

School of Mathematics

Newsletter Volume 18, Spring 2012



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This has been an unusual year in Minnesota. Winter forgot us, depositing but a single snowfall of any note, followed by an early and gradual spring (unlike our usual seasonal step function). Let's hope it does not presage an unseasonably hot summer. Life in the department has also continued to heat up, with an ever expanding range of activities and initiatives, spearheaded by both younger faculty and veterans. I am truly proud to be a member of such a high profile, innovative, and active mathematics program.

The past two years included unprecedentedly active hiring seasons, during which we landed 8 new regular faculty. In 2010-11, besides the 3 tenure track assistant professors mentioned in last years' newsletter, Jasmine Foo, Haoi-Minh Nguyen, and Kai Wen Lan (who will start this coming fall), we also hired a new tenured associate professor, Svitlana Mayboroda, who works in partial differential equations and applications. This year we hired two tenure track assistant professors: Arnab Sen, a probabilist currently at Cambridge University, UK, and Craig Westerland, a topologist currently at the University of Adelaide, Australia, as well as two tenured associate professors: Benjamin Brubaker, in number theory and combinatorics, currently at MIT, and Dmitriy Bilyk, in analysis and applications, at the University of South Carolina and visiting here the past year. All are outstanding hires, and most welcome additions to our faculty. Regrettably, Marta Lewicka, who joined the department in 2005, left us last summer for the University of Pittsburgh; we all wish her well. Also, sadly, Emeritus Professor David Storvick, a long-time and valued member of our faculty, passed away last fall; he will be sorely missed.

In summary, while we have made significant progress towards rebuilding the department to its accustomed size, ever-increasing student demand, particularly at the advanced undergraduate level, means that we remain understaffed.

In other hiring news, Mike Weimerskirch will be joining the Department as our Lower Division Math Coordinator — a new position that reports to the Director of Undergraduate Studies, and involves advising mathematics majors during the first part of their studies, streamlining the placement process, coordinating lower level mathematics courses, etc. Mike is a 2007 Minnesota Ph.D. in probability, having obtained his degree under Bert Fristedt. This year, we also hired 8 new postdocs, whose interests include financial math, dynamical systems, combinatorics, and applications.

Our faculty continues to rack up an impressive variety of recognitions and awards, underscoring the Department's overall strength in all three of its missions: research, teaching and service. These include: Adrian Diaconu and Gilad Lerman, who were both promoted to the rank of Associate Professor with tenure. Anar Akhmedov was awarded a Sloan Research Fellowship, the only award in the entire University of Minnesota this year. Andrew Odlyzko was elected both to a three year term as Vice-President of the American Mathematical Society and as a Fellow of the International Association for Cryptologic Research. Sergey Bobkov and Alexander Voronov, who will both be on sabbatical, were named Simons Fellows in Mathematics. Dennis Stanton was honored by a special issue of the journal *Advances in Applied Mathematics* for his contributions to combinatorics, special functions, and orthogonal polynomials. Chester Miracle and Bryan Mosher each received Outstanding Professor Awards from the College of Science and Engineering, while Paul Garrett received an Outstanding Faculty Award from the University of Minnesota Council of Graduate Students.

Another indication of the faculty's impact is the steady increase in the number and size of grants awarded to faculty the School of Mathematics (not counting the IMA) from a variety of sources, the total amount of which exceeds \$10M. Meanwhile, the Department continues to receive worldwide recognition for its stature and achievements. For example, the UK Times Higher Education magazine ranked the School of Mathematics fourth in the world by citation impact, while the latest Academic Ranking of World Universities rated us #11 in the world overall and #3 among public US universities.

Concurrently, our students are being honored for their achievements and promise. Current graduate students John Goes, Ryan Goh, and Derek Olson have each been awarded NSF Graduate Fellowships. As a result, there will be 5 NSF fellowships held by our graduate students next year, a five-fold increase over any previous time! Another grad student, Jered Bright, received an

Outstanding Teaching Assistant Award from the College of Science and Engineering. Our undergraduates are also excelling: Honorees include Grant Remmen, a senior in the University Honors Program, who was awarded both a Hertz Fellowship and an NSF Graduate Fellowship, and Xavier Eduardo Garcia, a junior, who received the Trjitzinsky Scholarship Award from the American Mathematical Society. And, among our many highly successful graduates, Irene Fonseca, who received her Ph.D. here in 1985 under David Kinderlehrer, and is now at Carnegie Mellon University, has been elected president of the Society for Industrial and Applied Mathematics. (Our own Doug Arnold previously served as SIAM president from 2009-10.) Another noteworthy former Minnesota student (of whom I am particularly proud) of is my son, Sheehan Olver, who is the subject of an article within this Newsletter.

Despite my many administrative duties as Department Head, I am still able to find time to remain active in research, with the vital assistance of students, postdocs, visitors, and other collaborators. I am particularly enthusiastic about a recent paper coauthored with one of my undergraduate REU students, Daniel Hoff, now in the Ph.D. program at the University of California at San Diego, in which we apply moving frames and differential geometry to design a new algorithm for the automatic assembly of jigsaw puzzles. As I write, I am looking forward to the arrival of my family along with many friends, colleagues, students, collaborators, and other researchers from around the world for a conference on May 17-20 in honor of my 60-th birthday. I confess that I have not completely reconciled myself to having already reached this milestone, and certainly don't feel that old. In particular, I must thank Willard Miller, former Head of Department, now emeritus professor, (and one of the main reasons why I am here in Minnesota), as well as the organizing committee and staff for all their hard work putting together what promises to be a lively and highly successful meeting.

It goes without saying that none of this would be possible without the outstanding service and support provided by our department administrators. Dick McGehee, as Director of Graduate Studies, and Bryan Mosher, as Director of Undergraduate Studies, continue to do yeoman service raising the quality and sweep of their respective programs. Arnd Scheel has easily adapted to his new role as Associate Head. Our centers continue to go from strength to strength, thanks to their superb Directors: Rina Ashkenazi and Laurie Derechin at MCFAM, Dan Spirn at MCIM, and Jon Rogness at MathCEP. Their reports later in the newsletter contain full descriptions of all their activities. And last, but most definitely not least, I rely every day on our exceptionally dedicated and professional office staff for keeping everything, including me, on track. Thanks to everyone for their role in making this such a well running department.

Thanks as always 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

Jasmine Foo

Jasmine Foo is joining us this year in the School of Mathematics as an assistant professor. She is an applied mathematician focused on modeling and analysis of biological systems. Her work includes using stochastic processes and population genetics to answer fundamental questions about the evolution of cancer cell populations, diversity in exponentially growing populations, the impact of treatment on drug resistance, and escape from population extinction.



Jasmine and her family (parents and a brother) moved to the United States from Malaysia when she was four. The family moved around a lot within the U.S. during her childhood. She

was often tested to figure out her grade and ended up skipping a few. She started high school at age 12 and graduated three years later.

At 15 she matriculated at Brown with the initial aim of studying history or anthropology. She eventually switched her major to physics and math after taking two particularly inspiring courses in her sophomore year: a physics course (special relativity and quantum mechanics) and a math course (abstract algebra). As an undergraduate she also had some formative research experiences working for two years in an experimental cosmology lab studying cosmic microwave background radiation, under the direction of Greg Tucker.

In the summer before her senior year at Brown she participated in a physics REU program at the Fermi Institute of the University of Chicago, studying instabilities under conditions found in Type Ia supernovae with Robert Rosner as her advisor. On Rosner's advice she investigated the Brown applied math program when she returned in the fall. There she met George Karniadakis who became her advisor on a senior independent study project in numerical analysis. She enjoyed this project a lot and Karniadakis encouraged her to go to graduate school in applied math.

She entered the applied math program at Brown in 2002 to study numerical PDEs with Karniadakis. During her thesis she worked mainly on the development and analysis of stochastic spectral methods, a class of numerical methods for treating PDEs with stochastic parameters. She also worked in applications to computational solid and fluid mechanics, studying fluid-structure interactions and vortex-induced vibrations in particular.

As part of her graduate DOE fellowship, she would attend yearly meetings in Washington, DC at which 10-15 fellows would give talks to present their work. There, from her peers

working in computational biology, she learned about intriguing if not very "well-nailed down" problems in mathematical biology to which her stochastic numerical methods were potentially applicable. This became so interesting to her that she began shifting her focus to biology in her last year of PhD work.

Upon getting her degree in 2008, she jumped professionally into mathematical biology. She took a postdoctoral position at Sloan-Kettering Institute in New York, where she was able to learn a lot of biology in an immersive environment. There she worked on the development of mathematical models of cancer evolution, and towards the application of these models to improve clinical outcomes. In addition to her advisor, Franziska Michor, she collaborated with Rick Durrett (Duke), William Pao (a thoracic oncologist at Vanderbilt), and several other excellent researchers. Sloan Kettering was an exciting place to work and collaborate with clinicians and experimental biologists, but it had the downside of lacking direct access to math journals. To keep herself supplied with math references she relied on JStor and a network of good friends at various math departments she could bug for papers. In 2010 her advisor's group moved to Harvard, where Jasmine had a joint appointment at the Dana-Farber Cancer Institute and the Harvard biostatistics department.

Jasmine arrived in Minnesota in Fall 2011. She is enjoying the camaraderie on her hallway and the stimulating atmosphere in the math department. She lives in St Paul halfway between the downtowns with two cats and her husband, Kevin Leder who is also a professor at the U. of M., in the ISYE program.

Svitlana Mayboroda

Svitlana Mayboroda joined the faculty of the School of Mathematics this fall. She works in the area of partial differential equations.

Svitlana was born in Kharkov, Ukraine and grew up there. She was a child when the Soviet Union broke down. Her parents, both trained as physicists in the Soviet era, took up other careers after Ukrainian independence.



She started school in the second grade (skipping the first), went to high school at age 14, entered college at age 16 and graduated at age 19 with two degrees at roughly master's level, one in applied mathematics from Kharkov University and the other an MBA with finance emphasis from the Kharkov Institute of Social Progress.

All during her high school and college years she held down various jobs, some nearly full time. In particular, she worked in a publishing house and co-authored six educational books, solution manuals and so forth.

Svitlana's mathematical interests developed in a direction influenced by the strongest areas of mathematics in Kharkov, and the mathematical traditions handed down from the Soviet era: analysis, functional analysis, partial differential equations,

singular integrals and mathematical physics. She also cultivated an interest in physics.

She was 20 years old when she first arrived in the U.S., to begin PhD studies at the University of Missouri. Her advisor was Marius Mitrea. In her thesis she studied the Poisson problem on Lipschitz domains and the mapping properties of Green's potentials on such domains. She was awarded the PhD in 2005. Collaboration with Steve Hoffman of University of Missouri began during her student days and continues to the present.

After getting her degree she got a postdoctoral position at Ohio State. Vladimir Maz'ya was a mentor at Ohio State. Collaboration with Maz'ya on a project concerning properties of higher order elliptic operators began then and continues to the present.

While officially at Ohio State, she took two leaves, half a year to the Australian National University, to work with Alan McIntosh, and half a year to Brown. Collaboration with Jill Pipher of Brown on the properties of elliptic operators with rough coefficients began at that time and continues to the present. It is a joint project also involving Carlos Kenig from the University of Chicago and Steve Hoffman.

In the last couple of years Svitlana has started to work with physicists. Her project with Marcel Filoche from Ecole Polytechnique is related to localization of vibrations in irregular and disordered systems.

She spent one month at the beginning of 2012 in Paris on a CNRS scholarship and probably will return to Paris for another stint in the fall. In Paris she has been collaborating with Guy David and Pascal Auscher at Paris-Sud (Orsay) on several projects in harmonic analysis and geometric measure theory, one of them intimately connected to the work in physics with Marcel Filoche.

Svitlana speaks Russian, Ukrainian, English and French, along with some Spanish and some Italian, and uses these skills on her frequent and wide travels. She loves to travel: she has visited most countries of Western Europe and many others.

She has been awarded a Sloan fellowship and an NSF career grant.

She has had one PhD student who stayed at Purdue and will graduate next year. At Purdue she supervised two undergraduates participating in an REU (Research Experience for Undergraduates), and has agreed next year to supervise a student taking part in UROP (Undergraduate Research Opportunity Program). She is also working with a post-doc here.

Somehow Svitlana also found time for training in classical ballet and she keeps practicing now although with so much travel she cannot rehearse as much as she would like. She also plays the piano.

Hoai Minh Nguyen

Our colleague Hoai-Minh Nguyen was born in 1979 in Vietnam. His research is focused on partial differential equations, Sobolev spaces, calculus of variations, material science, and numerical analysis.



He grew up and was educated in Ho Chi Minh City up to and including his undergraduate degree. But all his postgraduate education was obtained in France. To get the opportunity to study in France, he took three exams administered by professors from the

Ecole Polytechnique in French language, math and physics. The exam was very competitive.

Hoai-Minh went to France in 2001. For the first two months he stayed in Grenoble with a French family and had a crash course in French. Then he studied for two years at E.P. to get a (second) undergraduate-level degree in mathematics and applied mathematics. For his undergraduate thesis, in applied mathematics, he received an award in September 2003, an award given to only two students in applied mathematics per year. During 2003-2004 he studied to get his M.S. in numerical analysis at Paris VI. He was supported by an "excellence fellowship" from the French government, and graduated with highest honors. In the years 2004-2007 he studied again at Paris VI to get his PhD. His PhD advisor was Haim Brezis. Again he studied on a fellowship from the French government and graduated with highest honors. His thesis concerned new estimates for the topological degree and new characterizations of Sobolev spaces.

He was married in 2005 while studying for the PhD.

After getting his PhD he went to Rutgers 2007-2008, continuing to work with Brezis. He worked also with Michael Vogelius and Bert Peletier. With Peletier he studied math for medical pharmacodynamics which, roughly speaking, studies the best dose of a drug, which is interesting because both too large and too small doses can have no or bad effects.

He went to the Institute for Advanced Study for academic year 2008-2009 to take part in the geometric PDE program. He and his wife had their daughter that July in Princeton.

He then spent the period 2009-2011 in New York as an instructor at the Courant Institute. Among his advisors and collaborators at Courant were Fang-Hua Lin, Bob Kohn, Jalal Shatah and Nader Masmoudi.

While at Courant he took a class in calculus of variations taught by several distinguished instructors (Kohn, Lin, Shatah and also Lai-Sang Young). There Hoai-Minh has started a new line of research in calculus of variations and negative index materials.

Hoai-Minh joined the department last September. He enjoys very much the academic environment. He keeps working on his various directions.

Featured Colleagues

Dunham Jackson

Dunham Jackson was a distinguished member of the faculty of the University of Minnesota from 1919 to 1946. The postdoctoral research assistant professorships in the School of Mathematics are named after Jackson.



This article is a gloss on a biography of Jackson prepared for the National Academy of Sciences by William L. Hart, a former chair of our department. Remarks in quotes below are taken directly from the biography by Hart. The whole biography (from which we also took the photograph) can be found at this site:

books.nap.edu/html/biomems/djackson.pdf

Dunham Jackson was born July 24, 1888 in Bridgewater, Massachusetts. He descended from Mayflower stock on both sides and was raised a Congregationalist. His upbringing was both enlightened and strict.

“To get around the Puritan prohibition of study on Sunday, he once developed the bright idea of utilizing his father’s collection of Bibles in foreign languages and read the gospels in Greek as a legally religious and also intellectually advantageous Sabbath diversion.”

He entered Harvard at 16, and was distinguished not only in math but also astronomy, chemistry, physics, and languages, both ancient and modern. He wrote his first paper at that time - in algebra - under the tutelage of Maxime Bocher.

After obtaining both the B.A. and M.A. in mathematics at Harvard, Jackson traveled to Germany in 1909 to study for his Ph.D. at the University of Goettingen. It was then a golden age at Goettingen: David Hilbert, Felix Klein, Edmund Landau and Ernst Zermelo were all active there in teaching and research. Edmund Landau became Jackson’s Ph.D. advisor. Jackson’s thesis concerned trigonometric polynomial approximations to functions under various smoothness hypotheses. Topics related to his thesis were the main focus of his research for the rest of his life.

Halfway during his stay in Europe he had polio, which caused a permanent lameness in one foot. He nonetheless managed to get around gamely for the rest of his life.

He kept a diary in Goettingen full of philosophical reflections and the occasional quip of his professors.

“... Hurwitz’s pun last night: ‘What is the shape of a kiss? - It’s ellip-tical.’”

But the diary did not contain any personal revelations, in keeping with Jackson’s general reticence about personal matters.

After the award of his Ph.D. from Goettingen, Jackson returned in 1911 to Harvard to take up an instructorship.

There he remained until the United States entered World War I in 1917, at which time he was commissioned as a captain in the ordnance department of the Army. There he and several of his Harvard colleagues served the war effort by computing tables for aiming big guns. (A copy of a pamphlet on numerical integration produced by Jackson for the Army along with a copy of his thesis - written in German - are in the University of Minnesota’s library.) In 1919 he resigned his commission in the army and returned to Harvard.

In the spring of 1919 Jackson was offered an appointment as Professor of Mathematics in the College of Science, Literature and Arts at the University of Minnesota. The “hard sell” was applied both by President Marion Leroy Burton and chairman William H. Bussey of the mathematics department. Even though Jackson’s future at Harvard seemed bright, he decided to make the move, having been offered, besides a large increase in rank, an unparalleled opportunity to develop advanced mathematics at the University more or less from scratch, as well as freedom from routine administrative chores.

Around this time Jackson married. He and his wife raised two daughters in Minnesota. Jackson viewed Minnesota as an excellent place to raise a family and became a naturalized Minnesotan.

Jackson’s reticence about personal matters was not combined with stiffness or formality.

“At the University of Minnesota he transmitted this habit [of using first names] to members of his department, so that it became noted for its exceptionally friendly atmosphere, among both students and teachers.”

Jackson felt it was a mathematician’s duty to transmit as much knowledge as possible starting from minimal prerequisites and followed this principle in almost all his course offerings. He was a gifted and popular teacher at all levels. He enjoyed teaching elementary calculus very much and would have taught the course every year had he not been persuaded by his friend Hart to teach it only every third year.

He was active and took a leadership role in many professional societies, in particular the AMS (American Mathematical Society) and MAA (Mathematical Association of America). Of the latter he was in fact a charter member. He was elected a member of the National Academy of Sciences in 1935 and around the same time won the Chauvenet prize of the MAA for exposition.

At age 52, seemingly in robust good health, Jackson suffered a severe heart attack. For a couple years afterwards he could maintain a more or less normal life but thereafter was in steep decline. He nonetheless continued to supervise PhD students and graduated several during that period. (He had 21 in total.) He died November 6, 1946 at age 58.

The Dunham Jackson assistant professorships are a fitting memorial to one who contributed very much to his department, his profession and to the lives of his many students at all levels of mathematical attainment.

MathSciNet lists two books by Jackson: (i) *Fourier series and orthogonal polynomials*, reprint of 1941 original, Dover, 2004 and (ii) *The theory of approximation*, reprint of the 1930 original, AMS, 1994.

Arnd Scheel

Our colleague Arnd Scheel was born in the town of Wissen, in the Federal Republic of Germany. Eventually, Arnd's family (mother, father and brother) moved not far from Wissen, to Koblenz, in the Rhine valley, where his father worked at a school administrative center and his mother was an elementary school teacher. The Mosel and Rhine flow together at Koblenz. The famous Lorelei rock is nearby, as is the Marksburg, the only castle along that part of the Rhine that was never conquered or destroyed. Arnd's parents, originally both teachers, were roughly from this same area of Germany. They came from very poor families and grew up in the much-straitened circumstances of postwar Germany. Arnd says he doesn't know anyone in his parents' families who ever went to college, except for his parents, who both had two-year degrees.



Arnd played chess as a youngster, in a school club, but says he was never really good at it. It was very annoying playing tournaments: the main weapon was to blow smoke right in your face. Chess matches took up whole Saturday afternoons. They were not so rewarding. One of the smoke-blowers was a high school friend of Arnd's who later went into computer science.

Arnd was an undergraduate at the University of Heidelberg (Karl Ruprecht University). Klaus Gerhardt was one of his first teachers at the university and a good one. (Gerhardt has had several excellent Ph.D. students, among them Gerhard Huisken and Klaus Ecker.) As is typical for entry-level math courses in Germany, almost everything in Gerhardt's class was done with proof - the only thing Arnd recalls NOT being proved was the Hahn-Banach theorem. One of the earliest homework problems in Gerhardt's class was to find the closest point on a closed convex set in Hilbert space, which is easy only if you know (or can rediscover) the parallelogram identity.

According to Arnd, the German system in which he came up was elitist without being extremely selective about admissions. Weaker students would just get lost because the system required a very high level without providing feedback or assistance. The routine for beginning students was simply to hand in homework for four semesters and then to take three oral exams; after that the only further exams would be in the fifth year for the master's degree. The attrition under this system was enormous: Arnd's entering class of roughly 200 was by the third semester cut down to 15.

Arnd passed his first battery of exams after three semesters and started a master's thesis with an advisor in Heidelberg. (That advisor was Bernold Fiedler who a few years later would become Arnd's Ph.D. advisor in Berlin.) But Arnd was struck with the wanderlust, and being still pretty close

to home in Heidelberg, wanted to move. His advisor suggested France and had some connections there. In terms of money it was a simple solution (if he avoided Paris). Arnd already spoke French fluently because he had grown up in a part of Germany where most students learn French in high school. And since Arnd was already into rock-climbing at that age, the lure of beaches, mountains and cliffs was strong. So Arnd never finished at Heidelberg. Instead, he entered the fifth year program at the University of Nice, earning a master's degree at the Institut Nonlineaire de Nice (INLN) under the direction of Pascal Chossat.

After Arnd got his degree in Nice he decided to return to Germany for his Ph.D. His advisor Fiedler in the meantime had moved to Stuttgart, so Arnd followed, and wrote down a sketch of his future Ph.D. thesis. Then his advisor got a different job in Berlin, and happy to get out of the hated Stuttgart, Arnd followed again, ultimately getting his Ph.D. in Berlin at the Free University. His dissertation concerned differential equations and dynamical systems. (Arnd's research today continues in the same area.) After getting his degree, Arnd stuck around in Berlin, and got his "habilitation," a kind of super-Ph.D.

In 2001 Arnd took the job in Minnesota after applying around the world. On arrival the then-head of the department handed him a copy of Boyce-diPrima and sent him straight to the classroom, saying "here's the book, go do it." He took the initial shock in stride. Besides teaching he has ventured into administration. Currently the associate head of the department, he has previously served for three years as associate director of the Institute for Mathematics and its Applications (IMA).

Arnd mentioned that the one written exam he took in his whole college life was in Nice, on spectral methods in fluid mechanics numerics. For that he said he memorized some recursions for Chebychev polynomials, passed the exam, and quickly forgot all that stuff - the effort got him nothing. He is wary of putting students through similar cycles of memorization and regurgitation. He thinks that while students in the U.S. need to study a lot more mathematics, what they really ought to be learning often is NOT the stuff we are teaching. For instance, Arnd points to the emphasis on series solutions in the course on applied differential equations as an example where we teach easily testable algebraic manipulations rather than an understanding of the solutions of differential equations. The way he put it was that a student who knows her series solutions will still be ill prepared to judge the effect of killing cormorants on the fish population in Lake Minnetonka.

Outside the mathematics department, raising a small child and playing the piano are among Arnd's main activities. In younger life he was much into mountaineering and rock-climbing but parenthood and a flat landscape largely rule that out now. He nonetheless continues to enjoy outdoor activities, principally canoeing and hiking with family in the Boundary Waters, on the St. Croix, around Hayward, etc. Canoeing and also ice-skating are hobbies that he has cultivated since arriving in Minnesota, these being better suited to prairie life. Among piano composers, Arnd lists Bach, Haydn, Beethoven, and Schubert as favorites and then jumping forward to the 20th century lists Bartok and Shostakovich as well.

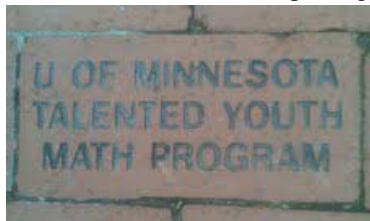
School of Mathematics Center for Educational Programs (MathCEP)

UMTYMP continues to be a very popular program, with the largest number of students in years registered to take our qualifying exam this spring. In recent years we have dealt with record enrollments in both the high school level courses, such as algebra, and the college level calculus courses. The larger student population creates both administrative and instructional challenges, but this is a good problem to have and it is gratifying to know the program is highly valued by the community. Our teacher professional development and enrichment programs are also healthy. Our largest enrichment program is still Girls Excel in Math (GEM), which serves nearly 300 girls in grades 4-6 from 18 urban and suburban schools throughout the Twin Cities metro area.

Three students (Matthew Brown, Alex Fisher and Lauren Sawallisch) began the center's MS in Mathematics with an Emphasis in Math Education degree this fall. Three other students are in the second (and final) year of the program. Jim Kolles finished his Master's degree in December; Jered Bright and Patrick Fingerson will complete their degrees at the end of this year.

MathCEP's postdoctoral staff is in a state of transition. Last spring Rebecca Schmitz finished her appointment and accepted a job at Michigan Tech, where she has already won a teaching award. Our current postdoc, Justin Sukiennik, has accepted a position beginning Fall 2012 at Colby College in Maine - his alma mater! To fill their shoes, we hired two new postdocs who will begin this fall. Jane Butterfield is finishing her degree in graph theory at the University of Illinois (Urbana-Champaign). David Clark is joining us from Michigan Tech, where he studied coding theory and finite geometries. We look forward to the enthusiasm and fresh ideas they will bring to our program.

Five years ago the Mathematical Association of America began a fundraising campaign in which donors sponsor an inscribed brick in the "Paul Halmos Commemorative Walk" outside of the MAA's Carriage House in Washington, DC. In a much appreciated gesture, Emeritus Professor Alfred Aeppli donated a brick in honor of UMTYMP before passing away in 2008. Last year MathCEP Director Jonathan Rogness attended a meeting at the MAA headquarters and was able to see the brick in person for the first time. A picture is included below.



Symposia

Riviere-Fabes Symposium

The 14th Riviere-Fabes Symposium on Analysis and PDE was held April 15-17, 2011, at School of Mathematics, University of Minnesota.

The two hour speakers were Hitoshi Ishii (Waseda University, Japan) and Michael Taylor (University of North Carolina).

The one hour speakers were Xiaochun Li (University of Illinois), Yvan Martel (University of Versailles), Robert McCann (University of Toronto) and Susanna Terracini (University of Milano).

The Organizing Committee consisted of Markus Keel, Nicolai Krylov, Marta Lewicka, Peter Poláèik, Fernando Reitich, Mikhail Safonov (chair), Daniel Spirn, and Vladimir Šverák.

The Symposium was sponsored by the NSF, the Riviere-Fabes Fund at the University of Minnesota, and the IMA through their Participating Institution Conference Program.

For more detailed information, see the website

http://www.math.umn.edu/conferences/riv_fabes_11/



Minnesota Center for Financial & Actuarial Mathematics (MCFAM)

Since MCFAM was launched 20 months ago, the program has grown to 280 students: 90 in the Master of Financial Mathematics (MFM) program and 190 in the undergraduate Actuarial program. Undergraduate enrollment this year is 35% greater than last year.

We have expanded the actuarial curriculum in several ways. One credit was added to Math 4065 to include Derivatives Markets. Preparatory workshops for the first two Actuarial exams, P and FM, were offered in the current academic year. A new Writing Intensive course (Math 4067W - Actuarial Mathematics in Practice) was developed and launched in Spring 2012. This course engages students in real world actuarial projects and is led by practicing actuaries from local companies (Travelers, Allianz, United Health Group/Mercer).

Over the past year there were new MFM initiatives. Seventeen students were involved in projects with 3 local quantitative finance firms. The MFM Advisory Board and Faculty are working

on curriculum enhancements and a new MCFAM Post Doc, Elisabeth Kemajou from Southern Illinois University, Carbondale, was hired.

The MCFAM Distinguished Lecture Series was launched in 2011 with lectures by acclaimed academicians from the fields of Actuarial Science and Financial Mathematics. Prof. Mary Hardy, the CIBC Chair in Financial Risk Management at the University of Waterloo gave a lecture on Communicating Applied Research in Actuarial Science. On March 30th Prof. Marco Avellaneda from Courant Institute of Mathematical Sciences gave a lecture on “Quantitative Hedge-Funds and Strategies: Myths and Realities”.

Substantial attention has been paid to career development and student placements. The Fall MCFAM Financial and Actuarial Mathematics Career Fair at TCF Stadium was a highlight event. About 200 students, 26 employers and 50 employer representatives participated. In addition, we held 4 major events to connect our students with industry practitioners.

Currently, 65% of the MFM students who were looking for jobs during the past 20 months have been placed; and 65% of the non-working MFM students also held internships. Another 40% of our 2012 Actuarial undergraduate seniors already have Actuarial jobs and internships.



IMA News

The next time you are on campus, please plan to drop by IMA’s new quarters. The IMA’s main offices are now located on the third floor of Lind Hall. The new space, which houses staff and visitors, will be the new “front office” of the IMA. One of the more interesting features in the remodeled space is the “Math Wall”, a wall of about 30 feet in length that is filled with mathematical equations submitted by IMA friends.

We are presently wrapping up the IMA Annual Thematic year on “Mathematics of Information” wherein the focus has been on analysis of big data. The IMA was a hub of activity in this important area attracting visitors from mathematics, computer science, statistics, and engineering.

The annual program for 2012-2013 is on “Infinite Dimensional and Stochastic Dynamical Systems and their Applications”. The theory of infinite dimensional dynamical systems is a vibrant field that has become central to the study of complex physical, biological, and societal processes. In parallel there has been an explosion of activity in stochastic or random dynamics, with new results on invariant manifolds, global attractors, and invariant measures for such systems. Taking stochastic effects into account is of central importance for

the modeling complex phenomena with inherent uncertainty. The IMA will be buzzing with activities around these two inter-related topics. As in previous years, there will be a large community of long-term visitors at the IMA during the year.

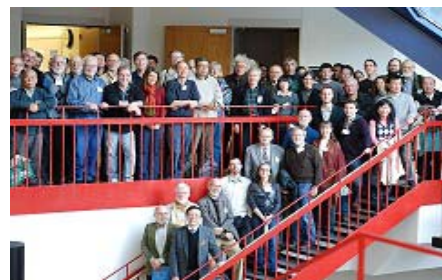


Fabien Morel of the University of Munich

The Second Abel Conference, this one in honor of John Milnor, took place in February 2012. This series of conferences is a collaboration between the IMA and the Norwegian Academy of Science and Letters, and features the work of the Abel Laureate. Milnor, who received the Abel Prize in 2011, was cited for his “pioneering discoveries in topology, geometry and algebra,” by the prize committee.

Starting this summer the IMA is an REU (Research Experience for Undergraduates) site. In this collaboration with Macalester College, the IMA selects 12 Math students to work in teams of 4 on interdisciplinary projects. In its first year, the unique program attracted more than 120 applications.

Visitors to the IMA home page probably noticed the new look that we implemented this year. We hope that the new web page makes it easier to find out all the programs and activities offered by the IMA, and also to get to resources such as the videos and slides of lectures presented at the IMA. We welcome your feedback.



Participants at the 2nd Abel Conference in honor of John Milnor

Remembering Former Colleagues

Edward T. Cline

Edward T. Cline died peacefully in Norman, Oklahoma, on March 23, 2012. He started his career in Minnesota when he came to the School of Mathematics as an Assistant Professor in 1966, having just obtained his Ph.D. from Caltech under Marshall Hall Jr. He left Minnesota in 1972 to go to the University of Virginia, after which he went to Clark University in 1975. Subsequently he moved to the University of Oklahoma in 1989 where he was a member of the faculty until his retirement in 2006.

During his time at Minnesota, Ed’s research work was on finite groups and their representations, extending the direction that his thesis had taken. In 1972 this direction changed slightly when he started a collaboration with Brian Parshall and Len Scott which was to last 40 years. The three authors, collectively known as CPS, produced 28 papers that were to have a very substantial impact on representation theory, notably of algebraic

groups and of abstract algebras. Their work was distinguished not just by its depth, but also by its broad and innovative perspective, with many of their techniques and concepts becoming standard. It was quite possibly the longest three-author collaboration there has ever been in the history of mathematics.

During the last 11 years of his life Ed battled against dementia and Parkinson's disease. He is survived by his wife, children and grandchildren.

David Storvick

Emeritus Professor of Mathematics David A. Storvick passed away in Minneapolis on November 5, 2011. David was a



distinguished member of the School of Mathematics, and a recognized researcher in the fields of complex analysis and mathematical physics. He received a Ph.D. degree in mathematics from the University of Michigan in 1956 as a student of Arthur Lohwater. After two

years at Iowa State University, David joined the CLA Mathematics Department in 1957 as an assistant professor. He spent the rest of his career at Minnesota, being promoted to associate professor in 1961 and to full professor in 1966. He enjoyed three sabbaticals, during which he visited the University of Wisconsin, Imperial College, London, and the University of York. During his career, he published 39 papers in top level research journals, many of them written with another former colleague, Robert Cameron. David's research accomplishments led to many invitations to speak at conferences throughout the world.

David was particularly active in service to the Department and University. He served as Associate Head of the School of Mathematics from 1964-70. He served as Associate Dean of the Institute of Technology from 1979-83 and then again from 1993-94. He served as Acting Director of the Gray Fresh Water Biological Institute from 1989-90. He also served several terms in the Faculty Senate and on University Senate committees. After many years of dedicated teaching, research, and service, David retired in 2004.

He will be missed by his colleagues and friends here in Minnesota.

Awards and Recognition

Graduate Students Awarded NSF

Current graduate students John Goes, Ryan Goh, and Derek Olson have all been awarded NSF Graduate Research Fellowships. The Fellowships provide tuition and a generous stipend for three years of support. Another NSF grad fellowship went to Grant Remmen, an undergraduate honors student majoring in astrophysics, physics, and mathematics.

Andrew Odlyzko

Professor Andrew Odlyzko has been elected a Fellow of the IACR, the worldwide society for crypto research, which has fewer than 5% of its membership as fellows. IACR's selection of fellows is based on "technical contributions and distinguished service to the cryptologic community". Prof. Odlyzko's research interests include computational complexity, cryptography, number theory, combinatorics, coding theory, analysis, probability theory, ecommerce, and economics of data networks.

Prof. Andrew Odlyzko was elected to be Vice-President of the American Mathematical Society, beginning in 2012 for a three year term. The American Mathematical Society, founded in 1888 to further the interests of mathematical research and scholarship, has over 30,000 individuals and 570 institutional members in the U.S. and around the world.

Remmen Awarded Hertz Fellowship

Grant Remmen, a senior in the University Honors Program, has been awarded a prestigious Hertz Fellowship to support his future graduate studies. Considered to be the nation's most prestigious and generous support for graduate education in applied sciences and engineering, the Hertz Fellowship is valued at more than \$250,000 per student, with support lasting up to five years. Grant will graduate summa cum laude from the College of Science and Engineering this spring with majors in astrophysics, physics, and mathematics. More details about Mr. Remmen's award are on the CSE website.

Anar Akhmedov

Assistant Professor Anar Akhmedov, has been awarded a prestigious Sloan Research Fellowship for 2012-2014. The Sloan award is "... to stimulate fundamental research by early-career scientists and scholars of outstanding promise." Anar's research specialty is low dimensional topology and symplectic topology.

Irene Fonseca

Prof. Irene Fonseca, the Mellon College of Science Professor of Mathematics at Carnegie Mellon University, has been elected president of the Society for Industrial and Applied Mathematics (SIAM). Prof. Fonseca obtained her Ph.D. degree in Mathematics at the University of Minnesota in 1985 under the direction of Prof. David Kinderlehrer, now also at Carnegie Mellon University. SIAM is the leading professional organization for applied and industrial mathematics, with over 13,000 individual members and almost 500 institutional members worldwide.

Sergey Bobkov and Alexander Voronov

Professors Sergey Bobkov and Alexander Voronov were both named Simons Fellows in Mathematics for 2012-13 by the Simons Foundation.

Prof. Bobkov's project is on "High Dimensional Phenomena and Information Theory", and will be undertaken at Yale University, University Paris 6, University of Bielefeld, and Tel Aviv University. Prof. Voronov's project is on "Categorical Foundations of Topological Quantum Field Theory", and will be pursued at the Institute for the Physics and Mathematics of the Universe at the University of Tokyo, where he has the position of Visiting Senior Scientist, and IHES, France..

Garcia Receives Scholarship from AMS

Xavier Eduardo Garcia received the Trjitzinsky Scholarship Award from the American Mathematical Society (AMS). Xavier moved to the U.S. from Colombia when he was twelve years old. He is a mathematics major in the University Honors Program, serves as a tutor in the Multicultural Center for Academic Excellence on campus, and intends to pursue a Ph.D. in mathematics.

Dennis Stanton

Volume 46 of the journal *Advances in Applied Mathematics* is a Special Issue in honor of Dennis Stanton, in recognition of his fundamental research in combinatorics, special functions, and orthogonal polynomials. The volume includes a tribute to Dennis, a summary of his career, testimonials, and a list of his publications. The Guest Editors are Mourad Ismail, Eric Koelink, and Victor Reiner.

Noted Alumni

Sheehan Olver received his B.S. in mathematics, *summa cum laude* with honors, from the University of Minnesota in 2004. He was awarded a Gates Fellowship to pursue a Ph.D. in applied mathematics from Cambridge University in the UK. He wrote his thesis under Prof. Arieh Iserles on the numerical evaluation of highly oscillatory integrals, and received his Ph.D. degree in 2009. By that time, he had already started his postdoc as a Junior Research Fellow at St. Johns' College in the University of Oxford. In 2011, he accepted an offer to become a Lecturer (assistant professor) in the School of Mathematics and Statistics at the University of Sydney, Australia, where he and his wife Laurel Wooten now reside.

In 2012, Sheehan was named one of two co-winners of the 2012 Adams Prize. The Adams Prize is named after the Cambridge mathematician John Couch Adams, and commemorates his role in the discovery of the planet Neptune. The first award was made in 1850, and previous recipients include such luminaries as James Clerk Maxwell, G.I. Taylor, W.V.D. Hodge, Stephen Hawking, and Roger Penrose. Sheehan's prize citation reads:

"Dr. Olver has been a driving force behind a new methodology using the Riemann–Hilbert transform in the computation of Painlevé equations and problems originating in random matrix theory. Addressing exceedingly difficult challenges, he developed and analysed algorithms of great efficacy and profound mathematical beauty. His work is setting the standard in an important new area of computational mathematics, with a wide range of applications, from number theory to theoretical physics."

Minnesota Center for Industrial Mathematics (MCIM)

The aim of the Minnesota Center for Industrial Mathematics (MCIM) is to develop and maintain the department's ties to mathematicians and researchers working in industry and at national laboratories.

The centerpiece of the MCIM is the joint IMA/MCIM Industrial Problems Seminar. This seminar series is designed to give students, postdoctoral fellows and faculty members contact with the types of mathematical challenges that arise at companies and labs. This year the seminar hosted a wide range of speakers including Diane Lambert (Google Research), Bonnie Ray (IBM's Watson Research Center), Linda Ness (Telcordia), Brian Stankiewicz (3M), Brian Donahue (National Institute for Standards and Technology), Aria Abubakar (Schlumberger Doll Research), and Ajaykumar Rajasekharan (Seagate Technology). Among the many themes arising in the lecture series was the need for robust mathematical techniques to handle large data sets, the role of mathematics in the design of sophisticated devices, and the use of mathematics to better predict complex systems.

Along with bring leading researchers working industry, MCIM aims to match graduate students with summer internships at leading companies. This year several graduate students applied for opportunities, and as of this point two of our graduate students have been selected for internships at Schlumberger Doll Research and Boston Scientific Corporation.

Math Library News

The mathematics community is actively debating important publishing issues, especially the relationship between researchers' values and publishers. Many University of Minnesota mathematicians have pledged to refrain from publishing, refereeing, and editorial work for Elsevier journals, to protest its pricing policies and other restrictions. Professor Doug Arnold and Henry Cohn present the case for the boycott in "Mathematicians Take a Stand," utilizing background and budget information provided by University Librarian Wendy Lougee; their article, currently available at <http://arxiv.org/abs/1204.1351>, will appear shortly in the AMS Notices. Even before this movement started, the Mathematics Library, in consultation with the department's topologists, canceled its subscription to "Topology" after the editorial board resigned for similar reasons. Graduate student Jonas Karlsson praised the arXiv as a more effective dissemination mechanism, during the Library's Open Access Week 2011 panel discussion on the future of scholarship. In the March 2012 Notices, Mathematics Librarian Kristine Fowler discussed how authors can retain more rights in traditional publishing venues. Her survey results on mathematicians' publishing views are available at <http://purl.umn.edu/109309>.

A major Mathematics Library purchase this year was the full set of SIAM e-books, nearly 400 titles. The print copies have been heavily used over the years, so the new online access will be a

significant convenience. Another library tool to make a researcher's workflow easier is the "Reload via U of M Libs" web browser button that streamlines access to subscribed journals when faculty members are off campus.

New services for students included the Professional Skills Portfolio Program, designed to help College of Science & Engineering students develop and showcase their non-technical skills such as writing and presenting. Kris Fowler introduced the Math Club and the MFM Career Workshop to the program, and also worked with Math 4067 Actuarial Mathematics in Practice on the professional skills of teamwork and use of information sources.

Undergraduate Program

From the Director of Undergraduate Studies

Studying undergraduate mathematics at Minnesota is more popular than ever. We teach and advise approximately 560 math majors, pursuing BS degrees through the College of Science and Engineering and BA degrees through the College of Liberal Arts.

Some of our undergraduates have been honored with national awards, which are announced elsewhere in the newsletter. Also, we provided partial financial support to 31 of our returning undergraduates, through the Dalaker, Hart, and Thorp funds.

We have developed new courses on actuarial mathematics and on calculus with biological applications, and we are developing a formal specialization within the major in mathematical biology.

We are enlarging our advising staff in response to the increase in number of majors, in particular Mike Weimerskirch, who will join us in the fall as lower-division coordinator, as Peter Olver mentioned in his note.

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.

John Goes, 2012 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship, Dihua Jiang, advisor.

Ryan Goh, 2012 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship, Arnd Scheel, advisor.

Xingjie Li, Doctoral Dissertation Fellowship, *The Development of Analysis of Atomistic-to-Continuum Coupling Methods*, Mitchell Luskin, advisor.

Derek Olson, 2012 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship and 2012 National Defense Science and Engineering Graduate Fellowship (NDSEG), Mitchell Luskin, 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, 2011 to February, 2012).

Fanbin Bu, *Integral equation methods for the simulation of viscoelastic ultrasound vibro-acoustography*, Fernando Reitich, advisor, Software Engineer, KLA-Tencor, Milpitas, CA.

Amy DeCelles, *Automorphic partial differential equations and spectral theory with applications to number theory*, Paul Garrett, advisor, Assistant Professor, Department of Mathematics, Goshen College, Goshen, IN.

Ming Fang, *Studies in One Dimensional Branching Random Walks*, Ofer Zeitouni, advisor, Postdoctoral Fellow, Mathematical Sciences Research Institute, Berkeley, CA.

Chung-I Ho, *Topological methods in symplectic geometry*, Tian-Jun Li, advisor, Postdoc, NCTS Math Division, National Tsing Hua University, Hsinchu, Taiwan.

Hsin-Yuan Huang, *Variational Methods and the Orbits with Collisions in the N-body Problem*, Richard Moeckel, advisor; Visiting Assistant Professor, National Taiwan University, Taipei, Taiwan.

King Yeung Lam, *A Semilinear Equation with Large Advection in Population Dynamics*, Wei-Ming Ni, advisor; Zassenhaus Assistant Professor, The Ohio State University, Columbus, OH.

Li Lu, *Two problems in parabolic PDEs*, Vladimir Sverak, advisor; Postdoc, Mathematics Department, University of British Columbia, Kelowna, B.C., Canada.

Yang Liu, *Convergence Analysis of the Immersed Boundary Method*, Yoichiro Mori, advisor; Postdoc, Drexel University, Philadelphia, PA.

Ya-Lun Tsai, *Real Root Counting for Parametric Polynomial Systems and Applications*, Richard Moeckel, advisor; Taichung, Taiwan.

Lei Zhang, *Automorphic Forms on Certain Affine Symmetric Spaces*, Dihua Jiang, advisor; Postdoc, Boston College, Boston, MA.

Teng Zhang, *Modeling Data by Multiple Subspaces: Theory and Algorithms*, Gilad Lerman, advisor; Postdoc, University of Minnesota, Institute of Mathematics and its Applications (IMA), Minneapolis, MN.

Likun Zheng, *Stochastic Fluctuations in Signaling, Gene Control and Pattern Formation*, Hans Othmer, advisor; Visiting Assistant Professor, University of California-Irvine, Department of Mathematics, Irvine, CA.

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