

Fine LETTERS

Spring 2016 Issue 5
Department of Mathematics Princeton University

Letter From the Chair

We cannot look back on the past year without first commenting on the tragic loss of John and Alicia Nash, who died in a car accident on their way home from the airport last May. They were returning from Norway, where John Nash was awarded the 2015 Abel Prize from the Norwegian Academy of Science and Letters. As a 1994 Nobel Prize winner and a senior research mathematician in our department for many years, Nash maintained a steady presence in Fine Hall, and he and Alicia are greatly missed. Their life and work was celebrated during a special event in October.

This has been a very busy and productive year for our department, and we have happily hosted conferences and workshops that have attracted mathematicians (and Princeton alumni) from around the world.

Since the fall, we have honored Professors John Conway, Yasha Sinai, and Sergiu Klainerman on the occasion of their birthdays and to mark their great contributions to their respective fields. We also hosted the 31st Annual Geometry Festival in April and have the annual visit of the “Women and Mathematics Program” (co-sponsored with the Institute for Advanced Study) and a workshop in Algebraic Geometry taking place this May. Significant mathematics are discussed and celebrated at these events, which also provide us with the opportunity to see the familiar faces of former graduate students and junior faculty who are now well-established in their various fields.

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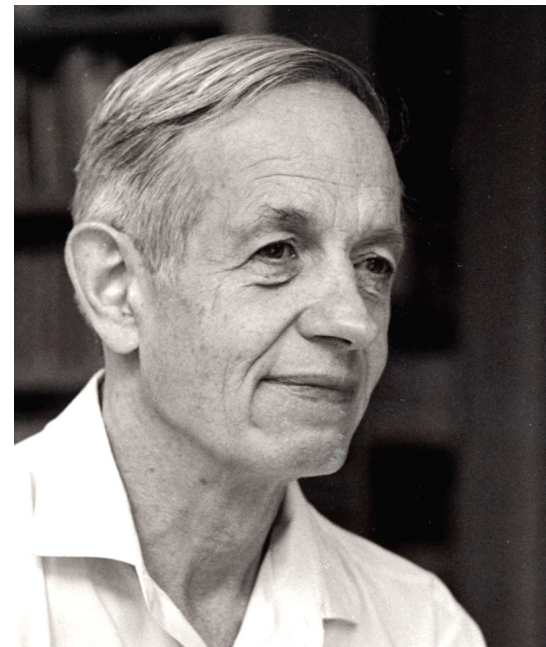
Celebrating the Lives of John and Alicia Nash

Returning from one of the crowning achievements of a long and storied career, John Forbes Nash, Jr. and his wife Alicia were killed in a car accident on May 23, 2015, shocking the department, the University, and making headlines around the world.

Nash came to Princeton as a graduate student in 1948. His Ph.D. thesis, “Non-cooperative games” (*Annals of Mathematics*, Vol 54, No. 2, 286-95) became a seminal work in the then-fledgling field of game theory, and laid the path for his 1994 Nobel Memorial Prize in Economics. After finishing his Ph.D. in 1950, Nash held positions at the Massachusetts Institute of Technology and the Institute for Advanced Study, where the breadth of his work increased. He was always known for applying novel approaches to the hardest problems, and throughout the early 1950s his research extended to the fields of partial differential equations and geometric analysis. For these contributions, Nash shared the 2015 Abel Prize with Louis Nirenberg.

“I think he prided himself that he had his way of thinking about things,” recounts Professor David Gabai *80. “He was such an extraordinary exemplar of the things that this department strives for. Beyond great originality, he demonstrated tremendous tenacity, courage and fearlessness.”

Were Nash’s story solely that of his mathematical achievements, it would be amazing enough. Unfortunately, beginning in the mid-



1950s Nash began to suffer from paranoid schizophrenia, which persisted for the next three decades. As the subject of Sylvia Nasar’s biography, *A Beautiful Mind*, and the 2001 film of the same name, Nash became far more than an influential mathematician; he became a symbol of hope and an inspiration for those suffering from schizophrenia and for their loved ones. Nash’s story goes from the peaks of academic achievement to the valley of despair, yet he managed to overcome his condition. After receiving the Nobel Prize, he returned to Princeton in 1995 as a senior research mathematician, where he remained a regular fixture in Fine Hall until his death.

Professor Sergiu Klainerman: “We all miss him. It was not just the legend behind him. He was a very, very nice person to have around. He was very kind, very thoughtful, very

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Nash ...continued from previous page

considerate and humble. All that contributed to his legacy in the department. The fact that he was always present in the department, I think that by itself was very moving.



Louis Nirenberg shares remembrances at the University Chapel

It's an example that stimulated people, especially students. He was an inspiring figure to have around, just being there and showing his dedication to mathematics."

To honor and celebrate the lives of John and Alicia Nash, the department hosted an all-day event on October 24, 2015. There were lectures on Nash's work and its legacy by Nobel Prize winning economist Eric Maskin (Harvard), Professor Sergiu Klainerman (Princeton), Abel

Prize recipient Mikhail Gromov (IHES), and Professor János Kollár (Princeton); a talk by Nasar on the lives of John and Alicia Nash; and a memorial service at the University Chapel.

Over 600 people attended the service at the Chapel where family, friends and colleagues of the Nashes shared their remembrances. Remarks were given on behalf of President Eisgruber by Robert Durkee, Vice President and Secretary of the University, followed by Kirsti Strøm Bull, President of the Norwegian Academy of Science and Letters; Louis Nirenburg, who shared the 2015 Abel Prize with Nash; David Smith, President of the MIT Club of Princeton (where Alicia was an active member); James Manganaro, friend of John and Alicia; and John David Stier, John Nash's son.

Sylvia Nasar gave a talk on the lives of John and Alicia Nash



From the Chair ...continued from previous page

We take pride in the awards bestowed upon our colleagues, alumni, and students. Professor Emeritus Andrew Wiles was recently awarded the 2016 Abel Prize by the Norwegian government, a prize that was awarded to Professor Yakov Sinai in 2014 and John Nash in 2015. Professor Christopher Skinner was a recipient of a highly-prestigious Simons Investigator award. Professor Fernando Codá Marques (together with our former Assistant Professor André Neves) received the Oswald Veblen Prize in Geometry from the American Mathematical Society. Stefanos Aretakis, an assistant professor in our department, was awarded one of 20 Alfred P. Sloan Research Fellowships for 2016, as was graduate alumni Elena Fuchs*10, who is now an assistant professor of mathematics at the University of Illinois, Urbana-Champaign.

In October we recognized some of our outstanding teachers by awarding departmental teaching awards to assistant professors Adam Levine and Javier Gómez Serrano, and graduate student Gregory Gauthier.

This is the end of my term as an Acting Chair of the Department. Our chair, Professor David Gabai, has been on a very well-deserved hiatus at the Institute for Advanced Study, enjoying once again his life as a full-time professional mathematician. David will be returning for his second term as Chair next year. It has been my privilege to work with my colleagues, the University's Administration and our amazing staff on continuing the tradition of excellence in our department.

It is my pleasure to thank Bob and Louisa Fernholz, Wei-Tong Shu, and the Class of 1971 Fund for their very generous and ongoing support of the activities of our department. I also want to thank Otto Albrecht for his generous donation of the Gomboc, a small sculpture of a convex body that will be placed in our Common Room for everyone to enjoy.

As many of you know, Princeton Reunions will take place from May 26th through 29th. We invite you to join us for our annual open house on Friday, May 27th, at 2 p.m. in the Fine Hall Common Room.

Igor Rodn

Igor Rodnianski, Acting Chair

Faculty Awards

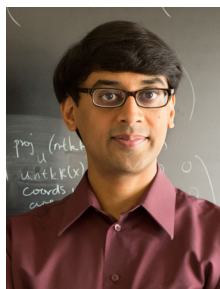
Stefanos Aretakis



was among 5 Princeton faculty members selected as Sloan Research Fellows this year by the Alfred P. Sloan Foundation.

Manjul Bhargava *01

received honorary doctorate degrees from the Indian Institute of Technology, Madras and Bates College. Professor Bhargava's other honors this year include: the Indo-Canadian Chamber of Commerce's Male Professional of the Year Award, India Abroad Publisher's Award for Excellence, the Australian Mathematical Society's Blue Hat Award, Children's Hope India's Making a Difference Award, and the Asian American Engineer of the Year Distinguished Science and Teaching Award.



Credit: Denise Applewhite

János Kollár

was awarded the 2016 Frederic Esser Nemmers Mathematics Prize for "his fundamental contributions to algebraic geometry, including the minimal model program and its applications, the theory of rational connectedness and the study of real algebraic varieties." Professor Kollár was also named Fellow of the American Academy of Arts and Sciences.



Fernando Codá Marques

shared the 2016 Oswald Veblen Prize in Geometry with André Neves (Imperial College London and Princeton faculty member from 2005-2009)



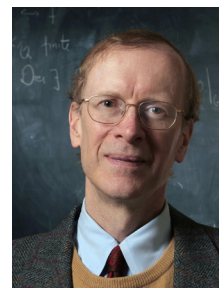
Christopher Skinner *97

was named one of the 2015 Simons Investigators. The citation for Professor Skinner remarks on his work "in number theory and arithmetic geometry. One of his striking recent results is a proof, in joint work with collaborators, that a positive proportion of elliptic curves defined over the rational numbers satisfy the Birch-Swinnerton-Dyer conjecture."



Sir Andrew J. Wiles,

Professor of Mathematics, Emeritus at Princeton and a Royal Society Research Professor at the University of Oxford, has been awarded the 2016 Abel Prize "for his stunning proof of Fermat's Last Theorem by way of the modularity conjecture for semistable elliptic curves, opening a new era in number theory." The citation continues, "Andrew J. Wiles is one of very few mathematicians—if not the only one—whose proof of a theorem has



Credit: Denise Applewhite

made international headline news. In 1994 he cracked Fermat's Last Theorem, which at the time was the most famous, and long-running, unsolved problem in the subject's history."

Shou-wu Zhang

was named a 2016 Simons Fellow in Mathematics by the Simons Foundation. The Fellows Programs provide funds to faculty for up to a semester-long research leave from classroom teaching and administrative obligations with the goal of increasing creativity and providing intellectual stimulation.



Fellows of the American Mathematical Society

Professors Alice Chang, Mihalis Dafermos *01, and Shou-wu Zhang have been named fellows of the American Mathematical Society for 2016.



Chang was cited for her "contributions to geometric analysis, nonlinear partial differential equations, and harmonic analysis;" Dafermos for his work in general relativity and PDEs; and Zhang for his "contributions to Arakelov geometry, arithmetic dynamics, and for extensions of the Gross-Zagier formula".

Faculty Appointments

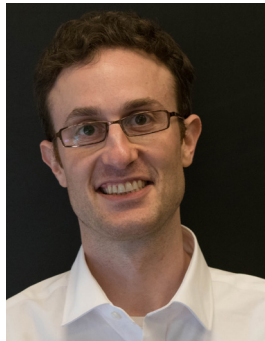
New Assistant Professor

Adam Marcus

Algorithms, Combinatorics, and Optimization

Adam Marcus comes to Princeton from Yale University where he was the Gibbs Assistant Professor in Applied Mathematics.

Marcus graduated from the University of Washington, St. Louis in 2003 with a B.A. in Applied Mathematics and an M.A. in Mathematics before completing his Ph.D. in 2008 at the Georgia Institute of Technology. Marcus' doctoral work was in Algorithms, Combinatorics, and Optimization under the supervision of Prasad Tetali, with a minor in Information Theory.



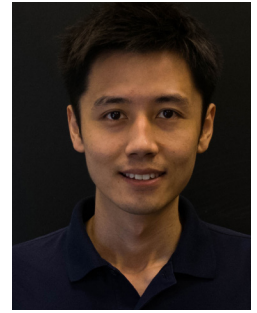
Hansheng Diao

Algebraic Number Theory

Ph.D. in Mathematics, Harvard University, 2014. B.S. in Mathematics, Massachusetts Institute of Technology, 2009.

Previous position:

Member, Institute for Advanced Study, 2014-15.



Tarek Elgindi

Nonlinear Partial Differential Equations arising in Fluid Dynamics

(50% Instructor, 50% NSF Postdoc)

Ph.D. in Mathematics, New York University, Courant Institute of Mathematical Sciences, 2014. B.S. in Mathematics (with Honors), University of Wisconsin—Madison, 2009.

Previous position:

Postdoctoral Research Fellow/NSF Postdoctoral Fellow, Princeton University Mathematics Department, 2014-15.



New Instructors

Nicolas Boumal

Optimization and Algorithms

Ph.D. in Applied Mathematics, Université Catholique de Louvain, 2014; M.A. in Engineering in Applied Mathematics, Université Catholique de Louvain, 2010; B.A. in Engineering summa cum laude (with a major in Applied Mathematics and minor in Electrical Engineering, 2008.

Previous position:

Postdoctoral Research at INRIA and École Normale Supérieure in Paris, France, 2014-2015.



Ori Parzanchevski

Groups and representation theory, Words and distributions in groups, Spectral theory of discrete and continuous structures, p-adic analysis, Structural combinatorics and algebraic topology, Random processes.

Ph.D. in Mathematics, the Hebrew University of Jerusalem, 2013. M.Sc. in Mathematics, summa cum laude, the Hebrew University of Jerusalem, 2008. B.Sc. in Mathematics and Amirim program, summa cum laude, the Hebrew University of Jerusalem, 2006.

Previous position:

Member, Institute for Advanced Study, 2013-2015.



Rafael Montezuma

Differential Geometry & Geometric Analysis

Ph.D. in Mathematics, IMPA (Instituto de Matemática Pura e Aplicada), 2015; M.S. in Mathematics, IMPA, 2011; B.S. in Mathematics, UFC-Ceará Federal University, 2009.



Teaching Awards

Junior Faculty Teaching Awards

Each year the Mathematics Department recognizes junior faculty and graduate students for exceptional undergraduate teaching. A major component of the selection criteria is based on teaching evaluations from their students.

This year's Junior Faculty Teaching Awards were given to Javier Gómez Serrano and Adam Levine. Gómez Serrano's students touted his ability to teach "fast-paced and well-planned" lectures while also making complicated ideas seem simple. As one of them put it: "Professor Serrano is the man. Period."

Levine's students showed an equal level of admiration, noting that his lectures were entertaining as well as enlightening, and that students were inspired to work hard for a teacher who really cared about helping them understand and appreciate mathematical thinking.



Adam Levine (left) and Javier Gómez Serrano receive their awards.

Graduate Teaching Award

Gregory Gauthier is this year's Graduate Student Teaching Award winner. His students were inspired by his enthusiasm and dedication to learn as much as possible in his linear algebra class, and were impressed not only by the



clarity of this explanations but also by the quality of his jokes. Classes were engaging, helpful, lively, and fun, and the students were grateful to know how much Greg cared about helping them succeed in a class they found to be quite challenging and abstract. The Department is also grateful for Greg's work as a mentor for the Putnam team, where he showed the same dedication and enthusiasm.

The Teaching Award certificates were presented at a special tea on Monday, October 12th, and are accompanied by a cash award.

From the Math Club

The Mathematics Club had another successful, busy year. In the regular colloquium series, professors and researchers in the Mathematics, Computer Science, ORFE, and Physics departments gave talks accessible to undergraduates on various mathematical subjects. Undergraduates of various years and graduate students met up in groups for the family-style mentoring program Mentoring Möbius, and chatted with their professors at Meet-

Your-Professor lunches. Math Club also hosted social events such as biweekly board game nights in the Fine Common Room (pictured), a Pi Day celebration, and the annual end-of-the-year banquet for students and faculty.

In November, the annual Princeton University Mathematics Competition (PUMaC) attracted over 100 Princeton undergraduate volunteers and over 500 high school competitors from across the country and around the world.



Finite Simple Groups: Thirty Years of the Atlas and Beyond

A Conference Celebrating the Atlases and Honoring John Conway on the Occasion of his 80th birthday.

The classification of finite simple groups was announced to be completed in 1983 and has been considered a major accomplishment of modern mathematics. Since then, it has opened up a new and powerful strategy to approach and resolve many problems that were considered inaccessible in group theory, number theory, combinatorics, coding theory, algebraic geometry, and other areas of mathematics. Beginning with Conway, Curtis, Norton, Parker and Wilson's book, the *Atlas of Finite Simple Groups* (Oxford University Press, 1985), character tables and other information on these groups has been compiled in what are now known collectively as the Atlases.

The main objective of this conference was to discuss the many applications of the Atlases while exploring recent developments and future directions of research, with particular focus given to the interaction between computation and theory with applications to number theory and algebraic geometry.

The first day of the conference was dedicated to John Conway (Professor of Mathematics, Emeritus, Princeton University) in celebration of his many fundamental contributions to the area.

Poster sessions were set up in the lobby outside of the auditorium, providing opportunities for mathematicians to discuss their research for an hour each day during the conference. A reception (provided by Labyrinth Books) was held on the first day of the conference to mark the publication of a biography of John Conway: *Genius At Play, The Curious Mind of John Horton Conway*, written by Siobhan Roberts and published by Bloomsbury USA.

A banquet was held at Palmer House, Princeton University's guest house, after the second day of the conference.

Additional support for the conference came from the National Science Foundation, the National Security Agency, and Deutsche Forschungsgemeinschaft.

Speakers:

- Michael Aschbacher *Caltech*
- Michel Broué *Paris 7*
- Jon Carlson *University of Georgia*
- John Conway *Princeton*
- Rob Curtis *Birmingham*
- Meinolf Geck *Stuttgart*
- Sasha Ivanov *Imperial College*
- Radha Kessar *City University, London*
- Martin Liebeck *Imperial College*
- Gunter Malle *TU Kaiserslautern*
- Gabriel Navarro *Valencia*
- Gabriele Nebe *RWTH Aachen*
- Simon Norton *Cambridge*
- Eamonn O'Brien *Auckland*
- Cheryl Praeger *Perth*
- Raphaël Rouquier *UCLA*
- Alex Ryba *Queens College, CUNY*
- Aner Shalev *Jerusalem*
- Ron Solomon *Ohio State*



Sinai & Ruelle: 80 Years

New Directions in Statistical Mechanics and Dynamical Systems

A two-day conference was held at Princeton University on December 16 and 17, 2015 in honor of the 80th birthdays of Yakov Sinai (Princeton) and David Ruelle (IHES). Lectures took place in McDonnell Hall on the first day and in Taplin Auditorium on the second day.

This conference immediately followed the 114th Statistical Mechanics Conference at Rutgers University, which also celebrated Ruelle and Sinai. (The traditional format of Rutgers' meetings is 24-minute talks that emphasize the physical applications.)

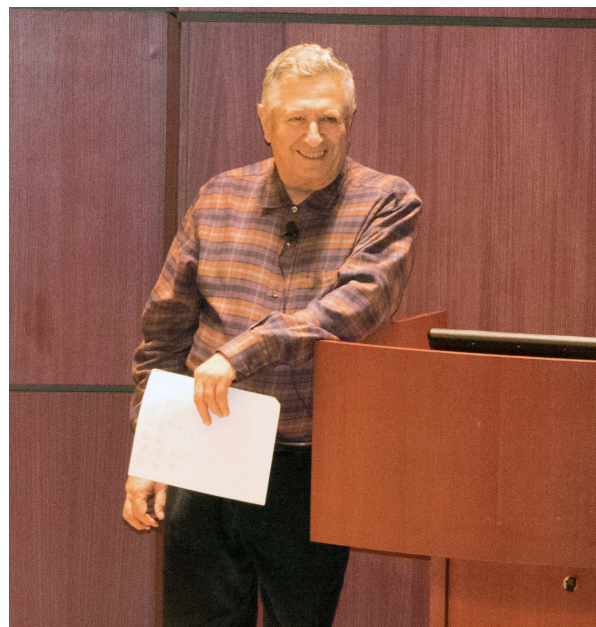
The two-day conference that followed at Princeton was to concentrate on the more mathematical aspects of Ruelle and Sinai's legacy. In particular, the high-level talks on the first day of the conference were in the areas where Ruelle and Sinai made their seminal contributions. By emphasizing new directions and open problems, the conference was able to demonstrate the breadth of their contributions and to show that they are still very active and inter-

esting area of research.

The first day concluded with a reception in the Professors' Lounge atop Fine Hall.

On the second day of the conference, Ruelle and Sinai each gave a talk that was aimed at undergraduate and graduate students.

The workshop was supported by the Princeton University Mathematics Department and the International Association of Mathematical Physics.



Yakov Sinai takes questions after his talk.



David Ruelle at the reception.

Speakers:

- Hillel Furstenberg
Hebrew University of Jerusalem
- Peter Sarnak
Princeton University & the IAS
- Charles Fefferman
Princeton University
- Senya Shlosman
Centre de Physique Théorique
- Hugo Duminil-Copin
Université de Genève
- David Ruelle
IHES
- Yakov Sinai
Princeton University



Analysis, PDEs, and Geometry



Honoring the Work of Sergiu Klainerman

In his work, Professor Sergiu Klainerman, who joined Princeton's faculty in 1987, pioneered many of the modern methods in Harmonic Analysis and Partial Differential Equations. His contributions include the vector-field method, the discovery of null operators, applications of Fourier Analysis to semilinear PDEs, $X^{s,b}$ norms, L^2 bilinear estimates, bilinear restriction theorems, and many others.

Sergiu Klainerman has also had an enormous impact in the fields of Geometric Analysis and General Relativity through his work on the stability of the Minkowski spacetime, uniqueness of black holes, formation of trapped surfaces, and low-regularity solutions of the Einstein vacuum equations.

To honor and celebrate Professor

Klainerman and his many achievements, the Mathematics Department hosted a four-day conference from January 23 to 26. Over one hundred participants, including thirteen of his students, came to hear seventeen leaders in these fields.

Speakers:

Jean Bourgain
Institute for Advanced Study
 Simon Brendle
Stanford University
 Jean-Yves Chemin
Université Pierre et Marie Curie
 Peter Constantin
Princeton University
 Mihalis Dafermos
Princeton University
 Charles Fefferman
Princeton University
 Gustav Holzegel
Imperial College London
 Gerhard Huisken
Oberwolfach
 Alex Ionescu
Princeton University

Carlos Kenig
University of Chicago
 Joachim Krieger
Ecole Polytechnique Fédérale de Lausanne
 Gustavo Ponce
University of California, Santa Barbara
 Igor Rodnianski
Princeton University
 Gigliola Staffilani
Massachusetts Institute of Technology
 Jérémie Szeftel
Université Pierre et Marie Curie
 Terence Tao
University of California, Los Angeles
 Daniel Tataru
University of California, Berkley

After four days of fascinating talks, the conference concluded with a banquet honoring Klainerman in the Frick Laboratory atrium.

Additional support was provided by the National Science Foundation.

Gigliola Staffilani, Sergiu Klainerman laughing with Elly Stein and Min Tang, and Terence Tao.



Geometry Festival

The 31st Geometry Festival was held at Princeton University the weekend of April 8 to 10. This was the first time that Princeton hosted the annual event.

This year's conference was focused on major recent results in geometry and related fields, including topics in conformal geometry, minimal surfaces, Kähler geometry, topology, Lagrangian submanifolds and symplectic four-manifolds.

Over 70 registered participants, plus members from the local mathematics community, among whom many were graduate students and postdocs, attended the talks given by Ian Agol (UC Berkeley and the

IAS), Fengbo Hang (Courant Institute, NYU), Nancy Hingston (The College of New Jersey), Jen Hom (Georgia Tech and the IAS), Claude LeBrun (SUNY, Stony Brook), Fernando Marques (Princeton), Davi Maximo (Stanford) and Jake Solomon (Hebrew University).

After the last talk on Saturday afternoon, most participants joined the speakers for a very nice banquet dinner at the Professors' Lounge in Fine Hall. Besides the great view of Princeton, the atmosphere of the banquet was warm and friendly.

The next Geometry Festival will be held in Duke University.

This conference would not have

been possible without the efforts of Scott Kenney, Gale Sandor, Will Crow and Carol DiSanto.

Congratulations to Our Putnam Team for their 3rd Place Finish!

Princeton's Team: Rodrigo Angelo, Andre Arslan, and Eric Schnider

Individual recognitions:

- Top 6:** Bumsoo Kim
- Top 16:** Xiaoyu Xu
- Top 26:** Andre Arslan and Zhuo Qun Song

Honorable Mention:

- Arka Adhikari,
- Rodrigo Angelo,
- Eric Neyman,
- Tim Ratigan,
- Eric Schneider, and
- Mel Shu

The Minerva Program

It was another successful year for the Minerva Program, bringing three mathematicians, each from a different field, to Princeton.

In November, Maryam Mirzakhani, Professor at Stanford University and a recipient of the 2014 Fields Medal, delivered three talks: "Geometry and dynamics on hyperbolic surfaces," "Dynamics on moduli spaces of hyperbolic surfaces," and "Counting mapping class group orbits on hyperbolic surfaces."

Maryam Mirzakhani



Lewis Bowen, Associate Professor at the University of Texas at Austin, was the Minerva Distinguished Visitor during the fall term. Bowen's residency allowed time to collaborate with students and faculty here; he delivered a five-part lecture series on "Benjamini-Schramm Convergence in Groups and Dynamics."

Finally, in the spring, Daniel Spielman, the Henry Ford II Professor of Computer Science and Applied Mathematics at Yale University, delivered another series of three Mi-

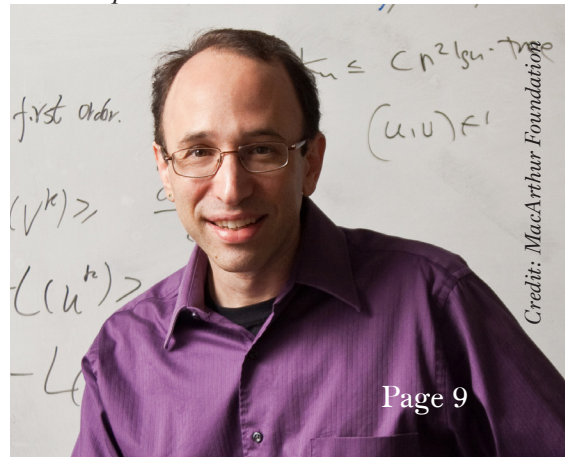
Lewis Bowen



nerva Lectures. His talks, "Sparsification of Graphs and Matrices," "The Solution of the Kadison-Singer Problem," and "Ramanujan Graphs and Free Probability," all attracted broad audiences, including members of the Mathematics Department, the Program in Applied and Computational Mathematics, and the Computer Science Department.

The Department is grateful for the continued support of the Fernholz Foundation that make this wonderful program possible.

Daniel Spielman



Program for Women and Mathematics

The Program for Women and Mathematics is an annual two-week residential program that focuses on a particular mathematical theme. It is generously sponsored by the NSF, IAS, and the Princeton Mathematics Department. The program aims to recruit more women in mathematics and to counter the higher attrition rate of female mathematicians compared to their male counterparts at key transition points.

About 40-60 undergraduate, graduate and postdoctoral women studying mathematics from institutions all over the U.S. gather on the campus of the Institute for Advanced Study in Princeton each May. Research mathematicians such as Professor Maria Chudnovsky '03 and Wei Ho '09 are recruited to give lecture series and colloquia which focus on a particular mathematical topic each year. Some topics in recent years are "Combinatorics and Graph Theory (2013)," "Random Matrix Theory (2014)," "Aspects of Algebraic Geometry (2015)," and "Curves, Loops, and Words in Geometry (2016)."

In addition to lectures and seminars, evening Women in Science seminars explore topics of interest to women mathematicians. Some popular topics include "Work-Life Balance in a Mathematical Career," "Surviving in Graduate School," "Career Paths for Women in Mathematics," "Becoming an Academic Mathematician," and "Using Language for Success which Offsets Stereotypical Behavior." Visits from female leaders in industry in recent years are very popular with participants; visitors include Jennifer Chayes of Microsoft

Research, Margarent Holen '95 and Inna Okounkova on finance, Claudia Perlich on display advertising, Tal Rabin of IBM Research, and Sandra Peterson of Johnson and Johnson.



Princeton Instructor Ana Caraiani with participants.

In the middle of the two-week program, participants spend a day in Fine Hall. Last May, Professor János Kollár, Veblen Fellow June Huh, and alumna Yaim Cooper '13 gave excellent and accessible talks on their work; in addition, Isabelle Nogues '15 gave a violin concert.

This May, our alum Carlee Joe-Wong '11 will talk about how she turned her undergraduate thesis into a startup company, and Lillian Pierce '02 '09 will share her experiences building support networks for women mathematicians at Princeton and Oxford. In addition, graduate student Sophie Spirkl and Professor Zoltán Szabó will give talks on their work. We also look forward to bringing Piper Harron back to Princeton. Piper's 2016 Ph.D. thesis, which touches on accessibility versus esotericism in mathematics, achieved viral status. She will visit the Women and Mathematics program during the first week and talk

about her mathematical work and her personal outlook on mathematical culture. Lunch, tea and dinner are other highlights of the day where participants enjoy meeting Princeton graduate students, postdocs, and faculty as well as the spectacular view from the top of Fine Hall.

Over two weeks, women mathematicians from all levels learn, work, and socialize together in a supportive environment. Mathematical bonds are often created between senior math-

ematicians and graduate students/postdocs. Past participants overwhelmingly report that they feel inspired and encouraged by the women they meet during the program, and that the program is a vital opportunity to reinvigorate their studies and research. Many student participants return to the program in

subsequent years as teaching assistants, lecturers, or colloquium speakers.

Since 1994, over 1,000 women mathematicians have visited Princeton as part of the Women and Mathematics program; about 70% have remained in academia. This

is an incredibly large and diverse group of women mathematicians. The program alumnae who have benefitted from their experience at the Women and Mathematics Program will help us to continue to strengthen the program for future women mathematicians.



Isabelle Nogues '15 gave a violin concert.

Mathematics on the Silver Screen

Ramanujan and Making *The Man Who Knew Infinity*

On April 11th, a piece of Hollywood came to Princeton for a public lecture about the life and work of Ramanujan and the making of the film, *The Man Who Knew Infinity*. Professor Manjul Bhargava '01 worked with the filmmakers as an associate producer and mathematical consultant on the film over the last 10 years, culminating in the April 29th U.S. premiere. Prior to opening night, Professor Bhargava gathered members of the cast, production, and distribution teams for a panel discussion and special screening of the film.



From *The Man Who Knew Infinity*

Credit: IFC Films

Based on the amazing story of one of the greatest minds in history, *The Man Who Knew Infinity* charts the incredible life of Srinivasa Ramanujan (played by *Slumdog Millionaire*'s Dev Patel), whose genius for mathematics takes him from obscurity in India to Trinity College, Cambridge University in the early 20th century. Spurred on by his mentor, G. H. Hardy (Academy Award winner Jeremy Irons), Ramanujan overcomes racism and the rigidity of academia to revolutionize the field with his startlingly

original theorems, which he attributes to divine inspiration.

The public lecture began with a talk by Bhargava on Ramanujan's work and its lasting impact on mathematics. Bhargava then led a panel discussion with Devika Bhise (actor), Matt Brown (writer & director), Ed Pressman (producer), Betsy Rodgers '95 (IFC Films), and Tristine Skyler '93 (executive producer).

Following the lecture, over 180 students, faculty, and staff attended a special screening of the film at the Princeton Garden Theater, where it received rave reviews

This event was co-sponsored by the Committee on Public Lectures and the Council on Science and Technology.

For more information on the film, visit: themanwhoknewinfinity.com

From left: Devika Bhise, Betsy Rodgers '95, Tristine Skyler '93, Ed Pressman, Matt Brown, and Manjul Bhargava '01



Undergraduate program

Undergraduate Profile: Ana-Andreea Stoica '16



Ana-Andreea Stoica '16, looks forward to joining the rest of her class for commencement this May. Growing up in Romania, Ana showed a strong interest in mathematics in middle school and competed in the Mathematical Olympiad during high school. As a mathematics major at Princeton, she found that the department's faculty and students formed a tight and engaging community. This inviting and flexible environment helped her overcome the challenges of Princeton life, from balancing rigorous course loads with independent interests to learning how to interact with faculty as mentors beyond the typical student/instructor relationship.

As an undergraduate, she felt com-

pelled to apply quantitative reasoning to the field of neuroscience. This passion led her to take courses by Professor Amit Singer and Professor Emmanuel Abbe (Department of Electrical Engineering and the Program in Applied and Computational Mathematics). She took a particular interest in Professor Abbe's work and asked him to advise her senior thesis, titled "Community detection in the stochastic block model — hypergraphs and beyond."

When Ana is not thinking about her mathematical pursuits, she enjoys table tennis, reading and playing the piano. Outside the math department, she particularly enjoyed courses such as "Urban Sociology" and "Radical Political Thought" which introduced her to new ways of thinking and expressing herself. In fact, before beginning graduate studies at the University of Pennsylvania, she hopes to work at a center dedicated to the application of mathematical models to social issues.

Summer Research for Undergraduates

For the fourth year the Mathematics Department sponsored summer research opportunities for rising juniors and seniors. A total of 11 students participated in summer research programs, and all but two of the participants remained in Princeton over the summer months to work on a specific research topic of their choosing while having the opportunity to consult their faculty advisor.

Two of these students received research stipends of \$4,500 from the Bershatsky Family Summer Research fund that was administered by the Office of the Dean of the College. The other students received stipends of \$4,000 that were funded by our department and the Jaywood Lukens '30 Scholarship Fund. This summer program was designed to provide independent research opportunities for rising juniors and seniors, but rising sophomores are also given consideration.

Mathematics majors are also encouraged to apply for financial support to allow them to attend research programs in mathematics at another institution. These pro-

grams can be an off-campus NSF-funded Research Experience for Undergraduates Program (known as an REU) in the United States or other special summer research programs being held elsewhere. The experience of being a participant in one of these research programs can provide that student with the chance to focus on a single mathematical research problem or area of mathematics.

Department Awards

2014-2015 Academic Year

George B. Covington Prize

Max Simchowicz '15

Alexander Smith '15

Middleton Miller '29 Prize

Kubrat Danailov '15

Thomas Kelly '15

Andrew H. Brown Prize

Daniel Dore '16

Yuval Wigderson '16

Peter A. Greenberg '77 Prize

Arka Adhikari '16

Bumsoo Kim '16

The Class of 1861 Prize

Eric Schneider '17

Supported for Summer 2015:

Arka Adhikari '16

Mark Aksen '17

Daniel Dore '16

Likith Govindaiah '17

Joane Joseph '16

Daniel Li '17

Miranda Moore '16

Avaneesh Narla '17

Joseph Obiajulu '17

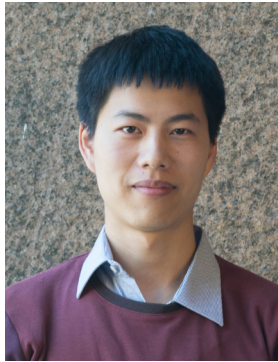
Alec Payne '16

Gloria Yin '18

Alexander Yu '16

Graduate Profile — Antoine Song

I am currently working in Geometric Analysis, more precisely in the variational theory of minimal surfaces, a topic recently reinvigorated by my advisor Fernando Codá Marques and his collaborator André Neves. A significant influence on my choice of specialization was the solution



to the Poincaré conjecture, which appeared around the time I started to consider becoming a mathematician as a tangible possibility. Even though the proof was too involved for me at that time, I found the whole idea of deforming manifolds by geometric flows fascinating. But more impor-

tantly, I was influenced by the mathematicians, the human drama and the history surrounding this famous conjecture. In other words, I realized that mathematics was defined by the people doing it, and not by the theorems and proofs.

After two years of preparatory classes in France, I went to the École Normale Supérieure in Paris. The first time I came to Princeton as a visiting student, I was impressed by the working conditions enjoyed by the graduate students, which partly explains why I decided to continue my Ph.D. here.

I am part of a trio as the cellist, and we performed the Ravel trio this year at the department recital. Although the connection between mathematics and music has almost become commonplace, their deeper resemblance was not obvious to me at first. I rather considered music, a temporal arrangement of sounds, as a way to counterbalance the mainly visual thinking required by geometric problems, as suggested somewhere by Alain Connes. Actually, I have come to a better understanding of these similarities thanks to composers such as Ravel. His music can be seen as an allegory of mathematics: a highly structured, cerebral but colorful balance between intellect and emotion.

Director of Graduate Studies — Peter Ozsváth *94

Princeton has a unique graduate program. We select a few top students from all over the world, who come here, united by their passion for mathematics. Our students are given great latitude to follow their interests, with very few formal requirements; they are encouraged to start on research as soon as possible. Students typically study together, and the ensuing bonds are deep, sometimes spanning one's mathematical career. I experienced this first-hand when I arrived here as a graduate student in 1989. Many of my classmates went on to be leaders in their subjects, and all of them were fascinating characters from varied backgrounds. Now, as Director of Graduate Studies (DGS), I have a second opportunity to take a good look at this program and to watch the formation of the next generation of mathematical leaders.

As DGS, I was guided by memories

of my own graduate experiences, advice from my colleagues, and especially the wisdom of my veteran co-DGS, Zsolt Patakfalvi. The graduate program also benefits greatly from the excellent staff, and particularly the ever-friendly, thorough and organized graduate administrator, Jill LeClair, who excels both on routine aspects, such as disseminating program policies; more exciting ones, such as organizing the annual Mathematics Department Recital; but most importantly, who takes a personal interest in and a dedication to improving the quality of life of all of our students.

There are several milestones during the year. In the Fall, we welcome the new entering class. General exams, which are oral exams spanning both



general and specialized topics, take place during the end of the winter and the end of the Spring. In late December, the entire math faculty participates in selecting the very top few of the applicants from a wide, international pool. At roughly the same time, other universities are also making postdoctoral offers to our finishing students. A Graduate Students Open House occurs typically in the early Spring. This is a fantastic one or two-day event filled with lectures from faculty, students, and post-docs alike (and excellent tea and cookies!), aimed at recruiting our visiting prospective students. The next first-year class is formed by April 15th. Exams and final thesis defenses typically occur in the early summer, leaving us ready to go through the next cycle.

Most recent Ph.D.s

Name	Undergrad	Advisor	Field	Thesis Title	Original Placement
Thomas Beck	Cambridge University	Fefferman	PDEs	Level set shape for ground state Eigenfunctions on convex domains	MIT/C.L.E. Moore Instructor
Dan Collins	Cornell University	Skinner	Number Theory	Anticyclotomic p -adic L -functions and Ichino's formula	Cornell University/ Assistant Visiting Professor
Yu Deng	MIT	Ionescu	PDEs	Long time behavior of some nonlinear dispersive equations	NYU/Courant Institute/ Courant Instructor
Heather Macbeth	University of Auckland	Tian	Kähler Geometry	Kähler-Einstein metrics, Bergman metrics, and higher alpha invariants	MIT/C.L.E. Moore Instructor
Andy Manion	University of Notre Dame	Szabó	Knot Theory; Khovanov homology	Constructions and computations in Khovanov homology	UCLA/Adjunct Assistant Professor
Ryan Peckner	UCLA	Sarnak	Number Theory	Two dynamical perspectives on the randomness of the Möbius function	Broad Institute of MIT and Harvard/Postdoctoral Associate
Ben Schweinhart	Swarthmore College	MacPherson (IAS)	Topology of Complex Systems	Statistical topology of embedded graphs	Harvard University, Center of Mathematical Sciences and Applications/ Postdoctoral Fellow
Liangming Shen	Beijing University Aeronautics and Astronautics	Tian	Geometric Analysis	Smoothing conic Kähler metrics and conical Kähler-Ricci flow	University of British Columbia/Postdoctoral Fellow
Andrei Tarfulea	University of Chicago	Constantin	PDEs	A study in the asymptotic behavior of nonlinear evolution equations with nonlocal operators	University of Chicago/ L.E. Dickson Instructor
Ila Varma	California Institute of Technology	Bhargava/ Taylor (IAS)	Number Theory	On local-global compatibility of cuspidal regular algebraic automorphic representations of GL_n	Harvard University/NSF Postdoctoral Research Fellow
Shuyun Conan Wu	University of Toronto	Gabai	Topology/3-manifolds	3-manifold topology with groups and randomness	McKinsey & Associates, Shanghai/ Associate

The annual Department Recital. From left: Gina Holland, Daniel Kriz (G2), Mark McConnell, Matthew de Courcy-Ireland (G3), and Lucia Mocz (G3), Mark Cerenzia (G3; ORFE) & Antoine Song (G1).



Administrative staff changes

Yvette Campbell

Faculty Assistant

The Department welcomed a new Faculty Assistant this fall. Yvette has a long history of working in higher education, and came to Princeton in 2013 as the



Assistant to the Chair in the Department of Operations, Research and Financial Engineering. Prior to that, Yvette worked at Gettysburg College and from 1995 to 2003 at the Institute for Advanced Study in their Human Resources and Visa Services offices.

As our new Faculty Assistant, Yvette is primarily responsible for processing faculty reimbursement requests and making travel arrangements for visitors.

Yvette lives in southern New Jersey

with her partner, Ira, and has many interesting hobbies including yoga, soap making, and various artistic endeavors.

Chad Maier

Systems Support Specialist

Since arriving in August, 2015, Chad has had a great impact improving the organization of our equipment and has provided vital support as Fine Hall underwent its largest single-year deployment of new workstations.

Chad moved to the Northeast from Austin, Texas where he lived from 2007 to 2015, working in computer support as well as music promotion. Indeed, music is a passion for Chad, and he has toured Europe working with the band Depeche Mode.

A native of Champaign, IL, Chad received his bachelor's degree from the University of Illinois, Urbana-Champaign in 1997. Today his hob-

bies include finding new bands and places to go camping in the area. Following in the footsteps of our other computing staff, Chad has been building his own server at home to expand and enrich what he is learning in Fine Hall.



William Crow

Assistant Manager, Communications & Operations

In November Will was promoted to Assistant Manager, Communications & Operations. In his new role Will spends more time working on the department's publications and website as well as taking on a larger role in organizing our special events.



The annual Department Recital. Clockwise from top-left: Kevin Chien '17 & Demi Fang '17, Yuchen Liu (G3), Florian Sprung, Maggie Miller (G1), and Peter Ozsváth '94 & Shevi Sperber.



Department Administration:

Chair:

David Gabai

Acting Chair:

Igor Rodnianski

Associate Chair:

János Kollár

Directors of Graduate Study:

Peter Ozsváth and Zolt Patakfalvi

Department Representative:

János Kollár

Assoc. Department Representative:

Jennifer Johnson

Senior Advisor:

Paul Yang

Junior Advisor:

Mark McConnell

Placement Officer:

Vlad Vicol

Department Manager:

Kathleen Applegate

Graduate Administrator:

Jill LeClair

Undergraduate Administrator:

LeeAnn Coleman



Department of Mathematics
Fine Hall — Washington Rd.
Princeton, NJ 08544

Alumni, faculty, students, friends, connect with us, write to us at
news@math.princeton.edu

Join us for our Alumni Open House

Friday, May 27th • 2:00 p.m. • Fine Hall Common Room

Join Professor Emeritus John H. Conway and members of the Mathematics Department for fun, refreshments, and maybe even some math!

*The annual Graduate Student Open House provides prospective students an opportunity to see the department's collegial atmosphere. Professor Christopher Skinner *97 talks with a prospective student (left), while current graduate students play cards with others.*

