

School of Mathematics

Newsletter Volume 25, Spring 2019



Head Lines Peter Olver

I am still here! As noted in last year’s Newsletter, after being pressed by the Dean and many of my colleagues, I re-enlisted as Department Head for three more years. While this is now my eleventh year in this position, I am still enjoying the opportunity to serve this amazing Department, while continuing to build on our many successes. Next fall, the Department will be having an External Review —last done 2005—and, despite the effort required to properly prepare for it, am looking forward to the process and the results.



In faculty news, we hired two new assistant professors this year: Paul Carter, who works in dynamical systems, and is currently a postdoc at the University Arizona; and Max Engelstein, who works in harmonic analysis and is currently at MIT — both will be joining us this coming fall, as will Tsao-Hsien Chen, who works in algebra and representation theory and was hired last year. In addition Chuan Xue, who works in math biology and is a former University of Minnesota Ph.D. student with Hans Othmer serving as her advisor, has accepted our tenured associate professor offer and will be joining us in Fall, 2020.

After 58 years of dedicated service, Chester Miracle is retiring at the end of this academic year. Chester is the last remaining member of the old College of Liberal Arts Math Department, which was merged into the current CSE Department in the mid 1960’s, and is much valued for his many years of stellar teaching and curriculum development. His long-standing presence in the Department will be missed, but we wish him many more productive years of Emeritus status. In sad news, we held two Memorial Services for departed colleagues this year. On March 8, we honored Emeritus Professor Charles McCarthy, who was killed in a vehicle/pedestrian accident on October 11 in Portland, Oregon. On April 26, we honored Associate Emeritus Professor James Thompson, who had been at the University of Minnesota since 1946 as student, lecturer and professor until his retirement in 1992, and died on August 22 at the age of 96 in Portland, Oregon. (He and Charlie had been in regular contact since

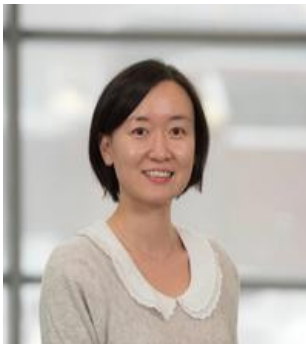
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moving there.) Most recently, Emeritus Professor Donald Aronson sadly died on April 15, 2009; a Memorial Service for Don is planned to be held in the fall.

I am extremely excited by our two new partnerships, with the National Alliance for Doctoral Studies in the Mathematical Sciences (the “Math Alliance”) and with the African Institute for Mathematical Sciences (AIMS). The University of Minnesota has become one of currently four inaugural partners of the Math Alliance, which focuses on fostering the growth of the community of mathematical scientists that promotes a diverse workforce.

Secondly, the University of Minnesota announced a new partnership with the African Institute for Mathematical Sciences (AIMS), which recruits Africa’s most talented university graduates and provides them with a one-year intensive Masters program in mathematics to enter technical professions or to pursue graduate studies in STEM fields: <https://www.nexteinsteinstem.org>. The University of Minnesota is one of only four universities in the United States who are AIMS academic partners, and, having taught in AIMS in 2006, I am very excited by developing this partnership, and recruiting their talented students to our programs.

Welcome to New Faculty



Li Wang was born in Wuhan, China, with her 15-minute older twin sister, Chun Wang. When they were little kids they competed with each other - from learning Chinese characters, multiplication tables, abacus computation, and later in every subject taught at school. Math was their favorite subject and the most

intense field of competition for them. The competition finally halted when the twins went to University. University. Li went to Huazhong University of Science and Technology to study mathematics.

After graduation from college, Li came to the US in 2007 to pursue her PhD at the University of Wisconsin-Madison, under the supervision of Professor Shi Jin. Her thesis was on multiscale methods for kinetic and hyperbolic equations, in which she developed domain decomposition methods for two-scale hyperbolic systems and asymptotic preserving methods for kinetic equations with high field limits. She received her PhD in June 2012, and spent 6 months at UCLA visiting Professor Andrea Bertozzi. With Andrea, she switched to a new research topic on shock dynamics for particle-laden flow, and developed a theory for

singular shocks that matches well with the experiments.

Li became a postdoc at UCLA where she continued her research in slurry flow, and also pursued a project on human crowd dynamics. This area has a lot in common with fluid dynamics and kinetic theory. Both projects are a mixture of modeling, analysis, and numerics. In January 2016, Li started as a tenure track assistant professor at SUNY Buffalo for two and a half years. Her research branched out into inverse problems in kinetic theory and computational methods in optimal transport.

Li joined the University of Minnesota in August, 2018 to be closer to her sister Chun who had been working for six years at the Department of Psychology. But they did not stay together. Chun decided to move to Seattle for work reasons. Now Li lives in Chun’s former condo in downtown Minneapolis, and cherishes the city and the university that Chun loved very much.



William (Will) Leeb was born and raised in New York City. Growing up, he enjoyed reading, solving puzzles, and playing the piano. While Will had many academic interests in high school, including history, computer science, physics, and music theory, he never thought he would end up concentrating in mathematics, let alone become a research mathematician. Matriculating at the University of Chicago in 2006.

Will originally planned to major in economics but soon switched to mathematics after an inspiring introductory analysis course in his first year. At Chicago, he won the Mathematics Department’s Paul R. Cohen Memorial Prize for top undergraduate performance, and was appointed a Student Marshal and elected to Phi Beta Kappa in his third year. Will has many fond memories of Chicago and the rigorous introduction to mathematics he received there.

As a graduate student at Yale, Will worked with his advisor Ronald (Raphy) Coifman on problems in metric approximation, particularly computationally-efficient embeddings of Earth Mover’s Distances and multidimensional tensor metrics. These methods have applications to the compression, organization, and denoising of large databases. Will considers himself extremely fortunate to have worked closely with Raphy and to have learned from his unique approach to mathematics and its applications. After completing his Ph.D, Will earned a postdoctoral fellowship from the Simons Foundation Collaboration on Algorithms and Geometry to support his research at Princeton University. Working with Amit Singer, Will developed a research program on principal component analysis, multireference alignment, and their application to cryoelectron microscopy and other scientific problems. Will is continuing this program at Minnesota, studying problems in statistical in-

ference characterized by high noise levels and many nuisance parameters. Since moving to Minnesota, Will and his wife Maisie have been enjoying concerts by the Minnesota Philharmonic Orchestra and exploring the state's beautiful lakes, parks and nature reserves.

Featured Faculty



Ionut Ciocan-Fontanine joined the School of Mathematics in 2000. He was born in 1967 in Ploiesti, Romania, situated 60 km from the capital, Bucharest. Ionut did well in his studies of math, but math itself held no special interest for him until the 5th grade when he started having different teachers for different

subjects. His 5th grade math teacher recognized his talent by assigning him an independent project involving the solution of simple diophantine equations. The capstone for the project was a paper and a presentation at a citywide competition at which he got second prize. Most of the other contestants were in high school. In 8th grade he got another math teacher to inspire him, this one responsible he says for putting him on the path to his career in mathematics. He started to publish solutions to problems in *Gazeta Matematica*, the Romanian high school mathematics journal founded in the 19th century and still operating today.

In 1985 Ionut was admitted to the mathematics department at the University of Bucharest. He spent four years there plus one more year to get an MS degree. He entered the field of algebraic geometry and was especially interested in birational geometry. He graduated from the university in 1991.

Ionut chose Utah for graduate school and began his studies there in 1992. He was drawn to Utah by its strength in birational geometry. While writing the later-to-become-influential paper "Quantum Schubert calculus" faculty member Aaron Bertram began to use Ionut as a sounding board. Bertram passed along a paper by A. Givental and B. Kim ("Quantum cohomology of flag manifolds and Toda lattices") containing heuristics and a conjecture about quantum cohomology. He proved the conjecture, the proof became his thesis, and he has pursued research from the launch point of his thesis ever since.

After graduating from Utah in 1996 Ionut spent '96-'97 at the Mittag-Leffler Institute in Stockholm participating in a special year organized by William Fulton. Also participating that year was Bumsig Kim, the junior co-author of the paper containing the conjecture that Ionut had proved. By luck, the two young postdocs--and direct competitors--

--were assigned to each other as office mates. They got to talking, wrote a couple of papers together during the special year, and they have been regularly collaborating ever since.

Since 2007, Ionut has spent a month or so every summer at the Korea Institute for Advanced Study (KIAS) to work with Kim. Their work on Quasimap Theory is featured in a joint survey paper with the same title in the Proceedings of the 2014 ICM, in conjunction with Kim's invited lecturer Bertram. Another outcome of the special year at Mittag-Leffler was a joint paper with his great-grand-advisor Fulton and advisor Bertram of which his grand-advisor Robert Lazarsfeld quipped "nice paper but it has a gap."

Ionut has become a later-in-life oenophile and is fascinated by U.S. politics.



Mitchell Luskin grew up in Los Angeles in a family that ran a small plumbing business. Although he did not continue in this line himself, a number of things rubbed off on him from this background. He sometimes used to help his father and grandfather in the summer and on Saturdays digging trenches and threading pipes for sprinkler systems and this left him with a strong work

ethic. When he went to university, he was a first-generation student.

Mitch went on to Yale for his undergraduate degree where he was taught by a number of notable mathematicians: Feit (combinatorics and character theory), Kakutani (analysis), and Jacobson (algebra), among others. He started at the University of Chicago as a graduate student in 1973. Numerical Analysis fit his interests well, so he gravitated towards Jim Douglas, Jr. and Todd Dupont, who became his Ph.D. advisers. Ironically, his thesis on fluid flow in networks of gas pipelines had some overlap with sprinkler systems. Another important formative graduate school experience was working with a geophysicist, George Platzman, on a finite element method to compute normal modes of the world's oceans. This experience hooked Mitch on interdisciplinary collaboration.

After his PhD in 1977, Mitch accepted a tenure-track assistant professor position at the University of Michigan without any postdoc experience. In his research he began collaborations with physicists and engineers. In 1980 Mitch got a one-year fellowship to visit the Courant institute. He had also heard about Minnesota's strong PDE group, its Chemical Engineering Department, and the recently awarded IMA; this attracted him to come here as an assistant professor in 1981. He became full professor in 1985. There was no numerical analysis at Minnesota so Mitch created numerical analysis courses during the early 1980s. He also started work on mathematical modeling

and simulation of materials. Mitch has enjoyed working with many graduate students, postdocs, and faculty, often in collaboration with materials scientists and physicists, on the modeling and computing of materials such as viscoelastic fluids, liquid crystals, and shape memory alloys.

Mitch is particularly excited about his current research focus on the modeling of two-dimensional materials. These materials, such as graphene, are a class of materials that are atom-thick and behave as two-dimensional structures. Many possess remarkable properties such as strength and flexibility, and they may be excellent conductors of heat and electricity.

There is the possibility of interleaving these materials to create stable structures with any combination of desired electronic, optical, magnetic, and thermal properties with atomic-scale features. This design space is too large to be fully explored by experimental methods, so Mitch is working to develop models and numerical methods to probe it and suggest where experimental effort can be best applied.

Mitch views the goal of controlling and optimizing the flow of electrons in 2D materials as a continuation at the atomistic scale of his earlier work on sprinkler and gas pipeline systems. The first 2D material workshops were organized by Mitch and other scientists at the IMA in May 2017 and March 2018 and there will be another related workshop in May 2019.

Mitch's wife, Barbara, is a Clinical Psychologist who works at the Autism Society of Minnesota. Their autistic oldest son lives in a group home, and they have a twin daughter and son who are pursuing a medical and clinical psychology career, respectively.

Featured Staff



Stephanie Lawson has worked at the University of Minnesota for over 4 decades. In that time she has been witness to changes and things that have stayed the same. She started as secretarial staff at the University in 1977 in the Department of Family Medicine. She worked with MD faculty and

PhDs whose focus was research. By 1985 she opted for a new environment and moved to the Economics Department, outlasting two buildings in which she worked prior to that: Powell Hall and the Botany building.

Stephanie found that the economists were frugal. Her first desktop computer at the Economics Department was a refurbished one bought by a faculty member at a discount

place that may have been on Lake Street. It was a big deal to have a laser printer at that time: to access one she had to go to a public lab. Eventually it became the norm for all staff to have a computer and printer. She was introduced to Latex, which served her well when applying for a position with the School of Mathematics.

In 1990, Monika Stumpf hired Stephanie as Word Processing Supervisor in Vincent Hall 105 in the School of Mathematics. When an opening for Senior Office Supervisor in the Math Undergraduate Office appeared, she applied and was accepted for that position in the summer of 1993. She remains to this day in the Math Undergraduate Office, having served under the following Undergraduate Directors: Professors Stephen Agard, John Eagon, David Frank, Lawrence Gray and, currently, Bryan Mosher.

Stephanie was here when the Internet first hit the University in a big way, opening a window of useful tools but, she says "also increased the workload". These days everything has to be done sooner, because the computer system requires a continual input of information. Before this, the natural inertia in the system of waiting for student registration reports provided some useful slack time". The increasing student population and number of math majors has also demanded new procedures and policies and opened the door for increased faculty advising and professional advisors.

Stephanie is philosophical about the changes. She went to a talk by author Mohsin Hamid, who said that everyone is migrant and must adjust to changing circumstances and times. She says the University has changed much through the years - whether for better or worse is a matter of opinion. The old saying seems true - the more things change, the more they remain the same. "The social and moral issues here 42 years ago are still here today."

Stephanie grew up in Minnesota, and finds that one unchanging part she loves here is time spent with friends (both two- and four-legged, some with beaks and tweets) and going to the movies or lakes.

New Initiatives

Math Alliance

The University of Minnesota became one of the four inaugural partners of the Math Alliance in 2018. Some of the goals of the Alliance are:

- To increase the number of doctoral degrees in the mathematical sciences among groups that have been traditionally underrepresented in those fields.
- To increase the number of Ph.D. from these groups who enter the professoriate in the mathematical sciences as well as other appropriate professions.
- To foster the growth of a community of mathematical scientists that promotes a diverse workforce.

(The Alliance's complete list of goals is at: <https://mathalliance.org/goals/>).

The Math Alliance pairs undergraduates with Alliance mentors who stay with them as they move into their graduate programs. Alliance scholars, as stated on the website, are “math sciences students, either undergraduates or students enrolled in a terminal Master’s program, who come from ethnic groups, families and/or regions that have had little prior experience with doctoral study in the mathematical sciences.” The criteria also states they must be interested in and serious about pursuing a graduate level degree.

As part of their responsibilities, Alliance scholars and mentors must attend the annual Field of Dreams Conference. The conference introduces the scholars to graduate Alliance programs in the mathematical sciences as well as professional career opportunities in these fields.

Dick McGehee, the Department’s Director of Graduate Studies, is leading our partnership with the Math Alliance and is proud that we now have eight Alliance Scholars in our PhD program. The IMA is also collaborating with the Math Alliance and from June 5-8, 2019 it is holding a workshop called Career Paths in Mathematical Sciences – An IMA/Math Alliance Workshop (<https://www.ima.umn.edu/2018-2019/SW6.5-8.19>). IMA Director, Daniel Spirn is pleased about this event and said “The Career Paths program will tap the institute’s extensive connections to industry to give an expansive view of the many career opportunities that open up with a math PhD. We are excited to develop and host this workshop.”

African Institute for Mathematical Sciences

The University of Minnesota and the African Institute for Mathematical Sciences (AIMS) announced a new partnership for exchanging knowledge and accelerating educational opportunities for talented African mathematicians. AIMS recruits Africa’s most talented university graduates and provides them with a series of intensive, cutting-edge courses in mathematics to enter technical professions or to pursue graduate studies. The University of Minnesota is one of only four universities in the United States who are AIMS academic partners.

AIMS has five centers, located in Limbe, Cameroon; Biriwa, Ghana; Kigali, Rwanda; MBour, Sénégal and Cape Town, South Africa. Students come from all over the African continent to pursue a one-year post baccalaureate program in mathematics that includes a final research project. The individual courses are three weeks in duration, in a broad range of mathematics and statistics, and taught by visiting professors from throughout the world. One of the benefits of our partnership is a guarantee that the University of Minnesota can send a lecturer and teaching assistant to teach one such course at one of the AIMS centers. After

successfully completing the course of study at AIMS, students earn a Masters degree, and are in an excellent position to pursue further graduate study, including Ph.D. programs in mathematics, statistics, and other STEM fields. See <https://www.nexstein.org> for more detailed information.



In March 2019, Sam Mukasa, former CSE Dean and currently in the Provost’s office, and Peter Olver visited the AIMS centers in Kigali and Cape Town. The goal was to develop this new and exciting partnership, to meet the students, and to encourage them to apply to Ph.D. programs at the University of Minnesota. Africans form a rapidly growing but mostly

untapped resource of bright and talented students that would enhance the University of Minnesota graduate programs, increasing diversity, fostering potential collaborative educational and research endeavors, and thereby benefiting the development of the mathematical infrastructure of the African continent.

Simons Collaboration on Localization of Waves

The Department of Mathematics at the University of Minnesota serves as the headquarters for the interdisciplinary and international Simons Foundation Wave Localization Collaboration, funded for four years at \$8M and led by Northrop Professor Svitlana Mayboroda. An additional investigator from the University of Minnesota, McKnight Presidential Mathematics Professor, Douglas Arnold, joins a collaboration that brings top experts in Physics and Mathematics from around the world to study the science of waves.

Philip Anderson is credited with discovering and defining strange wave phenomenon while working as a physicist at Bell Laboratories in the 1950s. He observed that in the presence of disorder, waves could stop and stay ‘localized’, remaining confined rather than propagating over an extended region. In 1977, Anderson received the Nobel Prize in physics for this discovery, later referred to as ‘Anderson localization.’ The theory of Anderson localization has garnered an enormous amount of attention in the past 50 years. While it still presents many challenges in itself, it turns out that a dramatic change from the “natural” behavior of waves that occurs in the presence of material and geometrical irregularities is at once more ubiquitous and more complicated than that. The mysterious ‘rogue wave’ behavior appear everywhere in our daily lives, from medical ultrasound scans on a broken bone to disrupted Wi-Fi connections at a busy airport.

The present project began in earnest in 2009 when Dr. Mayboroda presented her research on mathematics of thin plate vibration to a French audience of mathematicians and physicists. The presentation caught the attention of Marcel Filoche, a member of the audience, CNRS Research Director in Condensed Matter Physics at the École Polytechnique in France. He speculated whether the irregular bulging patterns Mayboroda

described in thin plates were related to the way acoustic vibrations in his research localized in some places, while disappearing in others, which started a long and fruitful collaboration.

By 2012, this work led Mayboroda and Filoche to define a single mathematical expression called the ‘landscape function’ which interprets information about the geometry and material a wave is moving through and uses it to draw the boundaries of localization. While the initial research was based on mechanical vibrations, they knew more could be unraveled in the quantum world of electron waves. Shortly thereafter Doug Arnold, a computational mathematician, and harmonic analysts Guy David and David Jerison joined the team. Together they dramatically amplified the understanding of the mathematical power of the landscape function for the Schrödinger equation to predict where and at what energy level eigenfunctions will localize, aiming at the understanding and control of waves of matter. Simultaneously, in collaboration with Claude Weisbuch and Jim Speck, first steps have been taken to apply the landscape theory in the context of semiconductors and, with Alain Aspect, to compare experimental results for cold atoms to the theory.

At this point, the project has substantially expanded. The PIs and consultants bring together mathematical tools from harmonic analysis and partial differential equations and probability, combined with high performance computational simulations and state-of-the-art experimental investigations of ultra-cold atoms and semiconductors. The team includes laureates of the most prestigious prizes in science and math: the Abel prize, the Nobel Prize, the Fields Medal and the Wolf Prize. Dr. Mayboroda is honored to lead the world-renowned team of principal investigators: “Their interdisciplinary expertise is critical and drives our success. It is a privilege to have a chance to work with these outstanding scientists on a subject that makes us all passionate from such different points of view. I am also grateful to the Mathematics Department, Ben Brubaker and Katherine Lindsay for their tremendous support.”

Please click here to review bios. Stay tuned as the group learns to ride the wave. <https://z.umn.edu/wavelocalization>



Left to Right: Row 1 – Doug Arnold, Alain Aspect, Svitlana Mayboroda, David Jerison; Row 2 – Jim Speck, Sir Richard Friend, Marcel Filoche, Guy David; Row 3 – Claude Weisbuch: Yves Meyer not pictured.

Symposia

Rivière-Fabes Symposium



The Rivière -Fabes Symposium, held April 5-7, 2018, invited four distinguished lectures in several areas of PDEs and Analysis. The distinguished speakers were: Ciprian Demeter (Indiana University), Charles Epstein (University of Pennsylvania); Joachim Krieger (Ecole Polytechnique Federale de Lausanne and Tatiana Toro (University of Washington). Over 30 graduate students and postdocs from outside universities attended. The NSF, the Rivière-Fabes Fund at the University of Minnesota, and the IMA, sponsor the symposium. Lecture topics are at:

Yamabe Memorial Symposium

The Symposium held September 28-30, 2018, meets every other year to advance areas of mathematics related to the interests of Hidehiko Yamabe, which touched on various areas of mathematics with significant geometric aspects. The theme of the 2018 symposium was “Moduli Spaces in Algebraic Geometry “ and the first time the symposium dedicated to a topic in Algebraic Geometry. The distinguished speakers were: Dan Abramovich (Brown University), Robert Friedman (Columbia University), Jun Li (Stanford), Shigeru Mukai (RIMS-Kyoto), Aaron Pixton (MIT), Yukinobu Toda (Kavli IPMU and University of Tokyo), and Chenyang Xu (BICMR Beijing). For lecture topics: <https://math.umn.edu/content/conference-schedule-2018>

Midwest Dynamical Systems and Satellite Conference Honoring Dick McGehee

The 2018 Midwest Dynamical Systems Conference (November 3-4, 2018) was preceded by a Satellite conference in honor



of Dick McGehee’s career contributions to mechanical systems. Dick McGehee’s conference was held November 1-2, 2018. It included 4 sessions: Celestial Mechanics and Vortices, Noninvertible Maps and Relations, Theory and Applications and Dynamical Systems in Models. The conference, organized by Dick’s former student, Dr. Bruce Peckham (UMN-Duluth), included many of his collaborators and students: Rick Moeckel, academic sibling (UMN-Twin Cities), Evelyn Sander, former student (George Mason University) and Jim Walsh, collaborator (Oberlin College). There were 15 speakers, 4 of which were current or former students, 4 current and former postdocs and a variety of Dick’s collaborators.

Remembering Former Colleagues



Charles Alan McCarthy (August 7, 1936-October 11, 2018) was killed in a vehicle/pedestrian accident on October 11 in Portland, Oregon, where he had lived for many years.

In 1956 Charles earned a Bachelor's degree from the University of Rochester (New York). In 1959, he completed a Ph.D. from Yale University under the direction of Einar Hille. His dissertation was in functional analysis: "On the Functional Calculus for Operators on a Banach Space." From 1959-1961, he did post-doctoral work at MIT.

In 1961, Charles was hired as an assistant professor at the University of Minnesota, promoted to associate professor in 1963, and in 1967 he became full professor. He had 20 publications in his areas of research: functional analysis, Banach algebras, L_p estimates, commuting Boolean algebras of projections on a Banach space, linear operators on Hilbert and Banach spaces and on finite-dimensional spaces (i.e., matrices). He collaborated on research with department colleagues Nestor Rivière and Walter Littman. He also supervised 2 Ph.D. students: Roger Countryman in 1966 and Ronald Rietz in 1972. Charles retired in 2002.

While living in the Twin Cities, Charles was very active with the Lake Harriet Streetcar Museum, operating and restoring streetcars as well as building structures. After moving to Portland, he continued this interest, working with the Willamette Shore Trolley. He was also an active hiker with Portland Parks and Recreation, often driving the vans to the trailheads. In addition, he was a lover of classical chamber music. He was a fit, sharp, fun, extremely thoughtful and a kind man who should have had many years left to live.



Emeritus Associate Professor Jim Thompson died on August 22, 2018, in Portland, Oregon, at age 96.

Jim was born in Coshocton, Ohio, on November 15, 1921. He loved Coshocton and Ohio history and could tell colorful stories about his childhood and college years.

He played clarinet and saxophone in school and community orchestras and in swing era dance bands. He loved Benny Goodman and Glenn Miller tunes all his life.

He received his undergraduate degree from the College of Wooster, then began graduate studies in mathematics at Brown University, which made a tremendous impression on him and his subsequent career. At Brown he found a mentor, Stefan E. Warschawski. When Prof. Warschawski went to the University of Minnesota in 1946, Jim followed. Jim completed his Ph.D. at Minnesota in 1951 with a thesis entitled "Studies of the Behavior of the Mapping Function on the Boundary in Conformal Mapping," written under the direction of Prof. Warschawski, who, the following year, would become the Head of the Mathematics Department in the Institute of Technology (IT).

After completing his degree in 1951, Jim stayed on as a post-doctoral instructor in the IT Math Department. In 1954, he was promoted to assistant professor and then to associate professor in 1967. He served as Director of Undergraduate Studies from 1973 until 1979. Seymour Cray was one of the thousands of undergraduates Jim taught over the years. Jim retired in 1992 and, for many years, continued to be a regular presence in the Department and its activities.

He loved exploring the parks and backroads of Minnesota, binoculars in hand to look for birds. Jim is remembered by colleagues as being an unusually kind and warm-hearted member of the Department, as well as being a 'caretaker' of its history. He will be greatly missed.

Awards and Recognition

Wei-Kou Chen was awarded by C18 the Young Scientist Award in mathematical physics. The IUPAP Young Scientist Prizes in Mathematical Physics are awarded triennially and recognizes up to three young scientists for their outstanding contributions to the field.

Dihua Jiang and Sasha Voronov have been named American Mathematical Society Fellows for 2019. Dihua Jiang is being recognized for contributions to automorphic forms, L -functions, representation theory, and the Langlands Program. Sasha Voronov is being recognized for contributions to mathematical physics, operad theory and homotopical algebra

Math Graduate Team: Analytical Acumen Award - State Data Science Challenge: For its third annual data science challenge, MinneAnalytics teams analyzed voter data ahead of the mid-term elections. A team of Math graduate students collected and wrangled real-world data, conducted exploratory data analysis, and built an informed model to predict voter turnout across all federal elections in Minnesota. Team members: Somyi Baek, Cora Brown, Sarah Milstein, and Michelle Pinharry won 2nd place and the Analytical Acumen Award in the graduate division. Faculty advisor: Professor Gilad Lerman.

Christine Berkesch has been chosen by the CSE Promotion and Tenure Advisory Committee to receive the Taylor Career Development Award. The award "recognizes exceptional contributions to teaching by a candidate for tenure during the probationary period. Faculty are considered for the award at the

time they are being evaluated for the granting of permanent tenure and promotion to the rank of associate professor.” Li Wang has been awarded an NSF CAREER grant for her project on “Computational methods for multiscale kinetic systems: uncertainty, non-locality and variational formulation”, which arise in a wide variety of fields, including plasma physics, semiconductors, animal swarms, and nuclear engineering. The Faculty Early Career Development (CAREER) Program is one of the most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars.

Retirements



Al Marden has retired from the department after 56 years of service. Al (Albert to many in his family) grew up in Milwaukee, where his father, Morris Marden, was a distinguished mathematician. Al went to Harvard as an undergraduate, and received an NSF graduate Fellowship that

enabled him to continue at Harvard for graduate school where he met his wife Dorothy. He completed his PhD in Mathematics at Harvard in 1962 under the supervision of Lars Ahlfors.

Al was hired in the Mathematics Department (Institute of Technology) at the University of Minnesota in 1962. He was promoted to Associate Professor in 1966 and to Full Professor in 1971. The Mardens drove to Minnesota from the east in an old car. Dorothy Marden recalls that they were welcomed by the many members of the Mathematics Department who lived in Prospect Park, where they continue to live in the same

In the 1980s Al along with David Epstein, Bill Thurston and Dennis Hejhal created a proposal to establish The Geometry Center at the University of Minnesota. The proposal was accepted by the NSF in 1987 and the Center was created. Computing power was an essential part of the concept, and the space was well equipped with workstations that were powerful for the time. Al persuaded two people from Cray to join the academic staff, and when the World Wide Web was formed, the Geometry Center was among the first 100 web sites on the planet. The Geometry Center hosted meetings, and ran summer courses for younger students. In 1991 the Geometry Center received funding for a further 5 years, but then funding was discontinued. The Center closed in 1998. The Geometry Center in its time, was at the forefront of technological development. One of its lasting legacies is the three movies that were produced using the software Geomview, developed at the Geometry Center between 1992 and 1996. These movies are Not Knot, Outside In and, The Shape of Space, and they are still available.

At a dinner on April 27, 2018, in honor of Al's career his three daughters spoke about being very familiar with the peculiarities of Vincent Hall where they grew up, including the door leading to 'Mortuary Science'. They recalled how their mother, Dorothy, went back to school in the 1970s to become a CPA, and how their father's sloppy joe recipe sustained them during this time. We wish Al well in retirement.

Charitable Giving

Charitable Giving at the School of Mathematics

We thank the many alumni and friends who regularly support our students and faculty in the School of Mathematics. Contributions to scholarships, fellowships, faculty research, and the Mathematics general fund enable the Department to recruit top graduate and undergraduate students, sustain and advance our research, and support our faculty. We wish to extend our deepest thanks to the following donors who made generous gifts in support of the School of Mathematics in Fiscal Year 2019 (July 1, 2018 - May 15, 2019)

Leadership Donors (\$1K +)

Samuel Albert, Allianz Life Insurance Company of North America, Benevity Community Impact Fund, Caroline M. Czarnecki Trust, Feshbach Family Charitable Fund, Thomas A. Freuler, Kusum N. Jain, Warren P. Johnson, Phyllis L. Kahn, Willard Miller, Jr., Peter J. Olver, David C. Oswald, Mark A. Otness, Erik J. Rasmussen, Svetlana Y. Rudnaya, Pamela G. Streed, William D. Tarara, Tonka Group LLC, Voya Foundation

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Donald W. Kahn Professorship in Mathematics

The School of Mathematics is grateful to Dr. Phyllis L. Kahn for her generous gift to endow the Donald W. Kahn Professorship in Mathematics. Honoring her late husband and beloved Mathematics Faculty member, Don Kahn, this Professorship will provide critical support to the Department and its distinguished faculty in perpetuity.

Charitable gift annuities support both the School of Mathematics and Donors

Donors age 55 and older wishing to support the School of Mathematics may want to consider charitable gifts annuities as the ideal vehicle to make a gift. Setting up a charitable gift annuity provides the donor with fixed annual payments for life and an immediate income tax deduction when the gift is made. For more information on charitable giving of any kind to the School of Mathematics, or to receive a personalized gift annuity illustration, please contact Emily Strand at ecstrand@umn.edu or 612-625-6798.

IMA News

Though the IMA's programming model has changed in recent years, the institute continues with its mission to organize and host scientific programs and to train postdocs and students. The institute looked to its community for the 2018-2019 academic year, and several activities were organized by School of Mathematics faculty, including Christine Berkesch, Ru-Yu Lai, Mitch Luskin, and Gregg Musiker.

Among the many highlights of the IMA's programming was the Sixth Abel Conference, in honor of Robert Langlands, held this past November. The IMA's Abel Conference celebrates the work of the Abel laureate and is a collaboration between the IMA and the Norwegian Academy of Science and Letters. Langlands is recognized for the visionary program that aims to build connections between representation theory and number theory, and the program featured many of the luminaries of field.

The 2018-2019 year was the second year for the institute's Data Science Consortium. This consortium, founded by the generous support of Target Corporation and Cargill, Inc., provides support for six industrial postdocs and scientific activities. The industrial postdocs spend half of their time working on projects directed by industrial scientists and the other half at the IMA doing research with a faculty mentor. Augmenting the postdoc program are semester-long focus periods that include workshops, long-term visi-

tors, and training programs. The second thematic program ran in the fall of 2018 and focused on "Data Science and Supply Chain Management". The IMA is currently gearing up for a summer program on "Resource Tradeoffs", organized by Gilad Lerman. Along with the thematic programs, the IMA's Data Science Lab director, Gilad Lerman, organized a popular year-long seminar series in data science.

School of Mathematics Center for Educational Programs (MathCEP)

Last year, MathCEP was expanded to encompass not just our traditional enrichment and outreach programs, but also other educational initiatives taking place in our department at the undergraduate level.

Mike Weimerskirch has continued to revamp the department's lower division mathematics courses, including the publication of video textbooks for the PreCalculus sequence. Duane Nykamp has spearheaded our efforts to create a new platform for creating, sharing, and evaluating open source educational materials for courses at all levels. Our long established programs, such as the University of Minnesota Talented Youth Mathematics Program (UMTYMP), continue to thrive. By next year we will have a full slate of UMTYMP courses in Duluth, joining the satellite site in Rochester and our main location on the Twin Cities campus.

Two of the MathCEP postdocs will leave at the end of 2018-19. Melissa Lynn has accepted a position at Gustavus Adolphus College in Minnesota, and Kaitlin Hill will continue her career at Wake Forest University in North Carolina. In the fall we will be joined by two new postdocs: Alexis Johnson, from Rice University, and Anila Yadavilli, from North Carolina State University. In other staffing news, Ted Huseby moved on from his administrative position in MathCEP. We're grateful for his hard work and service for the past 12 years. In his place, we welcome Katy Williams, who will focus on recruitment for our programs and student relations.

Minnesota Center for Financial & Actuarial Mathematics (MCFAM)

MCFAM continues to offer its students experiential learning through coursework and workshops. The "Actuarial Mathematics in Practice" course is in its 8th year. Students learn actuarial applications from visiting actuaries, many who are alumni. These companies sponsored their employees to participate: Allianz Life of North America, Deloitte, Arch Insurance, the Travelers Companies, Optum, Securian and WCRA Minnesota-Casualty Actuary Case Competition.

The Winter Financial Mathematics Modeling Workshop pairs graduate financial math student teams with local industry mentors to work on real world quantitative finance problems. Projects done in January 2019 included: “Machine Learning for Equity Classification”, “Smart Beta Investing in Commodities” and “Valuation and Replication Strategies for Variance Derivatives”.

In June, 2018 MCFAM, with support from MathCEP, held its first summer camp for high school kids called the world Machine Learning Camp for Girls. Dr. Kaisa Taipale, MCFAM Assistant Professor and program leader for the camp, noted: “High school students from across the Twin Cities and a wide variety of backgrounds were introduced to machine learning concepts. They utilized Excel, experimented with Python using Jupyter notebooks and scikit-learn algorithms.” Speakers from various corporations provided a glimpse of opportunities available for students with math, programming, and problem-solving skills.

MFM Instructor John Dodson and VP of Quantitative Risk Management at the Options Clearing Corporation, advised two graduate student research teams in 2018 on an application of implied volatility of options and on dynamic capital structure in the face of investment opportunities and potential bankruptcy. Their research will be presented at the SIAM Financial Engineering Conference in Toronto in June, 2019.

Minnesota Center for Industrial Mathematics (MCIM)

MCIM aims to expose our graduate students to the mathematical challenges and skills that arise in industry, while helping them become either leaders in industry or leaders in academia with broad background in industrial applications. It also aims to foster research collaborations between industrial and academic researchers.

The joint IMA/MCIM Industrial Problems Seminar has been very active and hosted a wide range of industrial speakers from corporations that include 3M, Boston Scientific, DataRobot, ExxonMobil, EVS, Gigantum, Honeywell, the Institute for Disease Modeling, Lowe’s, Medtronic, Metro Transit, Samsung, Seagate Technology, Stratasys and Target Corporation.

The seminar talks provide a window on the daily activities of mathematicians in industry. Moreover, the industrial visitors get to learn about the strength and expertise within our department.

These visits resulted in several summer internships as well as discussions that may potentially turn into collaborations. By early April, our students obtained internships in

the Air Force Research Lab, the Climate Corporation, Exxon-Mobil, the Voting Rights Institute and WindLogics. Help with industrial positions was also offered to graduating students and current postdocs. This academic year, a large number of graduating Ph.D. students have been searching for industrial positions and some of them have already accepted attractive offers from companies such as Ecolab, Google, Target Corporation and WindLogics.

Math Library News

The Mathematics Library collaborated with the Minnesota Center for Financial and Actuarial Mathematics (MCFAM) on a creative approach to increase students’ familiarity with the Bloomberg Professional financial data resource is jointly funded and implemented between MCFAM and the Math Library. In the 2018 “Summer Challenge,” students earned their Bloomberg Market Concepts Certification during dedicated library sessions, and attended a MCFAM workshop with industry professionals.

The School of Mathematics’ planning for the Writing Enhanced Curriculum project is another programmatic area involving the library. The proposed “contract” to guide students through a senior project with expectations, timelines and suggestions of useful resources, may incorporate components of the former Libraries’ Assignment Calculator template that had been jointly developed by math professor Victor Reiner and math librarian Kristine Fowler.

March 5 saw a fun maker pop-up activity, when Walter Library’s Breakerspace brought its vinyl cutter to the Math Library. Möbius strips and scans from *Proofs without Words* (by Roger B. Nelsen) were among the images turned into precision-cut stickers. The additional paper-folding supplies made the library’s origami books colorfully interactive.

This year the School of Statistics Technical Report series (1958--2013) was made openly available online through the University Digital Conservancy (conservancy.umn.edu). Since August 2018, when the majority of the series was made available, the 656 Technical Reports (plus 8 Special Reports) have been downloaded over 7,000 times.

Student Clubs

SIAM Student Chapter: The annual Mathematical Contest in Modeling for undergraduates was featured recently on the SIAM blog. The blog showcased a sample problem from *Say It Ain’t Snow*, where students model the optimal snow plowing strategy for neighborhoods with streets of varying regularity.

AMS Student Chapter: The UMN student chapter of the American Mathematical Society held a Pi Day pie-baking contest and an outreach event with the Minnesota Internship Center - several graduate student volunteers introduced high schoolers to fun areas and applications of mathematics.

AWM Student Chapter: The Association for Women in

Mathematics hosted popular events to bolster community among women in the mathematics department including a 4-day workshop for underrepresented undergraduates and a booth at the MN State Fair.

Math Club: Math Club is building engagement among undergraduate math majors. Study groups, advising, mentorship, talks by graduate students and fun get-togethers are all helping undergraduates become more involved in the department.

Undergraduate Program

Graduate teaching assistants Katherine Maxwell, Sarah Milstein, and Jorin Schug received the 2017-18 Outstanding Teaching Assistant Award. The instructional evaluation committee received more than 700 nominations from students in support of their Math TAs. Thirty math majors will be awarded 2019-20 departmental merit scholarships from the Christofferson, Dalaker, Gilquist, Lando, Othmer, Rasmussen, Richards and Thorp funds, totaling \$71,500. Two hundred undergraduates applied for Spring 2019 graduation with a BA or BS in Mathematics.

Faculty advisers selected eleven Outstanding Graduates in Mathematics for 2019: Bradley Arnoldussen, Andrew Brettin, Ciaradh Coomey, Jacob Elafandi, Shijia Liu Yang Luo, Zachary Mone, Julie Sherman, Kazimier Smith, Joseph Spletstoeser, Samuel Vance

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.

Felix, Bryan, 2018 National Science Foundation (NSF) Fellowship, Hans Othmer, advisor.

Gallegos, Joel, 2018 College of Science & Engineering (CSE) Inclusion Fellowship, Benjamin Brubaker, advisor

Logan, Kimberly, 2018 Louise T. Dosdall Fellowship, Paul Garrett, advisor

Mastrianni, Michelle, 2018 College of Science & Engineering (CSE) Graduate Fellowship, Victor Reiner, advisor

Woods, Timothy, 2018 College of Science & Engineering (CSE) Inclusion Fellowship, Richard McGehee, advisor

Ph.D. Graduating Students

Richard McGehee, Director of Graduate Studies in Mathematics and The Graduate School congratulate our recent graduating Ph.D. students (March 2018 to February, 2019).

Bridgland, Nicole, On the de Rham homology of affine varieties in characteristic 0, Lyubeznik, Gennady, advisor; Data Scientist, World Wide Technology, Maryland Heights, MO

Flores, Mauricio, Algorithms for Lp-based Semi-supervised Learning, Lerman, Gilad, advisor, Calder, Jeffrey, co-advisor; Lead Data Scientist, Target, Minneapolis, MN

Hiltner, Lindsey, Equilibrium Configurations of Hexagonal Liquid Crystals with Applications to Materials Science and Biology, Calderer, Carme, advisor

Huroyan, Vahan, Mathematical Formulations, Algorithms and Theory for Big Data Problems, Lerman, Gilad, advisor; Postdoctoral Research Associate, The University of Arizona, Tucson, AZ

Li, Lizao (Larry), Regge finite Elements with Applications in Solid Mechanics and Relativity, Arnold, Douglas, advisor; Quantitative Researcher, BlackRock, San Francisco, CA

Lindsay, Danika, Applications of Evolutionary Modeling to the Study of Drug Resistance in Cancer, Foo, Jasmine, advisor; Senior Operations Research Analyst, Target Corp., Minneapolis, MN

Massatt, Daniel, Electronic Structure of Incompensate Bilayer Heterostructures, Luskin, Mitchell, advisor; William H. Kruskal Instructor, Department of Statistics, University of Chicago, Chicago, IL

Maunu, Tyler, A Framework for Nonconvex Robust Subspace Recovery, Lerman, Gilad, advisor; Applied Mathematics Instructor, Massachusetts Institute of Technology, Cambridge, MA

Mohammed Ismail, Harris Ahmed, On Some Applications of a Generalized Dwork Trace Formula to L-functions associated to Exponential Sums over Galois Rings, Sperber, Steven, advisor; Assistant Professor, University of Minnesota-Morris, Morris, MN

Park, Jun Yong (June), Arithmetic of the moduli of fibered algebraic surfaces with heuristics for counting curves over global fields, Westerland, Craig, advisor; Postdoctoral Research Fellow, IBS Center for Geometry and Physics, Pohang, South Korea

Pham, Tuan, Topics in Navier-Stokes regularity near the boundary, Sverak, Vladimir, advisor; Fixed-term Assistant Professor, Oregon State University, Corvallis, OR

Rodenberg, Analise, 2D Peskin Problems of an Immersed Elastic Filament in Stokes Flow, Spirn, Daniel, advisor; Mori, Yoichiro, co-advisor

Sakalli, Sumeyra, New Exotic Symplectic 4-Manifolds with Nonnegative Signatures and Exotic Smooth Structures on Small 4-Manifolds, Akhmedov, Anar, advisor; Postdoctoral Fellow, Max Planck Institute for Mathematics, Bonn, Germany

Storey, Kathleen, Stochastic Models of Epithelial Cancer Initiation and Glioblastoma Recurrence, Foo, Jasmine, advisor; Postdoctoral Assistant Professor, University of Michigan, Ann Arbor, MI

Tian, Fangyang, On the Local Theory of Certain Global Zeta Integrals and Related Problems, Jiang, Dihua, advisor; Research Fellow, National University of Singapore, Singapore

Wilson, Joshua, Temporal control of Graphene Plasmons, Santosa, Fadil, Full Stack Software Engineer, Tempo Automation, San Francisco, CA

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The Newsletter Committee is composed of Laurie Derechin (Chair),
Greg Anderson, Robin Dixon, Bonny Fleming, Ru-Yu Lai, Peter
Olver, Jonathan Rogness, Harry Singh.

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