Math Times

Altgeld Hall, University of Illinois at Urbana-Champaign

Campus commits $30M to Altgeld/Illini Hall renovation project!

There has never been a greater need or demand for mathematics and mathematicians. New science and technology are creating unprecedented opportunities to address serious societal challenges and advance the human condition. Mathematics provides uniquely effective tools for solving problems and communicating about them; it makes interdisciplinary research in the sciences possible. At Illinois, the number of majors in Actuarial Science, Mathematics, and Statistics is up 30% since 2003, and including majors and non-majors we teach 30% more student-classes than we did then.

The world-class scientific enterprise at Illinois puts the Departments of Mathematics and Statistics in an extraordinary position to assume national leadership in the mathematical sciences. And yet we face a crisis: insufficient space that is also in outdated and poor condition hampers our progress towards greater national leadership.

With the support of the College of Liberal Arts and Sciences and the Urbana-Champaign campus, we have developed ambitious plans to renovate these buildings. The overall cost is estimated at between $80 million and $90 million.

We are very pleased to report that the campus has committed $30 million towards this renovation. This commitment is a wonderful continuation of the university's historic investment in excellence in the mathematical sciences, and recognizes the fundamental role that Mathematics and Statistics play in the mission of the University. With the campus's support, we plan to seek the remaining funding from a combination of private support and state funds.

Rendering of proposed collaborative space (top) and diagram showing collaborative spaces (purple shaded areas) planned for the renovated Illini Hall. Images by De Stefano Partners.

The proposed project will restore Altgeld Hall to its historic splendor and bring its facilities up to the standards worthy of a world-class University. It will transform Illini Hall from an aging anachronism into a vibrant center for collaborative learning and research. The proposed renovation will move Illinois to the forefront of a revolution in new quantitative methods in science and society, and it will benefit the thousands of students who learn from our courses each year.

Specifically the renovation will

• modernize 14,600 square feet of classroom space and create 6,800 square feet of new classroom space, appropriate for the interactive learning which is essential for 21st century instruction.

• create 5,300 square feet of space for collaborative instruction and research, an increase of almost 700%.

• unlock 11,000 square feet of new space for growth in these two departments.

• remake Altgeld and Illini Halls into campus destinations for interdisciplinary collaborations.

• enable us to put interaction between faculty and students at the center of the Illinois experience in Actuarial Science, Mathematics, and Statistics.

We are excited to embark on the journey to raise funds and begin construction on Altgeld and Illini Halls, a journey whose culmination will profoundly change the mathematical sciences at Illinois. There will be many opportunities to become involved in this exciting project. If you are interested, please contact Matthew Ando or Sheldon Katz.

Illinois Math Reception

The 2014 Joint Mathematics Meetings will be held January 15–18, 2014, in Baltimore, MD. The Illinois Department of Mathematics will host a reception on Friday, January 17, from 5:30-7:30 p.m. in the Johnson Room, located on the first floor of the Hilton Baltimore.

Everyone ever connected with the department is encouraged to get together for conversation and to hear about mathematics at the University of Illinois.

Follow us on Facebook and LinkedIn

Look for "Illinois Department of Mathematics" on Facebook and LinkedIn and find out about upcoming events, news items, and other happenings on campus. Check out the photo albums on our Facebook page with photos from the recent PhD alumni reunion and past homecoming events. Also, be sure to check out the videos on our Illinois Department of Mathematics YouTube channel!

From the department chair

Dear Friends,

The stories in this issue exhibit many aspects of what our department does: bring together outstanding faculty and students, and enable them to do great mathematics.

Our faculty are doing exciting research, and they are being recognized for it. Kay Kirkpatrick describes some of her work to understand superconductors, which among other things has been recognized with an NSF CAREER award. Rinat Kedem, Charles Rezk, and Slawomir Solecki have been invited to present their research at the 2014 International Congress of Mathematicians, in Seoul, Korea. Several of our faculty have received national and university recognition for their outstanding contributions.

We continue to recruit outstanding faculty. New faculty and postdocs provide essential renewal of our research and teaching. The constant influx of new faculty and students makes the university in general and our department in particular an exciting and vibrant place to work.

The department plays an important role in building the mathematics workforce at both the graduate and undergraduate level. In a typical year, we produce between 1% and 2% of the Mathematics PhDs in the country. The list of recent PhDs and what they are doing now hints at the diversity of their careers and the roles they will play in the future of the mathematics enterprise.

We have more than 800 undergraduate majors, and we are increasingly focused on involving undergraduates in research, for example via the BioMath project and the Illinois Geometry Lab. Research provides our students with an opportunity to develop and show creativity and initiative, and to put mathematics into action. The profiles of alumnus Tom Schrickel and undergraduate student Sarah Manuel suggest how powerful mathematics put into action can be.

Finally, to deliver a mathematics education worthy of the University of Illinois, we must provide world-class facilities. The proposed renovation of Altgeld and Illini Halls will renew our entire enterprise, providing a strong foundation on which to develop the mathematics and the mathematicians of the future.

Matthew Ando
Chair, Department of Mathematics

Tom Schrickel

by Jim Dey

Mathematics and music always came naturally to Tom Schrickel. He pursued both during his time at the University of Illinois and, 40 years later, continues to do the same. Math is his vocation, and music is his avocation.

"It's good to have a balance and spend time on things outside your business," said Schrickel, who is 62 and lives in Chicago.

But Schrickel's business—the structured lease financing industry—comes first. It's been a passion since a supervisor at the Continental Bank in Chicago suggested many years ago that he give it a try.

"I immediately fell in love with it, and I've been in the lease financing business ever since," said Schrickel, noting that he uses "my mathematics education as a part of my everyday life."

One of three children, Schrickel grew up in Sioux City, Iowa, and Palatine, Illinois, where his father worked for the Quaker Oats Co. A World War II veteran who went to the University of Wisconsin to study agronomy on the GI bill, Schrickel's father, Don Schrickel, emphasized the importance of education to his children.

"He was really proud of his education because it enabled him to take the next step and provide for his family," Schrickel recalled.

Noting that his son had an aptitude for math, the senior Schrickel urged him to study math in college because it would provide a solid foundation for whatever career he chose. "Those words really rang true, and I go around preaching that now," he said. "I thought math would be a great foundation, and I still think that."

In 1969, Schrickel followed his older sister Sue to the University of Illinois, where he was admitted as a James Scholar. Schrickel said he had a great experience at the UI, finding the professors in the math department to be "really outstanding" and his experiences playing piano and bass in the UI's concert band, orchestra, and jazz program exhilarating.

Schrickel's musical skills allowed him to earn extra cash as a student, but he said he decided to rely on his math studies to earn a living. He was particularly excited to move into higher level math courses that required abstract thinking involving "definitions, theorems and proofs," not straight formula-based problem solving.

"It's that type of analytical thinking I have tried to use throughout my business career," he said.

After graduating from the UI in 1973, Schrickel worked at Continental Bank by day while taking graduate classes in business administration at the University of Chicago by night. He recalled that it was a "difficult three years" because "there was no time to do anything other than work and go to school."

Even as he studied for his master's degree, graduating in 1976, Schrickel said his career at the bank was flourishing. He started in cost accounting, helping bank managers determine the costs of providing their various services.

"It was fascinating for someone who had essentially no business experience," said Schrickel. It was Schrickel's analytical skill that prompted his boss to eventually suggest he apply for a job in Continental's lease financing unit.

An arcane area of corporate finance, lease financing involves the purchase of high-cost capital equipment for companies that can't afford to buy it outright. The purchaser then leases the equipment to the user company at a price it can afford. An example would be that of an airline owning half the planes in its fleet while leasing the other half from lessors like Goldman Sachs or GE Capital.

Schrickel said that the business is extremely competitive because multiple bidders often vie for the leasing contract, requiring the winner to put together the most financially creative proposal.

After working for other companies for 20 years, he started his own—Schrickel Capital Corp.—in 1995. He is the only employee, working from a home office but said "it's not like I'm by myself."

"I'm always part of a team. ...The knowledge is very specialized, and many investors need advisors," Schrickel said, noting that he coordinates with lawyers, appraisers and accountants to put a transaction together.

"I typically advise the equity investor in the project, the people who are going to own it," he said. "I like doing aircraft and railroad cars. But the power plant area is most interesting because it is the most complicated. We have a direct tie to the mathematics world with the use of linear programming to optimize financing structures."

He said being self-employed allows him to work as much as he wants but that he plans to work "until my clients stop calling me." "The business I do is intellectually challenging" he said. "I enjoy solving problems for my clients."

But Schrickel said he does like taking time off, often traveling with his wife, Patricia Krapf, to Lake Geneva, Wis., and Scottsdale, Ariz. He golfs, reads and hikes, and maintains a relationship with the UI by serving on the department's Mathematics Development Advisory Board. One of his favorite activities outside the office is performing monthly with longtime friends in the Jazz Consortium, a 17-member jazz band playing at Durty Nellie's Pub in Palatine.

"It's like playing on a winning sports team," he said. "It's a great feeling when the band has a good night."

Jim Dey is an editorial writer and columnist for The News-Gazette in Champaign, Il.

RESEARCH HIGHLIGHT

Superconductors and Other Supercool Phenomena

by Kay Kirkpatrick

We face a big challenge in mathematical physics—to explain physical phenomena rigorously from first principles. The cool phenomenon of superconductivity, for instance, poses the question: Can we start from microscopic dynamics and derive rigorously the phenomenological theories of superconductivity?

Superconductors have essentially zero resistivity at low temperatures, but there is more to them than just perfect conductivity: Magnetic fields are expelled and bend around the superconductors, allowing levitation and applications such as particle accelerators and MRI machines. Phenomenological theories of superconductivity include Bardeen, Cooper, and Schrieffer's proposed theory in 1957 at the University of Illinois at Urbana-Champaign as an approximation; Ginzburg and Landau's in 1950 as a macroscopic description; and Bose-Einstein condensation in the 1960s at zero temperature. Physicists are trying to build and understand new superconducting materials that could lead to innovative technologies; physicists like Nadya Mason at Illinois have discovered surprising zero-temperature metallic states and other cool features in superconductor arrays.

A powerful approach to understanding these phenomena is to construct scaling limits, which can be visualized by considering a drop of dye in water. If we could zoom in to watch the dye on the molecular scale, the dye particles would look like billiards hitting other particles. Each one goes in a straight line for a short time, then hits another particle and goes in a new direction until the next collision. The particles' microscopic motion is Newtonian and sensitive to their initial position and velocity. Zooming out to the large scale, we see the dye diffusing throughout the water, spreading out uniformly. The macroscopic behavior is probabilistic and given by the diffusion (or heat) equation. Connecting this microscopic motion to the macroscopic behavior is the kind of scaling limit that we seek to construct.

Constructing scaling limits requires mathematical tools from probability, functional analysis, and partial differential equations. In my research, I develop tools to prove scaling limits, and I also study the mathematical aspects of both microscopic and macroscopic descriptions. These scaling limits include 1) Mean field limits, which often give the first insights into physical phenomena, and 2) Continuum limits, which justify discrete approximations of continuous phenomena.

I study mean-field limits for spin models of magnets and superconductors, models with particles that have spins in the circle (XY model) or in the sphere (Heisenberg model). My collaborators and I have discovered interesting non-normal behavior at the critical temperature in the mean-field Heisenberg model. We have also constructed a chain of XY models that exhibits a two-step phase transition to superconductivity, but so far the zero-temperature metallic state remains mysterious—it might be a spin glass, with random interactions between particles. It would also be nice to discover the critical behavior of more general mean-field spin models, and some of the results could have applications beyond physics, to neural networks.

Mean-field limits are also the first approach for understanding the interaction of bosons and rigorously deriving the cubic nonlinear Schrödinger equation (NLS) from the microscopic quantum dynamics. The cubic NLS gives the macroscopic description of Bose-Einstein condensation (BEC), in which a gas of supercooled bosons all occupy the same state and behave like a giant quantum particle.

Continuum limits of nonlinear lattices with long-range interactions have been proposed in the physics literature to understand electron transport in biopolymers like DNA, and we have been rigorously justifying the proposed fractional-derivative NLS models. The dynamics of the fractional NLS are interesting, with a twist on the Newtonian equations of motion for the expected position and momentum.

I hope both to deepen our understanding of nonlinear PDEs and to broaden applications in engineering and medicine. Developing mathematical tools will help us understand physical and biological phenomena; rigorously understanding these phenomena will help us advance mathematical knowledge.

Image credit: University of Fribourg (unifr.ch)

Kay Kirkpatrick

Kay Kirkpatrick is an Assistant Professor in the Department of Mathematics at the University of Illinois at Urbana-Champaign. She completed her PhD in 2007 at the University of California, Berkeley, under the direction of Fraydoun Rezakhanlou. She was an NSF postdoc at MIT, Courant Instructor at NYU, and PIRE fellow at Paris IX before joining the department in 2011. Her research interests are in statistical mechanics, probability, and partial differential equations. Currently she focuses on quantum probability, many-body dynamics, and models for condensed matter. Kirkpatrick received a 2013 NSF CAREER award.

Learn more about Kirkpatrick on her website at www.math.illinois.edu/~kkirkpat/.

Kedem, Rezk and Solecki to give invited lectures at ICM

Professors Rinat Kedem, Charles Rezk, and Slawomir Solecki have been invited to give lectures at the 2014 International Congress of Mathematicians (ICM) to be held August 13-21, 2014, in Seoul, Korea. The ICM is the largest international gathering in mathematics; it takes place once every four years, with invited speakers talking about the most important research developments in mathematics since the last ICM meeting. An invitation to speak at the ICM is among the most prestigious honors in mathematics. The program calls for a total of 200 invited lectures for the whole world. To have three ICM speakers from one department is a rare distinction.

Rinat Kedem will present her lecture in the Mathematical Physics section. After receiving her undergraduate degree in physics at Macalester College in St. Paul, Kedem did her graduate work under the supervision of Barry McCoy at the Institute for Theoretical Physics at Stony Brook. Her specialization was in the statistical mechanics of phase transitions in integrable models. Her conjectures from that time, about "fermionic character formulas" for the Virasoro modules related to conformal field theories, have given rise to an entire genre of research in combinatorial representation theory, which is active to this day. They have also proved to be related to wave functions in the quantum Hall effect in condensed matter physics.

Kedem later worked with Sato's "Kyoto School" of integrable models, then led by Tetsuji Miwa and Michio Jimbo. The specialty of this school is solving integrable models using the representation theory of quantum groups and affine algebras. Prior to coming to Illinois, Kedem also held positions at the University of California at Berkeley and the University of Massachussetts at Amherst.

Philippe Di Francesco, Morris and Gertrude Fine Distinguished Professor of Mathematics at Illinois, said of Kedem, "Rinat is a theoretical physicist turned mathematician. With representation theory as her all-time specialty, she worked on integrable lattice models and quantum groups with B. McCoy, B. Feigin, M. Jimbo and T. Miwa, and was at the origin of the still-developing subject of fermionic character formulas in representation theory. She applied this to problems in condensed matter physics with E. Ardonne and M. Stone, and made the connection to cluster algebras, another rapidly developing subject, on which we collaborated since 2007. Rinat has this special and unique ability to forge ahead and look for possible connections between her own work and other areas of both mathematics and theoretical physics, which is facilitated by her command of both languages."

Charles Rezk will present his lecture in the Topology section at the ICM meeting. His research interests lie at the intersection of algebraic topology and higher category theory. One branch of his work gives a definition of the notion of an "(∞, n)-category", which has been used in recent work in topological quantum field theory. Other work of his has helped to clarify the connections between algebraic topology and the theory of formal groups.

Rezk got his PhD at MIT in 1996, working under Mike Hopkins. After several years as a postdoc at Northwestern University and year at the Institute for Advanced Study at Princeton, he joined the Illinois Department of Mathematics in 2001.

Of Rezk, Professor Randy McCarthy says, "He wrote one of the founding documents in the ∞-category revolution, and he is a world leader in abstract homotopy theory. He recently extended Rezk's Segal Spaces to a powerful approach to (∞, n) spaces, now commonly called Rezk's theta-spaces. In an entirely different direction, Rezk is a world leader in the study of chromatic stable homotopy theory. In particular, he created the Rezk Logarithm and went on to make remarkable progress in understanding the power operations in Morava E-theory."

Slawomir Solecki will present his work in the ICM's Logic and Foundations section. Solecki got his PhD at Caltech in 1995 under the supervision of Alexander Kechris. After a postdoc at UCLA,

Image credit: iStock

he moved to Indiana University and then, in 2001, joined the Illinois Department of Mathematics. His research is, for the main part, motivated by studying dynamics of large groups (usually equipped with a metric separable, complete topology but lacking Haar measure). These explorations are informed by mathematical logic, in particular, by descriptive set theory, and involve, in an essential way, Ramsey theory and concentration of measure phenomena. Solecki proved the first instance of a conjectured dichotomy characterizing Borel equivalence relations reducible to orbit equivalence relations of Polish group actions. He clarified the relationship between extreme amenability of groups and concentration of measure by proving a Ramsey theorem using fixed point methods from algebraic topology, and developed an abstract, unified approach to finite pure Ramsey theory.

Professor Lou van den Dries said, "Solecki is a central figure in descriptive set theory and its interactions with analysis, topology, and combinatorics. His recent work on Ramsey theory is particularly prominent. He was hired in 2001 when the logic group in the department consisted of Henson (retired 2010), Jockusch (retired 2004), Pillay (now at Notre Dame), and myself. At the time descriptive set theory had become a very active area of research, with Solecki a rising star. Back then we were very happy when he joined our department, and are now delighted to hear that he has been invited to speak about his work at the 2014 ICM."

To learn more about the ICM, visit the conference website at www.icm2014.org/.

NEW FACULTY

Anil Hirani
Associate Professor
PhD 2003, California Institute of Technology

Anil Hirani completed his PhD at Caltech. His PhD years were sandwiched between jobs—in Silicon Valley and Tokyo before PhD and at the Jet Propulsion Lab and the University of Illinois Computer Science Department after PhD. He is interested in applied and computational mathematics. Specifically, he works on discretizations of exterior calculus as numerical methods for PDEs; and on applied and computational topology. He lives in Champaign with his wife and 3 children and enjoys growing vegetables in the family garden.

Anil Hirani

Ikemefuna Agbanusi
J.L. Doob Research Assistant Professor
PhD 2013, Boston University

Ike Agbanusi obtained his PhD at Boston University. His research interest is in partial differential equations and most especially in boundary value problems, Schrödinger operators and geometric applications. When he is not doing mathematics, Ike likes to spend time cooking, hiking and running with his girlfriend Jill. He also enjoys fantasy novels.

Ikemefuna Agbanusi

Funda Gultepe
Visiting Assistant Professor
PhD 2013, University of Oklahoma

Funda Gultepe completed her PhD at the University of Oklahoma under the supervision of Kasra Rafi. Her research interests are in intersections of geometric group theory and low dimensional topology which include mapping class groups, group of outer automorphisms of the free group, and random walk on groups. She enjoys using low dimensional topology in solving group theoretical and dynamical problems of on groups. Outside of mathematics, she enjoys reading both fiction and nonfiction and watching films.

Funda Gultepe

Ioan Marcut
J.L. Doob Research Assistant Professor
PhD 2013, Utrecht University

Ioan Marcut grew up in the town of Sibiu in Romania. He obtained his undergraduate degree in mathematics in 2007 at Babes-Bolyai University, Cluj, Romania. In 2007 Ioan moved to Utrecht, The Netherlands, where he joined the master class program "Quantum Groups, Affine Lie Algebras and their Application." During 2008–2012 he was a PhD student under the guidance of Marius Crainic in Utrecht, where he continued his research as a postdoctoral fellow, before joining our department in August 2013. Ioan's research is in the field of differential geometry, more specifically, he studies Poisson manifolds. Poisson geometry lies at the intersection of three very active areas of mathematics, namely Symplectic Geometry, Foliations and Lie Theory.

Ioan Marcut

Babak Modami
Visiting Assistant Professor
PhD 2013, Yale University

Babak Modami completed his PhD at Yale University under the supervision of Yair Minsky in May 2013. His research involves geometry, topology and dynamics of surfaces and their moduli spaces. He uses various combinatorial and coarse techniques to study geometric flows on the Teichmüller space, and also the mapping class group of surfaces. The focus of his PhD thesis was on developing a kind of symbolic coding for Weil-Petersson geodesics. He enjoys living in the cities of Champaign and Urbana and interacting with other scholars and students at the University of Illinois.

Babak Modami

Theodore Molla
J.L. Doob Research Assistant Professor
PhD 2013, Arizona State University

Theo Molla completed his PhD under the supervision of Henry Kierstead and Andrzej Czygrinow at Arizona State University. Prior to his PhD he worked as a computer programmer in the greater Phoenix Area. His research is in graph theory with an emphasis on directed graphs and extremal problems.

Theodore Molla

Stefan Müller
Visiting Assistant Professor
PhD 2008, University of Wisconsin-Madison

After completing his PhD at the University of Wisconsin-Madison in 2008 under the supervision of Yong-Geun Oh, Stefan Müller was a Research Fellow in the School of Mathematics at Korea Institute for Advanced Study. Before joining the Illinois Department of Mathematics, he spent one year as an Assistant Professor of Mathematics at Penn State University in Altoona. His research is in symplectic and contact geometry, with the main focus on topological Hamiltonian and contact dynamics. These relatively new theories are motivated by classical mechanics, and have applications to smooth and topological dynamics as well as to other branches of mathematics. Stefan enjoys spending his precious free time with his wife Minhye and their son Leon Maximilian. Other interests include playing and watching soccer, and his two cats Oskar and Curry.

Stefan Müller

Laura Schaposnik
J.L. Doob Research Assistant Professor
PhD 2013, University of Oxford

Laura Schaposnik grew up in La Plata, Argentina, where she did her undergraduate degree in Mathematics. She moved to England in 2008 and completed her PhD in 2013 from the University of Oxford under the supervision of Nigel Hitchin. Before coming to Illinois, she spent a year as a Wissenschaftlicher Assistent at Universität Heidelberg, Germany. Her research interest is on the moduli space of Higgs bundles and its relation to representation theory, algebraic geometry and mathematical physics. During her spare time, she enjoys teaching math in schools, cooking, taking photos for her Project 365 and exploring new cities.

Laura Schaposnik

Lizheng Tao
Visiting Assistant Professor
PhD 2013, Oklahoma State University

Lizheng Tao grew up in Shanghai China. He finished his PhD in 2013 at Oklahoma State University, under the direction of Dr. Jiahong Wu. His thesis focused on regularity problems of the partial differential equations, like the Navier Stokes, Boussinesq and Magnetic-Hydrodynamic equations. His current research interests also include other nonlinear PDEs derived from fluid dynamics. His personal interests and hobbies include working on automobiles and playing volleyball.

Lizheng Tao

Anush Tserunyan
J.L. Doob Research Assistant Professor
PhD 2013, UCLA

Anush Tserunyan grew up in Yerevan, Armenia, where she received her undergraduate and Master's degrees in computer science from Yerevan State University. She completed her PhD in mathematics at UCLA under the supervision of Alexander Kechris (Caltech). Her research lies in descriptive set theory, and focuses on the theory of definable equivalence relations and its applications in ergodic theory and topological dynamics. In her free time (what?), she either plays piano and tries to compose, or gathers and recycles the scratch papers of her fiancé (also a mathematician). If she is forced to exercise, she does fencing.

Anush Tserunyan

Yi Zhang
Visiting Assistant Professor
PhD 2012, University of Minnesota

Yi Zhang completed his PhD at the University of Minnesota under the supervision of Gennady Lyubeznik. His research interests are in commutative algebra and algebraic geometry. Specifically, he studies the computation of local cohomology modules over polynomial rings and the vanishing of Chow groups over regular local rings. Outside of mathematics, he loves travelling with his wife.

Yi Zhang

NEWS

Faculty Achievements

Alexander and D'Angelo named 2014 AMS Fellows

Professor Emerita Stephanie Alexander and Professor John D'Angelo have been selected to the 2014 class of Fellows of the American Mathematical Society (AMS). Alexander and D'Angelo are two of only fifty mathematical scientists selected for this honor this year. Alexander was cited for her contributions to geometry, for high-quality exposition, and for exceptional teaching of mathematics. D'Angelo's was cited for his contributions to several complex variables and Cauchy-Riemann geometry, and for his inspiration of students.

The AMS Fellows program, created in 2012, recognizes AMS members for outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics. To learn more about the AMS Fellows program visit www.ams.org/profession/ams-fellows/.

Berndt receives honorary doctorate

In December 2012, Professor Bruce Berndt received an honorary doctorate from SASTRA University in India. Berndt, Richard Askey, and George Andrews, known as the "Ramanujan Trinity," received their honorary doctorates at the SASTRA conference "The Legacy of Ramanujan" marking the 125th anniversary of the birth of the 20th century Indian mathematician Srinivasa Ramanujan. Professor Berndt holds the distinction of being known as Ramanujan's mathematical biographer, because he edited the original three notebooks of Ramanujan in five volumes and, with Andrews, is editing Ramanujan's lost notebook in another five volumes.

Ahlgren named University Scholar

Professor Scott Ahlgren has been named a University Scholar. Begun in 1985, the scholars program recognizes excellence in teaching, scholarship and service on all three U of I campuses. Ahlgren, a Professor of Mathematics and Associate Chair of the department, conducts research in number theory, connecting to many areas such as L-functions, elliptic curves and partitions.

Deville receives Campus Distinguished Promotion Award

Professor Lee DeVille has been awarded a 2013 Campus Distinguished Promotion Award by the Office of the Provost at the University of Illinois for his especially meritorious tenure case. Only three tenure cases are selected across campus each year. Deville received this special recognition based on the scope, quality and impact of his scholarship, teaching, service and engagement efforts.

McCarthy takes new role as Associate Chair for Instructional Technology and Director of NetMath

Professor Randy McCarthy has been named to a newly created position in the department: Associate Chair for Instructional Technology and Director of NetMath. McCarthy brings great energy and experience to the position. In the department, he has served previously as Director of Undergraduate Studies and Director of Graduate Studies. He is currently serving on the Senate's Educational Policy Committee and the campus's MOOC Review Committee.

IBEMEA:

The Integration of Biological, Epidemiological, Mathematical and Engineering Approaches to the Management of Mosquito-Borne Disease: An Interdisciplinary Global Challenge

IBEMEA is a project collaboration of scientists, mathematicians and engineers at the University of Illinois at Urbana-Champaign. This interdisciplinary group, which includes both faculty and graduate students, uses a holistic approach to the study of mosquito-borne diseases. Expertise from various areas, such as medical geography and spatial statistics, hydrology, mathematical modeling, ecology of infectious diseases, is combined to gain a better understanding of the way in which hydrological modeling and water management methods can affect the distribution of mosquito vectors and thus reduce the prevalence of infectious diseases that are vectored by mosquitoes.

The project is aimed at providing the next generation of scientists, mathematicians and engineers with the knowledge and skills they will need to take an interdisciplinary approach to predicting and managing the prevalence of infectious disease in both wildlife and human populations through the reduction of mosquito populations.

In addition to the collaborative research, graduate level courses are offered, as well as an IBEMEA speaker series featuring lectures and seminars on a range of topics related to mosquito-borne disease management.

Zoi Rapti, Assistant Professor of Mathematics, is one of the faculty associated with the program that also includes faculty from the College of Veterinary Medicine, the School of Molecular and Cellular Biology, the Department of Animal Biology, Department of Entomology, Department of Civil and Environmental Engineering, Department of Natural Resources and Environmental Sciences, and the Illinois Natural History Survey.

The IBEMEA Focal Point Project is supported by the Graduate College at the University of Illinois. Learn more about the IBEMEA project at http://vetmed.illinois.edu/path/ibemea/.
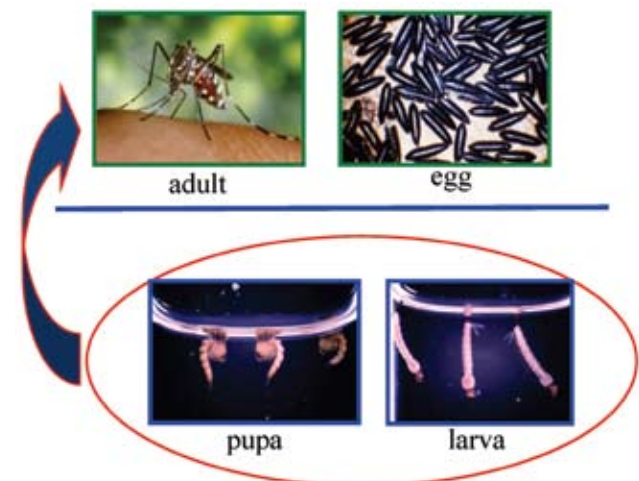
Aedes mosquito life cycle.

U of I team leads $2 million NSF study on STEM education

An interdisciplinary team of STEM education scholars at the University of Illinois has received a $2-million grant from the National Science Foundation's WIDER program to develop a transferable model for implementing evidence-based education reform in STEM gateway courses. This will be done by introducing proven pedagogies that move away from traditional lecture-based instruction and improving students' learning experience in the first two years of STEM coursework.

In December, the Obama administration announced that increasing the number of U.S. college graduates with degrees in science, technology, engineering and math (STEM) by one million over the next decade is a top priority that will be bolstered by several federal agencies. A new study at Illinois will seek to provide U.S. institutions of higher education with a model of best practices and methods to reform gateway STEM courses offered in the first two years of study, where increased enrollments, student retention, and diversity are critical to meeting the growing national demand for STEM degree holders.

The National Science Foundation will fund the multi-year study, slated to begin in January 2014, through a $2 million WIDER (Widening Implementation & Demonstration of Evidence Based Reforms) Grant. The ambitious U of I STEM education reform project spans three colleges—Liberal Arts and Sciences, Engineering, and Education—and targets 10 academic units—Physics, Mechanical Science and Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Computer Science, Mathematics, School of Integrative Biology, School of Molecular and Cellular Biology, Geology, and Chemistry. The gateway courses in these units enroll over 17,000 students annually, and several of the courses are required for nearly all STEM majors on campus.

U of I physicist and educational psychologist Jose Mestre is the principal investigator on the study. "The big idea here is not to invent new reforms," explained Mestre. "It's taking evidence-based reforms—these are best practices for teaching and learning in gateway STEM courses that have already been extensively tested and proven—and looking at how these can most effectively be implemented in an institutional setting. This is challenging because each department at a university will have its own methods and traditions and will generally resist change."

The team will attempt to circumvent that resistance by establishing "communities of practice"—collaborations of key faculty members within each academic unit that will develop each unit's strategy for implementing new pedagogies that move away from the traditional strictly lecture-based model of instruction. It's hoped that these communities, once established and provided with guidance and methods, will promote the organic emergence of the best-suited evidence-based reforms within their respective departments.

Lee DeVille, Associate Professor of Mathematics, is one of the senior personnel on the grant representing the Department of Mathematics, and will be leading the mathematics department's effort to interface with the larger WIDER group.

"The Mathematics Department here at Illinois has had a long track record of innovative and effective non-traditional pedagogies, especially at the freshman and sophomore levels. Some of these ideas are likely transferrable to other departments on campus, and, conversely, there are a large number of effective efforts outside math that we can learn a lot from," said DeVille. The mathematics department has had a long string of successes with nontraditional pedagogies, including the Illinois Geometry Lab, the Engineering Calculus Project, the *Calculus and Mathematica* calculus sequence, NetMath, and the BioMathematics Program—and the goal is to build upon these successes moving forward.

Two more co-principal investigators will coordinate reform efforts at each college. U of I geologist Jonathan Tomkin will work within the College of Liberal Arts and Sciences, and U of I mechanical engineer Matthew West, within the College of Engineering.

"The WIDER program will provide a substantial boost to reform efforts already underway in the College of Engineering, significantly enhancing the pace of innovation in our core gateway courses and allowing us to integrate our efforts with STEM departments in the College of Liberal Arts and Sciences, where engineering students learn core science subjects," said West. "In particular, the engineering Strategic Instructional Initiatives Program (SIIP) provided a test bed for the 'communities of practice' that form the centerpiece of our WIDER strategy, and going forward the SIIP and WIDER programs will synergistically interact to advance transformative pedagogy at the University of Illinois."

Tomkin added, "Liberal Arts and Sciences has the largest introductory STEM courses in the University. Every semester, thousands of students take classes in chemistry, biology and math. By accelerating the adoption of the best educational approaches and technologies in these classes, WIDER will enhance every science and engineering undergraduate experience."
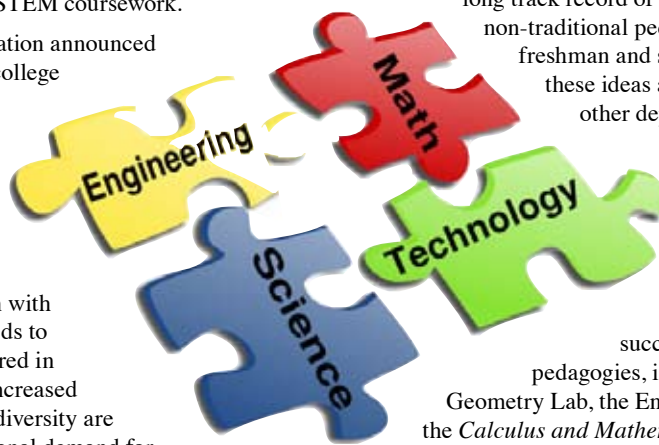
NEWS

## Students present summer research at REGS Day 2013

REGS Day 2013 was held October 9, 2013. REGS Fellows Matthew Mastroeni and Meghan Galiardi presented work from their summer research projects. REGS Research Assistantship Fellow Daniel Hockensmith presented work from his thesis. All three received monetary awards for their presentations. A pizza party and the awards presentation followed the talks.

Matthew Mastroeni (project advisor Sheldon Katz) presented "Matrix Factorizations and Singularity Categories in Codimension Two." His project involved the construction of a functor from the category of codimension two matrix factorizations of a regular sequence over a regular ring to the singularity category of the corresponding complete intersection ring.

Meghan Galiardi (project advisor Lee Deville) presented "Evolutionary Dynamics in Finite Populations." She used game theory to construct a Markov chain modeling the dynamics between two populations of finite size. By taking the large number limit, the Markov chain was approximated by a 1-parameter family of deterministic differential equations. Most of the REGS project was spent categorizing the possible bifurcation diagrams for this family. This family of differential equations represents the average of the Markov chain. Future work will study deviations from this limiting model using diffusion approximations.

Daniel Hockensmith, who will finish his PhD this academic year, is working under the direction of Eugene Lerman. He discussed "Folded Symplectic Geometry." Hockensmith spent the summer developing the tools necessary to show that if one specifies a set of invariants, taken to be components of a moment map, as well as a second cohomology class in a general orbit space W, then one may recover the toric folded symplectic manifold over W up to isomorphism. This work extends previous results of Delzant, Pires, Guillemin, Lerman, and Karshon.

The MCTP grant will continue to support REGS through May 31, 2014. For more information about REGS, visit www.math.illinois.edu/REGS/.
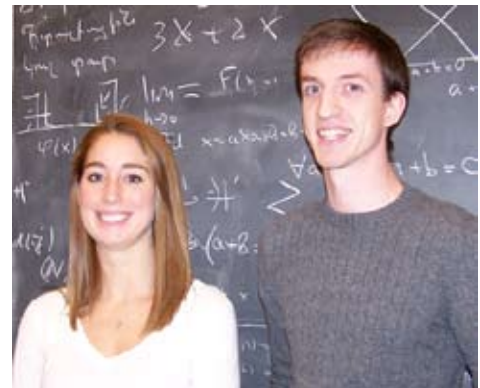
Meghan Galiardi, left, and Matthew Mastroeni
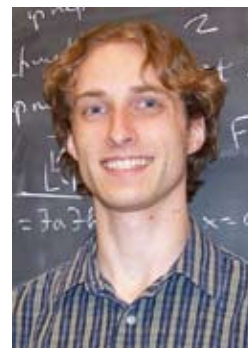
Daniel Hockensmith

Math and magic are theme for Sonia Math Day for Girls

The Indian mathematician Bharati Krishna Tirthaji once said, "'Is this mathematics or magic?' And we invariably answer and say: 'It is both. It is magic until you understand it; and it is mathematics thereafter'." This year the theme for the second annual Sonia Math Day for Girls was math and magic. Held on Saturday, November 9, 2013, the day consisted of several hands-on workshops for girls in grades 8-12. The event is designed to encourage high school girls in the Urbana-Champaign area to pursue mathematics and organized was by the President, Amelia Tebbe, and Vice President, Michelle Delcourt, of the local chapter of the Association for Women in Mathematics (AWM).

Assistant Professor Laura Schaposnik and graduate student Colleen Ackermann led a session on the mathematics behind a number of card tricks based in part on the book *Magical Mathematics* by Persi Diaconis and Ron Graham, as well as Colm Mulcahy's *Card Colm* on the Mathematical Association of America's website. Graduate students Neha Gupta and Juan Villeta-Garcia lead a discussion about "magic" squares, n by n grids with rows, columns, and diagonals summing to same number. Graduate student Sarah

Yeakel lead an activity on "Flexagation" and created models folded from strips of paper that can be folded in many different ways to mysteriously reveal new faces.

This event was supported by the U of I Department of Mathematics, the Illinois Geometry Lab, and the National Science Foundation.

Students learn about platonic solids at Sonia Math Day. Pictured from left: Bailey Wendt, Matthew Ando, James Unwin, Neha Gupta, Jennifer Wise, Sarah Yeakel. Photo by Laura Schaposnik.

Record participation in fall UI math contests

This year's math contest season is off to a fantastic start, with record participation levels in the first two major contest events, the UI Freshman Math Contest held on September 23, 2013, and the UI Mock Putnam Exam, held on September 25, 2013. A combined total of 71 students participated in these contests, easily beating last year's record turnout of 58 students.

The UI Freshman Math Contest is an entry level contest that provides freshmen an opportunity to show their problem solving skills in direct competition against their peers. First offered in 2011, this contest has been spectacularly successful and it is now the most popular of our local math contests, with 40 students participating this year. Haidong Gong, a Freshman in Mathematics, and Xinglun Li, a Freshman in Physics, both earned a perfect score and shared the top prize in this year's edition of this contest; Tong Li, a Freshman in Chemistry, was the runner-up.

The UI Mock Putnam Exam is a long-running local version of the Putnam Exam, a nationwide math contest for undergraduates that has been dubbed the "world's toughest math test." The exam consists of six challenging math problems, similar in nature to problems on Putnam contests, but a bit easier. The winner of this year's edition was Luvsandondov Lkhamsuren, a Sophomore in Computer Science and the runner-up in last year's Freshman Math Contest. In second place was Yijun Cheng, a Senior in Mathematics. Haidong Gong, a Freshman in Mathematics and co-winner of the UI Freshman Math Contest, and Moon Lee, a Senior in Mathematics, tied for third place.

The contests are organized by Professor A.J. Hildebrand and graduate student M. Tip Phaovibul.

NetMath Mentor Excellence Award recipients named

The NetMath Mentor Excellence Awards are given to our undergraduate mentors in recognition of outstanding performance throughout the past semester.

NetMath is an online distance learning program of the Department of Mathematics at the University of Illinois. NetMath mentors help students in online courses by grading assignments promptly, giving detailed feedback on coursework, and maintaining an enthusiastic and positive attitude. These mentors have received high evaluations from their students and we appreciate their diligence and dedication to our program. The award recipients for Fall 2013 are Ananya Uppal, Mahesh Vishwanath, and Brandon Wood.

Ananya Uppal is a Junior in Mathematics and Computer Science. She learned to use *Mathematica* when she started doing research at the Illinois Geometry Lab three semesters ago. Ananya enjoys mentoring for NetMath because it gives her the opportunity to work with *Mathematica* and also learn math.

Mahesh Vishwanath is a Sophomore with Junior standing in Computer Science. He is a black belt in Tae Kwon Do and enjoys

Our most recent PhD alumni
Who they are and where they are now

- Anja Bankovic, Visiting Assistant Professor, Boston College
- Christopher Bonnell, Associate Predictive Modeler, Allstate Insurance
- Thomas Carty, Assistant Professor, Bradley University
- Jinwon Choi, Research Fellow, Korea Institute for Advanced Study
- Desmond Cummins, Visiting Assistant Professor, West Point
- Abdulla Eid, American University in Cairo
- Sogol Jahanbekam, University of Denver
- Kyle (Fang-Kai) Jao, Summer intern at Facebook, and M.S. study in Computer Science
- Bo Gwang Jeon, Postdoc, Columbia University
- Eunmi Kim, Postdoc, National Institute for Mathematical Sciences (NIMS), Korea
- Chih-Chung Liu, Military service in Taiwan
- Rasimate Maungchang, Instructor, Walailuk University, Thailand
- Hyunchul Park, Visiting Assistant Professor, College of William and Mary
- Victoria Reuter, Assistant Professor, University of Wisconsin–Platteville
- Faruk Temur, Assistant Professor, Izmir Institute of Technology, Turkey
- Joseph Vandehey, Postdoc, University of Georgia
- Kelly Yancey, Postdoc, University of Maryland
- Matthew Yancey, Research Staff Member, Institute for Defense Analysis

coding in his spare time. Mahesh's hobbies include playing and watching sports of any kind.

Brandon Wood is a Sophomore in Aerospace Engineering. He transferred to the University of Illinois in January 2013. Before coming to Illinois, Brandon was in the Army and took all his classes online. During this time he took Math 220 and Math 231 online with NetMath, while being situated overseas. Brandon's hobbies include backpacking, climbing, writing and photography. His current interests lie in the field of interstellar space travel and the challenges of going into deep space.

Visit the NetMath website https://netmath.illinois.edu/ for more information.

NEWS

Midwest Dynamical Systems

The Midwest Dynamical Systems meeting has occurred at least annually for over 40 years. This year on November 1-3, 2013, the meeting was held at the University of Illinois for the first time. The meeting was supported by an NSF grant held by IUPUI (B. Kitchens, Principal Investigator) and funds from the University of Illinois and Northwestern University.

This was the largest Midwest Dynamical Systems meeting in history with over 100 participants from all over the Midwest and beyond. The organizers of the meeting were Jayadev Athreya (University of Illinois), Joseph Rosenblatt (University of Illinois), and Kelly Yancey (University of Maryland). The meeting gave all the participants an exciting view of a broad spectrum of cutting edge results and methods in the theory of dynamical systems.

There were nine talks: a plenary talk on Friday by Giovanni Forni (University of Maryland), and 8 special talks on Saturday and Sunday by Vitaly Bergelson (Ohio State University), Laura DeMarco (University of Illinois at Chicago), Marian Gidea (Yeshiva University), Francois Ledrappier (University of Notre Dame), Roland Roeder (IUPUI), Ayşe Şahin (DePaul University), Dan Thompson (Ohio State University), and Ralf Spatzier (University of Michigan). There was also a poster session with 12 participants presenting posters on Saturday afternoon.

Upcoming conferences

Poisson 2014

Poisson 2014 is the 9th in a series of international conferences on Poisson geometry. It will be held at the University of Illinois at Urbana-Champaign campus. The event is comprised of a Summer School (July 28–August 1, 2014), aimed at students in their final years, PhD students and young researchers, and a Conference (August 4–8, 2014), to be attended by students and researchers from around the world, including some of the leading mathematicians in the field of Poisson geometry. Local organizers are Eugene Lerman and Rui Loja Fernandes. Visit the conference website at www.math.illinois.edu/Poisson2014/.

Number Theory at Illinois:
A Conference in Honor of the Batemans

A Number Theory Conference honoring the Paul and Felice Bateman will be held at the Department of Mathematics, University of Illinois at Urbana-Champaign, June 5–7, 2014. Twenty invited talks and more contributed talks are planned. This meeting continues a long tradition of conferences organized by the Number Theory group in the Department of Mathematics. Local organizers are Harold Diamond and Bruce Reznick. Visit the conference website at www.math.illinois.edu/nt2014/.

LAS celebrates 100th anniversary

Gallery of Excellence recognizes five mathematicians

The College of LAS at the University of Illinois is celebrating its 100th anniversary. It's been a busy 100 years at LAS. For the next year, the largest college on campus will commemorate all that's been accomplished. As part of that celebration, LAS has created the LAS Gallery of Excellence, an ongoing list of the century's most significant faculty, staff, and alumni.

While the advances in science, education, and cultural understanding that trace their roots to the college are too many to count, the gallery is an attempt to symbolize them by highlighting some of the most prominent names to emerge from LAS since it was formed 100 years ago.

From brilliant teachers and researchers who spent their careers on campus, to alumni who left to make their mark elsewhere, those who call LAS home are responsible for some of the most important ideas and discoveries in the 20th and 21st centuries.

Five math department achievements were recognized in the first release of the LAS Gallery of Excellence. The math department honorees include the Four Color Theorem and four outstanding scholars, David Blackwell, Joseph Doob, Freeman Hrabowski, and Michio Suzuki.

The gallery will be updated with more names as this milestone year continues. Visit the LAS Gallery of Excellence at www.las.illinois.edu/100/excellence/.

Alumni News

Youn-Seo Choi, who received his PhD in 1999 under the direction of Bruce Berndt, is currently Chair of the School of Mathematics of the Korea Institute for Advanced Study (KIAS). KIAS is generally recognized to be the premier mathematics research institute in Korea.

Wojtek Samotij received his PhD in 2010 under the direction of Jozsef Balogh. He was awarded the prestigious EuroComb Prize in September 2013 for his fundamental results in extremal and probabilistic combinatorics, particularly for establishing extremal properties of sparse structures, and for obtaining sparse random analogs of classical results in combinatorics and additive number theory as well as counting versions of these analogs. The prize was established to recognize excellent contributions in Combinatorics, Discrete Mathematics and their Applications by young European researchers not older than 35.

Jaebum Sohn, who received his PhD in 2001 under the direction of Bruce Berndt, has been elected Secretary General of the Korean Mathematical Society. Sohn is an Associate Professor of Mathematics at Yonsei University in Seoul.

Sarah Manuel

By Jim Dey

Sarah Manuel has made the most of her college career, filling the roles of student and teacher while working as an intern at three different corporations.

Now, with an actuarial science job lined up at Deloitte Touche in Chicago after graduation, she is preparing to become a taxpaying professional in the workaday world.

"I'm definitely enjoying my (senior) year. But I think by the end I will be ready to enter the working world," said Manuel, a 21-year-old from St. Louis, Mo.

Manuel has excelled as an actuarial science student in the University of Illinois' math department, to the point that she was awarded the Bradley M. and Karen A. Smith Scholarship for the 2013-14 school year. Rick Gorvett, director of the actuarial science program, said Manuel was a natural choice for the award that honors an outstanding student in his department.

"When you consider the whole package—energy, intelligence, communications skills—she stands out," he said.

Majoring in actuarial science and economics while minoring in informatics and business, Manuel is an undergraduate assistant who teaches an exam review course for actuarial science majors and co-teaches a seminar for freshmen. She's already passed three professional actuarial exams and is the president of the Actuarial Science Club.

That all adds up to a busy schedule, but Manuel has no complaints.

"I really love what I'm doing. It does not really feel like I'm overworked," she said.

Her busy schedule is unusual. Gorvett described Manuel as "so involved in everything" and said he's watched her meet one challenge after another. "I've known her pretty much from day one, and she's done nothing but steadily increase my expectations for her career," he said. "She's going to be a good one."

Sarah Manuel

Manuel is one of those fortunate young people who, as a high school student, had thought about what she wanted to study and where she wanted to go to school. With an aptitude for math, but no interest in becoming a math teacher, Manuel said she thought about combining math and business. After hearing about the possibilities of actuarial science as a career, she spent a day shadowing an insurance company actuary to see what it was like.

"I talked to a lot of actuaries. They seemed like my kind of people," she said.

With her field of study confirmed, Manuel set about finding the right place to pursue her degree. She discovered the University of Illinois had a "a great actuarial science program" and confirmed her choice with a campus visit.

"Once I looked at the campus—it was so gorgeous—I knew it was the place for me. I love the U of I," Manuel said.

She was accepted from the start of her freshman year for internships, working for five semesters at the campus-based State Farm Research and Development Center. She later spent summers interning at CNA Insurance and Deloitte Touche, and said the experiences drove home the importance of being prepared for life after college.

"It gave me the chance to take on more responsibility in a corporate setting before I fully entered the corporate world. I gained a totally new perspective," Manuel said. The middle of three children, Manuel's father is a lawyer while her mother does accounting work for an advertising firm. She credits her parents for emphasizing the importance of pursuing academic success while not putting her under excessive pressure.

"My parents did a great job while I was growing up of motivating me," Manuel said.

Jim Dey is a columnist and editorial writer for The News-Gazette in Champaign-Urbana.

Homecoming

We welcomed back many alumni at Homecoming 2013 on a mild, but very windy October day. In addition to enjoying the luncheon buffet, alumni were able to visit the bell tower in Altgeld Hall and attend the Illinois Geometry Lab open house where one could see a demonstration of the 3D printer and talk with students about the research projects on display at the open house.

Join us next year on Saturday, October 25, 2014 when the Illini take on Minnesota! Information will be posted at www.math.illinois.edu/homecoming/ or visit us on Facebook.

HONOR ROLL OF DONORS

July 1, 2012 – June 30, 2013

We honor those who have given so generously to the Department of Mathematics
to strengthen and enhance excellence in mathematics at Illinois.*

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If you would like a hardcopy of this issue that does contain the
Honor Roll of Donors, please contact the editor
(see page 2 for contact information).

Department of Mathematics Giving Form

Today, more than ever, the Department of Mathematics relies on the generosity of its alumni and friends. Join us in ensuring a brilliant future by supporting the department in its educational and research missions.

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You will receive a receipt issued by the University of Illinois Foundation. Your gift is deductible as allowed by law. Thank you.

Math Times

IJM resumes regular publication schedule in 2014

by Renming Song, Editor-in-Chief

The *Illinois Journal of Mathematics* is on track to resume a regular publication schedule in early 2014 due to an increase in production by publishing six issues this past year instead of the usual four. The subscription rate for 2014 will remain at the 2013 level of $300 for the volume, with no price increases, publishing at 22 cents/page and allowing the IJM to hold its position as a high quality mathematics journal offered at a low cost.

We would like to take this opportunity to thank the following faculty members who have helped us with the journal over the past year, and we recognize that this may be an incomplete listing: Pierre Albin, Stephanie Alexander, Florin Boca, John D'Angelo, Harold Diamond, Lee DeVille, Lou van den Dries, Nathan Dunfield, Iwan Duursma, Rui Fernandes, Kevin Ford, Phil Griffith, Aimo Hinkkanen, Sasha Kostochka, Denka Kutzarova, Gabriele LaNave, Chris Leininger, Eugene Lerman, Xiaochun Li, Charles Rezk, Derek Robinson, Joseph Rosenblatt, Joe Rotman, Zhong-Jin Ruan, Alex Tumanov, and Alex Yong. The journal wouldn't be able to function without the generous help of referees and consultants.

We would also like to give special thanks to A.J. Hildebrand for his continued support of journal operations.

More information about IJM is available at http://ijm.math.illinois.edu/.

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Department of Mathematics