UNIVERSITY OF MINNESOTA

School of Mathematics

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Head Lines
Peter Olver

Unlike last year, spring made an early appearance in the Twin Cities, and we are already seeing the flowers blooming outside Vincent Hall — although it is perhaps slightly premature to declare us "snow-free". The year has, as usual, seen its share of welcome news and disappointments. Let me go over a few of the highlights from my own perspective; many more can be found within the Newsletter.

The most shocking and disappointing news of the year was the National Science Foundation's unexpected decision to cease funding the IMA. Although an official announcement has yet to be made, we have been told that there will be a two year ramp-down, with next year's control theory program fully funded and the following year's program in optics at a reduced level. Needless to say, this is a major blow, not just to the University of Minnesota, but to the applied mathematics community throughout the US and the world. Over the years, the IMA has had a far-reaching impact on mathematics and its applications, in the broadest sense, and has had a profound effect on the careers and research of so many. A petition in support of the IMA was set up early this year, and has attracted almost 3,500 signatories throughout the world: http://www.ipetitions.com/petition/support-the-ima. Fadil Santosa, the IMA Director, and I have been actively working with the University Administrators and the IMA Board of Governors to explore a range of options to prolong the life of this important asset to the mathematics community. However, it is already clear that, whatever the ultimate outcome of these efforts, the IMA will not be the same Institute that has existed over the past 33 years.

The Board of Regents approved the promotions of both Pavlo (Pasha) Pylyavskyy to associate professor with tenure and Dan Spirn to full professor. Dan's research areas combines partial differential equations and applied mathematics. Pasha's research is in algebraic combinatorics.

The Math Newsletter is published annually for the members, alumni and friends of the School of Mathematics

The Department hired two new Assistant Professors this year. Wei-Kuo Chen works in probability theory and mathematical physics with a special focus on stochastic dynamics, spin glasses and random matrices. Camelia Pop specializes in partial differential equations and stochastic processes, with applications to population genetics and mathematical finance. I look forward to welcoming them to Minneapolis this fall.

In further transitional news, Professor Peter Rejto, a long time member of the department, whose research area is functional analysis and its applications to quantum mechanics, will retire at the end of this academic year. I was disappointed to learn in November that Fernando Reitich has resigned his position as full professor in the School of Mathematics to continue his new and most challenging job as President and CEO of CAP S.A., a Chilean mining and steel production and processing company. Assistant Professor Panagiotis Stinis has resigned his position at the University of Minnesota to accept a position at the Pacific Northwest National Lab, housed on the campus of the University of Washington in Seattle, WA.

In sad news, Emeritus Professor Donald Kahn passed away in January. His singular presence in the department will be sorely missed; see inside for an extensive obituary describing his many contributions to the Department, Mathematics, Music, and Photography. In addition, Memorial Services for Bob Ellis and Charlotte Striebel were held last fall in the Math Library. Their obituaries can be found in the previous issue of the Newsletter.

Our graduate program continues to be exceptionally ably directed by Dick McGehee, while Bryan Mosher continues to spearhead a range of innovations and improvements to our undergraduate program. The work of the department is supported by our centers, MathCEP, MCFAM, and MCIM, and complete reports on all of their wide-ranging activities can be found within this newsletter. I must also highlight how active our various student organizations have become, including the Math Club, the Women in Mathematics (WIM), the American Mathematical Society (AMS) Student Chapter, the Society for Industrial and Applied Mathematics (SIAM) Student Chapter, the Actuary Club, and the Financial Mathematics Student Association.

I am very happy to report that the School of Mathematics has been the recipient of three new scholarship funds this year. The Hans G. and Sophie L. Othmer Scholarship will fund outstanding undergraduate students from Minnesota. The Professor Mark E. Gilquist Undergraduate Scholarship for students in math education comes from Prof. Neil Anderson in memory of his spouse, Mark Gilquist. The Isaac Benjamin Segal Scholarship for undergraduate research projects is donated in memory of undergrad student Ben Segal. These scholarships will play a significant role fostering and educating the next generation of mathematicians.

As always, thank you for your continued interest in and support of the School of Mathematics at the University of Minnesota. If you have any comments, questions, or suggestions, please stop by, call, or send me email.

Mathematically yours,
Peter Olver, olver@umn.edu, 612-625-5591

Featured Colleagues

Bert Fristedt

Bert Fristedt was born and raised in Minnesota and attended grade school in Glen Lake. He graduated from Hopkins High School in 1955. Bert's interest in mathematics was kindled early on, and he recalls his 5th and 6th grade teacher, Earl Edes, as being particularly inspiring. Mr. Edes introduced Bert to the Euclidean algorithm. Bert also remembers being drawn to games governed by logical rules, and in particular a Monopoly-type game called Big Business which honed his mental arithmetic skills. He often found himself as the teacher of rules and strategy to others. This transferred to his other passion - sports - where he sometimes ran little quizzes about plays for his teammates in order to push the team's performance to the next level. Bert's dedication to challenging himself led to his being named 'All State' in football, and helped him place second in the state discus throw.

Bert's gift for athletics won him a football scholarship here at the University of Minnesota. In spite of this he began to realize that his strengths were in deep, rather than quick, thinking and that he would need to focus on his studies in order to be competitive, so he turned down the football scholarship and dove into his school work. Bert fell in love with probability theory when he took a course with Edgar Reich. He found himself utterly engrossed in his mathematics, physics, and philosophy courses, and his hard worked paid off when he graduated with distinction in 1959. In reflecting on the differences between his experience and that of the current student body, Bert is pleased to note that despite the increase in the student population, there is much wider access to advising. This is to the benefit of the students, even if the students might be slightly less inclined to study than Bert remembers being.

Following his time at the U of M, Bert attended graduate school at MIT, completing his Ph.D. in 1963 under the direction of Henry McKean. Bert was influenced by the work of several MIT professors, and also by Harry Furstenberg, who visited MIT and taught the best probability course Bert took while a student there. Much of Bert's research in the 60's, including his thesis, focused on random processes with stationary independent increments, known as Levy processes.

While in Boston, Bert took advantage of his close proximity to the 'Green Monster', attending baseball games with other graduate students, with some of whom he still keeps in touch. Bert recalls one adventure in Boston Commons: he was in need of a dime to make a phone call, but only had a quarter in his pocket. He did the logical thing and started asking people around him for a trade. A person he asked only had a dime and a nickel. Bert, of course, offered to give the quarter for the fifteen cents that the other person had. The other person then responded quite quickly asserting that this wouldn't be fair to Bert, but he suggested flipping a coin for ten cents. If he won, they would follow Bert's original suggestion. If Bert won, the other person would just give Bert a dime. Bert did win and was able to make his phone call and keep his quarter.

After finishing his work at MIT, Bert joined the faculty at Minnesota in 1963. He was the Director of Undergraduate

Studies in Mathematics in the 80's, and he is now the Morse-Alumni Distinguished Teaching Professor. While at Minnesota for most of his career, he also spent one year each at Carleton College, the University of Wisconsin, and Liverpool University. Bert has taught courses various levels, on a wide variety topics and, of course, to a diverse assortment of students. Bert feels students learn better if they have a chance to engage the material adequately in class, usually favoring the four credit classes that come with more instruction time in order to create a more interactive experience for students. One of his fondest teaching memories took place several years ago on a day when he was late to class. Although he was flustered to be running behind he found, much to his delight, that his students had started class without him, beginning with the ritual of putting solutions on the blackboard. By the time Bert arrived, the chalkboards on three sides of the room were covered with solutions.

As an educator passionate about student engagement, Bert naturally began to be drawn to ways to improve math education at the K-12 level. This started through teaching math education courses at University of Minnesota. His concern with current high school textbooks caught the interest of parents and he began getting calls from them and ultimately started meeting with them. Bert ended up on a committee to write K-12 standards for the Minnesota Department of Education, and got involved in assessing the Minnesota standards test. He struggled to amend the textbooks used in K-12 schools but encountered resistance in making them more focused and in-depth, with a better assortment of topic choices. Since then he has been delighted to see some of these improvements instituted over the years.

Besides his work for the state, Bert represented Minnesota on the National Mathematics Advisory Panel, whose final report was submitted to the US Secretary of Education in March 2008, along with the reports of the 5 Task Groups and 3 Subcommittees. He was a member of the Assessment Task Group and the Instructional Materials Subcommittee, and is particularly proud of two contributions he made to the panel's final report: the identification of several negative features in problems used for state and national tests, as well as a report on current math textbooks, especially on their excessive lengths.

Bert has co-written three textbooks. "A Modern Approach to Probability Theory", written with Larry Gray, was born out of a motivation to broaden his knowledge base. He also wrote the research oriented text "Bandit Problems: Sequential Allocation of Experiments" with Donald A. Berry and the undergraduate text "Filtering and Prediction: A Primer" with Naresh Jain and Nicolai Krylov. Bert also wrote the comprehensive survey article "Sample functions of stochastic processes with stationary independent increments", and his most influential short paper is "The structure of random partitions of large integers", which appeared in the Transactions of the American Mathematical Society in 1993.

When asked why he has such passion for teaching, Bert confesses that he tends to throw himself into whatever has managed to pique his interest. Bert maintains that high interest to this day, and he can often be found in his natural habitat, the classroom, continuing to train up the next generation.

Al Marden

Albert (Al) Marden was born in Milwaukee. His father was a professor of math at University of Wisconsin-Milwaukee

(UWM) for about 45 years, having gone there at the height of the great depression in the mid 30s when it was a State Teachers College. During the years of World War II, UWM received many new students who needed technical training in various kinds of engineering. He taught those students. Later, the College was reestablished as a branch of the University in Madison and he founded the math department in UWM as a traditional research department. Eventually UWM became an independent institution and he was honored with the title "Distinguished Professor".

While all this was going on, Al graduated from Whitefish Bay High School. Al liked his math teacher, a Mr. Humke, who was also the basketball coach and whose son has recently retired as a math professor at St. Olaf College, Northfield MN. What Al enjoyed the most in school was playing in the orchestra and band with his flute and piccolo. He travelled around the county playing at football and basketball games, and at graduations.

Al went on to Harvard College as his father had before him. At the time, about half the class were graduates of the elite New England private schools, with solid classical educations and so it was a bit of a struggle there at first. The tuition started at $400/year. He played in the Harvard band, marched in the annual St Patrick's day parade, at the football games, and around the Princeton dorms in the early morning.

By graduation, Al was awarded an NSF graduate fellowship and he remained at Harvard for graduate school. Al had taken the basic graduate courses as an undergraduate (complex analysis with Ahlfors, real analysis with Brauer, algebra with Zariski), so he was ready to take the preliminary exam and to write the required expository paper on an assigned subject he knew nothing about (it was to be p-groups). He passed the prelims on the first try with 3 or 4 others, including Hironoka, Mumford, and Dade.

That was when Al felt it was time for a break and decided to go to medical school. He spent much of the following year taking an organic chemistry course. Then he met Dorothy. She was a student at Harvard School of Education and her presence changed things! Al did go to medical school the next year where he dissected a cadaver (which was very interesting) but became frustrated as his color blindness prevented him from reading the histology slides.

One year later, Dorothy and Al were married. Al returned to Harvard for mathematics and Dorothy was employed as a statistician and programmer at Harvard Medical School. Lars Ahlfors was willing to be Al's Ph.D. advisor: Al had taken two courses with him, and it was his precise, reserved Scandinavian manner as much as his mathematics that attracted Al. Al's thesis was on Riemann surfaces of infinite topological type.

Unbeknownst to Al, Ahlfors had recommended him to Steve Warschawski, who then ran one of the two math departments at UMN. In those days, job applications and interviews were not necessarily required in the academic world. What was required, in his case, was a personal recommendation from Ahlfors to Warschawski responding to a query from the latter. In the mid 20th century, complex analysis was one of the biggest fields and Ahlfors was its preeminent exponent.

Al had been at Harvard for 10 years. Leaving Harvard and Boston for Minneapolis was tough on Dorothy and him, but they piled their stuff into an old Pontiac handed down from Al's parents, and headed west. For a few summers after that they did return to Boston, but the department in Minneapolis led by Steve was so warm and friendly and the city so accessible that Al and Dorothy soon realized how fortunate they were to be here.

When Al arrived at UMN, there were two math departments, one in the Science and Engineering part of the university, the other in the Liberal Arts part. Steve had been hired by the new Dean to develop mathematics in the Science part and he did this, hiring a stellar group of mathematicians including Aronson, Calabi, Littman, Reich, Weinberger, and Serrin. Ian Richards and Al, both Ahlfors students, were the last hires. Steve made sure Al joined the Campus Club. There was a math table where most faculty ate and conversed, so he quickly got to know his colleagues.

Many mathematicians at that time lived in Prospect Park, close to UMN. Good houses were hard to find, but Dorothy had the name of an older couple, the Nelsons, who were said to be considering selling. She knocked on their door. To her surprise, Mrs. Nelson regarded her appearance as a divine message that it was time to move. Al and Dorothy bought the house on the spot, and have lived in it since. This was where their daughters Emily and Hilary were born, joining Juliana, who was born earlier. The proximity to UMN helped Dorothy attend the university part time and earn an MBA.

The years passed by, 52 and counting and, as Al says, "we barely noticed them". His daughters grew up, married well, and produced his 7 grandchildren. Dorothy prospered as a CPA, Minneapolis Society of Fine Arts Comptroller, stock broker, program director and became an elite runner. At the same time Al pursued his mathematics, working with hyperbolic 3-manifolds, graduating three Ph.D. students, and in recent times provided help to Vlad Markovic. There were regular trips to Europe for conferences and to meet with collaborators.

An important thing Al did was to organize the Geometry Supercomputer Project in 1985, resulting in a grant submission to NSF in 1986. In the early 1980's, UMN acquired one of the first Cray computers, the only university in the world to have one. The NSF had announced a competition to become an official NSF supported Computer Center, but the UMN was not successful in this, possibly because the focus had been more on hardware than on science. Dennis Hejhal and Al talked about what to do and came up with the idea of forming a consortium of mathematicians to do 'real science'. At the time, Al was working with David Epstein at Warwick and David in turn was close to Bill Thurston. David Epstein and Al put together a bunch of mathematicians centered around Bill: Jim Cannon, Fred Almgren, Allan Wilks, Robert Tarjan, David Mumford, Benoit Mandelbrot, David Dobkin, John Hubbard and Adrian Douady, all of whom knew Bill and liked working with him. From the very beginning the NSF strongly encouraged the whole group to prepare a 5-year proposal. In 1985, Bill, David Epstein and Al wrote the proposal. It was funded at about $7M, the largest grant heretofore awarded by the Division of Mathematical Sciences.

As it turned out, the Cray was not very useful, Sun and Silicon Graphics work stations were fast improving and far more flexible, and the lab where these computers were housed on the fifth floor of a West Bank building became the go-to place for math graphics. Toward the end of the grant the group had to decide what to do. The NSF had just announced their Science and Technology Institute program. It was clearly not meant for a bunch of mostly pure mathematicians, but the decision was to apply to this scheme anyway. They added some additional mathematicians and wrote a new grant, again centered around Bill Thurston. Mostow was the head of the NSF site visit team. They were warned that he was quite skeptical as to the value of computing in math. Mostow's team arrived and the first demo was done by Bill, who seemed to know what Mostow was working on. Before Mostow's eyes Bill programmed it, and in his amazement Mostow changed his mind. So against all expectation, Al's team was awarded one of these most prestigious of NSF grants, the only one in math. They named their new center The Geometry Center. During the years of its existence the center received many visitors and held a large summer program for undergraduates.

Toward the end of the 5 year funding period it was recognized that computing had become common in pure math, and the organizational structure Al together with his team had put in place was no longer viable. The Center closed around 1994.

Al tells the story as he remembers it. The bottom line is that he and his wife Dorothy have a good life here in Minneapolis and, in that, they feel very fortunate.

Vic Reiner

Vic was born in Utica, NY to Polish-Jewish immigrants who survived WWII and fled to the US after the war, where they met. The history of his mother, an OBGYN, and father, an electrical engineer, shaped him greatly. Vic was a typical child who spent much of his time playing tennis, bridge, and Dungeons and Dragons. Vic's bridge playing was partly at the behest of his parents, who encouraged him to follow in the footsteps of his grandmother, known to be a vicious player. Later in life when Vic met the great Israel Gelfand, Vic was reminded of this grandmother. By the time he was in high school Vic would occasionally ask his dad math questions, such as whether the curve you get when you hang a necklace is a parabola or how to explain why applying difference operators to sequences 1^n, 2^n, 3^n, ... gives constants. In both cases Vic's father was able to produce some old book with the answer, even though he claimed to hate math.

As a young man, Vic's plan was to be a medical doctor, like his mother and grandfather. As with the family pressure to become a bridge champion, Vic felt that going into medicine was expected of him, as it was for his two older brothers, who had both gotten medical training. Vic began his college education as a pre-med student, but by his junior year it became clear to him that he wanted to pursue math in graduate school. Vic fondly remembers a class taught by Nick Kuhn that fuelled his interest; in fact, some of Vic's current research is related to that done by Kuhn back then!

Initially, Vic's family wholeheartedly resisted the idea of going into math. His grandmother, the one who reminded him of

Gelfand in later years, told him that she hoped he would fail and return to medicine in defeat. Despite these protests, Vic started his graduate studies at MIT, quickly identifying Richard Stanley as his adviser. His family's resistance dwindled thereafter.

The period when Vic was under his mentorship was the first time that Stanley had a large number of advisees simultaneously: on the order of eight. This created an interesting community to interact with. It was also fun to be around G. C. Rota, who liked to make somewhat outrageous claims during his lectures. Vic's most memorable episode from his graduate years had to do with Gelfand's visit to MIT. MacPherson, who was at MIT then, gave a well-attended talk which lasted an hour. When it was over, Gelfand got up and commented on the talk for another hour. Later during the same visit, Gelfand saw a polytope toy Vic got as a gift from his wife Kristi. Gelfand was fascinated by the thing and asked Vic if he could have it, to which Vic could not say no. After that, Gelfand brought Vic to Kostant's office, where he tried to make Kostant rediscover on his own the axioms of a matroid. When Vic tried to help the struggling Kostant, he got yelled at by Israel Moiseivich.

The MIT math department of this time was prominently featured in the play "Truth Values" by Gioia De Cari. It portrays occasional male chauvinism encountered by a female graduate student in the department. According to Vic, even back then Gioia (or rather, Lisa, as she was called) spoke out about signs of discrimination. For example, she claimed that she was not passed to enough in the game of ultimate Frisbee, in which Vic was a permanent player. However, she spoke truth about the department, as Vic admits that at least one fellow male graduate student behaved in an offensive way towards women. This, of course, was not Vic, although he does feel guilty about the Frisbee thing.

Vic's instincts to follow his interest in math were correct for another reason: while at MIT, Vic met his wife Kristi. Kristi was a pre-med undergraduate at Harvard at the time. The two had to spend a couple of years apart after Vic got a Dunham-Jackson postdoc at Minnesota, but later Kristi transferred to the University of Minnesota Medical Center, allowing them to be together once more. Vic and Kristi have two daughters, Naomi and Lydia, and are quickly approaching the status of empty nesters; Naomi has already left home to attend Kristi's alma mater. Thankfully, they also have their dog Darwin and cat Eloise to keep their house lively.

After being a postdoc here, Vic was hired to stay at the University of Minnesota on a permanent basis. At the time the combinatorics group consisted of Edelman, Goldman, Stanton and White. Vic thinks the department has not changed much since then, except that the meetings have become much less contentious. Vic is proud of having collaborated with several members of the department, as well as running with some of them on a regular basis. Vic also enjoys the position of undisputed crossword king, beating even the notorious Bill Messing. However, Vic did lose to Bryan Mosher at Scrabble, and he fears Stanton as an opponent.

Among his many projects, Vic feels particularly proud of his work with Eagon on Alexander duality, his work with Shimozono on symmetric group representations, and his work with Stanton and White on cyclic sieving phenomena. One project that Vic really wishes he had completed is his parking space conjecture with Armstrong and Rhoades. Vic thinks that modern mathematicians are stronger than those of old times, for the reason that a larger portion of talented people now find their way into mathematics. As for Vic himself, hopes to find ways to apply cluster algebras to cyclic sieving, as well as ways to run his half-marathons faster. He also hopes to avoid becoming the department chair.

Symposia

Rivière-Fabes Symposium

The Seventeenth Rivière-Fabes Symposium on Analysis and PDE was held April 25-27, 2014, at the School of Mathematics, University of Minnesota. This year the format of the symposium was changed to have only two-hour speakers. The two-hour speakers were Alice Chang (Princeton), Frank Merle (Université de Cergy-Pontoise, Paris), Maciej Zworski (UC Berkeley), and Alexandru Ionescu (Princeton).

The Symposium was sponsored by the NSF, the Rivière-Fabes Fund at the University of Minnesota, and the IMA through their Participating Institution Conference Program. The conference succeeded in attracting and financing 43 graduate students and postdoctoral fellows from outside institutions. Along with local attendance this made possible to widely promote recent progress in the field.

For more detailed information, see the website:
http:// www.math.umn.edu/conferences/riv_fabes_14/

Yamabe Symposium

The seventh Yamabe Memorial Symposium took place from Friday to Sunday, October 17-19, 2014. The Yamabe Lecture was initiated jointly with Northwestern to commemorate the early passing of the brilliant Japanese mathematician Hidehiko Yamabe, who once was a faculty member at University of Minnesota and Northwestern University. The Yamabe Symposium, started in 2002 and held every two years at University of Minnesota, is an enhancement of the Yamabe Lecture tradition.

The theme this year was Current Topics in Three Manifolds, an area Yamabe worked in during his last years and in which made a lasting impact. The great power of the modern subject is expressed in part by its exposure of very surprising internal geometry of the manifolds. Thurston's initial breakthrough in the 1970s has expanded unabated to the present day. Another remarkable achievement is the resolution of the triangulation conjecture via three dimensional Seiberg-Witten theory.

The conference had over 50 registered participants, a majority of them graduate students and young researchers. More than 20 out-of-town participants were partially supported thanks to funds from the NSF, while expenses of the eight speakers were partially covered by funds from the Yamabe Foundation, thanks to a generous anonymous contribution. For more details see the website: http://math.umn.edu/yamabe/2014/

Remembering Former Colleagues

We are greatly saddened by the passing of Donald Kahn, on January 16, 2015. Don was a giant presence in the department, through his contributions in so many ways, his personal engagement with everyone around him, and notably the pleasant hours that so many of us spent talking with him about everything under the sun. Through these connections with him we became aware that he was a rare individual: a Renaissance Man if ever there was one. He was supremely and broadly talented, and not just in technical directions. Prominent among his talents were the ability to reassure, to provide sound, wise and balanced advice, to tell jokes and to entertain us through his love of conversation and of being with others. He was a great person to be around: you knew that if he was present at the lunch table the conversation would never flag. If you told a joke he would come back with 2 or 3 more. He was modest and motivated by the sheer pleasure of doing things, not by competition.

Donald William Kahn was born and grew up in New York City, primarily in Belle Harbor, Queens. According to the anecdotes he told about this time, it was a neighborhood with a rough edge to it which provided a compulsory education in being street-smart. He was born into a family of noted longevity, his father being the investor Irving Kahn who died recently at the age of 109, just a few weeks after Don. His mother, Ruth Perl Kahn, had a Ph.D. in psychology. After attending high school at Woodmere Academy he went to Cornell University as an undergraduate, where he decided to study mathematics. He then received his Ph.D. at Yale University in 1961 under the supervision of William Massey, writing a thesis with the title, 'On the Real Cohomology of Fibre Spaces'. After this he held a postdoc at Columbia University working with Samuel Eilenberg which, incidentally, provided him with many stories about Eilenberg's no-nonsense approach. After a visiting position at Heidelberg, Don moved to Minnesota in 1964 where he became assistant professor of mathematics. He was promoted to associate professor in 1967 and full professor in 1984. He served twice as the department's Director of Graduate Studies from 1992 to 1999. Don retired and assumed the rank of Professor Emeritus in 2010. During this time he was the author of 26 research publications and two mathematical books, the first an undergraduate text on topology which came out in 1975 and the second a more advanced treatment on global analysis which appeared in 1980. Both books remain in print. He supervised 8 Ph.D. students at the University of Minnesota.

Don met his wife Phyllis (State Representative Phyllis Kahn) when they were both students at Cornell and she was studying physics. It always seemed that Don was a very appropriate partner for such a prominent and strong politician: his own political sense was highly developed and astute, and he relished the contact with all, including the famous and influential. At gatherings he could invariably be seen using his strong social skills with whomever he met. It always appeared that he knew everyone in the room, and he probably did.

Don was passionate about all of the arts, but the art forms in which he was a most skilled practitioner were music and photography. They both occupied a large part of his time. Don enjoyed music in all its forms and was knowledgeable about it. You could discuss with him at one moment performance details of a classical piano trio, moments later be hearing about the jazz greats that he heard in New York in the 1950s and early 60s (he had heard them all) and after that be learning from him about songs from Broadway musicals. He was talented as a performer, on keyboards (piano and harpsichord), cello and trombone. He played classical chamber music regularly and played in an amateur chamber orchestra on Wednesdays. He went to hear jazz often and worked on jazz performance at the piano via transcriptions. He admired particularly the compositions of Thelonius Monk and could perform Round Midnight, as well as other pieces, at a moment's notice.

Don spent a great deal of time on photography. At departmental events he would invariably be there with his Leica, and the same was true everywhere he went where there was the opportunity to take photos. Often he shot black and white, and he would develop the prints himself, so that carefully cropped enlargements would appear on the mail room bulletin board a day or two after a mathematical event. We were lucky to have such a source of high-quality photos. For many years he would also take color slides and use the Cibachrome process to make prints from them at home, something only the serious enthusiast would be likely to do. When digital methods became available he was at first lukewarm about the idea, but more recently he took slides which he would scan and print out in color with a digital printer. Whether produced digitally or with chemicals, Don would always have on display in his office several large boards of 10 by 8 color enlargements of places he had been. Rather recently Don mounted an exhibition of photos taken in China. Just last year he published a book he had written with the title, 'Photography: a concise history'.

We remember Don's natural ability with languages. His command of French and German were extraordinary, and were strengthened during his visits to Toulouse and Heidelberg. Apparently he picked up Spanish during a month-long visit to Mexico City, and at the end of the month he gave his last two lectures in the language. It was important to him to use these languages, so that when French-speaking visitors would arrive in the department, for instance, he would speak to them in French. For a while he was attending regular conversation evenings organized by the Alliance Francaise, because he relished doing it.

All of these are remarkable achievements, and on a daily basis he was doing something that was notable. At the time he was Director of Graduate Studies he would take groups of students to the Guthrie to see what was currently playing. If you found the discussion turning to classic movies you would find that he knew in detail, and had an appreciation of, just about everything. We remember in particular his admiration for the cinematic work of Jacques Tati as M. Hulot, and his mild disappointment that times have changed so much that younger generations do not even know of this master, let alone appreciate his humor. At times in his life he was an enthusiastic scuba diver and a chaser of solar eclipses. He also maintained a generously decorated office door!

One area in which Don took the lead was in making donations and in organizing funds to which others could donate. He saw

the need to do this with the IMA, and in 2009 he single-handedly started the Eugene Fabes Directorship Fund, the intention of which was to pay for part of the IMA director's salary. He was prescient in seeing the need for independent endowment funds so as to lessen the reliance on other forms of funding. He set up the Ruth Kahn School of Mathematics Fellowship Fund, a fund which supports graduate students. He was a generous contributor to many other Math funds.

Although he had such a wide range of interests, we must mention that Don's contribution to the mathematical life of the department was never overshadowed by his other activities. Don was a fine and amiable teacher at all levels and a tireless supporter of mathematical research. He was a regular speaker in seminars. He put in considerable effort preparing accounts either of his own research or of expository material for the benefit of others, especially the students, and this meant a lot to him. He saw the importance of attending and supporting seminars on many topics, not just in his own specialty, because he perceived that the life of the department would be made better by this.

In all, we have lost a wonderfully talented colleague who lived life to the full, and who was more than willing to share his experiences with the rest of us. His passing is a great loss.

Awards and Recognition

AMS Fellows
Three current faculty (Maury Bramson, Mitchell Luskin and Willard Miller) were named Fellows of the American Mathematical Society in the 2015 list.

Vincent Quenneville-Bélair
Vincent Quenneville-Bélair won the award for Best Poster Design and Presentation for his poster, titled Finite Element Methods for the Evolution Problem in General Relativity, at the SIAM Conference on Computer Science and Engineering 2015.

Gregg Musiker
Gregg Musiker has been awarded the College of Science and Engineering George Taylor Career Development Award. The Award recognizes exceptional contributions to teaching by a candidate for tenure during the probationary period.

Doug Arnold
Doug Arnold has been selected for the J. Tinsley Oden Medal of the U.S. Association of Computational Mechanics "for seminal contributions as a research mathematician and educator specializing in computational mathematics, interdisciplinary research, numerical analysis, finite element methods, partial differential equations, mechanics, the interplay between these fields, and finite element exterior calculus." The Medal will be awarded at the 13th U.S. National Congress for Computational Mechanics, in San Diego in July, 2015.

Willard Miller
Willard Miller has been named a recipient of the 2015 University of Minnesota President's Award for Outstanding Service, in recognition of his many years of exceptional service to the Department, the IMA, the College of Science and Engineering, and the University.

Retirements

Peter Rejto
Peter Rejto retires this year after being a member of the math faculty for 50 years, a remarkable achievement even at a university that allows faculty to continue beyond the retirement age usual in many countries of the world. A dinner was held in his honor on April 21, 2015 and many colleagues shared their reminiscences which come from knowing him a long time. The most frequent comment was that Peter is a man of extraordinary generosity and kindness: a decent, caring human being.

Peter Alexander Rejto was born in Budapest on April 28, 1934 and remained in Hungary through to his early twenties. It was in 1956, at the time of the Hungarian uprising, that he left the country of his birth, crossing the border illegally. He maintains that a contributing factor which enabled him to do this successfully was that the Russian soldiers occupying the country at the time were draftees, and for this reason paid less attention to what was going on around them than they otherwise might. He then came to the US and completed a Ph.D. at the Courant Institute of New York University between 1957 and 1959 - an unusually short time. His adviser was Kurt Friedrichs, and Peter wrote a thesis with the title, 'On the Perturbation of Integral Operators of a Certain Kind'. This was the start of a career in mathematical research into partial differential equations and their applications in physics, notably quantum mechanics.

It was while at NYU that Peter met his wife Peggy, also a mathematician. Like several of our colleagues, they lived in New York in the early 1960s, in Greenwich Village in their case. Willard Miller was also in New York at that time, and he recalls meeting Peter at seminars in the Courant Institute in 1963, at which time Peter was teaching at NYU's campus in The Bronx. (The campus no longer exists.) Willard happened to be sharing an office with Charlie McCarthy at Courant, and credits Charlie with encouraging him, and possibly also Peter, to come to Minnesota. However it came about, the Rejtos drove across the country to Minnesota in a VW Beetle with a U-Haul trailer in tow, so that Peter could take up a position in our department. This was at a time when the present-day fast roads had not yet been built, and the tallest building in Minneapolis was the Foshay Tower. Peter was appointed Assistant Professor in 1965, Associate Professor in 1966 and then Professor in 1973 - a position he has held until this year when he becomes Professor Emeritus. At the same time Peggy pursued a very successful career at Normandale Community College, Bloomington, Minnesota, becoming department head and interim dean. Peter is the author of 45 mathematical papers and during his time at Minnesota three Ph.D. students graduated with him as advisor.

At the dinner in Peter's honor colleagues recalled how the Rejtos became part of the community in Prospect Park, where so many math colleagues seemed to live. They described acts of generosity and kindness, such as the lending of tools to help with household projects. In the department Peter was to the fore in volunteering to substitute in class when someone could not manage to teach: he may well hold a record for doing this! Colleagues also recalled his enthusiasm in seminars, in which Peter often asks questions. In retirement from teaching Peter hopes to use the time to do more mathematics, including attending more seminars. This increased activity will mean that we can be sure to see him often in the department in the future.

The Combinatorics REU

In the summer of 2000, Vic Reiner started what is now a well-known program, the Twin Cities combinatorics Research Experience for Undergraduates. The first four REU programs, which ran between 2000 and 2003, had an average of three students, and were funded by Vic in a variety of creative ways. One of these early students, Hans Christianson, went on to become a professor at the University of North Carolina. In 2005, Dennis Stanton joined forces with Vic, expanding the program to approximately five participants a year, until 2010 when Gregg Musiker and Pavlo Pylyavskyy joined as well. Since then, the program has averaged twelve participants, and been funded by an RTG grant obtained by the organizing team, which has allowed the organizers to focus the majority of their energy on crafting an even more challenging and productive experience.

The REU starts in early June, and always runs for eight weeks. During the first two weeks, the organizers present seven to nine problems. Students are asked to do some exercises to help them gain command of the material, and to read and present relevant papers about all the problems. It is up to each student to decide which problem to tackle. Students usually start working on two or three problems, which by the end of the program drops to one or two. Working in teams happens naturally, as there are more students than problems. It is not uncommon for those who prefer a solitary experience to work on their own, but most students enjoy the teamwork. At the end, teams write reports on the problems they focused on most heavily. Those whose results are deemed publishable by the organizers are encouraged to turn their reports into arXiv preprints.

One major piece of the REU's great success is the availability of graduate student and post-doctoral teaching assistants. While every student has access to the presenter of the problem, a lot of technical interaction happens with the TAs, who help students to sort out and present their ideas in the best possible way. While the TAs abstain from participating in the research for the duration of the program, they sometimes end up working with students as collaborators after the end of the REU, producing a joint publication. It is also not uncommon for graduate students and postdocs to be presenters of problems themselves, as was done by Rebecca Patrias, Joel Lewis, Max Glick and Jed Yang. This system works very well, and it is largely thanks to the NSF RTG grant DMS 1148634, which allows for funding of TAs as well as students.

An unusual attribute of the REU is the participation of a number of international students and there is grant money set aside specifically for these students. Unfortunately, NSF does not allow funds with the REU label to be used for international students, but it does not oppose funding a program under a different name, so the organizers formally run two programs: an REU and an URE, with the second directed specifically at non-resident students, funded by a different grant, the NSF DMS-1351590.

Over the years the REU has achieved some fame. At the beginning mainly strong local students were selected, but more recently the program has drawn on the best undergraduates from around the country. Between 2011 and 2015, the program welcomed sixty-three total participants, including 17 from MIT, 6 from Harvard, 4 from Princeton, 4 from University of Minnesota, and 3 students from Brown. Despite this fierce competition from New England, Midwestern schools such as Carleton College, St. Olaf College and Grinnell have also been represented.

Part of the success of the REU doubtless has to do with algebraic combinatorics being a particularly well suited area for undergraduate research. It provides a source of problems elementary or almost elementary in their formulation, yet having significant connections with less elementary areas such as algebraic geometry, representation theory, and dynamical systems. The potential contained within the suggested problems is evidenced by the students who continue working on their REU projects for years after the end of the program. Of the twenty-eight reports written in the programs of 2011-2014, seventeen have been put on the arXiv and have either been submitted for publication or appeared in major journals.

Looking at the accomplishments of the participants years after the REU provides no less impressive a picture of the program. Out of the thirty-six students that participated in the 2011-2013 programs, the majority of students were accepted to and attend graduate school. Seventeen of these went to Harvard, MIT, Berkeley, Princeton and Stanford. Several participants have also received distinguished awards, including the Judith A. Resnik award, the Alice T. Schafer prize, and several Barry Goldwater Scholarships.

The Twin Cities Combinatorics REU is an innovative program crafted to provide an engaging and career-shaping experience to all those who participate. It is poised to continue attracting many of the brightest minds to learn the skills - and joy - of mathematical research for years to come.

Alumni Honors

The 2014 Richard C. DiPrima Prize was awarded to Thomas D. Trogdon for his doctoral dissertation, "Riemann-Hilbert Problems, Their Numerical Solution and the Computation of Nonlinear Special Functions." According to the Prize Citation: "His dissertation has made outstanding contributions to the theory of and numerical methods for Riemann-Hilbert Problems and their applications to integrable systems, nonlinear partial differential equations, including the KdV and nonlinear Schrödinger equations, and special functions. The clear and elegant exposition of the subject abounds with new insight, rigorous theory and convergence results for new and powerful numerical methods." The Richard C. DiPrima Prize is awarded biennially by SIAM to a junior scientist who has done outstanding research in applied mathematics.

Thomas D. Trogdon is currently an NSF Postdoctoral Fellow at the Courant Institute of Mathematical Sciences, New York University. He received his BSc in Mathematics from the University of Minnesota in 2007, and his PhD in Applied Mathematics in 2013 from the University of Washington, Seattle. An extended version of his dissertation, co-authored with Sheehan Olver, another University of Minnesota alumnus, is scheduled for publication with the Society for Industrial and Applied Mathematics (SIAM).

School of Mathematics Center for Educational Programs (MathCEP)

Our University of Minnesota Talented Youth Math Program (UMTYMP) has grown considerably in the past few years. In 2008-09, for example, there were 128 students enrolled in single variable calculus, linear algebra, and multivariable calculus; in 2014-15, there were 268 students enrolled in those same classes. Combined with our high school level courses (algebra, geometry and precalculus), there are nearly 550 UMTYMP students attending classes on the Twin Cities campus. A few dozen more are enrolled at UMN-Rochester, and we are holding entrance exams in Duluth this spring.

Based on the increased enrollment, the College of Science and Engineering has increased its funding of UMTYMP, allowing us to hire a third full-time postdoc. Dr. Julie Rana will join us this fall, having completed her PhD in algebraic geometry at the University of Massachusetts, Amherst, and a teaching fellowship at Marlboro College in Vermont.

Three students are on schedule to finish the MS in Math with an Emphasis in Math Education degree: Erin Oakley, Erin Stuhlsatz, and Matthew Voigt. Oakley opted for the traditional version of this program, leading to a secondary teaching license in Minnesota. Stuhlsatz and Voigt chose the new option to teach at Normandale Community College, in preparation for teaching at post-secondary institutions. Voigt received an NSF graduate fellowship and will move to San Diego to continue in a mathematics education PhD program.

Our summer schedule has a number of enrichment camps and professional development opportunities for K12 students and teachers, including a Math Modeling Camp for High School Students in conjunction with the IMA and enrichment programs for UMTYMP students. Please visit www.mathcep.umn.edu for full information.

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 Eric Voth (St. Jude Medical), Benoit Couet (Schlumberger-Doll), Juan Garcia (MTS Systems), Earl Sun (Target Corporation), Lev Koyrakh (Medtronic), and Raya Horesh (IBM Research). The lecture series touched upon many areas of applied mathematics, and several of the seminars emphasized the growing need for sophisticated data analysis across a wide range of industries. Other themes included the need to understand problems which require robust computational techniques and the task of modeling and optimizing complex systems.

Math Library News

At long last, math students in the library have access to the Bloomberg Professional financial data resource, which is critical for the financial math program. This could only happen through collaboration with the Minnesota Center for Financial and Actuarial Mathematics, to jointly fund the subscription, provide the dedicated computers, and establish use policies. It's an important addition to the actuarial exams study guides and other curriculum-supporting resources the library provides.

The mathematics of voting was a hot topic on Nov. 4, 2014: when the Math Library's Twitter account (@umnmathlib) recommended print and online books such as Donald Saari's 'Chaotic Elections!' and Christoph Börgers' 'Mathematics of Social Choice,' hundreds of followers clicked through to learn more. The Twitter account is also used to increase awareness of events from Women in Math and the SIAM student group (@siamumn), as well as the IMA's public lectures and other activities (@ima_umn). This social media channel is another way to keep connected with the local mathematics community and to engage the library's users, in addition to the math news items and thought-provoking exhibits that greet users of the physical space.

The collections space presented a challenge this year, with the journals becoming so overcrowded that some had to be shelved in the library office. This space crunch was relieved by sending to storage selected journals for which we have online access, so that that content continues to be readily available (even faster than requesting delivery of the print volumes). Input provided by the faculty was key to identifying journals to keep on the shelves because of their browsing value and significance in the research process.

Sometimes online access can be the only workable solution: for the second time in two years, a request was received from another country for Emeritus Prof. Lawrence Markus's lecture notes, published as part of the School of Mathematics report series. With his permission, the library was able to scan the volumes and post them openly in the University Digital Conservancy (conservancy.umn.edu). 'Hamiltonian Dynamics and Symplectic Manifolds' (1973) is his most popular title so far, with over 50 downloads since it was made available in 2013. This strategy could be applied to sharing other original works effectively—with the added attraction that material in the Conservancy is highly ranked in Google searches.

Minnesota Center for Financial & Actuarial Mathematics (MCFAM)

The past year in MCFAM was one of collaboration within the University and with the quantitative finance and actuarial industry. There is an ever growing group of dedicated and involved industry practitioners - be it actuaries guest-instructing in our Actuarial Mathematics in Practice problem solving course, modeling mentors for the Winter Master of Financial Mathematics (MFM) Modeling Workshop or actuarial students helping MCFAM to develop an Online Probability (P) Exam Workshop.

We increased collaboration with faculty and departments from around the University. We worked with the Carlson School to coordinate University-wide cost sharing of Bloomberg Terminals now available in the Math Library. In addition to our usual collaboration with industry for our annual MCFAM Summer Symposium we also included other University of Minnesota faculty members in the planning and delivery of the Symposium: the School of Statistics, the department of Industrial Systems Engineering (ISyE) the Carlson School of Management's Medical Industry Leadership Institute (MILI) , the School of Public Health and the Department of Applied Economics. We held the first-ever Quant Finance and Statistics Career Fair between the MFM and Graduate Statistics Programs. We also joined forces with the University of St. Thomas's Actuarial Science Program and our local actuarial community and were awarded the honor of co-hosting the premier North American Actuarial Research Conference (ARC) in the summer of 2016.

The collaboration is also evident between our current students and alumni of the Actuarial and MFM programs. We have a growing Actuarial Alumni Mentoring program and have begun a tradition of connecting MFM alumni and current students during the IAQF New York City Career Fair and MFM student-sponsored Chicago Trek events. We just completed the MFM Spring Networking Event where we featured a nationally recognized panel called “How I Became a Quant”. Four of the six panelists were alumni of the MFM program, one is now an instructor in the program and one got his PhD in our School of Math. They are all working in the Twin Cities at: US Bank Treasury-Quantitative Modeling, Columbia Threadneedle (An Ameriprise Investment Company), Agribank, Whitebox Advisors Hedge Fund and Cargill Risk Management and Trading.

IMA News

In December 2014, the IMA received word from the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) that it has been recommended for a ramp-down. The NSF decision came as a shock. The IMA was invited to submit a non-competitive renewal proposal in early 2014. The high rating of the proposal led to a site visit in September 2014. The site visit committee recommended continued funding of the IMA. The DMS decision, which goes against the site visit team recommendation, will essentially end the IMA's successful run in its present form. Since its founding in 1982, the IMA has risen to become a premier Math Institute where researchers from mathematics and other disciplines collaborate on mathematical and scientific challenges of our time. While we await the NSF recommendation to be finalized, we have already begun the process of re-imagining the IMA and started seeking other funding sources to ensure that the IMA will continue to be a resource for the mathematical community and the University well beyond 2017.

The IMA Thematic Annual Program for the 2014-15 academic year is on "Discrete Structures: Analysis and Applications". Sergey Bobkov from the School of Mathematics is one of the organizers who shaped the program which focuses on the interplay between discrete mathematics and probability. Another organizer is Jerrold Griggs of the University of South Carolina, who was a long-term visitor in the 1988 IMA program in Applied Combinatorics. Jerry was able to return as long-term visitor in the Fall of 2014. The program also connected with the strong group in combinatorics in the department. Many faculty members, such as Gregg Musiker and Vic Reiner are heavily involved. A number of students and postdocs from the department participated in this exciting program. As the program winds down in May, the IMA is gearing up for the 2015-16 program in Control Theory and its Applications.

This summer the IMA is offering a two-week course on "Introduction to Uncertainty Quantification" in June. Also in June, it will host a workshop on "Reflected Brownian Motion" which is organized in recognition of Ruth Williams's 60th birthday. Ruth, who holds the Charles Lee Powell Chair in Mathematics at UC San Diego, was an IMA Postdoc in 1985. In July, the IMA will offer its second "Math Modeling Camp" for high school students. The camp is a collaboration with the MathCEP. Finally, in August, the IMA will run its popular "Mathematical Modeling in Industry" workshop where students work in teams on industrial projects while receiving guidance and mentoring from industry scientists.

Continuing the IMA's tradition of Abel Conferences, the influence of Yakov Sinai's work was the focus of the 2014 meeting which was held in October. The conference took place over two and one-half days with 58 people attending. In addition to the ten talks given by mathematicians who were deeply influenced by Sinai's work, the IMA hosted a banquet at which Sinai's former students had a chance to share stories about him.

Undergraduate Program

Graduate teaching assistants Heidi Goodson, Nathan Gray, Shannon Negaard, Erin Oakley, and Alexandra Ortan won the 2013-14 Outstanding Teaching Assistant Award. Students in mathematics courses submitted approximately 780 nominations in support of their TAs.

Thirty-two of our more than 600 math majors will be awarded 2015-16 merit scholarships from the department totaling approximately $73,000. In addition to scholarships from the existing Dalaker, Thorpe, Lando, Richards, and Hart funds, the School of Mathematics will award the new Mark I. Gilquist Scholarship, Hans G. and Sophie L. Othmer Scholarship, and Isaac Benjamin Segal Scholarship.

Four math majors, Alexandra Bosch, Han Yong Wunrow, Deandra Bardell, and Patrick Holec, were awarded merit scholarships from the College of Science and Engineering.

Maxwell Shinn, a graduating senior in neuroscience and mathematics, was named a 2015 Churchill Scholar under the program which funds study at Churchill College, Cambridge, UK.

Three math majors, Nathan Klein, Andrew Senger, and Sammy Shaker, were named 2015 Goldwater Scholars.

Ten math majors participated in the Putnam Competition, and four of them finished in the top 500 of over 4000 participants: Ian McMeeking (71st), Andrew Senger (311th), Ankan Ganguly (371st), and Christian Gaetz (426th). The U of M Putnam team finished 23rd out of 577 participating schools.

Six teams from the U of M - Twin Cities competed in the North Central Team Mathematics Competition sponsored by the MAA. All six teams finished in the top 25 of 90 participating teams, including teams finishing second, sixth, seventh, eighth, and ninth.

In Fall 2012, the School of Mathematics began offering specializations of the mathematics major in two areas of mathematical biology, genomics and physiology, in addition to existing specializations in actuarial mathematics, computer applications, and mathematics education. The first students choosing the math bio specializations will graduate this spring.

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.

Dallas Albritton, 2014 College of Science & Engineering (CSE) Graduate Fellowship, Paul Garrett, advisor.

Craig Corsi, 2014 College of Science & Engineering (CSE) Graduate Fellowship, Benjamin Brubaker, advisor.

Gabriela Jaramillo, 2014 Doctoral Dissertation Fellowship, Heterogeneities and Defects in Spatially Extended Systems, Arnd Scheel (advisor). She has been awarded an NSF Postdoctoral Fellowship and will be going to the University of Arizona, Shankar Venkataramani, advisor.

Katherine Meyer, 2014 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship, Richard McGehee, advisor.

Laurel Ohm, 2014 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship, Richard McGehee, advisor.

Vincent Quenneville-Belair, 2014 Doctoral Dissertation Fellowship, Using Computer Simulations to Design a New Telescope That Sees Gravity, Douglas Arnold, advisor.

Matthew Voigt, 2014 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship, Jonathan Rogness, advisor.

Xu Wang, 22014 Doctoral Dissertation Fellowship, Manifold Searching and Clustering: A Intrinsic Treatment, Gilad Lerman, 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, 2014 to February, 2015).

Averina, Viktoria Alexandrovna, A Mathematical Model of Neurally-Mediated Angiotensin II-Salt Hypertension, Hans G.Othmer, advisor; Principal Research Scientist, Boston Scientific Corp.

Bashkirov, Denis Aleksandrovich, The BV formalism for homotopy Lie algebras, Alexander A. Voronov, advisor, Teaching Specialist, School of Mathematics, University of Minnesota, Minneapolis, MN

Benson, Joseph J., Integrable Planar Curve Flows and the Vortex Membrane Flow in Euclidean 4-Space Using Moving Frames and the Variational Bicomplex, Peter J. Olver, advisor; Visiting Assistant Professor of Mathematics, St. Olaf College, Northfield, MN

Campbell, Patrick Ronald, Dynamical implications of network statistics, Duane Q. Nykamp, advisor

Chen, Nai-Chia, Periodic Brake Orbits in the N-Body Problem, Richard B. Moeckel, advisor

Csar, Sebastian Alexander, Root and weight semigroup rings for signed posets, Victor Schorr Reiner, advisor; Analytics Software Developer, Spiceworks, Austin, TX

Hoyer-Leitzel, Alanna R, Bifurcations and Linear Stability of Families of Relative Equilibria With A Dominant Vortex, Richard B. Moeckel, advisor; Ed Lorenz Postdoctoral Fellow, Mathematics of Climate Change, Bowdoin College & MCRN, Brunswich, ME

Kim, Minsu, A Thermomechanical Model of Gels, Yoichiro Mori, advisor; Teaching Specialist, School of Mathematics, University of Minnesota, Minneapolis, MN

Nie,Xiaolan, Complex Monge-Ampere equations and Chern-Ricci flow on Hermitian manifolds, Jiaping Wang, advisor; Visiting Assistant Professor, The Ohio State University, Columbus, OH

Oestreicher, Samantha M, Forced Oscillators with Dynamic Hopf Bifurcations and applications to Paleoclimate, Richard P. McGehee, advisor; Business Process Analyst, Target, Minneapolis, MN

School of Mathematics
University of Minnesota
127 Vincent Hall
206 Church Street S.E.
Minneapolis, MN 55455
http://www.math.umn.edu
dept@math.umn.edu
Telephone: (612) 625-5591
Fax: (612) 626-2017

Department Head:
Peter Olver
olver@math.umn.edu
Telephone: (612) 625-5591

Graduate Studies
Richard McGehee, Director
mcgehee@math.umn.edu
Telephone: (612) 624-6391

Undergraduate Studies:
Bryan Mosher, Director
Telephone: (612) 625-4848
mosher@math.umn.edu

Minnesota Center for Financial & Actuarial Mathematics (MCFAM)
Rina Ashkenazi, Academic Diector
Laurie Derechin, Executive Director
Telephone: (612) 626-8057
mcfam@umn.edu

Institute for Mathematics and its Applications (IMA)
Fadil Santosa, Director
Jiaping Wang, Deputy Director
Richard Braun, Associate Director
Carlos F. Tolmasky, Associate Director
Chehrzad Shakiban, Associate Director for Diversity
400 Lind Hall
207 Church Street S.E.
Minneapolis, MN 55455-0463
http://www.ima.umn.edu
Telephone: (612) 624-6066
Fax: (612) 626-7370

Minnesota Center for Industrial Mathematics (MCIM)
Daniel Spirn, Director
http://www.math.umn.edu/mcim
mcim@umn.edu
Telephone: (612) 625-2004
Fax: (612) 624-3333

School of Mathematics Center for Educational Programs (MathCEP)
Jonathan Rogness, Director
4 Vincent Hall
206 Church Street S.E.
Minneapolis, Mn 55455
http://www.mathcep.umn.edu/
Telephone: (612) 625-2861
Fax: (612) 626-2017

The Newsletter Committee is composed of Peter Webb (Chair), Christine Berkesch Zamaere, Adrian Diaconu, Bonny Fleming, Peter Olver, Pavlo Pylyavskyy, Harry Singh.

School of Mathematics
University of Minnesota
127 Vincent Hall
206 Church Street S.E.
Minneapolis, MN 55455