



College of Letters & Science
UNIVERSITY OF WISCONSIN-MADISON

*V³: a newsletter for the space of alumni
and friends of mathematics at UW-Madison*

JULY 2019



SARA NAGREEN



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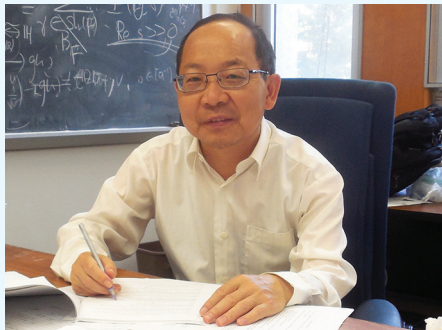
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A Word from the Chair



Welcome to the 2019 edition of the *Van Vleck Vector*.

It has been an eventful and exciting year in the Math Department. Many of our faculty, staff, and graduate students were recognized for their excellence, teaching, and service.

Mihaela Ifrim and Botong Wang have been named to 2019 Sloan Research Fellowships—prestigious and competitive awards given to promising young researchers in the early stages of their careers.

Mihaela Ifrim and Hung Tran were awarded the Early Career award by the National Science Foundation.

We had an astounding trio of Simons Fellows: Gheorghe Craciun, Autumn Kent, and Andreas Seeger. We tied the University of Illinois-Urbana Champaign for the most this year!

David Anderson was named a Vilas Distinguished Achievement Professor

and Sebastian Roch was named a Vilas Associate, a tribute to the high caliber of research performed by both. Qin Li was named as a Vilas Early Investigator, a high honor for faculty early in their careers.

I was elected an American Mathematical Society Fellow for my work with Shimura varieties.

Our graduate students continue to prove just how dynamic and deserving they are. Seven female PhD students graduated this year and all obtained prestigious postdoc jobs. Soumya Sankar won the Exceptional Service Award and Di Fang won the Capstone PhD Teaching Award. These campus-wide awards are difficult to win, but our students shine in the competition.

Our outstanding staff, Sara Nagreen and Soledad Benguria-Andrews, were awarded mid-career and early career excellence service awards respectively by the College of Letters & Science.

Congratulations to Qin Li and Hung Tran who have been promoted to tenure with associate professorship. We will welcome six new faculty next fall, including ICM speaker Alexei Poltoraski, Amy Cochran (joint with Population Health), Gao Chen, Vadim Gorin, Michael Kemeny, and Leonardo Zepeda-Nunez. We will also welcome ten postdocs.

In May, we hosted a conference on Fourier Analysis in honor of Andreas Seeger's 60th birthday. An entire week of presentations on the topic is truly a showcase for how much Andreas has influenced the field!

Our Director of Instructional Excellence, Shirin Malekpour, was promoted to Associate Dean for Teaching & Learning Administration in the College of Letters & Science. They recognized the excellence that Shirin brings to every minute of her day, and she's been a great addition to their staff.

The Visiting International Study Program (VISIP-MA) in the Math Department changed leadership this year and I took charge. I've made substantial efforts to welcome the VISIP students, and work with their home institutions in China to keep updated on their progress and successes. We've

had celebrations to help them feel at home, like our mid-autumn celebration (complete with moon pies) and Thanksgiving (with Chinese food). At least nine master's students from the 2017 VISIP program will continue their PhD graduate study at top US universities. Others will get another master degree in more applied areas, and still others will work in industry.

Sadly, we will also say goodbye to several of our faculty. Melanie Matchett Wood and Phil Wood are departing for Berkeley and Lu Wang is going to Caltech. Nigel Boston has elected to retire after a superb career here to head for the warmer clime of Florida. Julie Mitchell has become a director of the Bioscience Division at Oak Ridge National Lab. Bing Wang will become professor at USTC, China. We will miss them all and wish them the best!

With a heavy heart, we also bid goodbye to emeritus professor Terry Mil- lar, who died in March 2019 after a long battle with cancer. Terry was part of our department for decades, and also served as an assistant to the Provost of the university, leaving his mark on dozens of different research projects, as well as being a recognized expert in computable model theory. We are working with his family and friends to establish a memorial fund in honor of him to support our undergraduate education, especially in support of minorities and financially disadvantaged students in mathematics. Please consider joining this effort next year with your donation.

This is just a sampling of the happenings in our department this year. We know that our alumni celebrate with us our successes as they remember their time in Madison. The University of Wisconsin continues to be a leader in research, outreach, and teaching, and we are at the forefront in bringing excellence in mathematics to a new generation.

On, Wisconsin!

Tonghai Yang
Department Chair



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UW–Madison to Host a Fall 2019 AMS Sectional Meeting



Erdős Lecture speaker
Laurel Williams

The Fall 2019 Central Section Meeting of the American Mathematical Society will be held September 14–15, 2019, at the University of Wisconsin–Madison. The meeting will feature the 2019 AMS Erdős Lecture, invited talks, as well as many special sessions and contributed sessions on a wide variety of topics.

The AMS Erdős Memorial Lecture is an annual invited address made possible by a fund created by Andrew Beal, a Dallas banker and mathematics enthusiast. The lecture is named for mathematical legend Paul Erdős (1913–1996), who received an honorary doctoral degree from the University of Wisconsin–Madison in 1973 and was a frequent visitor to campus. The 2019 Erdős Lecture will be given by Lauren Williams of Harvard University,

and there will be a reception to follow.

The meeting is a wonderful opportunity for Mathematics Department alumni, friends, and former colleagues to experience all that is new on campus, hang out in familiar haunts, share in a weekend of great mathematics, and meet current department faculty members. Information about the program, lodging, and registration can be found at <https://go.wisc.edu/ia4obj>

Nigel Boston to Retire in 2019



Nigel Boston

Early after graduating with a PhD in Algebraic Number Theory in 1987, Nigel Boston thought the future held many years of pure math research. However, on a visit to the Isaac Newton Institute in Cambridge, UK, he found a book that changed his destiny. The Institute was newly built, and the library wasn't completely stocked. He wandered in and grabbed a book on coding theory from the bookshelf. He quickly became hooked. Soon after, a student who was debating her dissertation problem asked for guidance and Nigel suggested coding theory.

From that point forward, Nigel started to work with engineers on ways that algebra could be applied to solve real world problems. Such problems ranged from facial recognition methods, to the “Netflix” problems of connecting users with recommendations

that they might enjoy, to the problem of supply and demand of power systems as it adheres to the laws of circuit theory.

Nigel came to the University of Wisconsin after several years at the University of Illinois at Champaign-Urbana in 2002. He held a joint appointment in Math and Electrical Engineering. He has recently been working with the Wisconsin Institutes of Discovery (WID) on problems related to optimization.

The lure of warmer weather sealed the deal for Nigel. Florida is going to be his next home and Nigel looks forward to continuing to work part-time at universities down there. He's enjoyed the job of a mathematician, exploring and researching mathematical problems and hopes to continue to do so.



MAKE A GIFT

To mail a donation to support the Mathematics Department, include the designation “Mathematics Annual Fund” in the check's memo line. The check should be made payable to the UW Foundation.

Please send it to:
UW Foundation
U.S. Bank Lockbox
P.O. Box 78807
Milwaukee, WI 53278-0807

To make a secure gift online using your credit card, please visit
<http://supportuw.org/giveto/math>

If you have any questions or would like information on other giving options, please contact Rebekah Sherman at (608) 572-2077 or rebekah.sherman@supportuw.org

Message from the Dean



Dear alumni:
Sometimes friends, parents, and alumni ask me, “What can you do after graduation with a major in [fill in the blank]?”

My answer: “anything.”

Evidence comes from our philosophy majors and history majors working in Silicon Valley and on Wall Street; our mathematics and astronomy majors in marketing and law; our political science and psychology majors in consulting, non-profits, and entrepreneurial start-ups.

A favorite expression of mine is: “A major is not a career.”

Our students develop a set of skills that serve them for a lifetime: critical thinking, the ability to make connections across disparate ideas, analytical

reasoning, exemplary communication skills, and the ability to navigate differences across cultures and opinions. These skills are frequently mentioned by employers as the qualities most wanted in their employees.

To prepare our ambitious, hard-working students to think, work, and act in an increasingly complex world, my colleagues in L&S work tirelessly to design and administer cutting-edge coursework in every discipline. They develop new majors and certificates in response to high demand, manage programs that broaden students’ understanding of the world, leverage technology in ways that make students better learners, and build increasingly sophisticated skills that will serve students not only in their courses, but throughout their lives. Across L&S, every course, certificate, or degree reflects this forward-thinking approach.

I am proud of so many L&S faculty who bring energy and creativity to their teaching. From efforts to make larger classes feel smaller, to the connections made in First-Year Interest Groups, from our stimulating Honors program to our excellent Undergraduate Research Scholars program—our faculty are implementing high-impact learning practices in classes large and small.

A fundamental aspiration for a world-class university is to positively affect the lives of the students we teach. Together we are succeeding.

On, Wisconsin!

John Karl Scholz
Nellie June Gray Professor of Economics
Dean, UW–Madison College of Letters & Science

Swimming Microbes Steer Themselves into Mathematical Order

Freeing thousands of microorganisms to swim in random directions in an infinite pool of liquid may not sound like a recipe for order, but eventually the swarm will go with its own flow.

Theoretical modeling led by University of Wisconsin–Madison applied mathematician **Saverio Spagnolie** shows that the forces generated by different kinds of tiny swimmers will sweep them all up in predictable ways.

“When each individual particle experiences the flows created by all the other particles, it’s known that

really surprising effects can naturally emerge,” says Spagnolie. “The flows and orientations of the swimmers become coherent on a length scale much longer than any individual particle, resulting in huge flocks of organisms swimming in the same direction and, perhaps unintentionally, working together.”

The movement of crowds of things too small to easily see—like single-celled organisms and filaments inside individual cells responsible for cell-division—is critically important to research in materials science, engineering, and biochemistry.

By simulating the interactions of large groups of particles which each create a flow, Spagnolie and **Arthur Evans** of UW–Madison, University of Michigan physicist Christopher Miles, and mathematician Michael Shelley of the Flatiron Institute and New York University, found that when the particles are confined to a thin sheet and allowed to expand into an empty fluid, the collective motion can be described by equations already used in entirely different classical problems in fluid mechanics.

Link: <https://go.wisc.edu/37d758>

Temps in the Atlantic Can Predict Indian Monsoons

New research from an NYU/Abu Dhabi team has found that temperatures in the Atlantic are having a growing effect on the Indian monsoon, something that could prove crucial in predicting how severe rains are likely to be.

The study comes as climate change alters the patterns of monsoon rainfall in India, with likely far-reaching effects on agriculture, the economy, and society.

The team, which includes UW–

Madison Assistant Professor **Nan Chen** as well as three other NYU/Abu Dhabi researchers (Sabeerali CT, Ajayamohan RS, Bangalath HK), looked at the relationship between sea-surface temperature variability in the Atlantic and variability in the Indian summer monsoon.

Colder sea-surface temperatures in the eastern tropical Atlantic, linked to a weather system called the Atlantic

Zonal Mode (AZM), tend to be associated with stronger monsoon rains.

The colder temperatures over the Atlantic strengthen the waves into the Indian Ocean, which increases the difference in upper atmospheric temperature between the Indian Ocean and the Indian continent. This causes more powerful moisture-laden winds to blow onto the land, leading to greater monsoon rains.

Link: <https://go.wisc.edu/5mp05y>

The Wonderful World of Hagfish Slime



Hundreds of meters deep in the dark of the ocean, a shark glides toward what seems like a meal. It's kind of ugly, eel-like, and not particularly meaty, but still probably food. So the shark strikes.

This is where the interaction of biology and physics gets mysterious—just as the shark finds its dinner interrupted by a cloud of protective slime that appeared out of nowhere around an otherwise placid hagfish.

Jean-Luc Thiffeault, a University of Wisconsin–Madison math professor, and collaborators Randy Ewoldt and Gaurav Chaudhary of the University of Illinois, have modeled the hagfish's gag-inducing defense mechanism mathematically, publishing their work in the *Journal of the Royal Society Interface*.

The ocean-dwelling hagfish is unique for all the strangest reasons. It has a skull, but no spine or jaw. Its skin hangs loose on its body, attached only along the back. Its teeth and fins are primitive, underdeveloped structures best described with qualifiers—"tooth-like" and "fin-like."

But it has an amazing trick up that creepy, loose sleeve of skin: In the blink of an eye (or flash of attacking tail and teeth) the hagfish can produce many times its own body's volume in slime. The goop is so thick and fibrous, predators have little choice but to spit out the hagfish and try to clear their mouths.

"The mouth of the shark is immediately chock full of this gel," Thiffeault says. "In fact, it often kills them, because it clogs their gills."

The gel is a tangled network of microscopic, seawater-trapping threads unspooled from balls of the stuff ejected from glands along the hagfish's skin. These "skeins" are just 100 millionths of a meter in diameter (twice the width of a human hair), but so densely coiled that they can contain as much as 15 centimeters of thread.

Curious scientists have looked at the unraveling before, putting the skeins in salt water to see how long it took them to come apart.

"The hagfish does it in less than half a second, but it took hours of soaking for the threads to loosen up in experiments," says Thiffeault, whose research is focused on fluid dynamics and mixing. "Until they stirred the water, and it happened faster. The stirring was the thing."

The slime modelers set out to see if math could tell them

whether the forces of the turbulent water of a bite-and-shake attack were enough to unspool the skeins and make the slime, or if another mechanism—like a chemical reaction providing some pop to the skein—was required.

Ewoldt, a mechanical engineering professor, and his graduate student Chaudhary began unraveling skeins under microscopes, watching the process as loose ends of thread stuck to the tip of a moving syringe and trailing lengths spun out from the ball.

"Our model hinges on an idea of a small piece that's initially dangling out, and then a piece that's being pulled away," says Thiffeault. "Think of it as a roll of tape. To start pulling tape from a new roll, you may have to hunt for the end and pick it loose with your fingernail. But if there's already a free end, it's easy to catch it with something and get going."

Unrolling requires a big enough difference between the drag on the free end and an opposing push on the skein—a ratio larger than a tipping point the researchers refer to informally as the "peeling number"—to free more thread.

"That's unlikely to happen if the whole thing is moving freely in water," says Thiffeault. "The main conclusion of our model is we think the mechanism relies on the threads getting caught on something else—other threads, all the surfaces on the inside of a predator's mouth, pretty much anything—and it's from there it can really be explosive."

It doesn't even have to be a single snag.

"Biology being the way it is, it doesn't have to be exact. Things get to be messy," says Thiffeault. "That leading bit of thread can get caught a little bit, then slip, then get caught again. As long as it's happening to enough skeins, it's pretty fast that you're in the slime."

The skeins may get a boost from mucins, proteins found in mucus that could speed the breakup of packed thread, "but those kinds of things would just help the hydrodynamics," says Thiffeault, who once calculated the extent to which swimming marine life mix entire oceans with their fins and flippers.

"It's just hard to imagine there's another process other than hydrodynamic flow that can lead to these timescales, that burst of slime," he says. "When the shark bites down, that does create turbulence. That creates faster flows, the sorts of things that provide the seed for these things to happen. Nothing is going to happen as nicely as in our model—which is more of a good start for anyone who wants to take more measurements—but our model shows the physical forces play the biggest role."

The hydrodynamics of hagfish slime is not just a curiosity. Understanding the formation and behavior of gels is a standing issue in many biological processes and similar industrial and medical applications.

"One of the things we'd love to work on in the future is the network of threads. I love thinking about modeling materials as big random collections of threads," Thiffeault says. "A simple model of entangled threads may help us see how that network determines the macroscopic properties of a lot of different, interesting materials."

A grant from the National Science Foundation (CBET-1342408) helped support this research.

Support Plus Drive Equals Success By Aaron R. Conklin

A supportive environment helped a group of female graduate students in mathematics reach lofty goals. Already a leader in the number of women hired as faculty members, the department hopes to continue improving the experience for female students to help bring equity to the field.

After graduation, a group of six female graduate students in mathematics will head off to post-doctoral opportunities at some of the most prestigious institutions in the United States, including the Massachusetts Institute of Technology (MIT), Stanford University, the University of California-Berkeley, Texas A&M University, and the University of Michigan. Their success, in a field that has historically presented institutional challenges for women, says something important about the environment for female students in the Department of Mathematics at UW-Madison.

While the department has made important strides in improving the environment for female students—there are now eleven female faculty members, one of the highest proportions among major research universities in the United States—the challenges of being female in an incredibly competitive academic field are real.

“As a woman, to be taken into consideration as a valued mathematician, you have to work harder to prove your worth,” says Eva Elduque, one of the six graduate students. “It would have been a lot harder for me if there hadn’t been others like me here.”

Five of the graduate students hail from China—Wanlin Li, Amy Huang, Yuhua Zhu, Di Fang, and Yuan Liu—while Elduque hails from Spain. They didn’t just survive during their time at UW-Madison—they thrived.

All racked up an impressive set of awards: Just this year, Fang won a campus Capstone PhD Award for her work as a teaching assistant, while Elduque and Liu each won an



From left: Yuhua Zhu, Yuan Liu, Wanlin Li, and Di Fang pose with Math Department Chair Tonghai Yang. These four were part of a cohort of female graduate students to earn prestigious post-doctoral opportunities after graduation. Photo by Sara Nagreen

Excellence in Math Research award, and Zhu won the John Nohel Prize in Applied Mathematics. (A seventh female graduate student, Jing Hao, earned her degree in December and will begin post-doctoral work at Georgia Tech University in the fall.) While this isn’t the largest cohort of female graduate students to graduate from UW-Madison’s math program at one time, it is one of the most successful.

“These students are really strong and worked very hard,” says Tonghai Yang, department chair. “They should be proud of what they’ve accomplished here.”

Mathematics professor Jordan Ellenberg, who helped recruit the six female students while serving as the department’s director of graduate admissions, says that intentional hiring of female faculty, as well as gleaning and deploying best practices from peer institutions has helped to change the department’s culture. For instance, he points to changes the department made in one of its central placement exams. Previously, the test featured what Ellenberg described as “Math Olympiad-style” questions, where a trick, rather than depth of mathematical knowledge, was the key to finding a solution. Those types of questions tended to privilege male students, who were more likely to have encountered them on their school’s math teams, which are often dominated by boys.

“We didn’t make the test easier—we calibrated what we wanted to test for,” Ellenberg explains. “And the truth is that when it comes to the strength of the department, you can’t figure things out with a math problem. You have to hear it from the students.”

Improved communication with students—both male and female—is a point echoed by math professor Daniel Erman, who describes these women as “a really impressive and collaborative cohort.”

“Students succeed because they prop each other up,” he says. “Building these networks can be powerful.”

Forging connections was certainly a key for each of the six female graduate students. For Li, the opportunity to attend national conferences held by groups like the Association for Women in Mathematics and Women in Numbers gave her an important opportunity to network with other female mathematicians. Zhu agrees. “At the applied math conferences that I went to, I’m not the only female student,” she says. “I never felt alone in academics.”

Camaraderie among the six—and with female mentors within the department—also helped.

“We got together for brunches on the weekends, and we talked to each other when we’re not doing well, in math

Continued on page 7

Talent Search



Last year's Talent Search winner, Owen Hunt (left), with this year's winner, Ethan Yang (right).

The 2019 Talent Search Recognition Ceremony was held on May 17, 2019. During that event, the winner of the Van Vleck Scholarship was announced. Congratulations to Ethan Yang, a student at Madison Memorial High School. The Van Vleck Scholarship is \$6,000 over four years to attend UW–Madison.

Learn more about the Talent Search here: <https://www.math.wisc.edu/talent/>

What is the Mega Math Meet?

The Greater Dane County Advanced Learner Network and the Southern Lakes Advanced Learner Network coordinate Math Meet competitions.

Teams consist of four 5th-grade students and four 6th-grade students. Teams register and then compete with schools of comparable size at regional meets, where they complete four individual, timed math-problem-solving events, as well as one team event.

The first- and second-place teams qualify for the Mega Math Meet,

where they go on to compete at UW–Madison every year in May. The student mathletes again complete four individual timed events and then go onto the team event. The results are graded by UW Math graduate students and then awards are given both to outstanding individuals and teams.

This year's school winners were Middleton-Cross Plains in 1st place, Oregon in 2nd, and the Madison Metropolitan School District in 3rd.

Continued from page 6

or in life," Li says. "Connecting with female professors and post-docs was so important. They became my role models."

Last week, Yang took time for a celebratory lunch with five of the six students (Huang left early to join her advisor at the University of California San Diego. She'll begin her post-doc work at Texas A&M University in the fall). He took the opportunity to share some wisdom about the value of persistence and learning from struggles.

The advice resonated with Fang, who's headed to UC-Berkeley in July. "You have this landscape, and you have to ask yourself, what are the connections you can make?" Fang says. "These obstacles we've overcome will transport us to a better situation later in our careers."

Mental Math

Each year, students participating in the Mega Math Meet are given "Mental Math" problems to try to solve in just a few seconds. Below are several of this year's problems, with the answers printed on page 14 of this newsletter. Can you solve these problems in your head in less than 15 seconds?

$$\frac{4 \times 5 \times 3 \times 16}{60}$$

$$\frac{3 \times 3 \times 75 \times 16}{3 \times 25 \times 6 \times 50}$$

$$15000 \times 10^{-3} + 11 \times 10^3 + 3 \times 10^2$$

$$(3 + 6) + (7 \times 3) - (5 \times 2) + (9 \times 3) - (6 + 4)$$

$$\frac{14 \times 5 - 6 \times 4}{2 + 8}$$

$$\frac{30 \times 12 \times 7 \times 18}{21 \times 15 \times 3}$$

$$(5 \times 3) - (2 \times 3) - (3 \times 3) + (1 \times 8) + (4 \times 8)$$

$$(6 - 1) + (5 - 8) + (9 - 7) + (8 - 3)$$

$$(2 \times 5)^3 - (4 + 1)^2$$

$$\frac{15^2 \times 4^4 \times 5}{60^2}$$

$$\frac{24 \times 35}{6 \times 7 \times 2}$$

Answers on page 14

Comings and Goings

NEW ADMINISTRATIVE STAFF

Heidi Udelhoven joined the department in February 2019 as Academic Departmental Manager. She previously worked as a department manager in the School of Education, in the department of Educational Psychology, and before that as a Payroll and Benefits specialist in the College of Engineering. She attended UW–LaCrosse. In her spare time, she enjoys spending time with her 8-year-old triplets, cooking, reading, crocheting, and gardening.

Kris Marlow joined the department in January 2019 as the Human Resources Coordinator. She previously worked ten years in the School of Medicine and Public Health, then two-and-a-half years at UW Colleges and UW–Extension. She has a BA in English from UW–Madison. She likes to read, garden, pick up cool junk on the side of the road and turn it into something new, and watch, discuss, and obsess over *Game of Thrones*.

Kyle Martinez joined the department in July 2018 as an Undergraduate Advisor. This is his first job out of college after graduating from UW–Madison in August 2018. He previously worked as a Peer Advisor with the College of Letters & Science Academic Advising Services at the Student Orientation Advising and Registration (SOAR) program, and also served as a SOAR Operations and Advising Intern

with the Center for the First-Year Experience. In his spare time, he often goes on runs around Madison, works on growing plants, and reads. He is very happy to be with the Math Department and has enjoyed his time here. He thinks it is a fantastic department and the community has made his transition to the role very pleasant.

David Pettersen joined the department in July 2018 as the Undergraduate Program Coordinator. He is from the Milwaukee area, and studied Political Science and History at UW–Madison, graduating in May 2018. In his spare time, he does research on the Wisconsin Supreme Court and studies judicial campaigns extensively, attends conferences and speaks to various groups on the topic of sexual assault awareness, as well as the importance of our system of justice. For fun, David enjoys exploring new places, watching military history documentaries, hanging out with his family and family Beagle “Buddy,” and traveling Wisconsin!

Serena Boman joined the department in May 2019 as a Financial Specialist Senior. She previously worked in the Educational Psychology Department. She holds a BS in History from UW–Green Bay. She enjoys spending time on the lake, reading, or visiting local wineries. She is excited to meet everyone, stop by and say hi.

NEW TENURE TRACK

Shaoming Guo was a visiting professor at the Chinese University of Hong Kong until December 2018, and held postdoctoral positions at Indiana University Bloomington and MSRI, Berkeley prior to that. He received his PhD at the University of Bonn, Germany, under Christoph Thiele. His specialty is harmonic analysis and related analytic number theory, combinatorics, and partial differential equations.

Hao Shen came to us from Columbia University where he served as a Ritt Assistant Professor. Before that, he had a one-year postdoc at Warwick, and received his PhD from Princeton. His advisor was Weinan E. His specialty is probability and mathematical physics. In his spare time, he enjoys traveling and exploring different cultures.

Nan Chen was at Courant Institute of Mathematical Sciences and Center of Atmosphere and Ocean Science, New York University, as a postdoc prior to coming here. He also received his PhD there, studying under Andrew J. Majda. His specialty is applied mathematics, in particular uncertainty quantification, data assimilation, and prediction. He also develops mathematical tools with stochastic models for predicting weather, climate, and other natural phenomena. In his spare time, he enjoys hiking, traveling to various small towns, playing chess, and classical music. He is also a big fan of soccer, playing outdoor soccer games every week as long as there is no snow on the field.

NEW INSTRUCTIONAL STAFF

Justin Sukiennik joined the department in September 2018. He is the Director of Pre-Calculus Programs. He previously taught at the University of Puget Sound (2015-2018), Colby College (2012-2015), and University of Minnesota-Twin Cities (2009-2012). He studied at the University of Rochester for his graduate work in algebraic number theory. He gained much of the experience for this position as a teaching postdoc at the School of Mathematics

Center for Education Program (MathCEP) at the University of Minnesota. In his spare time, he hikes, cooks, sails, and travels.

Bobby Grizzard is a former Van Vleck Professor who returned to help us run the Instructional Excellence Program after Shirin Malekpour left. He studied at the University of Texas-Austin under Jeffrey Vaaler and graduated in 2014.

NEW VAN VLECK PROFESSORS

NAME	PHD	SPECIALTY
Hanlong Fang	2018, Rutgers Advisor: Xiaojun Huang	Several complex variables, complex geometry, CR geometry and geometric analysis
Omer Mermelstein	2018, Ben-Gurion University of the Negev Advisors: Assaf Hasson, Menachem Kojman	Combinatorial aspects of model theory
Mark Shusterman	2018, Tel-Aviv University Advisor: Lior Bary-Soroker	Group Theory, Number Theory, and Ergodic Theory
Shaosai Huang	2018, Stony Brook University Advisor: Xiuxiong Chen	Differential geometry and geometric analysis
Perna Gera	2017, University of Buffalo Advisor: David Salac	Numerical modeling, high performance scientific computation, and multiphase flow problems
Abhishek Deshpande	2018, Imperial College London Advisors: Thomas Ouldridge, Manoj Gopalkrishnan, Nick Jones	Chemical reaction networks, biological computation, retroactivity, systems biology and physics of computation
Daniel Corey	2018, Yale University Advisor: Sam Payne	Algebraic geometry with an emphasis on using combinatorial and computational methods to study algebraic varieties
Matthew Schrecker	2018, University of Oxford Advisor: Gui-Qiang Chen	Fluid dynamics and hyperbolic conservation laws, with an additional interest in geometric analysis
Trevor Leslie	2018, University of Illinois at Chicago Advisor: Roman Shvydkoy	Fluid Dynamics, Navier-Stokes and Euler Equations, Collective Dynamics, Partial Differential Equations
Ruixiang Zhang	2017, Princeton University Advisor: Peter Sarnak	Harmonic analysis, ranging from Euclidean harmonic (Fourier) analysis to incidence geometry and to harmonic analysis on locally symmetric spaces.
Jose Rodriguez	2014, University of California, Berkeley Advisor: Bernd Sturmfels	Applied algebraic geometry and algebraic statistics

GOINGS

Melanie Matchett Wood (Berkeley)

Shi Jin (Shanghai Jiao Tong University)

Phillip Wood (Berkeley)

Bing Wang (USTC, China)

Julie Mitchell (Oak Ridge Labs, but staying on as an honorary fellow)

IN MEMORIAM



Terry Millar died on Saturday, March 9, 2019, after a long battle with cancer. Terry was a faculty member in the Math Department

since 1976, retiring in 2015.

After dropping out of college to join the Marines for two years (including a brief stint as forward artillery observer in Vietnam), Terry started graduate school at Cornell and received his PhD in 1976 with Anil Nerode (twenty years his elder and still not retired!).

During the 1980's, Terry was one of the world's foremost researchers in computable model theory, an area which had been started by the Novosibirsk school of algebra and logic under Mal'cev and Ershov as well as, in the West, work of Fröhlich and Shepherdson, Rabin, and Nerode; and for a decade, Terry and Goncharov from Novosibirsk, both with coauthors, ended up proving the same results independently and almost simultaneously, but leaving many questions open to the current day.

In the late 1980's, computable model theory fell briefly out of fashion, and Terry remembered his other great talent, administration, first serving for many years as Associate Dean in the Graduate School and finally as assistant to the Provost. He also became heavily involved in mathematics education and teacher training and was in charge of large grants for multiple school districts across the country, including Madison's.

A few semesters before his retirement, Terry returned full time to the math department and revived in particular our history of mathematics course (using his unique expertise in both physics and logic).

He will be greatly missed in the department, and we mourn with his family this loss.

Undergraduate Accomplishments

MATH WELL REPRESENTED IN GOLDWATER SCHOLARSHIPS

Three University of Wisconsin–Madison students have been awarded prestigious Barry Goldwater Scholarships for undergraduate excellence in the sciences, two of them with Math Department ties.

The three are among 496 Goldwater Scholars named this year out of 1,223 college sophomores and juniors nominated from across the country.

The Goldwater Scholarship covers one year of tuition, fees, books, and room and board for juniors, up to a maximum of \$7,500. Winners who are sophomores are eligible for two years of paid expenses, up to a maximum of \$7,500 per year.

The two students with a tie to the Math Department are:

Claire Evensen, a junior from Verona, Wisconsin, studying biochemistry and mathematics, with honors in biochemistry and the liberal arts. For over two years, Evensen has researched transcription initiation in Professor Thomas Record's biochemistry laboratory. She has received several competitive university fellowships to support her work, including a Hilldale Fellowship. She is co-author on an article submitted to the journal *Biochemistry*, as well as posters presented at regional and national conferences; currently, she is preparing a first-author publication. This summer, she will work with Professor Philip Maini at the Wolfson Centre for Mathematical Biology at the University of Oxford, through UW–Madison's SCORE program. Evensen plans to pursue a PhD in mathematical biology.

Luquant Singh, a junior from Verona, Wisconsin, studying applied math, engineering, and physics (AMEP). Singh began research at UW–Madison the summer after graduating from high school. He currently conducts computational plasma physics research on the Helically Symmetric eXperiment (HSX), a fusion energy device, with Professor David T. Anderson. Singh has earned authorship on

national conference presentations and an in-preparation paper. He also serves on the design team for a new plasma physics device to be built at UW–Madison. He attends the university on a full-tuition music scholarship for clarinet performance. This summer, Singh will conduct computational plasma physics research at the Princeton Plasma Physics Laboratory under the direction of Stuart Hudson. After graduation, Singh plans to pursue a PhD in plasma physics.

UW STUDENTS PERFORM WELL ON VIRGINIA TECH MATH CONTEST

On October 24, 2018, several math students completed the Virginia Tech Math Contest. The Virginia Tech Contest is similar to the Putnam Exam, but perhaps somewhat easier; this year 94 schools from 29 states took part in the 40th contest and there were 792 participants. The maximum possible score was 70.

We were thrilled to discover two of our students ranked 2nd and 3rd nationwide!

Congratulations to **Liwei Jiang** (2nd) and **Sivakorn Sanguanmoo** (3rd).

Also notable, **Xiixin Li** (21st) and **Ruiting Tong** (24th).

PUTNAM EXAM RESULTS HIGHLIGHT EXCELLENCE AT UW

The UW–Madison Department of Mathematics participated in the national annual exam this fall. **Sivakorn Sanguanmoo** received an honorable mention, which is a very high honor on this competitive test. There was a team of three students from UW–Madison that scored in the top 200: **Chenghui Li**, **Liwei Jiang**, and **Sivakorn Sanguanmoo**. Another team, **Mingxuan Wu**, **Tairan Ma**, **Ruiting Tong**, and **Xiixin Li**, scored in the top 500.

The William Lowell Putnam Mathematical Competition is the preeminent undergraduate mathematics competition in the United States and Canada. Each year on the first Saturday in December, more than 4,000 students spend two three-hour sessions solving twelve problems.

Link: <https://go.wisc.edu/0qolc7>

VIOLET HIGGITT FRANK SCHOLARSHIP

Scholarship assistance to one or more students in the College of Letters & Science with special preference given to a student or students majoring in mathematics.

Patrick Dougherty, Ruimin Zhang, Haoruo Zhao, Ewan Harlow, James Tautges, Omar Mohamed Abdelhameed

DOWLING SCHOLARSHIP

Established to recognize and encourage mathematics majors who have demonstrated promise in their academic work. This scholarship is awarded in the fall to graduating math majors.

Yuqing Dai, Izak Oltman, Connor Olson, Zeyu Wei, Daotong Ge

IRMA NEWMAN SCHOLARSHIP

Scholarship for graduating math majors who are a targeted minority.

Jose Larrain, Michael Miranda, Gabriel F. Alfonso Fernandez

MARY ELLEN RUDIN SCHOLARSHIP

Awards are given to a graduating math major who is also female. Preference is given to students planning on graduate study.

Isabel Kristin Allen, Yunxuan Li, Xiaohan Zhu

R. CREIGHTON BUCK PRIZE

Prize rewards those with an outstanding capstone project.

Connor Olson, Zeyu Wei

MARK H. INGRAHAM SCHOLARSHIP

Prize awarded to outstanding students who have completed their freshman year in order to offset the cost of attendance.

Luquant Singh, Allison Schiffman, Mostafa Wail Hassan, Tyler Scott Wolter

DAVID L. YOUNG SCHOLARSHIP

Prize awarded to an outstanding undergraduate interested in a career as a mathematics educator.

Zach Schickert

FRANK D. CADY SCHOLARSHIP

Prize awarded to outstanding students who intend to graduate in the next academic year in order to offset the cost of attendance.

Noah Barnes, Jordan Francis, Isabele Allen



For Graduate Students, by Graduate Students

Two years ago, Graduate Coordinator **Kathie Brohaugh** talked to a small group of graduate students about why they came to Wisconsin. They liked interacting with their peers during the Visitor's Day event, their chance to see life in the Math Department, held each spring. It gave them insight into the culture and helped nudge them toward making the decision to come to UW–Madison.

Kathie worked with the graduate students in the department to add more graduate student peer interactions to recruiting visits. She listened to their suggestions for expanding current students' impact by presenting many different parts of the Visitor's Day presentations. She made arrangements to have a current grad student meet potential students at their hotel room, and set up paid lunches for a current and visiting graduate student to chat about whatever they'd like.

This intensive dose of peer interaction seemed to do the trick. Last year, our department had the largest incoming class of graduate students (37!) in recent years. The community building of peers talking to their peers seemed to resonate with prospective students. The peer interaction has expanded to a peer mentoring program for new students after they arrive.

PHD GRADUATES

Daniel Hast,
Advisor: Ellenberg
Peyman Morteza,
Advisor: Viaclovsky
Tamvana Makaluni,
Advisor: Andrews
Jinsu Kim,
Advisor: Seeger
Keith Gostelow,
Advisor: Bolotin
Jiyuan Han,
Advisor: Viaclovsky
Brandon Alberts,
Advisor: Boston
Ben Mark,
Advisor: Rebecca Willett
Ke Chen,
Advisor: Qin Li

Thomas Morrell,
Advisors: Thiffeault/
Spagnolie
Dae Han Kang,
Advisor: Seppalainen
Will Cocke,
Advisor: Boston
Thomas Edwards,
Advisors: Smith/
Stechmann
Eva El Duque,
Advisor: Maxim
Di Fang,
Advisor: S.Jin
Christian Geske,
Advisor: Maxim
Moises Herradon,
Advisor: Arinkin

Hang Huang,
Advisor: Sam
M. Ryan Julian,
Advisor: Boston
Yeon Eung Kim,
Advisor: H.Tran
Mao Li,
Advisor: Arinkin
Wanlin Li,
Advisor: Ellenberg
Yuan Liu,
Advisor: Boston
John Lynch,
Advisor: Thiffeault
Yuhua Zhu,
Advisor: Qin Li

MA GRADUATES

Yujie Tao
Quinton Westrich
Dmytro Kuzmenko
Yu He
Zhengqi Liu
Nianzi Li
Lijin Wang
Jiajia Guo

Jing Yu
Wanting Dai
Jingchao Gao
Yihan Zhang
Jingnie Tang
Chris Lin
Yingxiao Ye
Xuan Zhang

Hansi Zeng
Lianchen Gang
Yaozhong Liu
Zhixuan Zhang
Longjun Li
Dadong Peng
Yongzhe Zhang

GRADUATE FELLOWSHIP AWARDED

Jason Turner, a first-year graduate student in the Math Department, has been awarded a Department of Energy Computational Science Graduate Fellowship. This prestigious award provides outstanding benefits and opportunities to students pursuing doctoral degrees in fields that use high-performance computing to solve complex science and engineering problems. It covers four years of PhD research.

Sam Stechmann, Jason's advisor, notes, "This fellowship is a real honor, and Jason is very deserving. He has been an excellent student, both as an undergraduate and now as a graduate student, and this fellowship will help him pursue his interests in high-performance computing (HPC). He is thinking about applications to weather and climate predictions, where one major challenge is that the models are reasonably good but not perfect. Jason is planning to investigate some new methods for making computational predictions, where he will use multiple models, each with its own strengths and weaknesses, and allow them to communicate with each other during a prediction. By sharing information and taking advantage of each model's strengths, this strategy could create improved predictions."

Graduate Awards

MATH TEACHING ASSISTANTS WIN CAMPUSWIDE AWARDS

Of more than 2,000 teaching assistants on campus, these two were honored among a class of thirteen others for their contributions to the classroom, lab, and field teaching contributions.

Soumya Sankar has won the Exceptional Service Award. Soumya is a fourth-year graduate student in the Department of Mathematics, specializing in number theory. She has taught various single- and multi-variable calculus and precalculus courses. "Teaching has been an integral part of my life as a graduate student," Soumya said. "Among the most important aspects of teaching for me has been to motivate my students to learn math. I always try to find ways to convey my excitement and fascination for math to my students, in a way that helps relate to the subject and engage with it at a deeper level."

Di Fang has won the Capstone PhD Teaching Award. Di is a PhD candidate in the Department of Mathematics. Her research interest lies broadly in numerical computation and analysis of applied problems, including quantum systems, biological models, and stochastic differential equations. Di has been a teaching assistant for various math courses, including calculus classes. Her teaching philosophy is to make math fun and approachable. Some math topics can be formidable due to their seemingly complicated appearance; Di loves to inspire her students with motivations, and illustrate math concepts and formulas in ways that are interesting and relevant to real life. Nothing makes her happier than seeing her students having fun with math and, at the same time, learning.

GRADUATE STUDENT AWARDS 2018-19

Each year the department recognizes several students for significant contributions in research and for outstanding performance as teaching assistants.

EXCELLENCE IN RESEARCH AWARDS

Eva Elduque is advised by Laurentiu Maxim. She studies the topology of complex algebraic varieties and their singularities, by using techniques from both Topology and Algebraic Geometry. For example, in one of her research papers she computed global topological invariants of a complex arrangement complement in terms of combinatorial data associated with the singular points, and obtained important topological applications (such as distinguishing non-homeomorphic homotopy equivalent arrangement complements). In a different direction, she and Christian Geske gave an entirely topological proof for the signed Euler characteristic property of the intersection homology of closed subvarieties of abelian varieties. She also worked with her advisor for obtaining new obstructions of the class of fundamental groups of plane curve complements, by studying certain (non-abelian) solvable coverings of such complements.

Christian Geske is a student of Laurentiu Maxim. His research is devoted to the topological study of singular spaces, both as a setting to ask and answer questions already well-known in the non-singular setup, and as a tool for providing topological insights into algebra-geometric problems. He has worked successfully on the following topics, producing three research papers: (a) developing new topological duality theories for singular spaces; (b) proving results in algebraic geometry using topological methods in Singularity theory; (c) studying the topology of singular branched covers and their relation to knot invariants.

Mao Li, a student of Dima Arinkin, works in algebraic geometry. In his thesis, he constructs a version of the Poincaré line bundle on the compactified Jacobians of non-reduced curves. This is a far-reaching generalization of the self-duality for Jacobians of usual (that is, smooth) curves. To accomplish this, Mao developed a combination of known methods for singular curves and completely new ideas that allowed him to handle curves that have a double component as well. His result is particularly important from the viewpoint of the geometric Langlands program: in order to apply the duality to the Hitchin fibration, it is important to consider compactified Jacobians of all curves, including non-reduced ones.

Yuan Liu, a student of Nigel Boston, is an algebraic number theorist with an extensive understanding of group theory. Her thesis concerns a refinement

of the Inverse Galois Theory Problem, where one asks if there exists a G -extension of the rationals with given inertia at a prime p . She has also been writing a series of important papers together with Melanie Wood, outlining a vast generalization of the famous Cohen-Lenstra heuristics, requiring the development of new fundamental notions of random groups and delicate work with probability measures. She has also published on sporadic points on modular curves.

Alisha Zachariah, a student of Shamgar Gurevich, is working in the field of algebra and its applications to engineering problems. In the future every car moving in urban environments will need to have a radar calculating the channel, namely the location and relative velocity of nearby objects. Due to spectrum sharing and high resolution constraints, the IEEE 5G new standards assume that the devices work with very long vectors. In particular, this calls for processing algorithms that compute the channel in very efficient ways in terms of sampling and arithmetic complexity. The Heisenberg group and the sparse fast Fourier transform play an important role in her research. She obtained the first sub-linear algorithm for calculating radar channels.

JOHN NOHEL PRIZE IN APPLIED MATHEMATICS

John Nohel was a professor in the Department of Mathematics of the University of Wisconsin–Madison from 1961 to 1991. He was professor emeritus until his death in 1999. At Wisconsin, Professor Nohel was Chair of the Department from 1968 to 1970, and Director of the Mathematics Research Center (MRC) from 1979 to 1987. He was the founding director of the new Center for Mathematical Sciences (CMS) from 1987 to 1990. His research interest initially focused on Volterra integro-differential equations. In later years, his interests changed to mathematical problems in viscoelasticity and non-Newtonian fluid dynamics. The John Nohel Prize in Applied Mathematics was established to honor his memory and his good work with young people. The prize recognizes a graduate student who writes an outstanding PhD thesis in applied mathematics at UW–Madison.

Ke Chen, a student of Qin Li, works in applied and computational mathematics, at the intersection with computer science and statistics. Traditional numerical PDEs heavily rely on the analytical understanding of the underlying dynamics, and that severely restricts large-scale scientific computing. It is a rather urgent question to design some machine learning algorithms that can automatically capture numerical solutions to some general classes of PDEs with relaxed analytical requirements. Despite the popularity of machine learning techniques in various other areas during the past decade, the understanding of the interplay of machine learning and numerical PDEs is still rather premature. Ke is able to give the interpretation of the Johnson-Lindenstrauss lemma to multi-scale PDEs at the discrete setting, and design a random sampling technique that significantly advances the efficiency of multi-scale scientific computing.

Yuhua Zhu, a student of Shi Jin, works on uncertainty quantification for kinetic equations and related problems in machine learning. She established rigorous sensitivity theory for the Vlasov-Poisson Fokker-Planck equation with uncertainty, and efficient numerical methods for the problem, which can treat multiple scales and in very high dimensional random space. She also applied related theory to study the stochastic gradient descent method in machine learning which helped to understand the convergence property of this popular method.

ELIZABETH HIRSCHFELDER SCHOLARSHIP

Elizabeth (Stafford) Hirschfelder (1902–2002) received a PhD in mathematics at UW–Madison in 1930 and taught for almost twenty years in the Math Department. In the 1990s she established a scholarship fund for graduate women in mathematics, chemistry, and physics.

In 2018–19 Hirschfelder scholarships were awarded to four students in the Math Department: **Juliette Bruce**, **Hang Huang**, **Wanlin Li**, and **Alisha Zachariah** (see above).

Juliette Bruce, a student of Daniel Erman, works in algebraic geometry and commutative algebra. Her thesis work involves syzygies, which describe relations among the systems of polynomial equations used to describe shapes in algebraic geometry. Syzygies are known to encode many geometric invariants, but they are notoriously tricky to understand. Bruce proves an asymptotic result on syzygies in certain semi-ample limits, discovering subtle asymptotic behaviors not seen in previous work on the topic. She also works on computational topics, where she combined high-throughput computing and sparse linear algebra to compute syzygies in many new examples.

Hang Huang, a student of Steven Sam, works in commutative algebra and representation theory. She has written three papers on topics lying in the intersection of both subjects. Her work focused on the explicit calculation of equations and their higher order relations (syzygies) of ideals and modules which possess large amounts of symmetry. These calculations answered open questions posed in the literature and introduced new methods for organizing and working with complicated systems of equations.

Wanlin Li, a student of Jordan Ellenberg, works in number theory and arithmetic geometry. She has already released seven papers with a wide range of collaborators, centering on the arithmetic of algebraic curves in characteristic p with applications to analytic number theory over function fields. As one particular highlight, she obtained a lower bound on the number of quadratic Dirichlet L -functions over the rational function field vanishing at the central point, which shows that the function field analogue of a well-known conjecture Chowla is not only false but admits infinitely many counterexamples.

HENRY SCHAEF MATHMATICS AWARD

This award was established by Henry Schaerf during his lifetime. The awards committee chose three graduate students who showed excellent promise in the mid-stage of their PhD program.

In 2018–19 the recipients of the Henry Schaerf Award were Xiaocheng Li (advised by Simon Marshall), Ying Li (advised by Sam Stechmann), and Weitong Wang (advised by Melanie Wood).

DEPARTMENTAL TEACHING AWARDS

In 2018–19 the departmental teaching awards were split in three different categories. We gave separate awards for students in their early career as teachers, and mid-career awards for more advanced students. We also made an award for outstanding service.

The following students received departmental awards for their excellent performance as Teaching Assistants:

EARLY TEACHING AWARD

Caitlyn Booms, Sun Woo Park

SERVICE AWARD

Soumya Sankar

MID-CAREER AWARDS

Michel Alexis, Geoff Bentsen, Josh Blatz, Yun Li, Kit Newton, Bryan Oakley, Soumya Sankar, Hyejin Yeon, Yeyu Zhang

CAPSTONE AWARD

Eva Elduque

L&S TEACHING FELLOWS

The Teaching Fellow Award is granted to Teaching Assistants who have achieved outstanding success as students and teachers at UW–Madison. Winners of this award are named Teaching Fellows in the College of Letters & Science and serve as instructors at the L&S Fall TA Training, which takes place at the start of the fall semester.

Robert Laudone was named an L&S Teaching Fellow in 2018.



Alumni News

What are you doing after graduation?

Thomas Edwards (PhD, 2019) will be a software developer with ClearEdge3D in Broomfield, CO.

Di Fang (PhD, 2019) will be a Morrey Visiting Assistant Professor at UC-Berkeley.

Mao Li (PhD, 2019) will be a postdoc at Hebrew University, UIUC.

Eva El Duque (PhD, 2019) will be a postdoc at the University of Michigan.

Christian Geske (PhD, 2019) will be a postdoc at Northwestern University.

Willi Cocke (PhD, 2019) will be serving as a US Army Officer.

Yuhua Zhu (PhD, 2019) will be a postdoc at Stanford University.

Ke Chen (PhD, 2019) will be an R.H. Bing Instructor at UT-Austin.

Brandon Alberts (PhD, 2018) will be a Visiting Assistant Professor at University of Connecticut.

Bae Jun Park (PhD, 2018) will be a research fellow at the Korean Institute of Advanced Study.

Jiyuan Han (PhD, 2018) will be a postdoc at Purdue University.

Alumni Updates

Jiuya Wang (Melanie Wood, Advisor, 2018) has won the Association for Women in Mathematics (AWM) Dissertation Prize. This prize is awarded each year to three outstanding PhD dissertations presented by female mathematical scientists. Wang is currently a postdoc at Duke. Her dissertation title was “Malle’s conjecture for compositum of number fields.”

Grant Izmirlan (Ney, PhD, 1993) spoke at the UW Statistics Department in October 2018. The title of his talk was “Average- and λ - Power in Multiple Testing Scenarios using the BH-FDR Procedure.” Grant works as a mathematical statistician for the NIH in Bethesda, MD.

Bruce Wade (Strikwerda, PhD, 1987) is now professor and Department Head of Mathematics at the University of Louisiana at Lafayette.

Douglas John Strand (BA, 1969) died Saturday, April 28, 2018, at his home in Edgewood, MD, at the age of 70. Born in Madison, he was the son of the late Louis and Theodora (Thysse) Strand. Doug went to Central High School in Madison and attended college at Bethany in Mankato, MN, and UW–Madison. He was a Materials Engineer at Aberdeen Proving Ground in Maryland until his retirement in 2015, and was the president of the Sunrise Home Owners Association in Edgewood, MD. He is survived by his daughters, Jeannine Strand Marquez of Hopkins, MN, and Julie Strand of Minneapolis, MN; brother, Robert Strand of Madison; his grandchildren, Elijah and Adeline Marquez; and countless friends who will miss his wit and smile.

Faculty News

Every four years the UW–Madison Mathematics Department awards **Van Vleck Prizes** to faculty members on the basis of excellence in research and promise of significant future achievement. The prizes are funded by the Van Vleck Professorship Fund. The four winners of the 2019 Van Vleck Prizes are **Gheorghe Craciun**, **Jordan Ellenberg**, **Laurentiu Maxim**, and **Benedek Valko**.

Assistant Professor **Qin Li** has been awarded a **Vilas Early Investigator Award**. The award is meant to recognize research and teaching excellence in faculty who are relatively early in their careers. These awards not only provide very generous research funding to those who receive them, but they are among the most prestigious awards granted by the university.

Assistant Professors **Mihaela Ifrim** and **Hung Tran** have won **National Science Foundation Early Career Awards**. A hallmark achievement for young researchers, the **CAREER** award is described by the NSF as “a Foundation-wide activity that offers the National Science Foundation’s most prestigious awards in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization. Activities pursued by early-career faculty should build a firm foundation for a lifetime of leadership in integrating education and research.”

Sebastien Roch has been named as a **Vilas Associate**. The Vilas Associates Competition recognizes new and ongoing research of the highest quality and significance.

Three professors, **Gheorghe Craciun**, **Autumn Kent**, and **Andreas Seeger**, are among the **2019 class of Simons Fellows in Mathematics**. Each year, the Simons Foundation selects as many as fifty fellows conducting research in math and the physical sciences, providing funding for an academic leave from a term to a full year. The support, according to the foundation, is meant to help recipients “focus solely on research for the long periods often necessary for significant advances.” Founded in 1994 by Jim and Marilyn Simons, the Simons Foundation supports basic scientific research undertaken in the pursuit of understanding the phenomena of our world.

Craciun, a professor of mathematics and biomolecular chemistry, studies mathematical and computational methods for understanding properties of the biochemical networks in cells, like those that regulate gene expression, send signals, and manage metabolism.

Kent, an associate professor of mathematics, likes to work at the intersection of fields—studying families of geometric objects through hyperbolic geometry, topology, and group theory.

Seeger, a professor of mathematics, works in harmonic analysis. His research interests include problems on wave propagation, singular and oscillatory integrals, Fourier and spectral multipliers, and function spaces.

Mihaela Ifrim and **Botong Wang** have been named to **2019 Sloan Research Fellowships**—prestigious and competitive awards given to promising young researchers in the early stages of their careers.

“Sloan Research Fellows are the best young scientists working today,” says Adam F. Falk, president of the Alfred P. Sloan Foundation. “Sloan Fellows stand out for their creativity, for their hard work, for the importance of the issues they tackle, and the energy and innovation with which they tackle them. To be a Sloan Fellow is to be in the vanguard of 21st century science.”

Ifrim’s research includes fluid mechanics, harmonic analysis, and nonlinear dispersive equations with an emphasis on water wave equations. Wang focuses on topology of algebraic varieties and its interaction with combinatorics and algebraic statistics. Both mathematicians earned doctorates in 2012 and joined the UW–Madison faculty in 2017.

Each fellow receives a two-year \$70,000 fellowship from the foundation, which has awarded Sloan Research Fellowships in eight scientific and technical fields—chemistry, computer science, economics, mathematics, computational and evolutionary molecular biology, neuroscience, ocean sciences, and physics—since 1955.

Two of the four articles published in January 2019 in the *Bulletin of the American Mathematics Society* have UW connections. **Daniel Erman** and former faculty, **Steven Sam**, have an article titled “Cubics in 10 variables vs. cubics in 1000 variables: Uniformity phenomena for bounded degree polynomials”. **Jordan**

Ellenberg has been involved in work related to what Joshua Grochow published, “New applications of the polynomial method: The cap set conjecture and beyond”.

Melanie Matchett Wood has been elected to a three-year term on the **American Mathematical Society Council**, starting in 2019. The Council formulates and administers the scientific policies of the Society and acts in an advisory capacity to the Board of Trustees.

David Anderson has been named as a **Vilas Distinguished Achievement Professor**. Candidates for the professorships possess unusual qualifications and promise, having been recognized nationally and internationally for the quality of their research.

Tonghai Yang is the newest member of our department to be named a **Fellow of the American Mathematical Society (AMS)** for 2019. He was named for contributions to the theory of Shimura varieties, L-functions, automorphic forms, and complex multiplication. The Fellows of the AMS designation recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics.

Jordan Ellenberg was featured on NBC Sports to prove who was superior: Aaron Rodgers or Tom Brady. Jordan demonstrated how he came to his conclusion that Aaron Rodgers is, in fact, the better QB.

Sebastien Roch and former PhD student **Kun-Chieh (Jason) Wang** won **Best Paper Award** at the prestigious 22nd Annual International Conference on Research in Computational Molecular Biology (RECOMB) 2018. Their submission “Circular Networks from Distorted Metrics” combines ideas from mathematical biology, combinatorial algorithms, and theoretical statistics to make progress on the notoriously challenging problem of inferring phylogenetic networks from genetic data.

Trees have long been used as a representation of species relationships. However, complex evolutionary events, such as genetic re-assortments or hybrid speciations which occur commonly in viruses, bacteria, and plants, do not fit into this elementary framework. Circular networks are one of the many possible generalizations of trees studied in evolutionary biology. Although such networks can be hard to interpret, their neat visualization and fast reconstruction have made them an exploratory tool of choice to detect network-like evolution in genomic datasets. Roch and Wang devised a new estimation method that is both fast and, in a mathematically rigorous sense, more robust to the noise intrinsic to this type of evolutionary data.

Staff News

Soledad Benguria-Andrews and **Sara Nagreen** were honored for career achievement and excellence by the College of Letters & Science on May 8, 2019. Soledad won a **2019 Early Career Award** for her work with redefining the Calculus sequence; this impacts thousands of students each year! Sara won a **Mid-Career Award** for her impact on service, including several committees for recognition, climate, IT, communications, and information security.

Shirin Malekpour was promoted from her position as Director of Instructional Excellence to the College of Letters & Sciences Associate Dean for Learning and Administration. We miss her leadership and presence here but look forward to working with her in her new role.

Mark Castillo has worked at UW–Madison now for twenty-five years, fifteen of those years in the Math Department as the grants manager. He finds great reward in assisting the Van Vleck postdocs submit their very first proposals, as well as striving to provide the faculty understanding of the endless policy and rule changes. Those who have relied on him will tell you he continues to provide the highest level of support he can. Mark says this because every time a faculty member receives an award, he has a strong feeling of success, knowing he was able to provide a small but important part of their continuing achievements. Mark has very much enjoyed his time at the UW and in the Math Department. He is looking forward to retirement, but in the meantime, he will continue to serve the faculty here in the Math Department, assisting them as they find their way through the research admin labyrinth.

Answers to Mental Math on page 7:

1. 16 2. 12/25 3. 11315 4. 37 5. 4.6 or 23/5 6. 48 7. 40 8. 9 9. 975 10. 80 11. 10

We'd like to thank our donors for their support. Your assistance helps fund the activities that continue to make our department one of the top math departments in the country.
On, Wisconsin!

Okan Akalin	Cynthia Chin	Byron Froelich	Lisa Kelley	Dennis Osimitz	Jeffrey Stroomer
Walter Albers	Peter Cholak	Robert Fruit	Scott Kelley	Randolph Ott	Catherine Stuckey
David Appleyard	Larry Christenson	Eleanor Gaer	Ethan Kellogg	Jayne Overgard	Timothy Swast
James Arnold	Adam Christopherson	Patrick Gaffney	Peter Kent	Diana Palenz	Maynard Thompson
Michael Aschbacher	Michael Christopherson	Mark Gamb	Sangtae Kim	Larry Pantzer	Lowell Tonnessen
Paul Aspinwall	Richard Churchill	Joanna Gaynor	Craig Kowitz	Lee Parsons	Richard Turner
Jonathan Baer	Brian Cobb	Phillip Geil	Aaron Kriegel	Norbert Pelc	Jerald Tutsch
Christina Bahl	Lawrence Colassacco	Jeffrey Gibson	Brian Kroth	David Pettersen	David Twigg
Andrew Bailey	Kevin Compton	George Glauberman	Ila Kuestner	Jeffrey Poskin	Barbara Underberg
Clifford Baker	Jennifer Conant	Richard Glove	Thomas Kunkle	Daniel Prevenas	Elizabeth Vaden
Joni Baker	David Corris	Google Inc	Thomas Kurtz	Paul Rabinowitz	Benedek Valko
John Banerian	Patricia Crocker	Donald Goral	Oh Hoon Kwon	David Rasmussen	Lorna Vazquez
Dana Bartholomew	Joann Cross	Andrew Gould	Jennifer La Montagne	John Rehbeck	John Vedder
Lewis Baum	Kevin Davis	Deborah Graham	Alfred Lehnen	James Remington	Steve Verrill
Robert Beach	Nancy Davis	H. Steve Graham	Michael Lesar	Ken Rice	Alex Viana
Mary Beaumont	Rachel Davis	Kathy Green	Hao Lin	Joseph Richie	Brandon Von Feldt
Kathleen Beleckis	Richard Davis	Marie Griffin	Barbara Lind	Matthew Rock	Alan Vraspir
Miroslav Benda	Carl-Wilhelm De Boor	E Joseph Guay	Yiming Long	Robert Roepe	James Waddington
Tracy Benton	Carolyn De Maria	Rudiyanto Gunawan	Carter Luke	Garrick Rohm	Michael Wage
Suzanne Bernhardt	Geng Deng	Kirk Haller	Fang Ma	Randy Rusch	James Waldbly
Nancy Blair	Barry DeZonia	Sally Handy-Zarnstorff	Daniel Maki	Charles Salisbury	Lu Wang
Roger Blumer	Laura Dodd	Joan Hart	Jean Makovsky	Jeffrey Saltzman	Yingfei Wang
Susan Blumer	Zhe Dong	Charlie Hartman	Shirin Malekpour	Bruce Salzman	David Webb
Tina Bollig	Joseph Doniach	Robert Hathway	Joseph Malkevitch	Mary Schaefer	Bruce Weertman
Caitlyn Booms	Paul Donis	Craig Heberer	Dennis Mancl	Tyson Schmidt	Timothy Wehausen
Mark Boothby	Anne Dougherty	Billie Hellerstein	Lee Marquardt	Karina Schoengold	Gerald Wendling
Douglas Borsom	Tung Duong	Simon Hellerstein	Kay McAllister	Richard Schrott	Ronald Werhnyak
Keith Boyd	Ben Durham	James Henderson	Joseph McCloskey	Peter Schult	Dennis West
Matthew Boylan	Robert Easton	Henry Luce Foundation Inc	Tamara McGehee	Susan Schultheiss	Robert Wheeler
Paul Bradley	Gary Ebert	Bruce Henry	Nancy McKinley	Gary Schultz	Ronald Whitney
Colin Brochtrup	George Edwards	Eric Hestekin	Daniel McMillan	Michael Schwietzer	Kelly Wieand
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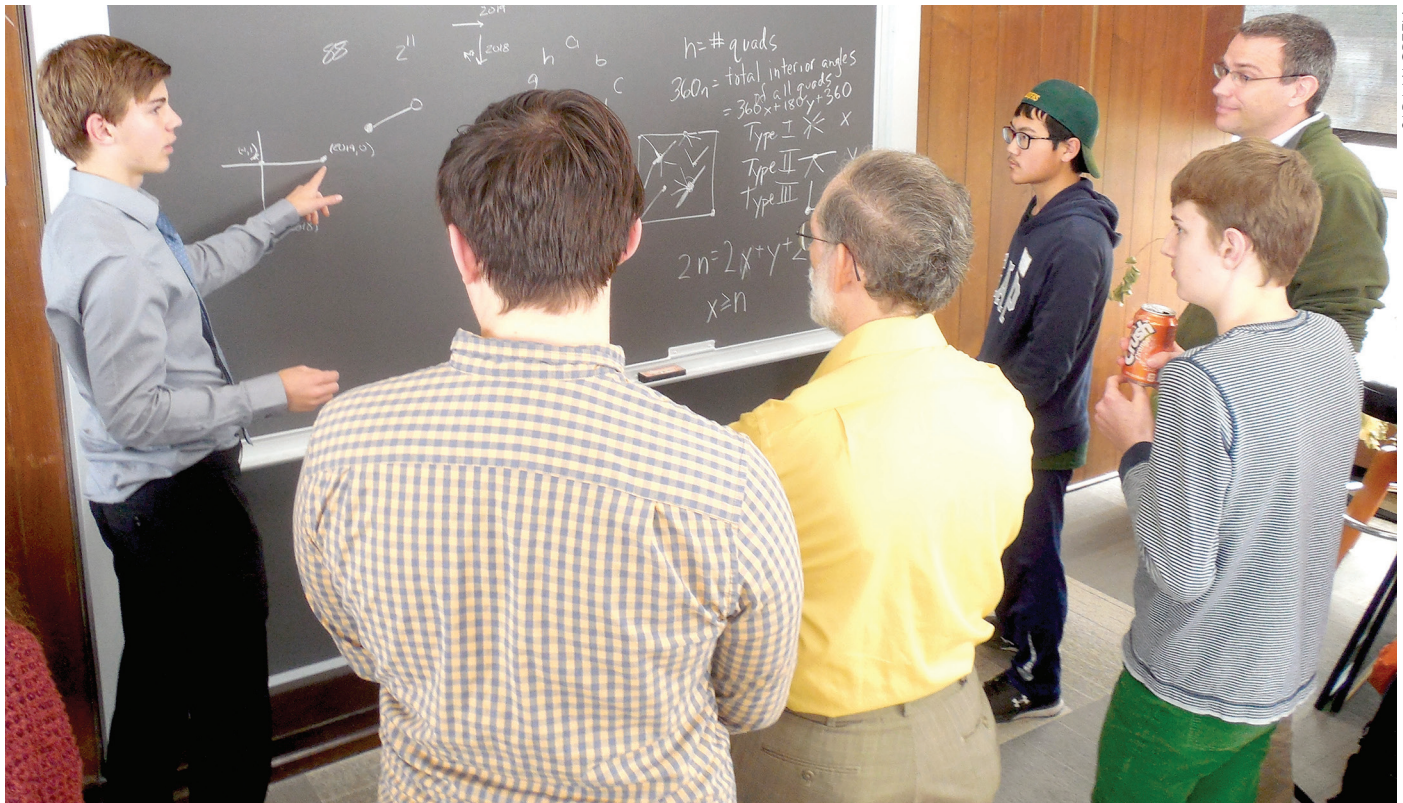


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