

RECKONINGS

SUMMER 2016

Message from the Chair

LOUIS F. ROSSI

It's a pleasure to share with you again all the great things happening in and around the Department of Mathematical Sciences. As a faculty, we measure ourselves by our students and our discoveries, and also to the degree to which we involve our students in our scholarship.

There is certainly plenty to celebrate in this issue of *Reckonings*.

Great departments create an environment where faculty flourish. With 43 faculty, there is always lot going on, and I thought I would touch on a few of the many highlights. Last fall, we welcomed Assistant Profs. Mahya Ghandehari, Dominique Guillot and Doug Rizzolo to the department. In addition to bringing talented instruction to our programs, they expand our research capacity into new areas including data mining, probabilistic graph theory, wavelet analysis and graph limits. This spring brought the happy news that Associate Prof. Nayantara Bhatnagar has been awarded a prestigious NSF CAREER grant, the premiere early career award given to a rare few who "...exemplify the role of teacher-scholars

through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations." Associate Profs. Sebastian Cioaba and Yvonne Ou were named to the editorial boards of the *Electronic Journal of Linear Algebra* and the *Journal of Applicable Analysis*, respectively, top journals in their fields. Profs. Dawn Berk, Bettyann Daley and Tammy Rossi who planned and deployed our Mathematical Sciences Learn Laboratory are the first instructional team ever to be recognized with the College of Arts and Sciences Teaching Award. Prof. Toby Driscoll was elected to the Society for Industrial and Applied Mathematics (SIAM) Council, a position of significant profession influence. Finally, Prof. Jinfa Cai has been named a Fellow of American Educational Research Association (AERA), one of two faculty in UD's history to hold this great honor.

A significant new addition to the Department is the Center for Applications Mathematics in Medicine (CAMM). Building on considerable research expertise within our department, on campus and at regional medical cen-

Continued on page 4

Inside

Chair's Message	1
New Center for Applications of Mathematics in Medicine Opens ...	2
Faculty Research Grants	3
New Faculty.....	4
College of Arts & Sciences Honors Faculty, Students, Alumni	5
The Theory of Dense Graph Limits: New Connections Between Analysis, Combinatorics and Data Science	6
Dr. Driscoll elected to SIAM Council Appointment.....	7
Mathematical Sciences in the Land of Aus.....	8
Departmental Student Awards	9
Graduate Program	
Alumnus Talk	10
New Math Learning Lab Offers One-Stop Shop for Student Success	11
Conference Corner	12
Job Experience as the SIAM President.....	13
Featured Graduate Students	14
Nayantara Bhatnagar is Awarded NSF CAREER Grant	15
Editorial Appointments	16
NACADA Outstanding Advising Award.....	16
Honors.....	17
Thank You to our Generous Donors!.....	18
Congratulations to our new Ph.D.s' new jobs!.....	19

Nayantara Bhatnagar is Awarded NSF CAREER Grant



Prof. Nayantara Bhatnagar is awarded the prestigious NSF CAREER Grant for her research on probability and combinatorics

Prof. Nayantara Bhatnagar's project, entitled "Phase Transitions in Some Discrete Random Models and Mixing of Markov Chains" will begin this summer and run for five years. The NSF CAREER

program is NSF's premiere early career award given only to those who "... exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations."

Faculty Research Grants 2016

PI / CO-PI	AGENCY	TITLE	AMOUNT/DURATION
Bhatnagar, Nayantara	NSF	<i>NSF CAREER: Phase Transitions in Some Discrete Random Models and Mixing of Markov Chains</i>	400K/5Y
Cai, Jinfa Cirillo, Michelle	DDOE	<i>Conceptual Understanding of Mathematics for Students in Grades 8-11</i>	44K/2Y
Cioaba, Sebastian	NSF	<i>The Interplay between Spectral and Combinatorial Properties of Graphs and Association Schemes</i>	130K/3Y
Driscoll, Toby Schleiniger, Gilberto	NIH	<i>NIH Delaware INBRE 3</i>	18K/1Y
Guillot, Dominique	UDRF	<i>Analysis of Clustering Algorithms via Graph Limits</i>	35K/2Y
Guyenne, Philippe	NSF	<i>Nonlinear Dispersive Water Waves in Multiscale Interaction Problems</i>	130K/3Y
Lazebnik, Felix	SIMONS	<i>Algebraic Constructions of Dense Graphs with Forbidden Cycle Lengths</i>	35K/5Y
Monk, Peter B	NSF	<i>Collaborative Rsch: Integrated Simulation of Non-homogeneous Thin-film Photovoltaic Devices</i>	500K/3Y
	NSF	<i>New Directions in the Qualitative Approach to Inverse Scattering Theory</i>	62K/1Y
Park, Jungeun	UDRF	<i>Improving Calculus Instruction through content-specific TA professional development</i>	35K/2Y
Plechac, Petr	DARPA	<i>BROWN/ DARPA Information Metrics for Reliable Uncertainty Quantification in Materials Design</i>	171K/2.5Y
Rakesh, Rakesh	NSF	<i>NSF Inverse Problems for the Wave Equation</i>	152K/3Y
Rizzolo, Douglas	UDRF	<i>Asymptotic Properties of Random Trees</i>	35K/2Y
Xiang, Qing	NSF	<i>Algebraic Methods in Combinatorics and Finite Geometry</i>	210K/ 3Y

New Center for Applications of Mathematics in Medicine Opens

BY R.J. BRAUN

The Center for Applications of Mathematics in Medicine (CAMM; www.mathandmedicine.org/)

was founded in the College of Arts and Sciences in Spring 2016. The founding director is Tobin Driscoll, with associate directors Pak-Wing Fok and Richard Braun. At the time of writing, CAMM boasts 20 faculty members from four departments and two colleges, five external associates, and six students. Among the members are five holding medical doctorates and a certified radiologist. The founding of CAMM was celebrated with a reception at the Faculty Commons in April with Deans George Watson, Doug Doren and John Pelesko, Department Chair Louis Rossi, and CAMM members.

CAMM's purpose is to coordinate research and education that advance the application of mathematics and computation to biomedical research and clinical practice in order to improve human health in the state, region, and beyond.

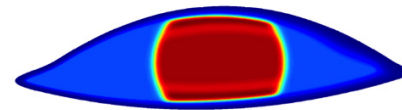
Why math and medicine? Our understanding of complex biological systems, including human health, are increasingly based on quantitative measurement and models built from first principles. Physicians are often brilliant empiricists, but are not usually as well trained to apply mathematical and computational techniques as are applied mathematicians. Similarly, academic mathematicians need guidance to find medical problems that are relevant to medical science or clinical practice and that would benefit from mathematical models. By facilitating collaboration between the members of these communities, CAMM enhances current mathematical knowledge in medicine and accelerates the understanding of intellectual challenges that

will shape new approaches to relevant problems and new generations of mathematical researchers.

Our research projects cover a wide range already; they including treatment of neonatal heart conditions, tear film and ocular surface dynamics, atherosclerosis, the BIAcore optical biosensor, and models for cancellous bone. Short introductory videos by some of our members can be found at www.mathandmedicine.org/projects.

Part of the foundation of CAMM is a series of projects on the tear film and the ocular surface. Profs. Braun and Driscoll have been funded by the NSF since 2007 and the NIH since 2010. They work closely with research associates Profs. Carolyn Begley (Indiana Optometry) and P. Ewen King-Smith (Ohio State Optometry). This set of projects has studied tear film motion during blinking, tear flow and saltiness (osmolarity) over the exposed ocular surface, and the breakup (disruption) of the tear film in small local areas. The results have appeared in top eye and mathematical journals, has produced 4 PhDs to date, and will produce three more PhDs and one MS student in the near future. Sixteen undergraduate students have worked on summer and thesis projects, with three winning undergraduate research awards, two going on to study optometry, one studying medicine, and others to mathematics, economics and finance.

The hypoplastic left heart syndrome (HLHS) project began in 2013 with a collaboration between Profs. Toby Driscoll and Gilberto Schleiniger, PhD student Lei Chen and Dr. Michael McCulloch of Nemours/Al duPont Hospital for Children. HLHS is a cardiac birth defect with a 20% mortality rate in the



A computed distribution of the saltiness of tears over the exposed ocular surface; this case has rapid evaporation and the darkest red indicates a six-fold increase in the saltiness over normal tears (Longfei Li, et al, Math. Med. Biol. 2016).

first year of life. Understanding the physiology of a patient in real time in the hospital is challenging but mathematical models of the heart and circulatory system have been developed that aid in this critical function. The needed parameters for the model are determined based on continuously collected bedside vital signs. The project goal is to provide clinicians with patient-specific warnings and diagnostics to provide timely treatment and prevention measures. The project is seeing a surge in participation with four new undergraduates and one new PhD student in the summer of 2016. The project is currently supported by funds from the Delaware IDeA Network of Biomedical Research (INBRE) grant, UD Summer Scholars, UD Summer Fellows and the Department of Mathematical Sciences.

Other projects include a recent PhD thesis by Dr. Brooks Emerick, under the guidance of Prof. Schleiniger and Dr. Bruce Boman of Christiana Care, Thomas Jefferson University and UD. Together, they developed a model of colon cancer development in colonic crypts. Prof. Fok and collaborators have developed effective models for atherosclerosis and vulnerable plaques, which are thought to be important in the onset of heart attacks. The properties and dynamics of cancellous bone, and how they change in health or with osteoporosis, has been the subject of

studies by Prof. Yvonne Ou and her collaborators. Prof. David Edwards and collaborators have studied the BIAcore optical biosensor; this device noninvasively measures reaction rates between important biological molecules, and its results are improved with accurate mathematical models to help interpret the results. Eight undergraduate students and three graduate students have worked on the project; two PhD dissertations have been completed. This project has been funded by both NSF and the National Institute for General Medical Sciences.

This has just been a quick summary of some of CAMM activities. CAMM will continue to add projects and members, and we look forward to growing; there is so much more that we could do. You can help us with our projects and growth by donating to support our students, collaborations, and expenses at www.mathandmedicine.org/donate.html.

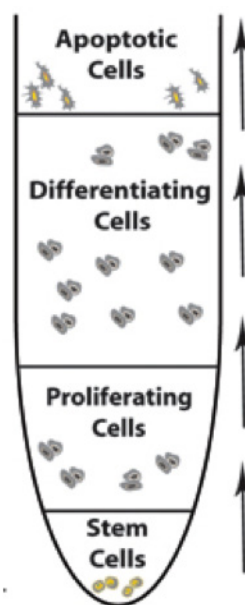


Diagram of individual colon crypt showing the position of the different cell types including stem cells at the base of the crypt.

Continued from page 1

Department saw an expansion in our stature on and off campus, growth in the size and quality of our undergraduate and graduate programs, and expansion of our research activities. From our new Mathematical Sciences Learning Laboratory in McKinly Hall over to our Active Learning Classroom on the second floor up to the coffee machine in our lounge, John's dedication to the faculty and students has been exemplary, and he will be missed. The good news is that his new office is not very far away, and I look forward to working with him in the coming years. Taking the helm mid-year was not easy, and I thank my colleagues, staff and students for their support during the transition.

Exciting times lie ahead. The University has been crafting its latest strategic plan entitled "Delaware Will Shine" during the last year with an unprecedented amount of faculty input. The current draft calls for UD to emerge as a "pre-eminent learner-centered research university." Meeting this challenge will be no easy task, but in many ways, our Department is ahead of the game. Our faculty are constantly re-imagining what a mathematics classroom should be and how best to reach students. At the same time, our research mission continues to expand into new areas with projects receiving national and international recognition. We have two CAREER fellows and a Sloan fellow amongst our junior faculty. Among our senior faculty, we have associate editors and chief editors of some of the highest ranked journals in our profession, two recipients of the Arts and Sciences Outstanding Researcher Award as well as the current President of the Society for Industrial and Applied Mathematics (SIAM). Our student clubs and organizations continue to thrive, and we are pleased to see our students complete their educations with us and move into exciting careers. We welcome news from our alumni. When you have a chance, send us a note math-contact@udel.edu or a tweet #UDmath.

College of Arts & Sciences Honors Faculty, Students, Alumni

Dean George Watson recognized seven faculty members (Brenda Shaffer, Lindsay Hoffman, Dawn Berk, Bettyann Daley, Paul Brewer, and Joseph Harris), six alumni with college awards (Paul A. Fioravanti Jr., Dr. Carol Van Dyke Freer, Tyron D. Jones, Andrew M. Stern, Mark S. Stewart, Joan E. Wainwright), and also honored faculty members and students who had previously received 2016 University awards.



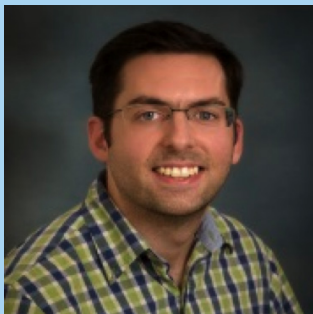
Pictured are (from left) Dean George Watson with faculty CAS award winners Brenda Shaffer, Joseph Harris, Bettyann Daley, Lindsay Hoffman, Tammy Rossi and Dawn Berk

NEW FACULTY



MAHYA GHANDEHARI

Mahya Ghandehari received her PhD in 2010 from University of Waterloo in Canada. Before joining University of Delaware in 2015, she held a position as a Post-doctoral fellow at Fields Institute for Research in Mathematical Sciences and University of Waterloo. Mahya's research focuses on non-commutative harmonic analysis as well as combinatorics, and the links between the two areas. In particular, she studies large networks, such as Facebook, using the theory of graph limits. Currently, Mahya's research focuses on the applications of non-commutative harmonic analysis in the study of continuous wavelet transforms, which have essential applications in many areas such as noise reduction in signals, pattern recognition, and image processing.



DOMINIQUE GUILLOT

Dominique Guillot received his PhD in 2010 from Laval University in Canada. Before joining the University of Delaware in 2015, he held a position as Post-doctoral fellow at Stanford University. Dr. Guillot works on problems involving mathematical analysis on cones of matrices, with applications in high-dimensional statistics. Another aspect of his work involves analyzing large networks and graph limits. He is also interested by applications of mathematics and statistics to climate science, in particular to the reconstruction of the climate of the past.

NEW POSTDOCS

JAMES MELBOURNE

James Melbourne received his PhD from the University of Minnesota in 2015 under the supervision of Sergey Bobkov. His thesis work focused on the adaptation of certain convex geometric tools to probability theory, with special interest in their application to infinite dimensional settings. He joined University of Delaware as a post-doctoral researcher in September 2015, hosted by Mokshay Madiman.

James's current research draws from a broad range of influences, but is primarily focused in information theory and probability theory, particularly topics that interface with geometry. Active projects include work on discrete curvature, Renyi entropy power inequalities, and convex measures. In the 2016-16 academic year he will join collaborators at Yale and Delaware for work on an NSF-funded INSPIRE project in mathematical linguistics.



TING WANG

Ting Wang joined the department in Fall 2015 as a postdoctoral researcher working with Prof. Petr Plechac. He received his PhD in Applied Mathematics from the University of Maryland, Baltimore County in 2015. His thesis mainly focused on the development and analysis of efficient sensitivity estimation algorithms for stochastic reaction networks.

Ting's current research interests lie in the interface between probability theory and computational methods for multiscale stochastic dynamical systems. Specifically, Ting is interested in utilizing Monte Carlo simulation technique for sampling and computation of stochastic reaction networks with multiple time scales. Currently, under the supervision of Prof. Petr Plechac, Ting is developing a parallel simulation algorithm for accelerating the simulation of continuous time jump Markov process with metastable states.

The Theory of Dense Graph Limits: New Connections Between Analysis, Combinatorics and Data Science

BY MAHYA GHANDEHARI AND DOMINIQUE GUILLOT

Many interesting structures in the world are naturally described using networks. For example, one of the largest and most commonly used networks is the internet. As of today, the internet contains more than 30 billion webpages that are interconnected with each other. Another popular network is the Facebook graph, which represents the friendship relationships between users of the social network. More generally, networks are used to describe relationships in many areas such as biology, statistical physics, engineering, and neuroscience, to name a few. For example, neuroscientists commonly use functional magnetic resonance imaging (fMRI) to construct networks describing how different parts of the brain interact with each other.

Analyzing and making sense of the information contained in very large networks is an extremely challenging task in modern data science. Networks are very high-dimensional objects that are difficult to visualize. They often evolve in time, and their nodes are not always labelled. Their number of nodes is also not generally constant in time, making the comparison of these graphs difficult to perform. The recent theory of *graph limits* developed by Borgs, Chayes, Lovász, Sós, Szegedy, Vesztegombi and others (1,2) provides a new way of approaching network analysis that shows a lot of promise.

To illustrate some of the ideas in that area, consider the following natural question: for a very large graph/network, compute the value of a given graph parameter (a function defined on graphs). For example, the graph parameter could be the number trian-

gles or the number of hexagons that are contained in the graph. Although such a task is immediate for graphs with a few nodes, it becomes extremely computationally intensive when working with graphs with millions or billions of vertices. In that case, a very natural strategy is often used: 1) sample a smaller number of vertices from the graph at random; 2) compute the graph parameter for the subgraph induced on the sampled vertices; and 3) use that value to approximate the graph parameter on the whole graph. The first and second steps are straightforward. The third step is also very natural, but how can we justify it? Is it true that a sampled sub-network will always provide a good approximation of the whole network when computing a given graph parameter? This is clearly not always the case. For example, consider a *star graph* S_n with one internal node and n leaves—see Figure 1.

Suppose that the graph parameter we want to compute is the maximum degree of the vertices in the graph (i.e., the maximum number of edges that are connected to a vertex in the graph). Note that a sampled sub-network will provide a correct approximation if and only if the internal node is chosen. A simple calculation shows that this happens with probability $k/(n+1)$ if k nodes are sampled uniformly from the $n+1$ nodes of the star. As a result, we need to sample a significant portion of the nodes for the approximation to be valid. The sampling procedure is therefore not a good approach to compute the maximum degree of a large graph. In general, how can we know if the sampling process will provide a good approximation for a given graph

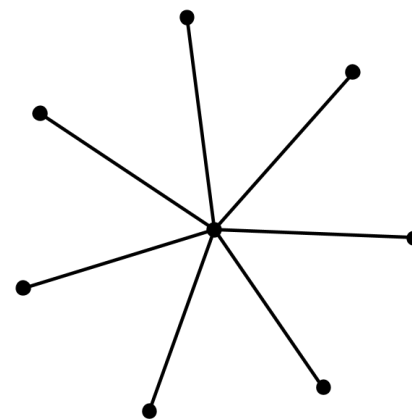


Figure 1. The star graph S_n .

parameter? Using techniques of mathematical analysis, probability theory, and combinatorics, the theory of graph limits provides a beautiful answer to this question.

In the theory of graph limits, each graph is first naturally identified with a function defined on the unit square $[0,1]^2$ and taking values in $[0,1]$. The identification is made via the adjacency matrix of the graph (see Figure 2). The space of all functions $W: [0,1]^2 \rightarrow [0,1]$ is called the space of *graphons*. Each graph is thus identified with a graphon. A natural *topology* is then defined on the space of all graphons. This topology enables us to measure how “close” graphs are to each other, even if the graphs have a different number of nodes, and if their vertices are not aligned (i.e., graphs can be compared up to isomorphism). Using that topology, one can study *limits* of graphs. Note that the graphon associated to a graph is always $\{0,1\}$ valued. However, a sequence of graphs can converge to a graphon taking any value in $[0,1]$. In fact, graphs are dense in the graphon

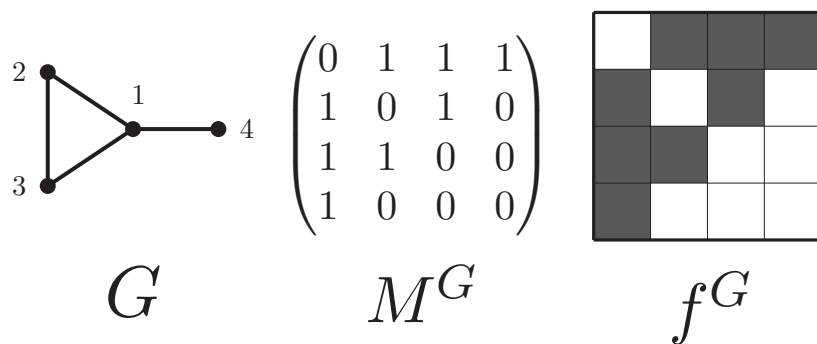


Figure 2. Left to right: A graph, its adjacency matrix, and its associated graphon (the function f^G is equal to 1 on the black squares and to 0 on the white squares).

space (i.e., for every graphon $W: [0,1]^2 \rightarrow [0,1]$, there exists a sequence of graphs $(G_n)_{n \geq 1}$ such that $G_n \rightarrow W$).

The graphon topology provides a new exciting setting for studying graphs

and networks. For example, let us go back to the problem of computing a graph parameter $f(G)$ for a very large network G . The theory of graph limits provides a nice representation of the parameters f for which the sampling

approximation works: these are precisely the functions that are continuous on the graphon space. In particular, the proportion of edges, triangles, hexagons, etc. in a graph are all continuous on the graphon space, and can thus be estimated by sampling a sub-network.

The area of graph limits is still young and is attracting a lot of interest in the mathematical community. Many applications of the theory still need to be developed. Several faculty members of the Mathematical Sciences department at U. Delaware (including the two authors of this article) are actively working in this field. We expect that this theory will have an important impact in several areas of pure and applied mathematics.

[1] Christian Borgs, Jennifer T. Chayes, László Lovász, Vera T. Sós, and Katalin Vesztegombi. Convergent sequences of dense graphs. I. Subgraph frequencies, metric properties and testing. *Adv. Math.*, 219(6):1801-1851, 2008.

[2] László Lovász. Very large graphs. In *Current developments in mathematics, 2008*, Int. Press, Somerville, MA, 2009.

Dr. Driscoll elected to SIAM Council Appointment



Dr. Tobin Driscoll has recently been elected to a three-year position on the SIAM (Society for Industrial and Applied Mathematics)

Council. SIAM is an international society made up of leading mathematicians, scientists, and engineers whose goal is to connect mathematics to science, technology, and society. Dr. Driscoll and three other members of SIAM

were elected by the members of the society to the Council, which advises the current president, Unidel Professor Pamela L. Cook, on the scientific policy of the organization. Dr. Driscoll's vision for the future of SIAM includes a focus on rising scholars in mathematics as well as the recent budget cuts that the NSF (National Science Foundation) has seen, both of which impact the future of SIAM, its members, and the industrial mathematics field. In particular, budget cuts have caused the NSF to begin phasing out funding for two of its national research institutes, the

IMA in Minnesota and the MBI in Ohio, which widely affects the applied mathematics community. Dr. Driscoll would like to promote active lobbying of NSF and congress to address these issues. In regard to postsecondary education, Dr. Driscoll's plans include a focus on adapting current curriculum to teach relevant ideas and skills to the students who will be the future of the field. He wants to make sure that SIAM also plays a part in recruiting diverse students into college mathematics programs, as demographics continue to evolve, to secure the field's future.

Mathematical Sciences in the Land of Aus

BY LOU ROSSI

In January 2016, I boarded a flight to Melbourne Australia where I would link up my colleague Charlie Boncellet from Electrical Engineering and 26 undergraduate mathematics, physics, computer science and engineering majors to spend a month learning and traveling together. Neither Charlie nor I had done this before, but we had been planning the project for over a year. Charlie approached me in the late Fall of 2014 to ask me if I would be interested in teaming up with him to offer pair of courses, one in electrical engineering and one in mathematics, for a single study abroad program in Melbourne. I did not know Charlie well, but it seemed like a fine idea. I had lived in Melbourne while on sabbatical several years ago and have friends and contacts there. Next to San Francisco, it's my favorite city in the world. I love math, and I love travel. What could be better than to guide students on a mathematical journey to this special part of the world?

One of the best things about this project for newbs like Charlie and me is that the University of Delaware has one of the oldest and most expansive study abroad programs in the United States. While Mathematical Sciences does not participate often, UD's Institute for Global Studies (IGS) has considerable infrastructure and expertise in offering programs around the world. IGS provides students with travel assistance, health coverage and UD has a long standing relationship with Trinity

College in the University of Melbourne. The program staff at Melbourne Uni would help us plan out accommodations, meals, excursions and activities well in advance. As a place to live and study, it is hard to beat Trinity College with its "faux Oxford" architecture and comfortable facilities.



The full study abroad group assembled in front of the Puffing Billy steam locomotive in the Dandenongs.

Our study abroad program was designed to meet the needs of upper division STEM students at the University of Delaware. This target audience is largely underserved because most study abroad courses are 100- or 200-level courses that can reach a broad audience. I linked my course on modeling and analysis to the location by designing an offering called "Mathematics of Sustainability". Model systems were drawn from ecological interactions, the spread of disease, the movement of wildfires and other processes relevant in Australia. While Australia is roughly the same size as the United States, it is mostly desert. Water conservation and land management is critical. Students

would have opportunities to visit many of these exotic and fragile ecological areas. Charlie would teach a scientific computing course to support students' modeling activities. In general, study abroad is more popular to women than men, but our final enrollment achieved almost gender parity with a good mixture of STEM disciplines primarily from mathematics and engineering disciplines. Outside of excursions, the routine was simple. Mornings would be spent in class. Afternoons and evenings were for homework and exploring the city.

Our program including a wide array of activities and excursions. In addition to visiting many of the attractions within Melbourne, we hiked through the Dandenong range, rolled down the Great Ocean Road, visited animal sanctuaries, camped

in the Grampians National Park and toured the Commonwealth Scientific and Industrial Research Organisation (CSIRO) which is the national government research agency in Australia. Melbourne hosts the Australian Open tennis tournament in January so many of us were able to enjoy seeing a match or two live.

One of the things that impressed Charlie and me was how quickly students found fun and inexpensive things to do in Melbourne. Thanks to a helpful social network app, the whole group was able to stay connected while exploring Melbourne individually, in small groups or as a mob. Students organized trips

to Cairns, Sydney and Tasmania during their free weekend. Charlie and I enjoyed getting to know our students better, and the students enjoyed getting to know us well too. Charlie and I were always present at meals and activities, but we were mindful not to hover or intrude. The students genuinely enjoyed including us in smaller groups whether it was visiting a museum, cycling up and down the foothills of Mt. Wellington in Hobart or jumping out of an airplane.

The internet, wifi and smartphones have transformed travel, but for all that, the most transformative experience for the class was spending four days and three nights camping along the Great Ocean Road and then in the Grampians,

a spectacular National Park a few hours west of Melbourne. Half the class had never been camping before and there was more than a little apprehension before we embarked. It gave the class a chance to sleep under the Large and Small Magellanic Clouds, chase mobs of 'roos in the early morning and watch an echidna devastate a nest of ants. Cell reception was spotty at best and wifi was non-existent, so students enjoyed spending more time conversing with one another. In the end, students found this to be the stand out experience on the trip.

Of course, one can study mathematics and scientific computing anywhere, but for Charlie and I, providing this experience was far more than connecting scientific topics to a particular part of the world.

For four weeks, our students were no longer a tiny part of a medium-sized, self-contained university. During this study abroad, they each became a big part of a tiny community of scholars exploring new surroundings. Overall, the students became empowered. Students' projects were outstanding, not only for the quality of the mathematics but also for their grasp of the central issues they were studying in the context of the Australian people and their environment. As a novice, I maintained some skepticism before embarking on this project. Now that I have gone through it once, I am convinced this an essential experience we should be offering to our students.

Departmental Student Awards

GRADUATE STUDENTS

SIAM Outstanding Efforts & Achievements Award: Ms. Lan Zhong

Baxter-Sloyer Graduate Teaching Award: Mr. Thomas Brown

Wenbo Li Award: Mr. Shixu Meng

Winter Research Symposium Poster awards: Mr. Tonatiuh Sanchez-Vizuet and Ms. Lan Zhong



UNDERGRADUATE STUDENTS

Clark Prize (Seniors): Jacek Cencek and Ryan McKenna

Undergraduate Research Prize: Joseph Brosch

Wolf Prize (Juniors): Daniel Atadan



Graduate Program Alumnus Talk

BY G. SCHLEINIGER

Dr. Nuno Crato, a PhD graduate from our Department of Mathematical Sciences who went on to pursue a research and academic career in the US and in his native Portugal, visited the Department on April 4, 2016.

The Department of Mathematical Sciences special guest graduated with a PhD in 1992, and went on to a wide-ranging career in the US and abroad, as a mathematician, a math-popularizer, and an occasional politician. His distinguished career includes appointments as pro-Rector of the Technical University of Lisbon, and president of the TagusPark, a science and technology park located in the Greater Lisbon subregion in Portugal. TagusPark is the largest Science and Technology organization in Portugal, with two university campuses within the Park and hundreds of technological firms. He also served three consecutive terms as president of the Portuguese Mathematical Society. In 2003 he was awarded the First Prize of the Public Awareness of Mathematics contest by the European Mathematical Society; in 2008 he was awarded the European Union Science Award (previously known as the Descartes Prize), second place as Science Communicator of the Year, and he received the National medal awarded by the President of the Portuguese Republic: Commander (Comendador) of the Prince Henry Order; and in 2016 he received the National medal awarded by the President of the Portuguese Republic for civil and peaceful services to the development of the country: Grand Cross (Grã-Cruz) of the Prince Henry Order, the highest recognition of a civilian by the Portuguese government. Between 2011 and 2015, Dr. Crato was Minister of Education and Science in the Portuguese government. Starting in May 2016, he will be a senior fellow at the European Joint Research Center in Italy.



Dr. Nuno Crato

Dr. Crato gave an informal talk to faculty and graduate students in Ewing Hall about his research and his career. He started by acknowledging what he owes to his UD education. Naturally, he emphasized that he learned what research is, and his training on how to do it. He likes to blend original theoretical and methodological research with solving problems of interest in diverse areas, in line with his education in our Applied Mathematics Program. He also emphasized that he learned a lot about good teaching practices, both from the example of his professors during his graduate student days in the Department, and from the directives he received from the professors he was helping as a TA. Maybe more surprisingly, he mentioned that his graduate work and, in particular, the help of his advisor, Professor Howard M. Taylor, helped him learn how to write well.

This skill helped him not only in the writing of his research papers, but also in his activity as a science writer. His book *Figuring It Out: Entertaining Encounters with Everyday Math* published by Springer, has been praised by quite a few math reviewers.

Dr. Crato was an Applied Mathematics graduate student at UD—most of his graduate work was done in stochastic models, time series, and econometric modeling. In reviewing some of his research, he highlighted a model he developed for the statistical analysis of random algorithms behavior. The issue is a puzzling behavior met by researchers dealing with extremely hard computational problems. The typical case is quasi-group problems of which Sudoku is a fun example. When solving these problems, researchers noticed a very wild behavior of the computing

He started by acknowledging what he owes to his UD education.

costs (measured as number of backtracks), and a seemingly increasing wandering mean. In practice, restarts are the way to bypass stalling computations. Collaborating with computer scientists from Cornell University, Crato worked

on a new stochastic model explaining the behavior of these algorithms. By assuming that the computing cost of these algorithms is an alpha-stable random variable, it is possible to explain its puzzling behavior and the effectiveness of the restart strategy. A simple random tree model is able to mimic the behavior of very different random algorithms for this type of problem.

Describing his views on math education, Crato criticized some features of mathematical education in a few countries, and he praised the common core standards for mathematics recently developed in the US. He armed his belief in the need for raising the level of math education, and in not shying away from rigor, denitions, and proofs. In his opinion, nothing can improve in elementary, middle, and secondary education without a more rigorous and content-based teacher training.

Attendants to the session may have been curious about his decision to serve in government. Crato explained with disarming simplicity the reason why he has worked at this high political level—he was invited and he thought that it was his duty to try and improve education. He served a full term, not a normal occurrence within the education portfolio in Portugal (this happened only in four cases so far). Dr. Crato has now returned to his research career.

[Crato] thought it was his duty to try and improve education.

New Math Learning Lab Offers One-Stop Shop for Student Success

Students can come to the new Mathematical Sciences Learning Laboratory for tutoring and other assistance with basic, foundational math courses.

If there's a University of Delaware department that really knows how to rely on numbers, it's Mathematical Sciences, and faculty members there have been seeing some worrisome data—a large proportion of freshmen failing or dropping their beginning math courses and, too often, difficulties with math causing interested students to abandon STEM classes altogether.

"We know that, nationally, a large number of students enter college with an interest in STEM [science, technology, engineering and math], but those numbers drop off," said John Pelesko, professor of mathematical sciences and interim associate dean for the natural sciences in the College of Arts and Sciences. "A lot of that attrition is due to negative experiences in college math classes, so we decided to address it. We realized that we can't fix this problem by doing the same things that got us here."



The department and the college came up with what they think is a solution. They established a dedicated "one-stop shop" to provide innovative teaching, specialized classroom space and tutoring, advising and test-taking services for students taking basic, foundational mathematics courses.

The Mathematical Sciences Learning Laboratory (MSSL) occupies a former physical therapy clinic in McKinly Lab. It

remodeled the area and introduced its services last spring and began operating on a full schedule this semester.

Its large classroom is modeled on the instructional space in the Harker Interdisciplinary Science and Engineering Laboratory, with movable desks and chairs to encourage small-group problem-solving and embedded technology to allow students and faculty to easily share and discuss their work.

Conference Corner



DelMar Numerics Day, 2015

DELMAR NUMERICS REACHES ITS 5TH EDITION

The DelMar Numerics Day is organized every spring by the Mathematics departments of the University of Delaware and the University of Maryland at College Park. This year, DelMar Numerics gets to its fifth edition and moves away from the bi-state area to George Mason University in Virginia. Saturday May 14 was the day chosen for this year's event, showcasing research in computational mathematics at large. Matthias Heinkenschloss from Rice University was the keynote speaker in DelMar Numerics Day 2016. For more information, see the conference site at <http://delmar.math.umd.edu/>

PROFESSOR GEORGE HSIAO HONORED AT CQWCAM 2015

Prof. George Hsiao (Carl Rees Professor Emeritus of Mathematics and Francis Alison Professor at the University of Delaware), along with Prof. Jean-Claude



ICIAM 2015

Nedelec (France) and Prof. Wolfgang L. Wendland (Germany), was recently honored for his lifelong academic achievements in computational mathematics at the 2nd Chongqing Workshop on Computational and Applied Mathematics. Among the six members of the organizing committee were three former PhD students of Prof. Hsiao from UD: Gabriel Gatica (now full

professor and Director of CI²MA at the University of Concepcion, Chile), Nilima Nigam (now full professor at Simon Fraser University, Canada), and Liwei Xu (now full professor and Vice Dean of College of Mathematics and Statistics of Chongqing University, China).

Job Experience as the SIAM President

BY PROF. PAMELA COOK



2015 and 2016 have passed amazingly quickly for me, there is truth to the statement that “time passes quickly when you are having

fun”. In fall of 2013 I was elected president of the Society for Industrial and Applied Mathematics (SIAM). The term for an elected president is four years, one as president-elect - 2014, two as president - 2015, 2016, and one as past-president - 2017. It has been a busy two years.

The job of SIAM president is eased by the amazing SIAM staff at the headquarters in Philadelphia, staff that carry on the major work of SIAM as the presidents and vice-presidents come and go, each of them with their own priorities. Still, the time involved in being SIAM President, while carrying on regular UD duties, has been close to overwhelming. The opportunity/necessity of travel has been terrific. Highlights of my travel included: Beijing, China to represent SIAM at the International Congress on Industrial and Applied Mathematics (ICIAM) meeting (with a side trip to the Great Wall and one to the Forbidden City), and Cambridge, UK, to meet with the SIAM UKIE (United Kingdom and Republic of Ireland) section members, and to give an invited talk in honor of their 20th anniversary.

The SIAM president is a member of the SIAM Science Policy Committee which meets twice per year with representatives of national funding agencies and makes “trips to the hill” to advocate for funding for priorities related to SIAM members’ activities. This has been an education for me, offering a glimpse of how the government operates, how the various entities work with each other, and how funding priorities are

defined and do or don’t evolve into programs.

Particularly rewarding has been my role as president in inviting individuals to stand for election to SIAM office and/or to serve on one of the many committees of SIAM. It is most impressive how dedicated SIAM members generally are, the time many of them commit to the society and its programs, and their positive and thoughtful responses to requests. I have been particularly impressed with current practices at SIAM which work to assure inclusiveness on committees, particularly to assure breadth of discipline, of workplace (academy, industry, government, laboratories), of international (non-US based) members, of gender, among other categories. The complexity of this inclusiveness can be seen in our numbers. SIAM has 14,000 members of which 40% are international (non-US based). Of the academic members roughly 60% identify as having a home in a math or applied math department, the other 40% represent computer and information science, engineering, or other sciences, among other areas. Women represent roughly 14% of the membership.

SIAM hosts 17 technical journals which range from the original and flagship *SIAM Journal of Applied Mathematics* to the most recent additions *SIAM Journal on Applied Algebra and Geometry* and *SIAM Journal on Uncertainty Quantification*. SIAM supports student sections, offers free membership to students, supports regional geographic sections, as well as SIAM Interest Groups (SIAGS). Currently there are 21 active SIAGs ranging from the SIAG on Analysis of Partial Differential Equations to the newest two SIAG on Applied Mathematics Education, and the Mathematics of Planet Earth. The primary activity of SIAM resides with its journals which are

well respected and most reasonably priced. With the current focus nationally and internationally on open access to research results/journal papers, the future of refereed journals is an open and driving question of major import to large (expensive) publishers, and of importance to smaller (and more reasonably priced) society publishers like SIAM. The future of publishing has been an important focus during my last few years at SIAM.

It has been a learning experience, an honor, and a passion for me to be involved in SIAM and to represent UD in SIAM. My involvement with SIAM began when I was a graduate student, my first conference presentation was at a SIAM annual meeting, my first paper was in a SIAM journal, the *SIAM J. of Math Analysis*. While at UCLA I served on the SIAM Southern California Section steering committee, and more recently I’ve served on the editorial board of and then Editor in Chief of the *SIAM J. of Applied Math*, on the editorial board of *SIAM Review (SIREV)*, as Secretary of SIAM, as Vice President for Publications of SIAM, and currently as President of SIAM. It has been an amazing journey and the support, mentoring, and external viewpoint that I’ve gotten through my SIAM activities has been invaluable.

The University of Delaware should be as proud of its strong activity and presence in SIAM as I am. Not only does UD has a SIAM Student Section (currently advised by Prof. Richard Braun), and several faculty who are or have served on SIAM Journal Editorial Boards, but also UD faculty have been twice represented among SIAM Presidents: Ivar Stakgold, then Chair of the Department of Mathematical Sciences at UD, was president of SIAM 1989, 1990.

More information is available on the SIAM website, www.siam.org/

FEATURED GRADUATE STUDENTS



JIANGE LI

Jiange Li grew up in Handan, China, a city with rich culture and a long history. He did his undergraduate study at Harbin Institute of Technology, China. In July 2009, he graduated with his Bachelor of Science in Applied Mathematics.

Jiange began his studies at UD in February 2010. During that summer, he worked in the Groups Exploring the Mathematical Sciences program with Professor Wenbo Li. Since then he continued working with Professor Wenbo Li, his advisor, on probability theory, particularly on small ball probability and random analytic functions. Unfortunately Professor Li passed away in Jan 2013. Since then Jiange started to work with Professor Mokshay Madiman. Jiange has diverse research interests including probability theory, combinatorics, particular additive combinatorics, information theoretic inequalities and convex geometry.

In addition to speaking at many seminars at UD, Jiange has presented his work at many conferences including the 13th & 14th Northeast Probability Seminar, New York; 14th New York Number Theory Seminar at CUNY; Seminar on Stochastic Process 2015 at UD.

Aside from research, Jiange enjoys various sports: playing basketball and billiards, doing gymnastics, and watching NBA plays. In 2013, he won the bocce-ball tournament with Lei Chen. He also enjoys traveling and hiking.

After graduate school, Jiange plans to pursue a career in academia where he can continue to work on problems in pure mathematics. While many people have influenced him inside and outside mathematics, Jiange appreciates the inspiration and guidance provided by his advisors Professor Wenbo Li and Professor Mokshay Madiman.

RYAN EVANS

Ryan Evans is from Mechanicsburg, Pennsylvania, a small town outside of Harrisburg, Pennsylvania. Ryan graduated with his B.S. in Mathematics from Bloomsburg University of Pennsylvania in May, 2010. During his time at Bloomsburg University, he collaborated with his Professor Dr. Yixun Shi and one of his classmates to publish an article on Sudoku puzzles, entitled "Generating Sudoku Puzzles and its Applications in Teaching Mathematics". His professors at Bloomsburg University encouraged him to pursue graduate studies in Mathematics, so after taking a year off, he enrolled at the University of Delaware in fall of 2011 to get his Ph.D.

Ryan started working with Dr. David Edwards in the fall of 2014 to study a class of chemical reactions, known as surface-volume reactions. A surface-volume reaction involves a stream of reactants, flowing through a fluid-filled volume, over a surface to which receptors are confined. Under the direction of Dr. Edwards, Ryan developed and studied a mathematical model for surface-volume reactions in optical biosensors—a device used to measure rate constants associated with such reactions. Mathematically, this involves modeling, partial differential equations, perturbation techniques, and numerical methods. This work has Ryan to collaborate with Dr. Udit Katugampola to study problems in fractional calculus, which culminated in a paper entitled "Applications of

fractional calculus in solving Abel-type Integral equations: surface-volume reaction problem". In addition, he had the opportunity to present his work at the National Institute for Standards and Technology (NIST), in Gaithersburg, MD; and the International Congress on Industrial and Applied Mathematics, in Beijing, China. After graduating with his Ph.D. in Applied Mathematics in May, 2016, Ryan will be continuing his work on surface-volume reactions in optical biosensors at NIST, under the direction of Dr. Anthony Kearsley.

Beyond Mathematics Ryan enjoys long distance running, swimming, the outdoors, reading, church, and spending time with his family and friends. Ryan is very grateful for the patience, guidance, and support of his advisor Dr. Edwards during his time here. Ryan would also like to thank the other departmental faculty and staff for their tremendous support during his time at UD.



TONATIUH SANCHEZ-VIZUET

I was born in a little town called Mexico City. During my first year of middle school I stumbled upon Stephen Hawking's "History of time" and I got completely hooked by it, thereby deciding that I would become a theoretical physicist and would spend my life understanding the mysteries of black holes. As a result I attended the School of Sciences at the National Autono-

mous University of Mexico (UNAM) from which I graduated with a degree in physics.

As an undergraduate student working on computational general relativity I came to realize that in order to tackle interesting problems from the applied sciences I would need to learn deeper mathematical methods than those that I had been exposed to during my training as a physicist. This switched my interest from theoretical physics into numerical analysis.

I went on to pursue a Masters degree in mathematics also at UNAM under the guidance of Prof. Antonio Capella-Kort. For my thesis I worked on numerical methods for non-linear conservation laws and implemented a finite volume scheme to solve numerically Euler's equations for gas dynamics in 3D and was conferred the degree summa cum laude in 2011.

Attracted by the wide variety of faculty with interests in computational mathematics and numerical analysis, I came to UD right after finishing my masters studies. During my first summer I worked with Professor Tobin Driscoll implementing a simple geometric algorithm for the solution of non-linear

conservation laws exploiting the capabilities of Chebfun, an open-source suite of tools for Matlab based on the powerful approximation properties of trigonometric polynomials.

My doctoral research was directed by Prof. Francisco-Javier Sayas and focused on the numerical treatment and analysis of the interaction between transient acoustic waves and obstacles with various kinds of elastic properties. The approach we use leads to systems that couple integral equations with partial differential equations and require a combination of Finite Elements, Boundary Elements and Convolution Quadrature for their numerical solution. This work gave rise to five research papers and is condensed on my thesis "Integral and coupled integral-volume methods for evolutionary wave-structure interaction".

During my time at UD I've had the opportunity to present my work at many different places in the US and abroad including the University of Oxford in England, the Public University of Navarra in Spain, the University of Concepción in Chile and the Karlsruhe Institute of Technology in Germany. I have also taken advantage of the opportunities offered by UD to attend

several summer schools and workshops in places like the Institute for Mathematics and its Applications at the University of Minnesota and the Mathematical Sciences Research Institute at the University of California, Berkeley. All these experiences were a key component of my professional development and allowed me to establish professional and personal contact with many experts on my field.

Amongst the many good things that Delaware gave me, the absolute best was the chance to meet Lise-Marie Imbert-Gerard, who was a visiting PhD student from the University of Paris VI and was crazy and brave enough to become my fiancée. Without her love and support I simply wouldn't have made it this far.

After my graduation I will be joining the Courant Institute of Mathematical Sciences at New York University as a postdoctoral associate. There I will work with Professors Leslie Greengard and Antoine Cerfon devising and implementing numerical methods for the simulation of the behavior of plasmas in fusion reactors. In the long run I would like to pursue a career in academia.

Editorial Appointments



JINFA CAI

Professor Jinfa Cai has been appointed as the Editor of Journal for Research in Mathematics Education (JRME) in the next five

years (2015-2020, the first year as the Editor-Designate). JRME is the premier research journal in mathematics education. Established in 1970 as an official journal of the National Council of Teachers of Mathematics (NCTM), JRME advances the frontiers of mathematics education by disseminating the highest quality research on the learning and teaching of mathematics at all levels—preschool through college. The work published in JRME over the past several decades has helped to guide research, foster innovations in practice, and inform policy debates and decisions.



SEBASTIAN CIOABA

Sebastian Cioaba has been named to the Editorial Board of The Electronic Journal of Linear

Algebra (ELA), a publication of the International Linear Algebra Society (ILAS), a refereed all-electronic journal that welcomes mathematical articles of high standards that contribute new information and new insights to matrix analysis and the various aspects of linear algebra and its applications.



MOKSHAY MADIMAN

Prof. Mokshay Madiman joins the editorial board of the IEEE Transactions on

Information Theory journal. The journal publishes high-quality theoretical and experimental papers concerned with the transmission, processing, and utilization of information theory.



YVONNE OU

Effective January 2016, Prof. Yvonne Ou serves as an associate editor of Journal of Applicable Analysis, an international

journal with primary focus on analysis that has application to scientific and engineering problems.

NACADA Outstanding Advising Award

Jamie Sutherland is the Winner of the Outstanding Advising Award by the National Academic Advising Association. The NACADA Outstanding Advising Award, <http://www.nacada.ksu.edu/Events-Programs/Awards/Association-Awards/Outstanding-Advising.aspx> is awarded to a faculty member whose primary role is not advising, and who advises students in addition to teaching and service for their department. Jamie received Region 2 recognition in February. This is national recognition for his outstanding work in the service of our majors and our undergraduate programs.



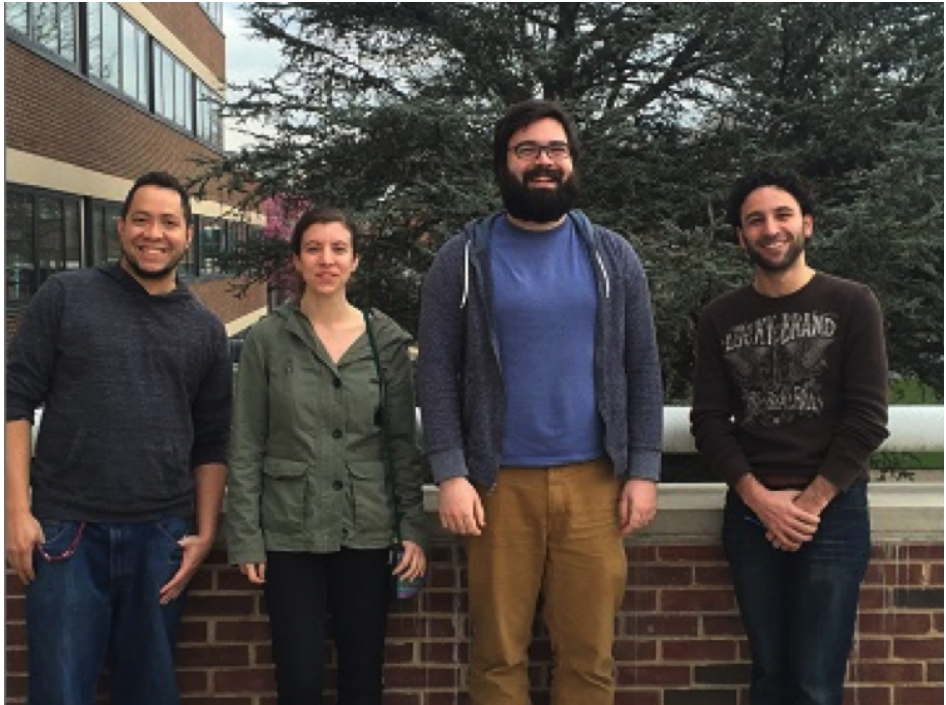
Jamie Sutherland (2nd from left in the front row)

Honors

JINFA CAI HONORED FOR NOTABLE, SUSTAINED RESEARCH ACHIEVEMENTS

Jinfa Cai, professor of mathematical sciences with a joint appointment in the School of Education at the University of Delaware, has been named a fellow of the American Educational Research Association (AERA), which cited his “notable and sustained research achievements” in the field of mathematics education.

Cai was one of 22 scholars selected as 2016 fellows of the association, which is the largest national interdisciplinary research association devoted to the scientific study of education and learning. The new fellows will be inducted at the AERA annual meeting in April in Washington, D.C.



Graduate student fellowship recipients (left to right): Allan, Irene, Jake, and Kelvin. (Ewing Hall in the background.)

GRADUATE STUDENT FELLOWSHIPS ANNOUNCED

Four graduate students of the Department of Mathematical Sciences will enjoy competitive fellowships from the Office of Graduate and Professional Education next academic year. Allan Hungria is the recipient of a Graduate University Fellow Award, Kelvin Rivera-Lopez will enjoy his second year with the Graduate Scholar Award, while both Irene de Teresa and Jake Rezac will receive the Graduate Dissertation Fellow Award. Congratulations to all of them!

Note: *Allan Hungria suffered a severe seizure on July 23 and has been hospitalized since then. He was in a coma for a week but has shown remarkable progress in recent days. As the therapy costs are likely to skyrocket, Allan’s wife Christina asked some of their friends to help her with that and they opened a GoFundMe account <https://www.gofundme.com/praying-forallan>. They will appreciate any help*

you can give them. In any case, you can visit the page for updates, as Christina posts messages there on Allan’s recovery.

SAMUEL COGAR RECEIVES NDSEG FELLOWSHIP

First year graduate student Samuel Cogar just received the prestigious National Defense Science and Engineering Graduate Fellowship. The NDSEG fellowship, awarded by the Department of Defense, provides financial support for three consecutive years, as well as full tuition costs. The NDSEG fellowship program is highly competitive with less than 200 fellowships awarded every year in fifteen scientific and technical disciplines.

Sam’s awarded proposal is based on a project in computational methods for inverse scattering, one of the flagships of the Department of Mathematical Sciences at UD.



Samuel Cogar

Thank You to Our Generous Donors!

Agilent Technologies Foundation
American Endowment Foundation
Amy E. Trauth-Nare
Andrew R. Caramanico
Anna Lewis Ellis '97M
Arthur V. Milholland '74M '76PhD
Ashish J. Modhera '91
Barbara Bartos Sloyer '07
Barbara G. and Robert J. VanDornick Sr.
Bayard O. '68 '72PhD and Elaine H. Baylis
Beverly Lutz Grunden '70 '72M and Larry A. Grunden
Boeing Company
Brice W. Cropper '73 and Kathleen Cantara Cropper '73
Caitlin L. Miller
Carl F. Geiszler '78 '80M and Gail Ford Geiszler '77
Carl O. Miller '53*
Christian Concepcion '14
Christine Woerner Ebert '94PhD and Gary L. Ebert
Clavel Albay Gempesaw '82M '91PhD and Conrado M. Gempesaw II
Daniel J. Gempesaw '08
Daniel J. Jr. '77 and Christine H. McBride
David J. Barsky '81
David J. Klemish '01
Deborah L. Ziomek
Debra L. Shenk '74
Denise Impagliazzo Griffiths '69M
Dennis E. Sweitzer '90M '93PhD
Dennis W. '69 '71M '73PhD and Diane M. Quinn
Deutsche Bank Americas Foundation
Diane Roberts Hodgkiss '80
Donna J. Minner '68
Dorothy J. Helm '69
Edward D. Mooney and Patricia A. Dillon-Mooney
Eileen B. McEnroe '74
Elinor L. Baker '73
Elizabeth Ligreci
Ellen Fischer Monk '88M and Peter B. Monk

Eugene R. Davis '81 '03M and Gayle McVey Davis '81
Evelyn A. Strawbridge '55
Faith A. Muirhead
Fay Jefferson Gagnon '60 and Ernest P. Gagnon
Fidelity Charitable Gift Fund
Francis J. and Carolyn S. Livoy
Francisco J. Sayas Gonzalez
Frank J. Miesnik '72 and Margaret Zetterlund Miesnik '72
Gary C. Robinson '69 and Kathleen Bunitsky Robinson '75
Gene Sand Hall '74 and Peter C. Hall
General Electric Foundation
George A. '72M '78PhD and Sara J. Gray
George A. Webber '58
Haifeng Zeng '09M
Hidefumi Katsuura '80M '84PhD and Frances Bazela Katsuura '72
Hyun-Joon Ahn '71M '75PhD
IBM International Foundation
Ivar Stakgold
James N. Walbert '70 '73M '75PhD
Jessica A. Moskowitz
Jiguang '00M '05M '05PhD and Yang-ping Sun

Jinfa Cai and Ning Wang
Jing Li '10M '13M '13PhD
Jo Anne Phillips Pratt '61
Joan Wyzkoski Weiss '75M
John F. Ahner '67 '72PhD
John F. Porter '81M '86PhD and Kathryn Frost Porter '83M '87PhD
Jonathan L. '89 and Alexandra S. French
Jorge G. Punchin '72M '78PhD and Maria Marrero Punchin '73M
Joseph K. Wald '73M '78PhD and Lindalee Curley Wald '73M
Joyce Neidig Budna '61
Julia Mann '14
Kimberly D. and Christopher J. Cavallio
Kirk E. '74M '80PhD and Lorraine H. Jordan
Liangping Ma '04PhD
Liza M. Bartle '74 '79M
Longfei Li '14PhD
Louis F. and Tammy A. Rossi
Lowell H. '67 and Mary Lou E. Tonnesen
Lucille Grimes Meissner '71M '76PhD
Margaret M. Donlan '66
Marie O. and John T. Senff
Marjorie A. Trenary
Martin G. and Karen Begley
MathWorks, Inc
Matthew J. Moyer '14
Melanie G. Steiger
Melinda S. Bush '81
Michael J. Zankowsky '88 and Linda Stewart Zankowsky '83M '06EdD
Michael P. Parvensky '14
Microsoft Corporation
Milan N. Lukic
Milton Rubin '41
Miriam R. Krantz '66
Patricia Albert Strocko '73 '80M and Raymond R. Strocko
Patricia L. and Scott W. Dooling
Patricia Miller Overdeer '49M
Paul R. and Joanne M. Thies
Peter P. Klopfenstein '78

Gifts

Gifts to the Department of Mathematical Sciences are used to support our general development goals. You may also designate your gift to be used for particular student awards as well as the Graduate Enrichment Account.

If you have any questions about making your gift, please contact UD's Annual Giving team at annualgiving@udel.edu or call toll-free at 866-535-4504.

Philip and Alice E. Broadbridge
Phyllis Roberson Schott '70M and Robert J. Schott
Raytheon Company
Regina Borinsky Swoope '64 '68M
Richard J. and Mary D. Braun
Richard L. Showers '69M
Richard S. and Peggy D. Sacher
Robert A. '86 and Teresa Grey
Robert G. Bowers '67M
Robert J. Ronkese '03M '07PhD
Robert L. and Kathy S. Gravell
Rochelle Paris Goren '75M
Ronald J. and Carol J. Vukelich
Ryan R. Martin '95
Sandra Andres Amory '70
Scott E. Rimbey
Shirley Phillips Miller '69M
Silicon Valley Community Foundation
Songzhu Mei
Stephen L. Koffler '70
Stephen M. Zemyan '70

Steven J. and Emily Amendum
Synopsys Foundation
Synopsys, Inc.
The Pfizer Foundation, Inc.
Thomas E. Favinger '94M '99PhD
Thomas J. Vozzo '83 and Linda Brucker Vozzo '83
Victoria Michalik Baker '70 '72M
W. Geary Andrews '62M
Weiran Zhu '15
Wenhua Yu
William A. Krebs Jr. '57 and Laurie Bliss Krebs '59
William G. Jr. '68M '72PhD and Nancy P. Lese
William J. Geppert Jr. '69M
Xiaohan Tang
Xuemei Chen
YiLing Yao
Yuecong Ma '12M
Yutong Wang '95M
Zhenzhen He
Zikun Gong

RECKONINGS

Newsletter of the Department
of Mathematical Sciences
University of Delaware
Summer 2016

EDITOR-IN-CHIEF

Yvonne Ou

ASSOCIATE EDITOR

Dominique Guillot
Jungeun Park

CONTRIBUTORS

Richard Braun
Pamela Cook
Mahya Ghandehari
Dominique Guillot
Louis Rossi
Francisco-Javier Sayas
Gilberto Schleiniger
Amanda Seiwell
Liwei Xu

DESIGN

Heather Harwood

Reckonings is produced by the
Department of Mathematical
Sciences as a service to alumni
and friends of the Department.

Please contact us by email at
math-contactus@udel.edu or
a tweet #UDmath



Congratulations to our new Ph.D.s' new jobs!

- James Alexander (Advisor: Felix Lazebnik), Synopsys Inc., Mountain View, CA
- Matthew Hassell, (Advisor: Francisco Sayas), JBT Automated Guided Vehicles
- Shixu Meng (Advisors: David Colton and Fioralba Cakoni), IMA postdoc (one year) followed by U. Michigan postdoc
- Tianyu Qiu (Advisor: Francisco Sayas), Rice University postdoc
- Ryan Evans (Advisor: David Edwards), NIST postdoc
- Shelvean Kapita (Advisor: Peter Monk), IMA postdoc
- Tonatiuh Sanchez-Vizuet (Advisor: Francisco Sayas), NYU postdoc



Department of Mathematical Sciences
University of Delaware
Ewing Hall
Newark, DE 19716

The University of Delaware is an equal opportunity/affirmative action employer and Title IX institution. For the University's complete non-discrimination statement, please visit www.udel.edu/aboutus/legalnotices.html

