Department Chair's letter

The department is continuing its period of transition and renewal. Although long-time faculty members John Conway and Ed Nelson became emeriti last July, we look forward to many years of Ed being amongst us and for John continuing to hold court in his "office" in the nook across from the common room. We are extremely delighted that Fernando Coda Marques and Assaf Naor (last Fall's Minerva Lecturer) will be joining us as full professors in September.

Our finishing graduate students did very well on the job market with four winning NSF postdoctoral fellowships. Andy Manion and Owen Biesel won departmental graduate student teaching awards, and Jon Fickenscher and Luc Nguyen won the inaugural junior faculty teaching awards for their excellent work as instructors. Graduate student Tom Beck won a teaching award from the Graduate School.

Adam Levine and Benoît Pausader joined us as assistant professors this year, with Benoît winning a Sloan Foundation fellowship. Tasho Kaletha also became a new assistant professor, being promoted from Veblen Research Instructor. Ana Caraiani and Florian Sprung joined us as Veblen Instructors. Javier Gómez Serrano and Steve Sivek joined us as instructors, and Jonathan Kommemi as an NSF postdoctoral research fellow. Assistant Professor Sucharit Sarkar was awarded an NSF Career Grant.

The Department has had excellent relations with the Institute for Advanced Study. Its faculty frequently give courses and advise our graduate students. To formalize this connection, Jean Bourgain, Helmut Hofer, Robert MacPherson and Richard Taylor were named Visiting Lecturers with Rank of Professor.

Essential to the functioning of the Department is having excellent staff members. Following careful searches we welcomed Ben Rose (from Computer Science) as our new systems manager, Michelle Matel as Assistant to the Chair and to the Department Manager, and Will Crow as Faculty Assistant. The uniform opinion of the faculty and staff is that we made great choices.

Among major faculty honors Alice Chang became a member of the Academia Sinica, Elliott Lieb became a Foreign Member of the Royal Society, John Mather won the Brouwer Prize, Sophie Morel won the inaugural AWM-Microsoft Research prize in Algebra and Number Theory, Peter Sarnak won the Wolf Prize, and Yasha Sinai the Abel Prize.

The upcoming International Congress of Mathematicians in Seoul, Korea will be well represented by Princeton faculty. Manjul Bhargava, János Kollár and Fernando Coda Marques will be plenary speakers, and Mihalis Dafermos, Sasha Sodin and Mark Braverman (Computer Science) will be invited sectional speakers. Mihalis is one of very few invited to speak in two sections (PDEs and Mathematical Physics). Sasha and Mark will be respectively speaking in mathematical physics and theoretical computer science.

We initiated the Minerva Distinguished Visitor program, welcoming back Andre Okounkov from Columbia, who gave a series of 10 lectures. We thank the Fernholz Foundation for making this possible.

I'd like to thank Bob and Luisa Fernholz, the Class of 1971, Wei-Tong Shu, and the Arnold and Lukens families for their very generous support.

Being surrounded by exceptional colleagues totally committed to their research, mentoring and teaching missions, immensely talented graduate students playfully pushing themselves mathematically, and very gifted undergraduates trying to figure out how they will change the world is both an awesome and humbling experience.

David Gabai *77, *80, Chair
gabai@princeton.edu

The Wolf Prize for Peter Sarnak

Professor Peter Sarnak will be awarded this year's Wolf Prize in Mathematics.

The prize is awarded annually by the Wolf Foundation in the fields of agriculture, chemistry, mathematics, medicine, physics, and the arts. The award will be presented by Israeli President Shimon Peres on June 1st at the Knesset.

Other Princeton current and past faculty who received the prize are: John Milnor (1989), Andrew Wiles (1995), Yakov Sinai (1996), and Elias Stein (1999).

For the full citation, go to: www.wolffund.org.il

The Abel Prize for Yakov Sinai

The Abel Prize, established in 2001 by the Norwegian government and named after Norwegian mathematician Niels Henrik Abel (1802-1829) is presented annually by the King of Norway to one or more outstanding mathematicians. The six million Norwegian krones prize will be awarded to Sinai at a special ceremony in Oslo on May 20th, in recognition of his status as one of the most influential mathematicians of the 20th century and for his "fundamental contributions to dynamical systems, ergodic theory, and mathematical physics."

For the full citation, go to: www.abelprize.no

Assistant Professors

Instructors

Adam Levine

Topology (specifically: the study of properties and applications of Heegaard Floer homology).

Ph.D. (2010); M.Phil. (2008); M.A. (2006), Columbia University; A.B. magna cum laude, Harvard University (2005). National Science Foundation Postdoctoral Research Fellow, 2010-2013. Lecturer/NSF Postdoctoral Fellow, Brandeis University (2012-2013).

Antonio Ache

Conformal Geometry, Differential Geometry, Partial Differential Equations.

Ph.D., University of Wisconsin, Madison (2012); B.S., Universidad Simón Bolívar, Caracas, Venezuela (2005). National Science Foundation Postdoctoral Research Fellow, 2012-2014; Postdoctoral Research Fellow/NSF Postdoctoral Fellow, Princeton University (2012-2013).

Steven Sivek

Low-dimensional Topology (with a special focus on contact and symplectic geometry, Floer homology theories, and knot theory.)

Ph.D., Massachusetts Institute of Technology (2011); S.B. in Computer Science and Engineering, MIT (2006). National Science Foundation Postdoctoral Research Fellow, 2012-2015; Postdoctoral Fellow, Harvard University (2011-2013).

Benoit Pausader

Analysis (partial differential equations and their interactions with physics and geometry).

Chargé de recherche, CNRS, U. Paris 13 (2012); Visiting Researcher, Princeton University (2011); Courant Instructor, New York University (2011); Assistant Professor, Brown University (2008); Assistant moniteur normalien, Cergy-Pontoise University (2006).

Javier Gómez Serrano

Analysis. Hydrodynamics of Incompressible Fluids.

Ph.D., Universidad Autónoma de Madrid (2013); M.S., Universidad Autónoma de Madrid (2010). Dual degrees in mathematics and engineering from the Universidad Politécnica de Cataluña, Spain.

administrative positions

Chair: David Gabai

Associate Chair: János Kollár

Directors of Graduate Study:
Alex Ionescu and Nicolas Templier

Department Representative: János Kollár

Associate Department Representative:
Jennifer Johnson

Senior Advisor: John Mather

Junior Advisor: Tasho Kaletha

Placement Officer: Vlad Vicol

Department Manager: Kathleen Applegate

Graduate Administrator: Jill LeClair

Undergraduate Administrator: LeeAnn Coleman

2013-2014

Veblen Research Instructors

The Veblen Research Instructorships are joint 3-year appointments between our department and the School of Mathematics at the Institute for Advanced Study. Typically, a Veblen Research Instructor will spend the first and third years of his/her appointment teaching and conducting research in our department; the middle year is spent at the Institute without teaching duties. A Veblen Research Instructor maintains offices in both institutions and is encouraged to participate in the mathematical life at each.

Florian Sprung

Iwasawa theory, elliptic curves, automorphic forms and representations (exploring how families of special values of L-functions relate to families of algebraic objects.)

Ph.D., Brown University (2013); M.Sc., The University of Tokyo (2009); B.A., Columbia University (2006).

Junior faculty profile

Ana Caraiani

Algebraic Number Theory, Representation Theory and Algebraic Geometry. Ph.D., Harvard University (2012); B.A. Summa cum Laude, Princeton University (2007). National Science Foundation Postdoctoral Research Fellow, 2012-2015; L.E. Dickson Instructor, University of Chicago, 2012-2013.

Ana Caraiani ('07) works in algebraic number theory and specifically on the Langlands program. The Langlands program is a vast network of conjectures meant to build bridges between most areas of pure mathematics, such as representation theory, algebraic geometry, and number theory. She is particularly interested in studying geometric realizations of Langlands correspondences, in questions concerning local-global compatibility and in p-adic aspects of the Langlands program. She recently worked on a project relating modularity lifting theorems (i.e., the kinds of theorems that led to the proof of Fermat's last theorem) to local questions about the existence of certain p-adic Banach spaces.

Caraiani was born in Romania. Her parents are engineers who used to give her brainteasers as a child, which she always enjoyed. When she was about 12 years old, she read a book about the recent proof of Fermat's last theorem and decided to become a mathematician. As a result, she began training for and participating in a number of math Olympiads (winning two gold medals in the International Math Olympiad).

As an undergraduate at Princeton she explored the different fields of mathematics (such as analysis and topology) and especially enjoyed the math reading courses that allowed her to delve deeper into a particular topic. Her first serious encounter with number theory occurred through her senior thesis under the guidance of Andrew Wiles, a great experience that convinced her to continue with number theory in graduate school. What attracted her most to number theory was that tools from other fields have to be used—sometimes unexpectedly—to solve problems. The Langlands program is precisely about building connections between different areas of mathematics.

In addition to the prizes Caraiani received before college, she also received numerous departmental prizes including the Class of 1861 Prize (2005), the Andrew H. Brown Prize for outstanding work as a junior (2006), the Covington Prize for excellence as a senior (2007), and the Miller Prize for the best senior thesis (2007). After graduating summa cum laude from Princeton in 2007, she entered Harvard University where she studied under Richard Taylor *88. She was awarded a three-year NSF research fellowship upon receiving her Ph.D. in 2012 and spent the first year of her fellowship as an L.E. Dickson Instructor at the University of Chicago.

Since returning to Princeton in September 2013, Caraiani has been partially supported by her NSF fellowship. This year, she taught MAT 214: Numbers, Equations, and Proofs, an introduction to mathematical reasoning and proofs through elementary number theory. She also taught MAT 419: Topics in Number Theory: Algebraic Number Theory, a course she designed to serve as an introduction to modular forms.

Caraiani will be spending the upcoming fall term at the Mathematical Science Research Institute (MSRI) in Berkeley, CA, and the 2015-16 academic year at the Institute for Advanced Study.

Sun-Yung Alice Chang
Doctor Honoris Causa of Université Pierre et Marie Curie

This degree is a mark of honorary distinction given to a scientist; it honors not only the scientific excellence of men and women, all of whom are involved in the advancement of science, but also their commitment to humanism and their contribution to the evolution of society as a whole.

The award was presented at a ceremony on November 13, 2013 at La Sorbonne in Paris.

David Gabai
Elected to the American Academy of Arts and Sciences

Professor David Gabai, Chair and Hughes Rogers Professor of Mathematics, has been elected to the American Academy of Arts and Sciences.

One of the nation's most prestigious honorary societies, the Academy is also a leading center for independent policy research. Members contribute to Academy publications and studies of science and technology policy, energy and global security, social policy and American institutions, and the humanities, arts, and education.

Elliott Lieb
Foreign Member of the Royal Society

Professor Elliott Lieb, professor of mathematics and Higgins professor of physics at Princeton University, was elected to the Fellowship of the Royal Society as a Foreign Member on May 2, 2013.

Foreign Members are elected for life through a peer review process on the basis of excellence in science. Each year 8 new Foreign Members are elected by existing Fellows. There are currently about 140 Foreign Members.

John Mather
2014 Brouwer Prize

The award was presented at the Dutch Mathematical Conference held on April 16–17, 2014 at Delft University of Technology.

Professor Mather was awarded this prize for work in the field of Dynamic Systems. The award citation highlights his pioneering work on the weak Kolmogorov-Arnold-Moser theory and the theory of Arnold diffusion.

Sophie Morel
Microsoft Research Prize in Algebra and Number Theory

This inaugural prize, awarded by the Association for Women in Mathematics (AWM) was presented at the Joint Mathematics Meetings held in Baltimore, Maryland in January 2014.

Established in 2012, this prize recognizes exceptional research in algebra and number theory by a woman early in her career. The award is made possible by a generous contribution from Microsoft Research. Its biennial presentation serves to highlight outstanding contributions by women in the field of algebra and to advance the careers of the prize recipients.

Benoît Pausader
Sloan Fellow

The Sloan Research Fellowships seek to stimulate fundamental research by early-career scientists and scholars of outstanding promise. They are awarded in recognition of distinguished performance and a unique potential to make substantial contributions to their field.

Sucharit Sarkar
CAREER Grant by the NSF

Assistant Professor Sarkar was awarded the grant March 2014.

The Faculty Early Career Development (CAREER) Program is a Foundation-wide activity that offers the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. Such activities should build a firm foundation for a lifetime of leadership in integrating education and research.

Peter Sarnak
Honorary degree Shandong University

A special Number Theory Conference to honor Peter Sarnak was organized by the Shandong University during his visit to accept an honorary doctoral degree.

The award ceremony, on January 7 2014, was followed by three days of lectures focusing on research areas influenced by Sarnak's work. Participating speakers came from the China, Canada, Hungary, Israel and the USA.

Yasha Sinai, right, celebrating the Abel Prize with staff members, Scott Kenney, Special Projects Manager, and Carrie Heyer, Assistant Business and Grants Manager.

NSF Mathematical Sciences Postdoctoral Research Fellowships

Allison Miller   **Aaron Pollack**

Shrenik Shah   **Bohua Zhan**

The purpose of the Mathematical Sciences Postdoctoral Research Fellowships (MSPRF) is to support future leaders in mathematics and statistics by facilitating their participation in postdoctoral research environments that will have maximal impact on their future scientific development. Awards will support research in areas of mathematics and statistics, including applications to other disciplines.

Princeton Graduate School Teaching Award

Thomas Beck has been selected as one of 5 Teaching Award recipients for 2014. The awards were presented at the annual Tribute to Teaching reception on April 29.

Each winner will receive $1,000.

The annual Teaching Awards are sponsored by the Graduate School and selected by Dean of the Graduate School and the Associate Dean for Academic Affairs.

Yakov Sinai

Yakov Grigorevich Sinai was born in Moscow, Russia. His grandfather, Veniamin Kagan, was a geometer, and his parents were prominent researchers in the medical and biological sciences. He received his Ph.D. degree from Moscow State University. Prior to his Princeton appointment, he held combined positions at Moscow State University and the Landau Institute of Theoretical Physics of the Russian Academy of Sciences. Sinai was elected as a foreign associate of the National Academy of Sciences and as a foreign member of the Academy of Arts and Sciences in the United States. He is a full member of the Russian Academy of Sciences, the Brazilian Academy of Science, the Hungarian Academy of Science, the Polish Academy of Science, and Academia Europea as well as being recently elected as a foreign member of the Royal Society in London. In addition to these honors, Sinai was awarded the Boltzmann Medal (1986), the Dannie Heineman Prize (1990), the Dirac Prize (1992), the Wolf Prize in Mathematics (1997), the Nemmer Prize (2002), and the Henri Poincáre Prize (2009).

In addition to the recent Abel Prize, Sinai's great contributions to mathematical physics were rewarded with the Leroy P. Steele Prize for Lifetime Achievement by the American Mathematical Society at the Joint Mathematics Meetings in San Diego, California in 2013. The prize was awarded to Sinai for "his pivotal role in shaping the theory of dynamical systems and for his groundbreaking contributions to ergodic theory, probability theory, statistical mechanics, and mathematical physics." The overwhelming influence of Sinai's work over the past fifty years was also noted in the citation, with reference to his more than 250 research papers, several books, and his supervision of more than 50 doctoral students, many of whom have become leaders in the field in their own right.

Sinai joined the Princeton faculty as a full professor in 1993 and has taught classes in Probability Theory and Random Processes. He served on the editorial board for the Annals of Mathematics for ten years and currently serves on the editorial boards for the Journal in Statistical Physics and the Journal in Probability Theory and its Applications.

Sinai's current research is on mathematical fluid dynamics and ergodic theory. He and Dong Li *06 recently constructed a new theory showing the appearance of new vortices as well as the merging and splitting of the vortices. They also developed a version of the Renormalization Group Method. This indicates a possibility of constructing new types of solutions to equations of fluid dynamics. Sinai's work with Francesco Cellarosi *11 contains new results about the ergodic properties of the Moebius function and the methods they've developed have direct implications to several classical problems of number theory. Sinai currently teaches a popular graduate seminar in Ergodic Theory and Statistical Mechanics using the textbook he co-authored with Leonid Korvalov ("Probability Theory, Random Processes and Random Fields," published by Springer-Verlag in 2007).

Y. Sinai, the Norwegian consul, Zenia Chrysostomidis and students at celebratory party for the Able Prize in Fine Hall. Photo by John Jameson.
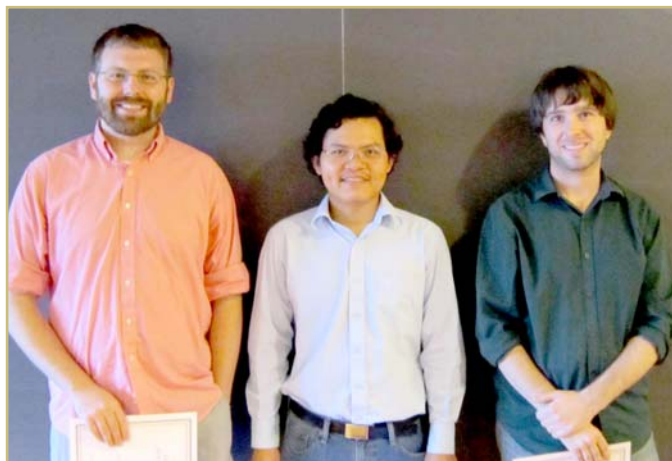
Teaching awards recognize excellence in teaching at the undergraduate level. Selection for both awards was made by a committee of senior faculty members.

Junior Faculty Teaching

This is the first year of the "Department of Mathematics Junior Faculty Teaching Award." The recipients are Jonathan Fickenscher and Luc Nguyen.

From left to right:
Jonathan Fickenscher
Luc Nguyen
Andrew Manion

Graduate Teaching

This is the second year of the "Department of Mathematics Graduate Teaching Award." Last year, it was awarded to Daniel Shenfeld. This year's recipients are Owen Biesel and Andrew Manion. Owen received his Ph.D. in June; Andy is a current graduate student.

Selection for both awards was made by a committee of senior faculty members.

Jonathan Fickenscher

The nominations remarked that Fickenscher is "a versatile teacher" and "an especially insightful, judicious and generous colleague" who has worked "tirelessly" and with "patient enthusiasm and care" for his students (and fellow instructors!) and that, as one student wrote, his " dedication to teaching is phenomenal." He has inspired students to do their best to meet his uncompromising expectations in math courses at all levels

In the course he developed and taught for the Freshmen Scholars Institute, which has become the cornerstone of the Institute's effort to prepare students for the complex problem solving required in Princeton's freshman math, chemistry, and physics curriculum, he has engaged students with a teaching style described as " lively," "accessible," "helpful," and even "amazing."

Owen Biesel

The nominations highlighted Biesel's commitment to teaching and dedication to his students and his "excellent pedagogical instincts" and "talent for communicating love of mathematics to students who come to the subject with very little confidence or enthusiasm." his course evaluations for MAT 100 far exceeded those of past instructors in a similar course. Students comented that he made "math fun and easy to understand" and that he was "an exceptional professor" who "helped to challenge us, encouraged participation, responded to all questions, and offered help outside of class" and "nice, funny, and overall interesting"

Luc Nguyen

The nominations remarked that he is "an exceptionally skilled teacher" who "views his teaching as an important service, and takes his responsibilities to the students, the department and other instructors very seriously." Students from the courses he has taught during his time at Princeton said the following:

"Luc is a fantastic teacher and is always willing to do whatever is necessary to help his students succeed. I wish he could be my math teacher for EVERY MATH CLASS!" **Calc II**

"The quality of the class was awesome. He made the class laugh and comfortable. He told jokes and got the class involved. Even better than that, he taught the course quite well." **Calc II**

"Prof Nguyen was an outstanding instructor-- one of the best instructors I've had in my 4 years at Princeton." **Complex Analysis**

"Luc rocks. At first I was intimidated by the math symbols I didn't understand and I didn't understand why things needed proving- they seemed true and that was enough for me. But later I came to absolutely love his teaching. Best math teacher I've had. Also, super funny, made class enjoyable. And fun to hangout with and very approachable in office hours." **Complex Analysis**

"Professor Nguyen was able to make even a topic as obscure as multivariable calculus sound relevant, practical, and interesting.… l also admired his ability to throw in a joke and get the whole class laughing when the topics were getting tricky or boring." **Calc II**

Andrew Manion

Manion was commended for skill and effectiveness in teaching. He "was truly exceptional, easily surpassing the performance of dedicated teachers with much more experience" and his course evaluations were among the highest ever obtained by an instructor in the first-year courses taught in the Princeton Mathematics Department. Students commented that he was "an awesome teacher," "honestly, the best math professor I have ever had in my life," and "one of my favorite professors this semester and just a generally cool guy."

Awards presented on Class Day 2013

Evgeni Simeonov Dimitrov and Irene Yuan Lo recipients of the 2013 **George B. Covington Prize in Mathematics** awarded for excellence in mathematics.

Ashwath Rabindranath and Maxim Rabinovich recipients of the 2013 **Middleton Miller '29 Prize** awarded for the best independent work in mathematics.

Ilias Giechaskiel and Andy Zhu recipients of the 2013 **Peter A. Greenberg '77 Prize** awarded for outstanding accomplishments in mathematics

Ante Qu '15 and Alexander Smith '15 recipients of the 2013 **Class of 1861 Prize** awarded to sophomores who received the highest scores on the Putnam Examination.

Teaching in the Freshman Scholars Program

by Jon Fickenscher

For the past two summers, I have enjoyed teaching Problem Solving in Mathematics, a quantitative component of the Freshman Scholars Institute (FSI) program. The six-week course is a fast-paced experience that exposes incoming freshmen to topics ranging from calculus to differential equations. We focus on intuition to develop concepts, as intuition is a universal aid in mathematical reasoning at any level. Students who continue to hone their intuition in future mathematics courses at Princeton in addition to enjoying academic success, find their coursework more enlightening.

The program curriculum has been refined from year to year. This coming summer, we are happy to retain last year's format for the six-week course, spending roughly two weeks each on limits/continuity, differentiation and applications to higher mathematics. Between three weekly lectures and lunch "office hours" in the dining hall, FSI instructors get to spend significantly more time with students per week than during a regular semester.

This program admits students with widely diverse backgrounds, and I enjoy hearing about their experiences. One student came from a high school with a graduating class size of about twenty, and he had to essentially teach himself calculus. Other students already attended full calculus courses that banned the use of calculators (typically, the lack of calculators comes as a shock to incoming students). Many students enter the program expressing

great apprehension; they feel they are less prepared than some of their classmates. However, by the end of FSI, background takes a back seat to the work accomplished in the course itself. It is very rewarding to watch students' confidence and ability grow in such a short span of time.

I am thankful to Diane McKay, the Director of FSI and Associate Dean of the College, for placing her trust in me regarding this course and to Dr. Jennifer Johnson, the Associate Departmental Representative and a Senior Lecturer in our department,

Alexander Iriza named Salutatorian

Mathematics major Alex Iriza '14 was named this year's Salutatorian. Iriza will graduate with a certificate in the Program for Applied and Computational Mathematics, and will return to Princeton in the fall to pursue a masters degree in computer science.

He is also a recipient of the **2013 Andrew H. Brown Prize** awarded to an outstanding junior in mathematics as well as the **Manfred Pyka Memorial Prize in Physics**. Iriza received the **Shapiro Prize for Academic Excellence** twice.

The Salutatorian is the second highest ranked student in a class (the first being the valedictorian). Traditionally, the Salutatorian gives the first speech at a graduation, a salutation. Because Princeton tradition requires that the salutation be delivered in Latin, the Salutatorian is most often a classics major.

Iriza studied Latin in high school and earned a perfect score on the **National Latin Exam** and a bronze medal at the **International Olympiad in Linguistics**. At Princeton, he continued his interest in the Latin language by taking classic Roman literature courses.

Eugene Katsevich has been named a 2014 **Hertz Fellow**. Katsevich will receive a stipend and full tuition for graduate school, and will begin his Ph.D. studies at Stanford in the fall.

for her guidance. I will remain appreciative to Scott Kenney for bringing this program to my attention during my first year at Princeton as well as his general encouragement. Furthermore, I am grateful to Professors Gabai and Kollár, and Dr. Johnson, and Dean McKay for the opportunity to welcome members of the class of 2018 to Princeton life this coming summer. We have a dynamic and eager group of faculty and graduate students involved, and I am excited to work with them and provide these students with this unique Princeton experience.

The Minerva Program

The second year of a successful program

Naor, a professor at the Courant Institute of Mathematical Sciences, New York University, was this year's Minerva Lecturer. His research interests are analysis, probability, quantitative geometry, and applications of these to combinatorics, mathematical physics and theoretical computer science.

Naor presented three lectures on the following topics: "An introduction to the Ribe program," "Dichotomies and universality in metric embeddings" and "Super-expanders and nonlinear spectral calculus."

A Czech-Israeli citizen, Naor obtained his undergraduate and graduate degrees from the Hebrew University in Jerusalem. He completed his Ph.D. thesis, titled "Linear and Non-Linear Geometric Problems in Banach Spaces," under the supervision of Joram Lindenstrauss.

Assaf Naor will become a permanent member of our faculty this summer.

The Minerva Program, started in the academic year 2012-2013, continued this year with lectures by two distinguished mathematicians:

Assaf Naor

Andrei Okounkov

Okounkov, a professor at Columbia University, joined the Princeton Mathematics Department for the spring semester as the inaugural Minerva Distinguished Visitor, and delivered a series of 10 lectures on "Quantum groups and quantum cohomology".

Okounkov works on representation theory and its applications to algebraic geometry, mathematical physics, probability theory and special functions. In 2006, he received the Fields Medal "for his contributions to bridging probability, representation theory and algebraic geometry."

Okounkov was a professor at Princeton University from 2002 to 2010, an assistant and associate professor at the University of California, Berkeley, and an instructor at the University of Chicago.

Videos of the lectures are now available at **https://www.math.princeton.edu/media/videos**

The "Math Guy" at Fine Hall!

Keith Devlin, Visiting Professor of Distinguished Teaching

Professor Devlin is Executive Director of Stanford's H-STAR institute, a co-founder of the Stanford Media Xresearch network, and a Senior Researcher at CSLI. He is a World Economic Forum Fellow, a Fellow of the American Association for the Advancement of Science, and a Fellow of the American Mathematical Society. His current research is focused on the use of different media to teach and communicate mathematics to diverse audiences. In this connection, he is a co-founder and President of an educational video games company, InnerTube Games. He also works on the design of information/reasoning systems for intelligence analysis. Other research interests include: theory of information, models of reasoning, applications of mathematical techniques in the study of communica-

tion, and mathematical cognition. He has written 32 books and over 80 published research articles. Recipient of the Pythagoras Prize, the Peano Prize, the Carl Sagan Award, and the Joint Policy Board for Mathematics Communications Award, in 2003, he was recognized by the California State Assembly for his "*innovative work and longtime service in the field of mathematics and its relation to logic and linguistics*." He is "the Math Guy" on National Public Radio.
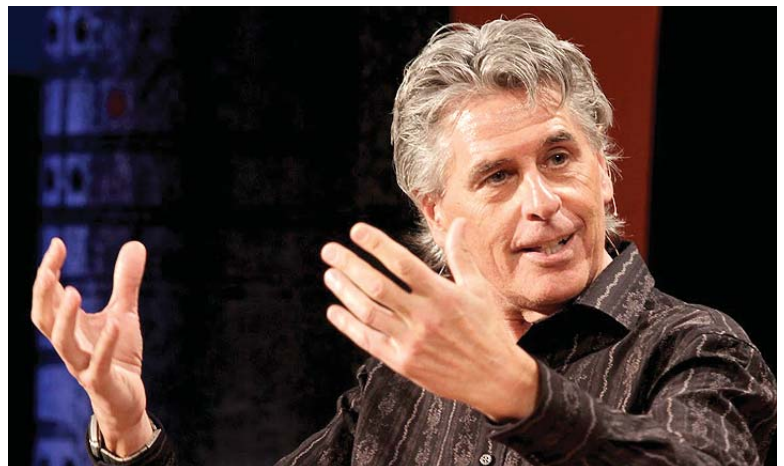
This spring Professor Devlin is teaching Math 198, Useful Fictions: How and why mathematics is developed and then changes the world. This course will combine Professor Devlin's online course, Introduction to Mathematical Thinking, with classroom discussion to provide a view of mathematics as a living, growing, creative human endeavor that classifies as both as a science and an art.

Keith Devlin's course *Mathematics: Making the Invisible Visible* is available on YouTube

Will Crow
Faculty Assistant

Will began as a temporary employee in our department in the spring of 2013. He became a permanent staff member in November, 2013 and can be found in the front reception area on the third floor. Will has a B.A. in Philosophy, which he obtained at Davidson College in North Carolina. He spent a post-baccalaureate year studying environmental biology at Columbia University.

Will's duties in the Math Department include updating our departmental website, arranging travel reservations and reimbursements, and assisting the faculty as needed. Will's computer skills serve him well and he enjoys the challenge of creating highly-technical mathematical documents by using the programs he has taught himself.

Will was born and raised in New York City and currently lives with his partner, Amy, in Yardley, PA.

Ben Rose
Systems Manager

Ben Rose trasferred to our department from a similar position in the Computer Science Department.

Ben received a B.S. in Computer Science from Stevens Institute of Technology, where he developed a Linux distribution used by faculty researchers. A summer internship in the networking department at the Institute for Advanced Study in Princeton led to a full-time job there.

Ben oversees the large Fine Hall network (shared by the Math Department and the Program in Applied and Computational Mathematics, also housed in Fine Hall). His basic responsibilities are also to ensure that all of the users' IT needs are met. He has a particular interest in Linux and enjoys working with colleagues on the Springdale Linux project, a clone recompile of Red Hat Enterprise Linux.

Ben was born and raised in NJ and currently lives in Lawrenceville, NJ, with his fiancée.

Michelle Matel
Assistant to the Chair/ Assistant to the Department Manager

A new position was created to further assist the Chair and the Department Manager. Michelle Matel joined us in July 2013, having worked previously in a similar position in Boston College's Mathematics Department.

Michelle has a B.A. (Michigan State University) and an M.A. (Stanford University) in Economics. She taught economics (Stanford University and Miami University in Oxford, Ohio) and worked in a variety of positions, including in the Admissions Office for Lasell College and as Assistant to the Chair at Boston College.

Michelle's responsibilities include assisting the Chair with his scheduling and correspondence, assisting the Department Manager with faculty reports and appointments, as well as assisting various faculty members on different projects.

She was born in Michigan, and currently lives in Hillsborough, New Jersey, with her husband and their son.

Staff profile

Alberta Molnar   Business and Grants Manager

Alberta joined the Math Department as our Grants Manager in September, 2010. She was promoted to Business and Grants Manager in March, 2013. Prior to coming to Princeton, Alberta worked at Rutgers University for 23 years as an accountant in University Accounting and then as the Business Manager at the Waksman Institute for Molecular Biology. She graduated from Douglass College as a music major—first as a piano major and then as a harpsichord major—and attended graduate school in music history (again as a harpsichord major) at Rutgers University as well.

As the Business and Grants Manager for our department, Alberta is responsible for all grant-related issues including preparing grant submissions to federal agencies and outside foundations; grant transfers to and from other universities; approval of grant expenses; budgeting, and account reconciliation. She serves as the departmental liaison with University research administration and other offices as well. Her attention to detail and strong financial background have made her an outstanding steward of our financial resources and she works to ensure departmental compliance and to communicate clearly with faculty about grant and departmental financial matters. In recognizing her strong abilities, the University asked Alberta to serve on the "Academic Prime Connect Group" for Princeton Prime and Concur, which will implement a new chart of accounts, enhance reporting and business processes throughout the Princeton campus, and upgrade all University financial systems and tools beginning in July, 2014. Alberta has especially enjoyed working with new faculty and helping them to, as she puts it, "navigate the waters" with rules and regulations that we are required to follow. She works diligently with our faculty members to assist them with their initial grant applications and to monitor the grant once it is awarded. Her bookkeeping skills and attention to detail are two assets she readily shares with the department and the Math Department appreciates the dedication she brings with her to every task she accomplishes.

Alberta is a New Jersey native proudly descended from several generations of Hungarian folk musicians. She has been married to her husband, Emil, for 30 years. In addition to playing her harpsichord, she also does needlework and is an avid gardener.

A treasure trove: The Math Club

Our department has a precious resource in the The Princeton Undergraduate Math Club, a well organized and very dynamic student-run group that has managed to provide a variety of activities and useful information to the undergraduate math community.

Its activities include:

- undergraduate colloquia (weekly)
- board game nights, (biweekly)
- field trips (e.g. to the Museum of Math)
- meet-your-professor lunches

The advising program Mentoring Moebius, described in our first newsletter, is also run by the Club.

In the past year, the club members collaborated with Princeton Public Library in organizing the Mercer County Math Circle, an approximately biweekly event that consists of talks for high school and middle school students in the area.

This year, the club hosted a special Pi Day celebration on 3/14, which involved eating a lot of pies, and listening to a talk on *A Recipe on Pi* by Visiting Professor William Dunham.

The club also holds the Princeton University Mathematics Competition (PUMaC) every year. Participants are high school students from around the country and also around the world, including countries such as Bulgaria and China.

The Princeton Undergraduate Math Club has recently compiled a comprehensive Guide for Math Students intended for undergraduates interested in mathematics. The Guide includes an extensive Course Guide, as well as sections on Summer Opportunities, Undergraduate Research, Combining Math with Other Subjects (including Computer Science, Economics, Finance), Applied Math, Club Academic Events, and Club Social Events.
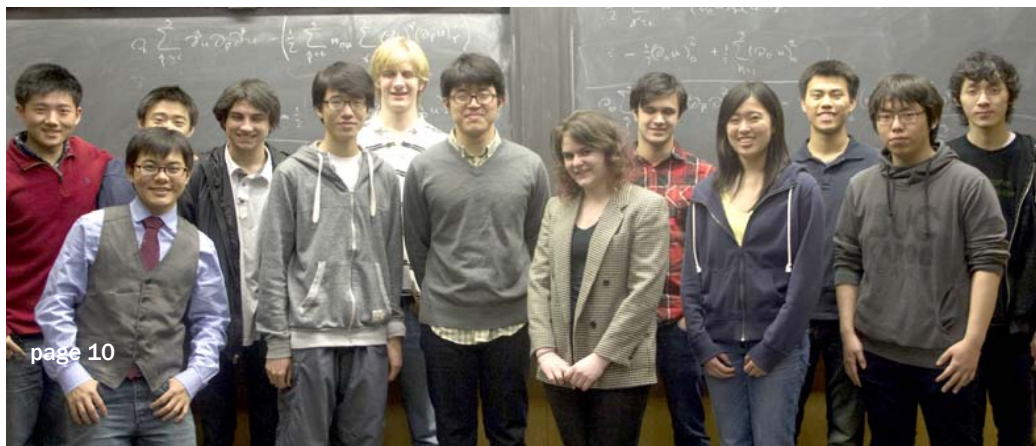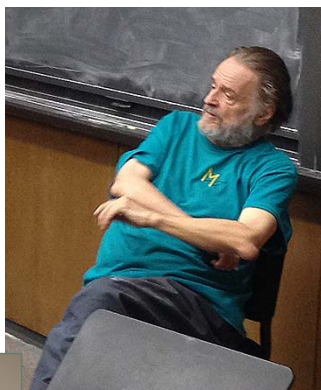
Princeton Summer Math Research

The summer program at Princeton funds eight weeks of on-campus mathematical research and/or guided independent study. Any eight weeks during the summer will do, provided you can make arrangements to work with your adviser during that period; they do not even have to be contiguous, so you could for instance, work for four weeks in June, then leave for a couple of weeks and return to finish the program in mid-July. Over the past two years, the program has provided $4000 stipends to approximately 10 math majors; rising juniors and seniors are given preference, but rising sophomores are often accepted.

The Princeton program differs from REUs in several respects. Primarily, it offers significant scope for choice: you can choose to work on whatever kind of project interests you, provided you can find a supervisor. This means you can work on a project that would simply not be offered at an REU. Moreover, while this is not always the case, particularly if you participate in one of the top REUs, REUs generally focus on areas slightly outside the mainstream and problems that require relatively little specialized knowledge. The result is that an REU experience, particularly early in your undergraduate career, will likely be more of an opportunity to focus on a single, specific problem than a way to learn mathematics that you're likely to use in the future. In contrast, the Princeton program represents a chance to build significant foundational knowledge in a specific area, which is particularly useful if you wish to pursue research in it.

The official website of Princeton University Mathematics Competition (PUMaC) among other valuable information contains the problem sets of past competitions

http://pumac.princeton.edu

The PUMaC team

The Graduate Open House March 2014

The Open House is our annual event for students admitted to the Ph.D program to check out the Department and speak to faculty and graduate students in order to help form their final decision on what graduate program to attend.

This year again, our department had the difficult task of choosing from a large pool of outstanding applicants. The incoming graduate students form a group with varied research interests and national backgrounds: the international cohort includes students from Australia, China, Germany, Greece, India, Italy, Korea, Russia and South Africa.

From the director of graduate studies

Alexandru Ionescu

It has been a privilege serving as a director of graduate studies again this year. Our graduate program continues to grow: we are expecting a new class of 19 students in Fall 2014, one of the largest classes in recent years. The Graduate School has been, again, very supportive at all stages of selection and recruitment, and I am looking forward to collaborating with them again next year.

The International Mathematical Union Executive Committee meeting

The International Mathematical Union (IMU) is an international scientific organization whose purpose is promoting international cooperation in mathematics. It is responsible for organizing the International Congress of Mathematicians, held every four years; the next ICM will be held in Seoul, South Korea in August 2014. IMU also awards a number of scientific prizes, including the Fields Medals. The Executive Committee of the IMU met in Fine Hall March 7–8, 2014.

From left to right: John Toland, Sylwia Markwardt, Vasudevan Srinivas, Manuel de Léon, Cheryl Praeger, Wendelin Werner, Marcelo Viana, Yiming Long, Christiane Rousseau, Laszló Lovász, Alexander Mielke, Ingrid Daubechies, Martin Grötschel. Not pictured: Peter Olver, Hyungju Park

Robert F. Coleman *79, died of a heart attack on March 24, 2014. He was 59 years old.

Coleman was a mathematics professor at the University of California, Berkeley since 1983. His research dealt primarily with number theory, p-adic analysis, and arithmetic geometry. He received a MacArthur Fellowship in 1987.

Coleman had been diagnosed with Multiple Schlerosis almost thirty years ago and was well-known for his good humor, fearlessness, and his ability to overcome difficult circumstances. He leaves behind his wife, Tessa Drake-Coleman, sister Rosalind, and brother Mark. A memorial service will take place from 2-4 p.m. on Saturday, May 31, 2014 at the Bancroft Hotel in Berkeley, California.

Since 1994, with the support of the NSF, the Institute for Advanced Study, together with Princeton University, has hosted an intensive eleven-day mentoring program for under-graduate, graduate, and postdoctoral women in mathematics.

The program brings together research mathematicians with students and postdocs on the campus of the Institute and is designed to address issues of gender imbalance in mathematics. Activities include lectures and seminars on a focused mathematical topic, mentoring, discussions on peer relations, an introduction to career opportunities, and a Women-in-Science seminar.

IAS Women and Mathematics

A Program of the **Institute for Advanced Study** and **Princeton University**

Random Matrix Theory

May 12–23, 2014

ORGANIZERS

Sun-Yung Alice Chang Princeton University
Antonella Grassi University of Pennsylvania
Dusa McDuff Barnard College and Columbia University
Christine Taylor Princeton University

LECTURERS

Catherine Donati-Martin Université de Versailles
Ioana Dumitriu University of Washington
Alice Guionnet Massachusetts Institute of Technology
**Elizabeth Meckes** Case Western Reserve University

Advisory Council meeting

The Math Department's Advisory Council met April 17-18, 2014 for the first time in seven years. The Council, chaired by Dr. Luisa Fernholz, consists of eight major figures in and around Mathematics, including four alumni (one of whom couldn't make the meeting). They took a very close look at the Department, meeting with undergraduates, graduate students, junior faculty, senior faculty, staff members, as well as the Chair of Physics, the Dean of the Graduate School and the Dean of the Faculty. A dinner for the Advisory Council and faculty members was held on Thursday evening, April 17th.

The Council wrote a report for the Department and University Administration providing recommendations and giving their view of the state of the Department. We are grateful to the Council for taking time from their extremely busy schedules to focus on the improvement of the Department.
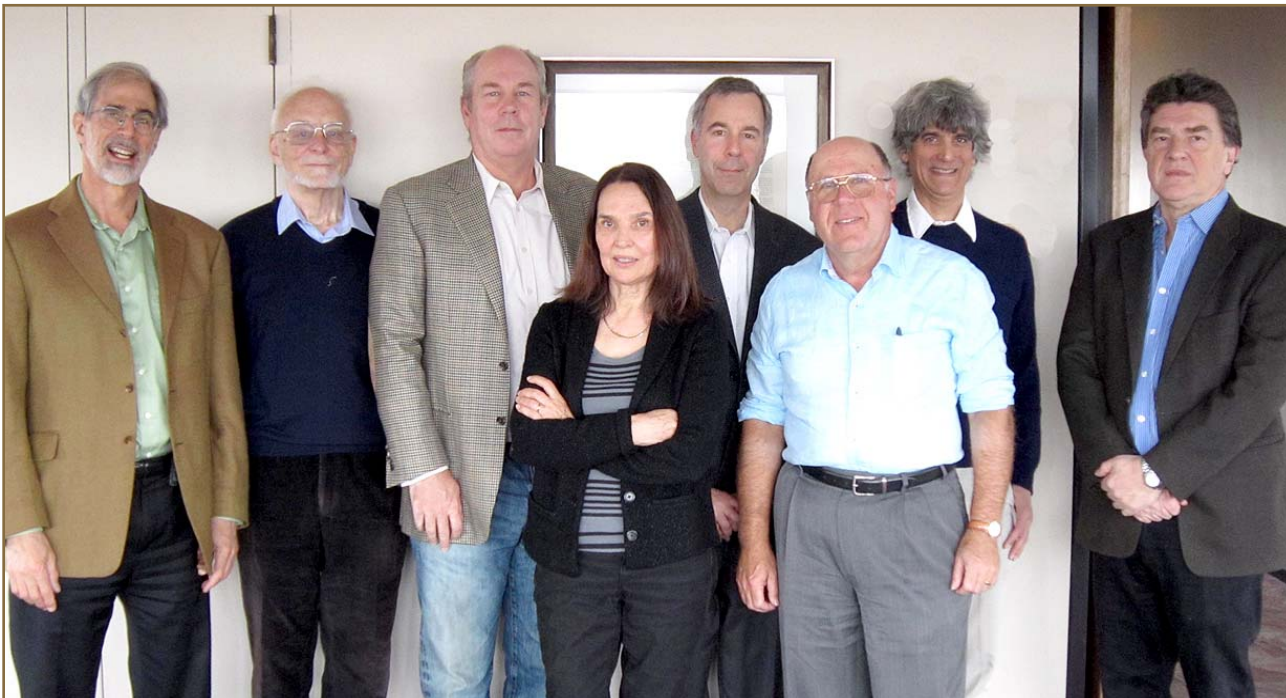
From left to right, front row: Luisa Fernholz, Henry Laufer; back row: David Eisenbud, Elwyn Berlekamp, John Fry, Robert Fefferman, David Gabai (Chair of the Department), Flavio Bartmann.

We are very grateful to our recent major donors:

The **Fernholz Foundation** for its generous funding of the Minerva Lectures and the Minerva Distinguished Visiting Professor program and its support of our graduate program.

The **Class of 1971 Endowed Fund for Mathematics** for discretionary support to strengthen the mission of the Department of Mathematics.

A bequest from the **Bradford H. Arnold *42 and Mary Ellen Arnold Fellowship Fund** to provide financial assistance to selected graduate students studying in the mathematics department.

The **Wei-Tong Shu *90 Fellowship Fund** to provide financial assistance to Math Department graduate students.

A bequest from **Jane H. Lukens W30** to establish the **Jaywood Lukens '30 Scholarship Fund** for undergraduate scholarships in memory of her husband, Jaywood Lukens, "for whom mathematics was fundamental in his profession as an actuary and for whom mathematics 'was always fun.'"

Untangling laws and knots a letter from Kenneth Perko '64

A mathematics major receiving Honorable Mention for the Class of 1861 Prize, I trod a carefully planned career path from Harvard Law School to a Wall Street law firm to a cushy corporate job and a comfortable early retirement. My legal experience included off-the-record examination at State Department headquarters of secret cables from an ambassador discussing corporate bribery of a friendly foreign government—this notwithstanding my previous private tour of East Germany, arranged by its then foreign minister. My experience at Princeton as Chairman of the largest student social organization on campus (some might say, anti-social) prepared me well for dealing with the sort of folks who run New York City, where I served as an officer of scores of subsidiaries of the corporate and partnership owners of Rockefeller Center (Radio City Music Hall was the most fun),

supervising, inter alia, the tricky business of their political contributions. After Stanley Friedman (Koch's deputy mayor in charge of everything, including the selection of judges) went to jail, I could brag to my boss that we hadn't wasted a penny.

My wife of 45 years is a Vassar-pedigreed, Columbia-trained architect who worked for a world-class prima donna, job captaining a small museum on Washington Square. We have two children, one of each traditional sex, and a grandson. When we give up our Scarsdale mini-estate it will be subdivided into three residential lots and a public cull-de-sac, to be named "Perko Court."

My second family is a collection of two-faced knots (with thin Khovanov homology) the first of which is illustrated at page 263 of Proceedings of the American Math-

ematical Society 45 (1974) and is now well known to topologists as "The Perko Pair." I expect it's the only thing about me that will be remembered 50 years from now.

Difficult as it may be for conspiracy theorists to believe, I am not the Kenneth Perko that worked secretly for the Air Force on stealth bombers, drones and the "star wars" project, whose talk at Princeton was miss-attributed to me in our Class Notes on page 33 of the February 9, 1994 PAW.
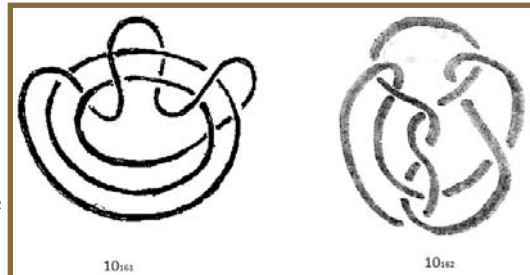

The famous Perko Knots

Knot tables

Mathematicians started tabulating knots in the late 19th century and by the 1885 Tait table listed all possible knots with up to 10 crossings. Contemporary tables reach 16 crossings.

A knot table begins with the "unknot", a simple circle, and continues with the trefoil, the knot with three crossings and so on, with various numbers of knots of various crossings.

A major difficulty for knot theorists consists in establishing knot equivalence, that is, to precisely determine when two knots can be considered the same. The accepted definition is that two knots are equivalent if one can be transformed into the other through ambient isotropy, a type of deformation of R^3 upon itself.

Two knots can be considered the same if they can be deformed to result in identical knots. But, as even for experienced topologists it has not been easy to
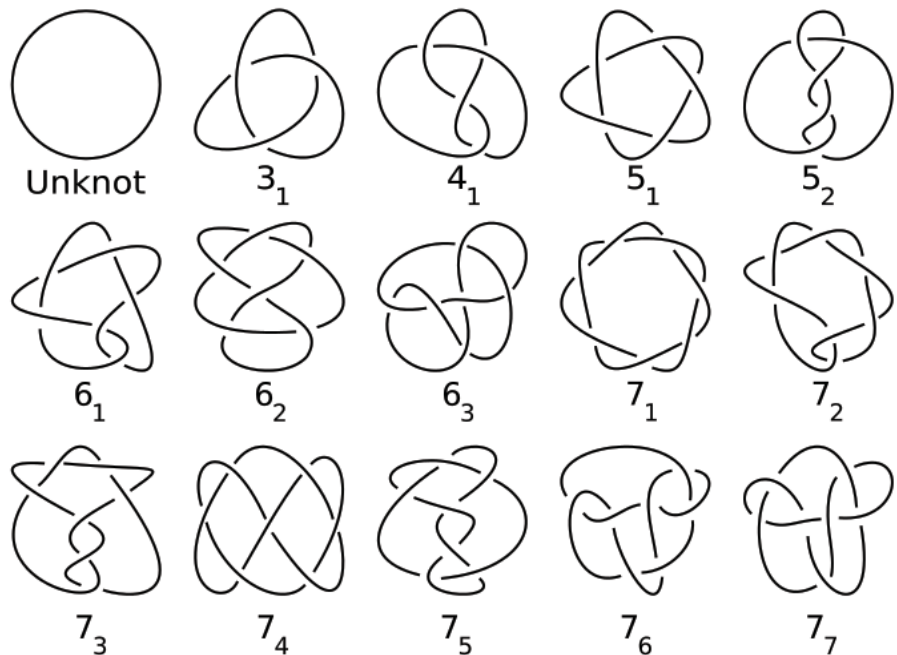
untangle all the knots, errors have continued to hide in the tables and to be missed by even the most experienced topologists. A famous case is that of the knots known in the Rolfsen's table as knots numbers

10_{161} and 10_{162}. These two knots became the famous **Perko Knots** when our alumnus, Kenneth Perko, a lawyer at the time, discovered in 1974 that they are in fact identical.

Our most recent Ph.Ds
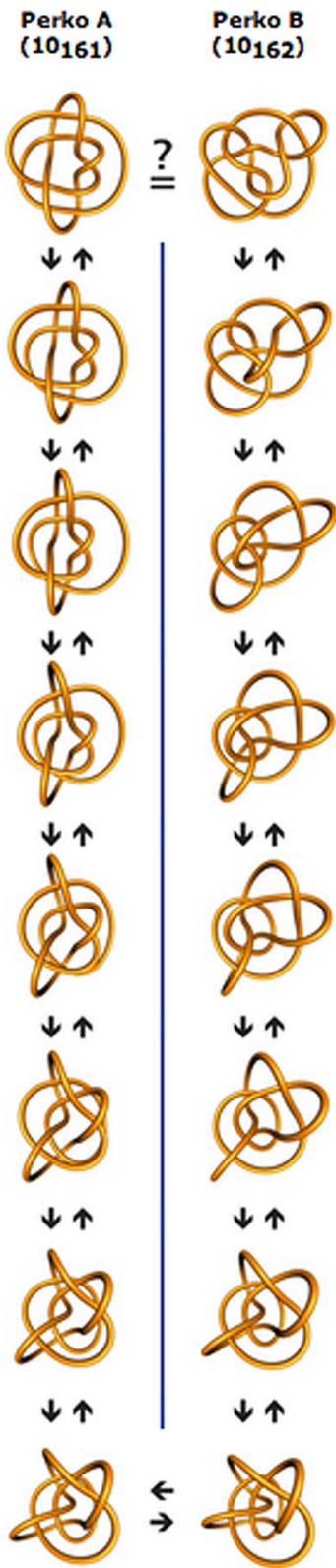
Perko A (10₁₆₁) $\qquad$ **Perko B (10₁₆₂)**

Image by Rob Scharein using the software KnotPlot (knotplot.com)

Boris Alexeev
J. Conway
An assortment of results in combinatorics and compressed sensing. Voleon Capital Management, CA, Senior Research Scientist.

Ali Altug
P. Sarnak
Analysis experiments with the trace formula. Columbia University, Postdoc.

Owen Biesel
M. Bhargava
Galois closures for rings. Leiden University, Postdoc.

Yaim Cooper
R. Pandharipande
The geometry of stable quotients in genus one. Harvard University, NSF Postdoc.

Gabriele DiCerbo
J. Kollár
Effectiveness boundedness results in algebraic and analytic geometry. Columbia University, Postdoc.

Mohammad Farajzadeh Tehrani
G. Tian
On moduli spaces of real curves in symplectic manifolds. Cornell University, Visiting Assistant Professor.

Kevin Hughes
E. Stein
Arithmetic analogues in harmonic analysis: Results related to Waring's problem. University of Edinburgh, Postdoc.

Philip Isett
S, Klainerman
Hölder continuous Euler flows with compact support in time. MIT, C.L.E. Moore Instructor.

Junehyuk Jung
P. Sarnak
On the zeros of automorphic forms. Required South Korea Military Service.

Michael McBreen
A. Okounkov
Quantum cohomology of hypertoric varieties and geometric representations of Yangians. MIT, Instructor, Postdoc.

YoungHan Park
P. Sarnak
Hyperbolic hypergeometric monodromy groups and geometric finiteness. WorldQuant, VP of Research.

Sung-Jin Oh
S. Klainerman
Finite energy global well-posedness of the (3+1)-dimensional Yang-Mills equations using a novel Yang-Mills heat flow gauge. UC Berkeley-Miller Institute, Postdoc.

Nicolas Reichert
A. Chang
Some results on a full nonlinear equation in Conformal Geometry. University of Washington, Acting Assistant Professor.

Rodolfo Rios Zertuche
A. Okounkov
Near-involutions, the Pillowcase Distribution, and Quadratic Differentials. Princeton University, Lecturer; Fall '13: Brown University-ICERM; 2014: Max Planck Institute for Mathematics, Postdoc.

Samuel Ruth
M. Bhargava
A bound on the average rank of j-Invariant zero elliptic curves. Princeton University, Lecturer; Bloomberg, NY, Software Engineer.

Giulia Saccà
G. Tian
Fibrations in Abelian varieties associated to Enriques surfaces. SUNY/Stony Brook, Postdoc.

Arul Shankar
M. Bhargava
Geometry of numbers methods for global fields. IAS, Member (1 year); Harvard University, Postdoc.

Daniel Shenfeld
A. Okounkov
Abelianization of stable envelopes in symplectic resolutions. GNS Healthcare, Cambridge, MA, Director of Machine Learning

Kevin Wilson
M. Bhargava
Three perspectives on n points $P^{\{n-2\}}$. Knewton, NY, Data Scientist.

Guangbo Xu
G. Tian
Symplectic vortex equation and adiabatic limits. UC Irvine, Postdoc.
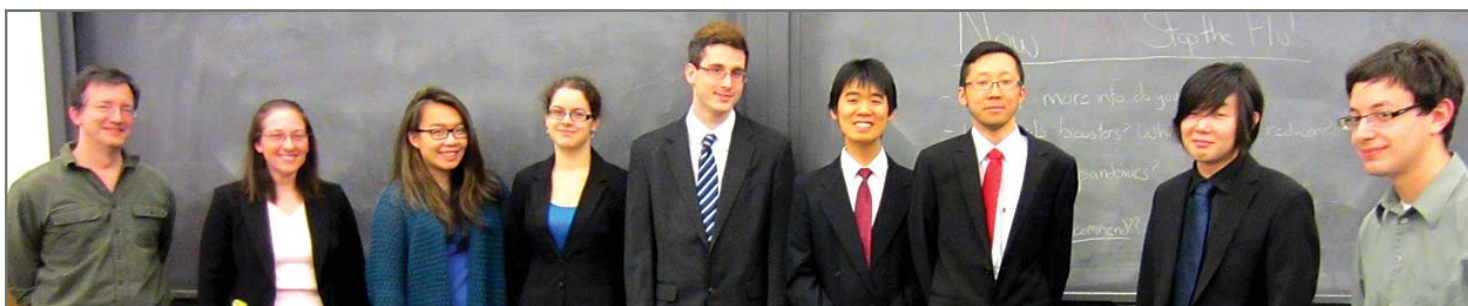
Shiwu Yang, I. Rodnianski
Nonlinear wave equations on time dependent inhomogeneous backgrounds. University of Cambridge, Postdoc.

The happy participants in the new course, History of Mathematics, introduced in the fall of 2013, and taught by Michael Barany and Christopher Skinner.

Math and music: our annual recital

Jill LeClair

Thanks to the efforts of our Graduate Administrator, Jill LeClair, the members of our department and their friends and families had the opportunity to enjoy another delightful afternoon of music.

The recital took place on May 8 in Taplin Auditorium and was followed, as usual, by a well attended reception in the Common Room.

Many thanks also to our musicians, who took time to prepare and play for us despite the demands of thesis writing and approaching exams.

This year's performers were:

Tim Brown (piano)

Laurent Côté '14 (violin)

Matthew de Courcy-Ireland, graduate student (piano)

Mark McConnell, lecturer, (baritone)

Isabelle Nogues '15 (violin)

Florian Sprung, Veblen instructor (bandoneón)

Ryan Peckner, graduate student (piano)

Feng Zhu '14 (piano)

and

Minh-Tam Trinh '14 (piano)

Join us next year in the audience or on stage!