

School of Mathematics

Newsletter Volume 17, Spring 2011



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I recently realized that I am now officially “over the hump”, meaning more than half way through my five year term as Head. So much has happened since I began, so I can safely predict another pair of challenging and exciting years still await me before the end of my term. I remain (cautiously) optimistic that, as we adapt to an increasingly uncertain future, the Department will nevertheless continue to thrive and take full advantage of new opportunities as they arise.

This past year saw an especially active (and still ongoing) hiring season, with large numbers of applicant files reviewed by our committee and faculty, and many candidates invited for interviews. As of this writing, three outstanding researchers have accepted our offers of tenure track assistant professor: Jasmine Foo, currently at the Dana Farber Cancer Institute, Harvard University, works in mathematical biology, stochastics, and numerical analysis, specializing in mathematical models for cancer; Kai Wen Lan, currently at Princeton University, conducts research in automorphic forms and number theory, concentrating on the geometry and topology of Shimura varieties; and Hai-Minh Nguyen, currently at Courant Institute, New York University, investigates a broad range of modern analysis, including differential equations, calculus of variations, materials science, and numerical methods. Even though the end of the semester is rapidly approaching, we may yet hire one or two additional faculty. Stay tuned.

Our faculty continues to rack up an impressive range of recognitions and awards, further underscoring the remarkable strength of the Department. Marta Lewicka and Dan Spirn, who both work in analysis of partial differential equations, were

promoted to Associate Professor with tenure, while Ionut Ciocan-Fontanine, who works in algebraic geometry, was promoted to Full Professor. Gilad Lerman and Dan Spirn were each awarded five year Career grants, which are the National Science Foundation's most prestigious awards given to junior faculty. Paul Garrett, nominated by our own graduate students, was the recipient of a University of Minnesota Council of Graduate Students (COGS) Outstanding Faculty Award for his wide ranging contributions to our graduate program. Chester Miracle and Bryan Mosher both received the 2010--11 Outstanding Professor Award in mathematics from the College of Science and Engineering (CSE). Douglas Arnold was elected a Fellow of the American Association for the Advancement of Science. Fadil Santosa was named a SIAM Fellow by the Society for Industrial and Applied Mathematics. Carme Calderer was appointed as the new chair of the SIAM Activity Group on Mathematical Aspects of Materials Science. Emeritus Professor Jerald L. Ericksen was awarded the first ISIMM prize by the International Society for the Interaction of Mechanics and Mathematics. And our students, both undergraduate and graduate, have also been receiving many varied honors, including a Rhodes Scholarship, an Astronaut Scholarship, high placement in mathematics team competitions, and doctoral dissertation and other fellowships. Names and details can be found inside.

With great regret, I have to report the extremely sad news that our colleague Mark Feshbach passed away at age 60 on August 26, 2010. Mark was a recognized expert in the field of algebraic topology, and a highly regarded researcher and teacher. As I optimistically noted in last year's column, he had accepted my invitation to take over from Larry Gray as Director of Undergraduate Studies. His unexpected death is a profound loss, both professional and personal, to us all.

Four other colleagues are no longer on the regular faculty roster. Two long serving professors, Walter Littman and Norman Meyers, have retired, and assumed the status of Emeritus Professor. Walter joined the Department in 1964 and had a long and distinguished research career in analysis of partial differential equations and control theory. Norman, who joined the following year, is a recognized contributor to the field of nonlinear analysis. In addition, two younger colleagues decided to resign their positions. Kathrin Bringmann, who joined the department in 2007, has assumed a professorship at the University of Cologne in Germany. Ezra Miller, who joined in 2002 and was promoted to associate professor in 2006, is now a professor at Duke University. I wish all of them well in this next phase of their careers.

After Mark Feshbach was no longer able to fulfill his duties as Director of Undergraduate Studies, I turned to Bryan Mosher, who was already serving as Assistant Director, to assume full responsibility for running our undergraduate programs. Since then, Bryan has been doing an exemplary job. In particular, the incorporation of extension classes into the regular instruction program proceeded even more

smoothly than I predicted. Despite the challenges posed by continuing enrollment increases, our undergraduate program remains in very good health overall. In particular the Honors Program, directed by Steve Sperber, has had spectacular growth over the last few years.

Last summer saw the launching of our new Minnesota Center for Financial and Actuarial Mathematics (MCFAM). The Center brings together under one roof our undergraduate actuarial program and the professional Masters in Financial Mathematics (MFM). The Center is now run by the talented and enthusiastic leadership team of Rina Ashkenazi, who has a Ph.D. in theoretical physics from the Weizmann Institute in Israel, as Academic Director, and Laurie Derechin, who has an MBA from ESADE, Barcelona, Spain, as Executive Director. Scot Adams, who laid the foundations for the highly successful MFM program, continues to be involved as teacher and Associate Director of the Center. In their first year, Rina and Laurie have already made a dramatic impact on both programs, raising awareness of the Center, placing students in internships and jobs, and fostering connections with the financial and insurance industries.

Dick McGehee continues to do an outstanding job as Director of Graduate Studies. We once again hosted a successful open house for 22 prospective graduate students from all over the US, and 13 of these students accepted, in an incoming class of 18 new Ph.D. students. This year is shaping up to be more challenging, due to a particularly bad job market, but I remain hopeful that most or all of our graduating students will find suitable positions.

Sasha Voronov has served as Associate Head of the Department for the past 4 years under both Larry Gray and me. Besides advising the Head on the issues of the day, the Associate Head also chairs the key committees: Hiring, Tenure, and Promotion. Sasha has been one of the best, and I wish him well as he prepares for next year's sabbatical in Japan. Starting this summer, Arnd Scheel will be the next Associate Head, and I am looking forward to working with Arnd in this capacity during the remainder of my term.

I continue to appreciate all the help, advice, and support of colleagues, staff, students, alumni, and friends. Thanks again for your continued interest in and support of the School of Mathematics. If you have any comments, questions, or suggestions, please don't hesitate to stop by, call, or send me email.

Welcome to New Faculty

Gregg Musiker

Gregg Musiker was born in Philadelphia, Pennsylvania and grew up in the northeast suburb of Langhorne. His mother is an elementary school teacher and his father is an accountant in private practice. He is an only child. He went to high school at George School in Newtown, Pennsylvania, a Quaker school. There he had the opportunity to take more advanced courses, e.g., a special course with just 4 other students on vector calculus, differential equations, statistics and probability.



He was a math major at Harvard, graduating in 2002. He pursued many interests there, including the physics/math connection and Chinese culture (both language and history). A course from Richard Stanley hooked him on combinatorics. His senior thesis concerned the then newly launched subject of cluster algebras. In his senior year he was also part of an undergraduate research group run by Jim Propp, concerned with Somos sequences. Somehow he had time left over from scholarship for ballroom dancing and bridge.

For his Ph.D. he went to UCSD. His first couple of years were spent studying topology. The knot theory he learned then is useful now for his current research on cluster algebras. Gregg's thesis advisor was Adriano Garsia. In the middle of Gregg's second year they picked as thesis topic that of elliptic curves studied by combinatorial techniques. Gregg subsequently came across "chip-firing" models in the literature (also known as "abelian sandpile" models in probability) and was on the way to completing his thesis: "A Combinatorial Comparison of Elliptic Curves and Critical Groups of Graphs." In the thesis Gregg linked structures associated with elliptic curves (Frobenius maps, torsion points, etc.) to structures associated with chip-firing models.

He spent 2007-2010 at MIT on an NSF postdoctoral fellowship, where his mentor was Richard Stanley. While a postdoc he co-organized the combinatorics seminar. In the last year of his postdoc he spent fall at MSRI attending a special semester on tropical geometry.

His time at MIT was marked by fruitful collaboration with fellow postdocs. His work with Josephine Yu introduced him to tropical geometry. A joint paper on this work (with third co-author Christian Haase) related sandpile groups to Jacobians of tropical curves. His work with Lauren Williams and Ralf Schiffler reintroduced him to cluster algebras. The three were able to prove a case of the "positivity conjecture" for cluster algebras, and the collaboration continues to this day. While cluster algebras and sandpiles are totally separate in his work—for now—they have overlapping elements such as mutation rules.

He arrived in Minnesota in the fall of 2010. He will be participating this summer as a mentor in a Research Experience for Undergraduates (REU) which for many

summers has been run by our colleagues Vic Reiner and Dennis Stanton.

Pavlo Pylyavskyy

Pavlo "Pasha" Pylyavskyy was born in Vinnitsa, Ukraine and grew up there. His mother started him doing math when very little because she was worried he would not do well enough in high school otherwise. His parents, both doctors, originally hoped for him to become a doctor. (His father is an oncologist and surgeon; his mother is a nephrologist.) But when he started getting really interested in math, his parents gave up their medical hopes and happily supported him.



He was a child during the Chernobyl disaster and remembers having to drink iodine. His family had to give up the Eastern European tradition of collecting mushrooms because, alas, mushrooms tend to gather radioactivity. He never took up that hobby again in the United States.

Starting at age 12, he entered many math competitions. Starting at age 13 he competed in the International Math Olympiad four times, getting successively bronze, silver, gold and gold medals. Now he says that he somewhat regrets so much effort on math competitions at the expense of more formal math training in high school. The Olympiads were important for "professional development" but in the end it was too much time devoted to elementary stuff.

After high school, he came to the U.S. and went to MIT. During that time he was a Putnam Fellow, i.e., he ranked in the top 5 nationwide in the Putnam competition. He used to live in a dormitory called "Russian House" the residents of which were mostly kids from the former Soviet Union or offspring of parents recently emigrated from there. He used to cook dinner once a week for 30 people. His specialties were beef stew and apple pie (not the American kind but rather sharlootka).

While an undergraduate at MIT he got interested in combinatorics. His chief influences were Richard Stanley and Alexander Postnikov. He applied to graduate schools, got into MIT and stayed. His official PhD advisor was Stanley but in reality he worked most closely with Thomas Lam. The latter at that time was a Benjamin Peirce Instructor at Harvard (just down Massachusetts Avenue from MIT in Cambridge).

Pasha's thesis topic was a collection of three closely linked conjectures about products of Schur functions due to: Okounkov; Fomin-Fulton-Li-Poon; and Lascoux-Leclerc-Thibon. In joint work with Postnikov and Lam, he proved the first two conjectures and part of the third—this was the main part of his thesis. Pasha is still working with Lam now. Their joint work concerns the notion of total positivity, which recently is the object of much attention. Sergey Fomin is another current collaborator. Pasha says of his work in combinatorics that all of it is rooted in Lie theory, one way or the other.

After getting his Ph.D. in 2007 he was awarded a Clay Liffoff Fellowship and spent three years as a T.H. Hildebrandt Research Assistant Professor at the University of Michigan. He came to Minnesota as an assistant professor in the fall of 2010. He will be participating this summer as a mentor in the above-mentioned REU, along with his colleague Gregg.

Featured Colleagues

Dihua Jiang

Dihua Jiang was born in Wenzhou, Zhejiang and grew up there. This city is on the Pacific Ocean roughly at the



midpoint of the north-south line running from Shanghai to Taipei, Taiwan. (In middle school, during a time of high tension between Taiwan and the mainland, Dihua was told that military jets launched from Taiwan could get to his house in 11 minutes - so be ready!) Wenzhou is crowded against the ocean by high mountains on three sides - pretty, but isolated. Because of this isolation,

the Wenzhou people for centuries have gone out into the rest of China and the world to make their living. They became famous in China for business acumen and cleverness. Perhaps not coincidentally, there have been many mathematicians from Wenzhou, for example, the Hsiang brothers Wu Yi (Berkeley) and Wu Chung (Princeton). Wenzhou folk are spread throughout the world now. Dihua says that on the streets of Paris he has heard people speaking his local dialect of Chinese and seen them eating typical food from his region.

Dihua got both a bachelor's and master's degrees in mathematics in China. He got the latter degree at East China Normal University, where most students trained to be teachers. He had to spend time in practice teaching at high school to graduate. At ECNU he had a teacher who influenced him greatly. This teacher, whose Ph.D. advisor had been Richard Brauer, had translated many math books into Chinese and had suffered a long detour through other pursuits during the Cultural Revolution. It was this same teacher who first exposed Dihua to the Langlands program. He told Dihua to read about it because it was "good stuff". Thus inspired, Dihua read about modular forms, elliptic curves and the program itself. Dihua said his first attempts to learn about the Langlands program on his own were not so successful, but his interest in and commitment to number theory grew steadily.

He decided to go to the U.S. in 1989. At an unusual time of year - April - in 1989, he applied to graduate schools. He sent two papers to the number theorist John Hsia, who in a quick reply asked him if he was interested in coming to do a Ph.D. at Ohio State. Dihua's response was "why not?". The invitation was so hasty that Dihua did not take any English test until after he arrived in the summer of 1989. By the fall of 1989 he was a TA. And he was ready to dive right into research because he had laid the groundwork with his studies in China. He chose Steve Rallis as his thesis advisor, becoming Steve's first student.

At first Steve asked him to work on a particular problem. Dihua solved it in three months. Then Steve said "that's the first theorem of your thesis - now keep going." The thesis was eventually about 300 pages and a modified version was published in the AMS memoir series. After the third year Steve asked if Dihua wanted to graduate. Dihua decided to stay two more years to learn more from Steve.

After receiving his Ph.D. from Ohio State, Dihua went to MSRI in Berkeley for a one-year postdoc during a special year on automorphic forms. During that time, because several excellent opportunities came his way (an offer of a Gibbs instructorship at Yale, a Ritt instructorship at Columbia, and an NSF fellowship), he decided to stay in the U.S. He chose to go to Yale, albeit with a one year leave to the Institute for Advanced Study in Princeton to talk to Robert Langlands. At Yale both Roger Howe and Ilya Piatetskii-Shapiro were his mentors. He co-authored a paper there with Piatetskii-Shapiro. When Dihua got a job offer from Minnesota in 1998 at the close of his Gibbs Instructorship, Howe said he'd better watch the movie "Fargo" before deciding to go there!

Dihua and his family have been in Minnesota ever since 1998. Dihua's wife is a computer scientist. They got married in China right after college. She had been a math classmate. After they moved to the U.S. his wife pursued computer science and software development. Her transition to working in the U.S. was smooth. She now works at Starkey Lab (a hearing aid company).

Dihua has graduated one student, Chufeng Nien, who worked on Representation Theory of p -adic Groups and finished in 2006. Ms. Nien got a tenure track assistant professorship at the National Cheng Kung University in Taiwan and was promoted to an associate professor there last year. She was invited to the 5th International Congress of Chinese Mathematicians for a 45 minute lecture in 2009. Dihua has another student, Lei Zhang, who works on automorphic forms on affine symmetric spaces. Mr. Zhang will graduate in the Summer of 2011 and has accepted a three year assistant professor position at Boston College, which starts in the Fall of 2011. Currently, Dihua has two more students, one in 4th year and one in 3rd year, both working on automorphic representations and L -functions. Dihua also has mentored several postdocs, including Dr. Ralf Schmidt, who is currently a tenured associate professor at the University of Oklahoma and has received a presidential award for his work.

Dihua says that even after 20 years of study, he continues to feel very excited about automorphic forms and the Langlands program. For instance, the Arthur-Selberg trace-formula approach discovered endoscopy structures for the discrete spectrum of square-integrable automorphic forms for classical groups. The recent progress on the Fundamental Lemma and its variants by B.-C. Ngo and others will confirm the existence of endoscopy transfers, a special kind of Langlands functorial transfer, for classical groups. Dihua, along with his longtime co-workers, David Ginzburg and David Soudry of Tel Aviv University, Israel, recently found integral transforms with kernels built from the residues of Eisenstein series, which explicitly construct families of endoscopy transfers for classical groups. It will be a long term project to complete all the cases.

In general the area of automorphic forms remains wide open, even after so much progress and the awards of several Fields Medals to leaders in this field. Algebra, number theory and analysis all play important roles in the program. Dihua says that anybody can get into the area if good at SOMETHING, while no one person seems to be able to master all aspects of the subject and dictate the future development. There are still many deep conjectures to be proved and still many examples to be explored. The Langlands program is 40-50 years old, and Dihua says it is not known how much longer it will take to be completed. Most of the "easy" things have been worked out - there are no "free lunch" projects left, he says. Dihua is happy to take on the hard work that remains and continue to contribute.

Fadil Santosa

Our colleague Fadil Santosa is currently serving as Director of the Institute for Mathematics and its Applications (IMA). He took time from his many activities there to talk with us about his life and his career in mathematics.



Fadil was born in Bandung, Indonesia, on the island of Java, and lived there until he was eighteen. Being of Chinese descent he had the experience of living as a member of an ethnic minority in a complex cultural landscape and is fluent in five languages. Life was often difficult, and his parents more

than once had to rebuild their business after destructive riots. His first school was a Chinese immersion school which was closed down by the government in 1965. After a year of private tutoring he attended a Jesuit school in Macao for two years. He still remembers seeing the Macao Grand Prix there, which led to an interest in fast cars and auto racing. Fadil has five siblings, all of whom also studied in Macao. Currently one lives in Vancouver, one in Singapore, and three in Indonesia. Fadil seems to have been the one member of his family who liked math and science; all his siblings were more inclined toward the arts and business.

Fadil's interest in science led him to do his undergraduate study in engineering at the University of New Mexico. He enjoyed math, physics, chemistry and biology equally. He got his degree in Mechanical Engineering. Math was not the primary focus then. But he did serve as a grader in the mathematics department.

After finishing his undergraduate studies, Fadil proceeded to earn a Ph.D. in Theoretical and Applied Mechanics at the University of Illinois at Urbana-Champaign. One of his thesis advisors there was the mathematician Robert W. Carroll. The topic of his thesis was Inverse Scattering Theory, i.e., the reconstruction of potentials based on scattering data. Fadil knew many graduate students in both mathematics and engineering, and still keeps in touch with them. He was particularly interested in applications to geophysics. Once, after giving a talk on his research at a SIAM conference, he was offered a job in the oil industry on the spot!

Turning down the oil industry job, he took instead a postdoctoral position at Cornell in the Department of Theoretical and Applied Mechanics, with Y. H. Pao. There he knew Larry Payne and through him first got to know our emeritus colleague and friend Hans Weinberger. (The latter was instrumental in founding the IMA that Fadil now heads.) Fadil spent nearly five years at Cornell, and was promoted to Assistant Professor in Applied Mechanics. But his emphasis shifted toward mathematics in this period.

In 1985 he moved to the department of Mathematical Sciences at the University of Delaware. There he was promoted to Associate Professor and then to Professor. His interest in applications continued, and he actually served as a Professor in Mechanical Engineering as well as Mathematical Sciences. At Delaware Fadil met and married the daughter of a colleague, Ralph Kleinman, leading to a family joke that Ralph hired him to get a son-in-law. Fadil's

research interests at Delaware were directed toward applications, particularly to medical imaging and to the oil industry. He maintained many industry connections during this period, collaborating in industrial research projects, and sending students to industry for internships.

Fadil's long association with the IMA began in 1987, when he came to Minnesota to participate in an IMA concentration period on inverse problems. He said this visit had the important consequence of starting him to work on problems in electrical impedance tomography. The visit also led to a research collaboration with Michael Vogelius which continues to the present day.

In 1995 he came to the University of Minnesota and became Associate Director of the Minnesota Center for Industrial Mathematics (MCIM), working with Avner Friedman. The MCIM runs an innovative program providing students in applied mathematics with internships in industry and an opportunity to fold industrial experience into their research. The program has been very successful and has inspired similar programs at other universities. Fadil became Director of the MCIM in 2000 and served as Director until 2007.

In 1997 Fadil began a long and fruitful service at the Institute for Mathematics and its Applications, becoming Associate Director for Industrial Programs. He held the post of Deputy Director from July 2001 to August 2004, and then became Director in July 2008, succeeding Doug Arnold. The IMA is currently thriving, and won a five-year renewal in 2010.

We asked Fadil what his current goals at the IMA are. He mentioned that fund-raising is a very important goal at present, and that he wants to keep on increasing the visibility of this very successful institute. The upcoming 2011-2012 year in information science promises much exciting interaction among many disciplines. He said it is noteworthy how young many of the top researchers seem to be. (For further information on recent and future IMA activities see Fadil's own report in this newsletter.)

Fadil has had fourteen Ph.D. students in Minnesota. All but two now work in industry. His own research continues. He has branched out into optics, and recently obtained a patent in that field (Multifocal optical device design, with recent Ph.D. recipient Jing Wang and our colleague Robert Gulliver). He has collaborated with Motorola on methods for decoding barcodes, and has filed a provisional patent on that also. We didn't try to pin Fadil down on his future plans, but it is clear that a very active role in teaching and research will be part of those plans, as well as many more contributions to the field of applied mathematics. We wish him well in all his activities.

School of Mathematics Center for Educational Programs (MathCEP)

The past academic year was a period of transition for MathCEP. For 30 years, Harvey Keynes has run our many outreach and enrichment programs and directed the various incarnations of the center (Office of Special Projects, ITCEP, and MathCEP). Keynes is now in a phased retirement, and beginning last summer Jonathan Rogness assumed the role of Director. Rogness first began working with Keynes on UMTYMP and other programs while a Ph.D. student in the department. He later joined the center as a postdoc and eventually as the associate director. Keynes will not be fully retired until 2013, and he and Rogness continue to work closely together on the center's various programs.

Fall 2010 marked the 31st anniversary of our flagship program, the University of Minnesota Talented Youth Mathematics Program (UMTYMP). Demand for the program continues to be strong. The admissions process has become increasingly competitive, and yet the last two years have seen record-sized incoming classes. UMTYMP alumni continue to be successful at colleges and universities around the nation. As always, a large percentage come to the University of Minnesota as undergraduates or graduate students, including a number in our department's own Ph.D. program.

Our outreach and teacher professional development programs continue to be very active. Twenty middle school teachers completed a summer institute in June 2010 through the support of an Improving Teacher Quality (ITQ) grant. Rogness has received a new ITQ grant which should fund these activities for the next two years. Our largest enrichment program, Girls Excel in Mathematics (GEM) continued its growth this year. Over 275 girls in grades 4-6 came to the department four times, supported by funds from the Center for Energy and Environment. MathCEP has another 200 elementary and middle school students enrolled in similar Saturday morning mathematics enrichment programs which are open to the public.

During the 2010-11 academic year, MathCEP had two postdocs, Justin Sukiennik and Rebecca Schmitz. Sukiennik will remain at the University for one more year. Schmitz is finishing her postdoc and had a very successful job search in the midst of a tough market. After a number of interviews, she accepted a tenure track position at Michigan Tech.

Four students have completed the first year of the center's MS in Mathematics with an emphasis in Education degree program. Next year three of them will continue through the program and earn their secondary teaching licenses. The fourth, Prerna Nadathur - an UMTYMP alumna - will leave to attend Oxford University as a Rhodes Scholar.

A team of three UMTYMP Calculus III students, Aniket Ketkar, Saurabh Mishra and Sylesh Volla, were designated as Meritorious Winners in the 2011 Mathematical Contest in Modeling. The IMA facilitated local entries in this international contest, which means these three high school students were considered a "college team" in the competition. Another UMTYMP alum who is still in high

school, Rohit Agrawal, earned an Honorable Mention in this year's Putnam Competition, the only student in Minnesota to do so. Jered Bright received a 2010-11 Outstanding Teaching Assistant award. Congratulations to all of these students.

Distinguished Scholar Award

Prerna Nadathur is named Rhodes Scholar.



The department is particularly proud that one of its graduate students, Prerna Nadathur, has been named a Rhodes Scholar for 2011. As well as currently being a student in our department, Prerna participated in the talented youth mathematics program UMTYMP while she was at Roseville High School. She went to the University

of Chicago as an undergraduate, where she was a Mathematics major with a minor in Linguistics.

The Rhodes Scholar program is the oldest international scholarship program in the world, and it funds students to go to Oxford to study. The program places emphasis not just on outstanding achievement in an academic field of interest, but also on broader personal development and concerns. Prerna reflects such breadth, both in her accomplishments and also in the program which she proposes to follow at Oxford: she will study for a M.Phil. degree in General Linguistics and Comparative Philology.

Prerna says that her experience of mathematics at school did not challenge her until she started UMTYMP, which provided her with her first serious encounter with mathematics. Had it not been for this she says might have been an English major. Her subsequent interest in linguistics at Chicago and her proposed course of study in Oxford allow her to follow a line which she regards as a confluence of mathematics and language. She is intrigued by the rules of language that allow us to communicate instantly and is fascinated by what it is about the make-up of the brain that allows us to process language so effectively. She is drawn to the aspects of linguistics which are particularly close to mathematics, and is also interested in what neuroscience may have to say about this aspect of brain function.

At the same time Prerna shows a concern for social and political activity which runs in tandem with her academic work. She has worked in India as part of a program of training workshops for rural teachers, with a special concern for the impact of such training on the role of women. She intends to continue her involvement with teaching. Prerna has also found time to develop herself in other ways: she is an accomplished pianist, with a liking for Mozart and plans to explore the 19th century piano literature further. She also plays the violin and played in the University of Chicago chamber orchestra while she was there.

The group of Rhodes Scholars is a collection of people of remarkable distinction which includes many who have had considerable impact on the world. Only 32 Scholars from the United States are selected each year. We congratulate Prerna on her membership of this group.

Symposia

S⁴ Conference for Willard Miller

On September 17-19, 2010, the School of Mathematics hosted a conference honoring the many mathematical contributions of Willard Miller, Jr., held on the occasion of



his retirement from the University of Minnesota. Entitled "Symmetry, Separation, Super-integrability and Special Functions" (S⁴ for short), the conference covered Willard's wide-ranging research interests, and featured many of his close friends, collaborators, students and colleagues. The conference was supported by a grant from the National Science foundation, as well as funds from the IMA, the Dean's office, and the School of Mathematics. Nineteen speakers gave exemplary talks. A banquet was held Saturday night, during which participants had a chance to socialize, eat, and reminisce about Willard's career, including his many contributions to the profession and to the Department, the IMA, and the College. A scholarship fund for students in a combined Bachelors/Masters' program that has been established in Willard's honor was announced, and donations solicited. A forthcoming special issue of the electronic journal SIGMA (Symmetry, Integrability and Geometry: Methods and Applications) will be devoted to the conference's mathematical themes. Willard, of course, has merely retired from teaching and administration; he continues his very active research program, including significant new advances in the analysis of superintegrable systems even since the conference took place.

Further details can be found on the conference web site:

<http://math.umn.edu/conferences/s4/>



Riviere-Fabes Symposium

The 13th Riviere-Fabe symposium took place April 23-25, 2010. The invited speakers were

Tristan Riviere (ETH Zurich)
 Daniel Tataru (Berkeley)
 Inwon Kim (University of California, Los Angeles)
 Alexander Olevskii (Tel Aviv University)
 Natasa Sesum (University of Pennsylvania)

Andrej Zlatoš (University of Chicago)

The organizing committee was:

Nicolai Krylov, Marta Lewicka, Peter Polacik, Fernando Reitich, Mikhail Safonov, Daniel Spirn, Vladimir Sverak.

The program of the symposium, more information on the history of the symposium, and some photos can be found at:

http://www.math.umn.edu/conferences/riv_fabes_10/

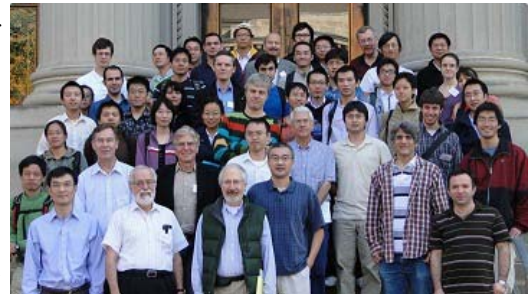
The Fall 2010 Yamabe Symposium

The fifth Yamabe Memorial Symposium took place from Friday to Sunday, October 8-10, 2010. Each of the following mathematicians gave a one-hour talk in the Symposium:

Toby Colding (Massachusetts Institute of Technology), Kenji Fukaya (Kyoto University), David Gabai (Princeton University), Ian Hambleton (McMaster University), Claude LeBrun (State University of New York at Stony Brook), Melissa Liu (Columbia University), Yi Ni (California Institute of Technology), Ron Stern (University of California at Irvine).

The conference was well attended, with 56 registered participants.

A majority of them were graduate students and young researchers. In total, in addition to the eight speakers, 25



out-of-town participants were partially supported for their expenses, thanks to the funds made available by the National Science Foundation. Speaker expenses were covered by funds from the Yamabe Foundation, which was made possible by a generous anonymous contribution. The success of this conference was particularly due to the high attendance of graduate students and young researchers. Funds for participant support were awarded competitively, based on the curriculum vitae and, in the case of young researchers, a letter of recommendation. Women and minorities were especially encouraged to apply.

There was a notably high degree of interaction among the speakers, organizers and other participants during the coffee breaks and the Saturday banquet. Discussions were mainly (but not exclusively!) of a mathematical nature. For graduate students and postdocs, these contacts may be used to great advantage in the future.

Further information including the schedule of the conference, titles and abstracts of talks, and the list of participants is available on the website <http://www.math.umn.edu/yamabe>.

Minnesota Center for Financial & Actuarial Mathematics (MCFAM)

Minnesota Center for Financial and Actuarial Mathematics (MCFAM) now houses *the only Actuarial program* offered at the University of Minnesota.

Under its new leadership within MCFAM, the Actuarial Program has received unprecedented support from the Actuarial community. Our new Advisory Board is extremely active and is helping us work toward being awarded the prestigious “Center of Actuarial Excellence” designation, granted by the Society of Actuaries, which comes with multi-year grants.

MCFAM’s Actuarial Specialization prepares students to become certified actuaries. In addition to faculty, we now have practicing actuaries from Allianz Life and United Health Group teaching core courses for the specialization. New initiatives this year are:

1. **The Actuarial Seminar (MATH 2001)** introduces students to the broad actuarial field through four three-week mini-case study modules conducted by four different groups of actuaries from: Allianz, United Health Group, Ameriprise and Travelers.
2. **The P Exam Workshop** prepares students for one of the first Actuarial exams relating to Probability - taught by faculty and practicing actuaries.
3. **Career Development/Advancement Services** include specialized career coaching, on-going workshops and events that bring industry and students together at the University. We have already seen an increase in placements this academic year.



Moments from the Actuarial Seminar class: Students work in teams under the mentorship of the instructing actuaries or watching a presentation of a new project.

IMA News

The National Science Foundation has renewed funding for the IMA for another 5 years starting September 2010. This last round of funding represents a strong endorsement by the mathematical sciences community for the institute’s

mission. The award is particularly gratifying as it was the outcome of an NSF call for proposals in which many universities submitted competing ideas for their vision of a mathematical sciences research institute. The current award will take the IMA past its 30th anniversary in 2012.

The IMA’s annual program for 2010-2011 is entitled “Simulating our Complex World: Modeling, Computation and Analysis”. It drew researchers in several areas of mathematics including numerical analysis, scientific computation, optimization, and inverse problems. Research topics addressed during the year are stochastic modeling of physical phenomena, decision making under uncertainty, numerical solutions of partial differential equations and modeling of complex systems.

The annual program for 2011-2012 is “Mathematics of Information”. This is a timely focus for the IMA as data from nearly every type of human activity are collected at an ever increasing rate. New techniques and algorithms are needed to extract useful knowledge from these data. In this highly interdisciplinary enterprise, mathematics is poised to make fundamental and game-changing contributions.

One exciting development at the IMA is the annual Abel Conference. The conference honors the work of the Abel Prize winner and takes place within one year of the award. This series is a collaboration between the IMA and the Norwegian Academy of Science and Letters. The first Abel Conference, which took place from January 3 to 5, 2011, celebrates the achievement of John Tate. Tate is well known for his important and lasting contributions to number theory. The conference drew over 80 participants ranging from graduate students to senior faculty, many of whom were students of John Tate. The photo below was taken at that conference.

It is worth mentioning that John Tate has a significant Minnesota connection.

His father, John Tate Sr., was for many years Professor of Physics at the University of Minnesota and is the eponym of Tate Hall, home of the departments of physics and astronomy.



This summer, the IMA is offering a week-long summer school for girls called “Girls and Mathematics”. The program, aimed at students entering grades 6 through 8, is one in which students work on probability, cryptography, and geometry. Studies have shown that it is precisely in these grades that students begin to lose interest in mathematics, and this program, organized by IMA Associate Director Irina Mitrea, has been designed to reverse this tide.

The IMA will say goodbye at the end of summer to its Deputy Director Markus Keel after 3 years of stellar service in which he played a critical role in shepherding the institute through the funding cycle. Markus is looking forward to being back in the School of Mathematics. He will be replaced by our colleague Jiaping Wang.

Remembering a Former Colleague

Mark Feshbach

Mark Feshbach died this past August after a terrible and hard fight with cancer. Mark was born sixty years ago, the



son of the famous M.I.T. physics professor Herman Feshbach. He was an undergraduate at Yale, where he met his wife Andrea. He went on to graduate school at Stanford, obtaining his Ph.D. in 1976 under Greg Brumfiel. His thesis contained a brilliant generalization of the classical double coset formula-from homological algebra-to the framework of Lie groups. Mark then went on to Northwestern

University where he taught for two years before joining our department in 1978 as an assistant professor. He was promoted first to associate professor and then to full professor in 1988.

In his research Mark seemed to have a knack for homing in on results which were fundamental and of lasting significance. In a number of instances lines of development which Mark started have subsequently been taken up and pursued further by others, but Mark was there first. His thesis work on the Becker-Gottlieb transfer for compact Lie groups is an example of this. So also is his work with Dave Benson on stable splittings of classifying spaces. It is definitive, and paved the way for others (including his student Mike Catalano) who have done further calculations and taken the theory further. Another example is Mark's construction of a transfer map for Hopf algebras in quite general circumstances. He was one of the world experts on group cohomology, making definitive calculations at various stages of his career: for orthogonal groups early on, and more recently for the symmetric groups. Although the cohomology of symmetric groups has been described many times, it is Mark's approach which recently has inspired others to go further. It was also Mark who identified the role of 'essential elements' in group cohomology, a concept which is seen as fundamental. Mark was an excellent collaborator, working jointly with Stewart Priddy, Bernard Badzioch, Len Evens, Jean Lannes and Sasha Voronov.

Mark had two students: Mike Catalano and James Swenson. He spent the two years 2007 - 2009 serving as program officer in the section on geometry and topology in the mathematical sciences division at the National Science Foundation in Washington DC. He traveled extensively, including visits to Sherbrooke (Canada), and several trips to Mexico, China and France. He signed on to be the director of undergraduate studies our department, starting in June, 2010, and, even while battling his illness, was actively involved in running and revamping the undergraduate program.

Mark and his wife Andrea were married for more than 30 years. They had two children, Rachel and David, now young adults on their way to becoming young professional people. They shared many interests in common, including cooking, music, Siberian huskies, the Yale alumni association, the Shir Tikvah synagogue,... The bar and bat mitzvahs of the

children were joyous family events. Mark is sorely missed by family, friends and colleagues.

A Memorial Fund for graduate student fellowships in mathematics has been established in Mark's honor.

Awards and Recognition

Douglas Arnold

Professor [Douglas Arnold](#) has been [elected as a Fellow of the American Association for the Advancement of Science](#), in recognition of his "outstanding research in the design, analysis, and implementation of algorithms for the numerical solution of partial differential equations, and for the leadership of [SIAM](#)."

Carme Calderer

Professor [Carme Calderer](#) has been appointed as the new chair of the [SIAM](#) Activity Group on [Mathematical Aspects of Materials Science](#). The Activity Group fosters activity at the interface between mathematics, computing, and materials science through the organization of conferences and minisymposia, as well as a wiki-style website. Her three year term as chair began January 1, 2011.

Ionut Ciocan Fontanine

Associate Professor Ionut Ciocan-Fontanine, who works in algebraic geometry, has been promoted to Full Professor.

Paul Garrett

[Paul Garrett](#) has been selected to receive one of the University of Minnesota [Council of Graduate Students](#) (COGS) Outstanding Faculty Awards. The award "recognizes faculty members who graduate students feel go above and beyond expectations to ensure the success of graduate students, both as students and as the next generation of scholars and researchers."

Jerald L. Ericksen

Emeritus Professor Jerald L. Ericksen has been awarded the first ISIMM prize by the [International Society for the Interaction of Mechanics and Mathematics](#). The prize is given every two years for exceptional contributions towards building new bridges between Mathematics and Mechanics, and was awarded during the [XVII STAMM Meeting in Berlin](#), August 30 - September 2, 2010.

Gilad Lerman

Assistant Professor [Gilad Lerman](#) has been awarded a five year Career grant award from NSF. The [Faculty Early Career Development \(CAREER\)](#) Program represents "...the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations." Gilad's research is in computational harmonic analysis, analysis of large data sets and statistical learning, and bio-informatics.

Marta Lewicka

Assistant Professor [Marta Lewicka](#), who works in analysis of partial differential equations, has been promoted to Associate Professor with tenure.

Chester Miracle and Bryan Mosher

Associate Professor [Chester Miracle](#) and Assistant Professor [Bryan Mosher](#) both received the 2010-11 Outstanding Professor

Award in mathematics from the College of Science and Engineering (CSE).

Daniel Spirn

Assistant Professor [Daniel Spirn](#), who works in analysis of partial differential equations, has been promoted to Associate Professor with tenure. Associate Professor [Daniel Spirn](#) has also been awarded a five year Career grant award from NSF. The [Faculty Early Career Development \(CAREER\)](#) Program represents "...the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations." Dan's research is in partial differential equations and applied mathematics.

Dennis Stanton

An [International Conference](#) on Number Theory and Special Functions, in honor of the 60th birthday of Professor Dennis Stanton, was held at [Georgia Southern University](#), March 14-16, 2011

Minnesota Center for Industrial Mathematics (MCIM)

In May 2010 Gilad Lerman was appointed as the MCIM director, replacing Carme Calderer. Since then, MCIM has expanded its educational activities to include undergraduate students. It offers a 1-credit undergraduate course which requires attendance of the MCIM/IMA seminar as well as group meetings with all MCIM industrial visitors. This course also offers help and preparation in applying for summer internships in industry.

An undergraduate internship was already arranged last summer at Vital Images. The student (Kyle Heuton) improved the company's method for denoising medical images of lower quality. This enabled the application of Vital's software to CT scans with less radiation (thus having lower quality) and consequently may decrease the risk of cancer due to CT scans (especially for children).

For this coming summer, the following three industrial internships for undergraduate students were already arranged: predictive modeling of mental states from MRI data at IBM; compressed sensing techniques for signal analysis at Xerox; and study of the borehole acoustic model at Schlumberger Doll Research.

The MCIM priority is still the education of graduate students in industrial mathematics. This year five graduate students applied for summer internships. Interviews were arranged in many major companies. Already, one of our graduate students was selected for an internship at Schlumberger Doll Research.

The IMA/MCIM seminar included twelve interesting talks in 2010-2011. Industrial speakers were invited from Alcatel-Lucent Technologies, D. E. Shaw Research, Ford, General Motors, Google Research, IBM, Mitsubishi Electric Research Laboratories, Vital Images, Yahoo! Research and Xerox.

MCIM has initiated close relations with the Career Center for Science and Engineering (CCSE). CCSE helps our students in their application process, e.g., by reviewing their application material, conducting mock interviews and helping them effectively use LinkedIn and other online tools.

Math Library News

With consistent funding, the Mathematics Library continues to support research and learning by providing both resources and services. A major resource acquisition this year was a set of e-books from Cambridge University Press, including classics like Björner et al's *Oriented Matroids* as well as selected recent works. Book formats are chosen strategically: Wiley's new *Encyclopedia of Quantitative Finance* in its online version will be most available to the off-campus students in the financial mathematics programs, while many readers prefer textbooks and specialized monographs as print books (which the library delivers where they're needed).

Supporting the growing trend in undergraduate research, resources and strategies for finding mathematics information were presented at a recent Math Club meeting, and students working on a math senior project now have a customized online tool to help them find information and keep on schedule. Other efforts to support students included expanding course-specific library webpages to cover all undergraduate courses, and providing extra copies of textbooks and solution manuals thanks to a generous gift in memory of Professor Leon Green.

The University Libraries' engagement with broader publishing issues included organizing an April faculty forum on sustainable publishing models for scholarly societies; Professor Doug Arnold was one of the speakers, based on his SIAM experience. Librarian Kris Fowler recently conducted an international survey of mathematicians' attitudes about current publishing issues such as Open Access, copyright, and the arXiv; the results will appear this summer in the Notices.

Retirements

Walter Littman

Walter Littman was born in Vienna, Austria, and arrived with his family in the US after an extraordinary trans-Siberian journey. Walter completed his Ph.D. in 1956 at the Courant Institute of New York University, under the direction of Louis Nirenberg, who also advised colleague Wei-Ming Ni. After three years at the University of California, Berkeley, followed by a year at the University of Wisconsin, Walter joined the Math Department in 1960. He was quickly promoted to associate professor in 1963 and full professor in 1966. He is a prolific researcher in analysis and partial differential equations, with well over 60 papers published over the years, many coauthored with current and former colleagues, including Avner Friedman, Nestor Riviere, Gene Fabes, Luis Caffarelli, Hans Weinberger, Bob Gulliver, and Larry Markus. His paper with Weinberger and Stampacchia on regular boundary points for uniformly elliptic partial differential equations is considered a classic in the field. More recently, he wrote a series of influential papers on control theory for partial differential equations. Walter supervised 9 Ph.D. students at Minnesota, almost all finishing in the 1990's. His many years as the Master of Ceremonies at departmental meetings and dinners are fondly remembered by all.

Norman Meyers

Norman Meyers did fundamental research in a broad range of analysis. He was particularly known as an expert in Bessel potentials. Born in Buffalo, NY, he completed his Ph.D. in 1957 at Indiana University, under the direction of David Gilbarg, who was also the advisor of colleagues Jim Serrin and Jerry Ericksen. After finishing his Ph.D., he immediately joined the University of Minnesota as an instructor, subsequently being promoted to assistant professor in 1959, associate professor in 1964 and full professor in 1968. Norman published over 20 papers in functional analysis, calculus of variations, integral inequalities, mathematical economics, partial differential equations, and potential theory. One paper, coauthored with Jim Serrin, on Sobolev spaces has the strikingly concise title $H=W$. He supervised one Ph.D. student, David Adams, now at the University of Kentucky.

Undergraduate Program

From the Director of Undergraduate Studies

The American Mathematical Society has chosen the School of Mathematics, in a random drawing, to receive one of the 2011 Waldemar J. Trjitzinsky Memorial Awards. The department will choose one undergraduate to receive the \$3000 scholarship.

In October, Matthew Coudron, a senior majoring in mathematics and physics, received a \$10,000 scholarship from the Astronaut Scholarship Foundation. Around 20 such scholarships are awarded nationally each year.

Undergraduates from the University of Minnesota, Twin Cities campus compete in two mathematics contests each academic year.

In 2010-2011, the North Central Team Competition occurred on Saturday, November 13, and involved 85 teams from colleges and universities in Minnesota, South Dakota, North Dakota, Manitoba, and western Ontario. The U of M, TC, entered 7 teams of 3 members each. Of the top ten teams, four were from the U of M, TC. In particular, the first place team, consisting of three U of M students - Matthew Coudron, Xin Jin, and Peter Lofgren - was the only team to score a perfect score.

The Putnam Competition, in which over 4000 undergraduates in the United States and Canada competed, emphasizes ingenuity and mathematical creativity. It was given on Saturday, December 4. Two U of M, TC, students did exceptionally well. Rohit Agrawal received first-tier Honorable Mention, and Nathan Fox, second tier.

Faculty members, Anar Akhmedov, Bert Fristedt, and Tyler Lawson ran practice sessions during Fall Semester for these contests.

Graduate Program

Graduate Student Fellowship Awards

Richard McGehee, Director of Graduate Studies in Mathematics and The Graduate School congratulates the following graduate students who received fellowships.

Amy DeCelles, Doctoral Dissertation Fellowship, *Automorphic Partial Differential Equations and Spectral Tehory with Applications to Number Theory*, Paul Garrett, advisor.

Lu Li, Doctoral Dissertation Fellowship, *Backward Uniqueness of the Heat Equation*, Vladimir Sverak, advisor.

Woldegebreal, Eyerusalem, Diversity of Views and Experiences (DOVE) Recruiting Fellowship, Paul Garrett, advisor

Ph.D. Graduating Students

Richard McGehee, Director of Graduate Studies in Mathematics and The Graduate School congratulate our recent graduating Ph.D. students (February, 2010 to February, 2011).

Chong Luo, *Modeling, Analysis and Numerical Simulation of Liquid Crystal Elastomer*, Carme Calderer, advisor, Postdoctoral Researcher, University of Oxford, Oxford Centre of Collaborative Applied Mathematics, Oxford, England.

Ivan G. Merev, *A Posteriori Error Estimates for Time-Dependent Hamilton-Jacobi Equations*, Bernardo Cockburn, advisor, R&D Portfolio Analytics (ALPHA), Bloomberg LP, New York, NY.

Catherine A. Micek, *Volume Transitions in Gels With Biomedical Applications: Mechanics and Electrodiffusion*, Carme Calderer, advisor, Visiting Assistant Professor, Department of Mathematics, Augsburg College, Minneapolis, MN.

Michelle N. Nielsen, *Stable convergence and Markov processes*, John R. Baxter, advisor, Asssitant Professor of Mathematics, Union University, Jackson, TN.

Jose A. Orozco Rodriguez, *Stability analysis of option implied risk-neutral distributions and the use of Nash games to treat ill-posed problems*, Fadir Santosa, advisor; Vision Ease Lense, Ramsey, MN.

Walter Rusin, *On solutions to Navier-Stokes equations in critical spaces*, Vladimir Sverak, advisor; Assistant Professor (NTT), Department of Mathematics, University of Southern California, Los Angeles, CA.

Linlin Su, *An Indefinite Nonlinear Diffusion Problem in Population Genetics*, Wei-Ming Ni, advisor; Visiting Assistant Professor, Department of Mathematical Sciences, Worcester Polytechnic Institute, Worcester, MA.

Kaisa E. M. Taipale, *Quantum Cohomologies and the Abelian-Nonabelian Correspondence*, Ionut Ciocan-Fontanine, advisor; Visiting Assistant Professor of Mathematics, St. Olaf College, Northfield, MN.

Esther R. Widiasih, *Dynamics of a Discrete Time Energy Balance Model with Ice Albedo Feedback*, Richard McGehee, advisor; Visiting Faculty, Department of Mathematics, The University of Arizona, Tucson, AZ.

Guoyi Xu, *Harmonic mean curvature flow in Riemannian manifolds and Ricci flow on noncompact manifolds*, Robert D. Gulliver, advisor; Visiting Assistant Professor, School of Physical Sciences, Mathematics, University of California, Irvina, CA.

Hao Yu, *Topological Field Theory and Quantum Master Equation in Two Dimensions*, Alexander A. Voronov, advisor.

Weiyi Zhang, *Symplectic geometry and its connection with complex geometry*, Tian-Jun Li, advisor; Post-Doc Assistant Professor, Mathematics at Michigan, University of Michigan, Ann Arbor, MI.

Fanhuan Zhou, *Design of Progressive Additional Lens with Wavefront Tracing Method*, Fadir Santosa, advisor; Quantitative Analyst, Citi Group, New York, NY.

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The Newsletter Committee is composed of Greg Anderson (Chair), John Baxter, Bonny Fleming, Peter Olver, Harry Singh, and Peter Webb.

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