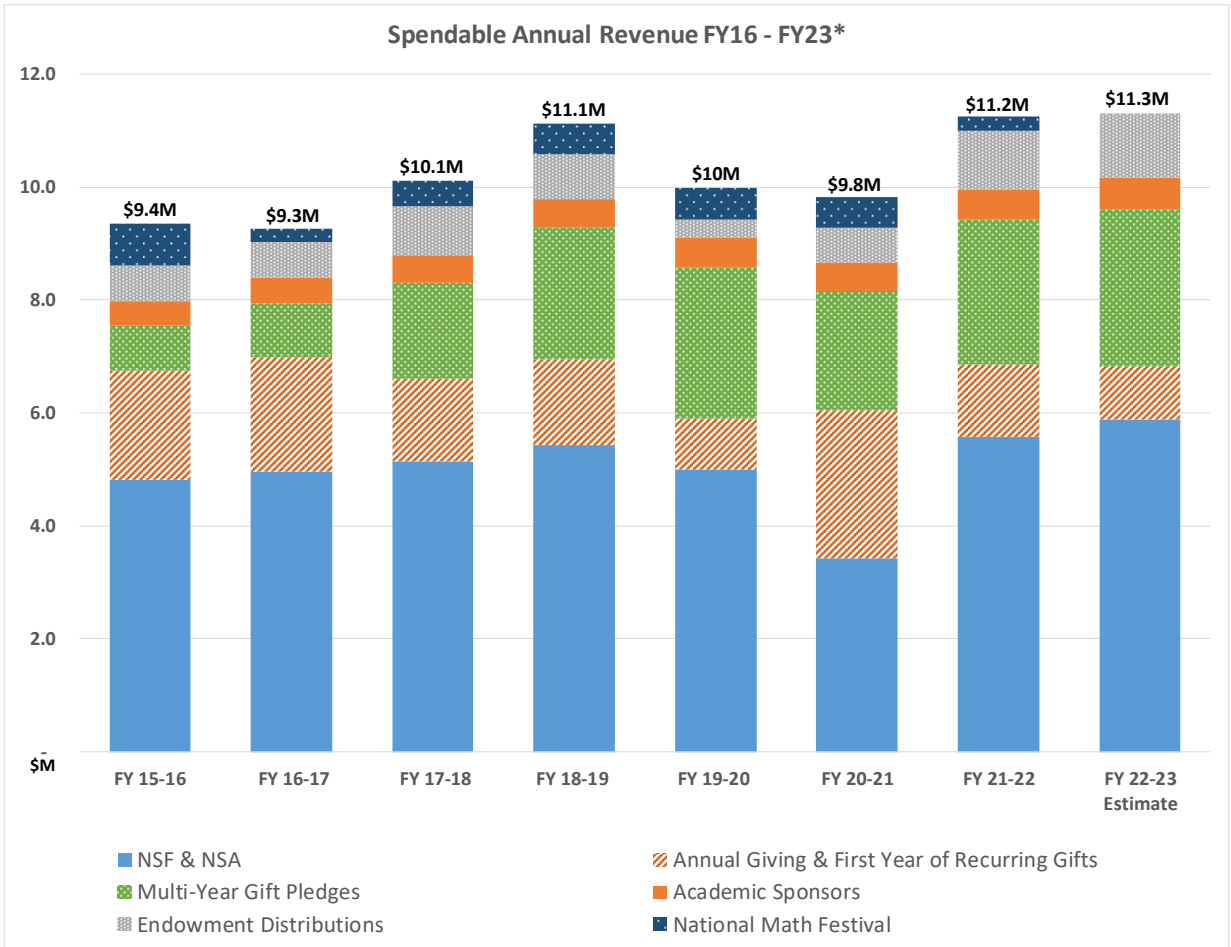
1.2   Summary of Visitor Data for 2022-23 Programmatic Activities

During the summer of 2022, 86 members participated in in-person reunions for virtual programs held during the COVID pandemic. Additionally, during the 2022-23 academic year, 223 in-person members participated in SLMath's semester-long flagship programs (28 of whom were Postdoctoral Fellows), with hundreds more participating online in the programmatic seminars. Including both online and in-person participants, SLMath's workshops had 2,150 attendees (not necessarily distinct, as some individuals attended multiple workshops).

The Postdoctoral program was particularly successful and is described in detail in Section 3. Of the Fellows, 29% were women, 18% were U.S. Citizens or Permanent Residents, and 68% listed a U.S. university as their home institution. Of those institutions, 36.8% are located in the Northeast, 21.1% in the West, 15.8% in the Midwest, and 26.3% in the South.

SLMath had a total of 309 members who spent time physically onsite at SLMath to attend either a regular semester program, or a reunion program. In the summer of 2022, two month-long reunions were held in order to assuage the impact of COVID on participants of virtual programs held during the pandemic. The 86 researchers who participated in a reunion program in 2022 spent an average of 18 days at SLMath per visit out of a possible 25 days representing 72% of the possible visit time. During the academic year, the 223 participants in SLMath's flagship programs spent an average of 90 days at SLMath per visit, or 3.02 out of a possible 4 months—representing roughly 76% of possible visit time. Peak attendance was in September 2022 for the fall semester and March 2023 for the spring semester.

Of the 309 participants who took part in a semester or reunion program in 2022-23, 28% were female, 50% reported being U.S. Citizens or Permanent Residents, and 61% listed a U.S. university as their home institution. Of those institutions, 30% are located in the Northeast, 31% are located in the West, 17% in the Midwest, and 22% in the South. Of the members, 13% received their Ph.D. in the past 4 years, 35% received their Ph.D. between 2010 and 2019, 17% received their Ph.D. between 2000 and 2009, 21% received their Ph.D. prior to the year 2000, and 14% were graduate students. Detailed demographic data can be found in Section 2.

SLMath's 2022-23 workshops were held in a hybrid format with options for both in-person and virtual attendance. Workshops held in the fall semester had limited in-person attendance due to COVID mitigation—they were restricted to members in residence and *invited* guests only. Restrictions were lifted for the spring semester and most of the workshops held in the spring were open to all mathematicians. There were a total of 2,150 participants who registered and attended virtually or in person (some individuals attended multiple workshops and are counted more than once). Of the 2,150 registered workshop participants, 30% were female and 49% were U.S. Citizens or Permanent Residents, of whom 17% reported being a member of an under-represented minority group as defined by NSF. In addition, 72% came from a U.S. institution. Detailed demographic data on aggregate workshop participants can be found in Sections 2 and 4, and demographics for individual workshops can be found in the Appendix.

Member Visits Summary*±

All program members	Summer 2022	Fall 2022	Spring 2023	2022-23	2004–23
Total Member Days	125	10,172	10,060	**20,357**	**327,657**
Total # of Member Visits	6	106	114	**226**	**4,474**
Average # of Days per Member Visit	20.83	95.96	88.25	**90.08**	**73.24**
Average # of Months per Member Visit	0.69	3.20	2.94	**3.00**	**2.44**
All female program members	Summer 2022	Fall 2022	Spring 2023	2022-23	2009–23
Total Member Days	25	2,793	2,678	**5,496**	**62,366**
Total # of Member Visits	1	28	31	**60**	**811**
Average # of Days per Member Visit	25.00	99.75	86.39	**91.60**	**76.90**
Average # of Months per Member Visit	0.83	3.33	2.88	**3.05**	**2.56**

Please note that this table calculates members' visits, which can be multiple.

±Table does not include participants of summer reunion programs. Summer 2022 data reflects visits by members of the Complementary Program.

Note: Chart does not include participants of summer reunion programs.

Member Visits by Month in 2022-23*

Chart: "Member Visits by Month in 2022-23*" — a purple area chart plotting # OF VISITS (y-axis, 0 to 120) against MONTH (x-axis). Data values by month:
- Jun '22: 1
- Jul '22: 5
- Aug '22: 72
- Sep '22: 93
- Oct '22: 96
- Nov '22: 94
- Dec '22: 88
- Jan '23: 77
- Feb '23: 85
- Mar '23: 91
- Apr '23: 90
- May '23: 76
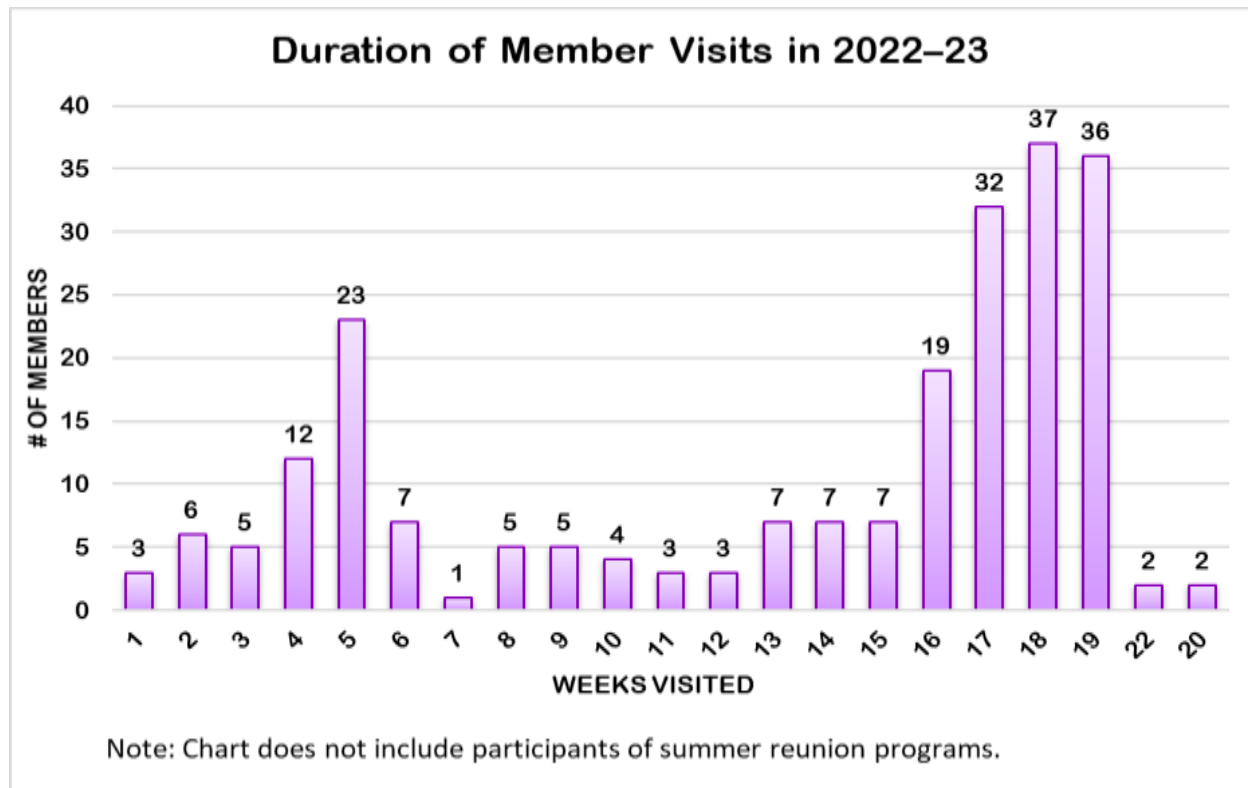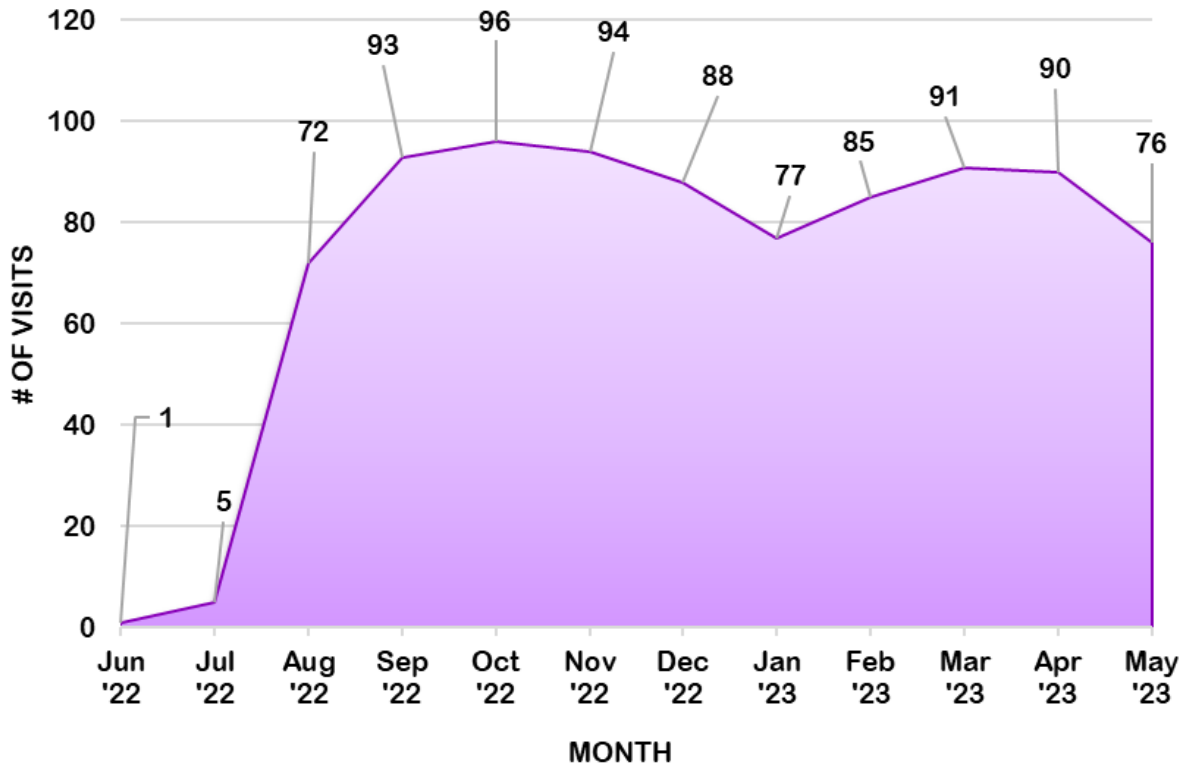
Note: Chart does not include participants of summer reunion programs.

Chart does not include participants of summer reunion programs. Summer 2022 data reflects visits by members of the Complementary Program.

1.3   Scientific Programs and their Associated Workshops

There were four semester-long programs, one complementary program, and two summer research programs that took place during the 2022-23 year, as well as nine programmatic workshops.

Note: Full descriptions of each activity can be found the Appendix (Section 8) of this Annual Report. In the lists of organizers of each activity below, the name of the lead organizer(s) *appears in orange when applicable.*

Program 1: Analytic and Geometric Aspects of Gauge Theory
August 22, 2022 - December 21, 2022
Organizers: Laura Fredrickson (University of Oregon), Rafe Mazzeo (Stanford University), Tomasz Mrowka (Massachusetts Institute of Technology), Laura Schaposnik (University of Illinois at Chicago), Thomas Walpuski *(Humboldt-Universität)*

Workshop 1: Connections Workshop: Analytic and Geometric Aspects of Gauge Theory [Hybrid Workshop]
August 25, 2022 - August 26, 2022
Organizers: Lara Anderson (Virginia Polytechnic Institute and State University), Laura Schaposnik *(University of Illinois at Chicago)*

Workshop 2: Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory [Hybrid Workshop]
August 29, 2022 - September 02, 2022
Organizers: Aleksander Doan *(University of Cambridge; University College London), Lorenzo Foscolo (University College London), Laura Fredrickson (University of Oregon), Ruxandra Moraru (University of Waterloo), Michael Singer (University College London)*

Workshop 3: New Four-Dimensional Gauge Theories [Hybrid Workshop]
October 24, 2022 - October 28, 2022
Organizers: Andriy Haydys (Université Libre de Bruxelles), Lotte Hollands (Heriot-Watt University, Riccarton Campus), Eleny-Nicoleta Ionel *(Stanford University), Richard Thomas (Imperial College, London), Thomas Walpuski (Humboldt-Universität)*

Program 2: Floer Homotopy Theory
August 22, 2022 to December 21, 2022
Organizers: Mohammed Abouzaid (Columbia University), Andrew Blumberg (Columbia University), Kristen Hendricks (Rutgers University), Robert Lipshitz (University of Oregon), Ciprian Manolescu *(Stanford University), Nathalie Wahl (University of Copenhagen)*

Workshop 1: Connections Workshop: Floer Homotopy Theory [Hybrid Workshop]
September 08, 2022 - September 09, 2022
Organizers: Teena Gerhardt (Michigan State University), Kristen Hendricks *(Rutgers University), Ailsa Keating (University of Cambridge)*

Workshop 2: Introductory Workshop: Floer Homotopy Theory [Hybrid Workshop]

September 12, 2022 - September 16, 2022

Organizers: Sheel Ganatra (University of Southern California), Tyler Lawson (University of Minnesota Twin Cities), Robert Lipshitz (University of Oregon), Nathalie Wahl (University of Copenhagen)

Workshop 3: Floer Homotopical Methods in Low Dimensional and Symplectic Topology [Hybrid Workshop]

November 14, 2022 - November 18, 2022

Organizers: Mohammed Abouzaid (Columbia University), Andrew Blumberg (Columbia University), Jennifer Hom (Georgia Institute of Technology), Emmy Murphy (Northwestern University), Sucharit Sarkar (University of California, Los Angeles)

Program 3: Algebraic Cycles, L-Values, and Euler Systems

January 17, 2023 - May 26, 2023

Organizers: Henri Darmon (McGill University), Ellen Eischen (University of Oregon), Benjamin Howard (Boston College), David Loeffler (University of Warwick), Christopher Skinner (Princeton University), Sarah Zerbes (ETH Zürich), Wei Zhang (Massachusetts Institute of Technology)

Workshop 1: Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems [Hybrid Workshop]

January 19, 2023 - January 20, 2023

Organizers: Henri Darmon (McGill University), Ellen Eischen (University of Oregon), Benjamin Howard (Boston College), Elena Mantovan (California Institute of Technology)

Workshop 2: Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems [Hybrid Workshop]

January 23, 2023 - January 27, 2023

Organizers: Henri Darmon (McGill University), Ellen Eischen (University of Oregon), Benjamin Howard (Boston College), Elena Mantovan (California Institute of Technology)

Workshop 3: Shimura Varieties and L-Functions

March 13, 2023 - March 17, 2023

Organizers: Michael Harris (Columbia University), David Loeffler (University of Warwick), Elena Mantovan (California Institute of Technology), Christopher Skinner (Princeton University), Sarah Zerbes (ETH Zürich), Wei Zhang (Massachusetts Institute of Technology)

Program 4: Diophantine Geometry

January 17, 2023 - May 26, 2023

Organizers: Jennifer Balakrishnan (Boston University), Mirela Ciperiani (University of Texas, Austin), Philipp Habegger (University of Basel), Wei Ho (Institute for Advanced Study), Hector Pasten (Pontificia Universidad Católica de Chile), Yunqing Tang (University of California, Berkeley), Shou-Wu Zhang (Princeton University)

Workshop 1: Connections Workshop: Diophantine Geometry [Hybrid Workshop]
February 02, 2023 - February 03, 2023
Organizers: Jennifer Balakrishnan (Boston University), ***Yunqing Tang*** *(University of California, Berkeley)*

Workshop 2: Introductory Workshop: Diophantine Geometry [Hybrid Workshop]
February 06, 2023 - February 10, 2023
Organizers: Hector Pasten (Pontificia Universidad Católica de Chile), Yunqing Tang (University of California, Berkeley), ***Shou-Wu Zhang*** *(Princeton University)*

Workshop 3: Degeneracy of Algebraic Points
April 24, 2023 - April 28, 2023
Organizers: Jennifer Balakrishnan (Boston University), ***Mirela Ciperiani*** *(University of Texas, Austin), Philipp Habegger (University of Basel), Wei Ho (Institute for Advanced Study), Hector Pasten (Pontificia Universidad Católica de Chile), Yunqing Tang (University of California, Berkeley), Shou-Wu Zhang (Princeton University)*

Program 5: Complementary Program 2022-23
August 22, 2022 - August 11, 2023
SLMath had a small Complementary Program comprised of one program associate, Daniel Carranza, (Johns Hopkins University), and the following 14 researchers: Mirela Ciperiani (University of TX, Austin), Spencer Dowdall (Vanderbilt University), Ellen Eischen (University of Oregon), David Eisenbud (University of California, Berkeley), Christopher Jankowski (Georgia Institute of Technology), Chris Kapulkin (University of Western Ontario), Eric Larson (Brown University), Grace Mwakyoma-Oliveira (Instituto Superior Técnico), Tim Perutz (University of Texas, Austin), Charmaine Sia (New York University, Courant Institute), Gigliola Staffilani (Massachusetts Institute of Technology), Amanda Tucker (University of Rochester), Volkmar Welker (Philipps-Universität Marburg), Jay Yang (Washington University)

Program Reunion 1: Higher Categories and Categorification
May 30, 2022 - June 24, 2022
Organizers: David Ayala (Montana State University), Clark Barwick (University of Edinburgh), David Nadler (University of California, Berkeley), ***Emily Riehl*** *(Johns Hopkins University), Marcy Robertson (University of Melbourne), Peter Teichner (Max-Planck-Institut für Mathematik), Dominic Verity (Macquarie University)*

Program Reunion 2: Definability, Decidability, and Computability in Number Theory
July 18, 2022 - August 12, 2022
Organizers: Valentina Harizanov (George Washington University), Barry Mazur (Harvard University), Russell Miller (Queens College, CUNY; CUNY, Graduate Center), Jonathan Pila (University of Oxford), Thomas Scanlon (University of California, Berkeley), Alexandra Shlapentokh (East Carolina University)

Summer Research in Mathematics (SRiM) 2022

June 06, 2022 to July 15, 2022

Selection Committee: Bianca Viray (University of Washington), Hélène Barcelo (MSRI/SLMath), Derek Bingham (Simon Fraser University), Benson Farb (University of Chicago), Charlie Fefferman (Princeton University), Teena Gerhardt (Michigan State University), Thoedora Bourni (University of Tennessee), Johann Franklin (Hostra University), Marni Mishna (Simon Fraser University), Julius Ross (University of Illinoiss, Chicago), Matthew Stover (Temple University)

African Diaspora Joint Mathematics Workshops (ADJOINT) 2022

June 20, 2022 - July 01, 2022

Program Directors: Edray Goins (Pomona College), Caleb Ashley *(Boston College), Naiomi Cameron (Spelman College), Jacqueline Hughes-Oliver (North Carolina State University), Anisah Nu'Man (Spelman College).*

2022 Research Leaders: Rebecca Hubbard (Perelman School of Medicine, University of Pennsylvania), Trachette L. Jackson (University of Michigan), Gaston M. N'Guerekata (Morgan State University)

1.4 Scientific Activities Directed at Underrepresented Groups in Mathematics

Connections Workshops

During the 2022-23 academic year, SLMath hosted four Connections workshops, one for each scientific program. These workshops have three overarching goals: (1) to give accessible introductions to the main themes of the program and exciting new directions in related research; (2) to provide participants the opportunity to become acquainted with the work of women in the field; and (3) to connect early-career researchers, especially women, gender-expansive individuals, and minorities, to potential senior mentors. A typical workshop consists of introductory lectures, presentations by post-doctoral researchers and graduate students, and a panel discussion addressing the challenges faced by all young researchers, but especially by women, in establishing a career in mathematics. Throughout the workshops, special effort is made to foster mentoring relationships between established and early-career researchers at the lunches, dinners, and coffee breaks. Participants of the Connections Workshop are encouraged to stay for the following week for the Introductory Workshop to the semester's program. The workshop organizers are also encouraged to propose week-end activities for small groups of women with similar research interests to discuss problems and perhaps to begin work on a joint research project (e.g. forming small research or study groups that would work on predetermined problems, read a paper, or learn new techniques). As is the case for all SLMath workshops, registration to attend Connections workshop lectures is open to all interested persons. For more information regarding each workshop, please refer to Section 1.3 above as well as the Appendix.

Celebration of Women in Mathematics 2023

May 12, 2023

Organizers: Ini Adinya (University of Ibadan), Masha Albrecht (Berkeley High School), Romina Arroyo (Universidad Nacional de Cordoba), Maria-Grazia Ascenzi (University of California Los Angeles), Mirela Ciperiani (University of Texas, Austin), Donatella Danielli (Arizona State University), Shanna Dobson (University of California, Riverside), Malena Espanol (Arizona State University), Olubunmi Fadipe-Joseph (University of Ilorin), Anna Fino (Università di Torino), Natalia Garcia-Fritz (Pontificia Universidad Católica de Chile), Adi Glucksam (Northwestern University), M.E. Hogan (Texas Tech University), Kuei-Nuan Lin (Pennsylvania State University), Zheng Liu (University of California, Santa Barbara), Liangbing Luo (Lehigh University), **Ornella Mattei** *(San Francisco State University), Julia Plavnik (Indiana University), Palina Salanevich (Universiteit Utrecht), Ramdorai Sujatha (University of British Columbia)*

The SLMath *Celebration of Women in Mathematics 2023* event was aimed at graduate students, with a focus on "Pathways in Mathematics." It was a hybrid workshop, with online and in-person activities at satellite institutions including SLMath; University of California at Riverside; University of California at Santa Barbara; University of California at Los Angeles; and University of Ibadan, Nigeria. In 2014, Maryam Mirzakhani was awarded the Fields Medal for her outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces, becoming the first woman, and the first Iranian, to be recognized for her mathematical achievements by this top mathematical prize. May 12th, her birthday, has been chosen to celebrate Women in Mathematics in her memory. The celebration takes place every year, all around the

world. The goal of the day is to inspire women everywhere to celebrate their achievements in mathematics, and to encourage an open, welcoming and inclusive work environment for everybody.

The organizing committee was composed of 20 women from universities around the world, including Africa, North America, South America, and Europe. There were four featured speakers, based out of Germany, the United States, Chile, and Panama respectively, who delivered their talks online. The presentations were followed by a panel discussion led by the four featured speakers and the workshop concluded with breakout sessions on various topics related building a career in mathematics. For more information, see the report in the Appendix.

Summer Research in Mathematics 2022
June 06, 2022 to July 15, 2022
Selection Committee: Bianca Viray (University of Washington), Hélène Barcelo (MSRI/SLMath), Derek Bingham (Simon Fraser University), Benson Farb (University of Chicago), Charlie Fefferman (Princeton University), Teena Gerhardt (Michigan State University), Thoedora Bourni (University of Tennessee), Johann Franklin (Hostra University), Marni Mishna (Simon Fraser University), Julius Ross (University of Illinois, Chicago), Matthew Stover (Temple University)

During the summer of 2022 SLMath hosted the Summer Research in Mathematics program, which provides space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals, whose ongoing research may have been disproportionately affected by various obstacles including family obligations, professional isolation, or access to funding. Through this effort, SLMath aims to mitigate the obstacles faced by these groups, improve the odds of research project completion, and deepen their research experience. The ultimate goal of this program is to enhance the mathematical sciences as a whole by positively affecting the research and careers of all of its participants and assisting their efforts to maintain involvement in the research community.

Groups of two to six mathematicians with partial results on an established research agenda met to advance their projects. Each member of the group must have a Ph.D. in mathematics or advanced graduate standing. 9 of the 11 research groups met at SLMath in Berkley, CA, one at the Banff International Research Station (BIRS), and one at DePaul University. With the exception of one researcher who collaborated with their group remotely from China, all groups met in-person for at least 11 days. For more information regarding this program, please refer to Section 6 of this annual report.

2022 African Diaspora Joint Mathematics Workshops (ADJOINT)
June 20, 2022 – July 01, 2022
Program Directors: Edray Goins (Pomona College), Caleb Ashley (Boston College), Naiomi Cameron (Spelman College), Jacqueline Hughes-Oliver (North Carolina State University), Anisah Nu'Man (Spelman College)

The main objective of ADJOINT is to provide opportunities for in-person research collaboration to U.S. mathematicians, especially African American mathematicians, who work in small groups with research leaders on various research projects. Through this effort, SLMath aims to establish and promote research communities that will foster and strengthen research productivity and career development among its participants. The ADJOINT workshops are designed to catalyze research collaborations, provide support for conferences to increase the visibility of the researchers, and to develop a sense of community among the mathematicians who attend. This program enhances the mathematical sciences and its community by positively affecting the research and careers of African-American mathematicians and supporting their efforts to achieve full access and engagement in the broader research community.

The ADJOINT 2022 program supported a total of 14 researchers divided into three groups, including three renowned scientists acting as Research Leaders. All teams were predominantly comprised of African American mathematicians and statisticians at various stages in their careers. Their research projects were pursued further during the academic year via periodic virtual meetings. For more information regarding this program, please refer to Section 7 of this report.

MSRI Undergraduate Program (MSRI-UP) 2022: Algebraic Methods in Mathematical Biology

June 11, 2022 - July 23, 2022
Program Directors: Federico Ardila (San Francisco State University), Duane Cooper (Morehouse College), Maria Mercedes Franco (Queensborough Community College (CUNY)), Rebecca Garcia (Sam Houston State University), Candice Price (Smith College), Anne Shiu (Texas A & M University; Texas A&M University)

The MSRI Undergraduate Program (MSRI-UP) is a comprehensive summer program designed for undergraduate students who have completed two years of university-level mathematics courses and would like to conduct research in the mathematical sciences. The main objective of the MSRI-UP is to identify talented students, especially those from underrepresented groups who are interested in mathematics, and make available to them meaningful research opportunities, the necessary skills and knowledge to participate in successful collaborations, and a community of academic peers and mentors who can advise, encourage and support them through a successful graduate program. For more information regarding this program, please refer to Section 5 as well as reports submitted under grant number DMS-2149642.

Mathematically Advancing Young Undergraduates Program (MAY-UP) 2023

May 14, 2023 to May 28, 2023
Program Directors: Duane Cooper (Morehouse College), Shelby Wilson (Morehouse College; Johns Hopkins University Applied Physics Lab), Lakeshia Legette Jones (Clark Atlanta University) and Monica Stephens (Spelman College)

The two-week pilot session of The Mathematically Advancing Young Undergraduates Program (MAY-UP) was held in May 2023 at Georgia State University. The program was directed primarily at first year students from the Atlanta University Center—a consortium of HBCUs which includes

Morehouse College, Morehouse School of Medicine, Spelman College, and Clark Atlanta University. Inspired by SLMath's successful undergraduate summer research program, MSRI-UP, MAY-UP aims to provide first-year students who demonstrate an interest in and talent for mathematics with the opportunity to explore the myriad of ways that they might build on and expand their mathematical interests in the future. MAY-UP 2023 provided 12 students with a glimpse into Linear Algebra; and the ways in which this topic may arise both theoretically and computationally in their future studies. The students engaged with topics with which they were mostly unfamiliar beforehand: matrices and matrix computation; applications of matrices: Hill ciphers; polynomial interpolation; cubic splines; least squares regression; eigenvalues and eigenvectors; image compression and principal component analysis; machine learning. As the program approached conclusion, students paired to select topics for final MAY-UP projects. Their topics were applications of linear algebra in various areas—public health, school graduation rates, disaster forecasting, and computing applications. For more information, see Section 5.3.

NSF Mathematics Institutes' Modern Math Workshop
Pre-conference workshop for SACNAS 2022, San Juan, Puerto Rico
October 26, 2022 - October 27, 2022
Organizers: Hélène Barcelo (MSRI / SLMath), Philip Hammer (Institute for Mathematical and Statistical Innovation), Christian Ratsch (University of California, Los Angeles; Institute of Pure and Applied Mathematics (IPAM)), Ulrica Wilson (Morehouse College; Institute for Computational and Experimental Research in Mathematics (ICERM))

This two-day annual workshop focuses on contemporary research in mathematics sponsored by all the NSF-funded mathematical sciences institutes. It is designed to expand opportunities for undergraduates from underrepresented groups to learn about careers in the mathematical sciences, and to build collaborative research and mentoring networks among undergraduates, graduate students, and recent PhDs. It takes place as a pre-conference event in conjunction with the national meeting of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS). Because SACNAS hosts scientific programs for faculty as well as special mentoring programs for undergraduates, holding the Modern Math Workshop during this period enables the participation of mathematicians at a variety of career stages.

At the end of the first day of the workshop, a reception is held which emphasizes opportunities for connecting with other researchers including an information booth run by each NSF Math institute. This event is intended to provide attendees with ample time to learn about the variety of activities and opportunities offered at each of the institutes. For more information, see reports submitted under grant DMS-1935867.

1.5   Summer Graduate Schools (Summer 2022)

SGS 1: Integral Equations and Applications
June 06, 2022 - June 17, 2022
Location: SLMath, Berkeley, CA, United States
Organizers: Fioralba Cakoni (Rutgers University), Dorina Mitrea (Baylor University), Irina Mitrea (Temple University), Shari Moskow (Drexel University)

SGS 2: Geometric Flows
June 19, 2022 - July 01, 2022
Joint with: Institute of Applied and Computational Mathematics (IACM-FORTH)
Location: Foundation for Research and Technology-Hellas, Heraklion Crete, Greece
Organizers: Nicholas Alikakos (National and Kapodistrian University of Athens (University of Athens)), Panagiota Daskalopoulos (Columbia University)

SGS 3: New Directions in Representation Theory
June 19, 2022 - July 01, 2022
Joint with: Australian Mathematical Sciences Institute (AMSI)
Location: University of Hawaii, Hilo, HI, United States
Organizers: Angela Coughlin (Australian Mathematical Sciences Institute), Joseph Grotowski (University of Queensland), Tim Marchant (Australian Mathematical Sciences Institute), Ole Warnaar (University of Queensland), Geordie Williamson (University of Sydney)

SGS 4: Algebraic Theory of Differential and Difference Equations, Model Theory and their Applications
July 04, 2022 - July 15, 2022
Location: St. Mary's College, Moraga, CA, United States
Organizers: Alexey Ovchinnikov (Queens College, CUNY), Anand Pillay (University of Notre Dame), Thomas Scanlon (University of California, Berkeley)

SGS 5: Random Graphs
July 05, 2022 - July 15, 2022
Location: SLMath, Berkeley, CA, United States
Organizers: Louigi Addario-Berry (McGill University), Remco van der Hofstad (Technische Universiteit Eindhoven)

SGS 6: Séminaire de Mathématiques Supérieures 2022: Floer Homotopy Theory
July 11, 2022 - July 22, 2022
Joint with: Séminaire de Mathématiques Supérieures (SMS)
Location: University of British Columbia, Vancouver, Canada
Organizers: Kristen Hendricks (Rutgers University), Ailsa Keating (University of Cambridge), Robert Lipshitz (University of Oregon), Liam Watson (University of British Columbia), Ben Williams (University of British Columbia)

SGS 7: Metric Geometry and Geometric Analysis
July 11, 2022 – July 22, 2022
Joint with: University of Oxford
Location: University of Oxford, United Kingdom
Organizers: Cornelia Drutu (University of Oxford), Panos Papazoglou (University of Oxford)

SGS 8: 2022 Joint PCMI School: Number Theory Informed by Computation
July 17, 2022 - August 06, 2022
Joint with: Park City Mathematics Institute (PCMI)
Location: Park City Mathematics Institute, Park City, UT, United States
Organizers: Jennifer Balakrishnan (Boston University), Rafe Mazzeo (Stanford University), Bjorn Poonen (Massachusetts Institute of Technology), Akshay Venkatesh (Institute for Advanced Study)

SGS 9: MSRI-NCTS Joint Summer School: Recent Topics in Well Posedness
July 18, 2022 - July 29, 2022
Joint with: National Center for Theoretical Sciences (NCTS)
Location: University of Hawaii, Hilo, United States
Organizers: Jungkai Chen (National Taiwan University), Mimi Dai (University of Illinois at Chicago), Yoshikazu Giga (University of Tokyo), Tsuyoshi Yoneda (Hitotsubashi University)

SGS 10: Topological Methods for the Discrete Mathematician
July 25, 2022 - August 05, 2022
Location: St. Mary's College, Moraga, CA, United States
Organizers: Pavle Blagojevic (Freie Universität Berlin), Florian Frick (Carnegie Mellon University), Shira Zerbib (Iowa State University)

SGS 11: Mathematics of Machine Learning
July 25, 2022 - August 05, 2022
Joint with: Istituto Nazionale di Alta Matematica Francesco Severi (INdAM)
Location: Courant Institute, New York, NY, United States
Organizers: Sebastien Bubeck (Microsoft Research)

SGS 12: Tropical Geometry
August 01, 2022 - August 12, 2022
Location: St. Mary's College, Moraga, CA, United States
Organizers: Renzo Cavalieri (Colorado State University), Hannah Markwig (Eberhard-Karls-Universität Tübingen), Dhruv Ranganathan (University of Cambridge)

SGS 13: Sums of Squares Method in Geometry, Combinatorics and Optimization
August 01, 2022 - August 12, 2022
Joint with: Banff International Research Station-Okanagan (BIRS)
Location: University of British Columbia, Okanagan, Canada
Organizers: Grigoriy Blekherman (Georgia Institute of Technology), Annie Raymond (University of Massachusetts Amherst), Cynthia Vinzant (University of Washington)

1.6   Other Scientific Workshops

MSRI / SLMath 40th Anniversary Symposium
April 13, 2023 - April 14, 2023
Organizers: Hélène Barcelo (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath)), Charles Fefferman (Princeton University), Dan Freed (University of Texas, Austin), Kristin Lauter (Facebook AI Research (FAIR) North America at Meta), Dusa McDuff (Barnard College), Andrei Okounkov (Columbia University; University of California, Berkeley), Tatiana Toro (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath))

1.7   Education & Outreach Activities

NSF Mathematics Institutes' Modern Math Workshop
October 26, 2022 - October 27, 2022
(cross-listed from section 1.4)
Organizers: Hélène Barcelo (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath)), Philip Hammer (Institute for Mathematical and Statistical Innovation), Christian Ratsch (University of California, Los Angeles; Institute of Pure and Applied Mathematics (IPAM)), Ulrica Wilson (Morehouse College; Institute for Computational and Experimental Research in Mathematics (ICERM))

Critical Issues in Mathematics Education 2023: Mentoring for Equity
March 22, 2023 - March 24, 2023
Organizers: Pamela Harris (University of Wisconsin-Milwaukee), Abbe Herzig (TPSE-Math), Aris Winger (Georgia Gwinnett College), Michael Young (Carnegie Mellon University)

May 12, a Celebration for Women in Mathematics, year 2023
May 12, 2023
(cross-listed from section 1.4)
Organizers: Ini Adinya (University of Ibadan), Masha Albrecht (Berkeley High School), Romina Arroyo (Universidad Nacional de Cordoba), Maria-Grazia Ascenzi (University of California Los Angeles), Mirela Ciperiani (University of Texas, Austin), Donatella Danielli (Arizona State University), Shanna Dobson (University of California, Riverside), Malena Espanol (Arizona State University), Olubunmi Fadipe-Joseph (University of Ilorin), Anna Fino (Università di Torino), Natalia Garcia-Fritz (Pontificia Universidad Católica de Chile), Adi Glucksam (Northwestern University), M.E. Hogan (Texas Tech University), Kuei-Nuan Lin (Pennsylvania State University), Zheng Liu (University of California, Santa Barbara), Liangbing Luo (Lehigh University), Ornella Mattei (San Francisco State University), Julia Plavnik (Indiana University), Palina Salanevich (Universiteit Utrecht), Ramdorai Sujatha (University of British Columbia)

2. Program and Workshop Data

2.1 Program Member List
(See email attachment)

2.2 Program Members Summary

Programs	Distinct Members	Women	%	Minorities*	%	US Home Inst.	%	US Citizens & Perm. Res.
Summer 2022†								
Higher Categories and Categorification, Part Two	45	11	24.4%	3	13.0%	20	44.4%	23
Definability, Decidability, and Computability in Number Theory, part 2	41	15	36.6%	1	5.9%	21	51.2%	17
Complementary Program 2021-22†	5	1	20.0%	1	25.0%	4	80.0%	4
2022-23 Academic Year								
Analytic and Geometric Aspects of Gauge Theory	48	11	22.9%	3	13.0%	32	66.7%	23
Floer Homotopy Theory	50	14	28.0%	1	3.1%	35	70.0%	32
Diophantine Geometry	54	18	33.3%	1	4.0%	34	63.0%	25
Algebraic Cycles, L-Values, and Euler Systems	51	10	19.6%	2	10.5%	29	56.9%	19
Complementary Program 2022-23	15	6	40.0%	0	0.0%	12	80.0%	11
Total # of Distinct Members	**309**	**86**	*27.8%*	**12**	*7.8%*	**187**	*60.5%*	**154**

Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents

†The Complementary Program is year-long and the visits reported here occurred after June 1, 2022 (during this reporting period) but before the start of the 2022-23 complementary program on August 22, 2022. SLMath also hosted two in-person reunions during Summer 2022 for members of programs that were held virtually due to COVID-19.

2.3   Program Members Demographic Summary

Gender	#	%
# of Distinct Members	309	100.0%
Male	214	69.3%
Female	86	27.8%
Other	2	0.6%
Decline to State	7	2.3%
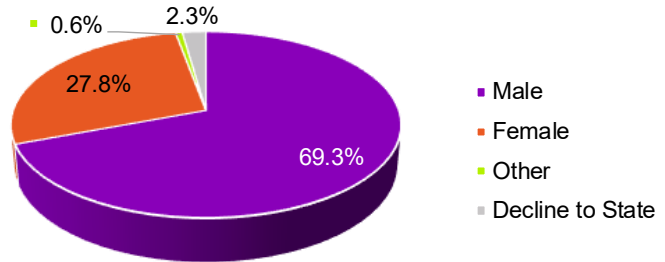
Race/Ethnicity*	#	%
White	180	58.3%
Asian	75	24.3%
Hispanic/Latino	33	10.7%
Black	2	0.6%
Native American	1	0.3%
Pacific Islander	0	0.0%
Decline to State	37	12.0%
Unavailable Info.	0	0.0%
Minorities**	12	7.8%
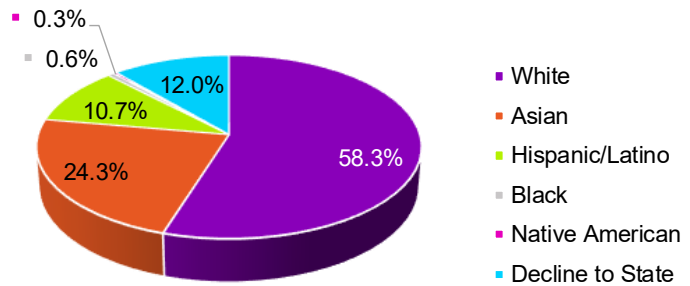
Citizenships	#	%
Foreign Home Inst.	122	39.5%
US Home Inst.	187	60.5%
Foreign Citizens	155	50.2%
US Citizen & Perm. Residents	154	49.8%
US Citizens	136	44.0%
US Permanent Residents	18	5.8%
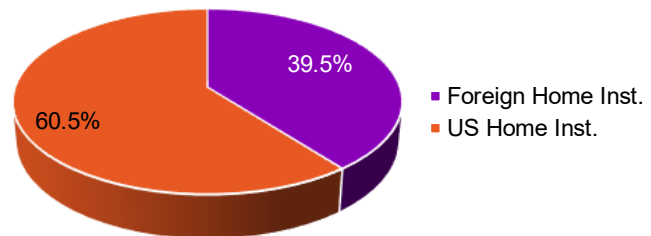
Year of Ph.D	#	%
Prog. Assoc. (GS)	44	14.2%
2021 & Later	32	10.4%
2020	7	2.3%
2015-2019	51	16.5%
2010-2014	58	18.8%
2005-2009	39	12.6%
2000-2004	14	4.5%
1995-1999	19	6.1%
1990-1994	15	4.9%
1985-1989	11	3.6%
1981-1984	9	2.9%
1980 & Earlier	10	3.2%
Total # of Distinct Members	309	100.0%
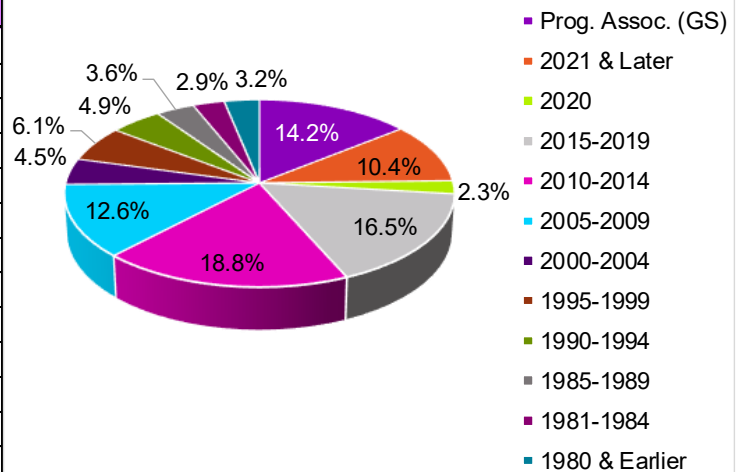
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander.
Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 Program Members Classified by State

State	#	%	2020 Census
South	**41**	**21.9%**	*38.1%*
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	2	1.1%	0.2%
FL	3	1.6%	6.5%
GA	7	3.7%	3.2%
KY	0	0.0%	1.4%
LA	1	0.5%	1.4%
MD	7	3.7%	1.9%
MS	0	0.0%	0.9%
NC	5	2.7%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	2	1.1%	2.1%
TX	11	5.9%	8.8%
VA	3	1.6%	2.6%
WV	0	0.0%	0.5%
West	**58**	**31.0%**	*23.7%*
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	45	24.1%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	2	1.1%	0.3%
NM	0	0.0%	0.6%
NV	1	0.5%	0.9%
OR	8	4.3%	1.3%
UT	0	0.0%	1.0%
WA	2	1.1%	2.3%
WY	0	0.0%	0.2%
Midwest	**32**	**17.1%**	*20.8%*
IA	0	0.0%	1.0%
IL	12	6.4%	3.9%
IN	2	1.1%	2.0%
KS	3	1.6%	0.9%
MI	3	1.6%	3.0%
MN	0	0.0%	1.7%
MO	4	2.1%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	1	0.5%	3.6%
SD	0	0.0%	0.3%
WI	7	3.7%	1.8%
Northeast	**56**	**29.9%**	*17.4%*
CT	2	1.1%	1.1%
MA	21	11.2%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	10	5.3%	2.8%
NY	14	7.5%	6.1%
PA	5	2.7%	3.9%
RI	4	2.1%	0.3%
VT	0	0.0%	0.2%
Other	**0**	**0.0%**	*0.0%*
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	**187**	**100.0%**	*100.0%*
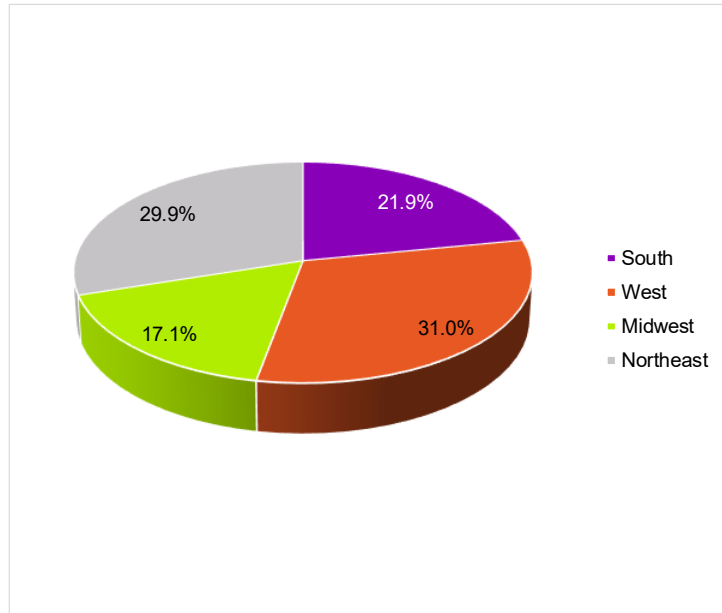
*Regions based on US Census classification

2022-23 Program Members Classified by Countries

Africa			**1**
	West Africa	Senegal	1
Americas			**216**
	North America	Canada	15
		United States	187
	South America	Brazil	1
		Chile	5
	Central America	Mexico	8
Asia			**6**
	East Asia	Japan	3
		China	1
	Western Asia	Israel	2
Europe			**83**
	Northern Europe	Sweden	2
		United Kingdom	25
		Denmark	1
		Ireland	1
	Southern Europe	Portugal	2
		Spain	1
		Greece	1
		Italy	3
	Western Europe	Belgium	2
		France	15
		Germany	24
		Switzerland	3
		Netherlands	1
	Eastern Europe	Czech Republic	1
		Hungary	1
Oceania			**3**
	Australia and New Zealand	Australia	3
Grand Total			**309**

Regions based on United Nations classification

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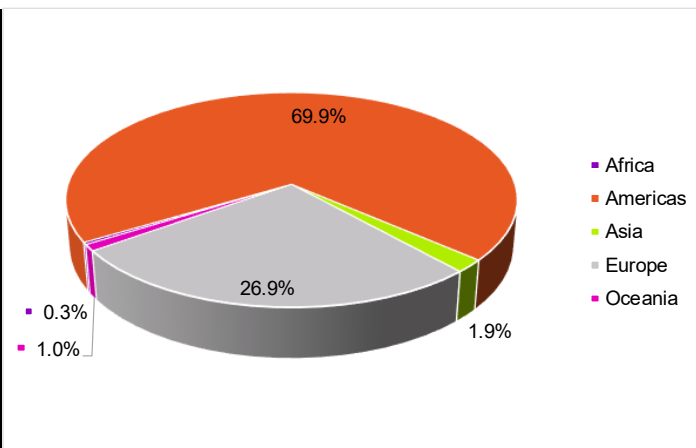
2.4 Workshop Participant List

(See email attachment)

2.5 Workshop Participant Summary†

Workshops	Total Registered	Registered & Participated†	%	Physically Signed In	Total on Zoom*
13 Scientific Workshops					
[HYBRID WORKSHOP] Connections Workshop: Analytic and Geometric Aspects of Gauge Theory	122	81	66%	50	43
[HYBRID WORKSHOP] Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory	196	145	74%	67	116
[HYBRID WORKSHOP] Connections Workshop: Floer Homotopy Theory	218	137	63%	50	86
[HYBRID WORKSHOP] Introductory Workshop: Floer Homotopy Theory	306	208	68%	87	156
[HYBRID WORKSHOP] New Four-Dimensional Gauge Theories	202	143	71%	99	92
[HYBRID WORKSHOP] Floer Homotopical Methods in Low Dimensional and Symplectic Topology	269	175	65%	99	112
Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems	131	89	68%	62	32
Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems	192	149	78%	87	110
Connections Workshop: Diophantine Geometry	119	91	76%	51	43
Introductory Workshop: Diophantine Geometry	188	131	70%	73	69
Shimura Varieties and L-Functions	227	165	73%	107	161
Degeneracy of Algebraic Points	139	104	75%	62	67
MSRI / SLMath 40th Anniversary Symposium	547	210	38%	unavail.	208
All 13 Workshops Total	**2,856**	**1,828**	**64%**	**894**	**1,295**

Workshops	Total Registered	Registered & Participated†	%	Physically Signed In	Total on Zoom*
3 Education & Outreach Workshop					
Critical Issues in Mathematics Education 2023: Mentoring for Equity	217	116	53%	84	51
Modern Math Workshop 2022	216	115	53%	unavail.	unavail.
May 12, a Celebration for Women in Mathematics (2023)	222	91	41%	20	101
All 3 Workshops Total	**655**	**322**	**49%**	**104**	**152**

Workshops	Total Registered	Registered & Participated†	%	Physically Signed In	Total on Zoom*
All 16 Workshops Total	**3,511**	**2,150**	**61%**	**998**	**1,447**

† Includes participants who attended in person and signed in for the workshop, as well as virtual participants who registered and identified themselves on Zoom.

* Includes virtual participants who did not register and/or could not be identified on Zoom. Some individuals participated both in person and via Zoom.

Workshops	Registered Participants†	Women	%	Minorities*	%	US Home Inst.	%	US Citizens & Perm. Res.	%
13 Scientific Workshops									
[HYBRID WORKSHOP] Connections Workshop: Analytic and Geometric Aspects of Gauge Theory	81	27	33.3%	2	5.1%	54	66.7%	39	48.1%
[HYBRID WORKSHOP] Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory	145	36	24.8%	3	5.0%	97	66.9%	60	41.4%
[HYBRID WORKSHOP] Connections Workshop: Floer Homotopy Theory	137	43	31.4%	6	10.9%	99	72.3%	55	40.1%
[HYBRID WORKSHOP] Introductory Workshop: Floer Homotopy Theory	208	55	26.4%	8	9.6%	146	70.2%	83	39.9%
[HYBRID WORKSHOP] New Four-Dimensional Gauge Theories	143	26	18.2%	3	5.3%	92	64.3%	57	39.9%
[HYBRID WORKSHOP] Floer Homotopical Methods in Low Dimensional and Symplectic Topology	175	36	20.6%	6	6.9%	132	75.4%	87	49.7%
Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems	89	26	29.2%	2	5.4%	61	68.5%	37	41.6%
Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems	149	35	23.5%	4	6.9%	97	65.1%	58	38.9%
Connections Workshop: Diophantine Geometry	91	29	31.9%	3	6.3%	73	80.2%	48	52.7%
Introductory Workshop: Diophantine Geometry	131	31	23.7%	4	6.6%	92	70.2%	61	46.6%
Shimura Varieties and L-Functions	165	37	22.4%	5	7.7%	108	65.5%	65	39.4%
Degeneracy of Algebraic Points	104	25	24.0%	4	8.0%	76	73.1%	50	48.1%
MSRI / SLMath 40th Anniversary Symposium	210	56	26.7%	14	11.8%	154	73.3%	119	56.7%
All 13 Workshops Total	**1,828**	**462**	**25.3%**	**64**	**7.8%**	**1,281**	**70.1%**	**819**	**44.8%**

Workshops	Registered Participants†	Women	%	Minorities*	%	US Home Inst.	%	US Citizens & Perm. Res.	%
3 Education & Outreach Workshop									
Critical Issues in Mathematics Education 2023: Mentoring for Equity	116	64	55.2%	35	34.7%	108	93.1%	101	87.1%
Modern Math Workshop 2022	115	52	45.2%	79	79.8%	109	94.8%	99	86.1%
May 12, a Celebration for Women in Mathematics (2023)	91	69	75.8%	3	7.9%	50	54.9%	38	41.8%
All 3 Workshops Total	**322**	**185**	**57.5%**	**117**	**49.2%**	**267**	**82.9%**	**238**	**73.9%**

Workshops	Registered Participants†	Women	%	Minorities*	%	US Home Inst.	%	US Citizens & Perm. Res.	%
All 16 Workshops Total	**2,150**	**647**	**30.1%**	**181**	**17.1%**	**1,548**	**72.0%**	**1,057**	**49.2%**

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

† Includes participants who physically signed in for the workshop, as well as virtual participants who registered and identified themselves on Zoom.

Note that the overall workshop data in section 2.5 is not distinct as some participants attended multiple workshops, but the statistics of individual workshops found in Section 13, Appendix, were calculated on distinct participant data.

2.6   Workshop Participant Demographic Data

2022–23 Workshop Participants Demographic Summary

Gender	#	%
# of Participants	2150	100.0%
Male	1426	66.3%
Female	647	30.1%
Other	19	0.9%
Decline to State	42	2.0%
Unavailable Info.	16	0.7%
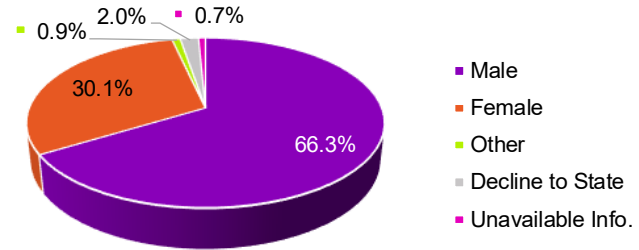
Race/Ethnicity*	#	%
White	938	43.6%
Asian	838	39.0%
Hispanic/Latino	198	9.2%
Black	76	3.5%
Native American	8	0.4%
Pacific Islander	6	0.3%
Decline to State	221	10.3%
Unavailable Info.	16	0.7%
Minorities**	181	17.1%
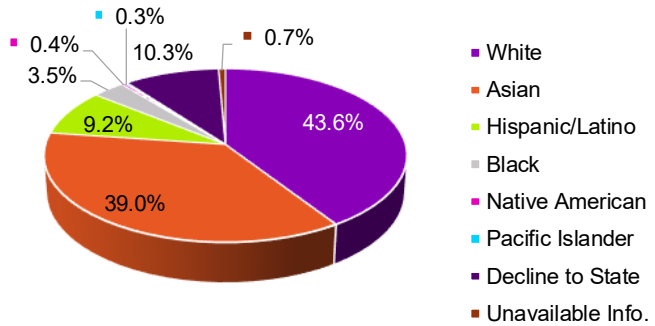
Citizenships	#	%
Foreign Home Inst.	602	28.0%
US Home Inst.	1548	72.0%
Foreign Citizens	1092	50.8%
US Citizen & Perm. Residents	1058	49.2%
US Citizens	927	43.1%
US Permanent Residents	131	6.1%
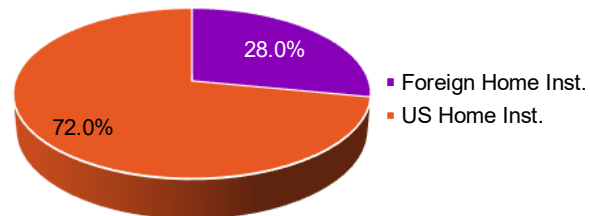
Year of Ph.D.	#	%
No Ph.D.	772	35.9%
2021 & Later	256	11.9%
2020	56	2.6%
2015-2019	278	12.9%
2010-2014	216	10.0%
2005-2009	164	7.6%
2000-2004	83	3.9%
1995-1999	100	4.7%
1990-1994	83	3.9%
1985-1989	36	1.7%
1981-1984	45	2.1%
1980 & Earlier	61	2.8%
Unavailable Info.	0	0.0%
Total # Participants	2150	100.0%
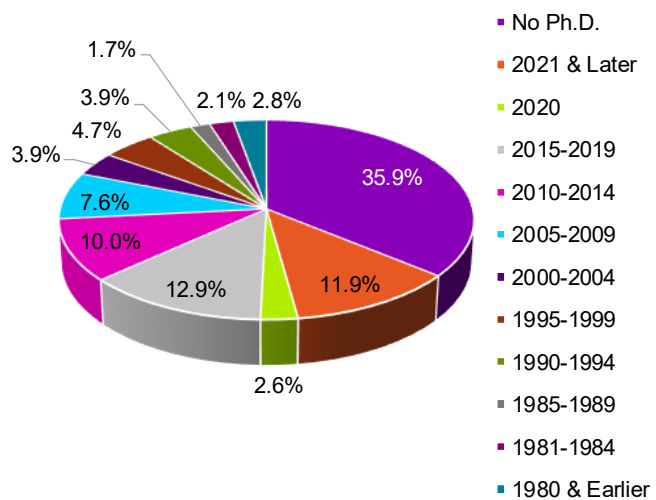
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022–23 Workshop Participants Classified by State

State	#	%	2020 Census
South	**256**	**16.5%**	*38.1%*
AL	4	0.3%	*1.5%*
AR	1	0.1%	*0.9%*
DE	0	0.0%	*0.3%*
DC	4	0.3%	*0.2%*
FL	13	0.8%	*6.5%*
GA	49	3.2%	*3.2%*
KY	2	0.1%	*1.4%*
LA	3	0.2%	*1.4%*
MD	27	1.7%	*1.9%*
MS	0	0.0%	*0.9%*
NC	43	2.8%	*3.1%*
OK	2	0.1%	*1.2%*
SC	0	0.0%	*1.5%*
TN	9	0.6%	*2.1%*
TX	75	4.8%	*8.8%*
VA	22	1.4%	*2.6%*
WV	2	0.1%	*0.5%*
West	**616**	**39.8%**	*23.7%*
AK	2	0.1%	*0.2%*
AZ	17	1.1%	*2.2%*
CA	518	33.5%	*11.9%*
CO	13	0.8%	*1.7%*
HI	1	0.1%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	1	0.1%	*0.6%*
NV	2	0.1%	*0.9%*
OR	37	2.4%	*1.3%*
UT	6	0.4%	*1.0%*
WA	19	1.2%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**202**	**13.0%**	*20.8%*
IA	2	0.1%	*1.0%*
IL	44	2.8%	*3.9%*
IN	16	1.0%	*2.0%*
KS	12	0.8%	*0.9%*
MI	44	2.8%	*3.0%*
MN	15	1.0%	*1.7%*
MO	12	0.8%	*1.9%*
ND	0	0.0%	*0.2%*
NE	5	0.3%	*0.6%*
OH	3	0.2%	*3.6%*
SD	1	0.1%	*0.3%*
WI	48	3.1%	*1.8%*
Northeast	**466**	**30.1%**	*17.4%*
CT	5	0.3%	*1.1%*
MA	174	11.2%	*2.1%*
ME	0	0.0%	*0.4%*
NH	5	0.3%	*0.4%*
NJ	84	5.4%	*2.8%*
NY	125	8.1%	*6.1%*
PA	49	3.2%	*3.9%*
RI	18	1.2%	*0.3%*
VT	6	0.4%	*0.2%*
Other	**8**	**0.0%**	*0.0%*
PR	8	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**1548**	**100.0%**	*100.0%*
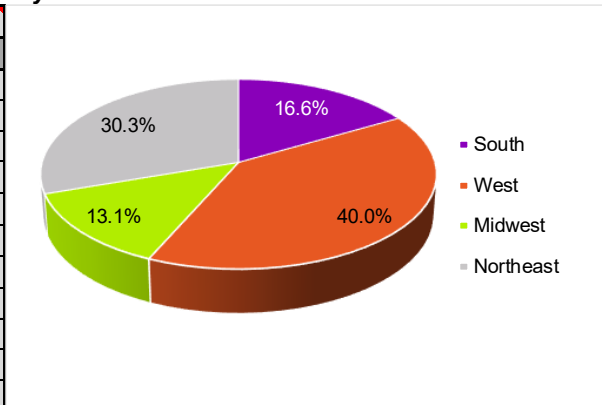
*Regions based on US Census Classification

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2022–23 Workshop Participants Classified by Country

Region	Sub-region	Country	Count
Africa			**15**
	Eastern Africa	Uganda	1
	Middle Africa	Cameroon	2
	Northern Africa	Algeria	3
		Morocco	1
	Western Africa	Nigeria	8
Americas			**1649**
	Central America	Mexico	5
		Panama	2
	North America	Canada	75
		United States	1548
	South America	Argentina	3
		Brazil	3
		Chile	12
		Peru	1
Asia			**136**
	Eastern Asia	China	17
		Japan	40
		Korea, Republic	18
		Macao	1
		Taiwan	1
	South-central Asia	India	38
		Iran	2
		Pakistan	2
	South-eastern Asia	Philippines	2
		Singapore	1
		Thailand	2
		Viet Nam	1
	Western Asia	Israel	8
		Saudi Arabia	1
		Turkey	2
Europe			**339**
	Eastern Europe	Hungary	3
		Poland	2
		Romania	1
	Northern Europe	Denmark	6
		Ireland	7
		Norway	2
		Sweden	4
		United Kingdom	114
	Southern Europe	Croatia	1
		Italy	11
		Portugal	5
		Serbia	1
		Spain	13
	Western Europe	Belgium	4
		France	64
		Germany	85
		Netherlands	5
		Switzerland	11
Oceania			**11**
	Australia & NZ	Australia	5
		New Zealand	2
	Micronesia	Guam	4
Unavailable Info.			**0**
Grand Total			**2150**

- 0.5%
- 0.7%
- 15.8%
- 6.3%
- 76.7%

Legend:
- Africa
- Americas
- Asia
- Europe
- Oceania
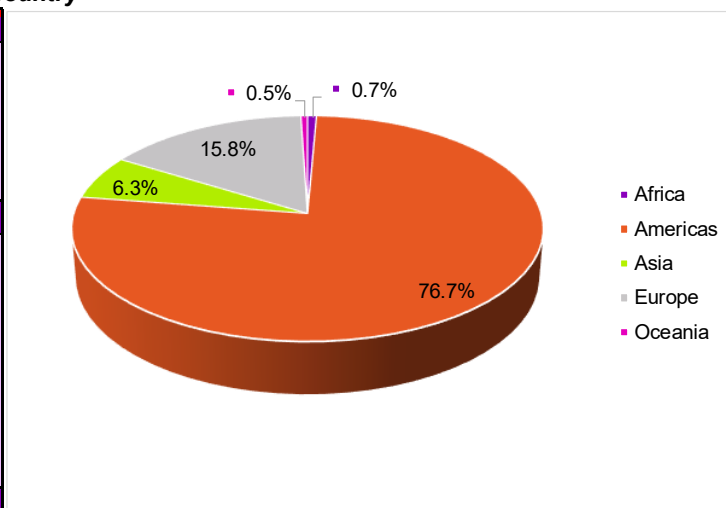
*Regions based on United Nations classification

2.7   Program Publication List
(Uploaded to NSF Public Access Repository)

3.   Postdoctoral Program

3.1   Description of Activities

The postdoctoral program at SLMath is central to our mission to promote continued excellence in mathematical research as well as to develop mathematical talent and cultivate a sense of belonging and engagement among members of the mathematical community. Each semester, SLMath's programs bring together experts from all over the world to discuss developments in some of the most exciting areas of fundamental mathematics. The union of established experts from across career stages with talented Postdoctoral Fellows provides an idyllic atmosphere for recent Ph.D. recipients to forge quality, lasting relationships with notable researchers who work in their particular research area.

Thoughtfully structured mentoring activities and procedures ensure that each Fellow is well-integrated and able to derive as much benefit from the programs as possible. Senior researchers meet weekly with their postdoctoral mentee to gauge and promote their progress during the program and are responsible for: discussing the research interests of the mentee and, often, beginning research collaborations together; advising the mentee on selecting research projects, writing, and publishing their research; advising the mentee on grant opportunities; and introducing the mentee to other senior researchers. In order to increase the visibility of their research within the program, all Post-doctoral researchers give a 5-minute talk concerning their research interests at the beginning of the program, as well as deliver an hour-long talk during a regular program seminar within the first half of the program. Fellows in SLMath's programs routinely form productive and lasting collaborations with other program members, publish and start new projects, and explore new research directions.

During the 2022-23 academic year, SLMath selected 28 postdoctoral scholars with research interests in the program areas. They were funded by SLMath's NSF core grant; a grant from the NSA; and private sources. Private funding sources include grants from an anonymous philanthropist, as well as Vincent Della Pietra, Stephen Della Pietra, and Dusa McDuff. Additional private funding was provided through SLMath's Berkelamp, Donoho, Gamelin, Huneke, and Viterbi Endowments for postdoctoral fellows.

Of the 28 Postdoctoral Fellows at SLMath, 8 (29%) were women, 5 (18%) were U.S. Citizens or Permanent Residents, and 19 (68%) came from a US institution. The program organizers were extremely satisfied with the Postdoctoral program and believed that it was by all accounts an enormous success.

Here are additional details on the Postdoctoral Fellows for each program:

Analytic and Geometric Aspects of Gauge Theory

Name: Arunima Bhattacharya
Year of Ph.D: 2019
Institution of Ph.D.: University of Oregon
Dissertation title: Regularity of fourth and second order nonlinear elliptic equations.
Ph.D. advisor: Micah Warren

Bhattacharya, Arunima

Mentor while at MSRI: Rafe Mazzeo

Pre-MSRI Institution: University of Washington, Seattle
Position at that institution: Postdoctoral Scholar
Mentor: Yu Yuan

Post-MSRI institution: University of North Carolina, Chapel Hill
Position: Tenure Track Assistant Professor
Anticipated length: Tenure track

Postdoctoral fellow's comments:

I had a wonderful experience learning new topics in gauge theory by attending amazing talks and through discussions with other members of the program.

I gave a talk on the Lagrangian mean curvature equations at the Gauge Theory seminar.

I completed a research project jointly with Jacob Bernstein and we wrote a paper on Colding-Minicozzi Entropies in Cartan Hadamard Manifolds. The preprint is now available on the arXiv.

I worked on a joint project with Rafe Mazzeo: the existence of conical special Lagrangian submanifolds of a singular Calabi-Yau manifold whose tangent cone touches the conic vertex of its ambient Calabi-Yau manifold.

I started a new research project with Rafe Mazzeo that is based on a certain version of renormalized area and the Allen Cahn functional.

Did you find your experience at MSRI beneficial? Why or why not?

I greatly benefited from the stimulating environment of MSRI.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

A big benefit of my experience at MSRI/SLMath was that it helped me to get to know the U.S. Number Theory community. Before coming to MSRI/SLMath, I had always been based in Europe and therefore my contact with the U.S. community had been rather limited. I also profited a lot from the facilities at MSRI/SLMath that are just perfect for mathematical research (both individual and in collaborations).

The mentorship model has also worked well for me: I have met with Scanlon regularly and discussed both mathematical research (one of my current research projects constitutes a kind of complement to some recent work of his) as well as the various challenges surrounding research and an academic career (e.g., he gave me advice on how to deal with having a paper under review for a long time without receiving any referee report).

The MSRI/SLMath staff has been very nice and helpful, making everything from housing to the visa application to the lunches go smoothly. I want to single out especially Linda Riewe, the librarian, who has provided a higher quality of service than I have experienced at any institution in my career so far.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I was not on the job market during my stay at MSRI.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was happy with the hybrid format. It gave me the flexibility to attend some talks virtual. I did not form any collaborations with virtual participants, mostly because I had a lot of other projects going on. I am not aware of any drawbacks. I think it was overall beneficial to have a hybrid format. I have no suggestions for improvement, everything was great.

Habibi Esfahani, Saman

Name: Saman Habibi Esfahani
Year of Ph.D: Graduated in the August of 2022

Institution of Ph.D.: Stony Brook University
Dissertation title: Monopoles, Singularities and Hyperkähler Geometry
Ph.D. advisor: Sir Simon Donaldson

Mentor while at MSRI: Jason Lotay

Pre-MSRI Institution: Stony Brook University
Position at that institution: Graduate student

Post-MSRI institution: Duke University
Position: Research assistant professor (postdoc)
Anticipated length: 1.5 Years
Mentors: Robert Bryant and Mark Haskins

Postdoctoral fellow's comments:

I really enjoyed my time and experience here at MSRI. It allowed me to focus on my research more than usual, mainly because I did not need to teach. Some of my projects progressed quite a lot here. I uploaded a paper on arxiv during my stay (mainly based on parts of my PhD thesis), and another paper is almost ready.

I started working on a joint project with Akos Nagy, Lorenzo Foscolo, and Goncalo Oliveira here, where Lorenzo Foscolo, and Goncalo Oliveira were staying at MSRI for a the program, and Akos Nagy was attending the gauge theory conference.

Did you find your experience at MSRI beneficial? Why or why not?

The fact that many experts in the field are here has been quite beneficial to me. The opportunity to discuss math with others who think about similar problems is quite rare, since usually in a university, there are not maybe people who would work on the same field. Here there were maybe 20 other mathematicians who were working on the subjects which I study. In particular, I really enjoyed the opportunity to talk to Rafe Mazzeo, Jason Lotay, and Thomas Walpuski during the semester.

Also, I gave two talks here at MSRI. One in the gauge theory conference and another one in the "What is ..? Seminar", which I think helped me to advertise my work more. Moreover, I had the pleasure to have Jason Lotay write a short biography of me for "The Emissary", which I think would be good for my CV and just getting more attention. Furthermore, in the process of making a video for MSRI, George Paul Csicsery did a short interview with me, which I quite enjoyed.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Well, I already had a postdoc offer from Duke University for 3 years, so I am not on the market at the moment, but I am sure it will be helpful for the future, since I got to know many people, and advertise my work in many ways. For instance, some people (who I met here) already invited

me to give a talk in their institutions during this and next semester. For instance, I will give a talk at UC Santa Barbara tomorrow in their differential geometry seminar.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was here during the whole program and attended talks and events in person, but I think it is quite good that there was the option of attending the talks online.

Holdt, Maximilian

Name: Maximilian Holdt
Year of Ph.D: 2022
Institution of Ph.D.: University of Kiel
Dissertation title: Hyperkähler Metrics on the Moduli Space of Weakly Parabolic Higgs Bundles
Ph.D. advisor: Hartmut Weiß

Mentor while at MSRI: Laura Fredrickson

Pre-MSRI Institution: University of Kiel
Position at that institution: Research Assistant
Mentor: Hartmut Weiß

Post-MSRI institution (or company): to be determined
Position: to be determined

Postdoctoral fellow's comments:

While at the MSRI I enjoyed participating in the program Analytic and Geometric Aspects of Gauge Theory. I had the opportunity to talk with different experts in the field about the possibilities of applying the construction of Hyperkähler metrics I developed in my Ph. D. Thesis towards other moduli spaces of Higgs bundles. In particular I was able to finish the work on a problem which arose out of my thesis concerning the equality of two differently constructed Hyperkähler metrics on the moduli space of Higgs bundles. I plan to publish this result along with the main results from my thesis in a single paper later on.

Another research topic I worked on was the jumping behavior of certain WKB curves on higher genus surfaces. These thoughts will be subject of future research.

I also started looking into other parts of gauge theory, specifically Seiberg Witten theory, to see how it relates to the things I already worked and where the current interests lie. This may be important for my career later on as I plan to broaden my mathematical horizon.

Finally I want to stress that the weekly meetings with my mentor Laura Fredrickson were very helpful in deciding which problems could be of interest for future research. Also she had very helpful advice concerning possible future career developments and I really enjoyed the overall mentoring experience.

Did you find your experience at MSRI beneficial? Why or why not?

The experience at MSRI was very beneficial as it allowed me to talk to many different people in and outside of my specific research field about future directions of that research. Most of all it was very helpful to have the uninterrupted time to focus on my own research ideas. Also it was very helpful to be able to talk to professors as well as other Postdocs about career development.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I think the fellowship was helpful for one as it helped me establish contact to different people with whom collaborations in the future might be possible. Also it allowed me to further develop my work with which I can apply for upcoming positions.

Another important aspect was the opportunity to hear from many different current leaders in the field about what they expect from someone who applies for a position at their institute. Also they gave very helpful advice concerning the current obstacles and opportunities in the job market.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I did follow some of the talks during the workshops and the rest of the program in person, and some talks I followed online. I think it was very helpful to always be able to switch between both forms as it allowed for more flexibility and better organization of different meetings. I did not collaborate with virtual participants as I was able to talk to everyone in person at the institute. Still I think that it is quite beneficial to have the opportunity to switch to virtual correspondence at any given time because schedules can be more flexible in this way.

The only problem I see with virtual participation concerns social gatherings. These are more complicated to have with virtual participation and it is rarely tried. So I think it might be possible to try this in the future by e. g. having tea time or movie nights or similar things on certain dates in a joint virtual environment.

Name: Xuesen Na

Year of Ph.D: 2022
Institution of Ph.D.: University of Maryland College Park
Dissertation title: Limiting Configurations for the SU(1,2) Hitchin Equation
Ph.D. advisor: Richard Wentworth

Mentor while at MSRI: Laura Schaposnik

Pre-MSRI Institution: University of Maryland College Park
Position at that institution: Postdoc
Mentor: Laura Schaposnik

Post-MSRI institution: University of Illinois Urbana-Champaign
Position: Postdoc
Anticipated length: 3 years
Mentor: Steven Bradlow

Postdoctoral fellow's comments:

I discussed with Prof. Laura Fredrickson on the topic of asymptotic geometry of SL(n,C) Hitchin moduli space as well as for certain real forms of SL(n,C). In particular, we discussed how to apply and extend the work of my dissertation to study asymptotic geometry in these contexts and I learned more details of her earlier work as well as the notion of special Kahler metric and relation between semi-flat metric and the construction of Gaiotto-Moore-Neitzke.

I also discussed with Prof. Laura Schaposnik on the topic of spectral data. Together with Laura Fredrickson, we discussed the potential of a project focusing on sub-integrable systems in Hitchin moduli spaces motivated by a recent paper by Hitchin.

I also discussed with Laura Schaposnik various aspects of the on-going collaboration with Johannes Horn and the possible project to describe singular G-Hitchin fiber using the language of our collaboration work.

Na, Xuesen

I also discussed with Laura Schaposnik and Richard Wentworth and made some progress on describing the generic SU(1,n) Hitchin fiber with n>2, extending my thesis work.

Lastly, I participated in collaborative work with Prof. Rafe Mazzeo and Dr. Siqi He on the compactification of rank two Hitchin moduli space, where some part of my thesis work on limiting configuration is useful.

Did you find your experience at MSRI beneficial? Why or why not?

I found my experience at MSRI to be extremely beneficial. It has offered a tremendous boost in terms of establishing new connections, with knowledge of current topics in the field and by socializing as an early career mathematician to the community. This has helped me regain some of the lost momentum due to long period of isolation during the pandemic.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

The fellowship will certainly help me in the future to look for tenure-track or non tenure-track position. The most direct effects include establishing collaboration and connections, and getting potential recommendation letters. I also had the opportunity to get very useful suggestions on the application process from various faculty members as well as postdocs.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I attended talks via zoom multiple times, both during the main workshops and for weekly program workshops. This has been rather beneficial since I live far away from the campus and the commute time is sometimes rather long. I have interacted with members at MSRI only in-person, but I have been keeping contact with outside collaborators using zoom. If possible I would still prefer in-person format but I agree that it is beneficial to have both format available (in addition to video online). One possible improvement is to also have zoom access (or online video) for the Q&A (for gauge theory program), with the participants' consent. Some of the answers there could be very useful but it has been hard to keep note while having lunch sometimes.

Parker, Greg

Name: Greg Parker
Year of Ph.D: 2022
Institution of Ph.D.: MIT
Dissertation title: Gluing Z_2-Harmonic Spinors on 3-Manifolds
Ph.D. advisor: Tomasz Mrowka and Clifford Taubes

Mentor while at MSRI: Prof. Thomas Walpuski

Pre-MSRI Institution: MIT
Position at that institution: Graduate Student
Mentors: Tomasz Mrowka and Clifford Taubes

Post-MSRI institution: Stanford University
Position: Szego Assistant Professor of Mathematics
Anticipated length: 3 years
Mentor: Rafe Mazzeo

Postdoctoral fellow's comments:

While at MSRI I have been able to participate in an immense number of seminars on topics very closely related to my work. In addition to these research seminars, there have also been more basic seminars (the "what is" seminar, the question session, the arXiv review) which have been immensely helpful. I have had a role in organizing the latter of these two, and have been able to present at all three. I have also begun collaborations with several other members of the program(s) that I hope will continue into the future.

Did you find your experience at MSRI beneficial? Why or why not?

Yes the experience at MSRI has been incredibly beneficial for my own research. The opportunities to ask various experts small questions on an everyday basis has saved time and given me a lot of perspective and context for my own work. It has also come as a welcome relief after my graduate student years were spent mostly in isolation during the pandemic with nobody to converse with.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Too early to say. I had my next position secured already when I accepted the MSRI position. I think the connections I have made at the program will be extremely valuable applying to future positions because I am familiar with many of the leaders in the field who can both advocate for me at various institutions or write compelling recommendations on my behalf.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was not personally a fan of the hybrid format for several reasons. I found that overwhelmingly the hybrid format simply provided an excuse for people to stay home from MSRI and participate virtually rather than attend in person. In fact, many times I observed seminars that were better attended virtually form people sitting in their office upstairs than by those who were willing to make the 50 foot trip to the seminar room. I felt this dynamic detracted from the benefit of having so many people gathered in one place and prevented forging many connections by in person interactions that otherwise would've been had. Granted, the hybrid format allowed people to participate who were only able to attend the program for a portion of the semester due to duties at their home institution, but I found participation in this capacity rarely generated conversation (people would attend with cameras off and not give questions or comments). I would recommend in future that virtual participation be limited in a way that would encourage/compel people to actually leave their offices and interact with the people in the building, since stimulating such interaction is one of the main purposes of the program.

Rezaee, Fatemeh

Name: Fatemeh Rezaee
Year of Ph.D: 2020
Institution of Ph.D.: University of Edinburgh
Dissertation title: Stability, Hilbert Scheme and PT Moduli of Genus Four Curves and Failure of the MMP/Wall-Crossing Correspondence
Ph.D. advisor: Prof. Arend Bayer

Mentor while at MSRI: Prof. Richard Wenthworth

Pre-MSRI Institution: University of Edinburgh
Position at that institution: Research fellow

Post-MSRI institution: University of Cambridge
Position: Fellow
Anticipated length: three years
Mentor: Prof. Mark Gross

Postdoctoral fellow's comments:

I've had various scientific experiences during this semester:
1) My primary field of research lies in algebraic geometry and the reason that I participated in this program was that I wanted to connect the field that I am expert in to different fields taking advantage of the opportunity

that many experts in differential geometry and gauge theory are around. I got to talk to several people in the program, sharing ideas and getting some ideas on how to make progress on the projects that I had in mind. Not only did I get ideas from talking with senior members of the program, but also I got to discuss various interesting problems with other postdocs and younger research members as well.

2) I've been discussing some research directions with young researchers in both parallel problems at MSRI; I'm certain that these discussions will lead to new collaborations with them on some interesting problem connecting algebraic geometry to gauge theory and symplectic geometry.

3) I've been working on a couple of papers which started previously, and I came up with very interesting ideas which uses combinatorial methods in some enumerative and computational problems related to some long standing problems in algebraic geometry. My suggested methods reinterpret and reformulate the problems in the combinatorics language. I am not an expert in combinatorics, but I was lucky [because] in the Complementary program at MSRI, there were experts in combinatorics and I got to discuss these [methods] with them and benefited from their help.

Did you find your experience at MSRI beneficial? Why or why not?

Of course, my experience at MSRI has been beneficial: being surrounded by experts who are working in different research areas than my primary research area gave me the chance to interact with them and discuss problems that are interesting from different points of views. On the other hand, MSRI's viable atmosphere is always inspiring to work independently as well as collaboratively. I learned how to discuss with mathematicians who use different mathematical languages and how to apply tools from other areas in my research.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Of course, this fellowship provided an excellent scientific and career trajectory. I already have another postdoctoral fellowship right after MSRI, and having all these experiences and fellowships in different continents will help me to get an academic permanent job. Also, having experience in different research areas in my case (thanks to this fellowship which provided me with the opportunity to be in a differential geometric program which is not directly related to my research area) will also be impressive from the point of view of employment in academia, which will make finding a permanent job easier, I believe.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I occasionally participated in some seminars remotely (I mostly attend the events in person). Although this hybrid format is very practical for attending seminars/workshops, I think interacting with in-person participants remotely still needs more work in a way that it's not just getting the questions from the online audience and maybe giving them longer time after the talk to be around. It is of course beneficial to have both online/virtual participants, but collaborating with virtual participants is a bit hard to imagine, however, this can be improved in the future if the online participants can also participate in less formal events rather than just the formal workshops/seminars.

Schulz, Sebastian

Name: Sebastian Schulz
Year of Ph.D: 2022
Institution of Ph.D.: The University of Texas at Austin
Dissertation title: Nilpotent Higgs bundles and families of flat connections
Ph.D. advisor: David Ben-Zvi and Andrew Neitzke (now Yale)

Mentor while at MSRI: Marina Logares

Pre-MSRI Institution: The University of Texas at Austin
Position at that institution: PhD student

Post-MSRI institution: Johns Hopkins University
Position: Postdoc
Anticipated length: 5 semesters
Mentors: Ibrahima Bah, Nitya Kitchloo

Postdoctoral fellow's comments:

My research concerns objects known as "Higgs bundles", and their study is tightly linked to many areas of mathematics, including Algebraic and Differential Geometry, Gauge Theory, Geometric Representation Theory, Mathematical Physics and more. I found the atmosphere at MSRI very vibrant and was exposed to many ideas and techniques in the broader area of gauge theory, and was able to get a better understanding of the similarities and differences to the narrower field within which I work, thanks to the many great seminars and conversations that were possible on a daily basis. While here, I continued working on projects that I have started before arriving, and have also began a collaboration with Richard Wentworth concerning "Real opers", who feature prominently in a novel

analytic formulation of the Geometric Langlands Program, and have started to look into a project joint with Saman Habibi concerning a relationship between G2 manifolds and Higgs bundles.

Did you find your experience at MSRI beneficial? Why or why not?

I found it very beneficial! As a young postdoc it was a great opportunity for me to meet many of the leading experts in the field, learn about open problems and ideas about how to tackle them, and to find advice both mathematically and professionally.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I definitely think so. Many important researchers in my field have gotten to know me better, and I think that these personal relationships are important for professional development. Moreover, I assume that collaborations with some of the members of this program will happen naturally, with the first step having been laid by our day-to-day interactions here at MSRI.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I participated almost exclusively in person but assume that the hybrid format was very convenient for the many people who had no other way to attend. I did not have many interactions with the virtual participants, and am unfamiliar with the format in which they were able to interact with other participants for example during the breaks of the workshop. I think that the hybrid format is beneficial because it creates more options to participate, though I was under the impression that the virtual attendees could be integrated better (I have no concrete recommendations for improvement).

Name: Max Zimet
Year of Ph.D: 2019
Institution of Ph.D.: Stanford University
Dissertation title: BPS STATES FROM GEOMETRY AND GEOMETRY FROM BPS STATES
Ph.D. advisor: Shamit Kachru

Mentor while at MSRI: Lorenzo Foscolo

Pre-MSRI Institution: Harvard University
Position at that institution: Postdoctoral fellow

Post-MSRI institution: Stanford University
Position: Postdoctoral scholar
Anticipated length: 9 months
Mentor: Rafe Mazzeo

Postdoctoral fellow's comments:

A main benefit of being here for me was getting to meet a lot of mathematicians and be exposed to the main problems that various fields were working on. As I am switching from physics to math, that was quite useful for me. I mostly focused on work with Andras Vasy at Stanford that I had initiated before this semester. It was also extremely valuable for me to be able to give a talk during the conference here, both so that mathematicians could learn what I was up to and converse with me about it, and so that I could gain experience (and feedback) from giving a math talk.

Did you find your experience at MSRI beneficial? Why or why not?

Yes, for the reasons described above. Fantastic working environment — quiet, nice office, lots of people around that I can discuss things with.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes — I got to meet people, gained experience giving a talk, was exposed to what more people are working on, and made progress in research.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Not very much virtual stuff — I was busy enough with in person things. But it was helpful to have conference talks recorded so that I could watch them at my leisure.

Floer Homotopy Theory

Name: Shaoyun Bai
Year of Ph.D.: 2022
Institution of Ph.D.: Princeton University
Dissertation title: Invariants from Equivariant Transversality in Sympletic Topology and Some Results on the Rouquier Dimension of Wrapped Fukaya Categories
Ph.D. advisor: John Pardon

Bai, Shaoyun

Mentor while at MSRI: Mohammed Abouzaid

Pre-MSRI Institution: Princeton Univerisity
Position at that institution: Graduate student
Mentor: John Pardon

Post-MSRI institution: Simons Center for Geometry and Physics, Stony Brook
Position: Postdoctoral Associate
Anticipated length: 1 semester

Postdoctoral fellow's comments:

During my stay at the MSRI, I participated in several learning groups and research seminars, from which I learned a lot about current status of various flavors of Floer homotopy theory, as well as classical knowledge of algebraic topology which will surely [play] an important role in Floer theory in the near future.

I continued my ongoing collaboration with another postdoc here: Mohan Swaminathan. We have obtained a compelling conjectural picture of bifurcation theory of embedded J-holomorphic curves in Calabi—Yau 3-folds.

Together with my mentor Mohammed Abouzaid, we have made decisive progress on constructing complex-bordism valued Gromov—Witten invariants. Such a theory is expected to play a fundamental role on the symplectic side of Floer homotopy theory.

Lastly, I completed the writing of the joint manuscript with Guangbo Xu "Arnold Conjecture over Integers", which solves a longstanding problem in symplectic topology.

Did you find your experience at MSRI beneficial? Why or why not?

I certainly find the experience at MSRI very beneficial. Except the progress I have made on my current and past projects, I found it very helpful to talk to other members of MSRI. MSRI provided a unique opportunity that gathers together many leading experts in the field. I got a chance to meet them in person and share my ideas with them. Knowing others and getting known by others will certainly benefit my role in the research community in the future.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I don't have a definitive answer to this question. I will join SCGP next spring and Columbia next fall. This plan has been fixed before my visit to

MSRI. I won't be on the tenure-track job market very soon, so it's hard to tell If my fellowship offered by MSRI will improve the outcome of my job hunting later.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I participated in all the activities in person at MSRI if possible, except when I needed to travel elsewhere sometime in between. I think the hybrid form is quite helpful in general because such a form provides those who couldn't travel to MSRI with a chance to attend my events virtually. I didn't collaborate with any virtual participants. Possibly because of the lack of chance to talk to people in a comprehensive way, it's hard for me to imagine how to start a collaboration with someone I meet online. Nevertheless, I think the MSRI should still continue the hybrid form because it will allow more people to benefit from the high-quality talks presented at MSRI. I don't have any concrete suggestion on how to improve the experience.

Klang, Inbar

Name: Inbar Klang
Year of Ph.D: 2018
Institution of Ph.D.: Stanford University
Dissertation title: Factorization theory of Thom spectra, twists, and duality
Ph.D. advisor: Ralph Cohen

Mentor while at MSRI: Michael Mandell

Pre-MSRI Institution: Columbia University
Position at that institution: Ritt Assistant Professor
Mentors: Andrew Blumberg / Mohammed Abouzaid

Post-MSRI institution:
 Columbia University (postdoc)
 Vrije Universiteit Amsterdam (tenure-track)
Position:
 Ritt Assitant Professor (Columbia)
 Assistant Professor (VU Amsterdam)
Anticipated length:
 one semester (Columbia)
 tenure-track (VU Amsterdam)
Mentors: Andrew Blumberg / Mohammed Abouzaid (Columbia)

Postdoctoral fellow's comments:

My semester at MSRI was very productive. I gave a 5-minute talk and 3 full-length talks, two at workshops and one at a learning seminar. I also gave a 12-minute answer to a question at a workshop's question session. I refereed two papers.

For my own research, I worked on revising two papers (both revisions are nearly done) and started a new collaboration with Teena Gerhardt. I have also had many illuminating conversations with other members of the program, some of which have been very beneficial for my own work.

Sheel Ganatra, Mona Merling, and I have talked several times about generalizations of Hochschild homology relevant to both homotopy theory and symplectic geometry.

Anna Marie Bohmann, Tye Lidman, and I have had several conversations about Seiberg-Witten Floer spectra and how they might fit into the framework of bicategorical traces.

My mentor, Michael Mandell, was incredibly helpful: I learned a lot about his and Andrew Blumberg's work on equivariant norms via factorization homology, and he helped me resolve an issue in one of my own papers.

Did you find your experience at MSRI beneficial? Why or why not?

Absolutely! It was very productive, and I had excellent mentorship and many illuminating conversations.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I received my offer from VU Amsterdam in July, before the program began. However, I am sure that having been selected as an MSRI postdoc was a point in my favor during the application process.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I mostly participated in person, as that was what I had been missing the most during the lockdown years. I appreciated the COVID precautions (particularly masking, testing while that ran, and eating outside), but the ban on visitors was a bit too strict. I'm sure many of us could have benefitted from having collaborators visit us.

Name: Abhishek Mallick
Year of Ph.D:2021
Institution of Ph.D.: Michigan State University
Dissertation title: Involutions and Heegaard Floer homology
Ph.D. advisor: Matthew Hedden

Mentor while at MSRI: Kristen Hendricks

Pre-MSRI Institution: Max Planck Institute of Mathematics, Bonn
Position at that institution: Research member
Mentor: Arunima Ray

Post-MSRI institution: Rutgers University, New Brunswick
Position: Hill assistant professor
Anticipated length: 2.5 years
Mentor: Kristen Hendricks

Postdoctoral fellow's comments:

This semester at MSRI was an amazing experience. I have benefited immensely from talking to various other members present here and by attending many seminars.

During this time I have posted the following paper in Arxiv "Rank-expanding satellites, Whitehead doubles, and Heegaard Floer homology" which was joint with Irving Dai, Matthew Hedden (also a member at the Institute) and Matthew Stoffregen. This project involved studying a curious property of the action of the satellite operators on the knot concordance group.

In this semester I have also worked on multiple projects, which are still ongoing. Some of them are with collaborators outside the Institute and some with the members. More specifically, I have worked with:

1) Maciej Borodzik, Irving Dai, and Matthew Stoffregen regarding equivariant surfaces and Khovanov homology.

2) Antonio Alfieri, Irving Dai, and Masaki Taniguchi (a member in the Institute) regarding an involutive theory for filtered Instanton Floer homology.

3) Masaki Taniguchi and Hakuto Konno (both are members) regarding corks and family Seiberg-Witten Theory.

Projects 2) and 3) in the above were initiated from the ideas that originated during my discussions with various members of the Institute.

Did you find your experience at MSRI beneficial? Why or why not?

Yes, this experience was extremely beneficial for me. As noted above I have had the opportunity to directly interact with many of the leaders in my field of research. These conversations have guided much of my research. Also I have initiated multiple exciting projects during my tenure here with members that were not my collaborator in the past. This would have been impossible without SLMath inviting me and many other mathematicians who were in residence for this semester. I will continue to foster these collaborations and I am really grateful to SLMath for giving me an opportunity to be a part of this. This semester has truly accelerated my research. I sincerely hope that I will get the opportunity to participate in other SLMath programs in the future.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Not currently, since my immediate position was determined before this semester, but I am sure being a recipient of this prestigious fellowship from SLMath will be looked upon favorably for my future endeavors.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I did participate in many of the talks virtually. However there was not much of a discussion with the virtual audience. Making the talks available over zoom was certainly beneficial. Also the recording of the talks are quite helpful.

Mukherjee, Anubhav

Name: Anubhav Mukherjee
Year of Ph.D: 2022
Institution of Ph.D.: Georgia Institute of Technology
Dissertation title: On embeddings of 3-manifolds in symplectic 4-manifolds
Ph.D. advisor: John B. Etnyre

Mentor while at MSRI: Ciprian Manolescu

Pre-MSRI Institution: Georgia Institute of Technology
Position at that institution: PhD student
Mentor: John B. Etnyre

Post-MSRI institution: Princeton University
Position: Instructor
Anticipated length: 3 years

Mentor: Peter Ozsvath

Postdoctoral fellow's comments:

It was a very nice experience overall. I was able to write this paper on exotic embeddings of 3-manifolds in 4-manifolds: arxiv.org/abs/2210.05029

Did you find your experience at MSRI beneficial? Why or why not?

Yes, discussing math with other people was a very pleasant experience for me. I am able to learn many new and interesting topics in Math. Hopefully, in future, I will able to write some papers using those ideas.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I am not sure.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The virtual part was beneficial. In particular, when I missed some talks, I can always go back and check the recordings and learn.
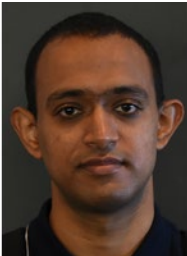
Swaminathan, Mohan

Name: Mohan Swaminathan
Year of Ph.D.: 2022
Institution of Ph.D.: Princeton University
Dissertation title: New results in the analysis of pseudo-holomorphic curves
Ph.D. advisor: John Pardon

Mentor while at MSRI: Ivan Smith

Pre-MSRI Institution: Princeton University
Position at that institution: Ph.D. student
Mentor: John Pardon

Post-MSRI institution: Stanford University
Position: Szego Assistant Professor
Anticipated length: 3 years
Mentor: Yakov Eliashberg, Eleny Ionel

Postdoctoral fellow's comments:

During my fellowship, in addition to the main workshops and program seminars (of both FHT and GT programs), I also participated in learning seminars such as Floer homotopy foundations seminar and Homotopy computations and applications seminar (giving a talk in the former). I also gave a talk in the FHT program seminar describing some recent work carried out joint with Amanda Hirschi (a program associate in the FHT program during November 2022). This work resulted in a paper, which will be posted on arXiv by next week.

During my time at MSRI, I also worked on my collaboration with Shaoyun Bai (a postdoc in the FHT program with whom I shared my office) on the topic of counting embedded curves in Calabi-Yau 3-folds and we have made progress on tackling some cases that were beyond the reach of our previous joint work.

Did you find your experience at MSRI beneficial? Why or why not?

My experience at MSRI was definitely very beneficial. In addition to furthering my own work and attending seminars, I got a chance to interact with many leading experts in my area who were in residence as part of the FHT program. It was very nice to be able to just walk up to someone's office with a "silly" question and get it answered rather quickly (or at least get helpful suggestions or hints). I also had several interesting mathematical discussions with people in the GT program and benefited from their insights and intuition for some of the research problems I'm currently working on or plan to think about in the near future.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Perhaps not immediately since my next round of applying for jobs is still about 2 years away. However, I'm sure that the mathematical contacts I've made during my stay here will be very useful when looking for collaborators when I find new problems to work on and also finding letter-writers during the next job application phase of my career.

Please comment on your experience with the hybrid format of the program.Did you virtually participate in program activities? Did you collaboratewith virtual participants? Why or why not? What were the benefits and/ordrawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I attended some of the MSRI talks on Zoom and I think the hybrid format works well with the highlight being the fact that online participants can hear the questions being asked by the live participants and also ask questions themselves (either verbally or in writing).

My collaboration with Amanda Hirschi (a program associate in the FHT program during November 2022) was mostly virtual except for the month

that she was in residence at MSRI. This worked quite well though it was definitely better to be able to meet and discuss in person.

I think it was beneficial to have a virtual element, in addition to the in-person element, since some speakers at the workshops didn't travel to MSRI and we got a chance to listen to them via livestream and also some participants were able to be at MSRI only for part of the semester.

Name: Melissa Zhang
Year of Ph.D: 2019
Institution of Ph.D.: Boston College
Dissertation title: Localization for Khovanov homologies
Ph.D. advisor: J. Elisenda Grigsby and David Treumann

Mentor while at MSRI: Liam Watson

Pre-MSRI Institution: University of Georgia
Position at that institution: Limited Term Assistant Professor
Mentor: Dave Gay

Post-MSRI institution: UC Davis
Position: Krener Assistant Professor
Anticipated length: 2.5 years
Mentor: Eugene Gorsky

Postdoctoral fellow's comments:

This semester, I've made connections with experts in the field, met new people, and was exposed to a lot of new ideas that tie together emerging ideas in my field and adjacent fields. I also worked on existing collaborations, posted a paper on the arXiv, started two new collaborations, ran a learning seminar, spoke at a board meeting, and prepared an NSF grant application.

Did you find your experience at MSRI beneficial? Why or why not?

My experience was certainly beneficial. Mathematically, I have both received new ideas and also shared my ideas. I have had the time and ability to focus on finishing up projects, including a grant application; it was helpful to get feedback in-person from kind and supportive experts like Lisa Traynor. I've also connected as a person with more people, and I suspect that these connections will be most beneficial, going forward.

My mentor, Liam, was also super helpful in guiding me and cheering me on; it's been really nice to get to know him much better, because I really like the math that he does. When I apply for tenure-track jobs again in a year, I'm thinking I might ask him for a reference letter.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

The fact that more people know me and my work now will certainly be helpful; furthermore, I also believe that the honor of having spent a semester as a named postdoc at MSRI/SLMath will also help my career.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The hybrid format helped me when I wanted to attend just part of a talk and then decide whether it was worth staying; in these cases, I joined virtually. I also enjoyed having virtual participants in the learning seminar and in other seminars. I didn't collaborate with virtual participants; it's just much easier to start collaborations in-person, and then move to virtual meetings, and I've had many more opportunities to talk to people in-person this semester.

Algebraic Cycles, L-Values, and Euler Systems
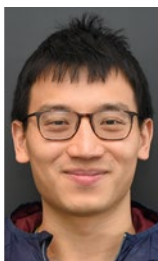
Name: Tony Feng
Year of Ph.D: 2019
Institution of Ph.D.: Stanford
Dissertation title: Etale Steenrod Operations and the Artin-Tate Pairing
Ph.D. advisor: Akshay Venkatesh

Mentor while at MSRI/SLMath: Michael Rapoport

Pre- MSRI/SLMath Institution: UC Berkeley
Position at that institution: Assistant Professor

Post-MSRI/SLMath institution: UC Berkeley
Position: Assistant Professor
Anticipated length: Tenure track

Feng, Tony

Postdoctoral fellow's comments:

I attended all the conferences and regularly attended the ES Research seminar, the ES learning seminar, the DG learning seminar. I occasionally attended the Euler System lectures and DG research seminars. I worked on projects with Ben Howard and Wei Zhang. I discussed potential research projects with Ziyang Gao, Gyujin Oh, Romyar Sharifi, Zhiyu Zhang. I also discussed some problems with Michael Rapoport, Tonghai Yang, Chao Li, and Qiao He.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Yes.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

No, I already had a permanent position.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I attended some events virtually. This was okay but not as good as attending in-person because only one blackboard could be captured at any time, which made things more difficult to follow. The microphone box helped although it was not always used.

Fornea, Michele

Name: Michele Fornea
Year of Ph.D: 2019
Institution of Ph.D.: McGill University
Dissertation title: On twisted triple products and the arithmetic of elliptic curves.
Ph.D. advisor: Henri Darmon and Adrian Iovita

Mentor while at MSRI/SLMath: Shouwu Zhang

Pre- MSRI/SLMath Institution: Columbia University
Position at that institution: Simons Junior Fellow/ Postdoctoral Research Scientist
Mentor: Michael Harris

Post-MSRI/SLMath institution: CRM Barcelona
Position: MdM-CRM Postdoctoral Fellow
Anticipated length: 2 years
Mentor: Marc Masdeu

Postdoctoral fellow's comments:

During my fellowship I participated in all the seminars organized by the ES program as well as some of those offered by the DioG program. Attending these seminars allowed me to gain new insights and perspectives on Euler Systems and some basic understanding of the various topics that were included in the Diophantine Geometry program.

During the semester I was able to make some progress on my research projects. Specifically, I finished a paper titled "Plectic Jacobians" which is a first step towards an Archimedean construction of plectic Heegner points using plectic Hodge theory.

I also began working on a new article with Henri Darmon titled "Mock Plectic Invariants". This project has been particularly exciting as it unifies my recent work on plectic Stark-Heegner points with Henri's theory of mock Hilbert modular surfaces.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

My experience at MSRI/SLMath has been extremely positive. The stay has rekindled my love for mathematics after the isolation I experienced in my previous postdoctoral position. Being surrounded by other mathematicians with similar interests and passions was a refreshing change.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I believe that the fellowship has helped and will help me in finding a permanent academic position. First of all because it revived my motivation and drive to do research, and second because it expanded my network which I expect will be a valuable asset when it will be time to find a tenure-track job.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I participated virtually only a couple of times. I appreciated the convenience to attend events when indisposed, however virtual interactions are not as effective for me to build new relationships as in-person interactions.

The experience at MSRI has been essentially perfect, I would only suggest updating the drinking fountain on the second floor.

Negrini, Isabella

Name: Isabella Negrini
Year of Ph.D: 2022
Institution of Ph.D.: McGill University
Dissertation title: A Shimura-Shintani correspondence for rigid cocycles of higher weight
Ph.D. advisor: Henri Darmon

Mentor while at MSRI/SLMath: Tonghai Yang

Pre- MSRI/SLMath Institution: University of British Columbia
Position at that institution: Research Postdoctoral Fellow
Mentor: Vinayak Vatsal

Post-MSRI/SLMath institution: University of Toronto
Position: Postdoctoral Fellow
Anticipated length: 2 years
Mentor: Stephen Kudla

Postdoctoral fellow's comments:

I met my mentor (T. Yang) once a week and we are currently looking for a project to work on together. I met with my PhD advisor (H. Darmon) every week and I got many inputs for future directions. I met my remote collaborator V. Vatsal weekly, we are currently writing a preprint. I met A. Pozzi weekly, in person and remotely, and we intend to work on a project together.

A new idea that V. Vatsal and I had, with significant input from H. Darmon, was how to evaluate additive rigid cocycles at RM points. We are writing our preprint on that.

I learnt about rigid cocycles for orthogonal groups reading with A. Pozzi the new paper which appeared about the topic. A. Pozzi asked me to join her to work on a project on rigid cocycles and families of modular forms this Fall.

I learnt about the Kudla program from many talks and from my mentor.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

I found it beneficial for getting to know new people. However, the amount of activities was overwhelming (even if one was following only [a] few of them).

A suggestion I have is to not do learning seminars. Indeed, as postdocs we would prefer to give a research talk to present our work, rather than giving a learning seminar. We felt a bit pressured to participate in a learning

seminar, but that was not feasible given that we were too busy with the many activities and meetings, so we had no time to learn and present a new topic in detail.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I already had my next job before starting the MSRI one. However, I hope that the networking that I did here will lead to new collaborations (e.g. whith Alice Pozzi, Tonghai Yang), which should help developing my research program.
Similarly, I learnt a lot from Henri Darmon, and this math knowledge should be helpful in writing new papers.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The hybrid format was crucial for me, as I have an invisible disability which impairs my auditory processing. This means that I do not benefit from in person seminars, the only way to get something out of them is to watch the recording and keep pausing it. Some speakers kindly sent recordings to me even if they didn't post them online.

I also often had Zoom meetings with other participants (when they were at MSRI or at their home), which was very helpful for me. The benefits are many, like the possibility to record and the ability to work from home. In my case this is important because I need a quiet environment to avoid distractions and multitasking, as my disability causes issues with task switching.

I also went to MSRI several days a week, because some participants don't like Zoom meetings. However those days were not productive for me and left me distracted and with a very scattered attention. However, I recognize that the only way to network is to show up in person.

I think hybrid events should continue, because several people benefit from joining remotely (people with disabilities, people with children, etc.).
An improvement could be to provide a Zoom link (and recording) for the "What is...?" seminar. Indeed, I had to follow it in person, but unfortunately could not get much out of it.
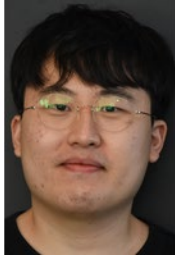
Name: Gyujin Oh
Year of Ph.D: 2022
Institution of Ph.D.: Princeton University
Dissertation title: Arithmetic of higher coherent cohomology of Shimura varieties
Ph.D. advisor: Christopher Skinner, Akshay Venkatesh

Mentor while at MSRI/SLMath: Henri Darmon

Pre- MSRI/SLMath Institution: Columbia University
Position at that institution: J. F. Ritt Assistant Professor (Postdoc)

Post-MSRI/SLMath institution: Columbia University
Position: J. F. Ritt Assistant Professor (Postdoc)
Anticipated length: 3 years

Oh, Gyujin

Postdoctoral fellow's comments:

The experience [at] MSRI has been extremely valuable to me. I have met numerous new people through this program. I started to think about at least 4 new research problems (on transcendental number theory, Griffiths conjecture for local systems, Sharifi's conjecture for GSp_4 and U(2,1), and dimension of weight one cusp forms) thanks to the interactions I had here, where one of them is being considered in a collaborative effort with other members.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Yes, firstly because I could meet many new people that I only had known through their papers in my field, but also because I could connect to people in the areas that are not directly in my research to open up the possibilities of new research directions.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, through connections I built here.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I did participate in some of the talks virtually. I, unfortunately, had no chance to meet with people who were participating virtually. It was simply impossible for me to interact with them, as there was no social activity involving virtual participants. It is great to have the flexibility of virtual

elements (such as broadcasting all the talks on Zoom), which I enjoyed whenever I had to stay at my place, but participating in the whole program virtually seems a bit pointless to me.

Name: Óscar Rivero Salgado
Year of Ph.D: 2021
Institution of Ph.D.: Universitat Politècnica de Catalunya.
Dissertation title: Arithmetic applications of the Euler systems of Beilinson--Flach elements and diagonal cycles.
Ph.D. advisor: Victor Rotger

Mentor while at MSRI/SLMath: Ellen Eischen
Pre-MSRI/SLMath Institution: University of Warwick
Position at that institution: Newton International Fellow (postdoc)
Mentor: David Loeffler

Post-MSRI/SLMath institution: Universidade de Santiago de Compostela (to be officially confirmed)
Position: Anticipated length: Tenure-track position

Postdoctoral fellow's comments:

During my fellowship at MSRI, I had the opportunity to engage deeply with the exciting and rapidly-evolving field of algebraic cycles, L-values, and Euler systems. Over the course of the semester, I attended numerous seminars, workshops, and colloquia, all of which exposed me to a wide range of cutting-edge research in this area. I was particularly struck by the depth and diversity of perspectives on offer, and I came away with a renewed appreciation for the richness and complexity of the questions being studied.

In addition to attending talks, I also had the chance to interact with a number of other postdoctoral fellows, as well as with the many distinguished researchers who were in residence at MSRI during my stay. I found these conversations to be incredibly stimulating, as they challenged me to think deeply about my own research and to consider new approaches and perspectives that I might not have otherwise encountered.

I would like to highlight the different papers on which I have been working on, emphasizing the different collaborations that emerged here:
- p-adic L-functions for GSp4xGL2. With David Loeffler (organizer of my program), we continued a collaboration that we had begun during my postdoc at Warwick, finishing the writing of two papers where we use the new ideas on higher Hida theory to construct a p-adic L-functions for GSp4xGL2.

- Hirzebruch--Zagier cycles and anticyclotomic Iwasawa theory. With Raúl Alonso (graduate student that attended one of the conferences during the semester), Francesc Castella (research member) and Michele Fornea (postdoc) we continued a previous collaboration whose aim is to construct an anticyclotomic Euler system for the Asai Galois representation using the geometry of Hirzebruch--Zagier cycles. We could interact with experts in the field that gave us key ideas to overcome certain difficulties that had appeared in early stages of the project. We hope to finish this paper soon.
- An R=T theorem with Gamma_1 level structure. The previous summer, I had participated at a collaborative workshop in Oregon, in which a group of six researchers had been working together about questions regarding congruences between modular forms and their interpretation in terms of Hecke algebras and Galois deformation rings. Three of us (Catherine Hsu, Alice Pozzi and myself) were in residence at MSRI most of the program, and this was extremely beneficial for the development of our project.
- A p-adic Harris--Venkatesh Conjecture. With Alice Pozzi (research member) we started a collaboration whose aim was the formulation and proof of a p-adic Harris--Venkatesh conjecture, building on my previous work about the arithmetic of critical Eisenstein series.
- A factorization formula for Siegel modular forms. With Kazim Büyükboduk (research professor) we started a long-term collaboration whose aim is to gain some insight about the factorization of p-adic L-functions attached to GSp4xGL2xGL2 using the theory of Selmer complexes.

Overall, my fellowship at MSRI was an immensely rewarding experience, and I feel that I gained a great deal from it both personally and professionally. I am grateful to the organizers of the program for their support and encouragement, and I look forward to continuing to engage with the vibrant community of scholars that I had the privilege to be a part of during my time in Berkeley.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Overall, I found my experience at MSRI to be highly beneficial. The program provided me with a unique opportunity to engage with some of the leading researchers in my field, to learn about the latest developments in algebraic cycles, L-values, and Euler systems, and to explore new mathematical ideas and techniques. In particular, I was able to attend and give talks on my own research, which helped me to refine my ideas and to receive feedback from a broad range of experts in the field. Moreover, I was able to start several new projects with collaborators I met during the

program, which I believe will be highly impactful in the coming years. Finally, the program (and the overlapping with the other semester in Diophantine Geometry) helped me to expand my mathematical horizons by exposing me to a wide range of research areas that I might not have encountered otherwise.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, I do feel that my fellowship at MSRI will help me with finding a future position. In fact, I have informally accepted a tenure track job, and I believe that my experience at MSRI played a significant role in my successful job search. While the fact that I was selected for the fellowship was certainly viewed favorably by the hiring committee, I think the greatest impact will be the long-term benefits that the program has provided me with. Specifically, I believe that the ideas and collaborations that I developed during my time at MSRI will enable me to produce high-quality research and make meaningful contributions to the field in the years to come, which will help me to build a strong academic career.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

While I appreciate the effort to incorporate hybrid elements into the program, I personally found that the vast majority of the activities were conducted in person. As such, I did not have much experience with virtual participation or collaboration with virtual participants. However, I do think that it was a good idea to offer remote participation options for those who were unable to attend in person, and I imagine that this was particularly helpful for individuals who were interested in attending talks remotely. Overall, while the hybrid format did not play a significant role in my own experience, I believe that it was beneficial to have both in-person and virtual elements, as this allowed the program to be more inclusive and accessible to a wider range of participants.
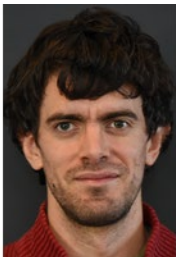
Name: Matteo Tamiozzo
Year of Ph.D: 2019
Institution of Ph.D: University of Duisburg-Essen
Dissertation title: On the Bloch-Kato conjecture for Hilbert modular forms
Ph.D. advisor: Massimo Bertolini

Mentor while at MSRI/SLMath: Christopher Skinner

Tamiozzo, Matteo

Pre- MSRI/SLMath Institution: University of Warwick
Position at that institution: postdoc
Mentor: David Loeffler

Post-MSRI/SLMath institution: University of Warwick
Position: postdoc
Anticipated length: until August 2023
Mentor: David Loeffler

Postdoctoral fellow's comments:

I worked on the redaction of the paper "Ihara's lemma for quaternionic Shimura varieties" (joint with Ana Caraiani). I also started a project on the construction of Selmer classes for elliptic curves. This grew out of a new idea I had at the beginning of my stay at MSRI, which I developed throughout the semester; I gave a talk on the outcome in the research seminar of the Euler Systems program. I discussed with Luca Dall'Ava, who was at MSRI during two workshops, regarding computations related to this project (which will probably be part of an appendix to the resulting paper). I also benefitted from discussions on the subject with Henri Darmon and Christophe Cornut, both at MSRI during the semester.
Finally, I gave a talk during the lecture series on Euler systems, and I was one of the organizers of the Career Development Seminar.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

The opportunity to interact with many people working on L-functions and related topics was beneficial, and made the overall MSRI experience enriching and stimulating. Some of the talks I attended were also very interesting and well done, and I greatly appreciated the resources in the MSRI library.

On the other hand, writing Mathematics was very hard for me throughout the semester. One/two weeks without events would have helped me focus more on the writing process.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I obtained a permanent position as associate professor in France while I was staying at MSRI. The above-mentioned project started at MSRI made my job application stronger. I also benefitted from support, discussions and comments with colleagues at MSRI while preparing my application. Furthermore, for my job interview I greatly benefitted from a comment from Sierra Sutherland.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I only participated in virtual activities when MSRI was closed due to a storm. I personally prefer to attend talks in person. I did not collaborate with virtual participants, as I very much prefer in-person interaction to discuss Mathematics. The possibility of having Zoom talks was useful in specific occasions, for instance to invite speakers from far away in the Career Development Seminar. It was also useful to minimize the impact of COVID.
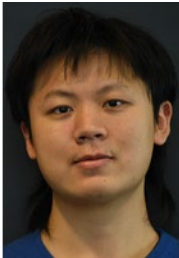
Name: Zhiyu Zhang
Year of Ph.D: 2022
Institution of Ph.D.: Massachusetts Institute of Technology
Dissertation title: Arithmetic transfers, modularity of arithmetic theta series and geometry of local-global Shimura varieties at parahoric levels
Ph.D. advisor: Wei Zhang

Mentor while at MSRI/SLMath: Ben Howard

Pre- MSRI/SLMath Institution: Massachusetts Institute of Technology
Position at that institution: Graduate Student

Postdoctoral fellow's comments:

It's fantastic! I learnt a lot from lectures and discussions. I collarborated/discussed with people here e.g. Andre Mihatsch, Daniel Disegni, Boya Wen, Tony Feng, Daniel Wang, Weixiao Lu, Qiao He, Tonghai Yang, Wei Zhang and Michael Rapoport. I began to do more geometric things in function fields, realize the correct level to work with may not be parahoric levels, doing generalizations of arithmetic fundamental lemmas, pullback formulas of Hecke correspondences, computing orbital integrals and local densities. I learned a lot and hope to produce a lot during the summer.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Very beneficial. I met a lot of experts in the area, and discovered new fundamental things to work on.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, the postdoctoral fellowship gave me a chance to [get to] know lots of experts and different mathematical ideas. This will encourage me to write more papers on my discoveries.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities?

I didn't really virtually participate in program

Did you collaborate with virtual participants? Why or why not?

No, as I don't know them well.

What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I believe it is beneficial to have virtual elements. Eventually, our discussions will continue after the program by zoom.

<u>Diophantine Geometry</u>

Baldi, Gregorio

Name: Gregorio Baldi
Year of Ph.D: 2020
Institution of Ph.D.: University College London
Dissertation title: Shimura varieties, Galois representations, and motives
Ph.D. advisor: Prof. Andrei Yafaev

Mentor while at MSRI/SLMath: Prof. Shou-Wu Zhang

Pre- MSRI/SLMath Institution: IHES
Position at that institution: Postdoc
Mentor: E. Ullmo (informally)

Post-MSRI/SLMath institution: IHES
Position: Postdoc
Anticipated length: 7 months (after that I'll have a CNRS position: assistant professor without teaching duties)

Postdoctoral fellow's comments:

While staying at the SLMath/MSRI I attended several talks and conferences from both programs that have definitely made my knowledge broader. I have discussed several ideas with E. Ullmo, A. Cadoret, D. Urbanik, B. Klingler (with whom I am currently collaborating), but also S. Zhang, W. Zhang, G. Grossi, M. Fornea, and D. Loeffler. Currently I am trying to finish five papers: one on mapping class groups, two on

representations of complex hyperbolic lattices (joint with N. Miller, M. Stover and E. Ullmo), one on a new Zilber-Pink take on G-bundles (joint with D. Urbanik) and finally one on the Chabauty method (with Cadoret and Ullmo). I have been working on several of the above papers for a while, but made important progress on at least a couple of them while I was here. The very last paper on Chabauty originated entirely here, based on a new idea I had while discussing related projects with my collaborators. I hope to finish all of them by the end of the solar year.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Very beneficial, mostly for the reason I mentioned above: I had the opportunity to be exposed to different areas of math and meet many collaborators as well as other mathematicians I only knew by fame.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I was offered a permanent position in March 2023 (CNRS), while I held the fellowship. I think that the fellowship helped my search for a permanent position, since it showed that many mathematicians [from] all over the world were interested in what I was doing.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I think the most important part was to meet people in person, and I was glad that many people came to the MSRI.
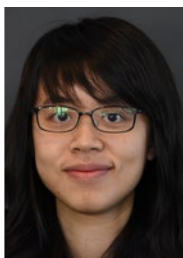
Name: Stephanie Chan
Year of Ph.D: 2020
Institution of Ph.D.: University College London
Dissertation title: On the 2-part of class groups and Diophantine equations
Ph.D. advisor: Andrew Granville

Mentor while at MSRI/SLMath: Mirela Çiperiani

Pre- MSRI/SLMath Institution: University of Michigan
Position at that institution: Postdoctoral Assistant Professor
Mentor: Wei Ho

Post-MSRI/SLMath institution: Institute of Science and Technology Austria
Position: Postdoc

Chan, Stephanie

Anticipated length: 2 years
Mentor: Tim Browning

Postdoctoral fellow's comments:

I started working on a collaboration with Irmak Balcik, Yuan Liu and Bianca Viray on extensions parameterized by superelliptic curves. I am also working on generalizing my previous work on the distribution of integral points in families of elliptic curves.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

I found my experience beneficial. It's an exceptional opportunity to be around experts in the field for an extended period of time. I learned about new research close to my area. I think this will lead to future collaborations.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes. I feel that the connections I made during this semester will be useful in the future. My research network will broaden my research program.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I mostly participated in person. I find participating in person more effective. It's a convenient option to have when it's not possible to be there in person, but it's difficult to get to know other participants who were not physically around. I think it's good to keep the virtual option available because some participants might have other commitments or constraints that prevent them from coming in person.

Name: Gabriel Andreas Dill
Year of Ph.D: 2019
Institution of Ph.D.: Universität Basel
Dissertation title: Unlikely intersections with isogeny orbits
Ph.D. advisor: Philipp Habegger

Mentor while at MSRI/SLMath: Thomas Scanlon

Pre- MSRI/SLMath Institution: Leibniz Universität Hannover
Position at that institution: Post-doc
Mentor: Ziyang Gao

Dill, Gabriel Andreas

Post-MSRI/SLMath institution:
      Leibniz Universität Hannover
      Universität Bonn
Position:
      Post-doc (Leibniz U.)
      Substitute professor (U. Bonn)

Anticipated length (or specify if tenure-track):
      4 months (Leibniz U.)
      2 years (U. Bonn)
Mentor:
      Ziyang Gao (Leibniz U.)
      N/A (U. Bonn)

Postdoctoral fellow's comments:

During the first month of my fellowship, I started a new collaboration with Sara Checcoli, who was a research member at MSRI/SLMath. During our time together at MSRI/SLMath, we already wrote a draft of one joint paper about a Galois property of fields generated by the torsion of an abelian variety over a number field. We also started a second joint project with the goal of making at least partial progress towards a conjecture of Rémond about lower bounds for heights in the case of elliptic curves. After my time at MSRI/SLMath, I will visit Checcoli in June in Grenoble to finish our first joint paper and to continue our collaboration. I am very grateful to MSRI/SLMath for this - without MSRI/SLMath, this collaboration would never have existed!

During my fellowship, I have also continued pre-existing collaborations with Fabrizio Barroero, Francesco Campagna, and Harry Schmidt, the latter two of whom both visited MSRI/SLMath at some point during my fellowship. Campagna's visit in March was especially productive in that we managed to solve the so-called modular support problem over finite fields - this was a question that we had already been thinking about for some time, but had been unable to make any progress on before. Also in this case, a draft of the paper was essentially written during our time together at MSRI/SLMath and we are now preparing it for publication.

At the beginning of March, I travelled to Arizona to serve as a project assistant at the Arizona Winter School. This was a great opportunity for me to meet many people in the U.S. Number Theory community and it was much easier to travel there from Berkeley than from Germany where I had been based previously.

At the end of March, I had the opportunity to give a talk called "Arithmetic Unlikely Intersections in Split Semiabelian Varieties (or: the Deeper Meaning of 1, 1, 4, 25, 11, 153664, ...)" on joint work in progress with

Francesco Campagna in the research seminar of the Diophantine Geometry program. During and after the talk, I received valuable feedback on this project from David Masser and Michael Stoll.

In April, I spent some time explaining Habegger's proof of the Bogomolov property for fields generated by the torsion of elliptic curves over Q to my office mate Wanlin Li, another post-doctoral fellow, who had generalized a result of Elkies that Habegger had used in his proof and was wondering about possible applications of it. I also remember answering several questions of Tangli Ge, also a post-doctoral fellow, at various points throughout the program. In this way, my time at MSRI/SLMath has been an opportunity for me not only to learn new mathematics from other people, but also to teach mathematics to other people that was new for them.

Another research member with whom I have regularly spoken about research, especially now towards the end of my fellowship, is Lars Kühne - while it is not yet clear whether our discussions will lead to a joint paper, I have definitely learnt a lot from them and some new ideas have come from them as well (whose final value and outcome is yet to be determined).

I'd like to end by mentioning one non-mathematical activity that I greatly enjoyed during my time at MSRI/SLMath: early during my stay, I bought a violin that I will donate to MSRI/SLMath at the end of my stay. I then regularly played duets for violin and piano with François Charles, using the piano in MSRI/SLMath's lecture hall. I hope that the violin will bring joy to many future mathematicians at MSRI/SLMath, both players and listeners!

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

A big benefit of my experience at MSRI/SLMath was that it helped me to get to know the U.S. Number Theory community. Before coming to MSRI/SLMath, I had always been based in Europe and therefore my contact with the U.S. community had been rather limited. I also profited a lot from the facilities at MSRI/SLMath that are just perfect for mathematical research (both individual and in collaborations).

The mentorship model has also worked well for me: I have met with Scanlon regularly and discussed both mathematical research (one of my current research projects constitutes a kind of complement to some recent work of his) as well as the various challenges surrounding research and an academic career (e.g., he gave me advice on how to deal with having a paper under review for a long time without receiving any referee report).

The MSRI/SLMath staff has been very nice and helpful, making everything from housing to the visa application to the lunches go smoothly. I want to single out especially Linda Riewe, the librarian, who has provided a higher quality of service than I have experienced at any institution in my career so far.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I feel like it has. It has certainly increased my personal network and hopefully my visibility within the mathematical community. The career development panels as well as the discussions with Scanlon, my mentor, have given me interesting and varied perspectives on the process of hiring and publishing. I feel that this will be useful when applying for jobs in the future.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Personally, I always attended talks either in person or not at all and I did not start any new collaborations with virtual participants (however, I of course continued pre-existing collaborations virtually with people not at MSRI/SLMath). I cannot remember any opportunity to interact with virtual participants during my stay at MSRI/SLMath from which such a collaboration might have arisen.

To give an example of a benefit of the hybrid format (in my opinion): Xinyi Yuan, whose visa had been denied, could give a virtual talk instead of an in-person one. His talk was very interesting and it would have been a shame if he hadn't been able to give it. To give an example of a drawback of the hybrid format: to me, it seemed that in almost every talk, some people in residence at MSRI/SLMath would still only participate virtually instead of in-person, often with their camera turned off as well. I do not want to denounce anybody, but to me, this seems to defeat the purpose of the program. It might help if participants were encouraged to participate in-person if they can.

Generally, it seems to me that the hybrid format is useful if participants are for some reason (such as an illness or a denied visa) unable to participate in-person, but that in-person participation provides a much better experience for everybody if it is possible. However, it is certainly also beneficial that the talks are livestreamed and recordings of them are put online if the speaker agrees to it - this has allowed several people from Europe to watch my talk, either live or later afterwards.

Ge, Tangli

Name: Tangli Ge
Year of Ph.D: 2022
Institution of Ph.D.: Brown University
Dissertation title: Uniform Mordell—Lang plus Bogomolov
Ph.D. advisor: Dan Abramovich

Mentor while at MSRI/SLMath: Emmanuel Ullmo

Pre- MSRI/SLMath Institution: Princeton University
Position at that institution: Postdoctoral research associate
Mentor: Shou-Wu Zhang

Post-MSRI/SLMath institution: Princeton University
Position: Instructor
Anticipated length: 3 years
Mentor: Shou-Wu Zhang

Postdoctoral fellow's comments:

My overall experience at MSRI is enjoyable and fruitful. I have met many mathematicians here. The passion in math from them has great influence on me. During the fellowship, I learned much knowledge from the experts both through talks and personal encounters. I have some ideas on what other people are doing in the different areas and it makes me excited to see all the connections in math. One idea I obtained during my visit is a reinterpretation of Vojta's method.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Yes, of course. The most important thing is to get to know many peers and mathematicians here. It is great to know people with a similar mathematical taste. My mentor Professor Ullmo is very nice and knowledgeable. The semester was too short for me to get used to the life here and get to feel at home. But I still value the experience very much.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes. Because I have acquired new knowledge and learned what to do in the future. Also, I got to know many mathematicians.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I like the idea of having both options. Sometimes I only wanted to attend part of the talk, because I am not in that area and it is very likely the talk

would be beyond my scope very soon. Attending virtually allows me to do that without potentially influencing the speaker. I do hope that questions can be asked and answered using microphones in the future, so that the virtual audience can also be involved.
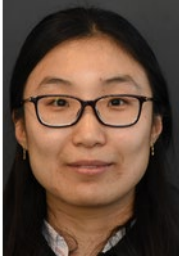
Li, Wanlin

Name: Wanlin Li
Year of Ph.D: 2019
Institution of Ph.D.: University of Wisconsin-Madison
Dissertation title: Frobenius Action on Jacobians of Curves over Finite Fields
Ph.D. advisor: Jordan Ellenberg

Mentor while at MSRI/SLMath: Jacob Stix
Pre- MSRI/SLMath Institution: Washington University in St. Louis
Position at that institution: Assistant Professor

Post-MSRI/SLMath institution: Washington University in St. Louis
Position: Assistant Professor
Anticipated length: tenure-track

Postdoctoral fellow's comments:

I attended all the workshops in the Diophantine geometry program and some talks in the Euler system program. I attended many seminar talks and career development activities. I had many productive conversations with my mentor Jacob Stix on the structure of the fundamental group. I worked on the paper "Positive density of primes of ordinary reduction for abelian varieties of simple signature" joint with CANTORAL FARF ́AN, MANTOVAN, PRIES, AND TANG.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

I found the experience at MSRI very beneficial. I had many stimulating conversations with researchers in my own research area. I learnt a lot of math through the seminars. I also benefited a huge amount from the career development panels.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

N/A

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or

drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I virtually participated in some seminar talks when other constraints prevent me from attending in person and I benefited from the hybrid format.

Name: David Urbanik
Year of Ph.D: 2022
Institution of Ph.D.: University of Toronto
Dissertation title: Algebraic Cycle Loci at the Integral Level
Ph.D. advisor: Jacob Tsimerman

Mentor while at MSRI/SLMath: Mark Kisin

Pre- MSRI/SLMath Institution: IHES
Position at that institution: Postdoctoral Researcher

Post-MSRI/SLMath institution: IHES
Position: Postdoctoral Researcher
Anticipated length: 2 years

Urbanik, David

Postdoctoral fellow's comments:

I had the pleasure of speaking to numerous colleagues in my area. One paper was completed, entitled "Existence and Density of Typical Hodge Loci". Two to three additional papers stemming from discussions and ideas originating at the MSRI are in progress.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

I found it beneficial because it allowed me to connect to other researchers in my area who I otherwise would not have the chance to meet.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I believe it has helped, because it allowed me to make myself and my work more broadly known to other researchers who may in the future help with finding employment.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

In my experience, almost every event had an in person component, and I only attended events in person.
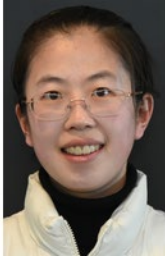
Name: Boya Wen
Year of Ph.D: 2022
Institution of Ph.D.: Princeton University
Dissertation title: Harmonic Analysis on Local Systems on Graphs -- Towards a Gross-Zagier Formula on CM-cycles over Shimura Curves
Ph.D. advisor: Shou-Wu Zhang

Mentor while at MSRI/SLMath: Wei Zhang

Pre- MSRI/SLMath Institution: University of Wisconsin - Madison
Position at that institution: Van Vleck Visiting Assistant Professor
Mentor: Tonghai Yang
Post-MSRI/SLMath institution: University of Wisconsin - Madison
Position: Van Vleck Visiting Assistant Professor
Anticipated length: ending May 2024
Mentor: Tonghai Yang

Postdoctoral fellow's comments:

I participated in the six workshops of both programs, and had time to work on papers that was started before I came, as well as starting new projects, and new thoughts that are not yet projects. I was able to finish https://arxiv.org/abs/2303.16512 with my collaborators (remotely) and submit it for publication. Another preprint coming out of my thesis is at the stage of solicitation feedback from mentors before I post it on the arXiv and submit for publication. I continued my collaboration with Congling Qiu and Zhiyu Zhang on a Gross-Zagier formula for CM cycles over Shimura curves — Zhiyu and I were both here in person, and Congling joined us for two weeks during workshops. A new project I started this semester is with Jordan Ellenberg on understanding the Q_p points coming out of the Quadratic Chabauty algorithm more theoretically — the project is still very much in a starting phase. Another project is with Padma Srinivasan and Abhishek Oswal on the Tate-Voloch conjecture for simple almost ordinary CM points on Siegel modular varieties, also a starting phase. Although Padma and Abhishek are not in residence this semester, it was the extra time when I'm away from teaching that allowed me to truly start working on it. There are various ideas stemming out of my thesis research coming from conversations with Wei Zhang, Henri Darmon, Ben Howard, and Jan Vonk. I don't have time to fully investigate them now, but they may lead to future projects.

Did you find your experience at MSRI/SLMath beneficial? Why or why not?

Yes. Time away from teaching has given me time to finish the projects that I should have finished earlier but haven't had enough time to. I also started new projects and have ideas that could fuel my future research. (See above.) I also had the chance to give talks (one at connection workshop, another at UC Berkeley, another one when I traveled to Denison University) as well as joining a panel at the connection workshop. Perhaps most important of all, I've met a group of wonderful female mathematicians and become friends with them. It is a very self-affirming experience. Through organizing the career development series and through talking to my friends here, I had the chance to reflect on my own career choices, my feelings towards research and teaching, and had more clarity on my upcoming job application season.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes. I had the chance to present my work in front of many number theorists at the connection workshop. I've become friends with many female mathematicians at various career stages who are willing to read through my application materials and give me advice. My mentor Wei Zhang has been super helpful too. The career development series that I co-organized provided me with a lot of helpful insights. I am also interested in a career at liberal arts colleges, and Cathy Hsu and Jen Berg have helped me a lot in understanding what those positions are looking for.

Please comment on your experience with the hybrid format of the program. Did you virtually participate in program activities? Did you collaborate with virtual participants? Why or why not? What were the benefits and/or drawbacks? Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Yes, I did virtually participate in some of the talks. I did have collaborators with whom I collaborate virtually but I don't think they are virtual participants of the programs. I think it is very beneficial to have both virtual and in-person elements. I listen to talks virtually when I'm interested in hearing the intro and not the whole talk, or when I'm sick. It is also helpful to have a recording of my own talk. One aspect that the experience could be improved is that I don't think the colors are as colorful on the virtual recordings — sometimes the yellow chalk just look like white and the speaker was trying to use the colors to help with the presentation.

3.2   Postdoctoral Fellow Placement List

2022-23 Postdoc Pre/Post-MSRI Institution Group

Family Name	First Name	Pre-MSRI Institution Name	Pre-MSRI Institution Group	Post-MSRI Institution Name	Post-MSRI Institution Group
Bai	Shaoyun	Princeton University	Math Private Large Group	Simons Center for Geometry and Physics, Stony Brook	non-group
Baldi	Gregorio	Institut des Hautes Études Scientifiques (IHES)	Foreign	Institut des Hautes Études Scientifiques (IHES)	Foreign
Bhattacharya	Arunima	University of Washington, Seattle	Math Public Large Group	University of North Carolina	Math Public Medium Group
Chan	Stephanie	University of Michigan	Math Public Large Group	Institute of Science and Technology Austria	Foreign
Dill	Gabriel	Leibniz Universität Hannover	Foreign	Leibniz Universität Hannover	Foreign
Feng	Tony	University of California, Berkeley	Math Public Large Group	University of California, Berkeley	Math Public Large Group
Fornea	Michele	Columbia University	Math Private Large Group	CRM Barcelona	Foreign
Ge	Tangli	Princeton University	Math Private Large Group	Princeton University	Math Private Large Group
Habibi Esfahani	Saman	Stony Brook University	Math Public Medium Group	Duke University	Math Private Large Group
Holdt	Maximilian	Christian-Albrechts Universität Kiel	Foreign	to be determined	n/a
Klang	Inbar	Columbia University	Foreign	Vrije Universiteit Amsterdam	Foreign
Li	Wanlin	Washington University, St. Louis	Math Private Large Group	Washington University, St. Louis	Math Private Large Group
Mallick	Abhishek	Max-Planck-Institut für Mathematik	Foreign	Rutgers University	Math Public Large Group
Mukherjee	Anubhav	Georgia Institute of Technology	Math Public Large Group	Princeton University	Math Private Large Group
Na	Xuesen	University of Maryland	Math Public Large Group	University of Illinois Urbana-Champaign	Math Public Large Group
Negrini	Isabella	University of British Columbia	Foreign	University of Toronto	Foreign
Oh	Gyujin	Columbia University	Math Private Large Group	Columbia University	Math Private Large Group
Parker	Gregory	Massachusetts Institute of Technology	Math Private Large Group	Stanford University	Math Private Large Group
Rezaee	Fatemeh	University of Edinburgh	Foreign	University of Cambridge	Foreign
Rivero Salgado	Oscar	University of Warwick	Foreign	Universidade de Santiago de Compostela	Foreign
Schulz	Sebastian	University of Texas, Austin	Math Public Large Group	Johns Hopkins University	Math Private Small Group
Swaminathan	Mohan	Princeton University	Math Private Large Group	Stanford University	Math Private Large Group
Tamiozzo	Matteo	University of Warwick	Foreign	University of Warwick	Foreign
Urbanik	David	Institut des Hautes Études Scientifiques (IHES)	Foreign	Institut des Hautes Études Scientifiques (IHES)	Foreign
Wen	Boya	University of Wisconsin-Madison	Math Public Large Group	University of Wisconsin - Madison	Math Public Large Group
Zhang	Zhiyu	Massachusetts Institute of Technology	Math Private Large Group	to be determined	n/a
Zhang	Melissa	University of Georgia	Math Public Medium Group	University of California, Davis	Math Public Large Group
Zimet	Max	Harvard University	Math Private Large Group	Stanford University	Math Private Large Group

Highlights

US Institutions are classified by the AMS into categories based on the size of their doctoral program and based on their Public or Private status.

A majority of the SLMath postdocs came from Public Large, Private Large, and Foreign institutions.

Of the seven postdocs coming from Public Large institutions, three returned to Public Large institutions, and the remaining four went to a Public Medium institution, a Foreign institution, a Private Large institution, and a Private Small institution respectively.

Of the ten postdocs coming from Foreign institutions, eight returned to a Foreign institution, one had not determined their next placement yet, and one went to a Public Large institution.

Of the nine postdocs who came from Private Large institutions, six went back to a Private Large institution, one had not determined their next placement yet, one went to a research institute, and one went to a Foreign institution.

Two postdocs came from Public Medium institutions, of whom one went to a Private Large institution and one went to a Public Large institution.

3.3 Postdoctoral Fellow Participant Summary

Programs	Distinct Postdocs	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
Algebraic Cycles, L-Values, and Euler Systems	7	1	14.3%	0	0.0%	4	57.1%	1
Analytic and Geometric Aspects of Gauge Theory	8	2	25.0%	0	0.0%	6	75.0%	2
Diophantine Geometry	7	3	42.9%	0	0.0%	4	57.1%	0
Floer Homotopy Theory	6	2	33.3%	0	0.0%	5	83.3%	2
Total # of Distinct Postdocs	**28**	**8**	**28.6%**	**0**	**0.0%**	**19**	**67.9%**	**5**

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

3.4   Postdoctoral Fellow Demographic Data

2022-23 Postdoctoral Fellows Demographic Summary

Gender	#	%
# of Distinct Members	28	100.0%
Male	19	67.9%
Female	8	28.6%
Decline to State	1	3.6%
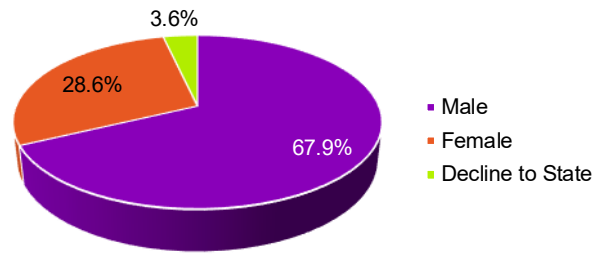
Race/Ethnicity*	#	%
White	10	35.7%
Asian	15	53.6%
Hispanic/Latino	1	3.6%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	2	7.1%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%
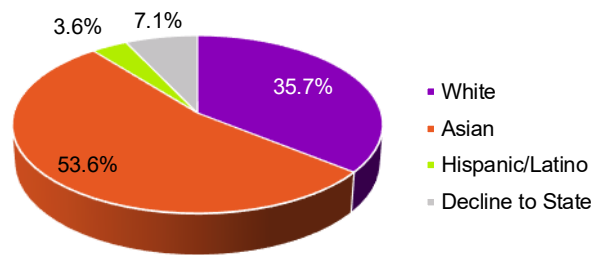
Citizenships	#	%
Foreign Home Inst.	9	32.1%
US Home Inst.	19	67.9%
Foreign Citizens	23	82.1%
US Citizens & Perm. Res.	5	17.9%
US Citizens	5	17.9%
US Permanent Residents	0	0.0%
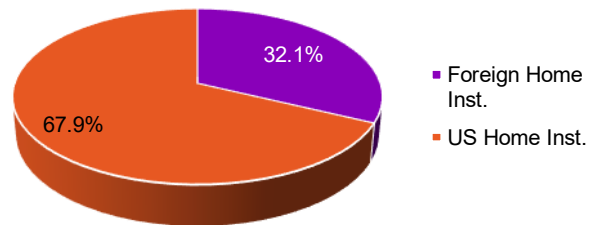
Year of Ph.D	#	%
2022	15	53.6%
2021	2	7.1%
2020	2	7.1%
2019	8	28.6%
2018	1	3.6%
2017	0	0.0%
Total # of Distinct Members	28	100.0%
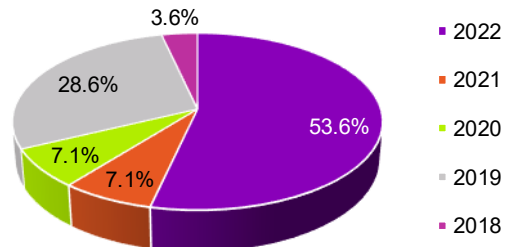
*Race/ethnicity selections are non-exclusive.
**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 Postdoctoral Fellows Classified by State

| State	#	%	2020 Census
South	5	26.3%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	1	5.3%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	5.3%	1.9%
MS	0	0.0%	0.9%
NC	2	10.5%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	1	5.3%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	4	21.1%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	4	21.1%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	3	15.8%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	1	5.3%	3.0%
MN	0	0.0%	1.7%
MO	1	5.3%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	1	5.3%	1.8%
Northeast	7	36.8%	17.4%
CT	0	0.0%	1.1%
MA	1	5.3%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	3	15.8%	2.8%
NY	3	15.8%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	19	100.0%	100.0%
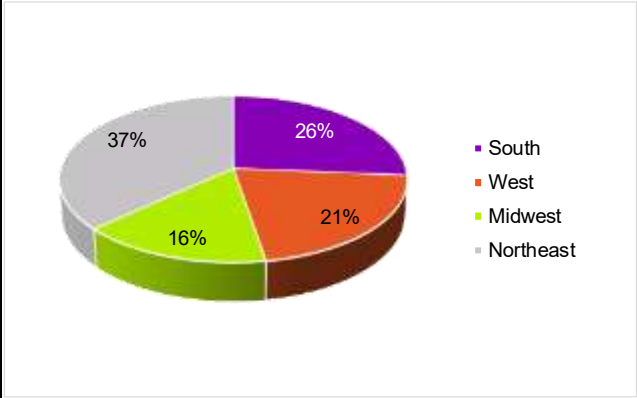
- South 26%
- West 21%
- Midwest 16%
- Northeast 37%

*Regions based on US Census classification

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2022-23 Postdoctoral Fellows Classified by Country

Africa			0
Americas			**20**
	North America	Canada	1
		United States	19
Asia			**0**
Europe			**8**
	Northern Europe	United Kingdom	3
	Western Europe	France	2
		Germany	3
Oceania			**0**
Grand Total			**28**

71.4%

28.6%

- Americas
- Europe
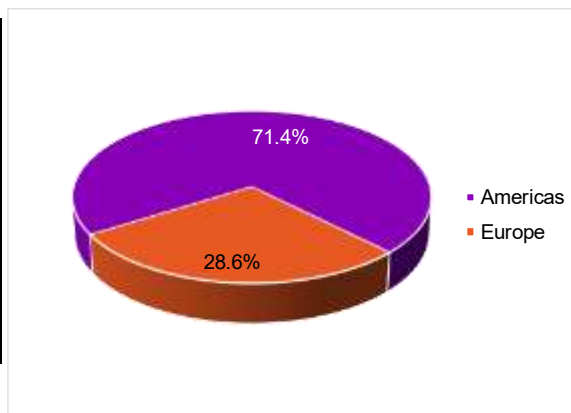
Regions based on United Nations classification

4. Graduate Program

In 2022-23, 1,170 graduate students participated in our 13 workshops (747 graduate students), summer graduate schools (389 graduate students), and programs (34 graduate students). While the majority of the graduate students were participants in our workshops or summer graduate schools, a smaller number of them were invited as 'Program Associates' in our scientific programs.

4.1 Summer Graduate School (SGS)

SLMath organized 13 summer graduate schools in the summer of 2022, five of which were held at SLMath or locally in the Berkeley area and the other eight of which were jointly held with other institutions. Attending one of SLMath's two-week summer schools can be a very motivating and exciting experience for a student; participants have often said that it was the first experience where they felt like real mathematicians, interacting with other students and mathematicians in their field.

Graduate students from one of SLMath's 115 Academic Sponsor Institutions or from Departments of Mathematics at Ph.D.-granting U.S. universities are eligible to attend the summer schools. For each institution, SLMath provides support for up to two students per summer and, under our "2+1+1" policy, SLMath will support an additional student if one of the students is female and another one if they are from a group that is underrepresented in the mathematical sciences. SLMath covers travel and local expenses with the maximal allowance for travel reimbursement being $600 for students from U.S. and Canadian universities (depending on the point of origin), and $700 for students from other sponsoring institutions.

The application procedure is as follows: The summer graduate schools and the open enrollment period for the summer of year n+1 are announced in August of year n. Graduate students must be nominated by their Director of Graduate Studies during the enrollment period. SLMath accepts nominees on a first-come first-served basis up to the limits of the capacity of each school, which is around 40-50 for onsite schools. If the chosen school is already full, the students are either kept on a waiting list or the nominating institution may make nominations to other schools until their quota is reached.

Below, we list the 13 Summer Graduate Schools that took place during the summer of 2022. Altogether 65 organizers, lecturers and TAs, and 389 graduate students participated in these schools. Women comprised 28% of the students and of the 191 students who were U.S. citizens or Permanent Residents, 44 (23%) were from historically underrepresented groups including 15 (3.5%) who identified themselves as Black, 53 (12.4%) as Hispanic/Latinx, 2 as Native American, and 1 as Pacific Islander. See the table in section 4.2 for detailed demographic data.

For a complete report on each SGS, please refer to the Appendix (Section 8).

SGS 1: Integral Equations and Applications
June 06, 2022 - June 17, 2022
Location: SLMath, Berkeley, CA, United States
Organizers: Fioralba Cakoni (Rutgers University), Dorina Mitrea (Baylor University), Irina Mitrea (Temple University), Shari Moskow (Drexel University)

SGS 2: Geometric Flows
June 19, 2022 - July 01, 2022
Joint with: Institute of Applied and Computational Mathematics (IACM-FORTH)
Location: Foundation for Research and Technology-Hellas, Heraklion Crete, Greece
Organizers: Nicholas Alikakos (National and Kapodistrian University of Athens (University of Athens)), Panagiota Daskalopoulos (Columbia University)

SGS 3: New Directions in Representation Theory
June 19, 2022 - July 01, 2022
Joint with: Australian Mathematical Sciences Institute (AMSI)
Location: University of Hawaii, Hilo, HI, United States
Organizers: Angela Coughlin (Australian Mathematical Sciences Institute), Joseph Grotowski (University of Queensland), Tim Marchant (Australian Mathematical Sciences Institute), Ole Warnaar (University of Queensland), Geordie Williamson (University of Sydney)

SGS 4: Algebraic Theory of Differential and Difference Equations, Model Theory and their Applications
July 04, 2022 - July 15, 2022
Location: St. Mary's College, Moraga, CA, United States
Organizers: Alexey Ovchinnikov (Queens College, CUNY), Anand Pillay (University of Notre Dame), Thomas Scanlon (University of California, Berkeley)

SGS 5: Random Graphs
July 05, 2022 - July 15, 2022
Location: SLMath, Berkeley, CA, United States
Organizers: Louigi Addario-Berry (McGill University), Remco van der Hofstad (Technische Universiteit Eindhoven)

SGS 6: Séminaire de Mathématiques Supérieures 2022: Floer Homotopy Theory
July 11, 2022 - July 22, 2022
Joint with: Séminaire de Mathématiques Supérieures (SMS)
Location: University of British Columbia, Vancouver, Canada
Organizers: Kristen Hendricks (Rutgers University), Ailsa Keating (University of Cambridge), Robert Lipshitz (University of Oregon), Liam Watson (University of British Columbia), Ben Williams (University of British Columbia)

SGS 7: Metric Geometry and Geometric Analysis
July 11, 2022 – July 22, 2022
Joint with: University of Oxford
Location: University of Oxford, United Kingdom
Organizers: Cornelia Drutu (University of Oxford), Panos Papazoglou (University of Oxford)

SGS 8: 2022 Joint PCMI School: Number Theory Informed by Computation
July 17, 2022 - August 06, 2022
Joint with: Park City Mathematics Institute (PCMI)
Location: Park City Mathematics Institute, Park City, UT, United States
Organizers: Jennifer Balakrishnan (Boston University), Rafe Mazzeo (Stanford University), Bjorn Poonen (Massachusetts Institute of Technology), Akshay Venkatesh (Institute for Advanced Study)

SGS 9: MSRI-NCTS Joint Summer School: Recent Topics in Well Posedness
July 18, 2022 - July 29, 2022
Joint with: National Center for Theoretical Sciences (NCTS)
Location: University of Hawaii, Hilo, United States
Organizers: Jungkai Chen (National Taiwan University), Mimi Dai (University of Illinois at Chicago), Yoshikazu Giga (University of Tokyo), Tsuyoshi Yoneda (Hitotsubashi University)

SGS 10: Topological Methods for the Discrete Mathematician
July 25, 2022 - August 05, 2022
Location: St. Mary's College, Moraga, CA, United States
Organizers: Pavle Blagojevic (Freie Universität Berlin), Florian Frick (Carnegie Mellon University), Shira Zerbib (Iowa State University)

SGS 11: Mathematics of Machine Learning
July 25, 2022 - August 05, 2022
Joint with: Istituto Nazionale di Alta Matematica Francesco Severi (INdAM)
Location: Courant Institute, New York, NY, United States
Organizers: Sebastien Bubeck (Microsoft Research)

SGS 12: Tropical Geometry
August 01, 2022 - August 12, 2022
Location: St. Mary's College, Moraga, CA, United States
Organizers: Renzo Cavalieri (Colorado State University), Hannah Markwig (Eberhard-Karls-Universität Tübingen), Dhruv Ranganathan (University of Cambridge)

SGS 13: Sums of Squares Method in Geometry, Combinatorics and Optimization
August 01, 2022 - August 12, 2022
Joint with: Banff International Research Station-Okanagan (BIRS)
Location: University of British Columbia, Okanagan, Canada
Organizers: Grigoriy Blekherman (Georgia Institute of Technology), Annie Raymond (University of Massachusetts Amherst), Cynthia Vinzant (University of Washington)

4.2 Summer Graduate Schools 2022 Data

Summer Graduate Schools	# of Students	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
2022 Joint PCMI School: Number Theory Informed by Computation‡	14	7	50.0%	0	0.0%	12	85.7%	7
Algebraic Theory of Differential and Difference Equations, Model Theory and their Applications	25	4	16.0%	5	33.3%	19	76.0%	15
Geometric Flows (Crete, Greece)‡	27	2	7.4%	1	10.0%	23	85.2%	10
Integral Equations and Applications	41	9	22.0%	3	17.6%	37	90.2%	17
Mathematics of Machine Learning (INdAM and Courant Institute)‡	22	13	59.1%	2	18.2%	18	81.8%	11
Metric Geometry and Geometric Analysis (Oxford, United Kingdom)‡	25	2	8.0%	6	31.6%	20	80.0%	19
MSRI-NCTS Joint Summer School: Recent Topics in Well Posedness‡	21	1	4.8%	0	0.0%	10	47.6%	6
New Directions in Representation Theory (AMSI and U. of Hawaii, Hilo)‡	24	8	33.3%	2	16.7%	21	87.5%	12
Random Graphs	43	16	37.2%	3	16.7%	35	81.4%	18
Séminaire de Mathématiques Supérieures 2022: Floer Homotopy Theory‡	39	8	20.5%	7	35.0%	37	94.9%	20
Sums of Squares Method in Geometry, Combinatorics and Optimization (BIRS)‡	20	8	40.0%	4	30.8%	16	80.0%	13
Topological Methods for the Discrete Mathematician	40	19	47.5%	7	33.3%	38	95.0%	21
Tropical Geometry	48	10	20.8%	4	18.2%	42	87.5%	22
Total # of Students	**389**	**107**	**27.5%**	**44**	**23.0%**	**328**	**84.3%**	**191**

Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

‡ *The number of students listed were those sponsored by MSRI. Joint summer schools had at least as many other participants sponsored by the host institution.*

Summer Graduate School Demographic Data

2022 Summer Graduate Schools Demographic Summary

Gender	#	%
# of Students	389	100.0%
Male	265	68.1%
Female	107	27.5%
Other	10	2.6%
Decline to State	7	1.8%
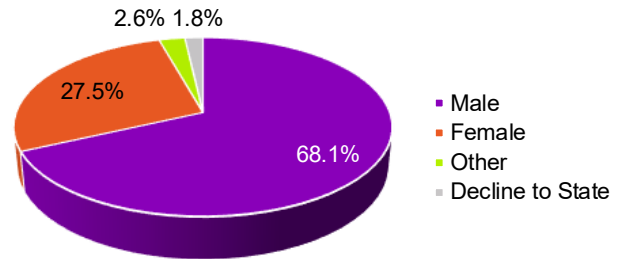
Race/Ethnicity*	#	%
White	201	47.2%
Asian	132	31.0%
Hispanic/Latino	53	12.4%
Black	15	3.5%
Native American	2	0.5%
Pacific Islander	1	0.2%
Decline to State	22	5.2%
Unavailable Info.	0	0.0%
Minorities**	44	23.0%
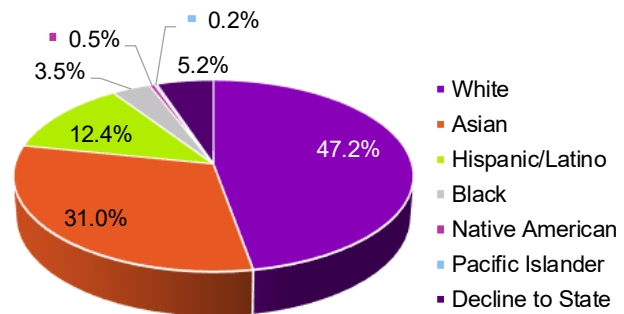
Citizenships	#	%
Foreign Home Inst.	61	15.7%
US Home Inst.	328	84.3%
US Citizens & Perm. Res.	191	49.1%
Foreign Citizens	198	50.9%
US Citizens	185	96.9%
US Permanent Residents	6	3.1%
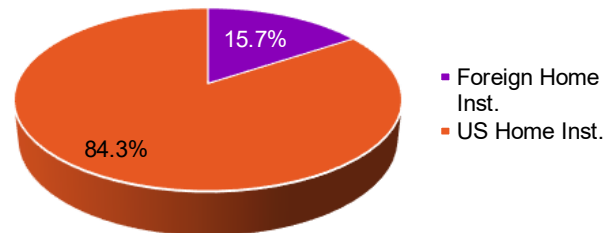
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022 Summer Graduate School Students Classified by States

| State	#	%	2020 Census
South	76	23.2%	38.1%
AL	5	1.5%	1.5%
AR	1	0.3%	0.9%
DE	2	0.6%	0.3%
DC	2	0.6%	0.2%
FL	4	1.2%	6.5%
GA	9	2.7%	3.2%
KY	4	1.2%	1.4%
LA	8	2.4%	1.4%
MD	6	1.8%	1.9%
MS	0	0.0%	0.9%
NC	10	3.0%	3.1%
OK	7	2.1%	1.2%
SC	0	0.0%	1.5%
TN	2	0.6%	2.1%
TX	14	4.3%	8.8%
VA	2	0.6%	2.6%
WV	0	0.0%	0.5%
West	91	27.7%	23.7%
AK	0	0.0%	0.2%
AZ	4	1.2%	2.2%
CA	52	15.9%	11.9%
CO	9	2.7%	1.7%
HI	3	0.9%	0.4%
ID	0	0.0%	0.6%
MT	1	0.3%	0.3%
NM	2	0.6%	0.6%
NV	0	0.0%	0.9%
OR	8	2.4%	1.3%
UT	3	0.9%	1.0%
WA	9	2.7%	2.3%
WY	0	0.0%	0.2%
Midwest	84	25.6%	20.8%
IA	3	0.9%	1.0%
IL	17	5.2%	3.9%
IN	13	4.0%	2.0%
KS	10	3.0%	0.9%
MI	6	1.8%	3.0%
MN	5	1.5%	1.7%
MO	9	2.7%	1.9%
ND	2	0.6%	0.2%
NE	5	1.5%	0.6%
OH	9	2.7%	3.6%
SD	0	0.0%	0.3%
WI	5	1.5%	1.8%
Northeast	77	23.5%	17.4%
CT	6	1.8%	1.1%
MA	21	6.4%	2.1%
ME	0	0.0%	0.4%
NH	3	0.9%	0.4%
NJ	9	2.7%	2.8%
NY	16	4.9%	6.1%
PA	19	5.8%	3.9%
RI	2	0.6%	0.3%
VT	1	0.3%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	328	100.0%	100.0%

Pie chart: South 23.2%, West 27.7%, Midwest 25.6%, Northeast 23.5%
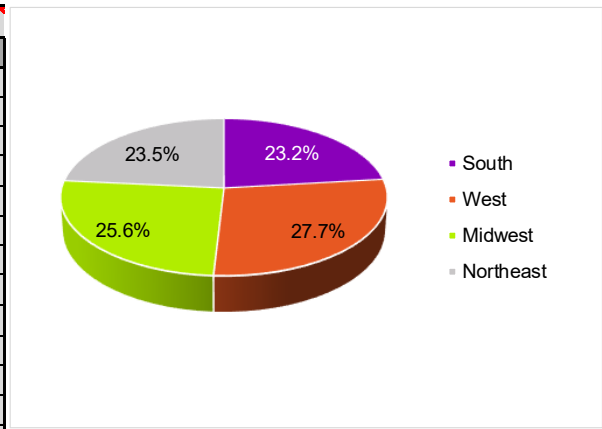
*Regions based on US Census classification

2022 Summer Graduate School Students Classified by Countries

Africa			1
	Western Africa	Nigeria	1
Americas			350
	Central America	Mexico	3
	North America	Canada	18
		United States	328
	South America	Brazil	1
Asia			15
	Eastern Asia	China	1
		China, Hong Kong Special /	3
		Korea, Republic of	1
		Taiwan	9
	Western Asia	Israel	1
Europe			18
	Southern Europe	Italy	3
		Spain	3
	Western Europe	Austria	2
		Germany	6
		Switzerland	1
		Netherlands	1
	Northern Europe	United Kingdom	2
Oceania			5
	Australia & New Zealand	Australia	5
Grand Total			389

- Africa 0.3%
- Americas 90.0%
- Asia 3.9%
- Europe 4.6%
- Oceania 1.3%

*Regions based on United Nations classification

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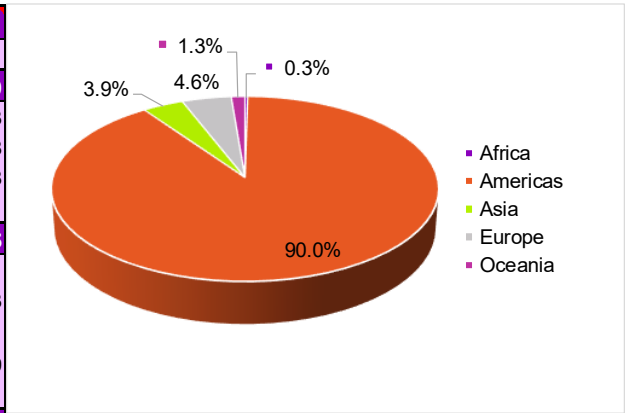
4.3   Program Associates

Program Associates (graduate students participating in the programs) benefit greatly from the opportunity to interact with leaders and postdoctoral fellows in their field, gaining intense exposure to current ideas and trends in their area of specialization. They were closely supervised and benefited from all member privileges, including shared office space. Each Program Associate was provided with an access card to the building, which allowed them to use the premises at any time, as well as bus and library passes. There were 34 graduate students who were in residence at SLMath as Program Associates during the 2022-23 academic year.

Program Associates do not typically receive funding as they are often able to receive support through their advisors or home institutions but, thanks to private funding, SLMath has recently introduced "named" Program Associate Fellowships that include funding of $12,000 for the duration of the program. Eight such Program Associate Fellows were supported during the 2022-23 academic year.

4.4   Program Associate Data

Programs	Distinct Prog. Assoc.	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
Analytic and Geometric Aspects of Gauge Theory	8	3	37.5%	0	0.0%	6	75.0%	2
Floer Homotopy Theory	10	3	30.0%	1	16.7%	7	70.0%	6
Diophantine Geometry	5	1	20.0%	0	0.0%	5	100.0%	3
Algebraic Cycles, L-Values, and Euler Systems	10	1	10.0%	0	0.0%	7	70.0%	3
Complementary Program 2022-23	1	0	0.0%	0	0.0%	1	0.0%	0
Total # of Distinct PAs	**34**	**8**	**23.5%**	**1**	**7.1%**	**26**	**76.5%**	**14**

Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022–23 Program Associate Demographic Summary

Gender	#	%
# of Distinct Members	34	100.0%
Male	24	70.6%
Female	8	23.5%
Other	1	2.9%
Decline to State	1	2.9%
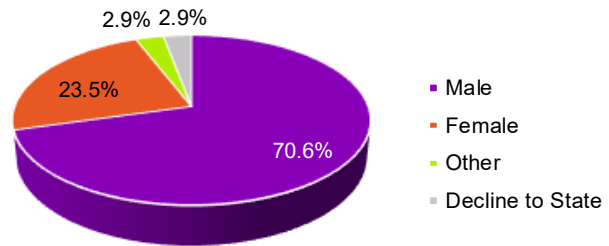
Race/Ethnicity*	#	%
White	15	44.1%
Asian	13	38.2%
Hispanic/Latino	5	14.7%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	3	8.8%
Unavailable Info.	0	0.0%
Minorities**	1	7.1%

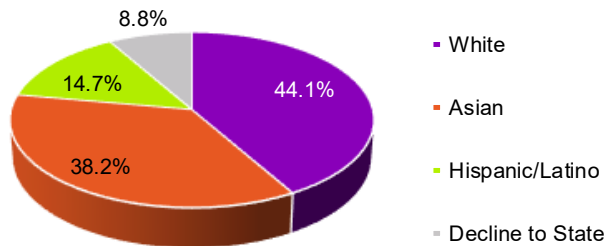| Citizenships	#	%
Foreign Home Inst.	8	23.5%
US Home Inst.	26	76.5%
Foreign Citizens	20	58.8%
US Citizens & Perm. Res.	14	41.2%
US Citizens	14	41.2%
US Permanent Residents	0	0.0%

*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.
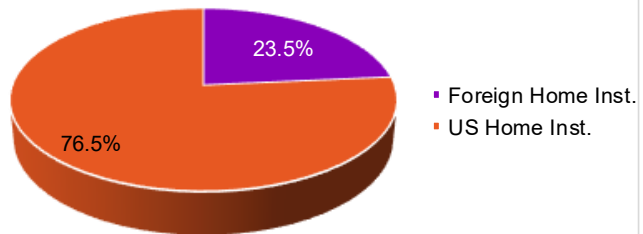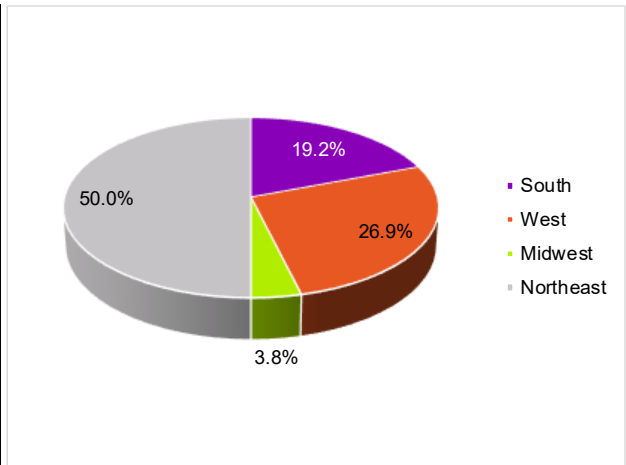
2022–23 Program Associates Classified by State

State	#	%	2020 Census
South	5	19.2%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	2	7.7%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	3.8%	1.9%
MS	0	0.0%	0.9%
NC	1	3.8%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	0	0.0%	8.8%
VA	1	3.8%	2.6%
WV	0	0.0%	0.5%
West	7	26.9%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	3	11.5%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	3	11.5%	1.3%
UT	0	0.0%	1.0%
WA	1	3.8%	2.3%
WY	0	0.0%	0.2%
Midwest	1	3.8%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	1	3.8%	1.8%
Northeast	13	50.0%	17.4%
CT	0	0.0%	1.1%
MA	8	30.8%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	1	3.8%	2.8%
NY	2	7.7%	6.1%
PA	1	3.8%	3.9%
RI	1	3.8%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	26	100.0%	100.0%

*Regions based on US Census classification

97

2022–23 Program Associates Classified by Country

Africa			**0**
Americas			**29**
	North America	Canada	3
		United States	26
Asia			**0**
Europe			**5**
	Northern Europe	United Kingdom	4
	Western Europe	Germany	1
Oceania			**0**
Grand Total			**34**
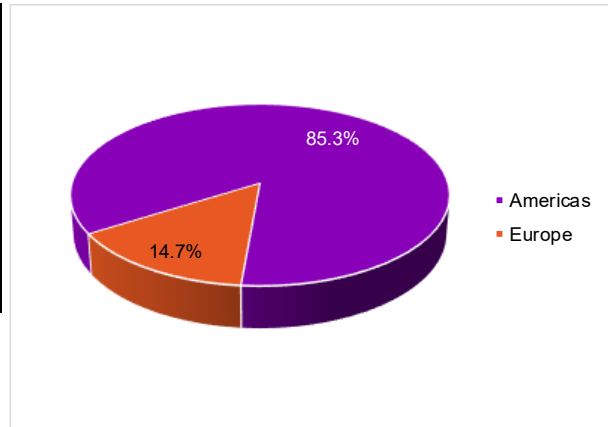
Regions based on United Nations classification

4.5 Graduate Student List
(Participants who attended 2022-23 workshops, including Summer Graduate Schools)
(See e-mail attachment)

4.6 Graduate Student Data
(Participants who attended 2022-23 workshops, excluding Summer Graduate Schools)

Workshops	Student Participants	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
13 Scientific Workshops								
[HYBRID WORKSHOP] Connections Workshop: Analytic and Geometric Aspects of Gauge Theory	36	8	22.2%	0	0.0%	24	66.7%	11
[HYBRID WORKSHOP] Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory	64	11	17.2%	0	0.0%	42	65.6%	12
[HYBRID WORKSHOP] Connections Workshop: Floer Homotopy Theory	67	15	22.4%	4	22.2%	51	76.1%	18
[HYBRID WORKSHOP] Introductory Workshop: Floer Homotopy Theory	105	26	24.8%	5	17.2%	81	77.1%	29
[HYBRID WORKSHOP] New Four-Dimensional Gauge Theories	52	8	15.4%	0	0.0%	33	63.5%	10
[HYBRID WORKSHOP] Floer Homotopical Methods in Low Dimensional and Symplectic Topology	73	13	17.8%	2	8.7%	61	83.6%	23
Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems	34	7	20.6%	0	0.0%	26	76.5%	10
Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems	65	11	16.9%	2	10.5%	47	72.3%	19
Connections Workshop: Diophantine Geometry	28	6	21.4%	0	0.0%	25	89.3%	12
Introductory Workshop: Diophantine Geometry	38	6	15.8%	1	6.3%	34	89.5%	16
Shimura Varieties and L-Functions	56	14	25.0%	1	6.7%	43	76.8%	15
Degeneracy of Algebraic Points	27	6	22.2%	1	11.1%	23	85.2%	9
MSRI / SLMath 40th Anniversary Symposium	33	4	12.1%	4	50.0%	27	81.8%	8
All 13 Workshops Total	**678**	**135**	**19.9%**	**20**	**10.4%**	**517**	**76.3%**	**192**
3 Education & Outreach Workshop								
Critical Issues in Mathematics Education 2023: Mentoring for Equity	26	16	61.5%	12	60.0%	24	92.3%	20
Modern Math Workshop 2022	27	16	59.3%	22	95.7%	26	96.3%	23
May 12, a Celebration for Women in Mathematics (2023)	16	14	87.5%	1	16.7%	11	68.8%	6
All 3 Workshops Total	**69**	**46**	**66.7%**	**35**	**71.4%**	**61**	**88.4%**	**49**
All 16 Workshops Total	**747**	**181**	**24.2%**	**55**	**22.8%**	**578**	**77.4%**	**241**

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

Note: The overall workshop data in section 4.6 is not distinct as some participants attended multiple workshops, but the statistics of individual workshops found in Section 13, Appendix, were calculated on distinct participant data.

5. SLMath Undergraduate Programs

5.1 MSRI-UP

Please note: MSRI-UP is funded by an independent NSF grant, DMS-2149642. The report was filed independently to the NSF in May 2023, thus there is no report attached in Section 8. Appendix.

The MSRI Undergraduate Program (MSRI-UP) is a comprehensive summer program designed for US citizen and permanent resident undergraduate students who have completed two years of university-level mathematics courses and would like to conduct research in the mathematical sciences.

The main objective of MSRI-UP is to identify talented students, especially those from underrepresented groups, who are interested in mathematics and make available to them meaningful research opportunities, the necessary skills and knowledge to participate in successful collaborations, and a community of academic peers and mentors who can advise, encourage and support them through a successful graduate program.

This objective is designed to contribute significantly toward meeting the program goal of increasing the number of graduate degrees in the mathematical sciences, especially doctorates, earned by U.S. citizens and permanent residents by cultivating heretofore untapped mathematical talent within the U.S. Black, Hispanic/Latino and Native American communities.

During the summer, each of the 18 student participants:

- participate in the mathematics research program under the direction of faculty and graduate student mentors;
- complete a research project done in collaboration with other MSRI-UP students;
- give a presentation and write a technical report on his/her research project;
- attend a series of colloquium talks given by leading researchers in their fields;
- attend seminars aimed at developing skills and techniques needed for research careers in the mathematical sciences;
- learn techniques that will maximize a student's likelihood of admissions to graduate programs as well as the likelihood of winning fellowships; and
- receive a $3,600 stipend, lodging, meals and round trip travel to Berkeley, CA.

After the summer, each student:

- has an opportunity to attend a national mathematics or science conference where students will present their research;
- becomes part of a network of mentors that will provide continuous advice in the long term as the student makes progress in his/her studies; and
- is contacted regarding future research opportunities.

MSRI-UP 2022: Algebraic Methods in Mathematical Biology
June 11, 2022 - July 23, 2022

The theme of the 2022 MSRI-UP was "Algebraic Methods in Mathematical Biology" and the research leader was Dr. Anne Shiu, Associate Professor of Mathematics at Texas A&M University.

MSRI-UP 2022 focused on mathematical models inspired by biology. The emphasis was on models that could be analyzed by algebraic and combinatorial methods. No background in biology was required, and all projects were accessible to undergraduate participants who had taken a course in linear algebra and a course involving proofs -- and were willing to learn, work in a team, and have fun!

The research projects were chosen from three areas of mathematical biology, with applications to biochemistry, neuroscience, and pharmacology.

Biochemical reaction networks
A reaction network can be represented by a directed graph in which each edge represents a chemical reaction such as, for instance, A+B ---> C, in which one unit of A and one of B react to form one unit of C. The focus of this REU component is on dynamical systems that arise from reaction networks taken with mass-action kinetics. The ordinary differential equations (ODEs) that govern these systems are polynomials in many variables, and therefore are amenable to algebraic techniques. Example project questions are as follows: How can a network's capacity for bistability or oscillations be predicted from its reaction diagram, and how is this capacity affected by operations on the diagram?

Convex neural codes
A starting principle in neuroscience is that "neurons that fire together, wire together". The aim of this REU component is to clarify which sets of neurons can fire together under the assumption that each neuron of interest codes for some convex region of some Euclidean space. This assumption is valid in certain biological settings, for instance, when each neuron has a corresponding place field, a convex region in space (this space might be a tabletop on which a laboratory rat is walking) and that neuron fires precisely when the subject (rat) is in that region. This research is motivated by place cells in neuroscience, which won its discoverers the 2014 Nobel Prize in Medicine.

Linear compartmental models
Mathematical models arising in biology and other applications often involve many unknown parameters. An important question, therefore, is whether and when these parameters can be recovered from data. If recovering the parameters is possible, the model is said to be identifiable. The question of which models are identifiable, is not fully answered, even for models that involve only linear ODEs and can therefore be summarized by a directed graph. These models are called linear compartmental models, and they are often used to describe how pharmacological drugs move within and affect the body. The proposed projects will build on related work using differential algebra, which transform the identifiability problem into questions involving linear algebra and combinatorics.

5.3 Mathematically Advancing Young Undergraduates Program (MAY-UP)

Please note: MAY-UP did not use any NSF funding, thus there is no report attached in Section 8. Appendix.

MAY-UP is a special intensive two-week residential program crafted to advance the development of early college students who demonstrate interest in and talent for mathematics. Goals of MAY-UP are to increase the pool of Black collegians who pursue majors in the mathematical sciences and, secondarily, to enhance students' appreciation and abilities with more advanced mathematical knowledge and tools, whatever their majors. MAY-UP was piloted May 14 to 28, 2023, in Atlanta, Georgia.

The program hosted 12 young undergraduates (10 just finished their freshman year, 2 their sophomore year), 4 each from Atlanta University Center (AUC) member institutions Clark Atlanta University, Morehouse College, and Spelman College. They were in residence at Georgia State University for the two week program under the leadership of Shelby Wilson of the Johns Hopkins University Applied Physics Laboratory who led an intensive scholarly program in Applied Numerical Linear Algebra assisted by three teaching assistants—two young graduate students (with Atlanta University Center undergraduate roots) and one advanced undergraduate. The students learned mathematics that was mostly new to them, and they learned to use computational tools (specifically Python) to approach and solve problems. They also gained access to a network of Black mathematicians who exposed them through panels and presentations to short-term and long-term possibilities in mathematics.

The students, mostly freshmen, were recruited and selected via nominations by professors who identified them as demonstrating standout proficiency and pleasure in mathematics. They were selected by the team of four directors—Drs. Duane Cooper of Morehouse College, Lakeshia Legette Jones of Clark Atlanta University, Monica Stephens of Spelman College, and Shelby Wilson of the Johns Hopkins Applied Physics Laboratory—who collaborated on an ongoing basis to shape the 2023 MAY-UP pilot.

During the Applied Numerical Linear Algebra program, the students engaged topics with which they were mostly unfamiliar beforehand: matrices and matrix computation; applications of matrices: Hill ciphers; polynomial interpolation; cubic splines; least squares regression; eigenvalues and eigenvectors; image compression and principal component analysis; and machine learning. The students learned to use Python programming, a majority of them having no prior knowledge of the language, as a tool to solve mathematical problems by developing specific skills such as plotting, inverting matrices, implementing methods, and importing modules. Typically, Dr. Wilson would introduce ideas to the group in its entirety, after which they would work on a mix of individual and small-group exercises in order to further engage with and understand the material.

As the program approached conclusion, students paired to select topics for final MAY-UP projects. Their topics were applications of linear algebra in various areas—public health, school graduation

rates, disaster forecasting, and computing applications. After deciding on project areas, the student pairs researched and developed an understanding of their topics in order to be able to introduce and explain them to peers, staff, and guests during the culminating session of MAY-UP Final Project Presentations.

The scholarly program was the program's core experience, but MAY-UP students were also introduced more broadly to mathematical ideas and opportunities, long-term and short-term. In particular, one afternoon each week was devoted to a colloquium speaker and a panel discussion. The colloquia introduced students to new mathematics and new mathematicians, who discussed their work and their journeys to and through mathematics. The first week, after a health-related cancelation of the invited speaker, Drs. Cooper and Wilson divided the colloquium time to present their research interests and their journeys. The Week 2 speaker was Talea Mayo of Emory University who was the first MSRI-UP student to earn a Ph.D. Dr. Mayo discussed Climate Change and Hurricane Storm Surge Risks followed by a discussion of her journey, replete with advice to the students and answers to their questions. The panel discussions were conducted on Zoom. The first was a Career Panel featuring a half-dozen professionals who discussed the wide range of careers available to students with advanced degrees in the mathematical sciences. Second was the Summer Opportunities Panel which featured six representatives of various summer mathematics REU programs or internships exemplifying possibilities the MAY-UP students, with additional readiness, could pursue in summer of 2024.

During the first weekend, the community of MAY-UP students and staff spent the day away from Georgia State to get better acquainted outside of the mathematical and residential setting. The mid-program Saturday excursion featured a walk from the campus to the Rev. Dr. Martin Luther King Jr.'s gravesite, followed by an Atlanta Streetcar ride to the National Center for Civil and Human Rights and its exhibits.

For the MAY-UP students who were already mathematical sciences majors, the program provided a mathematical experience useful towards their development. For MAY-UP's non-majors, the program did the same, and perhaps—through the two-week experience and possible follow-up activity—some will consider adding or changing to a major in the mathematical sciences. After the program, all 12 students reported that the mathematical topics they encountered during MAY-UP were useful or very useful, and 11 of 12 declared the Python programming they developed, as well as their final projects and presentations, to be useful or very useful.

This very first MAY-UP was a pilot offering that will undergo careful examination in hopes of continuing and expanding the program during months of May to come.

6.   Summer Research in Mathematics

6.1   Description

SLMath's Summer Research in Mathematics program provides space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals, whose ongoing research may have been disproportionately affected by various obstacles including family obligations, professional isolation, or access to funding. Through this effort, SLMath aims to mitigate the obstacles faced by these groups, improve the odds of research project completion, and deepen their research experience.

The ultimate goal of this program is to enhance the mathematical sciences as a whole by positively affecting the research and careers of all of its participants and assisting their efforts to maintain involvement in the research community.

A report on the SRiM 2022 program is included in Section 8, Appendix.

6.2   Eligibility & Application Process

Groups of two to six mathematicians with partial results on an established project were invited to submit an application to the program. Each member of the group was required to have a Ph.D. in mathematics or advanced graduate standing, and at least one US-Based group member was required.

Applications for SRiM 2022 were hosted on Math Programs and required a detailed Project Description, along with a CV and publication list.

Applicants were required to include the following in the Project Description:

- A brief history of the collaboration;
- The context, description, and goals of the research problems to be addressed;
- The partial results already obtained;
- A timeline for the project, describing how the group planned to pursue this project before, during and after the residence at SLMath;
- Anticipated impact on the careers of each participant;
- Whether any members of the group had benefited from this program;
- and a section on prior results. i.e. publications, additional speaking opportunities, career advancement.

7. African Diaspora Joint Mathematics Program

7.1   Description

The African Diaspora Joint Mathematics Workshop (ADJOINT) is a yearlong program that provides opportunities for U.S. mathematicians – especially those from the African Diaspora – to form collaborations with distinguished African-American research leaders on topics at the forefront of mathematical and statistical research.

Beginning with an intensive two-week summer session at SLMath, participants work in small groups under the guidance of some of the nation's foremost mathematicians and statisticians to expand their research portfolios into new areas. Throughout the following academic year, the program provides conference and travel support to increase opportunities for collaboration, maximize researcher visibility, and engender a sense of community among participants.

ADJOINT enriches the mathematical and statistical sciences as a whole by providing a platform for African-American mathematicians to advance their research and careers and deepen their engagement with the broader research community.

Each summer, three to five research leaders propose a research topic to be studied during a two-week workshop. During the workshop, each participant:

- conducts research at SLMath within a group of four to five mathematical and statistical scientists under the direction of one of the research leaders;
- participates in professional enhancement activities provided by the onsite ADJOINT Director;
- and receives funding for two weeks of lodging, meals and incidentals, and round-trip travel costs to Berkeley, CA.

After the two-week workshop, each participant:

- has the opportunity to further their research project with their team members including the research leader;
- has access to funding (up to $2000 per person) to attend conference(s) or to meet with other team members to pursue the research project, or to present results;
- and becomes part of a network of research and career mentors.

A report on the ADJOINT 2022 program is included in Section 8, Appendix.

7.2   Eligibility & Application Process

Each applicant must be a U.S. citizen or permanent resident, possess a Ph.D. in the mathematical or statistical sciences, and be employed at a U.S. institution.

The guiding principle in selecting participants and establishing the groups is the creation of diverse teams whose members come from a variety of institutional types and career stages. The degree of potential positive impact on the careers of African-Americans in the mathematical and statistical sciences is an important factor in the final decisions.

Applications for ADJOINT 2022 were submitted via Math Programs beginning August 15, 2021.

Applicants were asked to submit:

- a cover letter specifying which of the offered research projects they wished to be part of;
- a CV;
- a personal statement, no longer than *one page*, addressing how their participation would contribute to the goals of the program;
- and a research statement, no longer than *two pages*, describing their current research interests, and relevant past research activities, and how they relate to the project(s) of greatest interest to them.

7.3 ADJOINT 2020 Reunion

Please note: The 2020 ADJOINT Reunion was funded by a separate NSF grant, DMS-2016406. The report was filed independently to the NSF in November 2022, thus there is no report attached in Section 8. Appendix.

Due to the pandemic, the 2020 ADJOINT workshop was held entirely virtually. In order to give the virtual participants an opportunity to meet in-person, the ADJOINT directorate planned a week-long reunion program to include all five of the 2020 research groups, as well as one group from the 2021 cohort that did not get the chance to meet in person. The reunion took place in-person at SLMath from June 27 to July 2, 2022.

The Reunion program included a welcome session, individual research time for each group, two professional development panels (one on grant writing and another on work, wellness, and autonomy), lightning research presentations, daily group lunches and a catered banquet-style dinner with all participants. The ADJOINT 2020 Reunion took place concurrently with the ADJOINT 2022 workshop (which ran June 20–July 2, 2022 at SLMath) as well as the MSRI-UP 2022 program (which ran June 11, 2022 - July 23, 2022). The overlap between the ADJOINT 2020 Reunion and these other activities was designed to facilitate maximum interaction between the various ADJOINT cohorts and the undergraduate students in the MSRI-UP program.

The attendance at the weeklong Reunion was excellent. There were a total of 25 participants in the Reunion, including six research leaders, two onsite directors, and all but one participant from ADJOINT 2020. Three of the Reunion participants chose to attend virtually for personal reasons.

8. Appendix – Final Reports of Activities in 2022-23

Higher Categories and Categorification, Part Two
May 30, 2022 - June 24, 2022
MSRI, Berkeley, CA
USA

Organizers:

David Ayala (Montana State University)
Clark Barwick (University of Edinburgh)
David Nadler (University of California, Berkeley)
Emily Riehl (Johns Hopkins University)*
Marcy Robertson (University of Melbourne)
Peter Teichner (Max-Planck-Institut für Mathematik)
Dominic Verity (Macquarie University)

REPORT ON THE HIGHER CATEGORIES AND CATEGORIFICATION REUNION

May 30 – June 24, 2022

Organizers

- David Ayala (Montana State University)
- Clark Barwick (University of Edinburgh)
- David Nadler (University of California, Berkeley)
- Emily Riehl (Johns Hopkins University)
- Marcy Robertson (University of Melbourne)
- Peter Teichner (Max-Planck-Institut für Mathematik)
- Dominic Verity (Macquarie University)

Scientific Description

Participation. Members of the Spring 2020 MSRI semester program on Higher Categories and Categorification were invited to attend a four week reunion hosted at the Instituto de Matemáticas (The Institute) Universidad Nacional Autónoma de México (UNAM) in June 2022. Research Professors, Research Members, Postdoctoral Fellows, and Program Associates (many of whom had completed their PhDs in the interim) were complemented by half a dozen mathematicians working in similar areas who are currently based at various institutions around Mexico, one of whom — Omar Antolin-Camerena — joined the organizational team.

These participants represented a diversity along several axes: demographic, institutional, expertise.

Covid measures. Being mindful of travel expenses and the ongoing COVID pandemic, participants were asked to commit to at least a two week stay; many elected to come for the full four weeks. Participants were required to take COVID rapid tests upon arrival for three consecutive days. Fortunately, perhaps on account of the abundant outdoor workspace provided at The Institute, we did not observe any COVID cases. For many of the participants, this event was the first opportunity to connect in person with colleagues since the COVID pandemic struck.

Schedule. The weekday schedules of participants were highly synchronized. This was largely defined by common shared breakfasts and dinners at the hotel and catered lunches at The Institute, supplemented by morning and afternoon coffee breaks. Travel to and from The Institute was by group taxis at 9am and 6pm each day. On weekends, participants self-organized excursions to local villages or hikes, which were highly inclusive to all participants. This high degree of coordination provided scaffolding for impromptu conversations between diverse members.

Structure. Given the specific circumstances of our reunion, we wanted to facilitate the scientific opportunities that were most compromised by the pandemic. While we were able to hold two of

the three standard MSRI conferences in person and the third online and continue a lot of online seminars during the Spring 2020 semester, we felt that opportunities for small group collaborations were most negatively impacted. Thus, we sought to maximize collaborative research time in devising the reunion schedule. Roughly once a week, we convened for 60 second lightning introductions where each member described some of the mathematical topics they felt they were experts in as well as what they wanted to learn more about. In addition to serving as a social introduction, this practice positioned each participant as both an expert and a learner, which lent to substantive interactions across seniority-levels.

"The stand-up lighting intros may have felt a bit forced or formulaic, but actually I think were very helpful and did facilitate talking to people you didn't previously know, by making public shared areas of interest."

We also invited participants to advertise informal talks on a chalkboard in the coffee pavilion and encouraged junior members to take advantage of this opportunity to tell us about their recent results. The outcome of this process was 2-4 talks per week, which were well attended. Highlights included talks by Jan Steinebrunner on "The equifibered approach to infinity properads," by Tim Campion on lax gray tensor products for infinite-dimensional categories, and by Tomer Schlenk on the "Chromatic nullstellensatz theorem", among many others. Other participants were invited to give talks in the local community, including a colloquium talk by Luciana Basoaldo Bonatto at UNAM Mexico City.

"There were many events scheduled during the (shortened) semester at MSRI, which meant that everyone was very busy and there were fewer opportunities for one-one mathematics discussions there. In contrast, UNAM-Cuernavaca felt smaller and more contained, with fewer scheduled events. It was also easier to find people."

"Mostly just free time. MSRI tends to be overscheduled. The lunches also introduced people to more diverse groups than usual"

The geography and layout of The Institute amplified participants' experiences. Indeed, it went a long way to support the sort of spontaneous collaboration the organizers hoped to facilitate. Many members opted to work outside at the various outdoor chalkboards or palapas. It became common and encouraged practice for anybody to join an ongoing group discussion.

"The outdoor spaces at UNAM were just marvelous. It increased general well being and happiness of everyone, making casual and spontaneous conversations much more likely since almost no one spent time in their offices but outside, together."

"Facilities were excellent at institute e..g office space, availability of blackboards, collaborative/shared spaces. Lunch service was excellent. I benefited from having an "open schedule" rather than a day filled with obligations to attend seminars."

Outcomes. We are aware of at least one collaboration between a local participant and a visiting participant. Its status is a draft of a research paper that characterizes moduli spaces of tori in Lie groups. A genuine effort was made to ensure junior local participants, who were PhD and masters

students, had opportunities to discuss mathematics one-on-one with various senior members. In at least one instance, that relationship evolved into an email correspondence that has continued past the reunion program. One of the more senior participants, André Joyal, made a concerted effort to learn about the work of essentially every junior member, scheduling a series of one-on-one conversations that were greatly appreciated by all. We believe this degree of vertical interaction was especially enabled by the shared synchronized schedule (eg, meals, coffee, even hikes).

"Another nice feature of UNAM-Cuernavaca is that we were all at the same hotel so conversations often continued into the evenings and further socializing happened at breakfast, after dinner, on the weekends, etc. This made the program much more cohesive than is usual. Also I think it made it easier for more junior and more senior participants to socialize because this happened very naturally at the many meals we had together."

Based on our Exit Survey, participants generally had a productive experience, and felt supported and cared for by MSRI, the organizers, and especially The Institute in Cuernavaca. Overall, we were extremely grateful for the opportunity to reconvene the members of the Higher Categories and Categorification program, especially at a location that was so conducive to a mathematical reunion.

*Higher Categories and Categorification, Part Two Member Demographic Summary*

Gender	#	%
# of Distinct Members	45	100.0%
Male	33	73.3%
Female	11	24.4%
Other	0	0.0%
Decline to State	1	2.2%
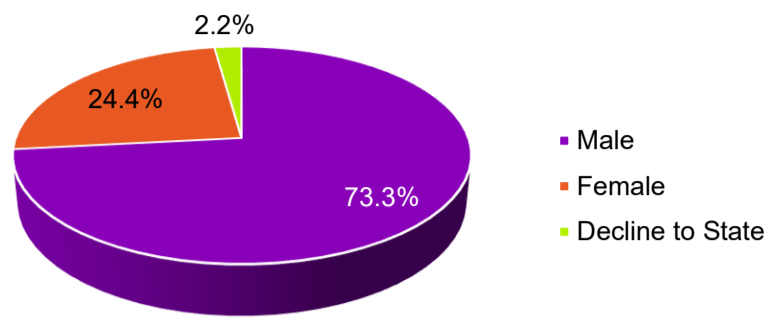
Race/Ethnicity*	#	%
White	26	57.8%
Asian	2	4.4%
Hispanic/Latino	15	33.3%
Black	0	0.0%
Native American	1	2.2%
Pacific Islander	0	0.0%
Decline to State	7	15.6%
Unavailable Info.	0	0.0%
Minorities**	3	13.0%
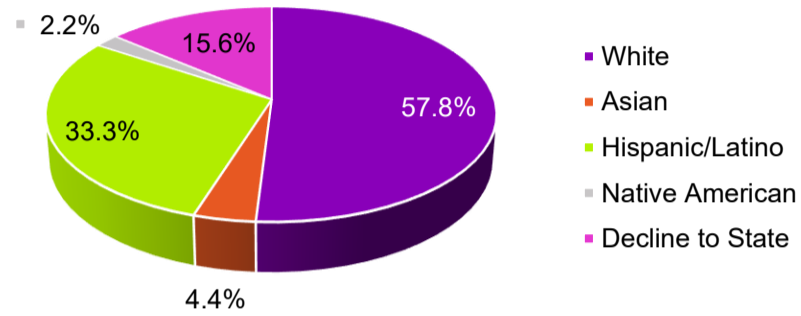
Citizenships	#	%
Foreign Home Inst.	25	55.6%
US Home Inst.	20	44.4%
Foreign Citizens	22	48.9%
US Citizen & Perm. Residents	23	51.1%
US Citizens	21	46.7%
US Permanent Residents	2	4.4%
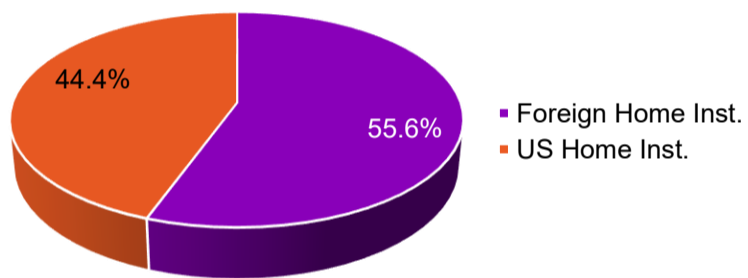
| Year of Ph.D	#	%
Prog. Assoc. (GS)	5	11.1%
2021 & Later	8	17.8%
2020	1	2.2%
2015-2019	8	17.8%
2010-2014	13	28.9%
2005-2009	5	11.1%
2000-2004	1	2.2%
1995-1999	1	2.2%
1990-1994	0	0.0%
1985-1989	2	4.4%
1981-1984	1	2.2%
1980 & Earlier	0	0.0%
Total # of Distinct Members	45	100.0%
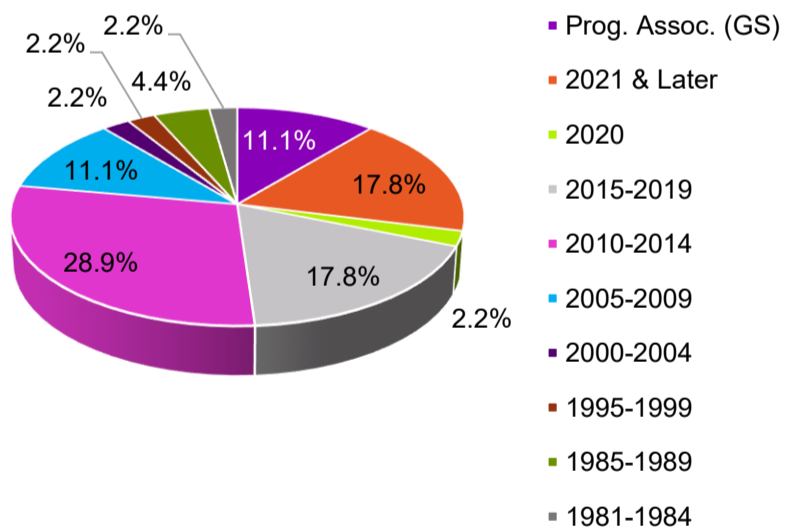
Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

### Higher Categories and Categorification, Part Two Member Demographic Summary Members Classified by State

State	#	%	2020 Census
South	**6**	**30.0%**	*38.1%*
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	1	5.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	1	5.0%	*1.4%*
MD	3	15.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	1	5.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**8**	**40.0%**	*23.7%*
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	4	20.0%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	2	10.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	1	5.0%	*0.9%*
OR	1	5.0%	*1.3%*
UT	0	0.0%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**4**	**20.0%**	*20.8%*
IA	0	0.0%	*1.0%*
IL	3	15.0%	*3.9%*
IN	0	0.0%	*2.0%*
KS	1	5.0%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	0	0.0%	*3.6%*
SD	0	0.0%	*0.3%*
WI	0	0.0%	*1.8%*
Northeast	**2**	**10.0%**	*17.4%*
CT	0	0.0%	*1.1%*
MA	2	10.0%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	0	0.0%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	*0.0%*
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	20	100.0%	*100.0%*

Pie chart: South 30.0%, West 40.0%, Midwest 20.0%, Northeast 10.0%
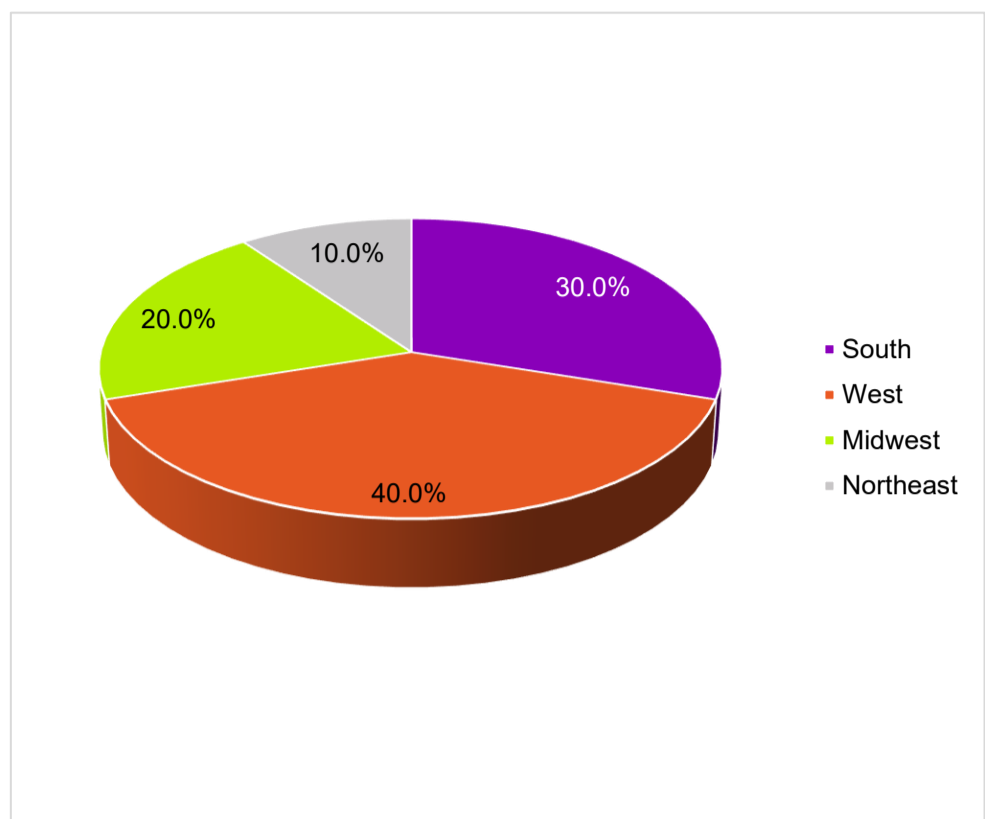
*Regions based on US Census classification

Higher Categories and Categorification, Part Two Members Classified by Countries

Africa			0
Americas			31
	North America	Canada	3
		United States	20
	Central America	Mexico	8
Asia			1
	Western Asia	Israel	1
Europe			11
	Northern Europe	Sweden	1
		United Kingdom	5
	Western Europe	Germany	4
	Eastern Europe	Czech Republic	1
Oceania			2
	Australia and New Zealand	Australia	2
Grand Total			45

- Americas 68.9%
- Europe 24.4%
- Oceania 4.4%
- Asia 2.2%
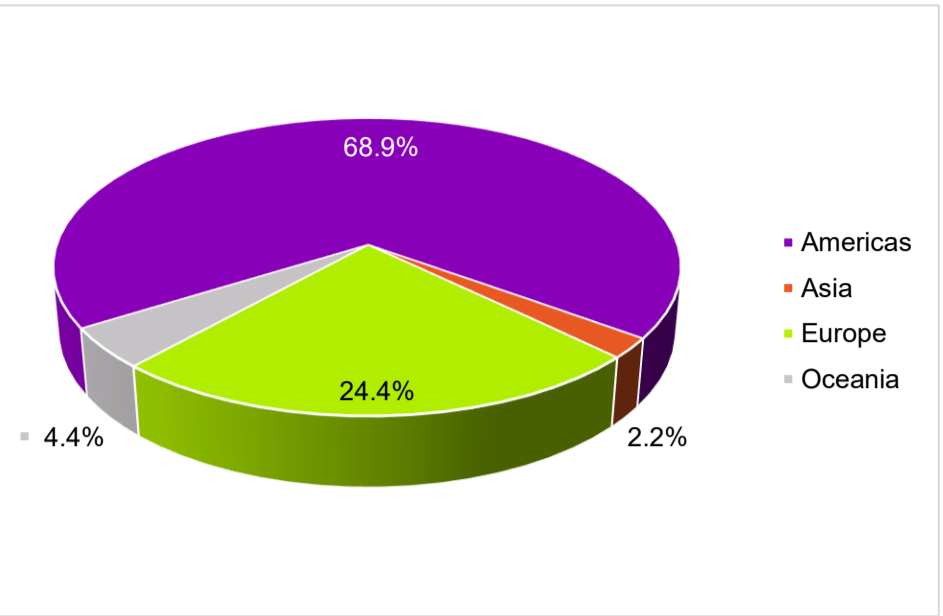
Regions based on United Nations classification

2022 Summer Research in Mathematics
June 6, 2022 – July 15, 2022

1.1 Description of Summer Research in Mathematics

Existing women's mathematics conferences are valuable collaborative opportunities but they are also very short in duration, usually lasting only a week, meaning projects started during those conferences remain unfinished once the participants return to their usual professional and personal responsibilities. SLMath's Summer Research in Mathematics (SRiM) program was created in response to this problem. The program provides space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals, with established projects. Such groups may apply for funding to spend two weeks or more together at SLMath where they will live and work in close proximity to one another and can make use of the Institute's resources. This focused, distraction-free collaboration can accelerate the completion of their research project and provide an opportunity for a deeper research experience than may have been possible otherwise.

Since the pilot cohort in 2017, SLMath has invited research groups to participate in the Summer Research in Mathematics program each summer. Due to COVID, the groups who were invited in 2020 were re-invited to attend in 2021 instead. As of May 2023, 3 (of 4) groups from 2017; 5 (of 6) groups from 2018; 9 (of 13) groups from 2019; 4 (of 10) groups from 2021; and 3 (of 11) groups from 2022 have so far had papers based on their SRiM project published or accepted for publication. A total of 54 published papers have resulted from the SRiM program since its inception, and a number more are under review or are currently in-progress.

SRiM 2022 was the fifth year of the program. Eleven research groups comprised of 39 total researchers met to continue their work on established projects. Each two to five person group spent two weeks collaborating on their projects at SLMath, with the exception of one group which met at the Banff International Research Station for Mathematical Innovation and Discovery (BIRS). As of May 2023, three of the SRiM 2022 groups have successfully published at least one paper. The whole 11-group 2022 cohort has reported: 4 published papers, 3 papers submitted for publication, and 24 in progress. In addition to making significant leaps on their respective projects, research groups were able to leverage travel funds provided by the SRiM program to present and discuss their work at relevant mathematics conferences and meetings around the world; 31 presentations have been reported thus far, at conferences such as the Joint Mathematic Conference, The Midwest Geometry Conference (co-organized by a SRiM participant), the Iberoamerican Pan Pacific Conference, the 40th Southeastern-Atlantic Conference on Differential Equations, the 13th Americas Conference on Diff. Equations and Nonlinear Analysis, and the AIMS Conference Series on Dynamical Systems and Differential Equations. These forums provide SRiM researchers with the opportunity to continue collaborations as well as improve their research portfolios by familiarizing the wider mathematical community with their ideas.

From the comments we received from participants following their stay, it is clear that the 2022 SRiM researchers' portfolios benefitted greatly from the program. When asked about the efficacy of the program in terms of individual impact, respondents repeatedly mentioned that the length of the program, the post-program travel support, and the chance to work face to face uninterrupted were particularly beneficial to their research productivity. A selection of demonstrative comments are included in section 1.3 below.

1.2 SRiM 2022 Research Groups

A total of 18 research groups comprised of 61 individuals applied to be a part of the 2022 program. The 2022 Summer Research in Mathematics program was the first round of applications for the program since the start of the COVID-19 pandemic (the SRiM visits in 2021 had been postponed from 2020). The 2022 Selection Committee, Chaired by Dr. Bianca Viray (University of Washington), developed a rubric with 9 categories to assess applications: motivation, partial results, research plan, participant suitability, alignment with program goals, institution and career stage, impact on Women, geographical location, and area of study.

Ultimately, 11 research groups comprised of 39 total researchers took part in the summer 2022 program. Nine groups met at SLMath, one group met at the Banff International Research Station, and one group (due to health and childcare issues related to COVID) met at a group member's home institution—DePaul University. The SRiM 2022 research groups and their topics are listed below.

Frieze Patterns and Cambrian Lattices
July 31, 2022 – August 13, 2022 at DePaul University

On positivity for a subclass of graph LP algebras
June 13, 2022 – June 24, 2022

Research Topic: Shapes from Echoes
June 6, 2022 – June 17, 2022

On the Dimension of Bergman Spaces
June 6, 2022 – June 17, 2022

4-Dimensional Perspectives on the Untwisting Number
June 4, 2022 – July 15, 2022

Subcritical Superlinear Elliptic Problems
June 6, 2022 – June 17, 2022

The Asymptotic Enumeration of Colorings Of The Middle Layers of The Hamming Cube
June 13, 2022 – June 24, 2022

Operator Algebraic Perspectives on Braid Groups
June 4, 2022 – July 15, 2022

Cohomogeneity Two Manifolds of Positive Sectional Curvature
June 13, 2022 – June 24, 2022 at BIRS (Banff International Research Station)

On Enumerating Numerical Semigroups through Integer Partitions
June 4, 2022 – July 15, 2022

Anti-van der Waerden numbers on Graphs
June 20, 2022 – July 1, 2022

2022 African Diaspora Joint Mathematics Workshop (ADJOINT)

June 20, 2022 – July 1, 2022

Program Directors:

Edray Goins (Pomona College)

Caleb Ashley (Boston College)*

Naiomi Cameron (Spelman College)

Jacqueline Hughes-Oliver (North Carolina State University)

Anisah Nu'Man (Spelman College)

1.1   Description of ADJOINT

The African Diaspora Joint Mathematics Workshop (ADJOINT) is a year-long program designed to provide the opportunity for in-person research collaboration to U.S. mathematical and statistical scientists, especially those from the African diaspora. Small groups of researchers work for an intense period of two weeks during the summer under the guidance of renowned African American scientists, who act as research leaders. After an intensive two-week research period, ADJOINT continues throughout the academic year (and beyond) by providing research groups with support for periodic virtual meetings and travel funds to enable visits among collaborators. Additional support is provided so that results can be presented at national and international conferences and published in peer-reviewed journals. A special session is organized annually at the Joint Mathematics Meeting (attended by thousands of mathematicians each year) to specifically highlight the research conducted by ADJOINT participants.

Research leaders are selected for their active, internationally renowned research portfolios and their strong history of mentorship. Each research leader proposes a topic on which their respective research group will collaborate during the two-week research period. The topics are published in advance of the application period. When applications have closed, they are reviewed by the ADJOINT Directorate and about twenty applicants are selected to participate. The selection rubric is designed to identify researchers for whom the program will have the most significant impact on their career and professional network. Following the summer session, the program provides conference and travel support to the participants in order to increase opportunities for collaboration, maximize researcher visibility, and foster a sense of community.

The ADJOINT program continues to positively affect the research and careers of Black mathematicians, thereby increasing the impact of their work and enriching the mathematical and statistical sciences.

1.2 Summary of ADJOINT 2022 Activities

In 2022, the two-week intensive period occurred from June 19 to July 2. The program was hosted on-site in Berkeley, CA where COVID testing protocols and masking requirements were still in place. The program overlapped with the ADJOINT reunion (described in section 7.3 of the main report) and the MSRI-UP program (described in section 5 of the main report) which afforded additional opportunities for networking and mentorship. Throughout the two-week intensive period each research group had freedom to organize their time in a manner that was most effective for them; however, it was recommended that each day begin with a period of "training," crosstalk, updates, debrief, feedback, strategy adjustment, etc. Each group's project is outlined in section 1.3 below.

Several events were designed to complement and support the groups' research activities. During the first week there was an orientation to the SLMath library, hosted by the SLMath librarian Linda Riewe, as well as a grant writing panel with three program officers from the NSF: Swatee Naik, Yuliya Gorb, and Carleitta Paige-Anderson. The panelists shared advice on how to find grant opportunities at various agencies and answered participant questions. Another activity held during

the first week was an intimate in-person only (no virtual attendance) session entitled "Work, Wellness, & Autonomy" aimed towards humanizing the mathematics profession by focusing on the lived experiences of the collective ADJOINT community. The panelists for this session included: Tepper Gill, Emile Davie-Lawrence, Federico Ardila, Rebecca Hubbard, Nathan Broaddus, and Naiomi Cameron. These six panelists include past and present ADJOINT research leaders, participants, and directors, in addition to an MSRI-UP onsite director. Common activities between ADJOINT participants and the MSRI-UP undergraduate student participants provided opportunities for networking and fellowship between the two groups. Lunches and coffee breaks were unstructured and held at overlapping times to allow for interaction between participants of the different summer activities. Opportunities for more structured interactions included an invitation for ADJOINT researchers to sit in on research talks given by MSRI-UP student participants. Finally, there were two research sharing sessions: one at the end of the first week, and one at the end of the second week. These provided space for the three groups to discuss their respective projects with the other groups.

Catalyst Consulting Group administered a retrospective-pre survey at the close of the two-week intensive period which was completed by all researchers and research leaders. The results were quite positive; the ADJOINT 2022 group reported that participants' expectations were met (or exceeded) in each category addressed by the survey. In particular, 91% of participants indicated that ADJOINT exceeded their expectations in 'beginning a new group project that will move towards publication' (which was also their top reason for joining the program). Program participants were also asked a series of questions about their connections to other mathematical and statistical scientists in the African Diaspora and social networks within the mathematical and statistical sciences communities, with the goal of determining ADJOINT's impact on participants' professional connections. Program participants reported gains across all six items. Overall, ratings were higher for each topic this year, compared with the results from ADJOINT 2021.

1.3 ADJOINT 2022 Research Groups

Improving validity and fairness of EHR research for medically underserved populations

Research Leader: Dr. Rebecca Hubbard (Perelman School of Medicine, University of Pennsylvania)

Healthcare-derived data including data from electronic health records (EHR) and medical claims have emerged as a key resource for learning about the health of populations and impact of medical interventions. Although healthcare-derived data are now widely used in biomedical studies, these data sources have many deficiencies including complex patterns of missingness and measurement error. For example, in contrast to data collected for research, healthcare data are generated when a patient seeks care in the healthcare system. As a result, the specific data elements available for a given patient vary in direct relation to the extent of the patient's healthcare involvement. An important consequence of this differential EHR data availability is its impact on the validity of research conducted in medically underserved populations. Patients who receive less or poorer quality care, including racial and ethnic minority and socioeconomically vulnerable populations, also have poorer quality data. Research using healthcare-derived data thus may generate results with poorer statistical properties for underserved populations and potentially exacerbate health disparities.

In this project, using healthcare-derived data and statistical simulation studies, we will investigate variability in data quality across underserved populations, quantify the impact of this differential data quality on bias and precision of results, and investigate alternative statistical methods for bias reduction to improve the quality, generalizability and fairness of research using healthcare-derived data.

Mathematical Model of Targeted Cancer Therapeutics

Research Leader: Trachette L. Jackson (University of Michigan)

Mathematical and computational modeling approaches have been applied to every aspect of cancer biology, from tumor initiation to malignant spread and treatment response. To pinpoint specific pathways critical for tumor progression, a substantial amount of research aimed at improving therapeutic outcomes for cancers is now focusing on the molecular biology of individual tumors. Increased understanding of these molecular mechanisms that mediate cancer pathogenesis is leading to the targeted manipulation of these pathways and the development of new cell-specific approaches to cancer therapy.

A powerful and practical way to optimize novel drug combinations for clinical cancer treatment is to use data-driven mathematical models. The overarching goal of this project is to develop such models of promising targeted cancer therapeutic agents that account for the variability in mechanistic processes associated with cell decision-making. We will leverage this heterogeneity to set up a virtual cohort of patients and run treatment optimization studies to predict treatment combinations that minimize tumor burden and/or maximize survival. We anticipate that this will allow us to identify attributes characterizing subpopulations that benefit most /least from these interventions alone and in combination with more traditional therapeutic approaches.

Fractional Calculus and Applications to Finance and Biology

Research Leader: Dr. Gaston M. N'Guerekata (Morgan State University)

Over the last decade, there has been a resurgence of study of fractional differential equations and their applications. Fractional differential equations are more appropriate and more efficient in modeling of memory-dependent phenomena as well as modeling in complex media, such as porous ones. For example, the fractional derivative of a financial process at a specific time is affected by all of the information and behavior of the model in all previous moments. In comparison, the classical derivative at a specific time is affected only by the information in the local neighborhood of that time. Surprisingly, a fractional order system is more stable than its integer model since the stability domain in the complex space of eigenvalues of the linearized system for fractional differential equations remains contained and is larger than the corresponding domain for ordinary differential equations.

In this research project, we will introduce some basic and popular concepts of derivatives of fractional order. We will review some applications to fractional modeling of financial and biological systems from recent literature. We will also propose the study of the existence, uniqueness, stability and long term behavior of mild solutions to some fractional evolution equations, both with and without impulses as research projects leading to publications.

Definability, Decidability, and Computability in Number Theory, part 2
July 18, 2022 - August 12, 2022
MSRI, Berkeley, CA
USA

Organizers:
Valentina Harizanov (George Washington University)
Barry Mazur (Harvard University)
Russell Miller (Queens College, CUNY; CUNY, Graduate Center)
Jonathan Pila (University of Oxford)
Thomas Scanlon (University of California, Berkeley)
Alexandra Shlapentokh (East Carolina University)

Report on DDC2, MSRI Summer 2022

October 2022

1   Introduction

The month-long program on Definability, Decidability, and Computability in Number Theory met in Berkeley July 18 – August 11, 2022.

Despite its length and scaled-down nature, this was a wonderful program in many respects. The composition of the group reflected well the original idea of bringing together people from computability, number theory and model theory, and the choice of participants worked very well in creating a stimulating and collegial environment.

2   Participation

Thirty people participated in-person in the program, including Scanlon (lead), Harizanov, Malliaris, Miller from the organizing committee. Four people came for two weeks, nine for three weeks, and seventeen for all four weeks. The exit survey shows high levels of satisfaction with the program. Of the 30 people who answered the question about satisfaction with collegiality, 27 selected 5/5 with the remaining three people choosing 4/5. 29/30 indicated they learned new techniques, 25/30 indicated they had new opportunities to present their work, and of course many worked on papers as detailed below. Of the 28 people who answered the question on overall professional satisfaction with the meeting, 26 selected 5/5 with the remaining two selecting 4/5.

The sense we had of the program overall was put well by one researcher who wrote:

> "The length of the program, the logistics of it, the timing in the summer, and the size and composition of the research group were all very nice."

3   General comments on logistics

Due to the shorter nature of the program, most participants stayed in the Marriott in downtown Berkeley. People seemed to find the hotel convenient in many

1

ways for the month-long program, and appreciated the advantage of being near other participants. (On its suitability for longer stays opinion was more divided.)

Health measures were generally successful, and of course were taken seriously by the group.

The regular testing and masking seemed to be an important component of ensuring that the handful of positive cases did not become general. Some participants asked that the policy on non-members be made clearer to allow for the possibility of accommodating visitors in special cases. It was nice to be able to hold our seminar in the large auditorium which provided ample space for social distancing. Finally, the policy of having all eating and drinking at tea outdoors was excellent. We might recommend the Institute consider installing more outdoor blackboards. An outdoor lecture space with a large blackboard and room for several dozen chairs would also have been popular with our group.

Even though meeting in person was a main draw for participants, the existence of remote options for collaboration and seminar attendance were appreciated. People regularly used the videolink in the space next to the kitchen to speak with absent co-authors, and members who were not able to attend in person for the entire period maintained momentum by joining the daily seminars remotely.

During the first week of the program, some of the participants interacted with undergraduate students from the MSRI-UP summer program on algebraic methods in mathematical biology, by meeting with students for lunch and discussion about graduate programs and careers in math, and also by attending some of students' final presentations.

4 Seminar

The program seminar was held Monday-Thursday during the four weeks of the program. Everyone in the program was invited to propose a talk if they wished. Talks were held just before tea, and some days, also just after tea, to accommodate everyone and in some cases, to hear second reports covering new results proved during the program. Participation was generally enthusiastic both in terms of speakers and in terms of audience attendance. In our observation, the association with tea-time was especially useful as it gave people a reason to congregate, discuss, and interact. It was also our observation that almost everyone who came to the first talks stayed for tea, and on days where there was a second talk, almost everyone from tea attended the second talk.

List of seminar speakers[1]: Franziska Janhke, Thanases Pheidas, Hector Pasten (two talks), Valentina Harizanov, Wesley Calvert, Douglas Cenzer, Alexandra Shlapentokh (virtual), Sylvy Anscombe, Blaise Boissonneau, David Marker, Chris Michael Laskowski, James Freitag, Juan Pablo De Rasio, Phillip Ditmann, Meng-Che Turbo Ho, Lynn Scrow, Arno Fehm, Russell Miller, Ted Slaman, Jinhe Vincent Ye, Paula D'Aquino, Eudes Naziazeno, Agnus Macintyre, Neer Bhardwaj.

---

[1]taken from MSRI calendar

2

For example, Philip Dittmann gave a seminar talk related to Odoni's 1985 conjecture (about Galois groups of iterated polynomials over arbitrary Hilbertian fields), which he and Borys Kadets disproved during the virtual semester of the program in fall 2020, while they were MSRI postdocs. Jinhe Ye and Meng-Che Ho, who were MSRI postdocs during the virtual semester, gave seminar talks on their research concerning curve-excluding fields and computable functors from groups to fields, respectively. Exceptionally, Héctor Pásten gave a second lecture in the seminar to report on some fantastic work with Natalia Garcia Fritz and Thanases Pheidas, started and completed during the program, on Diophantine definitions in polynomial rings and fields of rational functions.

Participant comments on the seminar were positive, praising:

- *"The ample time provided in the schedule for one's own work and collaborations, while having a daily focal point of seminar and tea for more social interactions."*

- *"The seminar series was for the most part very good, but not too intrusive on time for research and collaborations."*

- *"[one member] spoke on this project in the seminar series, and afterwards several other program members helped us prove a new result to add to the paper."*

There was also a reading group seminar focused on a recent paper by Chernikov and Hempel "On n-dependent groups and fields" (`https://arxiv.org/abs/1912.02385`). "The goal was to reach the proof of the henselianity conjecture in positive characteristic for n-dependent valued fields." The reading group seminar was held twice per week during the last three weeks of the program.

5   Projects

Participants indicated that they worked on a large range of projects during the program. 20/30 indicated that they initiated work in new areas and 21/30 initiated work with new collaborators. 21/30 indicated they worked on papers during the summer program, of whom 15 said they worked on more than one. Projects mentioned on the exit survey include work around big Ramsey degrees, models of PA, genericity in algebraically closed fields, generically and coarsely computable structures and isomorphisms, complexity of Artin-Schreier extensions, Ax-Kochen-Ersov theory, Turing degrees of certain theories of fields, definable groups in expansions of real closed fields, finitely ramified henselian valued fields, among many others. Several projects which were sufficiently far advanced to be mentioned on the exit survey were described as having begun from comments made during the meeting.

3

6 Conclusion

While we would have preferred to have met at MSRI for a full semester long program, this month long program was remarkably successful and could be a model for shorter research programs in the future. Participants appreciated the structure of a regular seminar paired with ample time for collaboration, informal discussions, and independent work.

4

Definability, Decidability, and Computability in Number Theory, part 2 Member Demographic Summary

Gender	#	%
# of Distinct Members	41	100.0%
Male	25	61.0%
Female	15	36.6%
Other	0	0.0%
Decline to State	1	2.4%
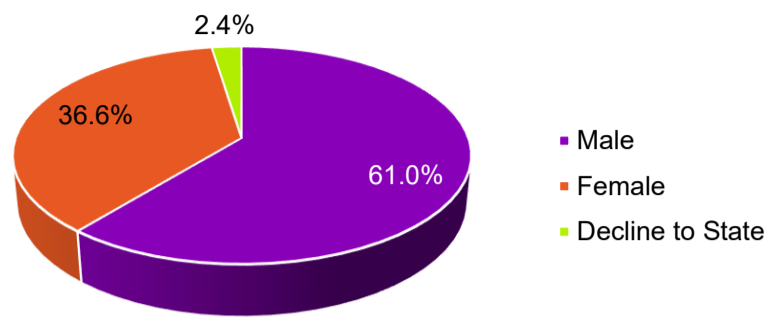
Race/Ethnicity*	#	%
White	24	58.5%
Asian	7	17.1%
Hispanic/Latino	3	7.3%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	8	19.5%
Unavailable Info.	0	0.0%
Minorities**	1	5.9%
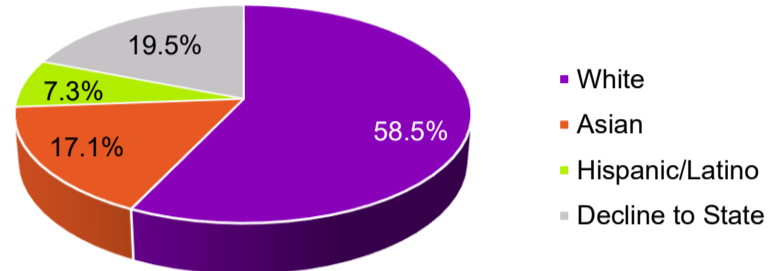
Citizenships	#	%
Foreign Home Inst.	20	48.8%
US Home Inst.	21	51.2%
Foreign Citizens	24	58.5%
US Citizen & Perm. Residents	17	41.5%
US Citizens	15	36.6%
US Permanent Residents	2	4.9%
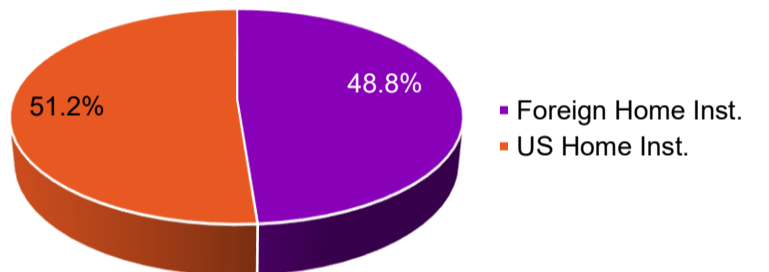
| Year of Ph.D	#	%
Prog. Assoc. (GS)	4	9.8%
2021 & Later	2	4.9%
2020	2	4.9%
2015-2019	5	12.2%
2010-2014	10	24.4%
2005-2009	3	7.3%
2000-2004	3	7.3%
1995-1999	2	4.9%
1990-1994	2	4.9%
1985-1989	3	7.3%
1981-1984	2	4.9%
1980 & Earlier	3	7.3%
Total # of Distinct Members	41	100.0%
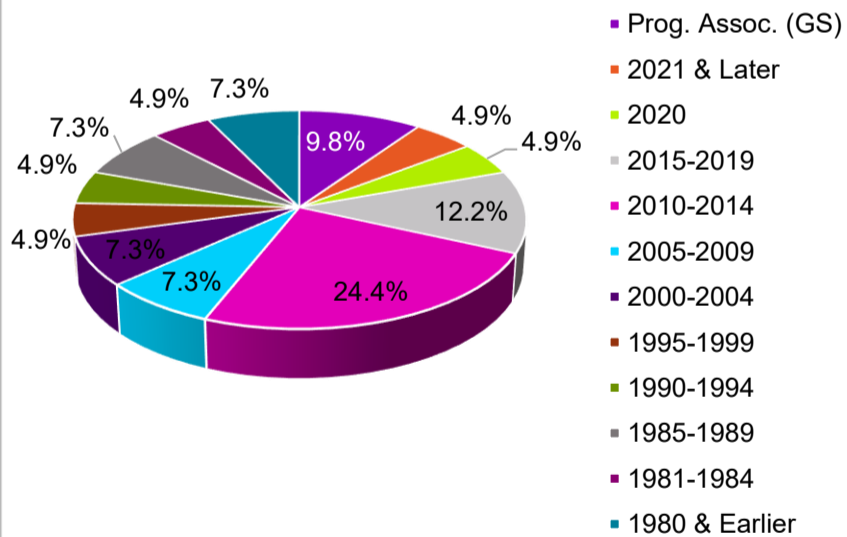
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

Definability, Decidability, and Computability in Number Theory, part 2 Member Demographic Summary
## Members Classified by State

State	#	%	2020 Census
South	**4**	**19.0%**	**38.1%**
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	2	9.5%	0.2%
FL	1	4.8%	6.5%
GA	0	0.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	4.8%	1.9%
MS	0	0.0%	0.9%
NC	0	0.0%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	0	0.0%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	**5**	**23.8%**	**23.7%**
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	5	23.8%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	**10**	**47.6%**	**20.8%**
IA	0	0.0%	1.0%
IL	7	33.3%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	1	4.8%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	1	4.8%	3.6%
SD	0	0.0%	0.3%
WI	1	4.8%	1.8%
Northeast	**2**	**9.5%**	**17.4%**
CT	1	4.8%	1.1%
MA	0	0.0%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	0	0.0%	2.8%
NY	1	4.8%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	**0**	**0.0%**	**0.0%**
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	21	100.0%	100.0%

Pie chart: South 19.0%, West 23.8%, Midwest 47.6%, Northeast 9.5%
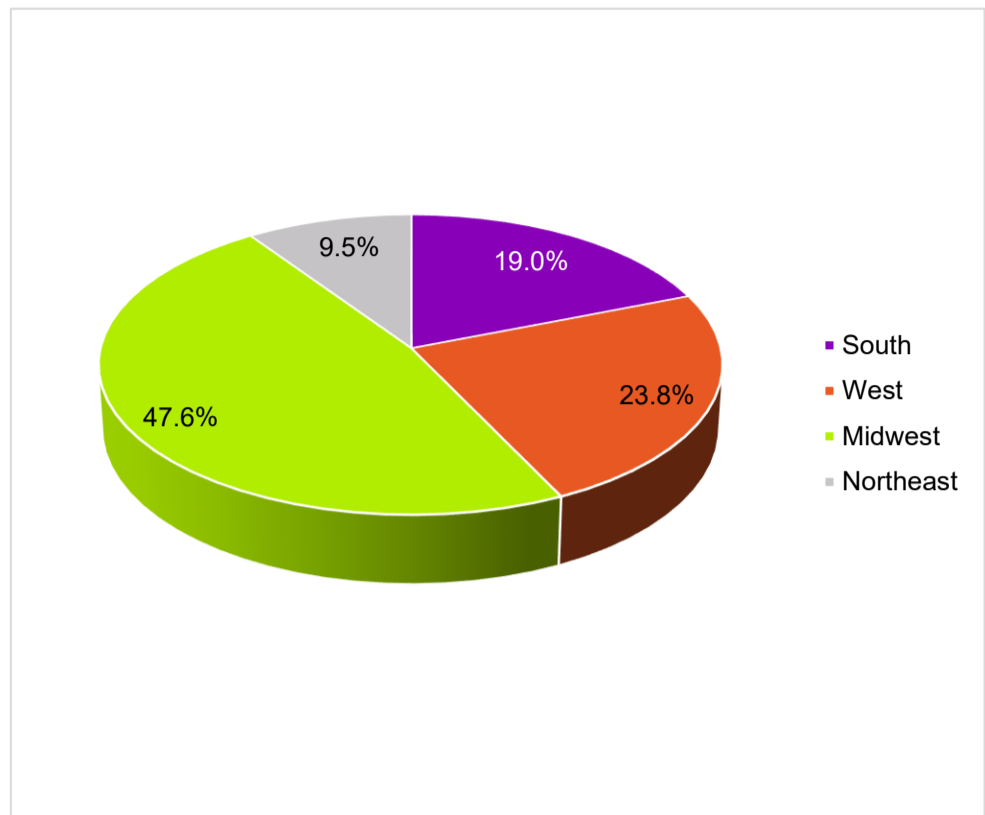
*Regions based on US Census classification

Definability, Decidability, and Computability in Number Theory, part 2 Members Classified by Countries

Africa			**1**
	West Africa	Senegal	1
Americas			**27**
	North America	Canada	2
		United States	21
	South America	Brazil	1
		Chile	3
Asia			**0**
Europe			**13**
	Northern Europe	United Kingdom	2
	Southern Europe	Greece	1
		Italy	2
	Western Europe	Belgium	1
		France	2
		Germany	5
Oceania			**0**
Grand Total			**41**
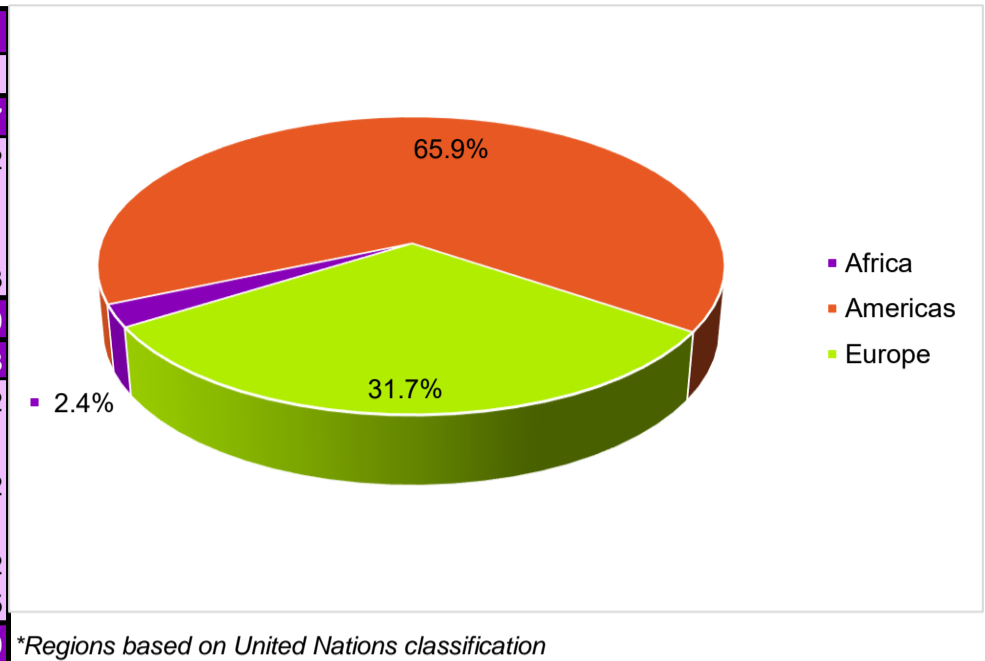
- Africa
- Americas
- Europe

65.9%

31.7%

2.4%

Regions based on United Nations classification

Analytic and Geometric Aspects of Gauge Theory
August 22, 2022 - December 21, 2022
MSRI, Berkeley, CA
USA

Organizers:
Laura Fredrickson (University of Oregon)
Rafe Mazzeo (Stanford University)
Tomasz Mrowka (Massachusetts Institute of Technology)
Laura Schaposnik (University of Illinois at Chicago)
Thomas Walpuski (Humboldt-Universität)

REPORT ON THE PROGRAM
"ANALYTIC AND GEOMETRIC ASPECTS OF GAUGE THEORY"

LAURA FREDRICKSON, RAFE MAZZEO, TOMASZ MROWKA, LAURA SCHAPOSNIK, AND THOMAS WALPUSKI

1. INTRODUCTION

The evolution of gauge theory presents a compelling story about the many ways in which mathematics and physics are intertwined and influence one another. In the last century, the insights and problems suggested by physicists have provided crucial direction and motivation for the mathematical developments, and the interchange between these fields continues to strengthen. The semester program *"Analytic and Geometric Aspects of Gauge Theory"* was organized to capitalize on new ideas, to help expedite their development, to ensure their success, and to chart out new directions for future work. In particular, careful attention was paid to make sure that the younger participants had a welcoming environment to the field, and for them to learn about different tools that could help them get to the forefront of some of the most compelling open problems problems in gauge theory. In what follows we shall described the details of our semester, and emphasize when possible the fruitful experiences that participants at all levels of their career have experienced whilst being part of our program.

> *The "Analytic and Geometric Aspects of Gauge Theory" program at SLMath was a wonderful opportunity for me to widen my horizon about other facets of gauge theory than the one I personally work on, and to get to know many of the leaders in the field. The latter was particularly important for me because it has been a struggle to meet new people during the pandemic times because of the lack of conferences.–* Sebastian Schulz

2. RESEARCH DEVELOPMENTS

Whilst we shall mention many developments in the breakthrough section of our report, we shall describe here a few examples of research advances members of our program have made during the semester. Our postdoc Saman Habibi Esfahani made excellent progress with his collaborators on constructing monopoles in higher dimensions with singularities along calibrated submanifolds; he also advanced considerably toward the goal of establishing existence of certain special Lagrangians conjectured to exist by Donaldson-Scaduto. Prof. Jason Lotay's work on the development of new links between gauge theory and calibrated geometry progressed further. Finally, Prof. Laura Fredrickson, Prof. Laura Schaposnik and postdoc Xuesen Na began new research concerning limiting geometries and special Lagrangians within $SU(2,1)$-Hitchin moduli spaces.

1

3. Organizational Structure

Our program hosted a Connections workshop, as well as an Introductory workshop and a main workshop. Towards the beginning of our program, during the Introductory workshop, we ran a number of mini-courses which provided both postdocs and students with a firm grounding to conduct their own work and give them an overview of the vast field of gauge theory. After these mini-courses, several reading and learning groups were run independently by program members. Outside of the workshop weeks, we organized four *official* weekly events (and one joint **"What is?"** seminar with the partner program):

- **Graduate Student Seminar** took place on Tuesdays 10-11, and was led by PhD student Izar Alonso Lorenzo. During this seminar series graduate participants of our program as well as the companion program presented their latest progress. This seminar was very well attended, and during the first weeks, Prof. Laura Fredrickson acted as a lead mentor, helping the chairs of the seminar, as well as the speakers, gauge how the session should move along, which level the talk should be presented at, etc. Her contribution to this was crucial to get the seminar series started in an efficient and fruitful way.

The organization of this weekly junior research seminar was part of our program's mentoring plan for younger members. As in our original plan, this was organized by graduate students and postdoctoral members, and was intended for the benefit of these graduate students and early postdocs. Most notably, this seminar series allowed these young researchers to present their own research (and to receive mentoring on how to give seminars), and it also provided a natural continuation of the introductory workshop, with talks on a sequence of fundamental results in various aspects of the subject with which not everyone was equally conversant. This helped all members learn material which made it possible for them to understand the ongoing research seminars and to interact meaningfully with as wide a variety of other participants as possible.

- **Program Seminar** took place Tuesdays 11-noon, and was led by postdoc Sebastian Schulz. During this seminar series all postdocs of the program presented their most recent developments, and also other senior participants presented their work.

This seminar series was attended our program's participants; however, numerous participants from the companion program also attended, and there were a substantial number of online participants as well.

- **Q&A Session** which took place on Tuesday during lunch 12-1, and was led by postdoc Saman Habibi Esfahani. During this session, participants of the program would meet outside on the first floor deck (near where the daily tea is served) to discuss questions that had been posed by other participants. These suggestions for questions were either given to Esfahani directly, or in other cases anonymously through an online form or by leaving a comment in the box by the auditorium).

This anonymous option allowed people to ask questions without worry that they would be thought too basic, and of course very often the answers to and discussions around such questions were greatly appreciated by the audience.

"I particularly enjoyed the Q&A sessions, where I learned about many different topics at an understandable level and learned about the research landscape. "– Prof. Jason Lotay (MSRI Chancellor's Professor, Oxford)

As part of Esfahani's curatorial role in fielding these questions, he contacted appropriate members in advance to ask them to prepare short presentations to address these questions. This led to very well organized and well attended sessions, and many positive comments:

"I benefited immensely from participating in the program and particularly enjoyed the weekly Q&A session where I learned about many concepts, open problems and techniques deployed in the topics that are at the forefront of contemporary gauge theory. I also relished the program conferences, particularly the minicourses during the introductory workshop: I thought that they were very well-structured and concise, so that I got a good feeling for recent activities, progress and struggles in certain areas within gauge theory."– Sebastian Schulz

Yet another goal of this gathering was be to hold periodic sessions to discuss open problems in the field. This was sometimes held in collaboration with young researchers from the parallel program on 'Floer homotopy theory', which served the dual purpose of strengthening relationships between these different groups and helping everyone to bridge the 'language gaps' between the two areas.

- **Journal Club** which was held on Thursdays during Lunch 12-1, and was led by postdoc Greg Parker. His role was to choose (or receive suggestions on) papers that had recently appeared on the arXiv and would be of general interest to the program participants, and ask people to give short presentations on these. Each session contained three or four such presentations. This was also very well attended and appreciated as a way to learn about new advances, both directly in Gauge Theory and more broadly in parts of geometry and Mathematical Physics close to our program.

"Besides the personal research aspects I really enjoyed a lot of the seminars, and found that generally the more casual ones were more beneficial. The question session, the arxiv review, and the 'what is' seminar were great environments to learn the basics of the important questions and basic techniques [...] it provided a great environment for more senior people to share 'big picture' or 'secret' background ideas that are things "known to the experts" but not often explicitly written. " – Greg Parker (Postdoc at MSRI and Szegö Assistant Professor at Stanford)

Finally, we also ran a number of social activities:

- **Weekly Program Dinner.** There was a weekly program dinner held on Wednesdays, and usually coordinated by postdoc Sebastian Schulz.

- **Weekend activities.** We organized social activities for members and their families on a regular basis, and these were led by various volunteers from both programs. We created a list of activities in a spreadsheet where people could add entries and keep track of what was going on shorturl.at/ntBUZ.

4. Postdoctoral fellows

The training and involvement of postdocs played an important role in our program. All postdocs were mentored by a senior researcher to ensure productive development in their research program and to help them with other aspects of their career (grants, job applications, etc.).The postdoctoral fellows program appeared to be very successful: most mentors met their mentees once a week to discus not only research but also career-related matters, and the postdocs seem to have very much appreciated this opportunity. In particular, it was great to read the following comments from postdoc mentees:

It was most fundamental to have postdocs participate of the program, both in term of the interactions they had with each other (fostering the innovation and building their contact networks) but also because of the different expertise each of them brought to the program. The different angle of research they had allowed for novel collaborations to arise, which were reflected in many different instances during the program:

"The most helpful thing was just the availability of people throughout the semester. There were lots of people who kept their doors open and were willing to strike up casual conversations. I also had a great experience with my mentor Thomas Walpuski since he was working on essentially a different formulation of the same result and we had many productive discussions in our weekly meetings." – Greg Parker (Postdoc at MSRI and Szego Assistant Professor at Stanford)

Finally, we received a lot of great feedback about how useful giving talks was for postdocs. The feedback that mentors gave to postdocs about their talks helped them both prepare for future seminars and understand how job talks should be approached.

"I'm very grateful for this semester at MSRI. While I mostly continued working on pre-existing projects, the semester was still extremely helpful for my growth as a mathematician. Aspects that I particularly enjoyed were: talking to a variety of mathematicians about their work and my work, the experience of giving a talk to a math audience, and attending a variety of talks." – Max Zimet (Postdoc at MSRI)

5. Graduate Students

During the semester our Chancellor's Professor Jason Lotay delivered a very successful course on *"Calibrated Geometry and Gauge Theory"*, which helped bringing together the students we had invited to participate of our program.

"I think the lecture course on Calibrated Geometry and Gauge Theory I gave as part of my Chancellor's Professorship duties was a great success, and I produced detailed lecture notes which I have made available online as a useful resource for graduate students and postdocs interested in the area.

Chancelor Professor Jason Lotay (University of Oxford)

Graduate students were also able to present their research advances in the week Graduate Student Seminar, as well as in more informal environments (daily afternoon coffee breaks at MSRI, outings, etc.)

"My experience at the MSRI has been highly beneficial. As a PhD student who started in the year 2019, my PhD studies have been greatly affected by the covid pandemic. In particular, I have barely had the chance to interact with the mathematical community outside of my home institution, the University of Oxford. Moreover, I could not meet people in the United States due to travel restrictions. Being at the MSRI allowed me to meet the experts in my area of interest and talk about mathematics with them. This was especially important at this time of my PhD as I am about to enter the academic job market. Furthermore, being here in-person allowed me to make connections which will hopefully develop into future collaborations. I have also benefited from the multiple activities happening in the program, such as the seminars, Q&A sessions and the journal club."– Izar Alonso Lorenzo (DPhil student at the University of Oxford)

6. Inclusivity

The organizing team was mindful of equity, diversity, and inclusivity and took the responsibility to make this program inclusive, to ensure the participation of women and underrepresented groups. Besides the efforts made to be inclusive during our workshops and seminars, we also paid special attention to present a welcoming environment throughout the semester, and in particular our program included the following activities:

- **Mentoring sessions for self-identified women**. During the first weeks of the program we held 10 sessions with different mentors (members of the program who volunteered to be mentors) during which participants could sign up to certain session and join a luncheon to discuss possibly sensitive subjects. The signup was made using SignUp Genius and was taken care of by Laura Schaposnik.
- **Women's lunch sessions.** During the semester, Laura Fredrickson and Laura Schaposnik organized informal lunch sessions including self-identified women from both programs, during which they would discuss any pertinent topics that could benefit from opinions from researchers around the world.

- **Program's Career Panel**. During the last month of the program, we held a *"Career panel"* during a lunch Q&A session, during which students and postdocs could ask a diverse array of questions both to the organizers of the program as well as to Prof. Dan Freed, who volunteered to lead the discussion. This session was very well attended and the junior participants found this extremely informative and useful.

Besides those formal initiatives taken, we also had informal discussions over lunch very often about different types of family support available, different childcare types one could seek, and more generally, how to navigate life with small children and academic duties. Participants seem to have very much appreciated such opportunities.

"Trying to manage a successful career with small children is challenging, at least to get the right balance and ensure that your children are well looked after. Talking with you [Prof. Schaposnik] and other members this fall about issues like this was very helpful."–
Paul Feehan (Professor at Rutgers)

Finally, timing of seminars was chosen carefully to be most convenient for those participants who needed to pick up their children in the later afternoons.

7. Highlights and Breakthroughs

Some of the breakthroughs were already listed in the earlier 'Research Developments' Section, but there were many other key developments during the Semester.

One exciting breakthrough involved advances in the study of diffeomorphism groups of 4-manifolds and spaces of embeddings of surfaces and 3-manifolds. During the program, Daniel Ruberman and Dave Auckly finished a big paper applying Yang-Mills gauge theory to questions about diffeomorphism groups of 4-manifolds and spaces of embeddings of surfaces and 3-manifolds, capping 25 years of work (*started at a conference at MSRI in 1998*).

Prof. Ruberman and Prof. Auckly also worked out a key step in a successor paper, applying Seiberg-Witten theory to related problems, which has lead to further stronger results, for example showing infinite generation of various homology and homotopy groups of such spaces, and also showing infinite generation of homotopy and homology groups of spaces of metrics of positive scalar curvature. They also started a new collaboration with postdocs Hokuto Konno, Anubhav Mukherjee, and Masaki Taniguchi, and have some preliminary results relating family Seiberg-Witten invariants to diffeomorphism groups and embedding spaces, and they expect to write at least one paper on the subject and have successfully applied for an AIM Square to continue this collaboration.

In a different direction, Prof. Jason Lotay and his collaborators found an exciting new link between gauge theory and calibrated geometry, bringing together gauge theory in low and high dimensions, and involving special holonomy, and they expect to finish their papers on the subject in the coming year.

In another direction, program members Laura Fredrickson and Max Zimet (together with Arnav Tripathy) worked out essential details in their proof establishing the convergence of the celebrated integral relation proposed by Gaiotto, Moore and Neitzke, which provides a new and powerful description of the hyperkähler metrics on Hitchin moduli spaces.

Max Zimet (together with Andras Vasy and Arnav Tripathy) completed the bulk of their work which shows that all four-dimensional hyperkähler manifolds can be realized as hyperkähler quotients. This greatly extends Kronheimer's construction in the four-dimensional ALE case. This construction involves singular equivariant instantons on k-dimensional tori T^k; here $k = 0$ produces ALE spaces, $k = 1$ gives ALF spaces, $k = 2$ corresponds to ALG spaces, and the most singular (and important) case is $k = 4$, which yields (compact) K3 spaces. This also proves a folklore conjecture that all complete hyperkähler four-manifolds arise as gauge-theoretic moduli spaces.

Postdoc Pre/Post-MSRI Institution Group

Family Name	First Name	Pre-MSRI Institution Name	Pre-MSRI Institution Group	Post-MSRI Institution Name	Post-MSRI Institution Group
Bhattacharya	Arunima	University of Washington, Seattl	Math Public Large Group	University of North Carolina	Math Public Medium Group
Habibi Esfahani	Saman	Stony Brook University	Math Public Medium Group	Duke University	Math Private Large Group
Holdt	Maximilian	Christian-Albrechts Universität K	Foreign	to be determined	n/a
Na	Xuesen	University of Maryland	Math Public Large Group	University of Illinois Urbana-Char	Math Public Large Group
Parker	Gregory	Massachusetts Institute of Techn	Math Private Large Group	Stanford University	Math Private Large Group
Rezaee	Fatemeh	University of Edinburgh	*Foreign*	University of Cambridge	*Foreign*
Schulz	Sebastian	University of Texas, Austin	Math Public Large Group	Johns Hopkins University	Math Private Small Group
Zimet	Max	Harvard University	Math Private Large Group	Stanford University	Math Private Large Group

## 2022-23 GT Postdoctoral Fellows Demographic Summary

Gender	#	%
# of Distinct Members	8	100.0%
Male	5	62.5%
Female	2	25.0%
Decline to State	1	12.5%
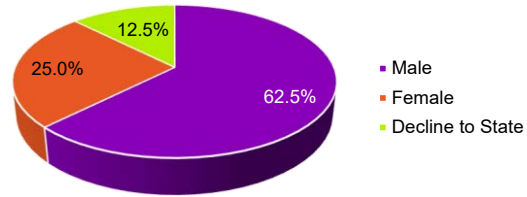
Race/Ethnicity*	#	%
White	4	50.0%
Asian	3	37.5%
Hispanic/Latino	0	0.0%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	1	12.5%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%
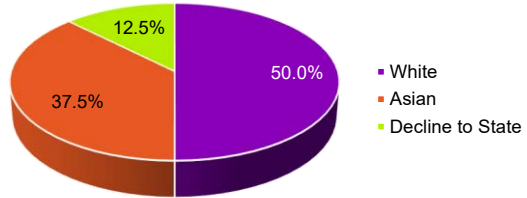
Citizenships	#	%
Foreign Home Inst.	2	25.0%
US Home Inst.	6	75.0%
Foreign Citizens	6	75.0%
US Citizens & Perm. Res.	2	25.0%
US Citizens	2	25.0%
US Permanent Residents	0	0.0%
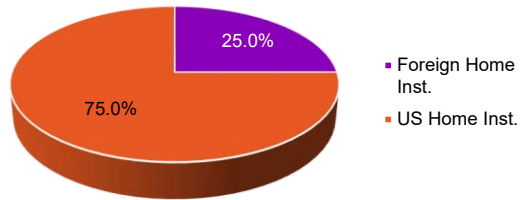
Year of Ph.D	#	%
2022	6	75.0%
2021	0	0.0%
2020	0	0.0%
2019	2	25.0%
2018	0	0.0%
2017	0	0.0%
Total # of Distinct Members	8	100.0%
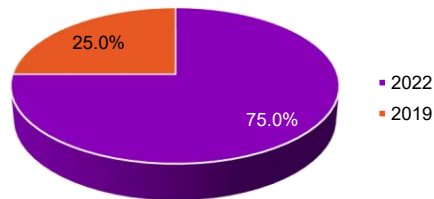
*Race/ethnicity selections are non-exclusive.
**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

### 2022-23 GT Postdoctoral Fellows Classified by State

State	#	%	2020 Census
South	4	66.7%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	0	0.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	16.7%	1.9%
MS	0	0.0%	0.9%
NC	2	33.3%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	1	16.7%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	2	33.3%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	2	33.3%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	0	0.0%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	0	0.0%	1.8%
Northeast	0	0.0%	17.4%
CT	0	0.0%	1.1%
MA	0	0.0%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	0	0.0%	2.8%
NY	0	0.0%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	6	100.0%	100.0%
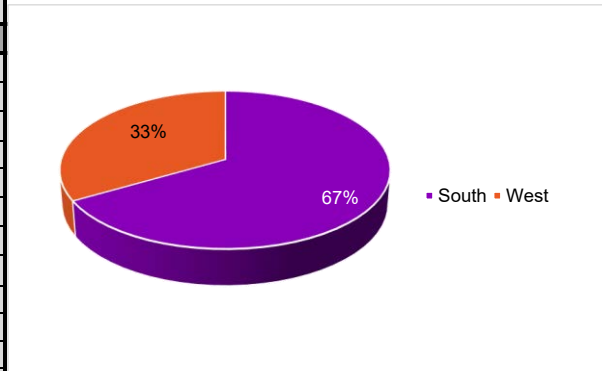
*Regions based on US Census classification

2022-23 GT Postdoctoral Fellows Classified by Country

Africa			**0**
Americas			**6**
	North America	United States	6
Asia			**0**
Europe			**2**
	Northern Europe	United Kingdom	1
	Western Europe	Germany	1
Oceania			**0**
Grand Total			**8**
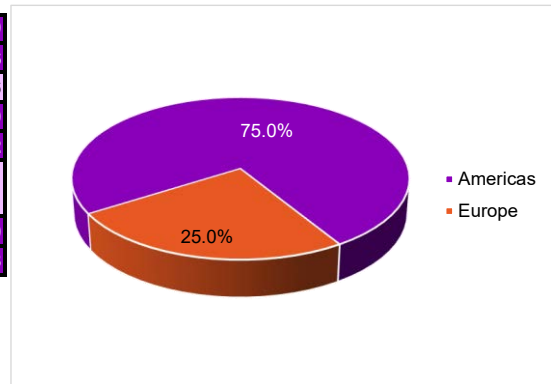
- Americas
- Europe

75.0%

25.0%

Regions based on United Nations classification

Analytic and Geometric Aspects of Gauge Theory

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	5	10.4%	4	80.0%	2	40.0%	1	25.0%
Research Professors	9	18.8%	8	88.9%	1	11.1%	0	0.0%
Postdoctoral Fellows	8	16.7%	2	25.0%	2	25.0%	0	0.0%
PD/RM	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Research Members	18	37.5%	7	38.9%	3	16.7%	2	28.6%
Program Associates	8	16.7%	2	25.0%	3	37.5%	0	0.0%
Total # of Distinct Members	48	100%	23	47.9%	11	22.9%	3	13.0%

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

Home Institution AMS Grouping

Role	US								Foreign
	Private Large	Private Small	Public Large	Public Medium	Public Small	Bachelors	Masters	Non-Group	
Organizers	2	0	1	1	0	0	0	0	1
Research Professors	0	1	5	1	0	0	0	0	2
Postdoctoral Fellows	3	0	0	1	0	0	0	2	2
PD/RM	0	0	0	0	0	0	0	0	0
Research Members	3	1	1	3	0	0	1	0	9
Program Associates	3	1	1	1	0	0	0	0	2
Total	11	3	8	7	0	0	1	2	16
%	22.9%	6.3%	16.7%	14.6%	0.0%	0.0%	2.1%	4.2%	33.3%

2022-23 GT Program Members Demographic Summary

Gender	#	%
# of Distinct Members	48	100.0%
Male	34	70.8%
Female	11	22.9%
Other	1	2.1%
Decline to State	2	4.2%
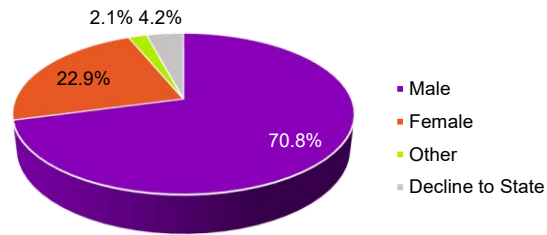
Race/Ethnicity*	#	%
White	31	64.6%
Asian	14	29.2%
Hispanic/Latino	4	8.3%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	4	8.3%
Unavailable Info.	0	0.0%
Minorities**	3	13.0%
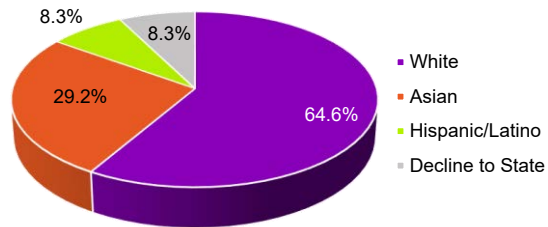
Citizenships	#	%
Foreign Home Inst.	16	33.3%
US Home Inst.	32	66.7%
US Citizens & Perm. Residents	23	47.9%
Foreign Citizens	25	52.1%
US Citizens	20	41.7%
US Permanent Residents	3	6.3%
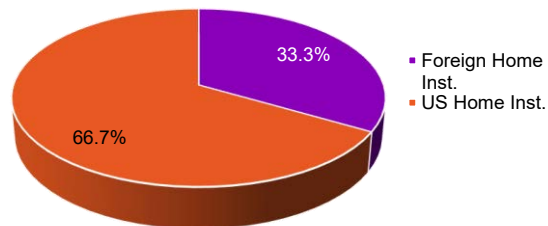
| Year of Ph.D	#	%
Prog. Assoc. (GS)	8	16.7%
2021 & Later	8	16.7%
2020	0	0.0%
2015-2019	8	16.7%
2010-2014	6	12.5%
2005-2009	4	8.3%
2000-2004	5	10.4%
1995-1999	1	2.1%
1990-1994	4	8.3%
1985-1989	3	6.3%
1981-1984	1	2.1%
1980 & Earlier	0	0.0%
Total # of Distinct Members	48	100.0%
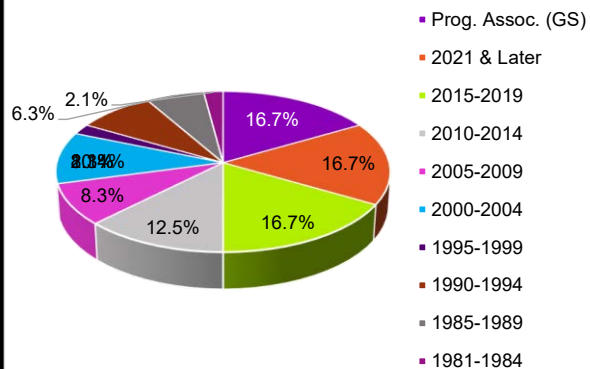
*Race/ethnicity selections are non-exclusive.

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2022-23 GT Program Members Classified by State

State	#	%	2020 Census
South	8	25.0%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	1	3.1%	6.5%
GA	0	0.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	3.1%	1.9%
MS	0	0.0%	0.9%
NC	2	6.3%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	2	6.3%	8.8%
VA	2	6.3%	2.6%
WV	0	0.0%	0.5%
West	10	31.3%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	9	28.1%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	1	3.1%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	5	15.6%	20.8%
IA	0	0.0%	1.0%
IL	1	3.1%	3.9%
IN	1	3.1%	2.0%
KS	1	3.1%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	2	6.3%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	0	0.0%	1.8%
Northeast	9	28.1%	17.4%
CT	0	0.0%	1.1%
MA	5	15.6%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	2	6.3%	2.8%
NY	2	6.3%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	32	100.0%	100.0%
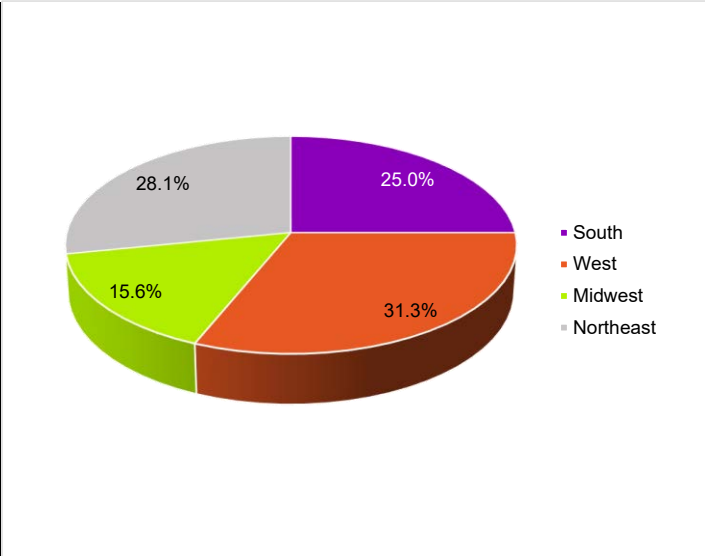
*Regions based on US Census classification

2022-23 GT Program Members Classified by Countries

Africa			**0**
Americas			**32**
	North America	United States	32
Asia			**2**
	Eastern Asia	China	1
		Japan	1
Europe			**14**
	Northern Europe	United Kingdom	6
	Southern Europe	Portugal	1
		Spain	1
	Western Europe	Belgium	1
		Germany	5
Oceania			**0**
Grand Total			**48**
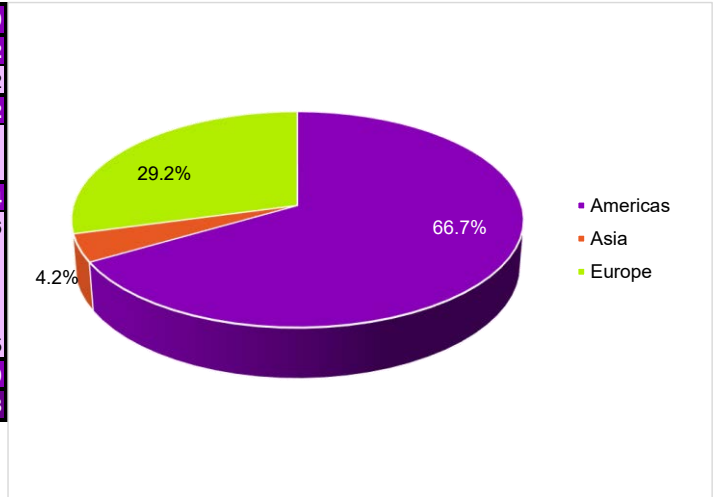
Regions based on United Nations classification

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Analytic and Geometric Aspects of Gauge Theory
August 22, 2022 - December 21, 2022

Total Program Members:	48
Total Survey Respondants:	46
Response Rate:	96%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	45	98%
No	1	2%
Total Responses	46	

Q2. I had opportunities to present my work to new audiences

Yes	43	93%
No	3	7%
Total Responses	46	

Q3. I initiated research with new collaborators

Yes	32	70%
No	14	30%
Total Responses	46	

Q4. I initiated research in new areas

Yes	34	74%
No	12	26%
Total Responses	46	

Q5. My research was advanced in these other ways:
Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?
Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	1	2%
2	1	2%
3	2	4%
4	5	11%
5 - Most Satisfying	36	80%
Total Responses (Exclusive of N/A)	45	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?
Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	38%
5 - Most Satisfying	5	63%
Total Responses (Exclusive of N/A)	8	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	38%
5 - Most Satisfying	5	63%
Total Responses (Exclusive of N/A)	8	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	1	13%
4	2	25%
5 - Most Satisfying	5	63%
Total Responses (Exclusive of N/A)	8	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	0	0%
3	2	25%
4	3	38%
5 - Most Satisfying	3	38%
Total Responses (Exclusive of N/A)	8	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	1	2%
3	4	10%
4	5	12%
5 - Most Satisfying	31	76%
Total Responses (Exclusive of N/A)	41	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	1	2%
3	2	5%
4	4	10%
5 - Most Satisfying	34	83%
Total Responses (Exclusive of N/A)	41	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	0	0%
2	0	0%
3	3	8%
4	8	22%
5 - Most Satisfying	26	70%
Total Responses (Exclusive of N/A)	37	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	0	0%
2	1	2%
3	3	7%
4	10	22%
5 - Most Satisfying	32	70%
Total Responses (Exclusive of N/A)	46	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	8	18%
5 - Most Satisfying	36	82%
Total Responses (Exclusive of N/A)	44	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	7	18%
5 - Most Satisfying	33	83%
Total Responses (Exclusive of N/A)	40	100%

Q24. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	1	3%
3	1	3%
4	6	16%
5 - Most Satisfying	29	78%
Total Responses (Exclusive of N/A)	37	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance

1 - Least Satisfying	3	9%
2	0	0%
3	3	9%
4	4	12%
5 - Most Satisfying	24	71%
Total Responses (Exclusive of N/A)	34	100%

Q28. School and Childcare Assistance

1 - Least Satisfying	1	13%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	7	88%
Total Responses (Exclusive of N/A)	8	100%

Q29. Visa Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	2	10%
4	2	10%
5 - Most Satisfying	17	81%
Total Responses (Exclusive of N/A)	21	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	1	2%
4	4	9%
5 - Most Satisfying	40	89%
Total Responses (Exclusive of N/A)	45	100%

Q32. How could we improve our administrative services?

Link to Qualitative Responses

Q33. Your comments about MSRI:

Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:

Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.

Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.

Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	21	46%
2	14	30%
3	10	22%
4	0	0%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	46	100%

Q38. Virtually from my office at MSRI

1 - Never	24	52%
2	18	39%
3	4	9%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	46	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	40	87%
2	4	9%
3	1	2%
4	0	0%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	46	100%

Q40. In person, without following along on Zoom

1 - Never	3	7%
2	0	0%
3	7	15%
4	12	26%
5 - Almost Always	24	52%
Total Responses (Exclusive of N/A)	46	100%

Q41. Is there anything that would increase the benefit of the virtual options above?

Link to Qualitative Responses

Floer Homotopy Theory
August 22, 2022 - December 21, 2022
MSRI, Berkeley, CA
USA

Organizers:
Mohammed Abouzaid (Columbia University)
Andrew Blumberg (Columbia University)
Kristen Hendricks (Rutgers University)
Robert Lipshitz (University of Oregon)
Ciprian Manolescu (Stanford University)*
Nathalie Wahl (University of Copenhagen)

REPORT ON THE PROGRAM ON FLOER HOMOTOPY THEORY

MOHAMMED ABOUZAID, ANDREW J. BLUMBERG, KRISTEN HENDRICKS, ROBERT LIPSHITZ,
CIPRIAN MANOLESCU, AND NATHALIE WAHL

1. INTRODUCTION

The aim of the program on Floer homotopy theory was to accelerate the cross-pollination of modern homotopy theory and Floer homology, broadly construed. There are outstanding problems in symplectic topology and the geometry of low-dimensional manifolds that require Floer homotopy theory, and new directions in homotopy theory that are motivated by new classes of examples provided by Floer homology.

Morse and Floer homology. Starting with work of Morse from nearly 100 years ago, the basic result of Morse theory is that given a smooth function $f \colon M \to \mathbb{R}$, where M is a compact smooth manifold and f satisfies the second derivative test, we can recover the topology of M by studying the critical points of f. Most concretely, there is a chain complex computing the singular homology groups $H_*(M)$ that is built from the moduli spaces of *flow lines* between critical points of f. The flows are controlled by the gradient ∇f, and the complex has differential defined in terms of counts of flow lines. Palais and Smale extended this to certain functionals on manifolds which are infinite-dimensional.

In the 1980s, seminal work of Floer extended the range of infinite-dimensional examples to which Morse theory applies to certain functionals associated to symplectic manifolds and low-dimensional smooth manifolds. Specifically, he constructed theories for the symplectic action functional for periodic orbits of a Hamiltonian diffeomorphism (Hamiltonian Floer homology), the symplectic action functional for paths between Lagrangian submanifolds (Lagrangian Floer homology), and the Cherns-Simons functional on connections on three manifolds (instanton Floer homology). Subsequent work developed these techniques and produced variants including monopole Floer homology and Heegaard Floer homology. These theories led to striking and radical progress on a wide variety of problems of central interest in low-dimensional topology, symplectic topology, and knot theory. These include, for example, a version of the Arnold conjecture on the fixed-points of Hamiltonian diffeomorphisms, the Weinstein conjecture on 3-manifolds, and surgery characterizations of knots.

A key point to note is that Morse theory recovers the homology of M and is hence an invariant of the *stable homotopy type* of M. On the other hand, the various Floer homologies are evidently *not* invariants of the stable homotopy type of the underlying manifold. This leads to a very natural question:

Question 1.1. *Can the various Floer homology theories be interpreted as the homology of some space, or more generally the invariants of the stable homotopy type of some space?*

Attempting to answer this question is the point of departure for *Floer homotopy theory*.

The stable category and brave new algebra. One of the insights of the last 50 years in algebraic topology is that the algebraic structure of the homology of a space captures only shadows of the rich structure available. For example, Poincaré duality for compact oriented manifolds provides an isomorphism $H^k(M) \cong H_{n-k}(M)$. But interpreting the cohomology M in terms of the *Spanier-Whitehead dual* of M gives a statement that is true for arbitrary cohomology theories, and holds without any orientation assumption.

1

The basic idea of the stable homotopy type of a space is to produce a category (the *stable category*, typically referred to as the category of spectra) which has the formal structure of the category of complexes and quasi-isomorphisms (i.e., has a triangulated homotopy category with a symmetric monoidal tensor product and shift functors). Every space gives rise to an object of the stable category. The existence of the symmetric monoidal structure gives rise to a theory of formal duality; the formal dual of a space in the stable category is precisely the Spanier-Whitehead dual.

The stable category provides a home for algebra and topology simultaneously: the objects of the stable category can be interpreted to represent (co)homology theories, and ordinary rings embed in spectra via the ordinary homology theories. The tensor product of spectra is set up to encode the cup product on cohomology theories; multiplicative cohomology theories give rise to ring objects in the category of spectra. In algebra, the initial commutative ring is the ring of integers $\mathbb{Z}$; in the category of spectra, the initial commutative ring is the sphere spectrum $\mathbb{S}$ and there is a canonical unit map $\mathbb{S} \to \mathbb{Z}$. Thus, even when studying purely algebraic objects there is a more refined viewpoint that comes from working over the sphere spectrum. This perspective is often referred to as "brave new algebra" following Waldhausen, as the algebra of spectra encompasses classical homological algebra but includes new ring objects. Lifting algebraic problems to brave new algebra over the sphere spectrum has turned out to be an immensely successful approach.

Stable homotopy types from flow categories. In the 90's, Cohen-Jones-Segal proposed a strategy for building a Floer stable homotopy type from a "flow category", which in Morse theory is a category $\mathcal{C}$ with objects the critical points and morphisms $\mathcal{C}(p, q)$ the moduli space of gradient flows between p and q. Whereas Morse and Floer homology use the 0-dimensional moduli spaces of flow lines, i.e., counts, to define the differentials in the respective complexes, the CJS construction proposes to use moduli spaces of arbitrary dimensions and suitable framings to glue them together using the Pontryagin-Thom construction. This idea has been massively influential, but it has only been quite recently that some of the ferocious technical issues that stymied the direct application of the CJS approach have been resolved.

Using flow categories, Lipshitz-Sarkar (and subsequently Lawson-Lipshitz-Sarkar and Hu-Kriz-Kriz) constructed a Khovanov homotopy type, i.e., a spectrum whose homology computes the Khovanov homology of a knot. There has subsequently been a flurry of work extending this (e.g., an odd Khovanov homotopy type by Sarkar-Scaduto-Stoffregen and Khovanov-Rozansky homotopy types by Jones-Lobb-Schütz) and studying enhanced algebraic structures on it (e.g., cup products). More recently, Abouzaid-Blumberg introduced a new approach to the Cohen-Jones-Segal construction and built a homotopy type in Hamiltonian Floer homology over a cohomology theory called Morava K-theory. Abouzaid-McLean-Smith considered a closely related construction that introduces a novel and radical simplification of our understanding of moduli spaces of pseudo-holomorphic spheres in terms of *global charts*. Building on this, Rezchikov and Bai-Xu have shown the existence of such global charts and flow categories for Hamiltonian Floer homology very generally.

Seiberg-Witten homotopy types. Another approach to a Floer homotopy type that has seen tremendous progress was initiated by Manolescu in 2001; the construction of a Seiberg-Witten Floer homotopy type using finite-dimensional approximations, following ideas of Bauer-Furuta. The idea here is to construct an S^1-equivariant homotopy type by filtering the eigenspaces of the Seiberg-Witten operator by finite-dimensional subspaces. The original construction required that the input be a homology three-sphere, but subsequent work of Khandawit-Lin-Sasahira generalized this to arbitrary manifolds. These homotopy types have been applied to prove gluing formulas that allow computation of Seiberg-Witten invariants via cut-and-paste of manifolds. A spectacular application of this construction has been the proof of the triangulation conjecture by Manolescu using a Pin(2)-equivariant version of the Seiberg-Witten invariants. In a different direction, Hopkins-Lin-Shi-Xu carried out Furuta's computational approach to the 11/8-conjecture.

Parametrized spectra and string topology. Work of Kragh has constructed parametrized spectra that represent the symplectic cohomology of the cotangent bundle. The nearby Lagrangian conjecture predicts that a closed exact Lagrangian submanifold in a cotangent bundle must be Hamiltonian isotopic to the zero-section. Steady progress has been made on the nearby Lagrangian conjecture and related questions using increasingly sophisticated homotopy-theoretic constructions. Most recently, Abouzaid-Courte-Guillermou-Kragh introduced the homotopical notion of twisting to Morse theory, and showed that every exact Lagrangian in a cotangent bundles arises from a twisted stable Morse function. These Floer homotopy types are closed related to the *string topology* structures on the free loop space of a manifold, originally constructed by Chas-Sullivan and the inspiration for a huge amount of work both in homotopy theory and also in symplectic topology.

2. Research developments

During the semester, there was extensive research progress including intensive work by existing collaborators in close proximity, new collaborations enabled by the bridging of the symplectic and algebraic topology communities, and wide-ranging discussions inspired by the many seminars and workshops. In subsequent sections, we review some of the progress by the postdoctoral members, the graduate students, and discuss some of the breakthroughs. Beyond this, the following collaborations and preprint production occurred:

- Abouzaid collaborated with Bai, Blumberg, Keatin, Kragh, Manolescu, Rezchikov, Shelukhin, and Smith (and released 2 submitted papers),
- Alishahi collaborated with Gorsky, Lipshitz, and Zhang (and produced 3 draft preprints).
- Bai collaborated with Abouzaid, Seidel, Shelukhin, and Swaminathan (and released a submitted paper).
- Blumberg collaborated with Abouzaid, Mandell, and Rezchikov (and produced 3 draft preprints and released a submitted paper).
- Bohmann collaborated with Gerhardt, Merling, Lidman, and Klang (and produced a draft preprint).
- Douglas collaborated with Kragh and Manolescu.
- Ganatra collaborated with Klang, Gorsky, and Merling (and produced 3 draft preprints and a submitted paper).
- Gerhardt collaborated with Bohmann, Klang, Merling, and Willis (and produced 3 draft preprints).
- Gorsky collaborated with Alishahi and Chandler (and produced a draft preprint and two submitted papers).
- Greene collaborated with Lobb.
- Hedden collaborated with Lobb, Mallick, Mark, Pinzon-Caicedo, Ruberman, and Watson (and produced a submitted paper).
- Hendricks collaborated with Alishahi, Hom, Lipshitz, and Mallick (and produced a draft preprint and two submitted papers).
- Hirschi collaborated with Porcelli and Swaminathan (and produced two submitted preprints).
- Hom collaborated with Daemi, Gong, Hendricks, Lidman, Manolescu, Mallick, Wang, and Zhou (and produced a draft preprint and a submitted paper).
- Keating collaborated with Abouzaid, Ganatra, Seidel, Smith, and Porcelli (and produced three draft preprints).
- Klang collaborated with Bohmann, Ganatra, Gerhardt, Lidman, and Merling.
- Honno collaborated with Auckly, Mallick, Mukherjee, Ruberman, and Taniguchi (and produced a draft preprint and 2 submitted papers).
- Kragh collaborated with Abouzaid, Atallah, Douglas, Hedenlund, Keating, Manolescu, Porcelli, Smith, Shelukhin, and Stelow.

- Lidman collaborated with Daemi, Pinzon-Caicedo, and Zhang (and produced 3 draft preprints).
- Lobb collaborated with Greene and Watson.
- Mallick collaborated with Hedden, Hendricks, Konno, and Taniguchi (and produced 4 draft preprints).
- Mandell collaborated with Blumberg (and produced 2 draft preprints and 1 submitted paper).
- Manolescu collaborated with Abouzaid, Daemi and Willis (and produced 1 draft preprint).
- Merling collaborated with Blumberg, Bohmann, Ganatra, Gerhardt, Klang, and Mandell (and produced 4 draft preprints).
- Rezchikov collaborated with Abouzaid, Blumberg, Lipshitz, and Shelukhin (and produced 4 draft preprints).
- Seidel collaborated with Bai (and produced a draft preprint).
- Shelukhin collaborated with Abouzaid, Bai, and Rezchikov.
- Smith collaborated with Abouzaid, Gorsky, Keating, Lipshitz, and Porcelli (and produced 3 draft preprints).
- Swaminathan collaborated with Bai, Deshmukh, Hirschi, and Rezaee (and produced a draft preprint).
- Tanaka collaborated with Traynor (and produced a draft preprint).
- Zhang collaborated with Akhmechet, Alishahi, Lidman, and Truong (and produced a draft preprint and a submitted paper).

3. Organizational Structure

The program included three workshops:

(1) A two-day *Connections Workshop: Floer Homotopy Theory* featuring talks by experts in Floer theory (and its applications to low-dimensional topology) and homotopy theory. It included two expository lectures aimed at graduate students and other researchers who are new to the field, as well as a sequence of research talks and a contributed short talks session. There was also a panel discussion focusing on professional development, and two networking group meetings. The speakers for this event were women and members of gender minorities;

(2) A week-long *Introductory Workshop: Floer Homotopy Theory* that introduced researchers in Floer theory to modern techniques and questions in homotopy theory and, conversely, introduced researchers in homotopy theory to ideas underlying Floer theory and its applications. The workshop consisted of two lecture series (one on Floer homology foundations and one on Stable homotopy foundations), together with 4 pairs of talks on the following topics: (i) string topology, (ii) infinity structures and operads, (iii) Atiyah-Bott-Shapiro orientations and the Cohen-Jones-Segal construction, and (iv) Monopole Floer theory and homotopy. There were also two moderated Q &A sessions, where participants submitted question in advance and experts answered them;

(3) A week-long research workshop on *Floer Homotopical Methods in Low Dimensional and Symplectic Topology*. This consisted of talks on recent research developments. The focus was on the interaction between homotopy theory and symplectic topology and low dimensional topology that is mediated by Floer theory. Among the topics covered are foundational questions, applications to concrete geometric questions, and the relationship with finite dimensional approaches.

During the weeks when the workshops were not happening, there were several regular seminar series, amounting to up to 7 talks per week:

(1) A *Program seminar* with 2 research talks every week. Every postdoc had the opportunity to present their work in this seminar. The other speakers were a mix of senior participants, program associates (graduate students), and visitors from UC Berkeley and Stanford;

(2) The *Graduate student seminar* where graduate students presented either their own work or gave an expository talk on a topic of common interest;

(3) A seminar series on *Floer homotopy foundations*, aimed at understanding the work in progress of Abouzaid and Blumberg on constructing a quasi-category of flow categories, as an algebraic setting for building spectral Fukaya categories;

(4) A *Homotopy types in low-dimensional topology seminar*, with expository talks about the Khovanov stable homotopy types and the knot Floer homotopy types;

(5) A *Reading group seminar* on symplectic Khovanov homology and related topics, aimed at understanding the work of Aganagic on Khovanov homology;

(6) A seminar series on *Homotopy computations and uses in Floer theory*, which featured expository talks on how to do relevant calculations in stable homotopy theory, e.g. calculations of Steenrod squares, K-theory, KO-theory, complex cobordism, topological Hochschild homology and Morava K-theory.

All the talks were given in hybrid mode, with in-person participations and streaming over Zoom. Online participants could ask questions in the chat, which were read by the seminar organizer. This helped expand the impact of the program to people who could not attend in person.

In addition to the seminars, we organized Math+X events on Thursday evenings, where the program participants discussed mathematics informally, over dessert or drinks, in a Berkeley restaurant. One of the goals of this event was to allow mathematicians who were visiting members of the program, but who were not permitted to enter the building, to interact with a broader group.

Furthermore, many participants came to the UC Berkeley math department on Wednesday evenings, to attend the Topology seminar there.

4. Postdoctoral fellows

Several of the postdoctoral members reported breakthroughs in their research during the program. In particular, postdoctoral member Shaoyun Bai, with Guangbo Xu, finished a proof of the Arnol'd conjecture over the integers during the program, one of the most famous conjectures in symplectic topology. Moreover, the technical details developed there are likely to provide the necessary tools to construct a Floer homotopy type with complex cobordism coefficients for any compact symplectic manifolds. Bai and organizer Mohammed Abouzaid have made progress towards realizing that proposal during the semester.

Postdoctoral member Semon Rezchikov, in consultation with organizer Andrew Blumberg, gave a new construction of equivariant Morse theory, adapted to studying Floer theory and structures on the loop space. New ideas developed this semester allows him to sidestep technical issues that have stymied the project for more than three years. He expects this will also relate to conjectures about cyclotomic structures in symplectic topology also proposed several years ago. In another direction, Rezchikov is writing a paper giving a simplified construction of Floer homotopy types which will allow more researchers to access and extend these tools.

5. Graduate Students

Nine program associates were formally associated with the program; additionally, many further students of program members were either in Berkeley for the term or able to visit during the program workshops. A regular graduate student seminar, largely organized by the program associates but also supervised by Joshua Greene, was held weekly on Monday afternoons. This seminar took place in Evans Hall on the UC Berkeley campus in order to accommodate attendance from additional graduate students not formally associated with the program.

Reports from graduate students indicate that their time was productive and they were able to use the opportunity to network with experts at the program well. For example, Hongyi(Hugo) Zhou was able to work on a project on piecewise linear surfaces and genus cobordism with his mentor

Jennifer Hom, one of our research professors, and their coauthor Matthew Stoffregen. Similarly, Sarah(Sally) Collins was able to finish a preprint on homology cobordism and smooth concordance, and was able to extensively discuss her future research plans with the experts present. Amanda Hirschi and Mohan Swamithan jointly proved a product formula for symplectic Gromov Witten theory, and expect their preprint to appear soon. Jesse Cohen worked on finishing up a paper on compositions of morphisms in bordered Floer homology, along with several projects for the Khovanov homology of links in $S^1 \times S^2$. Marcello Sarkis Atallah worked on several problems in symplectic dynamics, including a project joint with Egor Shelukhin. Graduate students also mentioned discussing their work with Matt Hedden, Kristen Hendricks, Thomas Kragh, Tye Lidman, Robert Lipshitz, Abhishek Mallick, Lisa Traynor, Liam Watson, Michael Willis, and Melissa Zhang (along with, in many cases, virtually all of the other program associates). Graduate students specifically mentioned the topical workshop as having stood out as especially interesting and helpful to their research, along with the weekly Program Seminar, the weekly Floer Homotopy Foundations Seminar, and the weekly Calculations in Homotopy Theory and Uses in Floer Theory Seminar.

6. INCLUSIVITY

Participants in the program and the associated workshops were invited and selected with an eye toward maintaining a diverse and inclusive enviroment. Overall, ten of the forty attendees of the semester-long program who spent some time in residence at the rank of research member or above were women, and three of the nine program associates. Similar attention was paid to the speaker lists of the two week-long workshops associated with the program, with the result that four of fourteen speakers for the introductory workshop and seven out of seventeen speakers for the topical workshop were women. Effort was also made to select speakers from a range of professional levels and of institution types. In both cases the organizers endeavored to use their limited invites to outside participants to bring together a diverse group of attendees and providing opportunities to more junior researchers.

Furthermore, during the third week of the semester, a two-day workshop *Connections Workshop: Floer Homotopy Theory* was held; one of the goals of this workshop was to provide a forum for showcasing the research of women and members of gender minorities within the (broadly-construed) field of Floer homotopy, and to provide a space for networking and career support. Conference events included two ninety minute expository talks aimed at graduate students and other researchers new to the field, five hour-long research talks, and a one-hour contributed talks session featuring six seven-minute talks. There was also a panel discussion on career advice; six panelists discussed topics drawn from a list of topics prepared by the organizers (and shared with the panelists beforehand), questions asked out loud by the audience, and questions submitted anonymously by the audience before and during the panel via a google form. These questions were loosely organized into two themes, professional development and work-life balance. Time was also set aside for participants who were women and members of gender minorities to chat in preassigned networking groups. Six groups of six participants each were planned, with each group having at least two participants either with tenure or within one or two years of attaining tenure, and with some effort being made to match groups along mathematical interests. Finally, a conference dinner was held on the MSRI deck on the first day of the conference.

7. HIGHLIGHTS AND BREAKTHROUGHS

Floer homotopy theory is a broad topic, and research achievements during the program mirrored its breadth.

One focus area of the program was applications of Floer homotopy theory to low-dimensional topology. To date, these applications have mainly come from $Pin(2)$-equivariant monopole Floer homology and its cousin, involutive Heegaard Floer homology. Using equivariant monopole Floer

homology, member Hokuto Konno and Jianfeng Lin discovered a new phenomenon unique to dimension 4: a dramatic failure of homological stability for the moduli space of simply-connected smooth 4-manifolds (or, equivalently, for their diffeomorphism groups). This result is particularly relevant, as homological stability is often proved using techniques from homotopy theory, so this is a new kind of interaction between homotopy theory and Floer theory. The structure of the paper was also influenced by conversations between Konno and Daniel Ruberman and David Auckly, both Research Professors in the Gauge Theory program; those conversations also clarified the relationship between the two groups' results. Another breakthrough application comes in the work of member Tye Lidman who, with Adam Levine and Lisa Piccirillo, gave a new gauge-theoretic invariant of 4-manifolds with $b_1 = 1$ and constructed exotic four-manifolds which all other gauge-theoretic invariants fail to distinguish. Another of Lidman's accomplishments during the semester also showcases the interaction between the two programs: with Juanita Pinzon-Caicedo of the complementary program and Chris Scaduto, he found bounds on the crossing numbers of knots coming from their $SU(2)$ character varieties. As a concrete example, they can bound the crossing number of a satellite knot $P(K)$ in terms of the winding number of P.

In addition to these striking applications, members also made important structural progress on these topics. For instance, organizer Kristen Hendricks and member Jennifer Hom, with Matthew Stoffregen and Ian Zemke, noticed a subtlety in their previous proof of the naturality of involutive Heegaard Floer homology that sheds light on what were previously puzzling issues in the correspondence between the structure of involutive Heegaard Floer homology and its conceptual inspiration $Pin(2)$-equivariant monopole Floer homology.

Another key area of the program was interactions between contact and symplectic topology and homotopy theory. At least two breakthroughs were made in this area by postdocs (see above). Another is joint work of members Hiro Lee Tanaka and Lisa Traynor, who developed stable homotopy types for Legendrian submanifolds using the theory of generating families. There are established generating family homology groups for Legendrian submanifolds, and Tanaka and Traynor have defined a generating family spectrum whose homology groups agree with the previously established generating family homology groups. Moreover, when the Legendrian and its generating family have a compatible Lagrangian filling, they show that the generating family spectrum is equivalent to the suspension spectrum of the quotient of the Lagrangian filling by its Legendrian boundary, and they can calculate some of the homotopy groups associated to the generating family spectra for various Legendrians and their fillings.

A third key topic of the program was interactions between stable homotopy theory and categorification. For instance, members Eugene Gorsky and Akram Alishahi started a project with Beibei Liu to study crossing change maps in Heegaard Floer homology and, in particular, the "splitting" maps relating the Heegaard Floer homology of a link to the homology of the corresponding split link. Unlike the situation for HOMFLY-PT homology, they have shown that that there are lots of genuinely different such maps. For example, for the (n, n) torus link the Heegaard Floer splitting maps are parametrized by the integer points in the permutahedron, each of these embeds the Heegaard Floer homology of $T(n, n)$ into the homology of unlink, and they are able to explicitly describe the image. They are exploring potential bounds on splitting numbers for more complicated links using this machinery.

Postdoc Pre/Post-MSRI Institution Group

Family Name	First Name	Pre-MSRI Institution Name	Pre-MSRI Institution Group	Post-MSRI Institution Name	Post-MSRI Institution Group
Bai	Shaoyun	Princeton University	Math Private Large Group	Simons Center for Geometry and	non-group
Klang	Inbar	Columbia University	Foreign	Vrije Universiteit Amsterdam	Foreign
Mallick	Abhishek	Max-Planck-Institut für Mathema	Foreign	Rutgers University	Math Public Large Group
Mukherjee	Anubhav	Georgia Institute of Technology	Math Public Large Group	Princeton University	Math Private Large Group
Swaminathan	Mohan	Princeton University	Math Private Large Group	Stanford University	Math Private Large Group
Zhang	Melissa	University of Georgia	Math Public Medium Group	University of California, Davis	Math Public Large Group

2022-23 FHT Postdoctoral Fellows Demographic Summary

Gender	#	%
# of Distinct Members	6	100.0%
Male	4	66.7%
Female	2	33.3%
Decline to State	0	0.0%
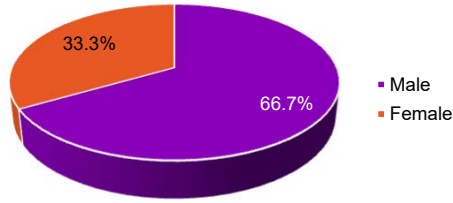
Race/Ethnicity*	#	%
White	1	16.7%
Asian	5	83.3%
Hispanic/Latino	0	0.0%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%
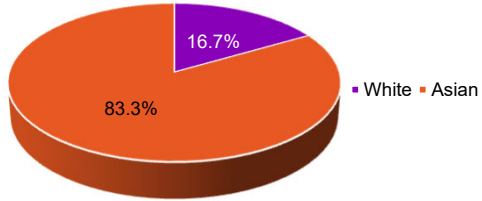
Citizenships	#	%
Foreign Home Inst.	1	16.7%
US Home Inst.	5	83.3%
Foreign Citizens	4	66.7%
US Citizens & Perm. Res.	2	33.3%
US Citizens	2	33.3%
US Permanent Residents	0	0.0%
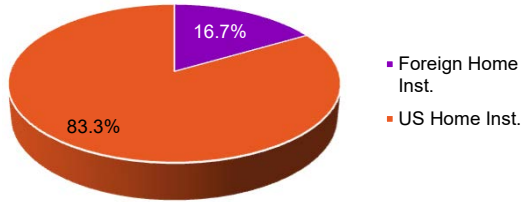
Year of Ph.D	#	%
2022	3	50.0%
2021	1	16.7%
2020	0	0.0%
2019	1	16.7%
2018	1	16.7%
2017	0	0.0%
Total # of Distinct Members	6	100.0%
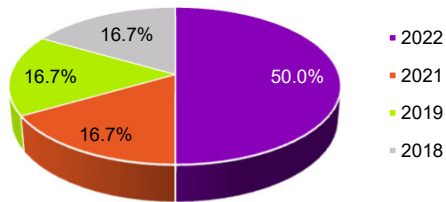
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 FHT Postdoctoral Fellows Classified by State

| State	#	%	2020 Census
South	1	20.0%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	1	20.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	0	0.0%	1.9%
MS	0	0.0%	0.9%
NC	0	0.0%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	0	0.0%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	1	20.0%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	1	20.0%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	0	0.0%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	0	0.0%	1.8%
Northeast	3	60.0%	17.4%
CT	0	0.0%	1.1%
MA	0	0.0%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	2	40.0%	2.8%
NY	1	20.0%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	5	100.0%	100.0%
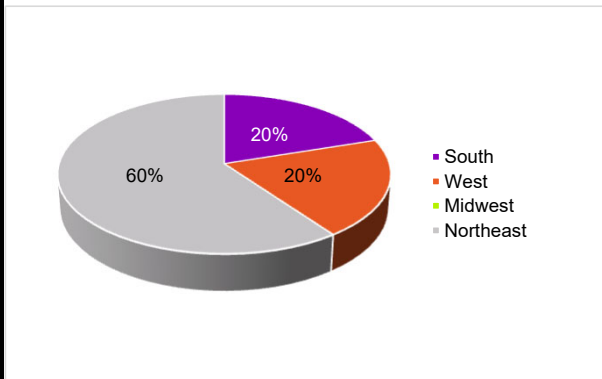
*Regions based on US Census classification

2022-23 FHT Postdoctoral Fellows Classified by Country

Africa			**0**
Americas			**5**
	North America	United States	5
Asia			**0**
Europe			**1**
	Western Europe	Germany	1
Oceania			**0**
Grand Total			**6**
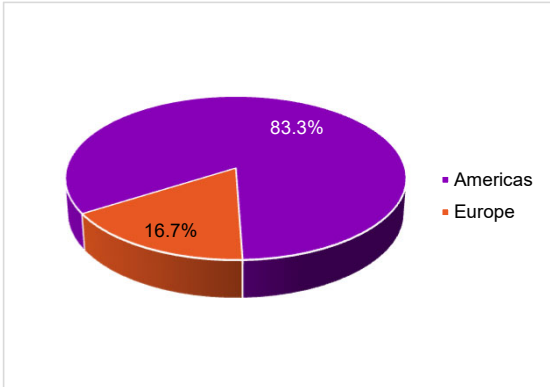
Regions based on United Nations classification

Floer Homotopy Theory

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	5	10.0%	5	100.0%	1	20.0%	0	0.0%
Research Professors	14	28.0%	10	71.4%	2	14.3%	0	0.0%
Postdoctoral Fellows	6	12.0%	2	33.3%	2	33.3%	0	0.0%
PD/RM	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Research Members	15	30.0%	9	60.0%	6	40.0%	0	0.0%
Program Associates	10	20.0%	6	60.0%	3	30.0%	1	16.7%
Total # of Distinct Members	**50**	**100%**	**32**	**64.0%**	**14**	**28.0%**	**1**	**3.1%**

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

Home Institution AMS Grouping

Role	US							Non-Group	Foreign
	Private Large	Private Small	Public Large	Public Medium	Public Small	Bachelors	Masters		
Organizers	3	0	1	1	0	0	0	0	0
Research Professors	4	0	5	0	0	0	0	1	4
Postdoctoral Fellows	2	0	2	0	0	0	0	1	1
PD/RM	0	0	0	0	0	0	0	0	0
Research Members	4	0	1	3	1	0	0	0	6
Program Associates	1	0	3	3	0	0	0	0	3
Total	**14**	**0**	**12**	**7**	**1**	**0**	**0**	**2**	**14**
%	**28.0%**	**0.0%**	**24.0%**	**14.0%**	**2.0%**	**0.0%**	**0.0%**	**4.0%**	**28.0%**

2022-23 FHT Program Members Demographic Summary

Gender	#	%
# of Distinct Members	50	100.0%
Male	35	70.0%
Female	14	28.0%
Other	0	0.0%
Decline to State	1	2.0%
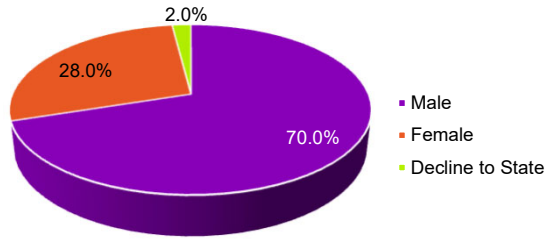
Race/Ethnicity*	#	%
White	31	62.0%
Asian	14	28.0%
Hispanic/Latino	2	4.0%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	6	12.0%
Unavailable Info.	0	0.0%
Minorities**	1	3.1%
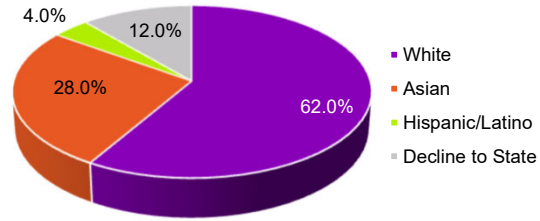
Citizenships	#	%
Foreign Home Inst.	15	30.0%
US Home Inst.	35	70.0%
US Citizens & Perm. Residents	32	64.0%
Foreign Citizens	18	36.0%
US Citizens	29	58.0%
US Permanent Residents	3	6.0%
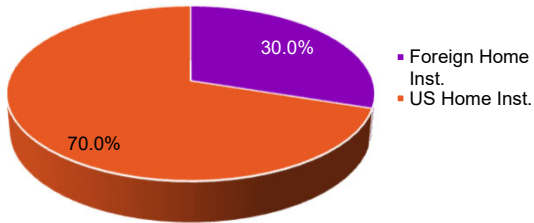
Year of Ph.D	#	%
Prog. Assoc. (GS)	11	22.0%
2021 & Later	4	8.0%
2020	1	2.0%
2015-2019	4	8.0%
2010-2014	11	22.0%
2005-2009	11	22.0%
2000-2004	1	2.0%
1995-1999	4	8.0%
1990-1994	2	4.0%
1985-1989	0	0.0%
1981-1984	0	0.0%
1980 & Earlier	1	2.0%
Total # of Distinct Members	50	100.0%
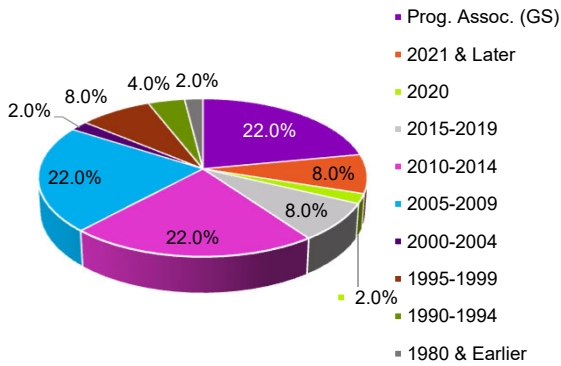
*Race/ethnicity selections are non-exclusive.
**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 FHT Program Members Classified by State

State	#	%	2020 Census
South	**10**	**28.6%**	**38.1%**
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	5	14.3%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	0	0.0%	1.9%
MS	0	0.0%	0.9%
NC	2	5.7%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	1	2.9%	2.1%
TX	2	5.7%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	**11**	**31.4%**	**23.7%**
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	7	20.0%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	4	11.4%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	**3**	**8.6%**	**20.8%**
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	1	2.9%	2.0%
KS	0	0.0%	0.9%
MI	2	5.7%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	0	0.0%	1.8%
Northeast	**11**	**31.4%**	**17.4%**
CT	0	0.0%	1.1%
MA	2	5.7%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	3	8.6%	2.8%
NY	3	8.6%	6.1%
PA	3	8.6%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	**0**	**0.0%**	**0.0%**
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	**35**	**100.0%**	**100.0%**

Pie chart:
- South 28.6%
- West 31.4%
- Midwest 8.6%
- Northeast 31.4%
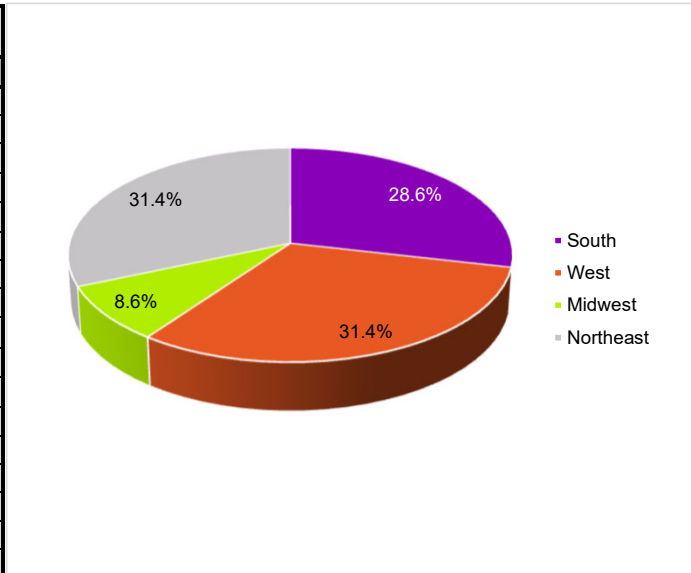
*Regions based on US Census classification

2022-23 FHT Program Members Classified by Countries

Africa			**0**
Americas			**39**
	North America	Canada	4
		United States	35
Asia			**2**
	Eastern Asia	Japan	2
Europe			**9**
	Eastern Europe	Hungary	1
	Northern Europe	Sweden	1
		United Kingdom	6
	Western Europe	Germany	1
Oceania			**0**
Grand Total			**50**
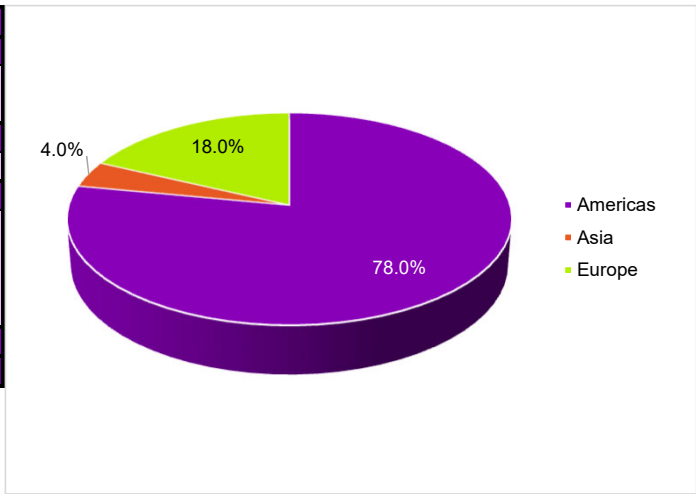
- Americas
- Asia
- Europe

4.0%

18.0%

78.0%

Regions based on United Nations classification

Floer Homotopy Theory
August 22, 2022 - December 21, 2022

Total Program Members:	50
Total Survey Respondants:	50
Response Rate:	100%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	47	94%
No	3	6%
Total Responses	50	

Q2. I had opportunities to present my work to new audiences

Yes	43	86%
No	7	14%
Total Responses	50	

Q3. I initiated research with new collaborators

Yes	38	76%
No	12	24%
Total Responses	50	

Q4. I initiated research in new areas

Yes	37	74%
No	13	26%
Total Responses	50	

Q5. My research was advanced in these other ways:
Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?
Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	0	0%
2	1	2%
3	7	14%
4	8	16%
5 - Most Satisfying	34	68%
Total Responses (Exclusive of N/A)	50	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?
Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	6	100%
Total Responses (Exclusive of N/A)	6	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	6	100%
Total Responses (Exclusive of N/A)	6	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	1	20%
4	1	20%
5 - Most Satisfying	3	60%
Total Responses (Exclusive of N/A)	5	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	1	11%
2	0	0%
3	2	22%
4	3	33%
5 - Most Satisfying	3	33%
Total Responses (Exclusive of N/A)	9	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	1	2%
2	0	0%
3	4	8%
4	15	30%
5 - Most Satisfying	30	60%
Total Responses (Exclusive of N/A)	50	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	1	2%
2	1	2%
3	11	23%
4	13	27%
5 - Most Satisfying	22	46%
Total Responses (Exclusive of N/A)	48	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	1	2%
2	3	7%
3	8	18%
4	11	24%
5 - Most Satisfying	22	49%
Total Responses (Exclusive of N/A)	45	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	1	2%
2	1	2%
3	6	12%
4	14	28%
5 - Most Satisfying	28	56%
Total Responses (Exclusive of N/A)	50	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	2	4%
3	1	2%
4	12	24%
5 - Most Satisfying	35	70%
Total Responses (Exclusive of N/A)	50	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?
Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?
Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?
Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	4	10%
5 - Most Satisfying	36	90%
Total Responses (Exclusive of N/A)	40	100%

Q24. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	1	3%
3	2	5%
4	6	16%
5 - Most Satisfying	28	76%
Total Responses (Exclusive of N/A)	37	100%

Q25. How could we improve our computing services?
Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?
Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance

1 - Least Satisfying	2	6%
2	0	0%
3	4	12%
4	9	26%
5 - Most Satisfying	19	56%
Total Responses (Exclusive of N/A)	34	100%

Q28. School and Childcare Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	8	100%
Total Responses (Exclusive of N/A)	8	100%

Q29. Visa Assistance

1 - Least Satisfying	0	0%
2	1	6%
3	1	6%
4	3	19%
5 - Most Satisfying	11	69%
Total Responses (Exclusive of N/A)	16	100%

Q30. How could we improve our relocation advisory services?
Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	1	2%
4	7	15%
5 - Most Satisfying	39	83%
Total Responses (Exclusive of N/A)	47	100%

Q32. How could we improve our administrative services?
Link to Qualitative Responses

Q33. Your comments about MSRI:
Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:
Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.
Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.
Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	26	52%
2	17	34%
3	6	12%
4	1	2%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	50	100%

Q38. Virtually from my office at MSRI

1 - Never	32	64%
2	13	26%
3	4	8%
4	1	2%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	50	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	38	76%
2	7	14%
3	1	2%
4	4	8%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	50	100%

Q40. In person, without following along on Zoom

1 - Never	1	2%
2	0	0%
3	3	6%
4	13	26%
5 - Almost Always	33	66%
Total Responses (Exclusive of N/A)	50	100%

Q41. Is there anything that would increase the benefit of the virtual options above?
Link to Qualitative Responses

Diophantine Geometry
January 17, 2023 - May 26, 2023
MSRI, Berkeley, CA
USA

Organizers:

Jennifer Balakrishnan (Boston University)
Mirela Ciperiani (University of Texas, Austin)
Philipp Habegger (University of Basel)
Wei Ho (Institute for Advanced Study)
Hector Pasten (Pontificia Universidad Católica de Chile)*
Yunqing Tang (University of California, Berkeley)
Shou-Wu Zhang (Princeton University)

REPORT ON THE SPRING 2023 PROGRAM ON DIOPHANTINE GEOMETRY

JENNIFER BALAKRISHNAN, MIRELA ÇIPERIANI, PHILIPP HABEGGER, WEI HO, HECTOR PASTEN,
YUNQING TANG, AND SHOU-WU ZHANG

1. INTRODUCTION

The subject of Diophantine Geometry spans a vast array of topics at the interface of number theory and algebraic geometry. The SLMath program in Diophantine Geometry facilitated the interaction among experts in different subjects within the field and led to many research developments. Researchers made progress on rational points on varieties, Vojta's conjecture, unlikely intersections, arithmetic of abelian varieties, Shimura varieties and local systems, Arakelov theory, and arithmetic dynamics. Indeed, many exciting theorems lie at the interface of multiple such areas. During the program, three workshops and numerous seminar series provided the platform for researchers of all career stages to showcase their work and stimulated discussions among researchers in different areas. It has been a fruitful program.

2. RESEARCH DEVELOPMENTS

Broadly speaking, Diophantine Geometry can be described as the study of rational and algebraic solutions of Diophantine equations from the point of view of rational and algebraic points on algebraic varieties. During the program, many new results on various aspects of rational points were discovered. In a similar spirit, there are also multiple new results on degree d points or points over certain extensions of the base field.

For instance, the recent proof of uniform Mordell–Lang (uniform bounds for rational points on families of curves) by Dimitrov–Gao–Habegger and Kühne indicated how ideas from functional transcendence and unlikely intersections can be used to study rational points. Many researchers made progress on unlikely intersections and André–Oort or more generally Zilber–Pink-type results. The recent proof of the general case of the André–Oort conjecture by Esnault–Groechenig–Pila–Shankar–Tsimerman required deep understanding of exceptional Shimura varieties and local systems on them. Much progress was made during the program on related questions along these two directions. Height theory and Arakelov geometry are the foundations of Diophantine Geometry; progress was made on classical topics such as height pairings, Schmidt's subspace theorem, and irrationality and transcendence problems with new tools and ideas. The new progress in unlikely intersections and Arakelov geometry provided new tools and inspiration on analogous questions in arithmetic dynamical systems and some progress was made here as well.

In the following, we provide a more detailed description of the progress in each sub-area of Diophantine Geometry mentioned above. As only briefly indicated in the above summary, all these subareas are closely related, and the discussions among program participants and also participants from the Euler Systems program are certainly extremely important in the development of all these results.[1]

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[1]To highlight the program and workshops participants, as a convenience for notation, in this section, we put their collaborators not associated with our program in brackets; this may affect the alphabetical order of last names, but we emphasize that all coauthors are viewed as making equal contribution to the theorems. This only applies to the work carried out during the program. We cite the full list of authors in the usual way when we refer to previous results.

- **Rational points and Vojta's conjecture**

  In order to understand rational points on an elliptic curve $E/\mathbb{Q}$ of analytic rank 2, especially $E(\mathbb{Q}) \otimes \mathbb{Q}_p$, for each imaginary quadratic field K under certain conditions, one can consider the so-called shadow line in $E(\mathbb{Q}) \otimes \mathbb{Q}_p$ associated to K. Balakrishnan, Çiperiani (Mazur, and Rubin) proved new results on the distribution of the shadow lines as K varies. In the work towards the Birch–Swinnerton-Dyer conjecture on rational points of elliptic curves, Euler systems have played an important role. In order to understand Kato's Euler system, Colmez (and Wang) proved new results on the factorization of the Beilinson–Kato system, providing an explanation for the product of special values of L-functions arising from Kato's Euler system. Towards the strong form of the BSD conjecture for abelian varieties, Stoll (and Keller) verified the strong BSD for some modular abelian surfaces over $\mathbb{Q}$.

  For rational points on higher genus curves, based on the new proof of Faltings's theorem by Lawrence–Venkatesh, Alpöge and Lawrence provided an algorithm to determine rational points conditional on various conjectures. On the other hand, along the line of Chabauty's method, Ellenberg and Wen, with inputs from discussions with Balakrishnan, Srinivasan, and Zureick-Brown, have carried out some preliminary computations towards a theoretical understanding of the $\mathbb{Q}_p$-points coming from the quadratic Chabauty algorithm.

  For surfaces of general type, Garcia-Fritz and Pasten were able to describe the exceptional sets in function fields Vojta's conjecture for smooth projective surfaces conditional on the corresponding number field Vojta's conjecture; they also introduced the notion of sparsity (very few in the vague sense) and proved the sparsity of rational points on irregular surfaces of general type over number fields.

  Brauer groups and Brauer–Manin obstructions also play important roles in the understanding of rational points on higher-dimensional varieties. Berg, Stoll, Viray, Vogt (Poonen, Pagano, and Triantafillou) provided new examples when Brauer–Manin obstructions require arbitrarily many Brauer classes. Várilly-Alvarodo (and James), with inputs from discussions with Stoll, used probabilistic approaches to compute Brauer groups of del Pezzo surfaces.

- **Fields of definition of points, arithmetic statistics, and counting problems**

  Beyond rational points, some participants of the program studied points with certain properties (such as bounded degree) on varietes, especially abelian varieties and their moduli spaces, which lead to interesting applications. Bourdon (Ryalls, and Watson) provided detailed descriptions of elliptic curves with minimal torsion in geometric isogeny classes; their result is closely related to points of certain degrees on certain modular curves. Chan, Liu, Viray (and Balçik) considered superelliptic curves C over number fields and for a fixed curve $\pi : C \to \mathbb{P}^1$ provided the precise distribution of the étale algebra associated to fibers of π. Checcoli and Dill proved a specific Galois property of subfields of the field generated by the torsion points of an abelian variety over a number field and thus deduced the Northcott property for all the Galois subfields with finite exponent Galois groups. Zureick-Brown (and Kobin) used properties of wild stacky curves to study modular forms mod p.

  In the direction of arithmetic statistics and counting, Liu generalized the Cohen–Lenstra–Martinet–Gerth conjecture, which studies the distributions of the non-abelian analogues of the class group. Ostafe (Bulinski, and Shparlinski) counted (asymptotically) embeddings of free groups into $\mathrm{SL}_2(\mathbb{Z})$ and its subgroups with respect to the naive height of the generators.

  Another related result is the work of Silverberg (Lenstra, and van Gent) on realizing orders as group rings.

- **Functional transcendence, unlikely intersections, and the Zilber–Pink conjecture**

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Wüstholz's analytic subgroup theorem for semi-abelian varieties is one of the most important results on periods of semi-abelian varieties. In the proof of the André–Oort conjecture based on the work of many people, inspiration was drawn from the comparison between abelian varieties and Shimura varieties. Motivated by this comparison, Gao, Ullmo (and Yafaev) proved a hyperbolic analogue to the analytic subgroup theorem.

To provide a better understanding of the functional transcendence results used in the proof of the André–Oort conjecture (and many other applications), Baldi and Urbanik used the framework of G-bundles to obtain effective functional transcendence results and a description of the distribution of orbit closures. Based on the earlier work of Baldi–Ullmo on special subvarieties and the Ax–Schanuel conjecture for ball quotients (the quotient of $PU(1, n)$ by a lattice), Baldi, Ullmo (Miller, and Stover) described the morphisms between ball quotients and studied superrigidity properties of these lattices.

For a family of variation of Hodge structures or motives, the philosophy of unlikely intersections provides heuristics on the distribution of Hodge loci and other loci of similar feature such as toric loci. Motivated by a question of Baldi–Klingler–Ullmo, Urbanik (and Khelifa) provided a general sufficient criterion for the analytic density of typical Hodge loci associated to a polarized $\mathbb{Z}$-variation of Hodge structures. Cadoret and Stix proved that for the compatible family of geometric local systems, under certain conditions, the rational points in the toric locus is not Zariski dense.

There are more results inspired from the unlikely intersection philosophy in other settings. Campagna and Dill proved various results towards arithmetic unlikely intersections in split semiabelian schemes over the ring of integers of some number field. Masser and Zannier discovered many counterexamples to a (false) claim of James Davenport in 1981 on elementary integration and they also provided precise description of all elliptic counterexamples. Masser and Ostafe solved some GCD problems for linear recurrences.

On the one hand, ideas from logic, such as o-minimality, were used in the proofs of some of these functional transcendence results; on the other hand, the André–Oort and, more generally, the Zilber–Pink conjecture, can be used to study certain definability problems. More precisely, Scanlon worked out a relation between (un)decidability of $\mathbb{C}(t)$ and the Zilber–Pink conjecture.

- **Abelian varieties, motives, and Shimura varieties**

Shankar (Oswal, and Zhu, with inputs from Patel) proved a p-adic analogue of Borel's theorem for compact Shimura varieties S of abelian type; more precisely, over a p-adic field every map from the punctured unit disc to S extends to a map from the unit disc; moreover, any rigid analytic map from the analytification of a variety to the analytification of S must come from an algebraic morphism. This result provided information on rigid analytic family of abelian varieties over p-adic fields.

Many other interesting results on arithmetic properties of abelian varieties were proved during the program. Kisin (and Mocz) proved the Northcott property in the isogeny class of an abelian variety over a number field, generalizing the earlier work of Mocz for the CM abelian varieties (via a different method). Generalizing Deligne's classification of isomorphism classes of ordinary abelian varieties over finite fields, Stix (and Centeleghe) gave a complete classification of many other types of abelian varieties over finite fields. Li, Tang (Mantovan, Pries) proved the higher-dimensional analogue of Elkies's theorem on infinitude of supersingular reductions of an elliptic curve over $\mathbb{Q}$ for certain abelian fourfolds over $\mathbb{Q}$ parametrized by a certain Shimura curve (of genus 0); also together with Cantoral-Farfán, they proved that the set of μ-ordinary reduction primes is of density 1 for Hodge generic

abelian varieties parametrized by unitary Shimura variety with Harris–Taylor type signature; this result can be viewed as a refinement of Serre's conjecture on ordinary reductions. The proof uses a preliminary understanding of the algebraic Sato–Tate group of such an abelian variety. In a more general setting, Kedlaya (and Banaszak) proved multiple results on algebraic Sato–Tate groups for motives of arbitrary weights.

- **Fundamental groups and local systems**

  In the recent proof of the general case of the André–Oort conjecture, the earlier work of Esnault–Groechenig was used to show the crystallinity of p-adic local systems on Shimura varieties of non-abelian type. Improving their previous work, Esnault (and Groechenig) proved in all generality that on a smooth complex quasi-projective variety X, rigid connections yield F-isocrystals on almost all good reductions $X_{\mathbb{F}_q}$ and that rigid local systems yield crystalline local systems on X_K (here K is the field of fractions of the Witt vectors of a finite field $\mathbb{F}_q$) for almost all $X_{\mathbb{F}_q}$.

  The study of local systems is closely related to fundamental groups. Stix (and Lara, Srinivas) proved that fundamental groups of proper varieties over algebraically closed fields are finitely presented, generalizing an earlier result of Esnault–Shusterman–Srinivas. Kühne and Stix also studied truncated local p-adic Galois groups isomorphic to their characteristic p analogue.

- **Heights, Arakelov theory, and algebraization theorems**

  Based on his earlier work on the existence of Beilinson–Bloch height pairings conditional on Grothedieck's standard conjecture, Zhang proved the unconditional existence of Beilinson–Bloch height pairing on the product of a smooth projective curve and a smooth projective surface over a number field and thus yielded a unconditional formulation of Gan–Gross–Prasad conjectures for $O(1,1) \times O(1,2)$ and $U(1,1) \times U(1,2)$.

  In the computation of arithmetic/Arakelov intersection, Green functions play an important role for the archimedean contribution. In order to relax the Heegner condition in Zhang's earlier work on a generalization of Gross–Zagier formulae for high weight modular forms, Wen studied arithmetic intersection in the Kuga variety over a Shimura curve and needed to study the self-intersection at bad primes of the Shimura curve. Towards this goal, Wen carried out harmonic analysis on local systems on graphs and constructed Green functions on the corresponding finite quotient of a Bruhat–Tits tree.

  The Schmidt's subspace theorem (over number fields) is a very important tool in Diophantine analysis. The desired generalization to arithmetic function fields/adelic curves would bring new applications. As a key step towards the desired generalization, Vojta provided an alternative proof of Schmidt's subspace theorem over geometric function fields (first proved by Wang) and this proof has the potential to be generalized.

  There were also new developments in generalizations and refinements of algebraization theorems with new Diophantine applications. Based on the previous work of Bost–Charles on reinterpretation of algebraization theorems (including the new quantitative version used in the recent work of Calegari–Dimitrov–Tang on the unbounded denominators conjecture) in the framework of theta invariants, Charles gave a new geometric interpretation of Dimitrov's previous work on the Schinzel–Zassenhaus conjecture and also a new proof of arithmetic holonomicity theorem (namely allowing certain types of denominators for the power series). Arithmetic holonomicity was first studied in earlier work of Calegari–Dimitrov–Tang with applications to irrationality of $\zeta_2(5)$; during the program, Dimitrov, Tang (and Calegari) improved the bounds in the previous version of their arithmetic holonomicity theorem and proved new irrationality results such as $\log(1 - 1/n)\log(1 - 1/m)$ when $0 \neq |m/n - 1|$ is very small. Along this direction, Dimitrov also proved a new converse theorem for GL_2.

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- **Arithmetic dynamics**

  Based on discussions with Dimitrov and Habegger, Tucker (Benedetto, Ghioca, and Juul) used Dimitrov's work on Schinzel–Zassenhaus conjecture to study iterated Galois groups of postcritically finite rational functions.

  In analogy with the unlikely intersection philosophy for semi-abelian varieties and Shimura varieties mentioned earlier, one may make similar conjectures for arithmetic dynamical systems. Motivated by such conjectures, Silverman (and Hindes) provided estimates of the size of semigroup orbits of reductions of certain arithmetic dynamical systems.

3. Organizational Structure

The program included three workshops:

(1) A two-day *Connections Workshop: Diophantine Geometry* featuring talks by experts Bourdon, Chan, Checcoli, Li, Liu, Sankar, Viray, and Vogt from various areas in Diophantine Geometry. Each talk consisted of both a gentle introduction to the specific area of the speaker's research and a report on the speaker's recent work. The research areas included rational points, arithmetic statistics, elliptic curves, and abelian varieties. The introduction part of the talks were aimed at graduate students and other researchers who are new to the field. There was also a panel discussion focusing on professional development. The speakers for this event were women and members of gender minorities;

(2) A week-long *Introductory Workshop: Diophantine Geometry* that introduced researchers to various different areas in Diophantine Geometry. The specific topics included arithmetic dynamics (Silverman and Tucker), various heights theory and their applications (Colmez, Ellenberg, Kisin, and Pasten), arithmetic statistics (A. Shankar), unlikely intersections and various applications of Lawrence–Venkatesh methods (Cadoret, Capuano, and Ullmo) and some other application of Shimura varieties to Diophantine problem (A. N. Shankar), rational points and Vojta conjecture (Balakrishnan, Gao, Ru, and Viada), algebraization theorems (Bost and Charles), and arithmetic analogues of topological invariants and quantum field theory with application towards Diophantine problem (Kim). With an eye towards recent development, the speakers provided enough background and introduction to these areas to help researchers building knowledge in new areas different from their previous research interest.

(3) A week-long research workshop on *Degeneracy of Algebraic points*. This consisted of talks on recent research developments. The focus was on effectivity results (Alpöge, Lawrence, Ostafe, Schmidt, and Zannier), new developments motivated from Dimitrov–Gao–Habegger and Kühne on uniform Mordell–Lang (Gao, Mavraki, and Yuan), applications of Shimura varieties and rigid local systems towards Diophantine results (Esnault, Shankar, Qiu and Tayou), heights of abelian varieties (Kisin), superelliptic curves (Bouw), and new viewpoints towards classical objects: converse theorems (Dimitrov), elliptic integrals (Masser), Roth's theorem (Vojta), and work of Edixhoven, Parshin, and Szpiro (Zhang).

During the weeks when the workshops were not happening, there were several regular seminar series:

(1) Research seminar organized by Ullmo and Vogt on various new research developments in Diophantine Geometry;

(2) Learning seminar organized by Gao and Shankar on recent important breakthroughs: (1) proof of the unbounded denominators conjecture (2) proofs of uniform Mordell–Lang and the theory of adelic line bundles (3) full proof of the André–Oort conjecture;

(3) (joint with Euler Systems program) "What is...?" lunch seminar organized by Colmez, Darmon, and Kisin featuring expository talks on important concepts;

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(4) (joint with Euler Systems program) Graduate student seminar organized by Darmon, Sing, and Wawrow;

(5) (joint with Euler Systems program) Career development seminar organized by Tamiozzo and Wen including topics such as job applications, grant applications, and collaborations.

All the talks (except the ones in the "What is...?" seminar) were made available in hybrid mode, with in-person participation and streaming over Zoom. Online participants could ask questions directly on Zoom. This helped expand the impact of the program to people who could not attend in person.

Furthermore, many participants came to the UC Berkeley math department on Mondays and Wednesdays to attend the RTG arithmetic geometry and number theory seminar and the number theory colloquium. Some participants gave talks at these seminars.

4. Postdoctoral fellows

Several of the postdoctoral members reported breakthroughs in their research during the program. In particular, Baldi and Urbanik have obtained new Zilber–Pink type results for G-bundles; Dill with Campagna, who visited SLMath during the Introductory workshop, solved modular support problem over finite fields and proved various results towards arithmetic unlikely intersections in split semiabelian schemes; Dill with Checcoli found new height-theoretic properties of subfields of the field generated by all torsion points of an abelian variety; Li, with collaborators (some in residence during the program and others visited during workshops), proved refinements of Serre's ordinary reduction conjecture for certain abelian varieties parametrized by certain unitary Shimura varieties. In addition to these results, all our postdoc members have started new projects (some with members and professors in residence and/or participants and speakers of workshops) inspired from the talks and informal discussions during the program.

Wen, joint with Tamiozzo from the other program, organized the Career Development Seminar series; not only postdoc members but also many other members in our program from various career stages found this seminar series highly useful.

5. Graduate Students

Five program associates were formally associated with the program; additionally, many further students of program members were either graduate students at Berkeley or able to visit during the program workshops. A regular graduate student seminar (joint with the Euler Systems program), largely organized by the program associates, was held weekly on Wednesdays.

Reports from graduate students indicate that their time was productive and they were able to use the opportunity to network with experts at the program well. In all the reports from program associates, they all indicated that they have learned new ideas applicable to their research and had the opportunities to present their work to the experts at the program. Some of them even initiated research with new collaborators. For example, Sweeting mentioned that she "had many valuable and enlightening conversations with mathematicians [at the program]" and she also had interaction with experts in the other program such as Darmon and Tamiozzo. Also, feedback that we received from graduate students traveling to attend workshops (not program associates) acknowledged the opportunity to talk to experts in the area. For instance, Park, a graduate student of research member Ellenberg, had some discussion with postdoc member Li during the introduction workshop and the discussion has led to a project in progress.

6. Inclusivity

Participants in the program and the associated workshops were invited and selected with an eye toward maintaining a diverse and inclusive environment. Overall, 15 of the 42 participants of

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the semester-long program who spent some time in residence at the rank of research member or professor were women, and 1 of the 5 program associates and 3 of the 7 program postdocs were women. Similar attention was paid to the speaker lists of the week-long workshops and the research seminar associated with the program, with the result that 4 of 18 speakers for the introductory workshop, 4 out of 18 speakers for the topical workshop, and 3 out of 12 speakers for the research seminar were women or members of underrepresented groups.

Effort was also made to select speakers from a range of professional levels and of institution types for both workshops and the research seminar. For the workshops, the organizers endeavored to use their limited invites to outside participants to provide opportunities to more junior researchers. Among the speakers, 6 out of 18 speakers for the topical workshop and 4 out of 12 speakers for the research seminar were postdocs (some of them received tenure-track level offers during the program).

Furthermore, the two-day workshop *Connections Workshop: Diophantine Geometry* was held early in the program; one of the goals of this workshop was to provide a forum for showcasing the research of women and members of gender minorities within the (broadly-construed) field of arithmetic geometry and Diophantine geometry, as well as to provide a space for networking and career support. Conference events included a panel discussion with panelists from different career stages to share advice on a wide range of related questions and a well-attended social dinner during which some of the discussion from the panel was continued in small groups.

There was also a bi-weekly lunch gathering for women and gender minorities organized by Hsu, a research member of the Euler systems program. Many of the women participating in our program were frequent attendees of these lunches, which provided a casual setting for discussions on mathematics, career development, work-life balance, and many other topics.

There were also many informal interactions among participants, which were very helpful for a supportive environment. For example, Wen, a postdoc member, mentioned that she "met a group of wonderful female mathematicians at various career stages and become friends with them. It is a very validating experience."

7. Highlights and Breakthroughs

Diophantine Geometry is a broad topic, and research achievements during the program mirrored its breadth.

Cadoret and Stix proved a substantial theorem on the sparsity of toric loci for ℓ-adic local systems arising from geometry. The distribution of CM points on Shimura varieties has been studied by many people (including many participants of the program) with fruitful outcomes such as the proof of the André–Oort conjecture. The toric locus is the analogue of the CM locus for geometric local systems. Cadoret and Stix studied rational and integer points (and more generally points of bounded degree) in the toric locus and proved that (under mild conditions) these points are not Zariski dense for a positive density set of ℓ. Their work is very important as it provided a first understanding of the toric loci beyond the previously known cases for subvarieties of Shimura varieties. For the Shimura variety of Hodge type with the local system coming from the universal family of abelian varieties, their result follows from an argument using the Pila–Zannier strategy, which was the key framework of the proof of the André–Oort conjecture. In the work of Cadoret and Stix, they brought the Lawrence–Venkatesh method into the picture. The work of Lawrence–Venkatesh provided a new proof of Faltings's theorem (on the finiteness of rational points). It was very exciting for participants of the program to see a new result with deep links to both the Pila–Zannier method and the Lawrence–Venkatesh method.

Another important theorem proved during the program is the work of Mocz and Kisin on the Northcott property in the isogeny class of abelian varieties. More precisely, given an abelian variety over a number field, Mocz and Kisin proved that in the geometric isogeny class of this abelian variety, for a given constant $C > 0$, there are only finitely many isomorphism classes whose Faltings

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height is less than C; their theorem is conditional on the Mumford–Tate conjecture for the given abelian variety. The Mumford–Tate conjecture has been proved for many abelian varieties, so this assumption is mild. Their proof used the classification of p-divisible groups by Scholze–Weinstein. It was exciting to see a new application of integral p-adic Hodge theory to study heights and Diophantine problems. Two recent examples of applications of p-adic Hodge theory to Diophantine Geometry are Lawrence–Venkatesh on Faltings's theorem and Esnault–Groechenig–Pila–Shankar–Tsimerman on the André–Oort conjecture; both have led to many further exciting new results. Thus we expect the new idea in the work of Mocz–Kisin will lead to new interesting theorems in the future.

A third research development is along the line of arithmetic algebraization theorems. The origin of algebraization theorems lies in the Borel–Dwork criterion, which was used by Dwork to prove the rationality of zeta functions of varieties over finite fields. The Borel–Dwork criterion provided a sufficient condition for a $\mathbb{Q}$-coefficient power series to be a rational function using its convergence properties. Calegari, Dimitrov, and Tang worked on various refinements and generalizations of such a criterion in a quantitative way and proved that $\log(1 - 1/n) \log(1 - 1/m)$ is irrational when $0 \neq |m/n - 1|$ is very small. Based on the earlier work of Bost–Charles, Charles gave many geometric interpretations and alternative proofs for various Diophantine applications using algebraization theorems and related results. Charles's work provided a better understanding of the arithmetic geometry behind the Diophantine analysis. Another progress on transcendence theory during the program is a hyperbolic analogue of Wüstholz's analytic subgroup theorem by Gao–Ullmo–Yafaev using methods from functional transcendence. It will be an interesting future direction to explore the links among these methods and results.

There are many other important research achievements and the above is only a small set of them. Many of these new theorems used ideas from different areas in arithmetic geometry and provided new links among various areas of Diophantine Geometry.

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Postdoc Pre/Post-MSRI Institution Group

Family Name	First Name	Pre-MSRI Institution Name	Pre-MSRI Institution Group	Post-MSRI Institution Name	Post-MSRI Institution Group
Baldi	Gregorio	Institut des Hautes Études Scientifiques (IHES)	Foreign	Institut des Hautes Études Scientifiques (IHES)	Foreign
Chan	Stephanie	University of Michigan	Math Public Large Group	Institute of Science and Technology Austria	Foreign
Dill	Gabriel	Leibniz Universität Hannover	Foreign	Leibniz Universität Hannover	Foreign
Ge	Tangli	Princeton University	Math Private Large Group	Princeton University	Math Private Large Group
Li	Wanlin	Washington University, St. Louis	Math Private Large Group	Washington University, St. Louis	Math Private Large Group
Urbanik	David	Institut des Hautes Études Scientifiques (IHES)	*Foreign*	Institut des Hautes Études Scientifiques (IHES)	*Foreign*
Wen	Boya	University of Wisconsin-Madison	Math Public Large Group	University of Wisconsin - Madison	Math Public Large Group

2022-23 DioG Postdoctoral Fellows Demographic Summary

Gender	#	%
# of Distinct Members	7	100.0%
Male	4	57.1%
Female	3	42.9%
Decline to State	0	0.0%
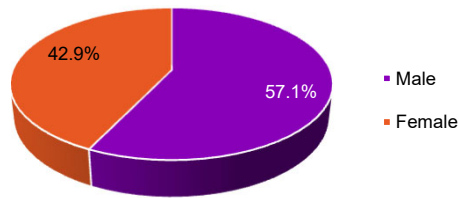
Race/Ethnicity*	#	%
White	2	28.6%
Asian	4	57.1%
Hispanic/Latino	0	0.0%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	1	14.3%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%
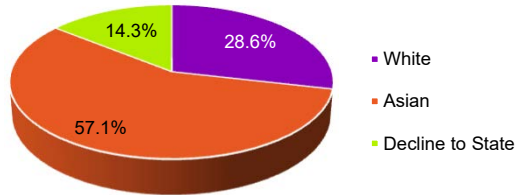
Citizenships	#	%
Foreign Home Inst.	3	42.9%
US Home Inst.	4	57.1%
Foreign Citizens	7	100.0%
US Citizens & Perm. Res.	0	0.0%
US Citizens	0	0.0%
US Permanent Residents	0	0.0%
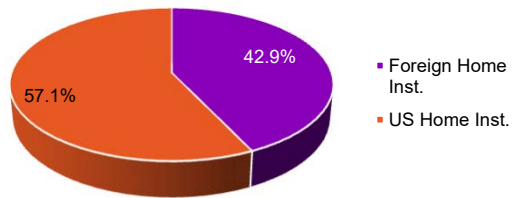
Year of Ph.D	#	%
2022	3	42.9%
2021	0	0.0%
2020	2	28.6%
2019	2	28.6%
2018	0	0.0%
2017	0	0.0%
Total # of Distinct Members	7	100.0%

*Race/ethnicity selections are non-exclusive.
**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

### 2022-23 DioG Postdoctoral Fellows Classified by State

State	#	%	2020 Census
South	0	0.0%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	0	0.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	0	0.0%	1.9%
MS	0	0.0%	0.9%
NC	0	0.0%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	0	0.0%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	0	0.0%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	0	0.0%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	3	75.0%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	1	25.0%	3.0%
MN	0	0.0%	1.7%
MO	1	25.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	1	25.0%	1.8%
Northeast	1	25.0%	17.4%
CT	0	0.0%	1.1%
MA	0	0.0%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	1	25.0%	2.8%
NY	0	0.0%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	4	100.0%	100.0%

- South
- West
- Midwest
- Northeast
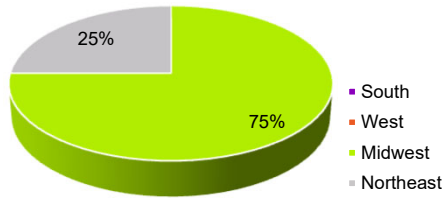
*Regions based on US Census classification

2022-23 DioG Postdoctoral Fellows Classified by Country

Africa			**0**
Americas			**4**
	North America	Canada	0
		United States	4
Asia			**0**
Europe			**3**
	Western Europe	France	2
		Germany	1
Oceania			**0**
Grand Total			**7**
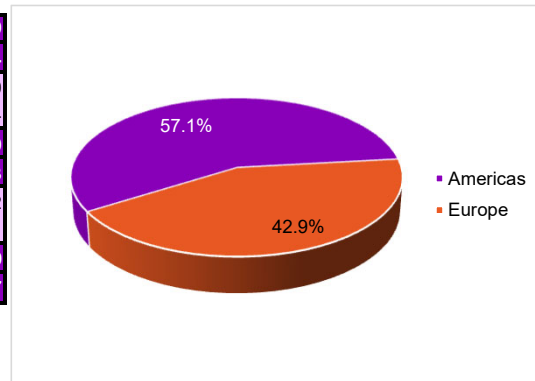
Regions based on United Nations classification

Diophantine Geometry

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	7	13.0%	4	57.1%	4	57.1%	0	0.0%
Research Professors	12	22.2%	7	58.3%	1	8.3%	1	14.3%
Postdoctoral Fellows	7	13.0%	0	0.0%	3	42.9%	0	0.0%
PD/RM	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Research Members	23	42.6%	11	47.8%	9	39.1%	0	0.0%
Program Associates	5	9.3%	3	60.0%	1	20.0%	0	0.0%
Total # of Distinct Members	54	100%	25	46.3%	18	33.3%	1	4.0%

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

Home Institution AMS Grouping

Role	US								Foreign
	Private Large	Private Small	Public Large	Public Medium	Public Small	Bachelors	Masters	Non-Group	Foreign
Organizers	2	0	2	0	0	0	0	1	2
Research Professors	3	0	4	0	0	0	0	0	5
Postdoctoral Fellows	2	0	0	0	0	0	0	2	3
PD/RM	0	0	0	0	0	0	0	0	0
Research Members	3	0	7	0	0	0	2	1	10
Program Associates	3	0	2	0	0	0	0	0	0
Total	13	0	15	0	0	0	2	4	20
%	24.1%	0.0%	27.8%	0.0%	0.0%	0.0%	3.7%	7.4%	37.0%

2022-23 DioG Program Members Demographic Summary

Gender	#	%
# of Distinct Members	54	100.0%
Male	33	61.1%
Female	18	33.3%
Other	1	1.9%
Decline to State	2	3.7%
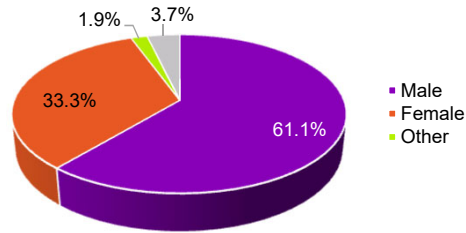
Race/Ethnicity*	#	%
White	29	53.7%
Asian	15	27.8%
Hispanic/Latino	4	7.4%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	8	14.8%
Unavailable Info.	0	0.0%
Minorities**	1	4.0%
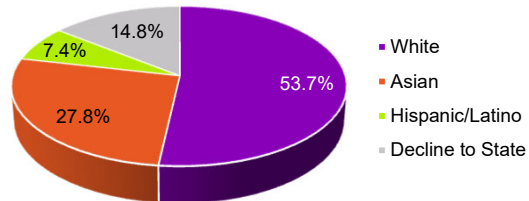
Citizenships	#	%
Foreign Home Inst.	20	37.0%
US Home Inst.	34	63.0%
US Citizens & Perm. Residents	25	46.3%
Foreign Citizens	29	53.7%
US Citizens	24	44.4%
US Permanent Residents	1	1.9%
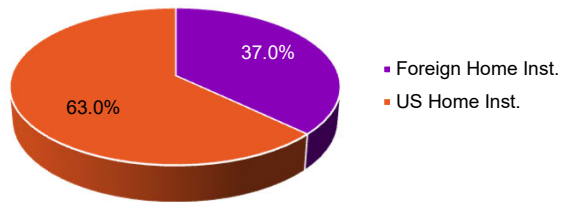
Year of Ph.D	#	%
Prog. Assoc. (GS)	5	9.3%
2021 & Later	3	5.6%
2020	2	3.7%
2015-2019	11	20.4%
2010-2014	11	20.4%
2005-2009	4	7.4%
2000-2004	1	1.9%
1995-1999	6	11.1%
1990-1994	3	5.6%
1985-1989	1	1.9%
1981-1984	4	7.4%
1980 & Earlier	3	5.6%
Total # of Distinct Members	54	100.0%
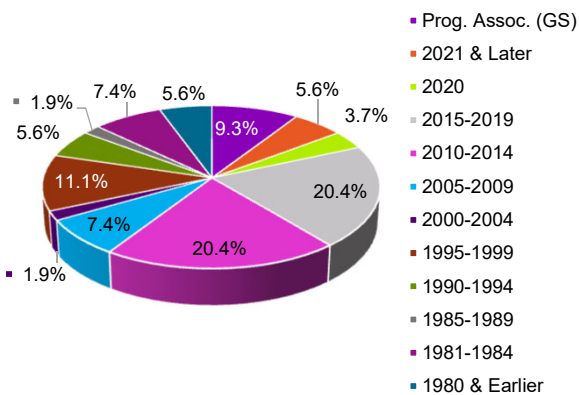
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 DioG Program Members Classified by State

State	#	%	2020 Census
South	**5**	**14.7%**	**38.1%**
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	1	2.9%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	0	0.0%	1.9%
MS	0	0.0%	0.9%
NC	1	2.9%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	3	8.8%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	**11**	**32.4%**	**23.7%**
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	9	26.5%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	2	5.9%	2.3%
WY	0	0.0%	0.2%
Midwest	**5**	**14.7%**	**20.8%**
IA	0	0.0%	1.0%
IL	1	2.9%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	1	2.9%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	3	8.8%	1.8%
Northeast	**13**	**38.2%**	**17.4%**
CT	0	0.0%	1.1%
MA	3	8.8%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	4	11.8%	2.8%
NY	2	5.9%	6.1%
PA	1	2.9%	3.9%
RI	3	8.8%	0.3%
VT	0	0.0%	0.2%
Other	**0**	**0.0%**	**0.0%**
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	**34**	**100.0%**	**100.0%**
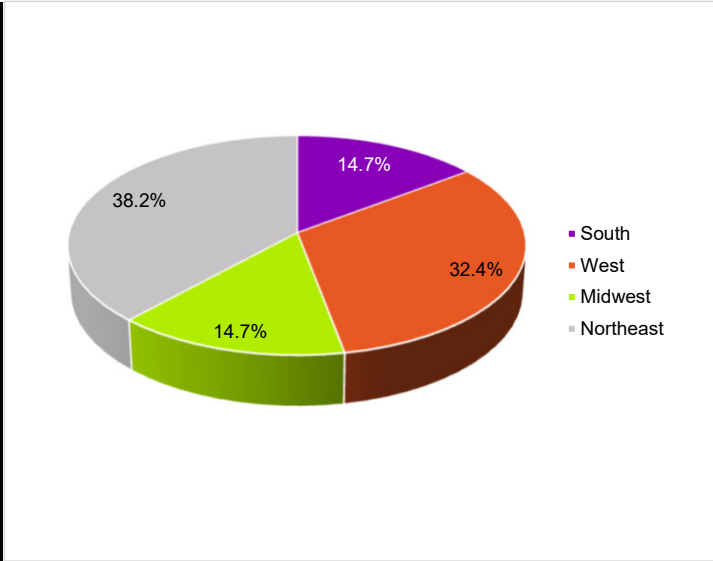
*Regions based on US Census classification

2022-23 DioG Program Members Classified by Countries

Africa			**0**
Americas			**36**
	North America	United States	34
	South America	Chile	2
Asia			**0**
	Eastern Asia	Japan	0
	Western Asia	Israel	0
Europe			**17**
	Northern Europe	Denmark	1
	Southern Europe	Italy	1
	Western Europe	Norway	0
		France	7
		Germany	6
		Switzerland	2
Oceania			**1**
	Australia & New Zealand	Australia	1
Grand Total			**54**
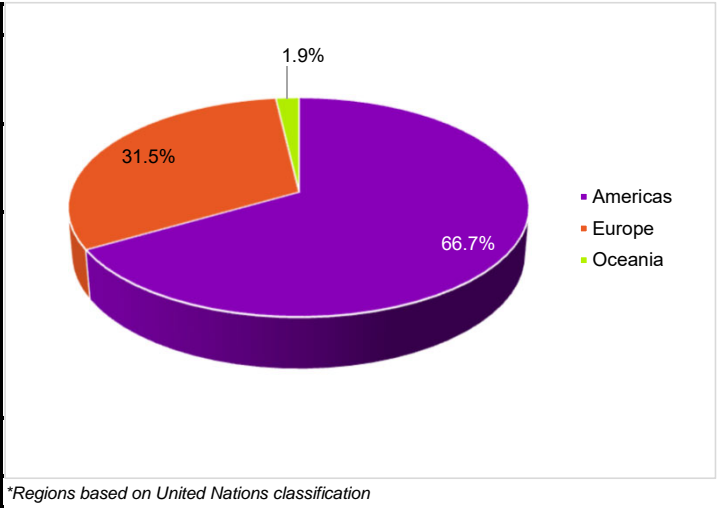
Regions based on United Nations classification

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Diophantine Geometry

January 17, 2023 - May 26, 2023

Total Program Members:	54
Total Survey Respondants:	50
Response Rate:	93%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	44	88%
No	6	12%
Total Responses	50	

Q2. I had opportunities to present my work to new audiences

Yes	43	86%
No	7	14%
Total Responses	50	

Q3. I initiated research with new collaborators

Yes	32	64%
No	18	36%
Total Responses	50	

Q4. I initiated research in new areas

Yes	28	56%
No	22	44%
Total Responses	50	

Q5. My research was advanced in these other ways:

Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?

Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	0	0%
2	0	0%
3	3	6%
4	9	19%
5 - Most Satisfying	35	74%
Total Responses (Exclusive of N/A)	47	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?

Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	1	10%
3	1	10%
4	0	0%
5 - Most Satisfying	8	80%
Total Responses (Exclusive of N/A)	10	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	7	100%
Total Responses (Exclusive of N/A)	7	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	2	29%
5 - Most Satisfying	5	71%
Total Responses (Exclusive of N/A)	7	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?
Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	0	0%
3	1	25%
4	1	25%
5 - Most Satisfying	2	50%
Total Responses (Exclusive of N/A)	4	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	3	6%
3	5	11%
4	13	28%
5 - Most Satisfying	26	55%
Total Responses (Exclusive of N/A)	47	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	2	4%
3	9	19%
4	12	26%
5 - Most Satisfying	24	51%
Total Responses (Exclusive of N/A)	47	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	0	0%
2	1	3%
3	4	10%
4	7	18%
5 - Most Satisfying	28	70%
Total Responses (Exclusive of N/A)	40	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	1	2%
2	1	2%
3	5	10%
4	6	13%
5 - Most Satisfying	35	73%
Total Responses (Exclusive of N/A)	48	100%

Q18. Professionally, my overall satisfaction with MSRI was

1 - Least Satisfying	0	0%
2	2	4%
3	5	10%
4	11	23%
5 - Most Satisfying	30	63%
Total Responses (Exclusive of N/A)	48	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?
Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?
Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?
Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?
Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	8%
5 - Most Satisfying	37	93%
Total Responses (Exclusive of N/A)	40	100%

Q24. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	0	0%
3	1	3%
4	7	18%
5 - Most Satisfying	32	80%
Total Responses (Exclusive of N/A)	40	100%

Q25. How could we improve our computing services?
Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?
Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance

1 - Least Satisfying	1	3%
2	2	6%
3	2	6%
4	6	17%
5 - Most Satisfying	24	69%
Total Responses (Exclusive of N/A)	35	100%

Q28. School and Childcare Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	1	17%
4	3	50%
5 - Most Satisfying	2	33%
Total Responses (Exclusive of N/A)	6	100%

Q29. Visa Assistance

1 - Least Satisfying	1	4%
2	0	0%
3	0	0%
4	5	21%
5 - Most Satisfying	18	75%
Total Responses (Exclusive of N/A)	24	100%

Q30. How could we improve our relocation advisory services?
Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	6	13%
5 - Most Satisfying	40	87%
Total Responses (Exclusive of N/A)	46	100%

Q32. How could we improve our administrative services?
Link to Qualitative Responses

Q33. Your comments about MSRI:
Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:
Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.
Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.
Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	17	35%
2	20	41%
3	11	22%
4	1	2%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	49	100%

Q38. Virtually from my office at MSRI

1 - Never	29	59%
2	11	22%
3	6	12%
4	2	4%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	49	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	46	94%
2	1	2%
3	2	4%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	49	100%

Q40. In person, without following along on Zoom

1 - Never	3	6%
2	0	0%
3	7	14%
4	13	27%
5 - Almost Always	26	53%
Total Responses (Exclusive of N/A)	49	100%

Q41. Is there anything that would increase the benefit of the virtual options above?
Link to Qualitative Responses

Algebraic Cycles, L-Values, and Euler Systems
January 17, 2023 - May 26, 2023
SLMath, Berkeley, CA
USA

Organizers:

Henri Darmon (McGill University)
Ellen Eischen (University of Oregon)
Benjamin Howard (Boston College)*
David Loeffler (University of Warwick)
Christopher Skinner (Princeton University)
Sarah Zerbes (ETH Zürich)
Wei Zhang (Massachusetts Institute of Technology)

REPORT ON THE PROGRAM ALGEBRAIC CYCLES, L-VALUES, AND EULER SYSTEMS

HENRI DARMON, ELLEN EISCHEN, BEN HOWARD, DAVID LOEFFLER, CHRIS SKINNER, SARAH ZERBES, AND WEI ZHANG

1. INTRODUCTION

The semester-long program on *Algebraic Cycles, L-values, and Euler Systems* revolved around two intertwined and fast developing themes.

1.1. L-functions and Selmer groups.

A series of central conjectures formulated in different degrees of generality by Deligne, Beilinson-Bloch, and Bloch-Kato aim to relate the special values or leading terms of motivic L-functions to arithmetic invariants generalising the class groups and regulators that appear in the analytic class number formula. A somewhat more amenable variation on this theme is expressed in the language of Iwasawa theory, and relates p-adic L-functions to the characteristic ideals of associated Selmer groups. Over the last four or five decades, two principal strategies have emerged to elucidate this relation: the first, based on congruences between modular forms and going back (at least) to the seminal work of Mazur-Wiles, and the second, based on *Euler systems* of special global classes constructed from special units, special cycles, or special elements in algebraic K-theory. Until relatively recently, Euler systems were largely confined to a handful of classical examples (involving circular or elliptic units, Heegner points, and Beilinson elements) and it was widely felt that their construction remained more of an art than a science. One of the exciting developments of the past decade or so has been the emergence of a more systematic conceptual understanding of the overall framework, leading to a plethora of new examples, with significant arithmetic implications.

1.2. Special cycles on Shimura varieties.

The seminal work of Gross and Zagier is an archetype of a vastly more general collection of formulae relating special cycles on (products of) orthogonal or unitary Shimura varieties with fourier coefficients of modular generating series and special values of L-functions. The program devoted to generalising these formulae and exploring their connections with theta liftings and the Siegel-Weil formula has enjoyed tremendous progress in the last three decades, with the emergence of new conceptual tools like the notion of Kudla-Millson forms, Borcherd's singular theta lift, and an effort to formulate and prove a Gross-Zagier style formula based on the period integrals of Gan-Gross-Prasad, The rich supply of algebraic cycles on Shimura varieties of orthogonal or unitary type that occur in these applications has fueled a lot of the progress on new Euler system constructions and presents great promise for future developments.

2. THE EULER SYSTEM LECTURE SERIES

The thematic semester was anchored by a regular lecture series devoted to Euler systems, which fell naturally into two parts:

- A series of lectures by Sarah Zerbes which had originally been envisaged as a semester-long activity, but had to be delayed and somewhat condensed when Sarah's arrival was postponed. In her lecture series, Sarah presented several new Euler system arguments involving special elements in the (higher) Chow groups of Hilbert modular surfaces and Siegel modular threefolds coming from Siegel units, with remarkable applications to the

1

Iwasawa main conjecture for the symmetric square motive and to the weak Birch and Swinnerton Dyer conjecture (in analytic rank zero) for abelian surfaces over $\mathbb{Q}$.

- A series of talks by Chris Skinner and Marco Sangiovanni-Vincentelli introduced exciting new perspectives in the foundations of Euler systems arguments. These may lead to important simplifications in existing approaches and spur progress in overcoming the obstacles that inevitably seem to attend any efforts to parlay new Euler systems into arithmetic applications. The basic idea is to realize the sought-for global Galois cohomology classes in the cohomology of complements of Shimura varieties in larger Shimura varieties, relative to some other sub-Shimura varieties. This leads, notably, to a flexible framework for associating global extension classes with Euler-system like properties to Eisenstein series. Previously, many Euler system constructions relied ostensibly on modular units, which seem hard to significantly generalize; on the other hand, Eisenstein series (which arise as the logarithmic derivatives of modular units, in some special instances) are more ubiquitous and placing them at the center of a variety of Euler system constructions offers the prospect of a more systematic understanding accompanied by important simplifications, as well as a broader range of settings that might be profitably explored in the future.

3. Workshops

The program included three workshops:

(1) A two-day *Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems* featuring talks by a young leaders and established experts. It included expository lectures aimed at graduate students and other researchers who are new to the field, covering such basic topics as circular units and Heegner points, as well as a sequence of research talks. There was also a panel discussion focusing on professional development. While emphasis was placed on the work of women mathematicians, the workshop was open to all researchers. This workshop was held in honor of mathematician Bernadette Perrin-Riou whose ideas have had a significant and lasting impact on the field.

(2) A week-long *Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems* that provided a coherent overview of current research in algebraic cycles, L-values, Euler systems, and the many connections between them. This included the study of special cycles on Shimura varieties and moduli spaces of shtukas, integral representations of L-values and the construction of p-adic L-functions, and the construction of Euler systems from special elements in Chow groups or higher Chow groups of Shimura varieties. Some of the workshop lectures were structured into short lecture series, allowing each series to begin with expository lectures on foundational results before moving on to current research. This workshop also marked the birthday of mathematician Bernadette Perrin-Riou.

(3) A week-long research workshop on *Shimura Varieties and L-Functions*, which consisted of talks focusing on more recent research developments. This topical workshop was dedicated to Shouwu Zhang, to mark the occasion of his 60th birthday, and to honour his numerous beautiful contributions to the theory of Shimura varieties and special values of L-functions. It highlighted cutting edge work on topics such as the construction of Euler systems; relations between special cycles on Shimura varieties and L-functions, such as generalized Gross-Zagier formulas and the Tate conjecture; the construction of Galois representations in cohomology; and related aspects of the theory of automorphic forms.

4. Regular seminars

During the weeks when the workshops were not happening, there were several regular seminar series, amounting to at least one lecture each day; indeed, the organisers aimed to have at least one

in-person event (between the two programs) each weekday to counter some participants' natural post-pandemic proclivity for working from home. The seminars consisted of:

(1) An ES research seminar which included talks by some of the organisers (Ben Howard, Henri Darmon, and Wei Zhang) but focused on contributions by early career mathematicians (Michele Fornea, Isabella Negrini, Gyujin Oh, Oscar Rivero Salgado, Matteo Tamiozzo, Rong Zhou, and Naomi Sweeting). Topics covered included the modularity of generating series of cycles on orthogonal Shimura varieties, the differences of real quadratic singular moduli, a function field analog of Kolyvagin's Euler system, plectic Stark-Heegner Points, a Shimura-Shintani correspondence for rigid analytic cocycles of higher weight, the arithmetic of weight-one modular forms, critical Eisenstein series with a view towards the Gross-Stark conjectures, a construction of Selmer classes via level raising, arithmetic level raising via motivic cohomology, and Kolyvagin's conjecture and higher congruences of modular forms.

(2) A learning seminar aimed at graduate students and postdocs met for a one month period between mid-February and mid-March, with four lectures by postdocs on the Sharifi conjectures.

(3) There were a few special seminars revolving around unitary Rapoport-Zink spaces and Euler systems norm relations, buy Zhiyu Zhang and Christophe Cornut respectively.

(4) A graduate student seminar and a professional development seminar, each aimed specifically at the early career participants, each met at least five times and were well-attended by all concerned. The professional development seminar covered topics of high interest to young mathematics, such as collaborating on research projects.

(5) A "what is..." seminar aimed at presenting basic notions to a generalist audience consisting of the participants in both programs met regularly in a more informal lunchtime setting to a standing room only audience in the Baker Board Room. Among the topics covered, in chronological order, were Rapoport-Zink spaces, Stark-Heegner points, derived schemes, diophantine geometry, Borcherds lifts, local systems, O-minimality, and the arithmetic Siegel Weil theorem, by Michael Rapoport, Henri Darmon, Tony Feng, Francois Charles, Richard Borcherds, Hélène Esnault, Thomas Scanlon, and Ben Howard respectively.

All the talks were given in hybrid mode, with in-person participations and streaming over Zoom. Online participants could ask questions in the chat, which were read by the seminar organizer. This helped expand the impact of the program to people who could not attend in person, although in person participation was encouraged when possible.

In addition to the seminars, there were frequent activities organised informally by subgroups of participants of varying size. Indeed, some of the participants commented that these unofficial grass-roots activities in which ideas could be exchanged more freely and in a less formal setting were the most valuable activities they took part in at the Institute, and care had to be taken to prevent the formal seminars from crowding out these exchanges.

Many participants also availed themselves of the UC Berkeley seminars in number theory and arithmetic geometry, as well as lecture series with a more number theoretic bent like the 2023 Chern lectures given by Peter Sarnak.

5. Postdoctoral fellows

Reports from the Postdoctoral Fellows are included in section 3 of the main report.

6. Graduate Students

10 program associates were formally associated with the program; additionally, many further students of program members were either in Berkeley for the term or able to visit during the program workshops. A regular graduate student seminar, largely organized by the program associates was held weekly on Wednesdays but petered out somewhat towards the end of the term.

Reports from graduate students indicate that their time was productive and they were able to use the opportunity to network with experts at the program well. For example, Marti Roset Julia (McGill) was able to pursue his collaboration with Lea Beneish at Berkeley and Darmon at the MSRI on a new approach to the Gross-Kohnen Zagier theorem for Shimura curves based on the Cerednik-Drinfeld theory of p-adic uniformisation of these curves. Marco Sangiovanni Vincentelli was further able to develop the novel approaches to Euler systems presented in his lectures with Chris Skinner, benefitting from the mentorship of the latter while he was in residence at the MSRI. Murilo Corato Zanarella was able to compute the structure of the relative Hecke algebra for the symmetric pair $(O(n), GL(n))$ and $(U(n), GL(n, E))$, and when combining with the method of level-raising congruence, to prove new instances of Bloch-Kato conjecture. Danielle Wang finished a draft proving a version of the twisted GGP conjecture relating the central value of certain Rankin-Selberg L-functions to the period integral for $(U(n, E/F), GL(n, E))$ for a quadratic field extension E/F.

7. Inclusivity

Participants in the program and the associated workshops were invited and selected with an eye toward maintaining a diverse and inclusive environment. Overall, 6 of the 27 attendees of the semester-long program who spent some time in residence at the rank of research member or professor were women, and 1 of the 10 program associates. Similar attention was paid to the speaker lists of the week-long workshops associated with the program, with the result that 4 of 11 speakers for the introductory workshop and 8 out of 18 speakers for the topical workshop were women or members of underrepresented groups.

Some effort was also made to select speakers from a range of professional levels and of institution types. In both cases the organizers endeavored to use their limited invites to outside participants to bring together a diverse group of attendees and providing opportunities to more junior researchers. Additionally, program member Catherine Hsu organized periodic women in math lunches, the first of which was informally tied to the Women in Numbers workshop in Banff in which some members were participating.

8. Highlights and Breakthroughs

Among the highlights of the activity were the lecture series of Sarah Zerbes which outlined the far reaching development of the Euler system program that she and her collaborators have been engaged in over the last decade, and which had never been presented with such thoroughness in a lecture series prior to then.

Another highlight was the unveiling of the new approach to Euler system constructions laid out by Chris Skinner and Marco Sangiovanni-Vincentelli in their lecture series. Their novel approach is to construct Euler systems by fusing together special cycles on Shimura varieties and Eisenstein cohomology classes, an idea with many potential generalizations.

Over the course of the semester, members Chao Li, Michael Rapoport, and Wei Zhang completed their construction of algebraic Hecke correspondences on integral models of unitary Shimura varieties. This allowed them to formulate new variants of the Arithmetic Fundamental Lemma, which plays a central role in ongoing attempts to prove higher-dimensional analogues of the Gross-Zagier theorem. Further applications are expected.

During the semester, members Tony Feng and Wei Zhang continued their joint work with Zhiwei Yun and they were able to prove the modularity of generating series of special cycles on the moduli of Shtukas for unitary groups.

Near the end of the semester, Zhiyu Zhang, a postdoc fellow, discovered a new type of special divisors that extend the construction of Kudla-Rapoport divisors, and used them crucially to prove a new Arithmetic Fundamental Lemma in the context of the arithmetic twisted GGP conjecture.

This is expected to lead to new Gross-Zagier type theorems for motives that were not covered by the arithmetic GGP previously formulated.

Postdoc Pre/Post-SLMath Institution Group

Family Name	First Name	Pre-SLMath Institution Name	Pre-SLMath Institution Group	Post-SLMath Institution Name	Post-SLMath Institution Group
Feng	Tony	University of California, Berkeley	Math Public Large Group	University of California, Berkeley	Math Public Large Group
Fornea	Michele	Columbia University	Math Private Large Group	CRM Barcelona	Foreign
Negrini	Isabella	University of British Columbia	Foreign	University of Toronto	Foreign
Oh	Gyujin	Columbia University	Math Private Large Group	Columbia University	Math Private Large Group
Rivero Salgado	Oscar	University of Warwick	Foreign	Universidade de Santiago de Compostela	Foreign
Tamiozzo	Matteo	University of Warwick	Foreign	University of Warwick	Foreign
Zhang	Zhiyu	Massachusetts Institute of Technology	Math Private Large Group	to be determined	n/a

2022-23 ES Postdoctoral Fellows Demographic Summary

Gender	#	%
# of Distinct Members	7	100.0%
Male	6	85.7%
Female	1	14.3%
Decline to State	0	0.0%
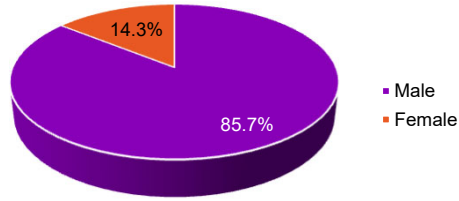
Race/Ethnicity*	#	%
White	3	42.9%
Asian	3	42.9%
Hispanic/Latino	1	14.3%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%
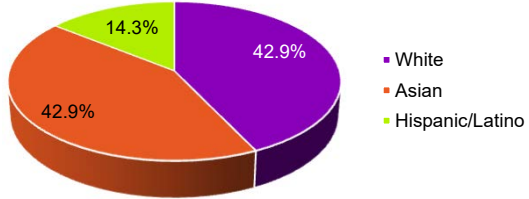
Citizenships	#	%
Foreign Home Inst.	3	42.9%
US Home Inst.	4	57.1%
Foreign Citizens	6	85.7%
US Citizens & Perm. Res.	1	14.3%
US Citizens	1	14.3%
US Permanent Residents	0	0.0%
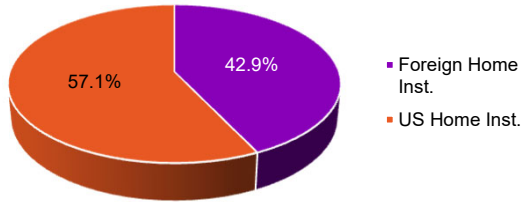
Year of Ph.D	#	%
2022	3	42.9%
2021	1	14.3%
2020	0	0.0%
2019	3	42.9%
2018	0	0.0%
2017	0	0.0%
Total # of Distinct Members	7	100.0%
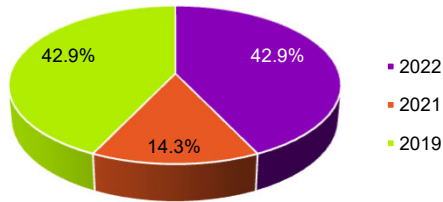
*Race/ethnicity selections are non-exclusive.
**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 ES Postdoctoral Fellows Classified by State

State	#	%	2020 Census
South	0	0.0%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	0	0.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	0	0.0%	1.9%
MS	0	0.0%	0.9%
NC	0	0.0%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	0	0.0%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	1	25.0%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	1	25.0%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	0	0.0%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	0	0.0%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	0	0.0%	1.8%
Northeast	3	75.0%	17.4%
CT	0	0.0%	1.1%
MA	1	25.0%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	0	0.0%	2.8%
NY	2	50.0%	6.1%
PA	0	0.0%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	4	100.0%	100.0%

- 25% — West
- 75% — Northeast
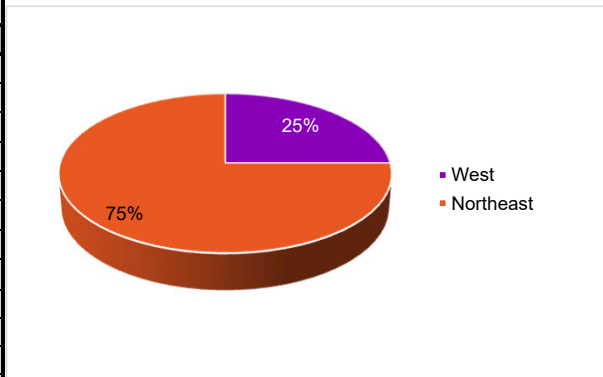
*Regions based on US Census classification

2022-23 ES Postdoctoral Fellows Classified by Country

Africa			**0**
Americas			**5**
	North America	Canada	1
		United States	4
Asia			**0**
Europe			**2**
	Northern Europe	United Kingdom	2
Oceania			**0**
Grand Total			**7**
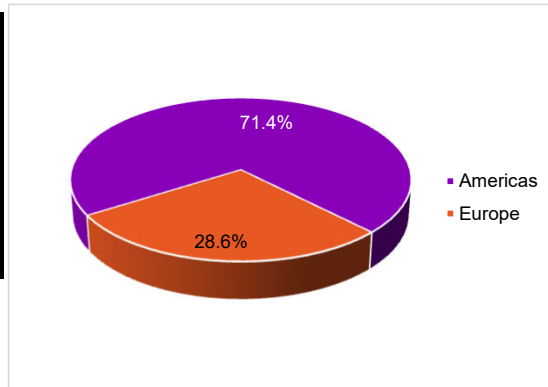
Regions based on United Nations classification

Algebraic Cycles, L-Values, and Euler Systems

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	7	13.7%	4	57.1%	2	28.6%	0	0.0%
Research Professors	8	15.7%	6	75.0%	1	12.5%	1	16.7%
Postdoctoral Fellows	7	13.7%	1	14.3%	1	14.3%	0	0.0%
PD/RM	1	2.0%	0	0.0%	1	100.0%	0	0.0%
Research Members	18	35.3%	5	27.8%	4	22.2%	1	20.0%
Program Associates	10	19.6%	3	30.0%	1	10.0%	0	0.0%
Total # of Distinct Members	51	100%	19	37.3%	10	19.6%	2	10.5%

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

Home Institution AMS Grouping

Role	US								Foreign
	Private Large	Private Small	Public Large	Public Medium	Public Small	Bachelors	Masters	Non-Group	
Organizers	2	1	0	1	0	0	0	0	3
Research Professors	0	0	4	1	0	0	0	0	3
Postdoctoral Fellows	3	0	1	0	0	0	0	1	2
PD/RM	0	0	0	0	0	0	0	0	1
Research Members	2	0	2	3	0	1	0	0	10
Program Associates	5	0	2	0	0	0	0	0	3
Total	12	1	9	5	0	1	0	1	22
%	23.5%	2.0%	17.6%	9.8%	0.0%	2.0%	0.0%	2.0%	43.1%

2022-23 ES Program Members Demographic Summary

Gender	#	%
# of Distinct Members	51	100.0%
Male	41	80.4%
Female	10	19.6%
Other	0	0.0%
Decline to State	0	0.0%
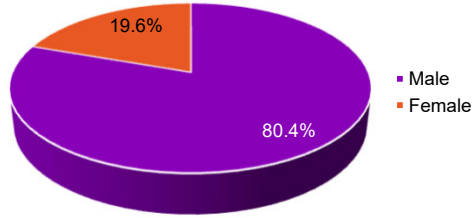
Race/Ethnicity*	#	%
White	25	49.0%
Asian	21	41.2%
Hispanic/Latino	3	5.9%
Black	1	2.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	3	5.9%
Unavailable Info.	0	0.0%
Minorities**	2	10.5%
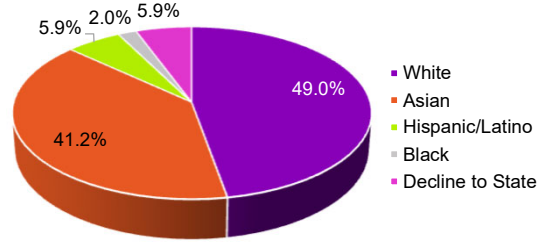
Citizenships	#	%
Foreign Home Inst.	22	43.1%
US Home Inst.	29	56.9%
US Citizens & Perm. Residents	19	37.3%
Foreign Citizens	32	62.7%
US Citizens	13	25.5%
US Permanent Residents	6	11.8%
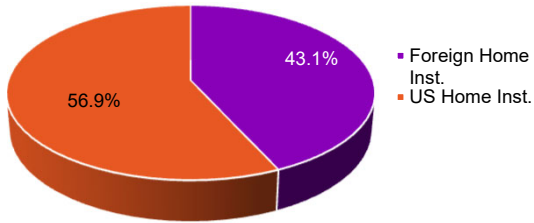
Year of Ph.D	#	%
Prog. Assoc. (GS)	10	19.6%
2021 & Later	6	11.8%
2020	1	2.0%
2015-2019	12	23.5%
2010-2014	3	5.9%
2005-2009	6	11.8%
2000-2004	3	5.9%
1995-1999	3	5.9%
1990-1994	4	7.8%
1985-1989	1	2.0%
1981-1984	1	2.0%
1980 & Earlier	1	2.0%
Total # of Distinct Members	51	100.0%
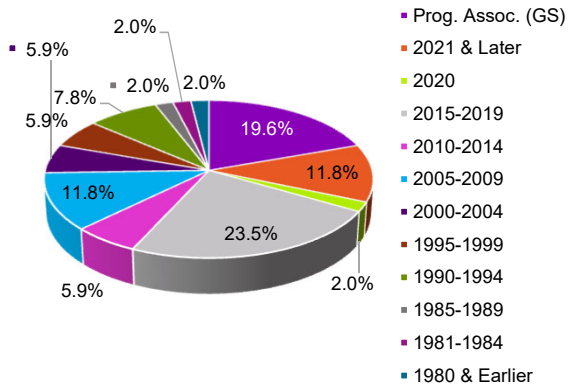
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022-23 ES Program Members Classified by State

State	#	%	2020 Census
South	**2**	**6.9%**	**38.1%**
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	0	0.0%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	3.4%	1.9%
MS	0	0.0%	0.9%
NC	0	0.0%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	0	0.0%	2.1%
TX	1	3.4%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	**11**	**37.9%**	**23.7%**
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	10	34.5%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	1	3.4%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	**2**	**6.9%**	**20.8%**
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	0	0.0%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	2	6.9%	1.8%
Northeast	**14**	**48.3%**	**17.4%**
CT	1	3.4%	1.1%
MA	7	24.1%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	1	3.4%	2.8%
NY	4	13.8%	6.1%
PA	1	3.4%	3.9%
RI	0	0.0%	0.3%
VT	0	0.0%	0.2%
Other	**0**	**0.0%**	**0.0%**
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	**29**	**100.0%**	**100.0%**
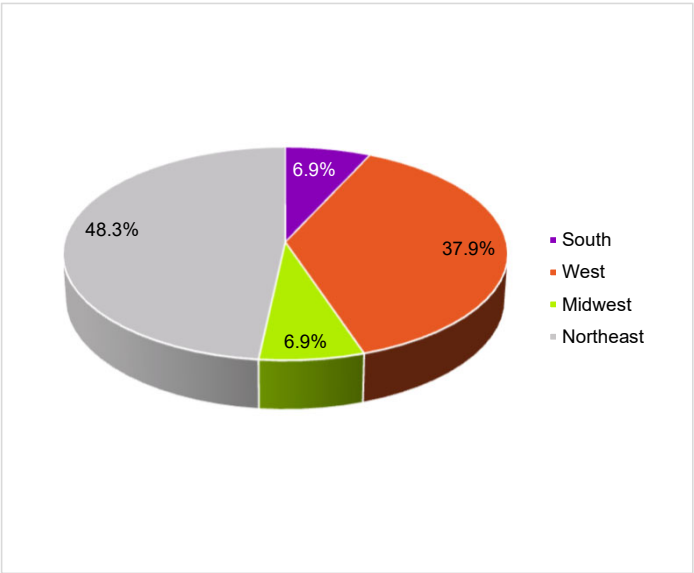
Pie chart legend:
- South — 6.9%
- West — 37.9%
- Midwest — 6.9%
- Northeast — 48.3%

*Regions based on US Census classification

205

2022-23 ES Program Members Classified by Countries

Africa			**0**
Americas			**34**
	North America	Canada	5
		United States	29
Asia			**1**
	Western Asia	Israel	1
Europe			**16**
	Northern Europe	Ireland	1
		United Kingdom	6
	Western Europe	France	5
		Germany	2
		Netherlands	1
		Switzerland	1
Oceania			**0**
Grand Total			**51**
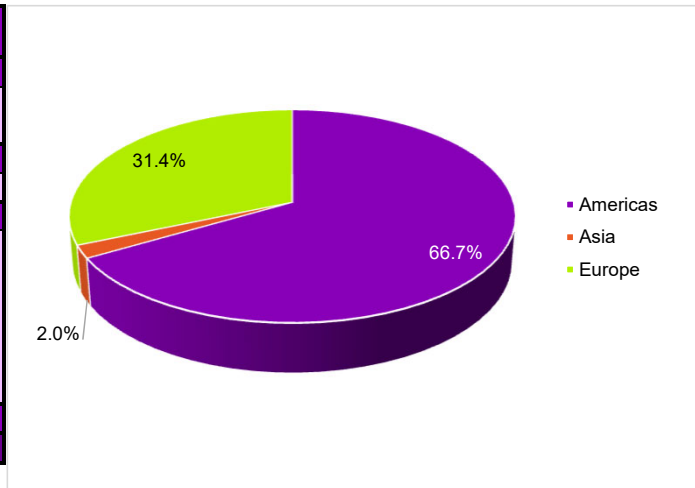
*Regions based on United Nations classification

206

Algebraic Cycles, L-Values, and Euler Systems
January 17, 2023 - May 26, 2023

Total Program Members:	51
Total Survey Respondants:	50
Response Rate:	98%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems
Yes	48	96%
No	2	4%
Total Responses	50	

Q2. I had opportunities to present my work to new audiences
Yes	44	88%
No	6	12%
Total Responses	50	

Q3. I initiated research with new collaborators
Yes	28	56%
No	22	44%
Total Responses	50	

Q4. I initiated research in new areas
Yes	28	56%
No	22	44%
Total Responses	50	

Q5. My research was advanced in these other ways:
Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?
Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?
1 - Least Satisfying	0	0%
2	1	2%
3	2	4%
4	15	30%
5 - Most Satisfying	32	64%
Total Responses (Exclusive of N/A)	50	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?
Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:
1 - Least Satisfying	0	0%
2	0	0%
3	1	13%
4	2	25%
5 - Most Satisfying	5	63%
Total Responses (Exclusive of N/A)	8	100%

Q10. Your overall mentoring experience:
1 - Least Satisfying	0	0%
2	1	13%
3	1	13%
4	1	13%
5 - Most Satisfying	5	63%
Total Responses (Exclusive of N/A)	8	100%

Q11. The lunch meeting with the directorate:
1 - Least Satisfying	0	0%
2	0	0%
3	2	25%
4	2	25%
5 - Most Satisfying	4	50%
Total Responses (Exclusive of N/A)	8	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?
Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	2	20%
3	2	20%
4	2	20%
5 - Most Satisfying	4	40%
Total Responses (Exclusive of N/A)	10	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	1	2%
3	3	6%
4	13	27%
5 - Most Satisfying	32	65%
Total Responses (Exclusive of N/A)	49	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	1	2%
3	4	8%
4	10	21%
5 - Most Satisfying	33	69%
Total Responses (Exclusive of N/A)	48	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	0	0%
2	0	0%
3	4	9%
4	9	21%
5 - Most Satisfying	30	70%
Total Responses (Exclusive of N/A)	43	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	0	0%
2	0	0%
3	4	8%
4	12	24%
5 - Most Satisfying	34	68%
Total Responses (Exclusive of N/A)	50	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	3	6%
4	7	14%
5 - Most Satisfying	40	80%
Total Responses (Exclusive of N/A)	50	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?
Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	7%
5 - Most Satisfying	40	93%
Total Responses (Exclusive of N/A)	43	100%

Q24. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	0	0%
3	1	3%
4	4	11%
5 - Most Satisfying	33	87%
Total Responses (Exclusive of N/A)	38	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance

1 - Least Satisfying	4	11%
2	3	9%
3	3	9%
4	5	14%
5 - Most Satisfying	20	57%
Total Responses (Exclusive of N/A)	35	100%

Q28. School and Childcare Assistance

1 - Least Satisfying	0	0%
2	1	33%
3	0	0%
4	0	0%
5 - Most Satisfying	2	67%
Total Responses (Exclusive of N/A)	3	100%

Q29. Visa Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	5%
5 - Most Satisfying	20	95%
Total Responses (Exclusive of N/A)	21	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	1	2%
4	6	12%
5 - Most Satisfying	42	86%
Total Responses (Exclusive of N/A)	49	100%

Q32. How could we improve our administrative services?
Link to Qualitative Responses

Q33. Your comments about MSRI:
Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:
Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.
Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.
Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	19	38%
2	23	46%
3	5	10%
4	2	4%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	50	100%

Q38. Virtually from my office at MSRI

1 - Never	31	62%
2	14	28%
3	3	6%
4	1	2%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	50	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	44	88%
2	1	2%
3	2	4%
4	1	2%
5 - Almost Always	2	4%
Total Responses (Exclusive of N/A)	50	100%

Q40. In person, without following along on Zoom

1 - Never	3	6%
2	4	8%
3	2	4%
4	8	16%
5 - Almost Always	33	66%
Total Responses (Exclusive of N/A)	50	100%

Q41. Is there anything that would increase the benefit of the virtual options above?
Link to Qualitative Responses

Complementary Program 2022–23

August 22, 2022 - August 11, 2023

MSRI

Berkeley, CA

USA

Complementary Program (2022–23)
August 22, 2022 to August 11, 2023

The Complementary Program has a limited number of memberships that are open to both mathematicians whose interests align with those of the Director or Deputy Director, and mathematicians who are partners of invited members of a core program.

During the 2022–23 academic year, SLMath had a small Complementary Program comprised of one program associate, Daniel Carranza (Johns Hopkins University) and the following researchers: Mirela Ciperiani (University of Texas, Austin), Spencer Dowdall (Vanderbilt University), Ellen Eischen (University of Oregon), David Eisenbud (University of California, Berkeley), Christopher Jankowski (Georgia Institute of Technology), Chris Kapulkin (University of Western Ontario), Eric Larson (Brown University), Grace Mwakyoma-Oliveira (Instituto Superior Técnico), Tim Perutz (University of Texas, Austin), Charmaine Sia (New York University, Courant Institute), Gigliola Staffilani (Massachusetts Institute of Technology), Amanda Tucker (University of Rochester), Volkmar Welker (Philipps-Universität Marburg), Jay Yang (Washington University).

Daniel Carranza (worked with Deputy Director Hélène Barcelo)
Program Associate, August 22, 2022 to July 31, 2023
Student of Chris Kapulkin, another member in the *Complementary Program*.
Johns Hopkins University
Baltimore, MD
United States

At SLMath, Daniel worked with Dr. Kapulkin on problems Homotopy Theory and (higher) Category Theory.

Mirela Ciperiani
Research member, January 1, 2023 to January 16, 2023
Organizer of the *Diophantine Geometry* program and partner of Dr. Timothy Perutz who was also a member of the 2022-23 *Complementary Program*.
University of Texas
Austin, TX
United States

Spencer Dowdall
Research Member, August 19, 2022 to December 16, 2022
Partner of Dr. Anna Marie Bohmann, Research Member in the *Floer Homotopy Theory* program.
Vanderbilt University
Nashville, TN
United States

At SLMath, Dr. Dowdall advanced research on existing projects including "Counting finite-order orbit points in Teichmuller space" with Dr. Howard Masur (University of Chicago); "Finiteness of fibers for Cannon–Thurston maps" with Elizabeth Field (grad student at University of Illinois at Urbana-Champaign); and an untitled work with Drs. Matthew G. Durham (University of California, Riverside), Christopher J. Leiniger (Rice, University), and Alessandro Sisto (Heriot-Watt University).

Ellen Eischen
Research Member, September 1, 2022 to December 16, 2022
Partner of Dr. Robert Lipshitz, Organizer in the *Floer Homotopy Theory* program.
University of Oregon
Eugene, OR
United States

At SLMath, Dr. Eischen made progress on a collaborative work with Dr. Giovanni Rosso (Concordia University) and Shrenik Shah (Princeton University) entitled "Algebraicity and p-adic interpolation for spin L-functions for GSp_6" which is in preparation.

David Eisenbud
Research Member, January 18, 2023 to July 31, 2023
University of California, Berkeley
Berkeley, CA
United States

Christopher Jankowski
Research Member, August 22, 2022 to December 14, 2022
Partner of Dr. Jennifer Hom, Research Professor in the *Floer Homotopy Theory* program.
Georgia Institute of Technology
Atlanta, GA
United States

While at SLMath, Dr. Jankowski progressed on a paper entitled "Investigations of q-pure q-weight maps on infinite-dimensional Hilbert spaces" with Drs. Daniel Markiewicz and Robert Powers (University of Pennsylvania). He also progressed on a project related to mathematics and education.

Chris Kapulkin (worked with Deputy Director Hélène Barcelo)
Research Member, August 22, 2022 to July 31, 2023
University of Western Ontario
Ontario
Canada

Eric Larson
Research Member, February 1, 2023 to May 19, 2023
Partner of Dr. Isabel Vogt, Research member in the *Diophantine Geometry* program.
Brown University
Providence, RI
United States

While at SLMath Dr. Larson spent most of his research time on projects in the exploratory stage one of which is tentatively entitled "The intersection of a space curve with a quadric in positive characteristic." In addition, Dr. Larson collaborated with Dr. Isabel Vogt (Brown University) on a manuscript entitled "Interpolation for Brill--Noether curves" and made revisions on a submitted manuscript, "The Maximal Rank Conjecture."

Grace Mwakyoma-Oliveira
Research Member, September 7, 2022 to December 12, 2022
Partner of Dr. Goncalo Oliveira, Research Member in the *Analytic and Geometric Aspects of Gauge Theory* program.
Instituto Superior Técnico
Lisboa, Portugal

During her stay at SLMath, Dr. Mwakyoma-Oliveira made progress on existing research through various discussions with other visiting mathematicians.

Timothy Perutz
Research Member, January 3, 2023 to May 19, 2023
Partner of Dr. Mirela Ciperiani, Organizer of the *Diophantine Geometry* program.
University of Texas, Austin
Austin, TX
United States

Charmaine Sia
Research Member, January 18, 2023 to May 16, 2023
Partner of Dr. Chao Li, Research Member in the *Algebraic Cycles, L-Values, and Euler Systems* program.
New York University, Courant Institute
New York, NY
United States

Gigliola Staffilani
Research Member, October 12, 2022 to December 15, 2022
Partner of Dr. Mrowka Tomasz, Organizer in the *Analytic and Geometric Aspects of Gauge Theory* program.
Massachusetts Institute of Technology
Cambridge, MA
United States

While at SLMath, Dr. Staffilani made progress on existing research.

Amanda Tucker
Research Member, January 23, 2023 to May 8, 2023
Partner of Dr. Thomas Tucker, Research Professor in the *Diophantine Geometry* program.
University of Rochester
Rochester, NY
United States

At SLMath, Dr. Tucker was able to collaborate in-person with Dr. Kevin McGown (California State University, Chico) on a project tentatively entitled "Counting D4 fields with local conditions and applications." They completed about half of the project and anticipates completing it in summer of 2023.

Volkmar Welker (worked with Deputy Director Hélène Barcelo)
Research Member, September 2, 2022 to October 31, 2022
Philipps-Universität Marburg
Marburg, Germany

At SLMath, Dr. Welker collaborated mainly with graduate student Daniel Carranza (Johns Hopkins University) and Drs. Hélène Barcelo (Simons Laufer Mathematical Sciences Institute) and Chris Kapulkin (University of Western Ontario) who were also on-site. The group focused on a project tentatively entitled "Suspensions in the discrete homotopy theory of graphs." Dr. Welker also worked on a draft entitled "The Garland Method Revisited" with Dr. Eric Babson (University of California, Davis).

Jay Yang
Research Member, January 30, 2023 to May 12, 2023
Partner of Dr. Wanlin Li, Postdoctoral Fellow in the *Diophantine Geometry* program.
Washington University
St. Louis, MO
United States

While in residence at SLMath, Dr. Yang collaborated in-person with Lauren Cranton Heller (a graduate student at University of California, Berkeley) on a new project entitled "Virtual Resolutions." He also made progress on a two existing projects with remote collaborators, "A Cellular Resolutions Package for Macaulay2" with Dr. Aleksandra Sobieska (University of Wisconsin, Madison), and "Virtually Shellable Simplicial Complexes" with Dr. Adam Van Tuyl (McMaster University).

2022–23 Complementary Program

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Research Professors	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Postdoctoral Fellows	0	0.0%	0	0.0%	0	0.0%	0	0.0%
PD/RM	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Research Members	14	93.3%	11	78.6%	6	42.9%	0	0.0%
Program Associates	1	6.7%	0	0.0%	0	0.0%	0	0.0%
Guests	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total # of Distinct Members	**15**	**100%**	**11**	**73.3%**	**6**	**40.0%**	**0**	**0.0%**

* Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

Home Institution Grouping

Role	US								Foreign
	Private Large	Private Small	Public Large	Public Medium	Public Small	Bachelors	Masters	Non-Group	
Organizers	0	0	0	0	0	0	0	0	0
Research Professors	0	0	0	0	0	0	0	0	0
Postdoctoral Fellows	0	0	0	0	0	0	0	0	0
PD/RM	0	0	0	0	0	0	0	0	0
Research Members	5	1	4	1	0	0	0	0	3
Program Associates	0	1	0	0	0	0	0	0	0
Total	**5**	**2**	**4**	**1**	**0**	**0**	**0**	**0**	**3**
%	**33.3%**	**13.3%**	**26.7%**	**6.7%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**20.0%**

2022–23 CP Members Demographic Summary

Gender	#	%
# of Distinct Members	15	100.0%
Male	9	60.0%
Female	6	40.0%
Other	0	0.0%
Decline to State	0	0.0%
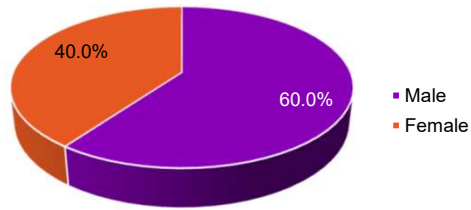
Race/Ethnicity*	#	%
White	11	73.3%
Asian	1	6.7%
Hispanic/Latino	1	6.7%
Black	1	6.7%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	1	6.7%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%
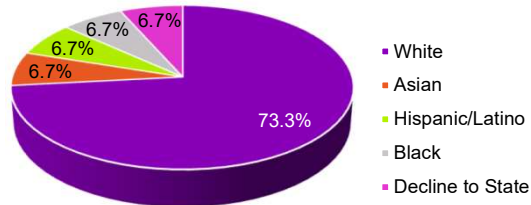
Citizenships	#	%
Foreign Home Inst.	3	20.0%
US Home Inst.	12	80.0%
US Citizen & Perm. Residents	11	73.3%
Foreign	4	26.7%
US Citizen	10	66.7%
Perm. Residents	1	6.7%
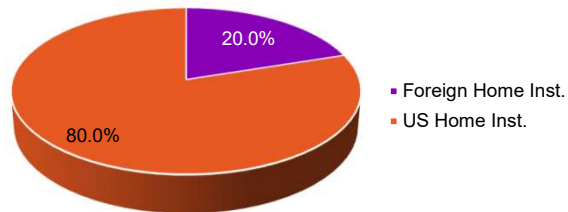
Year of Ph.D	#	%
Program Assoc. (GS)	1	6.7%
2021 & Later	1	6.7%
2020	0	0.0%
2015-2019	3	20.0%
2010-2014	2	13.3%
2005-2009	5	33.3%
2000-2004	0	0.0%
1995-1999	2	13.3%
1990-1994	0	0.0%
1985-1989	0	0.0%
1981-1984	0	0.0%
1980 & Earlier	1	6.7%
Total # of Distinct Members	15	100.0%
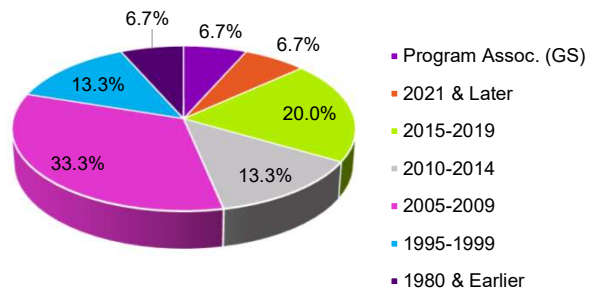
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

2022–23 CP Members Classified by State

State	#	%	2020 Census
South	5	41.7%	38.1%
AL	0	0.0%	1.5%
AR	0	0.0%	0.9%
DE	0	0.0%	0.3%
DC	0	0.0%	0.2%
FL	0	0.0%	6.5%
GA	1	8.3%	3.2%
KY	0	0.0%	1.4%
LA	0	0.0%	1.4%
MD	1	8.3%	1.9%
MS	0	0.0%	0.9%
NC	0	0.0%	3.1%
OK	0	0.0%	1.2%
SC	0	0.0%	1.5%
TN	1	8.3%	2.1%
TX	2	16.7%	8.8%
VA	0	0.0%	2.6%
WV	0	0.0%	0.5%
West	2	16.7%	23.7%
AK	0	0.0%	0.2%
AZ	0	0.0%	2.2%
CA	1	8.3%	11.9%
CO	0	0.0%	1.7%
HI	0	0.0%	0.4%
ID	0	0.0%	0.6%
MT	0	0.0%	0.3%
NM	0	0.0%	0.6%
NV	0	0.0%	0.9%
OR	1	8.3%	1.3%
UT	0	0.0%	1.0%
WA	0	0.0%	2.3%
WY	0	0.0%	0.2%
Midwest	1	8.3%	20.8%
IA	0	0.0%	1.0%
IL	0	0.0%	3.9%
IN	0	0.0%	2.0%
KS	0	0.0%	0.9%
MI	0	0.0%	3.0%
MN	0	0.0%	1.7%
MO	1	8.3%	1.9%
ND	0	0.0%	0.2%
NE	0	0.0%	0.6%
OH	0	0.0%	3.6%
SD	0	0.0%	0.3%
WI	0	0.0%	1.8%
Northeast	4	33.3%	17.4%
CT	0	0.0%	1.1%
MA	1	8.3%	2.1%
ME	0	0.0%	0.4%
NH	0	0.0%	0.4%
NJ	0	0.0%	2.8%
NY	2	16.7%	6.1%
PA	0	0.0%	3.9%
RI	1	8.3%	0.3%
VT	0	0.0%	0.2%
Other	0	0.0%	0.0%
PR	0	0.0%	0.0%
Other	0	0.0%	0.0%
Total	12	100.0%	100.0%

Pie chart legend: South (41.7%), West (16.7%), Midwest (8.3%), Northeast (33.3%)
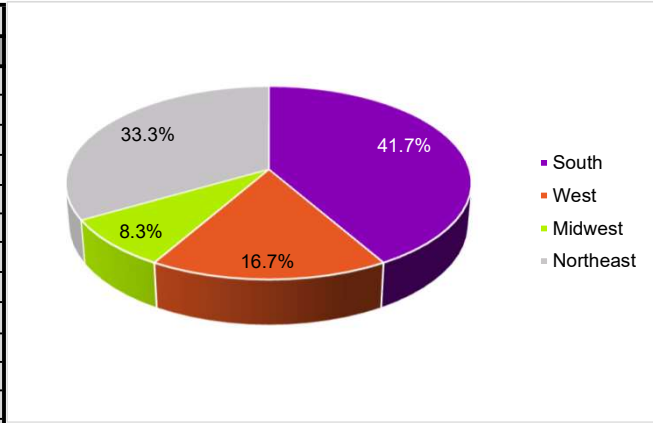
*Regions based on US Census classification

2022-23 CP Members Classified by Countries

Africa			**0**
Americas			**13**
	North America	Canada	1
		United States	12
Asia			**0**
	South-central Asia	**India**	**0**
Europe			**2**
	Western Europe	Germany	1
	Southern Europe	Portugal	1
Oceania			**0**
Grand Total			**15**

Americas — 86.7%
Europe — 13.3%
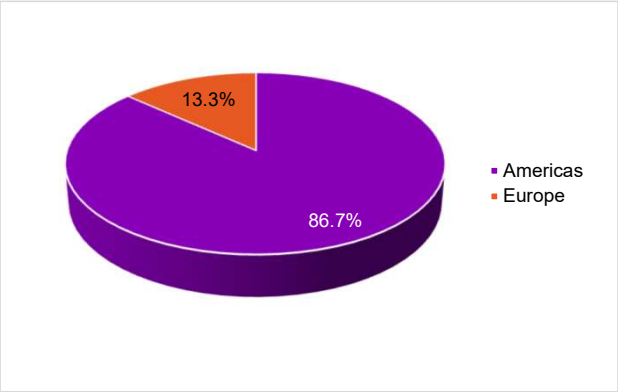
Regions based on United Nations classification

Complementary Program 2022-23
August 22, 2022 - August 11, 2023

Total Program Members:	15
Total Survey Respondants:	10
Response Rate:	67%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	8	80%
No	2	20%
Total Responses	10	

Q2. I had opportunities to present my work to new audiences

Yes	7	70%
No	3	30%
Total Responses	10	

Q3. I initiated research with new collaborators

Yes	4	40%
No	6	60%
Total Responses	10	

Q4. I initiated research in new areas

Yes	5	50%
No	5	50%
Total Responses	10	

Q5. My research was advanced in these other ways:
Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?
Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	0	0%
2	0	0%
3	1	10%
4	2	20%
5 - Most Satisfying	7	70%
Total Responses (Exclusive of N/A)	10	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?
Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	0	0%
Total Responses (Exclusive of N/A)	0	0%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	0	0%
Total Responses (Exclusive of N/A)	0	0%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	0	0%
Total Responses (Exclusive of N/A)	0	0%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	0	0%
Total Responses (Exclusive of N/A)	0	0%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	50%
5 - Most Satisfying	1	50%
Total Responses (Exclusive of N/A)	2	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	50%
5 - Most Satisfying	1	50%
Total Responses (Exclusive of N/A)	2	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	2	100%
Total Responses (Exclusive of N/A)	2	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	2	29%
2	0	0%
3	0	0%
4	1	14%
5 - Most Satisfying	4	57%
Total Responses (Exclusive of N/A)	7	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	13%
5 - Most Satisfying	7	88%
Total Responses (Exclusive of N/A)	8	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	4	100%
Total Responses (Exclusive of N/A)	4	100%

Q24. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	33%
5 - Most Satisfying	2	67%
Total Responses (Exclusive of N/A)	3	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance

1 - Least Satisfying	0	0%
2	1	13%
3	0	0%
4	1	13%
5 - Most Satisfying	6	75%
Total Responses (Exclusive of N/A)	8	100%

Q28. School and Childcare Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	2	100%
Total Responses (Exclusive of N/A)	2	100%

Q29. Visa Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	2	100%
Total Responses (Exclusive of N/A)	2	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	13%
5 - Most Satisfying	7	88%
Total Responses (Exclusive of N/A)	8	100%

Q32. How could we improve our administrative services?

Link to Qualitative Responses

Q33. Your comments about MSRI:

Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:

Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.

Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.

Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	5	50%
2	3	30%
3	1	10%
4	1	10%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	10	100%

Q38. Virtually from my office at MSRI

1 - Never	10	100%
2	0	0%
3	0	0%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	10	100%

Q39. In person, while using a device to follow along on Zoom
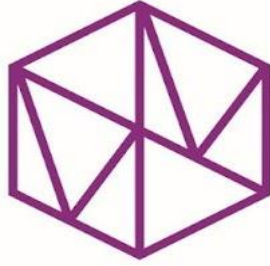
1 - Never	10	100%
2	0	0%
3	0	0%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	10	100%

Q40. In person, without following along on Zoom

1 - Never	3	30%
2	0	0%
3	4	40%
4	0	0%
5 - Almost Always	3	30%
Total Responses (Exclusive of N/A)	10	100%

Q41. Is there anything that would increase the benefit of the virtual options above?

Link to Qualitative Responses

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Connections Workshop: Analytic and Geometric Aspects of Gauge Theory

August 25, 2022 – August 26, 2022

Hybrid Workshop

Organizers:

Lara Anderson (Virginia Polytechnic Institute and State University)

Laura Schaposnik (University of Illinois at Chicago)

REPORT ON THE MSRI WORKSHOP
"Connections Workshop: Analytic and Geometric Aspects of Gauge Theory (Hybrid Workshop)"
August 25 – 26, 2022

Organizers

- Lara Anderson (Virginia Polytechnic Institute and State University)
- Laura Schaposnik (University of Illinois at Chicago)

Scientific Description

The mathematics and physics around gauge theory have, since their first interaction in the mid 1970's, prompted tremendous developments in both mathematics and physics. Deep and fundamental tools in partial differential equations have been developed to provide rigorous foundations for the mathematical study of gauge theories. This led to ongoing revolutions in the understanding of manifolds of dimensions 3 and 4 and presaged the development of symplectic topology. Ideas from quantum field theory have provided deep insights into new directions and conjectures on the structure of gauge theories and suggested many potential applications. The focus of this program will be those parts of gauge theory which hold promise for new applications to geometry and topology and require development of new analytic tools for their study.

This two-day workshop consisted of various talks given by prominent female mathematicians on topics of analytic and geometric aspects of gauge theory. These talks were appropriate for graduate students, post-docs, and researchers in areas related to the program. The meeting aimed to support young researchers working in analytic and geometric aspects of gauge theory by facilitating mentoring from senior colleagues and helping towards the development of crucial professional skills. The format included mentoring pairings, panel discussions, and Q&A sessions as well as the opportunity for informal discussions and connections.

Highlights of the Workshop

Both the talks and social activities were highly praised by the participants and speakers. Of particular interest were the mentoring sessions, during which the speakers and organizers acted as mentors, and participants signed up to be at their tables during a period each day. This setting allowed participants to ask questions both about their career as well as more general life-work balance. The organizers believe this was a great addition to workshops and will be running them more often. The workshop also included a panel discussion where online and in person participants could follow comments from panelists about what advice researchers would have given to their younger selves - those comments, possibly on the more intimate and anecdotal side, allowed participants to feel connected to the panelists and made them feel comfortable enough to follow up with further questions after the panel, something that was very well received.

Organizers

First Name	Last Name	Institution
Lara	Anderson	Virginia Polytechnic Institute and State University
Laura	Schaposnik	University of Illinois at Chicago

Speakers

First Name	Last Name	Institution
Francesca	Carocci	École Polytechnique Fédérale de Lausanne (EPFL)
Laura	Fredrickson	University of Oregon
Sherry	Gong	Texas A&M University
Marina	Logares	Universidad Complutense de Madrid
Sara	Maloni	University of Virginia
Ruxandra	Moraru	University of Waterloo
Laura	Schaposnik	University of Illinois at Chicago

Mathematical Sciences Research Institute

Connections Workshop: Analytic and Geometric Aspects of Gauge Theory

August 25 to August 26, 2022

Thursday, August 25, 2022			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome to MSRI
9:30 AM - 10:30 AM	Simons Auditorium	Ruxandra Moraru	Co-Higgs Bundles on Poisson Surfaces
10:30 AM - 11:00 AM	Front Courtyard		Coffee Break
11:00 AM - 12:00 PM	Simons Auditorium	Sherry Gong	An A-Infinity Category from Instantons
12:00 PM - 12:30 PM	Downstairs Deck		Mentoring Session
12:30 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Francesca Carocci	BPS Invariant from Non Archimedean Integrals
3:00 PM - 3:30 PM	Downstairs Deck		Tea Break
3:30 PM - 4:30 PM	Simons Auditorium	Francesca Carocci, Laura Fredrickson, Marina Logares, Ruxandra Moraru & Laura Schaposnik	Panel
4:30 PM - 6:30 PM	Simons Auditorium		Discussion Time
6:30 PM - 8:00 PM			MSRI Dinner

Friday, August 26, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Laura Fredrickson	The Asymptotic Geometry of the Hitchin Moduli Space
10:30 AM - 11:00 AM	Front Courtyard		Coffee Break
11:00 AM - 12:00 PM	Simons Auditorium	Sara Maloni	Some New Results in Higher Teichmüller Theory
12:00 PM - 12:30 PM	Downstairs Deck		Mentoring Session
12:30 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Marina Logares	Assorted Hitchin Systems
3:00 PM - 3:30 PM	Downstairs Deck		Tea Break
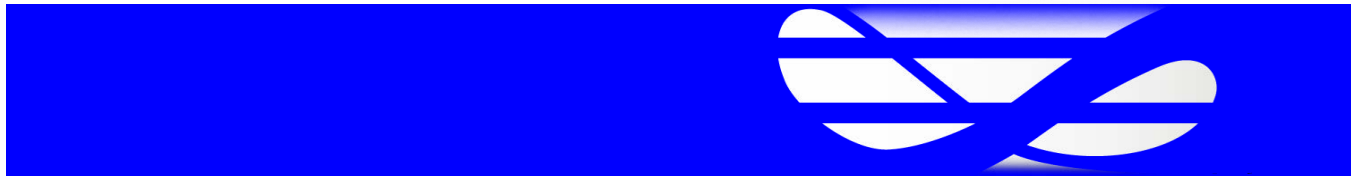
Identifiable Participants' Information

Participants		81

Gender		81
Male	64.20%	52
Female	33.33%	27
Other	2.47%	2
Declined to state	0.00%	0

Ethnicity*		89
White	47.19%	42
Asian	35.96%	32
Hispanic	6.74%	6
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	4.49%	4
Declined to state	5.62%	5

* ethnicity specifications are not exclusive

There were 5 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 46   Skipped: 0
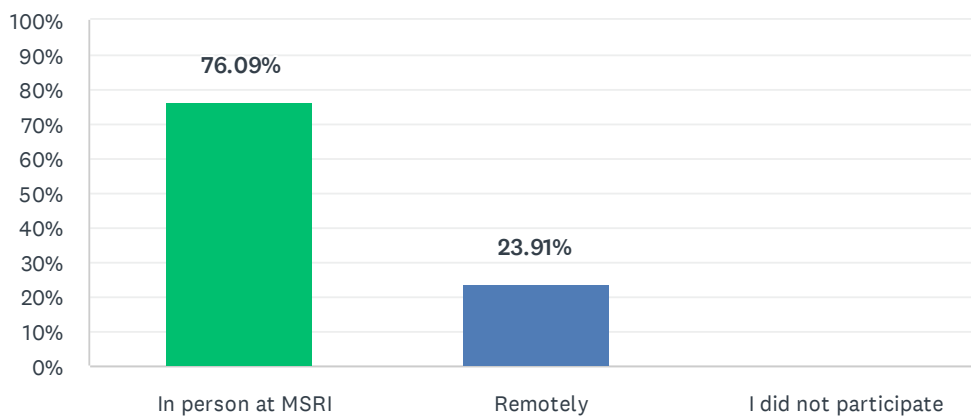
ANSWER CHOICES	RESPONSES	
In person at MSRI	76.09%	35
Remotely	23.91%	11
I did not participate	0.00%	0
TOTAL		46

Q2 The workshop was intellectually stimulating

Answered: 30   Skipped: 16
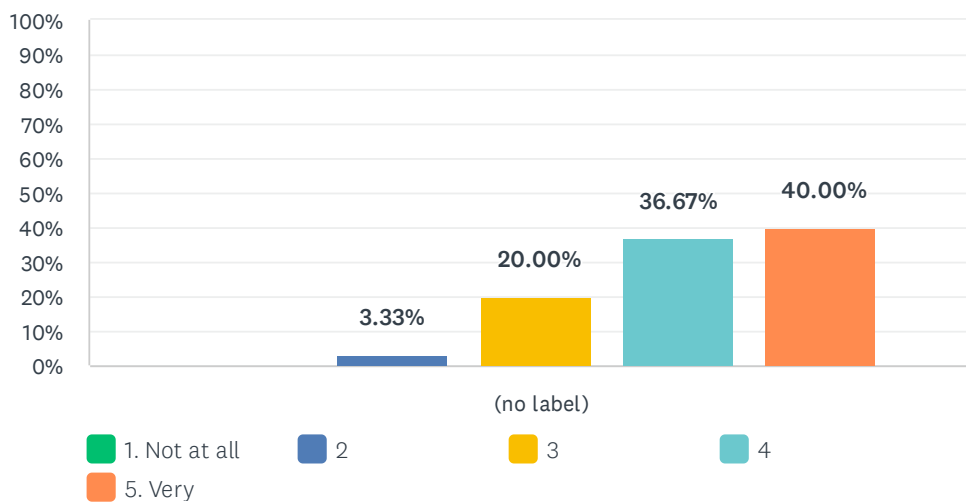
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.33% 1	20.00% 6	36.67% 11	40.00% 12	30	4.13

Q3 The overall experience of the workshop was worthwhile

Answered: 30   Skipped: 16
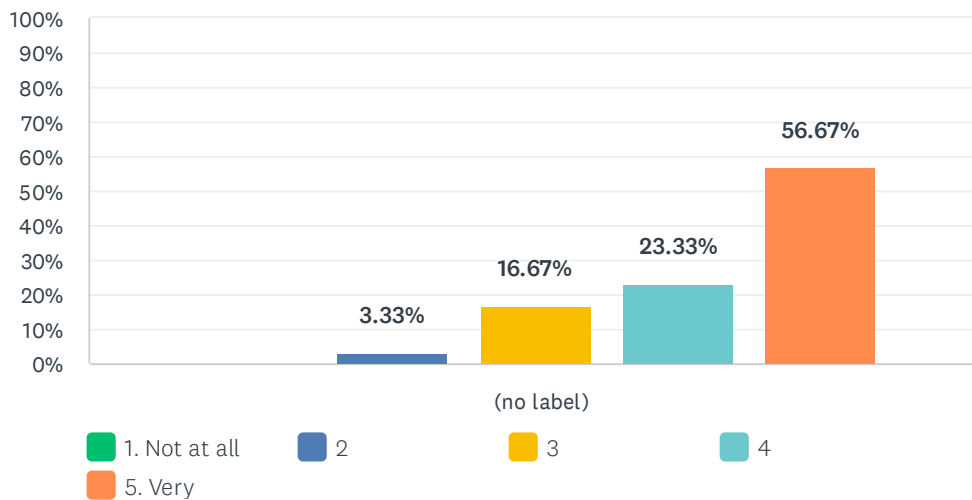
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.33% 1	16.67% 5	23.33% 7	56.67% 17	30	4.33

Q4 The lectures were at an appropriate level

Answered: 30   Skipped: 16
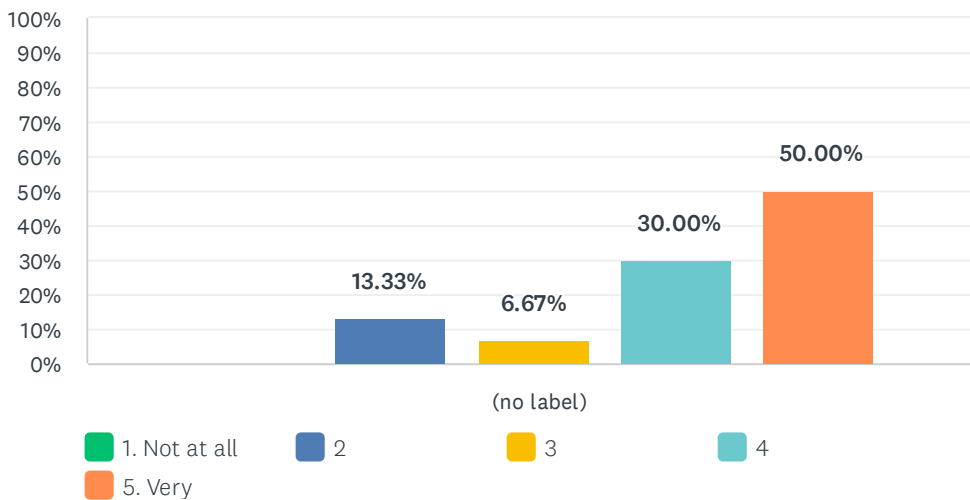
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	13.33% 4	6.67% 2	30.00% 9	50.00% 15	30	4.17

Q5 I was well prepared to benefit from the lectures

Answered: 30   Skipped: 16

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	3.33% 1	6.67% 2	16.67% 5	23.33% 7	50.00% 15	30	4.10

Q6 My interest in the subject matter was increased by the workshop

Answered: 30   Skipped: 16
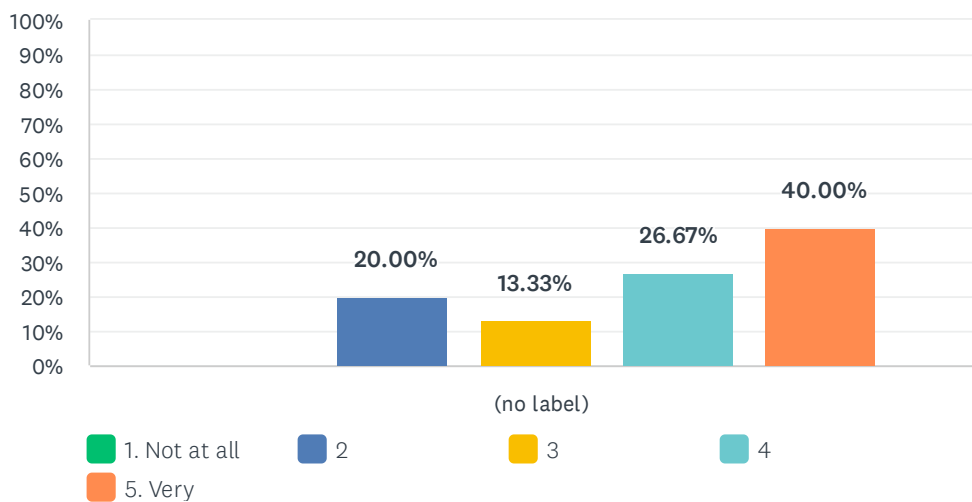
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	20.00% 6	13.33% 4	26.67% 8	40.00% 12	30	3.87

Q7 The workshop helped me meet people with similar scientific interests

Answered: 30   Skipped: 16
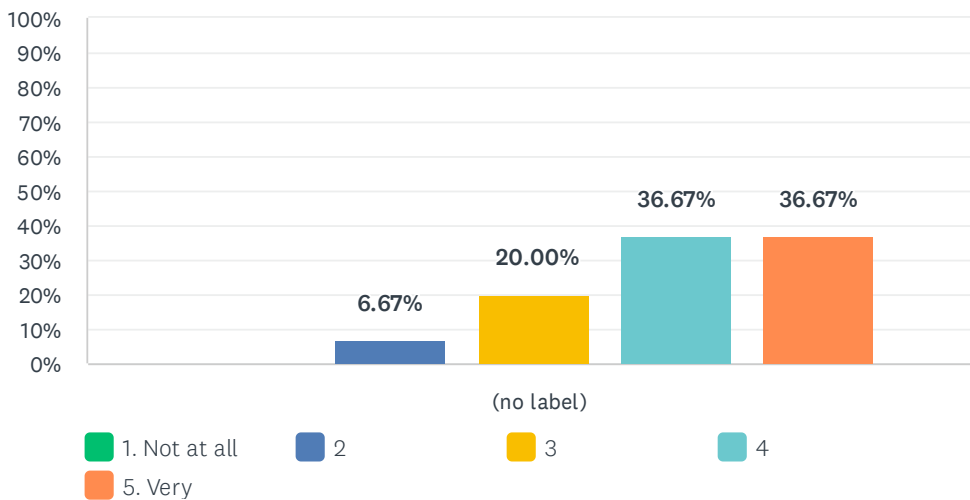
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.67% 2	20.00% 6	36.67% 11	36.67% 11	30	4.03

Q8 Did you find the mentoring session worthwhile?

Answered: 30   Skipped: 16

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	3.33% 1	10.00% 3	23.33% 7	63.33% 19	30	4.55

Q9 Did you find the panel discussion worthwhile?

Answered: 30   Skipped: 16
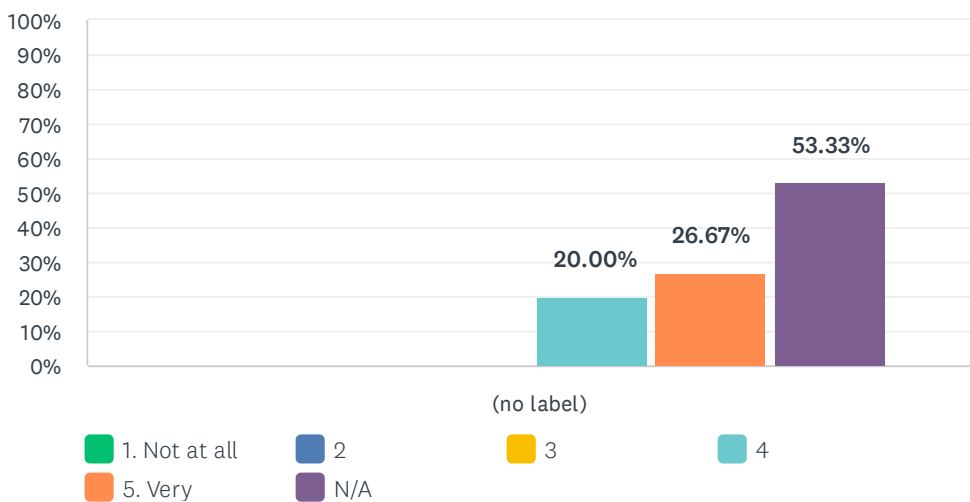
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	20.00% 6	26.67% 8	53.33% 16	30	4.57

Q10 What other subjects should be discussed in future panel discussions?

Answered: 1   Skipped: 45

#	RESPONSES	DATE
1	How to find good collaborators	8/26/2022 5:06 PM

Q11 Additional comments

Answered: 4   Skipped: 42

#	RESPONSES	DATE
1	So much male domination in questions ... and talks oriented to experts in subspecialties :-(	8/27/2022 10:39 AM
2	Thanks to the organizers for putting together such a rewarding conference experience :)	8/27/2022 7:11 AM
3	It seems a little strange to have this before the Introductory workshop, because the talks were mainly at too high a level given that the introductory courses haven't been given yet.	8/26/2022 7:22 PM
4	I think various circumstances led this Connections Workshop to maybe be not as appropriate as it might have been. The absence of a large in-person audience of people coming just for this was the main drawback. I understand this was necessary given the circumstances, but it did detract.	8/26/2022 5:56 PM

Q12 Did you attend the dinner?

Answered: 30   Skipped: 16
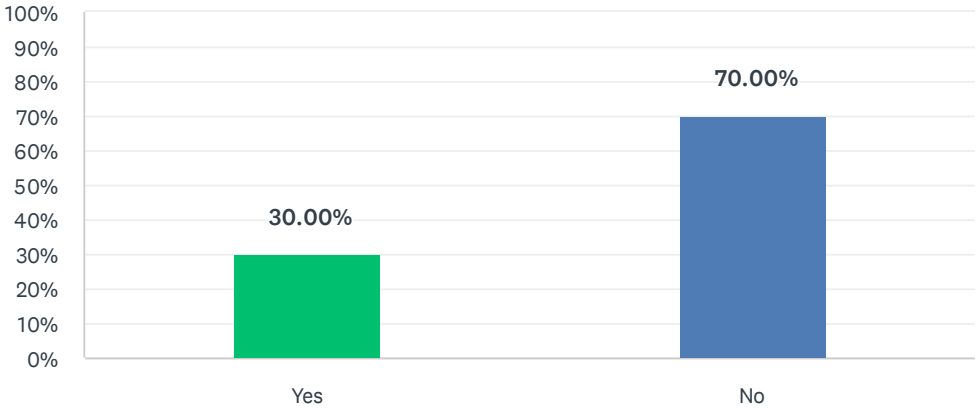
ANSWER CHOICES	RESPONSES	
Yes	30.00%	9
No	70.00%	21
TOTAL		30

Q13 Did the dinner help to solidify the contacts you made in the workshop?

Answered: 9   Skipped: 37
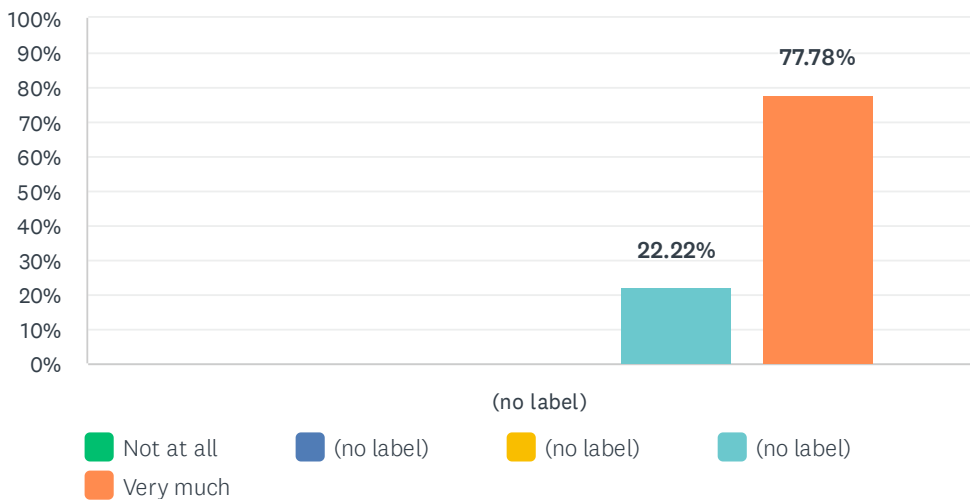
	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	22.22% 2	77.78% 7	9	4.78

Q14 Please provide any comments about the dinner

Answered: 2   Skipped: 44

#	RESPONSES	DATE
1	That was the only safe space to really connect ... all other times some dude would insert himself and change the subject of conversation :-(	8/27/2022 10:40 AM
2	It was awesome! Great to get to know people and nice to have a chance to try a restaurant in SF	8/27/2022 7:11 AM

The following responses are from the virtual participants.

Q15 I found the MSRI staff helpful

Answered: 30   Skipped: 16
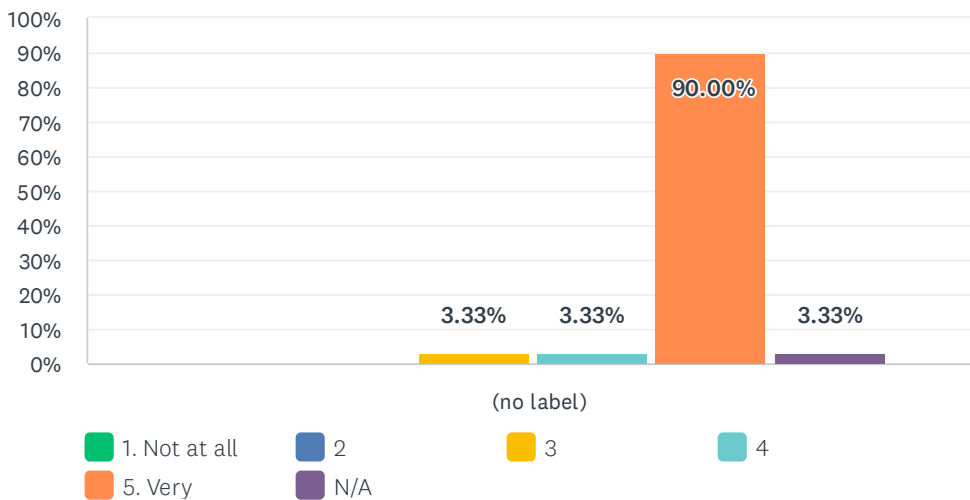
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	3.33% 1	3.33% 1	90.00% 27	3.33% 1	30	4.90

Q16 The MSRI facilities were conducive for such a workshop

Answered: 30   Skipped: 16
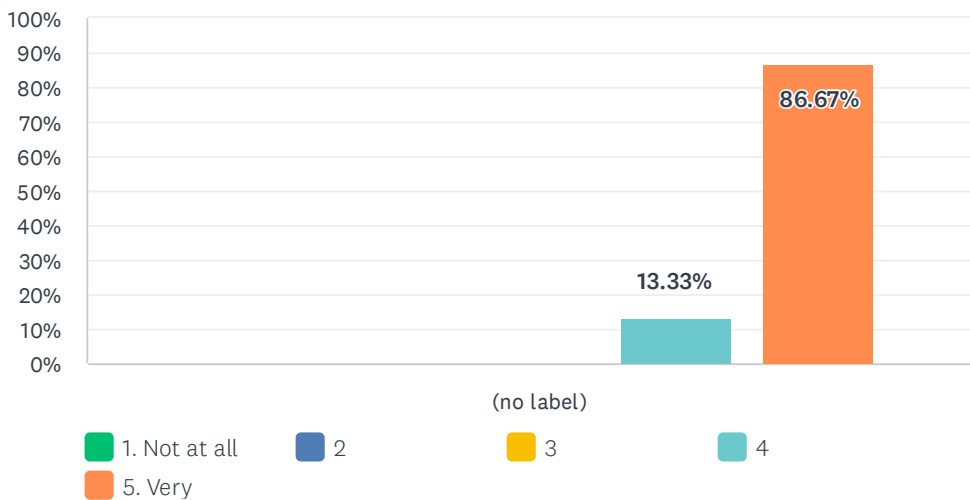
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	13.33% 4	86.67% 26	30	4.87

248

Q17 Did you use MSRI's wireless network?

Answered: 30   Skipped: 16
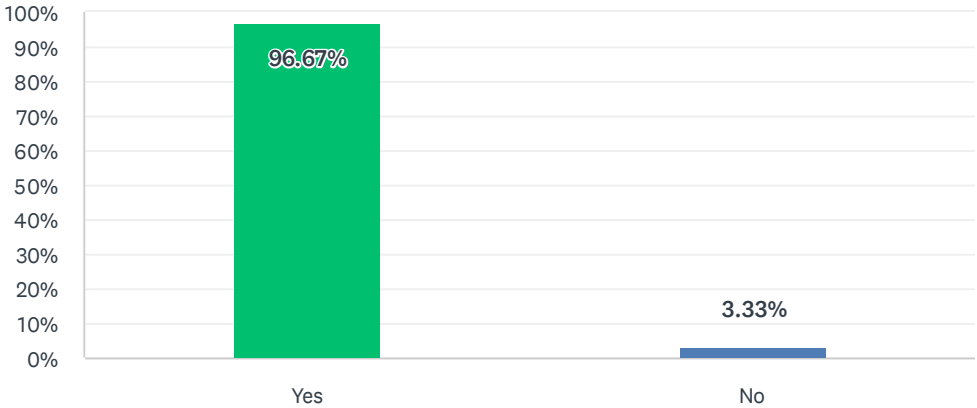
ANSWER CHOICES	RESPONSES	
Yes	96.67%	29
No	3.33%	1
TOTAL		30

Q18 Did you experience any difficulties with the network?

Answered: 30   Skipped: 16
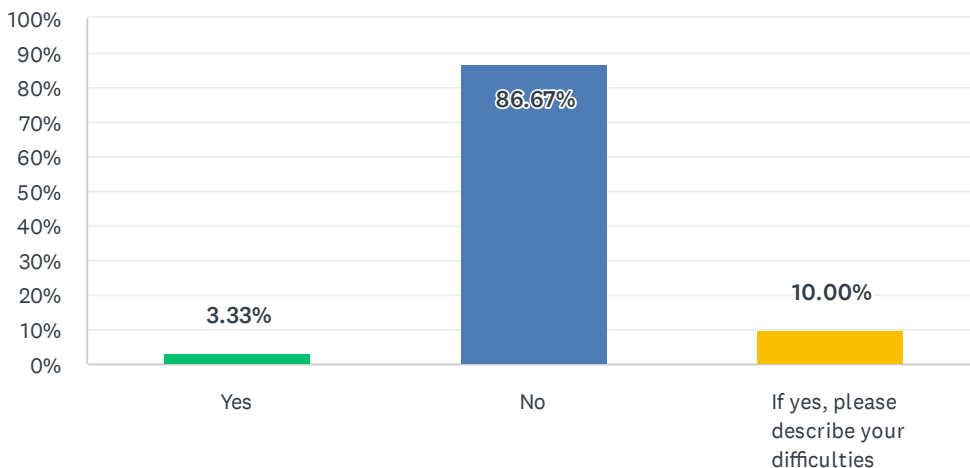
ANSWER CHOICES	RESPONSES	
Yes	3.33%	1
No	86.67%	26
If yes, please describe your difficulties	10.00%	3
TOTAL		30

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	eduroam didn't work, but the msri guest was good	8/27/2022 9:43 PM
2	I had to connect to MSRI staff	8/27/2022 7:15 AM
3	First day the network was down	8/26/2022 5:31 PM

Q19 The MSRI lunch arrangements were satisfactory

Answered: 30   Skipped: 16

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	3.33% 1	3.33% 1	20.00% 6	13.33% 4	53.33% 16	6.67% 2	30	4.18

Q20 The MSRI tea arrangements were satisfactory

Answered: 30   Skipped: 16
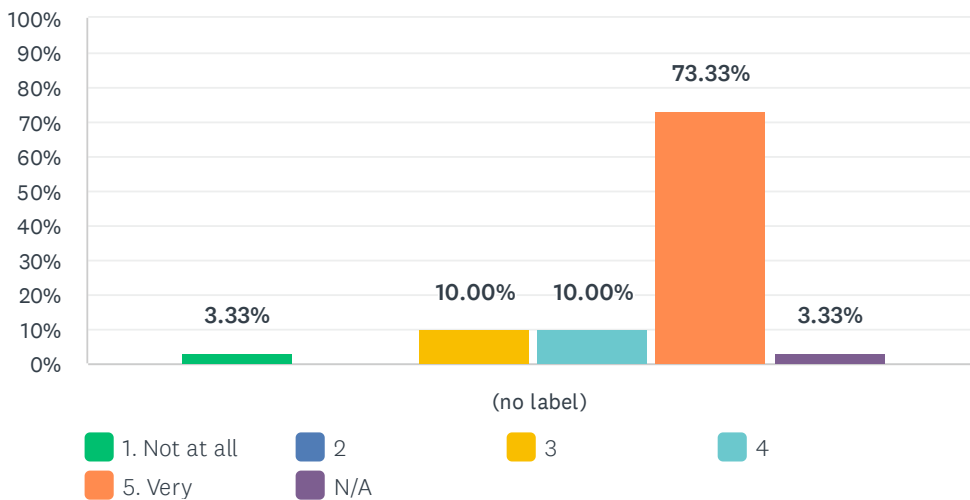
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	3.33% 1	0.00% 0	10.00% 3	10.00% 3	73.33% 22	3.33% 1	30	4.55

Q21 Additional comments about the MSRI staff, facilities and food

Answered: 4   Skipped: 42

#	RESPONSES	DATE
1	This is wonderful!	8/27/2022 10:41 AM
2	It would be good to provide lunch at the workshops, as it means more interaction and less fuss for participants.	8/26/2022 7:22 PM
3	The staff were very helpful and made the workshop a great experience.	8/26/2022 5:49 PM
4	More vegan food options would be very appreciated.	8/26/2022 5:13 PM

Q22 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3   Skipped: 43

#	RESPONSES	DATE
1	Most talk speakers assumed too much background.	8/28/2022 1:02 PM
2	I think this would do much better the week after the intro workshop -- and exclusive to women.	8/27/2022 10:43 AM
3	It was a shame that external participants were not allowed because it greatly affected the dynamic and atmosphere. It definitely did not feel like the many other connections workshops I've been, in a negative way. One needs a larger group at these workshops to make them effectively in my view.	8/26/2022 7:24 PM

Q23 I found the MSRI staff helpful
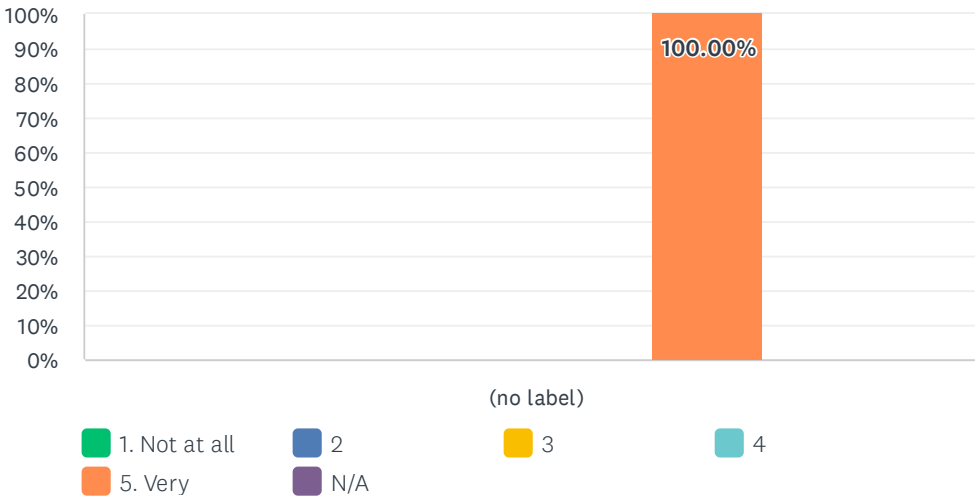
Answered: 4   Skipped: 42

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 4	0.00% 0	4	5.00

Q24 How many talks did you watch live?

Answered: 4   Skipped: 42
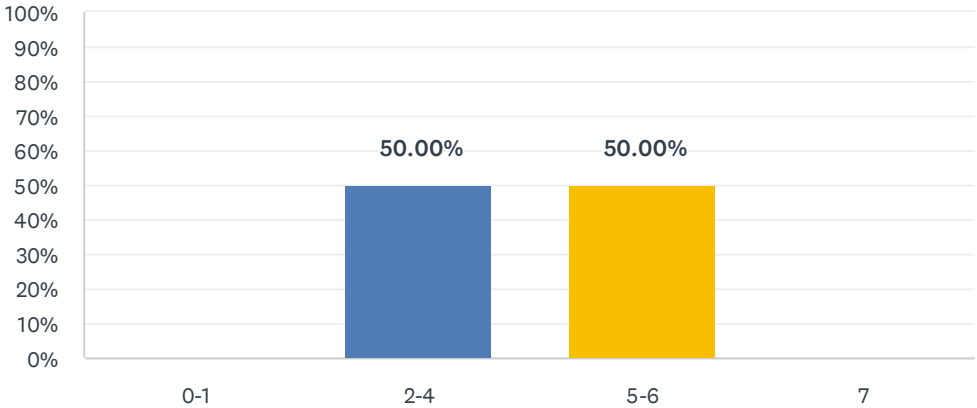
ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	50.00%	2
5-6	50.00%	2
7	0.00%	0
TOTAL		4

256

Q25 The workshop was intellectually stimulating

Answered: 4   Skipped: 42
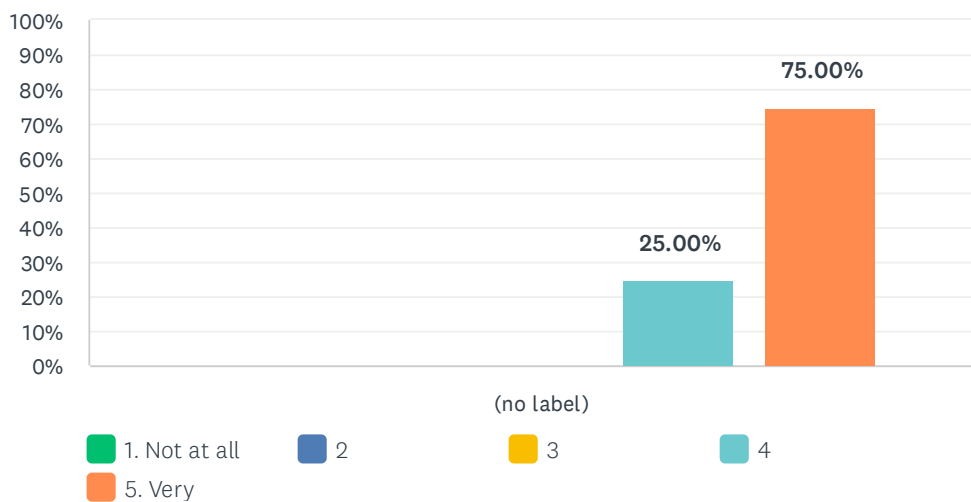
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75

Q26 The overall experience of the workshop was worthwhile

Answered: 4   Skipped: 42
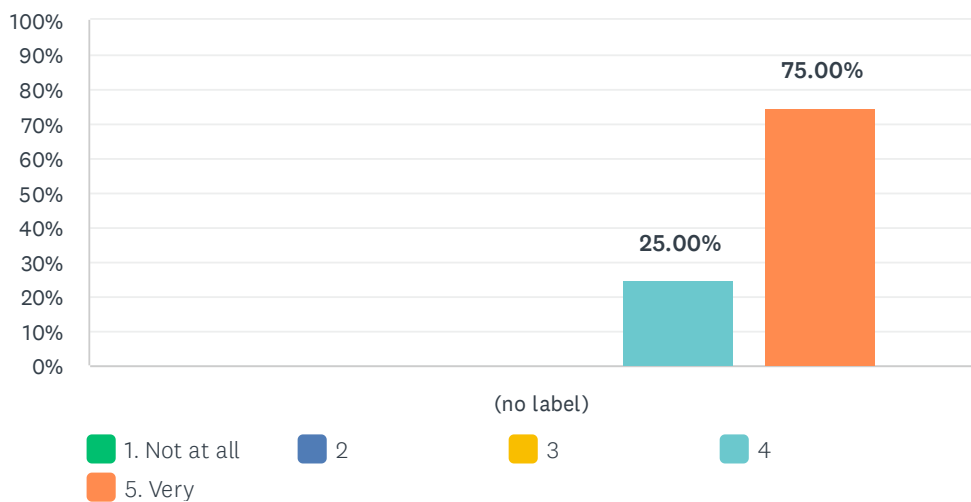
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75

Q27 The lectures were at an appropriate level

Answered: 4   Skipped: 42
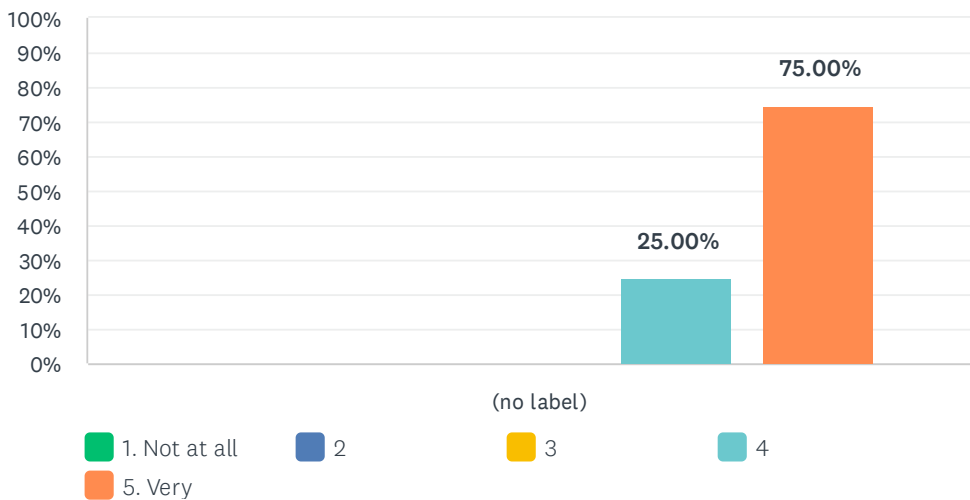
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75

Q28 I was well prepared to benefit from the lectures

Answered: 4   Skipped: 42
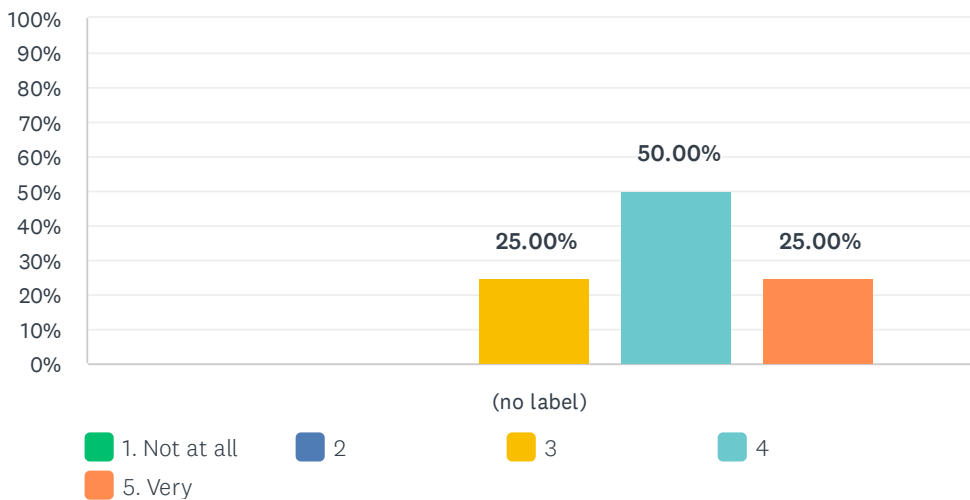
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	25.00% 1	50.00% 2	25.00% 1	4	4.00

Q29 My interest in the subject matter was increased by the workshop

Answered: 4   Skipped: 42
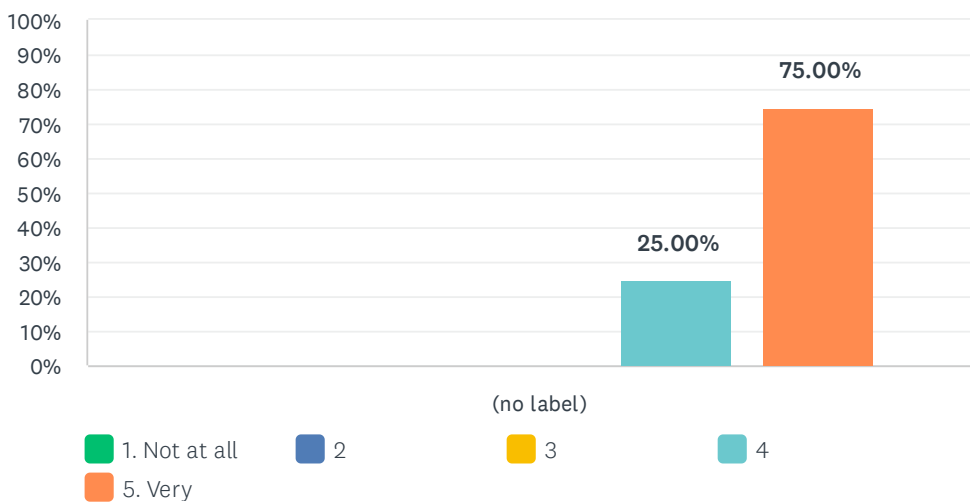
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75

Q30 The workshop helped me meet people with similar scientific interests

Answered: 4   Skipped: 42

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	25.00% 1	25.00% 1	25.00% 1	25.00% 1	0.00% 0	4	2.50

Q31 Did you find the panel discussion worthwhile?

Answered: 4   Skipped: 42
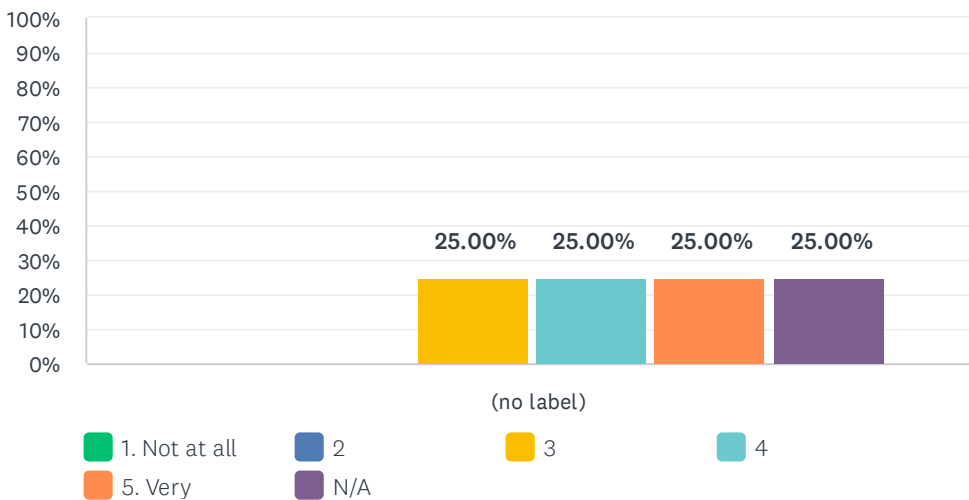
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	25.00% 1	25.00% 1	25.00% 1	25.00% 1	4	4.00

Q32 What other subjects should be discussed in future panel discussions?

Answered: 0   Skipped: 46

#	RESPONSES	DATE
	There are no responses.	

Q33 Additional comments

Answered: 0   Skipped: 46

#	RESPONSES	DATE
	There are no responses.	

Q34 Did you experience any technical difficulties accessing the workshop online?

Answered: 3   Skipped: 43
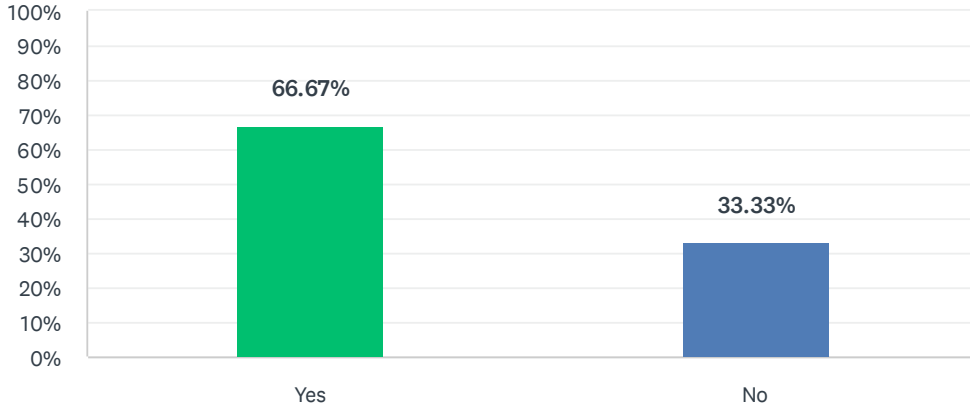
ANSWER CHOICES	RESPONSES	
Yes	66.67%	2
No	33.33%	1
TOTAL		3

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Zoom chat didn't seem to be monitored and it was difficult to hear questions asked from the audience when the mic wasn't used	8/28/2022 12:47 PM
2	Due to network issues I had to login and logout multiple times	8/26/2022 5:42 PM

Q35 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 3   Skipped: 43

#	RESPONSES	DATE
1	I had to participate online because of an unexpected health issue.	8/28/2022 12:47 PM
2	The sessions from 2 pm PDT time were from 2.30 am Indian Standard Time for me, so I had to miss those particular lectures.	8/27/2022 1:26 AM
3	Time zone difference was the main barrier	8/26/2022 5:42 PM

Q36 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?
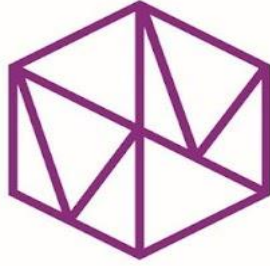
Answered: 1   Skipped: 45

#	RESPONSES	DATE
1	Not really, but agree it would be great if achieved!	8/28/2022 12:47 PM

Q37 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1   Skipped: 45

#	RESPONSES	DATE
1	The workshop lectures I attended were very interesting and useful.	8/27/2022 1:31 AM

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Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory

August 29, 2022 – September 02, 2022

Hybrid Workshop

Organizers:

Aleksander Doan (Trinity College; University College London)

Lorenzo Foscolo (University College London)

Laura Fredrickson (University of Oregon)

Ruxandra Moraru (University of Waterloo)

Michael Singer (University College London)

REPORT ON THE MSRI WORKSHOP
"Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory (Hybrid Workshop)"
August 29 – September 2, 2022

Organizers

- Aleksander Doan (Trinity College; University College London)
- Lorenzo Foscolo (University College London)
- Laura Fredrickson (University of Oregon)
- Ruxandra Moraru (University of Waterloo)
- Michael Singer (University College London)

Scientific Description

The mathematics and physics around gauge theory have, since their first interaction in the mid 1970's, prompted tremendous developments in both mathematics and physics. Deep and fundamental tools in partial differential equations have been developed to provide rigorous foundations for the mathematical study of gauge theories. This led to ongoing revolutions in the understanding of manifolds of dimensions 3 and 4 and presaged the development of symplectic topology. Ideas from quantum field theory have provided deep insights into new directions and conjectures on the structure of gauge theories and suggested many potential applications. The focus of this program were those parts of gauge theory which hold promise for new applications to geometry and topology and require development of new analytic tools for their study.

Highlights of the Workshop

The workshop highlighted the utility and impact of gauge theory in other areas of mathematics, as well as connections to physics. The workshop opened with four general talks by Lara Anderson, Tom Mrowka, Thomas Walpuski, and Rafe Mazzeo, who provided historical context, motivation, and overview of the subjects from different perspective: physics, topology, differential geometry, and analysis, respectively. The core of the workshop consisted of minicourses focusing on applications of gauge theory and its connections to various areas of mathematics. These minicourses were taught by experts in the corresponding fields: partial differential equations (Alex Waldron), three-manifold topology and knot theory (Sherry Gong), complex geometry (Song Sun), and Riemannian geometry (Jason Lotay). The remaining stand-alone lectures gave a brief introduction to most recent developments and research directions in gauge theory and adjacent fields. Overall, the workshop was very successful: the lectures were consistently well-attended, both in person and online, participants asked many questions and interacted with the speakers during the coffee breaks and after the talks.

Organizers

First Name	Last Name	Institution
Aleksander	Doan	Trinity College
Lorenzo	Foscolo	University College London
Laura	Fredrickson	University of Oregon
Ruxandra	Moraru	University of Waterloo
Michael	Singer	University College London

Speakers

First Name	Last Name	Institution
Lara	Anderson	Virginia Polytechnic Institute and State University
Sherry	Gong	Texas A&M University
Christopher	Kottke	New College of Florida
Jason	Lotay	University of Oxford
Ciprian	Manolescu	Stanford University
Rafe	Mazzeo	Stanford University
Tomasz	Mrowka	Massachusetts Institute of Technology
Olga	Plamenevskaya	State University of New York, Stony Brook
Laura	Schaposnik	University of Illinois at Chicago
Song	Sun	University of California, Berkeley
Alex	Waldron	University of Wisconsin-Madison
Thomas	Walpuski	Humboldt-Universität
Katrin	Wehrheim	University of California, Berkeley

Mathematical Sciences Research Institute

Introductory Workshop: Analytic and Geometric Aspects of Gauge Theory

August 29, 2022 - September 02, 2022

Monday, August 29, 2022			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Tomasz Mrowka	Lecture
11:00 AM - 12:00 PM	Simons Auditorium	Lara Anderson	Physical Perspectives on Gauge Theories and Dualities
2:00 PM - 3:00 PM	Simons Auditorium	Thomas Walpuski	Gauge Theory Beyond the Fourth Dimension
3:30 PM - 4:30 PM	Simons Auditorium	Alex Waldron	Basics of Yang-Mills Gauge Theory Pt I

Tuesday, August 30, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Rafe Mazzeo	Noncompactness in Low Dimensional Gauge Theories
11:00 AM - 12:00 PM	Simons Auditorium	Alex Waldron	Basics of Yang-Mills Gauge Theory Pt II
2:00 PM - 3:00 PM	Simons Auditorium	Sherry Gong	Introduction to Intanton Floer Homology Pt I
3:30 PM - 4:30 PM	Simons Auditorium	Olga Plamenevskaya	Contact 3-Manifolds and Gauge-Theoretic Invariants

Wednesday, August 31, 2022			
9:00 AM - 10:00 AM	Simons Auditorium	Song Sun	Gauge Theory and Complex Geometry Pt I
10:30 AM - 11:30 AM	Simons Auditorium	Sherry Gong	Introduction to Intanton Floer Homology Pt II
11:30 AM - 12:30 PM	Simons Auditorium	Jason Lotay	Gauge Theory and Special Holonomy Pt I

Thursday, September 01, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Song Sun	Gauge Theory and Complex Geometry Pt II
11:00 AM - 12:00 PM	Simons Auditorium	Jason Lotay	Gauge Theory and Special Holonomy Pt II
2:00 PM - 3:00 PM	Simons Auditorium	Katrin Wehrheim	The Symplectic Geometry of Connections
3:30 PM - 4:30 PM	Simons Auditorium	Christopher Kottke	An Introduction to Magnetic Monopoles

Friday, September 02, 2022			
9:00 AM - 10:00 AM	Simons Auditorium	Laura Schaposnik	Mirror Symmetry for Higgs Bundles, Generalized Hyperpolygons and More
10:30 AM - 11:30 AM	Simons Auditorium	Jason Lotay	Gauge Theory and Special Holonomy Pt III
11:30 AM - 12:30 PM	Simons Auditorium	Song Sun	Gauge Theory and Complex Geometry Pt III

Identifiable Participants' Information

Participants		145

Gender		145
Male	72.41%	105
Female	24.83%	36
Other	1.38%	2
Declined to state	1.38%	2

Ethnicity*		159
White	38.36%	61
Asian	40.25%	64
Hispanic	6.29%	10
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	4.40%	7
Declined to state	10.69%	17

* ethnicity specifications are not exclusive

There were 12 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 90   Skipped: 0
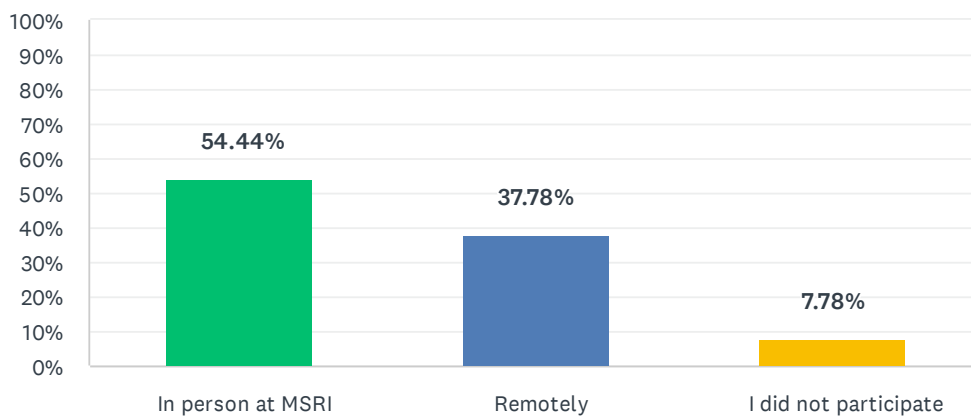
ANSWER CHOICES	RESPONSES	
In person at MSRI	54.44%	49
Remotely	37.78%	34
I did not participate	7.78%	7
TOTAL		90

Q2 The workshop was intellectually stimulating

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.78% 1	0.00% 0	8.33% 3	22.22% 8	66.67% 24	36	4.50

Q3 The overall experience of the workshop was worthwhile

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.78% 1	2.78% 1	2.78% 1	19.44% 7	72.22% 26	36	4.56

Q4 The lectures were at an appropriate level

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.78% 1	2.78% 1	8.33% 3	16.67% 6	69.44% 25	36	4.47

Q5 I was well prepared to benefit from the lectures

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.78% 1	2.78% 1	13.89% 5	13.89% 5	66.67% 24	36	4.39

Q6 My interest in the subject matter was increased by the workshop

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.78% 1	2.78% 1	5.56% 2	30.56% 11	58.33% 21	36	4.39

Q7 The workshop helped me meet people with similar scientific interests

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.78% 1	0.00% 0	5.56% 2	30.56% 11	61.11% 22	36	4.47

Q8 What were the highlights of the lectures?

Answered: 36   Skipped: 54

#	RESPONSES	DATE
1	I liked Song Sun's and Jason Lotay's lectures.	9/12/2022 2:30 PM
2	Jason Lotay's lectures	9/10/2022 7:18 AM
3	Higher-dimensional gauge theory	9/9/2022 7:39 PM
4	Lecture series.	9/6/2022 11:24 PM
5	The content	9/6/2022 4:33 PM
6	Prof. Mrowka's informal historical perspective is very enlightening for someone who is junior like me. I also enjoyed Rafe Mazzeo and Laura Schaposnik's presentations as well as the interactive experience provided by Prof. Wehrheim.	9/6/2022 1:04 PM
7	I thought the historical overviews given as part of the introductory panoramic talks were particularly helpful orientation to those starting out in their explorations of the area.	9/6/2022 12:58 PM
8	Introductory lectures pitched at the right level; connections made between subjects.	9/6/2022 12:16 PM
9	Jason Lotay's lectures were at just the right level, informative, and very well delivered. The one part lectures were also very good.	9/6/2022 12:15 PM
10	Minicourses were at an appropriate level for me (graduate student with some background in the area). I especially liked the style of Katrin Wehrheim's lecture.	9/6/2022 12:10 PM
11	I liked very much Prof. Schaposnik talk because the overview she gave on Higgs bundles as well as the opening eyes moment when she explained about the papers she published with her students.	9/5/2022 11:29 AM
12	The series of lectures by Song Sun and the overviews by Mrowka, Walpuski and Mazzeo. Werheim's talk was also intellectually stimulating.	9/5/2022 8:46 AM
13	The overview lectures on the subject as well as the mini courses.	9/4/2022 6:38 PM
14	J. Lotay's lectures on higher D gauge theory.	9/4/2022 5:55 PM
15	Great introductory lectures, especially by Tom Mrowka, Lara Anderson, Jason Lotay	9/3/2022 3:03 PM
16	Good!	9/3/2022 12:03 PM
17	Higgs bundles	9/3/2022 8:06 AM
18	The talks highlighted a lot of different areas and approaches to the subject. It was very nice to see it laid out so nicely.	9/2/2022 11:48 PM
19	the introduction part helped me a lot	9/2/2022 10:56 PM
20	.	9/2/2022 9:33 PM
21	As an outsider when it comes to gauge theory, I was motivated by many of the talks to explore more of this topic and possibly start working on it in the near future. The minicourses were especially helpful.	9/2/2022 8:27 PM
22	The overview talks are very helpful for me to understand the field much better.	9/2/2022 5:10 PM
23	na	9/2/2022 4:47 PM
24	I liked Lotay's lectures; not a subject I'd thought about much so they made me aware of some interesting directions.	9/2/2022 4:02 PM
25	I appreciated that there were a couple of different lecture series: some pitched at more beginners and others at more experts.	9/2/2022 3:40 PM

26	The talks by Jason Lotay were very clear and enlightening	9/2/2022 2:41 PM
27	Lecture series	9/2/2022 2:40 PM
28	I did not attend lectures because they were on zoom	9/2/2022 2:13 PM
29	Jason Lotay's mini course	9/2/2022 2:06 PM
30	Katrin Wehrheim encouraging participants to meet each other, and concrete, down-to-earth, slow-paced lectures.	9/2/2022 2:06 PM
31	not sure	9/2/2022 2:04 PM
32	Jason's peaceful way of taking the audience through different mathematical ideas	9/2/2022 2:04 PM
33	I enjoyed learning about the different gauge theories and a survey of the state-of-the art in the field.	9/2/2022 2:04 PM
34	When a speaker introduces the assumptions and notation ... or explains the motivation	9/2/2022 2:04 PM
35	I liked that the speakers told us about interesting open problems.	9/2/2022 2:04 PM
36	Elementary introduction to the subject	9/2/2022 2:03 PM

Q9 Additional comments

Answered: 6   Skipped: 84

#	RESPONSES	DATE
1	additional catch-boxes will help	9/6/2022 1:04 PM
2	I thought most of the other lecture series (except Song Sun's) were at too elementary a level.	9/6/2022 12:15 PM
3	I found some of the introductory lectures too basic, but I recognise I was not the intended audience for them	9/5/2022 8:46 AM
4	I did not attend because I would have had to attend virtually and was not interested in attending the conference in this format	9/2/2022 2:13 PM
5	It would have been great to have more in-person participation. The number of zoom participants was quite limited compared to the number of people originally registered for the workshop, it would seem to me.	9/2/2022 2:04 PM
6	Can we have anonymous questions, so non-experts can ask without fear of looking stupid ?	9/2/2022 2:04 PM

The following responses are from the virtual participants.

Q10 I found the MSRI staff helpful

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	2.78% 1	91.67% 33	5.56% 2	36	4.97

Q11 The MSRI facilities were conducive for such a workshop

Answered: 36   Skipped: 54
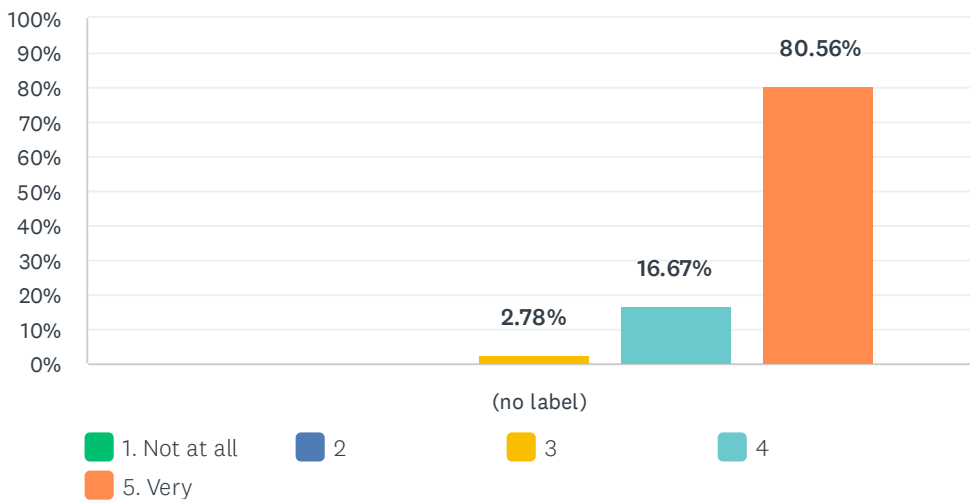
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.78% 1	16.67% 6	80.56% 29	36	4.78

Q12 Did you use MSRI's wireless network?

Answered: 36   Skipped: 54
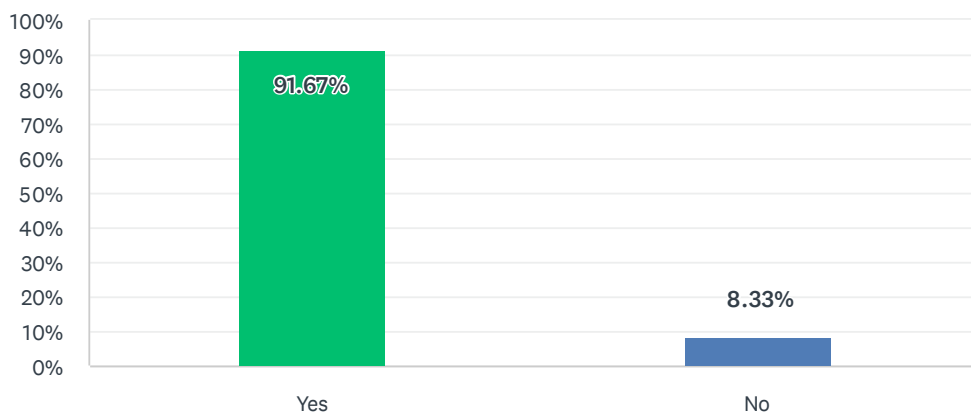
ANSWER CHOICES	RESPONSES	
Yes	91.67%	33
No	8.33%	3
TOTAL		36

Q13 Did you experience any difficulties with the network?

Answered: 36   Skipped: 54
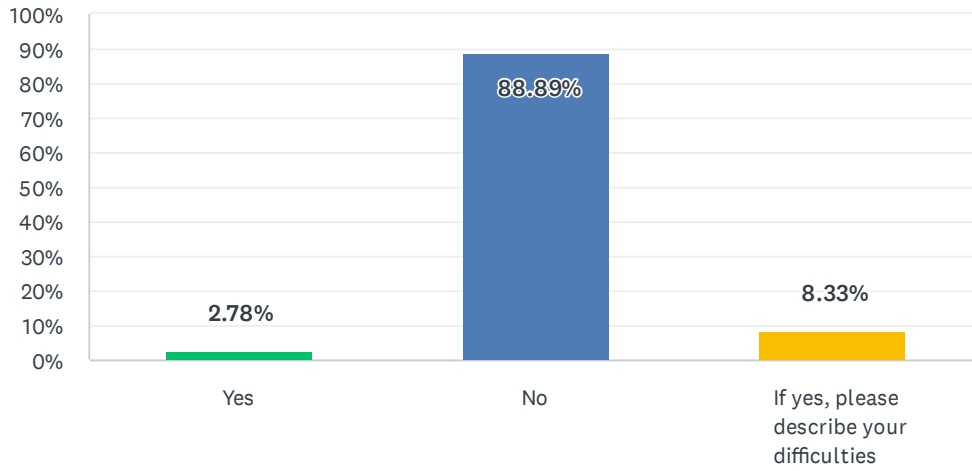
ANSWER CHOICES	RESPONSES	
Yes	2.78%	1
No	88.89%	32
If yes, please describe your difficulties	8.33%	3
TOTAL		36

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	members wifi did not work. Been using staff	9/2/2022 10:57 PM
2	Eduroam has been flakey all week.	9/2/2022 4:05 PM
3	Sometimes it would take some time to connect	9/2/2022 2:05 PM

Q14 The MSRI lunch arrangements were satisfactory

Answered: 36   Skipped: 54

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.56% 2	11.11% 4	30.56% 11	41.67% 15	11.11% 4	36	4.22

Q15 The MSRI tea arrangements were satisfactory

Answered: 36   Skipped: 54
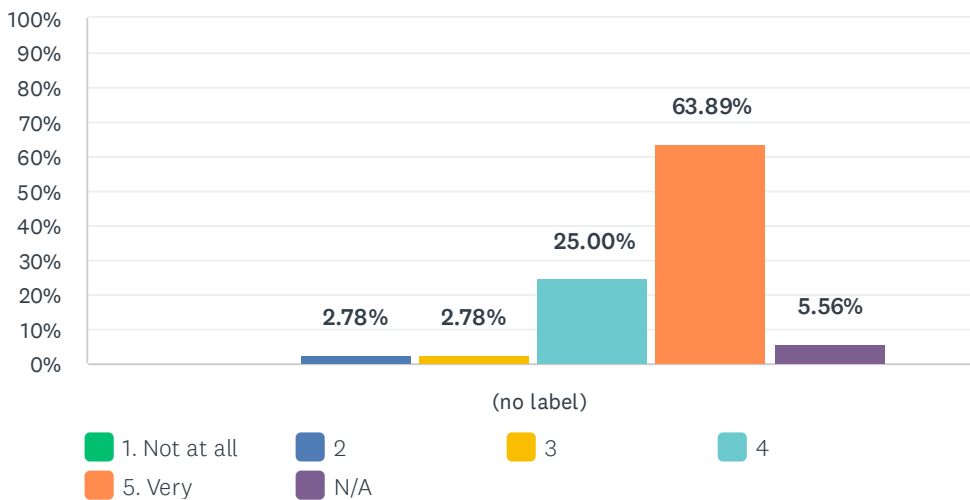
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.78% 1	2.78% 1	25.00% 9	63.89% 23	5.56% 2	36	4.59

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 10   Skipped: 80

#	RESPONSES	DATE
1	Lactose free milk (oat or soy milk) was very much appreciated.	9/6/2022 12:11 PM
2	Check-in for members on the first day took a very long time, and probably could have been sped up.	9/3/2022 3:04 PM
3	Food is a bit expensive	9/3/2022 8:07 AM
4	The Monday sandwich option (Stuffed In) is terrible. Can you replace it with something else?	9/2/2022 11:49 PM
5	Everybody's been nice; maybe there have been a few too many emails that duplicated information we had already received.	9/2/2022 4:05 PM
6	I could not attend in person so these are not applicable	9/2/2022 2:14 PM
7	The staff is doing an excellent job! Thank you especially to Sierra and Bertram.	9/2/2022 2:06 PM
8	It would be much better to provide a lunch buffet or catered lunch each day, because it meant the workshop group became fractured as different people had different lunch plans, which meant that less networking was done.	9/2/2022 2:05 PM
9	Thanks!!!	9/2/2022 2:05 PM
10	More vegan and vegetarian options would be appreciated.	9/2/2022 2:05 PM

Q17 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 3   Skipped: 87

#	RESPONSES	DATE
1	Would be nice to have an optional "background" reading list so that non-experts could easily find references.	9/2/2022 3:42 PM
2	Give clear prerequisites for the talks or the whole week! I spent most of my time looking up words I didn't know - but with all the notation that's less possible, so I really couldn't learn much from most talks.	9/2/2022 2:07 PM
3	I think providing lunch should be done.	9/2/2022 2:05 PM

Q18 I found the MSRI staff helpful
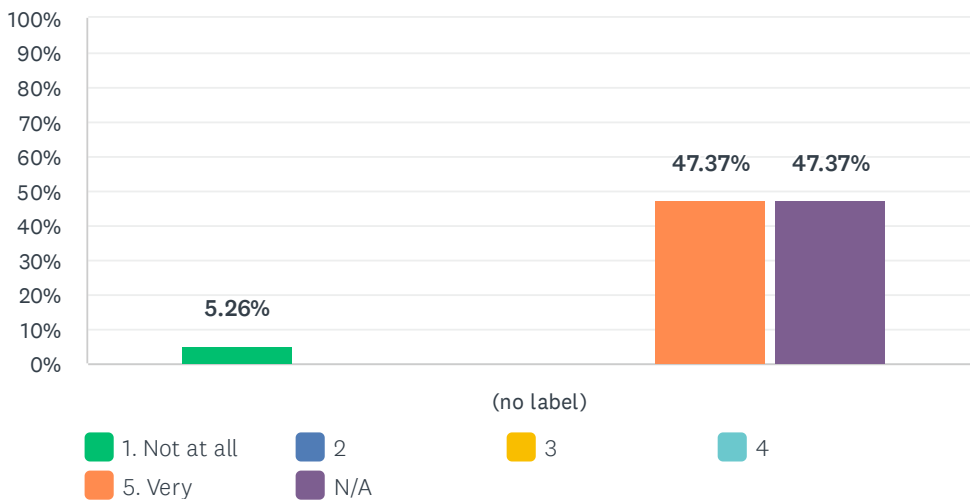
Answered: 19   Skipped: 71

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	0.00% 0	0.00% 0	0.00% 0	47.37% 9	47.37% 9	19	4.60

Q19 How many talks did you watch live?

Answered: 19   Skipped: 71
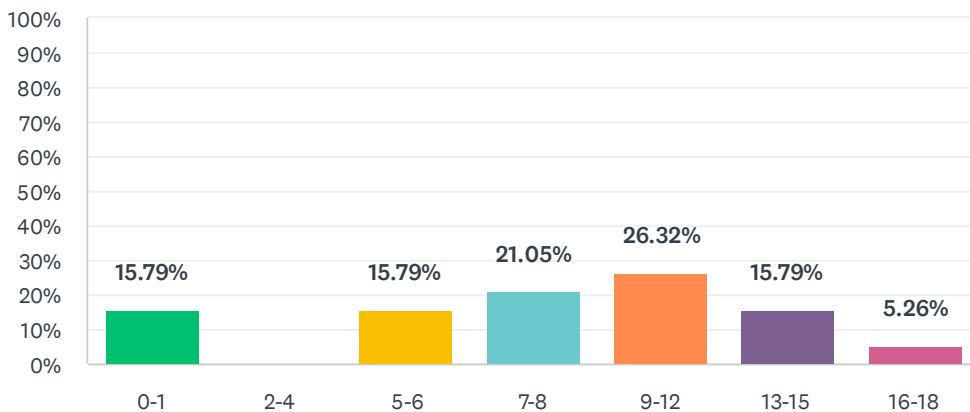
ANSWER CHOICES	RESPONSES	
0-1	15.79%	3
2-4	0.00%	0
5-6	15.79%	3
7-8	21.05%	4
9-12	26.32%	5
13-15	15.79%	3
16-18	5.26%	1
TOTAL		19

Q20 The workshop was intellectually stimulating

Answered: 19   Skipped: 71

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	0.00% 0	0.00% 0	26.32% 5	68.42% 13	19	4.53

Q21 The overall experience of the workshop was worthwhile

Answered: 19   Skipped: 71

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	0.00% 0	0.00% 0	31.58% 6	63.16% 12	19	4.47

Q22 The lectures were at an appropriate level

Answered: 19   Skipped: 71

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	0.00% 0	5.26% 1	31.58% 6	57.89% 11	19	4.37

302

Q23 I was well prepared to benefit from the lectures

Answered: 19   Skipped: 71

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	0.00% 0	21.05% 4	26.32% 5	47.37% 9	19	4.11

Q24 My interest in the subject matter was increased by the workshop

Answered: 19   Skipped: 71

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	0.00% 0	5.26% 1	15.79% 3	73.68% 14	19	4.53

Q25 The workshop helped me meet people with similar scientific interests

Answered: 19   Skipped: 71
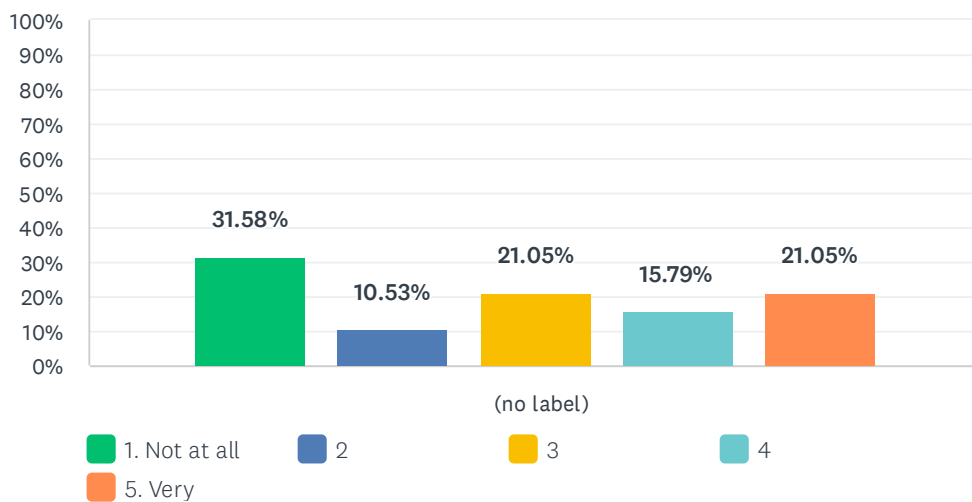
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	31.58% 6	10.53% 2	21.05% 4	15.79% 3	21.05% 4	19	2.84

Q26 What were the highlights of the lectures?

Answered: 19   Skipped: 71

#	RESPONSES	DATE
1	Variety of topics were covered.	9/7/2022 7:09 AM
2	Before they were winding off, when things were coming at a crescendo.	9/6/2022 4:13 PM
3	The minicourses	9/6/2022 12:23 PM
4	(Throwing microphone boxes XD) I think the talk on special holonomy was very inspiring. Dr. Lotay made everything very organized and beautiful. The complex geometry talk was also quite helpful although it was a bit fast in the end for me.	9/6/2022 12:22 PM
5	Me commenting at the end of Jason Lotay's talk.	9/6/2022 11:27 AM
6	Mazzeo's talk	9/4/2022 11:50 AM
7	I liked the introductory courses by Alex Waldron, very well organized !! Loved Jason's mini-course.	9/4/2022 5:43 AM
8	Not being allowed to attend them	9/3/2022 6:51 PM
9	That there was lots of time for questions.	9/3/2022 3:31 AM
10	Thomas Mrowka Song Sun Sherry Gong	9/3/2022 12:46 AM
11	The clarity of exposition	9/2/2022 11:04 PM
12	Yang-Mills Gauge Theory and use of gauge theory in analysis of PDE, low-dimensional topology, etc.	9/2/2022 10:38 PM
13	I was specializing in this field during my grad school years and it was a great review.	9/2/2022 3:56 PM
14	The mini courses	9/2/2022 3:44 PM
15	a very good presentation of the lectures	9/2/2022 3:15 PM
16	Correct level of lectures and various highlights of current progress	9/2/2022 2:55 PM
17	The three multi-part lectures series were excellent for introducing new people to the field.	9/2/2022 2:13 PM
18	The online Q&A so that more people can participate in the talk. I appreciate that some organizers would always watch the Zoom chat so that no questions would be left unanswered.	9/2/2022 2:07 PM
19	lotays and mazzeo's clear lectures	9/2/2022 2:03 PM

Q27 Additional comments

Answered: 5   Skipped: 85

#	RESPONSES	DATE
1	None.	9/7/2022 7:09 AM
2	Using Breakout Rooms would have let the virtual participants feel more involved. The use of the microphone box was really good as it meant that virtual participants could hear the questions being asked.	9/3/2022 3:31 AM
3	I wish I could have been there in person. Your Zoom setup is better than most others I have seen, but still there's no way to see all 6 boards at the same time. The in-person attendees definitely had a big advantage.	9/2/2022 2:13 PM
4	I noticed that some questions from in-person participants are hard to hear through Zoom. So sometimes I got lost and don't know what the speaker was answering.	9/2/2022 2:07 PM
5	please organise again in person!	9/2/2022 2:03 PM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 17   Skipped: 73
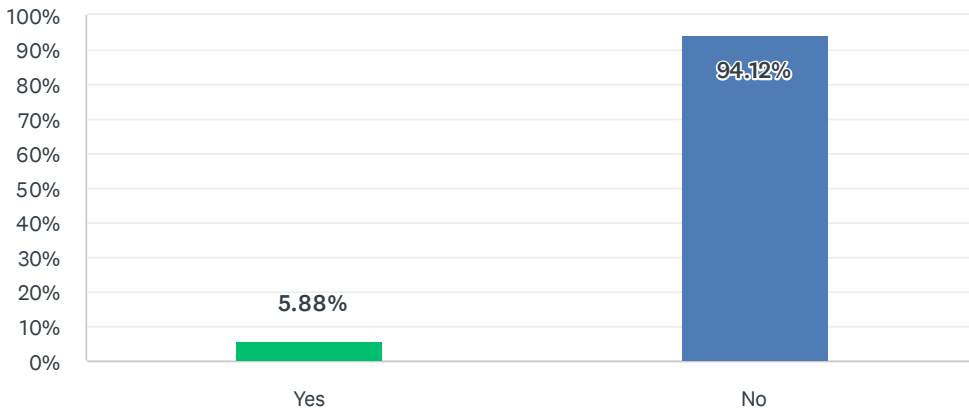
ANSWER CHOICES	RESPONSES	
Yes	5.88%	1
No	94.12%	16
TOTAL		17

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Twice today I was disconnected from the meeting. I don't know why.	9/2/2022 2:15 PM

Q29 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 17   Skipped: 73

#	RESPONSES	DATE
1	No effect.	9/7/2022 7:10 AM
2	Zoom made it possible for me to attend. Else, there was no chance for me.	9/6/2022 4:14 PM
3	Some time we could'nt hear the questions asked during the talk. Also taking notes its harder due to the camera clousing up and missing the blackboard that was filled before.	9/6/2022 12:25 PM
4	I'm actually pretty glad that I could participate online as I don't have much travel funding.	9/6/2022 12:23 PM
5	It was ok.	9/6/2022 11:29 AM
6	Lack of meeting people between talks	9/4/2022 11:52 AM
7	I live in Montreal, CA, and I as an Iranian I wouldn't be able to get the Visa on time and I would also have some financial trouble traveling to US, so I loved being able to participate online. Thanks !	9/4/2022 6:13 AM
8	Different time zones made participation impossible	9/3/2022 6:52 PM
9	Time zone differences meant that I could not attend the last talk of the day on three of the days. Having recordings of the talks helped.	9/3/2022 3:36 AM
10	Time zone differences meant I missed some talks.	9/3/2022 12:55 AM
11	The workshop was online	9/2/2022 11:05 PM
12	Missed the lectures from 1 pm PDT time as it is 1.30 am Indian Standard Time for me, here.	9/2/2022 10:48 PM
13	The online format was perfect, and the time zone suited me very well for me.	9/2/2022 3:18 PM
14	Time zone difference made it harder to watch all talks live	9/2/2022 2:55 PM
15	Well, I was able to attend virtually whereas I wouldn't have been able to before, so that's good. [My inability to attend in-person had nothing to do with COVID, but rather with family obligations.] I only had a 3 hour time difference, and in the right direction to not affect me adversely.	9/2/2022 2:15 PM
16	The online workshop saves time and effort for transportation.	9/2/2022 2:07 PM
17	Due to the time difference I only could watch the first 2 lectures.	9/2/2022 2:04 PM

Q30 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?
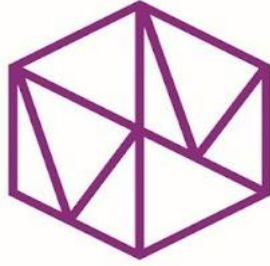
Answered: 8   Skipped: 82

#	RESPONSES	DATE
1	No.	9/7/2022 7:10 AM
2	Something like gather or discord can be quite helpful	9/6/2022 4:14 PM
3	No, difficult problem.	9/4/2022 11:52 AM
4	Don't hold them online, obviously	9/3/2022 6:52 PM
5	Use breakout rooms during the breaks/ lunch so that the virtual participants can discuss between themselves and try to capture some of the feeling of being at a conference. I have attended a couple of hybrid conferences and the one that used breakout rooms managed to make it feel like you were participating rather than just watching a video.	9/3/2022 3:36 AM
6	More could be done to encourage casual chat between online participants during breaks. People are reluctant to talk when they know their voice comes through the room speakers. It would be good to have breakout room permanently set up (these were sometimes set up, but not always). Having the opportunity to talk to the speaker by video link after each talk was great!	9/3/2022 12:55 AM
7	I don't think anything can really replicate the in-person experience.	9/2/2022 2:15 PM
8	Organise in person	9/2/2022 2:04 PM

Q31 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 4   Skipped: 86

#	RESPONSES	DATE
1	Looking forward to the next in person event.	9/7/2022 7:10 AM
2	It is a very interesting, motivating workshop	9/2/2022 10:49 PM
3	Thank you for allowing the online participation	9/2/2022 3:19 PM
4	Organise next time in person!	9/2/2022 2:04 PM

Connections Workshop: Floer Homotopy Theory

September 08, 2022 – September 09, 2022

Hybrid Workshop

Organizers:

Teena Gerhardt (Michigan State University)

Kristen Hendricks (Rutgers University)

Ailsa Keating (University of Cambridge)

REPORT ON THE MSRI WORKSHOP
"Connections Workshop: Floer Homotopy Theory (Hybrid Workshop)"
September 08 – 09, 2022

Organizers

- Teena Gerhardt (Michigan State University)
- Kristen Hendricks (Rutgers University)
- Ailsa Keating (University of Cambridge)

Scientific Description

The development of Floer theory in its early years can be seen as a parallel to the emergence of algebraic topology in the first half of the 20th century, going from counting invariants to homology groups, and beyond that to the construction of algebraic structures on these homology groups and their underlying chain complexes. In continuing work that started in the latter part of the 20th century, algebraic topologists and homotopy theorists have developed deep methods for refining these constructions, motivated in large part by the application of understanding the classification of manifolds. The goal of this program is to relate these developments to Floer theory with the dual aims of (i) making progress in understanding symplectic and low-dimensional topology, and (ii) providing a new set of geometrically motivated questions in homotopy theory.

This workshop featured talks by experts in Floer theory (and its applications to low-dimensional topology) and homotopy theory. It included two expository lectures aimed at graduate students and other researchers who are new to the field, as well as a sequence of research talks and a contributed talks session. There was a panel discussion focused on professional development. The speakers and panelists for this event were all women and members of gender minorities, and members of these groups and other underrepresented groups in mathematics were especially encouraged to attend. This workshop was open to all mathematicians.

Highlights of the Workshop

Each of the two days of the Connections workshop opened with a ninety-minute expository talk from an expert in the field. The first day Jennifer Hom (Georgia Tech) spoke on "Floer Homology and Homology Cobordism," and the second day Mona Merling (University of Pennsylvania) spoke on "An Introduction to Equivariant Stable Homotopy Theory." These two talks aimed at graduate students and other early career researchers set the stage for the five hour-long research talks spread over two days, as follows:

- Melissa Zhang (SLMath/UC Davis), "Khovanov Homology and the Involutive Heegaard Floer Homology of Branched Double Covers"
- Po Hu (Wayne State University), "Derived Representation Theory and Stable Homotopy sl_k Link Invariants"[virtual talk]
- Shira Tanny (IAS), "Floer Homology of Hamiltonians Supported on Subsets"

- Xin Jin (Boston College), "Microlocal Sheaves of Spectra and Symplectic Applications"
- Inbar Klang (SLMath/Columbia University) "Equivariant Factorization Homology and Tools for Studying It"

These talks highlighted contributions from women researchers in the many different flavors of mathematics which fall under the Floer homotopy umbrella. It was clear that speakers had made a special effort to make their talks accessible to new researchers.

There was also an hour-long contributed talks section, featuring six seven-minute talks from Orsola Capovilla-Searle (University of California, Davis), Ipsita Datta (Institute for Advanced Study), Renee Hoekzema (Universiteit Utrecht), Julia Semikina (University of Muenster), Weizhe Shen (Georgia Institute of Technology), and Catherine Cannizzo (University of California, Riverside)[virtual talk].

On the advice of SLMath, time was set aside for participants who were women and members of gender minorities to chat in preassigned networking groups. Six groups of six participants each were planned, with each group having at least two participants either with tenure or within one or two years of attaining tenure, and with some effort being made to match groups along mathematical interests. In general this effort seemed to produce good conversations and encourage participants to ask for advice. On the second day of the workshop, participants were encouraged to rearrange their groups, as it seemed that in practice one day was sufficient for each discussion.

A panel discussion on career advice was also offered, with panelists Akram Alishahi (University of Georgia), Anna Marie Bohmann (Vanderbilt), Orsola Capovilla-Searle (UC Davis), Juanita Pinzón Caicedo (Notre Dame), and Lisa Traynor (Bryn Mawr), and moderating by Ailsa Keating (Cambridge). The panel was attended by roughly thirty conference participants; panelists came prepared with a piece of advice they would give to their younger selves. The subsequent discussion topics were drawn from a list of topics prepared by the organizers (and shared with the panelists beforehand), questions asked out loud by the audience, and questions submitted anonymously by the audience before and during the panel via a google form. These questions were loosely organized into two themes, professional development and work-life balance.

A conference dinner was served on the Thursday night on the MSRI deck for participants who were women or members of gender minorities, and was extremely well-attended.

Organizers

First Name	Last Name	Institution
Teena	Gerhardt	Michigan State University
Kristen	Hendricks	Rutgers University
Ailsa	Keating	University of Cambridge

Speakers

First Name	Last Name	Institution
Catherine	Cannizzo	State University of New York, Stony Brook
Orsola	Capovilla-Searle	Duke University
Ipsita	Datta	Institute for Advanced Study
Renee	Hoekzema	Universiteit Utrecht
Jennifer	Hom	Georgia Institute of Technology
Po	Hu	Wayne State University
Xin	Jin	Boston College
Inbar	Klang	Columbia University
Mona	Merling	University of Pennsylvania
Iuliia	Semikina	University of Muenster
Weizhe	Shen	Georgia Institute of Technology
Shira	Tanny	Institute for Advanced Study
Melissa	Zhang	University of California, Davis

Mathematical Sciences Research Institute

Connections Workshop: Floer Homotopy Theory
September 08 to September 09, 2022

Thursday, September 08, 2022			
8:45 AM - 9:00 AM	Simons Auditorium		Welcome
9:00 AM - 10:30 AM	Simons Auditorium	Jennifer Hom	Floer Homology and Homology Cobordism
10:30 AM - 11:00 AM	Front Courtyard		Morning Tea
11:00 AM - 12:00 PM	Simons Auditorium	Melissa Zhang	Khovanov Homology and the Involutive Heegaard Floer Homology of Branched Double Covers
12:00 PM - 12:30 PM	Downstairs Deck		Networking Group Meetings
12:30 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Po Hu	Derived Representation Theory and Stable Homotopy sl_k Link Invariants
3:00 PM - 3:30 PM	Downstairs Deck		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Shira Tanny	Floer Homology of Hamiltonians Supported on Subsets
4:30 PM - 5:30 PM	Simons Auditorium		Panel Discussion
5:30 PM - 7:15 PM			Dinner

Friday, September 09, 2022			
9:00 AM - 10:30 AM	Simons Auditorium	Mona Merling	An Introduction to Equivariant Stable Homotopy Theory
10:30 AM - 11:00 AM	Front Courtyard		Morning Tea
11:00 AM - 12:00 PM	Simons Auditorium	Catherine Cannizzo, Orsola Capovilla-Searle, Ipsita Datta, Renee Hoekzema, Juliia Semikina & Weizhe Shen	Contributed Talks
12:00 PM - 12:30 PM	Downstairs Deck		Networking Group Meetings
12:30 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Xin Jin	Microlocal Sheaves of Spectra and Symplectic Applications
3:00 PM - 3:30 PM	Downstairs Deck		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Inbar Klang	Equivariant Factorization Homology and Tools for Studying It

Identifiable Participants' Information

Participants		137

Gender		137
Male	64.96%	89
Female	31.39%	43
Other	1.46%	2
Declined to state	2.19%	3

Ethnicity*		153
White	41.18%	63
Asian	39.87%	61
Hispanic	5.23%	8
Pacific Islander	0.00%	0
Black	0.65%	1
Native American	0.00%	0
Mixed	5.23%	8
Declined to state	7.84%	12

* ethnicity specifications are not exclusive

There were 9 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 68   Skipped: 0
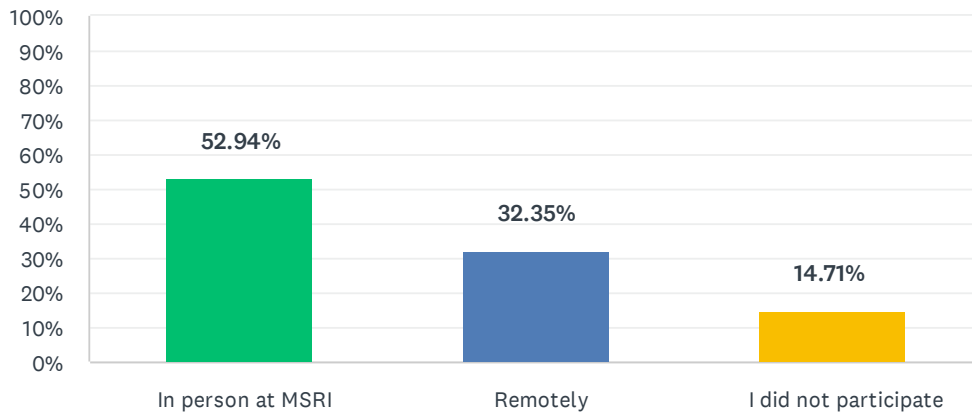
ANSWER CHOICES	RESPONSES	
In person at MSRI	52.94%	36
Remotely	32.35%	22
I did not participate	14.71%	10
TOTAL		68

Q2 The workshop was intellectually stimulating

Answered: 30   Skipped: 38
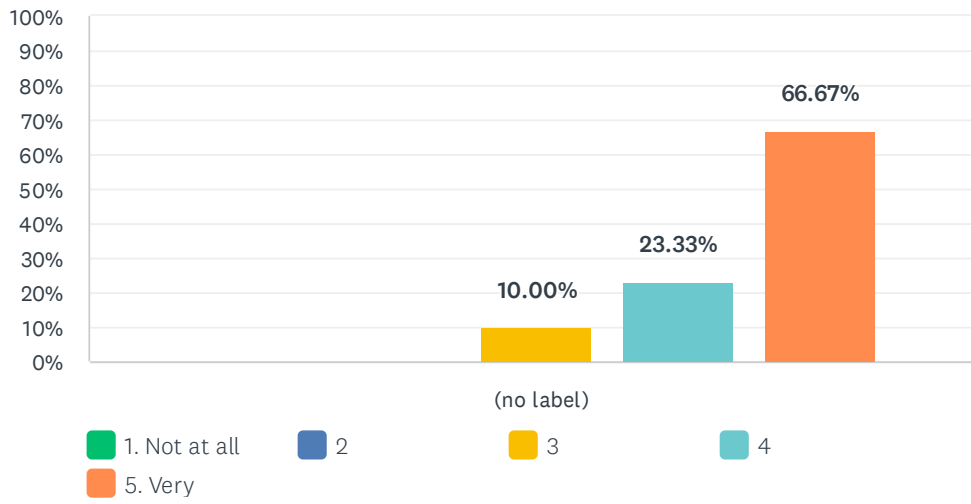
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.00% 3	23.33% 7	66.67% 20	30	4.57

Q3 The overall experience of the workshop was worthwhile

Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	13.33% 4	20.00% 6	66.67% 20	30	4.53

Q4 The lectures were at an appropriate level

Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.33% 1	10.00% 3	36.67% 11	50.00% 15	30	4.33

Q5 I was well prepared to benefit from the lectures

Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	3.33% 1	3.33% 1	20.00% 6	30.00% 9	43.33% 13	30	4.07

Q6 My interest in the subject matter was increased by the workshop

Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.33% 1	10.00% 3	36.67% 11	50.00% 15	30	4.33

Q7 The workshop helped me meet people with similar scientific interests

Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	13.33% 4	23.33% 7	10.00% 3	53.33% 16	30	4.03

Q8 Did you find the Networking Group Meetings worthwhile?

Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.67% 2	16.67% 5	23.33% 7	53.33% 16	30	4.36

Q9 Did you find the panel discussion worthwhile?
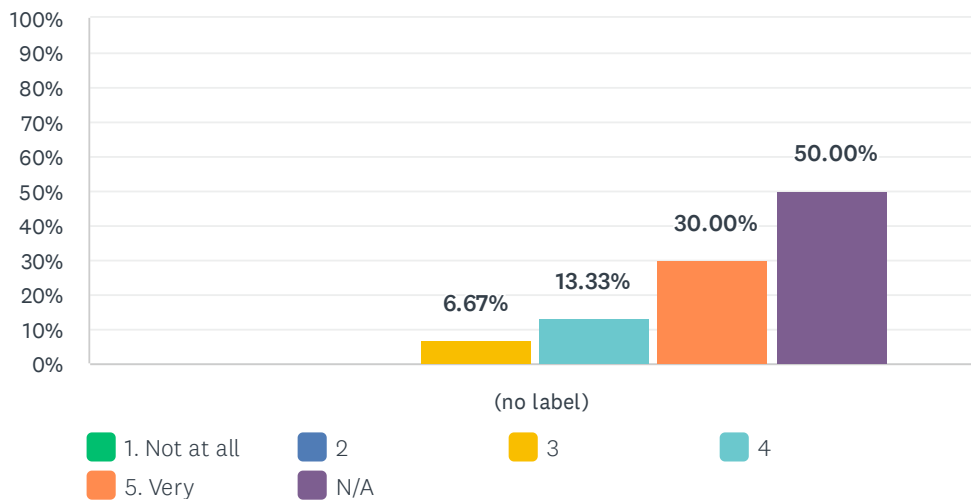
Answered: 30   Skipped: 38

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.67% 2	13.33% 4	30.00% 9	50.00% 15	30	4.47

Q10 What other subjects should be discussed in future panel discussions?

Answered: 1   Skipped: 67

#	RESPONSES	DATE
1	How to survive sexual harassment	9/11/2022 4:44 PM

Q11 Additional comments

Answered: 3   Skipped: 65

#	RESPONSES	DATE
1	Why is this happening before the introductory workshop? And why is the discussion dominated by men?	9/11/2022 4:44 PM
2	Thank you for the opportunity to participate in this conference!	9/11/2022 10:33 AM
3	Clarification: 3 years out of grad school, I've been to lots of panels and of course get less and less out of these early-career ones. However, I stuck around in the back and I think if I were a grad student or early postdoc, I would have gotten a lot out of this particular panel! Thanks a bunch to the organizers. :)	9/9/2022 4:53 PM

Q12 Did you attend the dinner?

Answered: 30   Skipped: 38
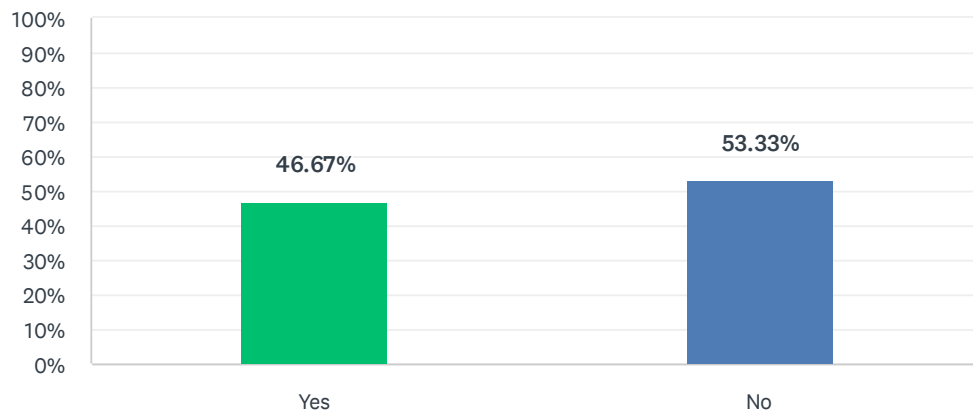
ANSWER CHOICES	RESPONSES	
Yes	46.67%	14
No	53.33%	16
TOTAL		30

Q13 Did the dinner help to solidify the contacts you made in the workshop?

Answered: 14   Skipped: 54
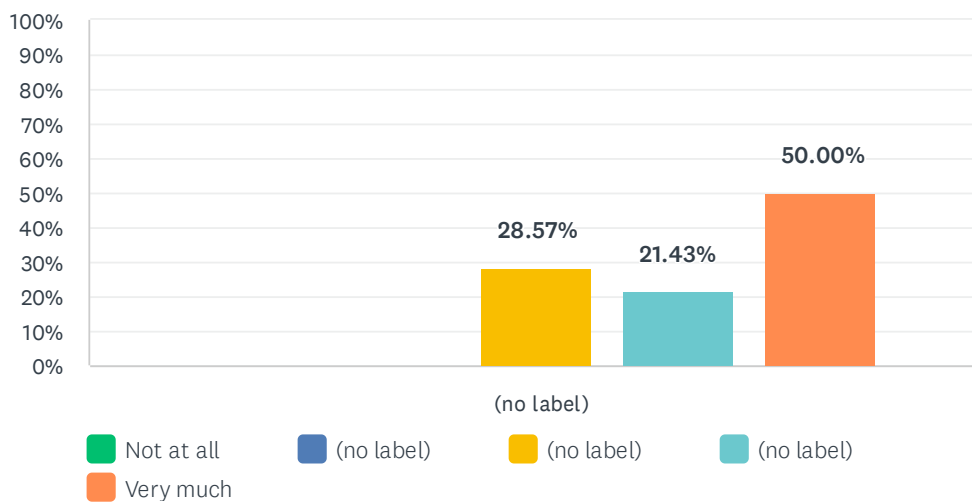
	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	28.57% 4	21.43% 3	50.00% 7	14	4.21

Q14 Please provide any comments about the dinner

Answered: 3   Skipped: 65

#	RESPONSES	DATE
1	Participants who had inadvertantly taken their masks off inside (because the drinks were inside) were shouted at to put them back on, and some of them were quite shaken by how aggressive the interaction felt to them. I appreciate the staff were working after hours, but I thought that could have been handled better.	9/22/2022 3:38 PM
2	When we only have an occasional hour over food to connect, we "just" use the space to vent. I would like more time in this safe space to start talking about math ... or at least constructive solutions to the problems we all face.	9/11/2022 4:46 PM
3	The food was cold, it would have been nice hot.	9/11/2022 10:34 AM

The following responses are from the virtual participants.

Q15 I found the MSRI staff helpful

Answered: 29   Skipped: 39
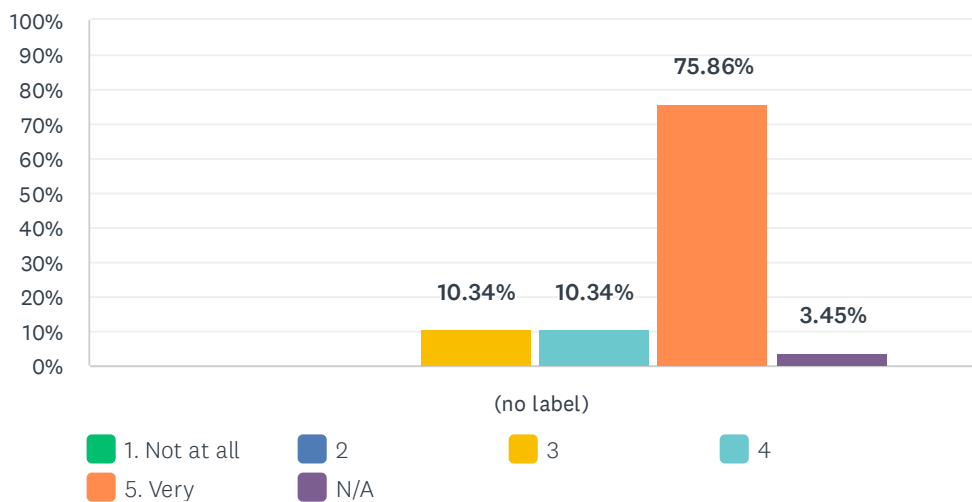
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.34% 3	10.34% 3	75.86% 22	3.45% 1	29	4.68

Q16 The MSRI facilities were conducive for such a workshop

Answered: 29   Skipped: 39
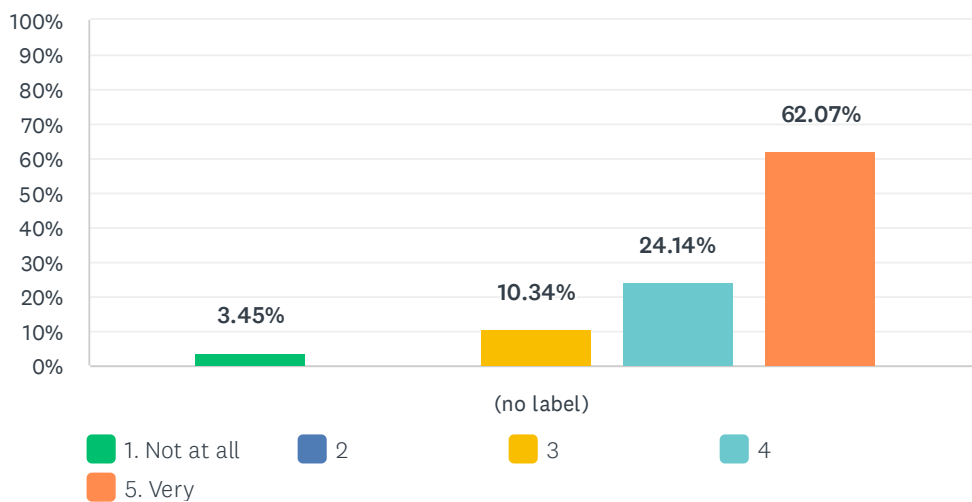
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	3.45% 1	0.00% 0	10.34% 3	24.14% 7	62.07% 18	29	4.41

Q17 Did you use MSRI's wireless network?

Answered: 29   Skipped: 39
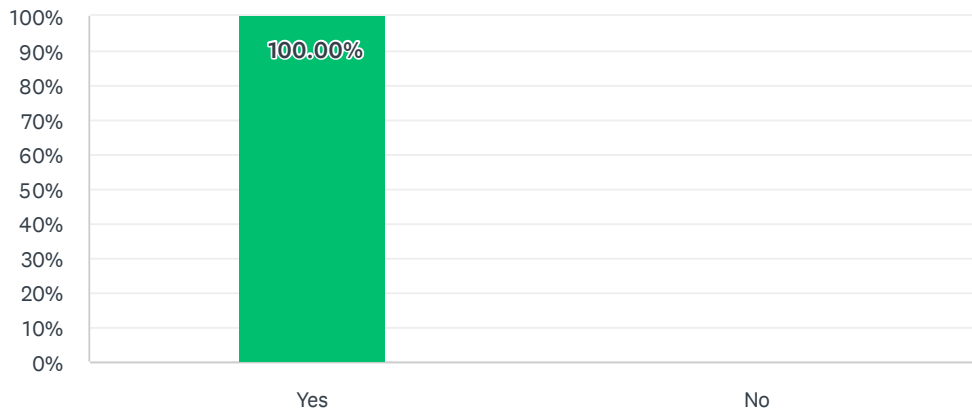
ANSWER CHOICES	RESPONSES	
Yes	100.00%	29
No	0.00%	0
TOTAL		29

339

Q18 Did you experience any difficulties with the network?

Answered: 29   Skipped: 39
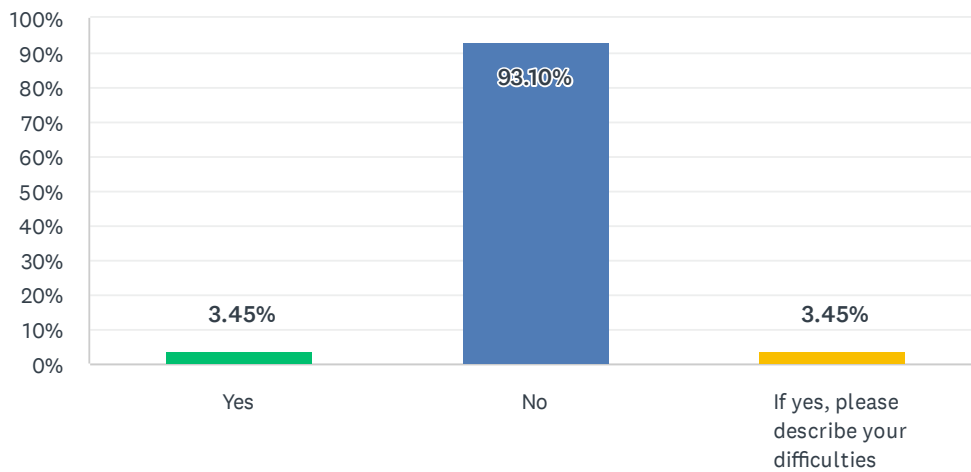
ANSWER CHOICES	RESPONSES	
Yes	3.45%	1
No	93.10%	27
If yes, please describe your difficulties	3.45%	1
TOTAL		29

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	Eduroam does not work at MSRI (but works fine on main Berkeley campus)	9/9/2022 9:31 PM

Q19 The MSRI lunch arrangements were satisfactory

Answered: 29   Skipped: 39

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.90% 2	24.14% 7	13.79% 4	27.59% 8	27.59% 8	29	3.86

Q20 The MSRI tea arrangements were satisfactory

Answered: 29   Skipped: 39
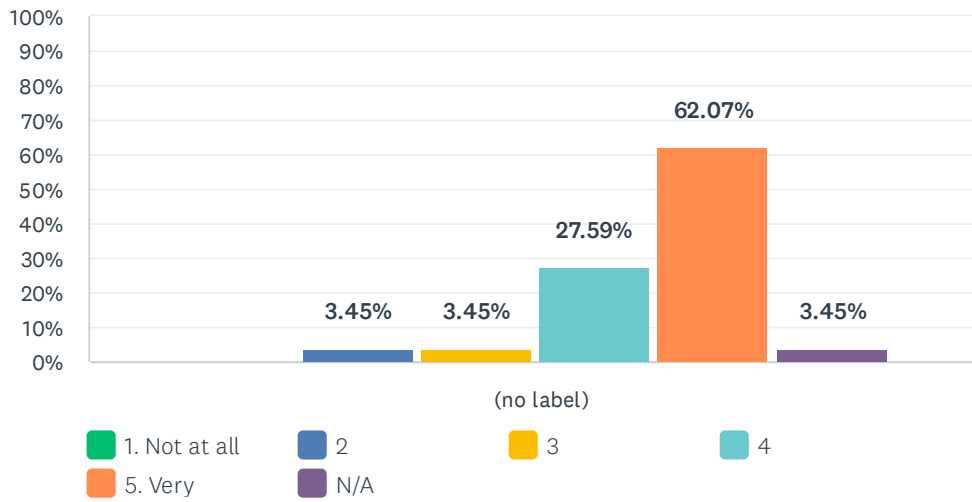
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.45% 1	3.45% 1	27.59% 8	62.07% 18	3.45% 1	29	4.54

Q21 Additional comments about the MSRI staff, facilities and food

Answered: 6   Skipped: 62

#	RESPONSES	DATE
1	It's only possible to purchase lunch if one has a US paypal account. This means that some overseas participants have no way of getting lunch, unless they take a frozen lunch or ask someone to order for them & reimburse them. (This also makes things tricky for participants with ethical objections to paypal, which are common in underrepresented communities.)	9/22/2022 3:41 PM
2	You're the best!!!	9/11/2022 4:46 PM
3	I appreciated the amount of fruit and veg on offer! At other conferences there has only been cake, so that was great. Would have been nice to take hot drinks into auditorium	9/11/2022 10:35 AM
4	Decaf coffee (even packets of instant) would be appreciated.	9/10/2022 3:55 PM
5	The space is very hot, and the patio is exhaustingly sunny, which was a bit unfortunate	9/9/2022 5:57 PM
6	More vegan options please	9/9/2022 5:45 PM

Q22 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 4   Skipped: 64

#	RESPONSES	DATE
1	Despite the rebranding from "Connections for Women" to "Connections", the format now feels somewhat at odds with how the community has evolved. I'm not sure what conversations have been had around this already, but I suggest this be thought about going forwards.	9/22/2022 3:44 PM
2	There's no direct bus from Berkeley Lab Guest House to MSRI, even though it had been reccomended by MSRI . This made getting to MSRI challenging/sweaty.	9/11/2022 10:36 AM
3	For the networking time, it was useful to just have people signed up to a table rather than having people "sign up" for a particular table.	9/10/2022 3:57 PM
4	The catch box made it more intimidating to ask questions, especially to ask for it from across the room. Would it be possible to have maybe multiple boxes?	9/9/2022 10:52 PM

Q23 I found the MSRI staff helpful
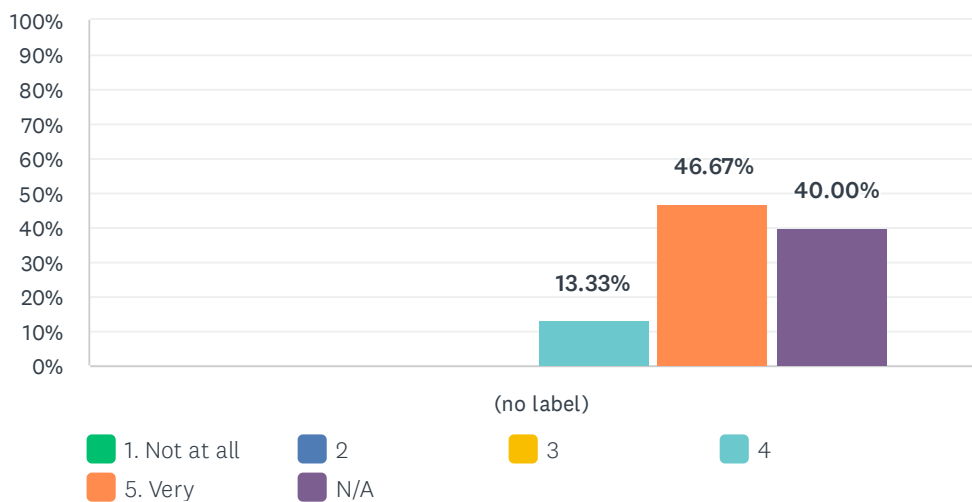
Answered: 15   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	13.33% 2	46.67% 7	40.00% 6	15	4.78

Q24 How many talks did you watch live?

Answered: 15   Skipped: 53
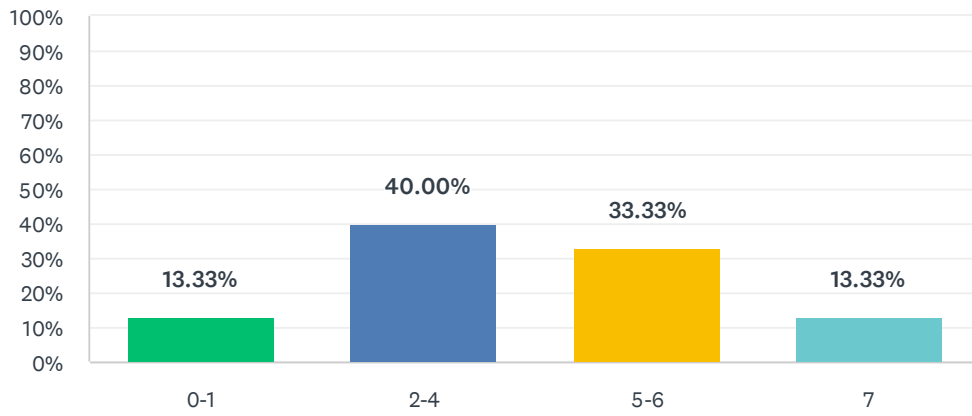
ANSWER CHOICES	RESPONSES	
0-1	13.33%	2
2-4	40.00%	6
5-6	33.33%	5
7	13.33%	2
TOTAL		15

Q25 The workshop was intellectually stimulating

Answered: 15   Skipped: 53
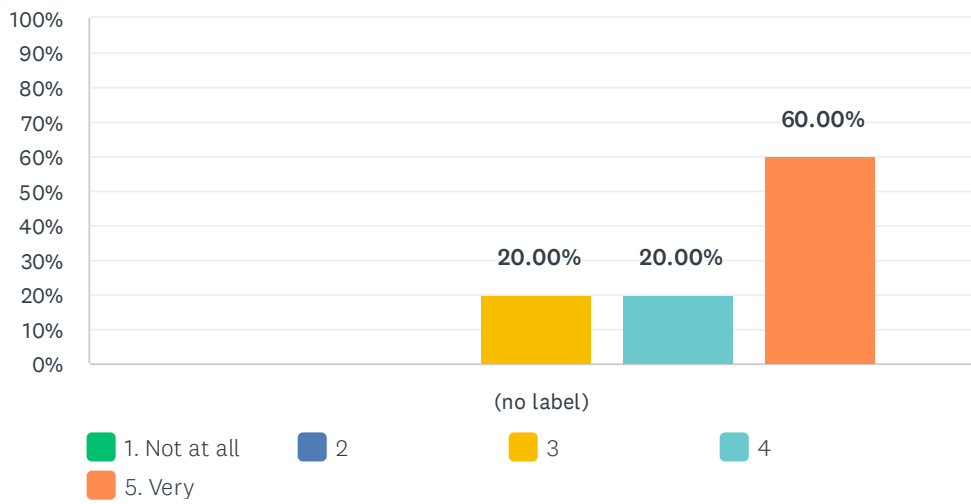
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	20.00% 3	20.00% 3	60.00% 9	15	4.40

Q26 The overall experience of the workshop was worthwhile

Answered: 15   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	6.67% 1	0.00% 0	13.33% 2	33.33% 5	46.67% 7	15	4.13

Q27 The lectures were at an appropriate level

Answered: 15   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	26.67% 4	40.00% 6	33.33% 5	15	4.07

Q28 I was well prepared to benefit from the lectures

Answered: 15   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	53.33% 8	33.33% 5	13.33% 2	15	3.60

Q29 My interest in the subject matter was increased by the workshop

Answered: 15   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.67% 1	20.00% 3	20.00% 3	53.33% 8	15	4.20

Q30 The workshop helped me meet people with similar scientific interests

Answered: 15   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	33.33% 5	6.67% 1	26.67% 4	13.33% 2	20.00% 3	15	2.80

Q31 Did you find the panel discussion worthwhile?

Answered: 15   Skipped: 53
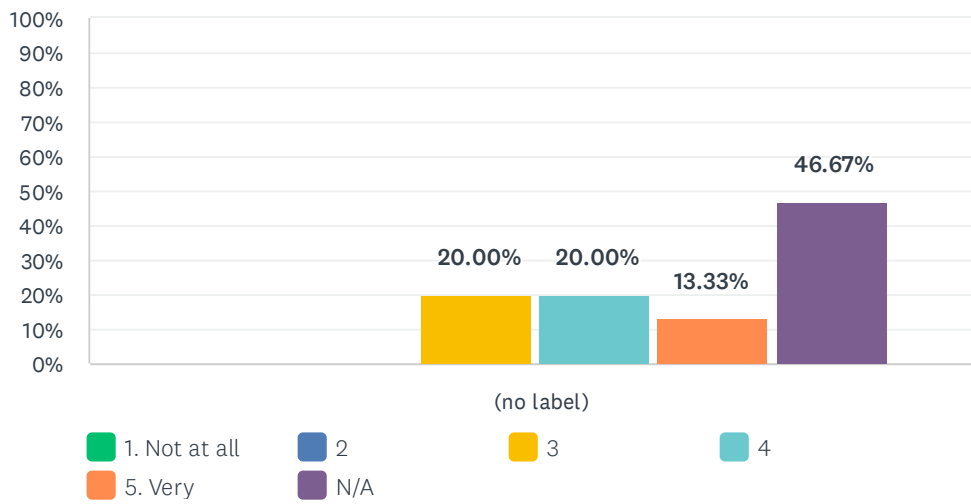
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	20.00% 3	20.00% 3	13.33% 2	46.67% 7	15	3.88

Q32 What other subjects should be discussed in future panel discussions?

Answered: 1   Skipped: 67

#	RESPONSES	DATE
1	The subjects discussed were appropriate.	9/10/2022 1:32 AM

Q33 Additional comments

Answered: 0   Skipped: 68

#	RESPONSES	DATE
	There are no responses.	

Q34 Did you experience any technical difficulties accessing the workshop online?

Answered: 14   Skipped: 54
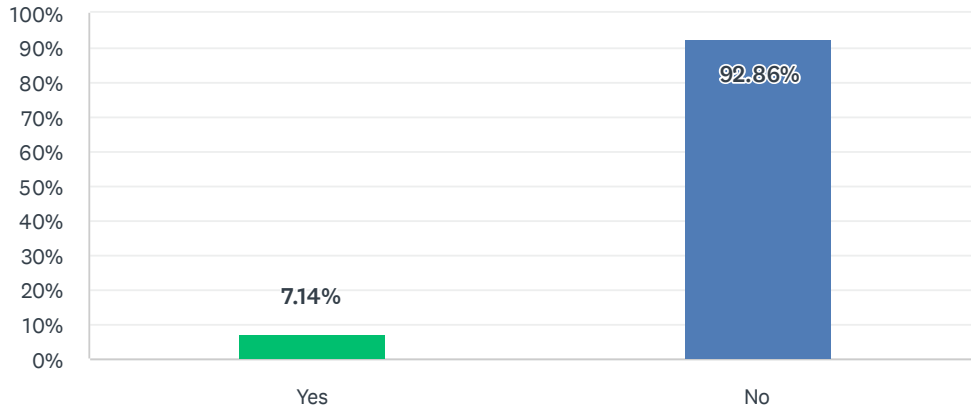
ANSWER CHOICES	RESPONSES	
Yes	7.14%	1
No	92.86%	13
TOTAL		14

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Network connection issues	9/9/2022 5:59 PM

Q35 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 14   Skipped: 54

#	RESPONSES	DATE
1	It allowed m to participate.	9/11/2022 10:36 PM
2	No impact on the content, but much less personal discussion	9/10/2022 8:08 PM
3	A 9 hour time difference severely restricted which lectures I could attend.	9/10/2022 12:13 PM
4	Attending online lectures which are intellectually stimulating will help me to do research in Floer theory.	9/10/2022 7:34 AM
5	It was harder for me to participate and to engage in conversartion. Luckly, the time zone differences made no impact.	9/10/2022 7:23 AM
6	None	9/10/2022 5:13 AM
7	No. It was very helpful.	9/10/2022 1:35 AM
8	I was able to come for 1 day, but having workshop online was very convenient.	9/10/2022 12:10 AM
9	No, at all.	9/9/2022 6:33 PM
10	Online attendance is great! Especially with MSRI equipment.	9/9/2022 6:15 PM
11	Time zone difference was the main barrier	9/9/2022 5:59 PM
12	In no way, except that I didn't get a chance to visit MSRI	9/9/2022 5:16 PM
13	I prefer in person attendance. I participated online as I wasn't given a choice but it severely limited my abilities to enjoy the material presented.	9/9/2022 5:03 PM
14	Without online section I could not attend it	9/9/2022 4:47 PM

Q36 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 4   Skipped: 64

#	RESPONSES	DATE
1	Gather town	9/11/2022 10:36 PM
2	Using virtual town meeting, where avatars meet in an virtual meeting town and speak via Zoom when they walk close: https://www.gather.town/	9/10/2022 8:08 PM
3	We can use Zulip,Slack and also we can do some social meetings for the people on Zoom	9/9/2022 6:33 PM
4	No idea.	9/9/2022 5:03 PM

Q37 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 0   Skipped: 68

#	RESPONSES	DATE
	There are no responses.	

Introductory Workshop: Floer Homotopy Theory

September 12, 2022 – September 16, 2022
Hybrid Workshop

Organizers:

Sheel Ganatra (University of Southern California)

Tyler Lawson (University of Minnesota Twin Cities)

Robert Lipshitz (University of Oregon)

Nathalie Wahl (University of Copenhagen)

REPORT ON THE MSRI WORKSHOP
"Introductory Workshop: Floer Homotopy Theory (Hybrid Workshop)"
September 12 – September 16, 2022

Organizers

- Sheel Ganatra (University of Southern California)
- Tyler Lawson (University of Minnesota Twin Cities)
- Robert Lipshitz (University of Oregon)
- Nathalie Wahl (University of Copenhagen)

Scientific Description

The development of Floer theory in its early years can be seen as a parallel to the emergence of algebraic topology in the first half of the 20th century, going from counting invariants to homology groups, and beyond that to the construction of algebraic structures on these homology groups and their underlying chain complexes. In continuing work that started in the latter part of the 20th century, algebraic topologists and homotopy theorists have developed deep methods for refining these constructions, motivated in large part by the application of understanding the classification of manifolds. The goal of this program is to relate these developments to Floer theory with the dual aims of (i) making progress in understanding symplectic and low-dimensional topology, and (ii) providing a new set of geometrically motivated questions in homotopy theory.

Over the last decade, there has been a wealth of new applications of homotopy-theoretic techniques to Floer homology in low-dimensional topology and symplectic geometry, including Manolescu's disproof of the high-dimensional Triangulation Conjecture and Abouzaid-Blumberg's proof of the Arnol'd Conjecture in finite characteristic. Conversely, results in Floer theory and categorification have opened new directions of research in homotopy theory, from string topology to S-Lie algebras. The goal of this workshop was to introduce researchers in Floer theory to modern techniques and questions in homotopy theory and, conversely, introduce researchers in homotopy theory to ideas underlying Floer theory and its applications.

Highlights of the Workshop

The workshop consisted of two lecture series of 5 lectures each, one on foundations of homotopy theory and one on foundations of Floer homology, together with four double talks on the more advanced topics.

The two lecture series were motivated by the question, "what material does one need in order to understand Abouzaid and Blumberg's resolution of the celebrated Arnol'd Conjecture using Floer homotopy theory." The homotopy theory series, given by Bohmann and Kupers, switched back and forth between the geometric and abstract approach to spectra, showing Morava K-theory in action. While the series started with classical motivation for stable homotopy theory from the Pontrjagin-Thom construction, by the end it sketched proofs of key duality results for

Morava K-theory. Along the way it introduced the notion of spectra and their connections to generalized homology theories and Atiyah duality. The course was laid out clearly enough that relative newcomers to stable homotopy theory were able to follow the entire arc of the lectures (as one can tell from the laudatory feedbcak). Similarly, McDuff and Wendl's Floer homology foundations series began with the basics of symplectic geometry and Morse homology, but managed to cover the main technical underpinnings of Floer theory in a general setting: transversality, compactness, and gluing results, the reason that multi-valued perturbations and virtual techniques are needed, and a hint at the construction of virtual moduli cycles. Again, in spite of the enormous amount of ground the series covered, both the live questions and a posteriori feedback confirmed that most audience members were able to follow it throughout. It was remarkable how well the pairs of speakers worked together: the lecture series were coherent, but each speaker was able to focus on their own areas of expertise, where their explanations were most elegant.

Turning to the afternoon lectures, Bottman and Wilkins gave a double talk on operads and infinity structures, starting from basic background in operads, and then giving hands on examples from recent developments in symplectic topology. Hingston and Oancea gave a double talk on string topology, and its relationship to symplectic homology, again starting with developments from two decades ago and reaching current topics of research. Klang and Kragh gave a double talk on Thom spectra, and how they appear and are needed in making stable homotopy types out of Morse theory data. Finally, Lin, Shi and Zhu gave examples of how deep homotopy-theoretic computations can be combined with gauge theory to prove new results about 4-manifolds.

The audience being a mixed crowd of symplectic topologists and homotopy theorist, the speakers made efforts throughout to talk to "the other side". There were also lots of questions from the audience during and after the talks, witnessing that the goal of the workshop was for everyone to learn.

In addition to the talks, there were two evening question-and-answer sessions. Participants submitted questions in advance, and the organizers found speakers or MSRI members would could try to answer them. Participants submitted more than thirty questions, ranging from specific questions newcomers to the subject wondered to general questions about the direction of the field. While not all questions could be answered in the time allotted, roughly half of them were addressed. The questions took the discussion in directions the organizers had not anticipated in advance---for instance, there was substantial interest in the status of a stable homotopy refinement of the Fukaya category---and brought more voices into the conference's conversation about Floer homotopy theory.

Organizers

First Name	Last Name	Institution
Sheel	Ganatra	University of Southern California
Tyler	Lawson	University of Minnesota Twin Cities
Robert	Lipshitz	University of Oregon
Nathalie	Wahl	University of Copenhagen

Speakers

First Name	Last Name	Institution
Anna Marie	Bohmann	Vanderbilt University
Nathaniel	Bottman	Université de Toulouse III (Paul Sabatier)
Nancy	Hingston	College of New Jersey
Inbar	Klang	Columbia University
Thomas	Kragh	Uppsala University
Alexander	Kupers	University of Toronto
Jianfeng	Lin	Tsinghua University
Dusa	McDuff	Barnard College
Alexandru	Oancea	Institut de Mathématiques de Jussieu
XiaoLin Danny	Shi	University of Washington
Chris	Wendl	Humboldt-Universität
Nicholas	Wilkins	Massachusetts Institute of Technology
Zhouli	Xu	University of California, San Diego

Mathematical Sciences Research Institute

Introductory Workshop: Floer Homotopy Theory

September 12, 2022 - September 16, 2022

Monday September 12, 2022			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Dusa McDuff	Floer Homology Foundations Pt 1
11:00 AM - 12:00 PM	Simons Auditorium	Alexander Kupers	Stable Homotopy Foundations: The Pontryagin-Thom Construction
2:00 PM - 3:00 PM	Simons Auditorium	Nicholas Wilkins	Infinity Structures and Operads Pt 1
3:30 PM - 4:30 PM	Simons Auditorium	Nathaniel Bottman	Infinity Structures and Operads Pt 2
4:30 PM - 6:20 PM	Front Courtyard		Reception

Tuesday, September 13, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Chris Wendl	Floer Homology Foundations Pt 2
11:00 AM - 12:00 PM	Simons Auditorium	Anna Marie Bohmann	Stable Homotopy Foundations: Generalized Cohomology Theories
2:00 PM - 3:00 PM	Simons Auditorium	Nancy Hingston	Loop Spaces and Poincaré Duality Part 1: Topological Aspects
3:30 PM - 4:30 PM	Simons Auditorium	Alexandru Oancea	Loop Spaces and Poincaré Duality Part 2: Symplectic Aspects
4:45 PM - 6:00 PM	Simons Auditorium		Floer Homology Q&A 1

Wednesday, September 14, 2022			
9:00 AM - 10:00 AM	Simons Auditorium	Chris Wendl	Floer Homology Foundations Pt 3
10:20 AM - 11:20 AM	Simons Auditorium	Anna Marie Bohmann	Stable Homotopy Foundations: Introduction to Spectra
11:35 AM - 12:35 PM	Simons Auditorium	Dusa McDuff	Floer Homology Foundations Pt 4

Thursday, September 15, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Chris Wendl	Floer Homology Foundations Pt 5
11:00 AM - 12:00 PM	Simons Auditorium	Alexander Kupers	Stable Homotopy Foundations: Atiyah Duality and Poincaré Duality
2:00 PM - 3:00 PM	Simons Auditorium	Inbar Klang	Thom Spectra and Orientations
3:30 PM - 4:30 PM	Simons Auditorium	Thomas Kragh	Spectral Orientations in Floer Theory
4:45 PM - 6:00 PM	Simons Auditorium		Floer Homology Q&A 2

Friday, September 16, 2022			
9:00 AM - 10:00 AM	Simons Auditorium	Anna Marie Bohmann	Stable Homotopy Foundations: Duality in Morava K-theory
10:30 AM - 11:30 AM	Simons Auditorium	Jianfeng Lin, XiaoLin Danny Shi & Zhouli Xu	Monopole Floer Theory and Homotopy Theory, Pt 1
11:30 AM - 12:30 PM	Simons Auditorium	Jianfeng Lin, XiaoLin Danny Shi & Zhouli Xu	Monopole Floer Theory and Homotopy Theory, Pt 2

Identifiable Participants' Information

Participants		208

Gender		208
Male	71.15%	148
Female	26.44%	55
Other	0.48%	1
Declined to state	1.92%	4

Ethnicity*		235
White	39.57%	93
Asian	40.85%	96
Hispanic	3.83%	9
Pacific Islander	0.00%	0
Black	0.85%	2
Native American	0.43%	1
Mixed	5.53%	13
Declined to state	8.94%	21

* ethnicity specifications are not exclusive

There were 14 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 116   Skipped: 0
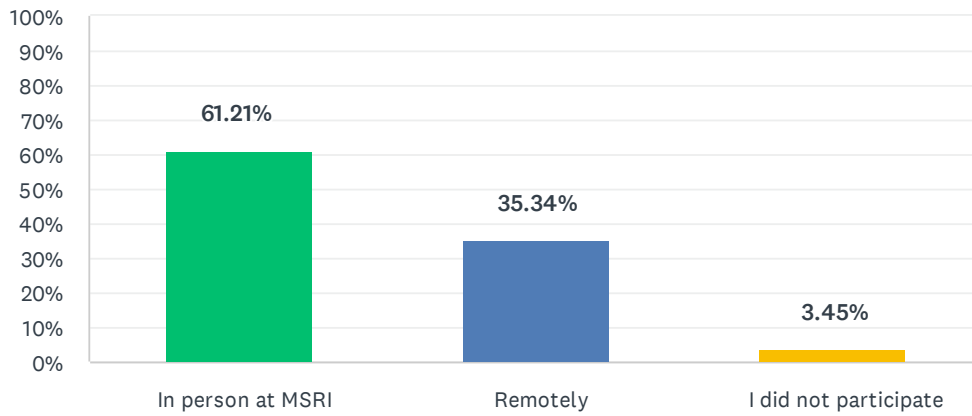
ANSWER CHOICES	RESPONSES	
In person at MSRI	61.21%	71
Remotely	35.34%	41
I did not participate	3.45%	4
TOTAL		116

Q2 The workshop was intellectually stimulating

Answered: 57   Skipped: 59
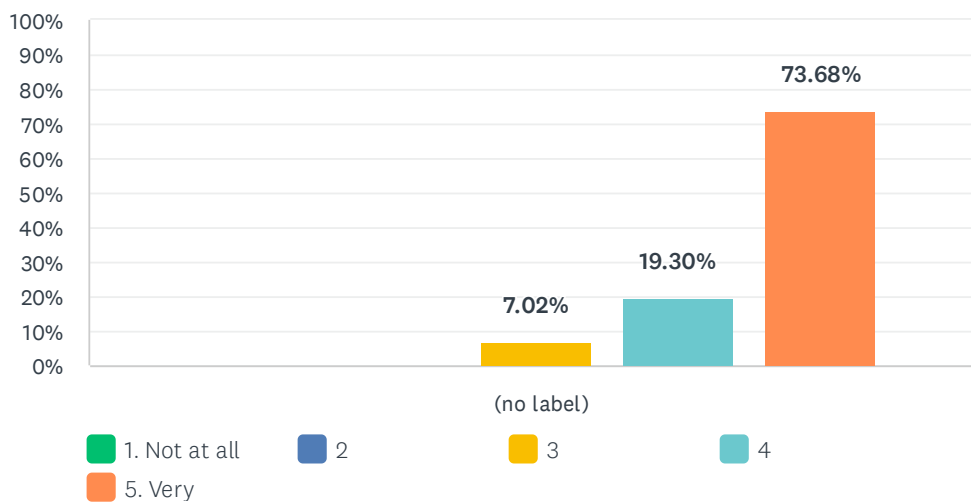
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.02% 4	19.30% 11	73.68% 42	57	4.67

Q3 The overall experience of the workshop was worthwhile

Answered: 57   Skipped: 59
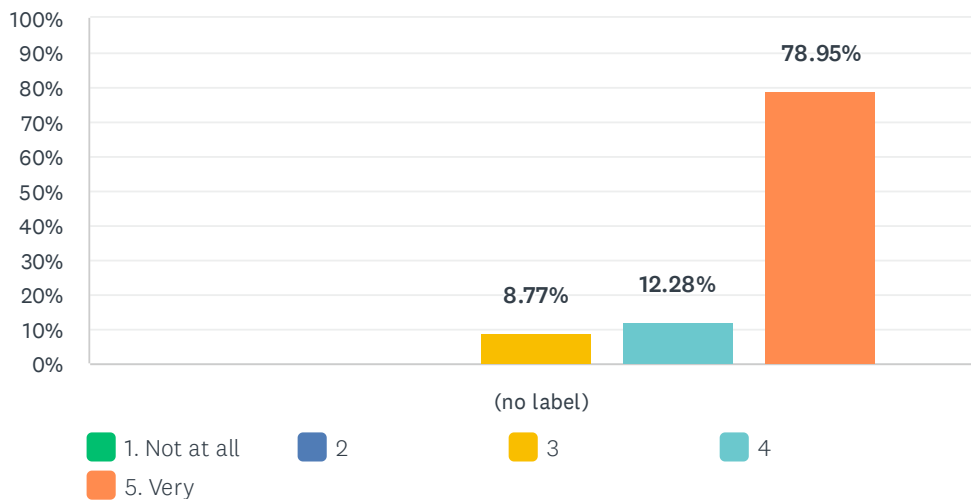
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.77% 5	12.28% 7	78.95% 45	57	4.70

Q4 The lectures were at an appropriate level

Answered: 57   Skipped: 59
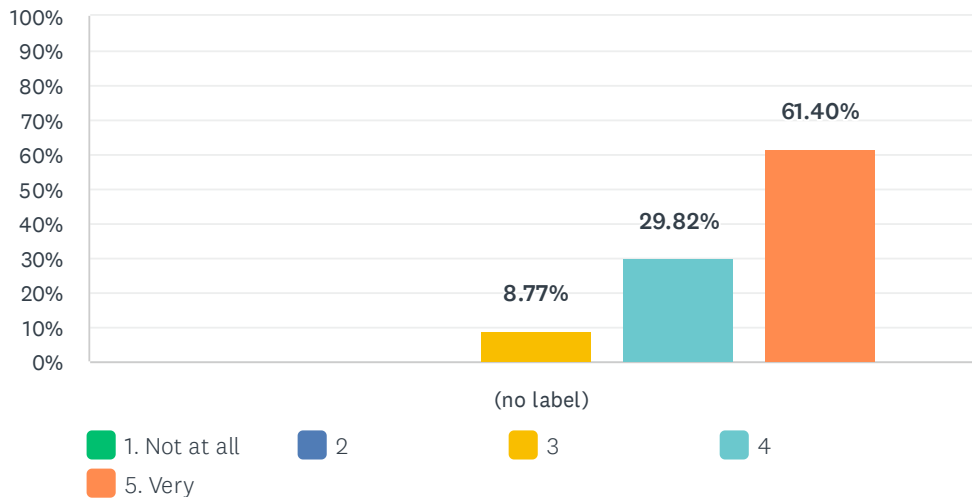
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.77% 5	29.82% 17	61.40% 35	57	4.53

Q5 I was well prepared to benefit from the lectures

Answered: 57   Skipped: 59
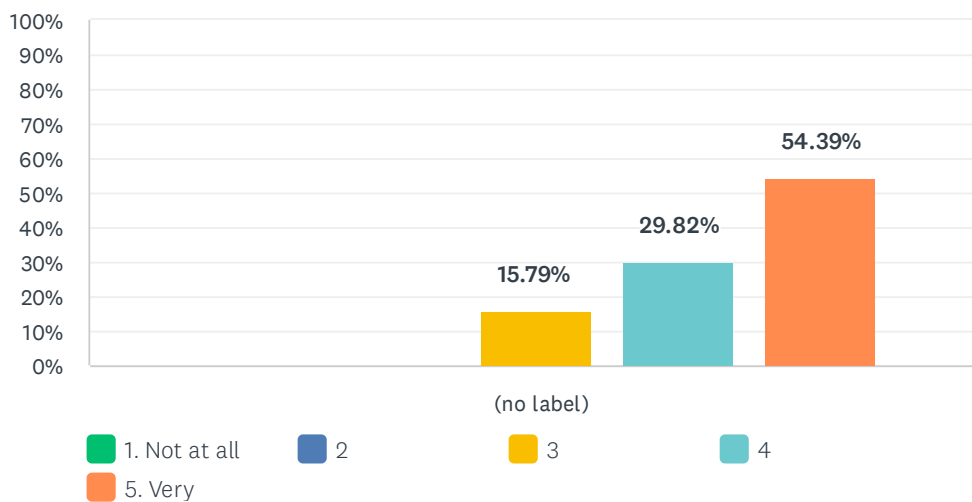
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	15.79% 9	29.82% 17	54.39% 31	57	4.39

Q6 My interest in the subject matter was increased by the workshop

Answered: 57   Skipped: 59
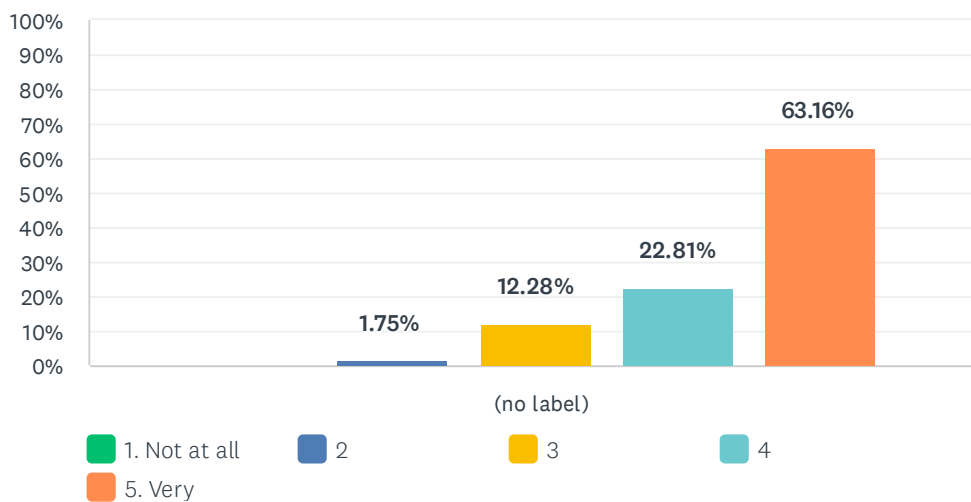
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.75% 1	12.28% 7	22.81% 13	63.16% 36	57	4.47

Q7 The workshop helped me meet people with similar scientific interests

Answered: 57   Skipped: 59
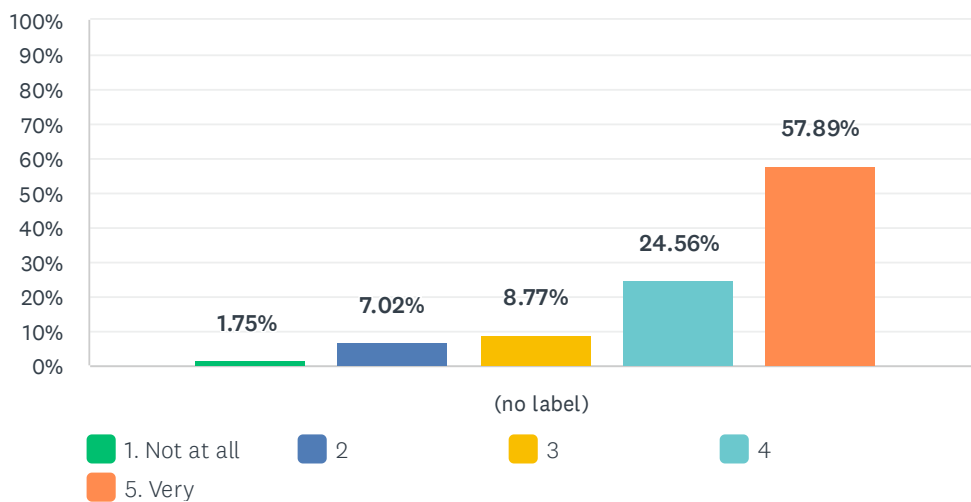
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	1.75% 1	7.02% 4	8.77% 5	24.56% 14	57.89% 33	57	4.30

Q8 What were the highlights of the lectures?

Answered: 57   Skipped: 59

#	RESPONSES	DATE
1	I liked learning about homotopy theory and my favorite part was the 3-speaker lecture on Friday.	9/28/2022 11:45 PM
2	I most enjoyed the homotopy theory talks and the talks about future directions. Thomas's lecture in particular was a highlight.	9/28/2022 9:52 AM
3	Stable homotopy mini-course	9/27/2022 3:33 PM
4	The fact that there were two speakers collaborating on each topic worked really well. A side effect I had not expected was that speakers concentrated more on being understood than on trying to advertise their own work.	9/27/2022 1:40 PM
5	Q&A	9/27/2022 12:26 PM
6	They were nice.	9/27/2022 11:54 AM
7	I liked how I learnt the theories I already knew from different angle. I also got lot of motivation for floer homologies because of plenty of examples that were provided by the speakers. This is something I was looking for a long time.	9/27/2022 11:35 AM
8	The 5 course lecture series	9/27/2022 11:32 AM
9	I liked the specialised lectures that came in pairs.	9/27/2022 11:32 AM
10	Lectures by Alexander Kupers were very amazing.	9/27/2022 11:26 AM
11	Anna-Marie's first lecture on Stable homotopy theory was awesome!! The stable homotopy series was at a great level and felt accessible, as a grad student with a background in algebraic topology.	9/23/2022 12:21 PM
12	The overview of Floer homology was excellent.	9/23/2022 10:08 AM
13	I appreciated the structure of the workshop: lecture courses plus paired lectures in the afternoon.	9/23/2022 9:39 AM
14	Clarity	9/23/2022 6:35 AM
15	I learned a lot from the lectures by Dusa McDuff and Anne Marie Bohmann.	9/23/2022 4:56 AM
16	The Q&A on Thursday was the highlight of the conference. This is where experts gave an overview of the field and problems. It is a shame it was not recorded and a lot of people missed it.	9/22/2022 11:24 PM
17	I just thought everyone did a great job introducing their different areas of expertise to an audience with a diverse range of backgrounds in Floer theory and homotopy theory. It did a great job setting up the program of the semester.	9/22/2022 7:46 PM
18	I personally found the Stable Homotopy Foundations series very educational. There was a story arc through the whole 5 lectures, and even though I didn't know what an Omega-spectrum was before this week, I learned so much from these lectures.	9/22/2022 7:37 PM
19	Mc Duff's lectures	9/22/2022 5:24 PM
20	?	9/22/2022 3:28 PM
21	Friendly and interesting explanations of contents, new and fascinating results, and talking with many participants helps me learn a lot.	9/22/2022 3:07 PM
22	The question panel	9/22/2022 3:06 PM
23	Many excellent lecture courses.	9/22/2022 3:04 PM

24	No opinion	9/22/2022 3:02 PM
25	I like the lectures by Professor McDuff	9/22/2022 3:01 PM
26	Good combination of two fields.	9/22/2022 2:59 PM
27	I liked lectures by Anna Marie Bohmann.	9/20/2022 9:23 PM
28	lectures: stable homotopy foundations	9/20/2022 6:14 PM
29	It was nice to have coordinated lectures, making it possible to go into greater depth.	9/20/2022 7:21 AM
30	I especially enjoyed the introductory course on stable homotopy theory	9/20/2022 12:35 AM
31	The two longer lecture series.	9/20/2022 12:31 AM
32	The stable homotopy series.	9/19/2022 7:17 PM
33	Surveying the results and techniques	9/19/2022 3:15 PM
34	…	9/19/2022 1:18 PM
35	I come from a symplectic background, and I found the lectures on spectra very useful.	9/19/2022 12:27 PM
36	.	9/19/2022 11:34 AM
37	Inbar Klang/Thomas Kraugh putting it all together	9/19/2022 10:59 AM
38	The introduction to stable homotopy lectures were useful to me as I am not familiar at all with this topic.	9/19/2022 10:56 AM
39	the stable homotopy theory minicourse	9/19/2022 10:35 AM
40	Sander Kupers's lectures were great.	9/19/2022 10:17 AM
41	It was all great.	9/19/2022 10:13 AM
42	The homotopy series of talks provided an excellent introduction, and I felt were geared at exactly the right level.	9/19/2022 10:07 AM
43	Most lecturers tried hard to explain basics and not show off!	9/19/2022 10:02 AM
44	Alexander Kupers nailed it!	9/19/2022 10:01 AM
45	Talks by Dusa McDuff	9/19/2022 9:57 AM
46	Learning about spectra	9/19/2022 9:51 AM
47	Chris Wendl's lectures were superb.	9/19/2022 9:51 AM
48	Dusa McDuff's first lecture was outstanding; even for those who knew the material was useful as a compilation of the development of the subject. I found stable homotopy theory lectures useful, as they guided me to further reading. Chris Wendl's lectures gave sufficient details to see the technical difficulties.	9/19/2022 9:49 AM
49	I thought the Stable Homotopy Lecture series was especially well done.	9/19/2022 9:48 AM
50	The talks by Anna-Marie Bohmann and Sander Kupers on homotopy theory were clear and engaging.	9/19/2022 9:47 AM
51	Excellent lecture series on Stable Homotopy Theory by Kupers-Bohmann, and an excellent paires 2h talk by Klang-Kragh.	9/19/2022 9:47 AM
52	Stable homotopy foundations: Generalized cohomology theories	9/19/2022 9:41 AM
53	Problem sessions	9/19/2022 9:34 AM
54	Learning new stuff	9/19/2022 9:31 AM
55	Bohmann's lectures were really well done.	9/19/2022 9:29 AM
56	They were very accessible.	9/19/2022 9:27 AM
57	Well-organised, good content.	9/19/2022 9:27 AM

Q9 Additional comments

Answered: 6   Skipped: 110

#	RESPONSES	DATE
1	It was a pitty MSRI was so worried about corona, both because of all the participants that were not allowed to come, but also because it made the ambience less relax.	9/27/2022 1:40 PM
2	The catch-box made me more stressed to ask questions. (I was worried if I could catch it, if it was far from me at the moment, I would be wasting everyone's time to get it passed to me, etc.)	9/23/2022 6:35 AM
3	I really liked how the Q&A was formatted -- specifically that the answerers were chosen carefully and also given time to think about how to present their answers concisely and accurately.	9/22/2022 7:37 PM
4	I was absolutely shocked that the vast majority of graduate students were unable to attend in person (especially given that the mask / testing policy was so exacting for people who were there). This feels like a huge mistake; I don't think the admin staff realise how much this creates a sense of have / have nots in the community -- which seems very much against MSRI's stated ethos. I really think that this will reflect poorly on MSRI going forwards, and significantly diminishes it in the eyes of the community.	9/22/2022 3:04 PM
5	I would have appreciated a lecture (possibly a minicourse) about "Floer homotopy theory from 10,000 feet" - explaining how everything fits together.	9/19/2022 12:27 PM
6	5 lectures a day is a slightly heavy schedule for allowing interaction and questions.	9/19/2022 10:02 AM

Q10 I found the MSRI staff helpful

Answered: 55   Skipped: 61

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.64% 2	3.64% 2	10.91% 6	72.73% 40	9.09% 5	55	4.68

Q11 The MSRI facilities were conducive for such a workshop

Answered: 55   Skipped: 61
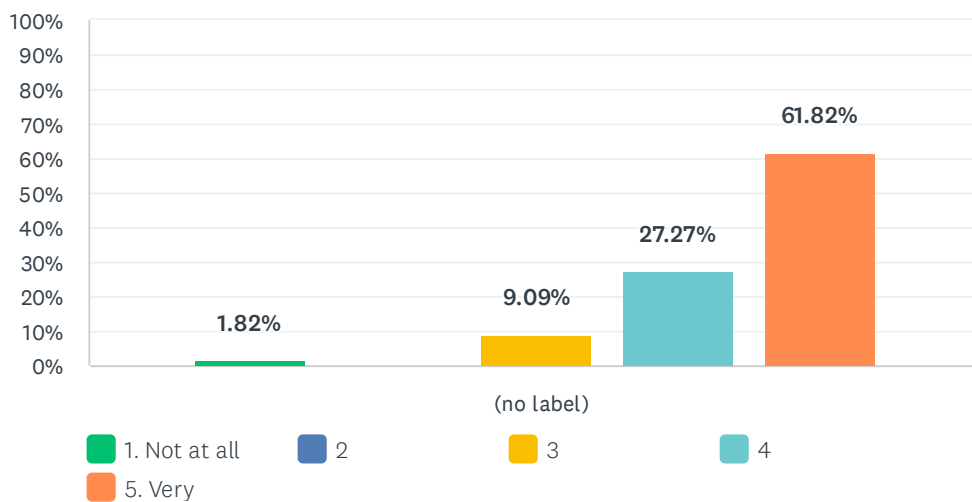
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	1.82% 1	0.00% 0	9.09% 5	27.27% 15	61.82% 34	55	4.47

Q12 Did you use MSRI's wireless network?

Answered: 55   Skipped: 61

ANSWER CHOICES	RESPONSES	
Yes	94.55%	52
No	5.45%	3
TOTAL		55

Q13 Did you experience any difficulties with the network?

Answered: 55   Skipped: 61
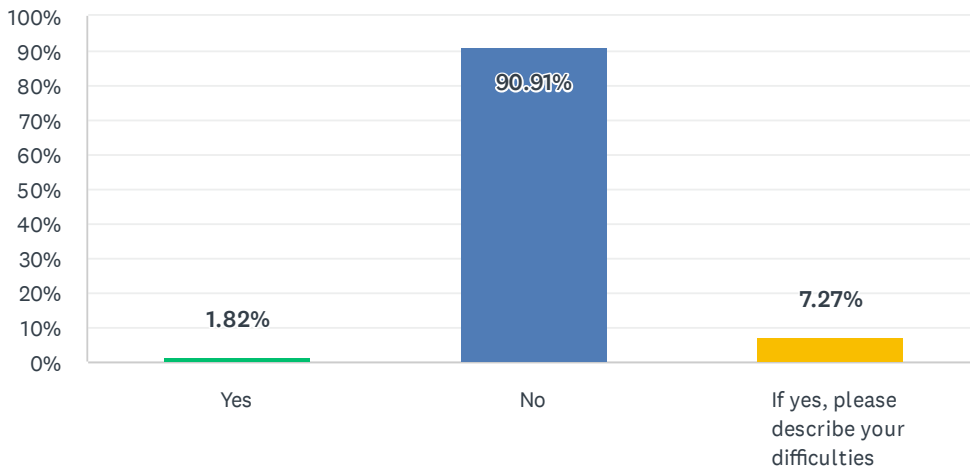
ANSWER CHOICES	RESPONSES	
Yes	1.82%	1
No	90.91%	50
If yes, please describe your difficulties	7.27%	4
TOTAL		55

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	Sometimes it was quite slow.	9/23/2022 6:39 AM
2	Sometimes it took longer than expected to connect to the MSRI-members network, and I never succeeded at connecting to eduroam at all	9/20/2022 12:38 AM
3	Can never store password in keychain	9/19/2022 10:02 AM
4	Eduroam was flaky one day	9/19/2022 9:30 AM

Q14 The MSRI lunch arrangements were satisfactory

Answered: 55   Skipped: 61

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	7.27% 4	12.73% 7	21.82% 12	32.73% 18	25.45% 14	55	4.07

Q15 The MSRI tea arrangements were satisfactory

Answered: 55   Skipped: 61

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.64% 2	1.82% 1	21.82% 12	65.45% 36	7.27% 4	55	4.61

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 13   Skipped: 103

#	RESPONSES	DATE
1	The staff was amazing and super helpful!! (This is my fault but) I often forgot to order lunch, and since MSRI is so isolated on the hill, there weren't many other options. But I appreciated that some food was available for purchase.	9/28/2022 9:53 AM
2	I could not order food myself in the lunch system and had to find ad hoc solutions every day. Food ran out at tea---I often arrived too late. The passing microphone was great, but the set-up of the room with few chairs in front taking a lot of space and everyone else a little far from the speaker, doesn't seem like an ideal use of the space. The staff seemed stress with the whole corona situation and the very many rules the institute has, and my interactions with the staff were mostly not so pleasant (mostly being told off I felt), which is really a pity. The other institutes I have visited were not like that.	9/27/2022 1:49 PM
3	Receptionist at the front desk was very friendly and helpful and amazing at remembering everyones names!	9/23/2022 12:23 PM
4	Decaf coffee was much appreciated!	9/23/2022 9:39 AM
5	The ice tray in the fridge is always empty, and the water during tea time is quite hot. Would it be possible to have some ice, or maybe some bottled water, for people who like iced/room-temperature water?	9/23/2022 6:39 AM
6	There was a pair of graduate students who had traveled all the way across the country to attend but were refused for two days because of a misunderstanding concerning covid regulations - it had not been made clear to them that MSRI had uninvited them to the conference because of their sudden strict covid regulations. In the end they were allowed to come but only after missing two days of the conference. I thought this was an exceptionally unfriendly thing to do to graduate students.	9/23/2022 5:05 AM
7	Eating outside is not so comfortable as it was too hot or too cold. Also it was easy to forget to order lunch, so many people were often left without lunch.	9/22/2022 11:25 PM
8	The MSRI staff are always so friendly and helpful. Thanks!	9/22/2022 7:38 PM
9	The coffee was not so great (though about what I normally expect from coffee at math conferences), and I found the catered lunch disappointingly bland almost every day (especially the Thai food).	9/20/2022 12:38 AM
10	Until indoor masking is no longer needed, there is a critical lack of sheltered (from sun and wind) outdoor blackboard / workspace with good comfortable seating. (There is *no* space that currently has these features, in my view.)	9/19/2022 1:20 PM
11	It was often quite chilly in the lecture hall	9/19/2022 11:00 AM
12	Thank you to Bertram for the amazing food all the time! I especially appreciate the healthy vegetarian food during tea time.	9/19/2022 10:18 AM
13	The staff are doing a great job. The Covid 19 rules at MSRI are to restrictive.	9/19/2022 10:15 AM

Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 9   Skipped: 107

#	RESPONSES	DATE
1	Was reccommended by MSRI to stay at Berkeley Lab Guest house but there was no direct bus running and the walk was 20-25 mins uphill in the heat! This wasn't ideal and I wouldn't recommend that to future visitors!	9/23/2022 12:24 PM
2	Thank you!	9/23/2022 6:40 AM
3	I would prefer it if the institute dropped the mask requirement and went into post-pandemic mode as the rest of the world is doing.	9/23/2022 5:06 AM
4	The atmosphere really did not seem very welcoming, with some grad students who made a mistake and flew all the way to Berkeley and showed up being turned away. (Easy mistake to make given the confusing emails about the hybrid format after accepting people). In any case, MSRI turning away grad students who came all the way like this really is not good optics and I think many people were quite horrified. Already with all the rules and protocols the place does not seem all the cozy.	9/22/2022 11:27 PM
5	It would be good to have scheduled sound / technical tests ahead of time for remote speakers (we had one for which the sound quality was awful).	9/22/2022 3:05 PM
6	I'll just add a vote of thanks for being so careful about Covid. This was my first real conference in the last 2.5 years, and I found having to jump through some hoops to get into the building (testing, proof of vaccination) reassuring!	9/20/2022 12:40 AM
7	Hybrid talks were a bit challenging.	9/19/2022 11:00 AM
8	Maybe the one Zoom lecture could have benefitted from a prior sound test, the sound was quite muffled.	9/19/2022 10:03 AM
9	Increased presence of graduate students would have been highly recommended. I found that the Covid restrictions put in place at MSRI were excessive.	9/19/2022 9:49 AM

The following responses are from the virtual participants.

Q18 I found the MSRI staff helpful

Answered: 26   Skipped: 90
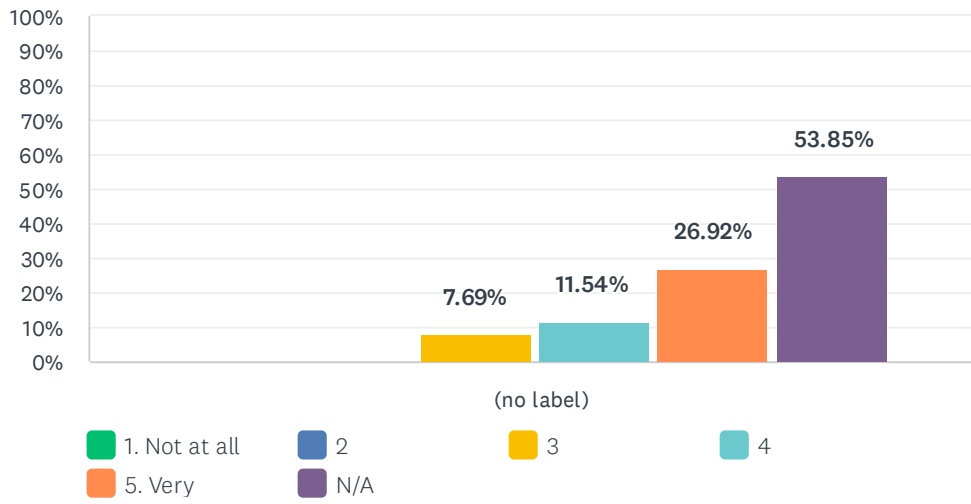
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.69% 2	11.54% 3	26.92% 7	53.85% 14	26	4.42

Q19 How many talks did you watch live?

Answered: 26   Skipped: 90
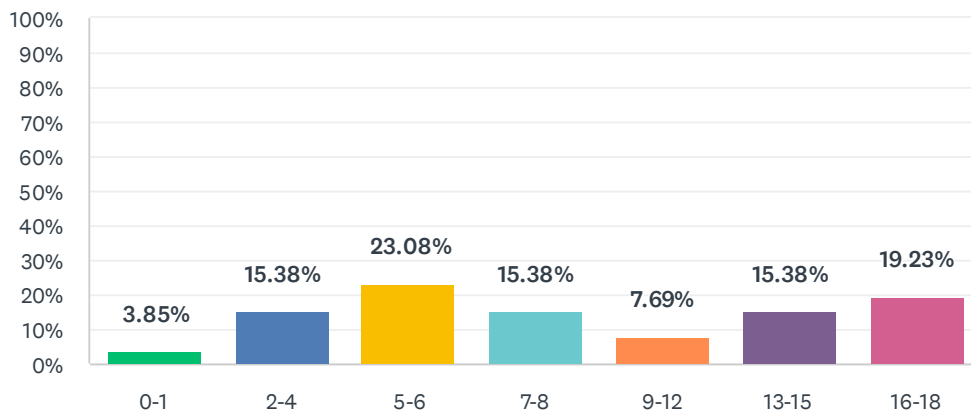
ANSWER CHOICES	RESPONSES	
0-1	3.85%	1
2-4	15.38%	4
5-6	23.08%	6
7-8	15.38%	4
9-12	7.69%	2
13-15	15.38%	4
16-18	19.23%	5
TOTAL		26

Q20 The workshop was intellectually stimulating

Answered: 26   Skipped: 90

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.54% 3	34.62% 9	53.85% 14	26	4.42

Q21 The overall experience of the workshop was worthwhile

Answered: 26   Skipped: 90
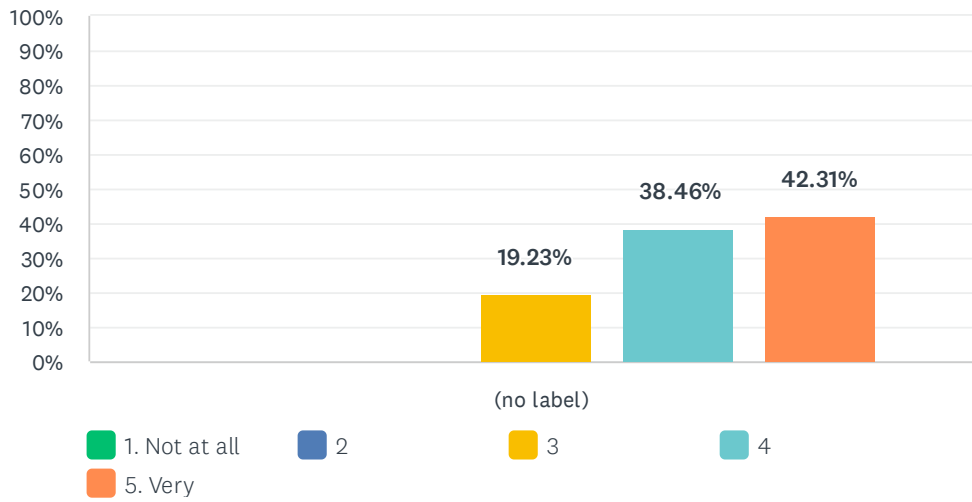
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	19.23% 5	38.46% 10	42.31% 11	26	4.23

Q22 The lectures were at an appropriate level

Answered: 26   Skipped: 90
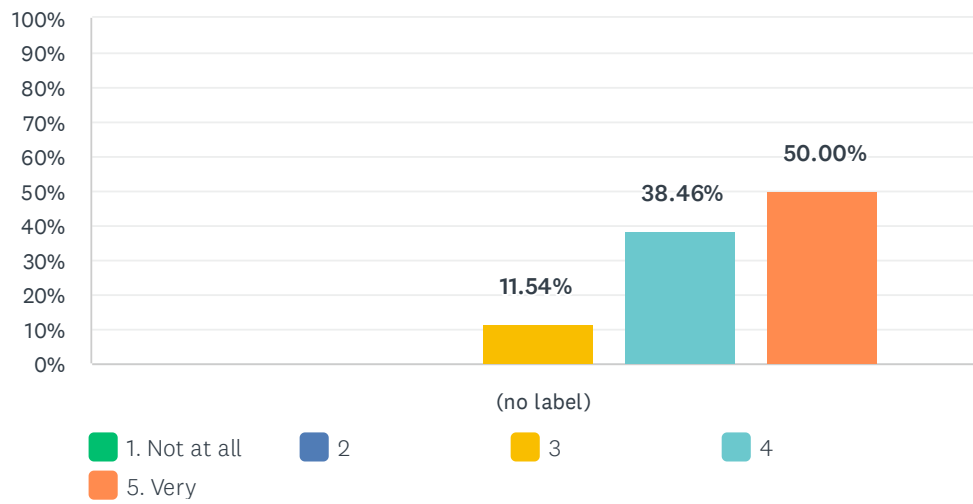
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.54% 3	38.46% 10	50.00% 13	26	4.38

Q23 I was well prepared to benefit from the lectures
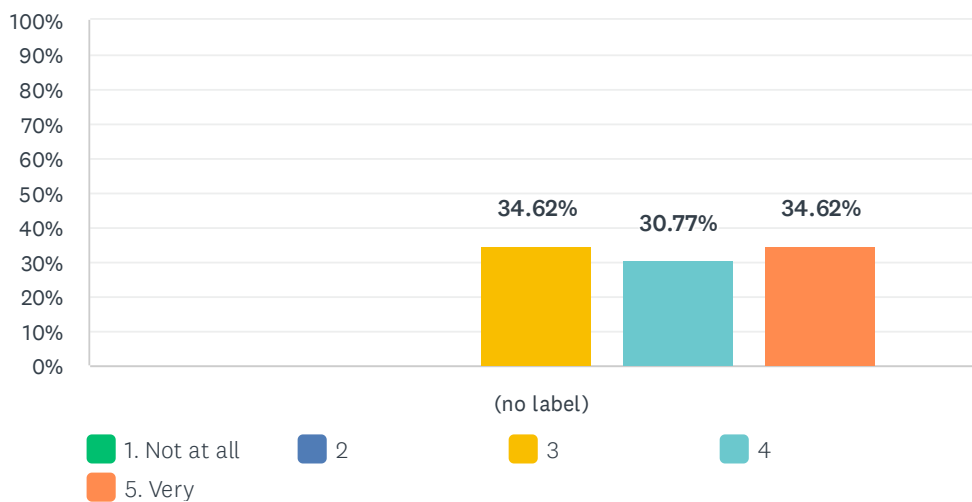
Answered: 26   Skipped: 90

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	34.62% 9	30.77% 8	34.62% 9	26	4.00

Q24 My interest in the subject matter was increased by the workshop

Answered: 26   Skipped: 90
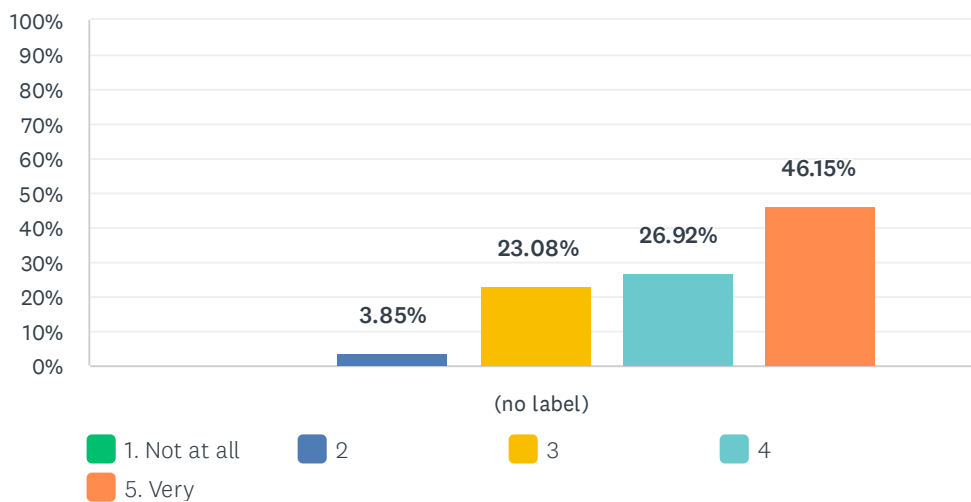
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.85% 1	23.08% 6	26.92% 7	46.15% 12	26	4.15

Q25 The workshop helped me meet people with similar scientific interests

Answered: 26   Skipped: 90
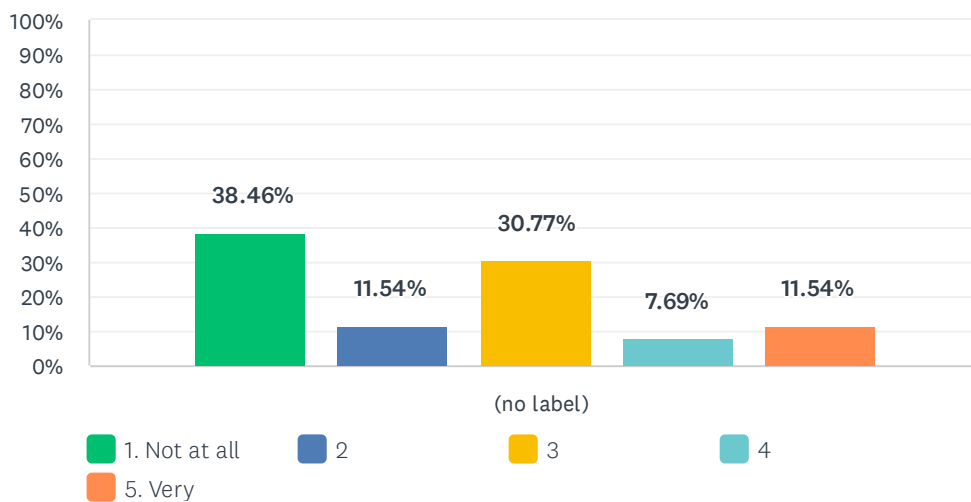
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	38.46% 10	11.54% 3	30.77% 8	7.69% 2	11.54% 3	26	2.42

Q26 What were the highlights of the lectures?

Answered: 26   Skipped: 90

#	RESPONSES	DATE
1	N/A	9/28/2022 1:48 PM
2	There were many enlightening explanations, to mention a few, it was Dusa's 15-mins explanation of what happens in the Abouzaid-Bloomberg preprint, the conceptualisation of different dualities via spectra by Alexander and Anna Marie, and the Mohammed's performance at Q&A	9/27/2022 3:26 PM
3	Stable Homotopy Intro	9/27/2022 11:38 AM
4	The introduction to techniques in stable homotopy theory, and operads were particularly helpful as someone primarily interested in symplectic geometry.	9/27/2022 11:37 AM
5	.	9/27/2022 11:28 AM
6	As an algebraic topologist, I found the series of lectures on Floer foundations very helpful in getting to know the general framework of the subject.	9/25/2022 7:52 PM
7	The zoom chat during the lectures was interesting	9/23/2022 7:48 AM
8	Klang's and Oancea's talks	9/22/2022 2:59 PM
9	Explaining advanced concepts in simple way.	9/21/2022 9:57 AM
10	I liked that they were aimed to cross subfield boundaries.	9/20/2022 3:17 PM
11	The last lectures, about the connection between floear theory and homotopy theory.	9/20/2022 11:29 AM
12	Good overview of fields new to me Passionate speakers Hybrid mode conference, interactive in real time	9/20/2022 6:38 AM
13	The talks themselves were obviously the main highlight, but I found the questions and discussions during and after talks exciting and informative as well.	9/19/2022 6:47 PM
14	The lectures provided an introduction to new connections between my area of expertise and other areas I am less familiar with. This will help me broaden my background and learn more about these less familiar areas.	9/19/2022 4:46 PM
15	The two person system was useful to get more than one hours worth of information on a subject.	9/19/2022 3:07 PM
16	The second Question session on Floer homotopy where Ivan Smith, Ciprian Manolescu, and Mohammed Abouzaid gave insights on Floer homotopy theory was an absolute treasure.	9/19/2022 11:54 AM
17	The series "Loop Spaces and Poincaré Duality Part" was the most beneficial for me. It is very related to the research I am doing and the lecturers gave a broad picture of cohomology of the loop spaces.	9/19/2022 10:42 AM
18	For me, it was the lectures by Dusa McDuff and Chris Wendl. Really enjoyed them!	9/19/2022 10:08 AM
19	The talk by Nate Bottman and the last talk by Anna Marie Bohmann were fantastic.	9/19/2022 9:55 AM
20	Really good interaction between the speakers and the audience.	9/19/2022 9:49 AM
21	I learned some stable homotopy theory	9/19/2022 9:44 AM
22	That they're recorded so that I can revisit them in the future	9/19/2022 9:40 AM
23	The lectures were targeted to starting researchers in this field, which is somehow helpful even for more experienced ones.	9/19/2022 9:33 AM
24	Ivan Smith's discussion during the Q&A session on Thursday evening was wonderful.	9/19/2022 9:33 AM

| 25 | Pontryagin-Thom construction and Floer Homology construction | 9/19/2022 9:29 AM |
| 26 | Dusa McDuff | 9/19/2022 9:28 AM |

Q27 Additional comments

Answered: 5   Skipped: 111

#	RESPONSES	DATE
1	Participate remotely means that I have to continue to do regular duties in my institute, like teaching classes ad holding office hours which happens at the same time as the lectures. As a result, most of the time I'm not watching the lectures live in real time (I only watched 1 live)	9/28/2022 1:48 PM
2	Next time, after asking for questions (in the Q/A forn) replay if the question "accepted", or maybe record the Q/A session (It was frustrating to stay awake until 4 am, to find that my question didn't got an answer)	9/20/2022 11:29 AM
3	I know the technology is still relatively new, but there were times where I had trouble hearing speakers appearing on Zoom. I was attending via Zoom, so I don't know if it was just a programme bug. It seemed like the in-person audience could hear just fine. I tried a variety of methods on my end to address the problem (maxing the volume, attaching external speakers, using headphones), but the sound was still very faint.	9/19/2022 6:47 PM
4	I look forward to the conference "Floer Homtopical Methods in Low Dimensional and Symplectic Topology" scheduled at November. Thank you for a wonderful week.	9/19/2022 11:54 AM
5	Thank you very much for arranging this outstanding set of lectures. It was very nice to hear lecturers from different perspectives that covered a range of perspectives and topics. I felt like I got a really good exposure to the key areas.The Q&A and discussion/ questions were also very helpful. When the videos are posted, I know I will review the videos and notes again and again. Thank you.	9/19/2022 10:08 AM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 25   Skipped: 91
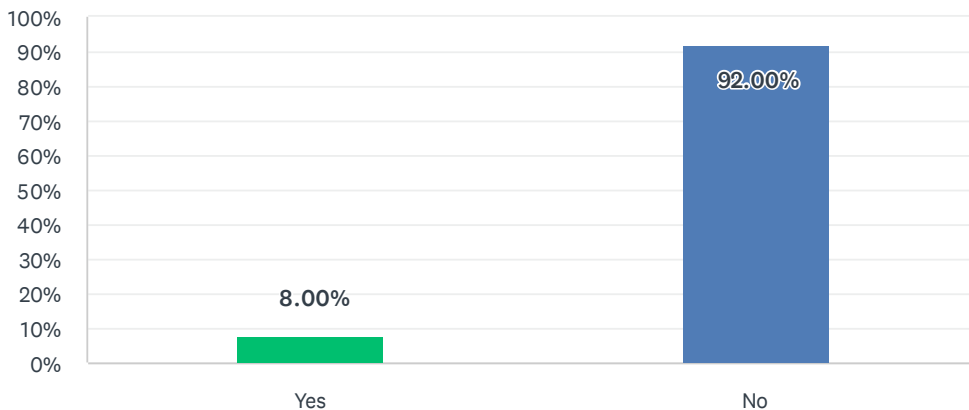
ANSWER CHOICES	RESPONSES	
Yes	8.00%	2
No	92.00%	23
TOTAL		25

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	See prior notes in "additional comments" on 1st page.	9/19/2022 6:57 PM
2	Network connectivity problems	9/19/2022 9:30 AM

Q29 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 25   Skipped: 91

#	RESPONSES	DATE
1	Participate remotely means that I have to continue to do regular duties in my institute, like teaching classes ad holding office hours which happens at the same time as the lectures. As a result, most of the time I'm not watching the lectures live in real time (I only watched 1 live)	9/28/2022 1:48 PM
2	Yeah, In my time zone the talks started at 5pm and could end as late as 2am, which is not the best time to think hard for me. Also, there is only that many questions one can ask during a talk, and there was no natural way to just casually chat with the speakers or other participants	9/27/2022 3:31 PM
3	I did not participate very much, largely because I had other things going on at the same time as the talks.	9/27/2022 3:03 PM
4	Timezone difference was hard.	9/27/2022 11:38 AM
5	It made it significantly easier to attend the workshop by eliminating travel.	9/27/2022 11:38 AM
6	.	9/27/2022 11:28 AM
7	N/A	9/25/2022 7:53 PM
8	Wasn't able to talk to or meet anyone, thus missed out on a lot of interaction	9/22/2022 3:00 PM
9	no.	9/21/2022 10:00 AM
10	The time zone difference was easy for lectures since I am on the east coast. However I was not able to attend the Q&As since they were too late.	9/20/2022 3:18 PM
11	The time differences was challenging, but I manage to see the lecture in live.	9/20/2022 11:37 AM
12	Less personal interactions in remote format	9/20/2022 6:42 AM
13	I wasn't going to get funding to attend, so being able to attend via Zoom made any participation at all on my part possible.	9/19/2022 6:57 PM
14	I was unable to travel to Berkeley at this time, so I was glad to be able to benefit (at least by watching the talks, if not interacting one on one with other researchers) through remote participation.	9/19/2022 4:49 PM
15	It was perfect.	9/19/2022 3:08 PM
16	The time zone difference was an issue, but I could accomodate.	9/19/2022 11:56 AM
17	It was just as usual.	9/19/2022 10:43 AM
18	No-I didn't have any issues. The online format was wonderful! My circumstance was- there is absolutely no way I could have attended in person. The online format really saved the day!	9/19/2022 10:12 AM
19	A 9 hour time difference was a problem. Of coures, missing out on the social interactions between/after talks diminishes the experience.	9/19/2022 9:59 AM
20	Convenience; moreover I think online workshop allows for more attendants.	9/19/2022 9:51 AM
21	It was hard to interact with people and talk about mathematics. There was also a barrier with time zone difference (I'm on ET).	9/19/2022 9:45 AM
22	I wanted to participate in person, but couldn't because of the pandemic	9/19/2022 9:41 AM

23	I live on the East coast. So the timing of the workshop did not always line up nicely with a daily routine. It also went quite late some evenings 9 pm EST	9/19/2022 9:35 AM
24	Time zone difference was the main barrier	9/19/2022 9:30 AM
25	Time zone made it difficult, but not impossible	9/19/2022 9:29 AM

Q30 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 13   Skipped: 103

#	RESPONSES	DATE
1	I don't know of any successful attempts to do that	9/27/2022 3:31 PM
2	There's no good solution for remote workshops, I've been to ones with gathertown, etc. It only works to a small extent	9/22/2022 3:00 PM
3	There was good interaction through chat box.	9/21/2022 10:00 AM
4	Break out room (between the lectures) are not a bad idea (I have good experience with this format). Maybe a kind of "social network" like discord channel /slack will be a good place to create discussions (instead of the zoom chat, which is the worst tool for this need)	9/20/2022 11:37 AM
5	Breakdown room in Zoom maybe helpful; GatherTown avatar game virtual environment may be helpful too.	9/20/2022 6:42 AM
6	I'm assuming "interaction" refers to out-of-auditorium events like networking, tea times, random hallway chatter, and so on. I have no idea how to remedy the online/in person disconnect. Attach some devices to some Roomba vacuums, open Zoom, and let the Roombas loose in the out-of-auditorium events? That's the best I've got.	9/19/2022 6:57 PM
7	I don't know any easy solutions, but I appreciated the conference hosts and others relaying questions from the chat to the speakers; not perfect but it was very helpful.	9/19/2022 4:49 PM
8	I have seen some attmepts by the Gather Town format, but I am not sure that it was effective. Maybe a phototime where online participants turn their camera on for a moment could help.	9/19/2022 11:56 AM
9	Maybe one could have online breakout sessions like in Zoom. For example, Zoom chat rooms.	9/19/2022 10:12 AM
10	A (not very realistic) possibility might be to organise local gathering (say one in Europe, one in Asia) where certain groups of people follow the lectures remotely together.	9/19/2022 9:59 AM
11	Maybe have some kind of online discussion forum for all participants.	9/19/2022 9:45 AM
12	There was no attempt to facilitate any interaction amongst the online participants, or with the online participants and in-person participants. When you set the bar so low, doing anything would be an improvement.	9/19/2022 9:41 AM
13	No. If possible hold workshops in person.	9/19/2022 9:35 AM

Q31 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3   Skipped: 113

#	RESPONSES	DATE
1	I had a great time learning new things and learning new ways to look at old things.	9/19/2022 6:59 PM
2	I know there was someone who said they would post a reading list. That would be really helpful. Also, for future--it would be great to post the reading list ahead of the workshop.	9/19/2022 10:14 AM
3	It would be great if the questions at the end of a talk were also available in the recordings.	9/19/2022 9:59 AM

New Four-Dimensional Gauge Theories
October 24, 2022 – October 28, 2022
Hybrid Workshop

Organizers:

Andriy Haydys (Université Libre de Bruxelles)

Lotte Hollands (Heriot-Watt University, Riccarton Campus)

Eleny-Nicoleta Ionel (Stanford University)

Richard Thomas (Imperial College, London)

Thomas Walpuski (Humboldt-Universität)

REPORT ON THE MSRI WORKSHOP
"New Four-Dimensional Gauge Theories (Hybrid Workshop)"
October 24 – October 28, 2022

Organizers

- Andriy Haydys (Université Libre de Bruxelles)
- Lotte Hollands (Heriot-Watt University, Riccarton Campus)
- Eleny-Nicoleta Ionel (Stanford University)
- Richard Thomas (Imperial College, London)
- Thomas Walpuski (Humboldt-Universität)

Scientific Description

This workshop brought together researchers working on new four-dimensional gauge theories from the perspectives of differential geometry, algebraic geometry, and physics. Over the last 25 years, physicists have made tantalizing conjectures relating the Vafa–Witten equation to modular forms and the Kapustin–Witten and Haydys–Witten equations to knot theory and the geometric Langlands programme. The analytical challenges in the way of establishing these predictions are now being pursued vigorously. More recently, algebraic geometers have had enormous success in confirming and refining Vafa–Witten's predictions for projective surfaces. The workshop served as a platform for reporting on recent progress and exchanging ideas in all of these areas, with the aim of strengthening existing and fostering new interactions.

Highlights of the Workshop

The workshop featured participants and speakers from (broadly speaking) three main topics – geometric analysis, algebraic geometry and physics. There was genuine interaction between these groups, going beyond what we had even hoped for.

Rather than having speakers from each distinct topic talking past each other, we had a number of lectures which operated deeply in all three areas simultaneously (Bousseau, Cherkis, Fredrickson, Tripathy, Zimet) and lectures which combined at least two of the three topics, with links to and motivation from the third (all the other talks). So for example we got to see hard analytical results about hyperkahler metrics described by generating series of enumerative algebraic geometry invariants combined in ways predicted by string theory.

We saw the birth of a new area of study in the intersection of the three areas (holomorphic Floer theory, discussed by Bousseau, Doan and others), we heard of new analytical results, new physics predictions, and new algebro-geometric computations which go significantly beyond what even string theorists dared predict. Inevitably a few talks went beyond the comfort zones of some in the audience but by and large the speakers did a superb job of drawing outsiders into their areas of expertise. The result was a very successful workshop that most participants felt they got a great deal out of.

Organizers

First Name	Last Name	Institution
Andriy	Haydys	Université Libre de Bruxelles
Lotte	Hollands	Heriot-Watt University, Riccarton Campus
Eleny-Nicoleta	Ionel	Stanford University
Richard	Thomas	Imperial College London
Thomas	Walpuski	Humboldt-Universität

Speakers

First Name	Last Name	Institution
Mina	Aganagic	University of California, Berkeley
Pierrick	Bousseau	University of Georgia
Mathew	Bullimore	University of Durham
Sergey	Cherkis	University of Arizona
Aleksander	Doan	Trinity College
Simon	Donaldson	State University of New York, Stony Brook
Laura	Fredrickson	University of Oregon
Sherry	Gong	Texas A&M University
Saman	Habibi Esfahani	MSRI - Mathematical Sciences Research Institute
Siqi	He	Academy of Mathematics and Systems Science
Martijn	Kool	Universiteit Utrecht
Jan	Manschot	Trinity College
Tomasz	Mrowka	Massachusetts Institute of Technology
Ãkos	Nagy	University of California, Santa Barbara
Gregory	Parker	Stanford University
Pavel	Putrov	Abdus Salam International Centre for Theoretical Physics
Arnav	Tripathy	Tsinghua University
Richard	Wentworth	University of Maryland
Max	Zimet	Harvard University

Mathematical Sciences Research Institute

Hybrid Workshop: New Four-Dimensional Gauge Theories

October 24, 2022 - October 28, 2022

Monday, October 24, 2022

9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Simon Donaldson	Overview of Some Appearances of Multivalued Solutions in Differential Geometry
11:00 AM - 12:00 PM	Simons Auditorium	Max Zimet	K3 Surfaces as Gauge-Theoretic Moduli Spaces
2:00 PM - 3:00 PM	Simons Auditorium	Matijn Kool	Vafa-Witten Invariants of Projective Surfaces - Overview
3:30 PM - 4:30 PM	Simons Auditorium	Pierrick Bousseau	Holomorphic Floer Theory and Donaldson-Thomas Invariants

Tuesday, October 25, 2022

9:30 AM - 10:30 AM	Simons Auditorium	Sergey Cherkis	All Gravitational Instantons from Monopole Moduli Spaces
11:00 AM - 12:00 PM	Simons Auditorium	Mina Aganagic	Homological Link Invariants from Mirror Symmetry
2:00 PM - 3:00 PM	Simons Auditorium	Siqi He	Existence and Non-Existence Results of Z2 Harmonic 1-Forms
3:30 PM - 4:30 PM	Simons Auditorium	Aleksander Doan	Holomorphic Floer Theory and the Fueter Equation

Wednesday, October 26, 2022

9:30 AM - 10:30 AM	Simons Auditorium	Tomasz Mrowka	Computations of Instanton Knot Floer Homology with Local Coefficients
11:00 AM - 12:00 PM	Simons Auditorium	Gregory Parker	Concentrating Local Solutions of the Two-Spinor Seiberg-Witten Equations

Thursday, October 27, 2022

9:30 AM - 10:30 AM	Simons Auditorium	Mathew Bullimore	Disconnected Gauge Groups and Categorical Symmetry
11:00 AM - 12:00 PM	Simons Auditorium	Laura Fredrickson	Hyperkahler Metrics Near Semi-Flat Limits
2:00 PM - 3:00 PM	Simons Auditorium	Pavel Putrov	Counting Solutions of Kapustin-Witten Equations on a Three-Manifold Times a Line from Physics Dualities
3:30 PM - 4:30 PM	Simons Auditorium	Ákos Nagy	On the Geometry of G_2-Monopoles and the Donaldson--Segal Program

Friday, October 28, 2022

9:30 AM - 10:30 AM	Simons Auditorium	Arnav Tripathy	Hyperkahler Mirror Symmetry
11:00 AM - 12:00 PM	Simons Auditorium	Jan Manschot	Path Integral Derivations of Vafa-Witten and K-Theoretic Donaldson Invariants
2:00 PM - 3:00 PM	Simons Auditorium	Richard Wentworth	Some Remarks on Yang–Mills Type Equations in Higher Dimensions
3:30 PM - 4:30 PM	Simons Auditorium	Saman Habibi Esfahani	Towards a Monopole Fueter Floer Homology

Identifiable Participants' Information

Participants		142

Gender		142
Male	79.58%	113
Female	18.31%	26
Other	0.70%	1
Declined to state	1.41%	2

Ethnicity*		158
White	43.04%	68
Asian	37.97%	60
Hispanic	4.43%	7
Pacific Islander	0.00%	0
Black	0.63%	1
Native American	0.00%	0
Mixed	5.06%	8
Declined to state	8.86%	14

* ethnicity specifications are not exclusive

There were 16 unidentifiable participants.

Q1 I primarily participated in the workshop:

Answered: 100   Skipped: 0
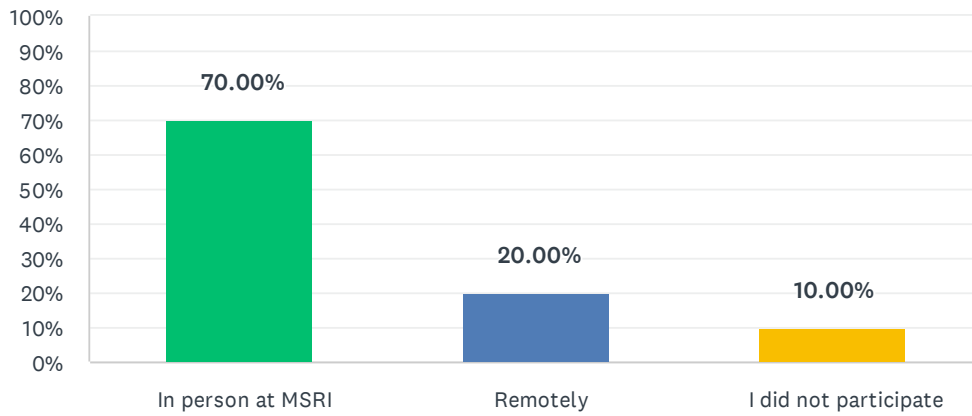
ANSWER CHOICES	RESPONSES	
In person at MSRI	70.00%	70
Remotely	20.00%	20
I did not participate	10.00%	10
TOTAL		100

Q2 The workshop was intellectually stimulating

Answered: 60   Skipped: 40
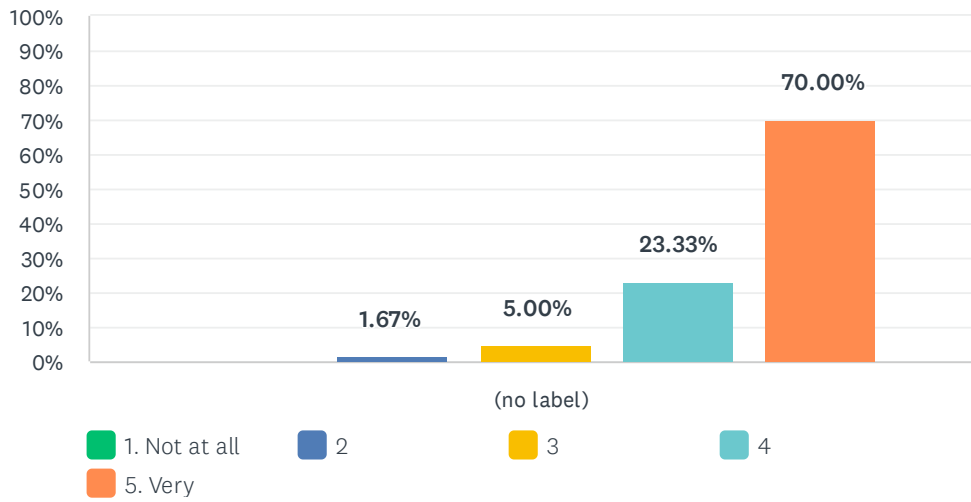
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.67% 1	5.00% 3	23.33% 14	70.00% 42	60	4.62

Q3 The overall experience of the workshop was worthwhile

Answered: 60   Skipped: 40
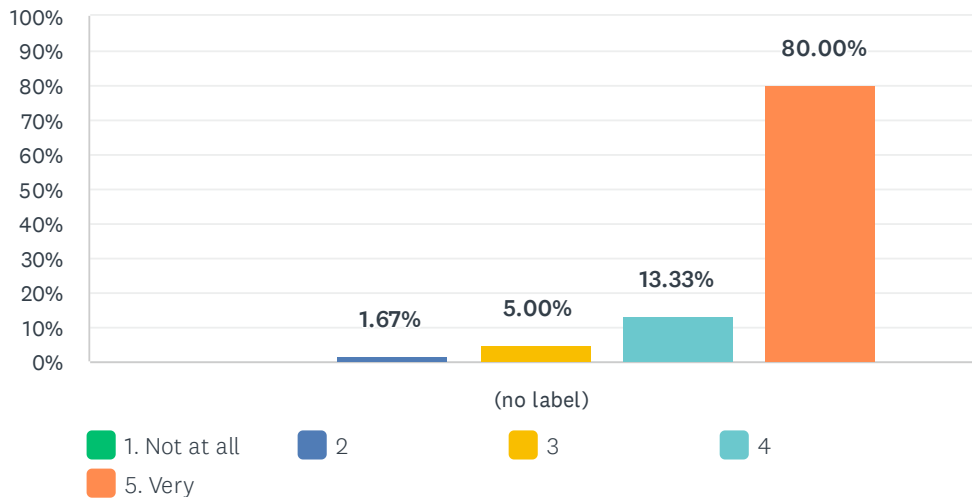
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.67% 1	5.00% 3	13.33% 8	80.00% 48	60	4.72

Q4 The lectures were at an appropriate level

Answered: 60   Skipped: 40

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	1.67% 1	1.67% 1	11.67% 7	33.33% 20	51.67% 31	60	4.32

Q5 I was well prepared to benefit from the lectures

Answered: 60   Skipped: 40

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	1.67% 1	3.33% 2	18.33% 11	28.33% 17	48.33% 29	60	4.18

Q6 My interest in the subject matter was increased by the workshop

Answered: 60   Skipped: 40

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.33% 2	8.33% 5	25.00% 15	63.33% 38	60	4.48

Q7 The workshop helped me meet people with similar scientific interests

Answered: 60   Skipped: 40

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.67% 1	3.33% 2	16.67% 10	78.33% 47	60	4.72

Q8 What were the highlights of the lectures?

Answered: 60   Skipped: 40

#	RESPONSES	DATE
1	Every moment.	11/9/2022 9:52 AM
2	Talks by Simon Donaldson, Martijn Kool, Siqi He, Greg Parker	11/8/2022 2:05 PM
3	I am not sure about how to interpret this question, as the word highlight has multiple meanings.	11/8/2022 1:33 PM
4	Clear explanations of physical concepts to us mathematicians.	11/8/2022 1:00 PM
5	The discussions were stimulating. Laura's handout notes were a nice touch!	11/8/2022 12:34 PM
6	The hybrid format worked very well.	11/8/2022 11:07 AM
7	Did not participate	11/8/2022 10:31 AM
8	Doan's lecture	11/8/2022 10:25 AM
9	Overview talks	11/8/2022 10:14 AM
10	?	11/3/2022 3:40 PM
11	Seeing members that I've gotten to know during the program speak bout their own work in detail. Also Selman's tweets.	11/3/2022 9:48 AM
12	I enjoy talking with people in the workshop.	11/3/2022 9:25 AM
13	.	11/3/2022 7:26 AM
14	..	11/2/2022 10:13 PM
15	Fredrickson's talk	11/2/2022 9:19 PM
16	Computations of Instanton Knot Floer Homology with Local Coefficients Tomasz Mrowka	11/2/2022 9:13 PM
17	It was great there there were themes (ALE manifolds, higher dimensional gauge theories) that were the subject of several related lectures	11/2/2022 7:59 PM
18	Interacting with the audience.	11/2/2022 6:42 PM
19	talks are all great! well prepared and inspiring.	11/2/2022 5:38 PM
20	The mix of in person and hybrid speakers	11/2/2022 5:16 PM
21	The content	11/2/2022 5:08 PM
22	Gregory Parker	11/2/2022 5:07 PM
23	-	11/2/2022 5:04 PM
24	I only attended two lectures.	11/2/2022 4:53 PM
25	All lectures were great	11/2/2022 4:48 PM
26	-	11/2/2022 4:27 PM
27	All the lectures were stimulating.	11/2/2022 4:23 PM
28	The lectures of Donaldson and Mrowka	11/2/2022 4:19 PM
29	-	11/2/2022 4:18 PM
30	The variety of topics covered and the interrelations between the various talks were the key highlights for me	11/1/2022 9:29 PM
31	Laura Anderson's lecture.	11/1/2022 12:03 PM

32	The talks complemented each other very well.	10/31/2022 7:16 AM
33	Great mix of topics and expertise.	10/31/2022 2:58 AM
34	The speakers did a great job showing how their work related to the work of others at the workshop. I particularly enjoyed Aleksander Doan's talk.	10/29/2022 8:11 PM
35	seeing Simon Donaldson	10/29/2022 5:53 PM
36	Learning about new perspectives on my subject area, and about current directions of research	10/29/2022 12:32 PM
37	there were a lot of interesting talks eg by Donaldson, Cherkis, Doan, Saman, etc	10/29/2022 11:03 AM
38	the content	10/29/2022 9:25 AM
39	Learning about how other subfields formulate and approach topics I have studied from one particular perspective.	10/29/2022 8:41 AM
40	The talk schedule is appropriate so that people have plenty of time for discussion.	10/29/2022 6:22 AM
41	I think there were some interesting details concerning the analysis related to the gauge theory problems.	10/28/2022 11:18 PM
42	The most interesting for me were talks by Donaldson, Aganagic, Mrowka, Putrov.	10/28/2022 10:38 PM
43	The lectures by Donaldson, Mrowka, and Zimet.	10/28/2022 10:32 PM
44	Doan's talk.	10/28/2022 9:50 PM
45	Donaldson's talk.	10/28/2022 9:26 PM
46	The talks of Doan, Cherkis, and Parker	10/28/2022 9:18 PM
47	Greg Parker, Siqi He, Ákos Nagy	10/28/2022 9:15 PM
48	Holomorphic floer	10/28/2022 8:14 PM
49	State-of-the-art, well-organized, well-timed, hybrid structure seemed to work	10/28/2022 7:36 PM
50	Knowing hot problems in gauge theory and interesting approaches to find new invariatnts.	10/28/2022 7:12 PM
51	Tom Mrowka' talk	10/28/2022 7:06 PM
52	Introductory ideas for studying G_2 manifolds, Donaldson's survey lecture New proof of the Bogomolov-Gieseker inequality	10/28/2022 5:45 PM
53	Repeated themes in lectures, connected by collaborators showing different aspects of a body of work.	10/28/2022 5:26 PM
54	For me the most interesting talks were the one by Donaldson (surveying the appearance of multivalued solutions in many diff geom contexts), the one by Siqi He (explaining in detail an instance of what Donaldson mentioned) and the one by Richard Wentworth (about a diff geom proof of theorems from alg geom for normal projective varieties).	10/28/2022 5:01 PM
55	For me, interesting work of young mathematicians.	10/28/2022 4:57 PM
56	Learned a lot from speakers and get to know many friends!	10/28/2022 4:55 PM
57	Donaldson's, Doan's and Esfahani's talks	10/28/2022 4:50 PM
58	Great selection of speakers. Really highlighted some recent advances in the field.	10/28/2022 4:50 PM
59	Well prepared, interesting, schedule well organised, topics well connected.	10/28/2022 4:49 PM
60	The talk is of high quality	10/28/2022 4:48 PM

Q9 Additional comments

Answered: 5   Skipped: 95

#	RESPONSES	DATE
1	I found the physics talks hard to follow	11/8/2022 2:05 PM
2	n/a	11/8/2022 12:34 PM
3	The local expenses are high. It is better to have higher reimbursement amount.	11/3/2022 9:25 AM
4	during several talks, the main/central projector did not project some features on the slides (shading, fainter parts of pictures, etc) so it was hard to follow the talk. It seems that the 2 side projectors were fine.	10/29/2022 11:03 AM
5	One of the best conferences I've been to in quite some time!	10/28/2022 4:50 PM

Q10 I found the MSRI staff helpful

Answered: 59   Skipped: 41

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	3.39% 2	1.69% 1	91.53% 54	3.39% 2	59	4.91

Q11 The MSRI facilities were conducive for such a workshop

Answered: 59   Skipped: 41
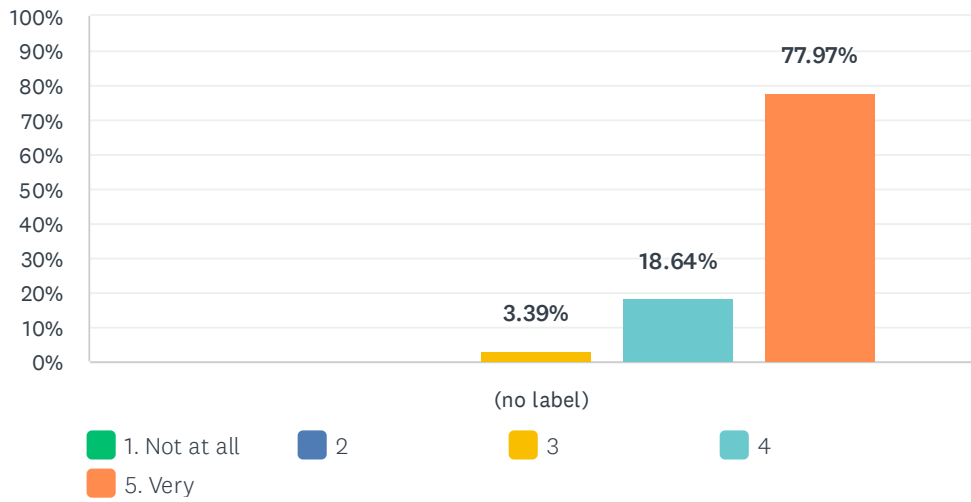
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	3.39% 2	18.64% 11	77.97% 46	59	4.75

Q12 Did you use MSRI's wireless network?

Answered: 59   Skipped: 41
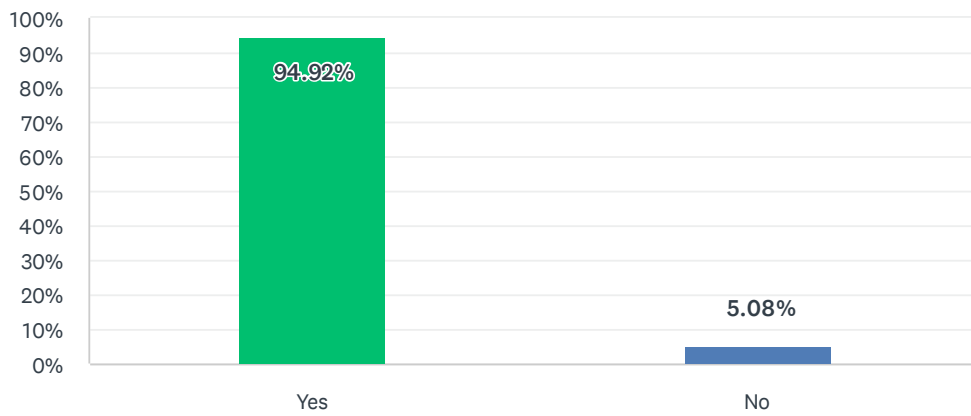
ANSWER CHOICES	RESPONSES	
Yes	94.92%	56
No	5.08%	3
TOTAL		59

Q13 Did you experience any difficulties with the network?

Answered: 59   Skipped: 41
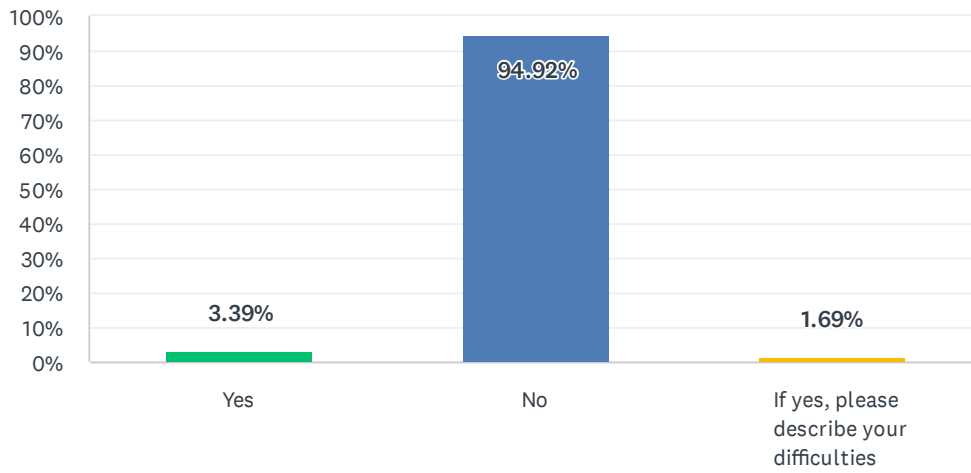
ANSWER CHOICES	RESPONSES	
Yes	3.39%	2
No	94.92%	56
If yes, please describe your difficulties	1.69%	1
TOTAL		59

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	I was unable to get on the internet	11/2/2022 8:00 PM

Q14 The MSRI lunch arrangements were satisfactory

Answered: 59   Skipped: 41

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	1.69% 1	8.47% 5	13.56% 8	27.12% 16	40.68% 24	8.47% 5	59	4.06

Q15 The MSRI tea arrangements were satisfactory

Answered: 59   Skipped: 41
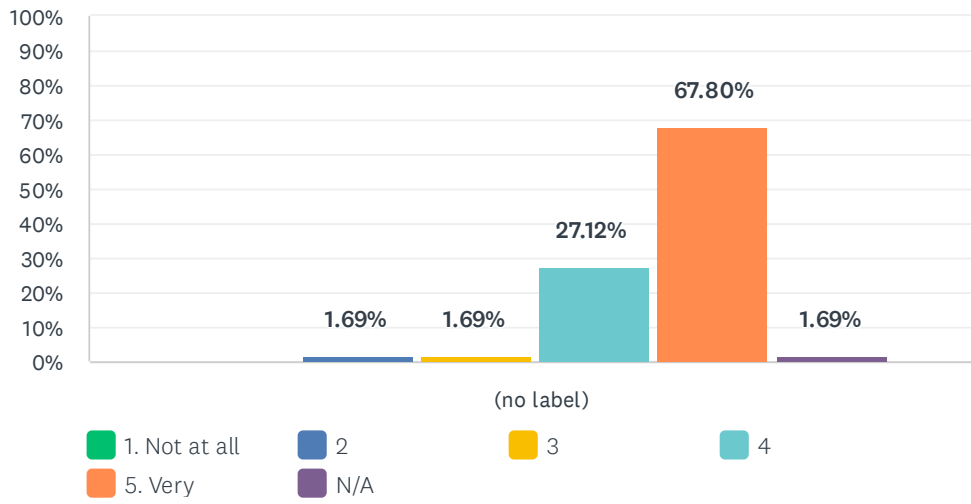
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.69% 1	1.69% 1	27.12% 16	67.80% 40	1.69% 1	59	4.64

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 13   Skipped: 87

#	RESPONSES	DATE
1	n/a	11/8/2022 12:34 PM
2	Lunch was really badly delayed one day, to the point of being a major disruption. Also, there aren't enough microwaves for the frozen lunches (someone said there used to be three but that one broke & wasn't replaced?).	11/8/2022 10:27 AM
3	Everybody is doing an excellent job! Thank you!	11/2/2022 4:53 PM
4	Very nice and helpful all around	11/2/2022 4:20 PM
5	On the catering dinner, information on the ingredients of the food (vegan/vegetarian) would be helpful. And more vegetarian /vegan options are always welcome!	11/2/2022 4:20 PM
6	The food could be a bit better.	11/1/2022 12:04 PM
7	All the MSRI staff are very helpful and nice. The tea is a highlight.	10/29/2022 8:12 PM
8	great environment for workshops/collaborations/research	10/29/2022 11:04 AM
9	The food was very late, I do not think the options are that great, and the arrangements for tea are not adequate for a larger group.	10/28/2022 11:19 PM
10	It should be made clearer that lunch needs to be ordered in advance (and made clearer before the first day of the workshop)	10/28/2022 9:19 PM
11	Lactose free milk is much appreciated! I suggest maybe having some warm/hot milk available as well.	10/28/2022 5:27 PM
12	The quality of the restaurants delivering lunches on Thursday and Friday are somewhat below those delivering on Monday-Wednesday	10/28/2022 4:59 PM
13	Can you please change the restaurants who deliver? I know it's difficult to find places that deliver, but some variety would be really nice ...	10/28/2022 4:50 PM

Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 6   Skipped: 94

#	RESPONSES	DATE
1	n/a	11/8/2022 12:34 PM
2	I was surprised that there were only two female speakers (I don't know whether some speakers cancelled or sth).	11/8/2022 10:27 AM
3	The main projector in the Simons Auditorium clearly has a problem with reproducing the slides faithfully.	11/2/2022 9:20 PM
4	It was a great workshop!	10/31/2022 2:59 AM
5	n/a	10/29/2022 11:04 AM
6	Lunch only could be paid using paypal, which was a problem as I don't use it. Maybe by debit card or credit card would have been more useful.	10/28/2022 7:13 PM

Q18 I found the MSRI staff helpful
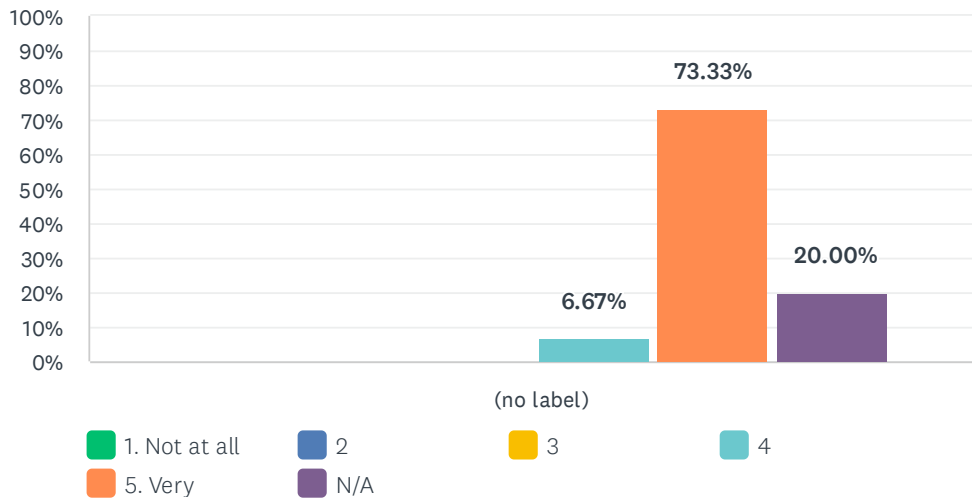
Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	6.67% 1	73.33% 11	20.00% 3	15	4.92

Q19 How many talks did you watch live?

Answered: 15   Skipped: 85
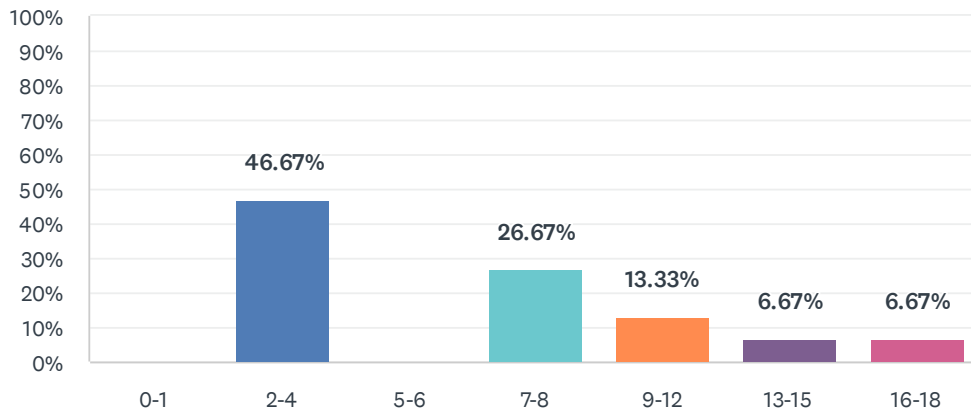
ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	46.67%	7
5-6	0.00%	0
7-8	26.67%	4
9-12	13.33%	2
13-15	6.67%	1
16-18	6.67%	1
TOTAL		15

Q20 The workshop was intellectually stimulating

Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	13.33% 2	20.00% 3	66.67% 10	15	4.53

Q21 The overall experience of the workshop was worthwhile

Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.67% 1	13.33% 2	13.33% 2	66.67% 10	15	4.40

Q22 The lectures were at an appropriate level

Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	26.67% 4	26.67% 4	46.67% 7	15	4.20

Q23 I was well prepared to benefit from the lectures

Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	13.33% 2	20.00% 3	26.67% 4	40.00% 6	15	3.93

Q24 My interest in the subject matter was increased by the workshop

Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.67% 1	13.33% 2	40.00% 6	40.00% 6	15	4.13

Q25 The workshop helped me meet people with similar scientific interests

Answered: 15   Skipped: 85

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	26.67% 4	0.00% 0	26.67% 4	20.00% 3	26.67% 4	15	3.20

Q26 What were the highlights of the lectures?

Answered: 15   Skipped: 85

#	RESPONSES	DATE
1	For me these were the talks by Fredrickson, Putrov, Bullimore and Tripathy.	11/9/2022 8:30 AM
2	Talks on Z2 harmonic spinors	11/8/2022 10:41 AM
3	Can't say	11/8/2022 10:15 AM
4	Learned about interesting directions in gauge theory	11/8/2022 10:14 AM
5	Interesting talks	11/4/2022 5:18 AM
6	The lectures were very clear	11/2/2022 11:21 PM
7	Tom's talk	11/2/2022 7:36 PM
8	Wide range of topics.	10/31/2022 7:17 AM
9	The description of multi valued harmonic maps by S. K. Donaldson.	10/30/2022 2:16 PM
10	Martijn Kool and Richard Wentworth's talks	10/30/2022 3:10 AM
11	Lecture recording were very impressive with smooth transition from slides to the blackboard.	10/29/2022 8:37 AM
12	interesting	10/29/2022 7:22 AM
13	Detailed explanation regarding many aspects of Gauge theories	10/29/2022 5:14 AM
14	Cherkin's and Mrowka's lectures.	10/28/2022 7:43 PM
15	advancing our understanding importantly	10/28/2022 5:57 PM

Q27 Additional comments

Answered: 3   Skipped: 97

#	RESPONSES	DATE
1	Although it is possible to enjoy the talks from a distance, the current hybrid setting is rather formal and discourages interaction between the in-person and online audiences. I think this is an important challenge for the MSRI to overcome.	11/9/2022 8:30 AM
2	It would be nice if the recorded lectures contained the questions and answers at the end	11/8/2022 10:41 AM
3	I appreciated chatting with Cherkin about an idea that I had of "fibring" his construction over the moduli space \M_1,0 of conformal structures (a.k.a. flat tori with area 1)....	10/28/2022 7:43 PM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 15   Skipped: 85
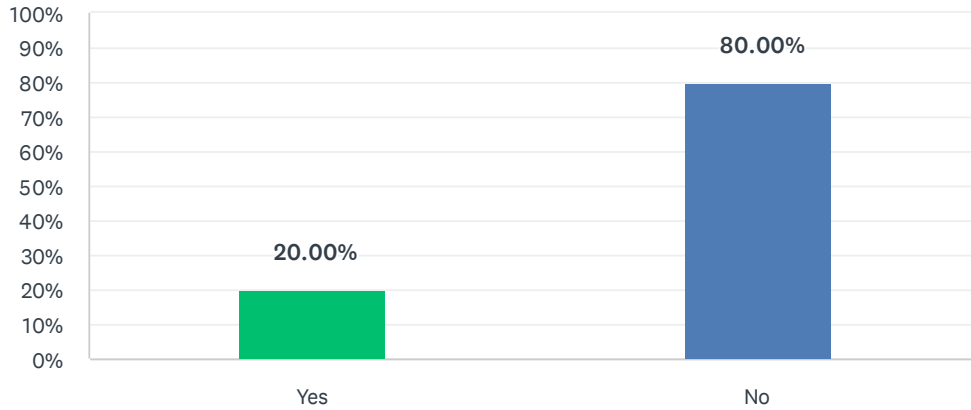
ANSWER CHOICES	RESPONSES	
Yes	20.00%	3
No	80.00%	12
TOTAL		15

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Communicating with other participants is not encouraged with the current setup.	11/9/2022 8:38 AM
2	The difficulties were essentially at the level of the bad quality of my local network connection.	10/30/2022 2:37 PM

Q29 How did attending the workshop remotely impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 15 Skipped: 85

#	RESPONSES	DATE
1	It is difficult to interact with other participants.	11/9/2022 8:38 AM
2	Time zones meant I could only attend the morning talks	11/8/2022 10:43 AM
3	It was fine	11/8/2022 10:17 AM
4	Yes, time zone difference was an issue	11/8/2022 10:15 AM
5	Due to the eight hour timezone difference it was impossible to follow all the talks and hard to join for the first ones.	11/4/2022 5:20 AM
6	The difference in time zone was a bit of a problem	11/2/2022 11:22 PM
7	Missed some talks due to personal reasons (but at least listened some talks)	11/2/2022 7:37 PM
8	No effect.	10/31/2022 7:17 AM
9	It was great to participate remotely since the deadline for a physical attendance was passed when I registered.	10/30/2022 2:37 PM
10	the time zone difference was a bit tough	10/30/2022 3:11 AM
11	Personal circumstances prevented me from attending in person. I am grateful that I could attend via Zoom.	10/29/2022 8:38 AM
12	I can not talk in person. Time zone is another problem.	10/29/2022 7:23 AM
13	Time zone difference was the main barrier	10/29/2022 5:14 AM
14	It was disappointing to not be able to discuss with in-person participants (Cherkin was also on Zoom, so that made out chat easy).	10/28/2022 7:52 PM
15	time zone differences make me hard to participate many lectures.	10/28/2022 5:58 PM

Q30 One important aspect that was missing due to the hybrid format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops in a hybrid format?

Answered: 7   Skipped: 93

#	RESPONSES	DATE
1	One could encourage discussions after talks where online participants can contribute as well, or plan separate hybrid discussion sessions. One could have portals in lounge areas where in-person participants can chat to online participants.	11/9/2022 8:38 AM
2	No	11/8/2022 10:43 AM
3	At the time for questions after the talk, perhaps the host for the session could choose a moment to explicit prompt and ask whether there are questions from the remote members of the audience.	11/8/2022 10:17 AM
4	Avoid hybrid conferences	11/8/2022 10:15 AM
5	Organise them in person.	11/4/2022 5:20 AM
6	It will be good, I think, to incite people to get in touch, by creating some online discussion rooms, according to subjects covered by the workshop. Or allow some participants to continue online discussion with the lecturers, if time permits.	10/30/2022 2:37 PM
7	It seems like you had remote participants appear on a Zoom screen to the side of the boards, but maybe there's a practical way to get in-person participants to also be identified on Zoom so that they can be engaged in something like Zoom chat to initiate further Zoom discussion between remote and in-person folks?	10/28/2022 7:52 PM

Q31 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1   Skipped: 99

#	RESPONSES	DATE
1	Put the after talk questions in the recordings	11/8/2022 10:44 AM

Modern Math Workshop 2022
October 26, 2022 – October 27, 2022
Hybrid Workshop

Organizers:

Hélène Barcelo (MSRI - Mathematical Sciences Research Institute)

Philip Hammer (Institute for Mathematical and Statistical Innovation)

Christian Ratsch (University of California, Los Angeles; Institute of Pure and Applied Mathematics (IPAM))

Ulrica Wilson (Morehouse College; Institute for Computational and Experimental Research in Mathematics (ICERM))

REPORT ON THE MSRI WORKSHOP
"Modern Math Workshop 2022"
October 26 – October 27, 2022

Organizers

- Hélène Barcelo (Mathematical Sciences Research Institute - MSRI)
- Philip Hammer (Institute for Mathematical and Statistical Innovation - IMSI)
- Christian Ratsch (University of California, Los Angeles; Institute of Pure and Applied Mathematics - IPAM)
- Ulrica Wilson (Morehouse College; Institute for Computational and Experimental Research in Mathematics - ICERM)

Scientific Description

As part of the Mathematical Sciences Collaborative Diversity Initiatives, the six NSF-funded U.S. mathematics institutes hosted their annual SACNAS pre-conference event, the 2022 Modern Math Workshop (MMW). The Modern Math Workshop encourages undergraduates from underrepresented groups to pursue careers in the mathematical sciences, and builds research and networking opportunities among undergraduates, graduate students and recent PhDs.

The workshop includes two mini-courses aimed at undergraduates, research sessions aimed at graduate students and recent PhDs, a panel addressing professional issues of interest to both, a networking reception open to all participants, as well as a plenary talk.

Highlights of the Workshop

Professors Moon Duchin (Tufts University), David Uminsky (University of Chicago), and Mario Banuelos (California State University, Fresno) delivered two timely and popular minicourses on topics at the forefront of applied mathematics:

1) *Modeling Democracy (with Geometry and Probability)*
2) *Mathematics of Data Science: Theory & Practice*

In addition, early-career mathematicians who had visited the MSIDI institutes were invited to speak about their research and experiences at the institutes.

1) Mathilde Gerbelli-Gauthier (Institute for Advanced Study): *Growth of cohomology in towers of manifolds: topology meets the Langlands program*
2) Leyda Almodóvar Velázquez (Stonehill College – ICERM): *DNA Self-Assembly: Computational Complexity and Pragmatic Solutions*
3) Gokce Dayanikli (Princeton University - IMSI): *Utilizing Power of Mathematics and Game Theory in Policy Making*

4) Rolando de Santiago (Purdue University - IPAM): *Quantum Chromatic Numbers and the Lexicographical Product of Quantum Graphs*
5) Therese-Marie Basa Landry (University of California, Santa Barbara - MSRI): *Developments in Noncommutative Fractal Geometry*

These presentations were very well-received, introducing attendees to new areas of research and prompting a number of discussions.

At the conclusion of day 1, the panel on "Thriving in Graduate School, Personally and Professionally" led by Federico Ardila (San Francisco State University) took place with active participation from attendees. This was followed by a networking reception with support from the American Mathematical Society (AMS) and the Society for Industrial and Applied Mathematics (SIAM). Each Institute hosted a table with information about their scientific activities which were likely to be of interest to the participants. This event was quite successful as the students and early career researchers were particularly excited about possible opportunities.

Day 2 of the workshop culminated in a plenary address by Leona Harris, Director of Equity, Diversity, and Inclusion at the AMS, entitled "Maximizing Your Professional Engagement to Bolster the Success of Your Mathematics Career and Using Your Voice to Shape the Profession." The conference room was full to capacity with a highly engaged audience, and the question and answer session lasted for more than an hour!

Further details of talks and activities may be found on the conference website.

Organizers

First Name	Last Name	Institution
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Philip	Hammer	Institute for Mathematical and Statistical Innovation
Christian	Ratsch	University of California, Los Angeles
Ulrica	Wilson	Morehouse College

Speakers

First Name	Last Name	Institution
Leyda	Almodóvar Velázquez	Stonehill College
Federico	Ardila	San Francisco State University
Mario	Banuelos	California State University, Fresno
Gokce	Dayanikli	Columbia University
Rolando	de Santiago	Purdue University
Moon	Duchin	Tufts University
Mathilde	Gerbelli-Gauthier	Institute for Advanced Study
Leona	Harris	American Mathematical Society
Therese-Marie Basa	Landry	University of California, Santa Barbara
David	Uminsky	University of Chicago

Mathematical Sciences Research Institute

Modern Math Workshop
October 26 - October 27, 2022

Wednesday, October 26, 2022		
12:00 PM - 12:45 PM		Registration
12:45 PM - 1:00 PM		Welcome
1:00 PM - 4:15 PM	Moon Duchin	Undergraduate Minicourse: Modeling Democracy (with Geometry and Probability)
1:00 PM - 4:15 PM	Mario Banuelos & David Uminsky	Undergraduate Minicourse: Mathematics of Data Science: Theory & Practice
1:00 PM - 1:40 PM	Mathilde Gerbelli-Gauthier	Growth of Cohomology in Towers of Manifolds: Topology meets the Langlands Program
1:45 PM - 02:25 PM	Leyda Almodóvar Velázquez	DNA Self-Assembly: Computational Complexity and Pragmatic Solutions
2:30 PM - 2:45 PM		Break
2:45 PM - 3:25 PM	Gökçe Dayanıklı	Utilizing Power of Mathematics and Game Theory in Policy Making
3:30 PM - 4:30 PM	Federico Ardila	Panel Discussion: Thriving in Graduate School, Personally and Professionally
4:30 PM - 6:00 PM		Modern Math Workshop Reception

Thursday, October 27, 2022		
8:45 AM - 9:15 AM		Coffee and Pastries
9:15 AM - 9:55 AM	Ronaldo de Santiago	Quantum Chromatic Numbers and the Lexicographical Product of Quantum Graphs
10:00 AM - 10:40 AM	Therese-Marie Basa Landry	Developments in Noncommutative Fractal Geometry
10:40 AM - 11:00 AM		Break
11:00 AM - 12:00 PM	Leona Harris	Maximizing Your Professional Engagement to Bolster the Success of Your Mathematics Career and Using Your Voice to Shape the Profession

Identifiable Participants' Information

Participants		**114**

Gender		**114**
Male	41.23%	47
Female	44.74%	51
Other	1.75%	2
Declined to state	12.28%	14

Ethnicity*		**158**
White	15.82%	25
Asian	6.96%	11
Hispanic	38.61%	61
Pacific Islander	1.27%	2
Black	12.03%	19
Native American	1.27%	2
Mixed	13.29%	21
Declined to state	10.76%	17

* ethnicity specifications are not exclusive

Q1 Was this your first time attending the Modern Math Workshop?

Answered: 60   Skipped: 0
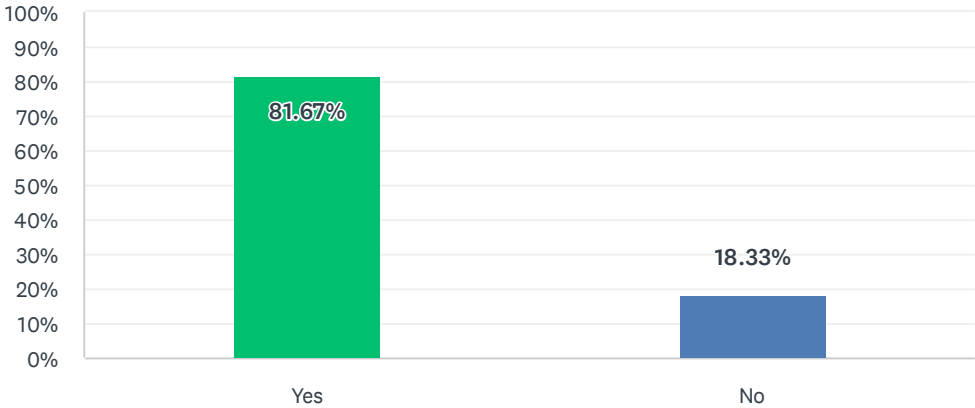
ANSWER CHOICES	RESPONSES	
Yes	81.67%	49
No	18.33%	11
TOTAL		60

Q2 What is your primary field or discipline? (choose one)

Answered: 57   Skipped: 3
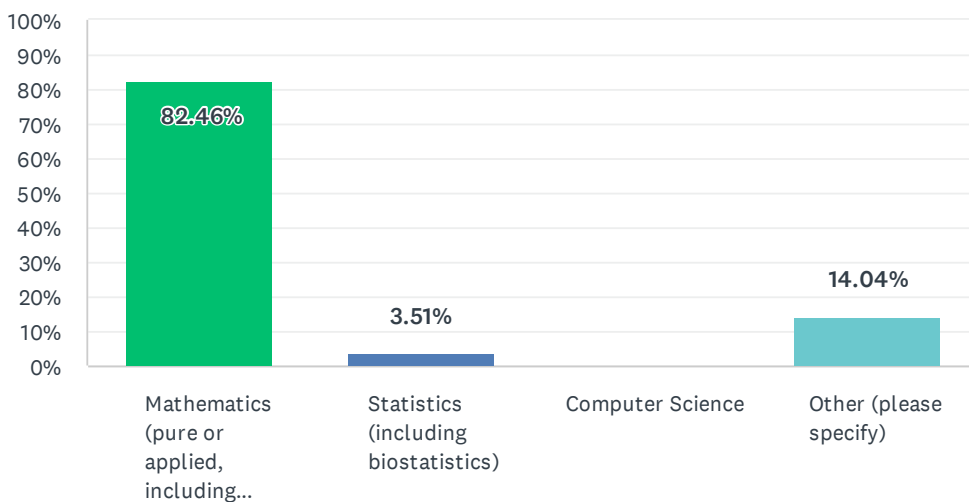
ANSWER CHOICES	RESPONSES	
Mathematics (pure or applied, including biomath)	82.46%	47
Statistics (including biostatistics)	3.51%	2
Computer Science	0.00%	0
Other (please specify)	14.04%	8
TOTAL		57

#	OTHER (PLEASE SPECIFY)	DATE
1	Physics	11/8/2022 6:13 PM
2	Chemical Engineering and Genetics	11/6/2022 12:33 PM
3	Mathematics Education	11/2/2022 2:37 PM
4	Engineering	11/2/2022 9:06 AM
5	Biochemistry	11/1/2022 8:17 PM
6	Neural Science	11/1/2022 4:58 PM
7	Data Science	11/1/2022 3:09 PM
8	physics	11/1/2022 3:05 PM

Q3 Your status or position at the time of the conference:

Answered: 57   Skipped: 3
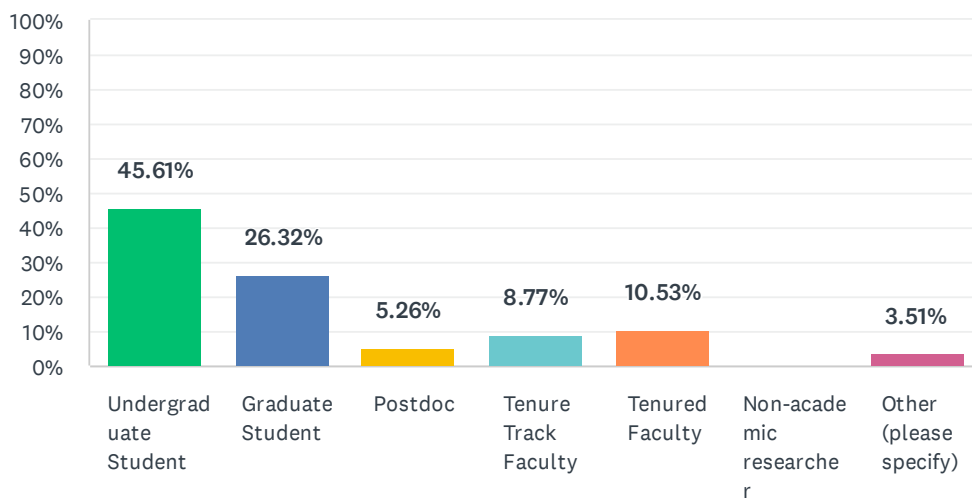
ANSWER CHOICES	RESPONSES	
Undergraduate Student	45.61%	26
Graduate Student	26.32%	15
Postdoc	5.26%	3
Tenure Track Faculty	8.77%	5
Tenured Faculty	10.53%	6
Non-academic researcher	0.00%	0
Other (please specify)	3.51%	2
TOTAL		57

#	OTHER (PLEASE SPECIFY)	DATE
1	post-bac	11/6/2022 12:33 PM
2	Policy (researcher assistant)	11/1/2022 3:18 PM

Q4 How would you rate the following sessions or features of the conference? (if you did not attend the session, please select N/A)

Answered: 55   Skipped: 5
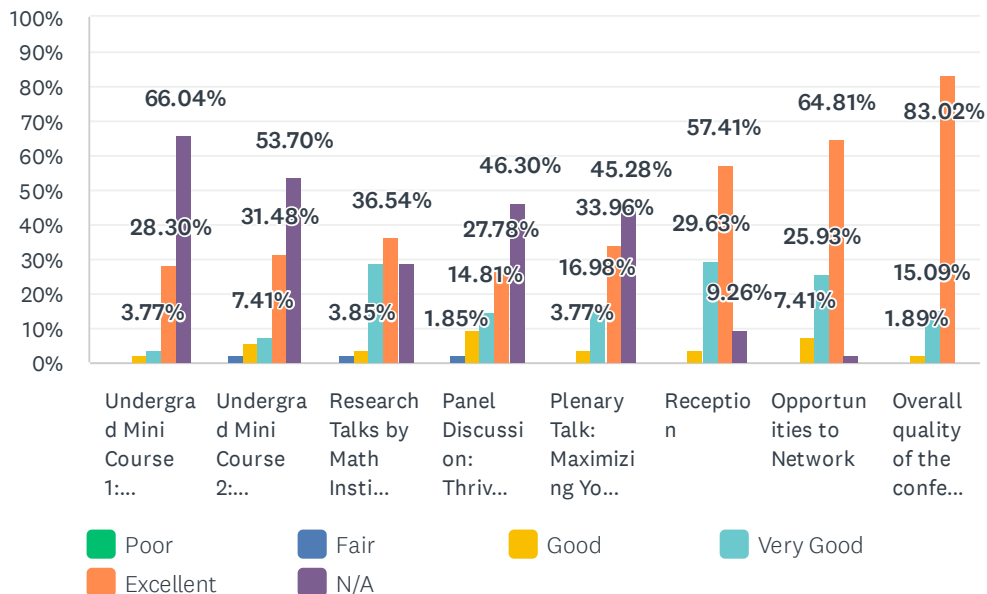
	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT	N/A	TOTAL	WEIGHTED AVERAGE
Undergrad Mini Course 1: Modeling Democracy (with Geometry and Probability) by Moon Duchin	0.00% 0	0.00% 0	1.89% 1	3.77% 2	28.30% 15	66.04% 35	53	4.78
Undergrad Mini Course 2: Mathematics of Data Science: Theory & Practice by Mario Banuelos and David Uminsky	0.00% 0	1.85% 1	5.56% 3	7.41% 4	31.48% 17	53.70% 29	54	4.48
Research Talks by Math Institutes	0.00% 0	1.92% 1	3.85% 2	28.85% 15	36.54% 19	28.85% 15	52	4.41
Panel Discussion: Thriving in Graduate School	0.00% 0	1.85% 1	9.26% 5	14.81% 8	27.78% 15	46.30% 25	54	4.28
Plenary Talk: Maximizing Your Professional Engagement to Bolster the Success of Your Mathematics Career and Using Your Voice to Shape the Profession by Leona Harris	0.00% 0	0.00% 0	3.77% 2	16.98% 9	33.96% 18	45.28% 24	53	4.55
Reception	0.00% 0	0.00% 0	3.70% 2	29.63% 16	57.41% 31	9.26% 5	54	4.59
Opportunities to Network	0.00% 0	0.00% 0	7.41% 4	25.93% 14	64.81% 35	1.85% 1	54	4.58
Overall quality of the conference	0.00% 0	0.00% 0	1.89% 1	15.09% 8	83.02% 44	0.00% 0	53	4.81

#	COMMENTS	DATE
1	N/A	11/2/2022 2:38 PM

2	Had a great time!! Lovely reception (delicious), and enjoyed meeting lots of people.	11/2/2022 1:42 PM
3	Structuring Network opportunities would be helpful. EG, having a lunch, having us sit with new people for at least one meal, and guiding conversations with prompts.	11/2/2022 8:22 AM
4	Always enjoy this event, thank you!	11/2/2022 6:49 AM
5	Federico's questions on the panel were *chef's kiss*.	11/2/2022 6:47 AM
6	I really enjoyed the Modern Math Workshop. This workshop is the reason why I apply to come to SACNAS.	11/1/2022 5:01 PM
7	Thank you for giving me this opportunity!	11/1/2022 4:44 PM
8	Wonderful conference! I was really hoping for IAS people in the reception though :(	11/1/2022 3:23 PM
9	I know food is really hard to do but maybe choosing local food would be beneficial and positive for everyone, being socially aware	11/1/2022 3:16 PM
10	Excellent conference! Can't wait to go to the Modern Math Workshop next year!	11/1/2022 3:07 PM

Q5 If you attended one of the undergraduate mini-courses listed above, please tell us what you did and did not like about it. We welcome your suggestions for improvement.

Answered: 23   Skipped: 37

#	RESPONSES	DATE
1	I appreciate that Moon went very slowly and made sure that students understood everything.	11/9/2022 3:17 AM
2	I really enjoyed the event and I enjoyed the refreshments . The talks were amazing and very informational. One improvement could be the lack of seating at the reception but I enjoy the whole thing over all a once in a lifetime experience. Thank you!!	11/8/2022 6:16 PM
3	I loved how interactive the mini-course that I took was. Honestly, I have no negative feedback. I specially enjoyed the graph theory aspects of this talk.	11/8/2022 11:05 AM
4	I thoroughly enjoyed Professor Duchin's talk and the engagement levels of the talk. From the beginning of the talk, we all introduced ourselves and it made the experience a lot more personal and engaging. I also enjoyed how much participation there was from the audience and the more personal aspects of Professor Duchin's talk. I was very inspired by her talk and will be looking more into her works.	11/8/2022 10:33 AM
5	Overall, it was enjoyable and engaging	11/8/2022 10:25 AM
6	I enjoyed the environment set up because it allowed everyone to be engaged. I wish there was an easier way to disseminate contact info to others and get peoples emails.	11/5/2022 10:40 AM
7	I really enjoyed Moon Duchin's course. The examples were plentiful, she was engaging and friendly, and of course the material is crucial. I don't see much room for improvement.	11/3/2022 1:26 PM
8	I liked how it was interactive and they had us do some math but we were not made aware that we would need writing materials. I also did not like that I could not attend both mini-courses.	11/2/2022 6:33 PM
9	I thought we would complete mathematic problem.	11/2/2022 2:38 PM
10	Dr. Duchin was amazing. It was really great to hear someone doing something so impactful with math that I understood.	11/2/2022 9:17 AM
11	We really needed tables to work on since these were meant to be a course, so notes were being taken. It also would have encouraged more questions I think.	11/2/2022 8:22 AM
12	Honestly it was a great style from coding back to conceptual mathematics.	11/2/2022 7:46 AM
13	I participated in the mini course 2: Mathematics of Data Science. I really enjoyed it. I have to admit that coming from a biochemistry background I was not expecting to understand as much as I did. The presentation was very engaging and the speakers were AMAZING teachers. I loved it and I highly recommend this mini-course to my peers.	11/1/2022 8:21 PM
14	it was very good, the professors did a great job of presenting, i had a very positive experience	11/1/2022 5:32 PM
15	The mini-session was facinating and very informational.	11/1/2022 5:30 PM
16	I thought the modeling democracy was a very interesting topic, the presenter made us engaged and part of the topic and I would keep it was is.	11/1/2022 5:30 PM
17	I liked that it was very organized and informative. There wasn't anything that I disliked about it.	11/1/2022 5:29 PM
18	I really liked both of the professors for the Data Science lecture. It was very interactive and comprehendible. The professors made it accessible for everyone involved. Even though data science is not my field, I felt intrigued and interested.	11/1/2022 5:01 PM
19	I loved the inclusivity of the presentation on data science. It was very good engaging and encouraging!	11/1/2022 3:24 PM

20	Amazing instructors with super digestible material!	11/1/2022 3:20 PM
21	I liked how interactive the mini course was	11/1/2022 3:16 PM
22	I love it the mini-course in Data Science.	11/1/2022 3:12 PM
23	I really liked the Data Science Mini-Course! I did not know about the applications of linear algebra into Data Science, and I found really interesting the representation of digital images with the singular value decomposition process. Keep up the excellent work!	11/1/2022 3:07 PM

Q6 Check the boxes of all the statements you agree with:

Answered: 53   Skipped: 7
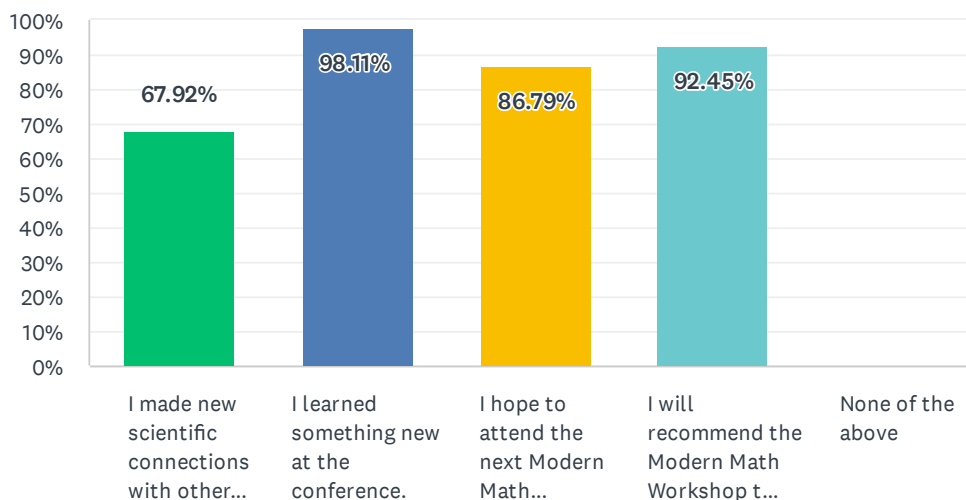
ANSWER CHOICES	RESPONSES	
I made new scientific connections with other participants that may lead to collaborations or other opportunities.	67.92%	36
I learned something new at the conference.	98.11%	52
I hope to attend the next Modern Math Workshop.	86.79%	46
I will recommend the Modern Math Workshop to others.	92.45%	49
None of the above	0.00%	0
Total Respondents: 53		

#	COMMENTS	DATE
1	As I mentioned, this is a wonderful idea! Having all US math institutes showcase work was quite exceptional.	11/1/2022 3:27 PM
2	Excellent initiative!	11/1/2022 3:10 PM

Q7 How many new connections did you make during this conference?

Answered: 53   Skipped: 7
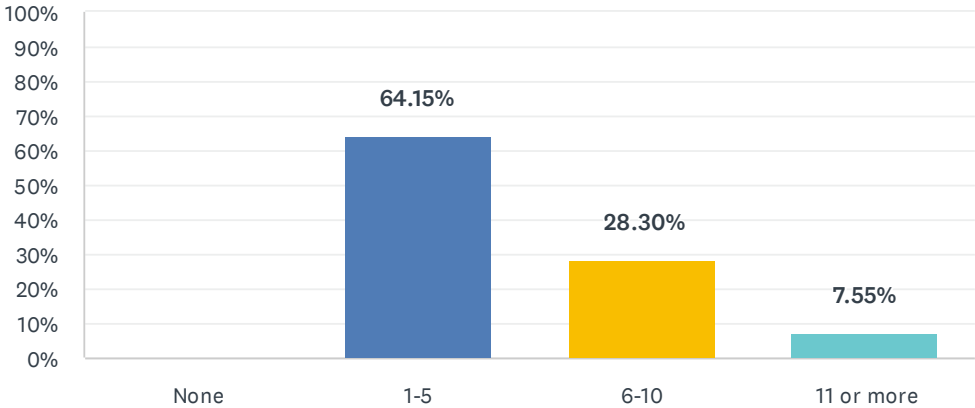
ANSWER CHOICES	RESPONSES	
None	0.00%	0
1-5	64.15%	34
6-10	28.30%	15
11 or more	7.55%	4
TOTAL		53

#	COMMENTS	DATE
1	N/A	11/2/2022 2:40 PM
2	I also found out of many workshops in my research interests!	11/1/2022 3:27 PM

Q8 On a scale of 1 to 5, please answer the following questions concerning the CONNECTIONS that you made during the Modern Math Workshop:

Answered: 53   Skipped: 7
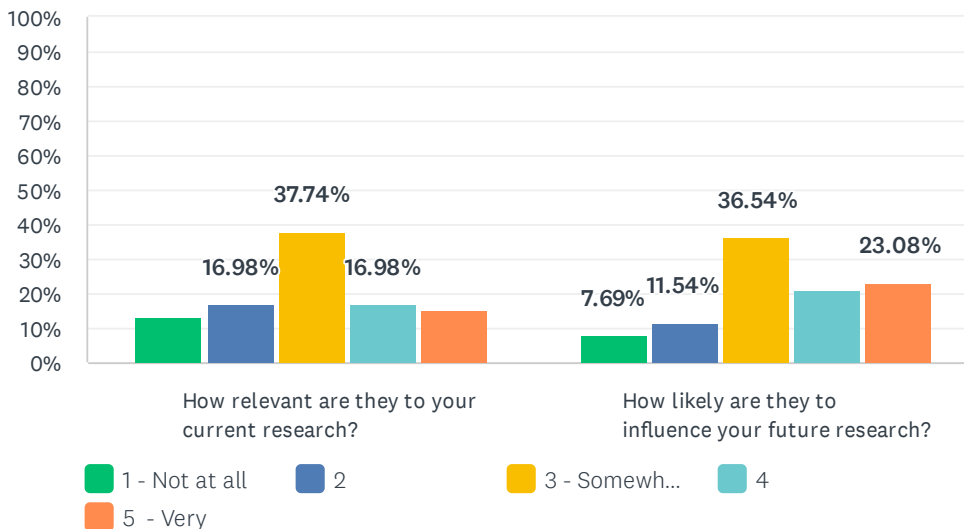
	1 - NOT AT ALL	2	3 - SOMEWHAT	4	5 - VERY	TOTAL	WEIGHTED AVERAGE
How relevant are they to your current research?	13.21% 7	16.98% 9	37.74% 20	16.98% 9	15.09% 8	53	3.04
How likely are they to influence your future research?	7.69% 4	11.54% 6	36.54% 19	21.15% 11	23.08% 12	52	3.40

#	COMMENTS	DATE
1	I am not committed to a certain area of research, so I am happy to explore what is happening.	11/9/2022 3:20 AM
2	I have considering exploring the work Professor Duchin does and her talk has made me at the very least, consider more interdisciplinary fields.	11/8/2022 10:34 AM
3	N/A	11/2/2022 2:40 PM
4	I'm not doing research or interested in research at the time that's why I answered (1) on both.	11/1/2022 5:58 PM

Q9 On a scale of 1 to 5, please answer the following questions concerning the KNOWLEDGE gained during Modern Math Workshop:

Answered: 53   Skipped: 7
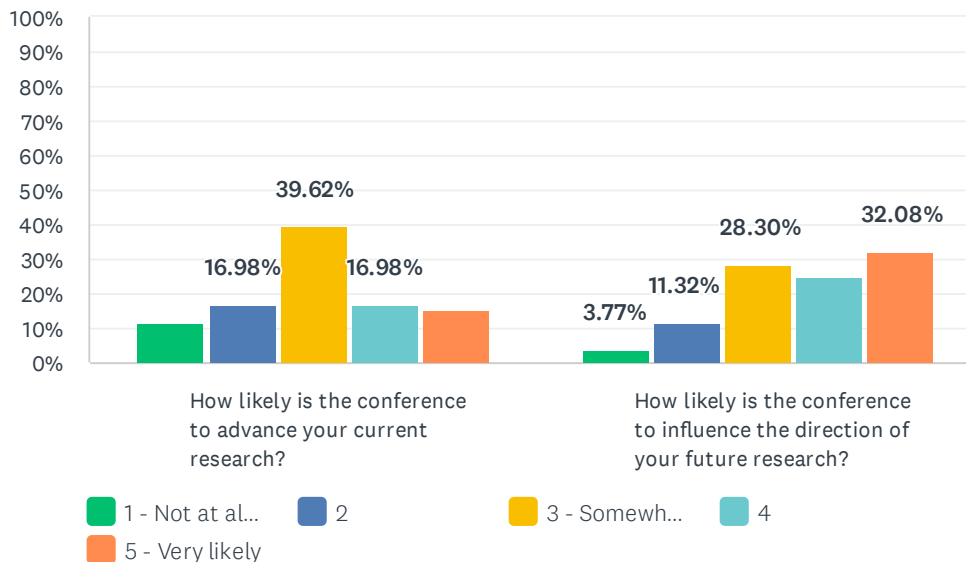
	1 - NOT AT ALL LIKELY	2	3 - SOMEWHAT LIKELY	4	5 - VERY LIKELY	TOTAL	WEIGHTED AVERAGE
How likely is the conference to advance your current research?	11.32% 6	16.98% 9	39.62% 21	16.98% 9	15.09% 8	53	3.08
How likely is the conference to influence the direction of your future research?	3.77% 2	11.32% 6	28.30% 15	24.53% 13	32.08% 17	53	3.70

#	COMMENTS	DATE
1	All of the lectures were on topics outside of my research area. Though I probably won't pursue research in these areas, I feel better informed to guide my students if their interest intersects with these topics	11/4/2022 12:04 PM
2	N/A	11/2/2022 2:40 PM

Q10 What aspect(s) of the conference did you like the most?

Answered: 33   Skipped: 27

#	RESPONSES	DATE
1	I liked the networking and the research talks.	11/9/2022 3:20 AM
2	I really liked the mini-course I attended.	11/8/2022 11:07 AM
3	I enjoyed the mini courses, the reception as we were able to talk to other people who were not in this year's MSRI-UP program.	11/8/2022 10:34 AM
4	How math focused it was and applicable to my interests	11/8/2022 10:27 AM
5	Meet mathematicians from different schools	11/8/2022 10:21 AM
6	Networking	11/8/2022 10:19 AM
7	I enjoyed the mini course a lot as well as the graduate student success panel. The networking opportunities were great.	11/6/2022 12:35 PM
8	The research talks with professors were really cool to learn about	11/5/2022 11:37 AM
9	The approachability of the speakers and their willingness to stay in touch.	11/5/2022 10:42 AM
10	Being able to connect with other mathematical biologists and gain understanding of how mathematics and statistics are used in biological contexts.	11/4/2022 8:59 PM
11	I really enjoyed getting to know the students and participating in the panel. It i so important that more sneior faculty interact with students across institutions. This is how we grow and sustain the profession	11/4/2022 12:04 PM
12	The environment was very welcoming!	11/3/2022 4:22 PM
13	The Undergrad Mini Course	11/3/2022 1:33 PM
14	I liked the opportunities to network and conversate with people like me in positions I wish to become, work with, or be a part of.	11/2/2022 6:37 PM
15	The connections and participations that was achieved.	11/2/2022 2:40 PM
16	Just being in person and attending a general math conference. Haven't done so since 2019. Also, the focus on diversity was inspiring.	11/2/2022 1:43 PM
17	I enjoyed the undergraduate session on Modeling Democracy and the Reception. The Paella was delicious and gave my table a conversation starter.	11/2/2022 8:27 AM
18	The feeling of being amongst mathematicians that enjoy research was great. Everyone had there own experience.	11/2/2022 7:51 AM
19	The grad school panel, the fact that it's before SACNAS.	11/2/2022 6:50 AM
20	I loved the organization and the warm community.	11/1/2022 8:25 PM
21	A math focus conference with people with research and industry. Food was very delicious and related to the culture of the island. Free shuttle to the convention center. Hotel commendations.	11/1/2022 5:58 PM
22	the networking, and undergraduate presentations	11/1/2022 5:35 PM
23	I liked that the conference provided various opportunities to network with people from my field of study, as well as people from different fields of study.	11/1/2022 5:32 PM
24	I liked the Data Science lecture and the panel about thriving in school the most.	11/1/2022 5:02 PM
25	The time to hear math talks!	11/1/2022 4:45 PM

26	I loved all the different talks!	11/1/2022 4:30 PM
27	I liked meeting new mathematicians at all levels	11/1/2022 4:07 PM
28	All 6 US institutes showcase work and share workshops and opportunities with attendees.	11/1/2022 3:27 PM
29	I liked the cultural backgrounds! Many underrepresented groups don't get to see people that look like that in spaces like these.	11/1/2022 3:26 PM
30	People, material, and culture !	11/1/2022 3:22 PM
31	Opportunities to connect to others	11/1/2022 3:17 PM
32	The mini-courses and the reception	11/1/2022 3:10 PM
33	The research talks were made to be very approachable even to those who didn't know anything about that specific research area	11/1/2022 3:02 PM

Q11 What aspect(s) of the conference did you like the least?

Answered: 26   Skipped: 34

#	RESPONSES	DATE
1	I didn't like that the undergraduate talks I went to did not have enough worksheets or time for students to do problems.	11/9/2022 3:20 AM
2	With regards to the panel discussion, I just hope the panelist would talk more about interesting facts about their research and maybe teach us skills on how we can apply them to our independent studies.	11/8/2022 1:37 PM
3	There was a sudden change of plans (the second day with the NSF), that made it seem like it was a bit unorganized. Other than this, I have no more feedback.	11/8/2022 11:07 AM
4	NA	11/8/2022 10:27 AM
5	Not too much food	11/8/2022 10:21 AM
6	Lack of snacks	11/8/2022 10:19 AM
7	The break between workshops could be longer	11/5/2022 11:37 AM
8	The events were overlapping and I couldn't attend the panel because I wanted to complete the mini course.	11/5/2022 10:42 AM
9	I felt like the focus of the conference and connects were more for pure math than any interdisciplinary field with mathematics.	11/4/2022 8:59 PM
10	This is not MSRI's fault, but I should have arrived a full day earlier rather than flying in on a red eye the same day as the start of the workshop. It made my entire conference experience more difficult than it needed to be. Lesson learned.	11/4/2022 12:04 PM
11	I generally liked everything that was strictly conference-related, but if I had to choose something: I did not like the Verdanza hotel.	11/3/2022 1:33 PM
12	The purple shuttle was delayed. I also did not like that there was not much water available.	11/2/2022 6:37 PM
13	N/A	11/2/2022 2:40 PM
14	The lack of lunch on the first day. It made it difficult to come early to network with people since getting food before the sessions started became the priority instead.	11/2/2022 8:27 AM
15	I wish it was longer because then I would get to learn even more than I did.	11/2/2022 7:51 AM
16	It's not quite clear who the workshop is geared towards.	11/2/2022 6:50 AM
17	I think it was perfect.	11/1/2022 8:25 PM
18	the research presentations were hard to follow	11/1/2022 5:35 PM
19	There could've been better lunch choices.	11/1/2022 5:32 PM
20	N/A	11/1/2022 5:02 PM
21	n/a!	11/1/2022 4:30 PM
22	Some talks were a bit unapproachable for me since they were very high level	11/1/2022 4:07 PM
23	IAS did not show up at the reception :(	11/1/2022 3:27 PM
24	N/A	11/1/2022 3:17 PM
25	N/A	11/1/2022 3:10 PM
26	Reception food. Not everyone was offered the frozen drinks and they ran out. Several varieties of desserts but I don't believe any were gluten free	11/1/2022 3:02 PM

Q12 How can we improve the quality of the conference? Your suggestions are welcome.

Answered: 21   Skipped: 39

#	RESPONSES	DATE
1	A place to do math problems at some point, like an hour problem session, would be nice for all the talks.	11/9/2022 3:20 AM
2	N/A	11/8/2022 11:07 AM
3	I think in terms of allotting time for mini courses and talks, all of the talks appeared to be very interesting so perhaps offering them more times throughout the day if possible to go to more talks.	11/8/2022 10:34 AM
4	More field trips please	11/8/2022 10:21 AM
5	Provide more talks on numerical analysis or optimization.	11/8/2022 10:19 AM
6	None at the moment	11/5/2022 11:37 AM
7	Give people enough time to attend more events, ie. no overlapping time frames!	11/5/2022 10:42 AM
8	Invite more organizations that focus on interdisciplinary fields in mathematics.	11/4/2022 8:59 PM
9	Ialways throroughly enjoy the Modern Mathematics Workshop every time that I have attended. I have no suggestions.	11/4/2022 12:04 PM
10	More water. More guidance for undergraduates or first-time conference attendees to allow them to understand how to decide which event to attend. For example, there were many sessions going on at the same time and I was unsure which to choose so maybe a quick introduction or summary to each session.	11/2/2022 6:37 PM
11	N/A	11/2/2022 2:40 PM
12	Structure the networking opportunities, see LatMath Conference's lunches for examples on how to do this. Then communicate what benefits people will get from that opportunity. Encourage senior faculty to attend. A panel by itself is not a great networking opportunity as it can be difficult to reach out to the panelists after the conference without a more personal connection.	11/2/2022 8:27 AM
13	Make a list of participants available (even only to the participants) ahead of time.	11/2/2022 6:50 AM
14	Include a topic or mini-course about the mathematics behind structural predictions of biological samples like proteins and DNA. Also include a topic about correlations and predictions that could be catered to a more biology/chemistry related academic background.	11/1/2022 8:25 PM
15	Maybe gear research presentations a bit more to undergraduates, i can not follow quantum chromatic numbers	11/1/2022 5:35 PM
16	The only complaint I had was about the options for lunch, other than that the conference was great.	11/1/2022 5:32 PM
17	n/a	11/1/2022 4:30 PM
18	I did not know about this workshop until MSRI UP. Maybe send more emails about it?	11/1/2022 3:27 PM
19	Would have loved to attend the two mini-courses. Would be be great if in the future these sessions are offered at different times so that I don't feel like I have to choose between them. I was very sad to miss Moon's workshop as it also seemed applicable to the work I am doing. Alternatively, it would be great to record them and then share the videos to the participants after the events (if possible).	11/1/2022 3:22 PM
20	In the past attendees had opportunity to present posters during the reception. If possible please bring back, it is an opportunity to talk about our own research, connect with people	11/1/2022 3:17 PM

Floer Homotopical Methods in Low Dimensional and Symplectic Topology

November 14 – November 18, 2022

Hybrid Workshop

Organizers:

Mohammed Abouzaid (Columbia University),

Andrew Blumberg (Columbia University)

Jennifer Hom (Georgia Institute of Technology)

Emmy Murphy (Northwestern University)

Sucharit Sarkar (University of California, Los Angeles)

REPORT ON THE MSRI WORKSHOP
"Floer Homotopical Methods in Low Dimensional and Symplectic Topology (Hybrid Workshop)"
November 14 – November 18, 2022

Organizers

- Mohammed Abouzaid (Columbia University)
- Andrew Blumberg (Columbia University)
- Jennifer Hom (Georgia Institute of Technology)
- Emmy Murphy (Northwestern University)
- Sucharit Sarkar (University of California, Los Angeles)

Scientific Description

The workshop focused on the interaction between homotopy theory and symplectic topology and low dimensional topology that is mediated by Floer theory. Among the topics covered were foundational questions, applications to concrete geometric questions, and the relationship with finite dimensional approaches.

Highlights of the Workshop

The lectures at the workshop reported on the latest developments in the foundations of Floer homotopy theory, and its applications to symplectic topology and the study of manifolds of dimension 3 and 4. An exceptionally large proportion of the speakers were towards the beginning of their career, as only 5 of the speakers were tenured, and this gave the workshop a youthful and electric atmosphere. Several speakers announced important new or forthcoming developments in their lecture; e.g. Kristen Hendricks explained the resolution, with her collaborators, of the naturality problem for involutive Heegaard Floer homology, Sungkyung Kang resolved a long-standing problem, due to Wall, by showing that there are 4-manifolds that become diffeomorphic after taking their connect sum with sufficiently many copies of a product of 2-spheres, but not after taking the connect sum with one such product, while Tim Large and Semon Rezchikov described work in progress, which respectively extends localisation techniques in Gromov-Witten theory to generalised cohomology, and develops a theory of fixed points for Floer homotopy types. The attendance hovered between 1/2 and 2/3 of the auditorium capacity, with cross attendance between the participants in the three branches of the program (homotopy theory, low dimensional topology, symplectic geometry).

Organizers

First Name	Last Name	Institution
Mohammed	Abouzaid	Columbia University
Andrew	Blumberg	Columbia University
Jennifer	Hom	Georgia Institute of Technology
Emmy	Murphy	Northwestern University
Sucharit	Sarkar	University of California, Los Angeles

Speakers

First Name	Last Name	Institution
Daniel	Alvarez-Gavela	Massachusetts Institute of Technology
Shaoyun	Bai	Princeton University
Peter	Feller	ETH Zurich
Sherry	Gong	Texas A&M University
Gary	Guth	University of Oregon
Kristen	Hendricks	Rutgers University
Xin	Jin	Boston College
Sungkyung	Kang	Institute for basic science
Tim	Large	Columbia University
Robert	Lipshitz	University of Oregon
Ciprian	Manolescu	Stanford University
Gage	Martin	Harvard University
Mark	McLean	State University of New York, Stony Brook
Mona	Merling	University of Pennsylvania
Semon	Rezchikov	Princeton University
Steven	Sivek	Max-Planck-Institut für Mathematik
Linh	Truong	University of Michigan
Melissa	Zhang	University of California, Davis

Mathematical Sciences Research Institute

Floer Homotopical Methods in Low Dimensional and Symplectic Topology

November 14, 2022 - November 18, 2022

Monday November 14, 2022			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Steven Sivek	Floer Homology and Non-Fibered Knot Detection
11:00 AM - 12:00 PM	Simons Auditorium	Shaoyun Bai	Normally Complex Polynomial Perturbations and Arnold Conjecture
2:00 PM - 3:00 PM	Simons Auditorium	Semon Rezchikov	Virtual Equivariant Morse-Floer Theory
3:30 PM - 4:30 PM	Simons Auditorium	Tim Large	Localization and Morava K-theory Gromov-Witten Invariants

Tuesday, November 15, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Xin Jin	Microlocal Sheaves of Spectra Supported on Lagrangians
11:00 AM - 12:00 PM	Simons Auditorium	Daniel Alvarez-Gavela	Normal Invariant of Nearby Lagrangians via Twisted Generating Functions
2:00 PM - 3:00 PM	Simons Auditorium	Mona Merling	Stable Spaces of Equivariant H-Cobordisms
3:30 PM - 4:30 PM	Simons Auditorium	Kristen Hendricks	Naturality Issues in Involutive Heegaard Floer Homology
4:30 PM - 6:20 PM	Front Courtyard		Reception

Wednesday, November 16, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Mark McLean	Generalized Holomorphic Curve Counting
11:00 AM - 12:00 PM	Simons Auditorium	Linh Truong	Homology Concordance and Knot Floer Homology
2:00 PM - 3:00 PM	Simons Auditorium	Gary Guth	Stabilizations, Satellites, and Exotic Surfaces

Thursday, November 17, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Ciprian Manolescu	A Knot Floer Stable Homotopy Type
11:00 AM - 12:00 PM	Simons Auditorium	Sherry Gong	Computations of Ribbon Concordances
2:00 PM - 3:00 PM	Simons Auditorium	Sungkyung Kang	One Stabilization is Not Enough for Contractible 4-Manifolds
3:30 PM - 4:30 PM	Simons Auditorium	Gage Martin	Annular Links, Double Branched Covers, and Annular Khovanov Homology

Friday, November 18, 2022			
9:30 AM - 10:30 AM	Simons Auditorium	Peter Feller	Homogenization of Knot Invariants and Slice-Bennequin Inequalities
11:00 AM - 12:00 PM	Simons Auditorium	Melissa Zhang	Equivariant Khovanov Stable Homotopy Types and their Applications

Identifiable Participants' Information

Participants		175

Gender		175
Male	76.57%	134
Female	20.57%	36
Other	0.57%	1
Declined to state	2.29%	4

Ethnicity*		213
White	39.44%	84
Asian	37.56%	80
Hispanic	2.82%	6
Pacific Islander	0.00%	0
Black	0.94%	2
Native American	0.47%	1
Mixed	8.45%	18
Declined to state	10.33%	22

* ethnicity specifications are not exclusive

There were 6 unidentifiable participants.

Q1 I primarily participated in the workshop:

Answered: 78   Skipped: 0
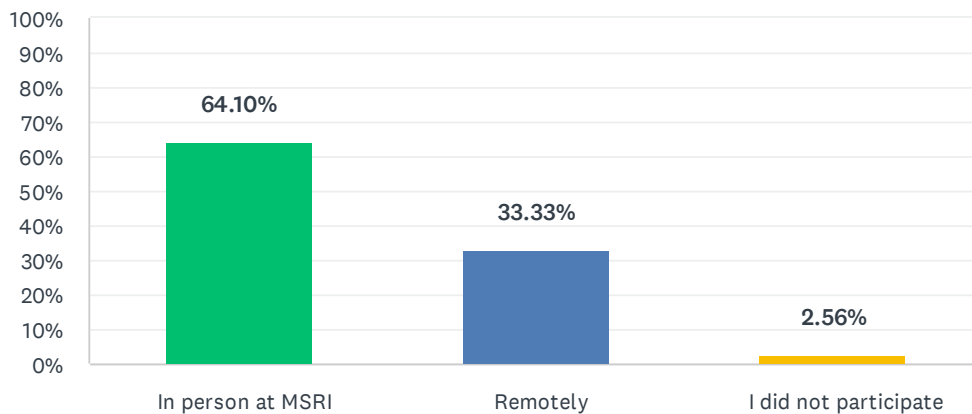
ANSWER CHOICES	RESPONSES	
In person at MSRI	64.10%	50
Remotely	33.33%	26
I did not participate	2.56%	2
TOTAL		78

Q2 The workshop was intellectually stimulating

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	0.00% 0	4.35% 2	28.26% 13	65.22% 30	46	4.54

Q3 The overall experience of the workshop was worthwhile

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	0.00% 0	4.35% 2	30.43% 14	63.04% 29	46	4.52

Q4 The lectures were at an appropriate level

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	0.00% 0	10.87% 5	39.13% 18	47.83% 22	46	4.30

Q5 I was well prepared to benefit from the lectures

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	2.17% 1	21.74% 10	32.61% 15	41.30% 19	46	4.09

Q6 My interest in the subject matter was increased by the workshop

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	0.00% 0	8.70% 4	32.61% 15	56.52% 26	46	4.41

Q7 The workshop helped me meet people with similar scientific interests

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.17% 1	17.39% 8	15.22% 7	65.22% 30	46	4.43

Q8 What were the highlights of the lectures?

Answered: 46   Skipped: 32

#	RESPONSES	DATE
1	I enjoyed finally hearing Ciprian talk about his work with Sucharit on the knot Floer homotopy type; this helps kick off the second phase of our learning seminar, where we try to read their paper in detail!	11/28/2022 10:54 AM
2	Steven Sivek's and Sherry Gong's lectures were memorable and may affect my research program.	11/26/2022 11:57 AM
3	mark mclean's lecture	11/23/2022 9:15 AM
4	Almost most of the seminars are very well prepared, so they increase my research interest and curiosity in the development of Fleor homotopy theory for low-dimensional manifolds.	11/22/2022 9:47 PM
5	Gary Guth's talk Stabilizations, Satellites, and Exotic Surfaces Sherry Gong's talk Computations of Ribbon Concordances	11/22/2022 5:47 PM
6	.	11/22/2022 3:52 PM
7	N/A	11/22/2022 3:28 PM
8	The lectures covered a variety of topics that are at the frontier of Floer homotopy theory and its applications. I got a chance to learn the exciting results from experts and interact with them.	11/22/2022 2:33 PM
9	interesting talks	11/22/2022 1:15 PM
10	A lot of interesting questions and interactions.	11/22/2022 1:01 PM
11	Lecture by Mona Merling which was close to what I have been thinking about.	11/22/2022 12:31 PM
12	Tim Large and Mark Mclean's talks were great.	11/22/2022 12:27 PM
13	Tim Large	11/22/2022 12:17 PM
14	…	11/22/2022 11:50 AM
15	The hybrid lectures were great; it was convenient to be able to rewatch the recordings.	11/22/2022 10:32 AM
16	Liked the talks by Gage Martin, Melissa Zhang, Mona Merling, Gary Guth, Steven Sivek, and Kristen Hendricks	11/22/2022 10:28 AM
17	Learning the new development of Floer homotopy theory	11/22/2022 9:55 AM
18	.	11/22/2022 9:43 AM
19	The lecture by Tim Large was very understandable and inspiring.	11/22/2022 9:41 AM
20	Garry Guth's talk was great	11/22/2022 9:40 AM
21	The highlights were the interactions between the audience and speakers, as well as the excitement of the speakers in showcasing their research.	11/21/2022 5:12 PM
22	seeing how different fields came together	11/21/2022 10:39 AM
23	I liked the breadth of topics covered in the workshop.	11/21/2022 1:11 AM
24	The talks on low-dimensional topology	11/20/2022 9:27 PM
25	I did not find the lectures stimulating or interesting.	11/20/2022 10:26 AM
26	The combination of Floer theory and homotopy theory is becoming more and more mature.	11/20/2022 10:08 AM
27	Some of the lecturers spent some time going over definitions and examples, which made it much easier to follow as a non-expert in some of these fields.	11/19/2022 11:11 PM

28	Sungkyung Kang	11/19/2022 9:03 PM
29	The mic cube	11/19/2022 3:41 PM
30	Progress on floer homotopy is real	11/19/2022 8:10 AM
31	Certain talks were great and just listening to the questions and answers was insightful.	11/18/2022 9:02 PM
32	All of the talks I attended were very good.	11/18/2022 7:56 PM
33	I thought the talks were mostly very clear, while also describing current developments. I particularly enjoyed Feller's talk: even though it was slightly off-topic for the workshop, it was elegant and interesting, with plenty of new ideas to consider.	11/18/2022 7:08 PM
34	Some excellent talks!	11/18/2022 4:37 PM
35	The speakers realized that the interests of the audience members were broad and so did a good job at introducing the questions.	11/18/2022 2:45 PM
36	Mark McLean's talk on "generalized holomorphic curve counting".	11/18/2022 2:38 PM
37	n	11/18/2022 2:34 PM
38	The lecture by Ciprian Manolescu	11/18/2022 2:12 PM
39	Talks about cool maths	11/18/2022 2:07 PM
40	Many of them gave new insights about the recent Floer homotopy theory.	11/18/2022 2:01 PM
41	They were great	11/18/2022 1:58 PM
42	They were good	11/18/2022 1:33 PM
43	Shaoyun Bai's explanation of orbifold bordism	11/18/2022 1:27 PM
44	the talks by Kang and Guth on their remarkable "one stabilization is not enough" results	11/18/2022 1:26 PM
45	It was nice to see what people are working on right now	11/18/2022 1:18 PM
46	The talk by "Xin Jin" was pretty good.	11/18/2022 1:17 PM

Q9 Additional comments

Answered: 3   Skipped: 75

#	RESPONSES	DATE
1	None	11/22/2022 9:55 AM
2	It was perhaps somewhat misleading to title the workshop as one about the applications of Floer-homotopic methods to low-dimensional topology. It seems like most of the talks were either on the topic of Floer homotopy itself or on low-dimensional topology, but I did not come out convinced that the homotopy methods apply generally in the low-dimensional setting.	11/21/2022 5:12 PM
3	There was not a lot of homotopy theory in the talks, at least not in an explicitly stated way, and so that was somewhat confusing.	11/19/2022 11:11 PM

1024 - Floer Homotopical Methods in Low Dimensional and Symplectic Topology Workshop - Participant Survey

Q10 I found the MSRI staff helpful

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.52% 3	13.04% 6	78.26% 36	2.17% 1	46	4.73

Q11 The MSRI facilities were conducive for such a workshop

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.35% 2	4.35% 2	4.35% 2	19.57% 9	67.39% 31	46	4.41

Q12 Did you use MSRI's wireless network?

Answered: 46   Skipped: 32

ANSWER CHOICES	RESPONSES	
Yes	95.65%	44
No	4.35%	2
TOTAL		46

Q13 Did you experience any difficulties with the network?

Answered: 46   Skipped: 32
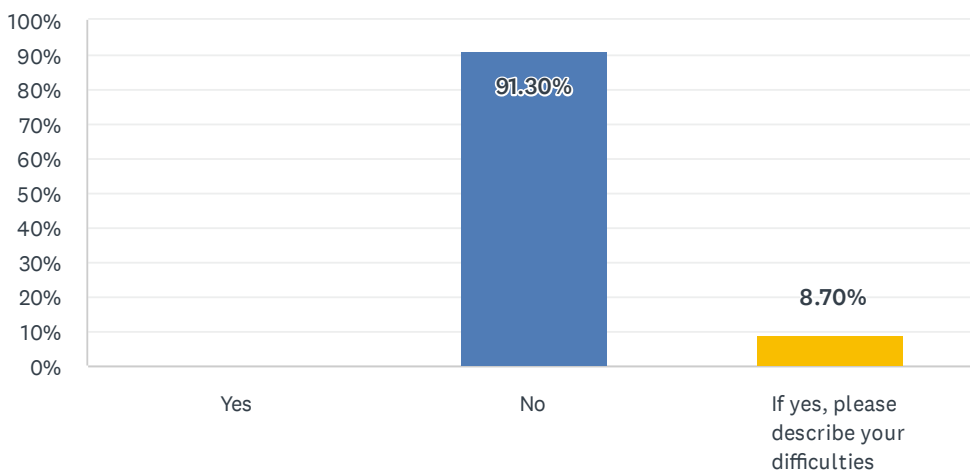
ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	91.30%	42
If yes, please describe your difficulties	8.70%	4
TOTAL		46

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	couldn't use eduroam, MSRI member worked fine for me.	11/22/2022 12:32 PM
2	Outside in the patio it was hard to obtain a consistent signal.	11/22/2022 12:28 PM
3	eduroam wouldn't work for me	11/22/2022 9:40 AM
4	Was not able to log into the Eduroam net	11/18/2022 1:19 PM

Q14 The MSRI lunch arrangements were satisfactory

Answered: 46   Skipped: 32

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	4.35% 2	6.52% 3	23.91% 11	21.74% 10	28.26% 13	15.22% 7	46	3.74

Q15 The MSRI tea arrangements were satisfactory

Answered: 46   Skipped: 32
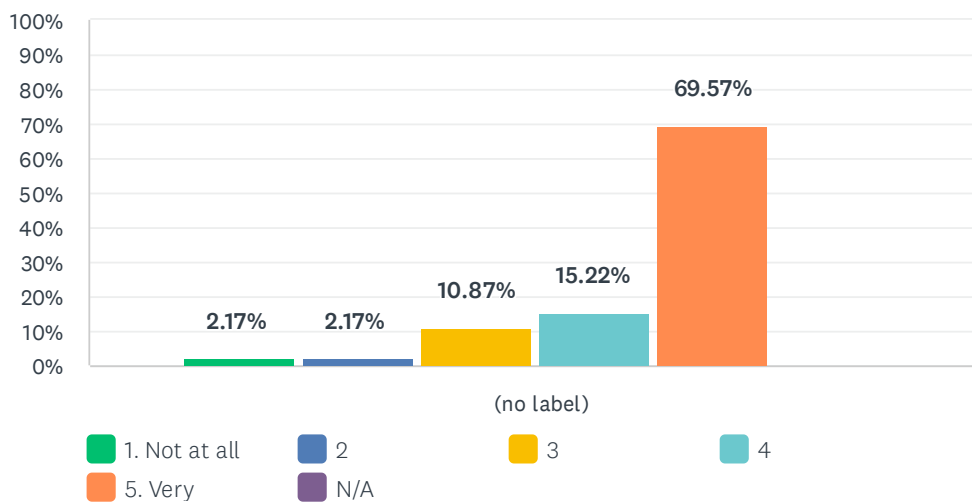
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	2.17% 1	10.87% 5	15.22% 7	69.57% 32	0.00% 0	46	4.48

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 14   Skipped: 64

#	RESPONSES	DATE
1	Lunch was nearly an hour late one day.	11/26/2022 11:58 AM
2	The covid restrictions were excessive for an era where every attendant is vaccinated+boosted and actively harmed the intellectual and social atmosphere of the workshop	11/23/2022 9:16 AM
3	Really nice staff.	11/22/2022 5:47 PM
4	Thai food on tuesday was so bad	11/22/2022 3:53 PM
5	It would be helpful to remind attendees to order lunch by the 9am deadline. Some attendees only found out on Monday at the 9.15am Welcome.	11/22/2022 1:04 PM
6	None	11/22/2022 9:55 AM
7	On the first day, I had not realized that the lunch orders would be done online, so it might be good to add a line in the welcome document that links to the website for the food order.	11/21/2022 5:14 PM
8	Sierra was SO helpful and hilarious. And her recommendations were very helpful for restaurants/bars/etc.	11/19/2022 11:12 PM
9	Easy to forget to order lunch, wish there was nicer tea. Other than that it is all rather cozy.	11/19/2022 8:11 AM
10	Sierra is the best!	11/18/2022 9:04 PM
11	For tea, it might be nice to have the coffee and the snacks in different places: the line got backed up at the coffee.	11/18/2022 7:09 PM
12	Ordered lunches were late some of the days. Additionally, it can take 20min to get a frozen lunch because of the queue for microwaves.	11/18/2022 4:38 PM
13	Things would be easier if we didn't have to wear masks inside.	11/18/2022 2:46 PM
14	The building being closed to outside participants was a catastrophe, it reduced the effect of the workshop to a fraction of what would have been possible	11/18/2022 1:28 PM

Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 4   Skipped: 74

#	RESPONSES	DATE
1	I wonder if you could relax some of the Covid stuff a bit.	11/22/2022 5:48 PM
2	None	11/22/2022 9:56 AM
3	The covid policies appear to be at odds with every other institution in the country at this point. ....why?	11/18/2022 4:39 PM
4	Maybe it's time to stop the masking requirement? No universities that I know of still have it.	11/18/2022 1:28 PM

Q18 I found the MSRI staff helpful
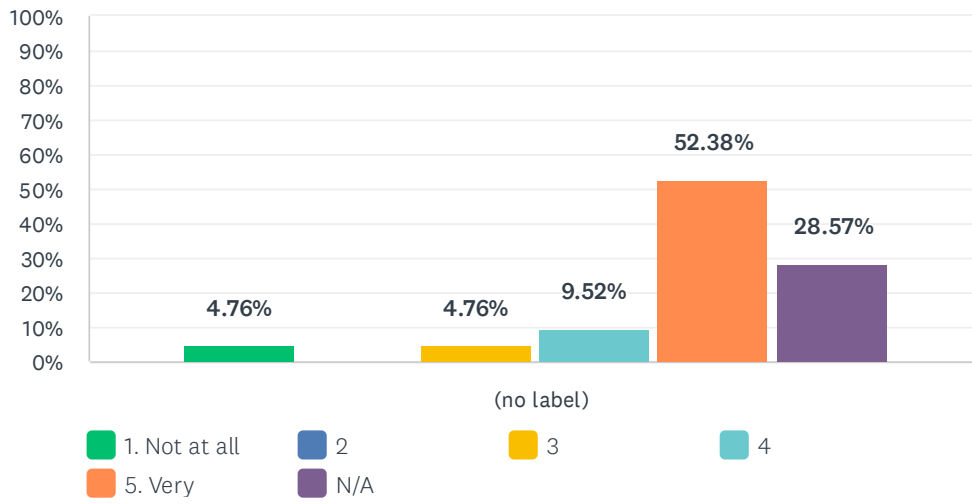
Answered: 21   Skipped: 57

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	0.00% 0	4.76% 1	9.52% 2	52.38% 11	28.57% 6	21	4.47

1024 - Floer Homotopical Methods in Low Dimensional and Symplectic Topology Workshop - Participant Survey

Q19 How many talks did you watch live?

Answered: 21   Skipped: 57
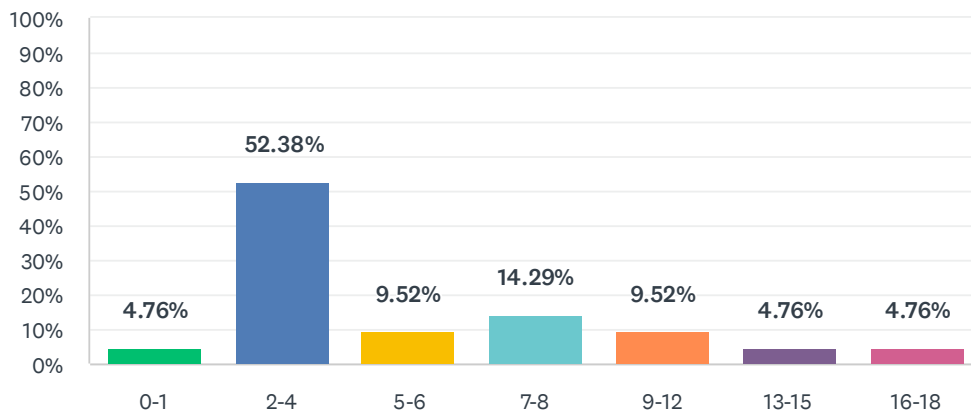
ANSWER CHOICES	RESPONSES	
0-1	4.76%	1
2-4	52.38%	11
5-6	9.52%	2
7-8	14.29%	3
9-12	9.52%	2
13-15	4.76%	1
16-18	4.76%	1
TOTAL		21

Q20 The workshop was intellectually stimulating

Answered: 21   Skipped: 57
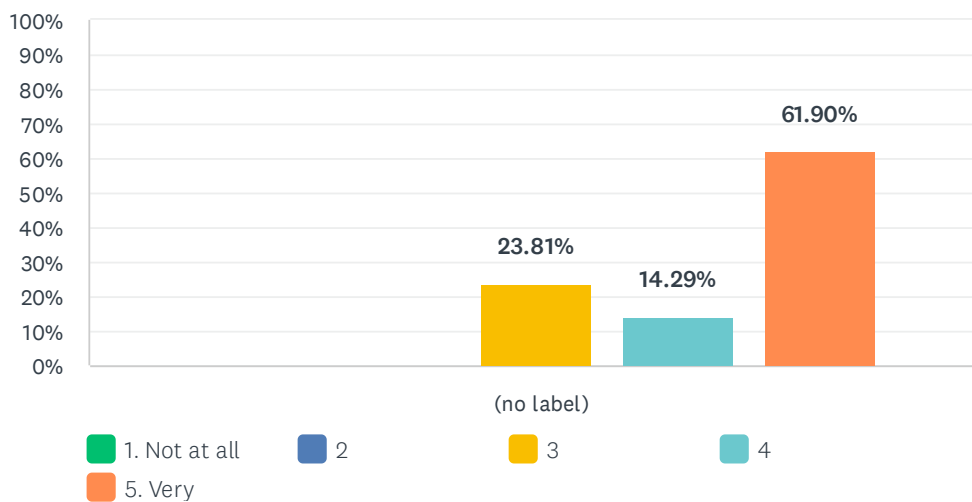
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	23.81% 5	14.29% 3	61.90% 13	21	4.38

499

Q21 The overall experience of the workshop was worthwhile

Answered: 21   Skipped: 57
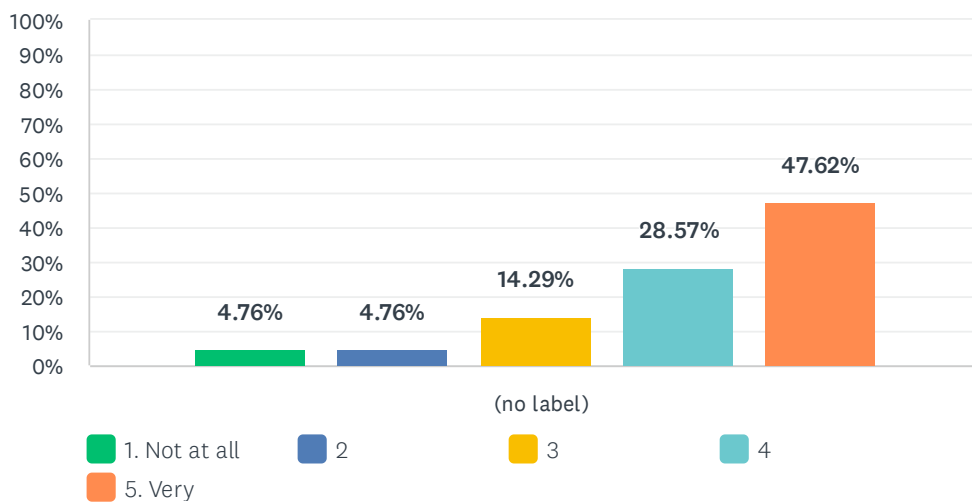
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	4.76% 1	14.29% 3	28.57% 6	47.62% 10	21	4.10

Q22 The lectures were at an appropriate level

Answered: 21   Skipped: 57
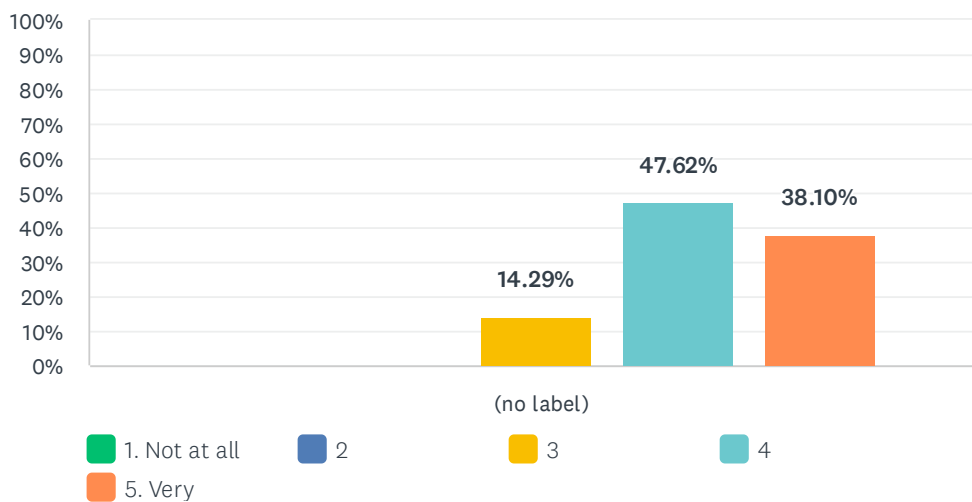
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.29% 3	47.62% 10	38.10% 8	21	4.24

Q23 I was well prepared to benefit from the lectures
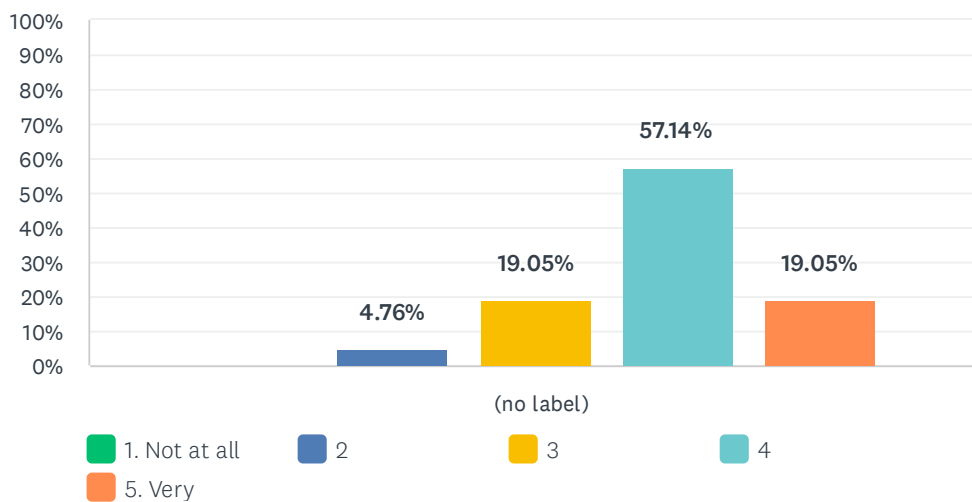
Answered: 21   Skipped: 57

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	19.05% 4	57.14% 12	19.05% 4	21	3.90

Q24 My interest in the subject matter was increased by the workshop

Answered: 21　　Skipped: 57

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	4.76% 1	23.81% 5	28.57% 6	38.10% 8	21	3.90

Q25 The workshop helped me meet people with similar scientific interests

Answered: 21   Skipped: 57
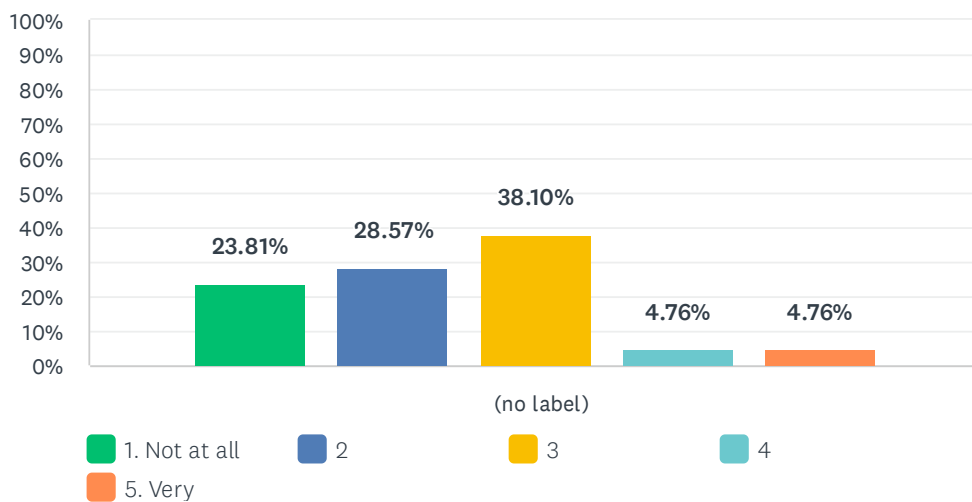
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	23.81% 5	28.57% 6	38.10% 8	4.76% 1	4.76% 1	21	2.38

Q26 What were the highlights of the lectures?

Answered: 21   Skipped: 57

#	RESPONSES	DATE
1	Stimulating subject matter, as well as interesting questions/discussion.	12/2/2022 11:12 AM
2	Ciprian's talk on knot Floer homotopy types	11/22/2022 11:34 PM
3	I am mainly interested in the symplectic aspects of Floer homotopy theory. In this regard, all the talks in the first day were very interesting to me.	11/22/2022 5:23 PM
4	Ciprian Manolescu Lecture	11/22/2022 12:54 PM
5	Very recent research front in lively presentations, with lots of question and answer. I feel myself get more familiar with the otherwise hard to understand material.	11/22/2022 12:34 PM
6	-	11/22/2022 12:20 PM
7	I was excited about Bai's talk about the Arnold conjecture over Z	11/22/2022 11:31 AM
8	interesting new ideas were presented	11/22/2022 9:51 AM
9	A great presentation of current research trends in Floer homotopy theory, in particular applications truly beyond improving results from Floer homology theory	11/22/2022 9:40 AM
10	The variety of perspectives on homotopical approaches to the nearby Lagrangian conjecture.	11/21/2022 8:42 AM
11	Deep enhancement of topics with respect to Floer Homology	11/20/2022 7:28 AM
12	The lecture of Mona Merlin was good,	11/20/2022 6:50 AM
13	Akubulut's additions in chat	11/19/2022 6:25 AM
14	.	11/19/2022 2:51 AM
15	n/a	11/18/2022 7:42 PM
16	Many interesting new results were presented.	11/18/2022 4:46 PM
17	N A	11/18/2022 3:45 PM
18	Large, Merling, McLean, Rezchikov	11/18/2022 2:33 PM
19	All about knots theory applications	11/18/2022 1:35 PM
20	Applications of Floer Homotopical Methods	11/18/2022 1:30 PM
21	I liked Tim Large's talk, for example.	11/18/2022 1:23 PM

Q27 Additional comments

Answered: 3   Skipped: 75

#	RESPONSES	DATE
1	It's much harder to participate in the workshop and make connections remotely, but I still appreciate the opportunity to listen to some of the talks live.	11/21/2022 8:42 AM
2	I hoped to hear about new technology of tackling calculations of framing/corner etc, but a lot of lecturers just swipe it under the rug, which was disappointing.	11/20/2022 6:50 AM
3	A significant number of the talks didn't seem to have anything to do with Floer homotopy theory.	11/18/2022 4:46 PM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 21   Skipped: 57
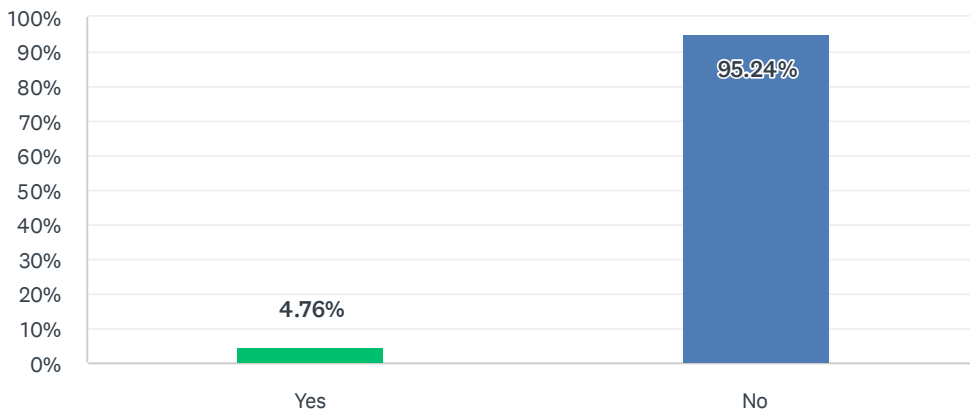
ANSWER CHOICES	RESPONSES	
Yes	4.76%	1
No	95.24%	20
TOTAL		21

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Some lag in the video streaming but only briefly.	11/18/2022 1:25 PM

Q29 How did attending the workshop remotely impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 21   Skipped: 57

#	RESPONSES	DATE
1	No negative impact.	12/2/2022 11:13 AM
2	want to talk to more people directly	11/22/2022 11:34 PM
3	Not at all.	11/22/2022 5:23 PM
4	a barrier to participation due to the distance	11/22/2022 12:56 PM
5	Limited interpersonal connection and free social time between the talks.	11/22/2022 12:35 PM
6	Time zone (Europe) was a barrier for attending class live.	11/22/2022 12:29 PM
7	Departmental and family commitments led to me not watching as many talks as I might have liked, but they also would have prevented me from attending in person, so having the option to participate remotely was helpful to me.	11/22/2022 11:34 AM
8	i would have much preferred to come in person if allowed	11/22/2022 9:51 AM
9	In person discussions are very valuable which was harder to achieve in remote setting.	11/22/2022 9:40 AM
10	It was a little more difficult to join all the talks due to the time difference.	11/21/2022 8:43 AM
11	Time zone difference was the main barrier	11/20/2022 7:28 AM
12	The zone differences (GMT +2) prevent me from participating in a lot of talk (but, there are records)	11/20/2022 6:53 AM
13	I was unable to network and meet others	11/19/2022 6:26 AM
14	As is almost unavoidable unless the room is equiped with a global microphone system, there were some instances when the local discussion was not audible in the remote session.	11/19/2022 2:57 AM
15	No in person communication	11/18/2022 7:43 PM
16	There was a barrier due to time zone differences. But of course the main barrier was the inability to have informal conversations with the speakers and other participants.	11/18/2022 4:48 PM
17	Remote participation was key to my ability to deliver a talk at the workshop since I have a 4 month old baby and am not yet ready to travel and spend large amount of time away from her	11/18/2022 3:48 PM
18	No negative impact	11/18/2022 2:34 PM
19	Pandemic hamer	11/18/2022 1:37 PM
20	In-person communication is a little difficult. Time zone difference is one barrier.	11/18/2022 1:32 PM
21	Yes; I'm 3 hours ahead so would finish attending at 7:30 pm here which is rather late since I still need to get home to eat and so on. I wanted to attend in person but was not accepted to be an in-person participant.	11/18/2022 1:25 PM

Q30 One important aspect that was missing due to the hybrid format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops in a hybrid format?

Answered: 6   Skipped: 72

#	RESPONSES	DATE
1	Make a brief presentation of each listener during a coffee break.	11/22/2022 12:29 PM
2	not really	11/22/2022 9:51 AM
3	maybe invite some expert to the zoom room, just after the talk (and the virtual participants can ask him/discuss some questions and details)	11/20/2022 6:53 AM
4	Maybe dedicated time slots for q&a sessions would be worth a try.	11/19/2022 2:57 AM
5	I don't think there is any substitute for in-person interaction. 'Hybrid' is a euphemism which means in practice that a bunch of people don't get to go. If you nonetheless decide to hold more such workshops, I would urge you to make an effort to invite the people who actually stand to benefit the most from the workshop (e.g. focus on graduate students). Perhaps you could ask applicants to write a paragraph explaining why the theme of the workshop is relevant to their research. I know lots of graduate students who didn't get to go and would have benefited enormously. Meanwhile, there were clearly many senior researchers whose work has nothing to do with Floer homotopy theory who were invited to attend in person.	11/18/2022 4:48 PM
6	I'm not sure... face to face interaction has no substitute that I can think of.	11/18/2022 1:25 PM

Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems

January 19, 2023 – January 20, 2023

Hybrid Workshop

Organizers:

Henri Darmon (McGill University)

Ellen Eischen (University of Oregon)

Benjamin Howard (Boston College)

Elena Mantovan (California Institute of Technology)

REPORT ON THE MSRI WORKSHOP
"Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems (Hybrid Workshop)"
January 19 – January 20, 2023

Organizers

- Henri Darmon (McGill University)
- Ellen Eischen (University of Oregon)
- Benjamin Howard (Boston College)
- Elena Mantovan (California Institute of Technology)

Scientific Description

This workshop was held in honor of mathematician Bernadette Perrin-Riou. The Connections Workshop featured presentations by both leading researchers and promising newcomers whose research has contact with the interrelated topics of algebraic cycles, L-values, and Euler systems. The goal was to present a variety of diverse results, so as to forge new connections, foster collaborative projects, and establish mentoring relationships. While emphasis was placed on the work of women mathematicians, the workshop was open to all researchers.

Highlights of the Workshop

The workshop presented a diverse collection of research talks revolving around the theme of the thematic semester, by influential women mathematicians in the subject at various career stages. Some particular highlights include new results in the study of the mod p geometry of Shimura varieties (e.g., a description of the supersingular loci of some unitary Shimura varieties by Fox—Imai), new constructions of algebraic cycles (e.g., higher-weight analogues of Heegner points on Shimura curves, by Qiu—Wen), and progress towards the Serre weight conjecture for Galois representations (e.g,, unramifiedness of Galois representation attached to weight 1 Hecke eigensystems appearing in the coherent cohomology of Hilbert modular varieties by Lee).

The presence of a lively and energetic audience, eager to exchange in person after close to two years of pandemic restrictions, definitely enhanced the quality of the experience and the intensity and fruitfulness of the scientific interactions.

In addition to the research talks, there was a well-attended panel, which focused on professional development advice and featured Jen Berg, Mirela Ciperiani, Rachel Pries, Yunqing Tang, and Ellen Eischen (as moderator).

Organizers

First Name	Last Name	Institution
Henri	Darmon	McGill University
Ellen	Eischen	University of Oregon
Benjamin	Howard	Boston College
Elena	Mantovan	California Institute of Technology

Speakers

First Name	Last Name	Institution
Mirela	Ciperiani	University of Texas, Austin
Maria	Fox	Oklahoma State University
Catherine	Hsu	Swarthmore College
Chi-Yun	Hsu	Université de Lille
Si Ying	Lee	Harvard University
Wieslawa	Niziol	Institut de Mathématiques de Jussieu
Rachel	Pries	Colorado State University
Boya	Wen	MSRI / Simons Laufer Mathematical Sciences Institute (SLMath)

Connections Workshop: Algebraic Cycles, L-Values, and Euler Systems
January 19 to January 20, 2023

Thursday, January 19, 2023			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Mirela Ciperiani	Local/Global Trace Relations on Elliptic Curves and Related Statistical Results
10:30 AM - 11:00 AM	Front Courtyard		Morning Tea
11:00 AM - 12:00 PM	Simons Auditorium	Si Ying Lee	Unramifiedness of Galois Representations Associated to Hilbert Modular Varieties
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Rachel Pries	L-Polynomials of Jacobians of Curves in Unitary Shimura Varieties
3:00 PM - 3:30 PM	Downstairs Deck		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Boya Wen	Green's Functions for Local Systems Over Graphs
4:30 PM - 5:30 PM	Simons Auditorium		Panel Discussion
6:30 PM - 8:30 PM			Dinner

Friday, January 20, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Chi-Yun Hsu	Eigenvariety for Partially Classical Hilbert Modular Forms
10:30 AM - 11:00 AM	Front Courtyard		Morning Tea
11:00 AM - 12:00 PM	Simons Auditorium	Catherine Hsu	Explicit Non-Gorenstein R=T via Rank Bounds
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Maria Fox	Supersingular Loci of Unitary Shimura Varieties
3:00 PM - 3:30 PM	Downstairs Deck		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Wieslawa Niziol	Duality for P-Adic Pro-Étale Cohomology of Analytic Curves

Identifiable Participants' Information

Participants		89

Gender		89
Male	67.42%	60
Female	29.21%	26
Other	1.12%	1
Declined to state	2.25%	2

Ethnicity*		95
White	42.11%	40
Asian	35.79%	34
Hispanic	5.26%	5
Pacific Islander	0.00%	0
Black	1.05%	1
Native American	0.00%	0
Mixed	3.16%	3
Declined to state	12.63%	12

* ethnicity specifications are not exclusive

There were 8 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 62   Skipped: 0
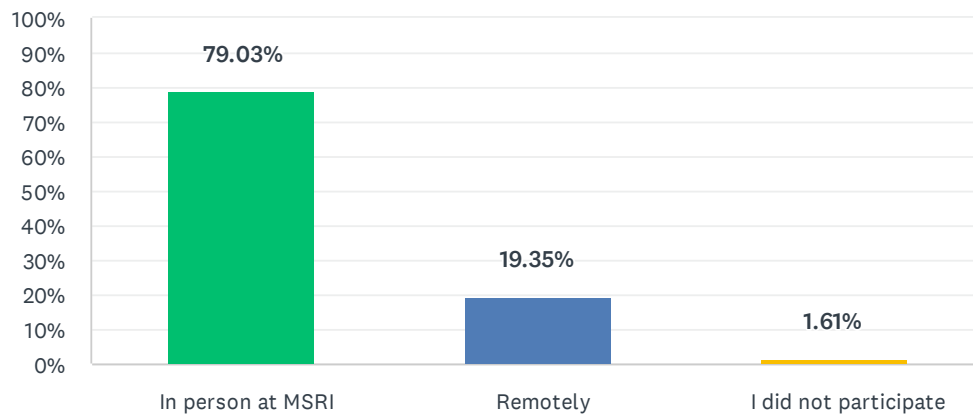
ANSWER CHOICES	RESPONSES	
In person at MSRI	79.03%	49
Remotely	19.35%	12
I did not participate	1.61%	1
TOTAL		62

Q2 The workshop was intellectually stimulating

Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 2	14.29% 6	35.71% 15	45.24% 19	42	4.21

Q3 The overall experience of the workshop was worthwhile

Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.38% 1	7.14% 3	45.24% 19	45.24% 19	42	4.33

Q4 The lectures were at an appropriate level

Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 4	19.05% 8	40.48% 17	30.95% 13	42	3.93

Q5 I was well prepared to benefit from the lectures

Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	7.14% 3	35.71% 15	21.43% 9	35.71% 15	42	3.86

Q6 My interest in the subject matter was increased by the workshop

Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 4	21.43% 9	33.33% 14	35.71% 15	42	3.95

Q7 The workshop helped me meet people with similar scientific interests

Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 2	4.76% 2	45.24% 19	45.24% 19	42	4.31

Q8 Did you find the panel discussion worthwhile?
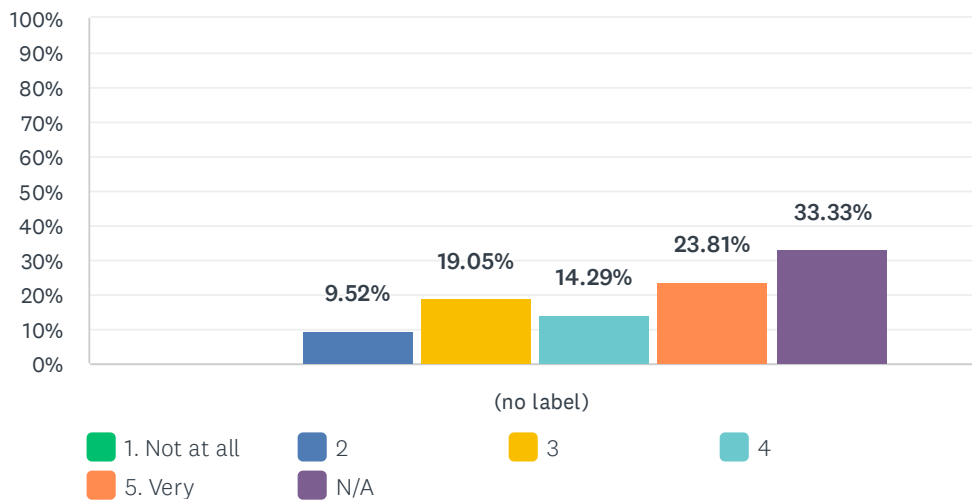
Answered: 42   Skipped: 20

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 4	19.05% 8	14.29% 6	23.81% 10	33.33% 14	42	3.79

Q9 What other subjects should be discussed in future panel discussions?

Answered: 4   Skipped: 58

#	RESPONSES	DATE
1	The panel had a huge audience and so I don't think people felt comfortable discussing difficult topics. Small group meetings on focused topics might have more value.	1/29/2023 5:42 AM
2	Tips for job applications and interviews (with panelists from different types of institutions).	1/22/2023 11:24 AM
3	How to find the right number of hours to work in a day/a week/a month/a year/a career	1/20/2023 5:44 PM
4	A possible topic could be how to write applications for permanent positions. Indeed, there is a lot of information on how to write postdoc applications, but no information about permanent positions.	1/20/2023 5:36 PM

Q10 Additional comments

Answered: 2   Skipped: 60

#	RESPONSES	DATE
1	This conference did a great job of showcasing the research of women in this field. But most of the talks were very technical and questions were mostly asked by male specialists in the audience. So I'm not sure whether a student from an underrepresented group would feel a greater sense of belonging from this workshop.	1/29/2023 5:42 AM
2	The description of the website says that it is geared towards an audience with diverse research interests. However, it feels that most of the questions are asked by experts in the topic on very specific technical details. I am sure it is out of good intentions and facilitates discussion within that area of expertise, but it may not be a comfortable/beneficial setting for audiences not specializing in the topic of that talk. It feels that these very specific technical questions sometimes also interrupts the flow of the speaker, especially for the speakers that are at an early career stage. The speaker selection was great and presents a wide range of research interests.	1/22/2023 11:24 AM

Q11 Did you attend the dinner?

Answered: 41   Skipped: 21
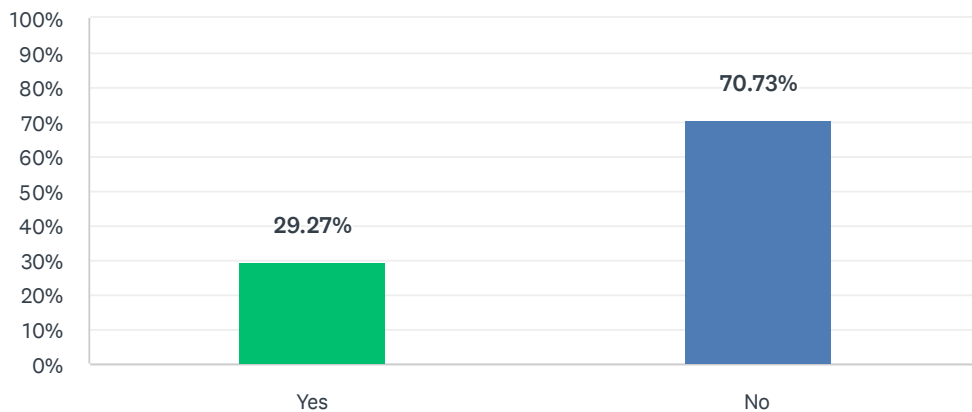
ANSWER CHOICES	RESPONSES	
Yes	29.27%	12
No	70.73%	29
TOTAL		41

Q12 Did the dinner help to solidify the contacts you made in the workshop?

Answered: 12   Skipped: 50
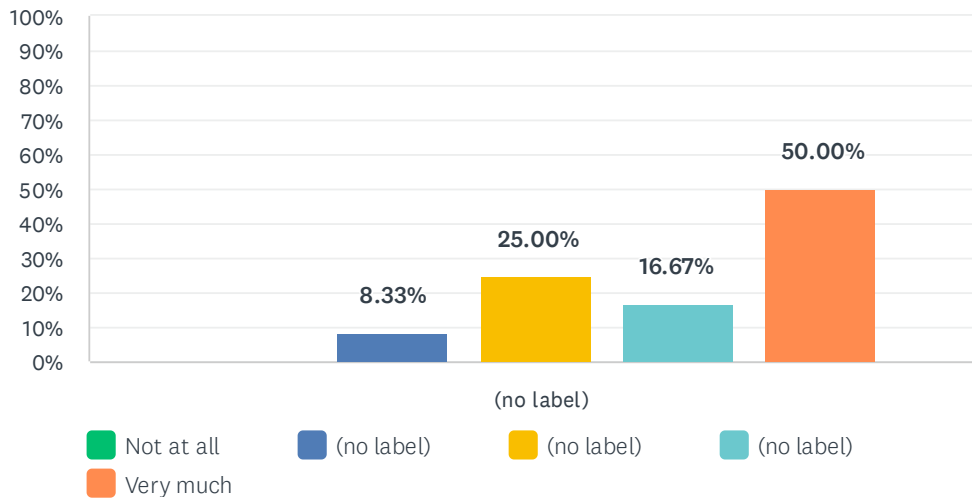
	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.33% 1	25.00% 3	16.67% 2	50.00% 6	12	4.08

Q13 Please provide any comments about the dinner

Answered: 4   Skipped: 58

#	RESPONSES	DATE
1	The dinner was very tasty and had a nice atmosphere. I got to know the women sitting close to me very well but did not get a chance to talk to some of the others.	1/29/2023 5:43 AM
2	The dinner was very nice!	1/22/2023 12:21 PM
3	Family style dinner is great -- more time on conversations, less time on studying the menu and waiting for everyone else's food to arrive.	1/22/2023 11:26 AM
4	We were told the dinner would be outdoors (because of the pandemic), but it was indoors. I and some others were disappointed with that.	1/20/2023 4:49 PM

In response to comment #4: The dinner was in a covered and partially enclosed courtyard.

Q14 I found the SLMath staff helpful

Answered: 41   Skipped: 21

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.88% 2	9.76% 4	82.93% 34	2.44% 1	41	4.80

Q15 The SLMath facilities were conducive for such a workshop

Answered: 41   Skipped: 21
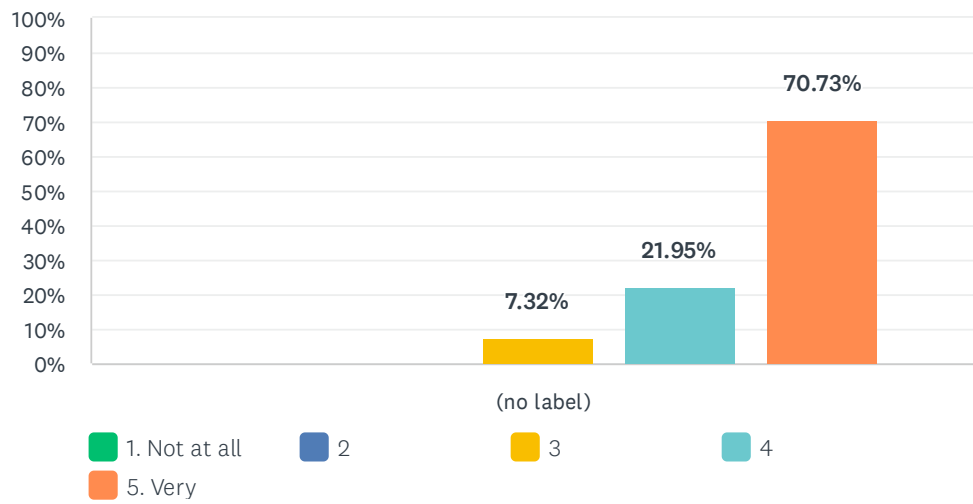
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.32% 3	21.95% 9	70.73% 29	41	4.63

Q16 Did you use SLMath's wireless network?

Answered: 41   Skipped: 21
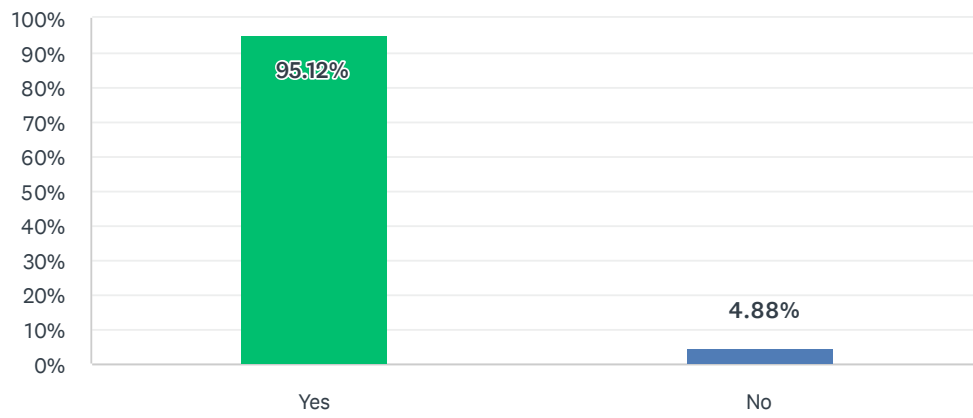
ANSWER CHOICES	RESPONSES	
Yes	95.12%	39
No	4.88%	2
TOTAL		41

Q17 Did you experience any difficulties with the network?
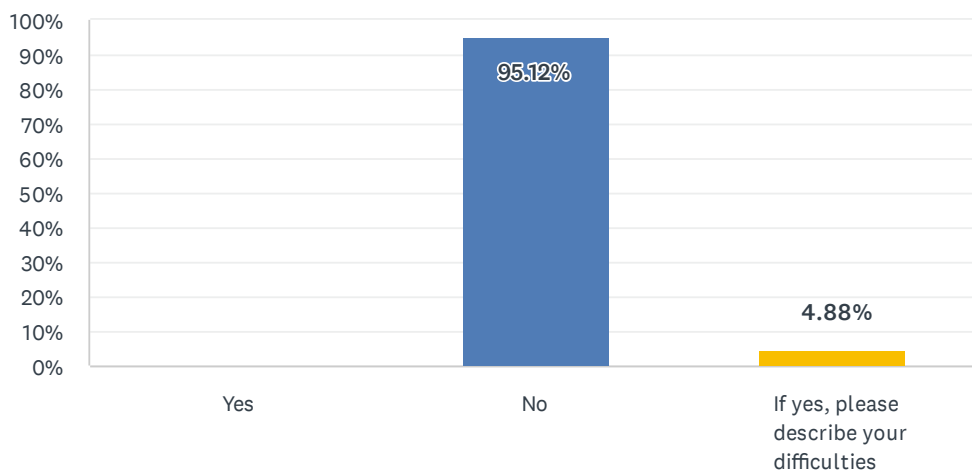
Answered: 41   Skipped: 21

ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	95.12%	39
If yes, please describe your difficulties	4.88%	2
TOTAL		41

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	Somehow the eduroam doesn't work.	1/30/2023 12:44 PM
2	I didn't know there was a network	1/20/2023 7:21 PM

Q18 The SLMath lunch arrangements were satisfactory
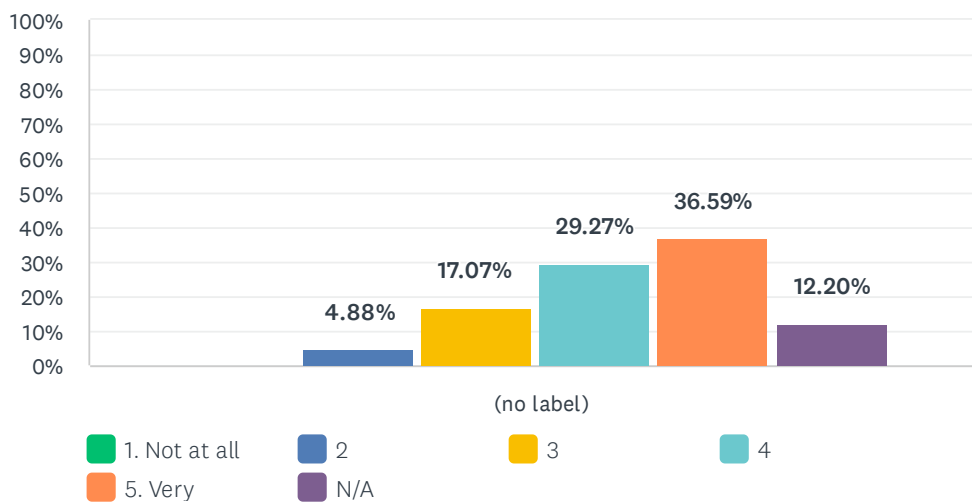
Answered: 41   Skipped: 21

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.88% 2	17.07% 7	29.27% 12	36.59% 15	12.20% 5	41	4.11

Q19 The SLMath tea arrangements were satisfactory
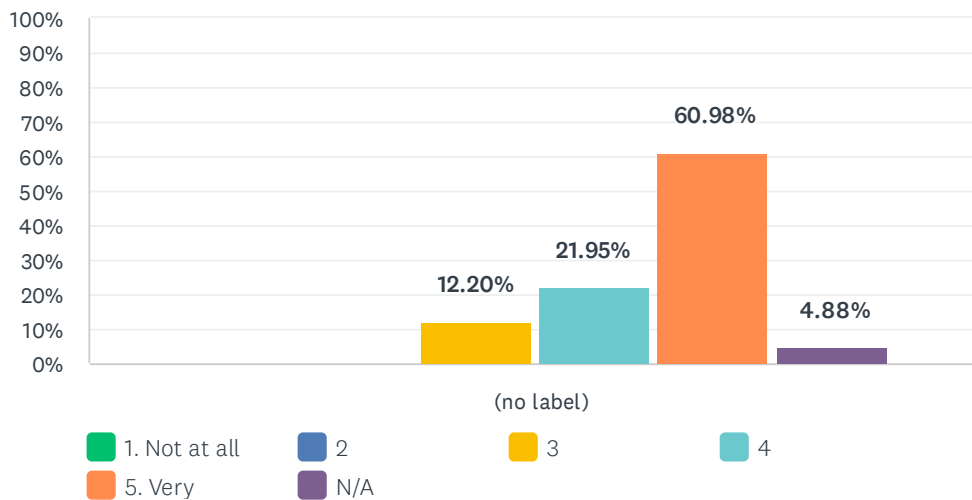
Answered: 41   Skipped: 21

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	12.20% 5	21.95% 9	60.98% 25	4.88% 2	41	4.51

Q20 Additional comments about the SLMath staff, facilities and food

Answered: 11   Skipped: 51

#	RESPONSES	DATE
1	a little chilly eating outside	1/29/2023 5:44 AM
2	Some more sweets during breaks would be nice.	1/28/2023 7:49 PM
3	Everything was great, thanks for hosting a very nice and well-organized workshop.	1/25/2023 8:45 AM
4	The staff are amazing. Wish we have better colored chalks -- the colored chalks doesn't seem to have as strong an impression as the good white chalks. Wish food delivery can be scheduled at noon right after the talks.	1/22/2023 11:34 AM
5	Serving tea outside may make sense due to lingering covid concerns, but it was much too cold to stand outside and chat with people, even with a sweater and light jacket.	1/20/2023 9:08 PM
6	It was too cold to have tea outside without heaters, especially on the shady side of the building.	1/20/2023 7:51 PM
7	Thanks for all your work!	1/20/2023 7:21 PM
8	Bongo burger could not deal with the number of participants ordering lunch on Friday. It might be helpful not to locate the tea/snacks where the sun is blocked, it was very cold.	1/20/2023 6:30 PM
9	Friendly staff	1/20/2023 6:07 PM
10	Sierra rocks!	1/20/2023 5:48 PM
11	The lunch from the restaurants came a bit late.	1/20/2023 5:36 PM

Q21 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1   Skipped: 61

#	RESPONSES	DATE
1	The point of the "Connections" workshop was not clear. What is the purpose of the workshop?	1/20/2023 4:52 PM

The following responses are from the virtual participants.

Q22 I found the SLMath staff helpful

Answered: 9   Skipped: 53
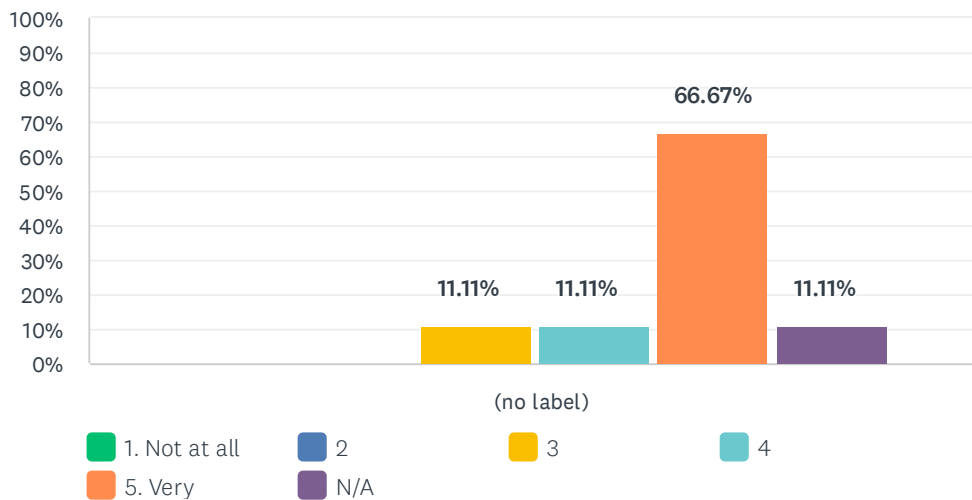
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.11% 1	11.11% 1	66.67% 6	11.11% 1	9	4.63

Q23 How many talks did you watch live?

Answered: 9   Skipped: 53
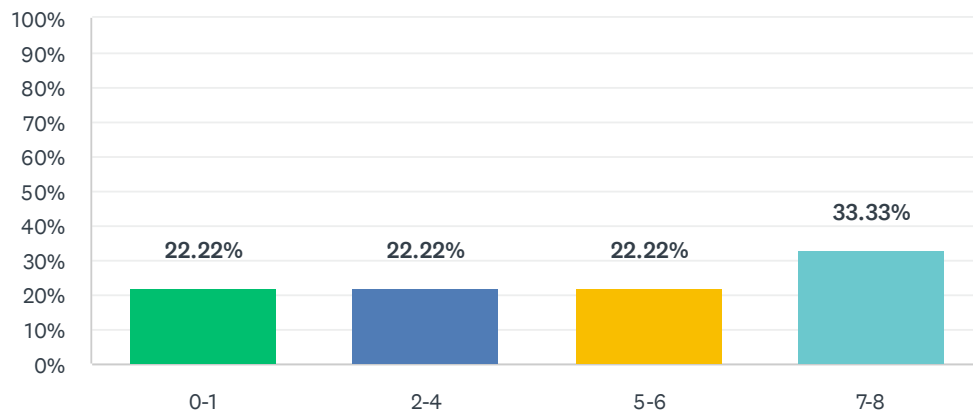
ANSWER CHOICES	RESPONSES	
0-1	22.22%	2
2-4	22.22%	2
5-6	22.22%	2
7-8	33.33%	3
TOTAL		9

Q24 The workshop was intellectually stimulating

Answered: 9   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	22.22% 2	22.22% 2	55.56% 5	9	4.33

Q25 The overall experience of the workshop was worthwhile

Answered: 9   Skipped: 53
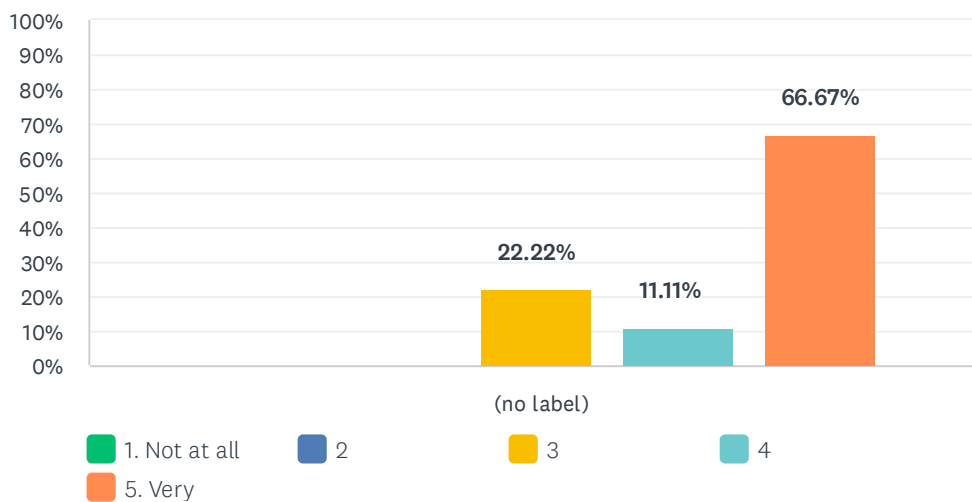
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	22.22% 2	11.11% 1	66.67% 6	9	4.44

Q26 The lectures were at an appropriate level

Answered: 9   Skipped: 53
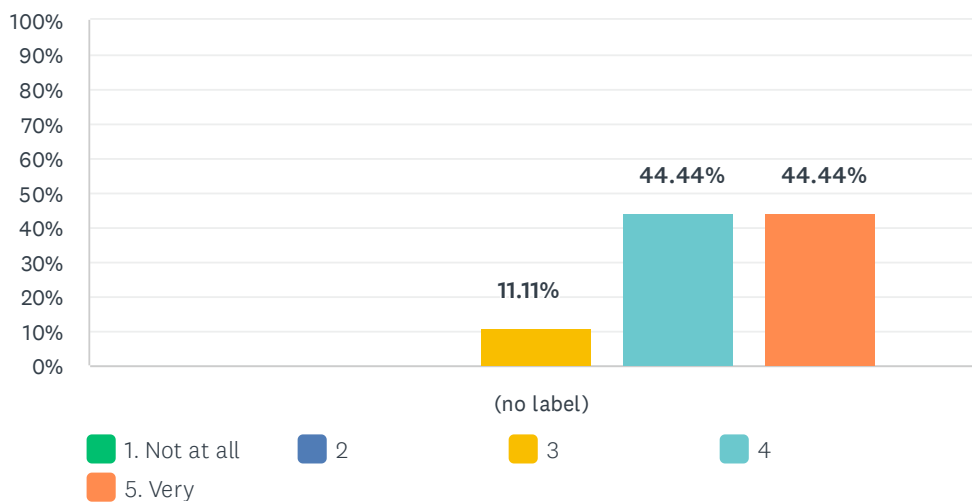
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.11% 1	44.44% 4	44.44% 4	9	4.33

Q27 I was well prepared to benefit from the lectures

Answered: 9   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	33.33% 3	33.33% 3	33.33% 3	9	4.00

Q28 My interest in the subject matter was increased by the workshop

Answered: 9   Skipped: 53
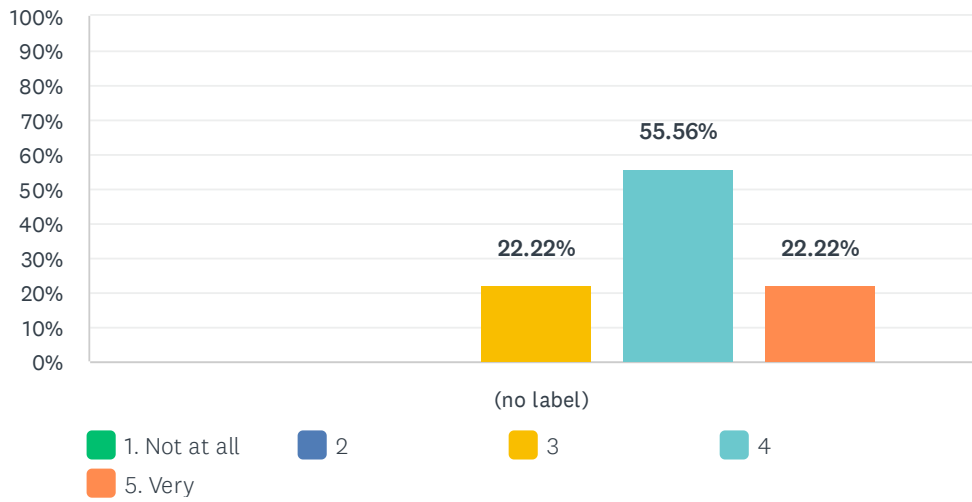
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	22.22% 2	55.56% 5	22.22% 2	9	4.00

Q29 The workshop helped me meet people with similar scientific interests

Answered: 9   Skipped: 53

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	11.11% 1	22.22% 2	22.22% 2	0.00% 0	44.44% 4	9	3.44

Q30 Did you find the panel discussion worthwhile?

Answered: 9   Skipped: 53
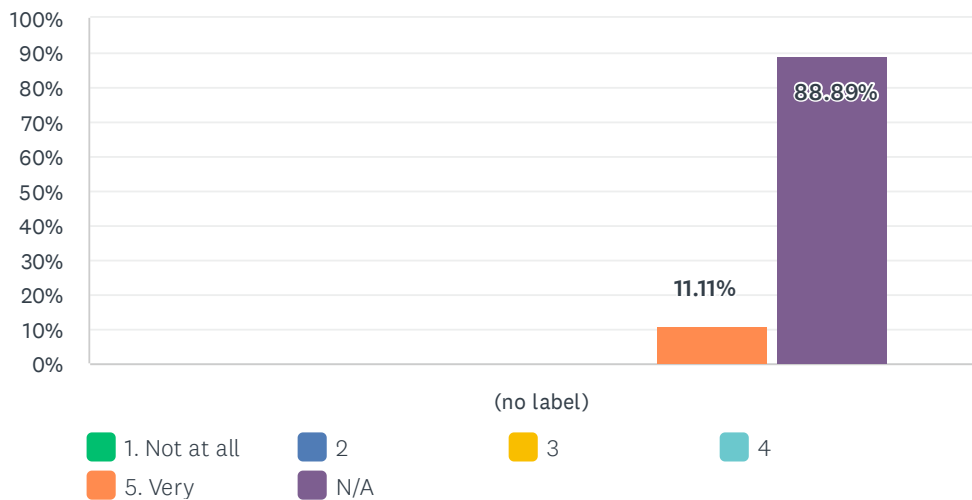
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	11.11% 1	88.89% 8	9	5.00

Q31 What other subjects should be discussed in future panel discussions?

Answered: 1   Skipped: 61

#	RESPONSES	DATE
1	Was everything are excellent	1/20/2023 7:35 PM

Q32 Additional comments

Answered: 1   Skipped: 61

#	RESPONSES	DATE
1	You do excellent job All things was clear in zoom I felt like I am with you in person Thank you	1/20/2023 7:35 PM

Q33 Did you experience any technical difficulties accessing the workshop online?

Answered: 8   Skipped: 54
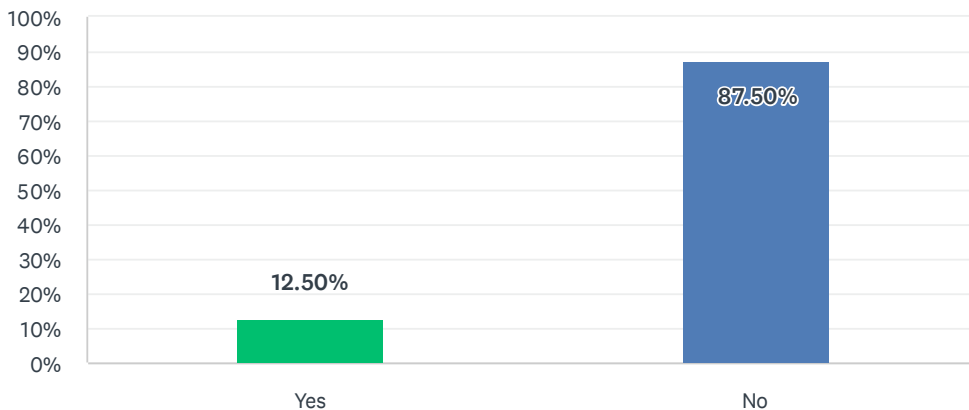
ANSWER CHOICES	RESPONSES	
Yes	12.50%	1
No	87.50%	7
TOTAL		8

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	The video froze often (thought it might be an issue on my end)	1/20/2023 8:53 PM

Q34 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 8   Skipped: 54

#	RESPONSES	DATE
1	no	1/21/2023 8:24 AM
2	I was glad that I was able to participate remotely. The time zone issue exists but does not make a huge problem.	1/21/2023 4:51 AM
3	Due to COVID situation availability of VISA is scarce. And due to huge time differences, I cannot attend talks of the later halves at all.	1/20/2023 9:35 PM
4	I was concerned about the recent storms in California.	1/20/2023 9:32 PM
5	I wasn't able to participate as I want to save money.	1/20/2023 8:53 PM
6	The time zone was different (- 11 hours) But the workshop was interesting	1/20/2023 7:41 PM
7	Participating online allowed me to attend the workshop, when otherwise I would not be able to due to family responsibilities.	1/20/2023 5:53 PM
8	It was convenient	1/20/2023 5:48 PM

Q35 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 4   Skipped: 58

#	RESPONSES	DATE
1	Maybe there should be a dedicated person who would voice the chat comments/questions in the lecture room.	1/21/2023 4:51 AM
2	Perhaps have online rooms where smaller groups of people can discuss topics of interest. I don't know if this is possible from a technical viewpoint.	1/20/2023 9:32 PM
3	Maybe zoom rooms?	1/20/2023 8:53 PM
4	No all things was excellent	1/20/2023 7:41 PM

Q36 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3   Skipped: 59

#	RESPONSES	DATE
1	I thank you for the opportunity to attend online.	1/21/2023 4:51 AM
2	The viewing of the board was good and hearing the speakers was good. So I'm not sure I have any improvements.	1/20/2023 9:34 PM
3	You do excellent job All things was clear in zoom I felt like I am with you in person	1/20/2023 7:41 PM

Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems

January 23, 2023 – January 27, 2023

Hybrid Workshop

Organizers:

Henri Darmon (McGill University)

Ellen Eischen (University of Oregon)

Benjamin Howard (Boston College)

Elena Mantovan (California Institute of Technology)

REPORT ON THE MSRI WORKSHOP
"Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems (Hybrid Workshop)"
January 23 – January 27, 2023

Organizers

- Henri Darmon (McGill University)
- Ellen Eischen (University of Oregon)
- Benjamin Howard (Boston College)
- Elena Mantovan (California Institute of Technology)

Scientific Description

This workshop was held in honor of mathematician Bernadette Perrin-Riou. The Introductory Workshop aimed to provide a coherent overview, including relevant background information, of current research in algebraic cycles, L-values, Euler systems, and the many connections between them. This included the study of special cycles on Shimura varieties and moduli spaces of shtukas, integral representations of L-values and the construction of p-adic L-functions, and the construction of Euler systems from special elements in Chow groups or higher Chow groups of Shimura varieties. Workshop lectures were organized into short lecture series, so as to allow each series to begin with expository lectures on foundational results before moving on to current research. The workshop was paired with activity in Paris celebrating the mathematical influence of Perrin-Riou.

Highlights of the Workshop

The workshop presented a varied selection of mini lecture series revolving around the themes of the program. Chris Skinner's lecture series opened the conference on a very accessible note, introducing the audience to some of the key motivating ideas behind the theory of Euler systems and succeeding, by the end of the second lecture, to touch on cutting edge research, introducing exciting new ideas that are likely to have a strong impact on the development of the subject. Skinner's talks were complemented by those of Sarah Zerbes, who introduced some of the more recent new instances of Euler systems. Other important aspects and topics related to the theory of Euler systems were explored in the lectures by Prasanna, Grossi, Liu and Pozzi. Kartik Prasanna focused on connections between cycles, the Langlands program, and Euler systems, and his lectures also resonated strongly with the audience. Giada Grossi discussed the key example of Heegner points, over her two lectures explained most of the ideas going into Kolyvagin's now-classic proof bounding Selmer groups of elliptic curves of analytic rank one. Zheng Liu gave a friendly introduction to p-adic L-functions. Alice Pozzi presented a construction of p-adic families of modular forms. The mini courses by Tony Feng and Sug Woo Shin focused on the study of cycles on unitary Shimura varieties and their function field counterparts, and touched on ideas which are likely to play an increasingly important role in future research. The lecture series by Antonio Lei on the Perrin-Riou map and the talks by Denis Benois and Laurent Berger were a moving tribute to the intellectual legacy of Bernadette Perrin-Riou on the subject.

The selected topics seemed to resonate well with the audience and lectures were generally well received.

The presence of a lively and energetic audience, eager to exchange ideas in-person after close to two years of pandemic restrictions, definitely enhanced the quality of the experience and the intensity and fruitfulness of the scientific interactions. We mention that Perrin-Riou faithfully attended the entire workshop remotely, although it typically ended at around 3 AM Paris time, including the Tuesday afternoon lectures which were delivered after the dinner banquet in Paris in her honor.

Organizers

First Name	Last Name	Institution
Henri	Darmon	McGill University
Ellen	Eischen	University of Oregon
Benjamin	Howard	Boston College
Elena	Mantovan	California Institute of Technology

Speakers

First Name	Last Name	Institution
Denis	Benois	Institut de Mathématiques de Bordeaux
Laurent	Berger	École Normale Supérieure de Lyon
Tony	Feng	University of California, Berkeley
Giada	Grossi	Université de Paris XIII (Paris-Nord)
Antonio	Lei	University of Ottawa
Zheng	Liu	University of California, Santa Barbara
Alice	Pozzi	Imperial College, London
Kartik	Prasanna	University of Michigan
Sug Woo	Shin	University of California, Berkeley
Christopher	Skinner	Princeton University
Sarah	Zerbes	ETH Zürich

Introductory Workshop: Algebraic Cycles, L-Values, and Euler Systems

January 23, 2023 - January 27, 2023

Monday, January 23, 2023			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Christopher Skinner	Euler Systems, L-Values, and All That: a Brief Introduction Pt I
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Simons Auditorium	Tony Feng	Special Cycles on Shimura Varieties and Moduli of Shtukas Pt I
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Kartik Prasanna	Cycles, Motives and Langlands Pt I
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Giada Grossi	The Kolyvagin System of Heegner Points Pt I

Tuesday, January 24, 2023			
8:00 AM - 9:00 AM	Simons Auditorium	Denis Benois	Iwasawa Theory for Critical Modular Forms
9:00 AM - 9:30 AM	Atrium		Break
9:30 AM - 10:30 AM	Simons Auditorium	Laurent Berger	Universal Norms and (Phi,Gamma)-Modules
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Simons Auditorium	Kartik Prasanna	Cycles, Motives and Langlands Pt II
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Giada Grossi	The Kolyvagin System of Heegner Points Pt II
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Tony Feng	Special Cycles on Shimura Varieties and Moduli of Shtukas Pt II
4:30 PM - 6:20 PM	Front Courtyard		Reception

Wednesday, January 25, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Antonio Lei	The Perrin-Riou Map and its Use in Iwasawa Theory Pt I
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Simons Auditorium	Christopher Skinner	Euler Systems, L-Values, and All That: a Brief Introduction Pt II
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
3:00 PM - 3:30 PM	Atrium		Afternoon Tea

Thursday, January 26, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Zheng Liu	P-Adic L-Functions Pt I
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Simons Auditorium	Sarah Zerbes	An Introduction to Euler Systems Pt I
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Sug Woo Shin	Cohomology of Shimura Varieties Pt I
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Antonio Lei	The Perrin-Riou Map and its Use in Iwasawa Theory Pt II

Friday, January 27, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Zheng Liu	P-Adic L-Functions Pt II
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Simons Auditorium	Sarah Zerbes	An Introduction to Euler Systems Pt II
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Sug Woo Shin	Cohomology of Shimura Varieties Pt II
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Alice Pozzi	Rigid Meromorphic Cocycles and P-Adic Families of Modular Forms

Identifiable Participants' Information

Participants		149

Gender		149
Male	73.83%	110
Female	23.49%	35
Other	0.67%	1
Declined to state	2.01%	3

Ethnicity*		157
White	38.85%	61
Asian	42.68%	67
Hispanic	4.46%	7
Pacific Islander	0.00%	0
Black	1.27%	2
Native American	0.00%	0
Mixed	2.55%	4
Declined to state	10.19%	16

* ethnicity specifications are not exclusive

There were 7 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 99   Skipped: 0
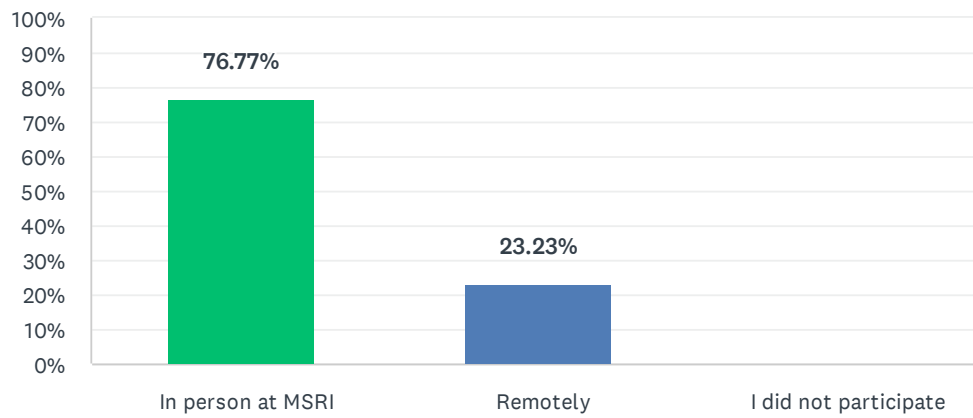
ANSWER CHOICES	RESPONSES	
In person at MSRI	76.77%	76
Remotely	23.23%	23
I did not participate	0.00%	0
TOTAL		99

Q2 The workshop was intellectually stimulating

Answered: 69   Skipped: 30
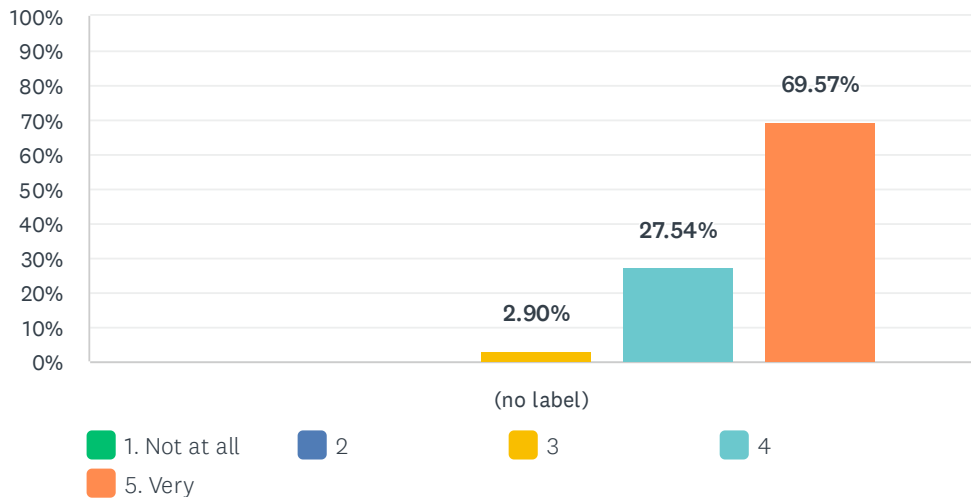
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.90% 2	27.54% 19	69.57% 48	69	4.67

Q3 The overall experience of the workshop was worthwhile

Answered: 69   Skipped: 30
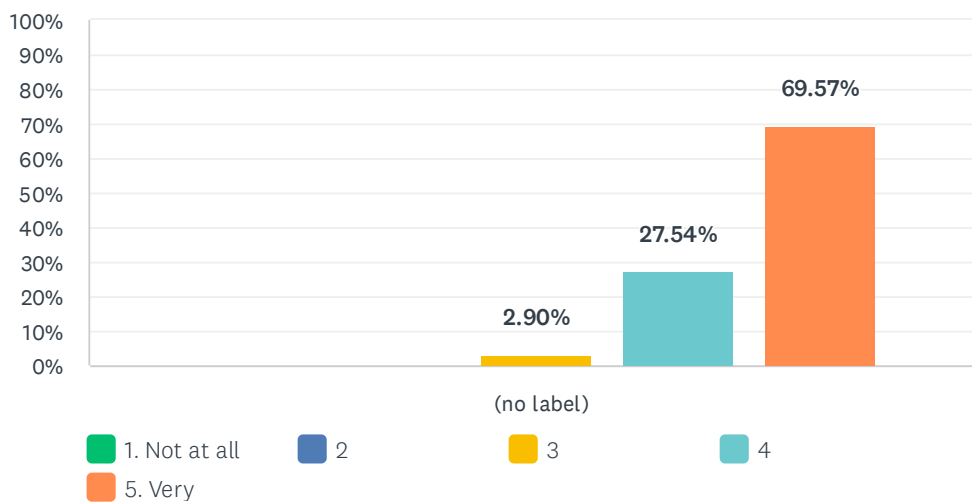
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.90% 2	27.54% 19	69.57% 48	69	4.67

Q4 The lectures were at an appropriate level

Answered: 69   Skipped: 30

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 3	14.49% 10	40.58% 28	40.58% 28	69	4.17

Q5 I was well prepared to benefit from the lectures

Answered: 69   Skipped: 30

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	7.25% 5	24.64% 17	27.54% 19	40.58% 28	69	4.01

Q6 My interest in the subject matter was increased by the workshop

Answered: 69   Skipped: 30

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.59% 8	33.33% 23	55.07% 38	69	4.43

Q7 The workshop helped me meet people with similar scientific interests

Answered: 69   Skipped: 30
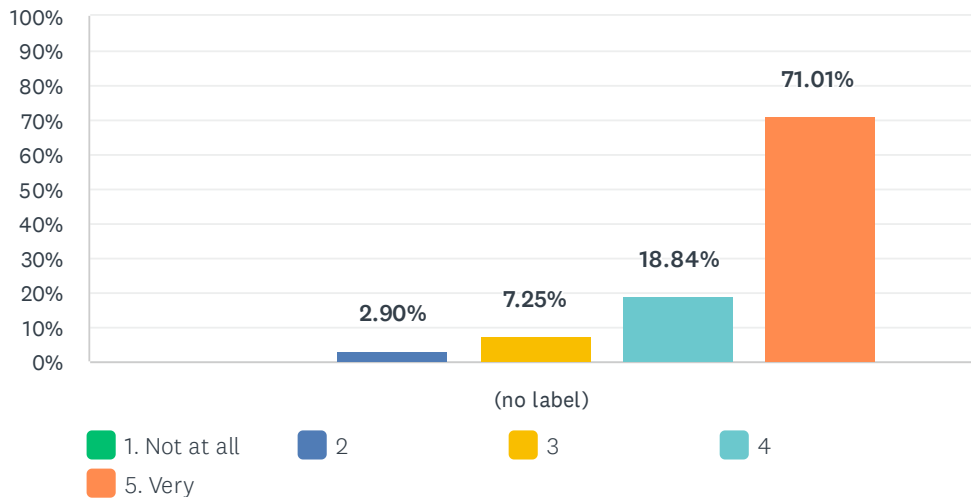
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.90% 2	7.25% 5	18.84% 13	71.01% 49	69	4.58

Q8 What were the highlights of the lectures?

Answered: 69   Skipped: 30

#	RESPONSES	DATE
1	Chris Skinner's talk was very impressive.	2/17/2023 5:57 AM
2	The talks given by Prof. Skinner on a new approach for constructing Euler systems, and the talks by Prof. Lei on Perrin--Riou's maps.	2/10/2023 9:49 AM
3	Lectures	2/7/2023 11:49 AM
4	The ones that give intuitions and big directions of the subjects are of more interest to me.	2/7/2023 11:40 AM
5	the lectures on the first day	2/7/2023 11:16 AM
6	Euler systems and the cohomology of Shimura varieties.	2/5/2023 12:07 PM
7	Alice Pozzi's lecture was the most interesting.	2/4/2023 3:13 PM
8	they were all very well prepared and interesting--I learned a lot of new stuff	2/2/2023 7:29 AM
9	Although every lecture was different from each other in terms of level, context, etc., I would say that all lectures were given by the experts in the field. Also the parts where the people threw each other the green microphone box was a lot fun to watch.	2/2/2023 12:07 AM
10	Very good lecture by Chris Skinner	2/1/2023 6:46 PM
11	It was very nice that most of the lecturers had two sessions of one hour each, so that way they could devote more time to the background and to explain the results more clearly.	2/1/2023 5:26 PM
12	I was particularly impressed by Prof Zheng Liu's first lecture, where she presented a way to find volumes of the p-adic measure by varying local Schwartz functions. In fact it reminded me exactly of some computations I did earlier by myself, and now I begin to understand what I computed! I also enjoyed Prof Zerbes's challenge at the end of her first lecture.	2/1/2023 5:05 PM
13	I liked the introduction given by Skinner	2/1/2023 3:21 PM
14	.	2/1/2023 2:26 PM
15	The answer to this question reflects only my personal opinion, but, coming from a different field, I was very pleased to learn more about the construction of Euler systems and Heegner points and how they have been used to study, for instance, problems around BSD conjecture.	2/1/2023 2:14 PM
16	Some lectures (like Skinner's) motivate people from an "elementary" example, some (like Feng's) provide interesting analogs, and some (like Shin's) give a both conceptual and detailed introduction on one particular topic.	2/1/2023 2:02 PM
17	I really enjoyed listening to Chris Skinner's lectures.	2/1/2023 2:00 PM
18	The talks of Sarah Zerbes that inspired new directions in looking for Euler systems.	2/1/2023 1:44 PM
19	Audience questions.	2/1/2023 1:42 PM
20	The Part I talks on the first day of the conference all intended to teach a broad audience, which was excellent.	2/1/2023 1:42 PM
21	Many of the talks were great overviews that were at a level accessible to graduate students. A bit of entertainment, jokes, etc. thrown in were nice touches too.	2/1/2023 3:32 AM
22	I enjoyed that each lecture series had 2 parts.	1/31/2023 4:01 PM
23	The talks that interested me the most were the ones by Antonio Lei and the ones by Zheng Liu. My research is closely related to the subject of Liu's talk so I knew in advance that they would interest me. On the other hand, I knew very little about the content of Lei's talk initially but his presentations were very enlightening and motivating.	1/31/2023 10:57 AM

24	Chris Skinner's first lecture was excellent for motivating the subject matter of the workshop. Antonio Lei's first talk was very clear and did not assume too much prior knowledge. Similarly, I found the large number of examples given by Sarah Zerbes in her first talk very useful.	1/30/2023 8:32 AM
25	Great	1/29/2023 11:01 AM
26	The lectures of females in math seem to be more well-prepared according to the audience compared to average	1/29/2023 9:38 AM
27	Every single talk was great. They were all very well-motivated, I especially found Tony Feng's talk well-explained. Kartik Prasanna mentioned Naomi Sweeting's recent work, which I find very interesting. The talks of Sarah Zerbes, Antonio Lei, Zheng Liu, Giada Grossi, and Chris Skinner all tied into each other very well.	1/28/2023 10:24 PM
28	I do like the lectures by Tony, Sarah and many others very much.	1/28/2023 7:16 PM
29	the engaged participants and speakers	1/28/2023 6:57 PM
30	The catch box	1/28/2023 3:57 PM
31	Prasanna's and Zerbes' pairs of lectures were my highlights. They presented ideas related to algebraic cycles that I was not aware of before and that I find extremely interesting.	1/28/2023 2:53 PM
32	The clarity of (at least some of) the expositions.	1/28/2023 12:19 PM
33	Quite a lot such as in the talks of Feng and Skinner with a lot of stimulating Q and A. The catch box is an ingenious device too!	1/28/2023 11:29 AM
34	Skinner's second lecture.	1/28/2023 11:17 AM
35	The motivating lectures by the leading experts in my research area.	1/28/2023 9:37 AM
36	Many of the lectures were great. I particularly enjoyed Chris Skinner's Kartik Prasanna's, and Sug Woo Shin's. I liked that they all gave a broad introduction to the topic while also explaining some very recent results and ideas.	1/28/2023 9:28 AM
37	Chris Skinner	1/28/2023 9:21 AM
38	Some lectures were very interesting, but some are not really at an introductory level.	1/28/2023 6:56 AM
39	I liked all the lectures I attended	1/28/2023 6:13 AM
40	several of the lecture series touched on new approaches that the community (or me at least) had been less exposed to during the pandemic, and felt fresh and exciting.	1/28/2023 5:52 AM
41	Diverse range of topics	1/28/2023 12:59 AM
42	Structure	1/28/2023 12:26 AM
43	Learning new material from experts in the field	1/27/2023 10:18 PM
44	introduction to Euler systems	1/27/2023 9:47 PM
45	The lectures were very organized and prepared.	1/27/2023 9:47 PM
46	Construction of Euler systems and computation for p-adic L-functions.	1/27/2023 8:46 PM
47	Tony Feng's lectures	1/27/2023 8:14 PM
48	Mostly pitched at right level for intro workshop	1/27/2023 8:05 PM
49	The talk by Prof. Tony Feng and Prof. Christopher Skinner	1/27/2023 7:56 PM
50	Learning about Shimura Varieties	1/27/2023 7:46 PM
51	Chris Skinner's talks	1/27/2023 7:40 PM
52	The chat-box	1/27/2023 7:35 PM
53	Being able to meet and talk to people who had thought about similar things as my own research, and who had meaningful insights to share about that and their own math.	1/27/2023 7:26 PM
54	Christopher Skinner's first lecture and Sarah Zerbes' first lecture. They did a great job communicating big ideas and important points -- very helpful for someone outside the area.	1/27/2023 6:58 PM

55	There were some very good ones, but most started introductory for a few minutes but by the end of the first lecture were way beyond introductory.	1/27/2023 6:50 PM
56	.	1/27/2023 6:42 PM
57	Skinner's second talk	1/27/2023 6:39 PM
58	Connections between different areas.	1/27/2023 6:00 PM
59	Getting answers to technical questions straight from the experts, interacting with future colleagues, beautiful lectures, overall being in math heaven!	1/27/2023 5:48 PM
60	Intro lectures were good. I'm actually at the institute for the other program, but had some interest in this workshop.	1/27/2023 5:48 PM
61	The micro-box.	1/27/2023 5:38 PM
62	Some personal favorites were the lectures by Skinner, Feng, and Pozzi.	1/27/2023 5:33 PM
63	Skinner's lecture series	1/27/2023 5:17 PM
64	I thought Chris Skinner's lectures were a model for lectures during an introductory workshop.	1/27/2023 5:09 PM
65	Sug Woo Shin's, Tony Feng's, and Kartik Prasanna's Lectures.	1/27/2023 5:08 PM
66	Chris Skinner's second talk was fantastic.	1/27/2023 5:00 PM
67	I am mostly here for DG, but it was really interesting to see people approach the same objects from an entirely different perspective.	1/27/2023 4:58 PM
68	Nothing particular	1/27/2023 4:51 PM
69	some exciting results announced	1/27/2023 4:46 PM

Q9 Additional comments

Answered: 6   Skipped: 93

#	RESPONSES	DATE
1	Many of the lectures were at too high of a level for students and people learning about the topics.	2/4/2023 3:13 PM
2	I really like the encouragement for questions during and after lectures.	2/1/2023 5:05 PM
3	No comment really, thank you for organizing this!	1/31/2023 10:57 AM
4	It would have been helpful to provide some sort of expectation or guideline for prerequisite knowledge coming into the workshop. As a grad student, I appreciate that I was one of the least knowledgeable people in attendance, but for an "introductory" workshop I did not feel adequately prepared at the start of the week in hindsight. I was able to at least partially rectify this during the week by speaking to my advisor, and others, so the workshop was still very helpful, but had some sort of guideline for prior knowledge/reading been available beforehand I could have gotten more out of the workshop.	1/30/2023 8:32 AM
5	I would have preferred if the more introductory talks would have been placed at the beginning of the week. It would have helped me better understand some of the first talks.	1/28/2023 12:19 PM
6	It was weird to have the connections workshop (where the talks were on current research, hence rather difficult) before the introductory workshop. I would have gotten much more out of the connections workshop if the order had been flipped.	1/27/2023 4:58 PM

Q10 I found the SLMath staff helpful

Answered: 69   Skipped: 30

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.45% 1	0.00% 0	7.25% 5	88.41% 61	2.90% 2	69	4.88

Q11 The SLMath facilities were conducive for such a workshop

Answered: 69   Skipped: 30
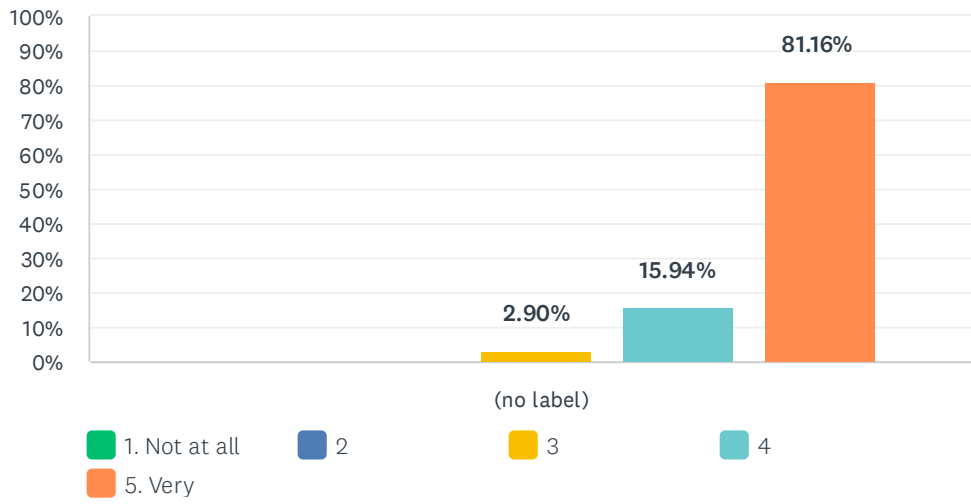
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.90% 2	15.94% 11	81.16% 56	69	4.78

Q12 Did you use SLMath's wireless network?

Answered: 69   Skipped: 30
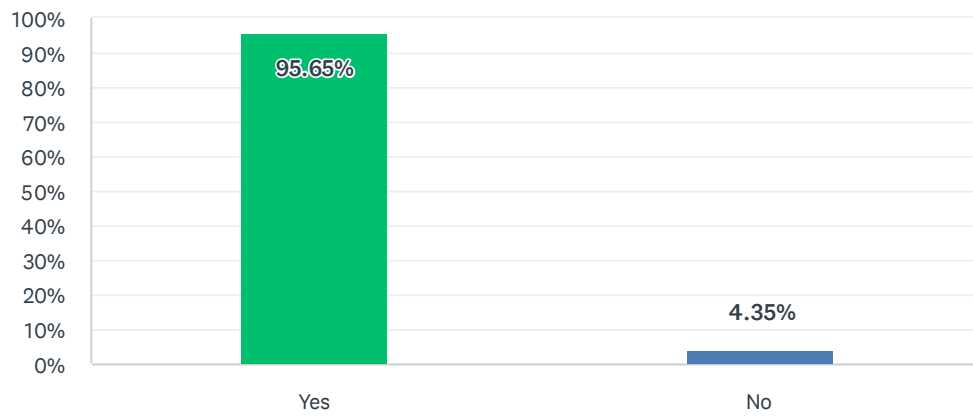
ANSWER CHOICES	RESPONSES	
Yes	95.65%	66
No	4.35%	3
TOTAL		69

578

Q13 Did you experience any difficulties with the network?

Answered: 69   Skipped: 30
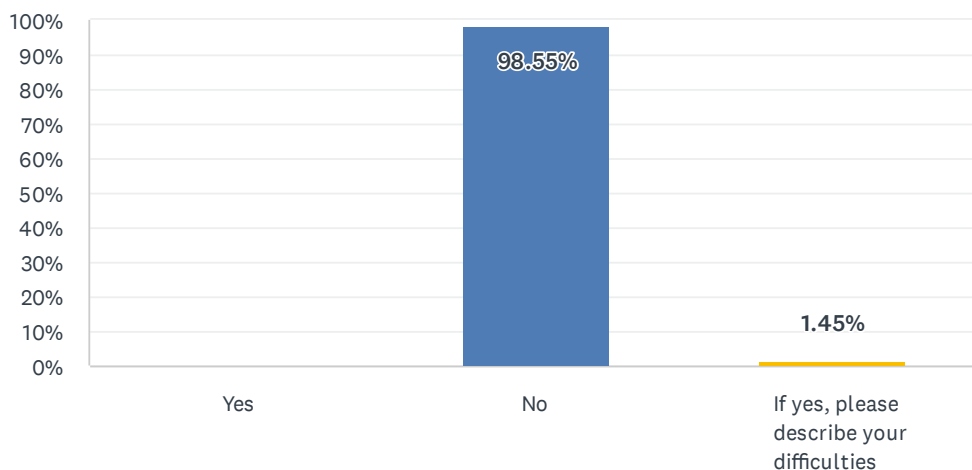
ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	98.55%	68
If yes, please describe your difficulties	1.45%	1
TOTAL		69

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	The eduroam network doesn't work, but it wasn't a problem because the SLMath network works.	2/1/2023 3:34 AM

Q14 The SLMath lunch arrangements were satisfactory

Answered: 69   Skipped: 30

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 3	14.49% 10	28.99% 20	43.48% 30	8.70% 6	69	4.22

Q15 The SLMath tea arrangements were satisfactory

Answered: 69   Skipped: 30
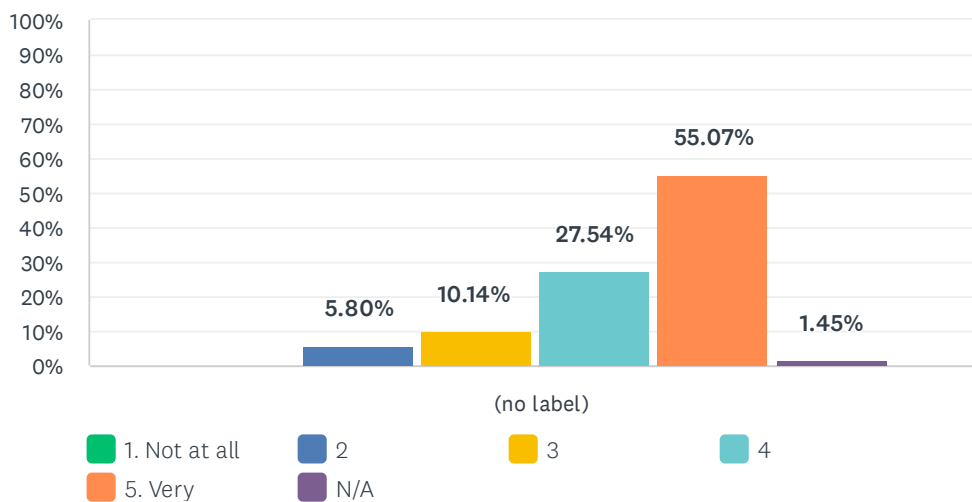
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.80% 4	10.14% 7	27.54% 19	55.07% 38	1.45% 1	69	4.34

Q16 Additional comments about the SLMath staff, facilities and food

Answered: 17   Skipped: 82

#	RESPONSES	DATE
1	I am very grateful to the staff, especially for answering patiently all my questions and being helpful with my queries, even though I might have asked too many.	2/2/2023 12:14 AM
2	The restaurant Thai Delight seems overpriced (rice is separate and charges $3+); I wasn't impressed by their food either.	2/1/2023 5:11 PM
3	There must be a more efficient way for lunch distribution.	2/1/2023 2:04 PM
4	Sometimes there was a bottleneck from the placement of the food and tea in a narrow corridor. It would be a lot easier for people to access quickly if it was always in an open space! Also would be nice to always have drink options in the food delivery menu.	2/1/2023 3:34 AM
5	I like the old lunch system better for workshops where SLMath had catering. However, I understand that might be more difficult since the pandemic.	1/31/2023 4:01 PM
6	Picking up the lunch seems to be some chaos from time to time	1/29/2023 9:39 AM
7	I wish there were more sweets during the breaks. It was great that the coffee was always promptly refilled!	1/28/2023 10:25 PM
8	It will be perfect if a little better coffee is available.	1/28/2023 7:16 PM
9	SLMath is a fantastic place to do research!	1/28/2023 9:29 AM
10	Tuesday lunch was too overpriced and sometimes the food is slightly cold.	1/28/2023 6:57 AM
11	The long line for coffee leading to the outdoor terrasse in the afternoon break was far from ideal. Most participants spent more time in line than outdoors with their coffee. Perhaps a better layout should be explored.	1/28/2023 5:55 AM
12	I interacted mostly with Bertram and Sierra, and they were super helpful and kind.	1/27/2023 8:06 PM
13	Beautiful and practical	1/27/2023 7:41 PM
14	This was probably the best-run conference I've ever been to.	1/27/2023 7:26 PM
15	There really need to be power outlets in the lecture hall.	1/27/2023 6:51 PM
16	Lunch was often late, the long queue for tea limited discussions among participants. The queue could be avoided by having two tables with the same food, hence two smaller queues.	1/27/2023 6:02 PM
17	seemed like the tea often ran out of popular food items early — sometimes before those at the back of the line even reached the table.	1/27/2023 4:59 PM

Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 5   Skipped: 94

#	RESPONSES	DATE
1	Maybe more group events for the junior/younger participants?	2/1/2023 2:05 PM
2	I've noticed that some workshops have "discussion sessions" for participants to discuss the content of the lectures among themselves (maybe with guidance from the experts). I wonder if this would be helpful to adopt for MSRI/SL Math's future workshops.	1/28/2023 10:27 PM
3	It would be even better if coffee is available for all participants on site during the day.	1/28/2023 9:39 AM
4	The staff was accommodating.	1/27/2023 9:48 PM
5	There was a strong gender imbalance among non speaking participants.	1/27/2023 6:03 PM

The following responses are from the virtual participants.

Q18 I found the SLMath staff helpful

Answered: 18   Skipped: 81
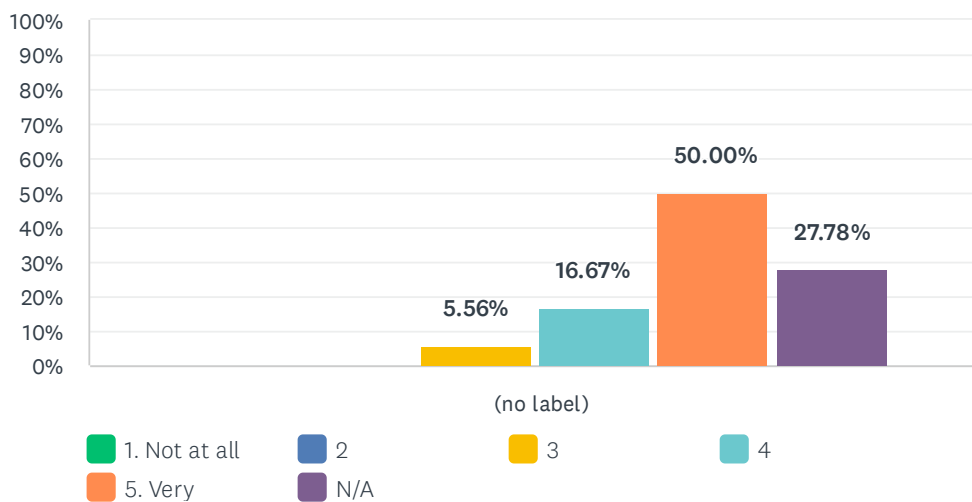
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.56% 1	16.67% 3	50.00% 9	27.78% 5	18	4.62

Q19 How many talks did you watch live?

Answered: 18   Skipped: 81
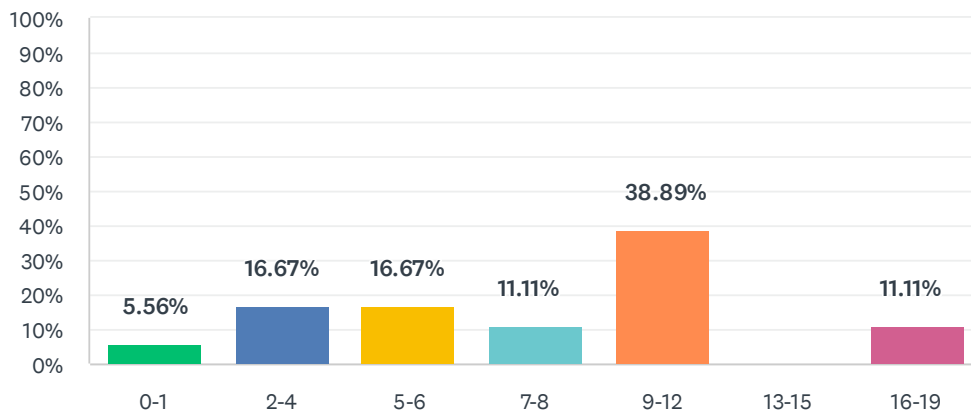
ANSWER CHOICES	RESPONSES	
0-1	5.56%	1
2-4	16.67%	3
5-6	16.67%	3
7-8	11.11%	2
9-12	38.89%	7
13-15	0.00%	0
16-19	11.11%	2
TOTAL		18

Q20 The workshop was intellectually stimulating

Answered: 18   Skipped: 81

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.56% 1	16.67% 3	11.11% 2	66.67% 12	18	4.39

587

Q21 The overall experience of the workshop was worthwhile

Answered: 18   Skipped: 81
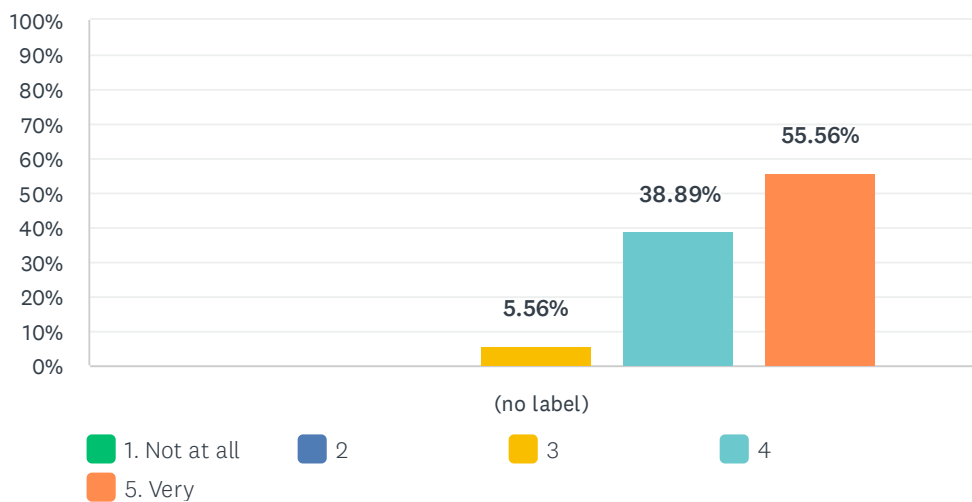
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.56% 1	38.89% 7	55.56% 10	18	4.50

Q22 The lectures were at an appropriate level

Answered: 18   Skipped: 81

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.56% 1	22.22% 4	22.22% 4	50.00% 9	18	4.17

Q23 I was well prepared to benefit from the lectures

Answered: 18   Skipped: 81
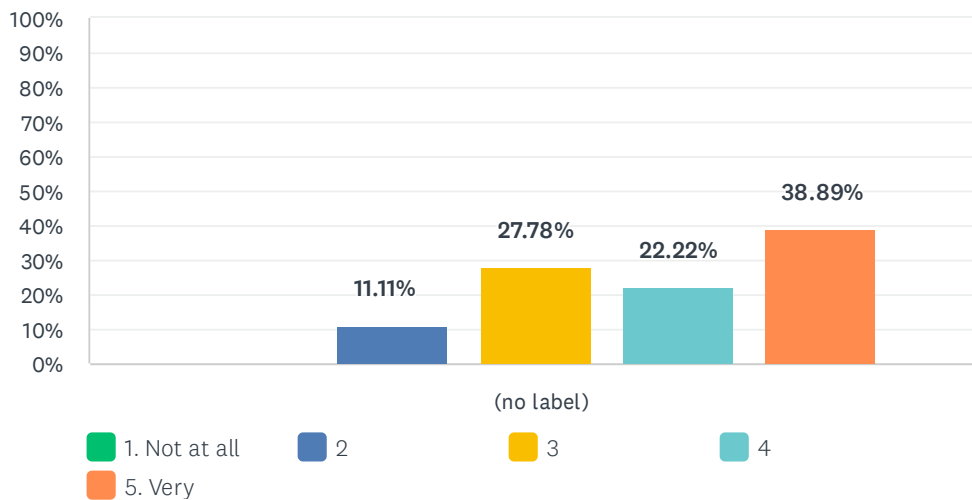
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	11.11% 2	27.78% 5	22.22% 4	38.89% 7	18	3.89

Q24 My interest in the subject matter was increased by the workshop

Answered: 18   Skipped: 81
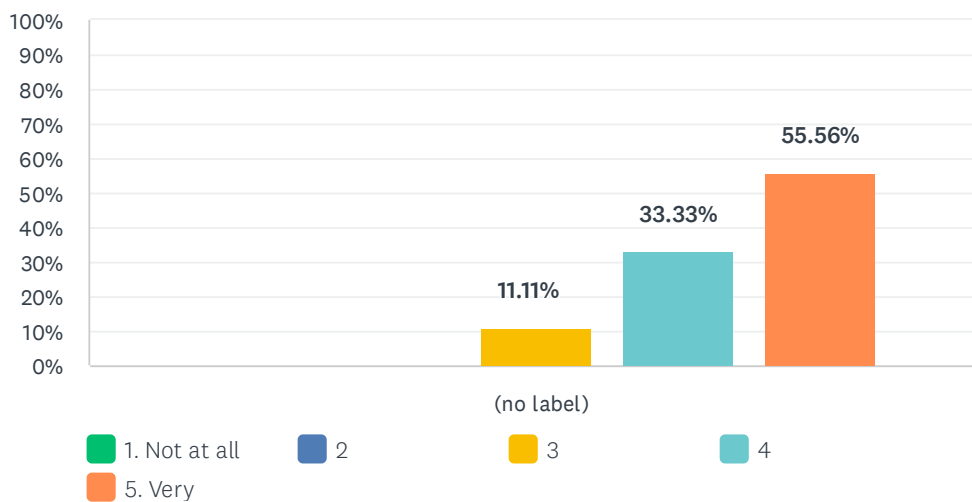
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.11% 2	33.33% 6	55.56% 10	18	4.44

Q25 The workshop helped me meet people with similar scientific interests

Answered: 18   Skipped: 81

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	27.78% 5	33.33% 6	16.67% 3	16.67% 3	5.56% 1	18	2.39

Q26 What were the highlights of the lectures?

Answered: 18   Skipped: 81

#	RESPONSES	DATE
1	Antonio Lei and Sarah Zerbes' minicourses	2/7/2023 11:04 AM
2	N/A	2/7/2023 10:28 AM
3	I gave a talk, but unfortunately did not attend the others	2/4/2023 4:02 AM
4	I was very interested in the lectures on the Kolyvagin system of Heegner points.	2/2/2023 12:24 PM
5	very good equipment for remote listeners.	2/1/2023 3:06 PM
6	I like the lectures by Tony Feng!	2/1/2023 2:17 PM
7	The speakers brought new and interesting perspectives to things I had seen previously.	2/1/2023 1:52 PM
8	The interconnections between all of them.	1/30/2023 9:25 AM
9	The introductory lecture about Euler systems are really helpful.	1/29/2023 10:12 AM
10	Brilliant mathematicians presented interesting ideas in a clear and engaging way.	1/29/2023 7:40 AM
11	The start of the first talk, Introduction to Introductory Workshop. Chris Skinner presented the connection between the analytic class number formula in the case of real quadratic fields and the computation of the class number by Gauss sums showing that the L-value is the intermediary.	1/28/2023 2:36 PM
12	They filled in some information for me that was super helpful related to my research interest. They also gave me a sense of different directions other researchers were going down related to that. I found the lectures to be highly engaging, and they were at a time that generally worked so that I could attend them.	1/28/2023 11:16 AM
13	Euler systems	1/28/2023 9:10 AM
14	They are about the machineries and recent theories. Very interesting!	1/28/2023 7:52 AM
15	Professor Prasanna's lectures on Cycles, Motives and Langlands. He clearly explained the connection between Beilinson's conjecture and Deligne's conjecture, which helps me to catch the idea very simply.	1/28/2023 2:12 AM
16	Knowledge stimulating lectures on Algebraic cycles, Euler Systems	1/28/2023 12:10 AM
17	Sug Woo Shin's talk on how to detect the Galois action on cohomology on Shimura variety.	1/27/2023 5:53 PM
18	I like the introduction to p-adic Hodge theory at the beginning of the talk on PR map. I also like the first lecture of Euler system, cohomology of Shimura varieties	1/27/2023 5:09 PM

Q27 Additional comments

Answered: 3   Skipped: 96

#	RESPONSES	DATE
1	I replied "not at all" in the last question, since I had to attend the workshop online. One loses that advantage when attending online vs in person.	1/30/2023 9:25 AM
2	As I attended remotely, I did not meet people with similar scientific interests. I would have if I had attended in person.	1/28/2023 2:36 PM
3	Thank you very much for facilitating this amazing workshop!	1/28/2023 11:16 AM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 18   Skipped: 81
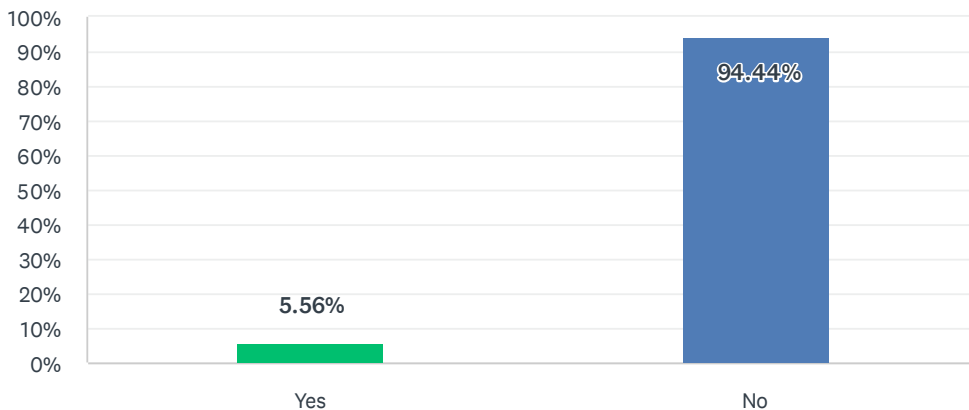
ANSWER CHOICES	RESPONSES	
Yes	5.56%	1
No	94.44%	17
TOTAL		18

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	I watched live. Sometimes the video is so vague that I couldn't see the equation and words.	1/27/2023 5:11 PM

Q29 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 18   Skipped: 81

#	RESPONSES	DATE
1	No impact	2/7/2023 11:04 AM
2	It made my participation possible	2/7/2023 10:28 AM
3	The time difference was too much, and I was also otherwise too busy	2/4/2023 4:05 AM
4	Time zone differences (I live in the GMT+1 time zone) mainly hampered my ability to listen to the talks.	2/2/2023 12:24 PM
5	no.	2/1/2023 3:07 PM
6	No	2/1/2023 2:17 PM
7	I was unable to attend in person, and having the workshop hybrid allowed me to attend when I otherwise wouldn't be able to.	2/1/2023 1:53 PM
8	No. I actually had an offer to come and attend in person which would have been my preference. But I could not make it due to other commitments so I attended online instead. Attending online is not as nice as attending in person, but it still allows to participate and learn somewhat.	1/30/2023 9:27 AM
9	It gives me chance to participate the workshop due to the funding :)	1/29/2023 10:12 AM
10	Other circumstances and lack of funding precluded in-person attendance. Remote access was essential for me.	1/29/2023 7:42 AM
11	I was concerned about the recent storms and atmospheric rivers in California so having an online option was really good.	1/28/2023 2:38 PM
12	I did have a class for an hour on MWF, but otherwise, not really.	1/28/2023 11:18 AM
13	health issues	1/28/2023 9:11 AM
14	Due to Time zone differences cannot watch all the lectures.	1/28/2023 7:53 AM
15	It is really hard to participate every lectures due to the time zone differences.	1/28/2023 2:14 AM
16	Time zone difference was the main barrier	1/28/2023 12:10 AM
17	It did not impact that much	1/27/2023 5:54 PM
18	I attended online as it's more convenient.	1/27/2023 5:11 PM

Q30 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 5   Skipped: 94

#	RESPONSES	DATE
1	Indeed. I don't know. That is one thing that an online format does not replicate very well.	1/30/2023 9:27 AM
2	This is a problem for me, but I don't know how to resolve it.	1/29/2023 7:42 AM
3	Would it be technically feasible to have a special online 'room' for online participants to engage with in-person attendees as well as each other.	1/28/2023 2:38 PM
4	Maybe a meet and greet session before hand? I also know that there are some tools online that allow random matching for 5 minutes (like a mini-Speed Dating but just in a Social way) and that sort of thing. Maybe some kind of icebreaker event.	1/28/2023 11:18 AM
5	maybe use the raise hand function in Zoom for asking questions	1/27/2023 5:11 PM

Q31 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3   Skipped: 96

#	RESPONSES	DATE
1	Very nice workshop! I was not familiar much with the topic but it is sort of adjacent to my area and thus still valuable. (I guess that was more of a general comment than a suggestion for improvement.) One thing that would have helped is if more people used the 'box' with the microphone when asking questions.	1/28/2023 2:42 PM
2	Thank you! I enjoyed the sessions a lot. I tried to attend the pre-workshop part from the 19th but I may have just missed the timing or something. I had logged on but didn't see anyone for that part (but did attend the conference from the 23rd).	1/28/2023 11:18 AM
3	It is very helpful for people in my circumstances to be able to attend at least virtually.	1/28/2023 9:13 AM

Connections Workshop: Diophantine Geometry

February 02, 2023 – February 03, 2023

Hybrid Workshop

Organizers:

Jennifer Balakrishnan (Boston University)

Yunqing Tang (University of California, Berkeley)

REPORT ON THE MSRI WORKSHOP
"Connections Workshop: Diophantine Geometry (Hybrid Workshop)"
February 02 – February 03, 2023

Organizers

- Jennifer Balakrishnan (Boston University)
- Yunqing Tang (University of California, Berkeley)

Scientific Description

This workshop highlighted talks on various aspects of Diophantine Geometry. The goal of the workshop was to bring together researchers at different career stages and of various backgrounds in order to establish new collaborations and mentoring relationships. Although we showcased the research of mathematicians who identify as women or gender minorities, this workshop was open to all.

Highlights of the Workshop

The speakers at the workshop all gave great talks on different aspects of Diophantine Geometry.

Checcoli "Small Algebraic Numbers and Where (Not) to Find Them" discussed the Northcott and Bogomolov properties of various subfields of the field of algebraic numbers.
Liu "Recent Progress in Nonabelian Cohen--Lenstra Program" discussed various heuristics distribution of the Galois group of maximal unramified extensions of a family of global fields and also how we can obtain certain unconditional results.
Bourdon "Minimal Torsion Curves in Geometric Isogeny Classes" discussed the existence points on modular curves of least possible odd degree in a given geometric isogeny class and related questions about elliptic curves.
Chan "Integral Points in Families of Elliptic Curves" discussed integral points on certain quadratic and cubic twist families of elliptic curves and proved that most such elliptic curves do not admit nontrivial integral points.
Vogt "Geometry of Curves with Abundant Low Degree Points" discussed curves with infinitely many closed points of small degree and give a full characterization of such curves when the small degree is no greater than 5.
Viray "Degree D Points on Geometrically Rational Surfaces" discussed various geometrically rational surfaces such as conic bundles and del Pezzo surfaces and gave full description on the possible degree of the closed points on these surfaces.
Sankar "Curve Classes on Conic Bundle Threefolds" discussed three dimensional conic bundles and studied the relations among rationality of the variety, curve classes, torsors of the intermediate Jacobian and torsors of certain Prym varieties.
Li "Ordinary and Basic Reductions of Abelian Varieties" discussed a generalization of Elkies's theorem on infinite supersingular reductions for elliptic curves to certain abelian fourfold parametrized by a genus 0 Shimura curve; she also discussed the density 1 results for mu-ordinary reductions.

The panel discussion was in a great atmosphere. Our moderator, Mirela Ciperiani, collected anonymous questions beforehand and started the panel discussion with a very smooth flow. Our panelists were Abbey Bourdon, Victoria Cantoral Farfan, Catherine Hsu, Bianca Viray, Boya Wen with very diverse background and shared their invaluable experience with the audience. The audience felt very relax and inspired and more questions and discussions came out naturally after the pre-received questions. It was a good experience for the participants.

Organizers

First Name	Last Name	Institution
Jennifer	Balakrishnan	Boston University
Yunqing	Tang	University of California, Berkeley

Speakers

First Name	Last Name	Institution
Abbey	Bourdon	Wake Forest University
Stephanie	Chan	MSRI / Simons Laufer Mathematical Sciences Institute (SLMath)
Sara	Checcoli	Université Grenoble Alpes (Université de Grenoble I - Joseph Fourier)
Wanlin	Li	CRM - Centre de Recherches Mathématiques
Yuan	Liu	University of Illinois at Urbana-Champaign
Soumya	Sankar	Ohio State University
Bianca	Viray	University of Washington
Isabel	Vogt	Brown University

Connections Workshop: Diophantine Geometry
February 02 to February 03, 2023

Thursday, February 02, 2023			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Sara Checcoli	Small Algebraic Numbers and Where (Not) to Find Them
10:30 AM - 11:00 AM	Front Courtyard		Break
11:00 AM - 12:00 PM	Simons Auditorium	Yuan Liu	Recent Progress in Nonabelian Cohen--Lenstra Program
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Abbey Bourdon	Minimal Torsion Curves in Geometric Isogeny Classes
3:00 PM - 3:20 PM	Downstairs Deck		Afternoon Tea
3:20 PM - 4:20 PM	Simons Auditorium	Stephanie Chan	Integral Points in Families of Elliptic Curves
4:30 PM - 5:30 PM	Simons Auditorium		Panel Discussion
6:30 PM - 8:30 PM			Dinner

Friday, February 03, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Isabel Vogt	Geometry of Curves with Abundant Low Degree Points
10:30 AM - 11:00 AM	Front Courtyard		Break
11:00 AM - 12:00 PM	Simons Auditorium	Bianca Viray	Degree D Points on Geometrically Rational Surfaces
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Soumya Sankar	Curve Classes on Conic Bundle Threefolds
3:00 PM - 3:30 PM	Downstairs Deck		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Wanlin Li	Ordinary and Basic Reductions of Abelian Varieties

Identifiable Participants' Information

Participants		91

Gender		91
Male	64.84%	59
Female	31.87%	29
Other	1.10%	1
Declined to state	2.20%	2

Ethnicity*		100
White	32.00%	32
Asian	47.00%	47
Hispanic	7.00%	7
Pacific Islander	0.00%	0
Black	2.00%	2
Native American	0.00%	0
Mixed	4.00%	4
Declined to state	8.00%	8

* ethnicity specifications are not exclusive

There were 3 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 42   Skipped: 0
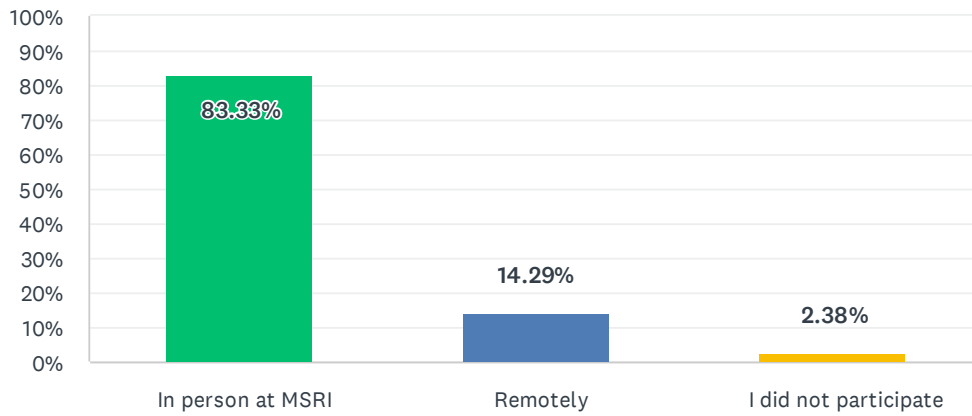
ANSWER CHOICES	RESPONSES	
In person at MSRI	83.33%	35
Remotely	14.29%	6
I did not participate	2.38%	1
TOTAL		42

Q2 The workshop was intellectually stimulating

Answered: 34   Skipped: 8
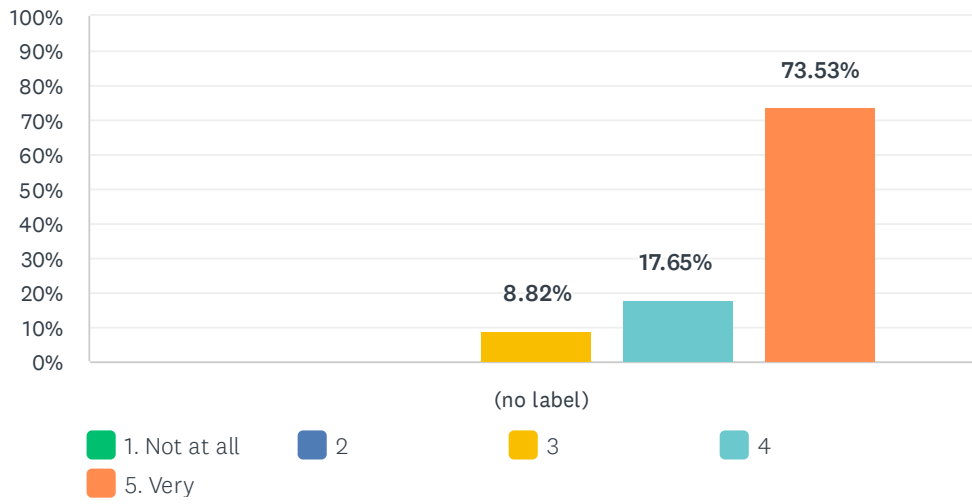
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.82% 3	17.65% 6	73.53% 25	34	4.65

Q3 The overall experience of the workshop was worthwhile

Answered: 34   Skipped: 8
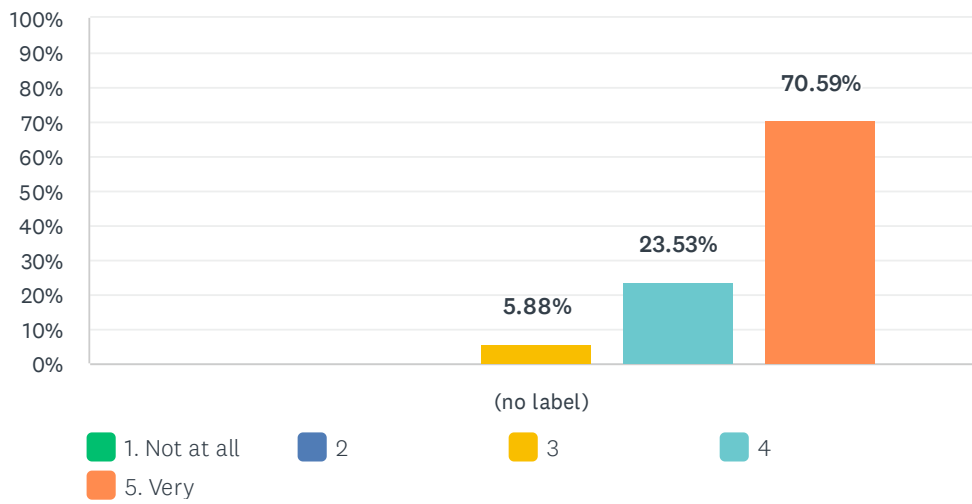
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.88% 2	23.53% 8	70.59% 24	34	4.65

Q4 The lectures were at an appropriate level

Answered: 34   Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.88% 2	23.53% 8	70.59% 24	34	4.65

Q5 I was well prepared to benefit from the lectures

Answered: 34   Skipped: 8
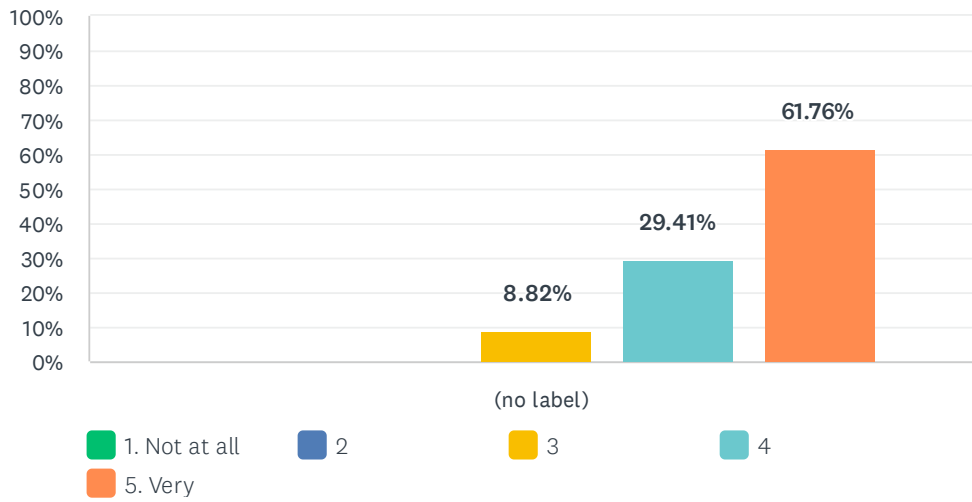
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.82% 3	29.41% 10	61.76% 21	34	4.53

Q6 My interest in the subject matter was increased by the workshop

Answered: 34   Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.94% 1	11.76% 4	23.53% 8	61.76% 21	34	4.44

Q7 The workshop helped me meet people with similar scientific interests

Answered: 34   Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.94% 1	0.00% 0	11.76% 4	14.71% 5	70.59% 24	34	4.50

Q8 Did you find the panel discussion worthwhile?

Answered: 34　　Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.88% 2	5.88% 2	44.12% 15	44.12% 15	34	4.68

Q9 What other subjects should be discussed in future panel discussions?

Answered: 0   Skipped: 42

#	RESPONSES	DATE
	There are no responses.	

Q10 Additional comments

Answered: 3   Skipped: 39

#	RESPONSES	DATE
1	Since so many of the junior women attending the semester program presented, it made those who did not get invited to present feel bad. Perhaps the scope of the workshop could have been broadened to be just number theory, and feature women/gender expansive mathematicians not already in residence at MSRI (and also who did *not* apply themselves -- b/c inviting people to speak who were rejected from the program is weird for a different reason).	2/7/2023 7:31 PM
2	It was a worthwhile panel discussion though, having five panels lessened the opportunity to discuss over more questions. Four would be appropriate next time.	2/4/2023 10:53 AM
3	I am a faculty member in the area so I already have a strong interest in the area and know many people, so there was not really a way for the conference to 'increase' that	2/4/2023 10:45 AM

Q11 Did you attend the dinner?

Answered: 34   Skipped: 8
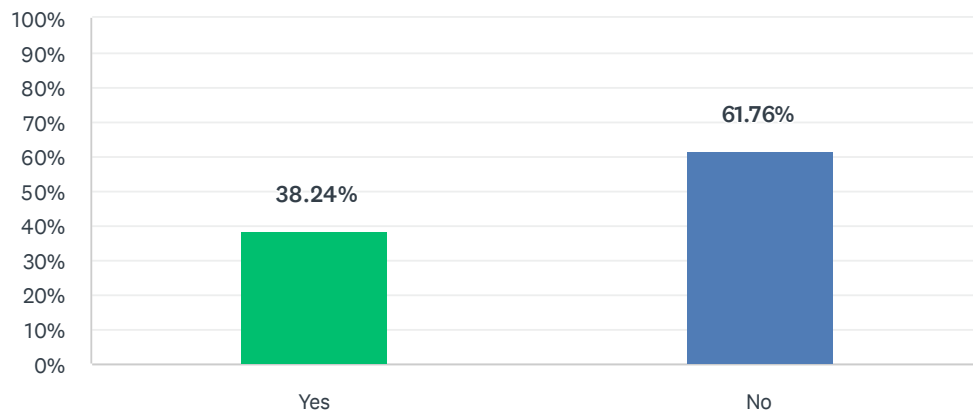
ANSWER CHOICES	RESPONSES	
Yes	38.24%	13
No	61.76%	21
TOTAL		34

Q12 Did the dinner help to solidify the contacts you made in the workshop?

Answered: 13   Skipped: 29
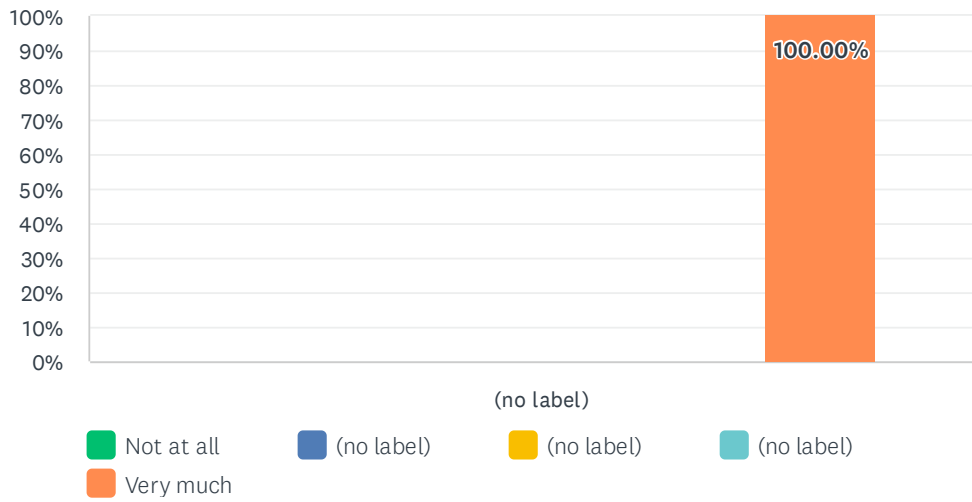
	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 13	13	5.00

Q13 Please provide any comments about the dinner

Answered: 1   Skipped: 41

#	RESPONSES	DATE
1	This was the best part of the workshop -- we continued a lot of the discussions that started during the panel discussion. It was a great community-building experience.	2/7/2023 7:31 PM

Q14 I found the SLMath staff helpful

Answered: 32   Skipped: 10
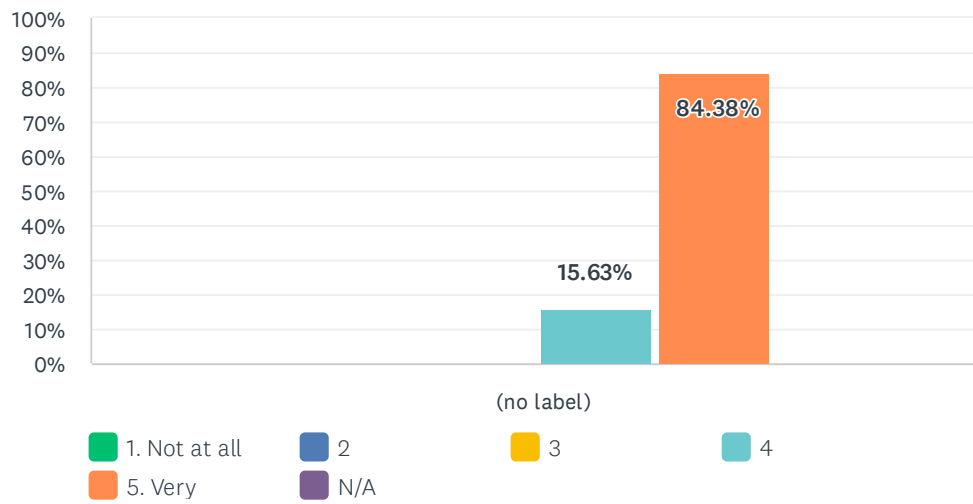
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	15.63% 5	84.38% 27	0.00% 0	32	4.84

Q15 The SLMath facilities were conducive for such a workshop

Answered: 32   Skipped: 10
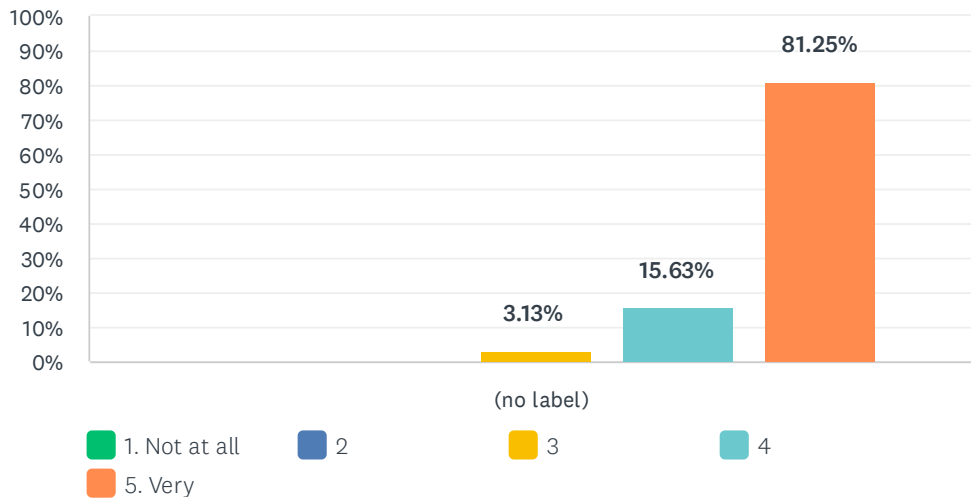
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	3.13% 1	15.63% 5	81.25% 26	32	4.78

Q16 Did you use SLMath's wireless network?

Answered: 32   Skipped: 10
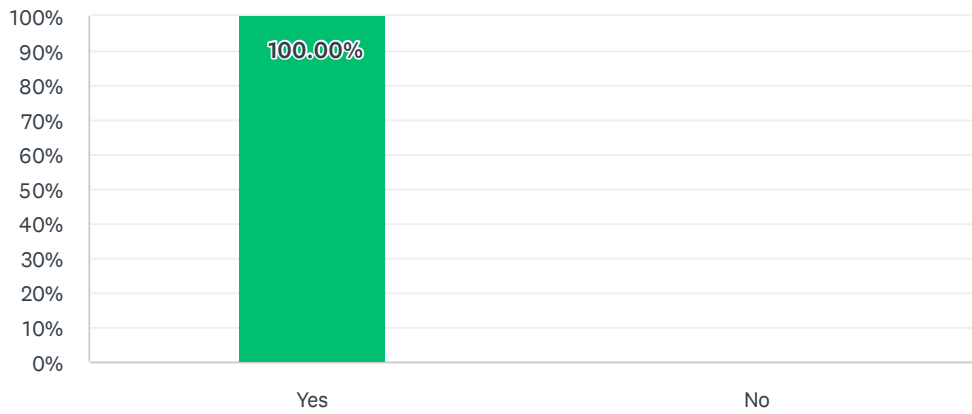
ANSWER CHOICES	RESPONSES	
Yes	100.00%	32
No	0.00%	0
TOTAL		32

Q17 Did you experience any difficulties with the network?

Answered: 32   Skipped: 10
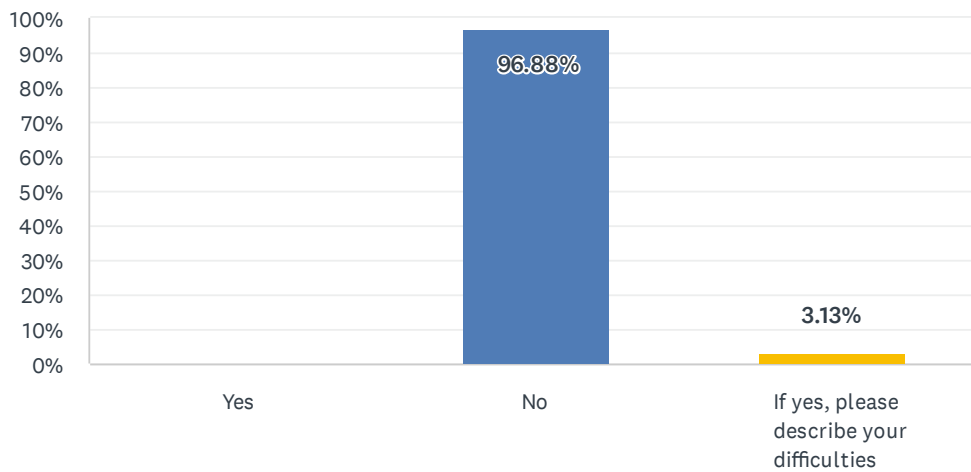
ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	96.88%	31
If yes, please describe your difficulties	3.13%	1
TOTAL		32

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	I received an "internet unstable" message several times and sometimes loading websites were very slow.	2/4/2023 10:46 AM

Q18 The SLMath lunch arrangements were satisfactory
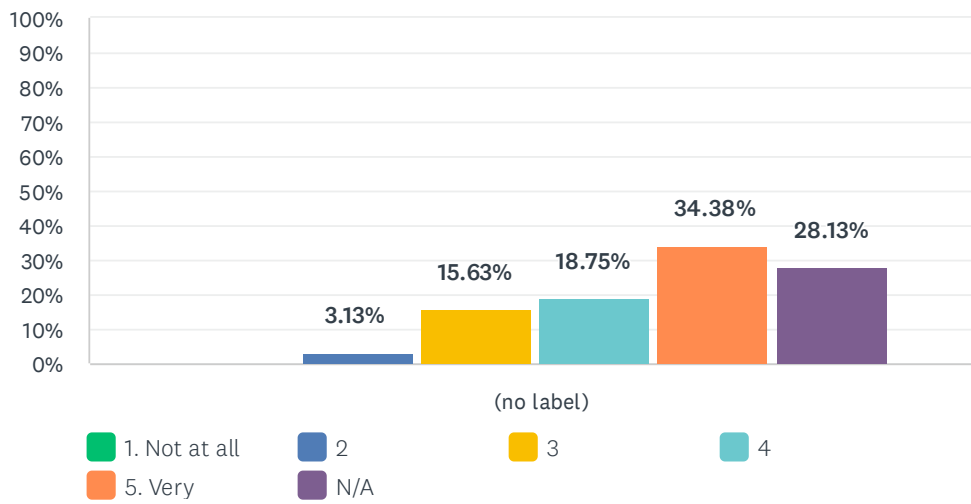
Answered: 32   Skipped: 10

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.13% 1	15.63% 5	18.75% 6	34.38% 11	28.13% 9	32	4.17

Q19 The SLMath tea arrangements were satisfactory
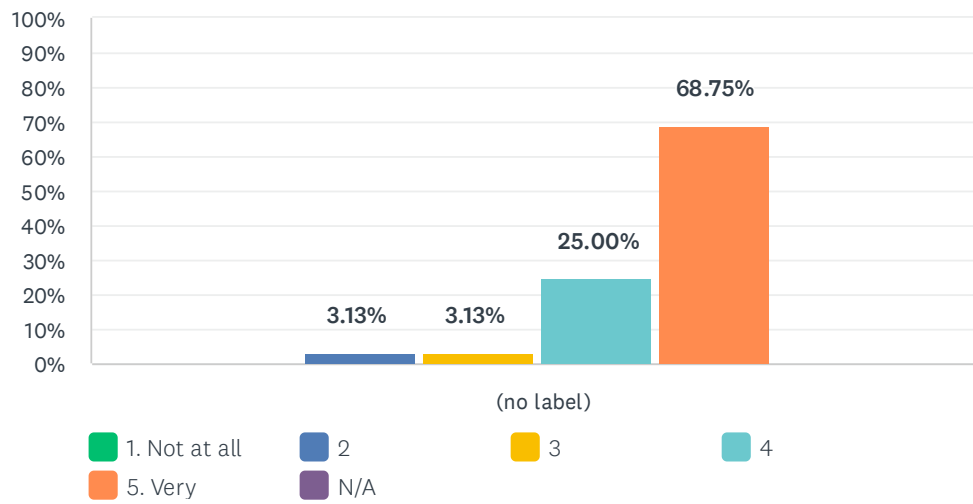
Answered: 32　　Skipped: 10

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.13% 1	3.13% 1	25.00% 8	68.75% 22	0.00% 0	32	4.59

Q20 Additional comments about the SLMath staff, facilities and food

Answered: 1   Skipped: 41

#	RESPONSES	DATE
1	Maybe have different restaurants in the future?	2/3/2023 7:06 PM

Q21 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1   Skipped: 41

#	RESPONSES	DATE
1	SLMath did a wonderful job with the conference. I was disappointed by the number of people in residence who did not make an effort to go to the conference. I don't think this is specific to the program though. I've seen it happen before that attendance at the Connections Workshop is much smaller than attendance at the follow-up Introductory Workshop. It just makes me sad because the talks and the Math presented at the workshop were amazing.	2/9/2023 9:18 AM

The following responses are from the onsite participants.

Q22 I found the SLMath staff helpful

Answered: 5   Skipped: 37
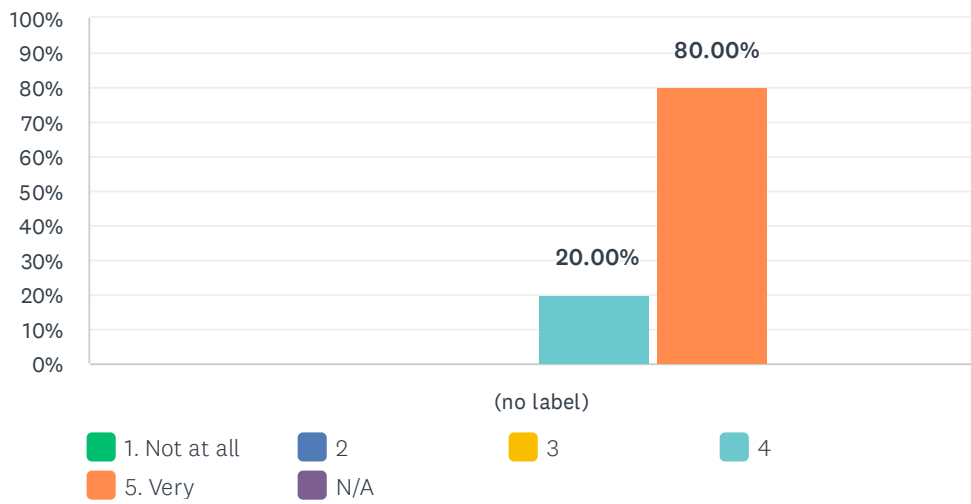
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	20.00% 1	80.00% 4	0.00% 0	5	4.80

Q23 How many talks did you watch live?

Answered: 5   Skipped: 37
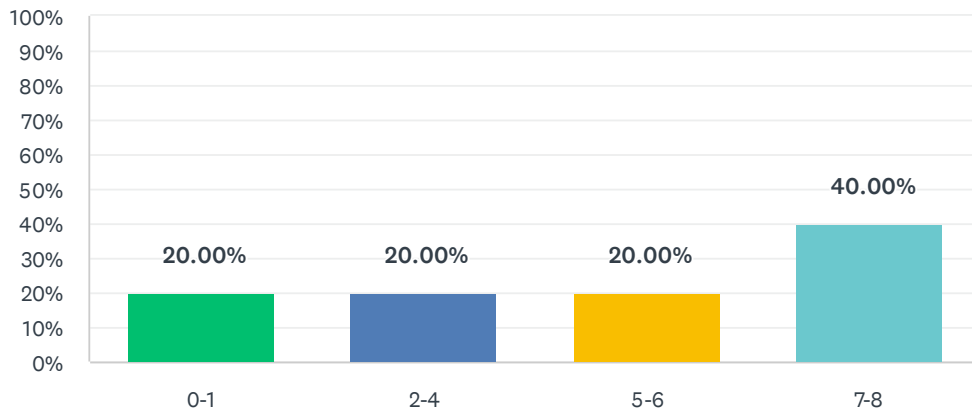
ANSWER CHOICES	RESPONSES	
0-1	20.00%	1
2-4	20.00%	1
5-6	20.00%	1
7-8	40.00%	2
TOTAL		5

Q24 The workshop was intellectually stimulating

Answered: 5   Skipped: 37
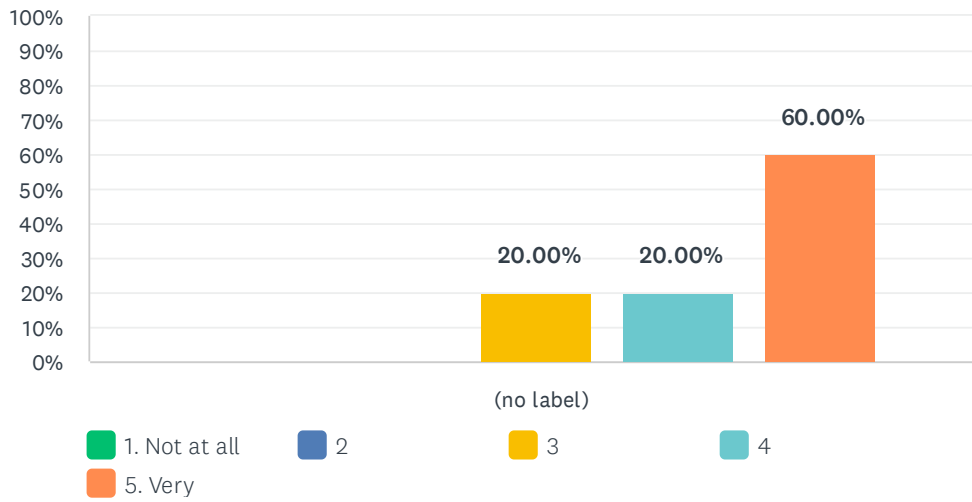
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	20.00% 1	20.00% 1	60.00% 3	5	4.40

632

Q25 The overall experience of the workshop was worthwhile

Answered: 5   Skipped: 37
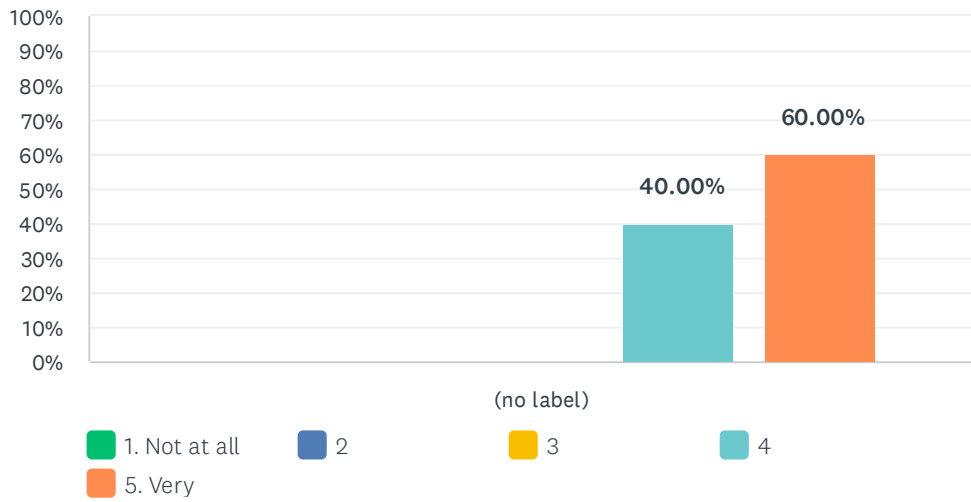
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	40.00% 2	60.00% 3	5	4.60

Q26 The lectures were at an appropriate level

Answered: 5   Skipped: 37
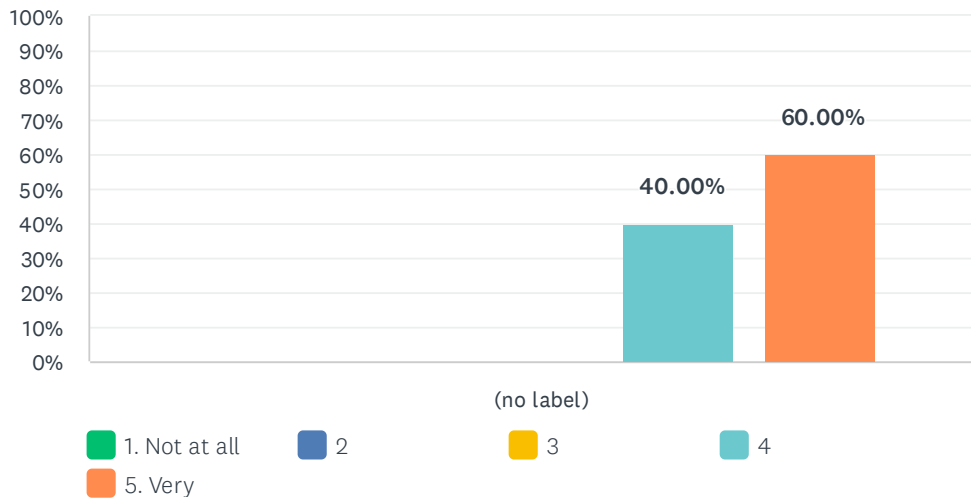
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	40.00% 2	60.00% 3	5	4.60

Q27 I was well prepared to benefit from the lectures

Answered: 5   Skipped: 37
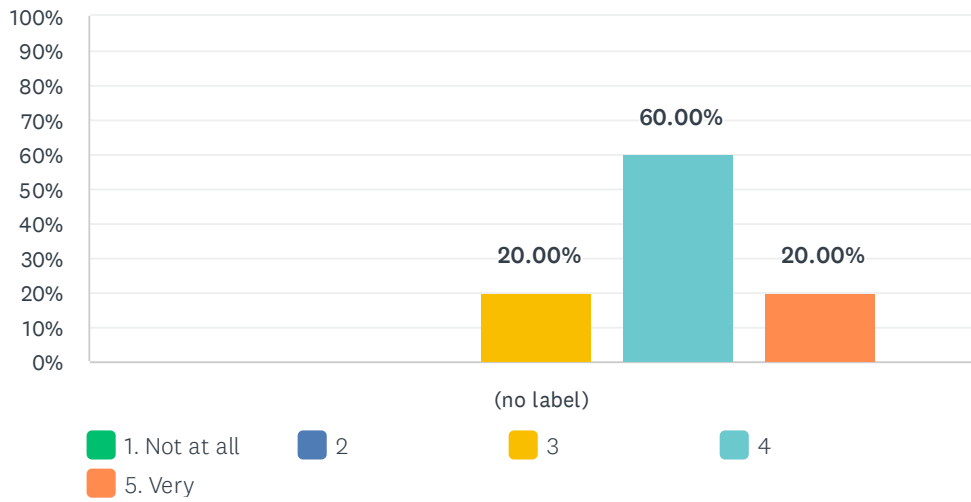
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	20.00% 1	60.00% 3	20.00% 1	5	4.00

Q28 My interest in the subject matter was increased by the workshop

Answered: 5   Skipped: 37
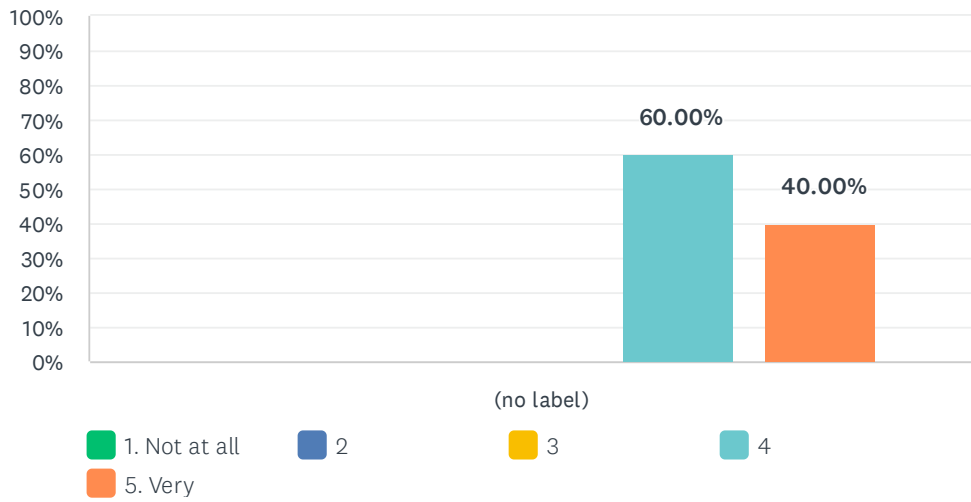
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	60.00% 3	40.00% 2	5	4.40

Q29 The workshop helped me meet people with similar scientific interests

Answered: 5   Skipped: 37
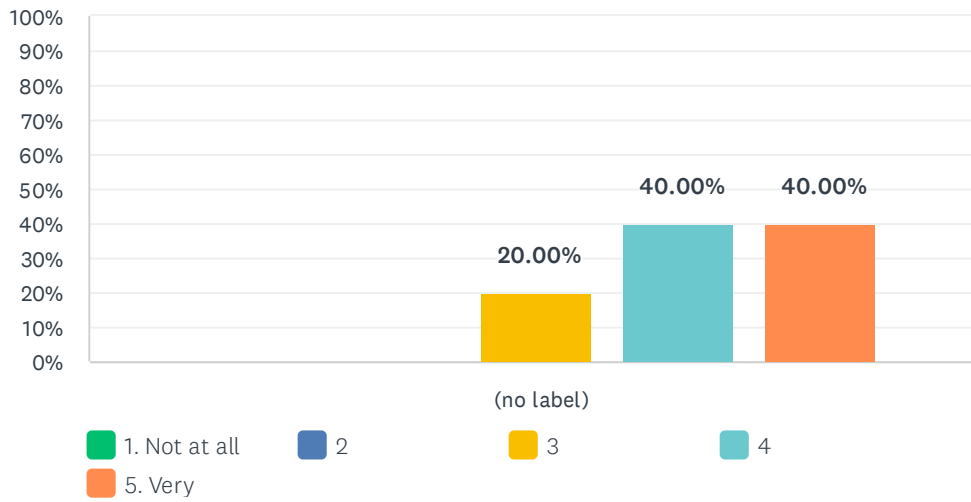
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	20.00% 1	40.00% 2	40.00% 2	5	4.20

Q30 Did you find the panel discussion worthwhile?
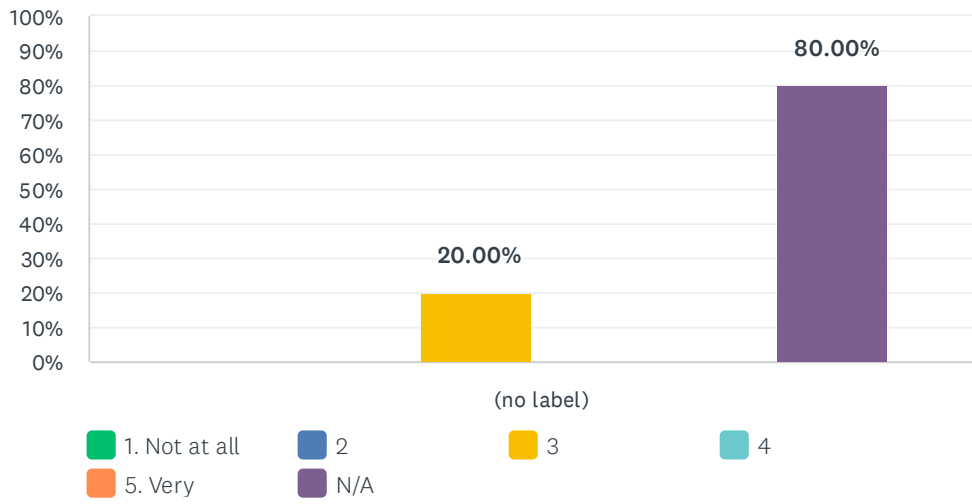
Answered: 5   Skipped: 37

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	20.00% 1	0.00% 0	0.00% 0	80.00% 4	5	3.00

Q31 What other subjects should be discussed in future panel discussions?

Answered: 2   Skipped: 40

#	RESPONSES	DATE
1	I don't feel my background in Diophantine Geometry is strong enough to adequately answer this question.	2/10/2023 9:36 PM
2	The connection with Gromov-Witten theory	2/4/2023 1:12 AM

Q32 Additional comments

Answered: 2   Skipped: 40

#	RESPONSES	DATE
1	I was disappointed that health concerns kept me from participating in person. As someone who has only recently been looking at Diophantine Geometry (and who has primary interests in Symplectic/Concact Geometry and Algebraic Geometry), I was interested in asking questions about interactions of subject matters in a more broad sense. Questions that may have been too broad to comfortably ask in a post-talk Q&A in the auditorium via Zoom.	2/10/2023 9:36 PM
2	From Zoom, the picture is not that clear, so I have to watch the video again after participating.	2/4/2023 1:12 AM

Q33 Did you experience any technical difficulties accessing the workshop online?

Answered: 5   Skipped: 37
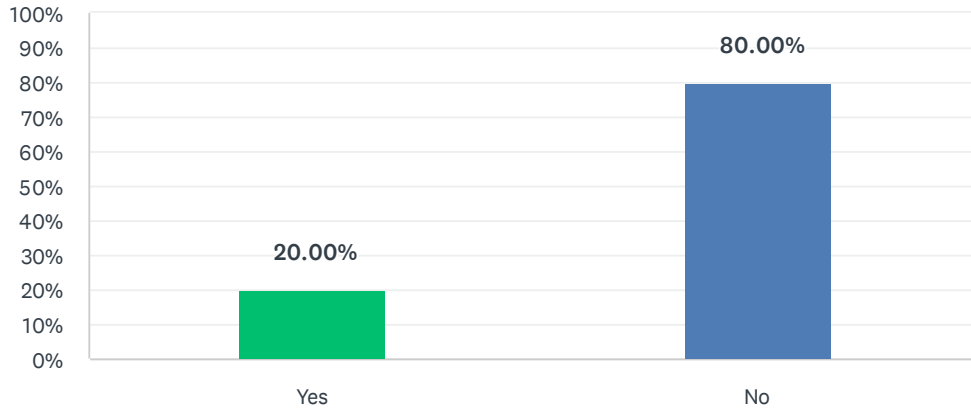
ANSWER CHOICES	RESPONSES	
Yes	20.00%	1
No	80.00%	4
TOTAL		5

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	The picture of the blackboard is not that clear.	2/4/2023 1:18 AM

Q34 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?
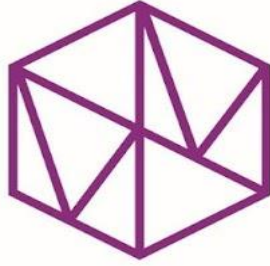
Answered: 5   Skipped: 37

#	RESPONSES	DATE
1	It made my participation possible. While I don't think my illness was COVID-related (I'm fairly positive that it was more allergy-related due to peak mold season), it was best to play it safe. I was excited to participate in the workshop, and I'm glad I was able to attend without being a potential Patient Zero.	2/10/2023 9:45 PM
2	there was a barrier to participation due to time zone differences.	2/4/2023 1:18 AM
3	I can only attend online. So thank you!	2/3/2023 7:27 PM
4	In this particular case I could not participate in most of the lectures because I got sick, but in other online workshops my problem is that at the same time of the lectures I have other duties, such as teaching courses, meetings, commute, etc	2/3/2023 5:57 PM
5	It made it more convenient.	2/3/2023 4:47 PM

Q35 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 3   Skipped: 39

#	RESPONSES	DATE
1	No suggestions off the top of my head.	2/10/2023 9:45 PM
2	Slack, Discord, or Zulip	2/4/2023 1:18 AM
3	In my experience, real-time interaction between participants has been useless as it never concerns mathematical content, and it is often restricted to small talk. I find a bit more useful tools like slack (usually before talks).	2/3/2023 5:57 PM

Introductory Workshop: Diophantine Geometry

February 06, 2023 – February 10, 2023

Hybrid Workshop

Organizers:

Hector Pasten (Pontificia Universidad Católica de Chile)

Yunqing Tang (University of California, Berkeley)

Shou-Wu Zhang (Princeton University)

REPORT ON THE MSRI WORKSHOP
"Introductory Workshop: Diophantine Geometry (Hybrid Workshop)"
February 06 – February 10, 2023

Organizers

- Hector Pasten (Pontificia Universidad Católica de Chile)
- Yunqing Tang (University of California, Berkeley)
- Shou-Wu Zhang (Princeton University)

Scientific Description

This workshop featured expository and research lectures about current developments in Diophantine geometry. This includes the uniform Mordell—Lang for rational points on curves, the Andre—Oort conjecture for special points on Shimura varieties, and effective results via Chabauty method, and related topics in Arakelov theory, unlikely intersections, arithmetic statistics, arithmetic dynamics, and p-adic Hodge theory.

Highlights of the Workshop

The workshop was mainly oriented to introduce advanced material on current developments and important well-established tools in Diophantine Geometry to a wider audience in Number Theory and related areas. It included several expository lectures oriented to different purposes: exposition of useful foundational theory, surveys around important techniques and results, overview of the methods involved in current developments, and some introductory research lectures.

At a scientific level, the attendants mentioned (in the exit survey) the following lectures as highlights:
- Silverman "Moduli spaces for dynamical systems on projective spaces" which discussed the construction of well-behaved moduli spaces in arithmetic dynamics as well as some applications and open problems.
- Ellenberg "Heights of rational points on stacks" which introduced a theory of heights (complexity of points) valid not only on varieties but also on stacks. With this theory one gets a unified point of view on various seemingly unrelated conjectures.
- Gao "Spartisy of rational and algebraic points" wich gave a beautiful overview on the current developments around the uniform Mordell—Lang conjecture, with an exposition of the main ideas involved in the proofs.
- Colmez "A product formula for periods" where Colmez guided the audience through the process by which he came to formulate his celebrated conjectures on the height of CM abelian varieties. In addition, he presented a survey of recent developments.
- Kisin "Heights in the isogeny class of an abelian variety" which discussed a very recent finiteness result for abelian varieties over the algebraic closure of Q (as opposed to number fields) extending celebrated work by Faltings.

- Pasten "Modularity and height bounds" provided a survey around a recent method to prove effective finiteness results for Diophantine problems by means of the modularity of elliptic curves. This was connected to the most updated unconditional results on the abc conjecture.
- Balakrishnan "Quadratic Chabauty for modular curves" gave an accessible overview of the most powerful current methods to compute rational points in curves, with some spectacular applications in the context of modular curves.
- Capuano "Unlikely intersections and applications to Diophantine problems" provided a very complete survey of results and open problems in the field of unlikely intersections, covering topics such as extensions of the Andre—Oort, Manin--Mumford, and Mordell—Lang conjectures.
- Arul Shankar "Polynomials with squarefree discriminant" had a more analytic flavor and it was highly valued by the attendants as it provided a summary of a completely different set of tools to attack certain Diophantine problems.
- Cadoret "On the toric locus of l-adic local systems" which discussed the application of Lawrence—Venkatesh method to study the sparsity of the rational points (or more generally, points of bounded degree) in the toric locus of local systems. See also the lectures by Ullmo and Baldi.
- Ananth Shankar "Tate-semisimplicity over finite fields" which gave an alternative proof of Tate's result on semisimplicity of Frobenius action on the tate modules of abelian varieties and explained how this method applied to local systems over exceptional Shimura varieties.

The participants also mentioned the exceptional opportunity they had to discuss with the top experts in the field, which was particularly valuable for early career mathematicians such as PhD students and postdocs.

The logistic component of the workshop (including the hybrid aspect) was also very much appreciated by the participants and, specially, the work of Sierra Sutherland was highly valued.

In summary, this was a very successful scientific event that fully accomplished its purpose of introducing the number theory community to the techniques, developments, and main questions in Diophantine geometry.

Organizers

First Name	Last Name	Institution
Hector	Pasten	Pontificia Universidad Católica de Chile
Yunqing	Tang	University of California, Berkeley
Shou-Wu	Zhang	Princeton University

Speakers

First Name	Last Name	Institution
Jennifer	Balakrishnan	Boston University
Jean-Benoit	Bost	Faculté des Sciences d'Orsay
Anna	Cadoret	Sorbonne Université
Laura	Capuano	Università degli Studi Roma Tre
François	Charles	École Normale Supérieure
Pierre	Colmez	Institut de Mathématiques de Jussieu
Jordan	Ellenberg	University of Wisconsin-Madison
Ziyang	Gao	Leibniz Universität Hannover
Minhyong	Kim	International Centre for Mathematical Sciences
Mark	Kisin	Harvard University
Hector	Pasten	Pontificia Universidad Católica de Chile
Min	Ru	University of Houston
Arul	Shankar	University of Toronto
Ananth	Shankar	University of Wisconsin-Madison
Joseph	Silverman	Brown University
Thomas	Tucker	University of Rochester
Emmanuel	Ullmo	IHES
Evelina	Viada	Universität Göttingen

Introductory Workshop: Diophantine Geometry

February 06, 2023 - February 10, 2023

Monday, February 06, 2023			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Joseph Silverman	Moduli Spaces for Dynamical Systems on Projective Space
11:00 AM - 12:00 PM	Simons Auditorium	Thomas Tucker	A Finite Index Conjecture for Iterated Galois Groups
2:00 PM - 3:00 PM	Simons Auditorium	Jordan Ellenberg	Heights of Rational Points on Stacks
3:30 PM - 4:30 PM	Simons Auditorium	Anna Cadoret	On the Toric Locus of L-Adic Local Systems (Joint work with J. Stix)

Tuesday, February 07, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Emmanuel Ullmo	On the Distribution of the Hodge Locus
11:00 AM - 12:00 PM	Simons Auditorium	Evelina Viada	Some Effective Methods in the Context of the Mordell-Lang Conjecture
2:00 PM - 3:00 PM	Simons Auditorium	Ziyang Gao	Sparsity of Rational and Algebraic Points
3:30 PM - 4:30 PM	Simons Auditorium	Pierre Colmez	A Product Formula for Periods

Wednesday, February 08, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Mark Kisin	Heights in the Isogeny Class of an Abelian Variety
11:00 AM - 12:00 PM	Simons Auditorium	Ananth Shankar	Tate-Semisimplicity Over Finite Fields

Thursday, February 09, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Min Ru	The Filtration Method in Diophantine Geometry
11:00 AM - 12:00 PM	Simons Auditorium	Hector Pasten	Modularity and Height Bounds
2:00 PM - 3:00 PM	Simons Auditorium	Jennifer Balakrishnan	Quadratic Chabauty for Modular Curves
3:30 PM - 4:30 PM	Simons Auditorium	Minhyong Kim	Path Integrals and L-Functions

Friday, February 10, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Jean-Benoit Bost	Formal-Analytic Surfaces: Nori's Bound in Arakelov Geometry and Archimedean Overflow
11:00 AM - 12:00 PM	Simons Auditorium	François Charles	Formal-Analytic Arithmetic Surfaces: Finiteness Theorems, and Applications to Arithmetic Fundamental Groups
2:00 PM - 3:00 PM	Simons Auditorium	Laura Capuano	Unlikely Intersections and Applications to Diophantine Problems
3:30 PM - 4:30 PM	Simons Auditorium	Arul Shankar	Polynomials with Squarefree Discriminant

Identifiable Participants' Information

Participants		131

Gender		131
Male	73.28%	96
Female	23.66%	31
Other	0.76%	1
Declined to state	2.29%	3

Ethnicity*		140
White	37.14%	52
Asian	42.14%	59
Hispanic	5.71%	8
Pacific Islander	0.00%	0
Black	2.86%	4
Native American	0.00%	0
Mixed	2.86%	4
Declined to state	9.29%	13

* ethnicity specifications are not exclusive

There were 12 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 53   Skipped: 0
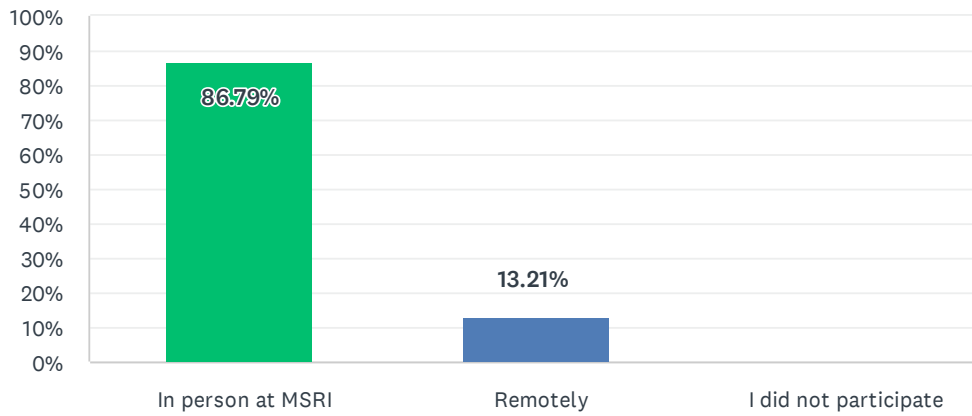
ANSWER CHOICES	RESPONSES	
In person at MSRI	86.79%	46
Remotely	13.21%	7
I did not participate	0.00%	0
TOTAL		53

Q2 The workshop was intellectually stimulating

Answered: 41   Skipped: 12
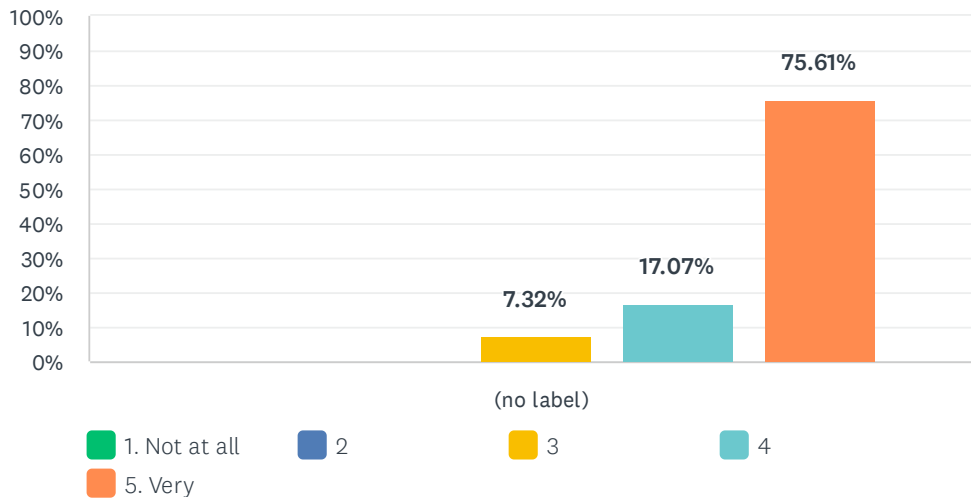
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.32% 3	17.07% 7	75.61% 31	41	4.68

Q3 The overall experience of the workshop was worthwhile

Answered: 41   Skipped: 12
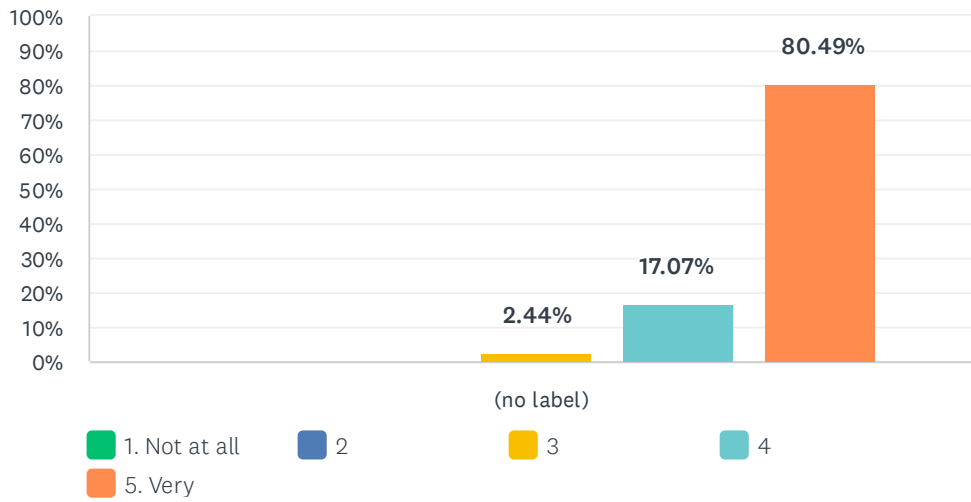
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.44% 1	17.07% 7	80.49% 33	41	4.78

Q4 The lectures were at an appropriate level

Answered: 41   Skipped: 12
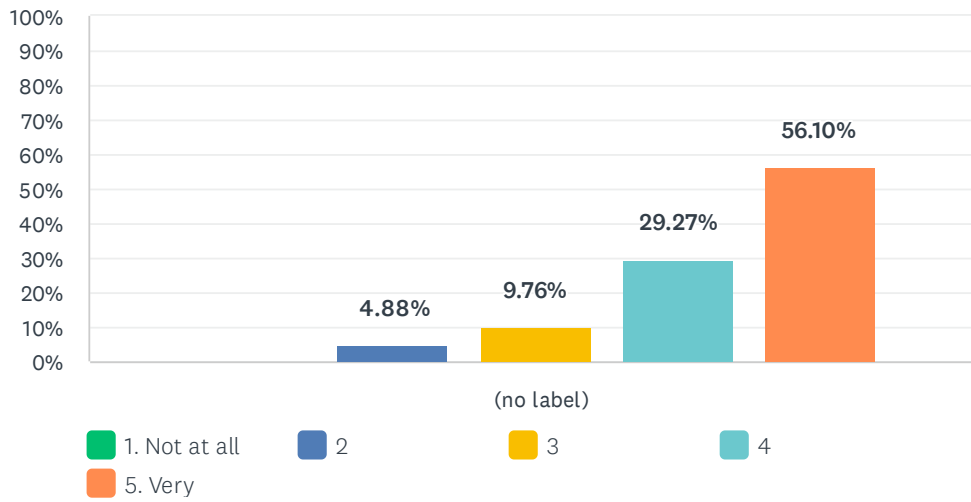
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.88% 2	9.76% 4	29.27% 12	56.10% 23	41	4.37

Q5 I was well prepared to benefit from the lectures

Answered: 41   Skipped: 12

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.44% 1	12.20% 5	24.39% 10	60.98% 25	41	4.44

Q6 My interest in the subject matter was increased by the workshop

Answered: 41   Skipped: 12
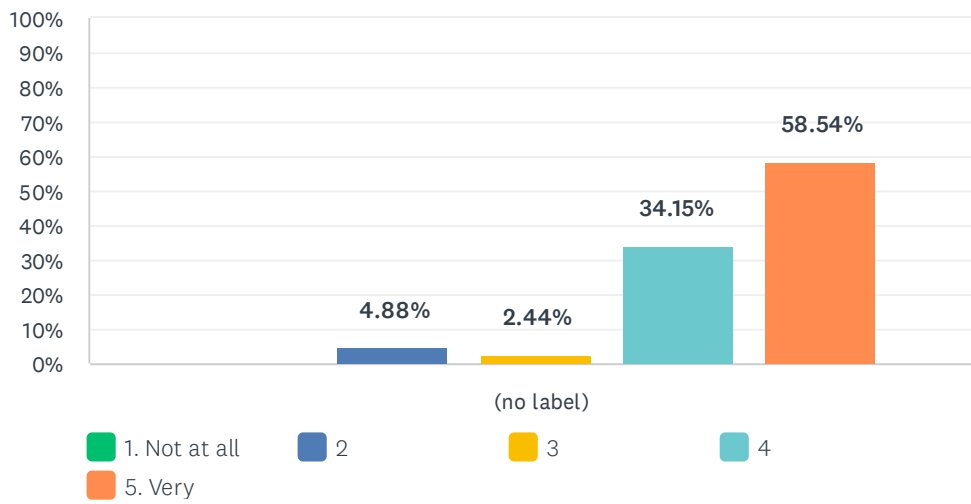
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.88% 2	2.44% 1	34.15% 14	58.54% 24	41	4.46

Q7 The workshop helped me meet people with similar scientific interests

Answered: 41   Skipped: 12
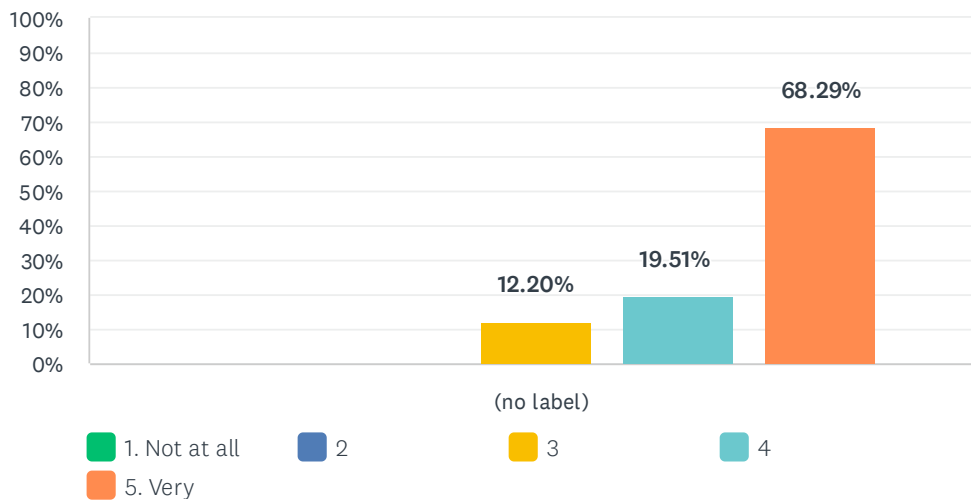
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	12.20% 5	19.51% 8	68.29% 28	41	4.56

Q8 What were the highlights of the lectures?

Answered: 41   Skipped: 12

#	RESPONSES	DATE
1	I liked the ones that explained difficult concepts in approachable ways while also managing to explain the recent result.	2/28/2023 8:23 AM
2	Great	2/16/2023 8:27 AM
3	Gao and Pasten's lectures	2/16/2023 7:35 AM
4	Lecturers motivating their results and giving accessible proofs/expositions of their methods (especially Gao) or general survey lectures (especially Pasten).	2/15/2023 12:18 PM
5	There was a nice atmosphere of openness to questions from the audience (especially with the microphone box). The talks were at a high level but it was welcoming as an early career participant that the lectures were intended to be "introductory" in many ways (the organizers even reminded speakers about this occasionally).	2/15/2023 1:14 AM
6	I enjoyed that many speakers made a great effort to present an accessible introduction to their research.	2/15/2023 12:32 AM
7	Hector Pasten's talk was very good.	2/14/2023 10:41 PM
8	Learned a lot from Arul Shankar's talk!	2/14/2023 10:32 PM
9	JB Bost + Francois Charles: combined talk	2/14/2023 7:23 PM
10	.	2/14/2023 6:23 PM
11	I found the lectures that gave a survey of results/ideas/conjectures in an area to be the most stimulating and interesting. In particular I found Ziyang Gao, Hector Pasten, and Arul Shankar gave wonderfully exciting talks.	2/14/2023 6:00 PM
12	I was very enthusiastic about most of the talks, including those of Ellenberg, Kisin, Ananth Shankar, Laura Capuano	2/14/2023 5:44 PM
13	Talks are well-prepared.	2/14/2023 4:44 PM
14	The talk by Ziyang Gao was amazing. I also liked the other lectures a lot.	2/14/2023 4:29 PM
15	All the speakers made an effort to make an extensive introduction to the topic, so it was easy to follow the workshop even for those of us who were not experts on the field.	2/14/2023 4:04 PM
16	all were fine	2/14/2023 3:35 PM
17	Gao's and Capuano's survey-style lectures did a really great job of introducing a whole list of problems in an area to a wide audience,	2/14/2023 3:21 PM
18	The workshop is absolutely amazing!	2/14/2023 3:09 PM
19	Excellent exposition of striking results	2/14/2023 2:48 PM
20	Gao, Colmez, Ananth Shankar	2/14/2023 2:33 PM
21	The lectures covered a wide range of novel topics in Diophantine Geometry.	2/14/2023 2:33 PM
22	Most of the speakers made a significant effort to be accessible to a wide audience.	2/14/2023 2:33 PM
23	Getting to learn new things and discussing them afterwards with both peers and seniors in the field.	2/14/2023 2:15 PM
24	the wonderful speakers	2/14/2023 2:10 PM
25	I enjoyed the talks by Gao, Bost and Charles	2/14/2023 1:56 PM

26	Ziyang Gao and Anna Cadoret's lectures	2/14/2023 1:54 PM
27	Rational points, unlikely intersections, artihmetic surfaces, dynamical systems,...	2/14/2023 1:54 PM
28	most of the talks were very interesting and well done!	2/14/2023 1:45 PM
29	good balance between overview talks and specialized research talks	2/14/2023 1:45 PM
30	Silverman's, Ellenberg's, Gao's, Balakrishnan's, Ru's, and Pasten's lectures	2/14/2023 1:44 PM
31	The talks that gave an overview were better than the ones that gave very technical details.	2/14/2023 1:39 PM
32	Talks I liked include those by Colmez, Kisin, Shankar, Pasten, and Balakrishnan	2/14/2023 1:31 PM
33	Watching people throw the box	2/14/2023 1:25 PM
34	Lectures of Ziyang Gao and Hector Pasten	2/14/2023 1:23 PM
35	The more introductory lectures	2/14/2023 1:21 PM
36	Almost all were blackboard talks.	2/14/2023 1:21 PM
37	The best talks (e.g. Gao, Ellenberg) were those which offered both an introduction to an area of research and an insight into recent progress.	2/14/2023 1:19 PM
38	Silverman, Gao, Pasten, Capuano	2/14/2023 1:15 PM
39	Seeing cutting edge math research	2/14/2023 1:13 PM
40	Some of the lectures themselves: Pasten, Silverman, Capuano, Ananth Shankar. There were so many good talks!	2/14/2023 1:12 PM
41	Ziyang Gao's lecture is very nice.	2/14/2023 1:10 PM

Q9 Additional comments

Answered: 5   Skipped: 48

#	RESPONSES	DATE
1	This was not really an "introductory" workshop. It would have been nice if there were something similar to Skinner's introductory lectures from the other introductory workshop. Also, I know that a few folks like Bost are famous, but his talk was very bad. (Most of the talks were very good though.)	2/16/2023 7:35 AM
2	.	2/14/2023 6:23 PM
3	none	2/14/2023 3:35 PM
4	The mathematical level of the talks were different and, in my opinion, some of the talks were "too" introductory, lacking to give an hint of the deepness of mathematics behind the results stated or at least of the kind of tehchnology used.	2/14/2023 2:33 PM
5	The afternoon tea break could have been better organised. Placing the two tables next to each other and along a wall meant it was very slow for people to access them. The placement of the tables in the morning was much better, as there was more space available.	2/14/2023 1:19 PM

Q10 I found the SLMath staff helpful

Answered: 41   Skipped: 12

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.44% 1	7.32% 3	87.80% 36	2.44% 1	41	4.88

Q11 The SLMath facilities were conducive for such a workshop

Answered: 41   Skipped: 12
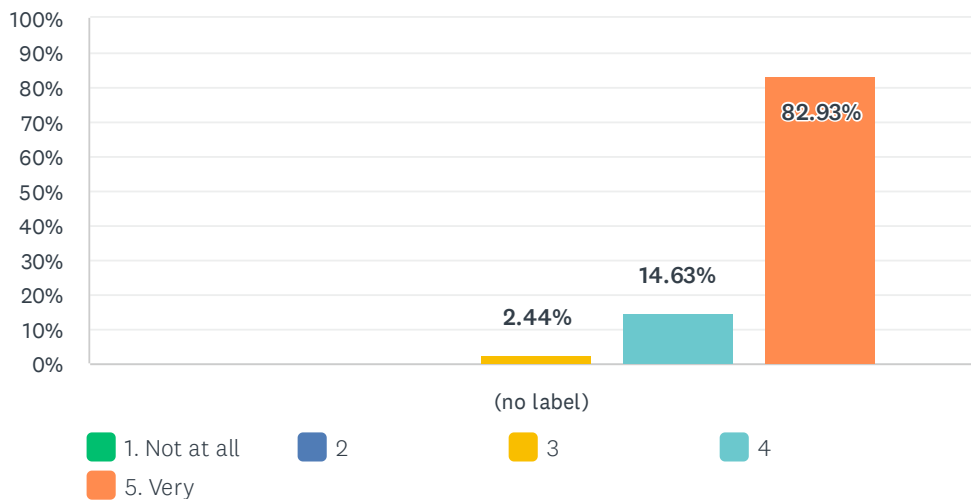
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.44% 1	14.63% 6	82.93% 34	41	4.80

Q12 Did you use SLMath's wireless network?

Answered: 41   Skipped: 12

ANSWER CHOICES	RESPONSES	
Yes	95.12%	39
No	4.88%	2
TOTAL		41

Q13 Did you experience any difficulties with the network?
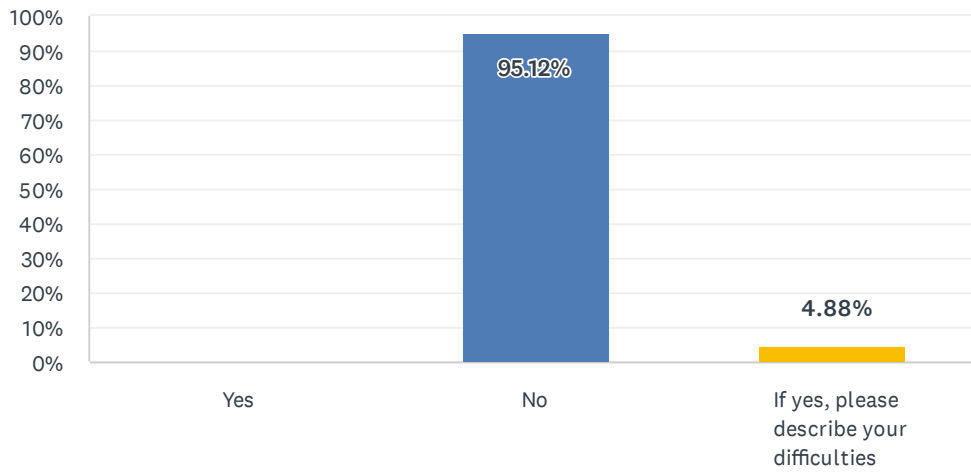
Answered: 41   Skipped: 12

ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	95.12%	39
If yes, please describe your difficulties	4.88%	2
TOTAL		41

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	It was a little spotty at times.	2/14/2023 3:22 PM
2	At times, access was spotty.	2/14/2023 1:13 PM

Q14 The SLMath lunch arrangements were satisfactory
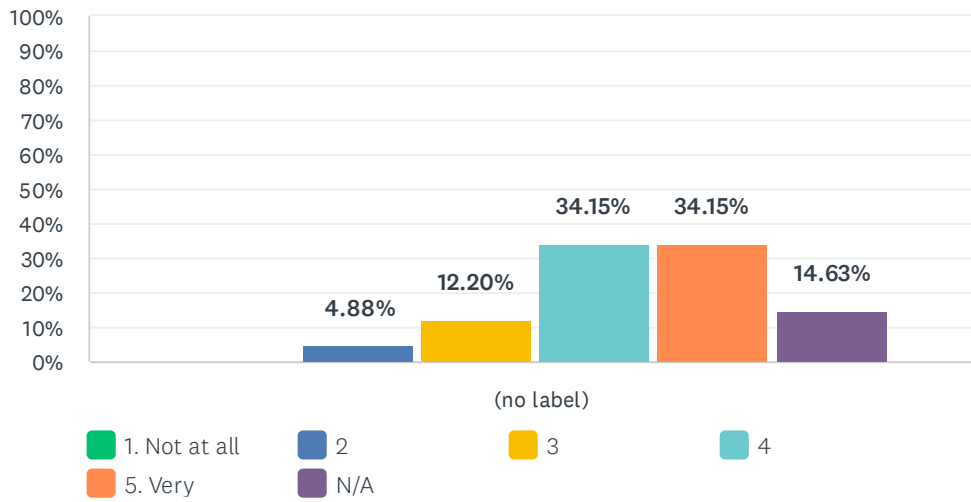
Answered: 41   Skipped: 12

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.88% 2	12.20% 5	34.15% 14	34.15% 14	14.63% 6	41	4.14

Q15 The SLMath tea arrangements were satisfactory
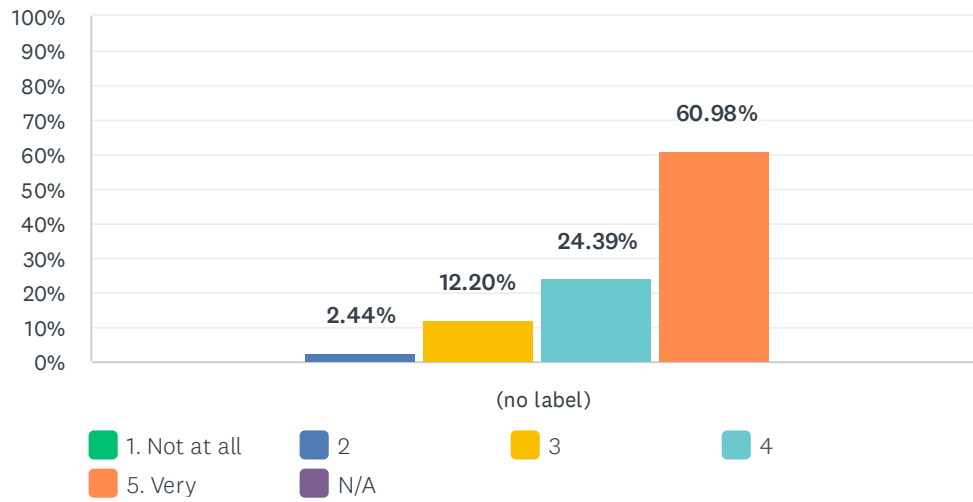
Answered: 41   Skipped: 12

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.44% 1	12.20% 5	24.39% 10	60.98% 25	0.00% 0	41	4.44

Q16 Additional comments about the SLMath staff, facilities and food

Answered: 11   Skipped: 42

#	RESPONSES	DATE
1	It would be nice if there were a few more outdoor chalkboards. Otherwise its perfect!	2/16/2023 7:36 AM
2	Previous emails from them claimed some requirements that in the end, participants did not have to meet.	2/15/2023 12:19 PM
3	The staff are wonderful! The lunch arrangements are very nice, although the 9am deadline is perhaps a bit early because there were a few days I only remembered to order lunch at 9:15 or 9:30am. The tea arrangements were also nice but sometimes the line was very long due to the placement of the table (the confined hallway only allows for passage from one side rather than from two or three directions in a more open space).	2/15/2023 1:16 AM
4	The afternoon tea on the patio seemed to lead to a bottleneck in the doorway. Not a real problem, but I wonder if there's a way to set up the coffee and food separately (as was often done in the mornings) to avoid the long line.	2/14/2023 6:01 PM
5	some days were too cold to be outside for tea.	2/14/2023 3:36 PM
6	Maybe a little more variation with food choices would be helpful.	2/14/2023 3:10 PM
7	The food was fine, but the way of distributing it to the participants was very inefficient.	2/14/2023 2:49 PM
8	The coffee is a bit bland, but I know it's hard with a conference with such large quantities. Have you ever thought about contracting with a coffee truck to come up and park in the parking lot all day, then just giving everyone one or two tokens for a free coffee they can use throughout the day?	2/14/2023 2:35 PM
9	Thai Delight (lunch) is a bit on the expensive side	2/14/2023 1:32 PM
10	I appreciated the outdoor teas.	2/14/2023 1:22 PM
11	Thank you to the staff for organising such a great workshop!	2/14/2023 1:20 PM

Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3   Skipped: 50

#	RESPONSES	DATE
1	It would be helpful for the graduate students (who are usually carrying a balance on a credit card to attend a conference) if they could get the reimbursement paperwork started before the conference.	2/16/2023 7:37 AM
2	none	2/14/2023 3:36 PM
3	Sierra is awesome.	2/14/2023 2:11 PM

The following responses are from the virtual participants.

Q18 I found the SLMath staff helpful

Answered: 4   Skipped: 49
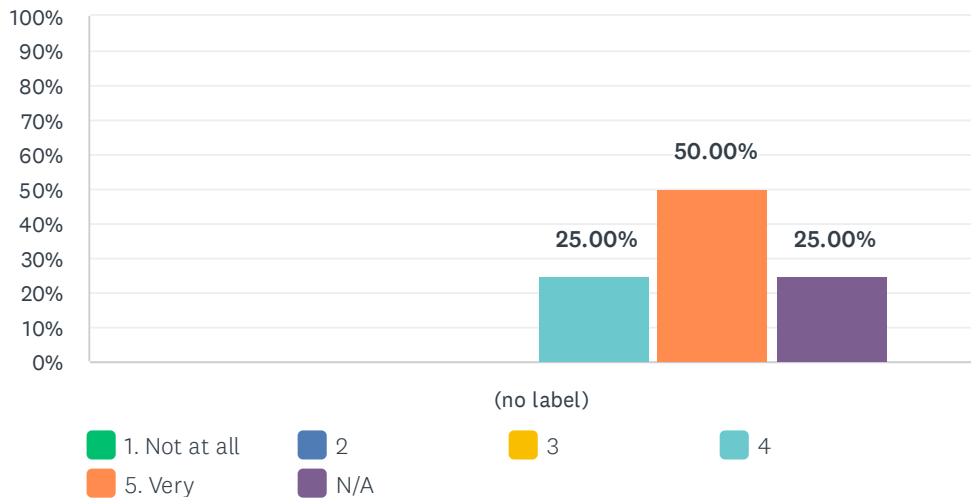
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 1	50.00% 2	25.00% 1	4	4.67

Q19 How many talks did you watch live?

Answered: 4   Skipped: 49
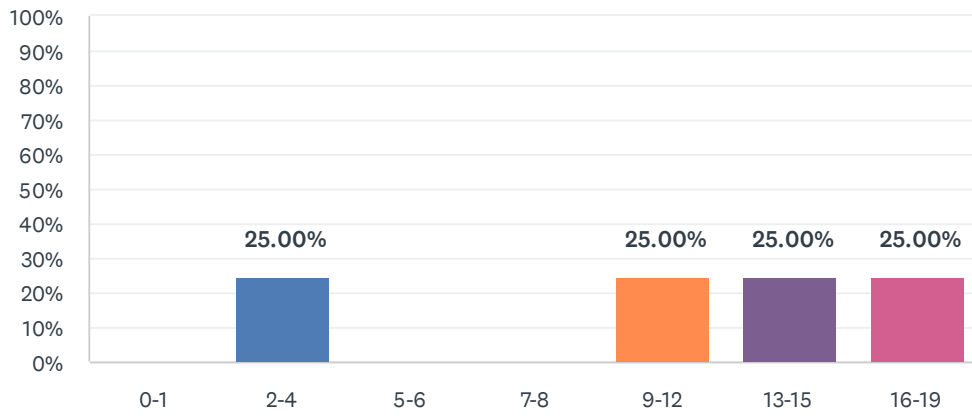
ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	25.00%	1
5-6	0.00%	0
7-8	0.00%	0
9-12	25.00%	1
13-15	25.00%	1
16-19	25.00%	1
TOTAL		4

Q20 The workshop was intellectually stimulating

Answered: 4   Skipped: 49
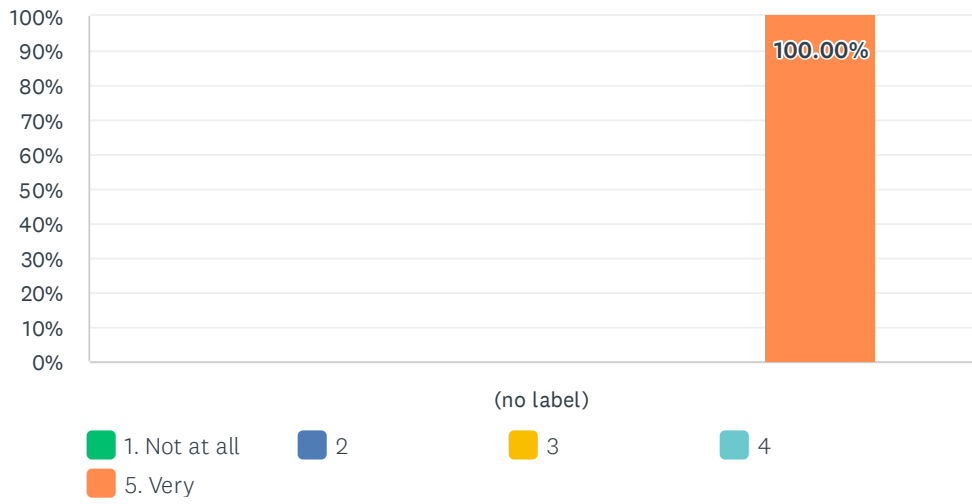
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 4	4	5.00

Q21 The overall experience of the workshop was worthwhile

Answered: 4   Skipped: 49
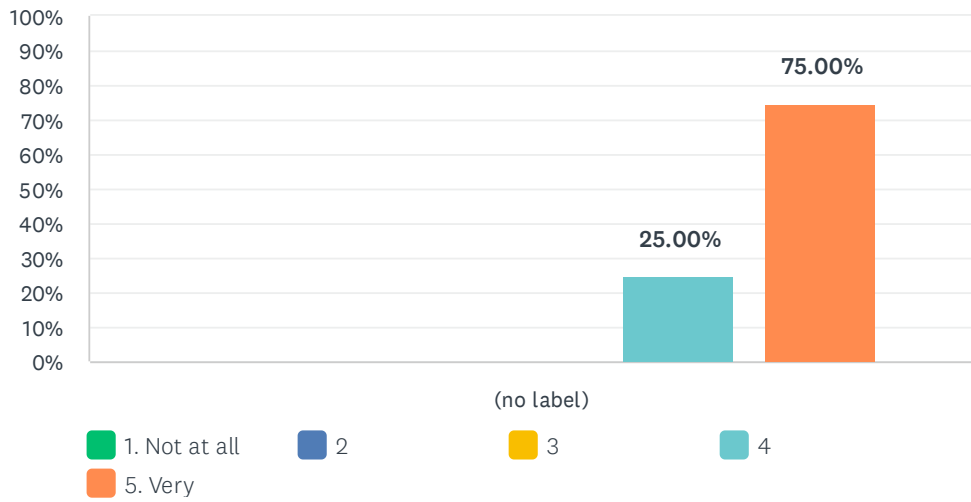
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75

Q22 The lectures were at an appropriate level

Answered: 4   Skipped: 49
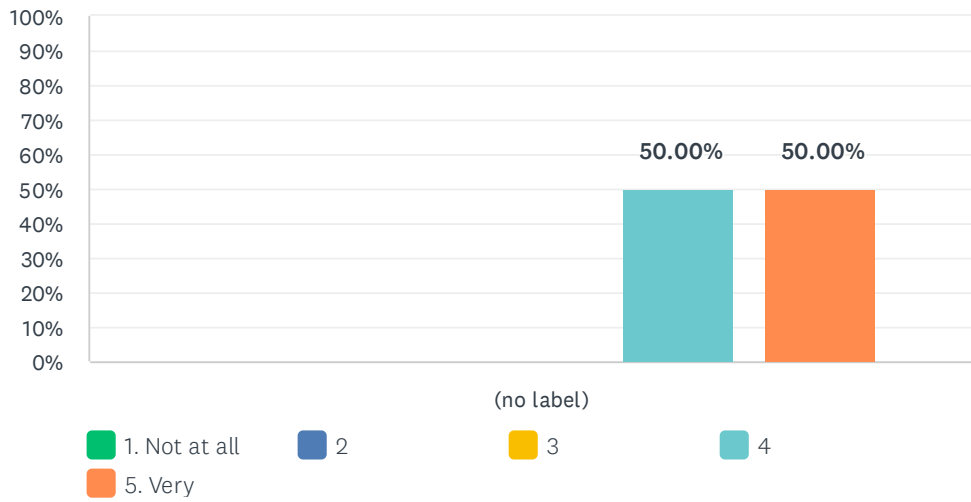
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	50.00% 2	50.00% 2	4	4.50

Q23 I was well prepared to benefit from the lectures

Answered: 4   Skipped: 49
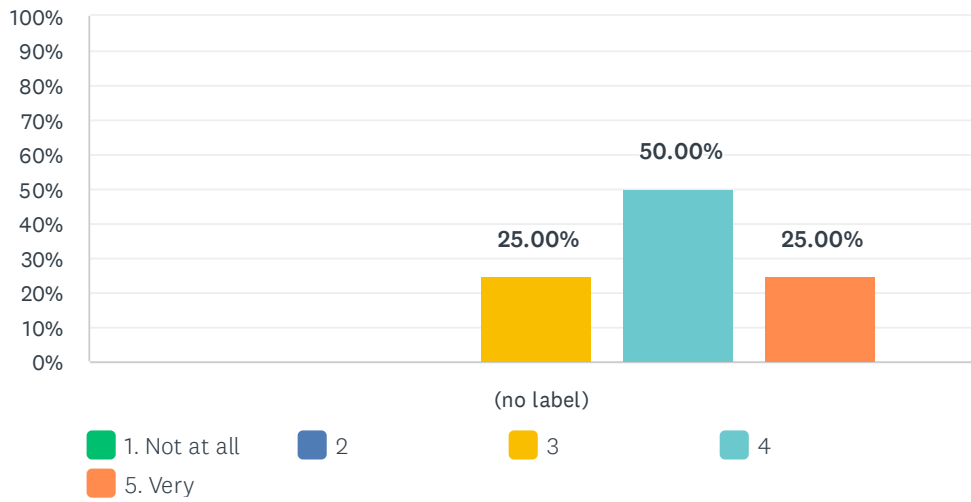
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	25.00% 1	50.00% 2	25.00% 1	4	4.00

Q24 My interest in the subject matter was increased by the workshop

Answered: 4   Skipped: 49
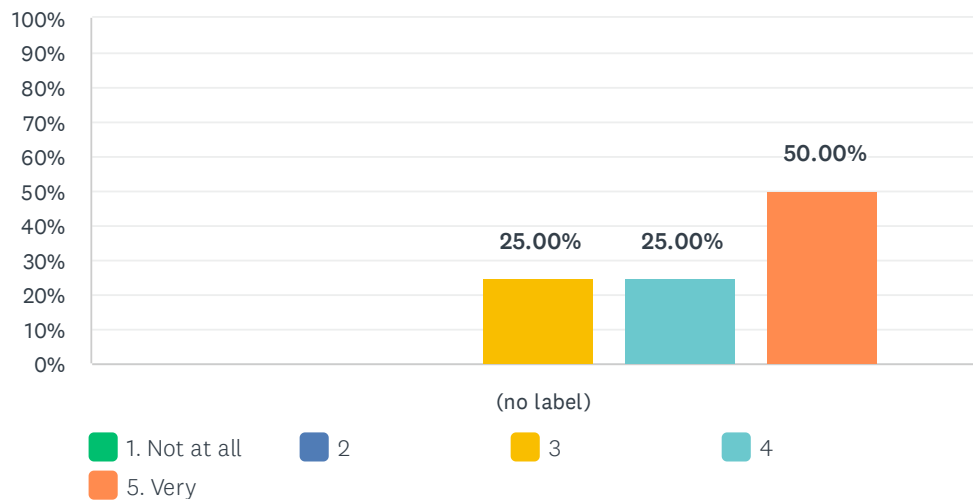
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	25.00% 1	25.00% 1	50.00% 2	4	4.25

Q25 The workshop helped me meet people with similar scientific interests

Answered: 4   Skipped: 49

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	50.00% 2	0.00% 0	25.00% 1	25.00% 1	0.00% 0	4	2.25

Q26 What were the highlights of the lectures?

Answered: 4   Skipped: 49

#	RESPONSES	DATE
1	new results on height theory	2/15/2023 3:02 AM
2	Filtration method in Diophantine Geometry and the Arithmetic surfaces	2/14/2023 5:44 PM
3	Connection between different methods	2/14/2023 1:32 PM
4	I especially enjoyed the lectures by Silverman, Ellenberg, Pasten, Charles and Balakrishnan.	2/14/2023 1:18 PM

Q27 Additional comments

Answered: 0   Skipped: 53

#	RESPONSES	DATE
	There are no responses.	

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 4   Skipped: 49
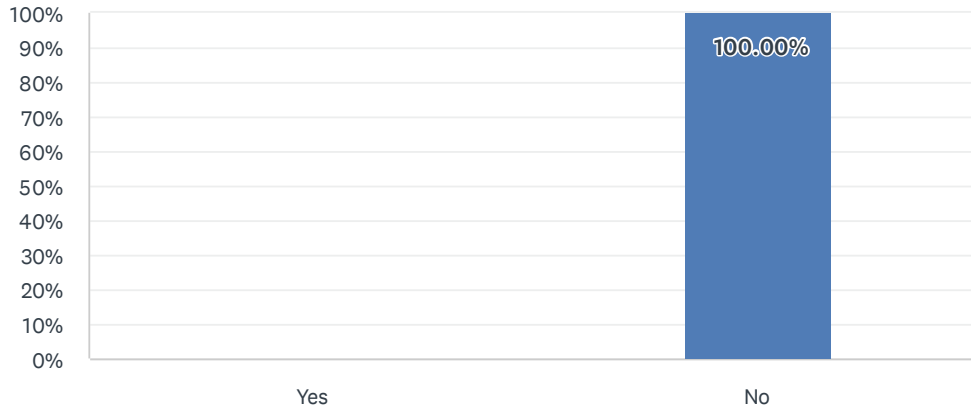
ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	4
TOTAL		4

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q29 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 4   Skipped: 49

#	RESPONSES	DATE
1	time zone difference put a limit on the number of talks I could watch live	2/15/2023 3:03 AM
2	Time zone difference was the main barrier	2/14/2023 5:44 PM
3	Personal circumstances due to health	2/14/2023 1:35 PM
4	There were some technical difficulties (during a few of the lectures) due to the camera not focusing, which hindered viewing the blackboard clearly.	2/14/2023 1:21 PM

Q30 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 1   Skipped: 52

#	RESPONSES	DATE
1	Informal online discussions after the talk with the speaker and participants	2/14/2023 1:35 PM

Q31 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1   Skipped: 52

#	RESPONSES	DATE
1	For talks given with slides it would be nice to see the slides and the speaker in an extra window	2/14/2023 1:35 PM

Topical Workshop: Shimura Varieties and L-Functions

March 13, 2023 – March 17, 2023

Hybrid Workshop

Organizers:

Michael Harris (Columbia University)

David Loeffler (University of Warwick)

Elena Mantovan (California Institute of Technology

Christopher Skinner (Princeton University)

Sarah Zerbes (ETH Zürich)

Wei Zhang (Massachusetts Institute of Technology)

REPORT ON THE MSRI WORKSHOP
"Shimura Varieties and L-Functions (Hybrid Workshop)"
March 13 – March 17, 2023

Organizers

- Michael Harris (Columbia University)
- David Loeffler (University of Warwick)
- Elena Mantovan (California Institute of Technology)
- Christopher Skinner (Princeton University)
- *Sarah Zerbes (ETH Zürich)* [unable to attend due to medical treatment]
- Wei Zhang (Massachusetts Institute of Technology)

Scientific Description

The topical workshop was dedicated to Dr. Shouwu Zhang, to mark the occasion of his 60th birthday, and to honor his numerous beautiful contributions to the theory of Shimura varieties and special values of L-functions. It highlighted cutting edge work on topics such as the construction of Euler systems; relations between special cycles on Shimura varieties and L-functions, such as generalized Gross-Zagier formulas and the Tate conjecture; the construction of Galois representations in cohomology; and related aspects of the theory of automorphic forms.

Highlights of the Workshop

The central focus of the workshop was the schedule of research talks, with 18 talks of an hour each. These presented a range of fascinating new work exploring different areas of number theory within the broad theme of Shimura varieties and L-functions. Highlights reported in the participant survey included Chao Li's talk on *The Kudla-Rapoport Conjecture for Krämer Models*, Ellen Eischen's on *Algebraic and P-Adic Aspects of L-Functions*, and Daniel Disegni's on *Gan-Gross-Prasad Cycles and Derivatives of P-Adic L-Functions*. For example, Disegni's talk (which concluded the workshop) outlined his work with Wei Zhang on a p-adic Gross-Zagier formula relating special cycles to derivatives of p-adic Rankin–Selberg L-functions, showing the ongoing vitality of the ideas introduced in Shouwu Zhang's work and their central role in current research.

On the organizational side, the conference proceeded very smoothly despite some significant challenges – notably, severe weather conditions and widespread power cuts on the Tuesday of the conference which forced MSRI to close for the day, so that day's session took place wholly online. The organisers are very grateful for the hard work and professionalism of MSRI's support staff who made the switch possible (and, of course, to the speakers for their patience with the resulting schedule changes). The majority of the lectures during the workshop were recorded and posted online, with several participants commenting in the survey on the exemplary clarity of the recordings; so these recorded talks will be a valuable resource for the mathematics community in the future. The superb facilities of MSRI's building (not only the main auditorium, but also the social spaces for discussion and networking) were much appreciated by the conference participants.

Organizers

First Name	Last Name	Institution
Michael	Harris	Columbia University
David	Loeffler	University of Warwick
Elena	Mantovan	California Institute of Technology
Christopher	Skinner	Princeton University
Sarah	Zerbes	ETH Zürich
Wei	Zhang	Massachusetts Institute of Technology

Speakers

First Name	Last Name	Institution
Massimo	Bertolini	Universität Duisburg-Essen
Ana	Caraiani	Imperial College, London
Daniel	Disegni	Ben Gurion University of the Negev
Ellen	Eischen	University of Oregon
Giada	Grossi	Université de Paris XIII (Paris-Nord)
Si Ying	Lee	Harvard University
Chao	Li	Columbia University
Yifeng	Liu	Zhejiang University
Jie	Lin	Universität Duisburg-Essen
Zheng	Liu	University of California, Santa Barbara
Kentaro	Nakamura	Saga University
Aaron	Pollack	University of California, San Diego
Michael	Rapoport	Universität Bonn
Yunqing	Tang	University of California, Berkeley
Ye	Tian	Academy of Mathematics and Systems Science
Tonghai	Yang	University of Wisconsin-Madison
Zhiwei	Yun	Massachusetts Institute of Technology
Yihang	Zhu	University of Maryland

Topical Workshop: Shimura Varieties and L-Functions

March 13, 2023 - March 17, 2023

Monday, March 13, 2023			
9:15 AM - 9:30 AM	Simons Auditorium		Welcome
9:30 AM - 10:30 AM	Simons Auditorium	Michael Rapoport	An AFL Conjecture for the Whole Hecke Algebra
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Live Streamed in Simons Auditorium	Massimo Bertolini	Diagonal Classes and the Birch and Swinnerton-Dyer Conjecture
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Tonghai Yang	Arithmetic Theta Kernel and Liftings
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Chao Li	Kudla-Rapoport Conjecture for Krämer Models

Tuesday, March 14, 2023			
9:30 AM - 10:30 AM	Zoom	Ana Caraiani	On the Modularity of Elliptic Curves Over Imaginary Quadratic Fields
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Zoom	Yifeng Liu	Level Raising via Unitary Shimura Varieties with Good Reduction and an Ihara Lemma

Wednesday, March 15, 2023			
9:00 AM - 10:00 AM	Simons Auditorium	Ye Tian	On Quadratic Twists of Elliptic Curves
10:30 AM - 11:30 AM	Simons Auditorium	Yunqing Tang	Irrationality of 2-Adic Zeta 5
11:45 AM - 12:45 PM	Simons Auditorium	Zhiwei Yun	Modularity of Higher Theta Series for Function Fields

Thursday, March 16, 2023			
9:00 AM - 10:00 AM	Simons Auditorium	Kentaro Nakamura	Zeta Morphisms for Rank Two Universal Deformations
10:00 AM - 10:30 AM	Atrium		Break
10:30 AM - 11:45 AM	Simons Auditorium	Giada Grossi	Mazur's Main Conjecture at Eisenstein Primes
11:45 AM - 11:50 AM	Atrium		Break
11:50 AM - 12:50 PM	Simons Auditorium	Yihang Zhu	Zeta Functions of Shimura Varieties: Past, Present, and the Near Future
12:50 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Si Ying Lee	Semisimplicity of Etale Cohomology of Some Shimura Varieties
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Simons Auditorium	Aaron Pollack	Exceptional Theta Functions
4:30 PM - 6:20 PM	Front Courtyard		Reception

Friday, March 17, 2023			
9:30 AM - 10:30 AM	Simons Auditorium	Ellen Eischen	Algebraic and P-Adic Aspects of L-Functions, with a View toward Spin L-Functions for GSp_6
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Simons Auditorium	Zheng Liu	P-Adic L-Functions for Finite-Slope Families on Symplectic and Unitary Groups
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Simons Auditorium	Jie Lin	Period Relations for Arithmetic Automorphic Periods on Unitary Groups
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Live Streamed in Simons Auditorium	Daniel Disegni	Gan-Gross-Prasad Cycles and Derivatives of P-Adic L-Functions

Identifiable Participants' Information

Participants		165

Gender		165
Male	75.76%	125
Female	22.42%	37
Other	0.00%	0
Declined to state	1.82%	3

Ethnicity*		175
White	37.14%	65
Asian	44.57%	78
Hispanic	4.00%	7
Pacific Islander	0.00%	0
Black	1.71%	3
Native American	0.00%	0
Mixed	2.86%	5
Declined to state	9.71%	17

* ethnicity specifications are not exclusive

There were 21 unidentifiable participants.

The following responses are from the onsite participants.

Q1 I primarily participated in the workshop:

Answered: 88   Skipped: 0
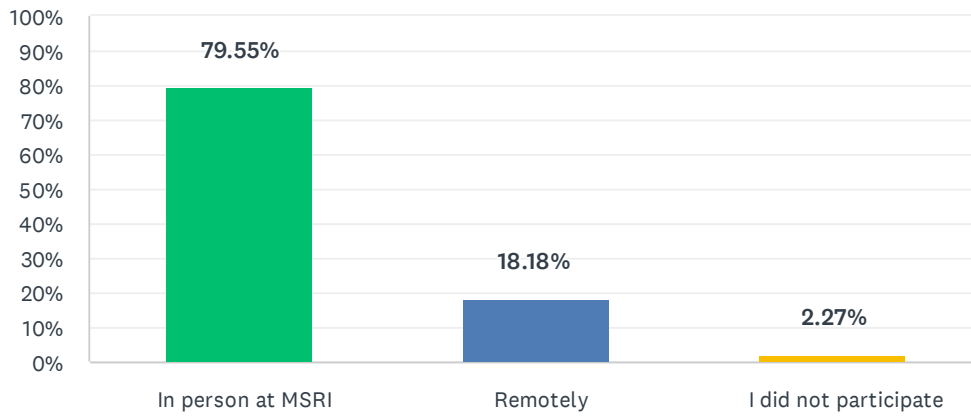
ANSWER CHOICES	RESPONSES	
In person at MSRI	79.55%	70
Remotely	18.18%	16
I did not participate	2.27%	2
TOTAL		88

697

Q2 The workshop was intellectually stimulating

Answered: 60   Skipped: 28
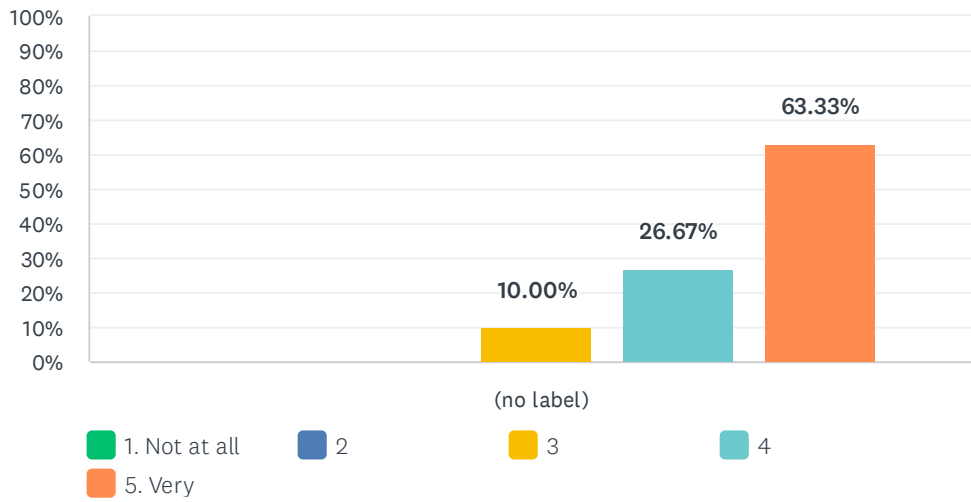
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.00% 6	26.67% 16	63.33% 38	60	4.53

Q3 The overall experience of the workshop was worthwhile

Answered: 60   Skipped: 28
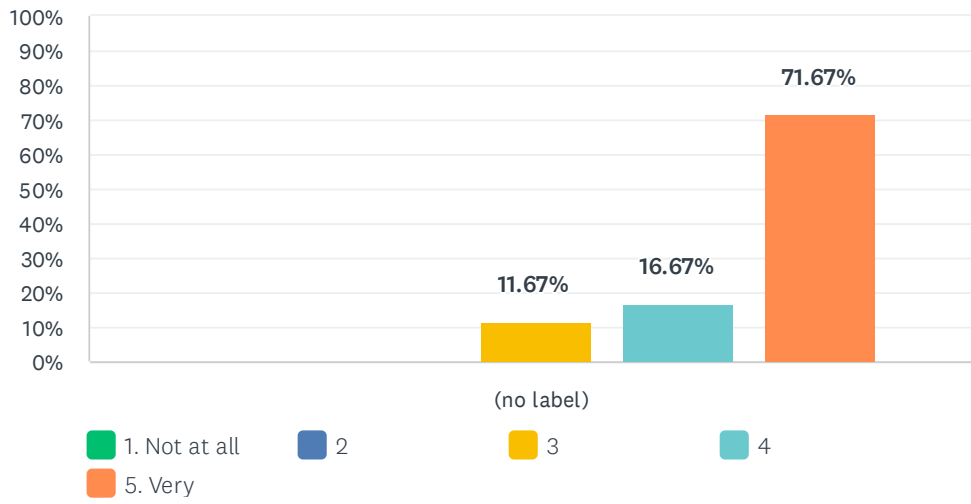
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.67% 7	16.67% 10	71.67% 43	60	4.60

Q4 The lectures were at an appropriate level

Answered: 60   Skipped: 28

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	1.67% 1	3.33% 2	11.67% 7	30.00% 18	53.33% 32	60	4.30

Q5 I was well prepared to benefit from the lectures

Answered: 60   Skipped: 28
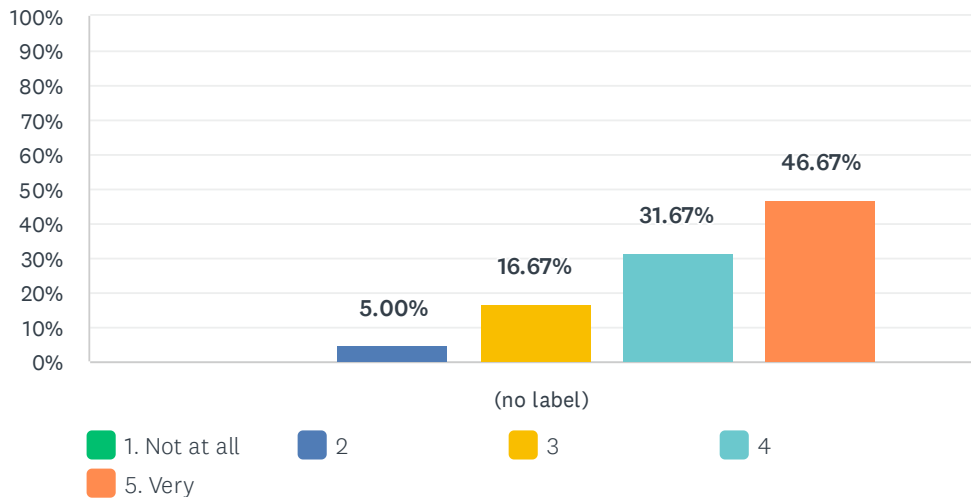
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.00% 3	16.67% 10	31.67% 19	46.67% 28	60	4.20

Q6 My interest in the subject matter was increased by the workshop

Answered: 60   Skipped: 28
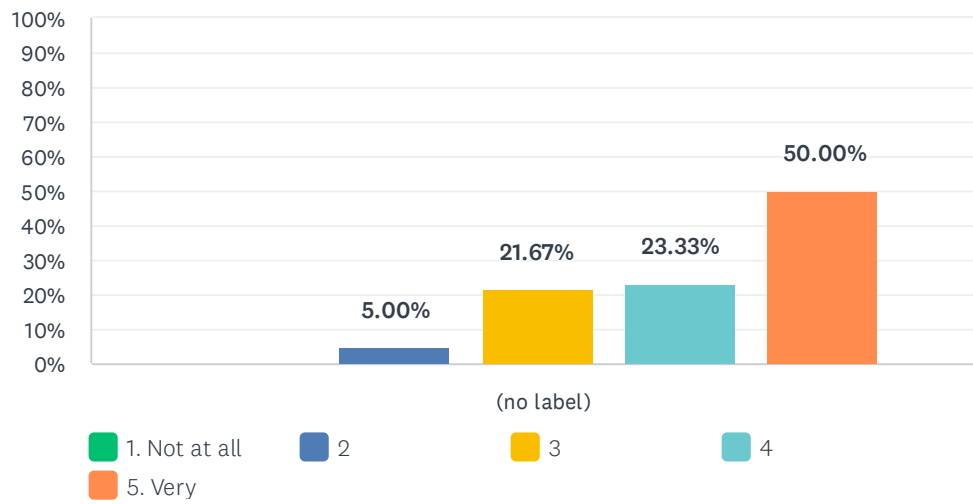
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.00% 3	21.67% 13	23.33% 14	50.00% 30	60	4.18

Q7 The workshop helped me meet people with similar scientific interests

Answered: 60   Skipped: 28
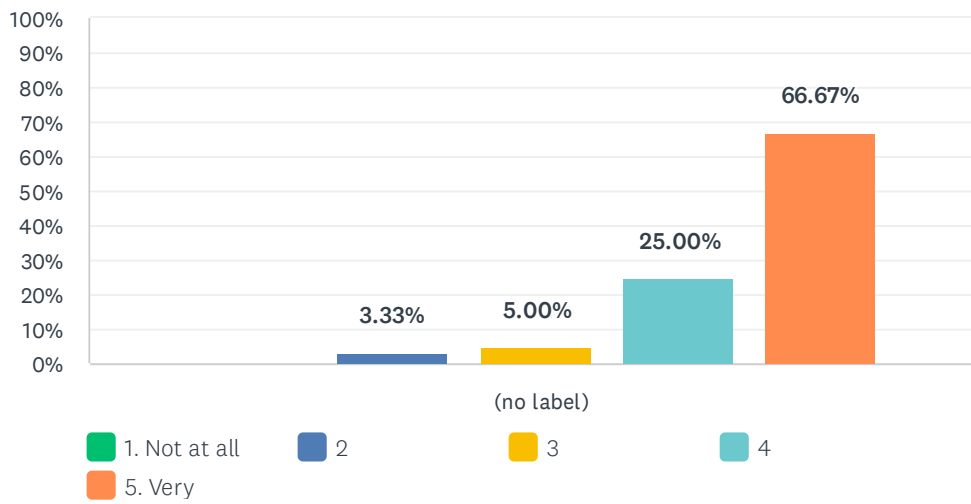
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.33% 2	5.00% 3	25.00% 15	66.67% 40	60	4.55

Q8 What were the highlights of the lectures?

Answered: 60   Skipped: 28

#	RESPONSES	DATE
1	Chao Li's talk on applications of comparing Theta Series and Eisenstein Series was outstanding.	3/28/2023 12:41 PM
2	I'm not familiar with all of the topics presented. So I really appreciated that many speakers spent some time to provide motivations and background.	3/27/2023 11:41 AM
3	I enjoyed Yunqing Tang's talk	3/26/2023 8:46 PM
4	All the talks	3/24/2023 12:59 PM
5	the way to put related topics and people together and the disccusion after lectures	3/23/2023 6:19 PM
6	Ellen Eischen's talk was very good	3/23/2023 1:24 PM
7	Opening lecture by Micheal Rapoport and the lecture by Yunqing Tang	3/23/2023 12:59 PM
8	Summary of development of close fields	3/23/2023 12:50 PM
9	Taken all together, they covered a breathtaking amount of difficult material.	3/23/2023 11:36 AM
10	I liked Michael Rapoport's talk and Daniel Disegni's talk.	3/23/2023 11:34 AM
11	-	3/23/2023 11:33 AM
12	All lectures were very good, very enjoyable.	3/23/2023 11:07 AM
13	Nice talk by Disegni	3/23/2023 10:48 AM
14	The equipment (blackboard, screens, mics, sound system, etc.) in the lecture hall.	3/23/2023 10:44 AM
15	All of the lectures were amazing, and were all on very interesting and relevant topics. In particular Chao Li's lecture was very fun.	3/23/2023 10:36 AM
16	Chao Li's lecture on Kudla-Rapoport conjecture for Kramer Model	3/23/2023 10:23 AM
17	Disegni's lecture was great, so was Chao Li's.	3/19/2023 10:21 PM
18	diversity	3/19/2023 5:19 PM
19	The variety of different problems being worked on	3/19/2023 4:42 PM
20	great	3/19/2023 4:26 PM
21	I don't know how to answer this question.	3/19/2023 12:55 PM
22	Chao Li's and Yunqing Tang's talks were great!	3/19/2023 10:18 AM
23	The lectures by Chao Li and Ana Caraiani.	3/19/2023 9:07 AM
24	Not only lectures but also discussions during breaks were extremely helpful.	3/19/2023 3:13 AM
25	The level of leading mathematicians in the conference	3/18/2023 9:31 PM
26	Interesting results and stories	3/18/2023 2:46 PM
27	Several of the lectures were very good (Pollack, Eishen, Rapoport, Caraiani, Tang). Zhu's lecture was especially good.	3/18/2023 12:41 PM
28	This is a conference with very high quality	3/18/2023 12:38 PM
29	Chao Li's lecture	3/18/2023 10:56 AM
30	N/A	3/18/2023 9:49 AM

31	Two lectures by: 1. Chao Li - Kudla Rapoport Conjecture for Kramer Model, and 2. Yihang Zhu - Zeta functions of Shimura Varieties: Past, present and near future	3/18/2023 9:43 AM
32	Michael Rapoport and Chao Li's talks are really benefit to me	3/18/2023 4:14 AM
33	Chao Li's lecture	3/17/2023 11:34 PM
34	Chao Li's talk	3/17/2023 11:05 PM
35	The lecture by Chao Li	3/17/2023 10:34 PM
36	Chao Li was fantastic	3/17/2023 9:20 PM
37	The scientific work of Shouwu Zhang	3/17/2023 9:02 PM
38	I think Chao Li and Zhiwei Yun's talks are great.	3/17/2023 7:50 PM
39	eischen, monday	3/17/2023 7:27 PM
40	Meeting people	3/17/2023 7:23 PM
41	Chao Li's talk	3/17/2023 7:23 PM
42	the engaged audience	3/17/2023 6:35 PM
43	They were all great	3/17/2023 6:14 PM
44	Some of the speakers make an effort to make their discussions accessible by the non-experts, this is always appreciated (using at least the first part to review the background and to motivate the results).	3/17/2023 6:02 PM
45	The talk by Disgeni	3/17/2023 6:01 PM
46	Getting to interact with established professors as well as early career mathematicians.	3/17/2023 6:00 PM
47	Throwing the box	3/17/2023 5:41 PM
48	In general, quality of the exposition of various threads of research generally not availably or easily found in the literature. Specifically, I enjoyed Rapoport's and Li's talk.	3/17/2023 5:38 PM
49	Chao Li's talk!	3/17/2023 5:38 PM
50	I particulrly enjoyed the lectures about special cycles and the arithmetic of unitary Shimura varieties which opened up promising perspectives for me.	3/17/2023 5:36 PM
51	Interesting lectures	3/17/2023 5:36 PM
52	I don't feel comfortable choosing a particular talk for such a survey but I was surprised by how much I enjoyed talks in subfields I have little interaction with ordinarily (e.g. the Kudla-Rapoport conjecture).	3/17/2023 5:32 PM
53	Introduction to diverse aspects of L-functions	3/17/2023 5:31 PM
54	Nice.	3/17/2023 5:27 PM
55	Zhiwei Yun's lecture	3/17/2023 5:23 PM
56	Various people meeting together.	3/17/2023 5:21 PM
57	Yunqing Tang's talk	3/17/2023 5:19 PM
58	I thought Chao Li's talk was very interesting	3/17/2023 5:19 PM
59	Very good speaker list with engaging Q&As	3/17/2023 5:18 PM
60	Everything	3/17/2023 5:17 PM

Q9 Additional comments

Answered: 3   Skipped: 85

#	RESPONSES	DATE
1	I am wondering if there is a better way to provide lunch	3/23/2023 6:19 PM
2	Many of the lectures were too technical even for the experts. Many of the slides had too much information each slide.	3/18/2023 12:41 PM
3	It should be called a conference, not a workshop on Shimura Varieties and L-functions.	3/18/2023 9:43 AM

Q10 I found the SLMath staff helpful

Answered: 59   Skipped: 29

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	3.39% 2	91.53% 54	5.08% 3	59	4.96

Q11 The SLMath facilities were conducive for such a workshop

Answered: 59   Skipped: 29
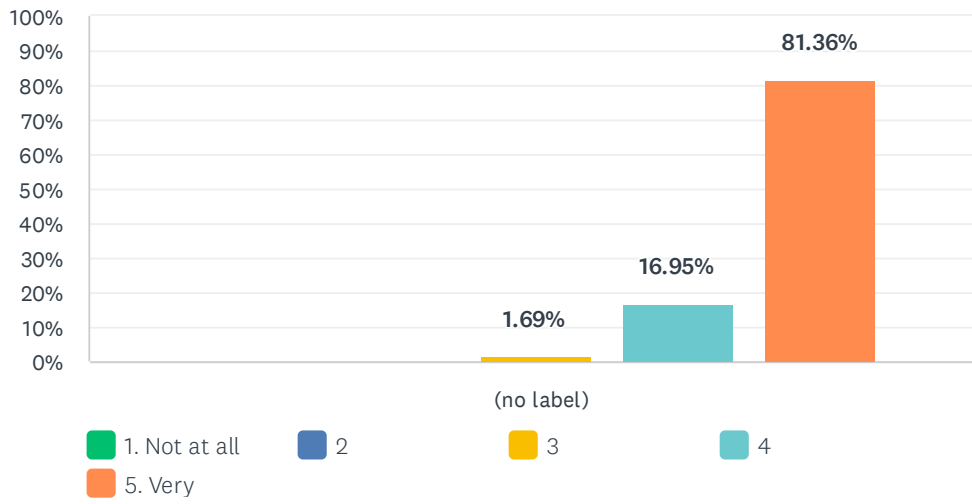
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	1.69% 1	16.95% 10	81.36% 48	59	4.80

Q12 Did you use SLMath's wireless network?

Answered: 59   Skipped: 29
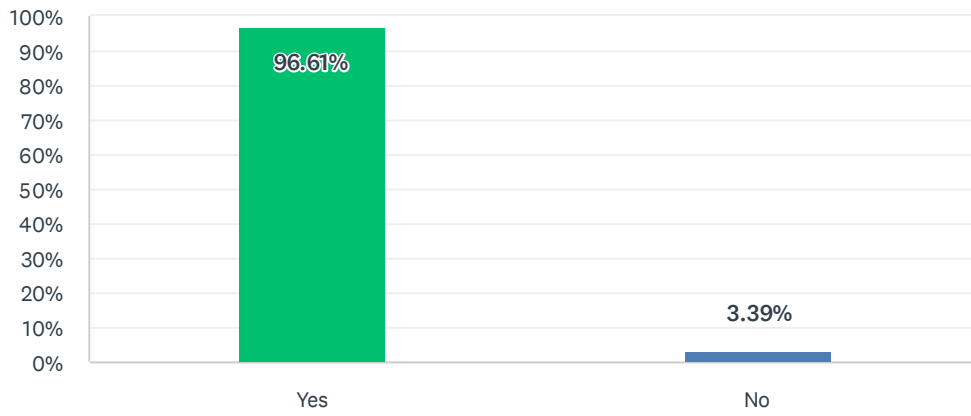
ANSWER CHOICES	RESPONSES	
Yes	96.61%	57
No	3.39%	2
TOTAL		59

Q13 Did you experience any difficulties with the network?

Answered: 59   Skipped: 29
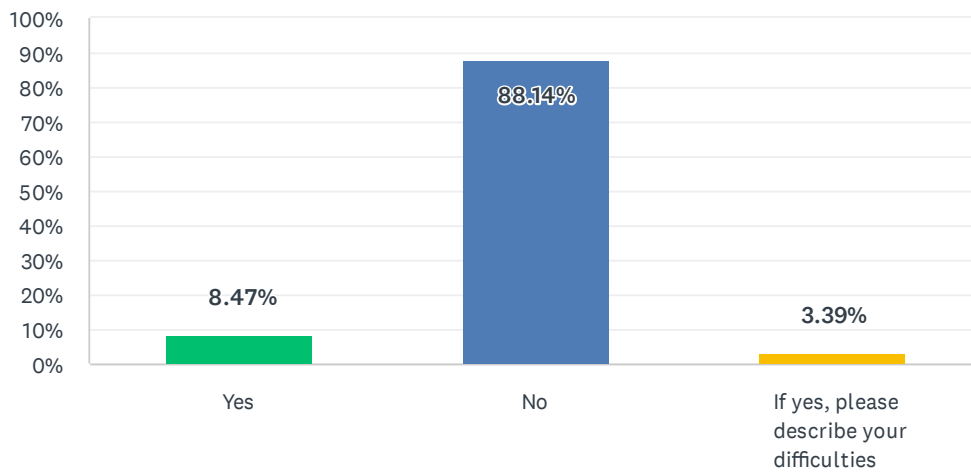
ANSWER CHOICES	RESPONSES	
Yes	8.47%	5
No	88.14%	52
If yes, please describe your difficulties	3.39%	2
TOTAL		59

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	A lot of the times the network didn't work on my phone	3/18/2023 10:58 AM
2	Only in the auditorium with the phone. Only the days after the storm.	3/17/2023 5:38 PM

Q14 The SLMath lunch arrangements were satisfactory

Answered: 59   Skipped: 29

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.69% 1	20.34% 12	15.25% 9	44.07% 26	18.64% 11	59	4.25

Q15 The SLMath tea arrangements were satisfactory

Answered: 59   Skipped: 29
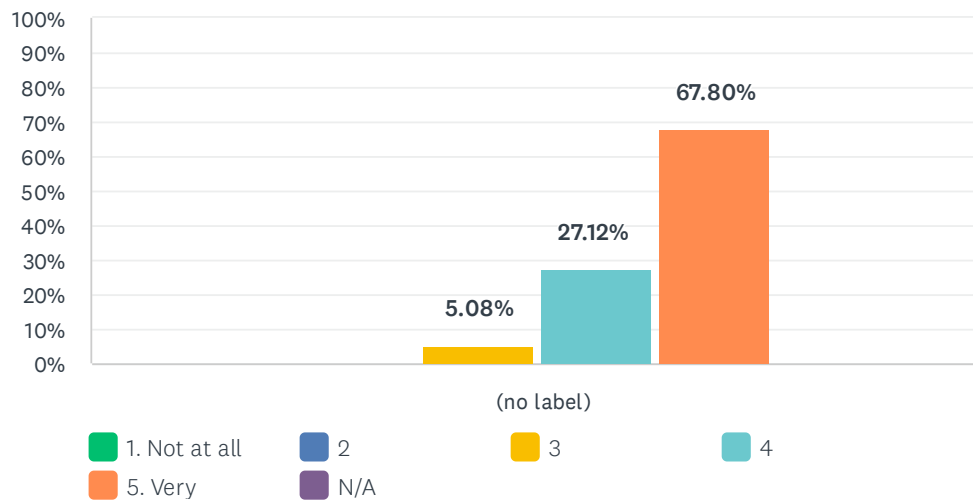
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.08% 3	27.12% 16	67.80% 40	0.00% 0	59	4.63

Q16 Additional comments about the SLMath staff, facilities and food

Answered: 13   Skipped: 75

#	RESPONSES	DATE
1	Thank you very much for your work!	3/27/2023 11:42 AM
2	More snacks would be better	3/24/2023 12:59 PM
3	Perhaps due to inclement weather, there weren't many good spaces to just sit and talk math with someone (unless you know someone who has an office). There aren't plugs for most of the tables in the "main room" (where tea is served).	3/23/2023 11:37 AM
4	The lunch has very limited options. The food at tea is much better.	3/23/2023 11:09 AM
5	The staff were very accommodating and helpful. They contributed to a very welcoming atmosphere.	3/23/2023 10:37 AM
6	Many thanks	3/23/2023 10:24 AM
7	Hope to have more fresh fruits for tea	3/18/2023 2:47 PM
8	The bagels would always run out early. (This is very minor.)	3/18/2023 12:41 PM
9	The lunch on Mondays and Thursdays could be better	3/18/2023 10:58 AM
10	Excellent!	3/18/2023 9:44 AM
11	Staff are great!	3/17/2023 5:42 PM
12	Could be more nutritious at times. Consider soylent?	3/17/2023 5:40 PM
13	The reception staff were always extremely helpful - even though mathematicians are not always easy to deal with!	3/17/2023 5:19 PM

Q17 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 1   Skipped: 87

#	RESPONSES	DATE
1	The majority of the talks would have been better if they were more accessible to non-experts in that very specific area.	3/19/2023 10:19 AM

The following responses are from the virtual participants.

Q18 I found the SLMath staff helpful

Answered: 11   Skipped: 77
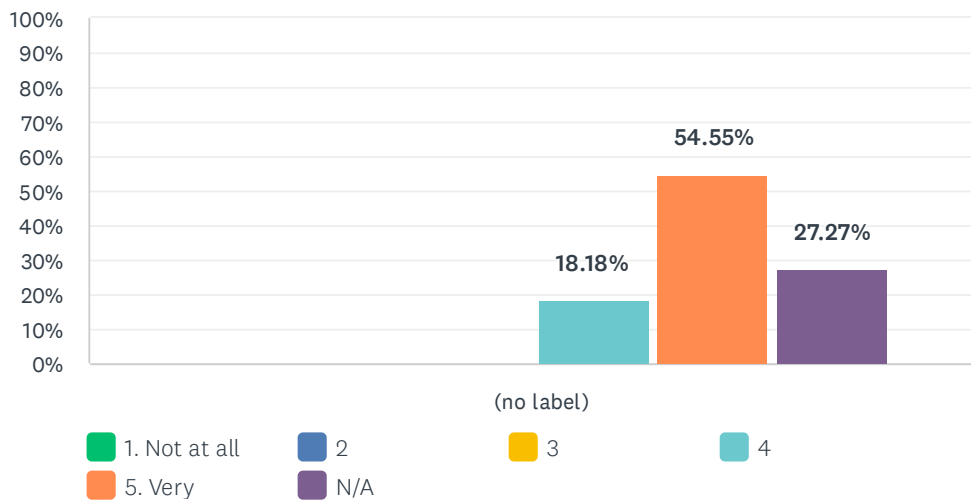
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	18.18% 2	54.55% 6	27.27% 3	11	4.75

716

Q19 How many talks did you watch live?

Answered: 11   Skipped: 77
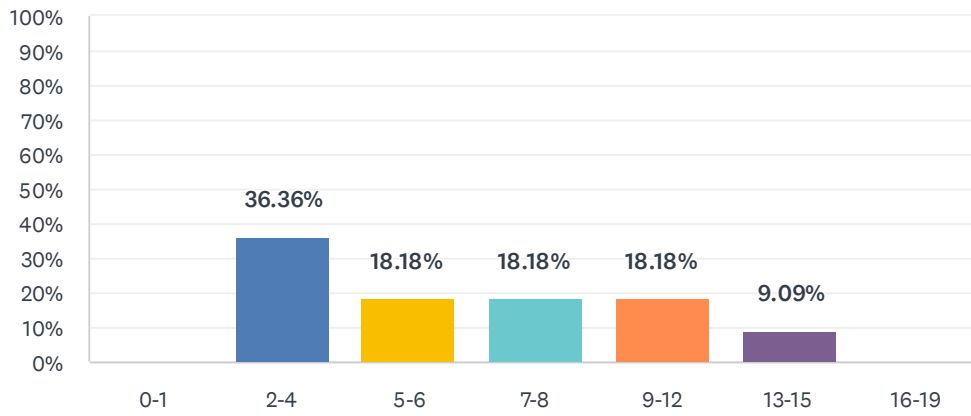
ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	36.36%	4
5-6	18.18%	2
7-8	18.18%	2
9-12	18.18%	2
13-15	9.09%	1
16-19	0.00%	0
TOTAL		11

Q20 The workshop was intellectually stimulating

Answered: 11   Skipped: 77
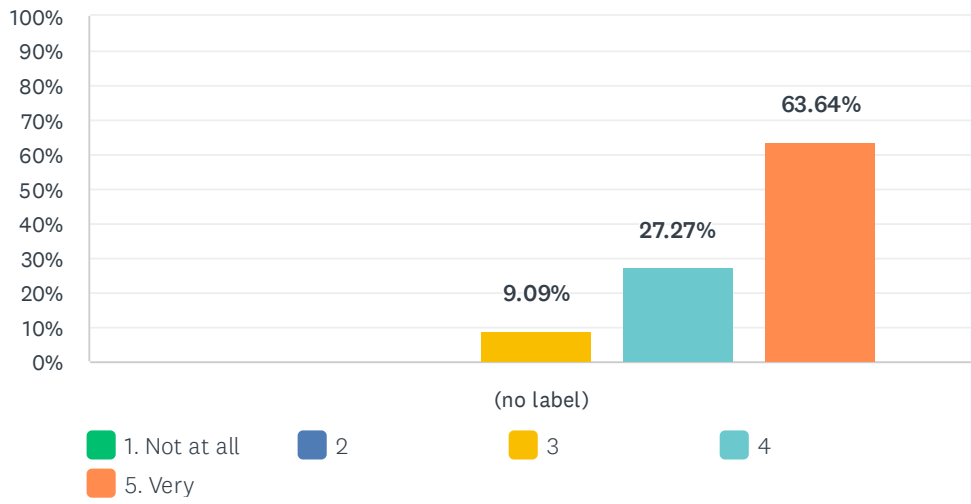
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	9.09% 1	27.27% 3	63.64% 7	11	4.55

Q21 The overall experience of the workshop was worthwhile

Answered: 11   Skipped: 77

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	18.18% 2	18.18% 2	63.64% 7	11	4.45

Q22 The lectures were at an appropriate level

Answered: 11   Skipped: 77
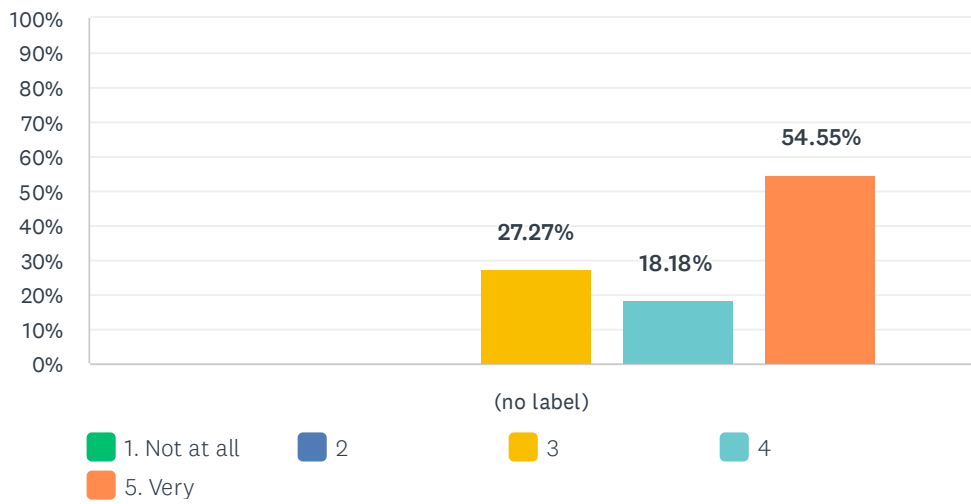
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	27.27% 3	18.18% 2	54.55% 6	11	4.27

Q23 I was well prepared to benefit from the lectures

Answered: 11   Skipped: 77
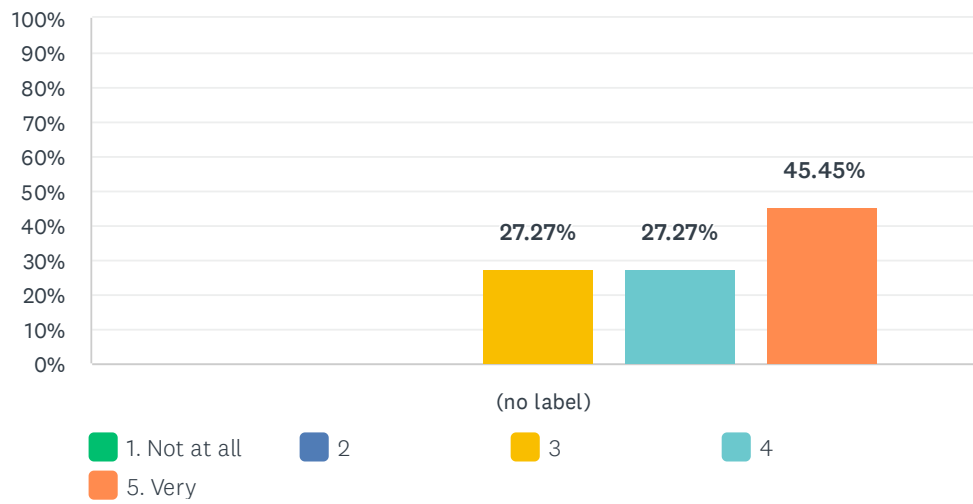
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	27.27% 3	27.27% 3	45.45% 5	11	4.18

Q24 My interest in the subject matter was increased by the workshop

Answered: 11   Skipped: 77
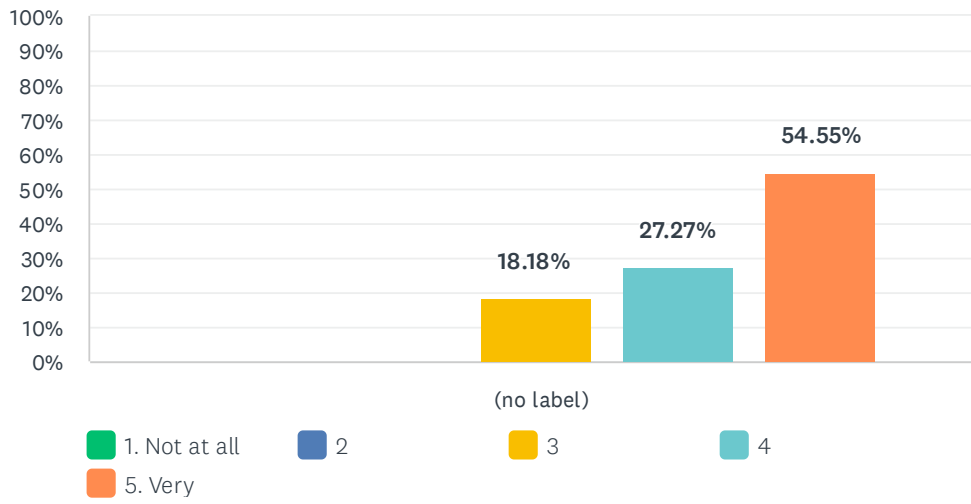
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	18.18% 2	27.27% 3	54.55% 6	11	4.36

Q25 The workshop helped me meet people with similar scientific interests

Answered: 11   Skipped: 77
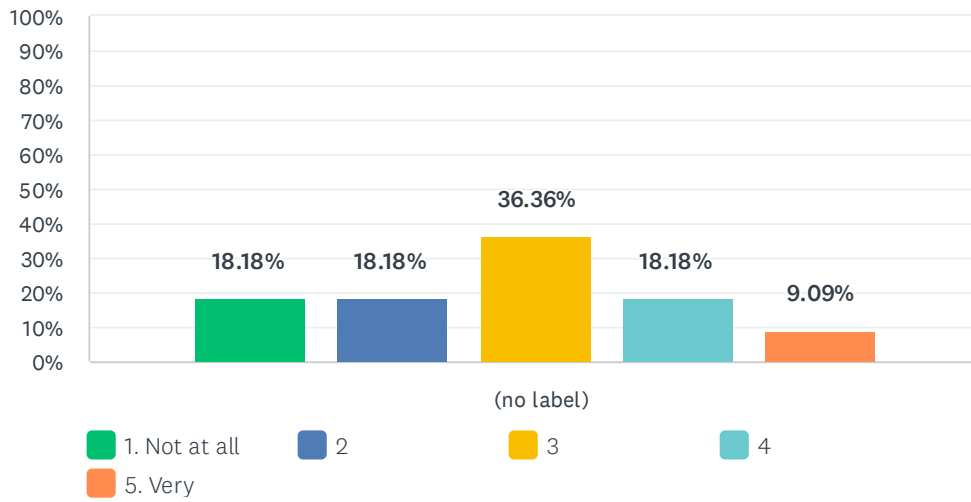
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	18.18% 2	18.18% 2	36.36% 4	18.18% 2	9.09% 1	11	2.82

Q26 What were the highlights of the lectures?

Answered: 11   Skipped: 77

#	RESPONSES	DATE
1	I was very interested in the Elliptic Curves over Quadratic Fields lecture, so that was a personal highlight for me. However, they were all very interesting!	3/23/2023 3:02 PM
2	Too many.	3/23/2023 10:29 AM
3	Theta functions and L functions	3/19/2023 7:39 AM
4	New progress on Euler systems and automorphic theory for higher groups.	3/19/2023 7:04 AM
5	These lectures were well prepared, and each one served as an nice invitation to the corresponding research field. I have learned a lot from them.	3/19/2023 6:41 AM
6	I only attended 1 1/2 of the lectures; no big highlights for me	3/18/2023 11:43 AM
7	It was exciting to see how much progress has been made in the study of arithmetic theta correspondences. It was also great to hear people talk about Shouwu's and to gain an understanding of his profound influence on the community.	3/18/2023 10:56 AM
8	Some specific talks were very well done	3/17/2023 9:46 PM
9	Yihang Zhu's talk.	3/17/2023 6:31 PM
10	Ellen Eischen's talk was the most interesting to me.	3/17/2023 5:29 PM
11	I like the one given by Ellen best!	3/17/2023 5:24 PM

Q27 Additional comments

Answered: 2   Skipped: 86

#	RESPONSES	DATE
1	Most of the questions do not really apply; I was only tangentially interested in the topics of the workshop	3/18/2023 11:43 AM
2	My participation was completely remote.	3/18/2023 10:56 AM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 10   Skipped: 78
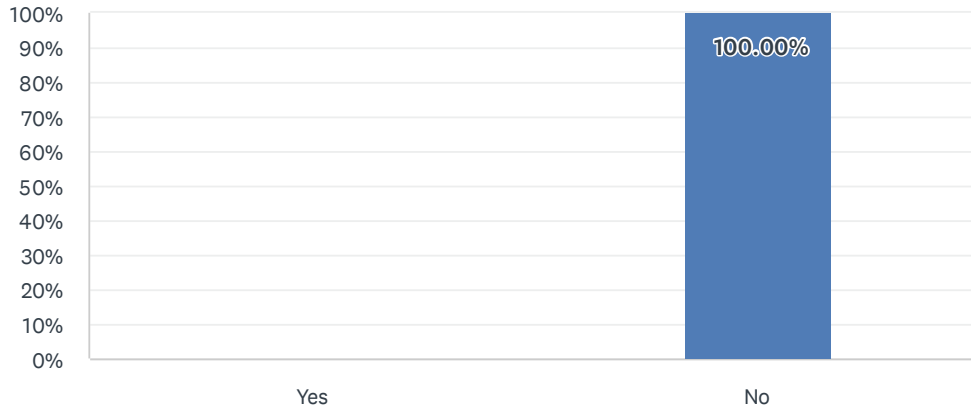
ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	10
TOTAL		10

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q29 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 10   Skipped: 78

#	RESPONSES	DATE
1	It provided a flexible way of accessing the lectures given my time schedule, but I definitely might have met more of the participants and been more immersed if I had opted for in-person. However, near the tail end of my PhD, I will probably opt for this instead!	3/23/2023 3:04 PM
2	Very helpful for people who dont have funding to attend the workshop in person!	3/23/2023 10:30 AM
3	Time zone difference was the main barrier	3/19/2023 7:39 AM
4	Due to other commitments I would not have been able to travel to MSRI.	3/19/2023 7:05 AM
5	Time zone differences do keep me away from attending some of the lectures.	3/19/2023 6:50 AM
6	--	3/18/2023 11:44 AM
7	I did not apply for funding so it was only possible for me to attend online.	3/18/2023 10:57 AM
8	I could only attend remotely due to teaching responsibilities, so the remote participation option was essential for me.	3/17/2023 6:32 PM
9	I think without the online option I would not have attended due to other Engagements.	3/17/2023 5:31 PM
10	No	3/17/2023 5:25 PM

Q30 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 2   Skipped: 86

#	RESPONSES	DATE
1	I have seen a few conferences use Zulip, and have found that to be pretty effective (with channels for online and in-person participants, sharing materials, asking questions, etc).	3/23/2023 3:04 PM
2	I think the online setup and that zoom participants can ask questions directly works pretty well.	3/17/2023 5:31 PM

Q31 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 3   Skipped: 85

#	RESPONSES	DATE
1	Thank you for the great conference! I really appreciate it!	3/23/2023 3:04 PM
2	Some talks are not recording apparently. That's my only concern. Otherwise, thank you for the wonderful experience and talks!	3/23/2023 10:31 AM
3	It is really surprising how easy it is to read the blackboard even if one is only attending via zoom.	3/17/2023 5:32 PM

Critical Issues in Mathematics Education 2023: Mentoring for Equity

March 22, 2023 – March 24, 2023

Hybrid Workshop

Organizers:

Pamela Harris (University of Wisconsin-Milwaukee)

Abbe Herzig (TPSE-Math)

Aris Winger (Georgia Gwinnett College)

Michael Young (Carnegie Mellon University)

In 2022-23, the Mathematical Sciences Research Institute (MSRI) is becoming the Simons Laufer Mathematical Sciences Institute (SLMath).

REPORT ON THE MSRI WORKSHOP
"Critical Issues in Mathematics Education 2023: Mentoring for Equity"
March 22 – 24, 2013

Organizers

- Pamela Harris (University of Wisconsin-Milwaukee)
- Abbe Herzig (TPSE-Math)
- Aris Winger (Georgia Gwinnett College)
- Michael Young (Carnegie Mellon University)

Scientific Description

The workshop Critical Issues in Mathematics Education: Mentoring for Equity aims to reach a broad audience of faculty and students in postsecondary mathematical sciences. Participants learned about the evidence base for effective mentoring, with a focus on culturally responsive mentoring that supports all students and faculty along their mathematical paths. The workshop included a combination of discussion of research evidence, review and adaptation of practical tools, and explicit training in effective mentoring, including how to bring these tools back to participants' home institutions. The workshop intertwined objectives of increasing participants' knowledge of the scholarship on effective mentoring, and engages participants in interactive activities to develop tangible skills as mentors and as mentor-trainers. This workshop cultivated local and national mentoring communities that bring effective tools and strategies to mentoring, so that mentees can persist and thrive in research, teaching, education, and throughout their education and careers.

Highlights of the Workshop

Highlights were numerous. Dr Abbe Herzig opened the proceedings with a talk on the science of mentoring, which detailed based practices centered around evidenced based practices. It was a great talk to start with as a way of setting the tone to center best practices supported by research. Organizer felt that the workshop had to center student voices, and Lucy Martinez represented admirably with her talk, Mentoring Experiences through the Lens of a Mentee. She set a great example for participants to respect and honor the perspectives of those we mentor. It was also modeling for seasoned participants to take the time to listen to the graduate student participants during the workshop. It was an absolute treat to have Dr. David Mandersheid take time out of his busy schedule as a National Science Foundation Director to speak on Building Institutional Support for Mentoring, providing advice on how to make change in our institutions at a systemic level. Dr. Tim McEldowney showed us important data on the lack of mentoring for mathematics major in his talk: Knowledge-GAP: the Impact of Mentoring on the Graduate School Application Process. All talk were followed by reflections in a custom designed journal where participants reflected on what they heard. Further, the journal provided group exercises and scenarios that challenged participants in their mentoring practice.

Critical Issues In Mathematics Education 2023: Mentoring For Equity

March 22, 2023 - March 24, 2023

Wednesday, March 22, 2023			
3:30 PM - 4:00 PM	Eisenbud Auditorium		Registration
4:00 PM - 4:30 PM	Eisenbud Auditorium	Pamela Harris, Abbe Herzig, Aris Winger & Michael Young	Workshop Overview and Logistics and Welcome from Organizers
4:30 PM - 5:30 PM	Eisenbud Auditorium	Abbe Herzig	The Science of Mentoring
5:30 PM - 6:00 PM	Eisenbud Auditorium		Activity 1: "Reflection: Remembering our Graduate School Experiences"
6:00 PM - 7:15 PM			Reception

Thursday, March 23, 2023			
9:00 AM - 9:15 AM	Eisenbud Auditorium		Check-In
9:15 AM - 9:30 AM	Eisenbud Auditorium		Reflect and Review
9:30 AM - 10:30 AM	Eisenbud Auditorium	Lucy Martinez	Mentoring Experiences through the Lens of a Mentee
10:30 AM - 10:45 AM	Atrium		Break
10:45 AM - 11:45 AM	Eisenbud Auditorium		Journal and Group Activity: "Scenarios - What Would You Do?"
11:45 AM - 12:00 PM	Eisenbud Auditorium		Lead into the Working Lunch
12:00 PM - 1:00 PM	Outdoor Decks		Working Lunch
1:00 PM - 2:00 PM	Eisenbud Auditorium	Sarah Sword	Studying Successful Doctoral Students in Mathematics from Underrepresented Groups
2:00 PM - 3:00 PM	Eisenbud Auditorium		Journal and Group Activity: "Personal Writing and Group Work: What Mistakes Have You Made as a Mentor?"
3:00 PM - 3:15 PM	Atrium		Break
3:15 PM - 4:15 PM	Eisenbud Auditorium		Activity 2: "Scenarios - Systemic Issues"
4:15 PM - 5:00 PM	Eisenbud Auditorium		Wrap-Up for the Day & Assignments for Tonight

Friday, March 24, 2023			
9:00 AM - 9:30 AM	Eisenbud Auditorium		Check-In & Activity Follow Up
9:30 AM - 10:30 AM	Eisenbud Auditorium	David Manderscheid	Building Institutional Support for Mentoring
10:30 AM - 10:45 AM	Atrium		Break
10:45 AM - 11:45 AM	Eisenbud Auditorium		Activity 3: "Scenarios - Systemic Issues"
11:45 AM - 12:00 PM	Eisenbud Auditorium		Lead into the Working Lunch
12:00 PM - 1:00 PM	Outdoor Decks		Lunch
1:00 PM - 2:00 PM	Eisenbud Auditorium	Tim McEldowney	Knowledge-GAP: the Impact of Mentoring on the Graduate School Application Process
2:00 PM - 2:15 PM	Atrium		Break
2:15 PM - 3:30 PM	Eisenbud Auditorium		Activity 4: What are You Going to do When You Get Back?
3:30 PM - 4:00 PM	Eisenbud Auditorium		Wrap-Up

Identifiable Participants' Information

Participants		116

Gender		116
Male	41.38%	48
Female	55.17%	64
Other	2.59%	3
Declined to state	0.86%	1

Ethnicity*		152
White	41.45%	63
Asian	12.50%	19
Hispanic	14.47%	22
Pacific Islander	0.66%	1
Black	12.50%	19
Native American	0.66%	1
Mixed	10.53%	16
Declined to state	7.24%	11

* ethnicity specifications are not exclusive

There were 3 unidentifiable participants.

Q1 Which best characterizes how much of this year's CIME workshop you attended? (Check one.)

Answered: 64   Skipped: 0
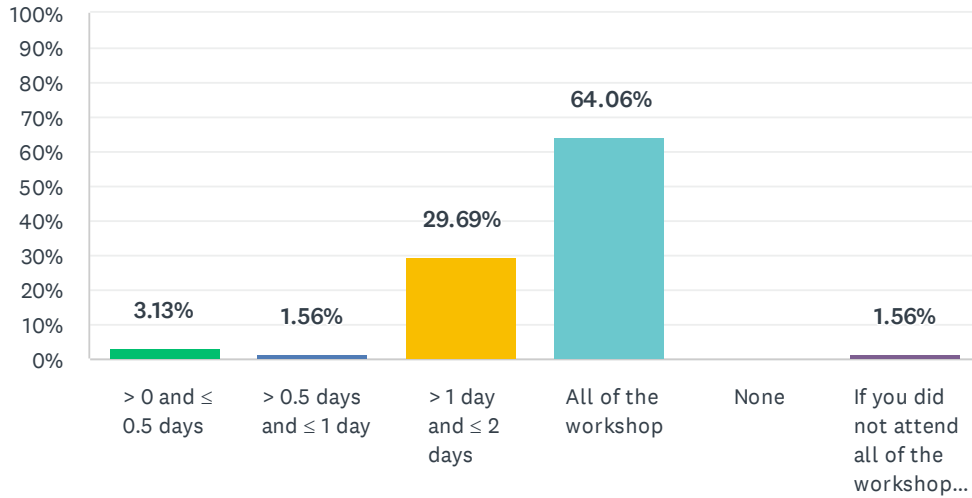
ANSWER CHOICES	RESPONSES	
> 0 and ≤ 0.5 days	3.13%	2
> 0.5 days and ≤ 1 day	1.56%	1
> 1 day and ≤ 2 days	29.69%	19
All of the workshop	64.06%	41
None	0.00%	0
If you did not attend all of the workshop, please explain why	1.56%	1
TOTAL		64

#	IF YOU DID NOT ATTEND ALL OF THE WORKSHOP, PLEASE EXPLAIN WHY	DATE
1	I needed to leave a bit early on Friday because of travel constraints	3/30/2023 6:21 PM

Q2 How did you attend (select all that apply)

Answered: 62   Skipped: 2
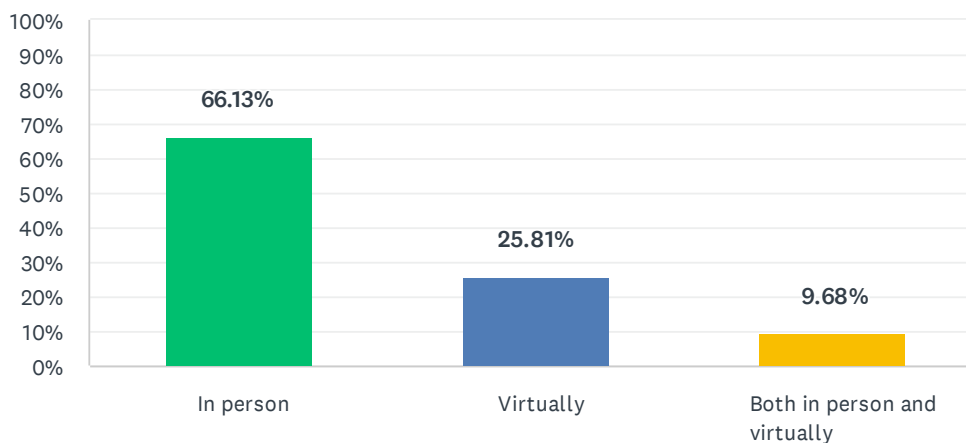
ANSWER CHOICES	RESPONSES	
In person	66.13%	41
Virtually	25.81%	16
Both in person and virtually	9.68%	6
Total Respondents: 62		

Q3 Which best characterizes how much of this year's CIME workshop you attended in person? (Check one.)

Answered: 62   Skipped: 2
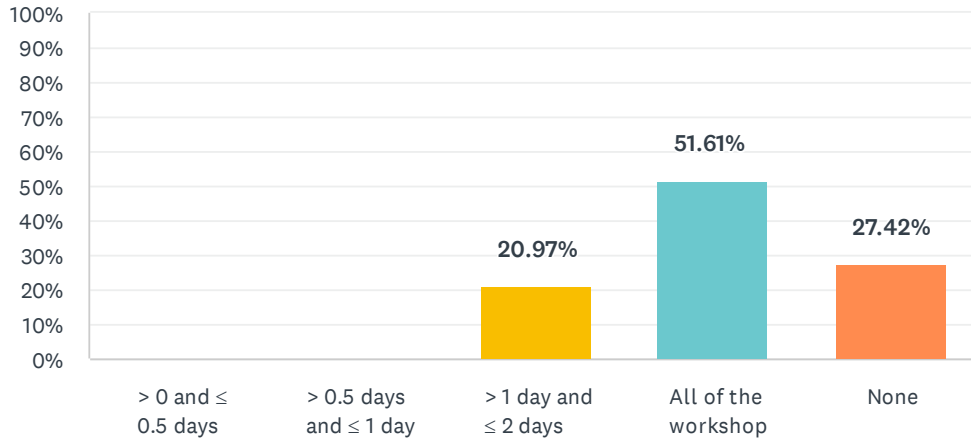
ANSWER CHOICES	RESPONSES	
> 0 and ≤ 0.5 days	0.00%	0
> 0.5 days and ≤ 1 day	0.00%	0
> 1 day and ≤ 2 days	20.97%	13
All of the workshop	51.61%	32
None	27.42%	17
TOTAL		62

Q4 If you did not attend all sessions, briefly describe the factors that impacted your attendance decisions.

Answered: 22   Skipped: 42

#	RESPONSES	DATE
1	I attended all of the talks. Because I was attending from a different time zone and from home, most of the discussions were difficult for me to attend because of constraints like childcare.	4/28/2023 9:08 AM
2	I was there every day of the workshop but I skipped some events because I still had some duties at my home university that I could not ignore.	4/16/2023 2:06 PM
3	A research meeting at my home institute that couldn't be rescheduled	4/15/2023 11:58 AM
4	Taking classes	4/12/2023 10:31 AM
5	Due to prior class conflicts this semester, I did not want to miss more classes.	4/12/2023 10:27 AM
6	Other responsibilities	4/12/2023 10:25 AM
7	My flight was changed so I reached after the first session.	4/10/2023 2:47 PM
8	I couldn't get away from my teaching for long enough to travel to SLMath in person, and had other commitments locally that weekend.	4/6/2023 2:31 PM
9	conflicts with teaching since I was attending virtually	4/5/2023 7:15 AM
10	I am a graduate student and I had other commitments on Wednesday afternoon and evening that I was not able to miss.	4/4/2023 5:08 PM
11	I was in the online setting, and thought the online participants could have more interaction	4/4/2023 3:06 PM
12	I attended all the sessions that did not conflict with classes I needed to teach at my institution.	4/4/2023 3:01 PM
13	Conflict with other meetings (which I could do virtually from MSRI)	4/3/2023 11:21 AM
14	Was busy Thursday morning personal conflict	3/31/2023 2:36 PM
15	COVID 19 and rise in Influenza virus	3/31/2023 5:55 AM
16	I am based in Germany, so some of the workshop was late for me.	3/30/2023 11:53 PM
17	delayed plane	3/30/2023 5:42 PM
18	I did not feel so well on the last day to attend in-person.	3/30/2023 4:52 PM
19	Found out about the workshop just a couple weeks before it ran, so I attended virtually, and had some work commitments I couldn't get out of. Will watch videos for sessions I missed.	3/30/2023 4:34 PM
20	Was late catching the train so I missed the few mins of Wednesday. But also left a little after lunch on Friday for a work-related meeting	3/30/2023 4:31 PM
21	I didn't have time off, so I had to work around my teaching schedule.	3/30/2023 3:33 PM
22	Physical and emotional exhaustion.	3/30/2023 3:33 PM

Q5 Why did you attend this year's CIME Workshop? (Select all that apply.)

Answered: 62   Skipped: 2
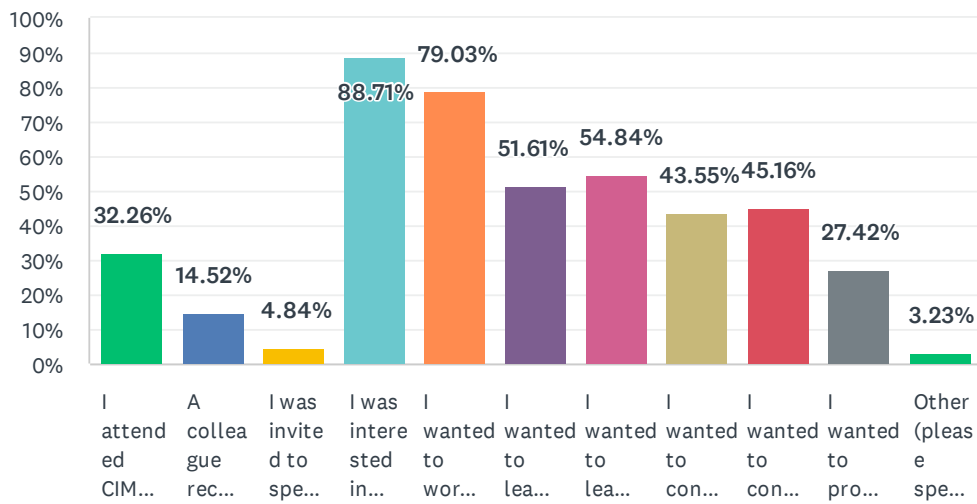
ANSWER CHOICES	RESPONSES	
I attended CIME previously and found it a valuable experience.	32.26%	20
A colleague recommended I attend.	14.52%	9
I was invited to speak, be on a panel, or facilitate a session.	4.84%	3
I was interested in this year's topic.	88.71%	55
I wanted to work toward equitable mathematics education.	79.03%	49
I wanted to learn how to support others in work around this year's topic.	51.61%	32
I wanted to learn more about current issues in mathematics education.	54.84%	34
I wanted to connect with participants in other professional communities.	43.55%	27
I wanted to connect with others involved in mathematics education.	45.16%	28
I wanted to promote this year's topic.	27.42%	17
Other (please specify)	3.23%	2
Total Respondents: 62		

#	OTHER (PLEASE SPECIFY)	DATE
1	I wanted to learn how to better mentor faculty colleagues whose experiences are different than my own.	4/12/2023 10:27 AM
2	i am on the EAC and wanted to observe.	3/30/2023 8:39 PM

741

Q6 Do you think you will attend a future CIME Workshop?

Answered: 62   Skipped: 2
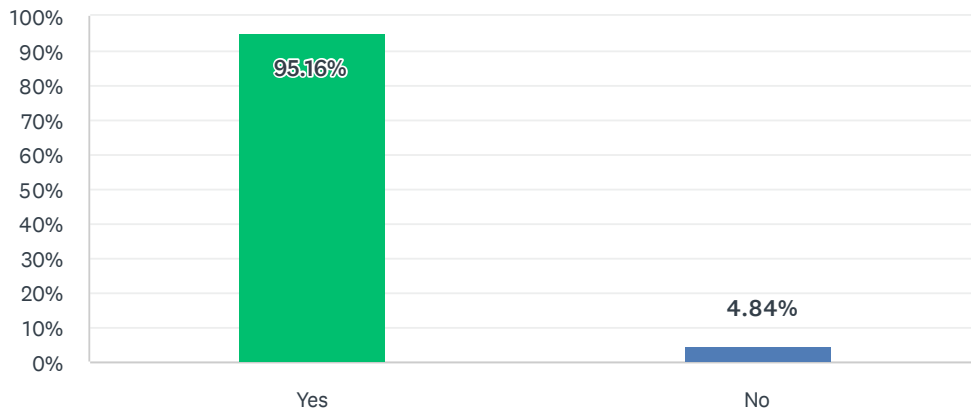
ANSWER CHOICES	RESPONSES	
Yes	95.16%	59
No	4.84%	3
TOTAL		62

#	WHY OR WHY NOT?	DATE
1	This was so helpful, and I have so much more to learn.	4/28/2023 9:09 AM
2	I'm interested in math education even though it is not my main focus area. So, I think I would attend depending on the topic.	4/16/2023 2:08 PM
3	CIME is an important part of the work done at SLMath, is well run, and I find it valuable.	4/14/2023 9:59 AM
4	because it is expensive, still waiting for a small reuimbursement	4/12/2023 10:36 AM
5	The workshops were valuable for my continued growth.	4/12/2023 10:28 AM
6	I need to be aware of the issues.	4/12/2023 10:26 AM
7	I find the talks very insightful and the networking very useful	4/10/2023 2:48 PM
8	The CIME workshop format incentivized active learning and created safe spaces to share our thoughts and grow. Moreover, the workshop gave me the opportunity to meet many incredible people who are trying to change the culture of mathematics and the nature of mathematics education. No matter how much any of us knows about critical issues in our field, there is always more to learn and there are always ways that we can improve; CIME provides the perfect opportunity to learn and practice.	4/4/2023 5:11 PM
9	I got a lot out of the conference and can already see effects from this on how I will approach many aspects of math education in the future.	4/4/2023 3:03 PM
10	Will depend on support and schedule, but enjoyed this one.	4/3/2023 1:00 PM
11	I learned a lot and made meaningful connections and want to continue doing so.	4/3/2023 8:08 AM
12	beautiful conference. the people were so friendly and caring	3/31/2023 2:37 PM
13	I want to learn more about current issues and the future issues that may arise in mathematics education	3/31/2023 5:57 AM
14	I hope so! I found this a valuable experience, and enjoyed connecting with others about these	3/31/2023 12:07 AM

	important issues. I think too, it was meaningful to me, as a postdoc, to be able to form relationships with others - especially as the mathematics education community is rather small at my institution.	
15	I attended a workshop in person in 2018 and found it a very valuable experience	3/30/2023 11:54 PM
16	Because CIME is an important vehicle and support for cross-community conversation.	3/30/2023 8:39 PM
17	It's a great community looking to push the conversation in math ed	3/30/2023 6:06 PM
18	All my CIME Workshop was valuable as it opens up my mind and gives me ideas to teach and research better.	3/30/2023 4:55 PM
19	This one was very helpful	3/30/2023 4:53 PM
20	I always learn a lot and it's a good way to keep abreast with current issues in math education. I also like the fact that the workshops are relatively small, which opens up opportunities for meaningful engagement and conversations.	3/30/2023 4:34 PM
21	I really loved meeting people in the math education community	3/30/2023 3:43 PM
22	It was a good experience, I really enjoyed listening to everyone's ideas and experiences, and it was well put together with good activities.	3/30/2023 3:33 PM
23	In general, I cannot afford additional travel beyond that required by research obligations. Luckily, I was already in residence at MSRI, so I am very grateful to have been able to attend.	3/30/2023 3:28 PM
24	well, maybe ... really looking for *real* change towards more equitable math for *all*	3/30/2023 3:27 PM
25	These are important venues for k-12 and post-secondary cross-talk.	3/30/2023 3:19 PM
26	The workshop was uplifting and enabled me to connect with others interested in the topic.	3/30/2023 3:17 PM

Q7 Including this year's workshop, how many CIME workshops have you attended?

Answered: 62   Skipped: 2
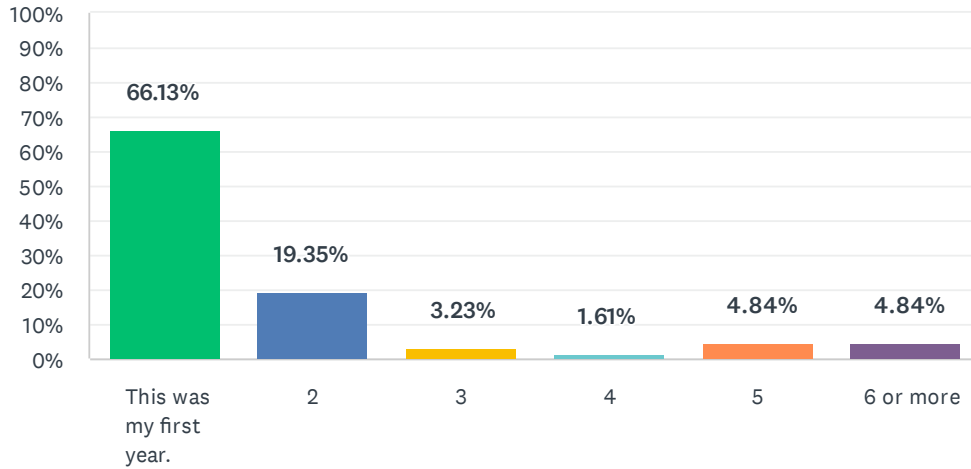
ANSWER CHOICES	RESPONSES	
This was my first year.	66.13%	41
2	19.35%	12
3	3.23%	2
4	1.61%	1
5	4.84%	3
6 or more	4.84%	3
TOTAL		62

Q8 With which of the following professional roles do you strongly identify? (Check all that apply.)

Answered: 62   Skipped: 2
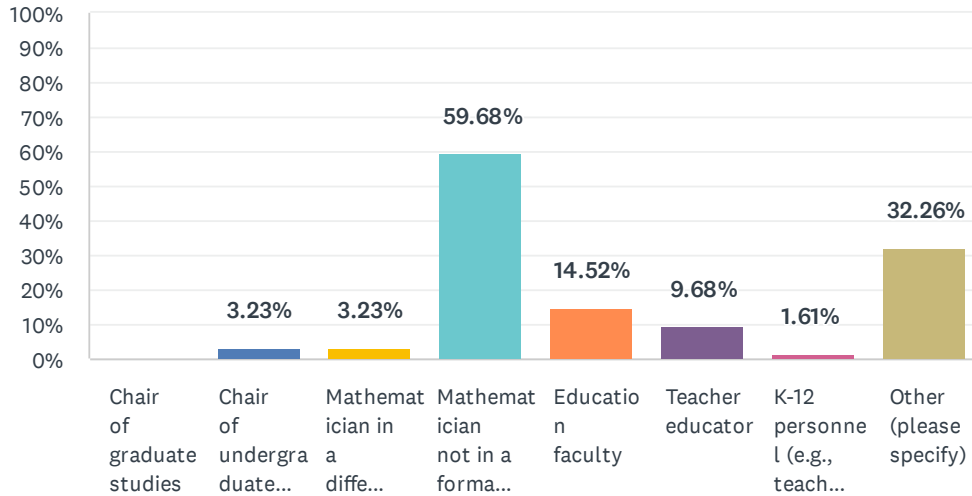
ANSWER CHOICES	RESPONSES	
Chair of graduate studies	0.00%	0
Chair of undergraduate studies	3.23%	2
Mathematician in a different departmental or institutional leadership role (e.g., dean, provost)	3.23%	2
Mathematician not in a formal leadership role	59.68%	37
Education faculty	14.52%	9
Teacher educator	9.68%	6
K-12 personnel (e.g., teacher, curriculum specialist, administrator)	1.61%	1
Other (please specify)	32.26%	20
Total Respondents: 62		

#	OTHER (PLEASE SPECIFY)	DATE
1	postdoc	4/15/2023 11:59 AM
2	Mathematics Education Researcher	4/12/2023 11:05 AM
3	Graduate student	4/12/2023 10:33 AM
4	Department Chair and Math Faculty (4-year institution)	4/12/2023 10:29 AM
5	grad student	4/8/2023 10:07 AM
6	Assistant Professor	4/4/2023 8:45 PM
7	grad student	4/4/2023 7:57 PM
8	Student	4/4/2023 6:48 PM
9	graduate student	4/4/2023 5:12 PM

10	Graduate student in mathematics education	4/4/2023 4:38 PM
11	Although I am the chair of the Math and Applied Sciences department, I am mostly a mathematics professor.	4/4/2023 3:05 PM
12	Graduate Student	4/3/2023 8:10 AM
13	PhD student	4/1/2023 7:13 PM
14	Graduate student	3/31/2023 2:14 PM
15	Educational non-profit manager	3/31/2023 6:41 AM
16	Postdoctoral Scholar	3/31/2023 12:09 AM
17	grad student	3/30/2023 6:07 PM
18	Community College	3/30/2023 4:36 PM
19	Graduate Student	3/30/2023 3:44 PM
20	Calculus Coordinator	3/30/2023 3:39 PM

Q9 Do you hold or are you pursuing a doctoral degree? (Choose one.)

Answered: 62   Skipped: 2
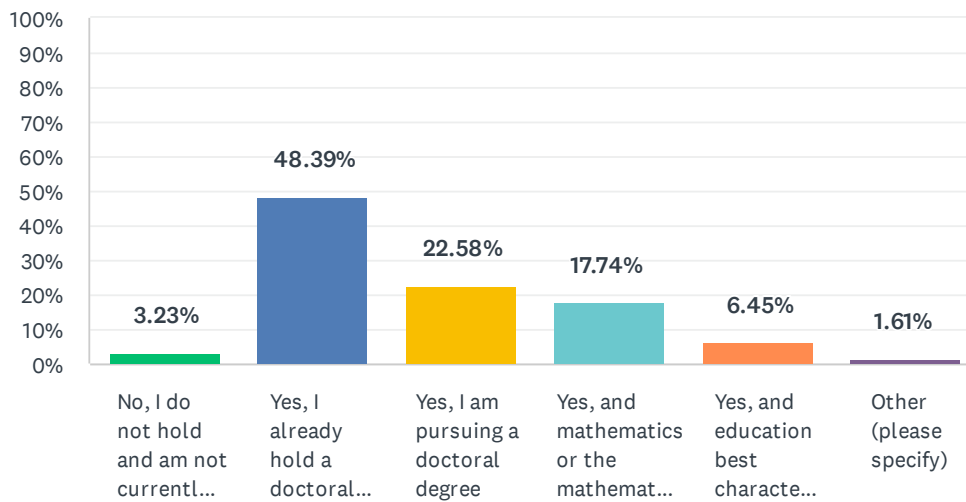
ANSWER CHOICES	RESPONSES	
No, I do not hold and am not currently pursuing a doctoral degree	3.23%	2
Yes, I already hold a doctoral degree	48.39%	30
Yes, I am pursuing a doctoral degree	22.58%	14
Yes, and mathematics or the mathematical sciences best characterizes my field of study	17.74%	11
Yes, and education best characterizes my doctoral field of study	6.45%	4
Other (please specify)	1.61%	1
TOTAL		62

#	OTHER (PLEASE SPECIFY)	DATE
1	I have a Ph.D. in mathematics education from a Mathematics and Statistics Department	3/31/2023 12:09 AM

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Q10 Of the following, which best characterizes your professional affiliation? (Choose all that apply)

Answered: 62   Skipped: 2
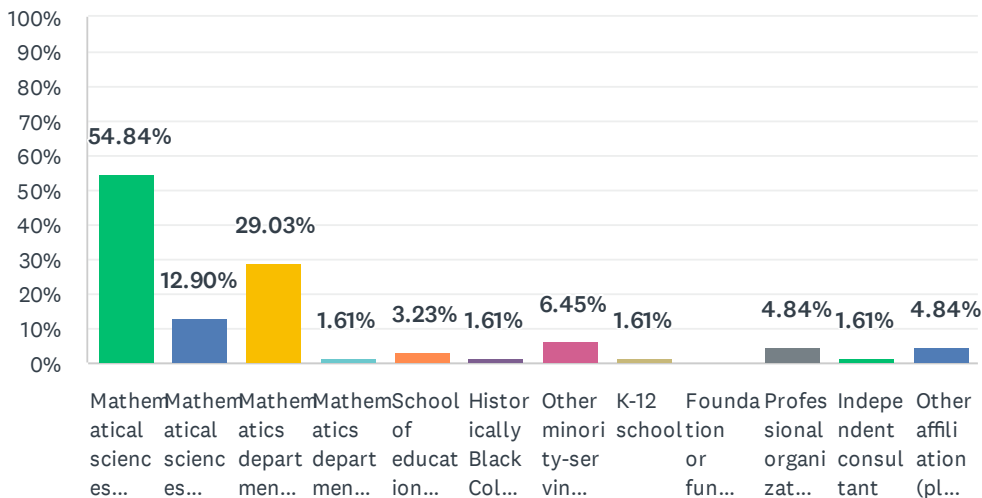
ANSWER CHOICES	RESPONSES	
Mathematical sciences department in an institution that awards doctoral degrees	54.84%	34
Mathematical sciences department in an institution that awards masters degrees but not doctorates	12.90%	8
Mathematics department in a 4-year post-secondary institution	29.03%	18
Mathematics department in a community college or 2-year post-secondary institution	1.61%	1
School of education in a post-secondary institution	3.23%	2
Historically Black College or University (designated an HBCU)	1.61%	1
Other minority-serving insitituion (designated an MSI)	6.45%	4
K-12 school	1.61%	1
Foundation or funding agency	0.00%	0
Professional organization (e.g., AMATYC, MAA, NCTM, TODOS, ...)	4.84%	3
Independent consultant	1.61%	1
Other affiliation (please specify)	4.84%	3
Total Respondents: 62		

#	OTHER AFFILIATION (PLEASE SPECIFY)	DATE
1	University in Europe	4/1/2023 7:13 PM
2	Educational non-profit	3/31/2023 6:41 AM
3	HSI	3/30/2023 3:20 PM

Q11 Please describe any other aspect of your identity that you deem relevant.

Answered: 8   Skipped: 56

#	RESPONSES	DATE
1	Latinx.	4/16/2023 2:09 PM
2	Postdoctoral Researcher who studies topics relevant to CIME 2023	4/12/2023 11:05 AM
3	I am white. I think this is important because folks that are not in underrepresented communities need to do this important work.	4/5/2023 10:45 AM
4	I wished that I could participate in person. But I had to choose the virtual due to various reasons.	4/4/2023 5:19 PM
5	white female	4/4/2023 3:05 PM
6	White, cisgender male, works at a PWI, isolated postdoc, working on research in equity, mentors graduate and undergraduate students	3/31/2023 12:09 AM
7	I am also involved in math-adjacent fields.	3/30/2023 3:34 PM
8	involved in mentoring in S-STEM scholarship program, a mathematics Bridge program	3/30/2023 3:20 PM

Q12 Please describe two or three things that you learned from this year's CIME workshop

Answered: 55   Skipped: 9

#	RESPONSES	DATE
1	The most important thing that I learned is the importance of listening to students, and providing informal settings for conversations to take place. The second thing is more of an action item I need to work on --- I need to make sure my schedule has space for more informal conversations with the student I mentor, or might mentor.	4/28/2023 9:13 AM
2	1) Mentorship agreement 2) Think about different scenarios	4/16/2023 2:13 PM
3	- The key differences between a mentor and an advisor - Even in peer-to-peer interactions, mentorship can take place. - The anonymity of the online journal makes it an excellent tool and I'd like to implement it in a classroom setting at some point.	4/15/2023 12:03 PM
4	The range of issues on participants plates. The range of passion about these issues.	4/14/2023 10:14 AM
5	I became aware of culturally sensitive mentorship, which helps all students and teachers progress mathematically. I learned about various skills for implementing best mentoring practices and hence helping the mentee to thrive.	4/12/2023 12:08 PM
6	More formal means of thinking about mentoring. Experience talking about my education research to mathematicians.	4/12/2023 11:15 AM
7	The role of identity in mentoring and the difference/connections between "How I identify myself," "How you define me," "How I define you," and how you define yourself." - How can I know what is best for you if I don't know…. Mentoring agreements are a thing and they can be useful. The impact of mentoring on graduate school applications and application process	4/12/2023 10:44 AM
8	I learned about the first talk which is the best one	4/12/2023 10:41 AM
9	I gathered valuable resources about mentorship and the importance of a mentorship agreement.	4/12/2023 10:36 AM
10	1. Impacts of mentoring 2. NSF opportunities	4/12/2023 10:30 AM
11	- that how we define other people defines how other people see themselves (and how other people define us defines how we see ourselves) - that we should be intentional, both in who we can support and in who can support us	4/11/2023 12:59 PM
12	I learned how to make the mentoring contract agreement in order to be conscious of the expectations both on the side of the mentor and mentee; thereby standardizing the experience and having something to check progress. I also learned the difference between being an advisor and a mentor. The different sharing of "what would you do" scenarios gave me much insights on how to tackle difficult scenarios especially when it requires intervention to disrupt a problematic situation without compromising my chances as a tenure-track faculty	4/10/2023 2:56 PM
13	there is a long way to go, this will need to be an effort over decades not years, we need a team to support us	4/8/2023 10:09 AM
14	I need to understand a person's identity and experiences especially when they are very different from mine.	4/7/2023 2:02 PM
15	I learned that I am constantly learning new language and that I need to practice receiving criticism/feedback from a place of learning and curiosity.	4/5/2023 10:47 AM
16	Mentors control access to opportunities. Mentors should have compassion and high standards. When sharing personal stories "preach from healed trauma." Happenstance mentoring is a reflection of privilege. Need to think more about whether mentoring in mathematical practices is inherently enacting whiteness.	4/5/2023 7:25 AM
17	A mentor does not need to have the same identity as the mentee, but acknowledge that the	4/5/2023 1:39 AM

identities are different and important to each of them. A mentor needs to realize that they may not be able to help the mentee in all aspects and areas

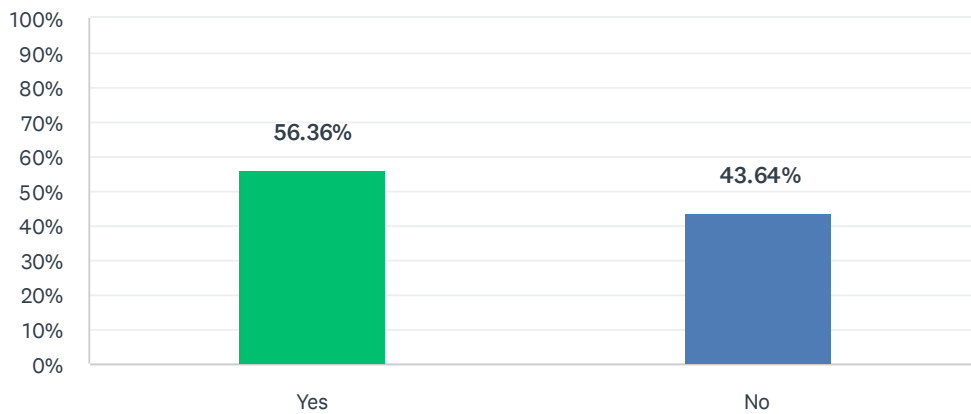| 18	How difficult it is for black students to finish a degree in mathematics	4/4/2023 10:48 PM
19	1. I learned that mentorship can take the form of just being a strong person one can look up to. 2. When mentoring a student I must make sure I know what it is the student wants. 3. Sometimes mentees just want a person to vent to not someone to solve their problems.	4/4/2023 8:08 PM
20	It's ok to have more than one mentor. In fact you should. Being a good mentor means listening to what your mentee needs. And as a mentee you need to be able to stand up for things at times.	4/4/2023 6:21 PM
21	I learned more from the students' perspectives and colleagues' perceptions.	4/4/2023 5:21 PM
22	Good mentorship takes continual practice. Moreover, there are lots of things that I can initiate as the mentee to help bolster an effective mentoring relationship for myself with my advisor.	4/4/2023 5:17 PM
23	1. Facilitating access to opportunities is important an important aspect of being a mentor. 2. Striking a balance in communication, emotional investment and professional investment is important. 3. A holistic approach is necessary for good mentorship.	4/4/2023 3:46 PM
24	Take care of myself in order to encourage others to take care of themselves. Check in on all aspects of a mentee's well-being.	4/4/2023 3:42 PM
25	Mentorship, at times, has barriers that reduce access transparency in professional mentoring and relational experiences that affect a person's dignity.	4/4/2023 3:35 PM
26	different aspects of mentoring	4/4/2023 3:27 PM
27	Importance of listening to hear and understand Aspects of mentorship Value of the collaborative structure of this workshop	4/4/2023 3:10 PM
28	Too common to focus on ourselves even when we are trying to aid others. Incidents in the classroom can be addressed right away as the organizers showed.	4/3/2023 1:03 PM
29	This was, hands down, the best CIME workshop I have attended. I learned about my own privileges and how to approach certain situations in mentoring, particular those involving minoritzed students.	4/3/2023 11:25 AM
30	As a graduate student, I can contribute to the mathematics community by finishing my degree. There are 8 dimensions of mentoring.	4/3/2023 8:13 AM
31	Should be willing to talk about finances with my mentees. More candid about this. Also acknowledging the white supremacy in academia without making students feel like they need to conform to it	3/31/2023 2:46 PM
32	How to support students more completely (in terms of the "dimensions" of mentoring presented, situations which can be difficult to navigate as a mentor, and balancing support and structure). Perspective faculty have of graduate students in terms of their abilities and responsibilities to be mentors.	3/31/2023 2:25 PM
33	The importance and effectiveness of mentoring What framework makes mentoring 'good'	3/31/2023 8:13 AM
34	- Tools about how to set up the mentoring relationship (contracts, initial meeting questions, etc.) - I found very helpful to hear/read the quotes of successful mentees of color. What they shared resonated with my own experience but having them collected in one place is helpful. - The importance of understanding my own goals and my mentees goals in looking for resources and supports.	3/31/2023 6:50 AM
35	Studying successful students and how to make the most out of the abilities.	3/31/2023 6:05 AM
36	-Importance of communicating/documenting mentoring expectations (e.g., mentoring plans) - Being a mentor doesn't mean mentoring everything (though, when our mentoring is at its best, it's multidimensional), BUT there is a responsibility to find other mentors for the mentee -There is a difference between my identity and how someone identifies me -Focus on the pain first	3/31/2023 12:25 AM
37	** Mentoring is not a program, but can happen through a program ** Benefits of co-mentoring ** "Calling out" looks different based on your identity	3/31/2023 12:00 AM
38	I was focused on who was and wasn't in the room and what this implies for the role of CIME	3/30/2023 8:49 PM

workshops. I was curious to see how a pedagogically considered conference designed by a close knit group of people compares with a conference designed by a committee of people who span diverse stakeholders relevant to an issue compare.

39	1. there are multiple ways to consider mentoring 2. feedback is a critical part of mentoring	3/30/2023 6:10 PM
40	mentoring contract, connections	3/30/2023 5:45 PM
41	I learned how important identity and power dynamics are in a mentoring relationship.	3/30/2023 5:12 PM
42	Find the pain first. The eight commonly-accepted dimensions of wellness.	3/30/2023 5:08 PM
43	When reflecting my experiences of graduate school and the advisors, I realized that not all advisors were my mentors. My mentor during my graduate school was who cared about me personally as well as academically.	3/30/2023 5:06 PM
44	I have a better understanding that mentoring is a valuable aspect to what I do. This is complicated, yet I am ready to learn more and be more supportive of my students.	3/30/2023 5:06 PM
45	(1) value of mentoring to student academic success (2) qualities of a good mentor (3) challenges in mentoring	3/30/2023 4:46 PM
46	Resources for mentors & menteed	3/30/2023 4:37 PM
47	Create structure in mentoring relationships and be aware of the power difference	3/30/2023 3:52 PM
48	I learned how to intervene when an unethical situation arises. I also learned about the importance and impact of mentors on mentees.	3/30/2023 3:49 PM
49	I learned that I do not have to solve ALL problems in my department I learned that mentoring is not necessarily a one-to-one activity or carried out in an activity or program. I learned about different characteristics of being a good mentos	3/30/2023 3:45 PM
50	- Problem solving vs. listening - Meaningful peripheral involvement (Abbe's talk) - Mentoring agreements	3/30/2023 3:43 PM
51	I wouldn't say I necessarily learned this, but I was reminded once again of how important it is for students to be heard and seen as their whole selves, and how I need to not assume that everyone's experience is like mine.	3/30/2023 3:42 PM
52	1. "Find the pain first." Before thinking of solutions, acknowledge the pain associated with what you've heard. 2. "Listen to understand, not to respond." Something to focus on to try not to get defensive over critical feedback. 3. I need to plan for mentoring meetings, not just wing it. There were many helpful resources shared during the conference, and I feel confident in my ability to do better in the future (though it will be a lifelong process). In particular, I need to open the door for students to share financial concerns relating to their position.	3/30/2023 3:40 PM
53	How to react to various scenarios; be brave about discussing issues related to inclusion, importance of mentoring of URMs	3/30/2023 3:37 PM
54	The discussion on how to hold own trauma and knowledge about hostile systemic structures - vs the promise of even "just" a PhD for a marginalized student - was extremely helpful!!! .. no easy answers ... but really helpful perspectives and principles.	3/30/2023 3:34 PM
55	How to interrupt situations in which someone may feel excluded, undervalued, or diminished. How important students find mentoring beyond traditional mathematical advising.	3/30/2023 3:23 PM

Q13 Did you identify an accountability partner?

Answered: 55   Skipped: 9

ANSWER CHOICES	RESPONSES	
Yes	56.36%	31
No	43.64%	24
TOTAL		55

#	COMMENTS	DATE
1	But I will now!	4/28/2023 9:13 AM
2	Same one I had before the workshop :)	4/12/2023 11:15 AM
3	Maybe? I didn't make a commitment, but someone else in my department was also attending virtually, and I was hoping I could be accountability partners with them.	4/11/2023 12:59 PM
4	Thanks for suggesting this!	3/30/2023 5:08 PM
5	I already have support within my own institution.	3/30/2023 3:40 PM
6	working on it though	3/30/2023 3:34 PM

Q14 As a result of your experiences in this workshop, how likely are you to change any relationships or practices with respect to your mentees, mentors, students, or colleagues?

Answered: 55   Skipped: 9
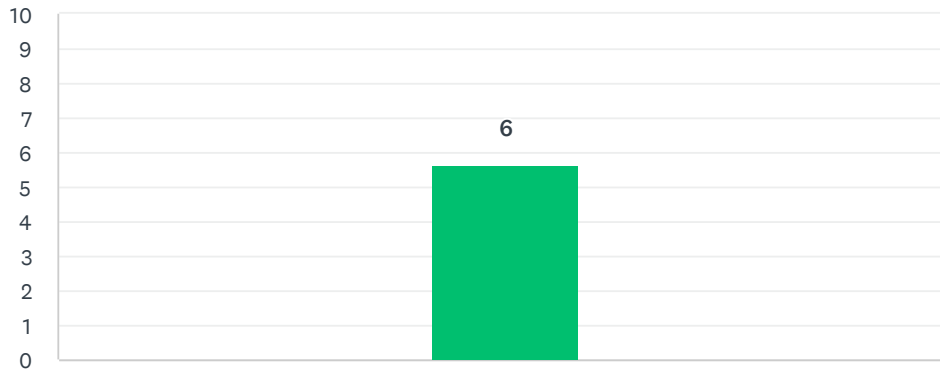
ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	6	309	55
Total Respondents: 55			

#		DATE
1	5	4/28/2023 9:13 AM
2	7	4/16/2023 2:13 PM
3	7	4/15/2023 12:03 PM
4	3	4/14/2023 10:14 AM
5	6	4/12/2023 12:08 PM
6	5	4/12/2023 11:15 AM
7	6	4/12/2023 10:44 AM
8	3	4/12/2023 10:41 AM
9	6	4/12/2023 10:36 AM
10	6	4/12/2023 10:30 AM
11	5	4/11/2023 12:59 PM
12	7	4/10/2023 2:56 PM
13	4	4/8/2023 10:09 AM
14	5	4/7/2023 2:02 PM
15	7	4/5/2023 10:47 AM
16	5	4/5/2023 7:25 AM
17	7	4/5/2023 1:39 AM
18	6	4/4/2023 10:48 PM

19	7	4/4/2023 8:08 PM
20	7	4/4/2023 6:21 PM
21	5	4/4/2023 5:21 PM
22	7	4/4/2023 5:17 PM
23	5	4/4/2023 3:46 PM
24	5	4/4/2023 3:42 PM
25	7	4/4/2023 3:35 PM
26	5	4/4/2023 3:27 PM
27	6	4/4/2023 3:10 PM
28	5	4/3/2023 1:03 PM
29	6	4/3/2023 11:25 AM
30	7	4/3/2023 8:13 AM
31	4	3/31/2023 2:46 PM
32	7	3/31/2023 2:25 PM
33	5	3/31/2023 8:13 AM
34	7	3/31/2023 6:50 AM
35	6	3/31/2023 6:05 AM
36	7	3/31/2023 12:25 AM
37	5	3/31/2023 12:00 AM
38	2	3/30/2023 8:49 PM
39	5	3/30/2023 6:10 PM
40	6	3/30/2023 5:45 PM
41	4	3/30/2023 5:12 PM
42	7	3/30/2023 5:08 PM
43	6	3/30/2023 5:06 PM
44	6	3/30/2023 5:06 PM
45	5	3/30/2023 4:46 PM
46	6	3/30/2023 4:37 PM
47	6	3/30/2023 3:52 PM
48	7	3/30/2023 3:49 PM
49	6	3/30/2023 3:45 PM
50	5	3/30/2023 3:43 PM
51	5	3/30/2023 3:42 PM
52	7	3/30/2023 3:40 PM
53	5	3/30/2023 3:37 PM
54	6	3/30/2023 3:34 PM
55	2	3/30/2023 3:23 PM

Q15 What did you like most about the workshop?

Answered: 55   Skipped: 9

#	RESPONSES	DATE
1	I'm so grateful that one of the speakers was a graduate student who could talk about her journey through undergrad to grad school, and the mentorship that helped get her there. This was by far the most valuable talk.	4/28/2023 9:13 AM
2	I like meeting people from different places and having interesting conversations about math education. I also enjoyed the flexibility of the facilitators, allowing us to keep conversations going when relevant.	4/16/2023 2:13 PM
3	The moderator did an excellent job. Also, the interaction with the notebook in real time was incredibly valuable.	4/15/2023 12:03 PM
4	The interactions with colleagues, the details involved in thinking about mentoring, and the back and forth about the issues in math education.	4/14/2023 10:14 AM
5	I totally enjoyed the diversity of topics - ranging form "Systemic Issues" to "What are You Going to do When You Get Back?".	4/12/2023 12:08 PM
6	Chance to see old friends and make new ones interested in improving mentoring	4/12/2023 11:15 AM
7	The format - all sessions are group sessions with mini breakouts where participants can share and discuss with others.	4/12/2023 10:44 AM
8	the discussions	4/12/2023 10:41 AM
9	I really appreciated when Lucy spoke about her experiences as a mentee and mentor. Additionally, it was clear that much thought had gone into making the online attendees feel as included as possible in the workshop.	4/12/2023 10:36 AM
10	The discussions.	4/12/2023 10:30 AM
11	I really liked that it was hybrid so I could participate online! I also really appreciated the time, thought, and effort by the organizers that went into creating the journal, and the opportunities for reflection it provided.	4/11/2023 12:59 PM
12	The ideas on how to make the mentoring contract and ways to improve one's mentoring by directing the mentee to resources that I may be unable to provide or people who might help better. Mentorship may be taxing when I feel I have to do everything to help the mentee succeed but ideas on how to out-source are very timely and helpful.	4/10/2023 2:56 PM
13	the last day was the best. the anonymous pallet posts were great	4/8/2023 10:09 AM
14	It was very interactive.	4/7/2023 2:02 PM
15	I liked the examples of mentorship agreements, and I liked the candid discussion that involved as many participants as possible.	4/5/2023 10:47 AM
16	Great speakers and presentations. Online journal was helpful. Good monitoring of zoom for online participants.	4/5/2023 7:25 AM
17	This topic is something so relevant and important. It helped me see mentor/mentee relationships in a practical way.	4/5/2023 1:39 AM
18	The topic	4/4/2023 10:48 PM
19	I liked all the great ideas people shared. I also liked the talk given by the graduate student Lucy.	4/4/2023 8:08 PM
20	The chance to talk about topics with everyone.	4/4/2023 6:21 PM
21	Both sides of the table are presenting.	4/4/2023 5:21 PM

22	I really liked the format of active participation. Putting our thoughts up on the Padlet was extremely helpful for opening up communication and for forcing us to think of the hard questions.	4/4/2023 5:17 PM
23	That I was able to meet various people at different stages in their careers and on different career paths who shared my passion and interest in equitable mentorship.	4/4/2023 3:46 PM
24	I really liked when we broke out into smaller groups.	4/4/2023 3:42 PM
25	Interaction and collaboration of the attendees. It was also nobbling to see the honoring of individual values while there was the continuum of active listening. The workshop was also a model exposure with lived experiences to understand the equability of mentorship.	4/4/2023 3:35 PM
26	Listening to everyone and their perspective	4/4/2023 3:27 PM
27	The organizational structure that facilitated a collaborative experience	4/4/2023 3:10 PM
28	Very well run -- the organizers demonstrated the values they professed.	4/3/2023 1:03 PM
29	Big group discussions interspersed with small group discussiions	4/3/2023 11:25 AM
30	The ability to have vulnerable and difficult conversations.	4/3/2023 8:13 AM
31	The people!	3/31/2023 2:46 PM
32	I enjoyed the case studies, specifically being able to think about the situations I will encounter in the future and preparing to react to those situations.	3/31/2023 2:25 PM
33	-The way it was organized: An interesting switch from presentation to tasks; very interesting choice of topics of the presenters -The openness of all participants -The generosity of the MSRI	3/31/2023 8:13 AM
34	I really like the journal and the set up where the participants could contribute and ask questions. One thing that I appreciated was the accountability from the organizers to challenge us to speak up when we feel a tension or feel uncomfortable. This is a challenge I accept and will work towards. Them modeling this was very helpful too in helping me grow in this way.	3/31/2023 6:50 AM
35	Improvement of teaching and analysis	3/31/2023 6:05 AM
36	Connecting with others. Relationships are important.	3/31/2023 12:25 AM
37	I thought the opportunity to engage even for virtual participants was excellent, and really appreciate the organizers thinking about how to include virtual participants.	3/31/2023 12:00 AM
38	Hearing from very different constituents, such as a department chair, a graduate student, someone striving to mentor, someone concerned with the ways in which mentoring gets in the way of advising.	3/30/2023 8:49 PM
39	I really liked the small working groups and the keynotes on the first and second day	3/30/2023 6:10 PM
40	topics	3/30/2023 5:45 PM
41	I enjoyed that there was ample time for participant input (but I would have been okay with a little less time dedicated to that).	3/30/2023 5:12 PM
42	The organizers, meeting like-minded mathematicians, the google doc journal	3/30/2023 5:08 PM
43	I was able to hear graduate students' voices a lot. This made me to re-think of my role of an advisor and a teacher.	3/30/2023 5:06 PM
44	Authentic conversations.	3/30/2023 5:06 PM
45	I found the talk by Lucy, the student from Rutgers quite insightful. One thing she said that has stuck with me is the idea of "listening to understand", something that I need to work on in my life.	3/30/2023 4:46 PM
46	Availability of resources to share with colleagues.	3/30/2023 4:37 PM
47	The opportunity to network and the openness of discussions	3/30/2023 3:52 PM
48	I loved the discussion activities and the journal.	3/30/2023 3:49 PM
49	The discussion of hypothetical scenarios as I felt identified with some of these situations	3/30/2023 3:45 PM

50	Genuine discussions	3/30/2023 3:43 PM
51	I liked getting to hear everyone's stories and experiences, mostly. I also liked the times when we got to post on the padlet because I was too shy to talk on Zoom, and I liked the activities where we had to think how we would respond to different situations. I actually also liked it when there was a little bit of conflict in the group, like when Pamela reminded us to think about how our words could be interpreted in a hurtful way. I actually was thinking exactly the same as her so I really appreciated her bravery. I felt that was a good demonstration of how to stand up for someone in a group situation and how to use the community standards effectively.	3/30/2023 3:42 PM
52	The format was excellent -- I learned *so much* from the discussions and the talks. The organizers did a fantastic job facilitating discussion.	3/30/2023 3:40 PM
53	The interactive style, giving everyone chance to speak	3/30/2023 3:37 PM
54	Taking space and time to translate theory into practical next steps.	3/30/2023 3:34 PM
55	The interactive and thoughtful nature of the discussions. It was a bit like a flipped classroom.	3/30/2023 3:23 PM

Q16 What did you like least about the workshop? How could it be improved?

Answered: 55   Skipped: 9

#	RESPONSES	DATE
1	I'm not sure. This was new to me, and I'm glad I could participate.	4/28/2023 9:13 AM
2	A few longer break would be have been nice for me. I still have to take care of other things while I'm at the conference and I couldn't find any other time to do so.	4/16/2023 2:13 PM
3	The breaks seemed a little short.	4/15/2023 12:03 PM
4	The need to register with PayPal to order lunch. I would prefer that there were food vendors that would take direct credit card payments or accept cash on site.	4/14/2023 10:14 AM
5	NA	4/12/2023 12:08 PM
6	The flight in to the Bay area. I need to move to somewhere with better plane access.	4/12/2023 11:15 AM
7	Sometimes a presenter's presentation would get off track due to audience discussion. The initial audience contributions/questions were great, but the convo would get off track or hijacked and I wanted to hear more about what the presenter(s) had to say.	4/12/2023 10:44 AM
8	the organization needs to be improved	4/12/2023 10:41 AM
9	There were times when the audience spoke without microphones, so I was unable to hear all of the interactions on Zoom. While the tossable mic and other mics were being passed around, there were moments when people needed to respond right away. I don't fault the presenters/workshop organizers because they were clearly trying to get mics to people. Improve? Maybe having more mics available or revoicing things that were said without mics when crucial to the conversation?	4/12/2023 10:36 AM
10	Not enough participant voices during the discussions.	4/12/2023 10:30 AM
11	I think I wish it was not so jam packed!	4/11/2023 12:59 PM
12	I wish accommodation was provided for us like last year's workshop; that really made networking easier.	4/10/2023 2:56 PM
13	I know for time you cannot read all of the pallet posts, but it might be nice to have a 5 minute break between posting and discussion where the organizers could read all of the posts and decide which to talk about	4/8/2023 10:09 AM
14	I can't think of anything to suggest for improvement.	4/7/2023 2:02 PM
15	I wished I could've had coffee with me in the room. Yes, this is not pivotal to the work of the CIME conference, but it did affect me in the sessions.	4/5/2023 10:47 AM
16	I was resisting so much reflection.	4/5/2023 7:25 AM
17	The timing - it was at a time when grades were due for the Winter quarter. Can look for a time when there is a longer break.	4/5/2023 1:39 AM
18	Discussions about racism	4/4/2023 10:48 PM
19	I could have done with out the professor from Texas who made the very tone deaf comments. But that cannot be helped.	4/4/2023 8:08 PM
20	N/A	4/4/2023 6:21 PM
21	I don't have any thing particular to say.	4/4/2023 5:21 PM
22	I didn't have any qualms with the structure of the workshop, though I did feel that a certain speaker did not want to be there or understand deeply some of the issues many members of	4/4/2023 5:17 PM

the audience were pointing out. Overall, though, I thought that even for participants who did not previously understand many of the oppressive structures in academia or the ways in which our language can unintentionally perpetuate those structures, the workshop posed ample opportunities for growth and understanding. I can't imagine that anyone who came to the workshop did not learn how to improve their being-as-mentor in the mathematics space.

23	It was glaringly obvious that the workshop was catered to faculty in large departments; a little more care for those who are not pursuing this career path will be greatly appreciated! Recognition for the mentorship experience that graduate students have as TAs or Instructors while fulfilling their graduate teaching duties will be appreciated.	4/4/2023 3:46 PM
24	I did not love that we mainly had large group discussions. I think that we would have more fruitful discussions if we had the opportunity to talk in small groups first.	4/4/2023 3:42 PM
25	N/A	4/4/2023 3:35 PM
26	none	4/4/2023 3:27 PM
27	I would love to be able to attend in person and possibly if I had been there in person I would have ideas of what could be improved. But I was impressed with how much I was able to get out of the workshop in the virtual environment and want to commend the organizers for how well this was done.	4/4/2023 3:10 PM
28	Group work was difficult in the auditorium.	4/3/2023 1:03 PM
29	None. It was planned and executed extremely well.	4/3/2023 11:25 AM
30	More smaller group conversations, then sharing with the entire collective.	4/3/2023 8:13 AM
31	Wish it was longer. Msri was also a bit of a trek to get to though the space was nice	3/31/2023 2:46 PM
32	It was unclear how the NSF presentation could be applied for my current situation; however, I understand that this was a faculty oriented workshop. Perhaps some guidance on how to write for some of these programs (like the GRFP), where the intellectual merit of abstract mathematics feels like it is overlooked by evaluators. I feel like that is generally applicable, especially since I would want my students to write for it in the future.	3/31/2023 2:25 PM
33	-	3/31/2023 8:13 AM
34	It was difficult for me to do the homework at night. I had other responsibilities and couldn't devote time for that. I don't think this affected my participation because I checked out the resources when the discussions about them were going on. I think some of the resources could be sent ahead of the conference for people that might be able to check them out ahead of time with more time instead than from one night to the next day.	3/31/2023 6:50 AM
35	Nothing is least	3/31/2023 6:05 AM
36	As someone with social anxiety, it was really hard to push through to meet people - perhaps there could be ways next time that are easier to join in on conversations or meet new people. Or maybe I just need mentoring on pushing through social anxieties.	3/31/2023 12:25 AM
37	Nothing comes to mind for me; I didn't identify an accountability partner, mostly because I didn't participate in small group activities, but that's on me. If I were in-person, or more engaged virtually, I would have done so.	3/31/2023 12:00 AM
38	It felt preachy at times. And I wish it had greater representation from groups in prominent advisory roles. (Instead the conference was dominated by graduate mentees and people mostly already invested in the ideas presented.	3/30/2023 8:49 PM
39	I didn't really enjoy the NSF keynote conversation since it felt like there were a lot of concerns, and maybe a conversation or fireside chat instead of a presentation would have been more helpful.	3/30/2023 6:10 PM
40	more collaborative work and connection building	3/30/2023 5:45 PM
41	I wanted to attend this workshop specifically because of who was organizing it. Unfortunately, only one of the four organizers gave a formal talk (although Aris moderated all of the workshop). I feeld have liked to have had plenary talks from the other organizers as well instead of just the bits they were able to contribute through the open-forum style time.	3/30/2023 5:12 PM
42	I would have liked if people said their names more often or if we started with introductions	3/30/2023 5:08 PM

43	There were a few people who spoke too much.	3/30/2023 5:06 PM
44	It appears the organizers were selective in enforcing their "rules" for collegiality. However, I was very bothered by a person shouting at another speaker for misspeaking a pronoun. I literally felt unsafe.	3/30/2023 5:06 PM
45	Giving my community college background I was hoping perhaps some of the sessions will explore this area of post-secondary education. I felt more emphasis was placed on 4-yr and grad school programs.	3/30/2023 4:46 PM
46	Moderators tried to include virtual participants but usually got wrapped up in the in person discussion. I feel like virtual chat was overlooked a lot.	3/30/2023 4:37 PM
47	Be longer	3/30/2023 3:52 PM
48	People were taking too much time to talk.	3/30/2023 3:49 PM
49	Probably more small group discussions and a summary of the ideas that were discussed after each section.	3/30/2023 3:45 PM
50	Being worried about saying the wrong thing. Some people's attitudes/tone were detrimental to freely sharing the challenges I face (though I appreciated the moderators' ability to address things that were said in a constructive manner). Discussions were often too faculty-centered.	3/30/2023 3:43 PM
51	Since I was attending in a different time zone, I got too sleepy towards the end of the days, but I don't think there's anything to be done about that. It was awesome that I could attend remotely for free, honestly I can't complain!!	3/30/2023 3:42 PM
52	That so few MSRI research members attended. I mean, come on... all they had to do was walk down the hall! It sent a very clear message that the topic of the conference is not important to the math research community outside of math education, which made me angry. I think MSRI could have done a better job communicating that the workshop was not just for people in math education. Anyone who mentors math students in any capacity should have been there. It was one of the most impactful conferences I've attended, and it will directly change how I work with my thesis students. I'm just so disappointed in my research community for not showing up.	3/30/2023 3:40 PM
53	It was well organized, welcoming, encouraging everyone to be involved. Please keep up with the good organization.	3/30/2023 3:37 PM
54	We had nowhere near enough time to get into the deep subtleties of these questions!	3/30/2023 3:34 PM
55	Like all students new to a flipped classroom, I found myself yearning for more "answers" and wanting to hear from someone who would tell me "three things to do next." I think that that was deliberate, but I think it might have been nice to have some more "direct instruction."	3/30/2023 3:23 PM

Q17 What else would you like to say about the workshop or how it might be improved (perhaps about the content, organization, venue, logistics, schedule, interactions with organizers or SLMath staff, etc.)?

Answered: 27   Skipped: 37

#	RESPONSES	DATE
1	Staff is outstanding; there is little need for change. The venue is delightful and always a pleasure. I could go for one more day to explore topics more deeply (perhaps make Wed a full day).	4/14/2023 10:14 AM
2	The travel reimbursement is not sufficient for anyone coming in from the East coast. I have grant funding so I am fine but that limits who can come.	4/12/2023 11:15 AM
3	Organization needs to be improved. The funding support is very low...	4/12/2023 10:41 AM
4	This is not on the organizers and was entirely on me, but I wasn't able to fully participate in some ways (aka do the homework) because I was attending remotely and still had to fulfil other professional obligations. If I'd known earlier that there would be some time needed to work through things outside of "workshop time" to truly get everything out of this workshop that was available to me, I might have tried to prioritize my time in the days before this workshop a little differently. However,	4/11/2023 12:59 PM
5	Thank you for the opportunity.	4/10/2023 2:56 PM
6	I really appreciate being able to attend remotely.	4/5/2023 7:25 AM
7	I really enjoyed the workshop. I met several people who are passionate about math and making the math world better.	4/4/2023 8:08 PM
8	None	4/4/2023 5:21 PM
9	NA	4/4/2023 3:35 PM
10	Thank you for organizing an amazing workshop.	4/4/2023 3:27 PM
11	Maybe the time of year so that it is not during a busy time at my university. (But I am sure that varies by person and institution, so not sure what is best.)	4/4/2023 3:10 PM
12	Thank you!	4/3/2023 1:03 PM
13	Seemed like there were conference participants that said insensitive things especially re: phrasing on race and talking about experiences that are their own. Unsure what to do But thinking about the balance between having a space that is safe and also a space that handles hard conversations and failure	3/31/2023 2:46 PM
14	This was a great experience for me. Thanks for putting it together and all the work that went into it.	3/31/2023 6:50 AM
15	I thank all SLMath co-ordinators, organizers and staff	3/31/2023 6:05 AM
16	At times, I wish there was a more explicit connection between equity and mentoring. This isn't to discount the content, but I think I am curious about the difference between "Mentoring for Equity" and "Mentoring Diverse Populations" (not that the latter isn't important!). The former just seemed more implicit - for example, we had conversations about whether we should support graduate students in an unjust system or to support them to change the system (and how we can do the latter ourselves) - to me, this definitely stuck out as Gutierrez's dominant/critical axes of equity. Long story short, I think that I would have benefitted from a framework that connects mentoring and theories of equity. I loved the workshop, learned so much, and am excited to connect it to my practice!	3/31/2023 12:25 AM
17	It needs better representation from mainstay communities doing the bulk of advising for doctoral students in both mathematics and mathematics education.	3/30/2023 8:49 PM

18	Thank you so much for your thoughtful planning and care about the program. I only wish I had heard the workshop was going to happen sooner so I could have applied for funding before the deadline. By not having funding I wasn't able to attend the conference in person the whole time.	3/30/2023 6:10 PM
19	A warning that one cannot walk though the Berkeley National Lab	3/30/2023 5:08 PM
20	Overall it was another great year of CIME workshop. I liked the physical copy of journal, but the order of the pages were not the same as the workshop order.	3/30/2023 5:06 PM
21	More support please. Secondly, let's move on from the topic of equity, etc...	3/30/2023 5:06 PM
22	Overall good workshop! Thank you for the opportunity!	3/30/2023 4:46 PM
23	Loved it	3/30/2023 3:52 PM
24	I liked the organization of the workshop. I plan to attend future CIME workshops. I suggest never scheduling junior people to give a talk on the first day. A more senior person should give the first talk to understand the audience.	3/30/2023 3:49 PM
25	Aside from the lack of representation among those *not* within math education, it was a fantastic and transformative experience. I've already updated our graduate student mentoring plan to incorporate what I've learned, and I've already talked to my chair about organizing a department-wide conversation on mentoring next semester.	3/30/2023 3:40 PM
26	Please keep the interactive style, engaging everyone involved.	3/30/2023 3:37 PM
27	I'd like to see a *lot* more time ... and some more attention to selecting participants ... or taking some of the less constructive participants off the mic.	3/30/2023 3:34 PM
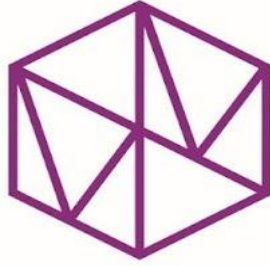
MSRI/SLMath 40th Anniversary Symposium

April 13, 2023 – April 14, 2023

Hybrid Event

Organizers:

Hélène Barcelo (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath))

Charles Fefferman (Princeton University)

Dan Freed (University of Texas, Austin)

Kristin Lauter (Facebook AI Research (FAIR) North America at Meta)

Dusa McDuff (Barnard College)

Andrei Okounkov (Columbia University; University of California, Berkeley)

Tatiana Toro (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath))

In 2022-23, the Mathematical Sciences Research Institute (MSRI) is becoming the Simons Laufer Mathematical Sciences Institute (SLMath).

REPORT ON THE MSRI WORKSHOP
"MSRI / SLMath 40th Anniversary Symposium"
April 13 – 14, 2023

Organizers

- Hélène Barcelo (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath))
- Charles Fefferman (Princeton University)
- Dan Freed (University of Texas, Austin)
- Kristin Lauter (Facebook AI Research (FAIR) North America at Meta)
- Dusa McDuff (Barnard College)
- Andrei Okounkov (Columbia University; University of California, Berkeley)
- Tatiana Toro (MSRI / Simons Laufer Mathematical Sciences Institute (SLMath))

Scientific Description

In 2022-23, SLMath (formerly MSRI) celebrates 40 years of serving the mathematical sciences community through our topic-focused programs and workshops, and the general public via our national and global outreach initiatives. Director Tatiana Toro and Deputy Director Hélène Barcelo invited the community to attend a symposium, where the speakers and the audience reflected upon these four decades of extraordinary activity. This celebration featured special guest speakers, panel discussions and an evening reception.

Highlights of the Workshop

The workshop started on Thursday April 13 in the morning with the highest registration numbers of any of our workshops thus far, over 500 people. The speakers included:

- Ian Agol: *40 Years of Knot Theory and 3-Manifolds*
- David Eisenbud: *Algebraists commuting in – and to --Berkeley*
- Wilfrid Gangbo: *Darboux Theorem and ellipticity*
- Alice Guionnet: *Large Random Matrices, Old and New*
- Dusa McDuff: *Thirty-Five Years of Symplectic Geometry at MSRI*
- Curt McMullen: *Low dimensional mathematics*
- Andrei Okounkov: *Examining Traces and Residues*
- Terry Tao: *Machine Assisted Proofs*

Most of the speakers focused on the development of their field over the part 40 years and how it tied to the history of the institute, through programs that had a decisive impact in the direction a given area of mathematics. They highlighted the developments both from the scientific and the human resources points of view. It was possible to follow the trajectory of several of the important figures in the field as they participated in programs as postdoctoral fellows first, then as research members and finally as research professors.

David Eisenbud focused on the people and how their participation in the institute programs shaped the field of Commutative Algebra as well as their professional paths. Wilfrid Gangbo made a very compelling statement about how MSRI and in particular the Deputy Director at the time and a faculty member in the mathematics department at UC Berkeley had saved his career. Alice Guionnet described the evolution of a field: Randon Matrices whose beginnings are tied to a program at MSRI/SLMath in1998-99. Dusa McDuff spoke about how during the 2010-2011 program a group undertook the job of providing ``*secure proofs*'' for some of the theorems that had become standard and how this had an incredible impact on the field. All the speakers took time to describe what they thought were the most interesting open questions in their fields, namely the mathematics of the decades to come.

Terry Tao's talk attracted a very large audience over 200 people in the auditorium and over 130 in zoom. The attendees included a large cohort of mathematics undergraduate students from UC Berkeley as well as graduate students, members of the Simons Institute for the Theory of Computing, and members of the community at large. His presentation included a historic overview of the role of computers in mathematics. He started with the role played by women (human computers) during the second world war. His point was that mathematics has been employing computers for many decades, that currently we face a fast-changing landscape and that is up to mathematicians to adapt. He described different ways he sees to interact with the computer, and with the large language models: a sound board for ideas, a source of conjectures, …ways we have yet to imagine.

See all recordings here: https://www.msri.org/workshops/1076

Brady Haran the producer of Numberphile (https://www.youtube.com/@numberphile) a YouTube channel sponsored by MSRI/SLMath did a half hour presentation about the channel and its impact as a way to bring high level mathematics, presented by high level mathematicians to a general audience. His talk was very successful.

Deputy Director Hélène Barcelo and Director Tatiana Toro took time to reminisce on the history of the institute and the people who have contributed to it through the years. They shared with the audience the mission statement:

- foster and communicate mathematical research in a broad range of fundamental topics and applications,
- develop mathematical talent and cultivate a sense of belonging and engagement, and
- inspire an appreciation of the power, beauty, and joy of mathematics.

They showcased how all the activities of the institute can be seen through this lens. Their presentation included videos of each one of the founders: Shiing-Shen Chern, Calvin Moore and Isadore Singer, and their views on the institute at its beginnings.

The event concluded by honoring all those who have made MSRI/SLMath a unique place where we encourage curiosity, we welcome new communities, and we provide collaborative spaces where mathematics can bloom, where all can thrive.

Organizers

First Name	Last Name	Institution
Hélène	Barcelo	MSRI / Simons Laufer Mathematical Sciences Institute (SLMath)
Charles	Fefferman	Princeton University
Dan	Freed	University of Texas, Austin
Kristin	Lauter	Facebook AI Research (FAIR) North America at Meta
Dusa	McDuff	Barnard College
Andrei	Okounkov	Columbia University
Tatiana	Toro	MSRI / Simons Laufer Mathematical Sciences Institute (SLMath)

Speakers

First Name	Last Name	Institution
Ian	Agol	University of California, Berkeley
David	Eisenbud	University of California, Berkeley
Wilfrid	Gangbo	University of California, Los Angeles
Alice	Guionnet	École Normale Supérieure de Lyon
Brady	Haran	Numberphile
Dusa	McDuff	Barnard College
Curtis	McMullen	Harvard University
Andrei	Okounkov	Columbia University
Terence	Tao	University of California, Los Angeles

MSRI/SLMath 40th Anniversary Symposium

April 13, 2023 - April 14, 2023

Thursday, April 13, 2023			
9:00 AM - 9:10 AM	Eisenbud Auditorium		Welcome
9:10 AM - 10:10 AM	Eisenbud Auditorium	Dua McDuff	Thirty Five Years of Symplectic Geometry at MSRI
10:10 AM - 10:30 AM	Atrium		Break
10:30 AM - 11:30 AM	Eisenbud Auditorium	David Eisenbud	Algebraists Commuting in — and to — Berkeley
11:30 AM - 12:00 PM	Eisenbud Auditorium	Brady Haran	Numberphile
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Eisenbud Auditorium	Ian Agol	40 Years of Knot Theory and 3-Manifolds
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Eisenbud Auditorium	Terence Tao	Machine Assisted Proofs
4:30 PM - 6:30 PM	Front Courtyard		Reception

Friday, April 14, 2023			
9:00 AM - 10:00 AM	Eisenbud Auditorium	Alice Guionnet	Large Random Matrices, Old and New
10:00 AM - 10:30 AM	Atrium		Break
10:30 AM - 11:30 AM	Eisenbud Auditorium	Wilfrid Gangbo	Darboux Theorem and Ellipticity
11:30 AM - 12:00 PM	Eisenbud Auditorium		Slideshow
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Eisenbud Auditorium	Curtis McMullen	Low-Dimensional Mathematics
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Eisenbud Auditorium	Andrei Okounkov	Examining Traces and Residues
4:30 PM - 5:30 PM	Eisenbud Auditorium		Thank You Ceremony

Identifiable Participants' Information

Participants		210

Gender		210
Male	68.57%	144
Female	26.67%	56
Other	0.00%	0
Declined to state	4.76%	10

Ethnicity*		235
White	46.81%	110
Asian	24.68%	58
Hispanic	9.79%	23
Pacific Islander	0.43%	1
Black	2.13%	5
Native American	1.28%	3
Mixed	4.26%	10
Declined to state	10.64%	25

* ethnicity specifications are not exclusive

There were 49 unidentifiable participants.

SIMONS LAUFER
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SCIENCES INSTITUTE

Topical Workshop: Degeneracy of Algebraic Points

April 24, 2023 – April 28, 2023

Hybrid Workshop

Organizers:

Jennifer Balakrishnan (Boston University),

Mirela Ciperiani (University of Texas, Austin)

Philipp Habegger (University of Basel)

Wei Ho (Institute for Advanced Study)

Hector Pasten (Pontificia Universidad Católica de Chile)

Yunqing Tang (University of California, Berkeley)

Shou-Wu Zhang (Princeton University)

REPORT ON THE MSRI WORKSHOP
"Degeneracy of Algebraic Points (Hybrid Workshop)"
April 23 – April 28, 2023

Organizers

- Jennifer Balakrishnan (Boston University),
- Mirela Ciperiani (University of Texas, Austin),
- Philipp Habegger (University of Basel),
- Wei Ho (Institute for Advanced Study),
- Hector Pasten (Pontificia Universidad Católica de Chile)
- Yunqing Tang (University of California, Berkeley)
- Shou-Wu Zhang (Princeton University)

Scientific Description

This workshop featured research lectures about exciting developments in Diophantine geometry. More precisely, the progress on Lang-Vojta conjectures, such as the Subspace Theorem, p-adic approaches to finiteness, and modular methods, as well as the spectacular progress that has been achieved on unlikely intersection conjectures thanks to new methods and tools, such as height formulas for special points, connections to model theory, refined counting results, and new theorems of Ax-Shanuel type (bi-algebraic geometry).The workshop concluded with an expository lecture focusing on the work of Edixhoven and Szpiro.

Highlights of the Workshop

At a scientific level, the attendants mentioned (in the exit survey) the following lectures as highlights:

- Zhang's overview of the diphantine geometry of the 20-th century focusing on the work of Edixhoven and Szpiro.
- Lawrence's talk where given a curve X of genus at least 2 over a number field K, he discussed an algorithmic approach to determining the set X(K), conditional on the Hodge, Tate, and Fontaine--Mazur conjectures.
- Gao's talk on degeneracy loci in families of abelian varieties and their applications in the recent developments on the uniformity of the number of rational points on curves
- Zannier's talk on integral points on curves including some new examples of such points on genus 2 curves.

- Masser's talk on some new elliptic integrals which are new counterexamples to the expectation by James Davenport that if an algebraic function $f(x,t)$ is not integrable (with respect to x) by elementary means when t is an independent variable, then there are most finitely many complex numbers τ such that $f(x,\tau)$ is integrable by elementary means.
- Dimitrov's talk on work which further refines the unbounded denominators conjecture to take the form of a converse theorem for GL(2, A_Q) without any twists by Dirichlet characters. The thrust of such theorems is to replace Weil's character twists by a bounded denominators condition on the Dirichlet series coefficients.
- Shankar's talk on a p-adic analogue of Borel's theorem for compact Shimura varieties S of abelian type; more precisely, over a p-adic field every map from the punctured unit disc to S extends to a map from the unit disc to S, and any rigid analytic map from the analytification of a variety to the analytification of S must come from an algebraic morphism.
- Levent's talk where he described a finite-time algorithm that, on input (g,K,S) with g > 0, K a totally real number field of odd degree, and S a finite set of places of K, outputs the finitely many g-dimensional abelian varieties A/K which are of GL_2-type over K and have good reduction outside S. This gives effective height bounds for rational points on infinitely many curves and (for each curve) over infinitely many number fields.

Organizers

First Name	Last Name	Institution
Jennifer	Balakrishnan	Boston University
Mirela	Ciperiani	University of Texas, Austin
Philipp	Habegger	University of Basel
Wei	Ho	Institute for Advanced Study
Hector	Pasten	Pontificia Universidad Católica de Chile
Yunqing	Tang	University of California, Berkeley
Shou-Wu	Zhang	Princeton University

Speakers

First Name	Last Name	Institution
Levent	Alpöge	Harvard University
Irene	Bouw	Ulm University
Vesselin	Dimitrov	Institute for Advanced Study
Helene	Esnault	Freie Universitat Berlin
Ziyang	Gao	Leibniz Universität Hannover
Mark	Kisin	Harvard University
Brian	Lawrence	University of Wisconsin-Madison
David	Masser	Universität Basel
Niki Myrto	Mavraki	Harvard University
Alina	Ostafe	University of New South Wales
Congling	Qiu	Yale University
Harry	Schmidt	Universität Basel
Ananth	Shankar	University of Wisconsin-Madison
Salim	Tayou	Harvard University
Paul	Vojta	University of California, Berkeley
Xinyi	Yuan	Peking University
Umberto	Zannier	Scuola Normale Superiore
Shou-Wu	Zhang	Princeton University

Topical Workshop: Degeneracy Of Algebraic Points

April 24, 2023 - April 28, 2023

Monday, April 24, 2023			
9:15 AM - 9:30 AM	Eisenbud Auditorium		Welcome
9:30 AM - 10:30 AM	Eisenbud Auditorium	Umberto Zannier	On Effectivity in Some Diophantine Problems
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Eisenbud Auditorium	Alina Ostafe	Integer Matrices with a Given Characteristic Polynomial and Multiplicative Dependence of Matrices
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Eisenbud Auditorium	Harry Schmidt	Effective Counting and Families of Abelian Varieties
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Eisenbud Auditorium	Levent Alpöge	Modularity and Effective Mordell

Tuesday, April 25, 2023			
9:30 AM - 10:30 AM	Livestreamed in Eisenbud Auditorium	Xinyi Yuan	Bigness of the Admissible Canonical Bundle
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Eisenbud Auditorium	Niki Myrto Mavraki	Preperiodic Points in Families of Rational Maps
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Eisenbud Auditorium	Salim Tayou	Reduction of Brauer Classes on K3 Surfaces
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Eisenbud Auditorium	Irene Bouw	Computing the Weil Representation of a Superelliptic Curve
4:30 PM - 6:20 PM	Front Courtyard		Reception

Wednesday, April 26, 2023			
9:30 AM - 10:30 AM	Eisenbud Auditorium	Mark Kisin	Heights in the Isogeny Class of an Abelian Variety
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Eisenbud Auditorium	Hélène Esnault	Crystallinity Properties of Complex Rigid Local Systems (Joint work in progress with Michael Groechenig)
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
3:00 PM - 3:30 PM	Atrium		Afternoon Tea

Thursday, April 27, 2023			
9:30 AM - 10:30 AM	Eisenbud Auditorium	Ziyang Gao	Degeneracy Loci in Families of Abelian Varieties and their Applications
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Eisenbud Auditorium	Vesselin Dimitrov	A Twisting-Free Converse Theorem for GL(2)
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Eisenbud Auditorium	David Masser	Some New Elliptic Integrals
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Eisenbud Auditorium	Ananth Shankar	A P-Adic Analogue of Borel's Theorem

Friday, April 28, 2023			
9:30 AM - 10:30 AM	Eisenbud Auditorium	Brian Lawrence	Conditional Algorithmic Mordell
10:30 AM - 11:00 AM	Atrium		Break
11:00 AM - 12:00 PM	Eisenbud Auditorium	Congling Qiu	Joint Unlikely Almost Intersections on Ordinary Siegel Spaces
12:00 PM - 2:00 PM	Outdoor Decks		Lunch
2:00 PM - 3:00 PM	Eisenbud Auditorium	Paul Vojta	Roth's Theorem Over Adelic Curves
3:00 PM - 3:30 PM	Atrium		Afternoon Tea
3:30 PM - 4:30 PM	Eisenbud Auditorium	Shou-Wu Zhang	Diophantine Geometry: All Our Yesterdays

Identifiable Participants' Information

Participants		104

Gender		104
Male	73.08%	76
Female	24.04%	25
Other	0.00%	0
Declined to state	2.88%	3

Ethnicity*		113
White	33.63%	38
Asian	43.36%	49
Hispanic	4.42%	5
Pacific Islander	0.88%	1
Black	2.65%	3
Native American	0.00%	0
Mixed	3.54%	4
Declined to state	11.50%	13

* ethnicity specifications are not exclusive

There were 4 unidentifiable participants.

Q1 I primarily participated in the workshop:

Answered: 56   Skipped: 0
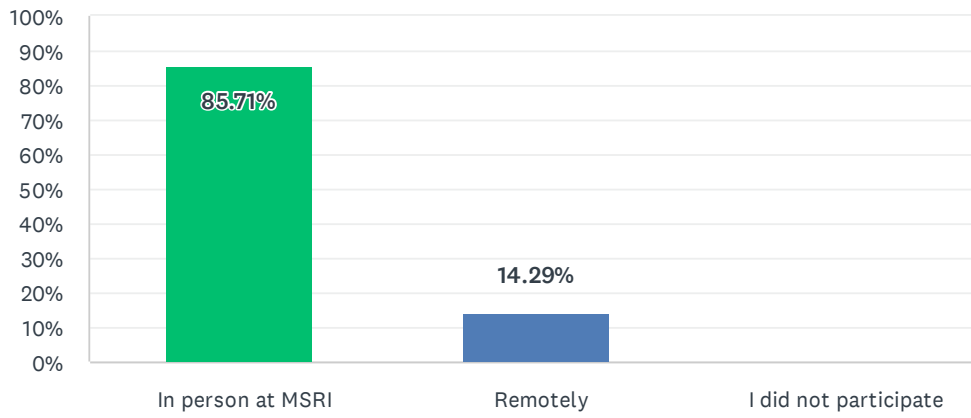
ANSWER CHOICES	RESPONSES	
In person at MSRI	85.71%	48
Remotely	14.29%	8
I did not participate	0.00%	0
TOTAL		56

Q2 The workshop was intellectually stimulating

Answered: 45   Skipped: 11
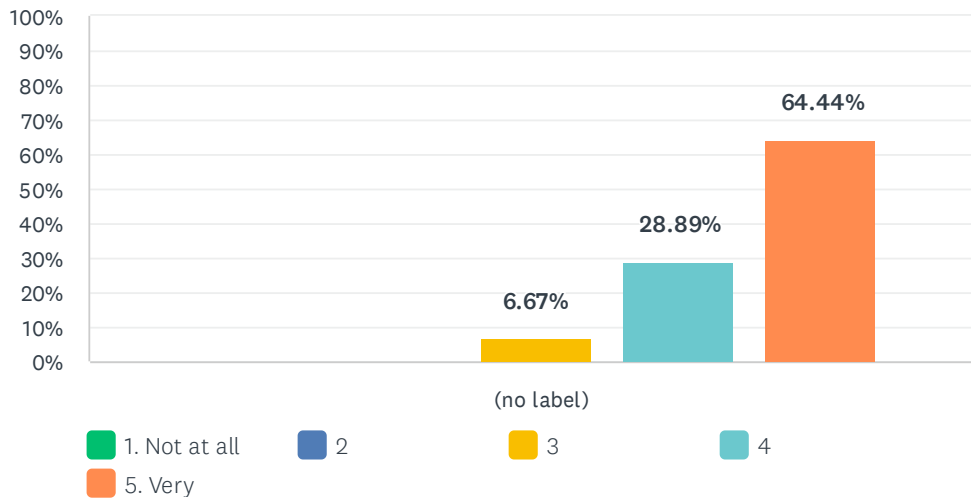
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.67% 3	28.89% 13	64.44% 29	45	4.58

Q3 The overall experience of the workshop was worthwhile

Answered: 45   Skipped: 11
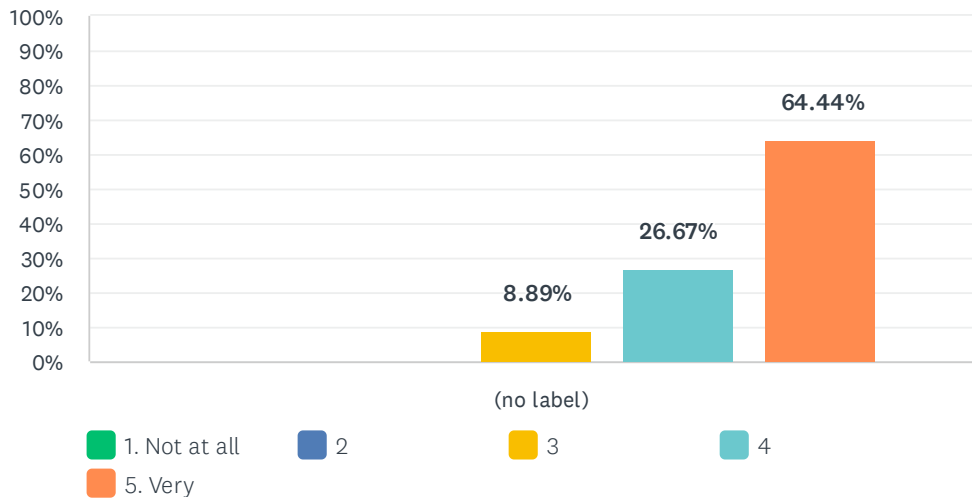
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.89% 4	26.67% 12	64.44% 29	45	4.56

Q4 The lectures were at an appropriate level

Answered: 45   Skipped: 11
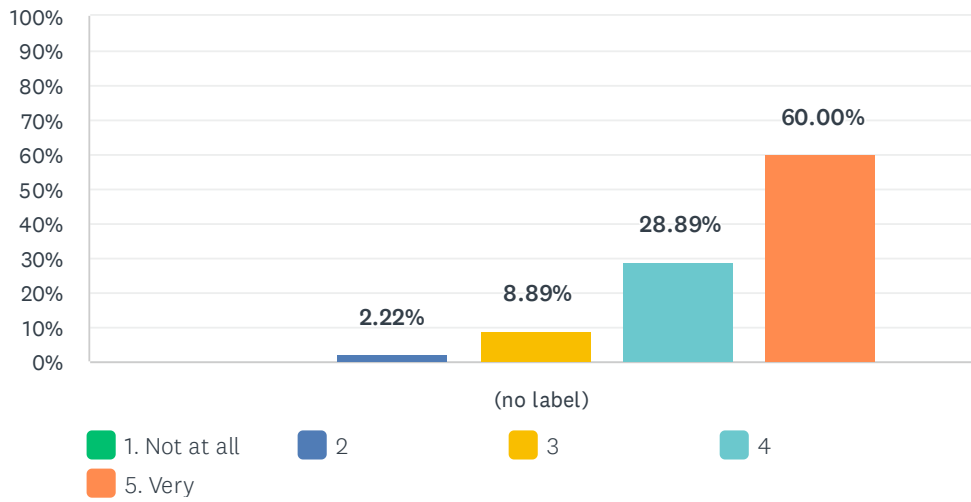
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.22% 1	8.89% 4	28.89% 13	60.00% 27	45	4.47

Q5 I was well prepared to benefit from the lectures

Answered: 45   Skipped: 11

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	2.22% 1	15.56% 7	24.44% 11	55.56% 25	45	4.29

Q6 My interest in the subject matter was increased by the workshop

Answered: 45   Skipped: 11

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.22% 1	20.00% 9	24.44% 11	53.33% 24	45	4.29

Q7 The workshop helped me meet people with similar scientific interests

Answered: 45   Skipped: 11

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	0.00% 0	11.11% 5	22.22% 10	64.44% 29	45	4.47

Q8 What were the highlights of the lectures?

Answered: 45   Skipped: 11

#	RESPONSES	DATE
1	I liked talks that stated the theorems concretely.	5/12/2023 12:15 PM
2	diversity of topics	5/10/2023 2:51 PM
3	All!	5/10/2023 1:20 PM
4	Interesting mathematics.	5/10/2023 12:47 PM
5	When the lecturer prepared an accessible talk.	5/10/2023 12:04 PM
6	I benefitted a lot from Ziyang Gao's lecture.	5/10/2023 11:16 AM
7	There were many great talks, some quite well-given. For instance the talk of Gao was both interesting and very well-delivered.	5/10/2023 9:55 AM
8	Gao, Lawrence, Shankar, Ostafe, Zannier's talks.	5/10/2023 9:32 AM
9	My favorite talk was the one by Gao	5/10/2023 8:54 AM
10	great	5/10/2023 8:47 AM
11	Everything was great.	5/10/2023 8:39 AM
12	Brian Lawrence's talk on Mordell Masser's talk on (the other kind of) integrality Zhang's overview of the 20th century	5/2/2023 9:06 PM
13	Ziyang Gao's lecture	5/2/2023 10:02 AM
14	(For me) Overview and slow paced lectures.	5/2/2023 9:23 AM
15	Personally, Both V Dimitrov and Masser's talks are surprising (results).	5/1/2023 10:21 AM
16	The workshop enabled me to get an overview of the newest developments in the field.	4/30/2023 1:33 PM
17	There were several very good talks by e.g., Zhang and Gao	4/30/2023 1:14 PM
18	.	4/29/2023 9:54 PM
19	I liked Shou-Wu Zhang's final talk	4/29/2023 4:13 PM
20	The lectures varied in style, some were more survey style, while others concentrated on very recent advances, and the methods behind them.	4/29/2023 3:47 PM
21	present the past, present, and future work in Dieophantine geometry	4/29/2023 1:40 PM
22	Ziyang Gao's lecture	4/29/2023 12:14 PM
23	Enjoyed the lectures	4/29/2023 8:53 AM
24	N/A	4/29/2023 7:33 AM
25	Some lectures were very well prepared, others less.	4/29/2023 7:11 AM
26	The talks of Ziyang Gao and of David Masser	4/29/2023 12:40 AM
27	The lectures cover the most advanced topics	4/28/2023 10:59 PM
28	Gao's lecture on degenerate subvarieties was terrific.	4/28/2023 9:48 PM
29	Too many to mention.	4/28/2023 9:29 PM
30	Ananth Shakar's lecture	4/28/2023 8:34 PM
31	I loved Zannier and Masser's talks	4/28/2023 6:48 PM

32	food	4/28/2023 6:04 PM
33	Shou-wu's historical note lecture.	4/28/2023 6:02 PM
34	The last lecture by Shouwu Zhang.	4/28/2023 5:47 PM
35	most of them	4/28/2023 5:40 PM
36	Many	4/28/2023 5:19 PM
37	many good lectures	4/28/2023 5:06 PM
38	Gao's lecture was beautifully crafted and executed. Shankar's lecture, even though slightly outside of my field of interest, was very interesting and educational.	4/28/2023 4:57 PM
39	Some of the talks offered a good historical perspective and extensive background, and that was very useful for those of us not so close to that topic.	4/28/2023 4:56 PM
40	The conference was unusually successful at combining different subject areas.	4/28/2023 4:56 PM
41	Ananth Shankar's on p-adic hyperbolicity was beautiful	4/28/2023 4:55 PM
42	New results	4/28/2023 4:54 PM
43	All very stimulating	4/28/2023 4:51 PM
44	The talks by Levent and Brian.	4/28/2023 4:47 PM
45	many of them	4/28/2023 4:46 PM

Q9 Additional comments

Answered: 5   Skipped: 51

#	RESPONSES	DATE
1	The workshop was a bit outside my area, and it was perhaps not as exciting as the introductory workshop on Diophantine geometry, but still very good.	5/10/2023 9:55 AM
2	I am from a different field. So the a couple of low ratings are due to me not familiar with the subject.	5/2/2023 9:23 AM
3	Thanks for organising Tracy and Sierra! Sierra has a remarkable memory for names.	4/28/2023 4:57 PM
4	I would have liked to have been able to access a list of participants of the workshop before it started. I also would have preferred not to have to change my flights, hotel, and childcare arrangments by a week at short notice because of the schedule conflict, but I can see that the alternative would have been inconvenient for other people.	4/28/2023 4:56 PM
5	Some lectures were too technical	4/28/2023 4:54 PM

Q10 I found the SLMath staff helpful

Answered: 45   Skipped: 11

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	4.44% 2	95.56% 43	0.00% 0	45	4.96

Q11 The SLMath facilities were conducive for such a workshop

Answered: 45   Skipped: 11
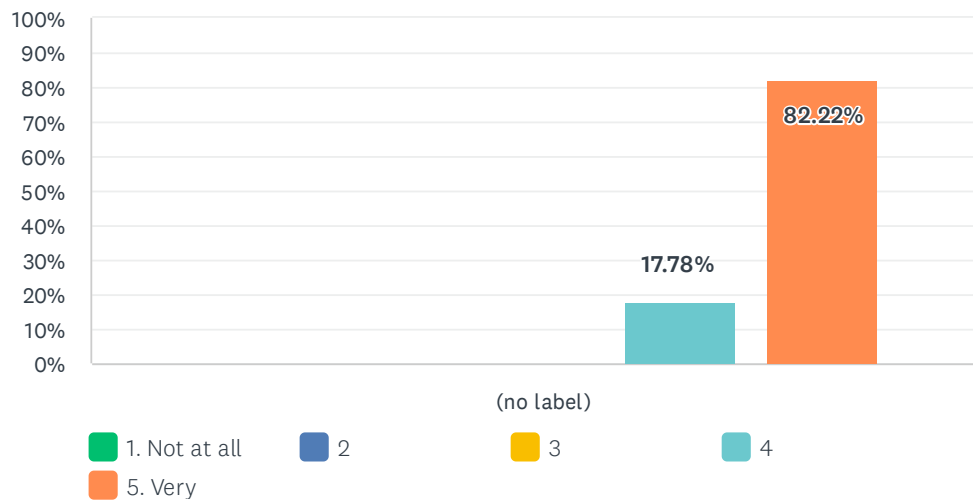
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	17.78% 8	82.22% 37	45	4.82

Q12 Did you use SLMath's wireless network?

Answered: 45   Skipped: 11
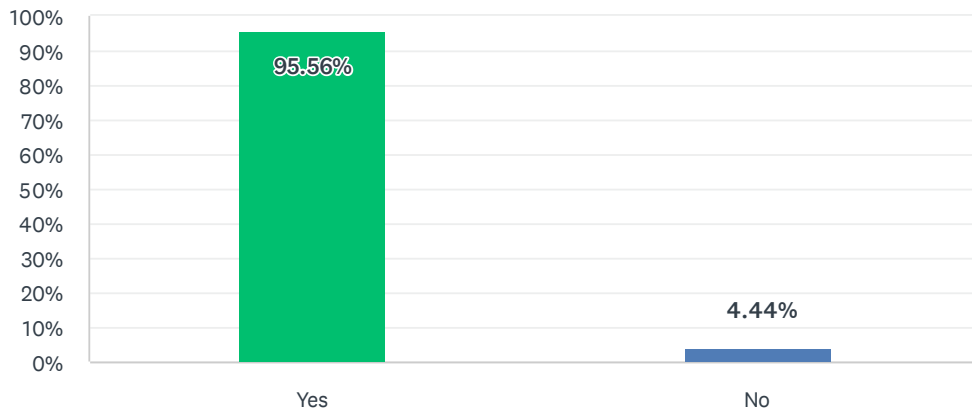
ANSWER CHOICES	RESPONSES	
Yes	95.56%	43
No	4.44%	2
TOTAL		45

Q13 Did you experience any difficulties with the network?

Answered: 45   Skipped: 11
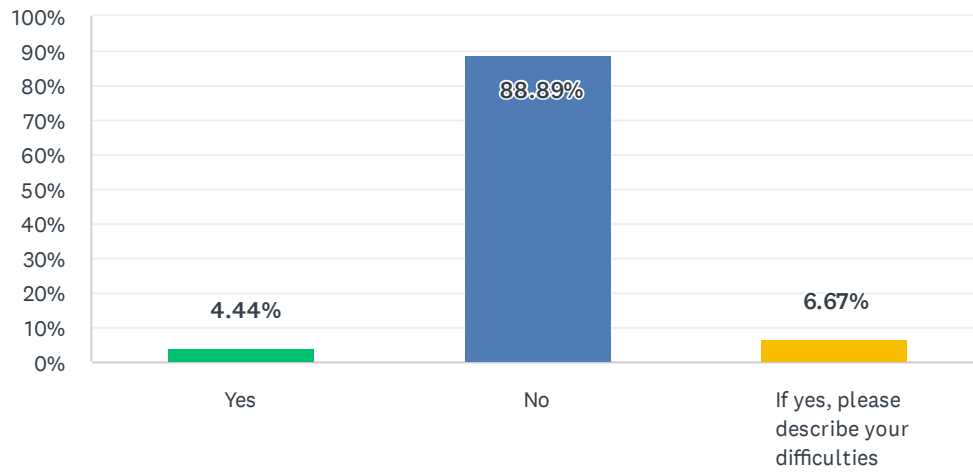
ANSWER CHOICES	RESPONSES	
Yes	4.44%	2
No	88.89%	40
If yes, please describe your difficulties	6.67%	3
TOTAL		45

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	It is just a little annoying that it doesn't connect to the MSRI_members wifi automatically. Not a big deal.	4/30/2023 1:14 PM
2	Eduroam doesn't seem to work (but the SLMath one does)	4/29/2023 8:54 AM
3	all fine, not eduroam however	4/28/2023 5:40 PM

Q14 The SLMath lunch arrangements were satisfactory

Answered: 45   Skipped: 11

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	0.00% 0	15.56% 7	26.67% 12	26.67% 12	28.89% 13	45	4.06

Q15 The SLMath tea arrangements were satisfactory

Answered: 45   Skipped: 11
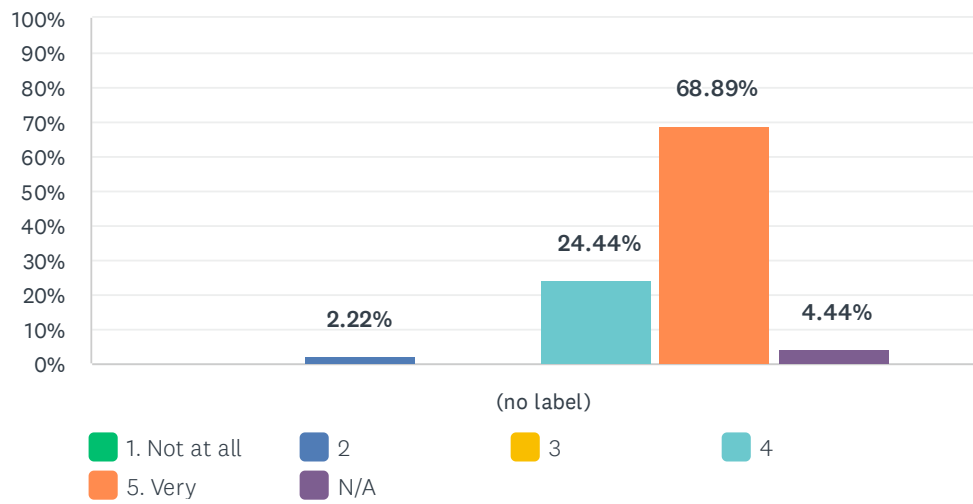
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.22% 1	0.00% 0	24.44% 11	68.89% 31	4.44% 2	45	4.67

Q16 Additional comments about the SLMath staff, facilities and food

Answered: 9   Skipped: 47

#	RESPONSES	DATE
1	I wish that tea were outside... the weather was beautiful and warm, it felt like a shame.	5/10/2023 12:05 PM
2	Lunch could be more varied, e.g., alternate every two weeks. Tea is good but could also vary more. Coffee is always plentiful. Would have been nice to have it outside that week as it was so nice.	5/10/2023 9:56 AM
3	Everyone was extremely helpful and friendly.	5/10/2023 8:40 AM
4	Excellent overall	5/2/2023 9:24 AM
5	Maybe a happy hour can be organised after the last talk.	4/29/2023 3:48 PM
6	The bagels in the morning are great!	4/29/2023 12:41 AM
7	The quality of food is really low	4/28/2023 11:00 PM
8	Sierra and Tracy were both very helpful.	4/28/2023 9:48 PM
9	It would be great if one could pay for the lunch on side by card.	4/28/2023 4:58 PM

Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 5   Skipped: 51

#	RESPONSES	DATE
1	It was frustrating that Levent Alpöge and Brian Lawrence only attended the conference for their own talks. Many participants, including myself, had several questions for both of them, and they disappeared at the first opportunity. Lawrence in particular has not been present for almost all of the program. I know several folks who received no funding, or partial funding, and it is somewhat frustrating to see a lack of participation from some funded participants (especially given the vigilance about funded postdocs staying in town). Secondly: the moderators at the talks could improve two things. (1) Please limit the Q&A after a talk to 5 minutes. Some of the Q&A went on for 10-15 minutes. (2) At several points the moderators did not do a sufficient job of "moderating" questions during the talks. I think it is important that participants can ask questions during the talk, but at numerous points audience members would not "back off" after receiving a valid answer to their question. The expectation should be that, maybe an audience member needs to think about an answer or about the mathematics for a bit, and not hold the speaker hostage to whatever thing they are confused about.	4/30/2023 1:19 PM
2	Maybe an open problem session can be also included within such a workshop.	4/29/2023 3:50 PM
3	all staff members are wonderful	4/28/2023 5:41 PM
4	Thanks again.	4/28/2023 4:58 PM
5	The speakers should be encouraged to deliver talks so that most of the audience can understand at least a significant part of the exposition	4/28/2023 4:55 PM

Q18 I found the SLMath staff helpful

Answered: 6   Skipped: 50
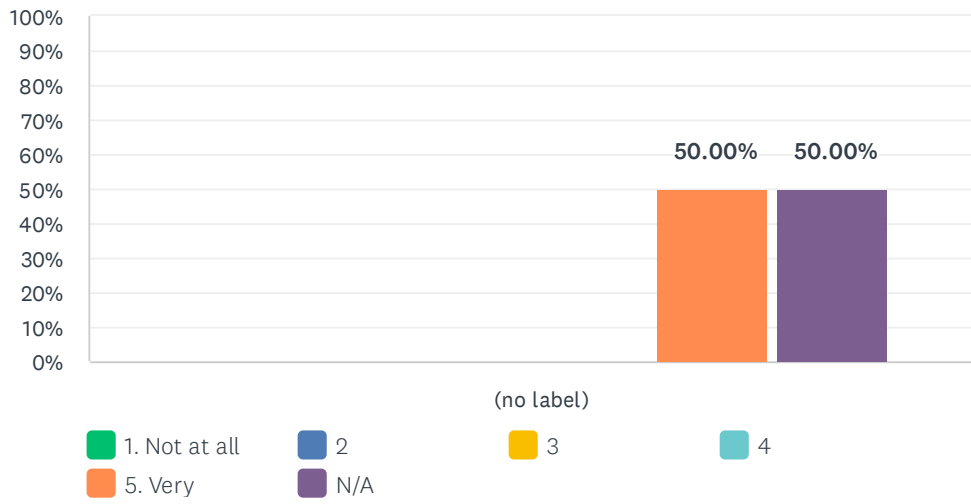
Legend: 1. Not at all, 2, 3, 4, 5. Very, N/A

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	50.00% 3	50.00% 3	6	5.00

Q19 How many talks did you watch live?

Answered: 6   Skipped: 50
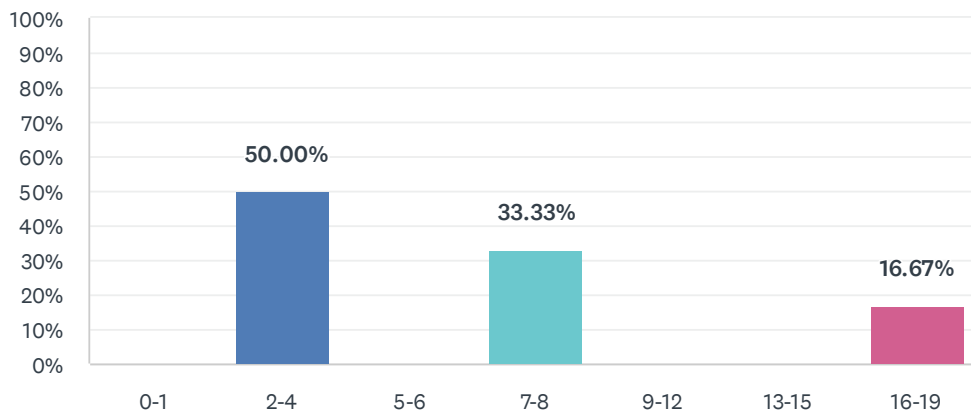
ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	50.00%	3
5-6	0.00%	0
7-8	33.33%	2
9-12	0.00%	0
13-15	0.00%	0
16-19	16.67%	1
TOTAL		6

Q20 The workshop was intellectually stimulating

Answered: 6   Skipped: 50

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	33.33% 2	0.00% 0	50.00% 3	16.67% 1	6	3.50

Q21 The overall experience of the workshop was worthwhile

Answered: 6   Skipped: 50

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	16.67% 1	16.67% 1	33.33% 2	33.33% 2	6	3.83

Q22 The lectures were at an appropriate level

Answered: 6   Skipped: 50

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	100.00% 6	0.00% 0	6	4.00

Q23 I was well prepared to benefit from the lectures

Answered: 6   Skipped: 50

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	33.33% 2	50.00% 3	16.67% 1	6	3.83

Q24 My interest in the subject matter was increased by the workshop

Answered: 6   Skipped: 50
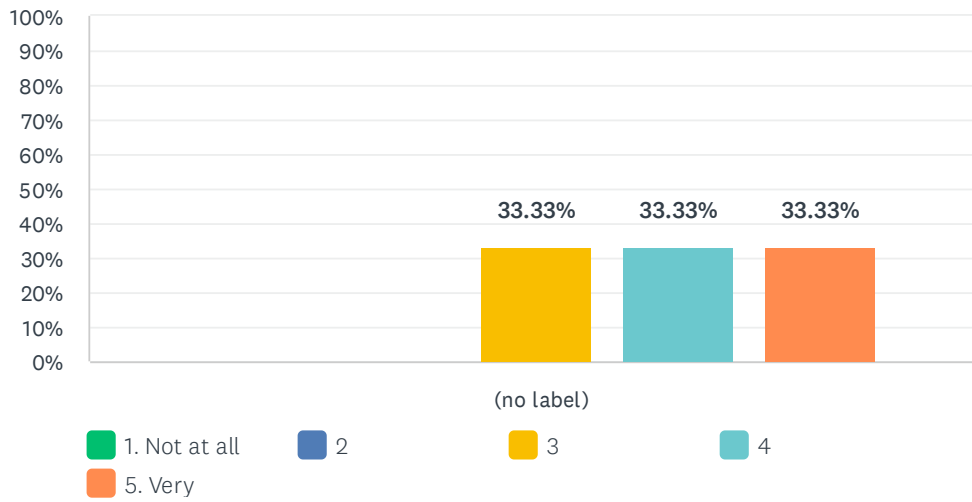
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	33.33% 2	33.33% 2	33.33% 2	6	4.00

Q25 The workshop helped me meet people with similar scientific interests

Answered: 6   Skipped: 50

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	16.67% 1	16.67% 1	33.33% 2	33.33% 2	0.00% 0	6	2.83

Q26 What were the highlights of the lectures?

Answered: 6   Skipped: 50

#	RESPONSES	DATE
1	The explicit bounds in arithmetic problems.	5/10/2023 1:43 PM
2	Degeneracy Loci in Families of Abelian Varieties and their Applications	5/1/2023 8:02 AM
3	Overall the lectures are god for following different ideas which are used in this area of research.	4/28/2023 11:32 PM
4	The topics were great.	4/28/2023 9:51 PM
5	Due to visa problem, I was not able to attend the events in person. So my answer is not typical.	4/28/2023 8:45 PM
6	prefer not to answer	4/28/2023 4:52 PM

Q27 Additional comments

Answered: 2   Skipped: 54

#	RESPONSES	DATE
1	If people like me could participate physically, I think it is much better to meet people in this area of research and try to connect to the experts in this area. If such kinds of seminars and programs could be run in developing countries I think it has great impact on the mathematics level of these countries. I propose that Simon center or other centers which has good amount of budget to give special budget for developing countries to run such programs. Thank you very much again for running such a good program physically and remotely,	4/28/2023 11:32 PM
2	It was a bit difficult to write down notes from the blackboard when the camera switched quickly to follow the speaker.	4/28/2023 9:51 PM

Q28 Did you experience any technical difficulties accessing the workshop online?

Answered: 6   Skipped: 50
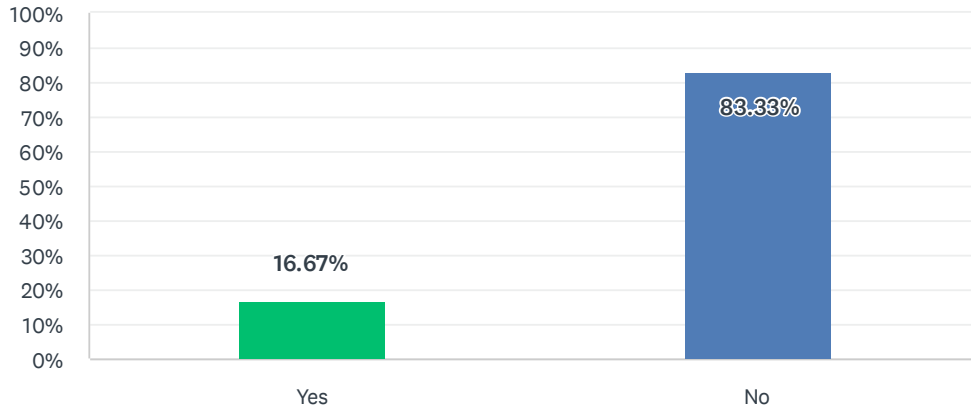
ANSWER CHOICES	RESPONSES	
Yes	16.67%	1
No	83.33%	5
TOTAL		6

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	sometimes I have some difficulties to connect the link and some times it takes couple of minutes to connect	4/28/2023 11:44 PM

Q29 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 6   Skipped: 50

#	RESPONSES	DATE
1	Online workshop saves time resources while also providing opportunities to see the new trends in the subject.	5/10/2023 1:44 PM
2	Time zone difference was the main barrier	5/1/2023 8:02 AM
3	we have 11 hours difference in our time zone and therefore I missed some of the lectures because they are in the late nights. I am interested to follow the seminars and lectures on zoom but the speed of internet is very important factor to connect on time and follow the lectures well. all in all this is a good experience for me.	4/28/2023 11:44 PM
4	Time zone difference affected my ability to focus on the live lectures, due to a 12.5 hr difference.	4/28/2023 9:53 PM
5	Yes, time difference is a hug barrier to me, unfortunately.	4/28/2023 8:45 PM
6	Time zone was an issue	4/28/2023 4:54 PM

Q30 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 3   Skipped: 53

#	RESPONSES	DATE
1	the interaction between participant is very good but one of the weak points to participate remotely is that one can not interact with other people in this way. If the people who participate physically specially the speakers could take more time for the people who participate remotely it will be better	4/28/2023 11:44 PM
2	An optional virtual happy hr would be nice. Maybe in gather.town	4/28/2023 9:53 PM
3	This problem is very relevant but difficult to solve. I don't have suggestions.	4/28/2023 4:54 PM

Q31 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 0   Skipped: 56

#	RESPONSES	DATE
	There are no responses.	
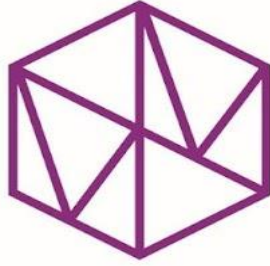
May 12, A Celebration for Women in Mathematics (2023)

May 12, 2023

Hybrid Workshop

Organizers:

Aleksander Doan (Trinity College; University College London)

Ini Adinya (University of Ibadan)

Masha Albrecht (Berkeley High School)

Romina Arroyo (Universidad Nacional de Cordoba)

Maria-Grazia Ascenzi (University of California Los Angeles)

Mirela Ciperiani (University of Texas, Austin)

Donatella Danielli (Arizona State University)

Shanna Dobson (University of California, Riverside)

Malena Espanol (Arizona State University)

Olubunmi Fadipe-Joseph (University of Ilorin)

Anna Fino (Università di Torino)

Natalia Garcia-Fritz (Pontificia Universidad Católica de Chile)

Adi Glucksam (Northwestern University)

M.E. Hogan (Texas Tech University)

Kuei-Nuan Lin (Pennsylvania State University)

In 2022-23, the Mathematical Sciences Research Institute (MSRI) is becoming the Simons Laufer Mathematical Sciences Institute (SLMath).

Zheng Liu (University of California, Santa Barbara)

Liangbing Luo (Lehigh University)

Ornella Mattei (San Francisco State University)

Julia Plavnik (Indiana University)

Palina Salanevich (Universiteit Utrecht)

Ramdorai Sujatha (University of British Columbia)

In 2022-23, the Mathematical Sciences Research Institute (MSRI) is becoming the Simons Laufer Mathematical Sciences Institute (SLMath).

May 12, a Celebration for Women in Mathematics (2023)

The May 12 event was organized by an international committee of 20 mathematicians identifying as female, to celebrate all women in Mathematics. The event was hybrid with satellite locations at four American institutions (MSRI//SLMath included) and one in Nigeria.

Following a format already proposed for the 2022 event, the 2023 celebration of women in Math started with the presentation of the four panelists: each mathematician introduced themselves and their work in the allotted 15 minutes time. First, each speaker discussed their own journey into Mathematics to then talk about their specific area of expertise. Ilka Agricola (University of Marburg) spoke about academic research, Kristin Lauter (META) about mathematics in industry, Salome Martinez (Universidad de Chile) about math teaching, and finally Jeanette Shakalli (Fundapromat) about math outreach. The speaker presentation was followed by an hour-long panel discussion in which the audience, both online and in person at the satellite locations, asked the panelists questions that were moderated by one of the committee members. After a break, the event resumed with a random social tea in which online participants were grouped randomly into breakout rooms with the goal to network and meet mathematicians from all over the world. The next part of the event occurred in person only at the satellite location and the online component, therefore, saw a smaller number of participants. Four breakout rooms were created where the committee members, in pairs of two, moderated the free discussion among the participants.

The feedback from the committee members and the participants was positive. Specifically, the introduction of a chat moderator and the free discussion, rather than a structured discussion, in breakout rooms were very well received. Widely approved was also the choice of the invited speakers, given their diversity in background and career path. Finally, a group of students from a local high school (Berkeley High School) join the activities at MSRI//SLMath, paving the way to the possibility to include high-schoolers in the 2024 May 20 event.

Constructive comments to improve the format for the 2024 edition included the suggestion to coordinate better with the panelists to have more technical presentations. The random social tea part of the event will also need to be restructured to ensure a constructive conversation among participants while creating a natural transition to the discussion either in the virtual breakout rooms or at the satellite locations. Finally, new ideas for the next edition were suggested by the current committee members. Some included the introduction of community rules to be read at the beginning of the event, to ensure a respectful debate in the breakout rooms. Satellite locations will be more independent with more freedom in the choice of topics to be discussed to better accommodate the needs of the local communities. Another interesting idea would be to organize the breakout rooms to have one panelist per room so that participants can have direct conversation with them. Finally, better ways to exchange contact info among the participants need to be found.

Organizers

First Name	Last Name	Institution
Ini	Adinya	University of Ibadan
Masha	Albrecht	Berkeley High School
Romina	Arroyo	Universidad Nacional de Cordoba
Maria-Grazia	Ascenzi	University of California Los Angeles
Mirela	Ciperiani	University of Texas, Austin
Donatella	Danielli	Arizona State University
Shanna	Dobson	University of California, Riverside
Malena	Espanol	Arizona State University
Olubunmi	Fadipe-Joseph	University of Ilorin
Anna	Fino	Università di Torino
Natalia	Garcia-Fritz	Pontificia Universidad Católica de Chile
Adi	Glucksam	Northwestern University
M.E.	Hogan	Texas Tech University
Kuei-Nuan	Lin	Pennsylvania State University
Zheng	Liu	University of California, Santa Barbara
Liangbing	Luo	Lehigh University
Ornella	Mattei	San Francisco State University
Julia	Plavnik	Indiana University
Palina	Salanevich	Universiteit Utrecht
Ramdorai	Sujatha	University of British Columbia

Speakers

First Name	Last Name	Institution
Ilka	Agricola	Philipps-Universität Marburg
Kristin	Lauter	Facebook AI Research (FAIR) North America at Meta
Salomé	Martínez	Universidad de Chile
Jeanette	Shakalli	Fundapromat

May 12, A Celebration For Women In Mathematics

May 12, 2023

Friday, May 12, 2023			
8:00 AM - 9:00 AM	Eisenbud Auditorium	Ilka Agricola, Kristin Lauter, Salomé Martínez & Jeanette Shakalli	Speaker Presentations
9:00 AM - 10:15 AM	Eisenbud Auditorium	Ilka Agricola, Kristin Lauter, Salomé Martínez & Jeanette Shakalli	Panel Discussion
10:30 AM - 10:45 AM	Eisenbud Auditorium		Break
10:45 AM - 11:15 AM	Eisenbud Auditorium		Social Tea
11:15 AM - 12:30 PM	Eisenbud Auditorium		Breakout Room Discussions

Identifiable Participants' Information

Participants		91

Gender		91
Male	18.68%	17
Female	75.82%	69
Other	1.10%	1
Declined to state	4.40%	4

Ethnicity*		97
White	41.24%	40
Asian	21.65%	21
Hispanic	7.22%	7
Pacific Islander	0.00%	0
Black	11.34%	11
Native American	0.00%	0
Mixed	3.09%	3
Declined to state	15.46%	15

* ethnicity specifications are not exclusive

There were 16 unidentifiable participants.

Integral Equations and Applications

June 06, 2022 – June 17, 2022

MSRI, Berkeley CA, USA

Organizers:

Fioralba Cakoni (Rutgers University)

Dorina Mitrea (Baylor University)

Irina Mitrea (Temple University)

Shari Moskow (Drexel University)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Integral Equations and Applications"
June 6 – 17, 2022

Organizers

- Fioralba Cakoni (Rutgers University)
- Dorina Mitrea (Baylor University)
- Irina Mitrea (Temple University)
- Shari Moskow (Drexel University)

Description

The field of Integral Equations has a long and distinguished history, being the driving force behind many fundamental developments in various areas of mathematics including Harmonic Analysis, Partial Differential Equations, Potential Theory, Scattering Theory, Functional Analysis, Complex Analysis, Operator Theory, Mathematical Physics and Numerical Analysis.

This school introduced graduate students to the systematic study of integral equations; Presented some of the latest theoretical advancements in the field and open problems; and Involved participants in a hands-on discovery lab focused on deriving results about integral operators in two dimensions relevant for both the theoretical and numerical treatment of Integral Equations in two dimensions.

Highlights of the School

The first week of the MSRI summer school on Integral Equations and Applications Summer School was focused on Integral Methods for Elliptic Boundary Value Problems in Irregular Domains. Many boundary value problems in mathematical physics can be phrased as boundary value problems for elliptic differential operators in non-smooth domains. The overall scope of the course was twofold:

1. to present an up-to-date, rigorous, and to a large extent self-contained, treatment of some of the most basic partial differential equations of mathematical physics in Lipschitz domains, via the modern tools of Harmonic Analysis. A common approach to handle such problems is by reducing them to a system of integral equations involving singular integral operators of single and double layer type.

2. to introduce students to present day research developments in the area and to emphasize key developments and tools from the tremendous recent advances made in employing the classical method of layer potentials in the treatment of the boundary value problems associated with the aforementioned PDEs.

- The first part, taught by Irina Mitrea, was focused on a thorough introduction of the classical theory. Topics covered included: Lipschitz domains in the graph case and the bounded case; surface measure and outward unit normal vector; non-tangential approach regions; non-tangential maximal functions; function spaces on Lipschitz boundaries; principal value and weakly singular integral operators on Lipschitz boundaries; general set up of the Dirichlet and Neumann boundary value problems for the Laplacian; Calder\'on-Zygmund operators; double layers (definition, properties, connections with the Dirichlet problem for the Laplacian); single layers (definition, properties, connections with the Neumann problem for the Laplacian); semi-Fredholm and Fredholm operators; index; Fredholm theory.

- The second part, taught by Dorina Mitrea, focused on second order constant coefficient homogeneous weakly elliptic operators. These operators have a nicely behaved fundamental solution and their null-solutions satisfy interior estimates, regularity, reverse-Holder, and unique continuation properties. With the ultimate goal of solving the L^p-Dirichlet and Regularity problems, for $p\in(1,\infty)$, three methods were reviewed: the harmonic measure method (which applies only in the case of scalar operators), the method based on Poisson kernels (which is applicable to systems for which a Poisson kernel in the sense of Agmon-Douglis-Nirenberg exists and when the domain is a half-space), and the method of boundary layer potentials. The latter method is very resourceful and works in uniformly rectifiable domains for which the outward unit normal has a sufficiently small BMO-norm and for weakly elliptic systems that possess distinguished coefficient tensors. An essential tool in carrying out this program is a sharp Divergence Theorem, recently proved by D. Mitrea, I. Mitrea, and M. Mitrea. A detailed analysis of its statement (including sharpness via counterexamples) was provided and numerous applications were given. Another key tool discussed was a Poisson Integral Representation formula for null-solutions of weakly elliptic systems in the presence of a suitable Green function for the transposed operator.

All the discussion sessions in the first week were led by Jeongsu Kyeong (TA) who focused on hands on explorations of particular aspects of the theory presented in lectures. Concretely he guided the participants in the study of Mellin transform techniques for singular integral operators in two dimensions, Relllich type identities (statement and proof of the standard version), Rellich with λ, spectral theory for K^*, applications to the invertibility of $\pm\frac 12I+K$ and $\pm\frac 12I+K^*$.

The second week of the MSRI summer school was focused on boundary and volume integral equations for elliptic PDEs with applications to inverse problems. There were two modules:

- **Module 1: Inverse scattering problems for impenetrable obstacles taught by Fioralba Cakoni.** The corresponding direct scattering problem was formulated as a boundary integral equation of Fredholm type. A solution approach based on boundary integral operators is very suitable to such problems since they are formulated in unbounded domains. Students were introduced to variational methods for proving mapping properties

of boundary integral operators in Sobolev spaces for the case of Lipschitz boundaries; an alternative approach to the one discussed during the first week. Then, the inverse problem of determining the geometry of the scatterer from far field data was discussed. Although the underlying PDE is linear, the inverse problem is nonlinear. In addition to proving unique determination for sufficiently large data set, we introduced a reconstruction approach known as the factorization method. At the core of this class of inversion methods, and more generally when solving inverse problems, one deals with inverting compact operators. This leads to severe instabilities due to the unboundedness of the inverse. To remedy this, students were introduced to regularization theory for compact operators.

- **Module 2: Inverse scattering problems for inhomogeneous media taught by Shari Moskow.** The direct scattering problem for inhomogeneous media is a transmission problem with nonconstant coefficients. Here the problem in the unbounded domain is most naturally reformulated as a volume integral equation, known as the Lipmann-Schwinger equation. Students were introduced to this volume integral equation and equivalence of the two formulations was proven. The Lipmann-Schwinger equation uses only the fundamental solution for the background and is hence easier to analyze. Furthermore, this formulation is suitable to solving the inverse problem of determining the unknown coefficient from far field or boundary data, and naturally leads important frequencies such as scattering poles and transmission eigenvalues. Uniqueness of the solution to the inverse problem was proven and various reconstruction methods, both iterative and non-iterative, were introduced.

Three discussion sessions on computational aspects of direct and inverse problem related to both modules, were taught by Isaac Harris. Students were introduced to numerical methods for solving integral equations, numerical regularization schemes and implementation of inversion algorithms.

Four discussion sessions in the form of exercises were taught by Heejin Lee (TA). Having accumulated sufficient theoretical background, in the last two of these exercise sessions students were given 3-4 problems to solve. They enjoyed this format very much.

Poster sessions: Each Monday afternoon, we have hosted a poster session for graduate student participants. There were around 30 presenters at these sessions and students kept discussing mathematics in the MSRI lobby into the late evening, way after the officially scheduled time was over. The poster sessions were successful in allowing students to learn of the research interests and accomplishments of the other summer school attendees.

During lectures, discussion sessions and the breaks, we had many stimulating discussions with students. We appreciated that the students showed great interest in the topic even though many were working on subjects tangentially related or unrelated. Students' participation during program was truly inspiring.

Next steps: To build on the momentum created by the summer school:

- Irina Mitrea and Shari Moskow, in collaboration with Nsoki Mavinga, have organized an invited paper session at MathFest for junior mathematicians (graduate students and postdoctoral fellows) working in Integral Equations and Applications. Three participants in the MSRI summer school have given talks in this session.

- Irina Mitrea and Shari Moskow are organizing a special session on Integral Equations at the Joint Mathematics Meetings in 2023 where 7 speakers in the session have participated in the MSRI event.

Organizers/Speakers		
First Name	**Last Name**	**Institution**
Fioralba	Cakoni	Rutgers University
Dorina	Mitrea	Baylor University
Irina	Mitrea	Temple University
Shari	Moskow	Drexel University
Teaching Assistants		
First Name	**Last Name**	**Institution**
Isaac	Harris	Purdue University
Jeongsu	Kyeong	Temple University
Heejin	Lee	Rutgers University

Mathematical Sciences Research Institute

Integral Equations and Applications

June 06, 2022 - June 17, 2022

Monday, June 06, 2022			
8:40 AM - 8:55 AM	Simons Auditorium		Introduction to MSRI
9:00 AM - 10:15 AM	Simons Auditorium	Irina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Irina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Jeongsu Kyeong	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Atrium		Poster Session I

Tuesday, June 07, 2022			
9:00 AM - 10:15 AM	Simons Auditorium	Irina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Irina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Jeongsu Kyeong	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Simons Auditorium	Jeongsu Kyeong	Discussion II

Wednesday, June 08, 2022			
8:45 AM - 10:00 AM	Simons Auditorium	Irina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:00 AM - 10:15 AM			Break
10:15 AM - 11:30 AM	Simons Auditorium	Dorina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
11:30 AM - 2:30 PM	Tilden Park		BBQ Lunch
2:30 PM - 5:00 PM			Free Afternoon

Thursday, June 09, 2022			
9:00 AM - 10:15 AM	Simons Auditorium	Dorina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Dorina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Jeongsu Kyeong	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Simons Auditorium	Jeongsu Kyeong	Discussion II

Friday, June 10, 2022			
9:00 AM - 10:15 AM	Simons Auditorium	Dorina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Dorina Mitrea	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Jeongsu Kyeong	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Simons Auditorium	Jeongsu Kyeong	Discussion II

Monday, June 13, 2022

9:00 AM - 10:15 AM	Simons Auditorium	Fioralba Cakoni	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Shari Moskow	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Heejin Lee	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Simons Auditorium		Poster Session II

Tuesday, June 14, 2022

9:00 AM - 10:15 AM	Simons Auditorium	Fioralba Cakoni	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Shari Moskow	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Heejin Lee	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Atrium	Isaac Harris	Discussion II (Computational Session)

Wednesday, June 15, 2022

8:45 AM - 10:00 AM	Simons Auditorium	Shari Moskow	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:00 AM - 10:30 AM			Break
10:30 AM - 11:45 AM	Simons Auditorium	Shari Moskow	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 AM - 1:30 PM			Lunch
1:30 PM - 5:00 PM			Free Afternoon

Thursday, June 16, 2022

9:00 AM - 10:15 AM	Simons Auditorium	Fioralba Cakoni	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Shari Moskow	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Heejin Lee	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Simons Auditorium	Isaac Harris	Discussion II (Computational Session)

Friday, June 17, 2022

9:00 AM - 10:15 AM	Simons Auditorium	Fioralba Cakoni	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
10:15 AM - 10:45 AM			Break
10:45 AM - 12:00 PM	Simons Auditorium	Shari Moskow	Integral Methods for Elliptic Boundary Value Problems in Irregular Domains - Lecture
12:00 PM - 2:00 PM			Lunch
2:00 PM - 3:15 PM	Simons Auditorium	Fioralba Cakoni	Discussion I
3:15 PM - 3:45 PM			Tea
3:45 PM - 5:00 PM	Simons Auditorium	Isaac Harris	Discussion II (Computational Session)

Officially Registered Student Information

Students		41

Gender		41
Male	75.61%	31
Female	21.95%	9
Other	2.44%	1
Declined to state	0.00%	0

Ethnicity*		45
White	53.33%	24
Asian	24.44%	11
Hispanic	11.11%	5
Pacific Islander	0.00%	0
Black	2.22%	1
Native American	0.00%	0
Mixed	4.44%	2
Declined to state	4.44%	2

* ethnicity specifications are not exclusive

Q1 The various topics within the summer school integrated into a coherent picture

Answered: 35   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	8.57% 3	40.00% 14	45.71% 16	35	4.26

Q2 The faculty speakers were generally clear and well organized in their presentation

Answered: 35   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.86% 1	20.00% 7	34.29% 12	42.86% 15	35	4.17

Q3 The Teaching Assistants were helpful

Answered: 35   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.57% 3	40.00% 14	51.43% 18	35	4.43

#	PLEASE PROVIDE SOME COMMENTS ON THE TAS.	DATE
1	Extremely knowledgeable, patient and clear communicators	6/23/2022 4:09 PM
2	Jeongsu was MARVELOUS	6/22/2022 3:48 PM
3	Jeong-Su was very well organized, but Heejin was less-so. It was clear what the goal of each of Jeong-Su's lectures was, and he spent time to solve the exercises we were given. This was not the case with Heejin, who gave exercises with no solutions. She was also often rushing to finish the lectures she gave.	6/20/2022 5:32 PM
4	The TAs were willing to help, explained the topics very clearly and provided great insights into the topics. I really appreciated their work.	6/20/2022 3:09 PM
5	Could be more focused on concrete examples.	6/17/2022 8:10 PM
6	All three TAs were very helpful. In addition, I liked problem sets provided by Heejin Lee.	6/17/2022 4:32 PM

Q4 The school was intellectually stimulating

Answered: 35   Skipped: 0
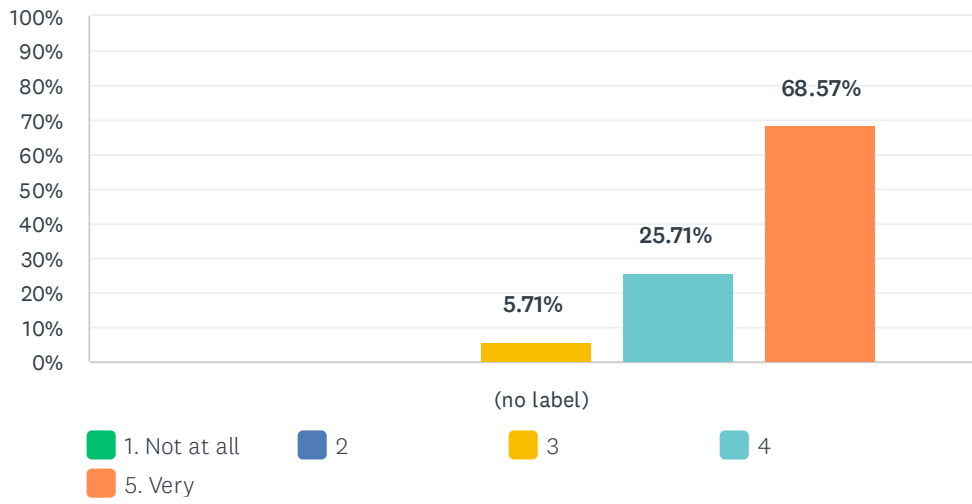
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.71% 2	25.71% 9	68.57% 24	35	4.63

Q5 My fellow students were appropriately selected to make the event interesting.

Answered: 35   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.71% 2	25.71% 9	68.57% 24	35	4.63

Q6 The overall experience of the school was worthwhile

Answered: 35   Skipped: 0
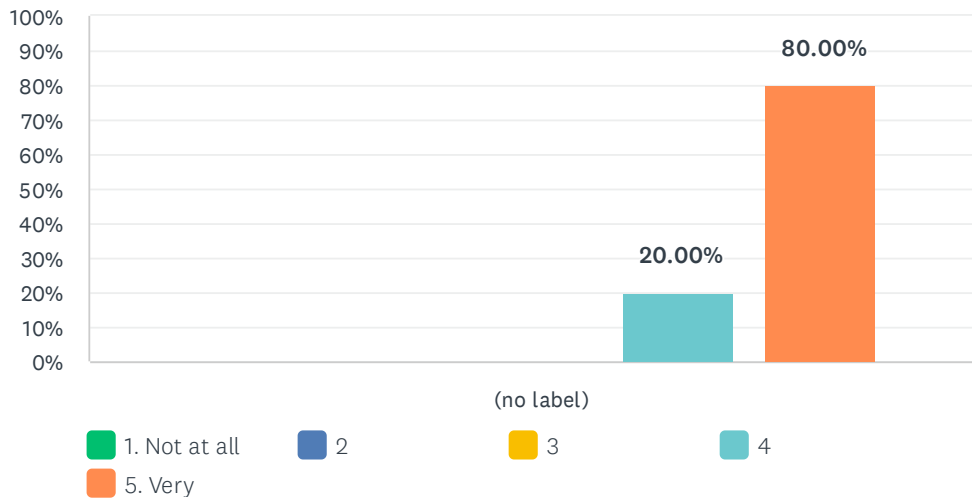
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	20.00% 7	80.00% 28	35	4.80

Q7 The Discussion Sessions were productive

Answered: 35   Skipped: 0
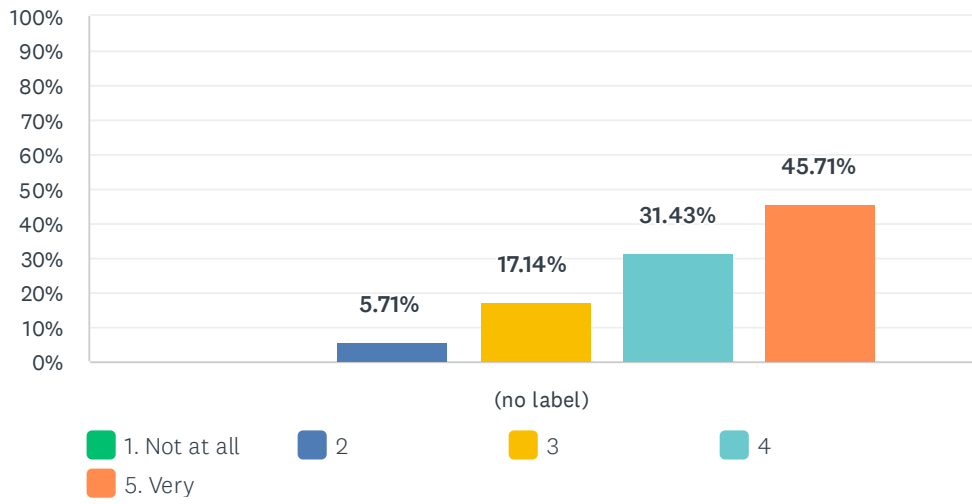
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	17.14% 6	31.43% 11	45.71% 16	35	4.17

Q8 The amount of material presented was

Answered: 35   Skipped: 0
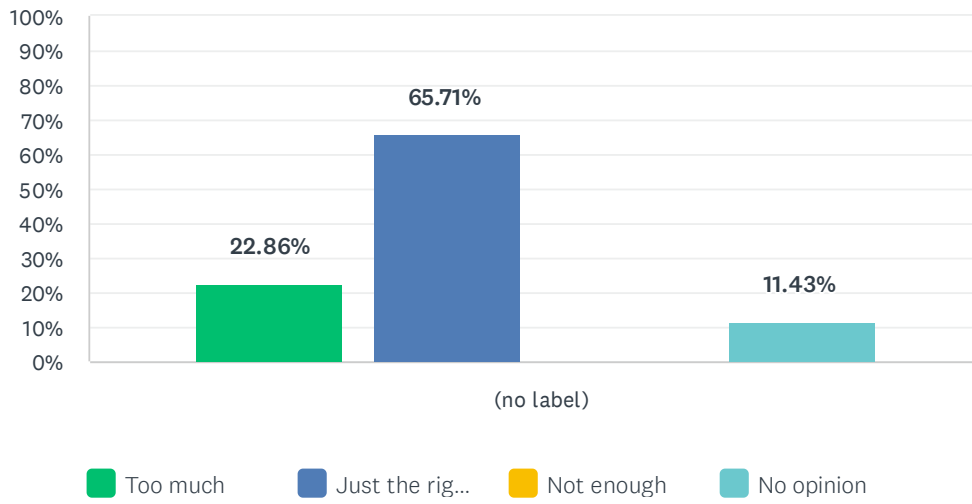
	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	22.86% 8	65.71% 23	0.00% 0	11.43% 4	35	2.00

Q9 Additional comments on the topic presentation and organization

Answered: 9   Skipped: 26

#	RESPONSES	DATE
1	This was an amazing experience, and I am grateful to everyone who made it possible!	6/23/2022 4:09 PM
2	I had an amazing experience during this summer school! The topics were very interesting and stimulating. And the professors and colleagues were wonderful!	6/22/2022 3:54 PM
3	The first week was extremely well organized. The goal and methods were well explained, and I feel I have learned some very useful ideas. In particular, the final goal of describing the sharp divergence theorem and its applications was exciting. In comparison, the second week was very poorly organized. The goals were unclear, and we would often switch between direct problems, inverse problems, and particular systems (inhomogeneous medium or exterior Dirichlet) without a clear indication.	6/20/2022 5:32 PM
4	The first week was amazing, but by the second week I was somewhat overwhelmed with the contents, so I feel that I had not enjoyed the second week as much as the first one.	6/20/2022 3:47 PM
5	The organizers were great, very approachable and amazing at teaching the material. This school made me want to learn more about the area and I feel like I learnt a lot of useful techniques and applications.	6/20/2022 3:09 PM
6	A lot of these comments are so vague and don't allow room for nuance that I don't trust the structure of this survey to accurately capture of a picture of anyone's experience. The use of slides made certain parts of lectures too fast to impart any lasting information. Other than giving a brief overview of an idea or showing pictures and animations slides should be avoided. The lectures moved fast which was ok, except only one of the discussion sessions (the first where we worked on problems) seemed newcomer friendly enough to the topic to actually give us experience working with the ideas presented.	6/19/2022 2:22 PM
7	Thank you for everything that was amazing !	6/18/2022 1:31 PM
8	The organization and presentation was great, but in my opinion, a summer school should be an invitation to an area (knowing we are graduate students) rather than theoretically trying to justify why a field of Mathematics exist by proving many theorems which, I think, are always available in books and papers. For, understanding a theorem and how to apply it is much more important than the proof. Usually, proofs logically make sense once the background and intricacies of the theorem are clear. In summary, it is not how far but how well.	6/17/2022 8:10 PM
9	Regarding my answer to #1, week 1 and week 2 were too disconnected in my opinion	6/17/2022 4:13 PM

Q10 I was well prepared to benefit from the school

Answered: 34   Skipped: 1

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.88% 2	26.47% 9	44.12% 15	23.53% 8	34	3.85

Q11 My interest in the subject matter was increased by the school

Answered: 34   Skipped: 1
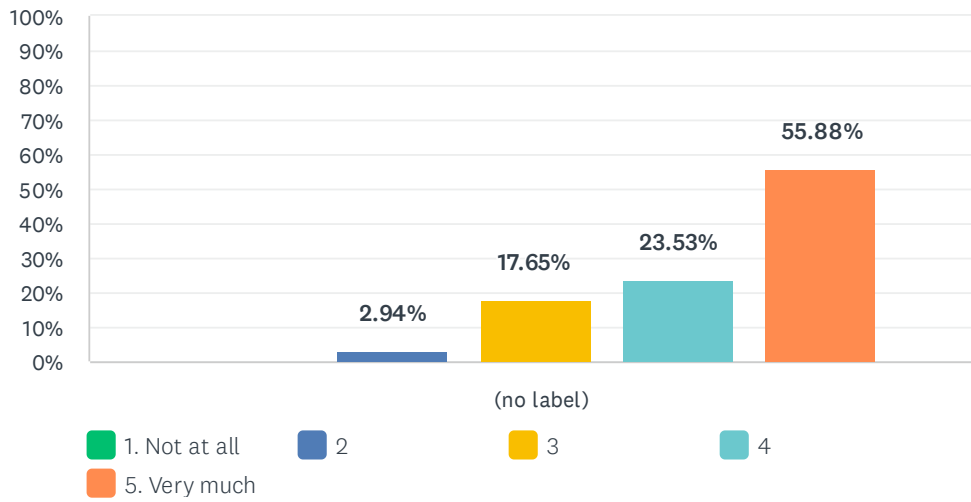
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.94% 1	17.65% 6	23.53% 8	55.88% 19	34	4.32

Q12 The school helped me meet people with similar scientific interests

Answered: 34   Skipped: 1
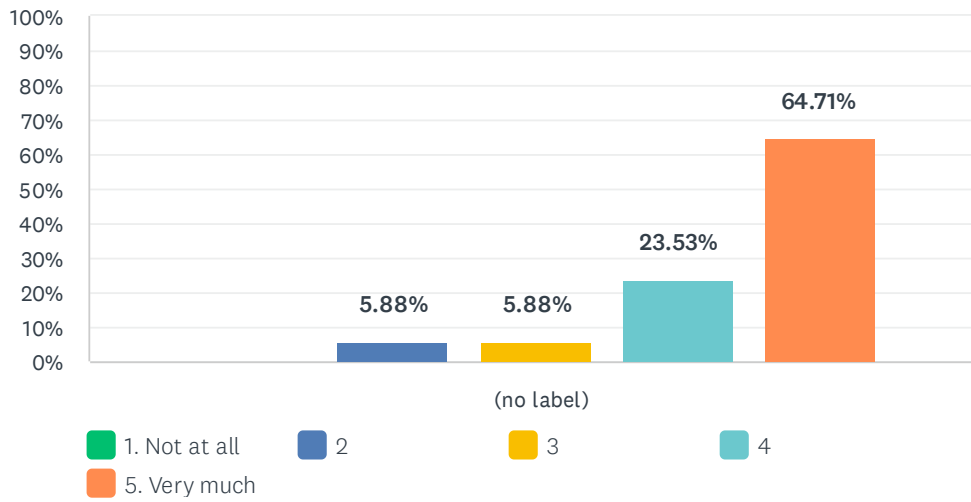
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.88% 2	5.88% 2	23.53% 8	64.71% 22	34	4.47

Q13 It is likely that I will work in the area of the school subject in the future

Answered: 34   Skipped: 1

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.94% 1	5.88% 2	35.29% 12	17.65% 6	38.24% 13	34	3.82

Q14 How would you evaluate your interaction with other participants?

Answered: 34   Skipped: 1
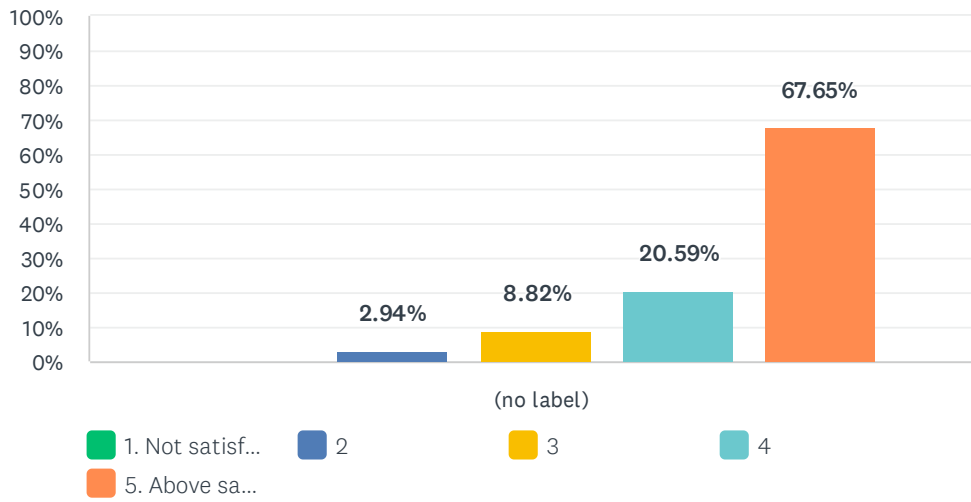
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.94% 1	8.82% 3	20.59% 7	67.65% 23	34	4.53

MSRI 991 SGS: Integral Equations and Applications - Participant Survey

Q15 Additional comments on personal assessment

Answered: 5   Skipped: 30

#	RESPONSES	DATE
1	Same as before, I had an amazing time. I'm very glad to meet such wonderful people and other math enthusiasts as me	6/22/2022 3:56 PM
2	I prepared as well as possible with the suggested material. Unfortunately, the material of the second week was not advertised in the preparations. For instance, the lecturers of the second week advertised a textbook of Colton and Kress for much of the material, but this was not listed in the suggested preparatory materials. Moreover, there was no preparation suggested for the scattering problems we focused on or the inverse problems. This was frustrating, because I would have studied it prior to coming and I think it would have helped me during the lectures.	6/20/2022 5:35 PM
3	I think my background was good enough to be able to follow, of course I had questions and some parts were left unclear but that contributed to my curiosity for the topic.	6/20/2022 3:11 PM
4	Again these questions seem to escape nuance and it's not clear what the organizers are trying to get from these questions.	6/19/2022 2:24 PM
5	It would have been nice to have more specific direction and resources for how best to prepare for this school, e.g., specific chapters from textbooks or papers to read.	6/17/2022 4:15 PM

847

Q16 I found the MSRI staff helpful

Answered: 34   Skipped: 1

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	8.82% 3	91.18% 31	34	4.91

Q17 The MSRI facilities were conducive for such a school

Answered: 34   Skipped: 1
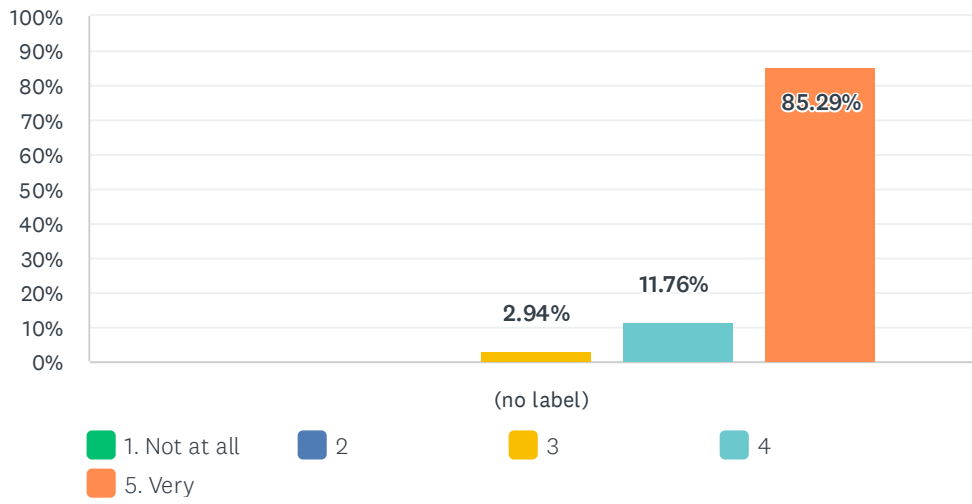
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.94% 1	11.76% 4	85.29% 29	34	4.82

Q18 The MSRI computer facilities were adequate for such a school

Answered: 34   Skipped: 1
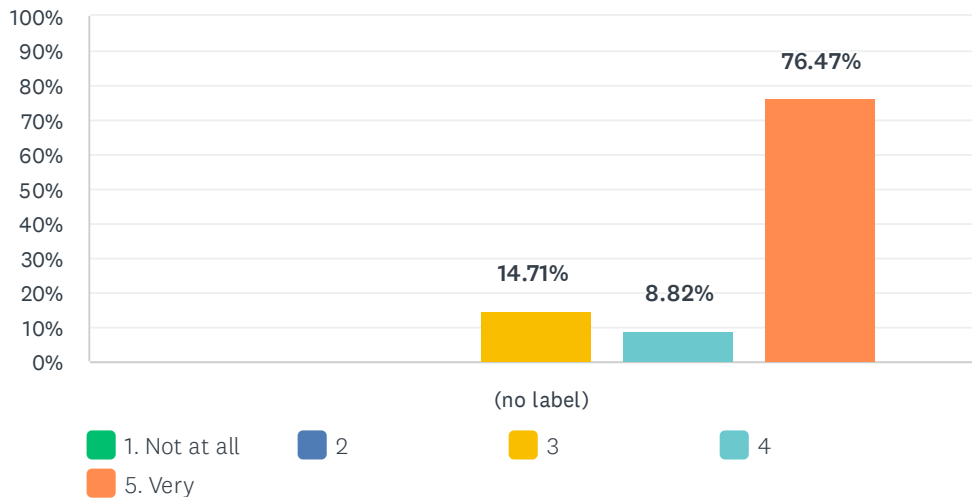
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.71% 5	8.82% 3	76.47% 26	34	4.62

Q19 Additional comments on the MSRI venue

Answered: 6   Skipped: 29

#	RESPONSES	DATE
1	MSRI has a really good structure in a wonderful location. It definitely helps a lot doing math with such a magnificent view!	6/22/2022 3:57 PM
2	It was phenomenal. The catered lunches were rather hit-or-miss, but otherwise the lecture hall and library were excellent.	6/20/2022 5:36 PM
3	MSRI is a great environment to do mathematics.	6/20/2022 3:11 PM
4	Facilities were fine, but really anywhere with a chalkboard and microphone would have been fine. Didn't use the computer facilities. All of the staff I interacted with were great both personally and in their roles.	6/19/2022 2:26 PM
5	Gorgeous place	6/18/2022 1:32 PM
6	It was a beautiful facility, though despite the notes on tables saying there was plenty of room on the deck, it got a little cramped out there at times.	6/17/2022 4:16 PM

Q20 How did you find the summer school accommodations?

Answered: 34   Skipped: 1

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.94% 1	5.88% 2	23.53% 8	32.35% 11	35.29% 12	34	3.91

Q21 How did you find the food at the dormitories?

Answered: 34   Skipped: 1
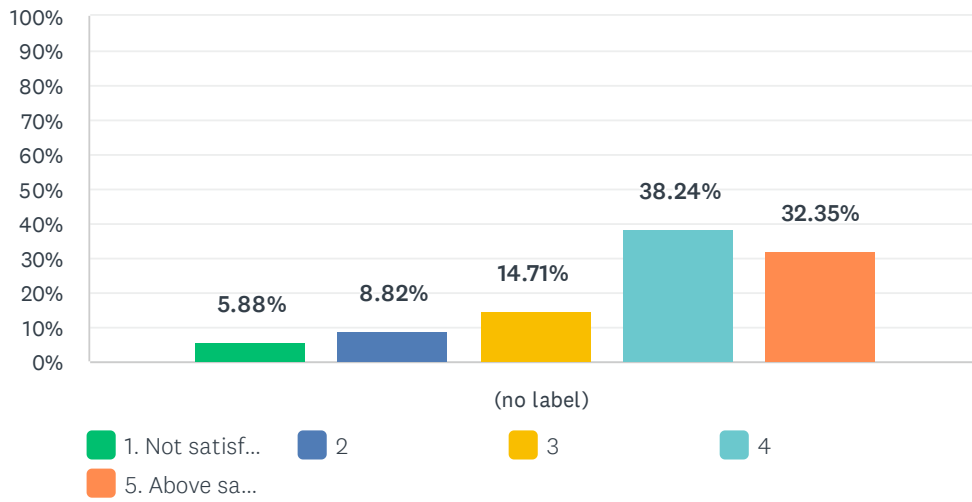
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	5.88% 2	8.82% 3	14.71% 5	38.24% 13	32.35% 11	34	3.82

Q22 How did you find the food provided by MSRI?

Answered: 34   Skipped: 1
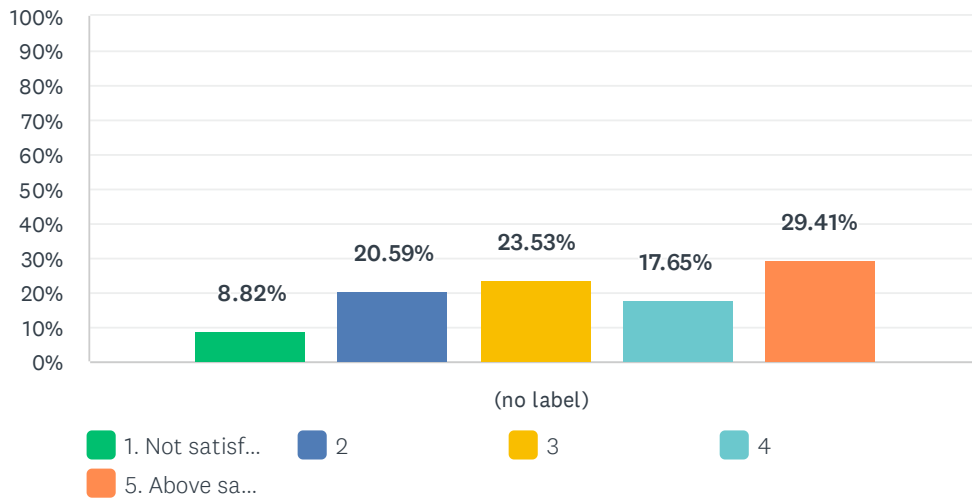
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	8.82% 3	20.59% 7	23.53% 8	17.65% 6	29.41% 10	34	3.38

Q23 Additional comments on accommodation and food

Answered: 7   Skipped: 28

#	RESPONSES	DATE
1	The lunch could be significantly better.	6/26/2022 2:53 PM
2	The only not-so-good thing was the internet connection we were provided. I couldn't make voice/videos calls using the internet conection at the dorms! And it was very annoying not being able to communicate well with my family...	6/22/2022 4:00 PM
3	I appreciated that MSRI alerted us about the beds being uncomfortable before we arrived, and they were correct. The dining hall was nice, and I appreciated being notified about it. It would have been better if we were alerted that the dormitories also had a full kitchen in each unit, including a refrigerator and stove. The food provided by the caterers during MSRI lunches ranged from fine to bland, but they were always willing to take suggestions, which was great.	6/20/2022 5:39 PM
4	Accomodation was very good, except the fact that Wi-fi and phone signal were not good at the dorms, so it was impossible to attend work-related zoom meetings,which was inconvenient.	6/20/2022 3:13 PM
5	Perfect	6/18/2022 1:33 PM
6	If there is anybody that needs good, tasty and healthy food on earth, it is a mathematician. Unfortunately, the food at MSRI was the direct opposite.	6/17/2022 8:16 PM
7	The beds were hard, and there's no reasonable way for anyone flying in to bring a mattress pad.	6/17/2022 4:19 PM

Q24 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 8   Skipped: 27

#	RESPONSES	DATE
1	Thank you for the experience! I look forward to joining future events.	6/24/2022 8:59 PM
2	There is nothing I would change!	6/23/2022 4:11 PM
3	No additional comments. I can only give thanks for the experience!	6/22/2022 4:01 PM
4	I have nothing else to add, it was a great experience for me and I recommend it to all graduate students.	6/20/2022 3:14 PM
5	Thank you for the privilege of the summer school!	6/17/2022 8:17 PM
6	My two weeks at MSRI were absolutely awesome in all ways possible!	6/17/2022 8:15 PM
7	Overall, it's great experience in MSRI. Thank you!	6/17/2022 4:43 PM
8	The main thing I can think of is a better list of preparatory materials to study before coming. A list of five textbooks is too general to be of any real use.	6/17/2022 4:20 PM

Geometric Flows

June 19, 2022 – July 01, 2022

Crete, Greece

Organizers:

Nicholas Alikakos (National and Kapodistrian University of Athens (University of Athens))

Panagiota Daskalopoulos (Columbia University)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Geometric Flows"
June 19 – July 01, 2022

Organizers

- Nicholas Alikakos (National and Kapodistrian University of Athens (University of Athens))
- Panagiota Daskalopoulos (Columbia University)

Description

This summer graduate school was a collaboration between MSRI and the FORTH-IACM Institute in Crete. The purpose of the school was to introduce graduate students to some of the most important geometric evolution equations.

One of the breakthroughs in the history of non-linear partial differential equations is the resolution of the Poincare conjecture and Thurston's Geometrization conjecture in 2004 by Grigori Perelman, based on the lifetime work of Richard Hamilton on the Ricci flow. Their work answered a famous topological conjecture by Henri Poincare dated back in 1904, answering one of the millennium mathematics problems.

The Ricci flow together is undoubtedly one of most important geometric evolution equations and has been recently studied in parallel with the Mean curvature flow, another important geometric evolution equation that occurs in the description of interfaces in multiphase physical models and has been studied in material science for almost a century. Another important fully nonlinear geometric flow is the Inverse mean curvature flow, known for its important applications to General relativity.

The purpose of this summer school was to introduce the students to these three important geometric flows, while connecting fundamental past works with current developments. The lecturers were internationally known experts in the field.

Highlights of the School

This summer school brought together 70 PhD students from the United States and Europe carefully chosen out of a pool of 300 applicants. The lectures were given by some of the most distinguished mathematicians worldwide who are working in geometric analysis today. In addition, five very talented young mathematicians working in the USA and Greece gave introductory lectures, aiming to prepare the students for the more advanced lectures by the senior lecturers. All lectures were given in the mornings. The afternoons were devoted to problem discussions, which were carefully chosen by the instructors. This was the highlight of the program, as it allowed the students to interact with one another, while learning by solving problems. Students took the initiative to form chat groups so that they continue this interaction after the summer program,

Organizers

First Name	Last Name	Institution
Nicholas	Alikakos	National and Kapodistrian University of Athens (University of Athens)
Panagiota	Daskalopoulos	Columbia University

Speakers

First Name	Last Name	Institution
Simon	Brendle	Stanford University
Theodora	Bourni	University of Tennessee
Kyeongsu	Choi	KIAS
Beomjun	Choi	POSTECH
Panagiota	Daskalopoulos	Columbia University
Panagiotis	Gianniotis	(University of Athens
Gerhard	Huisken	Math. Forschungsinstitut Oberwolfach
Florian	Johne	Columbia University

Mathematical Sciences Research Institute

Geometric Flows (Crete, Greece)

June 19, 2022 - June 30, 2022

Sunday, June 19, 2022		
11:45 PM - 12:15 AM		Registration

Monday, June 20, 2022		
12:15 AM - 12:30 AM	Hélène Barcelo & Charalambos Makridakis	Welcome
12:30 AM - 1:30 AM		Pre-Lecture: Review of Curvature, Commutator Identities for Covariant Derivatives
1:30 AM - 2:00 AM		Coffee Break
2:00 AM - 3:15 AM	Simon Brendle	Ricci Flow: Definition of Ricci Flow, Some Basic Examples, Self-Similar Solutions, Evolution of Curvature, Curvature Algebra in Three Dimensions
3:15 AM - 3:45 AM		Informal Questions
3:45 AM - 5:30 AM		Lunch
5:30 AM - 6:30 AM		Post-Lecture & Problem Session
11:45 PM - 12:45 AM		Pre-Lecture: Heat Equation on R^n and on Manifolds

Tuesday, June 21, 2022		
12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Panagiota Daskalopoulos	Ancient Solutions to Parabolic Equations: Ancient Solutions to the Heat Equation and to the Semi-Linear Heat Equation
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students
11:45 PM - 12:45 AM		Pre-Lecture: Maximum Principle for Scalar Heat Equations, Interior Estimates

Wednesday, June 22, 2022		
12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Simon Brendle	Ricci Flow: Hamilton's Maximum Principle for Systems, Preservation of Nonnegative Ricci in Three Dimensions, Pinching and Convergence in Three Dimensions, Curvature Conditions in Higher Dimensions
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students
11:45 PM - 12:45 AM		Pre-Lecture: Log-Sobolev Entropy and Nash Entropy

Thursday, June 23, 2022		
12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Simon Brendle	Ricci Flow: Perelman's Entropy, and Noncollapsing
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students
11:45 PM - 12:45 AM		Pre-Lecture: Extrinsic Curvature of Hypersurfaces, and Evolution Equations for Extrinsic Geometric Flows

Friday, June 24, 2022

12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Gerhard Huisken	Inverse Mean Curvature Flow: Properties of Smooth Solutions to IMCF
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students

Sunday, June 26, 2022

11:45 PM - 12:45 AM		Pre-Lecture: Level Set Approach to Extrinsic Geometric Flows (and the Relation to the Parametrized Version of the Flow); Weak Mean Curvature

Monday, June 27, 2022

1:00 AM - 2:15 AM	Gerhard Huisken	Inverse Mean Curvature Flow: Weak Solutions for Inverse Mean Curvature Flow
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students
11:45 PM - 12:45 AM		The 2-Dimensional Ricci Flow

Tuesday, June 28, 2022

12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Panagiota Daskalopoulos	Ancient Solutions to Geometric Flows: Ancient Solutions to the 2-Dim Ricci Flow
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students
11:45 PM - 12:45 AM		Pre-Lecture: Asymptotically Flat 3-Manifolds, their Role in General Relativity, the ADM-Mass and the Dominant Energy Condition

Wednesday, June 29, 2022

12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Gerhard Huisken	Inverse Mean Curvature Flow: Applications to General Relativity
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Post-Lecture & Problem Session
6:00 AM - 7:00 AM		Informal Discussions between Students
11:45 PM - 12:45 AM		Pre-Lecture: Curve Shortening Flow on the Plane

Thursday, June 30, 2022

12:45 AM - 1:15 AM		Coffee Break
1:15 AM - 2:30 AM	Theodora Bourni	Ancient Solutions to Geometric Flows: Ancient Solutions to the Curve Shortening Flow
2:30 AM - 3:00 AM		Informal Questions
3:00 AM - 5:00 AM		Lunch
5:00 AM - 6:00 AM		Free Afternoon
6:00 AM - 7:00 AM		Informal Discussions between Students
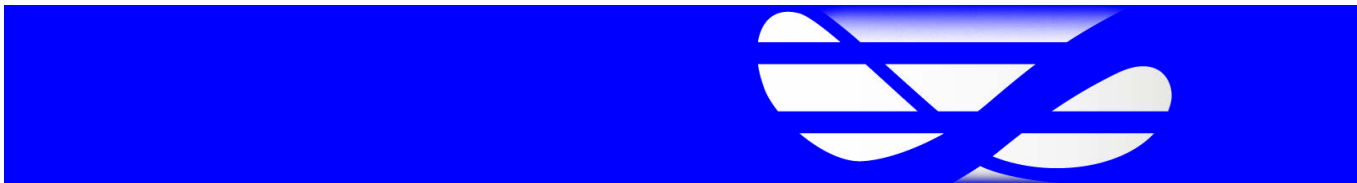
Officially Registered Student Information

Students		27

Gender		27
Male	81.48%	22
Female	7.41%	2
Other	3.70%	1
Declined to state	7.41%	2

Ethnicity*		38
White	36.84%	14
Asian	31.58%	12
Hispanic	10.53%	4
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	2.63%	1
Mixed	13.16%	5
Declined to state	5.26%	2

* ethnicity specifications are not exclusive

Q1 My home institution is located in:

Answered: 50   Skipped: 0
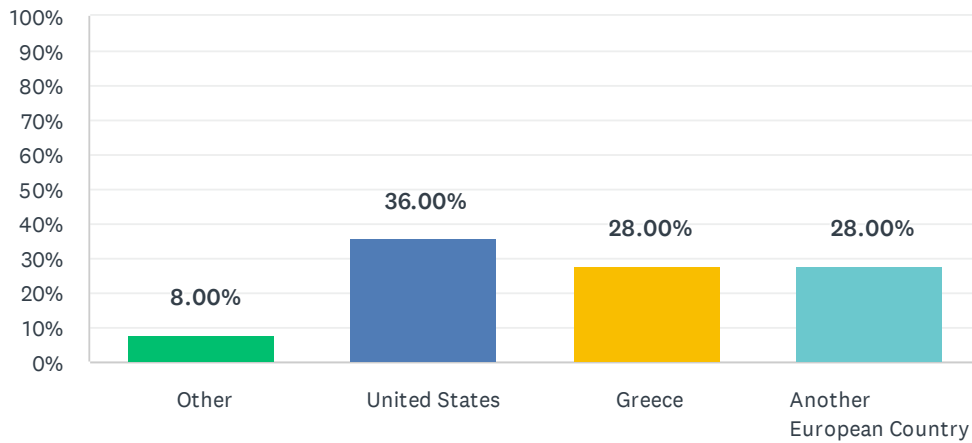
ANSWER CHOICES	RESPONSES	
Other	8.00%	4
United States	36.00%	18
Greece	28.00%	14
Another European Country	28.00%	14
TOTAL		50

#	OTHER (PLEASE SPECIFY)	DATE
1	United Kingdom	7/18/2022 9:06 AM
2	Germany	7/17/2022 10:13 AM
3	Taiwan	7/15/2022 5:01 PM
4	Australia	7/12/2022 3:53 AM
5	Italy	7/10/2022 1:21 PM
6	Spain	7/9/2022 5:57 AM
7	Mexico	7/8/2022 12:29 PM
8	Italy	7/8/2022 12:23 PM
9	United Kingdom	7/8/2022 12:22 PM
10	Queen Mary University of London	7/8/2022 12:13 PM
11	United Kingdom	7/8/2022 12:12 PM

Q2 The various topics within the summer school integrated into a coherent picture

Answered: 45   Skipped: 5
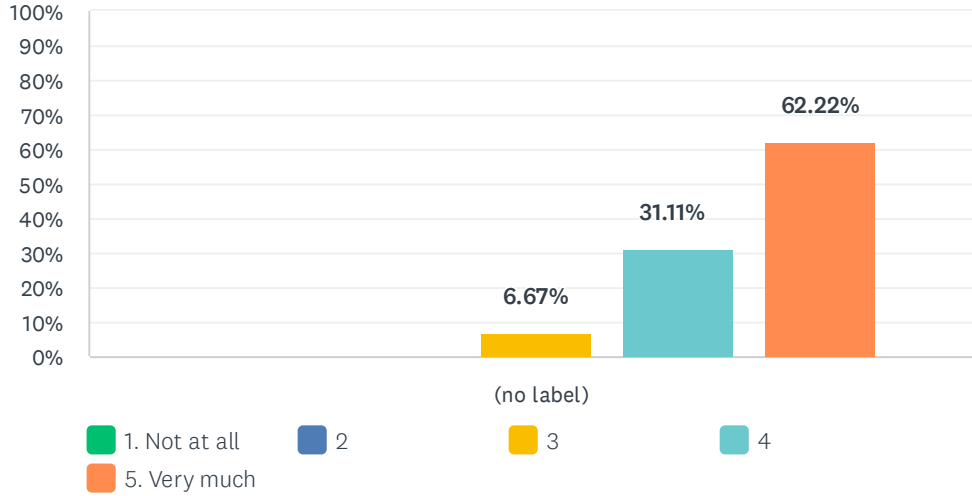
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.67% 3	31.11% 14	62.22% 28	45	4.56

Q3 The faculty speakers were generally clear and well organized in their presentation

Answered: 45   Skipped: 5
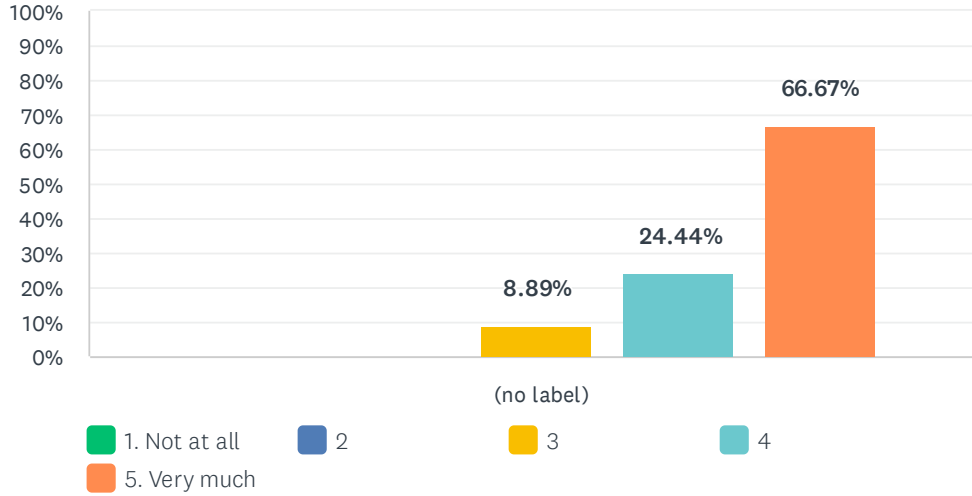
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.89% 4	24.44% 11	66.67% 30	45	4.58

Q4 The school was intellectually stimulating

Answered: 45   Skipped: 5

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	0.00% 0	4.44% 2	17.78% 8	75.56% 34	45	4.64

Q5 My fellow students were appropriately selected to make the event interesting.

Answered: 45   Skipped: 5
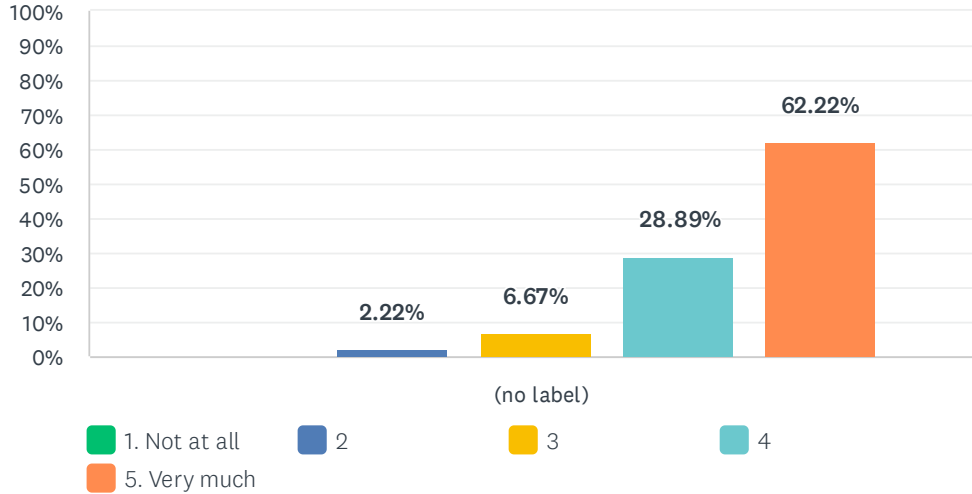
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.22% 1	6.67% 3	28.89% 13	62.22% 28	45	4.51

Q6 The overall experience of the school was worthwhile
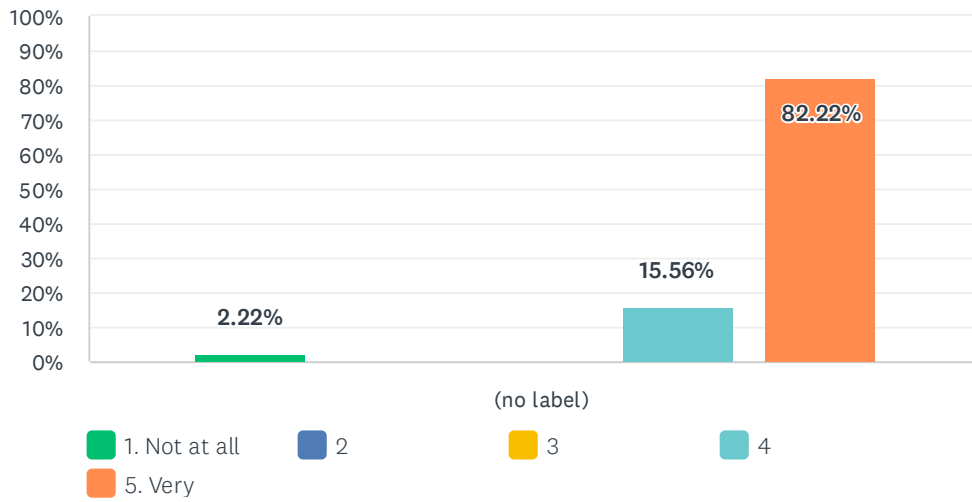
Answered: 45   Skipped: 5

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	0.00% 0	0.00% 0	15.56% 7	82.22% 37	45	4.76

Q7 The Problem Sessions were productive

Answered: 45   Skipped: 5
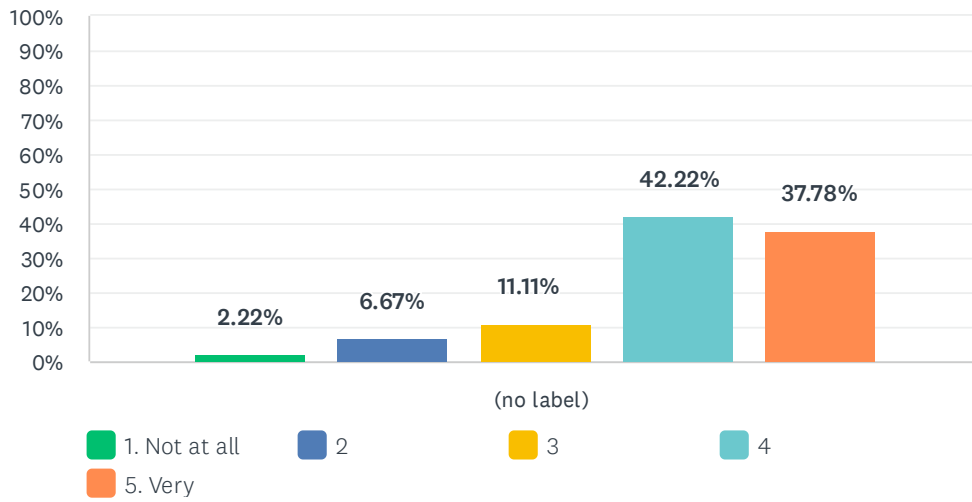
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	6.67% 3	11.11% 5	42.22% 19	37.78% 17	45	4.07

Q8 The amount of material presented was

Answered: 45   Skipped: 5

	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	2.22% 1	77.78% 35	6.67% 3	13.33% 6	45	2.31

Q9 Additional comments on the topic presentation and organization

Answered: 9   Skipped: 41

#	RESPONSES	DATE
1	I didnt enjoy the summer school as I watched it over zoom. There was no problem session for zoom people and I couldnt engage with anyone.	7/15/2022 1:08 PM
2	I think more advance notice of the materials in lectures would be good, so that students can get a bit acquainted on their own before the lecture	7/14/2022 11:27 AM
3	A discussion on the problem section the following day by the lectures would have been very helpful.	7/12/2022 3:54 AM
4	Would have been better if the questions were given overnight, to allow one to try them properly before the problems sessions. Also, to be divided into different groups throughout the fortnight would have been preferable.	7/8/2022 2:03 PM
5	Question 5 is a little weird	7/8/2022 1:06 PM
6	Thank you for the experience	7/8/2022 1:05 PM
7	It was amazing. Thank you so much for everything.	7/8/2022 12:33 PM
8	I wish there had been a little more exposition on current work in Ricci flow and the results that people expect or hope to prove using Ricci flow in the future, but that's just my personal opinion. Overall, I think everything was very well organized.	7/8/2022 12:22 PM
9	The summer school on geometric flows was excellent. The organisation was great and the speakers were clear and instructive. I hope MSRI will organise again a summer school as it was a great experience. I really enjoyed it.	7/8/2022 12:17 PM

Q10 I was well prepared to benefit from the school

Answered: 42   Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 2	19.05% 8	38.10% 16	38.10% 16	42	4.10

Q11 My interest in the subject matter was increased by the school

Answered: 42   Skipped: 8
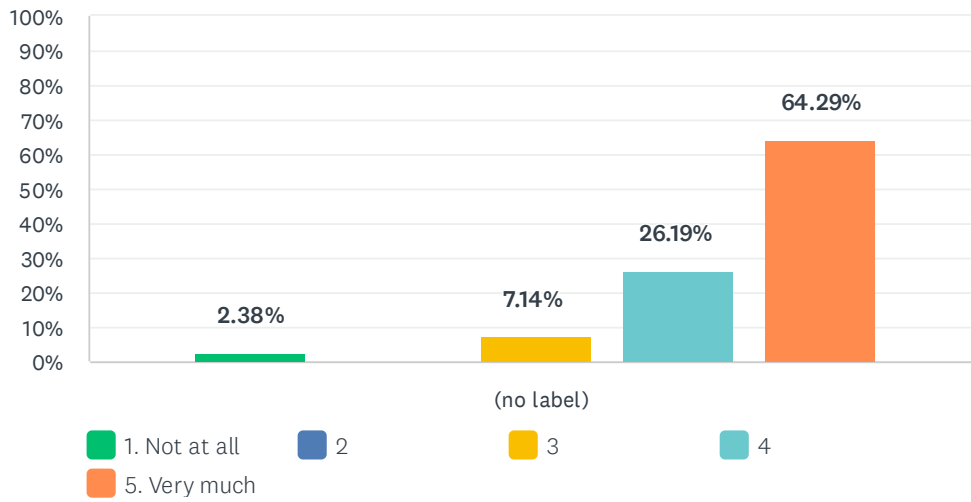
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.38% 1	0.00% 0	7.14% 3	26.19% 11	64.29% 27	42	4.50

Q12 The school helped me meet people with similar scientific interests

Answered: 42   Skipped: 8
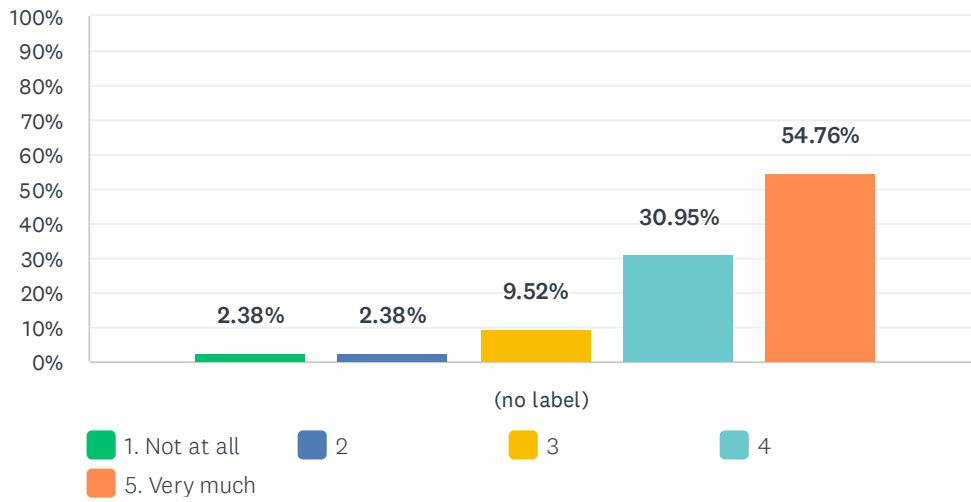
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.38% 1	2.38% 1	9.52% 4	30.95% 13	54.76% 23	42	4.33

Q13 It is likely that I will work in the area of the school subject in the future

Answered: 42   Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.38% 1	14.29% 6	28.57% 12	54.76% 23	42	4.36

Q14 How would you evaluate your interaction with other participants?

Answered: 42   Skipped: 8
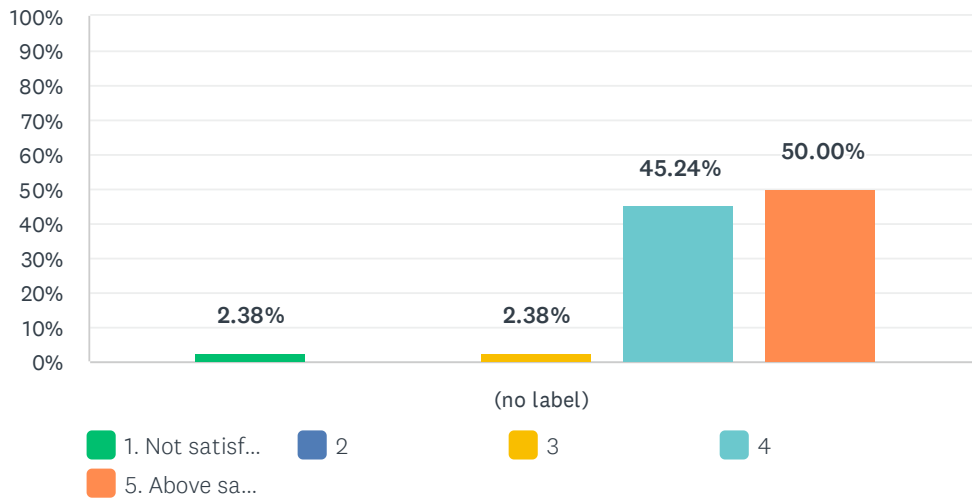
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.38% 1	0.00% 0	2.38% 1	45.24% 19	50.00% 21	42	4.40

Q15 Additional comments on personal assessment

Answered: 4   Skipped: 46

#	RESPONSES	DATE
1	Other students were very nice, but would have been nice to meet people already in geometric flows.	7/18/2022 3:26 PM
2	The summer school experience made me commit to working in geometric flows. I made some very good friends in only two weeks due to the school's emphasis on letting students build connections inside and outside the institute. I also had a really good experience talking with senior faculty and received a great deal of information and intuition that I'm not sure how i would find otherwise.	7/14/2022 11:29 AM
3	There were like five female participants, no Black students, and very few BIPOC in general. Please do better next time.	7/8/2022 1:06 PM
4	I am interested in Ricci flow and it was very helpful for me to see some related topics being presented at the summer school (mean curvature flow, singularities of flows in general) as well as meet other people working on Ricci flow.	7/8/2022 12:23 PM

Q16 I found the onsite staff helpful

Answered: 42   Skipped: 8
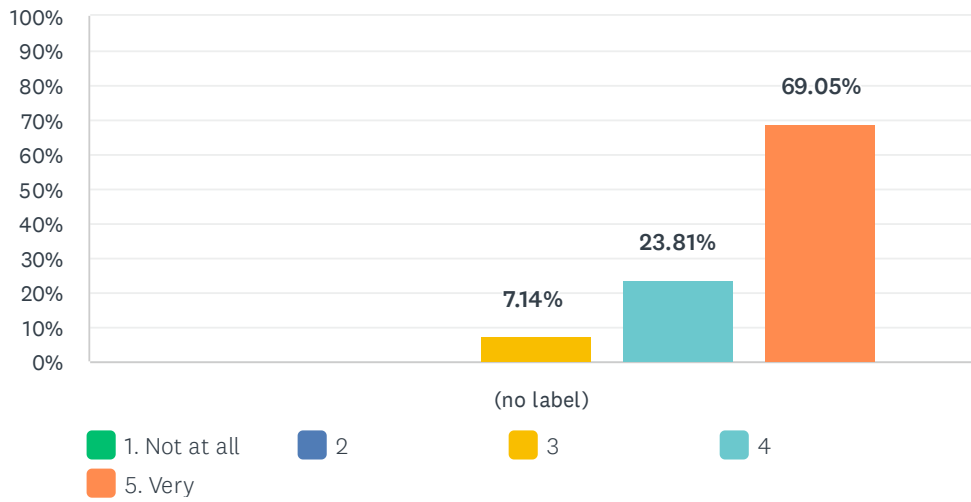
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.14% 3	23.81% 10	69.05% 29	42	4.62

Q17 The physical facilities were conducive for such a school
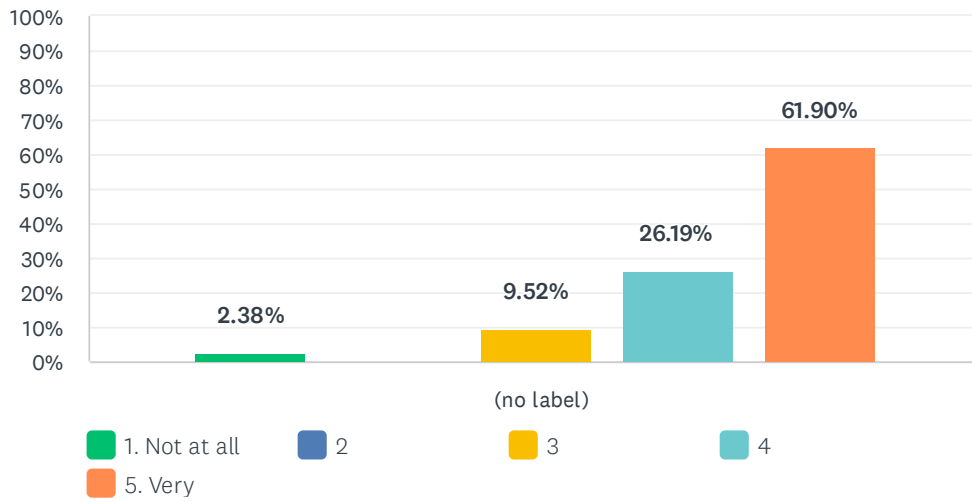
Answered: 42   Skipped: 8

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.38% 1	0.00% 0	9.52% 4	26.19% 11	61.90% 26	42	4.45

Q18 Additional comments on the venue

Answered: 1   Skipped: 49

#	RESPONSES	DATE
1	The FORTH premises are extremely beautiful.	7/8/2022 12:23 PM

Q19 How did you find the summer school accommodations?

Answered: 42   Skipped: 8
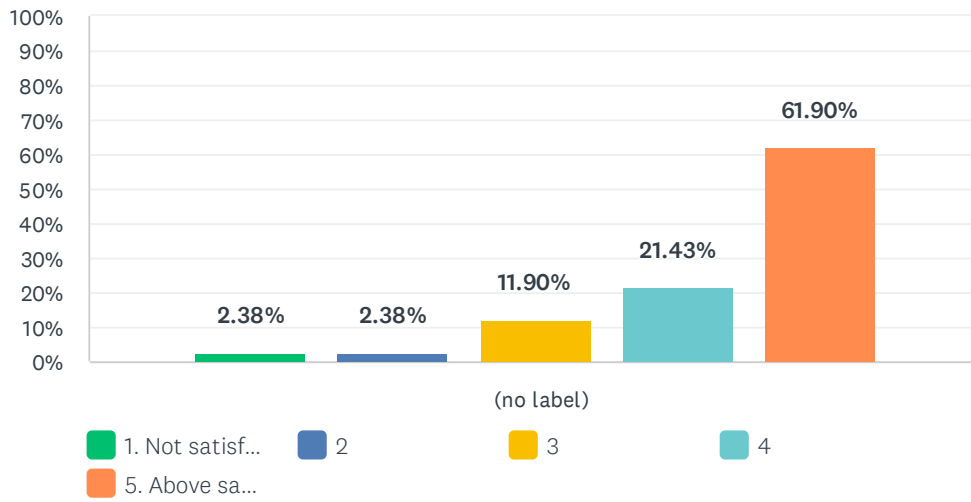
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.38% 1	2.38% 1	11.90% 5	21.43% 9	61.90% 26	42	4.38

Q20 How did you find the food at the school?

Answered: 42   Skipped: 8
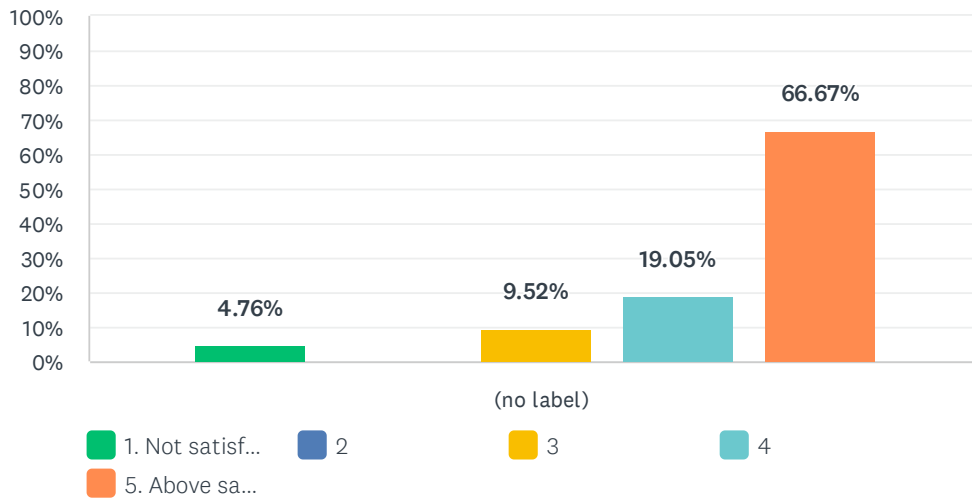
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 2	0.00% 0	9.52% 4	19.05% 8	66.67% 28	42	4.43

Q21 Additional comments on accommodation and food

Answered: 1   Skipped: 49

#	RESPONSES	DATE
1	Everything was great.	7/8/2022 12:24 PM

Q22 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 9   Skipped: 41

#	RESPONSES	DATE
1	It was not ideal to put two people together in one quite small hotel room during a high covid risk period. Apart from that it was a fantastic experience!	7/17/2022 10:17 AM
2	I might encourage the professors and senior faculty to sit with the students more during lunch, though of course some did and others may desire a break. I may also suggest that there be a lecture in the afternoon after lunch, perhaps after Problems and before leaving; i would suggest this since it was difficult to have continue working past 4pm or so, and a lecture would be easier to follow when tired. Overall it was a really fantastic experience and I would strongly strongly support continued funding for the summer school on its current form.	7/14/2022 11:34 AM
3	Great organisation! Hope to participate in another one in the upcoming years! It was a pleasure to host such a summer school in Greece!!!	7/9/2022 12:51 PM
4	In general, amazing experience. I will try to repeat	7/9/2022 5:59 AM
5	The summer school was a success, and a very positive experience overall. I think the problem sessions would be more interesting from the point of view of socialising if the groups were rotated somehow. That way we would get to know as many students as possible, and not have the same people every time (with whom we may or may not have something to share). In my opinion, this would help a lot in the social cohesion of the school (as everybody gets to know each other), and help the students meet the right people for them individually (which I think was the point all along).	7/9/2022 3:35 AM
6	Just to reiterate: the lack of diversity at this summer school was very disappointing. I would like to see MSRI and FORTH address the inclusion of traditionally underrepresented groups in mathematics with a much higher priority than it has done.	7/8/2022 1:10 PM
7	I think it was really good. I wish, we changed the work groups every other day to work woth different people.	7/8/2022 12:34 PM
8	Thank you so much for giving me this opportunity. The only minor suggestion I have might be to put the coffee break in the afternoon instead of the morning.	7/8/2022 12:25 PM
9	Even though I came from a foreign institute, but since I gave a greek bank account, I was treated like all the students from greek institutes and I had to still give receipts back and also the fact that they needed physical form receipts, also not shared was very annoying. It could easily be done by giving pictures of the receipts, shared receipts would be also fine. It made the whole experience with this extremely tiring. I would probably think twice of attending any conference/summer school if funded by Greece and still not being enough to give pictures of receipts back. Also, I believe the amount of time after lunch for the problem sheets was too much. 1h for lunch and 1h for collaborating for the problem sheets would be enough.	7/8/2022 12:20 PM

New Directions in Representation Theory

June 19, 2022 – July 01, 2022

AMSI and U. of Hawaii, Hilo, USA

Organizers:

Angela Coughlin (Australian Mathematical Sciences Institute)

Joseph Grotowski (University of Queensland)

Tim Marchant (Australian Mathematical Sciences Institute)

Ole Warnaar (University of Queensland)

Geordie Williamson (University of Sydney)

DIRECTOR'S REPORT

Associate Professor Masoud Kamgarpour
The University of Queensland

The AMSI Winter School 2022 was collaboration with the Mathematical Sciences Research Institute at Berkeley. It had two in-person hubs: one in Brisbane for Australian based students and one in Hawaii for American based students. The students and lecturers collaborated with each other using online tools such as Zoom, Slack, and Sococo.

Since its inception, the Winter School has grown to become of the most significant events in the Australian calendar for postgraduate students in mathematical sciences. Each year, the two-week program offers the participants the opportunity to expand their skills and build collaborative networks. The theme this year was "New Directions in Representation Theory". Representation theory is the art of encoding and describing symmetries of physical systems in mathematical terms.

Pioneered by Frobenius at the end of the 19th century, representation theory rose to prominence in the 1930s as a key tool for understanding the symmetries of quantum systems. It has since blossomed into an active field at the cutting edge of research in mathematics and physics. The selection of courses offered at the Winter School together with the high profile of the speakers attracted participants from top universities in Australia and the US. A huge impetus for the Winter School was provided by the leadership of Professor Geordie Williamson, a world-renowned representation theorist based at the University of Sydney. One of the highlights was the public lecture by Professor Williamson on the timely topic of Artificial Intelligence. In addition to the lecture itself, the discussions that ensued with members of community were quite eye-opening. For instance, I met someone whose daughter was recently interviewed by an AI for a government job. That such a thing is possible (and legal) is a testament to the rapid changes taking place in our times.

Mathematics has been playing a central role in these developments and will continue to be indispensable for those who want to understand the myriad of implications of such changes. In conclusion, the 2022 AMSI Winter School was a great success on many levels. It was an outstanding opportunity for Australia's next generation of mathematician. The students, lecturers, and organisers are all looking forward to the next occurrence of the Winter School

Organizers

First Name	Last Name	Institution
Angela	Coughlin	Australian Mathematical Sciences Institute
Joseph	Grotowski	University of Queensland
Tim	Marchant	Australian Mathematical Sciences Institute
Ole	Warnaar	University of Queensland
Geordie	Williamson	University of Sydney

Speakers

First Name	Last Name	Institution
Asilata	Bapat	University of Chicago
Uri	Onn	The Australian National University
Geordie	Williamson	University of Sydney
Ting	Xue	University of Melbourne

Teaching Assistant

First Name	Last Name	Institution
Sam	Jeralds	University of Queensland
Bregje	Pauwels	University of Sydney

Mathematical Sciences Research Institute

New Directions in Representation Theory (AMSI and U. of Hawaii, Hilo)

June 19, 2022 - June 30, 2022

Sunday, June 19, 2022		
1:00 PM - 1:30 PM		Opening Ceremony
1:30 PM - 2:00 PM		Tea Break
2:00 PM - 3:00 PM	Ting Xue	Introduction to Linear Algebraic Groups
3:00 PM - 4:00 PM	Uri Onn	Representation Zeta Functions
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Monday, June 20, 2022		
1:30 PM - 2:30 PM	Ting Xue	Introduction to Linear Algebraic Groups
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Uri Onn	Representation Zeta Functions
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Tuesday, June 21, 2022		
1:30 PM - 2:30 PM	Ting Xue	Introduction to Linear Algebraic Groups
2:30 PM - 3:00 PM		Tea Break & Group Photo
3:00 PM - 4:00 PM	Uri Onn	Representation Zeta Functions
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Wednesday, June 22, 2022		
1:30 PM - 2:30 PM	Ting Xue	Introduction to Linear Algebraic Groups
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Uri Onn	Representation Zeta Functions
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break

Thursday, June 23, 2022		
1:30 PM - 2:30 PM	Ting Xue	Introduction to Linear Algebraic Groups
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Uri Onn	Representation Zeta Functions
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Sunday, June 26, 2022

1:30 PM - 2:30 PM	Geordie Williamson	Kazhdan-Lusztig Polynomials: Representation, Geometry and Combinatorics
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Asilata Bapat	Triangulations, Rigid Motions and Applications to Representation Theory
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Monday, June 27, 2022

1:30 PM - 2:30 PM	Geordie Williamson	Kazhdan-Lusztig Polynomials: Representation, Geometry and Combinatorics
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Asilata Bapat	Triangulations, Rigid Motions and Applications to Representation Theory
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Tuesday, June 28, 2022

1:30 PM - 2:30 PM	Geordie Williamson	Kazhdan-Lusztig Polynomials: Representation, Geometry and Combinatorics
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Asilata Bapat	Triangulations, Rigid Motions and Applications to Representation Theory
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Wednesday, June 29, 2022

1:30 PM - 2:30 PM	Geordie Williamson	Kazhdan-Lusztig Polynomials: Representation, Geometry and Combinatorics
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Asilata Bapat	Triangulations, Rigid Motions and Applications to Representation Theory
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Thursday, June 30, 2022

1:30 PM - 2:30 PM	Geordie Williamson	Kazhdan-Lusztig Polynomials: Representation, Geometry and Combinatorics
2:30 PM - 3:00 PM		Tea Break
3:00 PM - 4:00 PM	Asilata Bapat	Triangulations, Rigid Motions and Applications to Representation Theory
4:00 PM - 5:00 PM		Problem Session 1
5:00 PM - 6:00 PM		Office Hour
6:00 PM - 7:00 PM		Dinner
7:00 PM - 7:30 PM		Tea Break
7:30 PM - 9:00 PM		Problem Session 2

Officially Registered Student Information

Students		24

Gender		24
Male	66.67%	16
Female	33.33%	8
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		28
White	46.43%	13
Asian	32.14%	9
Hispanic	10.71%	3
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	7.14%	2
Declined to state	3.57%	1

* ethnicity specifications are not exclusive

AMSI
AMSI

Help

Aggregated view
AMSI WINTER SCHOOL 2022 - FEEDBACK SURVEY ▾

40 responses in this report (out of **40** total responses) | **35 min. 18 sec.** average completion time | **34.19%** completion rate

Form responses received

Download as... ▾

0 responses
Jul 28

Jul 2 2022 | Jul 9 | Jul 16 | Jul 23 | Jul 30 | Aug 6
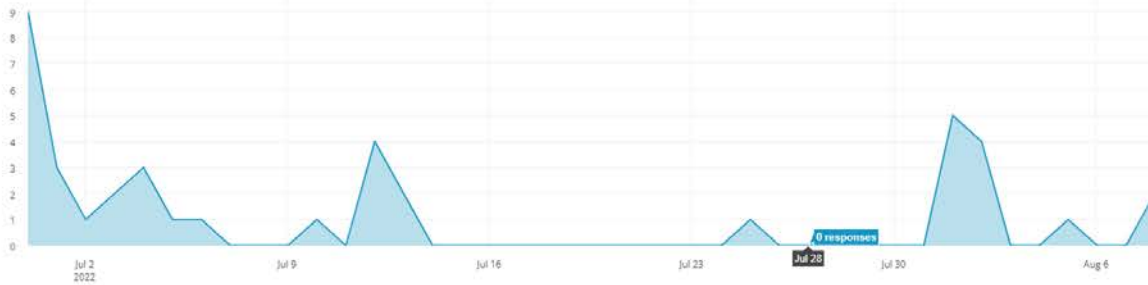
Likert Scale

Did you fully participate in all lectures and classes?

Download as... ▾
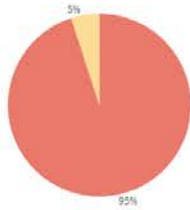
CHOICE	RESPONSES	PERCENTAGE
Yes, All of them	38	95%
Some of them	2	5%
No, none of them	0	0%

Likert Scale

I was well prepared to benefit from the school

Download as... ▾
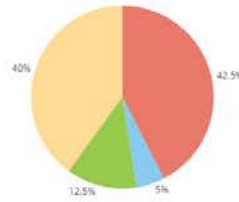
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	17	42.5%
Agree	16	40%
Neutral	5	12.5%
Disagree	2	5%
Strongly Disagree	0	0%

Likert Scale

The various topics within the program integrated into a coherent picture
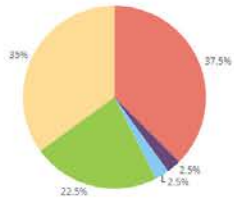
CHOICE	RESPONSES	PERCENTAGE
Agree	15	37.5%
Strongly Agree	14	35%
Neutral	9	22.5%
Disagree	1	2.5%
Strongly Disagree	1	2.5%

Likert Scale

The courses were well organised

Download as... ▾
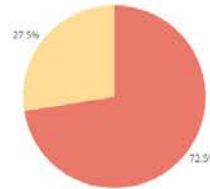
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	29	72.5%
Agree	11	27.5%
Disagree	0	0%
Neutral	0	0%
Strongly Disagree	0	0%

Likert Scale

The courses were relevant to my current research

Download as... ▾
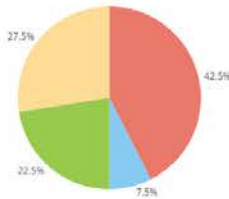
CHOICE	RESPONSES	PERCENTAGE
Agree	17	42.5%
Strongly Agree	11	27.5%
Neutral	9	22.5%
Disagree	3	7.5%
Strongly Disagree	0	0%

Likert Scale

The content of the courses was covered in sufficient depth

Download as... ▾
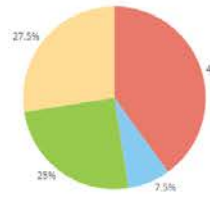
CHOICE	RESPONSES	PERCENTAGE
Agree	16	40%
Neutral	11	27.5%
Strongly Agree	10	25%
Disagree	3	7.5%
Strongly Disagree	0	0%

Likert Scale

The lecturers were professional and engaging

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	29	72.5%
Agree	10	25%
Neutral	1	2.5%
Disagree	0	0%

Likert Scale

The lecturers knowledge of the course content was high

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	33	82.5%
Agree	5	12.5%
Neutral	2	5%
Disagree	0	0%

2.5%

72.5%

82.5%
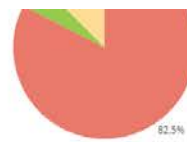
Likert Scale

The teaching assistants were helpful
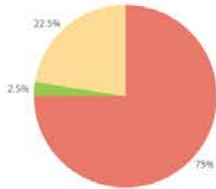
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	30	75%
Agree	9	22.5%
Neutral	1	2.5%
Disagree	0	0%
Strongly Disagree	0	0%

22.5%

2.5%

75%

Likert Scale

I found the Problem Solving sessions productive
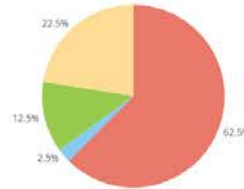
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	25	62.5%
Agree	9	22.5%
Neutral	5	12.5%
Disagree	1	2.5%
Strongly Disagree	0	0%

22.5%

12.5%

2.5%

62.5%

Likert Scale

I found the Sococo Office Hours useful
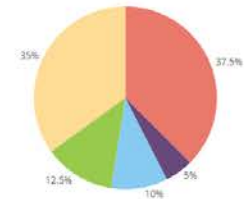
CHOICE	RESPONSES	PERCENTAGE
Agree	15	37.5%
Neutral	14	35%
Disagree	5	12.5%
Strongly Disagree	4	10%
Strongly Agree	2	5%

35%

37.5%

12.5%

5%

10%

Likert Scale

My interest in the subject matter was increased by the school
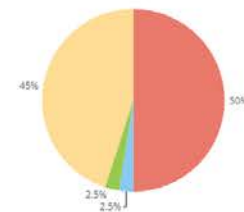
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	20	50%
Agree	18	45%
Disagree	1	2.5%
Neutral	1	2.5%
Strongly Disagree	0	0%

45%

50%

2.5%

2.5%

9

8

Likert Scale

I will apply knowledge gained from these courses into my research and studies
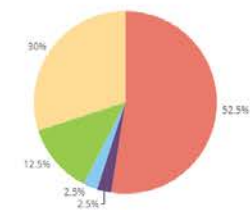
CHOICE	RESPONSES	PERCENTAGE
Agree	21	52.5%
Strongly Agree	12	30%
Neutral	5	12.5%
Disagree	1	2.5%
Strongly Disagree	1	2.5%

30%

52.5%

12.5%

2.5%

2.5%

Likert Scale

My fellow students were appropriately selected to make the event interesting
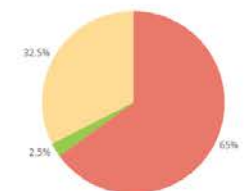
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	26	65%
Agree	13	32.5%
Neutral	1	2.5%
Disagree	0	0%
Strongly Disagree	0	0%

32.5%

2.5%

65%

Likert Scale

I found Slack a good way to network with lecturers and other participants, access class resources and organise my...
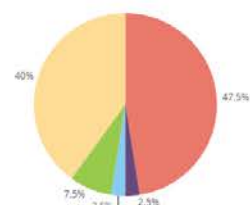
CHOICE	RESPONSES	PERCENTAGE
Agree	19	47.5%
Strongly Agree	16	40%
Neutral	3	7.5%
Disagree	1	2.5%
Strongly Disagree	1	2.5%

40%

47.5%

7.5%

2.5%

2.5%

Likert Scale

Sococo was a useful and convenient platform for group work and social activities

CHOICE	RESPONSES	PERCENTAGE
Disagree	13	32.5%
Agree	9	22.5%
Neutral	9	22.5%
Strongly Disagree	5	12.5%
Strongly Agree	4	10%

22.5%

32.5%

22.5%

10%

12.5%

Likert Scale

The school increased my knowledge of other research being

Likert Scale

The school strengthened my ability to undertake independent

undertaken in my field
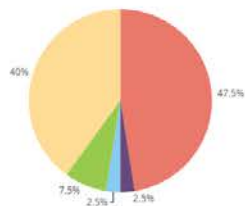
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	19	47.5%
Agree	16	40%
Neutral	3	7.5%
Disagree	1	2.5%
Strongly Disagree	1	2.5%

research
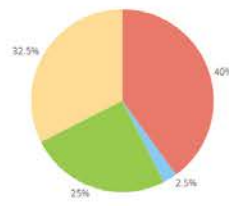
CHOICE	RESPONSES	PERCENTAGE
Agree	16	40%
Strongly Agree	13	32.5%
Neutral	10	25%
Disagree	1	2.5%
Strongly Disagree	0	0%

Likert Scale

Download as... ▼

The school strengthened my mathematical credentials
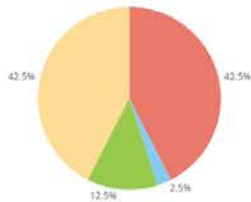
CHOICE	RESPONSES	PERCENTAGE
Agree	17	42.5%
Strongly Agree	17	42.5%
Neutral	5	12.5%
Disagree	1	2.5%
Strongly Disagree	0	0%

Likert Scale

Download as... ▼

I made useful contacts and networks at the school
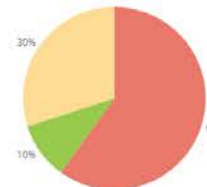
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	24	60%
Agree	12	30%
Neutral	4	10%
Disagree	0	0%
Strongly Disagree	0	0%

Likert Scale

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The school connected me with others I am likely to collaborate with in the future
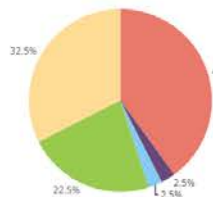
CHOICE	RESPONSES	PERCENTAGE
Agree	16	40%
Strongly Agree	13	32.5%
Neutral	9	22.5%
Disagree	1	2.5%
Strongly Disagree	1	2.5%

Likert Scale

Download as... ▼

It is likely that I will work in the area of Representation Theory in the future
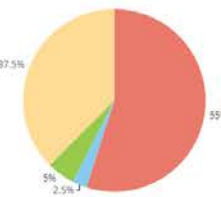
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	22	55%
Agree	15	37.5%
Neutral	2	5%
Strongly Disagree	1	2.5%
Disagree	0	0%

Likert Scale

Download as... ▼

How would you evaluate your interaction with other participants?
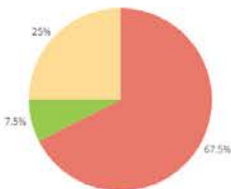
CHOICE	RESPONSES	PERCENTAGE
Above satisfactory	27	67.5%
Satisfactory	10	25%
Neutral	3	7.5%
Below satisfactory	0	0%

Likert Scale

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The Participant Talks were interesting and a valuable experience
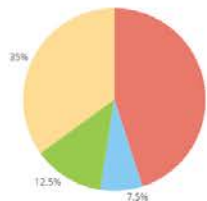
CHOICE	RESPONSES	PERCENTAGE
Agree	18	45%
Strongly Agree	14	35%
Neutral	5	12.5%
Disagree	3	7.5%
Did not attend	0	0%
Strongly Disagree	0	0%

Likert Scale

Download as... ▼

The Lunchtime Lecture (The Working Mathematician, presented by Optiver) was useful and motivating
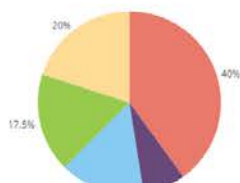
CHOICE	RESPONSES	PERCENTAGE
Did not attend	16	40%
Strongly Agree	8	20%
Agree	7	17.5%
Neutral	6	15%
Strongly Disagree	3	7.5%
Disagree	0	0%

Likert Scale

Download as... ▼

The Public Lecture (Professor Geordie Williamson) was interesting and informative
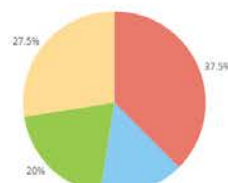
CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	15	37.5%
Agree	11	27.5%
Did not attend	8	20%
Neutral	6	15%
Disagree	0	0%
Strongly Disagree	0	0%

895

Likert Scale

Information on the AMSI-MSRI school website was easy to find

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Strongly Agree	11	27.5%
Agree	5	12.5%
Neutral	5	12.5%
Disagree	0	0%
Not Applicable	0	0%
Strongly Disagree	0	0%
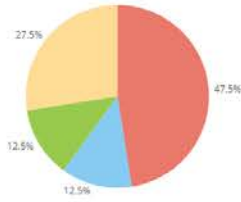
Likert Scale

The event application process was easy to follow

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Strongly Agree	13	32.5%
Agree	4	10%
Neutral	2	5%
Disagree	1	2.5%
Not Applicable	1	2.5%
Strongly Disagree	0	0%
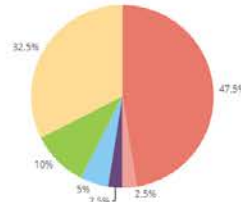
Likert Scale

Information on the AMSI-MSRI school website was easy to find

CHOICE	RESPONSES	PERCENTAGE
(no answer)	21	52.5%
Strongly Agree	10	25%
Agree	8	20%
Neutral	1	2.5%
Disagree	0	0%
Not Applicable	0	0%
Strongly Disagree	0	0%
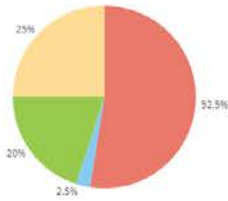
Likert Scale

The event application process was easy to follow

CHOICE	RESPONSES	PERCENTAGE
(no answer)	21	52.5%
Strongly Agree	11	27.5%
Agree	6	15%
Neutral	2	5%
Disagree	0	0%
Not Applicable	0	0%
Strongly Disagree	0	0%
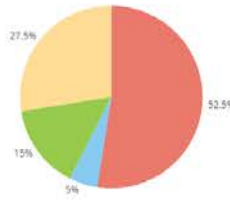
Likert Scale

The program fee payment process (via UQ-pay gateway) was easy to follow

CHOICE	RESPONSES	PERCENTAGE
(no answer)	21	52.5%
Strongly Agree	11	27.5%
Agree	5	12.5%
Not Applicable	2	5%
Neutral	1	2.5%
Disagree	0	0%
Strongly Disagree	0	0%
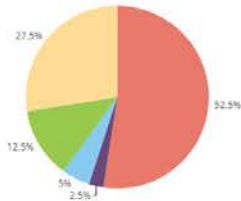
Likert Scale

AMSI-MSRI school was of a high standard

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	21	77.5%
Agree	8	20%
Neutral	1	2.5%
Disagree	0	0%
Strongly Disagree	0	0%
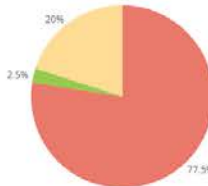
Likert Scale

The school was well organised

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	28	70%
Agree	12	30%
Disagree	0	0%
Neutral	0	0%
Strongly Disagree	0	0%
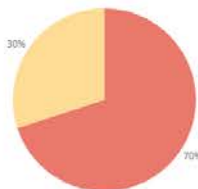
Likert Scale

I believe the AMSI-MSRI school is value for money

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	30	75%
Agree	10	25%
Disagree	0	0%
Neutral	0	0%
Strongly Disagree	0	0%
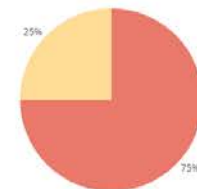
Likert Scale

I would recommend this school to friends/colleagues

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	28	70%
Agree	9	22.5%
Neutral	3	7.5%
Disagree	0	0%
Strongly Disagree	0	0%

Communication with school organisers was timely and clear

CHOICE	RESPONSES	PERCENTAGE
Strongly Agree	26	65%
Agree	12	30%
Disagree	2	5%
Neutral	0	0%
Strongly Disagree	0	0%

I attended an event hub in:

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
Hilo, Hawaii	21	52.5%
Brisbane, Australia	19	47.5%

47.5% 52.5%
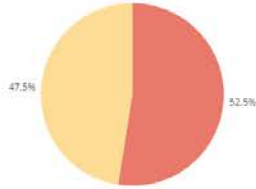
I found MSRI staff were approachable and helpful

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Strongly Agree	17	42.5%
Agree	3	7.5%
Neutral	1	2.5%
Disagree	0	0%
Strongly Disagree	0	0%

42.5% 47.5% 7.5% 2.5%
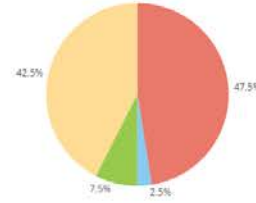
Facilities at The University of Hawaii, Hilo were conducive for this program

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Agree	10	25%
Strongly Agree	10	25%
Disagree	1	2.5%
Neutral	0	0%
Strongly Disagree	0	0%

25% 47.5% 25% 2.5%
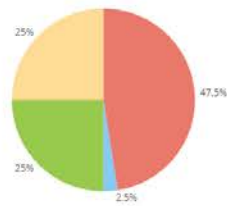
Your accommodation was satisfactory

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Agree	10	25%
Strongly Agree	8	20%
Neutral	3	7.5%
Disagree	0	0%
Strongly Disagree	0	0%

25% 47.5% 20% 7.5%
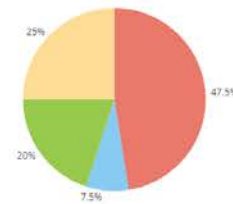
Food provided at the college was satisfactory

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Strongly Agree	16	40%
Agree	4	10%
Neutral	1	2.5%
Disagree	0	0%
Strongly Disagree	0	0%

40% 47.5% 10% 2.5%
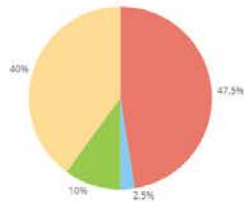
Food provided by MSRI was satisfactory

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	19	47.5%
Strongly Agree	10	25%
Neutral	6	15%
Agree	4	10%
Disagree	1	2.5%
Strongly Disagree	0	0%

25% 47.5% 15% 10% 2.5%
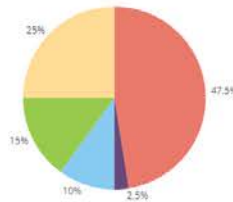
I found AMSI and UQ staff approachable and helpful

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	21	52.5%
Strongly Agree	17	42.5%
Agree	2	5%
Disagree	0	0%
Neutral	0	0%
Strongly Disagree	0	0%

42.5% 52.5% 5%
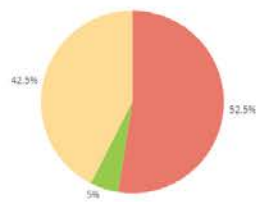
Facilities at The University of Queensland were conducive for this program

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
(no answer)	21	52.5%
Strongly Agree	13	32.5%
Agree	6	15%
Disagree	0	0%
Neutral	0	0%
Strongly Disagree	0	0%

32.5% 52.5% 15%
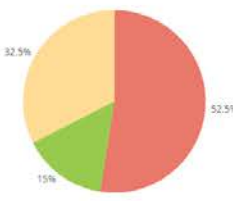
Food provided by AMSI and UQ was satisfactory

Download as... ▾

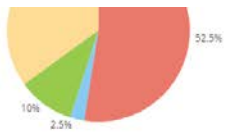| CHOICE	RESPONSES	PERCENTAGE
(no answer)	21	52.5%
Strongly Agree	14	35%
Agree	4	10%
Neutral	1	2.5%
Disagree	0	0%

35%

897
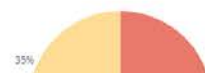
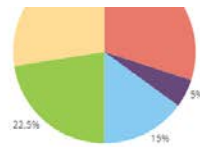## On a scale of 1 to 10, where 1 was poor, and 10 is excellent, how would you rate your overall experience at the...

Download as... ▾

CHOICE	RESPONSES	PERCENTAGE
10 - Excellent	12	30%
8	11	27.5%
9	9	22.5%
7 - Above Average	6	15%

27.5% 30%

Strongly Disagree 0 0%

■ 6	2	5%
1 - Poor	0	0%
2	0	0%
3	0	0%
4 - Below Average	0	0%
5	0	0%

What is your main reason for attending this event?

Download as... ▾
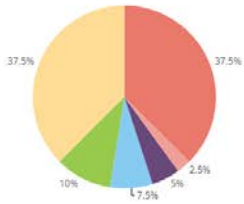
CHOICE	RESPONSES	PERCENTAGE
■ Broaden my knowledge	15	37.5%
■ The program relates to my re...	15	37.5%
■ Network and socialise	4	10%
■ To learn from particular pro...	3	7.5%
■ Help my career prospects	2	5%
■ Other	1	2.5%

What event format do you prefer

Download as... ▾
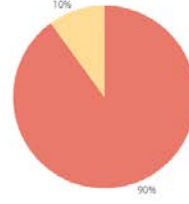
CHOICE	RESPONSES	PERCENTAGE
■ In person (on campus at the ...	36	90%
■ Hybrid (with local hubs)	4	10%
Other	0	0%
Virtual event	0	0%

AMSI would like to use testimonials for promotional purposes for future events. Are you happy for us to attribute...

Download as... ▾
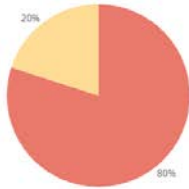
CHOICE	RESPONSES	PERCENTAGE
■ Yes	32	80%
■ No	8	20%

Algebraic Theory of Differential and Difference Equations, Model Theory and their Applications

July 04, 2022 – July 15, 2022

St. Mary's College, Moraga, CA

Organizers:

Alexey Ovchinnikov (Queens College, CUNY)

Anand Pillay (University of Notre Dame)

Thomas Scanlon (University of California, Berkeley)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Algebraic Theory of Differential and Difference Equations, Model Theory and their Applications"
July 4 – 15, 2022

Organizers

- Alexey Ovchinnikov (Queens College, CUNY)
- Anand Pillay (University of Notre Dame)
- Thomas Scanlon (University of California, Berkeley)

Description

The purpose of the summer school was to introduce graduate students to effective methods in algebraic theories of differential and difference equations with emphasis on their model-theoretic foundations and to demonstrate recent applications of these techniques to studying dynamic models arising in sciences. While these topics comprise a coherent and rich subject, they appear in graduate coursework in at best a piecemeal way, and then only as components of classes for other aims. In this Summer Graduate School, students learned both the theoretical basis of differential and difference algebra and how to use these methods to solve practical problems. Beyond the lectures, the graduate students met daily in problem sessions and participated in one-on-one mentoring sessions with the lecturers and organizers.

Highlights of the School

An interactive presentation style dominated at the lectures and problem sessions. The students contributed to the material development, which included coming up with interesting motivating examples, definitions, and conjectures.

Initially, some members of the audience were surprised by the format of the "lectures" in that the students were not necessarily fed definitions, theorems, and proofs, but were directed to produce those themselves by answering questions. This format led to lively, and often loud, discussions amongst the students. Over time, even the skeptical participants were converted.

The lectures ended with an open problem session, in which the students suggested potential multiple lines of attack. At the end of the school, several students said that they appreciated the particular approach of the school, and some of them will likely use the approach in their academic work.

There were two main threads in the lectures, one was about parameter identifiability, with many examples and exercises for the participants, to motivate the talks. The other thread was about differential algebra and model theory, which began also with many examples and exercises but ended in a more theoretical way with an attempt to give a rigorous explanation of how model theoretic methods can be applied to obtain multi-experiment identifiability, with explicit bounds on the number of experiments.

Exercise sessions took place every day. Formally, the exercise sections were run by the assistants. In practice, the distinction between the lectures and the exercise sections was blurred with the exercises worked in the afternoon sessions coming as extensions of ideas raised in the morning lectures. The senior lecturers and organizers joined the exercise sections to discuss with the students as they completed the exercises.   Where appropriate, the exercise sections included computational components in which the students were guided through coding techniques to implement the algorithms taught in the main lectures.

The student participants came from diverse backgrounds: some from applied mathematics, some from logic, some from number theory, some from computer science. Those students who had specialized in pure mathematics were shown how to carry out actual machine computations; those students specializing in applications learned to put their methods on rigorous foundations. There was a high level of enthusiasm and engagement with the material and we hope that we were able to get across the connections between modelling and model theory.

This was the first summer graduate school hosted in partnership with Saint Mary's College of California, some 12 miles from Berkeley. The bucolic setting of Saint Mary's campus enabled tightly-knit collaboration between lecturers, TAs, and students, and made their experiences especially fruitful, signaling an exceptional future for these collaborations.

There were minor hiccups with respect to the IT equipment and some of the room and board logistics; these were resolved in short order and the school concluded without incident.

This partnership – which continued with two other summer graduate schools hosted at St. Mary's College in summer 2022 – proved to be resounding success which we look forward to repeating in years to come.

Organizers		
First Name	**Last Name**	**Institution**
Alexey	Ovchinnikov	Queens College, CUNY
Anand	Pillay	University of Notre Dame
Thomas	Scanlon	University of California, Berkeley
Speakers		
First Name	**Last Name**	**Institution**
James	Freitag	University of Illinois at Chicago
Nicolette	Meshkat	Santa Clara University
Alexey	Ovchinnikov	Queens College, CUNY
Anand	Pillay	University of Notre Dame
Teaching Assistants		
First Name	**Last Name**	**Institution**
Jessica	Conrad	University of Michigan
Sebastian	Eterovic	University of California, Berkeley
Aleksandra	Sobieska	University of Wisconsin

Mathematical Sciences Research Institute

Algebraic Theory of Differential and Difference Equations, Model Theory and their Applications

July 04, 2022 - July 15, 2022

Monday, July 04, 2022		
8:45 AM - 10:30 AM		5 Minute Student Presentations
10:30 AM - 10:45 AM		Break
10:45 AM - 12:30 PM		5 Minute Student Presentations
12:30 PM - 2:00 PM		Lunch
2:00 PM - 3:30 PM		One-on-One Meetings (Students with Lecturers/Organizers/TAs)
3:30 PM - 4:00 PM		Break
4:00 PM - 5:00 PM		One-on-One Meetings (Students with Lecturers/Organizers/TAs)

Tuesday, July 05, 2022		
8:30 AM - 8:45 AM		Introduction to MSRI
9:00 AM - 10:15 AM	Alexey Ovchinnikov	Lecture I
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	James Freitag	Lecture II
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Ola Sobieska	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Sebastian Eterovic	Discussion for Lecture

Wednesday, July 06, 2022		
8:45 AM - 9:35 AM	Alexey Ovchinnikov	Lecture III
9:35 AM - 9:45 AM		Break
9:45 AM - 10:35 AM	James Freitag	Lecture IV
10:35 AM - 10:45 AM		Break
10:45 AM - 12:30 PM	Sebastian Eterovic	Discussion for Lecture
12:30 PM - 2:00 PM		Lunch
2:00 PM - 3:15 PM		Informal Discussion
3:15 PM - 3:45 PM		Break
3:45 PM - 5:00 PM		Informal Discussion

Thursday, July 07, 2022		
9:00 AM - 10:15 AM	Nicolette Meshkat	Lecture V
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	James Freitag	Lecture VI
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Ola Sobieska	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Sebastian Eterovic	Discussion for Lecture

Friday, July 08, 2022		
9:00 AM - 10:15 AM	Nicolette Meshkat	Lecture VII
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	James Freitag	Lecture VIII
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Ola Sobieska	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Sebastian Eterovic	Discussion for Lecture

Monday, July 11, 2022

9:00 AM - 10:15 AM	Alexey Ovchinnikov	Lecture IX
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Anand Pillay	Lecture X
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Nicolette Meshkat	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Sebastian Eterovic	Discussion for Lecture

Tuesday, July 12, 2022

9:00 AM - 10:15 AM	Anand Pillay	Lecture XI
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Nicolette Meshkat	Lecture XII
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Sebastian Eterovic	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Jessica Conrad	Discussion for Lecture

Wednesday, July 13, 2022

8:45 AM - 9:35 AM	Alexey Ovchinnikov	Lecture XIII
9:35 AM - 9:45 AM		Break
9:45 AM - 10:35 AM	Anand Pillay	Lecture XIV
10:35 AM - 10:45 AM		Break
10:45 AM - 12:30 PM	Sebastian Eterovic	Discussion for Lecture
12:30 PM - 2:00 PM		Lunch
2:00 PM - 3:15 PM		Informal Discussion
3:15 PM - 3:45 PM		Break
3:45 PM - 5:00 PM		Informal Discussion

Thursday, July 14, 2022

9:00 AM - 10:15 AM	Anand Pillay	Lecture XV
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Nicolette Meshkat	Lecture XVI
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Sebastian Eterovic	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Jessica Conrad	Discussion for Lecture

Friday, July 15, 2022

9:00 AM - 10:15 AM	Anand Pillay	Lecture XVII
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Nicolette Meshkat	Lecture XVIII
12:00 PM - 1:30 PM		Lunch
1:30 PM - 3:00 PM	Sebastian Eterovic	Discussion for Lecture
3:00 PM - 3:30 PM		Break
3:30 PM - 5:00 PM	Jessica Conrad	Discussion for Lecture

Officially Registered Student Information

Students		26

Gender		26
Male	65.38%	17
Female	19.23%	5
Other	3.85%	1
Declined to state	11.54%	3

Ethnicity*		32
White	53.13%	17
Asian	9.38%	3
Hispanic	9.38%	3
Pacific Islander	0.00%	0
Black	9.38%	3
Native American	0.00%	0
Mixed	9.38%	3
Declined to state	9.38%	3

* ethnicity specifications are not exclusive

Q1 The various topics within the summer school integrated into a coherent picture

Answered: 19   Skipped: 0
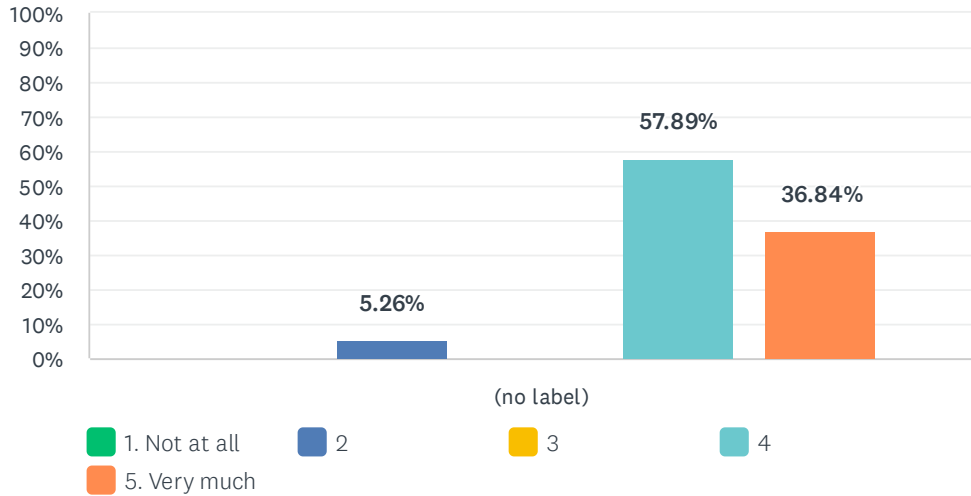
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.26% 1	0.00% 0	57.89% 11	36.84% 7	19	4.26

Q2 The faculty speakers were generally clear and well organized in their presentation

Answered: 19   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	21.05% 4	42.11% 8	36.84% 7	19	4.16

Q3 The teaching assistants were helpful

Answered: 19   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.53% 2	26.32% 5	63.16% 12	19	4.53

#	PLEASE PROVIDE SOME COMMENTS ON THE TAS.	DATE
1	Without the TAs, the summer school would have been much more scattered and difficult to follow. The TAs provided a chance to really stitch the topics and lectures together.	7/23/2022 10:15 PM
2	All three were very prepared and organized, with clear goals of what they wanted students to get out of each discussion.	7/19/2022 12:33 PM
3	Sebastian has a good knowledge of the topics and the interactive sessions were very engaging, educative and enlightening.	7/19/2022 9:44 AM

Q4 The school was intellectually stimulating

Answered: 19   Skipped: 0
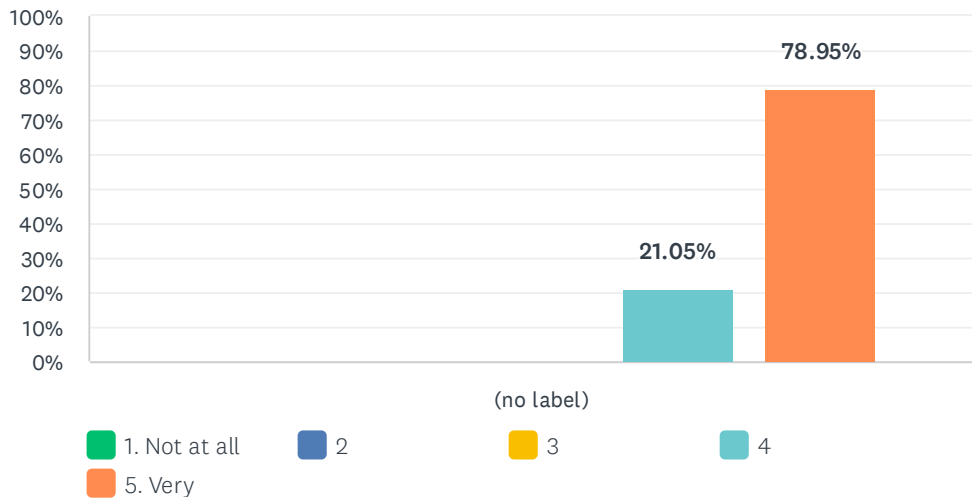
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	21.05% 4	78.95% 15	19	4.79

Q5 The discussion sessions were productive

Answered: 19   Skipped: 0
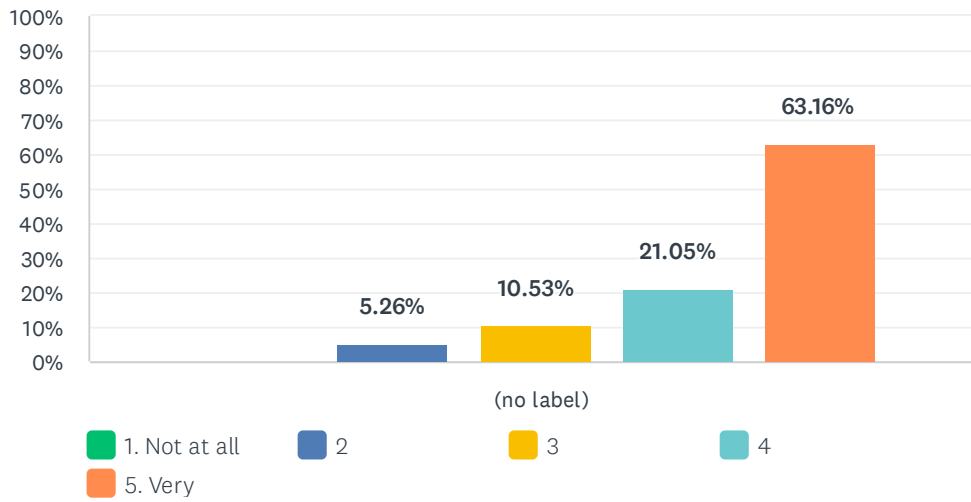
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.26% 1	10.53% 2	21.05% 4	63.16% 12	19	4.42

Q6 The amount of material presented was

Answered: 19   Skipped: 0
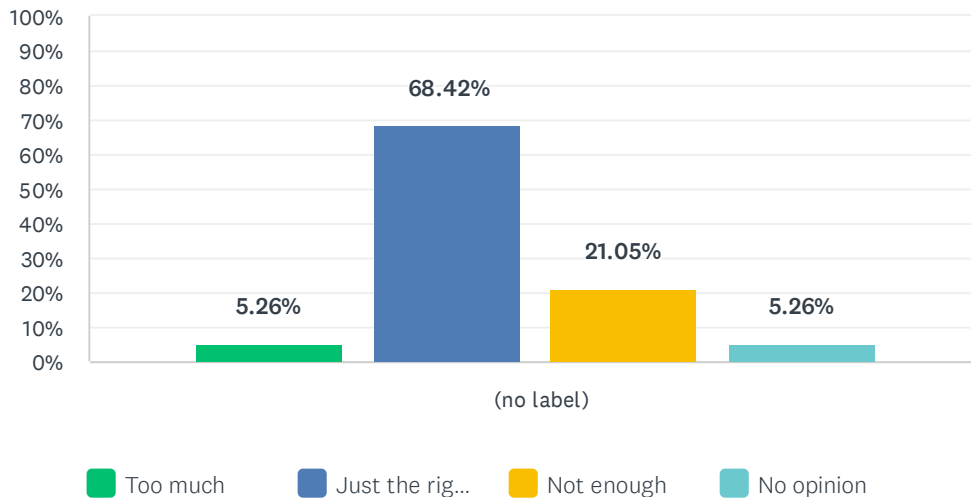
	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	68.42% 13	21.05% 4	5.26% 1	19	2.26

Q7 Additional comments on the topic presentation and organization

Answered: 4   Skipped: 15

| #	RESPONSES	DATE
1	I wish there was more mathematical biology emphasis in the material, and more application of the pure mathematics content to applied modelling. I realise that because of Covid one of the math bio speakers couldn't attend, which unfortunately was the content I was most interested in! I would have liked more time to do the applied maths/coding workshops, as that was most useful to me.	7/24/2022 9:07 PM
2	Some lectures had very noticeably much better prepared than others and it really helped or hurt how difficult it was to learn their respective topics. Also some of the lectures were in my opinion hindered by not assuming a more uniform knowledge background in line with the readings. I am not saying I expected everyone to do all the readings perfectly but there probably was opportunity to have a more uniform expectation about what readings we actually were supposed to do in order to have greater common ground.	7/23/2022 10:15 PM
3	All of the topics covered were done thoroughly and thoughtfully. However, it seems like some additional correspondence between the lecturers would have been helpful as there were several points were one lecturer disagreed with how another presented some of the information. This sometimes caused the lecturer to go off on a tangent or have to go much more in depth than they had planned, preventing them from covering all that they had hope (at least, that was my perception). This wasn't much of an issue as it gave me time to digest what was being covered, but I wanted to mention it in case it helps with organization next time.	7/20/2022 1:57 PM
4	I would have appreciated moving a little faster in the first week so we could see more detail toward the end of the school.	7/19/2022 12:33 PM

Q8 I was well prepared to benefit from the school

Answered: 19   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.26% 1	26.32% 5	31.58% 6	36.84% 7	19	4.00

Q9 My interest in the subject matter was increased by the school

Answered: 19   Skipped: 0
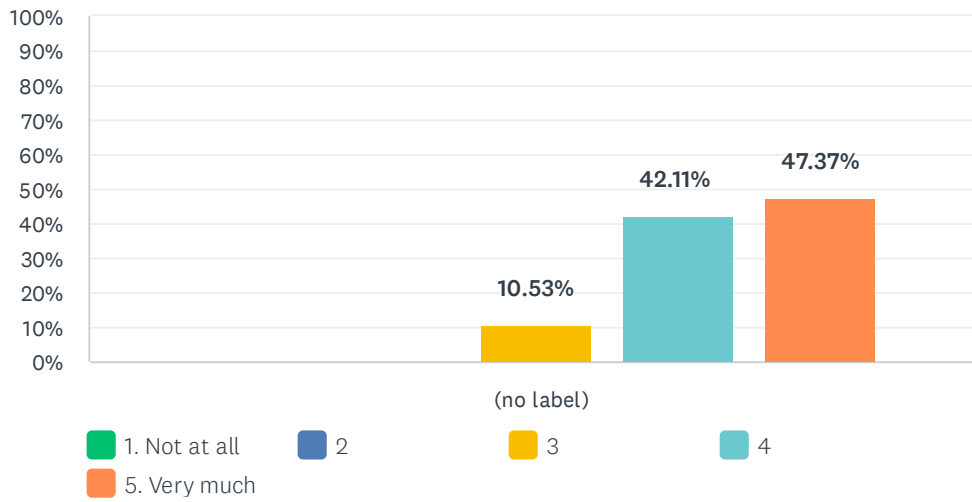
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.53% 2	42.11% 8	47.37% 9	19	4.37

Q10 The school helped me meet people with similar scientific interests

Answered: 19   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	42.11% 8	52.63% 10	19	4.47

Q11 It is likely that I will work in the area of the school subject in the future

Answered: 19   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	31.58% 6	26.32% 5	26.32% 5	15.79% 3	19	3.26

Q12 How would you evaluate your interaction with other participants?

Answered: 19   Skipped: 0
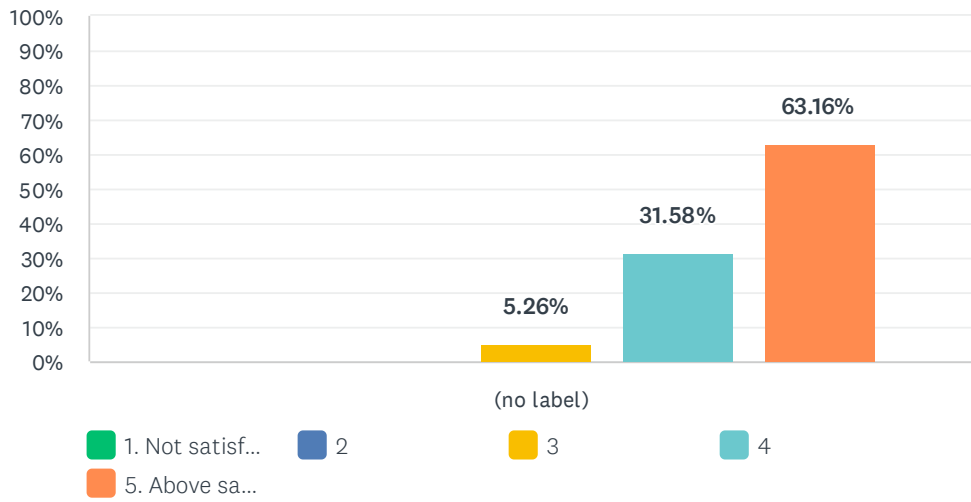
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	31.58% 6	63.16% 12	19	4.58

Q13 Additional comments on personal assessment

Answered: 3   Skipped: 16

| #	RESPONSES	DATE
1	It was great fun and really interesting content, even if it wasn't so relevant to my research. There are some new things I want to try however!	7/24/2022 9:09 PM
2	I personally intended to not necessarily become a differential algebraist or anything but to get more exposure in ideas close to my main interest in model theory. While I am not sure I will work on explicitly the things I learned in the summer school it was certainly invaluable to meet model theorists and to gain diverse exposure to math I otherwise never would have learned.	7/23/2022 10:17 PM
3	The two Wednesdays during the school were a great opportunity to converse with other individuals in the school about topics related to the school or their research interests. I am hoping that this school leads to some collaboration in the future as the topics covered were closely related to my work in disease modeling.	7/20/2022 2:01 PM

MSRI 933 SGS: Algebraic Theory Of Differential And Difference Equations, Model Theory And Their Applications - Participant Survey

Q14 I found the MSRI staff helpful

Answered: 19   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	31.58% 6	57.89% 11	5.26% 1	19	4.56

Q15 The St. Mary's facilities were conducive for such a school

Answered: 19   Skipped: 0
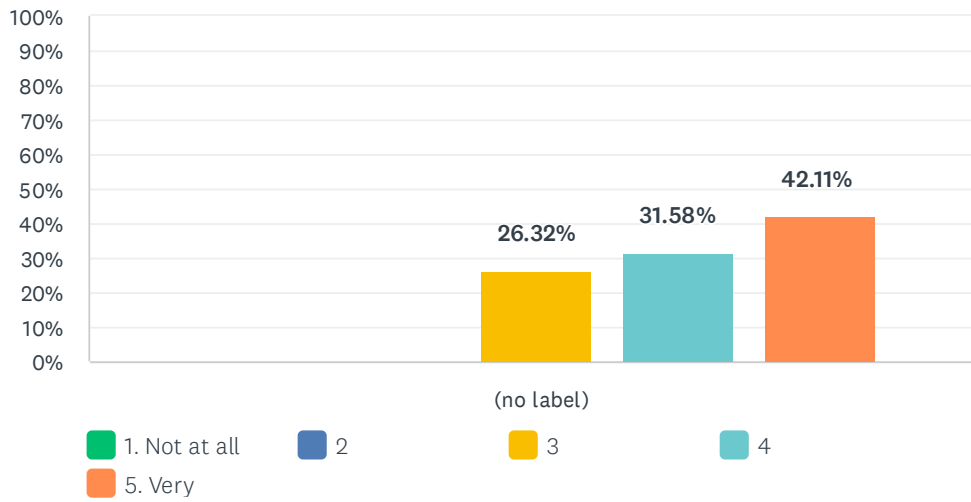
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	26.32% 5	31.58% 6	42.11% 8	19	4.16

Q16 The St. Mary's computer facilities were adequate for such a school

Answered: 19   Skipped: 0
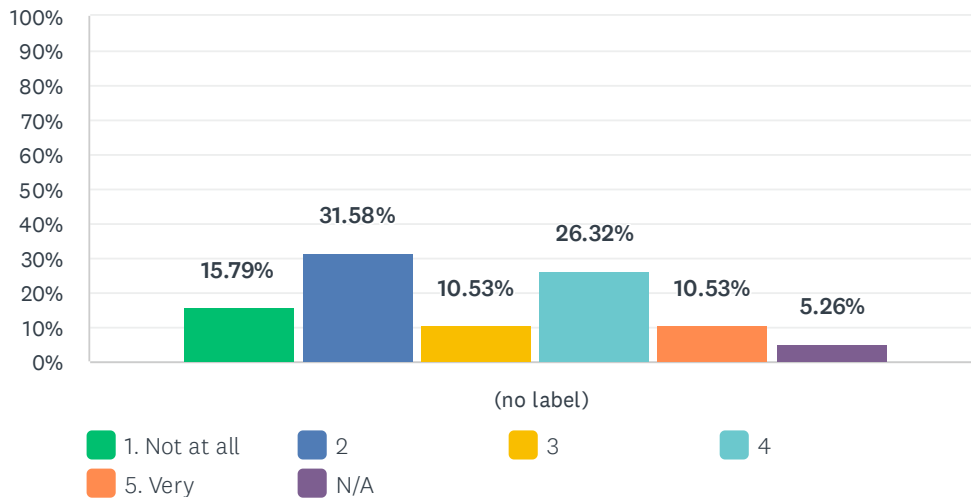
	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	15.79% 3	31.58% 6	10.53% 2	26.32% 5	10.53% 2	5.26% 1	19	2.83

Q17 Additional comments on the St. Mary's venue

Answered: 7   Skipped: 12

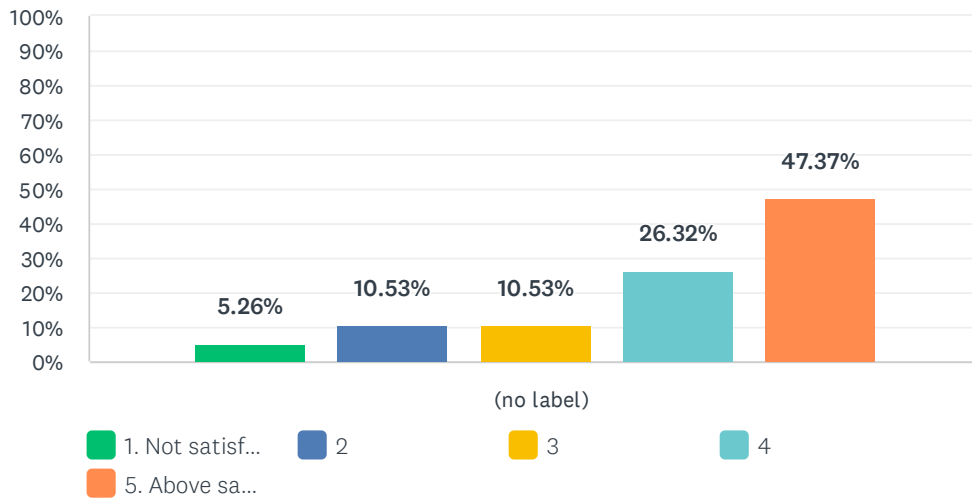| #	RESPONSES	DATE
1	The food caused me an upset stomach throughout the entire 2-week stay. Instead of eating at the cafeteria, maybe a food stipend to get groceries would've been better for my health.	7/31/2022 11:28 AM
2	I used my own laptop for all the coding	7/24/2022 9:10 PM
3	The St Mary's computer facilities were basically non existent or so slow to be almost unusable so I along with pretty much everyone else just used our own computers.	7/23/2022 10:22 PM
4	It would have been easier to use a room with blackboards instead of the digital boards. They take some time to get used to and at the summer school, time is valuable.	7/22/2022 9:54 PM
5	We were told that we would receive a PCR (covid-19) test on the second Thursday, but no one ever came to provide/collect them. Additionally, it seems like the lecturers at the beginning of the school did not have much contact with anyone at MSRI or St. Mary's as they were uncertain on a few things (printing, coffee, etc..). The computers in the St. Mary's lab were terribly slow and difficult to use. We had to rely on sharing our laptops after trying to use them twice.	7/20/2022 2:15 PM
6	I liked that St. Mary's was somewhat isolated, so that people mostly stayed on campus and spent time together. The location was very pretty and peaceful.	7/19/2022 12:34 PM
7	computers are very slow	7/19/2022 9:47 AM

Q18 How did you find the summer school accommodations?

Answered: 19   Skipped: 0
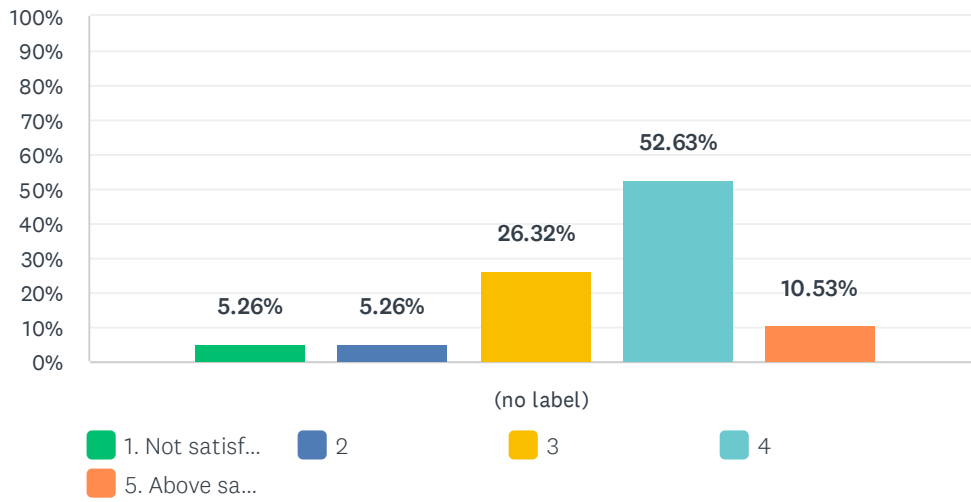
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	5.26% 1	26.32% 5	52.63% 10	10.53% 2	19	3.58

Q19 How did you find the food provided at St. Mary's?

Answered: 19   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	10.53% 2	10.53% 2	26.32% 5	47.37% 9	19	4.00

925

Q20 Additional comments on accommodation and food

Answered: 5   Skipped: 14

#	RESPONSES	DATE
1	I thought the food was excellent, even if vegetarian options were at times lacking. The fact we had to pay an extra fee to use the gym seemed a little unneeded but if it was unavoidable, I understand. Additionally, I think the rooms and dorms were fine but better linen and toiletry accommodations such as more than 1 meager blanket or pillow and not having to buy our own hand soap would be nice.	7/23/2022 10:24 PM
2	The dining hall was also used simultaneously by other groups on campus, and sharing that space with an estimated 150 teenagers from a summer camp activity isn't ideal from a pandemic point of view.	7/22/2022 9:55 PM
3	The bedding (blankets) provided was not sufficient for how cold the rooms became at night. Additionally, the bed that I was sleeping on had the pointy edge of a spring poking right through the middle of the bed when I laid down. We also did not receive any utensils/cups/containers for our two week stay until they were provided by MSRI. The food provided was great, but it would have been nice to not have to walk 30 minutes to the store and back to pick up essentials like soap.	7/20/2022 2:18 PM
4	I liked the townhouse-style dorm (though beds were very hard). The dining hall workers were very friendly and helpful.	7/19/2022 12:34 PM
5	The thermostat did not seem to be work	7/19/2022 12:14 PM

Q21 The overall experience of the school was worthwhile

Answered: 19   Skipped: 0
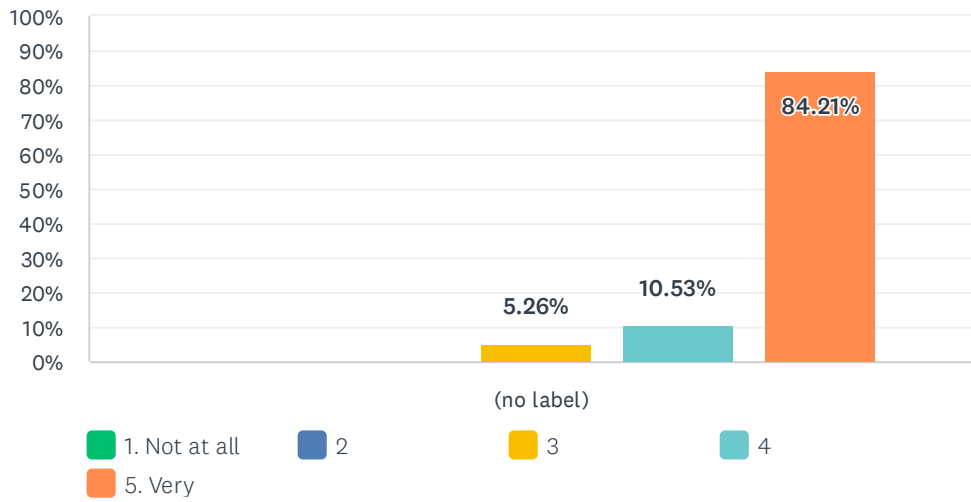
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	10.53% 2	84.21% 16	19	4.79

Q22 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 4   Skipped: 15

#	RESPONSES	DATE
1	Better integration of the different topics. It felt like two parallel topics with some overlap in the middle, but otherwise not relevant to each other's work. The balance felt skewed towards pure mathematics more than I would have liked.	7/24/2022 9:11 PM
2	I think encouraging lecturers to prepare more and perhaps provide notes or just some form of outline along with their lectures would make keeping up with the material much easier. The quality of lectures was all over the place and it was not clear that the lecturers were coordinating their lectures well, in particular during the second half.	7/23/2022 10:26 PM
3	It was colder than i expected (and in part packed for), especially with the windows being open in the lecture room in the morning which were rather cool. Maybe mentioning that explicitly helps people.	7/22/2022 9:58 PM
4	Even though St. Mary's itself did not feel particularly accommodating, the content covered and the lecturers/attendees made it an amazing experience.	7/20/2022 2:20 PM

Random Graphs

July 05, 2022 – July 15, 2022

MSRI, Berkeley, CA

Organizers:

Louigi Addario-Berry (McGill University)

Remco van der Hofstad (Technische Universiteit Eindhoven)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Random Graphs"
July 4 – 15, 2022

Organizers

- Louigi Addario-Berry (McGill University)
- Remco van der Hofstad (Technische Universiteit Eindhoven))

Description

The topic of random graphs is at the forefront of applied probability, and it is one of the central topics in multidisciplinary science where mathematical ideas are used to model and understand the real world. At the same time, random graphs pose challenging mathematical problems that have attracted the attention from probabilists and combinatorialists since the 1960, with the pioneering work of Erdös and Rényi. Around the turn of the millennium, very large data sets started to become available, and several applied disciplines started to realize that many real-world networks, even though they are from various origins, share many fascinating features. In particular, many of such networks are small worlds, meaning that graph distances in them are typically quite small, and they are scalefree, in the sense that there are enormous differences in the number of connections that their elements make. In particular, such networks are quite different from the classical random graph models, such as proposed by Erdös and Rényi.

Highlights of the School

History and content school: The school was organized by Louigi Addario-Berry and Remco van der Hofstad, who put together a joint lecture plan that started at the basics, but also covered more advanced topics. Together with the teaching assistants, Laura Eslava and Serte Donderwinkel, an exciting set of questions and tutorial problems was designed, aimed at helping the students to actively learn the material. The lectures were aimed to be highly interactive, which worked well with the catch box and the many questions that the students, who were very much engaged, posed.

The school started with a serious setback, when it became clear that Louigi would not be able to join us due to health problems. This was an enormous disappointment. However, Laura and Serte, together with Remco, quickly first assigned back-up lecturers, and then took over Louigi's lectures in equals shares.

The students seemed to enjoy the summer school, and it was very stimulating to lecture for them. Below, we give some quotes of the students from the survey at the end of the school.

``The school was very well structured. Lectures and tutorials worked together beautiful to introduce and develop the engaging material.''

``Remco, Laura and Serte were the driving force of the program, and we could feel their interest in our learning, their enthusiasm and passion for their work. I was interested in learning more about the topics thanks to them and fellow students''

``Remco's lectures were especially well-prepared and clear''

Discussion sessions: One cannot properly learn novel material without practicing a lot oneself. Thus, the tutorial sessions were crucial to keep the students engaged and reach a more mature level. Each lecture was accompanied by one tutorial. Every day, Serte and Laura would update the questions for the afternoon, based on the morning lectures. The questions started with very basic ones, but there were also quite challenging exercises. Most students made parts of these exercises, while some students really made the effort to make them all.

``The expertise and genuine interest of the instructors were obvious. Great care was clearly taken to prepare and present the material.''

``[…] working with different groups of people during the tutorials was important; each student brought a different perspective.´´

``Laura and Serte were very patient and accessible during the tutorials, offering insights and explanation to the problems when our groups got stuck. They also gave advice and information about the field and current research. They did amazingly with their lectures as well.''

Students: The students were very active, possibly excepting a few. Their background was very mixed, with some students even lacking sufficient background in probability theory (despite the stated prerequisites). They made up for this by working very hard, and this was highly rewarding for the lecturers. We tried to accommodate the mixed backgrounds by adding also more low-level questions in the tutorials, and this seemed to work well. The students worked in groups that we assigned on the first Tuesday, and reassigned on the next Monday. This made the group more coherent and social. We were very happy to read in the survey that the students felt welcome. Also, female students expressed their comfort in working with female peers and, at the last day of the school, they had the initiative to take a group photo of the women participants. Finally, through WhatsApp, some of the students formed a reading group that will continue to study random graphs, through the `Probabilistic Methods' book by Noga Alon and Joel Spencer. This is a wonderful follow-up on the Summer School that promises a continued effort from the students in this domain.

``The diversity in where the students were from, areas of interest and research, as well as years in the program created a wonderful dynamic. We had a decent size of women participants, which was nice to be in.''

``This group was very welcoming and interested in learning.''

``[…] My fellow students were always very helpful and willing to slow down to make sure everyone could have a moment to better understand the material.´´

``Would have been nicer to have more advanced/specialized students, but most were active and engaging in the tutorials and discussion.''

``As a probabilist, it was very interesting to meet people whose background was more in combinatorics and learn their perspective.´´

Organizers

First Name	Last Name	Institution
Louigi	Addario-Berry	McGill University
Remco	van der Hofstad	Technische Universiteit Eindhoven

Speakers

First Name	Last Name	Institution
Serte	Donderwinkel	University of Oxford
Laura	Eslava	UNAM - Universidad Nacional Autonoma de Mexico
Remco	van der Hofstad	Technische Universiteit Eindhoven

Teaching Assistants

First Name	Last Name	Institution
Serte	Donderwinkel	University of Oxford
Laura	Eslava	UNAM - Universidad Nacional Autonoma de Mexico

Mathematical Sciences Research Institute

Random Graphs

July 05, 2022 - July 15, 2022

Tuesday, July 05, 2022

8:45 AM - 9:00 AM		Introduction to MSRI
9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: Real-World Networks
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Serte Donderwinkel	Lecture: Introduction to the Erdös-Rényi Random Graph
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Wednesday, July 06, 2022

8:30 AM - 9:45 AM	Remco van der Hofstad	Lecture: Branching Process Preliminaries
9:45 AM - 10:15 AM		Break
10:15 AM - 11:30 AM	Remco van der Hofstad	Lecture: Local Convergence of Deterministic and Random Graphs
11:30 AM - 02:00 PM		Barbecue
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Thursday, July 07, 2022

9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: Configuration Model, Inhomogeneous Random Graphs
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Remco van der Hofstad	Lecture: Graphs with Inhomogeneities Countinued
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Friday, July 08, 2022

9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: Consequences of Local Convergence
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Eslava	Lecture: Sub- and Supercritical Erdös-Rényi Random Graphs
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Monday, July 11, 2022

9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: The Giant in Random Graphs is Almost Local
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Eslava	Lecture: Preferential Attachment Models Pt I
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Tuesday, July 12, 2022

9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: The Giant in the Configuration Model
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Eslava	Lecture: Preferential Attachment Models Pt II
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Wednesday, July 13, 2022

9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: Small-World Nature of Random Graphs
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Remco van der Hofstad	Lecture: Percolation on Power-Law Random Graphs
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Thursday, July 14, 2022

9:00 AM - 10:15 AM	Serte Donderwinkel	Lecture: "Critical Erdös-Rényi Random Graphs 1: Component Sizes"
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Remco van der Hofstad	Lecture: Critical Percolation on Power-Law Random Graphs
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2

Friday, July 15, 2022

9:00 AM - 10:15 AM	Remco van der Hofstad	Lecture: Related Random Graph Models
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Serte Donderwinkel	Lecture: "Critical Erdös-Rényi Random Graphs 2: Component Structure"
12:00 PM - 02:00 PM		Lunch
2:00 PM - 3:00 PM		Discussion Session 1
3:00 PM - 3:30 PM		Afternoon Tea
3:30 PM - 4:30 PM		Discussion Session 2
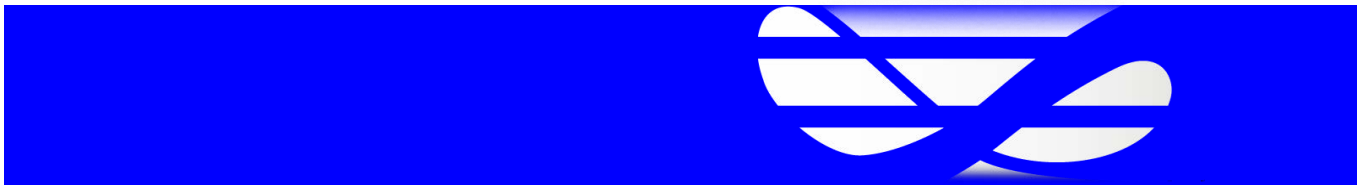
Officially Registered Student Information

Students		43

Gender		43
Male	60.47%	26
Female	37.21%	16
Other	0.00%	0
Declined to state	2.33%	1

Ethnicity*		47
White	46.81%	22
Asian	29.79%	14
Hispanic	8.51%	4
Pacific Islander	0.00%	0
Black	4.26%	2
Native American	0.00%	0
Mixed	4.26%	2
Declined to state	6.38%	3

* ethnicity specifications are not exclusive

40 responses out of 43 students is 93% response rate

Q1 The various topics within the summer school integrated into a coherent picture

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.00% 2	10.00% 4	85.00% 34	40	4.80

#	COMMENTS	DATE
1	And effort was made from the beginning to making us, the students, see the big picture of the topics we were covering.	7/23/2022 1:30 PM
2	The school was very well structured. Lectures and tutorials worked together beautiful to introduce and develop the engaging material.	7/15/2022 2:43 PM

Q2 The faculty speakers were generally clear and well organized in their presentation

Answered: 40   Skipped: 0

Legend:
- 1. Not at all
- 2
- 3
- 4
- 5. Very much

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.50% 1	7.50% 3	90.00% 36	40	4.88

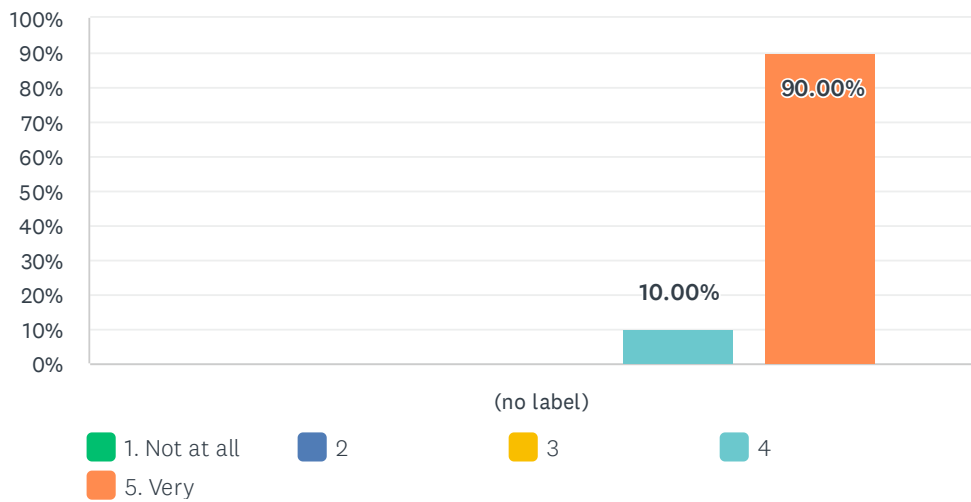| #	COMMENTS	DATE
1	I liked the detailed proofs of the main important results	7/24/2022 11:12 PM
2	Remco, Laura and Serte did a great job. The planing of the materials to be covered by Remco was fantastic. He is a fantastic lecturer and I hope he can lead more schools like this in the future.	7/23/2022 1:30 PM
3	Remco's lectures were especially well-prepared and clear.	7/18/2022 11:38 AM
4	The expertise and genuine interest of the instructors were obvious. Great care was clearly taken to prepare and present the material.	7/15/2022 2:43 PM
5	Would have been better with Louigi teaching, but the TAs filled the role well!	7/15/2022 2:39 PM
6	The lectures were amazing!	7/15/2022 2:36 PM

Q3 The Teaching Assistants were helpful

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.00% 2	10.00% 4	85.00% 34	40	4.80

#	COMMENTS	DATE
1	They were always happily willing to help and just to chat	7/24/2022 11:12 PM
2	Both Laura and Serte were extremely helpful with all the students during the exercise sessions.	7/23/2022 1:30 PM
3	Laura and Serte were very patient and accessible during the tutorials, offering insights and explanation to the problems when our groups got stuck. They also gave advice and information about the field and current research. They did amazingly with their lectures as well.	7/17/2022 7:15 PM
4	Without question the school could not have been to the standard which it archived without the amazing work of the TAs.	7/15/2022 2:43 PM

Q4 The school was intellectually stimulating

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	10.00% 4	90.00% 36	40	4.90

#	COMMENTS	DATE
1	Very stimulating, the group of students, the setting at the MSRI and the Wada Apartments, and the social activities (hike to BBQ and fields medal awarding watch party)	7/24/2022 11:12 PM
2	Remco did a fantastic job in organizing the materials to be covered during the weeks of the summer school.	7/23/2022 1:30 PM
3	Even the parts of the material that I had seen a little bit before, I learned something new about and got much more comfortable working with.	7/18/2022 11:38 AM
4	Despite my relative lack of background I have learned a tremendous amount, while constantly be challenged with results and ideas I will be digesting in the months to come.	7/15/2022 2:43 PM

Q5 My fellow students were appropriately selected to make the event interesting.

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.00% 2	10.00% 4	85.00% 34	40	4.80

#	COMMENTS	DATE
1	Yes, there were students from both applied and more pure mathematics, and additionally concentrating on different mathematical branches	7/24/2022 11:12 PM
2	I engaged in a lot of meaningful discussions with my fellow students both inside and outside of the classroom. And more importantly, most of them were kind and friendly.	7/23/2022 1:30 PM
3	As a probabilist, it was very interesting to meet people whose backgroound was more in combinatorics and learn their perspective.	7/18/2022 11:38 AM
4	The diversity in where the students were from, areas of interest and research, as well as years in the program created a wonderful dynamics. We had a decent size of women participants, which was nice to be in.	7/17/2022 7:15 PM
5	This group was increasingly friendly and supportive.	7/15/2022 2:43 PM
6	Would have been nicer to have more advanced/specialized students, but most were active and engaging in the tutorials and discussion.	7/15/2022 2:39 PM

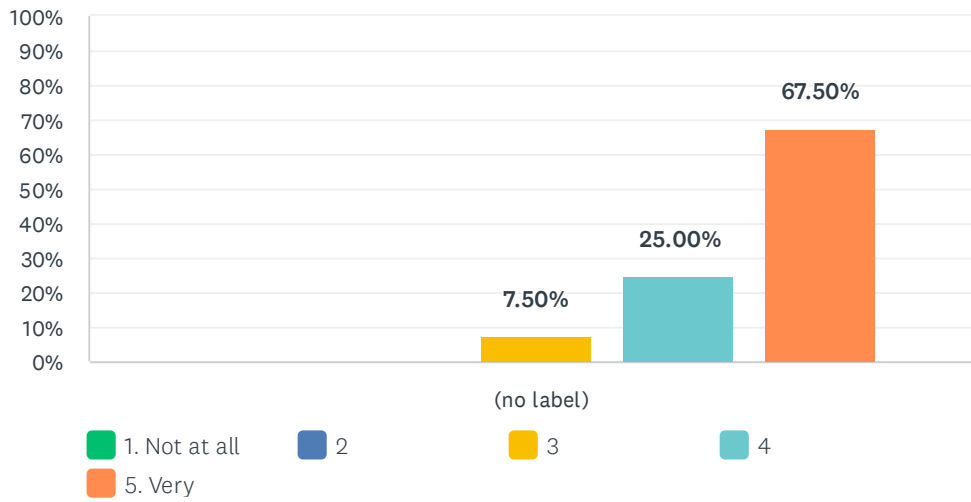# Q6 The overall experience of the school was worthwhile

Answered: 40   Skipped: 0
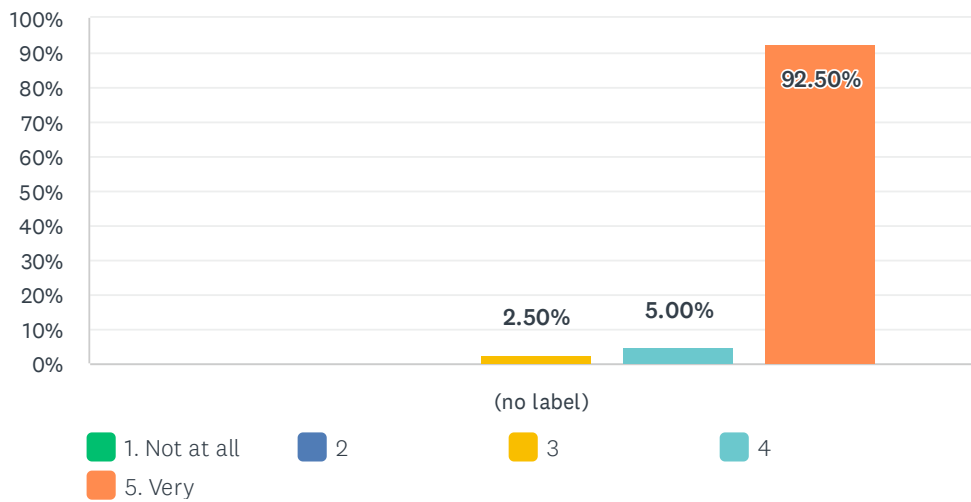
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.50% 1	5.00% 2	92.50% 37	40	4.90

#	COMMENTS	DATE
1	The fact that food and an accommodation was provided was excellent, even though double-occupancy rooms are not appropriate for adults anymore	7/24/2022 11:12 PM
2	MSRI really made an effort to integrate the students and making them feel comfortable, stimulated and integrated.	7/23/2022 1:30 PM
3	Remco, Laura and Serte were the driving force of the program, and we could feel their interest in our learning, their enthusiasm and passion for their work. I was interested in learning more about the topics thanks to them and fellow students	7/17/2022 7:15 PM
4	I am deeply thankful for the chance to have been here.	7/15/2022 2:43 PM

# Q7 The discussion sessions were productive

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.50% 3	25.00% 10	67.50% 27	40	4.60

#	COMMENTS	DATE
1	There were no official discussion sessions, but we chatted outside the lectures	7/24/2022 11:12 PM
2	The discussion sessions were very useful towards making me understand the material covered during the lectures in more detail.	7/23/2022 1:30 PM
3	learned much more from working in groups and participating in the discussion. Diversity in background and research areas provided everyone chances to contribute and built the discussion.	7/17/2022 7:15 PM

Q8 The amount of material presented was

Answered: 40   Skipped: 0
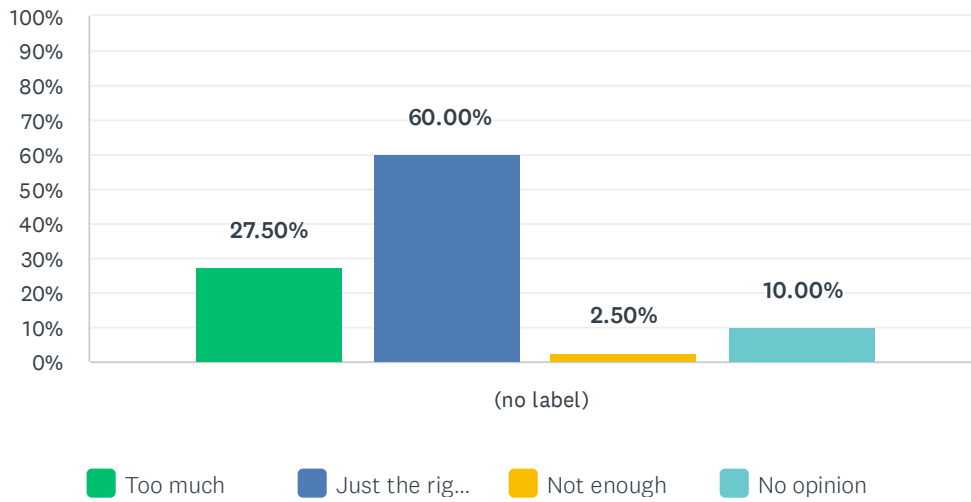
	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	27.50% 11	60.00% 24	2.50% 1	10.00% 4	40	1.95

#	COMMENTS	DATE
1	I enjoyed this experience.	7/26/2022 9:17 AM
2	Just the right amount, we can always consult the copied lecture notes after the workshop. The more the better/more resources for the future!	7/24/2022 11:12 PM
3	For me it struck the right balance of things I understood well and things I was happy with just understanding the vague idea.	7/15/2022 2:39 PM

Q9 Additional comments on the topic presentation and organization

Answered: 15   Skipped: 25

#	RESPONSES	DATE
1	Y'all are great!	7/26/2022 9:17 AM
2	The professor, Remco van der Hofstad, and the TAs/additional instructors, Laura Eslava and Serte Donderwinkel, were very happy to give any support and provided well-organized and on-point lectures. They were also great to be with and to talk to. Thank you!	7/24/2022 11:12 PM
3	I am very thankful to MSRI for this fantastic academical and personal experience. Everything was great and well planned.	7/23/2022 1:30 PM
4	Lunch was not the best. A simple catering service would have been better. Also, there was a serious safety issue of the trip to the Wednesday barbeque place.	7/22/2022 8:47 PM
5	The presentation and organization are so great! The Professor and TA carried whole lecture and this has been one of the most amazing summer graduate school ever!	7/22/2022 3:39 PM
6	The speakers and TAs were very good at cultivating an environment where people felt comfortable asking questions. Remco in particular was very patient and clear when answering clarifying questions.	7/18/2022 11:38 AM
7	The lectures were all very stimulating. Also, working with different groups of people during the tutorials was important; each student brought a different perspective.	7/18/2022 11:32 AM
8	Overall the summer school was very pleasant to be a part of, everything was organized seamlessly and the lectures were very enjoyable. My fellow students were always very helpful and willing to slow down to make sure everyone could have a moment to better understand the material.	7/17/2022 11:23 AM
9	Thank you MSRI staffs for offering this nicely organized, well-supported course with a bunch of wonderful fellow friends.	7/15/2022 6:22 PM
10	I really enjoyed the topics and I would love to contribute this field in the future.	7/15/2022 2:41 PM
11	Everything was great except for the hike. The trail was definitely not accessible to all bodies/fitness levels, and the destination wasn't even scenic. I would rather have just eaten on the decks at MSRI like usual. Everything else about the program was outstanding, and I am very glad I got the opportunity to participate!	7/15/2022 2:38 PM
12	I really enjoyed learning something outside my typical field of research	7/15/2022 2:38 PM
13	The summer school was a great experience. I throughly enjoyed the topics presented.	7/15/2022 2:36 PM
14	It was really great!	7/15/2022 2:35 PM
15	I think it would have been better to slow down a little bit at the end and cover things in more detail, but overall it was fantastic. Instructors were exceptional.	7/15/2022 2:34 PM

Q10 I was well prepared to benefit from the school

Answered: 40   Skipped: 0
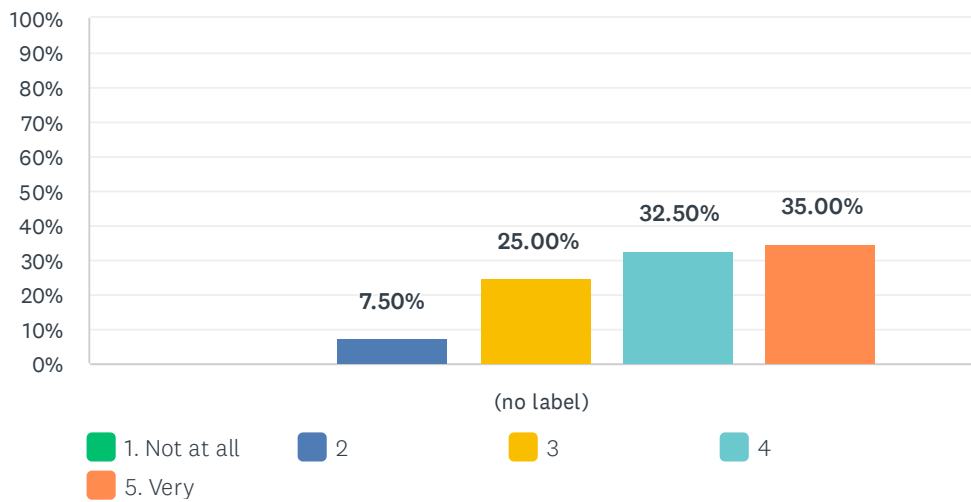
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	7.50% 3	25.00% 10	32.50% 13	35.00% 14	40	3.95

#	COMMENTS	DATE
1	Even though probability theory is not a main focus of my research, I was mostly prepared for the topics seen during the summer school, since I have taking related courses during my bachelors, masters and Phd programs.	7/23/2022 1:34 PM
2	I was ready to work hard and I gained a lot as a result.	7/15/2022 2:47 PM
3	The subject of the summer school aligns well with previous coursework I have completed as well as my research interests.	7/15/2022 2:34 PM

Q11 My previous knowledge was sufficient to follow the lectures and tutorials

Answered: 40   Skipped: 0
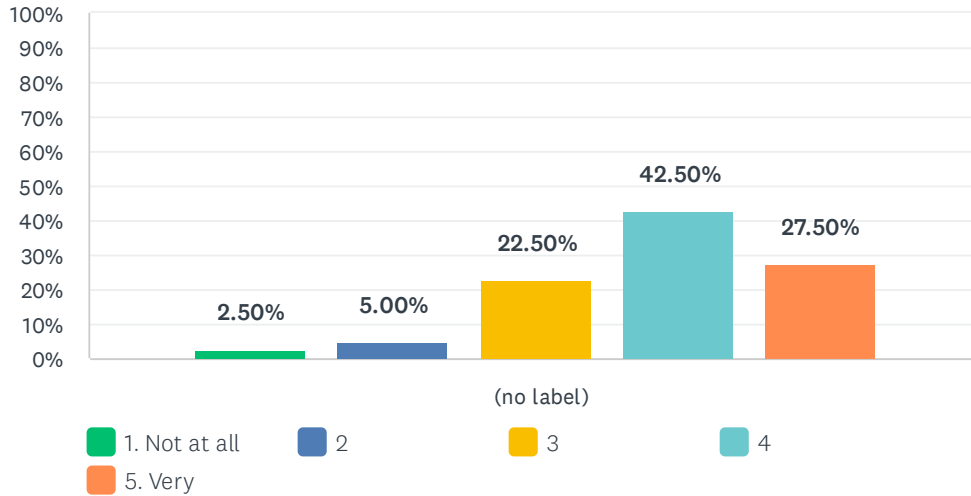
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	5.00% 2	22.50% 9	42.50% 17	27.50% 11	40	3.88

#	COMMENTS	DATE
1	My background was sufficient to achieve amazing progress due to this school.	7/15/2022 2:47 PM
2	I should have remembered a bit more probability theory but I was also expecting this.	7/15/2022 2:41 PM
3	I didn't have enough graph theory.	7/15/2022 2:35 PM

Q12 My interest in the subject matter was increased by the school
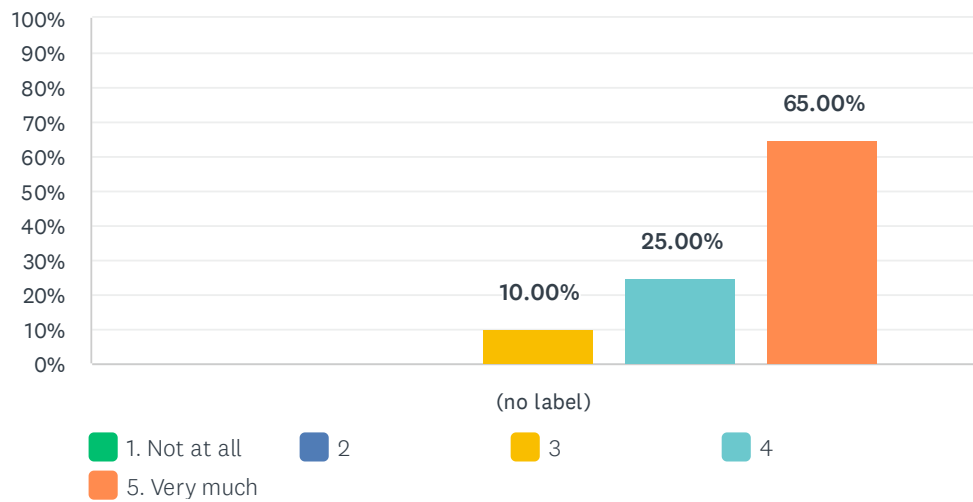
Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.00% 4	25.00% 10	65.00% 26	40	4.55

#	COMMENTS	DATE
1	A great effort was made to helped me appreciate the techniques and topics covered during the summer school.	7/23/2022 1:34 PM
2	I have a greatly enhanced interest due to the school.	7/15/2022 2:47 PM
3	Especially the extensions discussed in the second last lecture.	7/15/2022 2:35 PM

Q13 The school helped me meet people with similar scientific interests

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	15.00% 6	32.50% 13	52.50% 21	40	4.38

#	COMMENTS	DATE
1	I meet a lot of people from different backgrounds. Conversations with them were quite meaningful both academically and personally.	7/23/2022 1:34 PM
2	While not everyone is directly in my area of interest I have met many people with similar internet who I will know for some time to come.	7/15/2022 2:47 PM

Q14 It is likely that I will work in the area of the school subject in the future

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	7.50% 3	35.00% 14	32.50% 13	22.50% 9	40	3.65

#	COMMENTS	DATE
1	I'm combining the subject with (random) dynamical systems and localized-reaction diffusion systems	7/24/2022 11:15 PM
2	I hope I can apply some of the techniques I learned in this summer school in my future research.	7/23/2022 1:34 PM
3	My research is already a little specialized in a slightly different direction, but I hope to nudge it in a direction where I get to use more of what I learned here!	7/18/2022 11:41 AM
4	Y	7/15/2022 2:47 PM

Q15 How would you evaluate your interaction with other participants?
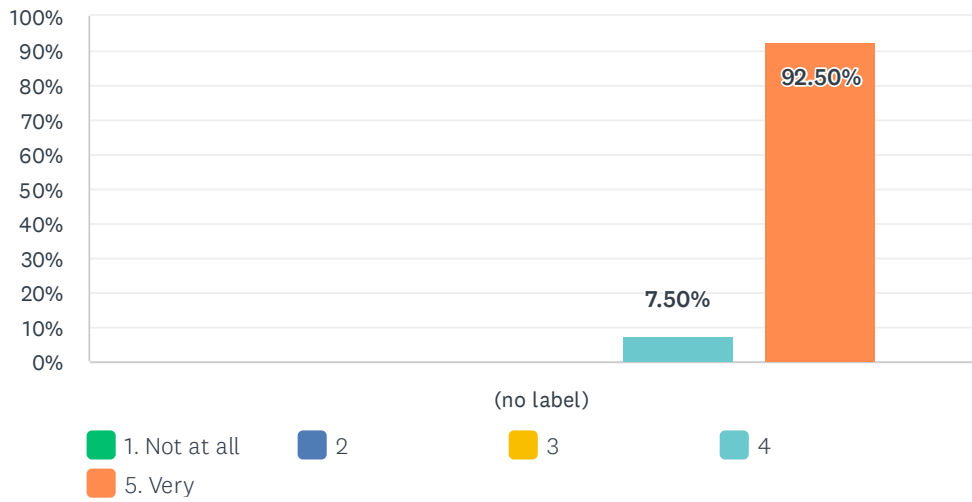
Answered: 40   Skipped: 0
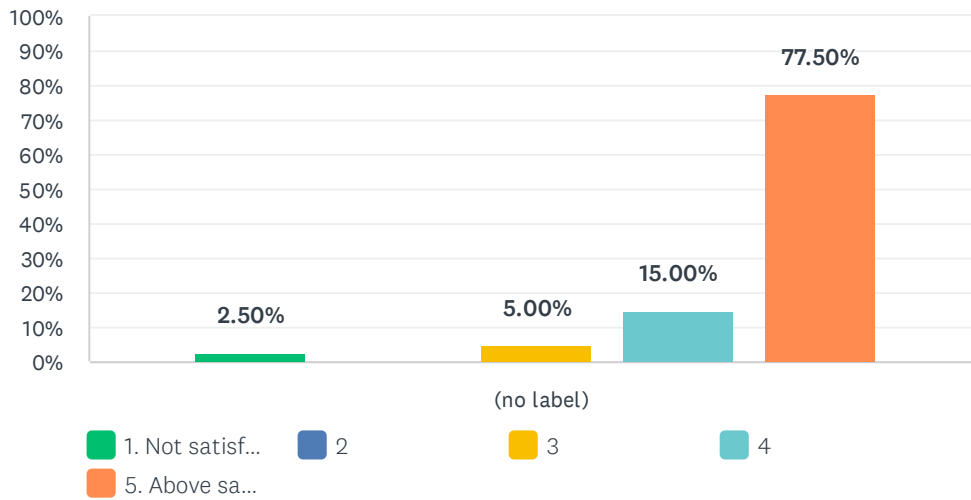
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	0.00% 0	5.00% 2	15.00% 6	77.50% 31	40	4.65

#	COMMENTS	DATE
1	Super nice and stimulating	7/24/2022 11:15 PM
2	The people I met were fantastic.	7/23/2022 1:34 PM
3	The other participants were all very kind, and I made some good friendships here.	7/18/2022 11:41 AM
4	I was exposed to COVID, so I could not attend in-person	7/17/2022 5:04 PM
5	This group was very welcoming and interested in learning.	7/15/2022 2:47 PM

Q16 The environment felt inclusive and welcoming

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	7.50% 3	92.50% 37	40	4.92

#	COMMENTS	DATE
1	MSRI does an excellent job in this regard.	7/23/2022 1:34 PM

Q17 Additional comments on personal assessment

Answered: 6   Skipped: 34

| #	RESPONSES	DATE
1	The learning curve was steep for me, so I've learned a lot! I also read the lecture notes each day again in the apartment for 1h and connected each day's lecture to my own research project in a now long list	7/24/2022 11:15 PM
2	I am extremely satisfied with all aspects of this summer school and with all the people involved.	7/23/2022 1:34 PM
3	Everybody is warm and welcoming and conversations are so pleasant, I made a lot of friends this time!	7/22/2022 3:40 PM
4	I feel good about the mastery of the material and several potential research topics are developed during the workshop.	7/15/2022 6:23 PM
5	I enjoyed the topics and the interactions with lecturers, TA, and other members a lot.	7/15/2022 2:42 PM
6	I felt well prepared for the school, albeit after they tuned the tutorials to the audience after the first few days	7/15/2022 2:41 PM

Q18 I found the MSRI staff helpful

Answered: 40   Skipped: 0

- 1. Not at all
- 2
- 3
- 4
- 5. Very
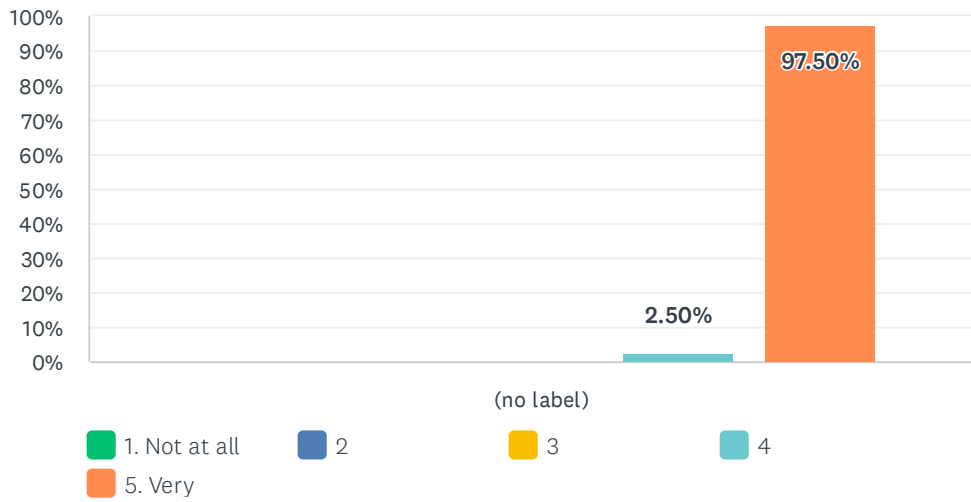
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	2.50% 1	97.50% 39	40	4.97

Q19 The MSRI facilities were conducive for such a school

Answered: 40   Skipped: 0
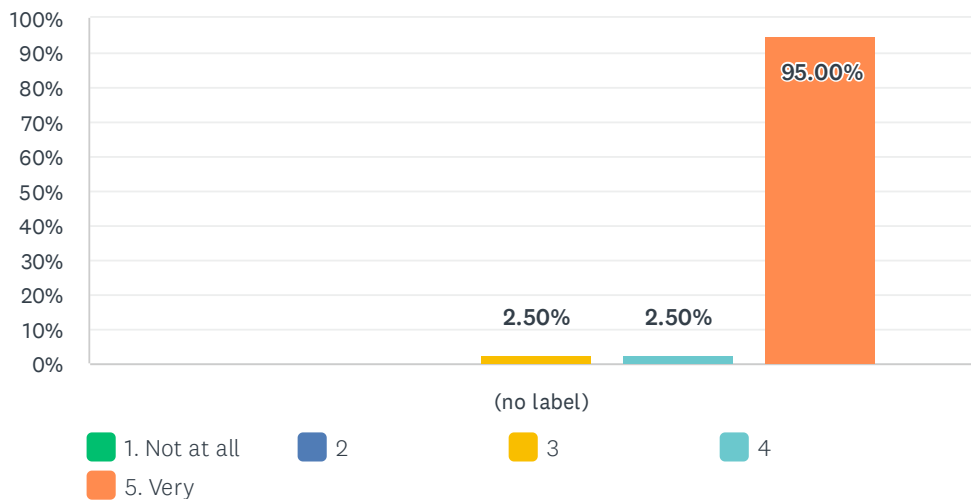
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.50% 1	2.50% 1	95.00% 38	40	4.92

Q20 The MSRI computer facilities were adequate for such a school

Answered: 40   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.50% 1	10.00% 4	17.50% 7	70.00% 28	40	4.50

Q21 Additional comments on the MSRI venue

Answered: 6   Skipped: 34

#	RESPONSES	DATE
1	I did not use the computer facilities	7/24/2022 11:16 PM
2	The staff was quite helpful. Sierra Sutherland was very kind. The facilities were great. My only suggestion, in regards to computer facilities in the library, is that they should install Google Chrome on their computers. It is more complete than Firefox. Firefox is not compatible with certain (academic) webpages and features.	7/23/2022 1:38 PM
3	Thank you and I appreciate the opportunity, hope to visit MSRI in the future again!	7/15/2022 6:23 PM
4	School was well organized! I think provided accommodations were of the utmost quality.	7/15/2022 2:42 PM
5	If I was being picky - better Wi-Fi would be nice, but this was only a minor inconvenience at times.	7/15/2022 2:37 PM
6	Amazing!	7/15/2022 2:36 PM

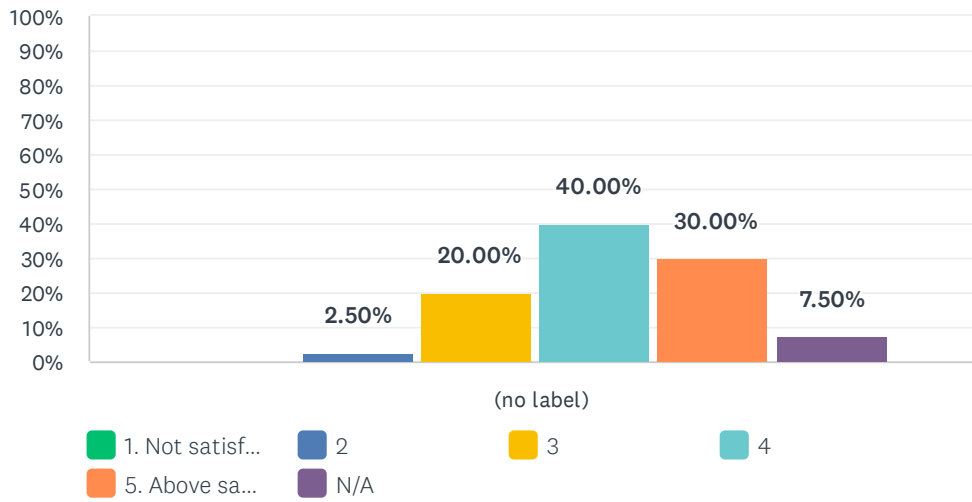# Q22 How did you find the summer school accommodations?

Answered: 40   Skipped: 0
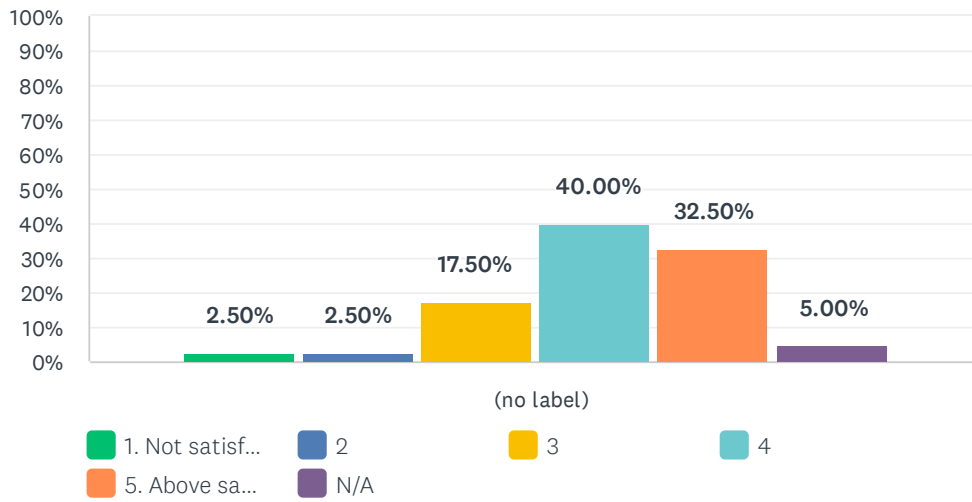
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	2.50% 1	17.50% 7	40.00% 16	32.50% 13	5.00% 2	40	4.03

Q23 How did you find the food at the dormitories?

Answered: 40   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.50% 1	20.00% 8	40.00% 16	30.00% 12	7.50% 3	40	4.05

Q24 How did you find the food provided by MSRI?

Answered: 40   Skipped: 0
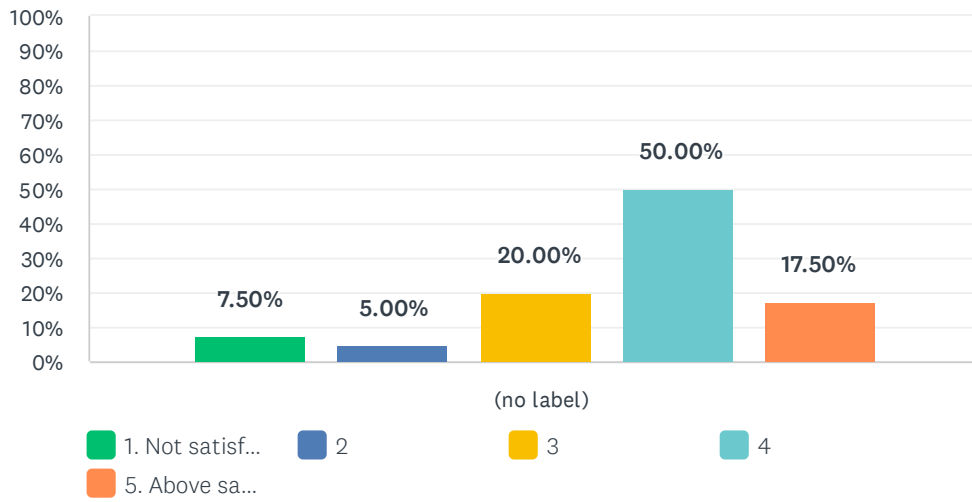
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	7.50% 3	5.00% 2	20.00% 8	50.00% 20	17.50% 7	40	3.65

Q25 Additional comments on accommodation and food

Answered: 10   Skipped: 30

#	RESPONSES	DATE
1	Double-occupancy room are not appropriate for adults (even PhD students) anymore. If alone in the room, the room and the residence building is great. The buffet at crossroads was very good, and the MSRI lunch was also good.	7/24/2022 11:19 PM
2	The mattresses on the dormitories are too hard. That is my only complain. Other than that, the food provided to us was, for the most part, quite satisfactory.	7/23/2022 1:40 PM
3	Having a roommate who snores was a lot of stress. Phds should get their own room.	7/22/2022 8:49 PM
4	The complains I have are mainly focused on food and housing. The dorm is absolutely cold, very very cold in fact. And the food provided for lunch is just not enough for every one. I do not like the food and housing, but lectures are wonderful enough to make up for it. Btw the wifi at the dorm are also very horrible.	7/22/2022 3:42 PM
5	It would have been nice to have our own rooms. I didn't mind the matresses being hard, but combined with the pillows being so soft, it was a bit rough. At first we couldn't control the temperatures in the dorms and they were very cold.	7/18/2022 11:44 AM
6	They are good and thank you!	7/15/2022 6:24 PM
7	The Wednesday hike/picnic probably should have had more warning/preparation. Dorms and dining hall were intuitive.	7/15/2022 2:44 PM
8	The MSRI food staff were excellent at providing food satisfying various dietary restrictions.	7/15/2022 2:38 PM
9	Comfortable enough.	7/15/2022 2:36 PM
10	Was very nice to have so many vegetarian options	7/15/2022 2:36 PM

Q26 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 7   Skipped: 33

#	RESPONSES	DATE
1	Mostly everything was above satisfactory. I hope MSRI keeps doing such a great job, and keep helping students feel stimulated and connected in the mathematical world.	7/23/2022 1:41 PM
2	The lectures, the MSRI facility, Professor and TA, and my peers are all absolutely wonderful. The only downside is the food and housing.	7/22/2022 3:42 PM
3	Nothing, I hope that we can have more opportunity to participate in other courses!	7/15/2022 6:25 PM
4	Thank you for organizing such schools! I hope to participate and run such schools in the future.	7/15/2022 2:43 PM
5	The hike was amazing! Would have been nice to have more notice that it was an hour each way. Also a hike each week would be great. I also think we should take rapid tests daily. We got lucky, but it would have been nice to be sure.	7/15/2022 2:42 PM
6	Thanks so much for this opportunity!	7/15/2022 2:39 PM
7	Everything here at MSRI is awesome!	7/15/2022 2:38 PM

Metric Geometry and Geometric Analysis

July 11, 2022 – July 22, 2022

University of Oxford, United Kingdom

Organizers:

Cornelia Drutu (University of Oxford)

Panos Papazoglou (University of Oxford)

REPORT ON THE SUMMER GRADUATE SCHOOL
"Metric Geometry and Geometric Analysis"
July 11 – 22, 2022

Organizers

- Cornelia Drutu (University of Oxford)
- Panos Papazoglou (University of Oxford)

Description

This Summer Graduate School introduced graduate students to key mainstream directions in Geometry, which sprang from Riemannian Geometry, in an attempt to use its methods in contexts of non-smooth geometry. The recent developments covered by the mini-courses and the research talks concerned metric generalizations of the theory of non-positively curved spaces and of various minimality problems, and discretizations of methods from Geometry, Geometric Measure Theory and Global Analysis.

Highlights of the School

The two weeks of the summer school addressed two different aspects of the main theme. The first week was more focused on research inspired by problems of minimality, such as the existence of periodic geodesics of minimal length (systoles) and inequalities relating them to other geometric parameters, or the generalization of the theory of minimal surfaces in higher dimensions and in the context of metric spaces. The second week was more oriented towards Geometric Group Theory, from the study of Gromov hyperbolic spaces via their boundaries using analytic methods to the theory of projection complexes and the equivariant embeddings into products of quasi-trees that can result from it.

Each morning, there were two lectures, from the two mini-courses of the week, and each afternoon started with a research talk, presenting various directions which sprang from the main themes of the week, continued with exercise sessions and finished with a last meeting, at 5 pm, of all the graduates attending the school either with the lecturers or with some of the mentors, who would try to respond to the most significant questions raised during the exercise sessions.

On the logistic side, there were a number of hiccups, due to the fact that most services in the Mathematical Institute and in the area around were only just out of the pandemic, understaffed and not entirely functional. On the scientific side, on the other hand, the enthusiasm with which both graduates and experienced researchers engaged in the activities of the school was overwhelming. Reasons for this might be the topic of the school and the fact that it was one of the first in person events after a long while. The researchers who accepted to give talks were at the very top in their area (Bridson, Lackenby, Nabutovsky, Sauer etc). Our call for mentors for the exercise sessions was successful beyond our wildest expectations, to the point that we had mentors who were associate professors (Mackay, Mondino, Sisto), assistant professors (Sert) or

high profile post-doctoral students (Jackel, Dell Aiera, Sun, Wade). Due to this success, each mentor ended up with small groups, of at most seven students, and the small size of the groups favored very intense communication. It was a very uplifting experience to see all these small groups taking over every possible working space (from the large common room on the first floor with its low tables and windows one could write on, to the benches outside on the Penrose paving, the tables next to the coffee self service point and the many classrooms) and to discuss eagerly the topics introduced in the morning, to the point where many research talks of the mentors, and even the first 15 minutes of some lectures partially answered questions raised in the exercise sessions. When walking past these groups, one was almost tempted to join them, as they seemed to have such a good time. While the lecturers of the first week were more mindful of a careful preparation of their lectures, and spent most of their afternoons preparing the next day lecture and list of exercises, the lecturers of the second week were completely caught in the spirit of the school, to the point where they both attended every 5 o'clock session, answered questions and continued discussing with students even when the session ended.

Organizers

First Name	Last Name	Institution
Cornelia	Drutu	University of Oxford
Panos	Papazoglou	University of Oxford

Speakers

First Name	Last Name	Institution
Mladen	Bestvina	University of Utah
Martin	Bridson	University of Oxford
Clément	Dell'Aiera	Ecole Normale Superieure de Lyon
Alice	Kerr	University of Oxford
Bruce	Kleiner	New York University, Courant Institute
Marc	Lackenby	University of Oxford
Urs	Lang	ETH Zürich
John	Mackay	University of Bristol
Andrea	Mondino	University of Oxford
Alexander	Nabutovsky	University of Toronto
Regina	Rotman	University of Toronto
Roman	Sauer	Karlsruhe Institute of Technology
Cargi	Sert	Universität Zürich
Alessandro	Sisto	Heriot Watt University
Bin	Sun	University of Oxford
Richard	Wade	University of British Columbia

Mentors

First Name	Last Name	Institution
Clément	Dell'Aiera	Ecole Normale Superieure de Lyon
Jonathan	Fruchter	University of Oxford
Frieder	Jackel	University of Bonn
Alice	Kerr	University of Oxford
Mattia	Luchese	University of Cambridge
John	Mackay	University of Bristol
Damaris	Meyer	ETH Zürich
Andrea	Mondino	University of Oxford
Sangrok	Oh	Kyungpook National University
Cargi	Sert	Universität Zürich
Alessandro	Sisto	Heriot Watt University
Bin	Sun	University of Oxford
Richard	Wade	University of British Columbia

Mathematical Sciences Research Institute

Metric Geometry And Geometric Analysis (Oxford, United Kingdom)

July 11, 2022 - July 22, 2022

Monday, July 11, 2022

9:30 AM - 10:30 AM	Regina Rotman	Lecture & Mini-Course 1: "Geometric Inequalities: Homotopies, Fillings and Geodesics"
11:00 AM - 12:00 PM	Urs Lang	Lecture & Mini Course 2: Isoperimetric Filling Inequalities in CAT(0) Spaces
1:00 PM - 2:00 PM	Andrea Mondino	Research Talk: "Smooth and Non-Smooth Aspects of Ricci Curvature Lower Bounds: an Optimal Transport Point of View"
2:30 PM - 3:30 PM	Cagri Sert	Research Talk: "Random Walks on Gromov-Hyperbolic Spaces: a Survey and Results in Large Deviations"
4:00 PM - 5:00 PM		Meet Your Mentor Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Tuesday, July 12, 2022

9:30 AM - 10:30 AM	Regina Rotman	Lecture & Mini-Course 1: "Geometric Inequalities: Homotopies, Fillings and Geodesics"
11:00 AM - 12:00 PM	Urs Lang	Lecture & Mini Course 2: Isoperimetric Filling Inequalities in CAT(0) Spaces
1:00 PM - 2:00 PM	Richard Wade	Research Talk: Hyperbolic Actions and Relative Free Factor Complexes
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Wednesday, July 13, 2022

9:30 AM - 10:30 AM	Regina Rotman	Lecture & Mini-Course 1: "Geometric Inequalities: Homotopies, Fillings and Geodesics"
11:00 AM - 12:00 PM	Urs Lang	Lecture & Mini Course 2: Isoperimetric Filling Inequalities in CAT(0) Spaces
1:00 PM - 2:00 PM	Martin Bridson	Research Talk: Rigidity for Automorphism Groups of Free Groups
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Thursday, July 14, 2022

9:30 AM - 10:30 AM	Regina Rotman	Lecture & Mini-Course 1: "Geometric Inequalities: Homotopies, Fillings and Geodesics"
11:00 AM - 12:00 PM	Urs Lang	Lecture & Mini Course 2: Isoperimetric Filling Inequalities in CAT(0) Spaces
1:00 PM - 2:00 PM	Alexander Nabutovsky	Research Talk: Old and New Trends in Systolic Geometry
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Friday, July 15, 2022

| 9:30 AM - 10:30 AM	Regina Rotman	Lecture & Mini-Course 1: "Geometric Inequalities: Homotopies, Fillings and Geodesics"
11:00 AM - 12:00 PM	Urs Lang	Lecture & Mini Course 2: Isoperimetric Filling Inequalities in CAT(0) Spaces
1:00 PM - 2:00 PM	Roman Sauer	Research Talk: Balls in Essential Manifolds and Actions on Cantor Spaces
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Monday, July 18, 2022

9:30 AM - 10:30 AM	Bruce Kleiner	Lecture & Mini Course 1: Metric Geometry and Analysis on Boundaries of Gromov Hyperbolic Spaces, and Applications
11:00 AM - 12:00 PM	Mladen Bestvina	Lecture & Mini Course 2: Projection Complexes and Applications to Mapping Class Groups
1:00 PM - 2:00 PM	Alessandro Sisto	Research Talk: An Introduction to Hierarchical Hyperbolicity
2:30 PM - 3:30 PM	Marc Lackenby	Research Talk: Knot Theory and Machine Learning
4:00 PM - 5:00 PM		Meet Your Mentor Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Tuesday, July 19, 2022

9:30 AM - 10:30 AM	Bruce Kleiner	Lecture & Mini Course 1: Metric Geometry and Analysis on Boundaries of Gromov Hyperbolic Spaces, and Applications
11:00 AM - 12:00 PM	Mladen Bestvina	Lecture & Mini Course 2: Projection Complexes and Applications to Mapping Class Groups
1:00 PM - 2:00 PM	Alice Kerr	Research Talk: Product Set Growth in Mapping Class Groups
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Wednesday, July 20, 2022

9:30 AM - 10:30 AM	Bruce Kleiner	Lecture & Mini Course 1: Metric Geometry and Analysis on Boundaries of Gromov Hyperbolic Spaces, and Applications
11:00 AM - 12:00 PM	Mladen Bestvina	Lecture & Mini Course 2: Projection Complexes and Applications to Mapping Class Groups
1:00 PM - 2:00 PM	Bin Sun	Research Talk: Every Countable Group is an Outer Automorphism Group of an Acylindrically Hyperbolic Group with Kazhdan's Property (T)
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Thursday, July 21, 2022

9:30 AM - 10:30 AM	Bruce Kleiner	Lecture & Mini Course 1: Metric Geometry and Analysis on Boundaries of Gromov Hyperbolic Spaces, and Applications
11:00 AM - 12:00 PM	Mladen Bestvina	Lecture & Mini Course 2: Projection Complexes and Applications to Mapping Class Groups
1:00 PM - 2:00 PM	Clément Dell'Aiera	Research Talk: Large Scale Geometry of Hecke Pairs
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer

Friday, July 22, 2022

9:30 AM - 10:30 AM	Bruce Kleiner	Lecture & Mini Course 1: Metric Geometry and Analysis on Boundaries of Gromov Hyperbolic Spaces, and Applications
11:00 AM - 12:00 PM	Mladen Bestvina	Lecture & Mini Course 2: Projection Complexes and Applications to Mapping Class Groups
1:00 PM - 2:00 PM	John Mackay	Research Talk: Boundaries of Random Group
2:30 PM - 4:30 PM		TA Session
5:00 PM - 5:30 PM		Further Explanation of Course Material by a Mentor or a Lecturer
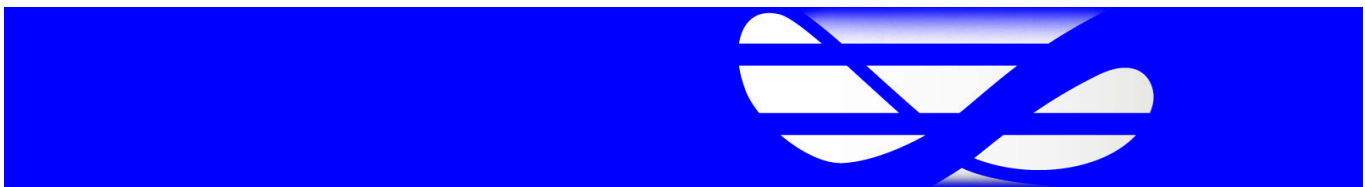
# Officially Registered Student Information

Students		25

Gender		25
Male	92.00%	23
Female	8.00%	2
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		31
White	41.94%	13
Asian	19.35%	6
Hispanic	12.90%	4
Pacific Islander	0.00%	0
Black	9.68%	3
Native American	0.00%	0
Mixed	9.68%	3
Declined to state	6.45%	2

* ethnicity specifications are not exclusive

Q1 My home institution is located in:

Answered: 38   Skipped: 0
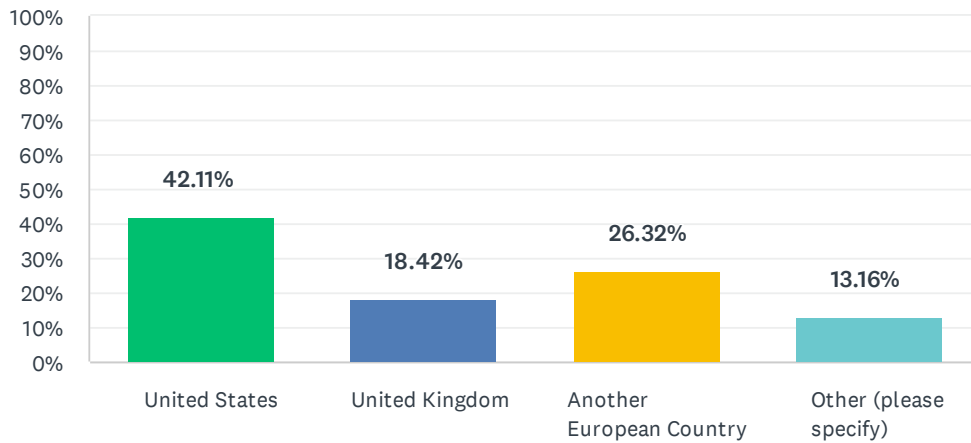
ANSWER CHOICES	RESPONSES	
United States	42.11%	16
United Kingdom	18.42%	7
Another European Country	26.32%	10
Other (please specify)	13.16%	5
TOTAL		38

#	OTHER (PLEASE SPECIFY)	DATE
1	Mexico	8/11/2022 5:20 PM
2	Canada	8/11/2022 10:55 AM
3	Canada	7/30/2022 8:26 AM
4	Canada	7/26/2022 1:46 PM
5	Israel	7/26/2022 11:41 AM

Q2 The various topics within the summer school integrated into a coherent picture

Answered: 35   Skipped: 3
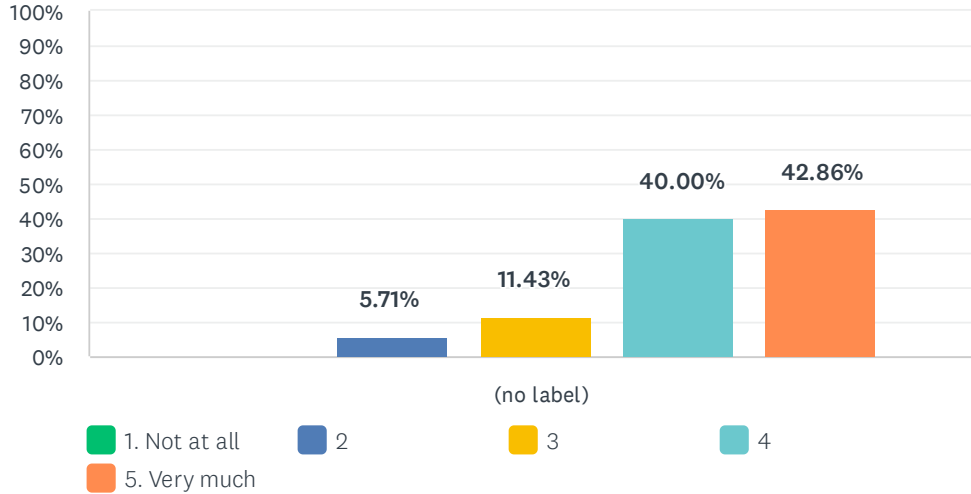
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	11.43% 4	40.00% 14	42.86% 15	35	4.20

Q3 The faculty speakers were generally clear and well organized in their presentation

Answered: 35   Skipped: 3
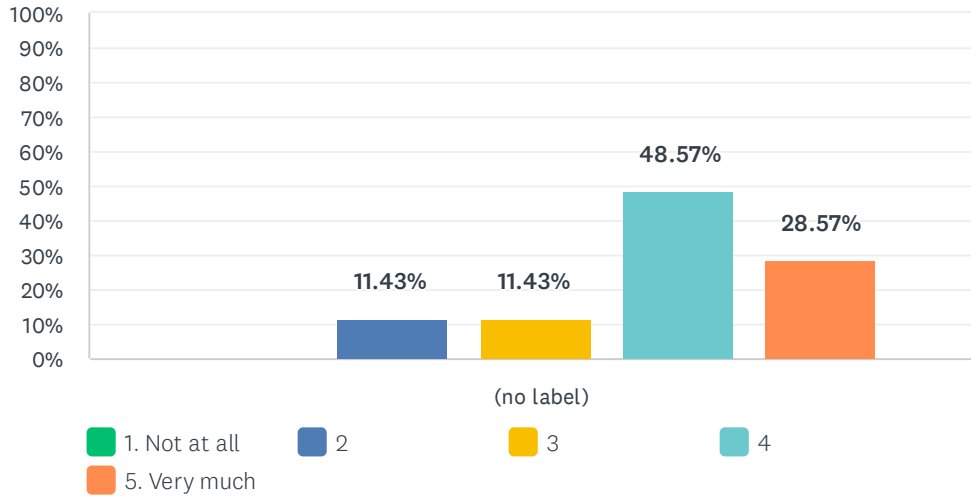
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	11.43% 4	11.43% 4	48.57% 17	28.57% 10	35	3.94

Q4 The school was intellectually stimulating

Answered: 35   Skipped: 3
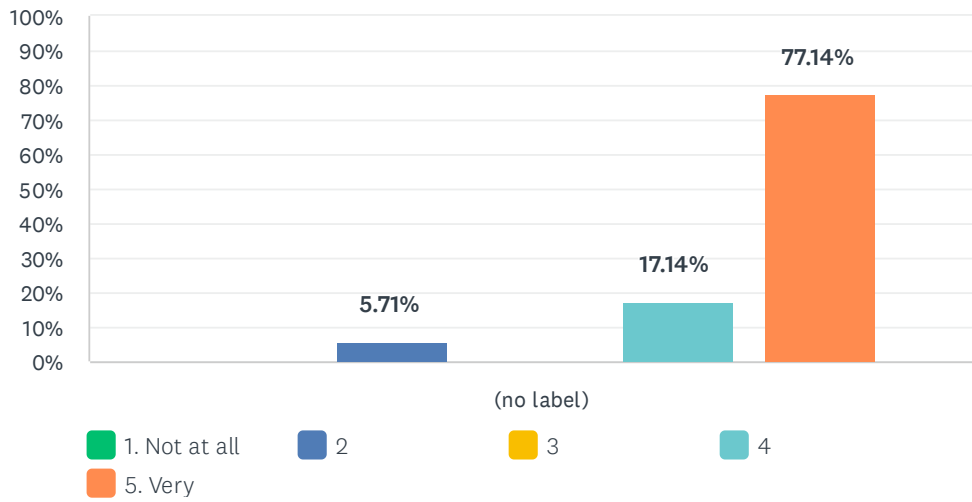
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	0.00% 0	17.14% 6	77.14% 27	35	4.66

Q5 The overall experience of the school was worthwhile

Answered: 35   Skipped: 3
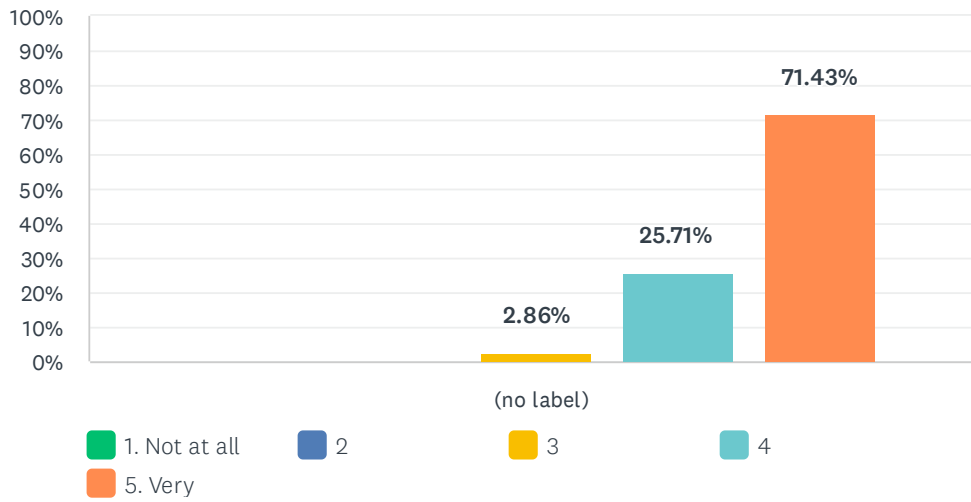
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.86% 1	25.71% 9	71.43% 25	35	4.69

Q6 The amount of material presented was

Answered: 35   Skipped: 3
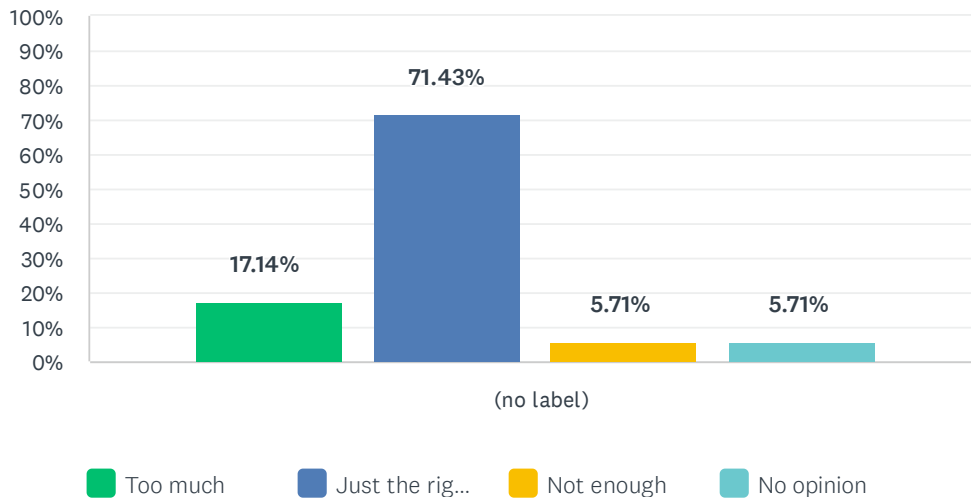
	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	17.14% 6	71.43% 25	5.71% 2	5.71% 2	35	2.00

Q7 Additional comments on the topic presentation and organization

Answered: 7   Skipped: 31

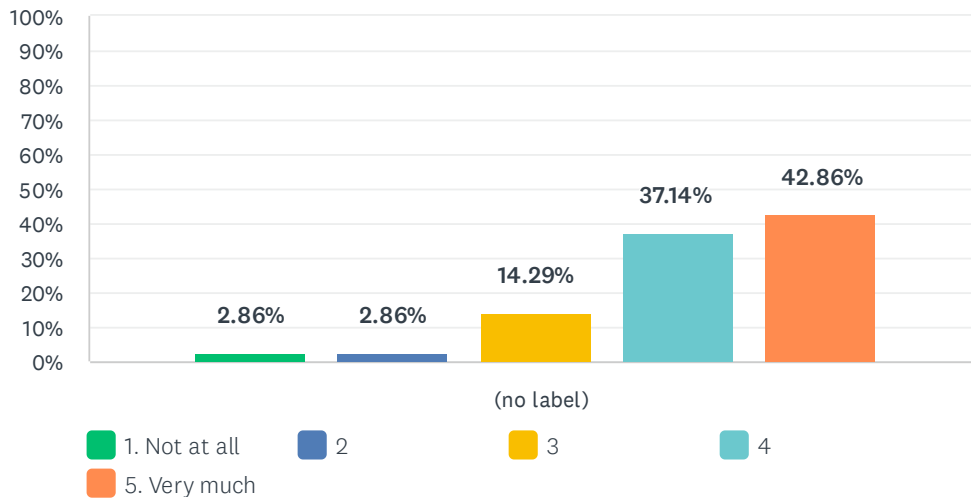| #	RESPONSES	DATE
1	If slides are used having them in advance or at least right after the talk would be appreciated. It would help to follow the lectures and do the exercises	8/14/2022 4:37 PM
2	Everything was fine excepto for the fact that they told us they would provide us with the lecturas and conferences but some of the lecturas were missing	8/11/2022 5:23 PM
3	Unfortunately, I found the minicourses of Prof. Rotman and Prof. Kleiner were extremely difficult to follow. I believe this has to do with the use of slides (rather than black/whiteboard) which resulted in covering too much material in too little time. Also, the two lecturers were assuming a high degree of familiarity with the subject, which is not covered by the recommended preparatory reading. On the other hand, I found the minicourses of Prof. Lang and Prof. Bestvina were very well suited for the audience. Because their courses were well paced and essentially self-contained. I wish that all four lectures had prepared more exercises to be worked on during the TA sessions in the afternoons. Generally, I found the schedule to be very full, from 9:30--17:30 each day with 1h lunch break did not leave any time for private discussions. In particular the question sessions from 17:00--17:30 each day were not very well used. I think the mornings were scheduled well. Then I would suggest instead to have a 2h lunch break, and on alternating days (1 research talk and 1:30h TA session) and (2h TA session and 0:30h question for lecturers).	7/27/2022 1:45 PM
4	Some lecturers tried to cover too many concepts in the week, I would have rather looked at fewer ideas in more detail. Also there was too much assumption on previous knowledge, and we should have been notified of the reading list further in advance to give us more time to prepare.	7/27/2022 6:20 AM
5	Both the minicourses and the research talks were very well presented, interesting and motivating. The TA sessions were helpful to understand and deepen the material of the minicourses	7/26/2022 1:48 PM
6	Some of these questions should be worded specifically toward the particular mini-courses as the mini-courses were not equal in quality. So, the answers you receive won't give you a true assessment of the quality of the mini-courses.	7/26/2022 11:43 AM
7	Amazing organization and a great experience	7/26/2022 11:33 AM

Q8 I was well prepared to benefit from the school

Answered: 35   Skipped: 3

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	25.71% 9	34.29% 12	34.29% 12	35	3.97

Q9 My interest in the subject matter was increased by the school

Answered: 35   Skipped: 3

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	2.86% 1	14.29% 5	37.14% 13	42.86% 15	35	4.14

Q10 The school helped me meet people with similar scientific interests

Answered: 35   Skipped: 3

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.29% 5	28.57% 10	57.14% 20	35	4.43

Q11 It is likely that I will work in the area of the school subject in the future

Answered: 35   Skipped: 3

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	5.71% 2	25.71% 9	31.43% 11	34.29% 12	35	3.89

Q12 How would you evaluate your interaction with other participants?

Answered: 35   Skipped: 3
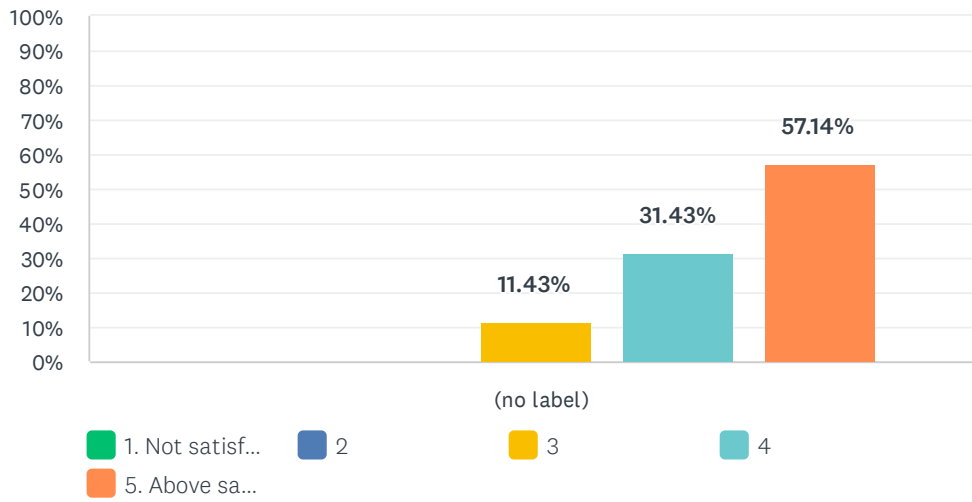
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.43% 4	31.43% 11	57.14% 20	35	4.46

Q13 Additional comments on personal assessment

Answered: 0   Skipped: 38

#	RESPONSES	DATE
	There are no responses.	

Q14 I found the onsite staff helpful

Answered: 35   Skipped: 3
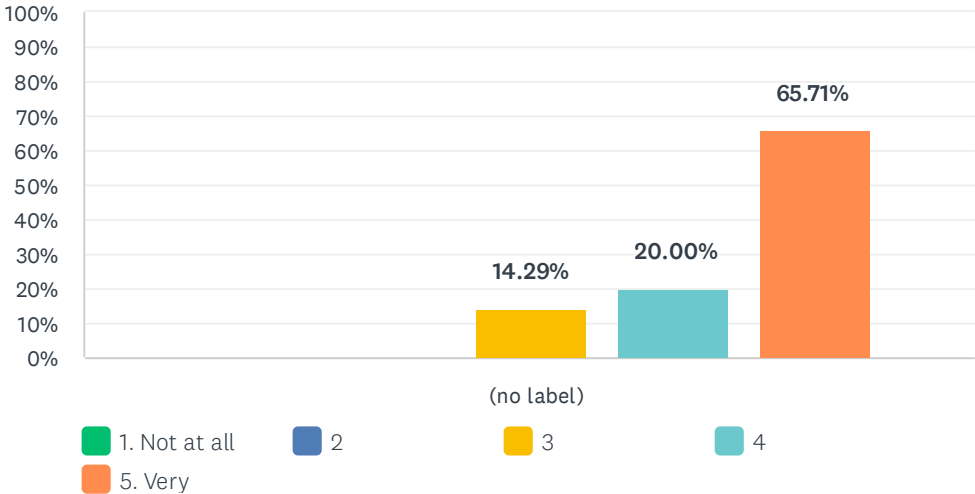
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.29% 5	20.00% 7	65.71% 23	35	4.51

Q15 The physical facilities were conducive for such a school

Answered: 35   Skipped: 3
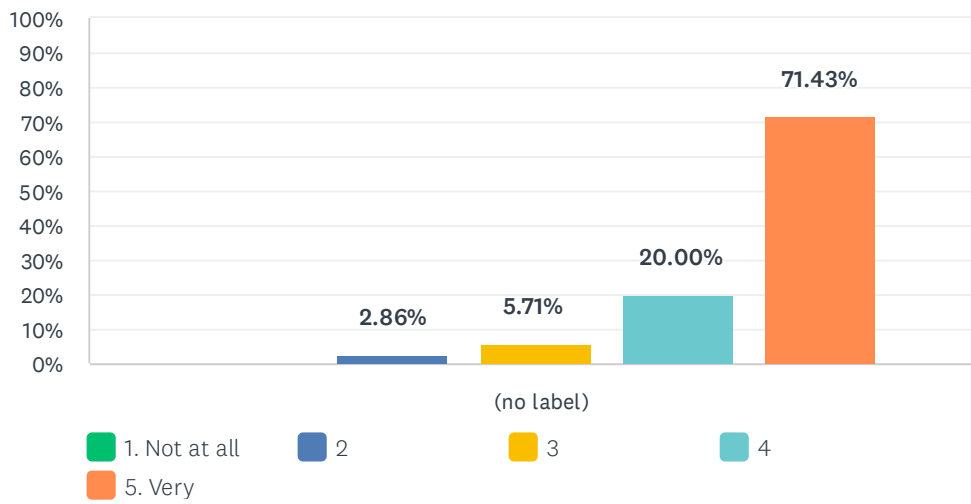
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.86% 1	5.71% 2	20.00% 7	71.43% 25	35	4.60

Q16 Additional comments on the venue

Answered: 2   Skipped: 36

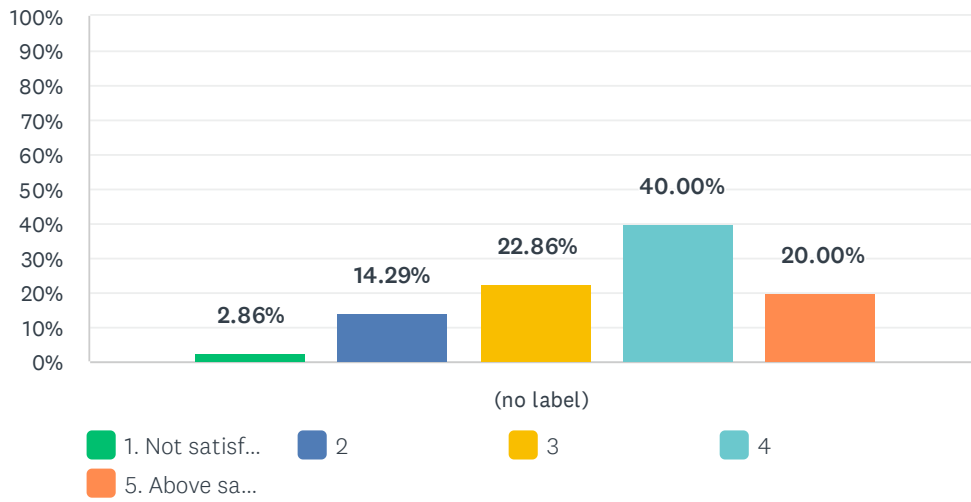| #	RESPONSES	DATE
1	More study rooms should have been booked for the TA sessions.	7/27/2022 6:21 AM
2	The information about which meals will be provided was false	7/26/2022 11:43 AM

Q17 How did you find the summer school accommodations?

Answered: 35   Skipped: 3

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	5.71% 2	20.00% 7	34.29% 12	37.14% 13	35	3.97

Q18 How did you find the food at the school?

Answered: 35   Skipped: 3

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	14.29% 5	22.86% 8	40.00% 14	20.00% 7	35	3.60

Q19 Additional comments on accommodation and food

Answered: 8   Skipped: 30

#	RESPONSES	DATE
1	We had vouchers to eat at the same place every night. It would have been nice for variety.	8/11/2022 4:13 PM
2	They gave us vouchers for a local restaurant - eating there every day for 10 days was a bit much.	8/11/2022 10:49 AM
3	It would have been nice to have meals at a different restaraunt during week 2, since going to the same restaurant for dinner for two weeks gets a little stale.	8/1/2022 5:42 AM
4	It was very unfortunate that the participants funded by MSRI had different arrangements for lunch in the first week and for dinner in both weeks. I feel that this inhibited the interaction between American and European participants severely, because it is often the informal setting of meals that allows to get to know each other better. As a UK based participant, the catering lunch in the first week consisted of the same sandwiches each day, which was not satisfying. The variety of the food at the cafe pi during the second week was better, but the long queue resulted in a significant waiting time (sometimes 20min), keeping in mind that the lunch break is only 1h long. I found it sad that there was no official conference dinner at all. Also, I found it unfortunate that the lecturers/speakers would have lunch separately from the participants, I have not experienced such a separation at any other summer school/conference. The accommodation in St. Edmunds Hall was excellent and I have not complaints about it.	7/27/2022 1:58 PM
5	Very disappointing that all the American students had free dinners whereas UK/EU students did not. This also gave American students more opportunities to socialise and network. Food as a whole was good.	7/27/2022 6:22 AM
6	The vegan options at the cafeteria were sometimes very limited (especially on Thursdays and Fridays).	7/26/2022 4:21 PM
7	I really liked the breakfast. I will miss it!	7/26/2022 11:46 AM
8	The dorms would get really hot, and the internet connection was spotty.	7/26/2022 11:33 AM

Q20 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 5   Skipped: 33

#	RESPONSES	DATE
1	The travel stipend was insufficient to have a full experience at the MSRI summer school.	8/11/2022 4:15 PM
2	I would have liked an official excursion, say during one afternoon of the first week. E.g. a hike/walk in Port Meadow, or a tour of Christ Church College. I find such outings are always important occasions to talk to fellow participants and lecturers/speakers in an informal setting.	7/27/2022 1:58 PM
3	I did enjoy the summer school, however it was a very intense two weeks. I would suggest in future that a day is allocated for an afternoon of free time, to allow us to take a break. Also all the talks over-ran for time, which meant we had shorter breaks. In future the time management could be improved.	7/27/2022 6:23 AM
4	In the future, I think it would be helpful for the school to organize a social activity for all the participants.	7/26/2022 4:22 PM
5	I think some of the speakers missed the mark on how much is reasonable to cover in the time allocated. Profs. Lang and Bestvina did a superb job of keeping their course tight, compact, and meaningful. It was clear they had a target message in mind, an advertisement of something they find interesting and believe is worth one's attention. I think future participants' experience would better if all the speakers kept their mini-course within the bounds of what's reasonable for 1 week. Students can also take a deeper dive given enough motivation.	7/26/2022 11:58 AM

Séminaire de Mathématiques Supérieures 2022: Floer Homotopy Theory

July 11, 2022 – July 22, 2022

University of British Columbia, Vancouver, Canada

Organizers:

Kristen Hendricks (Rutgers University)

Ailsa Keating (University of Cambridge)

Robert Lipshitz (University of Oregon)

Liam Watson (University of British Columbia)

Ben Williams (University of British Columbia)

The 2022 edition of the Séminaire de mathématiques supérieures on Floer Homotopy Theory was hosted by PIMS in Vancouver July 11–22, 2022. It received additional support from PIMS via the CRG *Novel techniques in low-dimension*.

Organizers:

Ailsa Keating, Cambridge University
Kristen Hendricks, Rutgers University
Robert Lipshitz, University of Oregon
Liam Watson, UBC
Ben Williams, UBC

The lecture notes and other resources from the school are hosted here:

https://sites.google.com/view/ailsakeating/floer-homotopy-theory-sms

1. Courses.

Floer homology fundamentals, 9 lectures, Catherine Cannizzo (SCGP) & Nate Bottman (Max Planck)
Operads and ring spectra, 7 lectures, Hiro Lee Tanaka (Texas State University)
String topology, 3 lectures, Katherine Poirier (New York City College of Technology)
Spectra and smash products, 4 lectures, Cary Malkiewich (Binghamton University)
Floer homotopy, 4 lectures, Mohammed Abouzaid (Columbia University)
Floer homology applications, 3 lectures, Jeff Hicks (University of Edinburgh)

2. Activities and highlights.

There were daily problems sessions, and each course was accompanied by detailed problem set and was assigned a TA to guide participants through the material. The school also included panels on *Career paths in academic mathematics* (chair: Ailsa Keating, panelists: Vinicius Gripp, Katherine Poirier, Robert Lipshitz) and *Work-life balance* (chair: Kristen Hendricks, panelists: Hiro Lee Tanaka, Catherine Cannizzo, Jeff Hicks). There were four additional 'Hot topic' lectures:

Ciprian Manolescu (Stanford University)

Title: A knot Floer stable homotopy type

Abstract: Given a grid diagram for a knot or link K in the three-sphere, we construct a spectrum whose homology is the knot Floer homology of K. We conjecture that the homotopy type of the spectrum is an invariant of K. Our construction does not use holomorphic geometry, but rather builds on the combinatorial definition of grid homology. We inductively define models for the moduli spaces of pseudo-holomorphic strips and disk bubbles, and patch them together into a framed flow category. The inductive step relies on the vanishing of an obstruction class that takes values in a complex of positive domains with partitions. (This is joint work with Sucharit Sarkar.)

Vinicius G. B. Ramos (Instituto de Matemática Pura e Aplicada)

Title: The equivalence of the Ekeland-Hofer and equivariant symplectic homology capacities

Abstract: The Ekeland-Hofer capacities are some of the earliest symplectic capacities. They were defined without Floer theory and their calculation for ellipsoids and polydisks laid the foundation for the understanding of symplectic embeddings for a long time. More recently, Gutt and Hutchings defined a sequence of capacities using positive S^1 equivariant symplectic homology, which are harder to define, but much easier to compute. In this talk, I will explain how there is an isomorphism from the Hamiltonian Floer homology of a class of Hamiltonians to its $H^{1/2}$-Morse homology and how this implies that those two sequences of capacities coincide. This is joint work with J. Gutt.

Po Hu (Wayne State University)

Title: Spectral representation theory methods in stable homotopy categorification

Abstract: Starting around 2000, many knot invariants have been obtained by categorifications of knot polynomials. The first example was Khovanov homology, which is a categorification of the Jones polynomial. Other examples include Khovanov-Rozansky homology, as well as knot Floer homology. In 2011, yet another generation of knot invariants was discovered by Lipschitz and Sarkar, who found a stable homotopy version of Khovanov homology. To generalize stable homotopy categorification further, one needs to develop analogues of certain constructions from the representation theory of Lie algebras over the sphere spectrum S. In this talk, we shall discuss some such methods and their basic applications.

Abigail Ward (MIT)

Title: Symplectomorphisms mirror to birational transformations of P^2

Abstract: We construct a non-finite type four-dimensional Weinstein domain M_{univ} and describe a HMS-type correspondence between certain birational transformations of P^2 preserving a standard holomorphic volume form and symplectomorphisms of M_{univ}. The space M_{univ} is universal in the sense it admits every Liouville four-manifold mirror to a log Calabi-Yau surface as a Weinstein subdomain; our construction recovers a mirror correspondence between the automorphism group of any open log Calabi-Yau surface and the group of symplectomorphisms of its mirror by restriction to these subdomains. This is joint work in progress with Ailsa Keating.

2.5 Feedback.

Participants were asked to fill out an anonymous online survey following the workshop. Twenty participants completed the survey. Their feedback was overwhelmingly positive, with Tanaka's course singled out for special praise. For example, here is a typical response to "Which of the lecture courses was your favorite, and why?":

> Ring Spectra and Operads, since Hiro did an exceptional job of making what is often a very abstract and intimidating subject feel both extremely natural and concrete. That said, all of the lecture series were excellent so it is very hard to pick a favorite.

Other courses also received positive feedback; for example, another answer to that question was:

> Hiro's and Katherine's lecture's were of course exceptional, this is coming from someone who did not think that they would enjoy that type of math. I also really enjoyed the Floer Homology Fundamentals and Applications courses. I think it's an ambitious goal to talk in so little time about the "under-the-hood" aspects of Floer Homology, but it was very much worthwhile for me to attend those lectures from lecturers who were courageous enough to address some of the gorey details. I really appreciate the insight Catherine, Nate and Jeff provided!

When asked, "In your opinion, which aspects of the workshop worked particularly well?", in addition to the lectures many students singled out the problem sessions and opportunity to meet other participants; for example:

> The problem sessions: the exercices were well chosen and the TAs were very patient and available.

> The problem sessions were possibly the most useful part of the workshop! I wish there had been more time to work on problems and that the problems that were to be used in the following lectures had been indicated.

Interactions among grad students. Especially after pandemic, this was really very refreshing. Another reason why this mattered to me is that I don't get to interact with many Symplectic /Contact topology grad students since my institute doens't have too many of them. Talking to grad students working in the same field has been a very enjoyable experience.

When asked for suggestions for improvement, there was a lot of variation, ranging from complaints about the online platform (Discord), requests for more social activities, and comments on the refreshments. (All respondents to the survey participated in-person, so were making only casual use of the online platform.)

Complete responses to the survey are attached.

3. Participants.

TAs for courses are marked with (*).

* Borghi, Olivia, University of Melbourne
Hogan, Tamara, University of Melbourne
Shah, Pamela, University of British Columbia
Zendehboodi, Roomina, University of British Columbia
Jenny, Amanda, University of Cambridge
Calle , Maxine, University of Pennsylvania
Dai, Xinle, Harvard University
Lee, Catherine, UC Berkeley
Lo, Han, University of Georgia
* Pacheco-Tallaj, Natalia, MIT
* Wang, Luya, UC Berkeley
Wright, Ana, University of Nebraska-Lincoln
Cunha Filho, Marcelo, IMPA
Sarkis Atallah, Marcelo, Université de Montréal
Vicente de Leon, K. Alejandro, IMPA
Chen, Wenzhao, University of British Columbia
Gant, William, University of British Columbia
Lu, Junyu, University of Manitoba
Mahmoud, Ahmed, University of Saskatchewan
Marian, Mihai, University of British Columbia
Villacis, Francisco, University of Waterloo
Shibata, Taisuke, Reserch Institute for Mathematical Science, Kyoto university
Kim, Kyoungmo, Seoul National University
Garci, Sergio, Universidad Autonoma de Madrid
* Muniz Brea, Alvaro, University of Edinburgh
Acuna, Ricardo, Washington University in St. Louis
Auyeung, Shamuel, Stony Brook University
Benson, Jordan, University of California, San Diego
Bhat, Deeparaj, Massachusetts Institute of Technology
* Binns, Fraser, Boston College
Bzoma, Oskar, University of Massachusetts Amherst
Capovilla-Searle, Michele, University of Iowa
Chanda, Soham, Rutgers University
Chedalavada, Anish, University of Illinois, Chicago
Clausen, David, University of California, Irvine

Cohen, Jesse, University of Oregon
* Deshmukh, Yash Uday, Columbia University
Gabbard, Malcolm, Kansas State University
* Gregoric, Rok, The University of Texas at Austin
Knutsen, Erik, University of Colorado, Boulder
Kumar, Amit, Louisiana State University
Liu, Zitian, Indiana University Bloomington
Liu, Siyang, University of Southern California
Lopez, Jose, Texas A&M University
Mejia, Andres, University Of Pennsylvania
Ning, Shengzhen, University of Minnesota
Pandit, Nikhil, Stanford University
Parikh, Aakash, Rutgers University
Raghunath, Sriram, Rutgers University
Roy, Agniva, Georgia Tech
Rubin, Shanon, UC Davis
Soundararajan, Sidharth, Boston University
Tominaga, Akira, Johns Hopkins University
Villanueva Vega, Daniel, University of Notre Dame
Vinnakota, Sireesh, Claremont Graduate University
Yao, Yuan , UC Berkeley
Zhang, Chen, Michigan State University
Chassé, Jean-Philippe, Université de Montréal
Manchester, Alex, Rice University
Ray, Catherine, Northwestern University
Sangam, Karuna, Rutgers University
* Hirsh, Joseph, Credmark (industry)

MSRI Supported Student Information

Students		39
Gender		**39**
Male	71.79%	28
Female	20.51%	8
Other	7.69%	3
Declined to state	0.00%	0
Ethnicity*		**47**
White	31.91%	15
Asian	38.30%	18
Hispanic	17.02%	8
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	8.51%	4
Declined to state	4.26%	2

* ethnicity specifications are not exclusive

SMS Floer Homotopy Workshop: Feedback

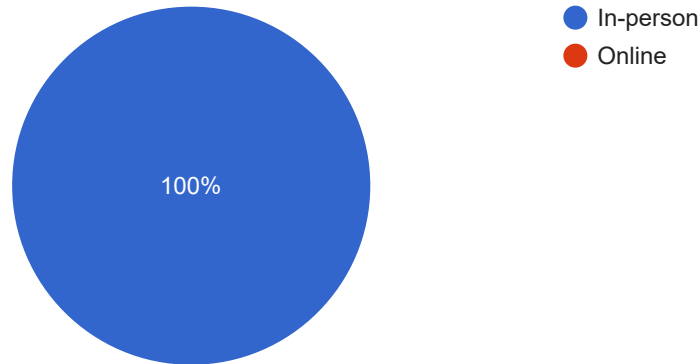20 responses

What is your current academic status?

Copy

20 responses

- Graduate student (pre-research)
- Graduate student (actively engaged in research)
- Postdoctoral fellow
- Tenure-track or tenured faculty

75%

20%
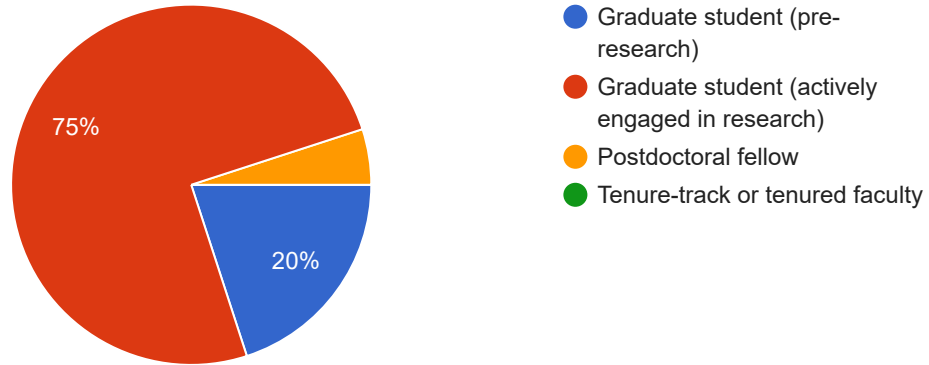
Did you participate in the workshop in-person or online?

Copy

20 responses

- In-person
- Online

100%

Which weeks of the workshop were you present for?

Copy

20 responses

- Week 1
- Week 2
- Both

100%
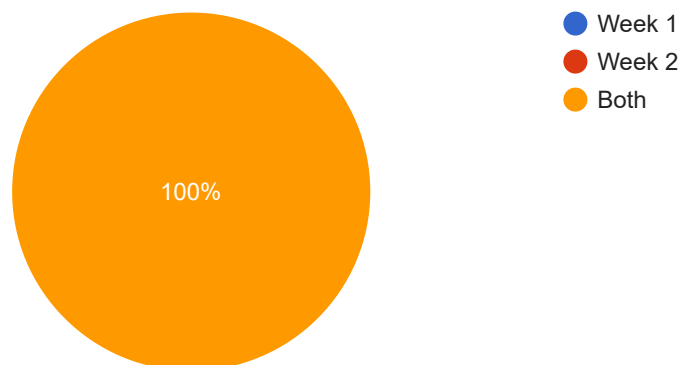
Which of the lecture courses was your favorite, and why?

20 responses

Operads and Ring Spectra, because of Hiro Tanaka's lively lectures

Ring Spectra and Operads, since Hiro did an exceptional job of making what is often a very abstract and intimidating subject feel both extremely natural and concrete. That said, all of the lecture series were excellent so it is very hard to pick a favorite.

Spectra and Operads, Hiro was a great speaker and motivated every topic incredibly well

Operads and ring spectra by Hiro and String topology by Kate. They explain everything clearly. There are not only details but also ideas behind the topic in the lecture which are very helpful for understanding the topics. In additions, the notes created by Hiro are incredible and the exercises in both courses are helpful in learning.

All the lectures were wonderful, but I especially enjoyed Hiro's. It was thoughtfully organized and some of the best motivation for spectra I've seen.

Floer Homology, it is the one related the most to my research

Tanaka's on ring spectra and operads. He clearly explained a lot of abstract and categorical algebra that has daunted me in the past while also tying it to symplectic geometry which is my area of research.

Operad and ring spectra. Hiro's lecture was down-to-earth and I could easily follow even I knew very little about this algebraic stuff.

String Topology - Kate was great and I learned a lot that's relevant to my research.

Everyone was wonderful.

Tie between Abouzaid's Flow Categories and Hiro's course.
Abouzaid's course because of the idea he presented were very organized, I just like the notion of Flow Category I guess.

Hiro's course was just simply great. He is a great expositor, he gets his point across very clearly and his lectures are very engaging.

Operads and ring spectra. The course had clear, attainable goals and the instructor was fantastic. I also enjoyed the string topology course for the same reasons.

Operad

Katherine Poirier's lectures on string topology, since it was clear, efficient and well structured.

Operads and Ring Spectra--Hiro provided copious amounts of illuminating motivation and overall the course was very clear and exciting!

Hiro's course was by far the clearest and most motivated. Cary's was very good too, for similar reasons.

I might pick Operads and Spectra since I learned the most out of it.

Spectra, Operads, and \infty-categories by Hiro Lee Tanaka. This was pretty much new to me and Hiro did a great job at giving me some intuition of how to think about these theories. Also, presented very clearly and with enthusiasm.

Hiro's lectures because I really liked him as a teacher (he is very eloquent and close) and it was very helpful to see spectra from the point of view of omega-spectra instead of prespectra.

Hiro's and Katherine's lecture's were of course exceptional, this is coming from someone who did not think that they would enjoy that type of math. I also really enjoyed the Floer Homology Fundamentals and Applications courses. I think it's an ambitious goal to talk in so little time about the "under-the-hood" aspects of Floer Homology, but it was very much worthwhile for me to attend those lectures from lecturers who were courageous enough to address some of the gorey details. I really appreciate the insight Catherine, Nate and Jeff provided!

In your opinion, which aspects of the workshop worked particularly well?

20 responses

The review of prerequisite material followed by expert presentation of the state of the art was great for a beginner to start solving problems.

I especially liked the emphasis on exercises; active learning is always a plus.

I thought the schedule was very well done, the topics were nicely spread out so that it didn't feel too saturated or overwhelming.

Lectures and problem sessions.

The accommodations were great, and I also found the problem sessions fun.

Organization, accomodation, great scientific and supporting staff, health safety

I enjoyed being able to talk with the lecturers who were all very approachable

Online(discord) and in-person discussions

The speakers were all great. I particularly enjoyed Kate, Hiro and Cary's talks and learned a lot. The variety of material to break up the Floer homology (which I'm far less comfortable with) helped me have time to grapple with some difficult new material. Also, enjoyed the hot topic talks, Ciprian's was particularly cool!

Lectures

Interactions among grad students. Especially after pandemic, this was really very refreshing. Another reason why this mattered to me is that I don't get to interact with many Symplectic /Contact topology grad students since my institute doens't have too many of them. Talking to grad students working in the same field has been a very enjoyable experience.

The lectures together with the problem sessions.

Course

The problem sessions: the exercices were well chosen and the TAs were very patient and available.

I really like the minicourse format since it provides much more opportunity to get a passing familiarity with a field than a research talk.

The inclusion of lecture notes was good, and Hiro's course was great.

The lectures are excellent and are even accessible to people who don't work in that field; I can really learn something out of them.

Course selection worked well in my opinion.

I really liked that all speakers were young researchers. It also made it feel more accessible.

The problem sessions were possibly the most useful part of the workshop! I wish there had been more time to work on problems and that the problems that were to be used in the following lectures had been indicated.

In your opinion, what should the organizers consider doing differently next time?

17 responses

Maybe they should do the three lectures is a row and leave lunch for later. And we could have tea before the first lecture, to start fresh.

The only thing that I feel could have been improved upon is that Prof. Abouzaid's lecture series was too short to give a clear picture of the eponymous subject of the summer school. A more in-depth development of Floer homotopy would have made the summer school feel more cohesive and give participants with less background a clearer understanding of the connections between the other lecture series.

Make lecture recordings available sooner

Nothing.

It would be nice to have more social interaction events / opportunities to mingle outside of just the coffee breaks. Speaking of coffee, it would have been much appreciated to have the coffee available before the 9am lecture!

Maybe planning some extra scientific activities in order for the attendants to bond further

I think maybe the organizers could assign small groups for problem sessions (maybe randomly) and then have those groups work together for a few sessions before everyone gets a new assignment. I think this would help people get to know each other more on a mathematical level and also foster collaboration.

Problem sessions earlier in the day or more variety in the scheduling. I was exhausted after 3 lectures and had no real capacity to engage in the problem sessions in the afternoon.

Everything was great more or less

A catered Lunch would have increased the amount of socialization, although I understand COVID is one of the reasons why it was not done this time.

I found the fundamentals of Floer theory course very hard to follow. It was my first time seeing the material, and I think the organizers tried to fit too much material into a short time frame. Also, the courses were a little bit disjoint. I was expecting the courses to be disjoint in week 1 and then come together in week 2. But I didn't see the connection to Floer theory with some of the talks on spectra and infinity categories. Perhaps it was there and I missed it.

I think that a formal-ish dinner would have been a good idea for people to connect with others and to relax.

Furthermore, I find Discord extremely unpleasant to navigate—I know that I'm in the minority, but I'm not alone. It would've much nicer to make the exercise sheet and the lecture notes on say the official website. Likewise, there could have been a few printed version for us who are less tech savvy.

I wish there was time set aside to do problems on our own in addition to the problem sessions so that we could have a chance to think quietly before asking questions in a noisy room.

The mini-courses didn't feel very connected. In particular, the topic of Floer homotopy introduced in Mohammed's lectures was hard to understand in the context of Week 1. It would have been nice to have some more worked examples in, say, some recitation sections, as opposed to less-structures problem sessions.

Using a microphone to amplify the voice of the speakers. People sitting at the back simply could not hear the lecturers that spoke in a softer tone.

Maybe be closer to the graduate students, like talk to the entire group or ask for feedback in class.

I hope that future schools of this kind do not begin to rely more and more on platforms such as discord. This school did not "rely" on it and it is a great tool for the online participants, but I am ever so slightly worried and I hope that it will still be possible to fully experience summer schools in the future as an offline participant.

Do you have any other comments?

11 responses

No.

It would have been nice if coffee had been available before the first lecture in the morning.

N/A

No.

Thank you for all the work you put into making this happen!

Great Summer School, hope to be back to UBC soon!

Thanks for a great first in-person event since COVID!

None.

There should have been actual food (not just cookies) and the coffee should have been ready by the time of the next lecture in the morning.

The Floer homology and Floer homotopy courses were quite hard for me to follow, even as someone working in symplectic topology who came in with no knowledge of spectra.

It was an awesome experience and I'm really glad I was able to participate in it. The organization was very good and the speakers and lectures were also incredible.

2022 Joint PCMI School: Number Theory Informed by Computation

June 17, 2022 – August 06, 2022

PCMI - Park City Mathematics Institute, Park City, Utah

Organizers:

Jennifer Balakrishnan (Boston University)

Rafe Mazzeo (Stanford University)

Bjorn Poonen (Massachusetts Institute of Technology)

Akshay Venkatesh (Institute for Advanced Study)

Report on the 2022 Park City Mathematics Institute (PCMI) Graduate Summer School

After a hiatus of two years, PCMI resumed its in-person activities in the summer of 2022. The research theme for the summer was ``Number theory informed by computation''. The lead organizers for this theme were: Jennifer Balakrishnan (Boston University), Bjorn Poonen (MIT) and Akshay Venkatesh (IAS). This particular program had been scheduled originally for Summer 2020, but was postponed because of the pandemic. It took place as a one-week online program in Summer 2021. The team of organizers initially included also Kristin Lauter (Facebook), who had to step back for the 2022 program because of other commitments.

PCMI consists of several parallel programs. The ones most directly tied to the research theme are the Research Program (RP), the Graduate Summer School (GSS), the Undergraduate Summer School (USS) and the Undergraduate Faculty Program (UFP). These will be described below. The other programs taking place during the three week session include the Teacher Leadership Program, a professional development opportunity for teachers in grades 7-12, and the Workshop on Rehumanizing Mathematics, a two week activity facilitated by Dr. Rochelle Gutierrez (UIUC).

The core activity of PCMI is the GSS. This brings around 80 graduate students each year to participate in a set of minicourses delivered by leading experts in the field and on topics chosen by the organizers to reflect important themes in this specific research area. The RP brings approximately 40 researchers, ranging from postdoctoral fellows to senior researchers. These researchers engage in collaborations and discussions with one another, and participate in a loosely structured workshop for the three weeks, with seminar talks, working groups, etc. There are two senior leading figures in the field who are named Clay Senior Scholars, whose role is to interact with `everyone'. The USS brings approximately 45 undergraduate students, who participate in a lecture series geared toward their level, and also engage in small group research activities run according to the successful Experimental Math Lab model pioneered by Steering Committee member Jayadev Athreya (University of Washington). The UFP brings small cohort of faculty at primarily undergraduate-facing institutions to reengage with research, and take part in an intensive workshop course on a topic related to the main theme.

The GSS minicourses and lecturers in 2022 were:
Henry Cohn (Microsoft and MIT): Numerical exploration in sphere packing, Fourier analysis and physics;
Joseph Silverman (Brown): An introduction to lattices, lattice reduction and lattice-based cryptography;
Andrew Sutherland (MIT): Computational tools for number theorists;
Nadia Heninger (UCSD): Lattices, lattice reduction, and computational problems in cryptanalysis and coding theory;
Kristin Lauter (Facebook): Supersingular isogeny graphs in cryptography;
Hendrik Lenstra (U. Leiden): Algorithms in algebraic number theory;
Melanie Matchett Wood (Harvard): Arithmetic statistics;
David Harvey (U. New South Wales): Counting points on curves over finite fields;

Bianca Viray (U. Washington): Rational points on varieties and the Brauer-Manin obstruction;
Jan Vonk (Leiden): Singular moduli for real quadratic fields;
Olivier Wittenberg: (Paris Nord): Around the inverse Galois problem.

The Clay Senior Scholars for 2022 were: Hendrik Lenstra and Maryna Viazovska.

The USS lecture series was given by Christelle Vincent (U. Vermont), whose topic was `An introduction to Cryptography'.

The UFP program leader was Sinai Robins (U. São Paolo), who centered his program around his new manuscript `A friendly introduction to Fourier analysis on polytopes'.

The structure of PCMI allows for participants in any one of these programs to attend any of the other programs, and to interact with participants from any of these (or the other two) programs.   The GSS minicourses have various levels of difficulty, and the more introductory amongst these are quite appropriate for the stronger undergraduates. Similarly, the undergraduate course is quite suitable for graduate students with less preparation. This broad structure makes it possible for every participant to find engaging material appropriate for their level.

Another great benefit of the PCMI format is the possibility for students at various levels to meet one another, but also to meet the leading researchers in their field. Thus it is very easy for undergraduates to interact with graduate students, from whom they can get a very good sense of what graduate study in various departments looks like, or for graduate students to meet other students in their field at other universities. These relationships typically extend far beyond PCMI and provide a lasting benefit to participants. Students (both undergraduate and graduate) may also interact with the big stars in their field, as well as postdocs, which provides valuable mentoring opportunities.

Beyond these various lecture series, there are a number of `cross-program' activities to allow participants at all levels to interact with one another, and to have some common grounds for discourse.  Amongst the activities that took place in 2022 were general audience lectures by Hendrik Lenstra and Maryna Viazovska, two evening events with `gentle competive style' called Pizza and Problem Solving and the Estimathon, both facilitated by Andy Bernoff (Harvey Mudd), and a showing in the Park City Public Library of the documentary Secrets of the Surface, about Maryam Mirzakhani.

In 2022, the PCMI GSS was named as one of the MSRI graduate summer schools. MSRI sent a total of 14 students nominated by sponsoring institutions to PCMI this year; the financial arrangement was that MSRI provided $1000 toward the expenses, and travel costs for these fourteen students. This is approximately half of what PCMI needs to fund each of these students (travel, lodging and meals).   In terms of the students who attended, the only concern from the PCMI point of view is that the students nominated by the MSRI sponsoring institutions are taken on a first-come-first-serve basis. This has the potential for bringing some students

who are not adequately prepared. However, the structure of PCMI, where less prepared students can participate in the undergraduate program, for example, substantially alleviates this issue. Furthermore, we agreed on some screening by the program organizers to ensure that all of the nominated students had a reasonable level of preparation to get something out of the program. This relationship between SLMath and PCMI is very beneficial for PCMI and we would be pleased to continue it in the future if there is interest at SLMath.

Rafe Mazzeo
Director, Park City Mathematics Institute

Dena Vigil
Program Manager, Park City Mathematics Institute

Organizers

First Name	Last Name	Institution
Jennifer	Balakrishnan	Boston University
Rafe	Mazzeo	Stanford University
Bjorn	Poonen	Massachusetts Institute of Technology
Akshay	Venkatesh	Institute for Advanced Study

Speakers

First Name	Last Name	Institution
Henry	Cohn	Microsoft Research
Tim	Dokchitser	University of Bristol
Nadia	Heninger	University of California, San Diego
Hendrik	Lenstra	Universiteit Leiden
Joseph	Silverman	Brown University
Andrew	Sutherland	Massachusetts Institute of Technology
Bianca	Viray	University of Washington
Melanie	Wood	Harvard University

	Monday July 18	Tuesday July 19	Wednesday July 20	Thursday July 21	Friday July 22
8:00–8:30	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast
8:30–9:30	GSS Lecture: Silverman TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Silverman TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Silverman TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Silverman TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Silverman TLP Math Course UFP Seminar Workshop Rehumanizing Math
9:40–10:40	GSS Prob Session: Silverman TLP Math Course RP Seminar: Manes/Varilly–Alvarado UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Silverman TLP Math Course RP Problem Session: Poonen UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Silverman TLP Math Course RP Seminar: Srinivasan/Hast UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Silverman TLP Math Course RP Seminar: Mercuri/Keller UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Silverman TLP Math Course RP Seminar: Paterson/Ellenberg UFP Seminar USS XML Workshop Rehumanizing Math
11:00–12:00	GSS Lecture: Cohn TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Cohn TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Sutherland TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Cohn TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Cohn TLP RoP UFP Seminar Workshop Rehumanizing Math
12:00–1:00	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)
1:00–2:00	GSS Prob Session: Cohn TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math	GSS Prob Session: Cohn TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math	Half Day – No Sessions 1:30–6:30pm Hike to Bloods Lake & Clayton Peak with Bjorn Poonen	GSS Prob Session: Cohn TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math	GSS Prob Session: Cohn TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math
2:00–3:00	GSS Lecture: Sutherland TLP Working Groups UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Sutherland TLP Working Groups UFP Seminar Workshop Rehumanizing Math	Half Day – No Sessions	GSS Lecture: Sutherland TLP Working Groups UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Sutherland TLP Working Groups UFP Seminar Workshop Rehumanizing Math
3:15–4:15	Cross Program Lecture Christelle Vincent (Prospector Theater)	Cross Program Lecture OPEN (Prospector Theater)	Half Day – No Sessions	Cross Program Lecture Jordan Ellenberg (Prospector Theater)	Cross Program Lecture Hendrk Lenstra (Prospector Theater)
4:30–5:30	GSS Prob Session: Sutherland TLP Session USS Problem Session Workshop Rehumanizing Math	GSS Prob Session: Sutherland TLP Session USS Problem Session Workshop Rehumanizing Math	Half Day – No Sessions	GSS Prob Session: Sutherland TLP Session USS Problem Session Workshop Rehumanizing Math	GSS Prob Session: Sutherland TLP Session USS Problem Session Workshop Rehumanizing Math
5:30 – 9:30	Opening Reception (DoubleTree)	Optional Evening Activities as scheduled (various)		Optional Evening Activities as scheduled (various)	Optional Evening Activities as scheduled (various)

	Monday July 25	Tuesday July 26	Wednesday July 27	Thursday July 28	Friday July 29
8:00–8:30	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast
8:30–9:30	GSS Lecture: Lenstra TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Lenstra TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Lenstra TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Lenstra TLP Math Course UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Lenstra TLP Math Course UFP Seminar Workshop Rehumanizing Math
9:40–10:40	GSS Prob Session: Lenstra TLP Math Course RP Problem Session: Venkatesh UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Heninger TLP Math Course RP Seminar: Love/Kedlaya UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Lenstra TLP Math Course RP Seminar: Morrison/Sharif UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Lenstra TLP Math Course RP Seminar: Alpöge/Logan UFP Seminar USS XML Workshop Rehumanizing Math	GSS Prob Session: Lenstra TLP Math Course RP Seminar: Campagna/Schoof UFP Seminar USS XML Workshop Rehumanizing Math
11:00–12:00	GSS Lecture: Lauter TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Matchett Wood TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Matchett Wood TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Matchett Wood TLP RoP UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Matchett Wood TLP RoP UFP Seminar Workshop Rehumanizing Math
12:00–1:00	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)
1:00–2:00	GSS Prob Session: Lauter TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math	GSS Prob Session: Matchett Wood TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math	Half Day – No Sessions	GSS Prob Session: Matchett Wood TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math	GSS Prob Session: Matchett Wood TLP Working Groups USS Lecture–Vincent Workshop Rehumanizing Math
2:00–3:00	GSS Lecture: Heninger TLP Working Groups UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Lauter TLP Working Groups UFP Seminar Workshop Rehumanizing Math	Half Day – No Sessions	GSS Lecture: Heninger TLP Working Groups UFP Seminar Workshop Rehumanizing Math	GSS Lecture: Heninger TLP Working Groups UFP Seminar Workshop Rehumanizing Math
3:15–4:15	Cross Program Lecture Equity Panel (Prospector Theater)	Cross Program Lecture Maryna Viazovska (Prospector Theater)	Half Day – No Sessions	Cross Program Lecture Eli Luberoff (Prospector Theater)	Cross Program Lecture Name (Prospector Theater)
4:30–5:30	**GSS Lecture**: Lauter TLP Session USS Problem Session Workshop Rehumanizing Math	GSS Prob Session: Lauter TLP Session USS Problem Session Workshop Rehumanizing Math	Half Day – No Sessions	GSS Prob Session: Heninger TLP Session USS Problem Session Workshop Rehumanizing Math	GSS Prob Session: Heninger/ Matchett Wood TLP Session USS Problem Session Workshop Rehumanizing Math
5:30 – 9:30	Optional Evening Activities as scheduled (various)	Pizza & Problem Solving (Dining Tent)		Estimathon (Dining Tent)	Optional Evening Activities as scheduled (various)

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	Monday August 1	Tuesday August 2	Wednesday August 3	Thursday August 4	Friday August 5
8:00–8:30	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast
8:30–9:30	GSS Lecture: Harvey TLP Math Course UFP Seminar	GSS Lecture: Harvey TLP Math Course UFP Seminar	GSS Lecture: Harvey TLP Math Course UFP Seminar	GSS Lecture: Vonk TLP Math Course UFP Seminar	GSS Lecture: Harvey TLP Math Course UFP Seminar
9:40–10:40	GSS Prob Session: Harvey TLP Math Course RP Seminar: Stange UFP Seminar USS XML	GSS Prob Session: Harvey TLP Math Course RP Problem Session: Balakrishnan UFP Seminar USS XML	GSS Prob Session: Harvey TLP Math Course RP Seminar: Banwait/Vogt UFP Seminar USS XML	GSS Prob Session: Vonk TLP Math Course RP Seminar: Pagano/Fité UFP Seminar USS XML	GSS Prob Session: Harvey TLP Math Course RP Seminar: Rickards/Bergdall UFP Seminar USS XML
11:00–12:00	GSS Lecture: Viray TLP RoP UFP Seminar	GSS Lecture: Viray TLP RoP UFP Seminar	GSS Lecture: Wittenberg TLP RoP UFP Seminar	GSS Lecture: Viray TLP RoP UFP Seminar	GSS Lecture: Vonk TLP RoP UFP Seminar
12:00–1:00	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)	Lunch (Dining Tent)
1:00–2:00	GSS Prob Session: Viray TLP Working Groups USS Lecture–Vincent	GSS Prob Session: Viray TLP Working Groups USS Lecture–Vincent	Half Day – No Sessions	GSS Prob Session: Viray TLP Working Groups USS Lecture–Vincent	GSS Prob Session: Vonk TLP Working Groups USS Lecture–Vincent
2:00–3:00	GSS Lecture: Vonk TLP Working Groups UFP Seminar	GSS Lecture: Wittenberg TLP Working Groups UFP Seminar	Half Day – No Sessions	GSS Lecture: Wittenberg TLP Working Groups UFP Seminar	**GSS Prob Session**: Wittenberg TLP Working Groups UFP Seminar
3:15–4:15	Cross Program Lecture Career Arcs Panel (Prospector Theater)	Cross Program Lecture XML Presentation (Prospector Theater)	Half Day – No Sessions	Cross Program Lecture XML Presentation (Prospector Theater)	Cross Program Lecture Name (Prospector Theater)
4:30–5:30	GSS Prob Session: Vonk TLP Session USS Problem Session	GSS Prob Session: Wittenberg TLP Session USS Problem Session	Half Day – No Sessions	GSS Prob Session: Wittenberg TLP Session USS Problem Session	GSS Prob Session: Everyone TLP Session USS Problem Session
5:30 – 9:30	Optional Evening Activities as scheduled (various)	PCMI Movie (Park City Library)	Half Day – No Sessions	Closing Dinner (Dining Tent)	

Officially Registered Student Information

Students		14

Gender		14
Male	50.00%	7
Female	50.00%	7
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		14
White	71.43%	10
Asian	14.29%	2
Hispanic	7.14%	1
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	0.00%	0
Declined to state	7.14%	1

* ethnicity specifications are not exclusive

MSRI-NCTS Joint Summer School: Recent Topics in Well Posedness

July 18, 2022 – July 29, 2022

University of Hawaii-Hilo & Taipei, Taiwan

Organizers:

Jungkai Chen (National Taiwan University)

Mimi Dai (University of Illinois at Chicago)

Yoshikazu Giga (University of Tokyo)

Tsuyoshi Yoneda (Hitotsubashi University)

REPORT ON THE SUMMER GRADUATE SCHOOL
"MSRI-NCTS Joint Summer School: Recent Topics in Well Posedness"
July 18 – 29, 2022

Organizers

- Jungkai Chen (National Taiwan University)
- Mimi Dai (University of Illinois at Chicago)
- Yoshikazu Giga (University of Tokyo)
- Tsuyoshi Yoneda (Hitotsubashi University)

Description

The purpose of the summer school was to introduce graduate students to fundamental results on the Navier-Stokes and the Euler equations, with special emphasis on the solvability of its initial value problem in various domains as well as the large time behavior of a solution, and mathematical analysis on turbulence. These topics have long research history. However, recent studies clarify the problems from a broad point of view, not only from functional analysis but also from detailed studies of behavior of the flow.

Highlights of the School

Basically, each day of the summer graduate school consisted of two parts. In the morning session, there were two lectures (separated by a coffee break) taught by one lecturer. After a communication lunch break, we had the afternoon session. We set 30 minutes question time and two problem sessions, led by the TAs (also separated by a coffee break). On Tuesday afternoon, Wednesday morning and Thursday afternoon in the second week, there were presentations by the students. The lecturers were Lorenzo Brandolese (Universite Lyon 1), Sylvie Monniaux (Aix-Marseille Université) and Tsuyoshi Yoneda (Hitotsubashi University).

The lectures were designed to start from the very basic facts of the mathematical analysis of fluid dynamics, such as energy method of the incompressible Navier-Stokes equations, Lipschitz domain with various boundary conditions, and dimensional analysis on turbulence, known to all graduate students and lead the participants gently to the frontiers of mathematical fluid dynamics. The problem sessions had been carefully designed to provide practice and enrichment. In the presentation session, each students gave talks on their own research in 15 minutes. After each talk, there were always several questions pop up, and then became intense discussion. The chairman was always afraid of the time keeping. For each presentation session, we allocated three hours for their talks, but we felt three hours are not enough! Lecturers were highly impressed by the general quality of student presentations. In a few cases, they agreed to write recommendation letters for participants' applications to postdoctoral positions.
The participants would be seen eagerly discussing. After finishing each lecture, several participants were always approaching the lecturer and discussing during the coffee break. For example, a lecturer had a very nice experience with a student from Taiwan who had very bright eyes when he understood the argument of the advanced theory ``maximal regularity". This brainstorming occurred not only during the morning sessions, but also over lunch break and afternoon sessions. Consequently, new research projects with some participants have been started, which is initiated by this MSRI lecture. We feel that the summer school surely inspired all participants, and would help with their future research carrier.

Organizers

First Name	Last Name	Institution
Jungkai	Chen	National Taiwan University
Mimi	Dai	University of Illinois at Chicago
Yoshikazu	Giga	University of Tokyo
Tsuyoshi	Yoneda	Hitotsubashi University

Speakers

First Name	Last Name	Institution
Lorenzo	Brandolese	Universite Lyon 1
Sylvie	Monniaux	Aix-Marseille Université
Tsuyoshi	Yoneda	Hitotsubashi University

Teaching Assistants

First Name	Last Name	Institution
Shih-Hsin	Chen	National Center of Theoretical Sciences
Sarah	Strikwerda	North Carolina State University

Mathematical Sciences Research Institute

MSRI-NCTS Joint Summer School: Recent Topics in Well Posedness

July 18, 2022 - July 29, 2022

Monday, July 18, 2022

8:45 AM - 9:00 AM		Introduction
9:00 AM - 10:15 AM	Lorenzo Brandolese	Lecture
10:45 AM - 12:00 PM	Lorenzo Brandolese	Lecture
1:30 PM - 2:00 PM		Question and Answer
2:00 PM - 3:00 PM		Problem and Discussion Session
3:30 PM - 4:30 PM		Problem and Discussion Session

Tuesday, July 19, 2022

9:00 AM - 10:15 AM	Sylvie Monniaux	Lecture
10:45 AM - 12:00 PM	Sylvie Monniaux	Lecture
1:30 PM - 2:00 PM		Question and Answer
2:00 PM - 3:00 PM		Problem and Discussion Session
3:30 PM - 4:30 PM		Problem and Discussion Session

Wednesday, July 20, 2022

9:00 AM - 10:15 AM	Tsuyoshi Yoneda	Lecture
10:45 AM - 12:00 PM	Tsuyoshi Yoneda	Lecture

Thursday, July 21, 2022

9:00 AM - 10:15 AM	Lorenzo Brandolese	Lecture
10:45 AM - 12:00 PM	Lorenzo Brandolese	Lecture
1:30 PM - 2:00 PM		Question and Answer
2:00 PM - 3:00 PM		Problem and Discussion Session
3:30 PM - 4:30 PM		Problem and Discussion Session

Friday, July 22, 2022

9:00 AM - 10:15 AM	Sylvie Monniaux	Lecture
10:45 AM - 12:00 PM	Sylvie Monniaux	Lecture
1:30 PM - 2:00 PM		Question and Answer
2:00 PM - 3:00 PM		Problem and Discussion Session
3:30 PM - 4:30 PM		Problem and Discussion Session

Monday, July 25, 2022

9:00 AM - 10:15 AM	Tsuyoshi Yoneda	Lecture
10:45 AM - 12:00 PM	Tsuyoshi Yoneda	Lecture
1:30 PM - 2:00 PM		Question and Answer

| 2:00 PM - 3:00 PM | | Problem and Discussion Session |
| 3:30 PM - 4:30 PM | | Problem and Discussion Session |

Tuesday, July 26, 2022

9:00 AM - 10:15 AM	Lorenzo Brandolese	Lecture
10:45 AM - 12:00 PM	Lorenzo Brandolese	Lecture
1:30 PM - 4:30 PM		Student Presentations

Wednesday, July 27, 2022

| 9:00 AM - 12:00 PM | | Student Presentations |

Thursday, July 28, 2022

9:00 AM - 10:15 AM	Sylvie Monniaux	Lecture
10:45 AM - 12:00 PM	Sylvie Monniaux	Lecture
1:30 PM - 4:30 PM		Student Presentations

Friday, July 29, 2022

9:00 AM - 10:15 AM	Tsuyoshi Yoneda	Lecture
10:45 AM - 12:00 PM	Tsuyoshi Yoneda	Lecture
1:30 PM - 2:00 PM		Question and Answer
2:00 PM - 3:00 PM		Problem and Discussion Session
3:30 PM - 4:30 PM		Problem and Discussion Session
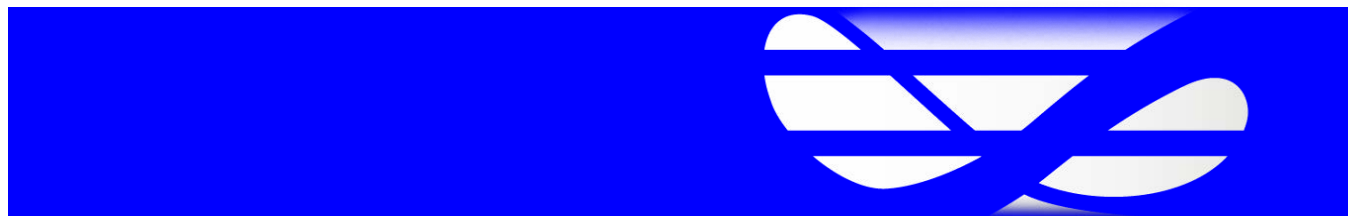
Officially Registered Student Information

Students		21

Gender		21
Male	95.24%	20
Female	4.76%	1
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		21
White	28.57%	6
Asian	61.90%	13
Hispanic	9.52%	2
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	0.00%	0
Declined to state	0.00%	0

* ethnicity specifications are not exclusive

Q1 My home institution is located in:

Answered: 21   Skipped: 0
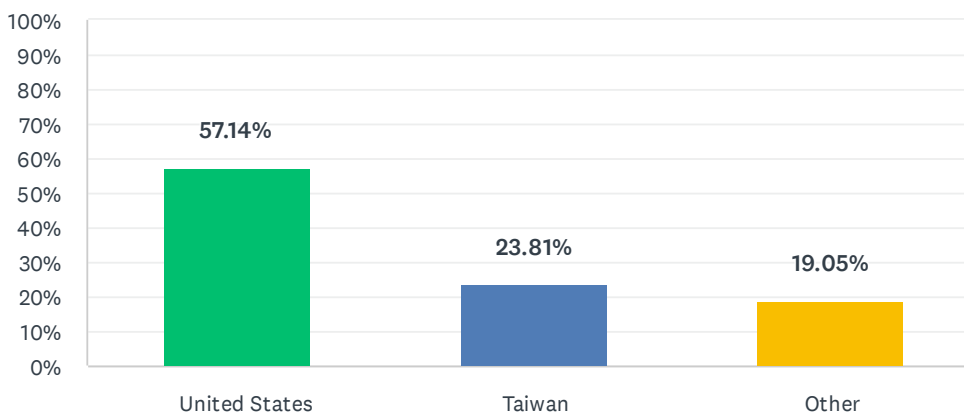
ANSWER CHOICES	RESPONSES	
United States	57.14%	12
Taiwan	23.81%	5
Other	19.05%	4
TOTAL		21

#	OTHER (PLEASE SPECIFY)	DATE
1	Hong Kong	8/11/2022 7:53 PM
2	Canada	8/4/2022 12:20 AM
3	Hong Kong	8/2/2022 9:42 AM
4	Australia	8/1/2022 5:32 PM

Q2 The various topics within the summer school integrated into a coherent picture

Answered: 21   Skipped: 0
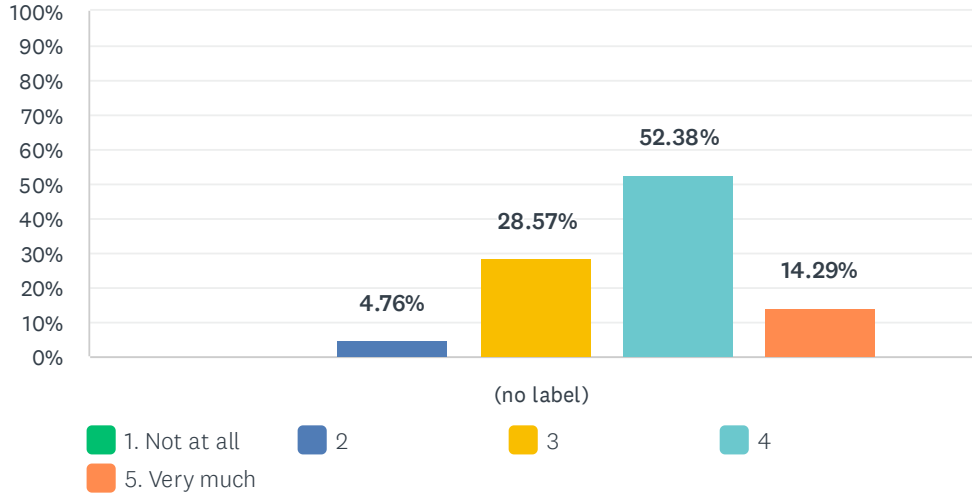
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	28.57% 6	52.38% 11	14.29% 3	21	3.76

Q3 The faculty speakers were generally clear and well organized in their presentation

Answered: 21   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 2	28.57% 6	42.86% 9	19.05% 4	21	3.71

Q4 The teaching assistants were helpful

Answered: 21   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	19.05% 4	47.62% 10	28.57% 6	21	4.00

| #	PLEASE PROVIDE SOME COMMENTS ON THE TAS.	DATE
1	Could have improved the experience by working out more examples	8/15/2022 7:43 PM
2	It's unfortunate that one of the TA got positive. However, it would be much better if TA would give clearer guidance to everybody, not to almost exclusively his group.	8/7/2022 11:00 AM
3	It's hard to evaluate exactly, given that one of the TA tested positive for COVID in the middle of the program. I think they put a lot of effort to make the problem session worthwhile, although it seems like 2 groups - a group from US institutions and a group from Taiwan institutions - have failed to form one group.	8/3/2022 5:23 PM
4	It would have been helpful if the TAs circulated in the room more and spoke to people more often.	8/2/2022 9:10 AM
5	TA are really good, and hard working. Their teaching is clearly.	8/1/2022 4:46 PM
6	I think all of us can see both TAs' efforts and they are indeed conscientious.	8/1/2022 4:41 PM
7	TA Chen is well-prepared for all the exercise. In othe words, he can show almost all details that you need to do for the exercise. TA Sarah prefers the intuition part than the technique part in the TA classes. All of above, they keep the TA class well-balanced in intuition and technique. I really enjoy it ☺ Thanks them again ☺	8/1/2022 4:10 PM
8	Sarah was incredibly helpful but the other TA not so much.	8/1/2022 2:48 PM
9	shoutout to Sarah	8/1/2022 1:40 PM

Q5 The school was intellectually stimulating

Answered: 21   Skipped: 0
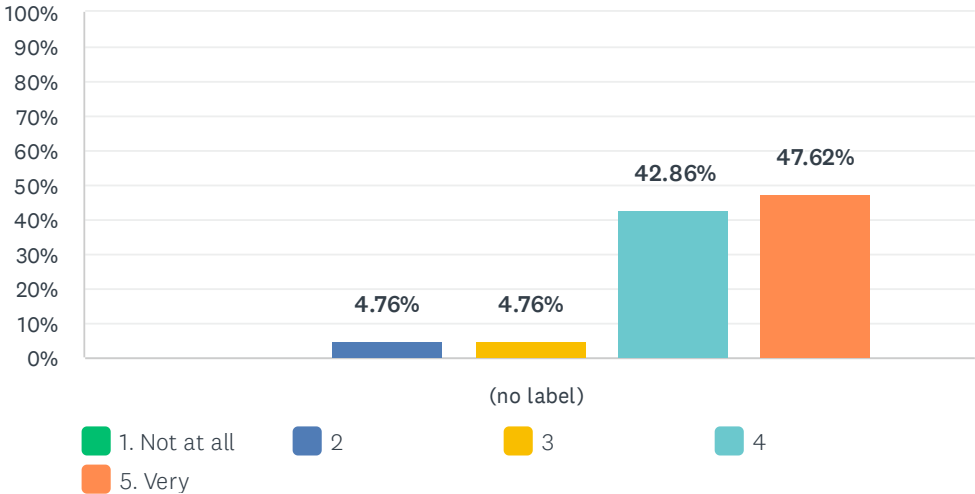
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	4.76% 1	42.86% 9	47.62% 10	21	4.33

Q6 The Problem & Discussion Sessions were productive

Answered: 21   Skipped: 0
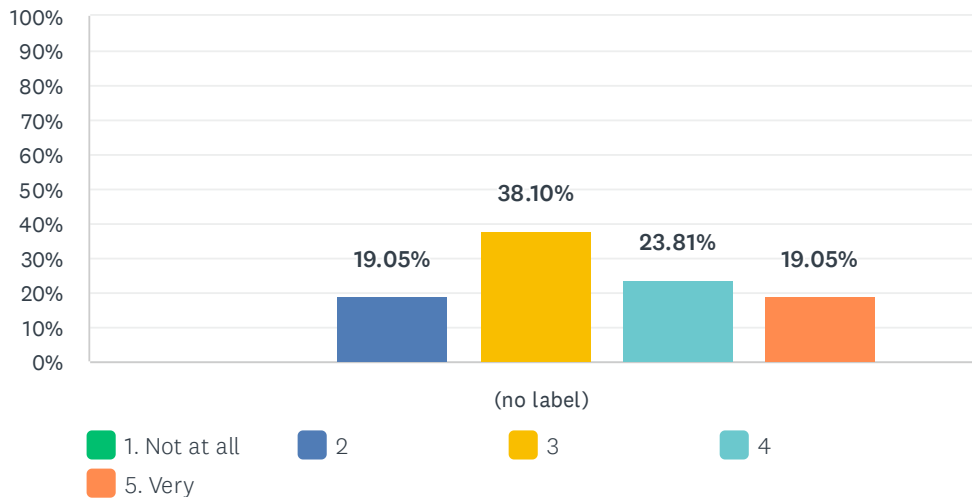
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	19.05% 4	38.10% 8	23.81% 5	19.05% 4	21	3.43

Q7 The amount of material presented was

Answered: 21   Skipped: 0

	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	71.43% 15	4.76% 1	19.05% 4	21	2.38

Q8 The overall experience of the school was worthwhile

Answered: 21   Skipped: 0
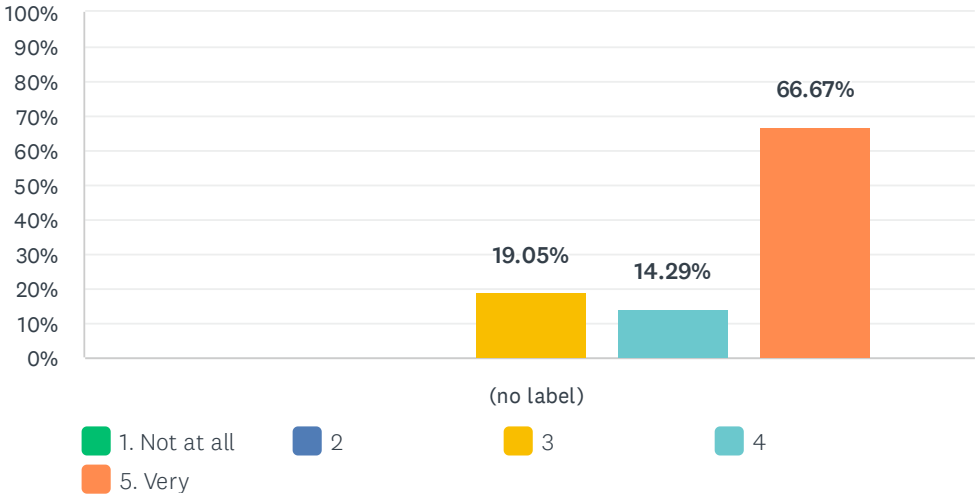
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	19.05% 4	14.29% 3	66.67% 14	21	4.48

Q9 Additional comments on the topic presentation and organization

Answered: 8   Skipped: 13

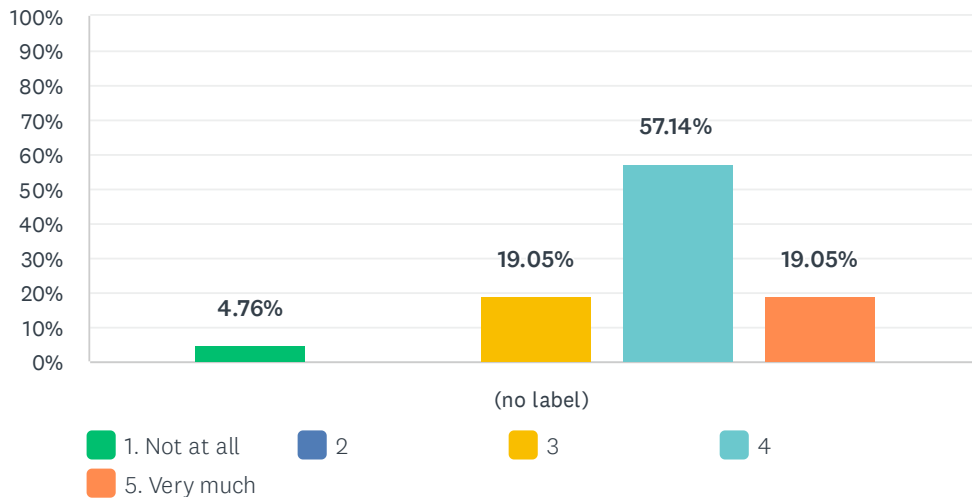| #	RESPONSES	DATE
1	The recording is an absolute disaster.	8/11/2022 7:54 PM
2	I really enjoyed that the summer school was organized into morning lecture sessions with sufficient time in the afternoon to get to know the other participants and enjoy the environment. I formed great connections at this summer school that will definitely boost my academic work because of the time allotted to socialization.	8/4/2022 1:29 PM
3	I'm not aware whether this was MSRI's policy, but, in my opinion, it would have been better if each topic was presented in consecutive days, finishing each topic before moving onto next one. I don't think 3 topics were related enough to the extent that shifting between 3 topics were beneficial in understanding the topics. To me, it ironically made it harder to appreciate each talk, being lost what is the point of the talks and relationship between them.	8/3/2022 5:23 PM
4	Someone needed to keep the 15 minute talks to 15 minutes. Numerous people were going over on their time.	8/2/2022 9:10 AM
5	No	8/1/2022 4:46 PM
6	I hope we can see our goal as soon as possible so as not to dive into the technical detail due to the limitation of two weeks.	8/1/2022 4:41 PM
7	They try their best for this activity. It is really exciting and exhausts me. However, I prefer blackboard then whiteboard. Because the whiteboard always has somewhat reflections that make me pay a lot of unnecessary physical and vision. However, overall is very good. Thanks for everything ☺	8/1/2022 4:10 PM
8	The zoom setup could be improved. It was nearly impossible to read the board.	8/1/2022 2:48 PM

Q10 I was well prepared to benefit from the school

Answered: 21   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	9.52% 2	28.57% 6	28.57% 6	28.57% 6	21	3.67

Q11 My interest in the subject matter was increased by the school

Answered: 21   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	0.00% 0	19.05% 4	57.14% 12	19.05% 4	21	3.86

Q12 The school helped me meet people with similar scientific interests

Answered: 21   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	9.52% 2	42.86% 9	42.86% 9	21	4.24

Q13 It is likely that I will work in the area of the school subject in the future

Answered: 21   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	4.76% 1	23.81% 5	28.57% 6	38.10% 8	21	3.90

Q14 How would you evaluate your interaction with other participants?

Answered: 21   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 2	14.29% 3	28.57% 6	47.62% 10	21	4.14

Q15 Additional comments on personal assessment

Answered: 4   Skipped: 17

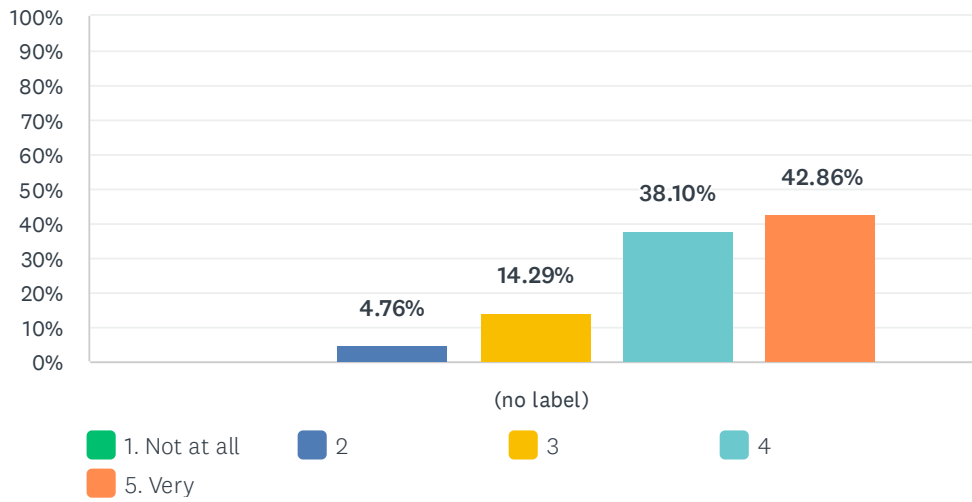| #	RESPONSES	DATE
1	It could have been better if the lecturers gave more guidance regarding what are needed to follow their talks, beforehand. I understood a big portion, but am regretful of what I could have, if I knew some things in advance. One of the professor seemed to be introducing too many definitions that are not well defined from the mathematician's view, since he was trying to integrate physics. Those problems could have easily been solved, I guess, if he had given some material before the start of this program.	8/3/2022 5:27 PM
2	No	8/1/2022 4:47 PM
3	I am surprised that I do not encounter too much cultural shock as I have anticipated.	8/1/2022 4:45 PM
4	I am not a PDE guy and more interested in analysis(harmonic and complex analysis). In this activity, I realize that the importance of distribution and Fourier transform and interpolation technique for solving PDE. It provides me very nice way to study the Boltzmann equation.	8/1/2022 4:19 PM

Q16 I found the MSRI staff helpful

Answered: 21   Skipped: 0
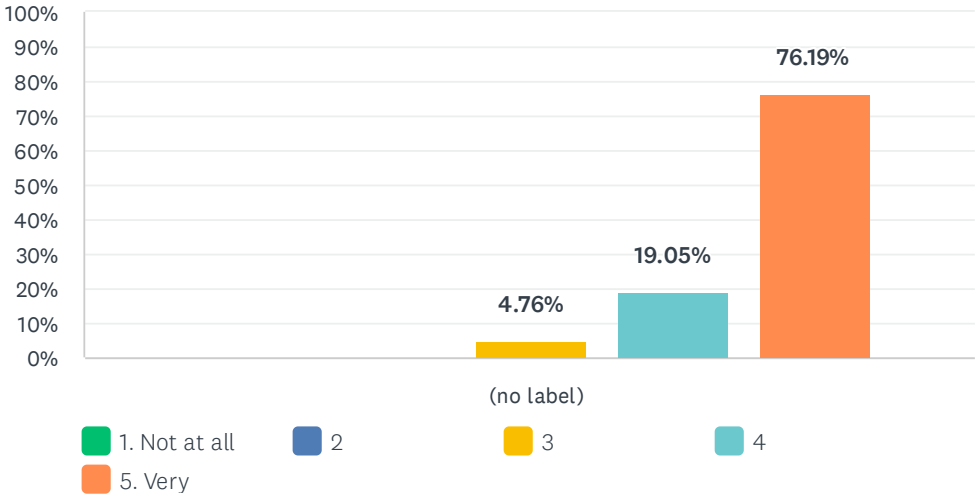
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.76% 1	19.05% 4	76.19% 16	21	4.71

Q17 The physical facilities were conducive for such a school

Answered: 21　　Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	14.29% 3	38.10% 8	42.86% 9	21	4.19

Q18 Additional comments on the venue

Answered: 5   Skipped: 16

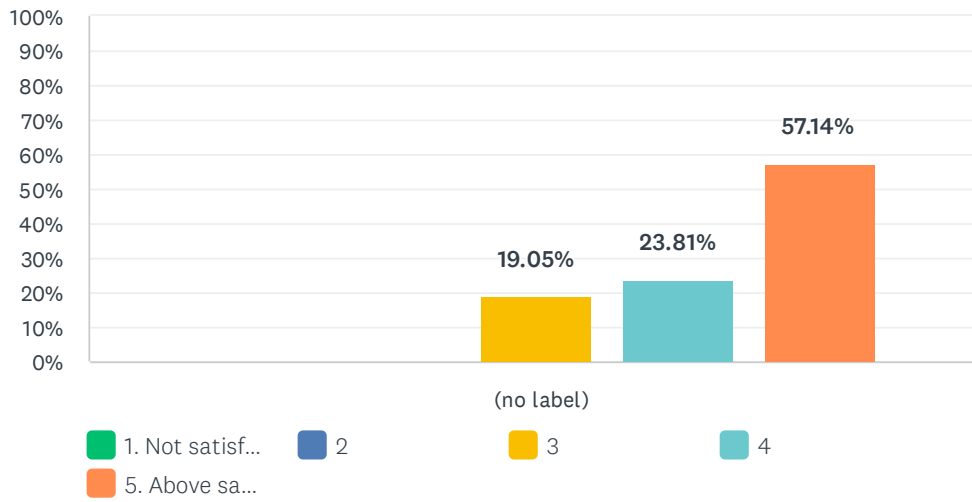| #	RESPONSES	DATE
1	Some students said that the dorm rooms were moldy and not good for sleeping	8/15/2022 7:44 PM
2	I have a really mixed feeling about this place that makes it hard to give 'a' score to the venue. Dorm room were not great at all - some of the participants experienced coughing only when they were at their rooms (presumably due to mold), there were lack of cooling system, shower rooms were awful, and there were too many bugs (although this probably can't be avoided in such island). Dining hall was awesome, probably one of the best in the United States, which is also unanimous thought between participants. Lecture room building was fine, although to keep the social distancing, some of the chairs were placed too far away from the board.	8/3/2022 5:34 PM
3	No	8/1/2022 4:47 PM
4	This is a good place. But to my surprise, there is no math department in Hilo, so we have fewer opportunities to have more conversations with local people.	8/1/2022 4:47 PM
5	That dining hall was the best I have ever attended. It was a pleasure.	8/1/2022 1:41 PM

Q19 How did you find the summer school accommodations?

Answered: 21   Skipped: 0
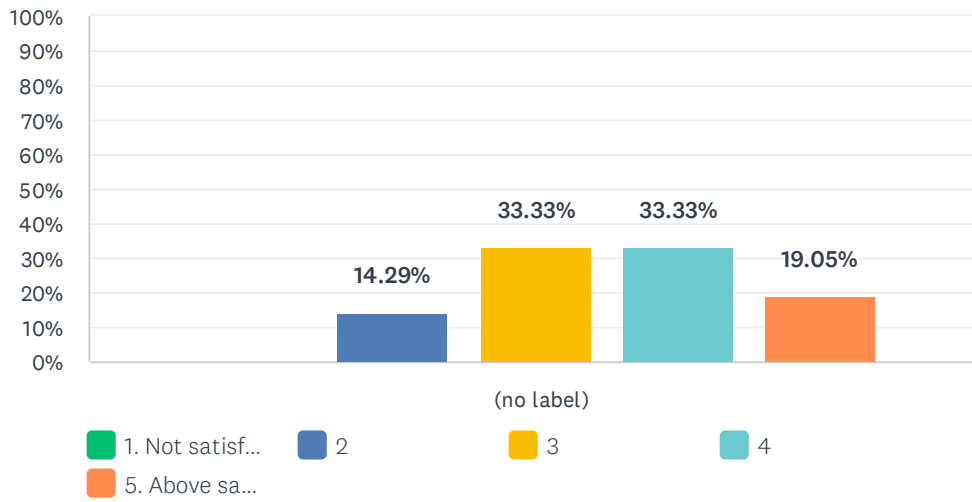
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	14.29% 3	33.33% 7	33.33% 7	19.05% 4	21	3.57

Q20 How did you find the food at the dormitories?

Answered: 21   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	19.05% 4	23.81% 5	57.14% 12	21	4.38

Q21 Additional comments on accommodation and food

Answered: 8   Skipped: 13

#	RESPONSES	DATE
1	The local staff at Hawaii University are AWESOME.	8/7/2022 11:01 AM
2	The only issue with the accodomations was that there seemed to be some kind of mold issue and we often woke up feeling congested.	8/4/2022 1:31 PM
3	Best dining ever. Food was delicious!	8/4/2022 12:23 AM
4	I guess I wrote comment for this blank in the previous one.	8/3/2022 5:34 PM
5	A few of the rooms had mold in them. Besides that they were very adequate and satisfactory. The food was phenomenal.	8/2/2022 9:11 AM
6	Although I am not accustomed to American-style food, I still enjoy the meal I had in the restaurant. Also, the accommodation is good!	8/1/2022 4:50 PM
7	No	8/1/2022 4:48 PM
8	There was some mold in the rooms.	8/1/2022 2:49 PM

Q22 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 4   Skipped: 17

#	RESPONSES	DATE
1	I may have preferred the honolulu campus over the hilo campus	8/15/2022 7:45 PM
2	I think I wrote enough. Thank you for organizing this program, and hope you enjoy great summer.	8/3/2022 5:35 PM
3	I highly recommend uploading the content (or outline) of the lectures in advance. It would be definitely better if we can know what we will learn this summer school.	8/1/2022 4:51 PM
4	No, it's really good.	8/1/2022 4:49 PM

Mathematics of Machine Learning (INdAM and Courant Institute)

July 25, 2022 – August 05, 2022

New York, US & Rome, Italy

Organizers:

Sebastien Bubeck (Microsoft Research)

Organizers

First Name	Last Name	Current Institution
Sebastien	Bubeck	Microsoft Research

Speakers

First Name	Last Name	Current Institution
Joan	Bruna	New York University, Courant Institute
Nicolo	Cesa-Bianchi	Universita degli Studi di Milano
Nicolas	Flammarion	École Polytechnique Fédérale de Lausanne (EPFL)
Robert	Schapire	Microsoft Research
Mengdi	Wang	Princeton University

Teaching Assistants

First Name	Last Name	Current Institution
Nataly	Brukhim	Princeton University
Anand	Kalvit	Graduate School of Business, Columbia University
Sudeep Raja	Putta	Columbia University

Mathematical Sciences Research Institute

Mathematics Of Machine Learning (INdAM And Courant Institute)

July 25, 2022 - August 04, 2022

Monday, July 25, 2022

9:00 AM - 10:00 AM	Nicolas Flammarion	Lecture: Convex Optimization
10:15 AM - 11:15 AM	Nicolo Cesa-Bianchi	Lecture: Online Learning
11:30 AM - 12:30 PM	Robert Schapire	Lecture: Statistical Learning Theory

Tuesday, July 26, 2022

9:00 AM - 10:00 AM	Nicolas Flammarion	Lecture: Convex Optimization
10:15 AM - 11:15 AM	Nicolo Cesa-Bianchi	Lecture: Online Learning
11:30 AM - 12:30 PM	Robert Schapire	Lecture: Statistical Learning Theory

Wednesday, July 27, 2022

9:00 AM - 10:00 AM	Nicolas Flammarion	Lecture: Convex Optimization
10:15 AM - 11:15 AM	Nicolo Cesa-Bianchi	Lecture: Online Learning
11:30 AM - 12:30 PM	Nicolo Cesa-Bianchi	Lecture: Online Learning

Thursday, July 28, 2022

9:00 AM - 10:00 AM	Nicolas Flammarion	Lecture: Convex Optimization
10:15 AM - 11:15 AM	Nicolas Flammarion	Lecture: Convex Optimization
11:30 AM - 12:30 PM	Robert Schapire	Lecture: Statistical Learning Theory

Friday, July 29, 2022

9:00 AM - 10:00 AM	Nicolo Cesa-Bianchi	Lecture: Online Learning
10:15 AM - 11:15 AM	Joan Bruna	Lecture: Deep Learning Theory
11:30 AM - 12:30 PM	Joan Bruna	Lecture: Deep Learning Theory

Monday, August 01, 2022

9:00 AM - 10:00 AM	Robert Schapire	Lecture: Statistical Learning Theory
10:15 AM - 11:15 AM	Joan Bruna	Lecture: Deep Learning Theory
11:30 AM - 12:30 PM	Mengdi Wang	Lecture: Reinforcement Learning

Tuesday, August 02, 2022

9:00 AM - 10:00 AM	Joan Bruna	Lecture: Deep Learning Theory
10:15 AM - 11:15 AM	Joan Bruna	Lecture: Deep Learning Theory
11:30 AM - 12:30 PM	Mengdi Wang	Lecture: Reinforcement Learning

Wednesday, August 03, 2022		
11:30 AM - 12:30 PM	Mengdi Wang	Lecture: Reinforcement Learning

Thursday, August 04, 2022		
10:15 AM - 11:15 AM	Robert Schapire	Lecture: Statistical Learning Theory
11:30 AM - 12:30 PM	Mengdi Wang	Lecture: Reinforcement Learning

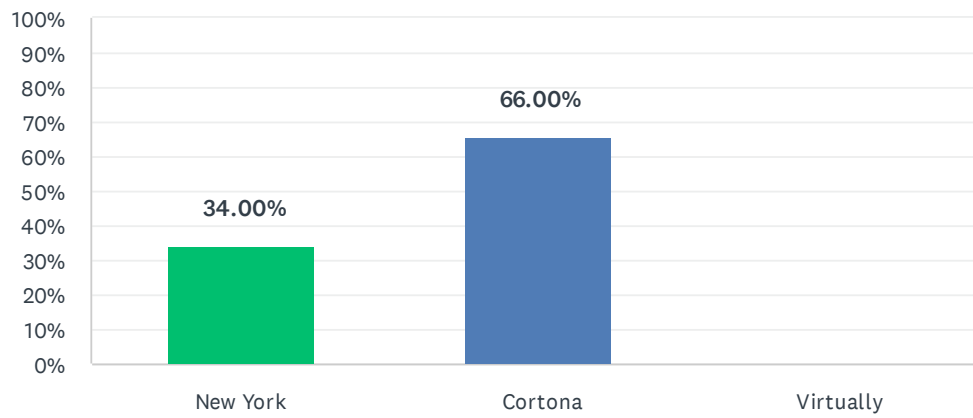# Officially Registered Student Information

Students		23

Gender		23
Male	43.48%	10
Female	56.52%	13
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		25
White	56.00%	14
Asian	20.00%	5
Hispanic	8.00%	2
Pacific Islander	0.00%	0
Black	4.00%	1
Native American	0.00%	0
Mixed	4.00%	1
Declined to state	8.00%	2

* ethnicity specifications are not exclusive

Q1 I participated in:

Answered: 50   Skipped: 0

ANSWER CHOICES	RESPONSES	
New York	34.00%	17
Cortona	66.00%	33
Virtually	0.00%	0
TOTAL		50

Q2 My home institution is located in:

Answered: 50   Skipped: 0
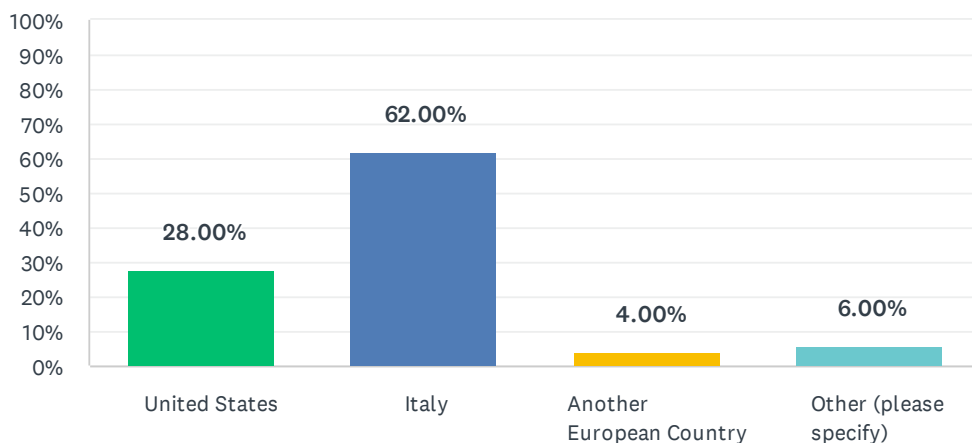
ANSWER CHOICES	RESPONSES	
United States	28.00%	14
Italy	62.00%	31
Another European Country	4.00%	2
Other (please specify)	6.00%	3
TOTAL		50

#	OTHER (PLEASE SPECIFY)	DATE
1	Mexico	8/6/2022 8:42 PM
2	Canada	8/6/2022 5:25 PM
3	Taiwan	8/5/2022 7:20 PM

Q3 The various topics within the summer school integrated into a coherent picture
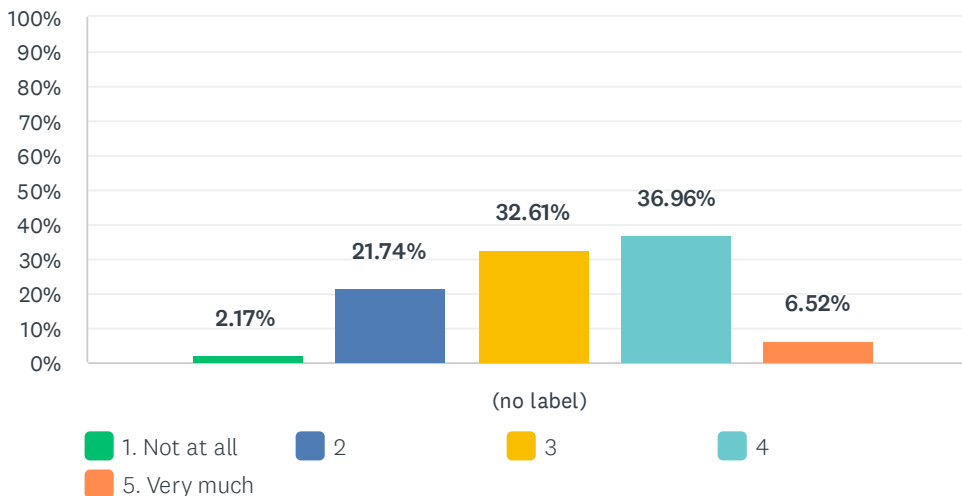
Answered: 46   Skipped: 4
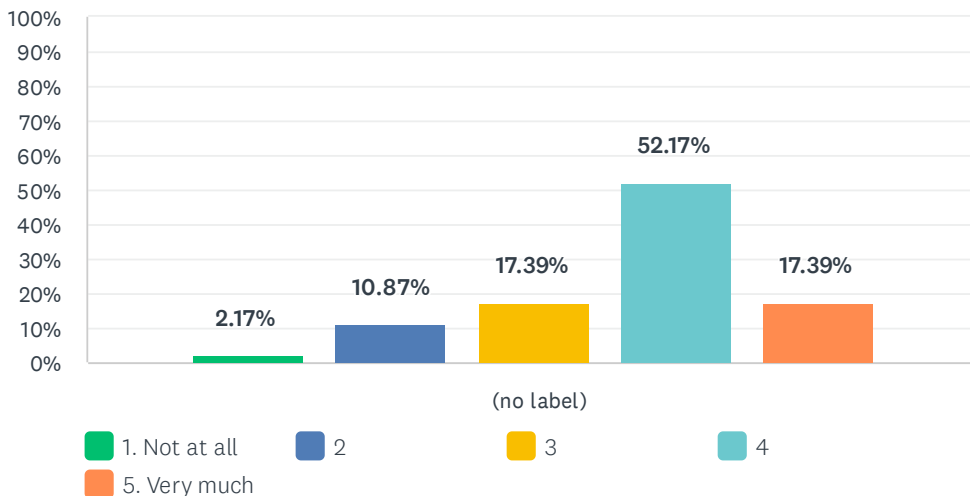
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	10.87% 5	17.39% 8	52.17% 24	17.39% 8	46	3.72

Q4 The faculty speakers were generally clear and well organized in their presentation
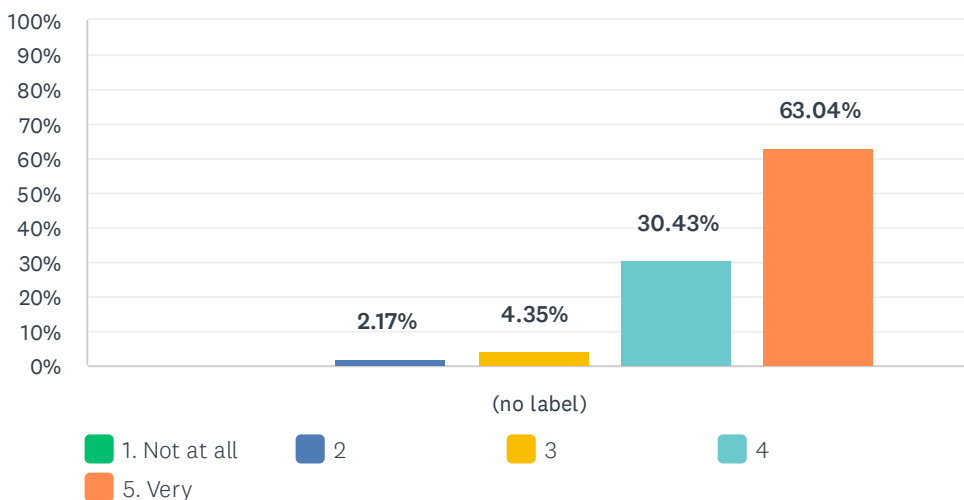
Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	21.74% 10	32.61% 15	36.96% 17	6.52% 3	46	3.24

#	COMMENTS	DATE
1	The professor of Convex Optimization was not so easy to follow due to a strong french accent. The slides of the professor of Online Learning were a bit too dense.	8/11/2022 2:46 AM
2	I would have preferred to avoid proofs altogether for time's sake, giving references instead.	8/10/2022 3:46 AM
3	I would say all speakers were generally well organized, but the clarity varied by speaker. I did feel that some speakers were successful in communicating their content via Zoom, but the virtual format (and the speakers' approaches to working within the format) made it difficult to understand some speakers' content in the time given. I will detail my thoughts on the various approaches to presenting in the "additional comments" section below.	8/8/2022 7:18 PM
4	It would have been so much better if we got to attend classes in person and not over zoom.	8/8/2022 9:45 AM
5	Since we were in NY, I wished we had more in person interactions with the Professors	8/8/2022 8:09 AM
6	I'd say this experience was all over the map. Most speakers were very prepared/organized, but not necessarily clear. Some speakers went very fast and responded that "the slides are posted" if we ever asked for a slower delivery. I think that response is problematic because I'd rather spend our class time learning a few things well than giving an unclear overview of 10 topics per lecture.	8/7/2022 1:04 PM
7	RL was not clear nor organized	8/6/2022 1:03 AM
8	The fact that the speakers were online had a negative influence on the overall teaching	8/6/2022 12:26 AM
9	I found the speakers that wrote out their notes rather than use slides were more effective.	8/5/2022 4:27 PM
10	I think they all did a great job, but I think they assumed we had some knowledge that we didn't actually have, so it made it hard to keep up and understand sometimes.	8/5/2022 2:18 PM
11	The audio was not optimal, at the point some presentations were difficult to follow.	8/5/2022 2:16 PM

# Q5 The teaching assistants were helpful

Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.17% 1	4.35% 2	30.43% 14	63.04% 29	46	4.54

| #	COMMENTS	DATE
1	They were great	8/24/2022 10:39 AM
2	Cesare Molinari had inappropriate behaviors towards female participants	8/10/2022 3:46 AM
3	All of the teaching assistants were helpful when we had questions. Alberto was particularly helpful and made a point to circulate and check on the groups regularly throughout the practice sessions.	8/8/2022 7:18 PM
4	They were our only help throughout the experience, and were very knowledgable. I especially appreciate Alberto's assistance.	8/7/2022 1:04 PM
5	The TAs were extremely helpful during the sessions. I wish they had spent time with us outside of the practice sessions so we could ask broader questions and learn about their research.	8/5/2022 4:27 PM

Q6 The school was intellectually stimulating
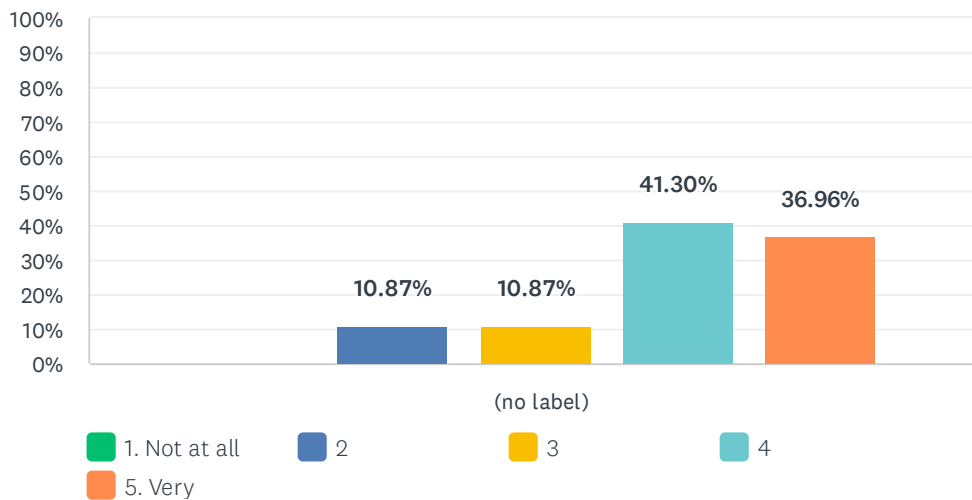
Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	10.87% 5	10.87% 5	41.30% 19	36.96% 17	46	4.04

Q7 The practice sessions were productive

Answered: 46   Skipped: 4
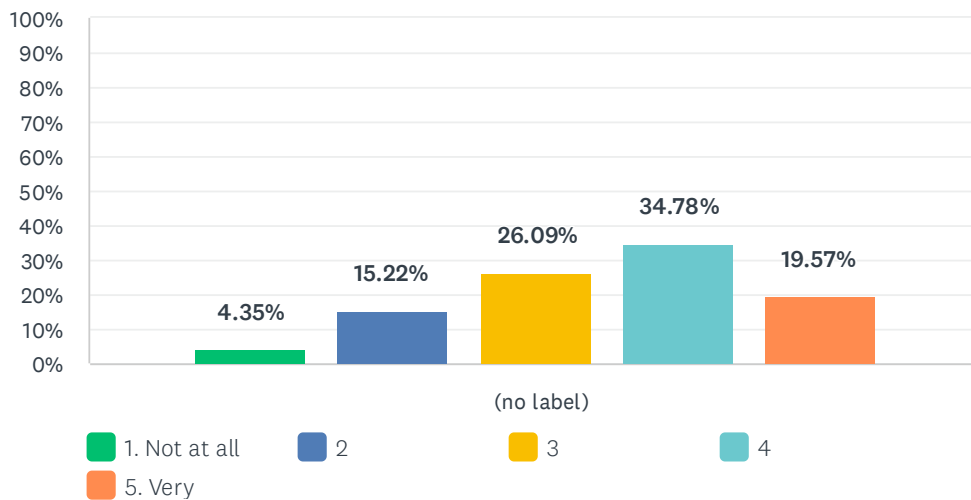
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.35% 2	15.22% 7	26.09% 12	34.78% 16	19.57% 9	46	3.50

Q8 The amount of material presented was

Answered: 46   Skipped: 4
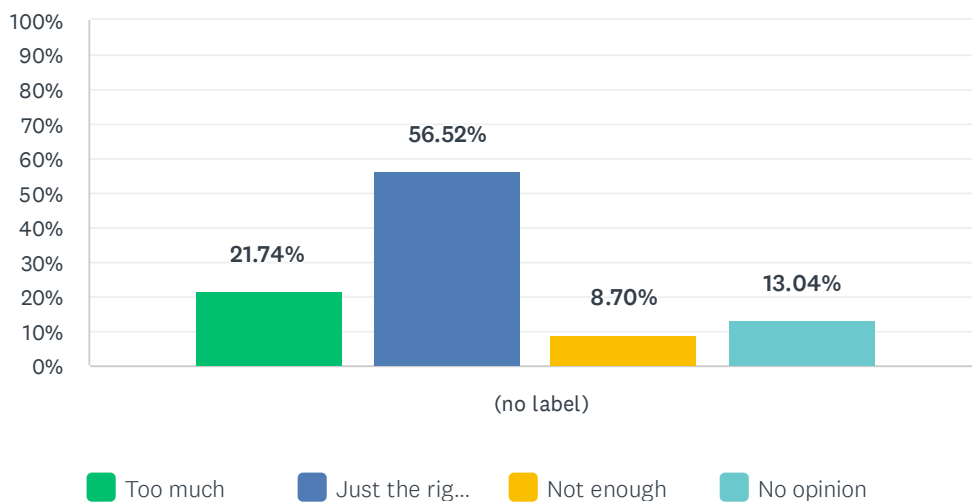
	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	21.74% 10	56.52% 26	8.70% 4	13.04% 6	46	2.13

Q9 Additional comments on the topic presentation and organization

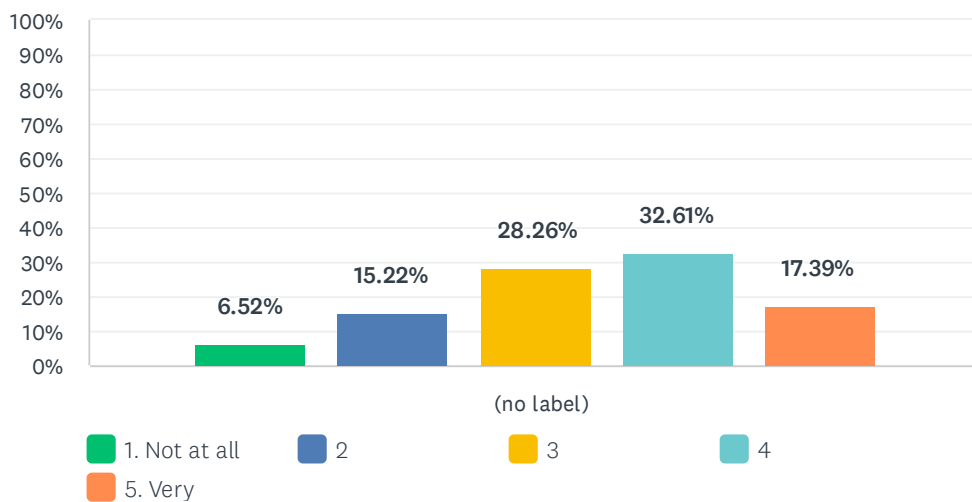Answered: 16   Skipped: 34

#	RESPONSES	DATE
1	Would have been nice to have the professors by zoom to help us with the problems	8/24/2022 10:39 AM
2	In my opinion the online format is not the best option to do this type of school. The lack of interaction between speakers and participants does not allow to create links and and professional relations.	8/16/2022 5:59 AM
3	I love this summer school in general. It would be much more efficient if the faculty speakers were also in-person. And it will be better if we have access to NYU's facilities such as the library.	8/10/2022 12:29 PM
4	I did feel that the virtual format hindered some of the speakers' communication. For instance, when using slides to present, sometimes speakers can tend to move very quickly (especially without an in-person audience to give feedback), which can make it hard for the audience to follow along, especially if we don't have a copy of the slides. If a speaker will be using slides or resources prepared ahead of time (as opposed to writing everything live during the lecture), I think it would be extremely helpful for the audience to have a copy of the slides beforehand. That way, we can follow along and annotate the slides throughout the lecture (we were given slides ahead of time for the statistical learning theory course, which I really appreciated!). I do think this issue would also have largely been solved by the speakers lecturing in person, since they would likely be able to write on the board and naturally move at a better pace.	8/8/2022 7:18 PM
5	I came to the summer school thinking more about interactions with the instructors and experts in the field. It was sad that we had to attend classes online. Problem sessions were very helpful, students interacted with themselves and the TAs. However, more interactions with the instructors would have been so much better.	8/8/2022 9:45 AM
6	Since we were in NYU, I wished we had more in person networking opportunities with Industry people in regard to industry practices of machine learning.	8/8/2022 8:09 AM
7	For most of us it was difficult to know what the experience was going to be like coming into the program. I believe most of us were not aware that the courses would ALL be remote (some people would have preferred to stay home had they known), and few of us were clear on whether this was going to focus on theory or application.	8/7/2022 1:04 PM
8	Even though I think the instructors did their best and were very organized throughout the summer school, I believe my learning rate would be higher if the classes were not via Zoom. None of us knew we will be listening classes via Zoom and we had some technical problems some days that create somehow distraction. Some classes were taught with presentations and it went too fast most of the time. If the instructors were there in person, I believe it would have been easier to arrange the speed of lectures depending on the students mimics and behaviors in general. In general, it was a good experience for me though. Thank you very much for the opportunity!	8/7/2022 9:41 AM
9	The online presentations completely neglect the networking and the direct interaction with the speakers. The connection problems caused a further drop in the quality of the presentation. The practice sessions could have also developed direct computational applications of the concepts presented during the classes: more programming was expected.	8/6/2022 3:20 AM
10	provide organized, clear and not hand-written handouts for the lectures - don't neglect the numerical, implementation and computational side of the topics - consider some algorithms in the lectures and try to use it in the practice sessions - analyze real world examples and best practices from a mathematical perspective - check the venues to avoid incorrect climate that stifles productivity and motivation. - more manageable timetable.	8/6/2022 1:26 AM
11	We didn't know speaker were online until we arrived in Cortona	8/6/2022 1:03 AM
12	I suggest the speakers to share in advance their presentation if they are using slides/handwritten notes with something written in advance	8/6/2022 12:26 AM

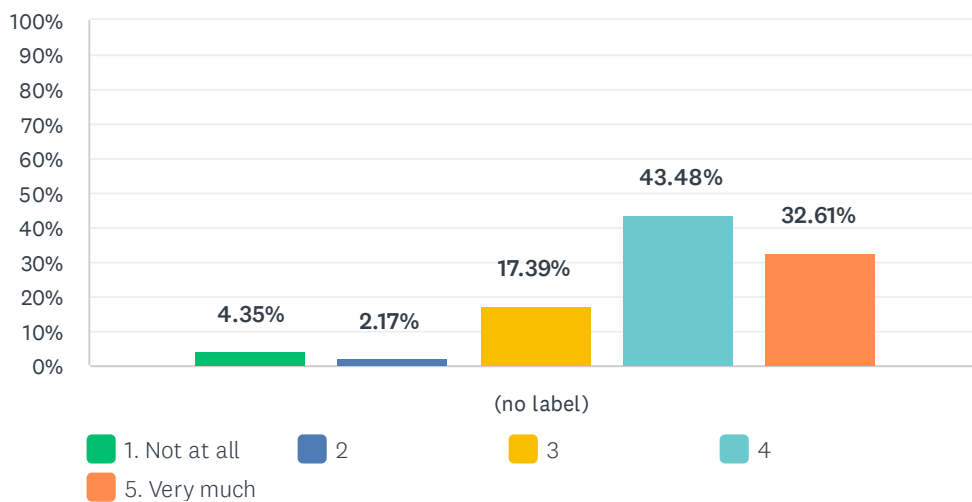| 13	Some of the courses were taught at a level that made it hard to complete the practice problems. I wish there had been problems offered of varying levels (including more introductory problems).	8/5/2022 4:27 PM
14	The problems ended up taking a lot longer than the practice sessions set aside time for.	8/5/2022 2:43 PM
15	My main point of criticism is: Teachers should have put more effort into producing lecture material which is clear and understandable. I have had the impression that most of the lectures were prepared in a hurry and with little attention to the didactic aspect, which instead should have been the main focus especially considering that the lectures were not in-person. Also, many courses racked up too many concepts at the expense of concentrating on establishing the basics. It was hard to catch up even after studying during the free time. Then, I would have expected at least some of the lectures to be in-presence. As a PhD student who is soon-to-graduate, I was also looking to do some networking for finding a possible post-doc, so having some of the lecturers present on-the-spot could have given me way higher opportunities for that. Remote lectures are good for the teachers since they don't need to move from home, but are a terrible medium for students. In Italy there are no more covid restrictions, so there is actually no excuse for not having had at least one of the courses in-person. A minor comment: we were notified by the Italian secretariat to bring our own PC for the practice sessions. Many students like me expected at least some if these sessions to be more practical with some coding exercises which could've also helped with the understanding of the subjects for those who, like me and many others, don't have extremely solid mathematical bases to grasp advanced concepts immediately. Finally: a suggestion for the next year. There were some free time spots where having some activities for students not necessarily linked to the themes of the school itself might have greatly benefitted the students' experience. Sports, hikes, social activites can greatly increase cohesion between the students especially after 2 years of COVID where all of this was unfortunately lacking.	8/5/2022 2:26 PM
16	I have very little background in ML, so I felt like things went kind of fast, but that's just me.	8/5/2022 2:18 PM

Q10 I was well prepared to benefit from the school

Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	6.52% 3	15.22% 7	28.26% 13	32.61% 15	17.39% 8	46	3.39

Q11 My interest in the subject matter was increased by the school

Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	4.35% 2	2.17% 1	17.39% 8	43.48% 20	32.61% 15	46	3.98

Q12 The school helped me meet people with similar scientific interests

Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 2	10.87% 5	28.26% 13	56.52% 26	46	4.37

Q13 It is likely that I will work in the area of the school subject in the future

Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	6.52% 3	10.87% 5	28.26% 13	30.43% 14	23.91% 11	46	3.54

Q14 How would you evaluate your interaction with other participants?

Answered: 46   Skipped: 4
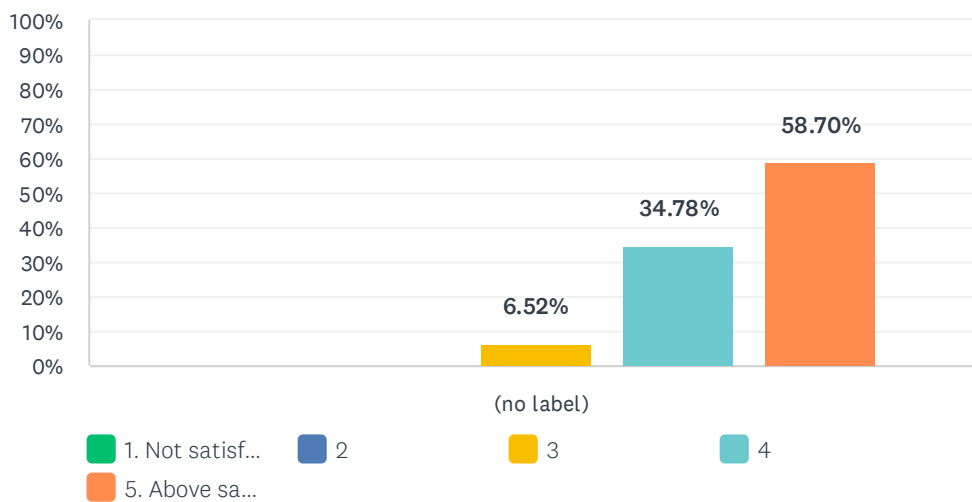
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.52% 3	34.78% 16	58.70% 27	46	4.52

Q15 Additional comments on personal assessment

Answered: 4   Skipped: 46

#	RESPONSES	DATE
1	I appreciate the opportunity of meeting people from different institutes sharing similar research interests. I think we would continue to talk to each other after the school ended.	8/10/2022 12:31 PM
2	For me, interacting with fellow math graduate students was one of the best aspects of the summer school. It would have been nice to have more interaction with the instructors. I do think that it may not have been clear exactly what prior knowledge/experience the instructors would be assuming we had going into the summer school.	8/8/2022 7:25 PM
3	I wish the course had offered opportunities to interact with faculty and post docs outside of courses. While I networked with the other students, I would have loved the opportunity to network with the faculty/post docs.	8/5/2022 4:34 PM
4	As previously stated, interactions with other students could be increased by having extracurricular activities like sports or social activities.	8/5/2022 2:28 PM

Q16 I found the onsite staff helpful

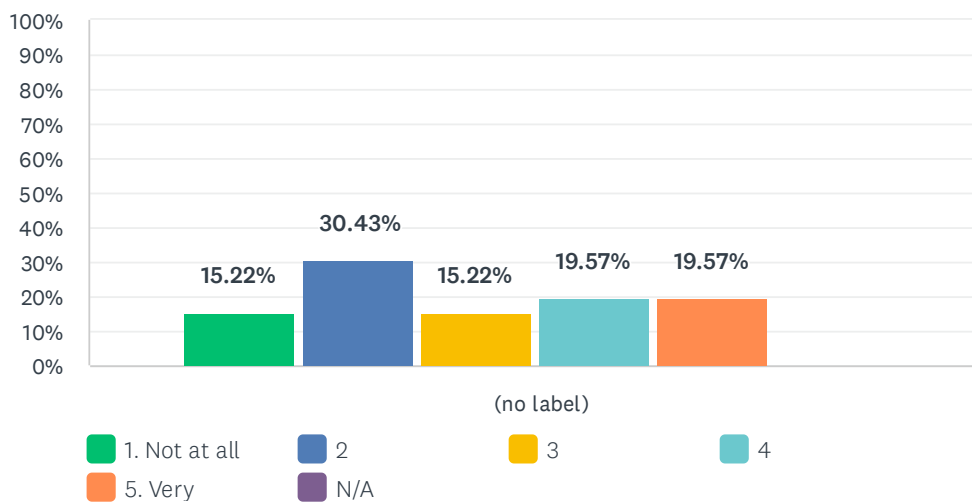Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	2.17% 1	6.52% 3	15.22% 7	30.43% 14	39.13% 18	6.52% 3	46	4.05

Q17 The physical facilities were conducive for such a school

Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	15.22% 7	30.43% 14	15.22% 7	19.57% 9	19.57% 9	0.00% 0	46	2.98

Q18 Additional comments on the venue

Answered: 12   Skipped: 38

#	RESPONSES	DATE
1	The Palazzone building is a bit too far from the railway station and challenging to reach without a car. The internet connection in the Palazzone building is not so stable.	8/11/2022 2:49 AM
2	We only have access to NYU's norm, dining halls and the building we took classes. It would be much better if we also have access to the library. However, we only have a temporary NYU ID card for the accessing the dorm and we were told that we didn't have the privilege to access the library.	8/10/2022 12:33 PM
3	The venue had very few plugs, no air conditioning and basically no comforts whatsoever. It was very hard to be productive in such an environment and the incompetence and rudeness of the staff made things even worse.	8/10/2022 3:51 AM
4	I'm not sure if he counts as "onsite staff," but I did want to emphasize that Alberto was incredibly helpful, both with facilitating the practice sessions and with making sure we were taken care of during the two weeks (for instance, he helped us find the NYU guest wifi username and password, which was some students' only option for connecting to the internet on campus). The staff at Brittany Hall were also very helpful in getting us checked in and out. I think the classroom could have been chosen better--the room we were in was pretty small and cramped, and there were not many outlets near the seats. Since many of us were using a laptop and/or tablet for at least some of our time in the classroom, this was a bit inconvenient. The desks attached to the seats were also very small, which made taking notes and working on the problem sets a bit difficult. The classroom was in the basement of the building we were in (and had no windows), so it did tend to feel a bit isolating from the rest of the building and university. It would have been nice to be closer/more connected to the math or CS department at NYU.	8/8/2022 7:36 PM
5	NYU dorms were not very comfortable and the food was not very healthy and sometimes really bad. I ended up eating out most of the times.	8/8/2022 9:47 AM
6	We found the TAs helpful, but there were no onsite staff. We never interacted with the Courant Institute nor its facilities.	8/7/2022 1:05 PM
7	It was too hot in Palazzone, no AC and no fans, the internet connection was bad	8/6/2022 1:04 AM
8	We really suffered due to the lack of air conditioning or fans. The audio quality was not good, especially when students from New York asked their questions far away from their microphone (they have been asked several time to come closer or repeat the question, but they ignored our requests)	8/6/2022 12:31 AM
9	There was no air conditioning (room temperature above 30° C / 86 °F) and the internet connection was unstable.	8/6/2022 12:04 AM
10	We had a few technical issues, but nothing that was too problematic. (I.e. the zoom connection failed a few times)	8/5/2022 4:35 PM
11	Despite being an artistically wonderful site, the Palazzone was not ergonomic for such courses. The WiFi was spotty and 4G connection non-existent. The desks in the lecture hall were too small and could not support a laptop. The common spaces were not open in the evening, not allowing for group studying. Study halls for traditional study were lacking (there would have been an additional room which was unexplainalbly left closed). In addition, comparing with my past summer school experiences (even in historical places like Kavli Moen Gard in Norway) there were too many restrictions, it felt like being in a china shop.	8/5/2022 2:34 PM
12	We didn't have any staff on site, which truthfully made things harder. We were all sometimes confused about logistics of things, and having an organizer in person would have been helpful.	8/5/2022 2:19 PM

Q19 How did you find the summer school accommodations?

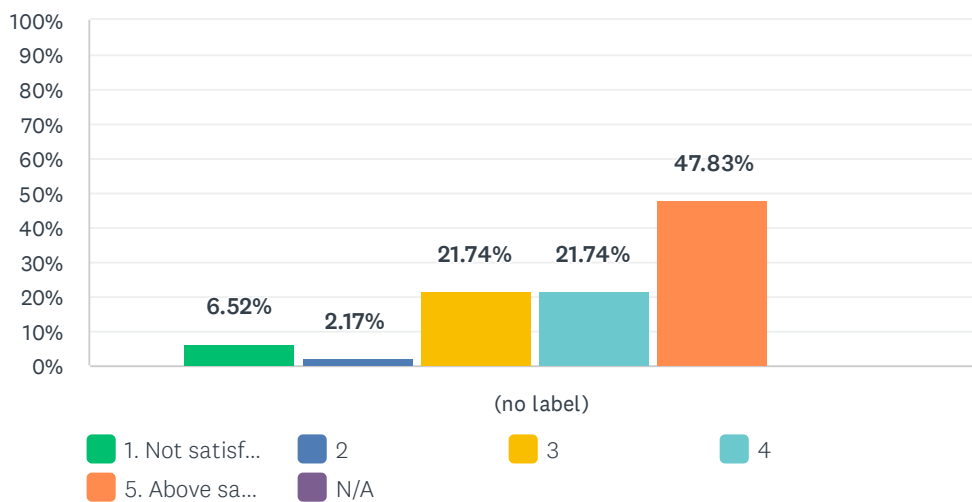Answered: 46   Skipped: 4

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	8.70% 4	8.70% 4	30.43% 14	21.74% 10	30.43% 14	0.00% 0	46	3.57

Q20 How did you find the food at the school?

Answered: 46   Skipped: 4

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	6.52% 3	2.17% 1	21.74% 10	21.74% 10	47.83% 22	0.00% 0	46	4.02

Q21 Additional comments on accommodation and food

Answered: 12   Skipped: 38

#	RESPONSES	DATE
1	Free food and pretty good! No complaints	8/24/2022 10:39 AM
2	It's fine in general.	8/10/2022 12:34 PM
3	The Palazzone is by no means whatsoever suitable for accommodation.	8/10/2022 3:53 AM
4	I was pleasantly surprised at how large the dorm rooms were. The location was convenient, and it was very helpful to have easy access to a laundry room. The food was pretty average but probably on par for what one would expect from a university dining hall. I really appreciated having the option to have all of our meals covered if we ate at the dining hall, especially given how expensive dining in New York is. If possible, I think it would be nice to also give an allowance to participants to eat at least a few meals outside of the dining hall (maybe replacing a few of the dining hall vouchers), though I realize that may become prohibitively expensive.	8/8/2022 7:42 PM
5	The accommodations were distributed unequally: 5 people were in a room while others had 1 person in a room that could fit 5. It didn't make a lot of sense. The checkout process was pretty difficult and the wifi was awful. Not everyone has access to eduroam, and relying on the sporadic and ever-changing NYU wifi made things really difficult.	8/7/2022 1:07 PM
6	There were cockroaches in the dorm.	8/7/2022 9:47 AM
7	Did not even provide an extra blanket in case of need. No cleaning for 10 days where 4 people were sharing the same washroom. When my husband visited, did not even let him sit in the lobby to wait.	8/6/2022 5:29 PM
8	provide more fans and air-conditioning	8/6/2022 3:54 AM
9	Eating meat every day, twice a day, it was too much	8/6/2022 2:41 AM
10	The food was generally ok but I'm vegetarian and I had tomato sauce pasta for two weeks, I think it could have been better	8/6/2022 1:07 AM
11	Sharing a dorm room was difficult, and I don't think anyone slept well. I wish we had stayed in a suite, but had our own room. The food was terrible.	8/5/2022 4:36 PM
12	The dorm food was not great. I would've preferred having a daily food budget instead.	8/5/2022 2:20 PM

Q22 The overall experience of the school was worthwhile
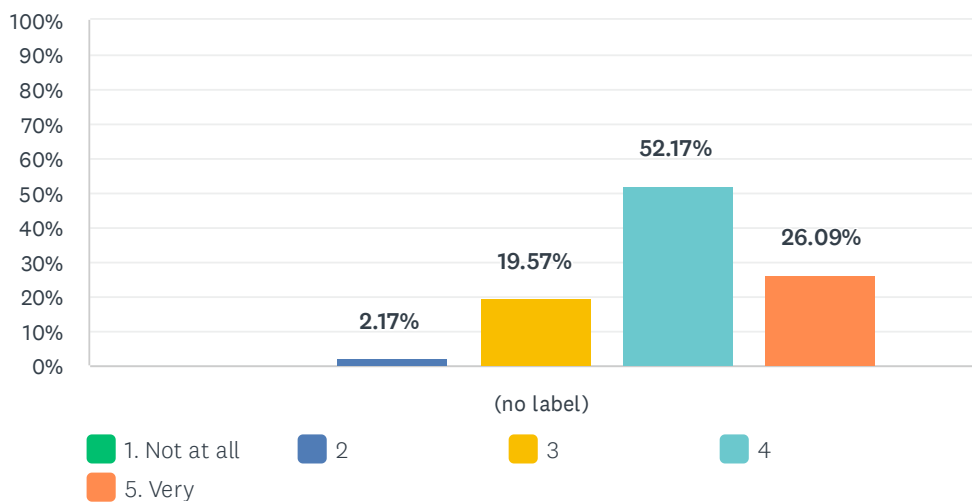
Answered: 46   Skipped: 4

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.17% 1	19.57% 9	52.17% 24	26.09% 12	46	4.02

Q23 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 16   Skipped: 34

#	RESPONSES	DATE
1	I understand that we were having a hybrid school. I would prefer a school with all faculty speakers onsite.The online format is a bit strange (all students were in-person but watching online streaming classes in the classroom). I understand that the summer school is held by MSRI not NYU, but I feel a bit difficult to access NYU's resources (like the library) and we didn't have an in-person organizer from MSRI (we only have TAs there).	8/10/2022 12:39 PM
2	Fire Silvana	8/10/2022 3:54 AM
3	Based on my own experience and my conversations with other participants, I don't think most of us realized that all of the instructors would be lecturing via Zoom. I feel this could have been communicated more clearly leading up to the summer school--it was a bit surprising to arrive and find that the instruction would be completely virtual (other than the TA supervision during practice sessions). The online format, combined with the classroom being a bit isolated from the rest of the university, made the summer school feel disconnected from MSRI and NYU. I think the summer school would be much more successful with instructors lecturing in person when possible. I think participants would also appreciate having some more interaction with MSRI and NYU throughout the summer school, maybe through a couple of informal social events like tea times.	8/8/2022 7:55 PM
4	I think for a summer school on Machine Learning it would be nice to have some people from the industry as well, to help us relate how the things that we learn in class are being used in the industry. For me that would have made this summer school so much better.	8/8/2022 9:49 AM
5	I wish we had more interactions with industry people. And since we were at NY, I guess MSRI could get some invited speakers from NYU affiliated industry giants like Facebook and Microsoft to give an idea of industry practices in ML. And also more Networking opportunities would have been really helpful as well. Overall I had a great time and thank you.	8/8/2022 8:11 AM
6	This program seems to welcome people with a diverse backgrounds, but there was very little to help students with varying levels of proficiency in the presenting language, English, as well as to provide enough time for many to take proper breaks between classes. Technical difficulties and lecturers who wanted to "fit in" as much content as possible really ate into our free time, meaning most of our courses happened continuously rather than with the expected amount of downtime.	8/7/2022 1:09 PM
7	Like I said above, I would have appreciated the opportunity to meet instructors in person along with the other participants, not via Zoom.	8/7/2022 9:54 AM
8	The professors should have been physically present. It almost felt useless to travel all the way to see that you have to attend online classes. The main aim was the professor student interaction for me and that was completely lacking. The professors tried their best I guess but we should have been informed earlier that it is an online school. I found the practice sessions really helpful as the TAs were continuously interacting and we were solving problems in groups. I think they would have been even more helpful if groups changed after every 2-3 days.	8/6/2022 5:32 PM
9	I was very disappointed by the fact that nobody told us in advance the lecturers were online and not in person. I can totally understand the reasoning, but I thought it would be fair to say it in advance.	8/6/2022 2:42 AM
10	Do the school in presence, remote is terrible, you cannot interact with the speakers.	8/6/2022 1:09 AM
11	- provide organized, clear and not hand-written handouts for the lectures - don't neglect the numerical, implementation and computational side of the topics - consider some algorithms in the lectures and try to use it in the practice sessions - analyze real world examples and best	8/6/2022 12:48 AM

	practices from a mathematical perspective - check the venues to avoid incorrect climate that stifles productivity and motivation.	
12	Please, tell people in advance when the speakers are not in presence.	8/6/2022 12:32 AM
13	In future, I think the hybrid experience requires a lot more organized plans. In addition to the coursework, I wish we had had panels, discussions, etc. (even if they were over zoom)! I think that would have made coming to New York for the school a lot more valuable compared to taking the coursework online at home.	8/5/2022 4:37 PM
14	The audio quality for hybrid setups need to be improved.	8/5/2022 2:46 PM
15	I wish there was more information about the schedule beforehand	8/5/2022 2:45 PM
16	The communication for the logistics of the event was alright. It was not made clear to me that all the lecturers would be remote, and that is something I wish I'd known.	8/5/2022 2:21 PM

Topological Methods for the Discrete Mathematician

July 25, 2022 – August 05, 2022

St. Mary's College, Moraga, California

Organizers:

Pavle Blagojevic (Freie Universität Berlin)

Florian Frick (Carnegie Mellon University)

Shira Zerbib (Iowa State University)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Topological Methods for the Discrete Mathematician"
July 25 – August 05, 2022

Organizers

- Pavle Blagojevic (Freie Universität Berlin)
- Florian Frick (Carnegie Mellon University)
- Shira Zerbib (Iowa State University)

Description

Recently, progress in the field of topological methods in discrete mathematics has been rapid and has generated a lot of activity with the resolution of major open problems, the emergence of new lines of inquiry, and the development of new tools. These exciting new developments have not been digested into a textbook treatment.

The summer school led participants from appealing, simple-to-state problems at confluence of combinatorics, geometry, and topology to sophisticated topological methods that are required for their resolution. In recent years topological methods have found numerous novel applications in mathematics and beyond, such as in data science, machine learning, economics, the social sciences, and biology. The problems discussed were particularly well-suited to rapidly put students in a position to approach related research questions.

Highlights of the School

The summer school consisted of three lectures series:

Pavle Blagojevic, "Using equivariant topology,"
Florian Frick, "Intersection patterns in combinatorics, geometry, and topology,"
Shira Zerbib, "KKM-type theorems and their applications."

The lecture series complemented each other and gave three different point of views to a variety of topological methods and to a wide set of problems in discrete mathematics that can be approached using those tools.

Each day, two or three lectures were given (alternating between the three instructors). The lectures were followed by a problem session managed by the TAs (Tatiana Levinson and Daniel McGinnis). In those sessions, the students worked in small groups on problem sheets. The groups were assigned by the TAs and changed every day, so that each students had the chance to interact with all their peers.

In the beginning of the second week the instructors presented nine open research problems. Each student chose one or more problems they wanted to work on, and during the last session of each day students worked in groups on the problems according to their choices. The TAs and instructors joined the research groups to offer possible directions and support. These research sessions were well-received by participants, since they could explore topological methods in an interactive manner, while applying newly learned techniques on well-motivated problems. Minor progress on some of these problems was already achieved during the summer school.

Due to the secluded setting, many informal learning discussions took place also in the evenings and nights. In addition, the students had organized multiple social events such as hiking in the area, trips to San Francisco and the Ocean during the weekend, gathering at the local brewery, etc. The TAs and instructors joined many of these events.

This was the second summer graduate school hosted in partnership with Saint Mary's College of California, some 12 miles from Berkeley. As mentioned by the organizers above, the bucolic setting of Saint Mary's campus enabled tightly-knit collaboration between lecturers, TAs, and students, and made their experiences especially fruitful, signaling an exceptional future for these collaborations.

There were minor hiccups with respect to the IT equipment and some of the room and board logistics; these were resolved in short order and the school concluded without incident.

This partnership – which also included two other summer graduate schools hosted at St. Mary's College in summer 2022 – proved to be resounding success which we look forward to repeating in years to come.

Organizers		
First Name	**Last Name**	**Institution**
Pavle	Blagojevic	Freie Universität Berlin
Florian	Frick	Carnegie Mellon University
Shira	Zerbib	Iowa State University
Speakers		
First Name	**Last Name**	**Institution**
Pavle	Blagojevic	Freie Universität Berlin
Florian	Frick	Carnegie Mellon University
Shira	Zerbib	Iowa State University
Teaching Assistants		
First Name	**Last Name**	**Institution**
Tatiana	Levinson	Freie Universität Berlin
Daniel	McGinnis	Iowa State University

Mathematical Sciences Research Institute

Topological Methods for the Discrete Mathematician

July 25, 2022 - August 05, 2022

Monday, July 25, 2022		
9:00 AM - 9:15 AM		Introduction
9:15 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt I
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt I
1:45 PM - 3:00 PM	Pavle Blagojevic	Using Equivariant Topology Pt I
3:30 PM - 4:30 PM		Discussion Session

Tuesday, July 26, 2022		
9:00 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt II
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt II
1:45 PM - 3:00 PM	Pavle Blagojevic	Using Equivariant Topology Pt II
3:30 PM - 4:30 PM		Discussion Session

Wednesday, July 27, 2022		
9:00 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt III
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt III
1:45 PM - 3:00 PM	Pavle Blagojevic	Using Equivariant Topology Pt III
3:30 PM - 4:30 PM		Discussion Session

Thursday, July 28, 2022		
9:00 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt IV
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt IV
1:45 PM - 3:00 PM	Pavle Blagojevic	Using Equivariant Topology Pt IV
3:30 PM - 4:30 PM		Discussion Session

Friday, July 29, 2022		
9:00 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt V
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt V
1:45 PM - 3:00 PM	Pavle Blagojevic	Using Equivariant Topology Pt V
3:30 PM - 4:30 PM		Discussion Session

Monday, August 01, 2022		
9:00 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt VI
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt VI

1:45 PM - 3:00 PM		Discussion Session
3:30 PM - 4:30 PM		Problem Session

Tuesday, August 02, 2022

9:00 AM - 10:15 AM	Pavle Blagojevic	Using Equivariant Topology Pt VI
10:45 AM - 12:00 PM	Shira Zerbib	KKM-Type Theorems and their Applications Pt VII
1:45 PM - 3:00 PM		Discussion Session
3:30 PM - 4:30 PM		Problem Session

Wednesday, August 03, 2022

9:00 AM - 10:15 AM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt VII
10:45 AM - 12:00 PM	Pavle Blagojevic	Using Equivariant Topology Pt VII
1:45 PM - 3:00 PM		Discussion Session
3:30 PM - 4:30 PM		Problem Session

Thursday, August 04, 2022

9:00 AM - 10:15 AM	Shira Zerbib	KKM-Type Theorems and their Applications Pt VIII
10:45 AM - 12:00 PM	Florian Frick	Intersection Patterns in Combinatorics, Geometry, and Topology Pt VIII
1:45 PM - 3:00 PM		Discussion Session
3:30 PM - 4:30 PM		Problem Session

Friday, August 05, 2022

9:00 AM - 10:15 AM	Pavle Blagojevic	Using Equivariant Topology Pt VIII
10:45 AM - 12:00 PM	Shira Zerbib	KKM-Type Theorems and their Applications Pt IX
1:45 PM - 3:00 PM		Discussion Session
3:30 PM - 4:30 PM		Problem Session

Officially Registered Student Information

Students		40

Gender		40
Male	50.00%	20
Female	47.50%	19
Other	2.50%	1
Declined to state	0.00%	0

Ethnicity*		54
White	38.89%	21
Asian	33.33%	18
Hispanic	12.96%	7
Pacific Islander	0.00%	0
Black	3.70%	2
Native American	0.00%	0
Mixed	11.11%	6
Declined to state	0.00%	0

* ethnicity specifications are not exclusive

Q1 The various topics within the summer school integrated into a coherent picture
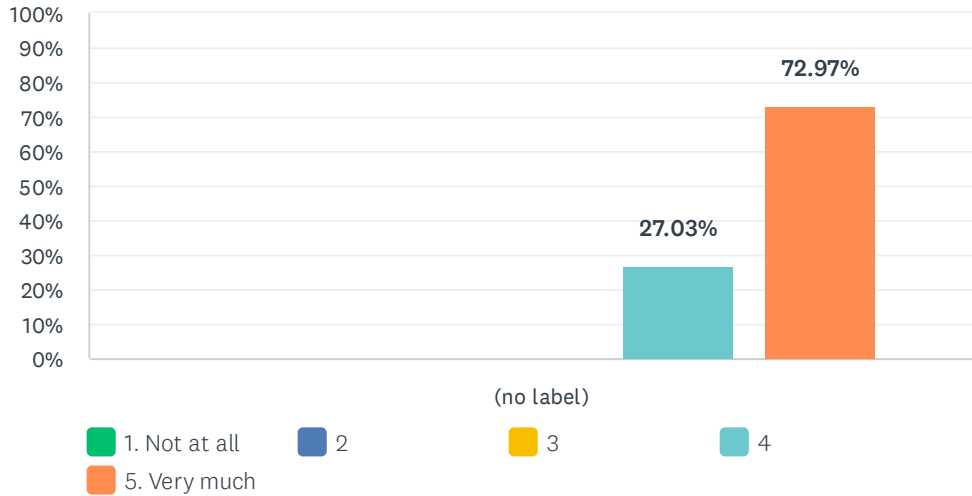
Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.41% 2	24.32% 9	70.27% 26	37	4.65

Q2 The faculty speakers were generally clear and well organized in their presentation

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	27.03% 10	72.97% 27	37	4.73

Q3 The teaching assistants were helpful

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.70% 1	5.41% 2	16.22% 6	75.68% 28	37	4.65

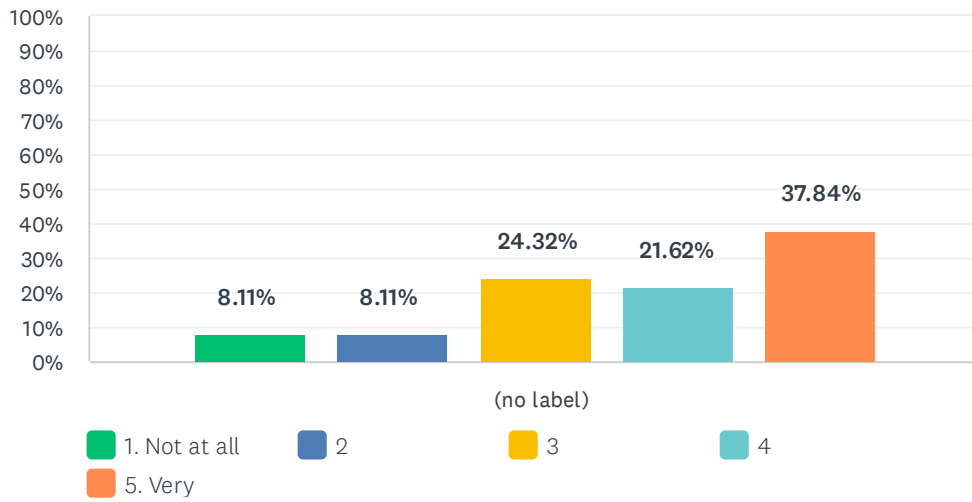| #	PLEASE PROVIDE SOME COMMENTS ON THE TAS.	DATE
1	Danny and Tatiana were knowledgeable, competent and always ready to help.	8/12/2022 2:00 PM
2	I didn't speak to them much, so I can't really comment on this, but they seemed decent based on interactions with other participants.	8/12/2022 12:27 PM
3	They were nice, it probably would help them if they had seen some of the problems beforehand but they were very willing to help and had insightful comments.	8/11/2022 4:58 PM
4	I appreciated that the TA's gave us interesting and challenging problems to discuss. At the same time, the atmosphere was relaxed and friendly!	8/11/2022 11:43 AM
5	They were both very friendly, and provided some nice handouts to supplement the lectures.	8/11/2022 11:25 AM
6	Tatiana and Daniel were amazing, insightful, patient , and knowledgable.	8/11/2022 10:55 AM
7	I didn't speak to Tatiana very much, but I did work with Daniel plenty, and he was consistently extremely helpful and personable.	8/10/2022 9:25 AM
8	Both TAs were very helpful in the discussion sessions.	8/9/2022 1:09 PM
9	They are helpful and friendly. Thank you!	8/8/2022 6:59 PM
10	The selection of problems was great and very helpful for understanding of the material of the lectures. I enjoyed it!	8/7/2022 10:36 PM
11	Good	8/6/2022 1:12 PM
12	In social settings, they were both very nice, pleasant people. However, sometimes during problem sessions I felt like my questions were being treated as "dumb" which was not a great feeling.	8/6/2022 12:50 PM

Q4 The school was intellectually stimulating

Answered: 37   Skipped: 0
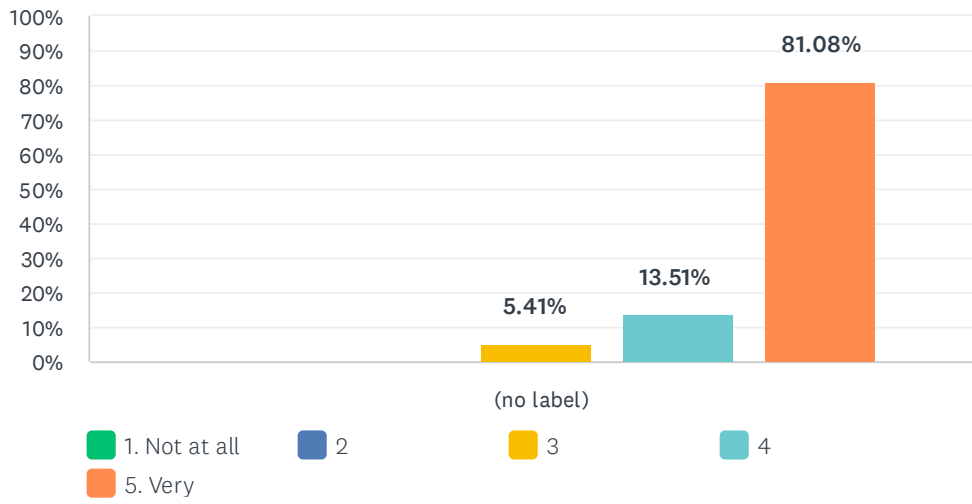
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.41% 2	13.51% 5	81.08% 30	37	4.76

Q5 I benefited from the additional preparatory offering

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	8.11% 3	8.11% 3	24.32% 9	21.62% 8	37.84% 14	37	3.73

Q6 The discussion sessions were productive

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.70% 1	2.70% 1	13.51% 5	29.73% 11	51.35% 19	37	4.24

Q7 The amount of material presented was

Answered: 37   Skipped: 0

	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	2.70% 1	91.89% 34	0.00% 0	5.41% 2	37	2.08

Q8 Additional comments on the topic presentation and organization

Answered: 10   Skipped: 27

#	RESPONSES	DATE
1	I had a really great time. The instructors and TAs were very approachable and knowledgeable. I appreciated how all the instructors' topics came together	8/18/2022 12:58 PM
2	The organizers and lecturers did a tremendous job. I was a little worried about being able to get anything out of this summer school, but they did a phenomenal job meeting me at the skill level I had going into the school and elevating me to where I needed to be in order to participate fully.	8/12/2022 2:00 PM
3	They were all very nice, I wish we had more opportunities to meet in a less formal/math social	8/11/2022 4:58 PM
4	Shira's lecture series was amazing. The instructor was clear and organized. The way that she presented proofs and techniques felt intentional and reasonable. I feel that I learned techniques that will help me grow as a research mathematician and a communicator of mathematics.	8/11/2022 11:43 AM
5	I only say that the amount of material presented was too much because I don't have a strong background in graph theory, topology or algebraic topology. Other wise the material was very well presented and challenged me. Additionally, I wasn't able to go to the prep offering via zoom, but the suggested papers were very helpful.	8/11/2022 10:55 AM
6	Unfortunately I caught COVID and had to quarantine and missed quite a bit of the program. The lectures were a bit hard to see via Zoom, and it wasn't really productive to try attending the discussion sections via Zoom.	8/9/2022 12:21 PM
7	I wasn't able to attend the extra sessions before the summer school, but the reading materials were interesting. The TAs were helpful, but I would have liked a little more guidance as to the goal of the problem sessions in advance and how they would prepare us for the open problems in week 2. Those problems maybe could have been introduced at the end of week 1, but it was nice not to have any pressure to work on the problems during the weekend.	8/8/2022 11:50 PM
8	Everyone is so nice, and I'd also like to thank organizers who care about our life a lot. Thank you a lot!	8/8/2022 6:59 PM
9	It would have been nice to know the research problems earlier than the beginning of the second week. For example, on Friday of the first week, or even earlier. This way, I think I would have made a better choice of a problem to work on.	8/7/2022 10:36 PM
10	Both Florian and Shira had excellent lectures, but Pavle's were difficult to follow and difficult for me to connect to mathematics I care about. I also didn't find the discussion sessions to be a good use of my time, but I saw others seeming to get a lot out of them so perhaps that is on me. Overall, I enjoyed the summer school.	8/6/2022 12:50 PM

MSRI 982 SGS: Topological Methods for the Discrete Mathematician - Participant Survey

Q9 I participated in the preparatory remote lectures during the week prior to the summer school

Answered: 37   Skipped: 0
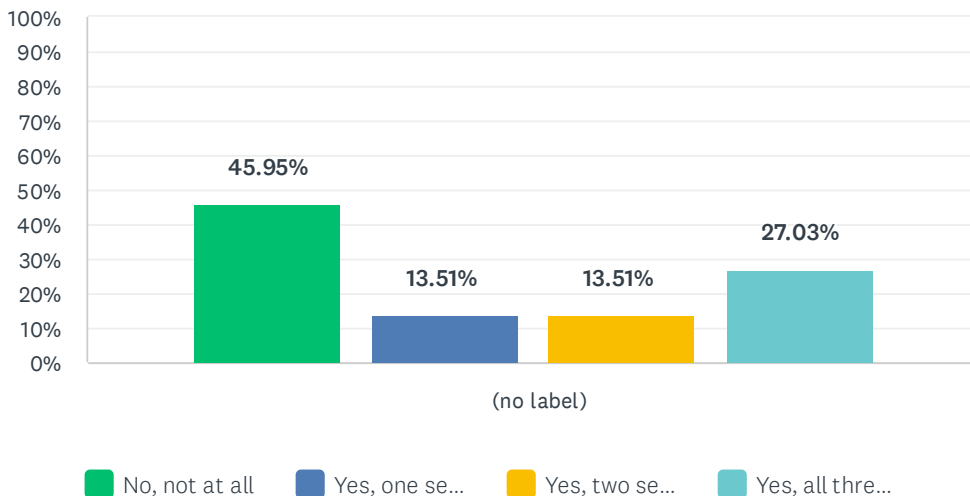
	NO, NOT AT ALL	YES, ONE SESSION	YES, TWO SESSIONS	YES, ALL THREE SESSIONS	TOTAL	WEIGHTED AVERAGE
(no label)	45.95% 17	13.51% 5	13.51% 5	27.03% 10	37	2.22

Q10 Additional comments about the preparatory week

Answered: 4   Skipped: 33

| #	RESPONSES	DATE
1	I watched the lecture preparatory lecture sent by Dr. Florian Frick.	8/11/2022 9:30 PM
2	Prefer live lectures!	8/8/2022 7:04 PM
3	I didn't have time for it in the week before the summer school because of another conference.	8/7/2022 10:37 PM
4	Needed more notice about those meetings.	8/6/2022 1:12 PM

Q11 I was well prepared to benefit from the school

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.41% 2	27.03% 10	40.54% 15	27.03% 10	37	3.89

Q12 My interest in the subject matter was increased by the school

Answered: 37   Skipped: 0
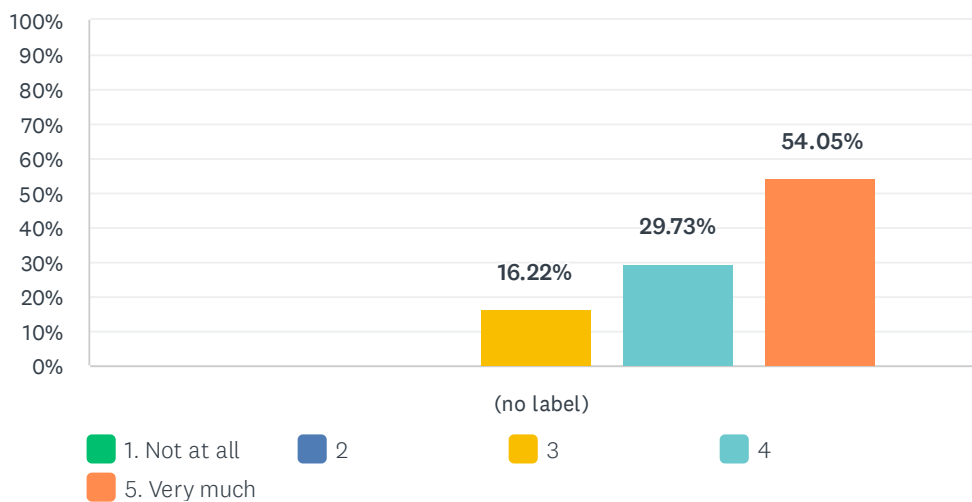
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	16.22% 6	29.73% 11	54.05% 20	37	4.38

Q13 The school helped me meet people with similar scientific interests
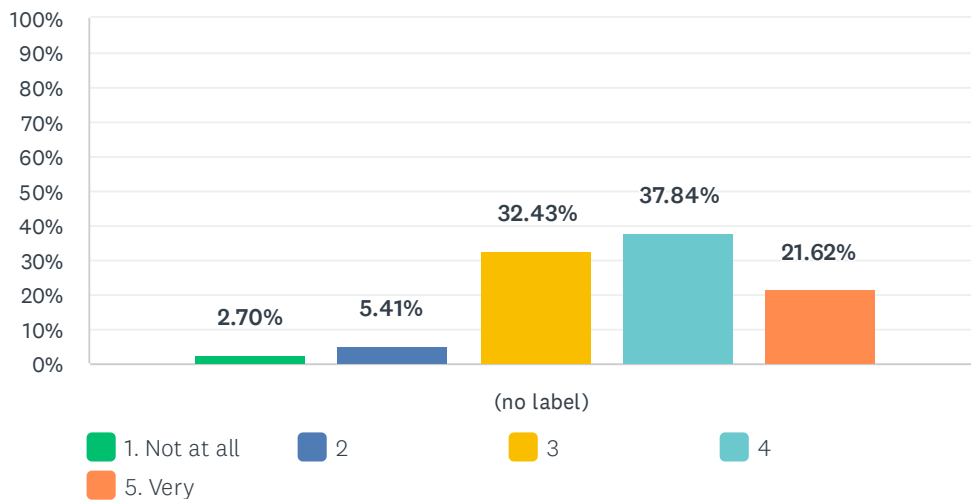
Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.70% 1	16.22% 6	21.62% 8	59.46% 22	37	4.38

Q14 It is likely that I will work in the area of the school subject in the future

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.70% 1	5.41% 2	32.43% 12	37.84% 14	21.62% 8	37	3.70

Q15 How would you evaluate your interaction with other participants?

Answered: 37   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	13.51% 5	32.43% 12	54.05% 20	37	4.41

Q16 Additional comments on personal assessment

Answered: 4   Skipped: 33

#	RESPONSES	DATE
1	Everyone was so nice and helpful and wanted to learn.	8/11/2022 10:56 AM
2	The fellow summer school participants were EXCELLENT. I made plenty of good friends.	8/10/2022 9:26 AM
3	It was amazing meeting everyone and being able to work on interesting problems with them. This summer school really rekindled my enjoyment in solving problems, and I made a ton of friends. I think having meals in the cafeteria really fostered those connections since we all ate together every day.	8/8/2022 11:52 PM
4	This is really a great chance to find more problems to solve and find cooperators! I just feel like that I didn't prepare well, but I still obtain a lot! Thank you so much!	8/8/2022 7:07 PM

Q17 I found the MSRI staff helpful

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.41% 2	2.70% 1	10.81% 4	75.68% 28	5.41% 2	37	4.66

Q18 The St. Mary's facilities were conducive for such a school

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.70% 1	16.22% 6	24.32% 9	56.76% 21	37	4.35

Q19 Additional comments on the St. Mary's venue

Answered: 12   Skipped: 25

#	RESPONSES	DATE
1	The classrooms were nice, and there was a lot of green space to work.	8/18/2022 1:01 PM
2	Overall, I would say that things were okay at St. Mary's. The campus was accessible and well maintained and the classroom space was certainly adequate. While I understand the lodging can't be of perfect quality, it was a little below my expectations, and I thought my expectations to be a little low. On top of this, I think the school was a little over-booked with other camps/schools and this led to some logistical issues when it came to dining.	8/12/2022 2:05 PM
3	Saint Mary's itself was okay, though I wish it wasn't so remote. I would've rather spent the 2 weeks at a place like UC Berkeley, which was only 12 miles away.	8/12/2022 12:30 PM
4	Meals in the dinning room were a bit too heavy and fatty for my taste, but this is not a big deal!	8/12/2022 1:36 AM
5	St. Mary's campus is beautiful.	8/11/2022 11:46 AM
6	St. Mary's is a beautiful campus and provided nice hikes and comfortable housing.	8/11/2022 10:56 AM
7	The weather is 10/10	8/10/2022 9:26 AM
8	It was convenient having housing, meals, and work so close together. It was difficult to travel without a car in the area, particularly with limited cell service to call an Uber around the Redwood Regional Forest area.	8/9/2022 12:00 AM
9	A great chance to learn more about LAC! Many thanks!	8/8/2022 7:08 PM
10	It was fine. I wish it hadn't been quite so remote; it was difficult to get basic necessities with things on campus being closed for the summer.	8/6/2022 12:51 PM
11	There was little space to work in groups outside of the classroom (or we just weren't told where to find them).	8/6/2022 9:16 AM
12	Adequate, lovely weather, but very isolated.	8/6/2022 12:40 AM

Q20 How did you find the summer school accommodations?

Answered: 37   Skipped: 0
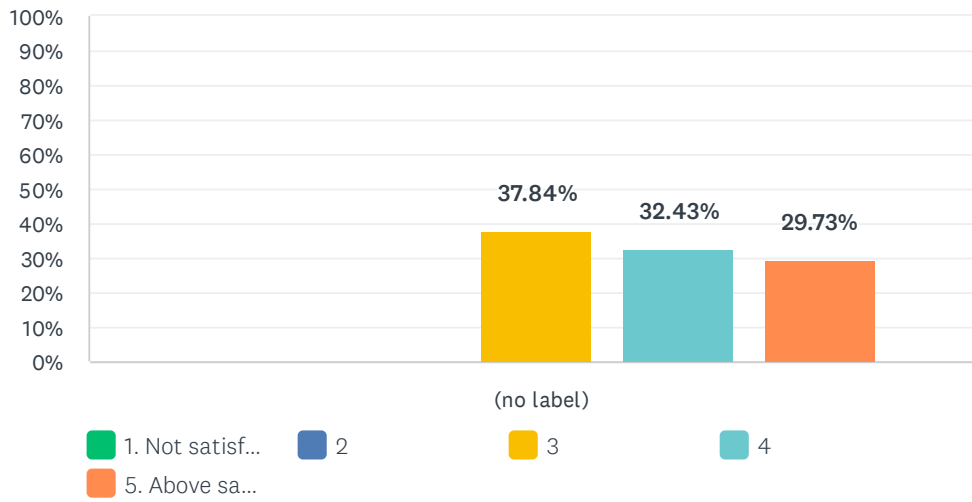
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	37.84% 14	32.43% 12	29.73% 11	37	3.92

Q21 How did you find the food provided at St. Mary's?

Answered: 37   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	5.41% 2	5.41% 2	37.84% 14	27.03% 10	24.32% 9	37	3.59

Q22 Additional comments on accommodation and food

Answered: 12   Skipped: 25

#	RESPONSES	DATE
1	The dining hall would claim certain meals were vegan/vegetarian, but on more than one occasion I was served meat. Also, the online menus did not match what was served. There was a lot of space in the suites, but I would have appreciated if they had provided either thicker blankets, or more blankets on the first night.	8/18/2022 1:01 PM
2	The townhome I stayed in was adequate, though it needed a few repairs. The food served in the dining hall was far from the greatest, to be frank, but I do appreciate that it was free.	8/12/2022 12:31 PM
3	The food at the dinning hall was a bit to heavy and fatty for me, but it is not a big deal!	8/12/2022 1:36 AM
4	They did not always have nice vegetarian options	8/11/2022 5:00 PM
5	The food varied widely. Sometimes meat was overcooked or bland, but mostly I would have just preferred more vegetable options.	8/11/2022 11:29 AM
6	The food was satisfactory. The staff was very friendly.	8/11/2022 10:57 AM
7	My one complaint - and I feel bad for complaining at all - is that the pillows aren't great. Everything else is satisfactory.	8/10/2022 9:27 AM
8	The food staff were amazing, in particular those responsible for bringing me food while I was in quarantine went above and beyond to help me.	8/9/2022 12:22 PM
9	The dorms were adequate, and when I contacted Chris about any issues, they were resolved quickly. I appreciated that we had private rooms with apartment mates. The food options were a little limited for a vegan diet, but altogether I'm grateful that we had housing and meals provided. If we didn't have meals at St. Mary's, it would have been very difficult to find other arrangements because of the distance to town.	8/9/2022 12:00 AM
10	My roommates were so nice and the staff in the dining hall were friendly as well!	8/8/2022 7:11 PM
11	The lack of vegetarian options was upsetting. There were many meals where the only vegetarian protein available was chickpeas on the salad bar, which is really not a viable option.	8/6/2022 12:53 PM
12	We were not provided toiletries. The beds were uncomfortable, the pillows were horrible.	8/6/2022 9:17 AM

Q23 The overall experience of the school was worthwhile

Answered: 36   Skipped: 1
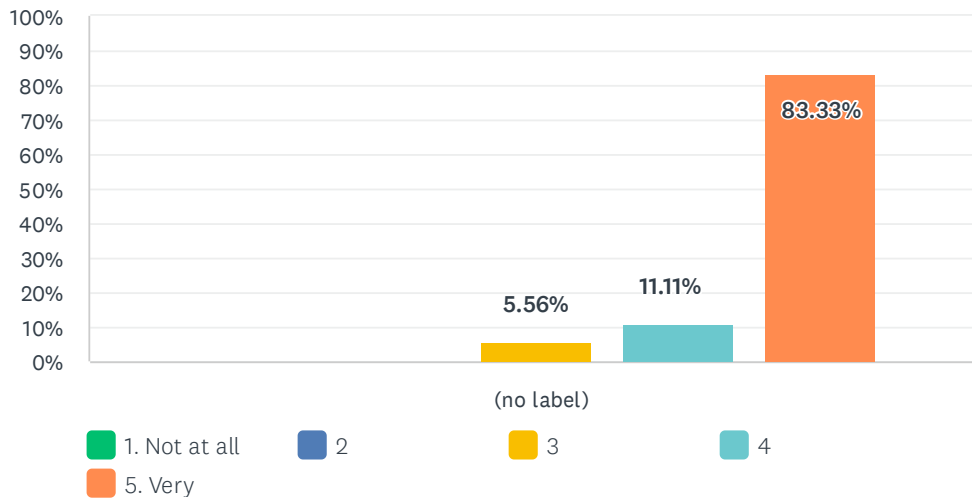
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.56% 2	11.11% 4	83.33% 30	36	4.78

Q24 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 5   Skipped: 32

#	RESPONSES	DATE
1	I would have rather not spent so much time stuck in back-to-back lectures during the first week. That made the first week such a drag for me. The lectures being so long made it worse. I liked the second week a bit more as it was focused on open problems and working toward possible solutions of those problems. More interactive work during the workshop would have been preferred (not necessarily group work, but just activity-based lectures). I would have also preferred a more urban setting for the workshop.	8/12/2022 12:35 PM
2	I would love the opportunity to attend a future MSRI grad course again. It was an amazing experience that I will never forget.	8/11/2022 10:58 AM
3	It was a really fantastic experience, I would love to do this again! We had an easier time communicating via Discord than Slack. I think for the sake of keeping in touch afterwards, maybe a participant list, possibly with email addresses, would be good to share within the group? Or maybe each person would prefer to just exchange contact info during the summer school. I know one of the attendees did not speak during lectures to ask questions because he did not want to be recorded. I would be more comfortable if only my audio and not video were recorded during those lectures, particularly if it's being saved and not just live streamed on Zoom. I would have preferred being at MSRI since St. Mary's was a nice location but a bit remote for not having a car.	8/9/2022 12:11 AM
4	I spent some time finding the route, and then there were reminder emails when the time was near, so I think whether it would be better to tell students the related email time ahead to avoid wasting time. Besides, would you please provide laundry detergent? It's hard to find small capacity. But overall, awesome!	8/8/2022 7:25 PM
5	The best outcome of the school was to meet people interested in similar topics.	8/6/2022 9:17 AM

Sums of Squares Method in Geometry, Combinatorics and Optimization (BIRS)

August 01, 2022 – August 12, 2022

University of British Columbia, Okanagan, Canada

Organizers:

Grigoriy Blekherman (Georgia Institute of Technology)

Annie Raymond (University of Massachusetts Amherst)

Cynthia Vinzant (University of Washington)

Organizers

First Name	Last Name	Institution
Grigoriy	Blekherman	Georgia Institute of Technology
Annie	Raymond	University of Massachusetts Amherst
Cynthia	Vinzant	University of Washington

Speakers

First Name	Last Name	Institution
Grigoriy	Blekherman	Georgia Institute of Technology
Annie	Raymond	University of Massachusetts Amherst
Cynthia	Vinzant	University of Washington

Teaching Assistants

First Name	Last Name	Institution
Shengding	Sun	Georgia Institute of Technology

Mathematical Sciences Research Institute

Sums Of Squares Method In Geometry, Combinatorics And Optimization (BIRS)

August 01, 2022 - August 12, 2022

Monday, August 01, 2022

9:00 AM - 9:15 AM	Welcome
9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Tuesday, August 02, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Wednesday, August 03, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session

Thursday, August 04, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Friday, August 05, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Monday, August 08, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session

| 1:45 PM - 3:00 PM | Lecture 2 |
| 3:30 PM - 5:00 PM | Problem Session |

Tuesday, August 09, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Wednesday, August 10, 2022

| 9:30 AM - 10:45 AM | Lecture 1 |
| 10:45 AM - 12:00 PM | Problem Session |

Thursday, August 11, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Friday, August 12, 2022

9:30 AM - 10:45 AM	Lecture 1
10:45 AM - 12:00 PM	Problem Session
1:45 PM - 3:00 PM	Lecture 2
3:30 PM - 5:00 PM	Problem Session

Officially Registered Student Information

Students		20

Gender		20
Male	60.00%	12
Female	40.00%	8
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		22
White	36.36%	8
Asian	18.18%	4
Hispanic	27.27%	6
Pacific Islander	4.55%	1
Black	4.55%	1
Native American	0.00%	0
Mixed	4.55%	1
Declined to state	4.55%	1

* ethnicity specifications are not exclusive

Tropical Geometry

August 01, 2022 – August 11, 2022

St. Mary's College, Moraga, California

Organizers:

Renzo Cavalieri (Colorado State University)

Hannah Markwig (Eberhard-Karls-Universität Tübingen)

Dhruv Ranganathan (University of Cambridge)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Tropical Geometry"
August 1 – August 12, 2022

Organizers

- Renzo Cavalieri (Colorado State University)
- Hannah Markwig (Eberhard-Karls-Universität Tübingen)
- Dhruv Ranganathan (University of Cambridge)

Description

Enumerative geometry and the theory of moduli spaces of curves are two cornerstones of modern algebraic geometry; the two subjects have had a significant influence on each other. In the last 15 years, discrete and combinatorial methods, systematized within tropical geometry, have begun to provide new avenues of access into these two subjects. The goal of this summer school was give students crash courses in tropical and logarithmic geometry, with a particular focus on the applications in enumerative geometry and moduli theory. The school consisted of three courses of seven lectures each.

Highlights of the School

Early during the course of the school, we had multiple sessions with short, introductory presentations by participants, to foster collaboration among participants. All participants put a really good effort into presenting their work in a few minutes, and several times we had to interrupt the question sessions for timing reasons, as the short presentations gave rise to lively interactions. We felt giving participants the opportunity to introduce themselves both personally and mathematically was instrumental in increasing the interaction among them. The introductory presentations had another effect: it became clear that many participants had a background which is somehow related to the theory of matroids. While this theory is intimately related to tropical geometry and even to moduli spaces showing up in enumerative geometry, matroids did not make a direct appearance in the lecture courses, also due to the fact that we tried to keep the lecture courses accessible to students of all backgrounds. But the students seized the chance to organize themselves even further: they organized two additional late afternoon sessions in which they discussed the theory of matroids. The organizers did not take part in these additional sessions, giving the participants the opportunity to interact without being observed by teachers. But we heard that these additional sessions were very well received. Many participants told us about their good experience and their lasting interactions about their individual research problems related to matroids.

In the following exercise sessions, the participants easily organized themselves into groups that worked well together. Throughout the school, the exercise sessions were lively and active, with groups of students working on various problems related to the lecture courses. Given the broad spectrum of background and interests among participants, we chose to not give the exercise

sessions too much structure. Rather, we presented them with a large number of exercises at many different levels, and allowed them to choose what to work on and with whom. Having the additional help of the TA's was especially instrumental at this point, as it allowed to have more power to provide individualized help. We were impressed by the level of activity, self-organization and the motivation of the students and we are very confident that they all took away something important.

The TA's also gave some lectures on topics that connected both to the summer school as well as their own research. These talks ended up being extremely important, as the TA's were seen by man participants as people they could identify with, and that positively modelled how to move about the early stages of a mathematical career. Of course it was somewhat bittersweet for us organizers to realize that we are already too "old" for current grad students to see us as their future selves, but that seems unavoidable. We believe we at least managed to be the friendly and somewhat relatable kind of old folks.

A comment that we heard often is that the atmosphere of the school was particularly friendly, inclusive and supportive. We had the same impression. A comment heard from the participants, and that we felt rather happy with is "you can tell that the organizers are good friends, and that infuses the character of the school".

Organizers/Speakers

First Name	Last Name	Institution
Renzo	Cavalieri	Colorado State University
Hannah	Markwig	Eberhard-Karls-Universität Tübingen
Dhruv	Ranganathan	University of Cambridge

Teaching Assistants

First Name	Last Name	Institution
Vance	Blankers	Northeastern University
Thomas	Blomme	Université de Genève
Francesca	Carocci	Imperial College, London

Mathematical Sciences Research Institute

Tropical Geometry

August 01, 2022 - August 11, 2022

Monday, August 01, 2022		
9:00 AM - 9:15 AM		Introduction
9:15 AM - 10:15 AM	Renzo Cavalieri, Hannah Markwig & Dhruv Ranganathan	Lecture
10:45 AM - 11:45 AM	Dhruv Ranganathan	Lecture 1
1:30 PM - 3:30 PM		Introductions and Discussions
4:00 PM - 5:00 PM		Free Time to Work on Problems

Tuesday, August 02, 2022		
9:15 AM - 10:15 AM	Renzo Cavalieri	Lecture 1
10:45 AM - 11:45 AM	Hannah Markwig	Lecture 1
1:30 PM - 3:30 PM		Short Talk Session
4:00 PM - 5:00 PM	Thomas Blomme	Discussion about Exercises 1

Wednesday, August 03, 2022		
9:15 AM - 10:15 AM	Dhruv Ranganathan	Lecture 2
10:45 AM - 11:45 AM	Renzo Cavalieri	Lecture 2

Thursday, August 04, 2022		
9:15 AM - 10:15 AM	Hannah Markwig	Lecture 2
10:45 AM - 11:45 AM	Dhruv Ranganathan	Lecture 3
1:30 PM - 2:30 PM		Free Time to Work on Problems
2:30 PM - 3:30 PM	Francesca Carrocci	Activity 1
4:00 PM - 5:00 PM	Vance Blankers	Discussion about Exercises 1

Friday, August 05, 2022		
9:15 AM - 10:15 AM	Renzo Cavalieri	Lecture 3
10:45 AM - 11:45 AM	Hannah Markwig	Lecture 3
1:30 PM - 2:30 PM		Free Time to Work on Problems
2:30 PM - 3:30 PM	Thomas Blomme	Activity
4:00 PM - 5:00 PM	Francesca Carrocci	Discussion about Exercises 1

Monday, August 08, 2022		
9:15 AM - 10:15 AM	Dhruv Ranganathan	Lecture 4
10:45 AM - 11:45 AM	Renzo Cavalieri	Lecture 4
1:30 PM - 2:30 PM		Free Time to Work on Problems
2:30 PM - 3:30 PM	Vance Blankers	Activity 1
4:00 PM - 5:00 PM	Thomas Blomme	Discussion about Exercises 2

Tuesday, August 09, 2022

9:15 AM - 10:15 AM	Hannah Markwig	Lecture 4
10:45 AM - 11:45 AM	Dhruv Ranganathan	Lecture 5
1:30 PM - 2:30 PM		Free Time to Work on Problems
2:30 PM - 3:30 PM	Francesca Carrocci	Activity 2
4:00 PM - 5:00 PM	Thomas Blomme	Discussion about Exercises 2

Wednesday, August 10, 2022

| 9:00 AM - 10:15 AM | Renzo Cavalieri | Lecture 5 |
| 10:45 AM - 11:45 AM | Hannah Markwig | Lecture 5 |

Thursday, August 11, 2022

9:15 AM - 10:15 AM	Dhruv Ranganathan	Lecture 6
10:45 AM - 11:45 AM	Renzo Cavalieri	Lecture 6
1:30 PM - 2:30 PM		Free Time to Work on Problems
2:30 PM - 3:30 PM	Thomas Blomme	Activity 2
4:00 PM - 5:00 PM	Francesca Carrocci	Discussion about Exercises 2

Friday, August 12, 2022

9:15 AM - 10:15 AM	Hannah Markwig	Lecture 6
10:45 AM - 11:45 AM	Vance Blankers	Activity 2
1:30 PM - 2:30 PM		Free Time to Work on Problems
2:30 PM - 3:30 PM		Discussion

Officially Registered Student Information

Students		48

Gender		48
Male	70.83%	34
Female	20.83%	10
Other	6.25%	3
Declined to state	2.08%	1

Ethnicity*		57
White	45.61%	26
Asian	29.82%	17
Hispanic	7.02%	4
Pacific Islander	0.00%	0
Black	3.51%	2
Native American	1.75%	1
Mixed	7.02%	4
Declined to state	5.26%	3

* ethnicity specifications are not exclusive

Q1 The various topics within the summer school integrated into a coherent picture
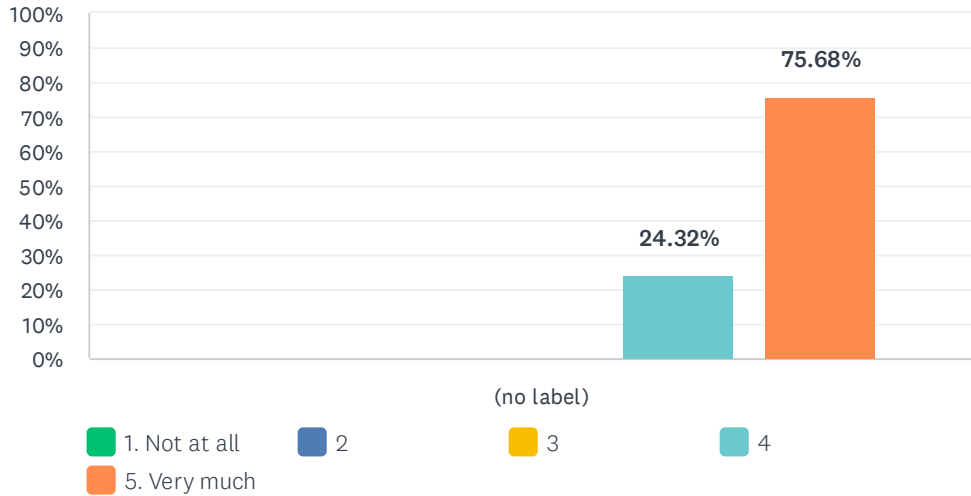
Answered: 37   Skipped: 0
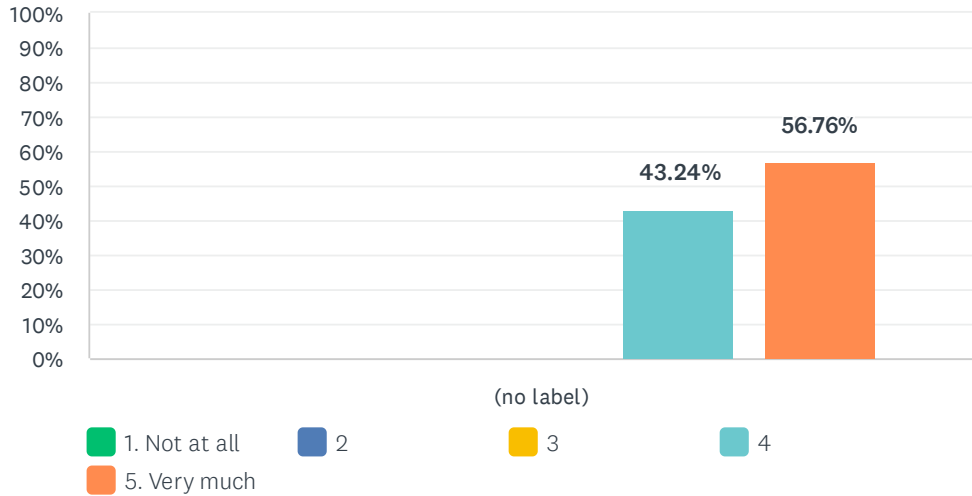
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	43.24% 16	56.76% 21	37	4.57

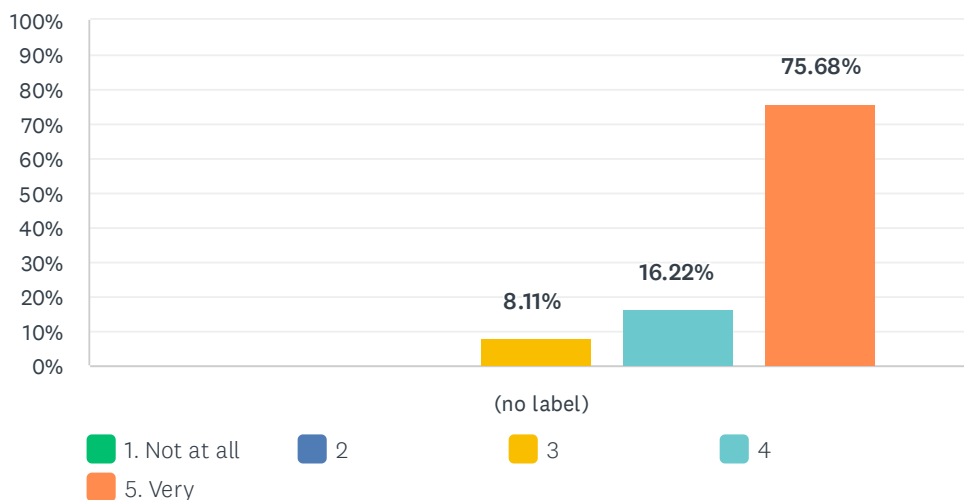# Q2 The faculty speakers were generally clear and well organized in their presentation

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	24.32% 9	75.68% 28	37	4.76

Q3 The teaching assistants were helpful

Answered: 37   Skipped: 0

- ■ 1. Not at all ■ 2 ■ 3 ■ 4
- ■ 5. Very

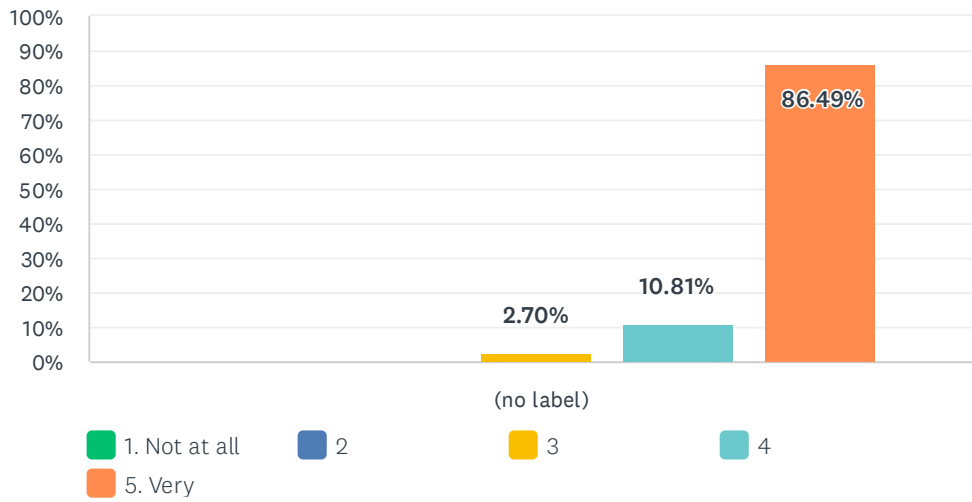|	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.11% 3	16.22% 6	75.68% 28	37	4.68

#	PLEASE PROVIDE SOME COMMENTS ON THE TAS.	DATE
1	All TAs were approachable and friendly. I really enjoyed the facts they they were also able to give talks on topics which interested them and were somewhat related to the main courses. The extra exposure to new material was interesting and you could tell the TAs were passionate about their talks	8/30/2022 3:16 PM
2	I really enjoyed talking and learning with all of them.	8/29/2022 12:01 PM
3	Francesca, Thoma, Vance. You guys are awesome!	8/15/2022 1:05 AM
4	I thought the TA's were very helpful in regards to the problem sessions. However, some of their talks were to technical for me to n understand.	8/13/2022 9:55 AM
5	The TAs provided great help during the exercise sessions. My background in algebraic geometry is quite weak, so I didn't understand much during the first TA talks about their research, but as school went on, I really appreciated their talks. It gave a sense of what's happening today "near" the material we were learning in the lectures.	8/12/2022 7:46 PM
6	The TAs were both friendly and knowledgeable.	8/12/2022 7:35 PM
7	The exercise sessions were lacking structure. It would have been nice if the TAs were more active in helping people decide which problems to work on and also in providing solutions to challenging problems. The TA talks were good but a bit messier than the lectures. I did not love that some of the later lectures depended on TA talks since I paid less attention in those/was not taking notes. (Not because they weren't interesting, just because I was tired and it was a lot of math).	8/12/2022 4:40 PM
8	I enjoyed the TA lectures a lot	8/12/2022 4:29 PM
9	The TA's were amazing and a great addition to the school!	8/12/2022 4:10 PM
10	They were helpful and friendly.	8/12/2022 4:09 PM
11	They were very down to earth and approachable. They nurtured a casual and welcoming environment	8/12/2022 4:06 PM

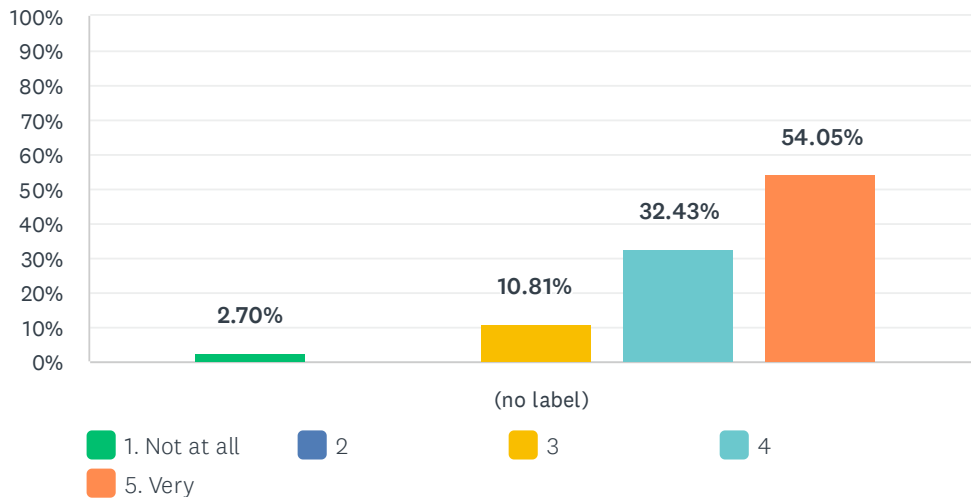| 12 | I think that the TAs were very approachable and knowledgeable, but I think I would have benefitted from more structure during exercise sessions. | 8/12/2022 4:05 PM |
| 13 | They were great!! | 8/12/2022 4:05 PM |

Q4 The school was intellectually stimulating

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.70% 1	10.81% 4	86.49% 32	37	4.84

Q5 The discussion sessions were productive

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.70% 1	0.00% 0	10.81% 4	32.43% 12	54.05% 20	37	4.35

Q6 The amount of material presented was

Answered: 37   Skipped: 0
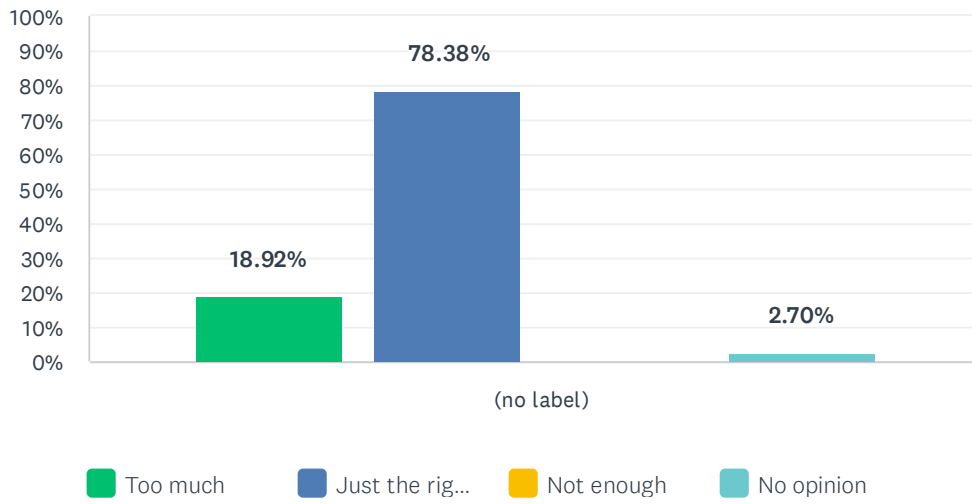
	TOO MUCH	JUST THE RIGHT AMOUNT	NOT ENOUGH	NO OPINION	TOTAL	WEIGHTED AVERAGE
(no label)	18.92% 7	78.38% 29	0.00% 0	2.70% 1	37	1.86

Q7 Additional comments on the topic presentation and organization

Answered: 12   Skipped: 25

#	RESPONSES	DATE
1	I only say too much for me personally, I am between the first and second year of my Master's and it seems most people there were in the final years of their PhDs, so I found there was some material in the talks that was new to me but glossed over as something that should already be known. However, the instructors, TAs, and fellow participants were very knowledgeable and happy to help.	8/30/2022 3:16 PM
2	I found Renzo's lectures hard to follow due to the focus on drawing pictures on the board rather than details and theorems. I think covering the material more rigorously, even if we could cover less ground, would be valuable. Other than that, I really enjoyed all three of the courses.	8/29/2022 12:01 PM
3	Thank you.	8/17/2022 7:46 AM
4	Some emphasis on open problems and potential future research would have been appreciated.	8/15/2022 2:55 PM
5	Everything was perfect. Maybe it could be the place where it is easy to get to some main street. The bus ends too early. If there would have been some events with beer for all, it could have been better.	8/15/2022 1:05 AM
6	I thought Renzo's lecture series was very well done. I learned a lot from it.	8/13/2022 9:55 AM
7	The topic presentation was great. The first 2-3 days felt pretty overwhelming, but after a couple days the flow of material seemed much more manageable to me. Not sure if things actually slowed down though, or if it was a matter of getting a little more familiar with the material and talking with the speakers/tas/other students.	8/12/2022 7:46 PM
8	Everything was great!	8/12/2022 7:35 PM
9	I think it would have been very helpful for me if the videos of the talks given by the TAs were recorded and uploaded on MSRI webpage. Even though I wasn't able to grasp the concepts they presented now I could come back and look at the videos.	8/12/2022 5:51 PM
10	I found Renzo's last lecture in particular almost impossible to follow. I love that Hannah includes so many complete examples, although sometimes it would feel like 20 minutes of computations that were too fast to really follow, so that doing all that board work ended up not being entirely helpful.	8/12/2022 4:40 PM
11	Very good summer school!	8/12/2022 4:10 PM
12	I thought it was well organized. I liked the breaks between lectures. They were helpful in keeping me focused throughout the day.	8/12/2022 4:09 PM

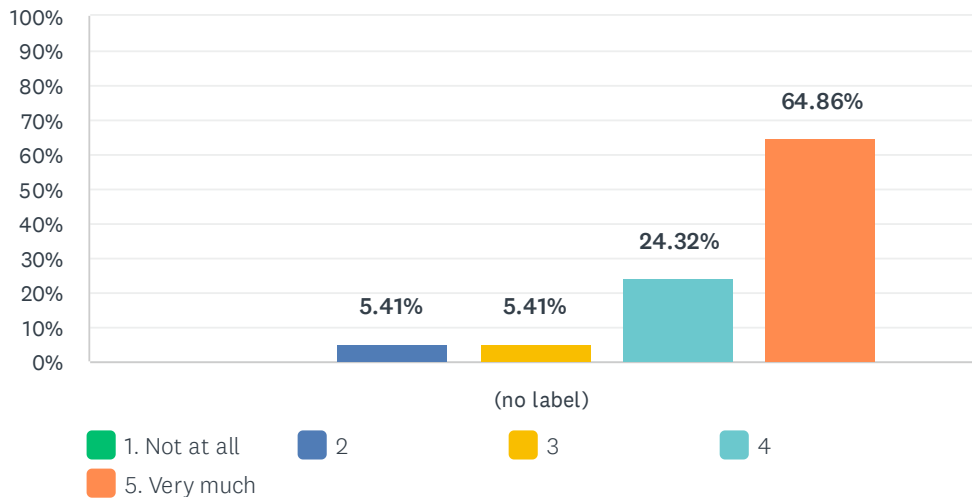# Q8 I was well prepared to benefit from the school
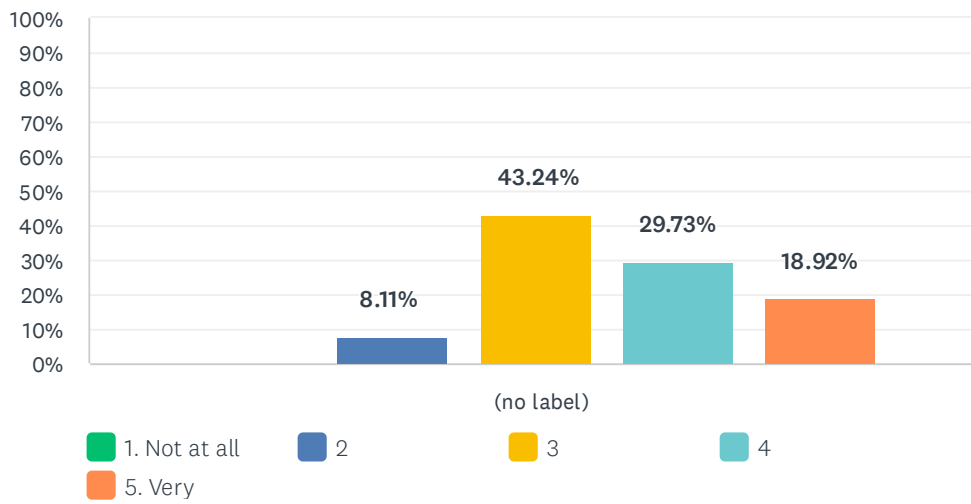
Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.11% 3	43.24% 16	29.73% 11	18.92% 7	37	3.59

Q9 My interest in the subject matter was increased by the school

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.41% 2	5.41% 2	24.32% 9	64.86% 24	37	4.49

Q10 The school helped me meet people with similar scientific interests

Answered: 37   Skipped: 0
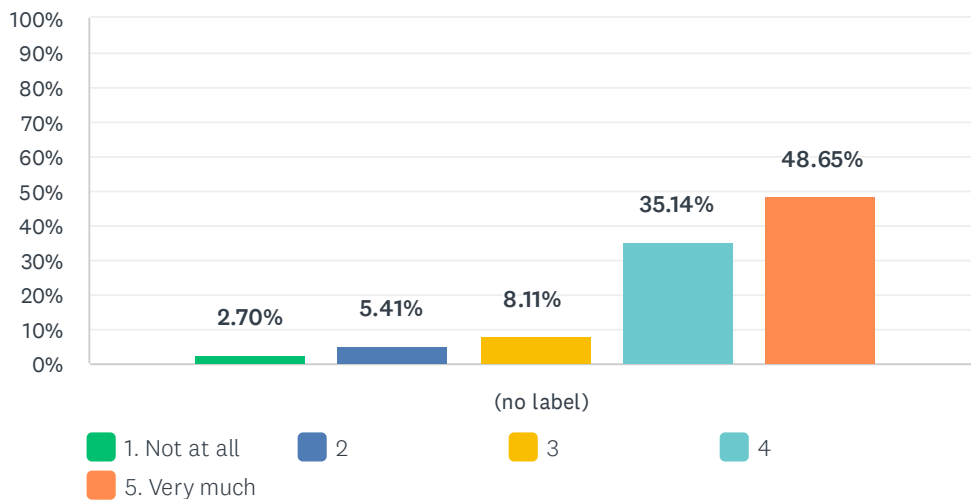
	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.70% 1	5.41% 2	8.11% 3	35.14% 13	48.65% 18	37	4.22

Q11 It is likely that I will work in the area of the school subject in the future

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	18.92% 7	27.03% 10	27.03% 10	27.03% 10	37	3.62

Q12 How would you evaluate your interaction with other participants?

Answered: 37   Skipped: 0

(no label)

■ 1. Not satisf...   ■ 2   ■ 3   ■ 4
■ 5. Above sa...
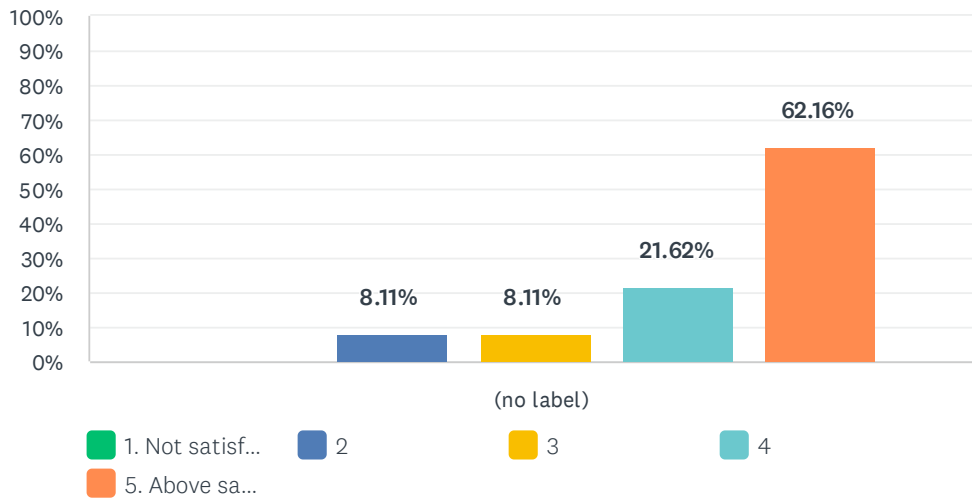
	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.11% 3	8.11% 3	21.62% 8	62.16% 23	37	4.38

Q13 Additional comments on personal assessment

Answered: 7   Skipped: 30

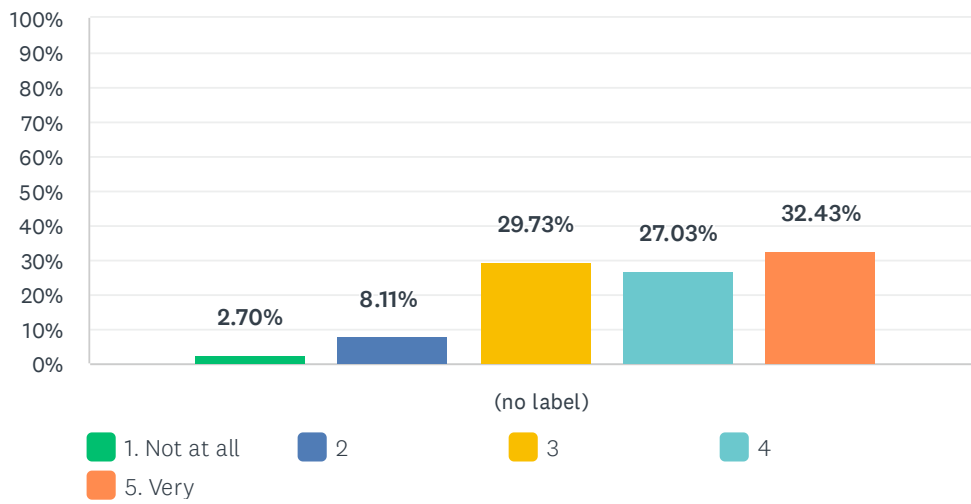| #	RESPONSES	DATE
1	This was the first meeting of mathematicians I attended in person as a graduate student. I was thrilled with how friendly it was and how interesting it was to speak to people with similar interests. There are many people from the school I will keep in contact with and potentially collaborate with.	8/30/2022 3:18 PM
2	Thank you	8/17/2022 7:46 AM
3	I wish I'd come into the summer school knowing more algebraic geometry, but kind of expected that. However, the program exceeded my expectations for how much I'd be able to apply to my research, and I've got a hopefully small research problem in tropical geometry to tackle.	8/12/2022 7:57 PM
4	The school painted a good picture of the correspondence between algebraic and tropical geometry through enumerative geometry. Even though I understood the concepts, (until we started working with Virtual classes) I don't see myself working in enumerative geometry during my PhD but I will try to apply the techniques in my area. Maybe during Postdoc I can enter Enumerative geometry and by the time I think I'll understand virtual classes and come back and watch the videos.	8/12/2022 5:51 PM
5	The 5 minute talks were a great way to learn what people are working on.	8/12/2022 4:29 PM
6	The whole summer school was really good to get to know people in my field and to find future collaborators.	8/12/2022 4:11 PM
7	The environment was great! I enjoyed making friends with others in my area that I might not have met otherwise.	8/12/2022 4:11 PM

Q14 I found the MSRI staff helpful

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.41% 2	24.32% 9	64.86% 24	5.41% 2	37	4.63

Q15 The St. Mary's facilities were conducive for such a school

Answered: 37   Skipped: 0

	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.70% 1	8.11% 3	29.73% 11	27.03% 10	32.43% 12	37	3.78

Q16 Additional comments on the St. Mary's venue

Answered: 21   Skipped: 16

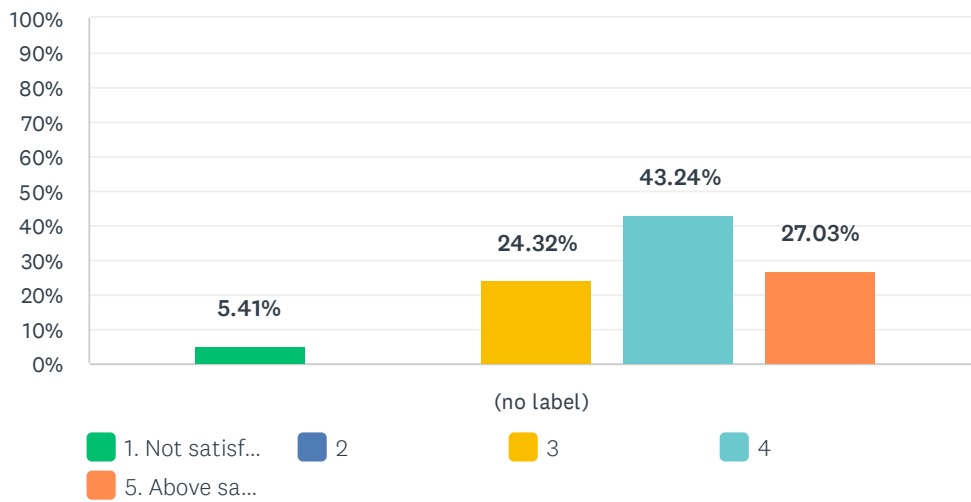| #	RESPONSES	DATE
1	The facilities at St. Mary's were good, but there wasn't very much to do in the surrounding Moraga, California, and it was difficult to go to San Francisco via public transit (and to return afterwards)	8/30/2022 3:19 PM
2	Infrequent public transportation schedule was hard to work around without using Uber/Lyft.	8/24/2022 12:27 PM
3	Thank you	8/17/2022 7:47 AM
4	The boards and markers provided caused multiple issues with readability. Numerous participants commented that they could not read what was being presented. This also seems to be an issue in the recordings. Also, the extensive construction on campus during the second week was certainly disruptive and limited my ability to find quiet places to work.	8/15/2022 3:00 PM
5	Thanks for all your service it was all perfect	8/15/2022 1:06 AM
6	It wasn't clear to me where in the school was available for working (free classrooms, group study rooms in the library, etc).	8/13/2022 2:54 PM
7	The food was ok, a couple of times the meat was undercooked and vegetarian options were pretty limited. I wish the dining hall was open for longer hours because I was usually hungry early in the afternoon but there was no where to buy snacks or food on or near campus and the dining hall was closed.	8/13/2022 11:53 AM
8	I would have preferred a location closer to San Francisco.	8/13/2022 9:56 AM
9	When the cafeteria was limited due to construction, it was hard to get filling vegetarian options and town was too far away to get food without a car.	8/12/2022 9:42 PM
10	This place is pretty good! I really like to see animals.	8/12/2022 8:57 PM
11	I couldnt see the notes on the whiteboards well in the classroom. Blackboards/new markers would be great to have	8/12/2022 5:57 PM
12	It's a great place !	8/12/2022 5:51 PM
13	There were not enough markers which were full of ink, which was a meaningful hinderance to the lectures. It was often difficult to read the board. We also ran out of green tea within just a few days.	8/12/2022 4:41 PM
14	The dining hall vegetarian options were not very good.	8/12/2022 4:30 PM
15	MSRI should have paid more attention to white boards being greasy and quality of board markers. This gave a hard time to lecturers at the first few days of school.	8/12/2022 4:28 PM
16	I'd prefer a not as openly religious venue, as there are a lot of participants from different religious backgrounds, who have made very different experiences with catholicism and Christianity.	8/12/2022 4:15 PM
17	The "pro-life" monument on campus made me uncomfortable. I did like that there were gender neutral bathrooms within a reasonable distance from the building we had class in.	8/12/2022 4:14 PM
18	The food was absolutely terrible. Cold and soggy most days, with terrible vegetarian/vegan options. From what I saw, the chicken was still raw in the center most days. I think I lost about 5 pounds. There's also a pro-life monument on campus, which was very jarring	8/12/2022 4:13 PM
19	I think that the venue was quite remote, and as a result I felt relatively isolated on campus. I don't think that this makes St Mary's a poor choice of venue, but I do think that future summer schools here should provide more structure to allow participants to go into the bay area and/or find activities to do nearby Moraga.	8/12/2022 4:08 PM

| 20 | I was uncomfortable with all the religious imagery, and having to look for gender neutral restrooms wasn't easy (despite the map provided). | 8/12/2022 4:08 PM |
| 21 | too far from everything, traveling cost high | 8/12/2022 4:07 PM |

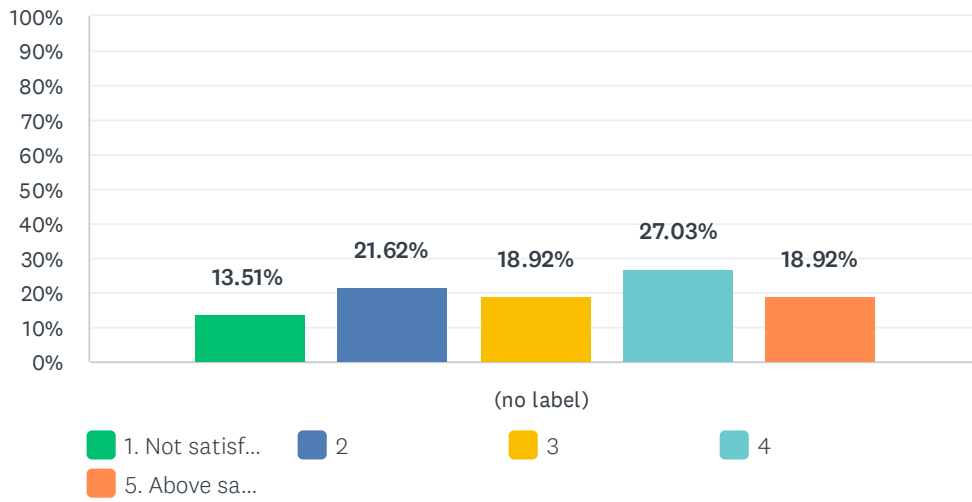# Q17 How did you find the summer school accommodations?

Answered: 37   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	5.41% 2	0.00% 0	24.32% 9	43.24% 16	27.03% 10	37	3.86

Q18 How did you find the food provided at St. Mary's?

Answered: 37   Skipped: 0

	1. NOT SATISFACTORY	2	3	4	5. ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	13.51% 5	21.62% 8	18.92% 7	27.03% 10	18.92% 7	37	3.16

Q19 Additional comments on accommodation and food

Answered: 18   Skipped: 19

#	RESPONSES	DATE
1	No complaints	8/30/2022 3:20 PM
2	I did not enjoy my stay at the dorms. The beds and pillows were old and uncomfortable, and I needed three of their thin blankets to be warm enough at night. I had serious plumbing issues the first day, which were promptly fixed, but the shower needed to be cleaned and it was not. Hand soap was not provided, which was quite inconvenient. Lastly, some light bulbs were burnt out, and the old-fashioned key would easily get stuck in the lock on the front door.	8/29/2022 12:15 PM
3	Thank you	8/17/2022 7:47 AM
4	The meat-free food options were unsatisfactory. The options were extremely limited and repetitive, and seemed to be chosen with no concern for the students' nutritional needs. Items were occasionally labelled with basic allergy information, but did not include more detailed ingredient lists for people with dietary restrictions. The accommodations could have been greatly improved with simple additions like hand soap and cups.	8/15/2022 3:11 PM
5	Foods were great	8/15/2022 1:07 AM
6	The beds and pillows were quite uncomfortable and made it hard to sleep	8/13/2022 10:56 AM
7	The residence halls were fine. The food was limited on campus and far from town options.	8/12/2022 9:44 PM
8	The food was great except during the period when the dining hall was closed. It was still okay then, but not as good.	8/12/2022 7:58 PM
9	No hand soap in bathrooms	8/12/2022 5:57 PM
10	The food was very good but a bit repetitive. But it was satisfactory.	8/12/2022 5:53 PM
11	On the first day, I founded our restroom didn't get water current, so we needed to call a person for repair. Food is great in general, but the break fast is high calorie and they were full of sugar, and I frequently skipped breakfast but not lunch and dinner were great.	8/12/2022 5:28 PM
12	Food for vegetarians was not always great (very often there was no real protein for vegetarians).	8/12/2022 4:41 PM
13	The accommodations were fine, but it would have been nice if they provided hand soap in the bathrooms. The food wasn't great. There were very limited vegan options and the food was surprisingly cold. My friend was served undercooked chicken.	8/12/2022 4:17 PM
14	See previous comment. Borderline inedible. Probably actually illegal because the food was absolutely not being served at a safe temperature	8/12/2022 4:13 PM
15	Accommodations were alright. I thought the beds could be more comfortable, and I am still confused about why an architect would design the bathrooms the way that they are. The food was certainly less than satisfactory. I found much of it to be rather bland, and a friend of mine was served chicken that was almost raw in the middle.	8/12/2022 4:11 PM
16	The dinning services were horrible. The food seemed unsanitary (the meat was perpetually cold)	8/12/2022 4:10 PM
17	Vegetarian and vegan options were lacking	8/12/2022 4:08 PM
18	Food was not great, and there were almost no vegan options.	8/12/2022 4:04 PM

Q20 The overall experience of the school was worthwhile

Answered: 37   Skipped: 0
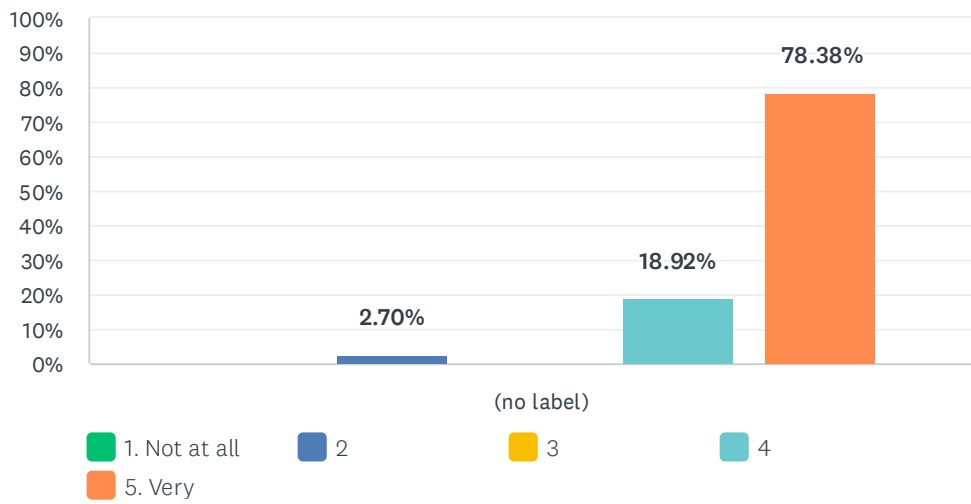
	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.70% 1	0.00% 0	18.92% 7	78.38% 29	37	4.73

Q21 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 8   Skipped: 29

#	RESPONSES	DATE
1	An excellent experience overall. I would love the opportunity to participate in another MSRI summer school given the chance. Thank you to Dhruv, Hannah and Renzo in particular.	8/30/2022 3:21 PM
2	I believe a short list of items to bring, such as hand soap, body wash, shampoo, and laundry soap, would have been very helpful.	8/29/2022 12:17 PM
3	Thank you very much.	8/17/2022 7:47 AM
4	The location was not ideal for travelers. Given that it was summer, the on-campus stores were not stocked to provide for 80+ people arriving with no soap, detergent, etc. The limited bus service often made reaching nearby towns expensive.	8/15/2022 3:15 PM
5	want to attend again	8/15/2022 1:07 AM
6	Opening the bar on campus and adding an outdoor dance floor would have greatly improved the experience.	8/13/2022 11:55 AM
7	Sometimes it is hard to recognize what the instructor is writing for various reasons: Sometimes Dhruv's words are small, sometimes the whiteboard is too dirty, or sometimes the instructor draws some tiny pictures. By the way, it is hard to see the word on the board in the recording. (Maybe this is hard to make it better, but this is still an issue.)	8/12/2022 9:05 PM
8	Please pick a place with better food!!	8/12/2022 4:13 PM