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 academics as young 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 at all of its appointment and admission levels and is committed to fostering greater diversity in earlier grades through its 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 and statistics. 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, and Civil and Environmental Engineering, as well as the Institute for Data, Systems, and Society and the Broad Institute.

Faculty

Four new faculty members joined the department during AY2018. As of June 2018, we had 49 faculty members.

Zhiwei Yun joined the department as a full professor in January 2018. Professor Yun, a representation theorist working on the Langlands program, has produced fundamental results at the intersection of algebraic geometry, number theory, and representation theory. He received his BS in mathematics from Peking University in 2004 and his PhD from Princeton University in 2009. He was a CLE Moore Instructor at MIT from 2010 to 2012, after which he joined the faculty at Stanford University. He moved to Yale in 2015 as a full professor. Prior to his MIT appointment, Yun's distinctions included the 2012 SASTRA Ramanujan Prize, the 2013 Packard Fellowship and the 2016 Morningside Silver Medal of Mathematics.

Wei Zhang joined the department faculty as a full professor in September 2017. Professor Zhang is a number theorist who works in automorphic forms and arithmetic geometry. Among many results, he is known for his work on the generalized Gross-Zagier formula that has generated a great deal of research activity in number theory. He received his BS in mathematics from Peking University in 2004 and his PhD from Columbia University in 2009. He took an appointment as an assistant professor at Harvard University in 2010 and joined the Columbia University faculty in 2011. Zhang's distinctions (prior to his MIT appointment) have included a 2013 Sloan Research Fellowship, the 2016 Morningside Gold Medal, and a 2017 Simons Fellowship.

Giulia Saccá joined the faculty as an assistant professor in September 2017 following a Simons instructorship at Stony Brook University. Her program focuses on hyper-Kähler and Calabi-Yau manifolds and their degenerations, K_3 surfaces, moduli spaces of sheaves, families of abelian varieties, and symplectic resolutions. Professor Saccá received her PhD from Princeton University in 2013. During 2014–2015, she was a member of the Institute for Advanced Study.

Yufei Zhao also joined the faculty as an assistant professor in September 2017. His specializations include combinatorics and graph theory, with a focus on problems involving extremal, probabilistic, and additive aspects of combinatorics. He received his PhD from MIT in 2015, studying under Jacob Fox. He was subsequently appointed an Esmee Fairbarn Junior Research Fellow at the University of Oxford and a research fellow at the Simons Institute for the Theory of Computing at the University of California, Berkeley (UC Berkeley).

Ankur Moitra was promoted to associate professor without tenure.

Professor Richard Stanley retired from the MIT mathematics faculty in January 2018, having served over 44 years. He first came to MIT as a CLE Moore Instructor in 1970. Following a Miller Research Fellowship at UC Berkeley, he joined the mathematics faculty in 1973. Professor Stanley is a seminal figure in the development and expansion of algebraic and enumerative combinatorics in the 20th century—an area of mathematics that applies methods of abstract algebra, including group theory and representation theory, in various combinatorial contexts. His publications include the two-volume *Enumerative Combinatorics*, a major scholarly work of explication and instruction that accommodated the expansion of the field. In 2001, Stanley received the Leroy P. Steele Prize for Mathematical Exposition from the American Mathematical Society (AMS) for this work. Other distinctions include the Society for Industrial and Applied Mathematics (SIAM) George Pólya Prize in combinatorics (1975), a Guggenheim Fellowship (1983), the Rolf Schock Prize in Mathematics (2003), and the University of Montreal Aisenstadt Chair (2007). Stanley was the inaugural holder of the Mathematics Department's Norman Levinson Professorship Chair (2000–2010). He was appointed a senior scholar at the Clay Mathematics Institute in 2004 and later received an honorary doctorate from the University of Waterloo. In 2007, he was given an honorary professorship at Nankai University. He is a fellow of the American Academy of Arts and Sciences and a member of the National Academy of Sciences.

Faculty Awards and Honors

The faculty received a number of major distinctions this year both for their research and for their student mentoring.

Professors Alexei Borodin and Larry Guth were each named fellows of the American Academy of Arts and Sciences. Alexei Borodin studies problems at the interface of representation theory and probability that link to combinatorics, random matrix theory, and integrable systems. With Ivan Corwin and Patrik Ferrari, he received the inaugural Alexanderson Award from the American Institute of Mathematics for an outstanding research article published within the past three years. Larry Guth's research program includes mathematics in metric geometry, harmonic analysis, and extremal combinatorics. Some of Guth's work is related to Kakeya-type problems regarding how simple shapes such as cylinders can overlap in space.

Professor Peter Shor received the 2017 Dirac Medal from the International Centre for Theoretical Physics (with Charles Bennett of IBM and David Deutsch of the University of Oxford), for "pioneering work in applying the fundamental concepts of quantum mechanics to solving basic problems in computation and communication." Shor also received the 2018 Institute of Electrical and Electronics Engineers (IEEE) Eric E. Sumner Award for his contributions to quantum communication and information theory. In addition, he received a 2017 IEEE Information Theory Society Paper Award.

Professor Frank Thomson Leighton was selected to receive the 2018 Marconi Prize. The Marconi Society, dedicated to furthering scientific achievements in communications and the Internet, honored Leighton for his fundamental contributions to technology and the establishment of the content delivery network industry.

Professor Michael Sipser, dean of the School of Science, was named a 2017 fellow of the Association for Computing Machinery for his "contributions to computational complexity, particularly randomized computation and circuit complexity." Professor Alan Edelman was named a 2018 fellow of IEEE for his "contributions to the development of technical-computing languages" (namely the Julia language for numerical/scientific computing). Professor Emeritus James Munkres was named a fellow of the American Mathematical Society for his "contributions to algebraic topology and for exposition."

Zhiwei Yun and Wei Zhang were jointly awarded the New Horizons in Mathematics Breakthrough Prize, which is given to promising junior researchers who have already produced important work in mathematics. The prize recognized their "deep work on the global Gan-Gross-Prasad conjecture and their discovery of geometric interpretations for the higher derivatives of L-functions in the function field case."

Professor David Jerison was awarded a 2018 Simons Fellowship in Mathematics.

Professor William Minicozzi was appointed the next Singer Professor of Mathematics (following Tomasz Mrowka). The Singer Professorship was established by the James and Marilyn Simons Professorship Fund in honor of Institute Professor Isadore Singer.

Professor Scott Sheffield was appointed the Leighton Family Professor of Mathematics. The chair was established in 2007 by the Leighton Family Fund.

Two faculty members were recognized at the 2018 Institute Awards Convocation for mentoring: Professor Pavel Etingof won the MIT Frank E. Perkins Award for Excellence in Graduate Advising, presented by the MIT Graduate Student Council (the second time he has received this distinction), and Professor Gigliola Staffilani won the Earll M. Murman Award for Excellence in Undergraduate Advising, given by the Office of Undergraduate Advising and Academic Programming.

Associate Professor Ankur Moitra received the 2018 Young Investigator Award from the Office of Naval Research for his proposed research project (An Algorithmic Theory of Robustness).

Distinctions conferred on the department's assistant professors included the following:

- Andrei Negut received a 2018 Sloan Research Fellowship.
- Aaron Pixton was appointed the Class of 1957 Career Development Assistant Professor.
- Giulia Saccá received the Annamaria Molteni Award for Mathematics and Physics for her research on hyper-Kähler geometries. The award is issued by the Italian Scientists and Scholars in North America Foundation.
- Yufei Zhao received the Dénis König Prize from the SIAM Activity Group on Discrete Mathematics for a paper (with David Conlon and Jacob Fox) published in Geometric and Functional Analysis. This prize recognizes an early-career researcher for outstanding research in discrete mathematics published in the last three years.

Henry Cohn, adjunct professor and principal researcher at Microsoft New England, received the 2018 AMS Levi L. Conant Prize for outstanding exposition. Henry's article, "A Conceptual Breakthrough in Sphere Packing," appeared in the February 2017 *Notices of the AMS.*

Peter Kempthorne, lecturer in statistics, was presented the MIT 2018 Outstanding Rookie Advisor Award by the Office of the Vice Chancellor for his advising of first-year students.

Lectures

Professor Alexei Borodin gave the Dvoretzky Lectures at The Hebrew University of Jerusalem in May 2018. He also presented a plenary address at the Foundations of Computational Mathematics Triennial Conference, held in Barcelona, Spain, in July 2017.

Professor Tobias Colding gave the 2017 Coxeter Lectures at the Fields Institute in Toronto, Canada, in November 2017.

Professor Alan Edelman presented a keynote address at the December 2017 IEEE BigData Conference. He was also a keynote speaker at the BASIS SoftExpo conference in Daka, Bangladesh, in February 2018. In October 2017, he delivered the Dean's Lecture at Binghamton University.

Professor Bjorn Poonen delivered the Rademacher Lectures at the University of Pennsylvania in November 2017.

Professor Gigliola Staffilani was selected by the European Mathematics Society as its lecturer for 2018. In May 2018, she gave the Göran Gustafsson Lectures in Mathematics at KTH Royal Institute of Technology in Stockholm, Sweden.

Professor Gilbert Strang gave an invited lecture at the 2018 SIAM annual meeting.

Professor Wei Zhang delivered the fall 2017 Monroe H. Martin Lectures at Johns Hopkins University.

Senior Administration

Professor Michel X. Goemans will be appointed department head, following a year as interim department head in AY2018 while Professor Tomasz Mrowka was on sabbatical.

In AY2019, William Minicozzi will follow Professor John Bush as associate department head for education, Tobias Colding will continue as chair of the pure mathematics committee, and Peter Shor will remain the chair of the applied mathematics committee. Professor Bonnie Berger will serve as interim chair of the applied mathematics committee during the fall term while Peter Shor takes a sabbatical.

Wei Zhang will follow William Minicozzi as co-chair of the graduate committee in pure mathematics, while Professor Davesh Maulik will continue as co-chair. Professor Jonathan Kelner will continue as chair of the graduate committee in applied mathematics. Professor Ju-Lee Kim will follow Professor Philippe Rigollet as co-chair of the committee of undergraduate advisors. Professor Steven Johnson will continue as the other co-chair.

Nan Lin replaced William Lawson as the department's administrative officer as of March 2018.

Development

The Department of Mathematics had another successful year in reaching out and 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.

The department had a successful year in fundraising. One of our alumni helped us establish a new endowed fellowship called the Landis Fellowship. In addition, we continue to focus on our outreach programs and are raising funds to endow our Program for Research in Mathematics, Engineering, and Science (PRIMES)—which targets high school students— and to endow MathROOTS—the newest addition to the PRIMES outreach program (more details on PRIMES and MathROOTS are provided below). The department continues to publish its annual newsletter, *Integral*, for our alumni and friends.

Simons Lecture Series

The 2018 Simons Lectures were given by Stephen P. Boyd, the Samsung Professor of Engineering and the Fortinet Founders Chair of the Department of Electrical Engineering at Stanford University, and Sylvia Serfaty, the Silver Professor of Mathematics at New York University's Courant Institute of Mathematical Science. Professor Boyd is known for his work applying the methodology of convex optimization to machine learning, signal processing, circuit design, and other applications. His lectures addressed applied convex optimization. Professor Serfaty is an analyst working on nonlinear partial differential equations in mathematical physics. Her lectures focused on systems with Coulomb interactions. The lectures took place in April 2018, with a department dinner honoring the speakers at the Samberg Conference Center on April 22.

Conferences

- Representation Theory, Geometry, and Quantization: The Mathematical Legacy of Bertram Kostant (May 28–June 1, 2018), organized by Professors Roman Bezrukavnikov, Pavel Etingof, David Vogan, and Shrawan Kumar (University of North Carolina). Professor Kostant was a member of the mathematics faculty from 1962 to 1993. Bert (as he was known) impacted nearly every corner of Lie theory. The conference featured many leading mathematicians who gave their perspectives on the past and future of the field.
- Directed Reading Program Conference at MIT (May 26–27, 2018).
- Integrable Probability Boston 2018 at MIT (May 14–18, 2018), organized by Professor Alexei Borodin, Assistant Professor Vadim Gorin, Professor Jinho Baik (University of Michigan), Professor Ivan Corwin (Columbia University), and Assistant Professor Leonid Petrov (University of Virginia).
- Current Developments in Mathematics 2017 (November 17–18, 2017), jointly organized by the Harvard and MIT mathematics departments and held at the Science Center at Harvard University.
- Symplectic Geometry and Microlocal Analysis: In Honor of Victor Guillemin on his 80th Birthday (November 10–12, 2017), organized by Professors Richard Melrose, Gunther Uhlmann (Hong Kong University of Science and Technology and University of Washington), and András Vasy (Stanford University).

Summer School and Workshops

- Boston City Limits 2018: Summer School on Mathematical General Relativity and Geometric Analysis of Waves of Fluids (June 11–22, 2018), organized by Associate Professor Jared Speck.
- Graduate Workshop in Algebraic Geometry for Women and Mathematicians of Minority Genders (February 17–18, 2018), partially sponsored by the Harvard and MIT mathematics departments and organized by graduate student Isabel Vogt and an assistant professor from Brown University, Rohini Ramadas, with Professors Poonen and Staffilani as faculty sponsors. The workshop included four speakers and 11 teaching assistants who worked with 67 students.
- Workshop on Lie theory and Mathematical Physics (July 26–28, 2017), organized by postdoctoral fellow Xiaomeng Xu and Professor Chenchang Zhu (Göttingen University).

Building Diversity

Professor Staffilani heads the diversity advisory committee, which discusses initiatives and reviews ongoing practices throughout the year. We have many initiatives devoted to building a strong, more diverse application pool at all levels and increasing the diversity in the pipeline.

Overall, the department has seen a modest stepwise increase in minority scholars at the postdoctoral level over the last three years, from 3% in AY2016 to 8% in 2017 and 13% in 2018. Our percentage of postdoctoral women has remained steady at 13%. Our search committees make every effort to fully consider all women and minority applicants. We still have no minority members at the faculty level, but we will add a tenured woman associate professor, Nike Sun, in September 2018, returning the number of tenured women faculty members to four.

Over the last two years, our graduate student enrollment has continued to be 18% women and between 5% and 6% underrepresented minority students.

In terms of diversity at the undergraduate level, math majors continue to lag behind the Institute's overall undergraduate enrollments of 29% underrepresented minority students and 46% female students. We have a number of initiatives in place to create more diversity in mathematics at all levels. Our Summer Program in Undergraduate Research (SPUR; described below) was augmented with the new SPUR+ initiative for top women and underrepresented minority students. We hosted a special math event, the Math Puzzles Social, last February at Walker Memorial; the event featured games of strategy, dexterity, and logic arranged by the Eureka: On the Spot company. The first run was a success, and we have planned a second version for October 2018 in the Simons building; this second event will be open to a broader community. To allow more informal contact between undergraduates on one hand and faculty, postdocs, and graduate students on the other, the department opened its daily teas to all math majors and interested undergraduates twice each week.

Outreach: PRIMES Circle and MathROOTS

The Program for Research in Mathematics, Engineering, and Science successfully ran the PRIMES Circle section for the sixth consecutive year. The program teaches a mathematical enrichment curriculum to students of underprivileged backgrounds from the Boston area. A total of 15 students from urban public high schools, including two African American, two Hispanic, and 13 female students, participated in the 2018 program, which culminated in a mini-conference at MIT in May 2018.

From June 17 through July 1, 2018, the Department of Mathematics hosted its fourth MathROOTS summer camp program. MathROOTS offers an accelerator summer camp experience for high school underrepresented minority students selected nationally. This year 20 students participated, broken down (in terms of self-identification) as follows: 10 female, eight African American, seven Latino, one Native American, and four multiracial. Thus far, of 53 MathROOTS alumni eligible to apply for college (from 2015 to 2017), 33 have been admitted and 22 have accepted.

Martin Luther King Visiting Professorship Program

The department successfully nominated Professor Kasso Okoudjou of the University of Maryland's Department of Mathematics for a full year as a Martin Luther King Visiting Professor. He will teach full time in AY2019, participate on our diversity advisory committee, and explore efforts to recruit more minority and women math majors.

Directed Reading Program

The department continues to support the directed reading program (DRP) following the conclusion of the program's initial funding. The program pairs an undergraduate student with a graduate student to work through one or more math texts over the Independent Activities Period (IAP). This year, 21% of the 24 participants: were underrepresented minority students and 25% were female.

Professor Staffilani was a co–principal investigator on a National Science Foundation grant to support a conference on the Directed Reading Program. The conference took place at MIT in May 2018 with approximately 60 participants. It featured talks on best practices and a workshop on how to start DRPs in mathematics departments around the country.

Building a Community for Women in Mathematics

Professor Staffilani hosts regular Women in Mathematics dinners at her home for women faculty, postdoctoral associates, graduate students, and women mathematicians in the greater Boston area. This past fall, more than 40 women gathered at her home.

The department hosts a Women in Math lunch seminar three to four times a term. A senior woman mathematician is invited to talk about her career and share her research.

Girls' Angle: A Math Club for Girls is a hub in Cambridge for activities and mentoring for girls in middle school. A number of MIT women math majors and graduate students participate as mentors.

For the seventh consecutive year, the department hosted the Advantage Testing Foundation Math Prize for Girls competition for high school students. In total, 266 young women from the United States and Canada competed, resulting in three first-prize winners. 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 the Undergraduate Society of Women in Mathematics, which helps welcome new women mathematics majors and brings speakers to the campus to describe how mathematics relates to their work in both academics and industry.

Curriculum Updates

Ongoing reform of the core 18.0N subjects is being done with a view to raising the level of mathematical literacy across the Institute among students in science and engineering. AY2017 saw the release of Gilbert Strang's new subject 18.065 Matrix Methods in Data Analysis, Signal Processing, and Machine Learning, which has been a resounding success, attracting more than 100 students from across the Institute whenever it is offered.

The 18.642 Topics in Mathematics with Applications in Finance course has been added to our list of Communication Intensive offerings. Also, in response to student demand, we have added recitations to a number of our classes, including 18.600 Probability and Random Variables and 18.650 Fundamentals of Statistics.

The Mathematics Department has been a strategic partner with the new Institute for Data, Systems, and Society (IDSS) since its official launch in 2016, with a view to developing statistics at MIT. The department has hired three statisticians: Associate Professor Philippe Rigollet, Professor Elchanan Mossel, and very recently Associate Professor Nike Sun (who will begin in September 2018). Rigollet and Mossel have developed and revamped several statistics classes. The revamping and renaming of 18.650, now Fundamentals of Statistics, has been a clear success, with enrollment jumping from approximately 30 students in the fall of 2015 to over 100 students in the spring 2018 semester. A new subject on computational statistics that emphasizes the application of computational methods to problems in statistics and data science is currently being piloted by Lecturer Peter Kempthorne. Its development was supported by a d'Arbeloff grant awarded to Philippe Rigollet. Finally, the department is a major contributor to the new statistics and data science minor administered by IDSS, which offers classes from across campus, including seven Course 18 subjects. In the absence of a statistics department, Course 18 also remains the major of choice for students pursuing studies in statistics. We currently offer three undergraduate subjects in probability and statistics, with more, such as the computational statistics class, now being developed and piloted.

At the graduate level, new links are being forged with both IDSS and the Doctoral Program in Computational Science and Engineering (CSE). The first students in the new joint CSE and math graduate program will begin in the fall of 2018. This fall we will also offer admitted math graduate students the option of participating in the new mathematics and statistics track with IDSS.

MITx

The 18.01x Calculus and 18.03x Ordinary Differential Equations courses are now offered worldwide through the edX platform and are running successfully. In addition to extending the range of MIT's educational mission, the subjects provide valuable supporting material for residential Institute offerings through the MITx platform. For example, in the spring term, 18.01 is now taught (typically to a small group of 5–10 students) entirely from online materials and so can be managed by a graduate student rather than a faculty member.

The 18.02 Multivariable Calculus offering is next in line. The department recently received an express grant from the Office of Digital Learning to create interactive 3D images for 18.02. These images will form the basis for the interactive online course content to be developed for 18.02. The current long-term objective is to have all of the core courses (18.01–18.06) in an MITx/edX format.

The democratization of education through OpenCourseWare, MITx, and edX programs presents exciting opportunities for MIT on the international stage. The principal challenge to our department in contributing to such efforts is the imposition it places on faculty time. The future of online education is bright, but it is still difficult to foresee what impact it will have on the university environment or the mathematics faculty.

Graduate Students

There were 128 graduate students in mathematics in AY2018, all in the PhD program. A total of 23 students received their doctoral degrees between September 2017 and June 2018, and one student left the program with a master's degree.

Following completion of their degrees, most of these graduates advance to postdoctoral positions in mathematics and related departments at other universities. This year, graduates will be taking positions at institutions such as the University of Chicago, Columbia University, MIT, University of Minnesota, Northwestern University, the Courant Institute of Mathematical Sciences, the University of Pennsylvania, Stanford University, Yale University, and the University of California, Berkeley. Also, one graduate has accepted an assistant professor position at the Minerva Schools at Keck Graduate Institute. In the international arena, graduates will be moving into positions at the University of Cambridge and ETH Zürich as well as a joint position at the Perimeter Institute and the University of Toronto.

At least five members of this year's graduating class have chosen non-academic jobs, including software engineering positions at Google, LinkedIn, and Rubricks Inc. and a quantitative analyst position at D.E. Shaw.

Twenty new students will enter the mathematics doctoral program in September 2018, including three students admitted into our new joint program with Computational Science and Engineering. In addition, one student is transferring into our third-year class, and another returns to begin his third year after an absence of several years to complete his Korean military service. The new entering class includes three women. The department continues the policy of offering full fellowship support to all first-year students in mathematics and will support new CSE students on research assistantships.

Graduate students Kevin Sackel and Jane Wang each received the Charles and Holly Housman Award for Excellence in Teaching for their exceptional skill in 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 for a record three papers this year; winners were graduate students Ewain Gwynne, Jonasz Slomka, and co-authors Amelia Perry and Alex Wein.

Majors

The mathematics major is the third largest major at MIT and the largest within the School of Science. According to the official fall fifth-week tally for AY2018, 368 students listed mathematics as their major: 245 were in Course 18 (Mathematics), and 123 were in Course 18C (Mathematics with Computer Science). By spring, enrollment had increased to well over 400 undergraduates. Of these students, 152 graduated with bachelor's degrees in mathematics (103 with mathematics as a first major and 49 with mathematics as a second major).

Our senior survey produced only limited responses. Among the 83 students whose postgraduate plans are known, 16 will continue in graduate programs in mathematics, 17 in programs in computer science, and six in programs in physics or astrophysics; another eight students will pursue graduate work in other fields (primarily finance,

law, and biomedical fields). Somewhat fewer than half will be pursuing non-academic opportunities, with 12 entering jobs in computing and software engineering, nine in the financial sector, three in consulting services, and the remaining students in research positions at various labs and in other research domains. Several plan to travel or explore opportunities before deciding on next steps.

The Jon A. Bucsela Prize in Mathematics, given in recognition of distinguished scholastic achievement, professional promise, and enthusiasm for mathematics, was awarded to Sammy Luo ’18.

The 2017 MIT team placed first in the William Lowell Putnam Mathematical Competition, with five MIT students placing among the top six individual scorers, designated as Putnam Fellows. This year’s Putnam team consisted of senior Sammy Luo, junior Yunkun Zhou, and sophomore Allen Liu. Yunkun Zhou was also a Putnam Fellow, as were Omer Cerrahoglu ’18, Jiyang Gao ’20, Junyao Peng ’21, and Ashwin Sah ’21.

MIT students accounted for 17 of the top 25 individual scorers and 21 of the 75 students who received honorable mentions or above (38% of all such recipients). Students benefited from excellent coaching by Assistant Professor Yufei Zhao.

Undergraduate and High School Summer Research Programs

Summer Program in Undergraduate Research

In summer 2017, the department hosted its 21st 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. In 2017, nine MIT undergraduates participated in SPUR, mentored by nine graduate students. The Hartley Rogers Jr. Prize for best project was shared by SPUR teams Justin Lim ’20 and mentor Frederic Koehler G and Jianqiao Xia ’19 and mentor Augustus Lonergan G.

Also in summer 2017, the department added a new initiative, SPUR+, specifically targeted to top women and underrepresented minority students who may not have the research background expected of SPUR participants. Four MIT undergraduates, mentored by two graduate students, took part in SPUR+, which began three weeks earlier than SPUR with guided reading and then continued for six weeks with research in parallel with SPUR activities.

CLE Moore Instructor Chris Negron served as the first SPUR+ academic coordinator. He reported that the four participants appeared to enjoy their experience, and SPUR+ will continue for the foreseeable future and has been expanded to accommodate six students 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.

Research Science Institute

Summer 2017 was the 25th year of the department’s participation in the Research Science Institute program for gifted high school students. Nine graduate students mentored nine high school students in the six-week program. The students came from six different

states as well as Bulgaria, Singapore, and Spain. Four students won semifinalist awards for their research projects at Siemens 2017; in addition, two students were named finalists and two were named national scholars in the 2018 Regeneron Student Talent Search. Karthik Yegnesh won the Second Award in Math and an American Mathematical Society honorable mention at the 2018 Intel International Science and Engineering Fair.

Program for Research in Mathematics, Engineering, and Science

In calendar year 2018, the department participated in the eighth year of the Program for Research in Mathematics, Engineering, and Science. Twenty-nine gifted high school students from the greater Boston area worked with 16 postdoctoral researchers and graduate student mentors on research projects or in reading groups in the mathematical section of PRIMES. Additionally, in the expanded PRIMES-USA math section, 21 exceptional out-of-state students selected from a national pool are conducting research projects under the supervision of 15 graduate students, postdoctoral researchers, and outside faculty via telecommunication channels.

Another section of PRIMES, PRIMES Circle, teaches a mathematical enrichment curriculum to promising students from urban high schools in the Boston area (see the diversity section for a more complete description).

PRIMES held its eighth annual conference at MIT in May 2018, where all student research projects were presented. The 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. In all, 24 PRIMES students will be admitted to MIT as undergraduates in fall 2018 and will likely continue their research through the Undergraduate Research Opportunities Program.

In fall 2017, PRIMES and PRIMES-USA math students successfully completed 29 individual and group math research projects that they had been working on during calendar year 2017. Franklyn Wang won second prize in the 2017 Siemens Competition in Math, Science, and Technology, and two other students were national finalists. Six students were finalists in the 2018 Regeneron Science Talent Search competition, and nine became national scholars. Gopal Goel won the 4th Grand Award in Mathematics and the 2nd Special Award (from AMS) at the 2018 Intel International Science and Engineering Fair. He also received an Outstanding Presentation Award at the Mathematical Association of America's 2018 Joint Mathematics Meeting.

Lusztig Mentors

Professor George Lusztig donated a significant portion of his 2014 Shaw Prize in Mathematical Sciences to establish the George Lusztig PRIMES mentorships, which are awarded each year to continuing PRIMES mathematics mentors for exceptional mentoring service in past years. The 2018 Lusztig PRIMES mentors were graduate students Zhenkun Li, Gwen McKinley, and Ao Sun.

Michel X. Goemans
Department Head
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