Fine LETTERS

Spring 2012, Issue 1
Department of Mathematics Princeton University

On behalf of our department, welcome to the inaugural issue of the "Fine Newsletter!"

We constantly feel the need to reach out to each other and share information on "what is happening at Fine Hall." Over the years, we also felt the urge to share the information with our alumni and friends. We like to think we share a common bond as residents of Fine Hall and through our love of mathematics and devotion to the profession. We hope the newsletter will serve to connect us.

Many things have happened at Fine Hall during the last year. Our department has three new senior faculty members: Professors **Peter Constantin** (jointly appointed with the Program in Applied and Computational Mathematics), **Peter Ozsvath**, and **Shou-Wu Zhang**, 10 new junior faculty hired for the present 2011-12 academic year, 9 new junior faculty for the 2012-13 academic year; 6 new staff members have joined us over the past two years. We have the good news that **Mihalis Dafermos** from Cambridge and **Sophie Morel** from Harvard have accepted our offers and will join our faculty during the next academic year.

We are strengthening our undergraduate program by re-organizing and updating the curriculum for each of our course offerings. We are also adding new "bridge courses" for our math majors and beginning graduate students.

This year, due to the generous support of the **Fernholz Foundation**, we will begin the *Minerva Distinguished Lecturer* series and a *Distinguished Visiting Professor* program, which will bring distinguished visitors to our department to give series of lectures in advanced topics on a yearly basis.

I hope you will enjoy reading the newsletter and provide us with feedback and that this will be a starting point for us to share our common experiences and concerns with each other!

With warm regards, *Alice Chang*
chair of the department

An outstanding student

Photos by: left, Frank Wojciechowski, right, Denise Applewhite

John Vincent Pardon '11
Mathematics Major and Class Valedictorian received the *2012 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student* for work done while he was at Princeton.

The Morgan Prize is presented annually by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics. The prize was awarded on Friday, January 5, 2012, at the Joint Mathematics Meetings in Boston.

Pardon, now a first-year graduate student at Stanford University, was honored "for solving a problem on distortion of knots posed in 1983 by Mikhail Gromov." The prize citation referred to the"brilliant geometric understanding" that Pardon brought to bear on this problem and went on to say: "John's elegant proof was a beautiful mix of geometry and topology combined with some analytic arguments." continued on page 5

- **Notes from the conference in honor of Eli Stein May, 2011** on page 8
- **Major overhaul of the mathematics curriculum** on page 12
- **Panorama of Topology: A conference in honor of William Browder** took place on May 8-11, 2012. Details on our website; a story will be published in our next issue.

The Minerva Distinguished Lecture Series

will allow for a distinguished mathematician to visit our department and deliver three accessible lectures on a topic of current interest over a period of one to two weeks.

We are happy to announce that **Jean-Pierre Serre** accepted to open the lecture series. He will be followed by **Terence Tao** and **Ian Agol.**

The Distinguished Visiting Professorship in Mathematics

will provide funding for a distinguished mathematician to visit our department for a semester and give an accessible lecture course, to meet once a week, on a topic of current interest.

The purpose of these positions is to enrich our mathematical environment and increase interaction and discussion both within our department and across universities.

ALUMNI, FACULTY, STUDENTS, FRIENDS:

Send us your comments. Share your stories. Ask your favorite professors questions. Suggest activities you would be likely to attend. Write to us at:

news@math.princeton.edu

Faculty News / New faculty

Administrative positions for 2012-13 academic year

Chair:
David Gabai

Associate Chair:
Christopher Skinner

Directors of Graduate Study:
Alex Ionescu
Nicolas Templier

Undergraduate Representative:
Christopher Skinner

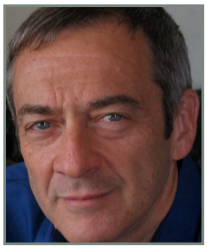
Associate Undergraduate Representative:
Jennifer Johnson

Senior Advisor:
John Mather

Junior Advisor:
Manjul Bhargava

Placement Officer:
Micah Warren

Professors



Peter Constantin is the William R. Kenan, Jr. Professor of Mathematics and Applied and Computational Mathematics, jointly appointed with the Program in Applied and Computational Mathematics, where he also selves as director. Peter Constantin comes to us from the University of Chicago where he was chairman of the mathematics department for the last five years. Constantin's research focuses on turbulent convection, the physics of exploding stars and other topics related to fluid dynamics.

Peter Ozsvath, who comes to Princeton from MIT, received the AMS's Oswald Veblen Prize in Geometry with Zoltán Szabó in 2007, "for their contributions to 3- and 4-dimensional topology through their Heegaard Floer homology theory". Ozsvath obtained his Ph.D. from Princeton in 1994. His current research is directed mainly in low-dimensional topology gauge theory.

Shou-Wu Zhang's main contributions are in number theory and arithmetical algebraic geometry where he developed the theory of positive line bundles in Arakelov theory as well as the theory of arithmetic dynamics. Before Princeton, Zhang was a professor at Columbia University where he received his Ph.D. in 1991.

General Relativity at Princeton (GRAP)

GRAP, partly funded by an FRG grant, is a new center, dedicated to mathematical GR and its applications, established in the fall of 2011 within our department.

Its principal investigators are Alex Ionescu, Sergiu Klainerman and Igor Rodnianski in mathematics and Frans Pretorius and Paul Steinhardt in physics. External consultants are Spyros Alexakis, University of Toronto, Mihalis Dafermos, Cambridge University (at Princeton from Spring 2013) and Jeremy Szeftel, Ecole Normale Superieure, Paris.

The mission of the group is to:

- consolidate the strength of the mathematics department in Analysis, Geometry and PDEs related to mathematical GR;
- reach out across the usual departmental barriers to train a new generation of graduate students and postdocs with interdisciplinary skills, strongly rooted in the physical, mathematical and computational aspects of gravity and cosmology;
- take advantage of and contribute to the revival of scientific interest in GR within both the mathematics and physics communities as well as to foster closer collaboration, consultation and synergy between them;
- consolidate and expand the strength of the two departments in theoretical and numerical relativity, as well as cosmology, by developing our young talent and attracting new ones.

CURRENTLY IN THE PRINCETON MATHEMATICS DEPARTMENT

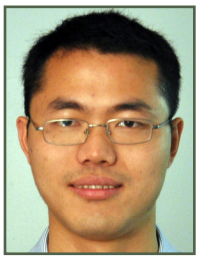
65 regular faculty members
12 visitors and research staff members
4 emeritus faculty in residence
66 graduate students
73 undergraduate majors.

New faculty

Assistant Professors

Zeev Dvir
Joint appointment with Computer Science Department. Theoretical Computer Science. Ph.D. and Ms.C. Computer Science, Weizmann Institute of Science. Bs.C. in Mathematics and Computer Science, Tel Aviv University. Previously in the Computer Science Department, Princeton University and the Institute for Advanced Study, School of Mathematics.

Stefan van Zwam
Combinatorics. Ph.D. and M.Sc. from Technische Universiteit Eindhoven, The Netherlands. Previous position: Postdoctoral Researcher, Centrum Wiskunke en Informatica, Amsterdam, The Netherlands.



Xinyi Yuan
Number Theory, Arakelov Geometry, Automorphic Forms, Shimura Varieties and Algebraic Dynamics. Ph.D. in Mathematics, Columbia University and B.S. in Mathematics, Peking University, Beijing. Previous positions: Clay Research Fellow, Clay Mathematics Institute, Cambridge, MA.

Instructors

Costante Bellettini
Veblen Research Instructor. Geometric Analysis, Geometric Measure theory, Calibrated geometries, Elliptic Partial Differential Equations. Ph.D. ETH, Zurich, Switzerland, Masters, Scuola Normale Superiore of Pisa (Italy) and University of Pisa.

Zsolt Patakfalvi
Algebraic Geometry, Complex Geometry. Ph.D. University of Washington, Seattle. Masters (summa cum laude), Eotvos Lorand Univ. in Budapest, Hungary. Masters in Computer Science, Technical University of Budapest, Hungary.

Jeffrey Case
Instructor & NSF Postdoctoral Fellow. Global Reimannian and Lorentzian Geometry, Conformal Geometry, Geometric Analysis, General Relativity. Ph.D. and M.A. U.C. Santa Barbara, B.S. in Mathematics and Computer Science, Minnesota State University. Previous position: Postdoctoral Research Fellow/NSF Postoctoral Fellow, Mathematics Department, Princeton Univ.

Claudiu Raicu
Algebraic geometry, commutative algebra and their computational aspects, tensors, representation theory, toric varieties, resolutions. Ph.D. U.C. Berkeley; B.S. University of Bucharest, Romania.

Kevin Tucker
Algebraic geometry. Ph.D. Univ. of Michigan, B.Sc. Univ. of Chicago. Previous position: Postdoctoral Research Fellow, Univ. of Utah.

Jonathan Fickenscher
Interval Exchange Transformations and Rauzy Diagrams, Affine Interval Exchange Transformations, Linear Involutions and Generalized Permutations. Ph.D. Rice University; B.S. in Computer Science & Mathematics, University of Texas at Dallas.

Simons Research Fellow/ Postdoctoral Research Associate

Penka Georgieva
Symplectic Topology, Moduli Spaces, Gromov-Witten Theory. Ph.D. Stanford University; M.Sc. and B.Sc. Sofia Univiversity, Bulgaria.

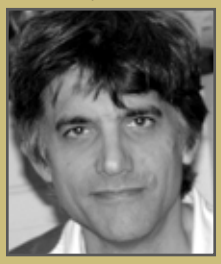
Fabio Pusateri
Analysis, PDE's, Harmonic Analysis, Hamilltonian Dynamics. Ph.D., Courant Institute, NYU; M.A. and B.S., University of Roma Tre, Italy.

Claudiu Raicu was awarded **The Princeton University Engineering Council "Excellence in Teaching" Award** for enhancing the quality of education at Princeton University through dedication and commitment to student learning that surpassed the norm.

Faculty news

Honored

David Gabai
the Hughes-Rogers Professor of Mathematics, was elected to the National Academy of Sciences on May 3, 2011.



Amit SInger
(jointly appointed Associate Professor in the Mathematics Department and the Program in Applied and Computational Mathematics) was awarded the *Presidential Early Career Award for Scientists and Engineers*. This is the highest honor bestowed by the United States government on science and engineering professionals in the early stages of their independent research careers.

Manjul Bhargava
the Thomas D. Jones Professor of Mathematical Physics and the Brandon Fladd, Class of 1983, Professor of Mathematics, and **Igor Rodnianski** (on leave at MIT) were awarded the 2011 *Fermat Prize* established in 1989 by the Toulouse Mathematics Institute in France. The biennial prize is offered to researchers whose work is accessible to the greatest number of mathematicians in fields shaped by Renaissance French mathematician Pierre de Fermat.

Bhargava was recognized for his work on various generalizations of the Davenport-Heilbronn estimates and for his recent startling results (with Arul Shankar) on the average rank of elliptic curves.

Rodnianski was recognized for his fundamental contributions to the studies of the equations of general relativity and to the propagation of the light on the space-time curves (in collaboration with Mihalis Dafermos, Sergiu Klainerman, and Hans Lindblad).

Retired Simon (Si) Bernard Kochen

Si is a major figure in mathematics whose contributions in areas of mathematical logic, model theory, number theory, and quantum mechanics are well known to mathematicians and of interest to many who are not professional mathematicians.

Si was born in Antwerp, Belgium. Fleeing from the Nazis, his family was saved due to the selfless bravery of a Norwegian ship captain, who took them from Calais to England where he grew up. He later emigrated to Canada and earned his bachelor's and master's degrees at McGill University. He obtained his Ph.D. from Princeton in 1959 for a thesis in mathematical logic directed by Alonzo Church.

He joined the faculty at Cornell University, rising to professor by 1965, but returned to Princeton in 1967. He served as chair of the mathematics department from 1990 to 1993; after that and until his retirement this year, he continued to serve the department as departmental representative and associate chair with general responsibility for the undergraduate academic program in mathematics.

Si is widely known for three very important and striking results in mathematics, applying techniques of mathematical logic to problems in a variety of fields with results to which he has left his name as a lasting memorial.

1. Ax-Kochen Theorem, for which he and James Ax in 1967 shared the Frank Nelson Cole Prize in Number Theory. This result was developed in a distinguished series of papers applying p-adic techniques and model theory to problems of Diophantine number theory. Si's subsequent work in that area led to what are now known as the Kochen ring and the Kochen operator in number theory.

2. Kochen-Specker Theorem in quantum mechanics, a result that imposes constraints on the permissible types of hidden variable theories that attempt to explain some of the peculiarities and indeterminacy of quantum mechanics through deterministic models involving hidden states. This theorem demonstrates a contradiction between basic assumptions of hidden variable theories and the predictions of quantum theory. The prediction of quantum mechanics on which the Kochen-Specker Theorem was based has been confirmed by a recent experiment.

3. A strengthening of the Kochen-Specker Theorem is the more recent work by Si and John Conway on the Free Will Theorem. That theorem asserts that if human experimenters have a certain amount of free will then so do elementary particles.

Manjul Bhargava, left, and Igor Rodnianski, right, receive the Fermat Prize at the Université Toulouse III in Toulouse, France, from Bertrand Monthubert,center, president of the university.

Congratulations to our former faculty members

Ingrid Daubechies for becoming the president of the International Mathematical Union (2011–2014)

Elon Lindenstrauss for being awarded the 2010 Fields Medal, for work done while a member of our department.

Demetrios Christodoulou and **Andrei Okounkov** for being elected to the National Academy of Sciences on May 3, 2012.

Our most recent alumni

2010 & 2011 Ph.D recipients

Who they are and where they are now

Ben Bakker, NYU Courant Instructor

Bhargav Bhatt, U. of Michigan Ann Arbor, Asst. Professor

Richard Bamler, Stanford University, Simons Postdoctoral Fellow

Francesco Cellarosi, MSRI

Margaret Doig, U. of Indiana, Postdoc

Jacob Fox, MIT Tenure-track Asst. Prof.

Alexandra Fradkin, Center for Communications Research

Elena Fuchs, UC Berkeley, Simons Postdoctoral Fellow,

Hans-Joachim Hein, Imperial College, London, Research Associate,

Thomas Horine, Indiana U., Instructor

Arie Israel, NYU - Courant, Postdoc

Andrei Jorza, CalTech, Postdoc

Jun Kitagawa, U. of British Columbia,Postdoc

Po-Shen Loh, Carnegie Mellon U., Tenure-track Asst. Prof

Garvin Luli, Yale U., Gibbs Asst. Prof.

Martin Luu, Stanford U., Szego Asst. Prof

Simon Marshall, Northwestern U., Postdoc

Richardo A. Saenz, Universidad de Colima, Mexico, Research Professor,

Iman Setayesh, School of Mathematics, Institute for Research in Fundamental Sciences (IPM), Tehran, Postdoc

Vivek Shende, MIT/C.L.E, Instructor

Jacob Tsimerman, Harvard University, Junior Fellow

Peter Varju, Visiting Researcher, Hebrew University – Einstein Institute of Mathematics

Yi Wang, Szego Assistant Professor (2011) Postdoctoral Member, MSRI

Zhiren Wang, Gibbs Assistant Professor, Yale

Phillip Whitman, Associate Director of Research, INTECH Investment Management, Princeton

Hau-Tieng Wu, Princeton University, PACM, Postdoc

Zhong Tao Wu, CalTech, Simons Postdoc

Pin Yu, Tsinghua U., Lecturer

PoLam Yung, Rutgers U., Hill Asst. Prof

John Pardon, continued from page 1

John learned about this problem on his own (and in high school). According to his letters of recommendation, "with this problem, no one had any idea how to get started; the key insight that cracked this problem is due to John." His research paper about this work appeared in the July 2011 issue (volume 174, number 1) of the ANNALS OF MATHEMATICS.

As an undergraduate, Pardon, in addition to publishing several papers and presenting talks at Princeton and other institutions, built a collection of impressive awards:

- shared the Class of 1939 Princeton Scholar Award, given annually to the undergraduate who, at the end of the junior year, has achieved the highest academic standing for all preceding college work at the University.
- twice won the University's Shapiro Prize for Academic Excellence
- received prizes for outstanding achievement within Princeton's mathematics department
- was elected to Phi Beta Kappa
- won the Barry M. Goldwater Scholarship, a national award recognizing outstanding potential in math, natural sciences or engineering.
- won a National Science Foundation Graduate Research Fellowship to support his graduate studies at Stanford University beginning this fall.
- as a cellist he twice won Princeton University Sinfonia's annual concerto competition.
- was a member of the team that won the non-native-speaking section of the International Varsity Debate, a biennial Chinese language competition organized by China Central Television and Singapore's Media Corp, held in Singapore and broadcast across the Chinese-speaking world.

Ph.D Disertations 2010 & 2011

Entropy Bounds for Quantum Limits

Extremal Problems in Combinatorial Geometry and Additive Combinatorics

Donaldson's Theorem, Heegaard Floer Homology, and Results on Knots

Recovering a Variety from its Derived Category

L-Invariants of Low Symmetric Powers of Modular Forms and Hida Deformations

Cohomology of Z-free resolutions of p-groups

Orbit Parametrizations of Curves

Ricci Solitons and Collapsed Spaces

Discrete Analogues in Harmonic Analysis

Topics in Heegarrd Floer Homology

The Jacquet-Langlands Correspondence for GL(2)

On the Uniqueness of Kerr- Newman Black Holes

Moduli Spaces for Rings and Ideals

Towards a Springer Theory for Global Function Fields

Hodge Polynomials of Moduli Spaces of Stable Pairs on K3 Surfaces

Derived Direct Summands

Spherical Seifert Fibered Spaces, Knot Surgeries and Heegaard Floer Homology

Ramsey Numbers

Arithmetic Properties of Apollonian Circle Packings

On Gravitational Instantons

Crystalline Representations for GL(2) Over Quadratic Imaginary Fields

Results in Extremal and Probabilistic Combinatorics

Cm,w Extension by Bounded-Depth Linear Operators

On the Cohomology and Quantum Chaos of the General Linear Group in Two Variables

Marcinkiewicz Multipliers in Products of Heisenberg Groups

Uniqueness Theorems for Linear Wave Equations

Floer Homology and Dehn Surgery

On the Rigidity of Charged Black Holes

Gagliardo-Nirenberg-Sobolev Inequalities and Finite Type

Stability of Einstein Metrics of Negative Curvature

Limit Theorems for the Theta Sums Via Renormalization and Homogeneous Dynamics

A New Construction for the First Janko Group

A Bounded Linear Extension Operator for L2,p R2

Two Regularity Problems in Optimal Transportation

Derformations of Local Properties of Automorphic Galois Representations

Forbidden Structures and Algorithms in Graphs and Digraphs

Relative Hilbert Scheme of Points

Hilbert Schemes of Points on Integral Plane Curves

Towards and Unconditional Andre- Oort Conjecture

Random Walks and Spectral Gaps in Linear Groups

On Some Geometric Inequalities and Applications

On Higher Rank Commulative Actions by Toral Automorphisms

Adaptive Analysis of Complex Datasets

Graduate Program

David Gabai:

Being a Director of Graduate Study (DGS) is a great job. It is fun getting to know the students; it is awesome to watch our students progress from extremely talented first years to full-fledged mathematicians, and it is a pleasure to work with my co-DGS Nicolas Templier. Having Jill LeClair as our ever-friendly, welcoming and organized graduate administrator makes being DGS nearly effortless.

It is interesting to compare how things have changed from when I was a student. The emphasis was and is to give graduate students maximal opportunity to become independent researchers while subjecting them to a minimal amount of requirements. These days some students finish in four years and most finish in five. Most of the students in my class finished in four years; however, we were considered slackers because nearly all students starting a few years earlier who finished, finished in three! I don't think that current students work any less hard, rather our 5th year students are functioning more like postdocs of old. They often have several papers and have multiple projects going. Last year we reduced the language exam requirement from two to one, though many faculty wanted to eliminate it altogether. The general exam is still typically a 2.5-3 hour exam where three professors grill a student on three basic topics and two advanced ones; however, now a student can request his or her committee. We try to accommodate requests, but some professors are extremely popular and get grumpy when we over work them. Most of my fellow students were from North America while now well over half are international. Then and now, they all seem very impressive!

Nicolas Templier:

Serving as DGS in an interesting job. I am happy to work with David Gabai and Jill LeClair. First semester as DGS is like being a first year student; there are many new skills to learn. I like the friendly atmosphere in the department which is well-suited for research and encourages the exchange of ideas between students and faculty. It is great to see students build and pursue their own research path and produce outstanding theses. I enjoy the lunch seminars in the common room. The speaker explains what he feels is really important in the subject, not just why a specific new result is better than what has been done before.

New courses introduced in Spring 2012

MAT 509 Prof. R. Taylor
Algebraic Number Theory: Abelian varieties

MAT 540 Prof. J. Chen
Introduction to Minimal Surface Theory

MAT 568 Prof. P. Ozsvath
Low-Dimensional Topology and Symplectic Geometry: Bordered Floer homology

MAT 584 Prof. Z. Dvir
Topics in Discrete Geometry: Incidence theorems and their applications

MAT 590 Prof. S. Zhang
Topics in Arithmetic Geometry: Congruent numbers and Heegner points

MAT 595 Prof. S. Van Zwam
Matroid Theory

Graduate Student Awards

2010-2011

Andy Manion
National Defense Science and Engineering Graduate (NDSEG) Fellowship

Liangming Shen
Chinese Scholarship Council Fellowship

Ila Varma
National Science Foundation Fellowship

The Princeton University Graduate School Honorific Fellowships, which provide funding to students displaying the highest scholarly excellence in graduate work during the year, were awarded to:

Richard Bamler
Harold W. Dodds Fellowship

Peter Varju
Charlotte Elizabeth Procter Fellowship.

2011-2012

William Cavendish was awarded the 2012 Porter Ogden Jacobus Fellowship, Princeton's top honor for graduate students. The fellowship, awarded for work of the highest scholarly excellence, supports the final year of Ph.D. study.

Cavendish, who will graduate in June 2012, obtained his undergraduate degree in mathematics at the University of Chicago and a master's at Brown University. His work at Princeton focuses on low-dimensional topology and geometry, and, more specifically, questions about symmetries of low-dimensional objects. His thesis advisor is David Gabai.

Graduate profiles

Early recognition for impressive results

Although only in his third year of graduate study, **Arul Shankar** has achieved a major result that made his name widely circulated in the sphere of number theory. Arul had an important role in Manjul Bhargava's work on various generalizations of the Davenport-Heilbronn estimates and the remarkable results on the average rank of elliptic curves, which earned Bhargava the 2011 Fermat Prize.

Arul, originally from Chenai, India, belongs to a family of mathematics lovers: his mother is a computer scientist, his father a mathematician and his younger brother won a silver medal at the International Mathematical Olympiad.

Working with Manjul Bhargava provided Arul not only with a deeper understanding of mathematics, but also with invaluable guidance and human experience.

"The major reason for my decision to work with Manjul," says Arul, " was that I found his work to be extremely beautiful - both the problems and the methods he employs; his work is very simple and yet incredibly deep. When first reading his papers, I found some of the techniques he used to be striking; nothing that I had seen in number theory before was anything like it. Above all else, I find working on these problems truly enjoyable. It was also very important to me that Manjul is an amazingly friendly, patient, and understanding person who is very generous with his time and treats his students more like friends."

The rank of elliptical curves in a nutshell

by Arul Shankar, graduate student

In a paper published in July 2010 with my advisor, Manjul Bhargava, we proved the Birch and Swinnerton-Dyer conjecture for a positive proportion of elliptic curves. We prove that the average rank of all rational elliptic curves is finite. The methods used also imply that a positive proportion of elliptic curves (in fact, at least 10% of elliptic curves) have rank 0. A rational elliptic curve is defined by an equation of the form y^2=x^3+Ax+B, where A and B are integers. The set of rational solutions to such an equation (along with the point at 'infinity') form a finitely generated abelian group. The rank of an elliptic curve is defined to be the rank of its associated group.

PROMYS is a challenging program designed to encourage ambitious high school students to explore the creative world of mathematics. Each summer, approximately 75 high school students from around the country gather on the campus of Boston University for six weeks of rigorous mathematical activity. Through their intensive efforts to solve an assortment of unusually challenging problems in Number Theory, participants will practice the art of mathematical discovery.

The Alice T. Schafer Prize for excellence in mathematics by an undergraduate woman is an annual award established by the Association for Women in Mathematics (AWM).

A young woman's path to success

Ila Varma is a second year graduate student from Albuquerque, NM, who is working in algebraic number theory.

Ila's orientation toward mathematics started early in her education, as her parents always emphasized the importance of mathematics and logical reasoning in everything.. But she credits the Boston University sponsored PROMYS program for having "opened my eyes to pure mathematics as a high school student".

As an undergraduate at CalTech, she continued her contact with PROMYS by working there each summer, an activity that, she claims, allowed her to find more and more reasons to spend her life studying mathematics.

Her dedication to mathematics and the quality of her work brought her a series of awards in her senior year: the Eric Temple Bell Undergraduate Mathematics Research Prize for the best original mathematics paper; an Honorable Mention in the Alice T. Schafer Prize for displaying excellence in mathematics; the HSP Huygens Scholarship.

After graduating with honors in 2009, a Fulbright Scholarship allowed her to spend a year at Leiden University in the Netherlands, where she did a master's thesis under Prof. Bas Edixhoven and obtained a M.Sc. cum laude in Mathematics. Ila came to Princeton with a prestigious NSF Graduate Research Fellowship.

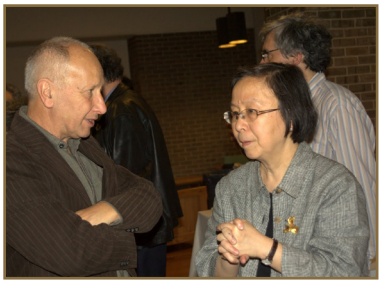
Ila worked with the Princeton Math Circle and continued to attract high school students interested in math. She also serves as the Organizer for the Princeton Graduate Student Seminar.

Conference in honor of Eli Stein

Analysis and Applications: A Conference in Honor of Elias M. Stein

On the occasion of Elias M. Stein's 80th birthday, the department hosted a major international conference in honor of his lifetime accomplishments. The conference, held on May 16-20, 2011, was organized by Charles Fefferman (Princeton University), Alex Ionescu (Princeton University), Duong Phong (Columbia University) and Stephen Wainger (University of Wisconsin, Madison). There was also a Panel Discussion lead by Lillian Pierce (Oxford University) and Rami Shakarchi.

Professor Stein's son, Jeremy Stein, a Professor of Economics at Harvard University, nominated by President Obama to the Federal Reserve Board of Governors, gave a lecture on the "Financial Crisis and Financial Reform."



The inspirational role of Elias M. Stein

excerpts from a longer article written by Lillian Pierce '02 GS '09

I hate to break it to the Hollywood set, but mathematics can be a wonderfully social pursuit. Of course, sometimes we like holing up in solitude while we wrestle with a problem. And maybe we aren't the classiest dressers on campus. But mathematicians don't just float around each other like noble gases. We talk about problems, work together on solutions, give seminars and lectures, write papers and books, advise students, contribute to an oral tradition of anecdotes, and dream about future discoveries; all these interactions serve to build a community of mathematicians. Once in a while someone comes along who is prodigiously accomplished not just in mathematics but also in the more intangible personal skills that build community, and the leadership of such a person can benefit an entire field of mathematics. Last May, a conference at the Math Department celebrated the 80th birthday of just such a leader: Elias M. Stein. Mathematical lectures at the conference illustrated the effect Prof. Stein's mathematical work has had on the field of harmonic analysis (and beyond), but one more unusual event featured a panel discussion of three arenas in which he has had unprecedented success: mentoring, collaborating, and writing books.

Front row from left: Lillian Pierce, Stephen Wainger, Ricardo Saenz, Eli Stein, Charlie Feffermann, Alex Ionescu, D.H. Phong. Second row, from left: Kevin Hughes, Alan Greenleaf, Chris Sogge, Andrea Frazer, Dalia Dafni, Po Lam Yung. Top row: Greg Zuckerman.

Conference in honor of Eli Stein



From left to right: moderators: Rami Shakarchi (GS '09) Lillian Pierce ('02, GS '09); panelists: Loredana Lanzani (University of Arkansas), Stephen Wainger (University of Wisconsin at Madison), Gerald Folland (University of Washington, GS '71), Ingrid Daubechies (Duke University).

Mentoring, collaborating, and writing books

excerpts from a longer article written by Lillian Pierce '02 GS '09 and available in its complete form online

MENTORING. The panelists discussed how to be a good mentor, and several key ideas stood out. At its heart, mentoring aims to increase the awareness of all the possible opportunities and goals available. In particular, mentors can be role models, and this aspect of mentoring can be a motivation for someone who aims to encourage young mathematicians who don't fit the stereotypical image of a mathematician. As a role model, it may be important to analyze the actual image you are projecting, and perhaps adjust how you present yourself professionally or personally to students, depending on what type of inspiration you think the students need. Mentors can convey informal knowledge about the practice of mathematics—not technical points per se, but more of a philosophical or aesthetic sense of how math works, and what makes a question interesting. The altruistic mentality of mentoring need not be dissociated from other professional relationships one has in the context of collaborating, teaching, advising. Being a good mentor, a good colleague, or a good teacher, all involve, in some form, nurturing the members of the community.

It also isn't solely the responsibility of the mentor to initiate and sustain the relationship—if you are feeling in need of some guidance, inspiration, or encouragement, look around: someone you know already is probably ready to help.

COLLABORATING. In many courses in the math department, students are encouraged to collaborate on solving problem sets. Collaboration becomes even more important and rewarding when you start doing original research rather than solving known problems. How to be a good collaborator? Panelists described the singular pleasure of collaborating with Prof. Stein, who conveys such genuine appreciation of each collaborator's contribution, whether large or small, that it creates a positive and trusting environment that in turn stimulates new ideas. Collaboration with a more senior mathematician can be an important form of mentoring in itself, but how does a younger mathematician get the courage to collaborate with someone much more knowledgeable? Just remember that a more senior mathematician probably also has many more responsibilities, and is probably very happy to have a collaborator who will flesh out the main ideas with detailed computations. Of course, mathematical research is not all smooth sailing, and any collaborative project will encounter challenging headwinds.

For advice on how to weather the storm and create a long and fruitful collaboration, one can turn back a century to the four axioms outlined by J. E. Littlewood, who had a famously successful and amicable collaboration with G. H. Hardy, which they carried on in an epistolary fashion (yes, by paper mail).

(1) The writer of the letter is under no obligation to check that the letter is correct;

(2) The recipient of the letter is under no obligation to reply to (or even read) the letter;

(3) It is preferable that both collaborators not think about the same technical point at the same time;

(4) No matter who contributes what to the project, both are credited as equal co-authors.

BOOKS. Good books in math don't have an expiration date. How does one write a good book? First one must determine if the book you'd like to write is actually needed. Then you must hold in mind your intended audience, and shape the book so that it tells a story. There is always a balance that must be reached, between what one wants to write about, and what other people want to read; in particular, the mathematics must be presented in a way that is clearly understandable to the intended audience (for example, with intuitive, consistent notation). Sometimes, there is a need for a book that presents recent research in an expository fashion, so that new ideas become accessible to a wider audience. Some books codify a broad field of research, and reading them becomes a rite of passage for young researchers. Other books are true textbooks, meant to introduce students to classical mathematics. In the case of the Princeton Lectures in Analysis series by Stein and Shakarchi (Fourier Analysis, Complex Analysis, Real Analysis, and Functional Analysis), (***) the texts present classical material but in a new, unified, fashion. Readers ranging from undergraduate students to senior mathematicians point to the many strengths of this series: the variety of interesting applications of the theory (and unconventional proofs of theorems); a large selection of good problems of many different levels; a convincing presentation of the historical origins of ideas.

Mentoring Moebius

by Kevin Wilson, graduate student

Fine Hall can be a scary place. When you arrive as a freshman, you are surrounded by some of the most famous mathematicians on earth, some of the best graduate students, and--perhaps most terrifying at all--some of the sharpest undergraduates in America. Moreover, there are so many classes and tracks that, even for those intrepid enough to stick around, the experience can be daunting.

Our goal in Mentoring Moebius is to help undergraduates navigate this complex world. In the fall of each year, we, in conjunction with the university's Major Choices program and the Undergraduate Math Club, hold several events at which freshmen and sophomores can meet up with upperclassmen concentrators, graduate students, and faculty. During these events, we encourage people to sign up for the Mentoring Moebius program.

For those who sign up, we pair them with graduate student mentors, who have not too long ago been in their mentees' shoes. Mentors get to know their mentees over lunch and coffee as well as at several dinners we sponsor each year. Our hope is that mentors help mentees figure out their interests (in math or otherwise), help them choose classes, and advise them on summer projects.

Mentoring relationships often last several years. As mentees progress through their undergraduate years, mentors often help students determine the faculty member with whom they will do their independent work. Also, they introduce them to other graduate students interested in their chosen topics.

Mentoring Moebius has had great success in bringing together graduate and undergraduate students, and we hope it continues to do so.

Josko Plazonic, Systems Manager, was awarded the 2010-11 President's Achievement Award for his outstanding contributions to the Mathematics Department and the Program in Applied and Computational Mathematics. Plazonic joined the staff in the Department of Mathematics in 2001.

Training, Research and Motion (TRAM)

TRAM, funded by the Global Collaborative Research Fund, is a network between our department and other world leading centers of mathematics. It provides graduate students and faculty with the opportunity to attend special lecture series, workshops, and programs at one of the participating institutions. It also supports research stays at the partnering institutions as well as joint network activities. The current partnering institutions are:

- Hausdorff Center for Mathematics, University of Bonn (Germany)
- Centre for Mathematical Sciences, University of Cambridge(England)
- Moscow Center for Continuous Mathematical Education, Independent University of Moscow(Russia)
- Einstein Institute of Mathematics, The Hebrew University of Jerusalem
- School of Mathematical Sciences, Tel Aviv University
- The Weizmann Institute of Science
- Department of Mathematics at the Academia Sinica (Taiwan)
- Department of Mathematics at ETH Zurich (Switzerland)

The **Noetherian Ring** is an informal organization for the Princeton math department's women at all levels, from freshmen to senior faculty. It offers opportunities for female mathematicians to interact with one another in many different forums, with the goal of building networks of support.

Mentoring Möbius is a comprehensive mentoring program for undergraduates interested in mathematics. Founded in 2006 by the Noetherian Ring, this program has since 2009 been open to men as well as women.

Want advice, discussions of problems, gossip, Elsevier boycott?

GREAT RESOURCES ONLINE

just google them!

Some blogs of note that point to other noteworthy blogs

- Terry Tao *96
- Tim Gowers
- Quomodcocumque
- thecostofknowledge

Massively collaborative mathematics projects - polymath1
a great way for non-academic alumni to keep in touch and participate in current research.

MathOverflow
Connect with mathematicians from all over the world; ask questions, participate in discussions.

Princeton Math Graduate Students' Guide to Generals
not only useful but lots of fun!
www.math.princeton.edu/generals

Undergraduate program growing!

Letters from the undergraduate advisors

Manjul Bhargava
advisor to the seniors

It has been very exciting for the mathematics department lately, as the number of mathematics majors has steadily increased over the past few years, from about 12 a year just ten years ago to about 40 a year today. Judging from enrollment in introductory courses this year, it seems this number will be rising even further in the coming years! The sheer number of enthusiastic students joining our department lately has been a joy to see.

There have been many factors contributing to this new popularity. Several faculty, including Professors Bhargava, Chang, Gunning, Johnson, and Skinner, have been thinking deeply about and constantly adjusting our introductory courses to make them more welcoming and attractive for prospective majors. We are also offering more large, general-audience courses on mathematics such as the interdisciplinary "Magic of Numbers", which has constantly drawn over 100 students whenever it is offered. These courses have introduced large numbers of freshmen and sophomores to the beauty and ubiquity of mathematics, and have helped to increase the profile of and popularize the department on campus. Other new popular introductory courses, in number theory, combinatorics, and game theory, have also made the entry into the mathematics major more flexible.

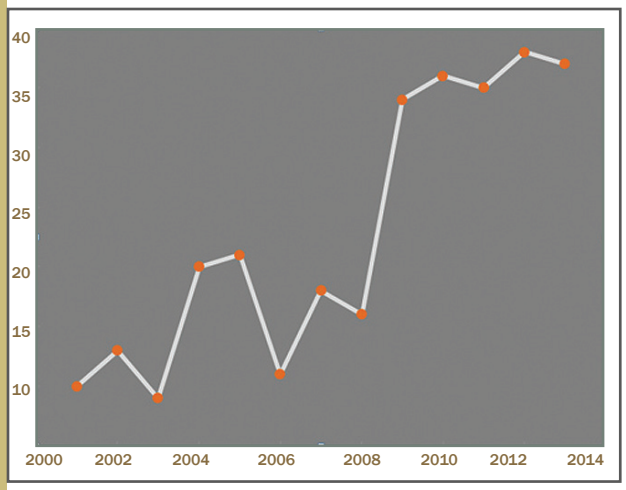
In addition, the entire range of mathematics courses has been reorganized and modernized so that students learn the basics well, but also learn about the many new exciting developments in mathematics research in the last few years (much of it conducted at Princeton by our faculty and graduate students!). There has also been a broadening of the research interests of faculty members working in more applied areas of mathematics. Finally, the mathematics program has emphasized undergraduate research in a wide range of areas, both at the junior and senior level. Through six junior seminars offered every year, juniors get a glimpse of research-level mathematics as well as first-hand experience in communicating mathematics. The senior theses allow for further in-depth research in a broad range of topics in both pure and applied mathematics topics while working one-on-one with faculty members. These initiatives have allowed us to attract not only many more students who want to become professional mathematicians, but also a rapidly increasing number of students who want to make a mark in industry and elsewhere, where the Princeton mathematics major and training gives them a distinct advantage.

Robert Gunning
advisor to the juniors

The undergraduate mathematics program has been changing fairly steadily over the past half dozen years during which I have been acting as an adviser to mathematics majors. This is in part a reflection of changes in the undergraduate student body, with the admission of more students interested in mathematics, especially more "foreign" undergraduates, with previous schooling in Europe or Asia. To that extent, the body of undergraduate mathematics majors has become rather more like the body of graduate students in mathematics.

It is also in part a reflection of a broadening of the fields of interest of the mathematics faculty, with more members of the department interested in areas closer to applied mathematics and closer relations with faculty members in other departments. For instance 14 of the 37 graduating seniors in 2011 had their senior theses directed by faculty in other departments: Chemistry, Computer Science, Economics, Electrical Engineering, Operations Research and Financial Engineering, Philosophy, and even the Woodrow Wilson School of Public and International Affairs. In each case, though, a second reader from the Mathematics Department was closely involved with the senior, available to the student for advice and consultation and a member of the senior final examination committee setting the grades for the senior thesis and for the oral presentation of the thesis that has replaced the final senior comprehensive examination in mathematics.

The possibility of being a mathematics major while interested to a great extent in applications of mathematics to a range of areas has been an important facet of the increasing interest students have in the department. It is still the case that more than half of the graduating seniors continue to graduate work in mathematics or applied mathematics; others go on to a rather wide range of activities, such as medical school, graduate study in economics, work in financial or research corporations, or teaching, for instance. The proportion of women among the undergraduate mathematics majors is still quite small, 6 of the 37 graduating seniors in 2011; but 5 of them graduated with high honors or highest honors in mathematics and 3 of them won departmental prizes. The undergraduates continue to work together well, with a nicely functioning undergraduate math club that, among other activities, runs a successful mathematics competition for high school students in this part of the country.



Increase in the number of mathematics majors at Princeton.

Undergraduate news

Major changes to our curriculum

Due to the increasing number of majors in our department, it has become very important for us to maintain a good spread of courses offered on a regular basis. To accomplish this, at the recommendation of the Math Department Curriculum Committee (Manjul Bhargava, chair; Alice Chang, David Gabai, Robert Gunning, Christopher Skinner, and Nicolas Templier), we have begun to put in place the following changes to the mathematics curriculum at Princeton:

- Eliminating (or upgrading to graduate courses) those undergraduate courses that consistently have extremely small enrollment (eg: Second semester differential geometry, MAT 328)

- Introducing some basic permanent courses consistently demanded by our students, but offered only occasionally in the past (with huge enrollments!). Eg: Representation theory.

- Some of our more advanced undergraduate courses have traditionally been considered graduate courses at most other institutions. We are beginning to transform these courses into what we term "Bridge courses", i.e., courses with graduate course numbers that would be of interest to advanced undergraduates as well as beginning graduate students.

-The "bridge courses" have multiple advantages: 1. they enable graduate students to enroll in them; 2. our undergraduates would be happy to take some graduate courses (making their transcripts more competitive and on par with other schools, such as Harvard); 3. they allow more interaction between undergraduate and graduate students; 4. combining advanced undergraduate/beginning graduate courses, would lead to increased enrollments in them.

- The course numbers we have attached to our courses in the past have been essentially random, making it hard for faculty and students to ascertain what exactly the courses offered, and making it hard for students to comprehend which sets of courses might satisfy their requirements. The numbers have now been assigned more logically so that it is easier (both in the present and in the future) to appropriately adjust our course offerings to our students' needs.

The first digit of a course number indicates the level of the course (first year, …, fourth year, graduate) - this is the university standard. The second digit will be used to indicate the subject area (0: Logic and Foundations; 1: Number Theory; 2: Real Analysis, etc.)

The third digit at the 100-200 level will indicate whether a course is intended as a service course, or primarily for math majors. In the 300's and 400's, it will indicate whether courses are more applied (hence more appealing to other majors) or primarily intended for pure mathematics majors. In the 500's, it will differentiate between bridge courses and more advanced research-oriented courses.

With these numberings, it is now MUCH simpler to describe what our requirements for the pure math major are, and it would also make it easier for other departments to express their math requirements.

(a detailed description is available on our website)

- Students who do not come to Princeton with prior knowledge of proofs were often having trouble with our math-major-entry course 215. A number of students left or considered leaving the math major because they simply could not keep up with their colleagues who had prior experience with proofs.

Therefore, we have proposed that (as at other schools such as Harvard, Michigan, Chicago,…) we offer more than one track of our current MAT 215. The first track would not be as fast-paced or assume any prior knowledge of proofs. The second track would have the same prerequisites as in the past.

Just a few years ago, we did not have enough students in 215 to allow such a split; but we now regularly have 60+ students in 215, so it is natural to split up this course anyway. This proposal will be implemented this Fall (2012) in order to further increase the flexibility of our mathematics major, and to ensure that we don't lose any further promising mathematics majors for this reason.

Philosophy and.....

A thesis in mathematics and philosophy by Jeremy Silver

This thesis will discuss two methods of proving completeness of S4 modal logic with respect to transitive, reflexive relational models. The first is based on Makinson's proof (1966), which uses the concept of a maximal consistent set to construct such models. The other approach is algebraic. In 1948 Tarski and McKinsey showed that S4 is complete with respect to the class of closure algebras. Then in 1951, Tarski and Jonsson extended the Stone Representation Theorem to show that every closure algebra is representable as an algebra of sets with an additional operation arising from a reflexive, transitive relation. With this result, Tarski could have obtained the desired completeness result; however, he overlooked the connection between modal logic and algebra, so it was not until Kripke (1963) that the final result was proved. In this thesis I will outline both the model-theoretic and algebraic proofs and demonstrate that they are effectively the "same" up to isomorphism.

Professor John P. Burgess the John N. Woodhull Professor in the department of Philosophy is also an "associated faculty" in the Department of Mathematics. His connection with the department dates to his undergraduate years when, under the guidance of Simon Kochen, he obtained an A.B. in mathematics (summa cum laude FBK) with a thesis in Probability Logic. He returned to Princeton as a faculty member in 1975, shortly after obtaining his Ph.D. in Logic & Methodology from UC Berkeley.

Publications by prof. J.P. Burgess:

Philosophical Logic (Princeton Foundations of Contemporary Philosophy), Princeton Univ. Press, 2009.

Mathematics, Models, and Modality: Selected Philosophical Essays, Cambridge Univ. Press

Computability and Logic with George S. Boolos, and Richard C. Jeffrey;Cambridge Univ. Press

A Subject With No Object: Strategies for Nominalistic Interpretation of Mathematics with Gideon Rosen, Clarendon Press - Oxford

.....Mathematics

Jeremy Silver, a member of the Tigertones a capella group as well as of the Cube Club, had the opportunity to solve a Rubik cube at the White House where the Tigertones had been invited to sing.

Like many bright high school graduates who come to Princeton, Jeremy Silver, '12, was interested in apparently divergent fields - languages and linguistics, math and physics, philosophy - and had difficulties choosing the one on which to concentrate. By his third year, he found not only a way to continue his love of many areas of knowledge but also a wonderfully satisfying intersection of them: mathematical logic. Now, as a math major, he is working on his senior thesis under the supervision of John Burgess the John N. Woodhull Professor of Philosophy.

Jeremy is one of those creative students who manage to carve their academic path by incorporating all the areas they love. In high school Jeremy learned Latin, Greek and Japanese. When he discovered the beauty of mathematical forms from Pato, and Bertrand Russell led him to formalized math logic, he started to look at languages through a mathematical framework.

At Princeton he took courses in math, economics, engineering, philosophy and linguistics and his choice of majors progressed from comparative linguistics to physics and, finally, influenced by a course of logic taught by prof Nelson, he settled on mathematics.

Jeremy's year saw the greatest increase in the number of math majors, to a large extent because of the increased flexibility and diverse course offerings in the department.

2010-2011 Undergraduate Student Awards

Adam Classen Hesterberg '11 and **Maria Monica Nastasescu '11** shared the Middleton Miller '29 Prize for best independent work in mathematics.

Tzvetelina Kirilova Tzeneva '11 and **Qingzhen Sophie Wang '11** shared the Peter A. Greenberg '77 Prize for outstanding accomplishments in mathematics.

Erick Phillip Knight '12 Andrew H. Brown Prize for outstanding junior in mathematics.

Evgeni S. Dimitriov '13 the Class of 1861 Prize for the sophomore who makes the best record on the Putnam Examination.

Mohit Agrawal '11, a mathematics major from West Lafayette, Indiana, was named a George J. Mitchell Scholar to spend a year studying economics and politics at the National University of Ireland, Galway. The Mitchell Scholarships, awarded by the Washington, D.C.-based U.S.-Ireland Alliance, recognize outstanding American students who exhibit the highest standards of academic excellence, leadership and community service.

Juggling more than numbers

The existence of a Princeton Cube Club and a Juggling Club might not come as a surprise to those who know that the university supports 300 undergraduate and 50 graduate student organizations. More suprising is that, in both clubs, math is the major with most representatives.

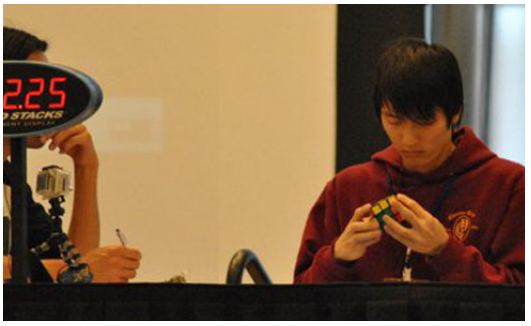
Shotaro ("Macky") Makisumi, '12, came to Princeton with two passions acquired in his early teens: mathematics and cubing. He can now look proudly at his achievements in both: he was admitted for doctoral studies at the University of Chicago and at Stanford, and he founded the Princeton Cube Club where he helped start a tradition of hosting an annual international competition recognized by the World Cube Association.

The Cube refers to the most popular puzzle game in the world (more than 3.5 million sold so far), the Rubik Cube, invented in the late 1970s by the Hungarian Erno Rubik. Interest in the game waned in the 1980 but boomed again in the 21st century due to intense activity on the internet.

Those who hesitate joining the club thinking that striving to solve the puzzle in less than 20 seconds is not much of a challenge, will be happy to know of the many options to make the game more thrilling; one can solve it: blindfolded, underwater in a single breath, using a single hand, with one's feet.

And knowing math seems to help. Shotaro, who was born in Japan, settled with his parents in Pasadena when he was 11. He credits an algebra course taken as a highschool student at CalTech with giving him a mathematical approach to solving the cube, especially when doing it blindfolded. By the age of 15, Shotaro had obtained seven world records in speed cubing.

Shotaro can also solve several cubes while juggling them. And that just might help improve his math abilities. A study conducted at the Oxford Centre for Functional Magnetic Resonance Imaging of the Brain (FMRIB) and published in the journal Nature Neuroscience, shows improved brain connectivity as a result of the movements involved in juggling.



Above: Shotaro Makisumi at a competition.
Below: members of the juggling and cube clubs.

More than math

Alex Kontorovich, clarinet; Adrian Banner, piano. Photos by Alan Lankin

Manjul Bhargava, tabla.

Math and Music

Every year, thanks to the efforts of our Graduate Administrator, **Jill LeClair,** the department organizes a music recital in Taplin Hall. It is a a rewarding reminder of the strong connection between the abstract beauty of both mathematics and music and the creativity necessary to display it to the world. It is also a delightful occasion for students, faculty, and alumni to get together and share their love of music.

The recital has a long history of intermittent production but its current form and organization is due to the initiative of a visiting professor, Tim Gowers (currently at Cambridge University) and three talented students: undergraduates Lillian Pierce, and Alex Kontorovich, and graduate student Adrian Banner. The first music recital was organized by Jill LeClair in Taplin Auditorium on May 24, 2002.

The recital continued to take place in May until last year when its date was moved to December. Originally a small performance by four people, over the years the recital induced more alumni to return and more Fine Hall people to participate, leading to a play list of more than 10 musicians.

While some of our musicians are casual amateurs, others are accomplished performers, members of successful ensembles who participate in international music events. Lillian Pierce (violin) and John Pardon (cello) were soloists with the Princeton University Orchestra and won various competitions for their instruments. Adrian Banner and Alex Kontorovich are members of the Klezdispensers, a popular group that appears frequently at various East Coast locations as well as in Canada. Professor Manjul Bhargava is a student of world renowned tabla player, Zakir Hussain.

Some of Our Musicians

prof. Bill Browder - flute
prof. Manjul Bhargava -tabla
Adrian Banner *02 - piano
Alex Kontorovich '02 - clarinet
Lillian Pierce '02 *09 - violin
Robert Haraway- electric guitar
Kevin Wilson - piano
Francesco Cellarosi -saxophone
Ilya Vinogradov - violin

Students, faculty, staff and alumni who would like to perform at the next recital are encouraged to email Jill LeClair.

We are grateful to our donors

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

The **Fernholz Foundation** for their funding of the Minerva Lecture Series and the Minerva Distinguished Visiting Fellow, as well as other needs of the department.

A bequest from **Jane H. Lukens W30** to establish the **Jaywood Lukens '30 Scholarship Fund** for 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.'"

Wei Tong Shu *90

With the help of Prof. Shiing-Shen Chern and Prof. Wu-Chung Hsiang, whom I met in China, I was accepted by the math PhD program at Princeton University. I arrived in Princeton on Sept. 3, 1986 with two suitcases and $50 in my pocket. I felt I was the luckiest person on Earth. Thus began the journey of a young man from a village in China in pursuit of the American Dream.

At Princeton, I became interested in Partial Differential Equations and General Relativity, and I wrote my dissertation in Yang-Mills equations under the supervision of Prof. Sergiu Klainerman. After my PhD, I started my academic career in three top institutions: IHES in France, IAS in Princeton, and MIT. I was 25 at the time, my academic success promoted my curiosity, which went beyond the math world. I left the "ivory tower" and went to work on Wall Street, first with two short stays at Morgan Stanley and Goldman Sachs, and finally settling at Bear Stearns for 15 years, as the Senior Managing Director for Head of the Interest Rate Options and Exotics Trading in New York.

With the math PhD from Princeton, I gained my entrance to the world of finance as a quant and had the great fortune to work under the famous Fisher Black at Goldman Sachs. However, as I wanted to experience the more dynamic action of the business world, I quickly switched to become a derivative trader at Bear Stearns. As my advisor, Prof. Klainerman would say, I have no patience. I think trading fits me well with its quick actions and quick results. The analytic and quantitative training in Princeton has served me well throughout my career in business.

When Bear Stearns collapsed in 2008 during the financial crisis, I lost my job, and took some time off to ponder the future. But, as I love working in the dynamic world of financial markets, I later returned to the business, this time working for the Dutch Bank, ING, as the Managing Director for Head of the Interest Rate and Exotics Trading in Asia. As a trader, I often say that I would rather be lucky than be smart every day. My best luck in life is being a Princetonian.

Nathan Kaplan '11

Here's my life update, mathematical and otherwise, since graduating in 2007. I spent a year in Cambridge studying with other '07 math majors Ian Petrow, Tammy Broderick and Michael Li, where I learned that in England everything is a little classier, including maths with its extra 's' at the end. After serving my time as a 'mathmo' (please start using this term) I moved over to Cambridge in Massachusetts to study at Harvard. I'm in my fourth year of the PhD program working on some problems in number theory with Professor Noam Elkies. In the math department I am surrounded by Princetonians like Ana Caraiani '07, Aaron Silberstein '07, Andrei Negut '08, George Boxer '10, and Adrian Zahariuc '11 (not to mention all the former Tigers down the road at MIT).

Studying math at Princeton prepared me well for much of what I've encountered at Harvard, but unfortunately not so well for my 2009 appearance on Who Wants to be a Millionaire. It turns out I should have spent less time working late on problem sets and more time watching Gone with the Wind and learning about flowery textiles. Unfortunately I didn't draw the question from an earlier season of the show, How many edges are there on a cube? (which of course is 8+6-2, by Euler's formula), or the $50,000 question from two months before my appearance- Which of these snack foods are common examples of hyperbolic paraboloids, a type of mathematical shape? A. Funyuns, B. Bugles, C. Pringles, D. Combos. (This is left as an exercise for the interested reader.)

No matter where the world of math ends up taking me (hopefully to Jeopardy next), Fine Hall will always have a special place in my heart. I am particularly excited to see it when I come back this year for my 5th reunion! I'll close with a piece of advice for current students: Studying math at Princeton is a wonderful opportunity. Make the most of it!

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Summer Program in Analysis & Geometry

funded by an NSF/RIG grant

July 23 – Friday, August 10, 2012

A three-week intensive program for 30 advanced undergraduates and first-year graduate students consisting of two related courses in analysis and geometry, each with nine lectures spanning 1.5 weeks.

Week 1 into Week 2: July 23 - August 1

Harmonic Analysis: Some basic operators and the role of curvature (A. Israel, Courant Institute/NYU and E. Stein, Princeton University).

The course provides an introduction to Fourier transform, Lp spaces, and several essential operators, such as the Hardy-Littlewood maximal function, fractional integrals, and singular integrals. Presentations on: the Radon and X-ray transform. Spherical averaging operators and the corresponding maximal functions; generalizations of the above where "non-vanishing" curvature plays a role; restriction theorems.

Week 2 into Week 3: August 1 - August 10

Nonlinear Evolution Equations (A. Ionescu and S. Klainerman, Princeton University).

The course provides an introduction to applications of Fourier analysis to the study of certain nonlinear evolution equations. Topics covered: restriction theorems, $\Lambda(p)$ problems, Strichartz estimates; applications to nonlinear Schroedinger equations, geometric wave equations and classical field theory; applications to Yang–Mills and wave maps in the Minkowski space.

Newsletter edited by Anca Niculin, printed by the Print & Mail Services, Princeton University

2011-2012 Undergraduate Awards

The George B. Covington Prize in Mathematics for excellence in mathematics.
Xue Liu
Shotaro Makisumi

The Middleton Miller '29 Prize for the best independent work in mathematics.
Edgar Dobrian, **Oleg Lazarev**
Chuen-Ming Mike Wong

The Peter A. Greenberg '77 Prize for outstanding accomplishments in mathematics.
Hyungjune Kang
Evan Brooks Warner

The Andrew H. Brown Prize for outstanding junior in mathematics.
Matthew Carl Superdock '13

The Class of 1861 Prize for the sophomore who makes the best record on the Putnam Examination.
Qiuyi Zhang '14

Sigma Xi Book Award for Outstanding Research to.
Oleg Lazarev