Department of Mathematics

The Department of Mathematics is a world-class leader in mathematical research, education and outreach, and is the top-ranked mathematics department in the United States. It is unique among elite departments in its dedication to teaching and mentoring, and the scope of its program is a key part of MIT's educational mission at all levels. Our graduates are sought after, both in industry as highly trained problem solvers, and in academia as outstanding researchers. Key to the department's success is recruitment of the very best junior and senior faculty and graduate students in an ever-more competitive environment. The department strives for diversity in all its appointment and admission levels, and is committed to fostering diversity in earlier grades through numerous outreach programs to high school and middle school students.

Our award-winning faculty are leaders working in many central fields in pure and applied mathematics. We have specialists in analysis, geometry, topology, algebra, number theory, physical applied mathematics, computational science, computational biology, theoretical computer science (including quantum computing, optimization, machine learning, and computational complexity), combinatorics, probability, and statistics. Because of the department's breadth, our faculty interact with researchers in other MIT departments, including Electrical Engineering and Computer Science, Biology, Physics, Mechanical Engineering, Civil and Environmental Engineering, as well as the Institute for Data, Systems, and Society and the Broad Institute.

Faculty

New Faculty

Four new faculty members were appointed in the department during AY2019. As of June 2019, we had 51 faculty members.

Tristan Collins joined the mathematics faculty as assistant professor in September 2018. He maintains a research program in complex geometry concentrating on problems in gauge theory and areas of algebraic geometry, such as mirror symmetry. He received his PhD from Columbia University in 2014 studying under Duong H. Phong. Collins was subsequently appointed a Benjamin Peirce Fellow at Harvard University and concurrently a visiting assistant professor at Chalmers University in spring 2017. Collins was awarded a 2018 Sloan Research Fellowship.

Peter Hintz joined the faculty as assistant professor in January 2019. Hintz is an analyst studying hyperbolic partial differential equations, particularly those relevant to Einstein's equations of general relativity. His program incorporates methods from microlocal analysis, spectral and scattering theory, and dynamical systems. He completed his PhD at Stanford University in 2015 under András Vasy and was subsequently appointed a Miller Research Fellow at the University of California, Berkeley. In 2017 Hintz received a research fellowship from the Clay Mathematics Institute.

Nike Sun joined the department as associate professor with tenure in September 2018. Her research interest lies at the intersection of probability, statistical physics, and the

theory of computing. She completed her BA in mathematics and MA in statistics at Harvard University in 2009, and the MASt (Master of Advanced Study) in mathematics at the University of Cambridge in 2010. She received her PhD in statistics from Stanford University in 2014 under the supervision of Amir Dembo. After her doctorate, she held a Schramm fellowship at Microsoft New England and in the MIT Department of Mathematics from 2014–2015. In 2016 she joined the statistics faculty as an assistant professor and a Simons postdoctoral fellow at the University of California, Berkeley. In 2017 Sun received the Rollo Davidson Prize for young probabilists, "for her achievements in probability theory and specifically on the random k-SAT conjecture."

Chenyang Xu, who joined the Mathematics Department as professor in September 2018, specializes in higher-dimensional algebraic geometry, an area that involves classifying algebraic varieties primarily through the minimal model program. With collaborators, Xu expanded the minimal model program to varieties of certain conditions, such as those of characteristic p in higher dimensions. A graduate of Peking University, Xu completed his PhD at Princeton University under János Kollár in 2008. He came to the MIT mathematics department as a CLE Moore Instructor, 2008–2011, and was subsequently appointed assistant professor at the University of Utah. He returned to Peking University as a research fellow at the Beijing International Center of Mathematical Research in 2012, where he was promoted to professor in 2013. Among his distinctions, Professor Xu was awarded China's inaugural Future Science Prize in Mathematics and Computer Science in 2017 and the 2019 New Horizons Prize for Early-Career Achievement in Mathematics.

Faculty Changes

Assistant professors Jörn Dunkel and Semyon Dyatlov were promoted to associate professor without tenure. Associate Professor Jonathan Kelner was promoted to full professor.

Associate Professor Gonçalo Tabuada resigned from MIT for a faculty appointment at the University of Warwick, UK.

Faculty Awards and Honors

The faculty were honored with a number of major distinctions for their research and teaching.

Professor Bonnie Berger was selected for the 2019 Senior Scientist Award by the International Society for Computational Biology for her "visionary, foundational, and deep contributions to the field."

Professor Tom Leighton received the Secure Computing Media's Visionary Award as Akamai Technologies' chief executive officer at the 23rd annual Secure Computing Awards gala, March 2019, in San Francisco, CA. The Visionaries of the Last 30 Years category honors those who have shaped the industry and will continue to impact the future.

Professor Elchanan Mossel was named a 2019 Simons Investigator of Mathematics. The award is given to outstanding theoretical scientists to support long-term investigations in fundamental questions. He was an organizer of the Foundations in Deep Learning program at the Simons Institute in Berkeley, CA, from May to August 2019.

Professor Peter Shor was awarded the 2018 Micius Quantum Prize "for his groundbreaking theoretical work on factoring algorithms and quantum error correction." The Micius Quantum Prize recognizes significant science advances, ranging from early conceptual contributions to recent experimental breakthroughs.

Professor Chenyang Xu was awarded the 2019 New Horizons in Mathematics Prize "for major advances in the minimal model program and applications to the moduli of algebraic varieties." This prize, part of the Breakthrough Prize series, recognizes promising young researchers who have already produced important work in mathematics.

Professor Zhiwei Yun received the Gold Medal of Mathematics at the 8th International Congress of Chinese Mathematicians in Beijing. Formerly known as the Morningside Medal of Mathematics, the Gold Medal is given to exceptional mathematicians of Chinese descent under the age of 45 for their achievements in pure and applied mathematics.

Professors Bonnie Berger, Larry Guth, Elchanan Mossel, Zhiwei Yun, and Wei Zhang were selected as members of the 2019 Class of American Mathematical Society Fellows, recognized for their "outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics" in their respective fields.

Professor David Jerison received a 2019 Guggenheim Fellowship. He will use the fellowship to study interfaces that divide regions in optimal ways, such as those interfaces that minimize energy, cost, or loss of information.

Professor Victor Kac was awarded a 2019 Simons Fellowship in Mathematics, which will support his research during an upcoming sabbatical year at University La Sapienza of Rome. He also received the Raymond and Beverly Sackler American Fellowship at the Institut des Hautes Études Scientifiques near Paris, France.

Professor William Minicozzi received the 2018 School of Science Teaching Prize for Undergraduate Education for his instruction of 18.02 Calculus. He was also recognized by MIT's Office of the Vice Chancellor with the Outstanding Veteran First-Year Advisor Award.

Associate Professor Semyon Dyatlov received the 2018 Early Career Award from the International Association of Mathematical Physics for his "introduction and the proof of the fractal uncertainty principle, which has important applications to quantum chaos and to observability and control of quantum systems." He also received a National Science Foundation CAREER Award.

Associate Professor Ankur Moitra was awarded the School of Science Teaching Prize for Graduate Education for his design of the graduate seminar, 18.S996/18.409 Algorithmic Aspects of Machine Learning. Notes from this subject have been turned into a monograph that is used at other institutions.

Associate Professor Nike Sun received a National Science Foundation CAREER Award.

Assistant Professor Andrew Lawrie was selected by the department's faculty nominating committee to receive the Edmund F. Kelly Research Award, given once every three years to a junior faculty member doing foundational research.

Assistant Professors Andrew Lawrie and Yufei Zhao were each awarded a 2019 Sloan Research Fellowship.

Assistant Professor Vadim Gorin received the 2018 Young Scientist Prize of the International Union of Pure and Applied Physics "for his groundbreaking work on the universality of local correlations in random tilings and nonintersecting random walks, and the discovery of locally interacting particle systems linked to random matrix ensembles."

Assistant Professor Yufei Zhao has been named the second recipient of the School of Science's Future of Science Award. Zhao also now holds the Class of 1956 Career Development Faculty Chair.

The MIT research support committee selected two faculty members to receive support from the Solomon Buchsbaum AT&T Fund for AY2019: Associate Professor Jörn Dunkel and Assistant Professor Yufei Zhao.

Lecturer Tanya Khovanova received the School of Science Infinite Mile Award in the Mentor Award category. Khovanova is the head mentor of the mathematics section of MIT's Research Science Institute, and—since its inception in 2010—of the department's PRIMES (Programs for Research in Mathematics, Engineering, and Science) program—a free, yearlong afterschool research program for high-school students. She was nominated for her exceptional ability to guide and inspire her colleagues.

Lectures

Professor Tomasz Mrowka delivered a plenary address at the International Congress of Mathematicians 2018, which was held in Rio de Janeiro, Brazil, in August 2018. Other MIT mathematics faculty who were invited speakers were Professors Bjorn Poonen and Wei Zhang (number theory), Professors Zhiwei Wei and Chenyang Xu (algebraic and complex geometry), and Professor Alexander Postnikov (combinatorics).

In June 2019, Professor John Bush gave both a plenary lecture at the Waves Cote d'Azur, held in Nice, France, and a plenary and public lecture at the 30th anniversary of the Oxford Centre for Industrial and Applied Mathematics, University of Oxford, UK.

Professor Pavel Etingof delivered the Zassenhaus lectures at Ohio State University in March 2019.

Professor Gigliola Staffilani gave two more lectures as part of her responsibilities as the 2018 European Mathematics Society (EMS) Lecturer. In July 2018 she delivered the EMS lecture at the University of Rome, Italy, and in September 2018 she gave the EMS lecture at the European Women in Mathematics General Meeting, held at the University of Graz, Austria. Professor Staffilani also delivered the Earle Raymond Hedrick Lecture Series at the Mathematical Association of America's MathFest, held in Denver, CO, in August 2018.

Professor Lawrence Guth gave the Joram Lindenstrauss Lectures at Hebrew University of Jerusalem, Israel, in January 2019.

Professor Victor Kac delivered a plenary lecture at the 32nd International Colloquium on Group Theoretical Methods in Physics, held at Czech Technical University in Prague, Czech Republic, in July 2018. He gave a second plenary lecture at the Kac-Moody Geometry International Conference, held in Besse-et-Saint-Anastaise, France, in May 2019.

Professor George Lusztig gave the Distinguished Lecture at the International Consortium of Chinese Mathematics in Taipei, Taiwan, December 2018.

Professor Bjorn Poonen delivered a plenary lecture at the Canadian Number Theory Association meeting in Quebec, Canada, July 2018. In January 2019, he gave the Baruch Distinguished Lecture at Baruch College in New York City. He also gave the American Mathematical Society's Arnold Ross Lecture at Pennsylvania State University in May 2019.

Professor Paul Seidel delivered the Floer Memorial Lecture at Stanford University in October 2018.

Professor Gilbert Strang gave the Owens Lecture at Wayne State University in March 2019.

Professor David Vogan delivered one of two Department of Mathematics 90th Anniversary Distinguished Lectures at the National University of Singapore in March 2019.

Department Administration

Michel X. Goemans completed his first year as department head and William Minicozzi completed his first year as associate department head. Bjorn Poonen chaired the Faculty Nomination Committee and Alexei Borodin chaired the Moore Committee (for instructor hiring).

Tobias Colding continued as chair of the Pure Mathematics Committee and Peter Shor as chair of the Applied Mathematics Committee. Bonnie Berger served as interim chair of the Applied Mathematics Committee during fall 2018 while Shor was on sabbatical.

Davesh Maulik and Wei Zhang co-chaired the Graduate Committee in Pure Mathematics and Jonathan Kelner chaired the Graduate Committee in Applied Mathematics. Ju-Lee Kim and Steven Johnson served as co-chairs of the Committee of Undergraduate Advisors.

The department head has set up an executive committee to advise him on issues arising in the department. This year, the committee consisted of Alexei Borodin, William Minicozzi, Elchanan Mossel, Tomasz Mrowka, Paul Seidel, Gigliola Staffilani, and Pavel Etingof.

Development

The department had another successful year engaging alumni and friends of the department. We continued to host events and faculty talks for alumni, parents, and friends, as well as stewardship events for donors. Our top priority was graduate fellowships, and MathWorks agreed to support a number of new fellowships. In addition, we continue to focus on support for endowing the department's PRIMES program for high school students, with a particular focus on funding for MathROOTS, the newest addition to PRIMES.

Simons Lecture Series

The 2019 Simons Lectures were given by Alexander Barvinok, professor of mathematics at the University of Michigan, and June Huh, visiting professor and Clay Research Fellow at the Institute for Advanced Study, Princeton, NJ. The two lecture series took place between April 24 and May 1, with a department dinner honoring the speakers at the Museum of Science on Saturday, April 27, 2019.

Alexander Barvinok is known for his advances in computational complexity and algorithms in algebra, geometry, and combinatorics. His Simons lectures were on combinatorics, complexity, and complex zeroes of partition functions.

June Huh's interests are in geometry, topology, and combinatorics of algebraic varieties. His Simons lectures focused on the notion of Lorentzian polynomials and their key properties.

Conferences

- November 16–17, 2018: Current Developments in Mathematics 2018, jointly organized by the mathematics departments of Harvard University and MIT. The conference took place at Harvard's Science Center.

- August 20–24, 2018: Arithmetic Geometry, Number Theory, and Computation in the Mathematics Department, organized by Assistant Professor Jennifer Balakrishnan (Boston University), Professor Noam Elkies (Harvard University), Professor Brendan Hassett (Brown University), Professor Bjorn Poonen (MIT), Dr. Andrew Sutherland (MIT), and Associate Professor John Voight (Dartmouth College).

Education

Curriculum Updates

The core Course 18 subjects are being reformed with a view to raising the level of mathematical literacy across the Institute. In AY2019, there were a number of small changes to the curriculum in the mathematics General Institute Requirements (GIRs), 18.01 Calculus and 18.02 Calculus, made after conversations with other departments. These classes, as well as 18.03 Differential Equations, are prerequisites for more than 100 classes across many departments. The department anticipates broader changes to 18.01 and 18.02 Calculus, with implications downstream for 18.03 Differential Equations and 18.06 Linear Algebra.

Starting in fall 2019, a satisfactory grade on the mathematics diagnostic examination for physics (MDX) will be required for 18.01 Calculus advanced placement credit. Previously, students received credit for 18.01 if they scored a 5 on the advanced placement calculus BC (AP BC) exam. A number of these students did poorly in 18.02 Calculus in the fall. Further study showed that success in 18.02 was predicted by the MDX, administered by the Physics Department (Course 8) for 8.01 Physics I placement. Students with AP BC credit and low MDX scores achieved fewer As and many more grades of C or below in 18.02. However, the same cohort performed much better in 18.02 if they first took 18.01 in the fall. Starting in fall 2019, the MDX will be required for 18.01

AP BC credit. This change was developed in collaboration with Course 8, approved by the Committee on the Undergraduate Program this spring, and is being implemented in coordination with Course 8 and the Office of the First Year. We believe that the new process will help students master essential skills and achieve better outcomes, both in 18.02 and in the long term.

This was the first year for the pass/no record (P/NR) GIR experiment, allowing entering students to take some GIR subjects with P/NR after their first semester. The experiment was intended to allow for more student exploration. The experiment did not have a significant impact on mathematics GIR enrollments. There was an increase in enrollments in some of the more advanced subjects, notably 18.06 Linear Algebra, which went from 156 students in fall term 2017 to 205 in fall term 2018 (fifth-week data). It also appears that first-year students interested in majoring in mathematics used the P/NR option to take advanced math subjects, including graduate-level subjects, without the risk of a disappointing grade. Instructors in 6.042 Mathematics for Computer Science and spring term 18.02 Calculus reported some adverse impact on student performance. This is illustrated by data on student performance in spring term 2018 (with essentially all students taking 18.02 for a grade) versus spring term 2019 (with roughly 50% of student taking 18.02 P/NR). The average rate of homework non-submission for the last three problem sets went up from 17% to 24%, and the average score on the final went down from 89% to 84%. The student self-reported hours of work on the class dropped by more than one hour per week (9.9 to 8.5). These changes are concerning for a core subject that is fundamental for future science, math, and engineering classes.

Spring term 2019 saw the debut of a new intermediate level undergraduate subject, 18.900 Geometry and Topology in the Plane, developed by Professor Paul Seidel. The subject introduces students to geometric and topological thinking in a broad sense. It is intended to bridge the gap between introductory core subjects and more advanced and abstract upper-level classes where the students do rigorous proofs. The first year was a success and the subject will be offered again this year.

Finally, 18.642 Topics in Mathematics with Applications in Finance, has reverted to its previous non-communication-intensive in mathematics (non-CI-M) form, effective AY2020. This change was made to appeal once again to the many students in other departments (including graduate students) who are interested in the subject matter but deterred by the work-heavier communication-intensive aspect.

MITx

The subjects 18.01x Calculus (a series of three online modules) and 18.03x Ordinary Differential Equations (a series of five online modules) are offered worldwide through the edX platform and have been running successfully each year. The textbook for 18.03 now entirely contains the interactive online materials developed and deployed on the MITx platform for our residential students. The on-campus subjects 18.01 Calculus, 18.01A Calculus (a six-week class offering a rapid review of one-variable calculus), and 18.03 Differential Equations collect a portion of the homework online through the MITx platform. The use of online homework allows students to receive immediate feedback and verify that they have the basic skills needed to solve the more involved paper homework.

The subject 18.02x Multivariable Calculus is currently in development in collaboration with an OpenCourseWare video project to re-record 18.02. The department has created a series of interactive 3D images using Mathematica notebooks that explore tricky calculus concepts and ideas; this was supported by an express grant from the Office for Digital Learning. These notebooks were used in lectures for the first time in spring 2019, with access for students to use them on their own. We have now received a full grant to build the interactive course materials, which will utilize interactions with these visualizations. So far, the department has spent time to design problems with real-world context to use throughout the course—problems that involve themes of environment and sustainability. These problem designs are supported by a small grant from the MIT Environmental Solutions Initiative.

The long-term objective is to have all of the core subjects (18.01–18.06) in an MITx/edX format; 18.05 Introduction to Probability and Statistics and 18.06 Linear Algebra are next on the list. The time needed to do this continues to be the main challenge to faculty members who contribute to these efforts. The support of Digital Learning Laboratory scientists and fellows who work in the department for the development and use of these courses is essential to the success of these subjects.

Graduate Students

There were 122 graduate students in mathematics in AY2019, all in the PhD program. A total of 25 students received their doctoral degrees between September 2018 and June 2019, and two students left the program with a master's degree.

A majority of the students who completed their PhDs advanced to postdoctoral positions in mathematics and related departments at other universities. These included appointments at the California Institute of Technology, the Institute for Advanced Study, Princeton University, Stanford University, the State University of New York at Stony Brook, the University of California, Los Angeles, the University of Georgia, the University of Indiana, the University of Pennsylvania, and the University of Chicago. One student is continuing at MIT, working for MITx, and another will join the Broad Institute.

Among those electing to pursue jobs in industry, the most popular options included jobs in finance, consulting, software and computing, and research and analytics, with positions at such organizations as Barclay's Bank, DMC Inc., Google, Insight Data Science, McKinsey & Company, Susquehanna International Group, Samsung, Symbotic, and Zapata Computing.

There will be 26 new students entering the mathematics doctoral program in September 2019, including one student admitted into the department's joint program with Computational Science and Engineering. The entering class includes three women. The department continues the policy of offering all first-year doctoral students full fellowship support; the new student in the joint program will receive a research assistantship.

Graduate Student Awards

Graduate students Vishal Arul, Gweneth McKinley, and Sam Turton each received the Charles and Holly Housman Award for Excellence in Teaching for their exceptional skill and dedication to undergraduate teaching. The Charles W. and Jennifer C. Johnson Prize for an outstanding research paper accepted in a major journal was awarded to graduate student Cesar Cuenca.

Doctoral student Kristin Marie-Dettmers Kurianski was chosen as an honoree in the 2019 biennial celebration of Graduate Women of Excellence. The celebration, organized by the Office of the Dean for Graduate Education, recognizes graduate women based on their leadership and service contributions to the Institute, their dedication to mentoring, and their drive to make changes to improve the student experience. Kristin and others were recognized on April 29, 2019, where honorees presented posters on their accomplishments and future plans.

Mathematics Majors

The mathematics major is the third largest major at MIT, and the largest within the School of Science. During AY2019, a total of 367 students listed mathematics as their major at the official fall fifth-week tally—253 in Course 18 (Mathematics) and 114 in Course 18C (Mathematics with Computer Science). Enrollment increased to more than 400 undergraduates by the spring 2019 term. Of these, 146 students graduated with bachelor's degrees in mathematics, 99 with mathematics as a first major and 47 with mathematics as a second major. Although responses to the department's senior survey were incomplete, of the 87 students whose postgraduate plans are known, six will continue in graduate programs in mathematics, 21 in programs in computer science, eight in programs in physics or astrophysics, and one in each of finance, mechanical engineering, and operations research. A larger group will pursue non-academic opportunities, with 14 entering jobs in computing and software engineering, 23 entering the financial sector (although a number of these are software engineering positions within financial firms), six joining consulting services, and several working in nonprofits and public policy.

Undergraduate Awards

The Jon A. Bucsela Prize in Mathematics, given in recognition of distinguished scholastic achievement, professional promise, and enthusiasm for mathematics by a mathematics major, was awarded to Yunkun Zhou '19. Sophomore Ashwin Sah received a Barry M. Goldwater Scholarship. Danielle Wang '19 was the runner-up for the Alice T. Schafer Prize for excellence in mathematics by an undergraduate woman. Lisa Yang '19 received honorable mention.

Putnam Triumphs

The 2018 MIT team placed second in the William Lowell Putnam Mathematical Competition, with two MIT students placing among the top five individual scorers, designated as Putnam Fellows. The Putnam team consisted of senior Yunkun Zhou and sophomores Ashwin Sah and Junyao Peng. Two of the five Putnam Fellows were sophomore Yuan Yao and first-year student Shengtong Zhang. Senior Danielle Wang won the Elizabeth Lowell Putnam Prize, the second time in her four years that she was awarded this recognition for a top-scoring woman participant.

In addition to MIT's two Putnam Fellows, MIT students accounted for nine of the next 10 top individual scorers, six of the next 12, and 28 of the 74 students who received honorable mention, for a total of 45 out of the 101 test takers who received an honorable mention or higher. Students benefited from excellent coaching by Assistant Professor Yufei Zhao.

Undergraduate and High School Summer Research Programs

Summer Program in Undergraduate Research

In summer 2018, the department hosted its 22nd Summer Program in Undergraduate Research (SPUR), a six-week intensive mathematical research experience for MIT undergraduates in which each undergraduate pursues an individual or team project with a graduate student mentor. There is also a version, SPUR+, that targets top women and members of minority groups and starts three weeks earlier. Nine MIT undergraduates participated in the 2018 SPUR program and four in the SPUR+ program, mentored by eight graduate students. SPUR teams Julius Baldauf-Lenschen '19 with mentor Ao Sun, Dhruv Rohatgi '21 with mentor Jake Wellens, and SPUR+ team Juan Gil '20 and Joshua Amaniampong '21, both mentored by Jake Wellens, shared the 2018 Hartley Rogers Jr. Prize for the best projects.

Research Science Institute

Summer 2018 was the 26th year of the department's participation in the Research Science Institute program for gifted high school students. In all, 10 graduate students mentored 11 selected high school students in the six-week program. The students came from eight different states in the US as well as from Bulgaria and Kazakhstan. For their research projects, two students won National Scholar awards in the 2019 Regeneron Student Talent Search. Four students became finalists at the 2019 Intel International Science and Engineering Fair (ISEF), and Chavdar Lalov won the Third Award in Mathematics from the American Mathematical Society's jury at Intel ISEF-2019.

Program for Research in Mathematics, Engineering and Science

In calendar year 2019, the department participated in the ninth year of the Program for Research in Mathematics, Engineering, and Science. Locally, 26 gifted high school students from greater Boston worked with 17 postdoctoral researchers and graduate student mentors on research projects, or participated in reading groups in the mathematical section of PRIMES. Additionally, in the PRIMES-USA math section, 15 exceptional out-of-state students selected from a national pool are conducting research projects under the supervision of 13 graduate students, postdoctoral associates, and outside faculty via telecommunication channels.

In fall 2018, PRIMES and PRIMES-USA math students successfully completed 29 individual and group research projects that they had worked on during calendar year 2018. Vincent Huang took ninth place, Aayush Karan became a finalist, and 12 students won National Scholar awards in the 2019 Regeneron Science Talent Search Competition. Rinni Bhansali and Aayush Karan won the 2nd Grand Award in Mathematics at Intel ISEF-2019. Karan also won the 3rd Special Award (from the American Mathematical Society) and an honorable mention (from the National Security Agency) at Intel's fair. In addition, nine students received Outstanding Presentation Awards at the Mathematical Association of America's Undergraduate Student Poster Session, at the 2019 Joint Mathematics Meetings.

In May 2019, PRIMES held its eighth annual conference at MIT. Organized by Professor Pavel Etingof and Lecturer Slava Gerovitch, there were over 40 presentations by more than 70 students from MIT PRIMES, PRIMES Circle (free after-school math enrichment

program for talented high school students living in commuting distance of Boston), PRIMES-USA, and the PRIMES Solve-Theorize-Explore-Prove (STEP) program for seventh- to ninth-grade students. This well-attended event demonstrates the solid success of the program. Several projects will likely lead to publication in professional journals and will be strong contenders at national science competitions for high school students.

All together, 20 PRIMES students will enroll at MIT as first-year students in fall 2019, and will likely continue their research through the Undergraduate Research Opportunities Program.

Lusztig Mentors

Through the generosity of Professor George Lusztig, the Lusztig PRIMES mentorships are annually awarded to continuing PRIMES mathematics mentors for exceptional mentoring service in prior years. The 2019 Lusztig PRIMES mentors were graduate students Christian Gaetz, Zhulin Li, and Chris Ryba.

Building Diversity

Professor Gigliola Staffilani has continued to head the Diversity and Community Building Committee (formerly the Diversity Advisory Committee) to discuss initiatives and review ongoing practices to build a more diverse pool at all levels. This has been and continues to be a priority.

For AY2019, the department's postdoctoral associates were 10% women and 10% members of underrepresented minority groups. There are still no faculty members from underrepresented minorities, but there is one tenured woman associate professor, Nike Sun. The department's percentage of faculty women is now 9%, still below the national average. Our faculty search committees make every effort to consider all women and minority-group applicants for postdoctoral and junior faculty positions, and to consider top women and minority scholars for both junior and senior faculty positions.

The diversity of our graduate student enrollment dropped slightly to 17% women and 4% underrepresented minorities. However, diversity among the mathematics majors incrementally increased to 35% women and 17% members of underrepresented minority groups (from 14%).

Community Building among the Mathematics Majors

The department has increased the number of activities outside regular classroom hours where math majors can meet and interact with other members (graduate students, postdoctoral associates, or faculty) of the department. This was the second year of our fall-term Math Puzzles Social, open to all Institute undergraduates, and the second year we opened our daily teas to all undergraduates twice a week. These take place in the department's renovated and spacious common room, where students can always come to socialize with the community and develop contacts for mentoring. The department also implemented a sign-up database for incoming and interested undergraduates, with opportunities to sign up at the Academic Expo and at department alumni forums and panel presentations held throughout the year. This gives us a way to disseminate department news and upcoming socials and events open to undergraduates.

For the mathematics majors, the department's Summer Program in Undergraduate Research-Plus, which targets top women students and students from underrepresented minority groups, was especially successful in its second year, as reported by Faculty Advisors David Jerison and Ankur Moitra. SPUR+ begins three weeks earlier than SPUR with guided reading, then joins the SPUR teams for six weeks with research projects. Four MIT undergraduates, mentored by two graduate students, took part in SPUR+ in summer 2018. The department is grateful for the continued support of SPUR+ by both the School of Science and the Office of the Provost.

During spring 2019, Academic Administrator Barbara Peskin and Professor Staffilani organized a sign-up sheet for graduate students and postdocs to tutor students in upper-level math classes. This is done on a purely volunteer basis and proved very effective for students. The practice is under review, however, as it was clear that there will need to be additional resources and structure to maintain this service in future years.

Finally, the department initiated celebrating Pi Day (March 14) with pizza and a friendly competition to design a mathematics T-shirt, thanks to support from the School of Science. This event was open to all community members and math majors and it was well attended. Its success ensured that it will become an annual event.

Outreach: PRIMES Circle and MathROOTS

The Program for Research in Mathematics, Engineering, and Science successfully ran the PRIMES Circle section for the seventh consecutive year. The program teaches a mathematical enrichment curriculum to female students and those with underprivileged backgrounds from the Boston area. A total of 15 students from urban public high schools, including one Hispanic and 12 female students, participated in the 2019 program, culminating in presentations at the annual PRIMES conference at MIT in May 2019.

From June 23 through July 7, 2019, the department hosted its fifth MathROOTS summer camp program. A total of 20 students participated. They self-identified as follows: eight female, seven African-American, 11 Hispanic, and two African-American-Latino students. Thus far, of 80 former MathROOTS alumni eligible to apply for college (from summers 2015–2018), 42 students have been admitted to MIT and 28 have accepted.

Martin Luther King Visiting Professorship Program

Professor Kasso Okoudjou of the Department of Mathematics at the University of Maryland was appointed as a Martin Luther King, Jr., Visiting Professor. He taught full time, continued his research program in applied harmonic analysis, and participated on the Diversity and Community Building Committee. His contract was renewed for a second full year (AY2020).

Directed Reading Program

The department continues to support the Directed Reading Program. The program pairs an undergraduate student with a graduate student to work through one or more mathematics texts over the Independent Activities Period. In January 2019, out of 40 participants, 18% were female and 10% were members of underrepresented minorities.

Building a Community for Women

The department continues a number of community building initiatives for women, with these updates in AY2019:

- Professor Staffilani's annual Women in Mathematics dinner (hosted in her home) for women faculty members, postdoctoral associates, graduate students, and mathematicians in the greater Boston area, attracted more than 40 guests.

- The department's Women in Math Lunch Seminar series, which meets three to four times a term, invites women undergraduates along with faculty, graduate students, and postdoctoral associates. Eight or more undergraduates have attended each of the seminars.

- MIT women math majors and graduate students continue to offer mentoring at Girls' Angle, A Math Club for Girls, a club located in Cambridge, MA, for middle school girls. The club recently hired a woman mathematician as head mentor; and—as agreed with the founder of Girls' Angle—in AY2020 the head mentor will receive a courtesy appointment in MIT's Mathematics Department.

- For the eighth consecutive year, the department hosted the Advantage Testing Foundation Math Prize for Girls competition for high school students on September 23, 2018. In total, 285 young women from the United States and Canada competed for ranking and monetary awards, with the top 45 students invited to a mathematics prize Olympiad in November. The competition exposes strong young women math students to mathematics at MIT. More than half of the awardees have later matriculated at MIT.

The department maintains funding support for a number of on-campus events and organizations for women, members of minority groups, and others:

- African Student Association's Cultural Night

- Camp Kesem at MIT (provides a week-long, free summer camp as well as year-round support for children of cancer patients)

- MIT SPOKES

- Ebony Affair (sponsored by the MIT Black Students' Union and Black Graduate Student Association)

- Society of Hispanic Professional Engineers at MIT

- Undergraduate Society for Women in Mathematics (welcomes new women mathematics majors and arranges campus talks by outside women mathematicians)

Michel X. Goemans
Department Head
Professor of Mathematics