



2020 MATH PUrview

Message from the Department Head



Greetings from the new department head! I feel honored to join the department. Read in this issue about the many exciting things happening here and please

know that much good mathematics is happening each day in our classrooms and offices. My husband and I were graduate students at Purdue from 1987 to 1992, and I can report that the building is still the same, many of our professors are still around and active, and the same bookstores are still open.

I am grateful to my predecessor, Professor Gregory Buzzard, for leading the department for seven strong years. Among other accomplishments during his time as head, the department hired over 25 world-class faculty members, brought faculty teaching into line with peer institutions, improved conditions for graduate students, and worked to bring to Purdue the National Math Alliance, which in 2017 received the AMS Mathematics Programs that Make a Difference Award.

High on my priority list as the head are continued excellence of the department, hiring plans for increasing faculty diversity, increasing graduate student stipends to match peer institutions, reducing years to PhD, celebrating Master's degrees, career training for graduate students (including non-

academic jobs), equitable loads, joy in research and in teaching, and the support for what is needed to achieve that.

I am writing this in month seven or so of the pandemic. Since early summer Purdue University has been at the forefront of preparations for face-to-face education while also providing for the completely online cohort. The good news is that due to careful planning, pre-arrival testing, ongoing testing, and the strong dedication of all involved, we are still in face-to-face mode after four weeks of the semester. Much of our energy and resources these days is going into teaching in different modalities and into meeting the needs of our students, faculty and staff in this changed world.

The changed world of this year also includes new awareness of racial inequities in the country. Since early summer, graduate student Alden Bradford has been running a well-attended informal anti-racist reading group, and since August, Professor Rodrigo Bañuelos has been a member of the Steering Committee of the newly established university-wide Racial Equity Task Force. We must all together shift how and whom we educate, assess, mentor, admit, hire, and welcome.

Read on to catch up with more of our many activities, visit our webpage at math.purdue.edu to learn more, and stay safe!

Irena Swanson
Professor and Head

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Highlights

Jie Shen selected as SIAM Fellow



Professor Jie Shen was named as one of the members of the 2020 Class of Society for Industrial and Applied Mathematics (SIAM) Fellows.

The goals of the SIAM Fellows Program are 1. To honor SIAM members who are recognized by their peers as distinguished for their contributions to the discipline. 2. To help make outstanding SIAM members more competitive for awards and honors when they are being compared with colleagues from other disciplines. 3. To support the advancement of SIAM members to leadership positions in their own institutions and in the broader society.

The distinguished members of the 2020 Class of SIAM Fellows were nominated for their exemplary research as well as outstanding service to the community. Through their contributions, SIAM Fellows help advance the fields of applied mathematics and computational science.

SIAM Features Boutin's Work on Shape From Echoes



Mireille (Mimi) Boutin and co-author Gregor Kemper from TU Munich have recently shown that one can reconstruct the walls of a room from first order echoes acquired by four microphones placed in a non-planar configuration on a drone. In the first case considered, a loudspeaker is placed inside the room and emits one high-frequency impulse. In the second case, the loudspeaker is placed on the drone and navigates in a rigid fashion with the microphone arrangements. Reconstruction algorithms are provided for both cases, and a proof is given that the set of drone placements for which the reconstruction might lead to ghost walls (i.e. walls that are not there) is of measure zero. Specifically, the bad drone placements are contained in a dimension 5 structure within the 6-dimensional space of drone positions and orientations. The research, published in SIAM J. Appl. Alg and Geometry, is featured in SIAM News.

Irena Swanson selected as next Department Head

Irena Swanson, Professor of Mathematics at Reed College in Portland, Oregon and a Purdue alumna, became Department Head of Mathematics on July 1, 2020. Swanson received her Bachelor of Science degree from Reed College and her doctoral degree in mathematics from Purdue University. She was named a 2019 Fellow of the American Mathematical Society in recognition of her research contributions to commutative algebra, as well as service to the profession and mentorship. In 2018, she was awarded a Fulbright Fellowship to the University of Graz in Austria.



Swanson is the first woman to lead the Department of Mathematics at Purdue.

“It is a great honor to return to Purdue as head of the Department of Mathematics,” she said. “My highest priority is the continued excellence of the department, which we will achieve together by enhancing diversity through faculty hires, expanding opportunities for graduate students and maintaining an active learning environment for all students.”

13th Annual Women in Mathematics Day

Karen Smith, University of Michigan, Keeler Professor of Mathematics
Jean Rubin Memorial Talk titled “*Singularities of Algebraic Varieties*”



Karen E. Smith graduated from Princeton University in 1987 with a major in mathematics and certification to teach high school mathematics in New Jersey public schools. At the University of Michigan, Smith wrote a thesis in commutative algebra under the direction of Professor Melvin Hochster, finishing in 1993. After spending one year working with Craig Huneke at Purdue University on an NSF postdoctoral fellowship, she moved to Massachusetts to be a Moore Instructor at MIT. Professor Smith is now teaching and doing research in algebraic geometry and commutative algebra at the University of Michigan. Smith was awarded the 2001 Ruth Lyttle Satter Prize in recognition of her work in commutative algebra. In 2015, she was named a Fellow of the American Mathematical Society. She was chosen to deliver the AMS-AWM Noether Lecture at the Joint Mathematics Meeting in 2016. In 2019, she was

elected to the National Academy of Sciences, and she was inducted into the 2020 class of Fellows of the Association for Women in Mathematics.

The Women in Math Day is an annual event honoring women in the field of mathematics. The event is dedicated to Jean E. Rubin, Professor of Mathematics at Purdue University from 1967 until her death in 2002.

Robert Gustafson named a 2020 Goldwater Scholar

Robert Gustafson, a junior pursuing a major in Physics and Astronomy, Mathematics, and a member of Honors College, has been named a 2020 [Goldwater Scholar](#). Robert stood out as a leader among his peers in physics since early in his studies in associate professor of physics and astronomy Raphael Lang’s dark matters research group. His independent spirit further shined through in NASA’s Jet Propulsion Laboratory when he was able to propose a new method of using neutrinos to determine the interiors of solar system bodies.



The Goldwater Scholarship Program; one of the oldest and most prestigious national scholarships in the natural sciences, engineering and mathematics in the United States; seeks to identify and support college sophomores and juniors who show exceptional promise of becoming this nation’s next generation of research leaders in these fields.

The characteristics the Foundation seeks in a Goldwater Scholar include a strong commitment to a research career in the natural sciences, mathematics or engineering, the effective display of intellectual intensity in the sciences, mathematics or engineering, and the potential for a significant future contribution to research in his/her chosen field.

New Assistant Professors Fall 2020

Oleksandr (Sasha) Tsymbaliuk received a PhD from Massachusetts Institute of Technology in Mathematics in 2014 under the direction of Prof. Pavel Etingof. From 2014-2017, he was a Research Assistant Professor at the Simons Center for Geometry and Physics, and then served as a Gibbs Assistant Professor at Yale University from 2017-2020. He has been a frequent invited researcher to MPIM (BONN), IHES (France), and RIMS (Kyoto). His research has been supported by numerous National Science Foundation awards.



Prof. Tsymbaliuk's research is primarily concerned with various topics in representation theory, motivated by questions in algebraic geometry and integrable systems. He specializes in the study of shifted quantum groups, affine Yangians and quantum toroidal algebras, with applications to the study of Coulomb branches and Toda-like integrable systems.



Sam Nariman received a Phd at Stanford University under the supervision of Prof. Soren Galatus in 2015. Professor Nariman was a postdoc at the University of Munster, at Michael Weiss' group, for one year and then was a Boas Assistant Professor at Northwestern University from 2016-2019. He spent the academic year 2019-2020 at the University of Copenhagen before joining Purdue University.

Professor Nariman's research interests in general, include applications of homotopy theory in studying moduli space of geometric structures on manifolds and in particular flat manifold bundles, stable homology of moduli spaces, automorphism groups of manifolds. Recently has dabbled in symmetries of three-manifolds.

Rolando de Santiago received his Phd from the University of Iowa in 2017 under the guidance of Professor Ionut Chifan. Professor de Santiago was an RTG Assistant Adjunct Professor and a UC Presidential Postdoctoral Fellow at the University of California, Los Angeles under the supervision of Professor Sorin Popa.

Professor de Santiago's research interests are Operator Algebras, von Neumann Algebras, Functional Analysis, Ergodic Theory, Group Theory, Fractal Geometry.



Daniel Le received his PhD in Mathematics from the University of Chicago in 2015 under the direction of Prof. Matthew Emerton. He was a Postdoctoral Fellow at the University of Toronto (2015-2016) and a Member at the Institute for Advanced Study (2016-2017) before returning to the University of Toronto as an NSF Postdoctoral Fellow (2017-2020).

Professor Le's research concerns the relationship between the Galois theory of number fields and automorphic forms. More specifically, he studies moduli spaces and deformation spaces of local Galois representations and their applications to mod p and p -adic local-global compatibility questions in the Langlands program.



Christopher Janjigian received his PhD in Mathematics in 2016 from the University of Wisconsin-Madison under the direction of Benedek Valko. During the 2016-2017 academic year, he was a postdoctoral researcher in the Laboratoire de Probabilite et Modeles Aleatoires at Universite Paris Diderot (Paris 7). From 2017 through 2020, he was a postdoctoral Assistant Professor in the Stochastics Group at the University of Utah.

Professor Janjigian's research interests are specializing in probability. His research is currently mainly focused on the infinite volume structure of random walks in random potentials (RWRP). His recent work has focused on the structure of models in the Kardar-Parisi-Zhang universality class and in particular on the structure of infinite volume measures and infinite geodesics in directed polymer and percolation models. He is also interested in related topics like stochastic partial differential equations and interacting particle systems.



Ning Wei received her PhD in Mathematics in 2016 from the University of Minnesota, Twin Cities under the supervision of Prof. Yoichiro Mori and Prof. Alena Talkachova. From 2016-2018, she was a Visiting Assistant Professor at Duke University and then served as a Visiting Assistant Professor at Purdue University from 2018-2020.

Prof Wei's research is mainly concerned with cardiac electrophysiology, renal physiology, circadian clock and fluid dynamics. She specializes in developing and applying numerical and analytical techniques to study different models, which are primarily related to ventricular arrhythmias, circadian modulation of ventricular arrhythmias and ionic transport in kidney. She also seeks collaborations with experimentalists to test the models and results against biological experiments.

Awards and Honors

Haizhao Yang receives NSF CAREER Award

The CAREER Award is the National Science Foundation's most prestigious award for early-career faculty. These awards are given to junior faculty who embody the role of teacher-scholars through research, education and the integration of these concepts within the mission of their organizations. NSF CAREER Awards support promising and talented researchers in building a foundation for a lifetime of leadership.

Professor Haizhao Yang received this award to support his research into the mathematical foundations of numerical methods based on deep learning. He will develop cutting-edge algorithms for the efficient solution of high-dimensional and highly nonlinear partial differential equations and provide theoretical guarantees for accuracy. These algorithms are expected to greatly advance the simulation of complex physical systems arising in many fields in science and engineering.



Linquan Ma receives 2020 Sloan Research Fellowship

The Department congratulates **Professor Linquan Ma** who received a 2020 Sloan Research Fellowship. This is a two-year, \$75,000 fellowship awarded by the Alfred P. Sloan Foundation in recognition of distinguished performance and a unique potential to make substantial contributions to their field.

Professor Ma joins 19 other early-career scholars in mathematics who were also awarded fellowships this year by a selection committee of distinguished scholars. Candidates are tenure track professors in the United States and Canada who have recently received their PhD in a qualifying field. Fellows are selected on the basis of their independent research accomplishments, creativity, and potential to become leaders in the scientific community through their research contributions.



Professor Buzzard and collaborators receive SIAM Imaging Sciences Best Paper Prize



Professor Greg Buzzard, together with collaborators from Purdue's School of Electrical Engineering and other external collaborators, has received the 2020 SIAM Activity Group on Imaging Sciences Best Paper Prize. This prize is awarded every two years to the author(s) of the most outstanding paper on mathematical and computational aspects of imaging published within the four calendar years preceding the year prior to the award year. The term “imaging” can be broadly interpreted to include image formation, inverse problems in imaging, image processing, image analysis, image interpretation and understanding, computer graphics, and visualization.

The work of Buzzard and collaborators introduced a powerful and flexible method for incorporating information encoded implicitly in algorithms or neural networks into methods for reconstructing images from a wide variety of data sources, including CT scans and MRI data. This work has inspired dozens of related methods, including one version that was recently incorporated into the chip hardware for a major cellphone manufacturer. The paper appeared in the IEEE Transactions on Computational Imaging; the prize was awarded at the 2020 SIAM Conference on Imaging Science.



Mathematics is not about numbers, equations, computations, or algorithms; it is about UNDERSTANDING.

- William Paul Thurston

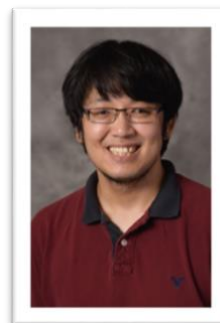
Mathematics graduate students receive the Purdue Teaching Academy Graduate Teaching Award

Three PhD students in Mathematics, **Alden Bradford**, **Seongjun Choi** and **Zachary Letterhos**, were selected to receive the Purdue Teaching Academy Graduate Teaching Award. This award

honors graduate students with teaching responsibilities from across campus for their dedication to Purdue students and their outstanding teaching contributions. Recipients are selected by each academic department for their commitment to undergraduate education. Departments may select one recipient for every 50 graduate teaching assistants they support. The Graduate Teaching Award is sponsored by the Teaching Academy and the Office of the Provost.



Alden Bradford



Seongjun Choi



Zachary Letterhos

2019-2020 Ruth and Joel Spira Faculty Teaching Awards

Four faculty members received teaching awards made possible through a generous donation by Ruth and Joel Spira. The awards have been established for recognizing excellence in mathematics teaching at Purdue.

You can see a list of [past awardees on the Spira website](#).

Steve Bell: Excellence in Graduate Teaching

David Norris: Excellence in Undergraduate Service Teaching

Thomas Sinclair: Excellence in Undergraduate Mentoring and Undergraduate Teaching

Bernd Ulrich: Excellence in Graduate Mentoring and Graduate Teaching.



Professor Steve Bell



David Norris, Lecturer



Professor Thomas Sinclair



Professor Bernd Ulrich

*The land of easy mathematics where he who works adds up and he who retires subtracts.
— Nùria Añó*

Department of Mathematics Awards

Every April the Department holds a reception to honor students earning scholarships and awards. This year's event was held virtually on April 23, 2020. The following students were recognized!



Congratulations to the following Students!!

MATHEMATICS AWARDS

Michael Golomb Math Award

Simon Langowski

Eugene V. Schenkman Memorial Award

Samuel Mercier

Jerison Memorial Award in Analysis

Riley Bogard

Glen E. Baxter Memorial Award

Garrett Mulcahy

Merrill E. Shanks Memorial Award

Mason Atha, Spencer Papp, Jacob Buening

Senior Achievement Award

Michael Cinkoske, Gregory Dexter, Simon Langowski, Samuel Mercier, Matthew Prashker

Putnam Exam

Simon Langowski, Matthew Prashker, Grace Bowling, Ethan Brady, Mahdi Bu Ali, Jaewoong Choi, Zijie Zhou

College of Science Outstanding Senior

Matthew Prashker

College of Science Outstanding Junior

Kevin LaMaster

College of Science Outstanding Sophomore

Joseph Veltri

College of Science Outstanding Freshman

Sterling Saint Rain

MATHEMATICS SCHOLARSHIPS

Alton & Juanita S. Andrews

Mohamed Saleh

Thomas Arai Scholarship

Aibek Kappassov

Leonard D. & Anna W. Berkovitz Scholarship

Zijie Zhou

Mark Hoppy Memorial Scholarship

Evan Hodes

Virginia Mashin Scholarship

Kristen Ferguson, Megan Hernly, Han Truong

Arthur Rosenthal Scholarship

Kevin LaMaster, Sofia Lalani, Michelle Dunn, Ethan Brady

Jean Rubin Scholarship

Jayla Langford, SooKyung Lee, Hayung Suh

Helen Clark Wight Scholarship

Jackson Wolkins, Naveen Vivek, Zachary Smith, Luis Haro Gonzalez

Craig Wilson Scholarship

Zhiyao Xu

Andris A. Zoltners Scholarship

Sterling Saint Rain

Gerald R. MacLane Scholarship

Sterling Saint Rain

Math Scholarship

Saahil Chanrakant Bhatia

Gordon L. Walker Scholarship

Qichen Liu

GRADUATE AWARDS

Abhyankar Award for Algebraic Geometry

Daniel Bath

Abhyankar Award for Commutative Algebra

Yihui Liang

Gerald R. MacLane Memorial Award

Kiseok Yeon



Excellence in Teaching TA Award

Maria Berardi, Alden Bradford, Seongjun Choi, Kyle Dahlin, Milana Golich, Zachary Letterhos

Certificate of Merit for TA Teaching

Nicholas Egbert, Alexander Hazeltine, Daniel Shankman, Harrison Wong, Matthew Weaver

Excellence in Service TA Award

Christopher Creighton

ACTUARIAL SCIENCE AWARDS AND SCHOLARSHIPS

Outstanding Freshman in Actuarial Science

Ally Timko

Outstanding Sophomore in Actuarial Science

Jake Rahn

Outstanding Junior in Actuarial Science

Taylen Hovanec

Outstanding Senior in Actuarial Science

Madison Trout

Northwestern Mutual Actuarial Science Service Award

Alisa Santiago

Milliman Awards

Samuel Muir, Elissa Haake, Zach Smith, Nicholas Farber, Spencer Polak

Swiss Re Awards

Laura Hayes, Luke Cooley, Danial Dzulkipli, Kaitlyn Stangl, Michelle Brian

Aegon Scholarship

Seamus Keogh

Bill & Marilyn Chen Scholarship

Kamun Goh

Actuarial Science Scholarship

Suyash Uppal	Sarah McDanell	Lauren Sturges	Leen A. Abdelkhalag
Eston Brunswig	Shina Wang	Liqing Chen	Zachary Balgut Tan
Owen Pierce	YuAn Michelle Wen	Sage Thompson	Shobana Klyer
Luke Nitschke	Christopher Choy	Emily Maxwell	David Gillette



Faculty Promotions

David Ben McReynolds was promoted from Associate Professor to Professor effective Fall 2020. Professor McReynolds received his PhD from the University of Texas, Austin. His research focuses on geometry, topology, geometric group theory, and algebra. Professor McReynolds is currently funded by an NSF Grant.



Monica Torres was promoted from Associate Professor to Professor effective Fall 2020. Professor Torres received a PhD from the University of Texas, Austin. Her research interests are Geometric Measure Theory, Partial Differential Equations, Shape Optimization, Nonlinear Hyperbolic Conservation Laws and Shock Waves, Free Boundary Problems. Professor Torres is currently funded by an NSF Grant and a Simons Foundation Award.



Kiril Datchev was promoted from Assistant Professor to Associate Professor effective Fall 2020. Professor Datchev received his PhD from the University of California, Berkeley. His research interests are Analysis, partial differential equations, mathematical physics. Professor Datchev is currently funded by an NSF Grant.



Deepam Patel was promoted from Assistant Professor to Associate Professor effective Fall 2020. Professor Patel received his PhD from the University of Chicago. His current research interests lie in the interactions between algebraic geometry and number theory.



Xiangxiang Zhang was promoted from Assistant Professor to Associate Professor, effective Fall 2020. Professor Zhang received his PhD from Brown University. His research interests are applied math, numerical analysis and scientific computing. Professor Zhang is currently funded by an NSF Grant.



Retirements



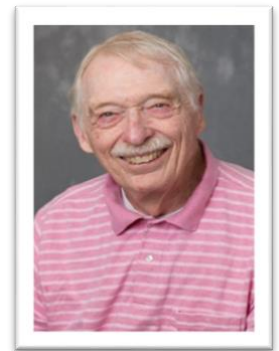
Patricia E. Bauman was named Professor Emeritus after retiring in July 2020. Professor Bauman received her PhD from the University of Minnesota. Her research area is partial differential equations and applied mathematics.

Daniel Phillips was named Professor Emeritus after retiring in July 2020. Professor Phillips received his PhD from the University of Minnesota. His research area is partial differential equations and applied mathematics.



In Memoriam

Robert E. Zink, Professor emeritus of Mathematics, earned a PhD from the University of Minnesota, was an award-winning teacher and student advisor. Professor Zink first came to Purdue as Instructor in 1953/54 and then as Assistant Professor in 1956. He spent his entire academic career at Purdue, attaining the rank of Professor in 1966, a title he held until his retirement in 1998 and continued to teach for many years after his retirement, most recently in 2017. He was recognized by students and his peers for excellence in teaching, earning the Murphy Excellence in Undergraduate Teaching Award in 1995 and receiving the Frederick L. Hovde Outstanding Faculty Fellow Award in 1985.



More obituary info:

<https://www.legacy.com/obituaries/jconline/obituary.aspx?n=robert-e-zink&pid=196637884>

Keep Us Up To Date



Dr. Randall Wright (PhD in Operator Theory with Carl Cowen, 1989 and FSA, 2000) retired in 2019 from a 24 year career with Transamerica and Tata Consultancy Services that culminated in managing actuarial support for over 10 million life insurance and annuity policies. He has returned to academia as Associate Professor and Actuarial Science Programme Director at Swansea University in Wales, where he is excited to be launching this new programme to develop the next generation of actuaries. He is active with the UK Institute and Faculty of Actuaries COVID-19 Action Taskforce (ICAT) conducting actuarial analysis of the pandemic. With his wife and teenaged daughter he enjoys hunting fossils along the rugged Welsh coastline and exploring the many castles.

Dr. Christopher Creighton, 2020 Purdue Graduate, started as a Lecturer of Mathematics at Colorado State University, Pueblo this Fall where he is having fun teaching College Algebra online. With his new colleagues, he is working on a pilot program to use tech and online collaboration tools to promote active learning during online teaching. Outside of work, he is enjoying finding new trails to hike with his spouse, Kelly. Chris was a TA for many years in the Department of Mathematics while at Purdue. Prior to his graduation, Chris received the *Excellence in Service TA Award!*



Vianney Filos-Gonzales, recent 2020 Master of Science in Mathematics graduate, celebrated the birth of her first child on February 17, 2020! Alanis Vianney was born at 4:45 pm weighing 8 lbs. 9 oz. and 53.5cm! Vianney was awarded the *2017-18 Department Excellence in Teaching Award*. Congratulations to Vianney and her family!



Dr. Kevin Kreider (PhD in Applied Mathematics with Vaughan Westion, 1986) has been a member of the Department of Mathematics at The University of Akron, Ohio, since 1989, and is currently the chair of Mathematics as well as acting chair of Statistics. He held a postdoctoral position at Ames Lab, Department of Energy, Ames, Iowa from 1987 to 1989. He has published over 40 research articles in a variety of areas, including aeronautical acoustics and corrosion modeling, and was named one of the top 25 university professors in the country by BusinessInsider in 2013. He and his wife enjoy hiking, biking and kayaking (no white water any more!), as well as watching their two children start their own graduate studies, in mathematical biology and in piano performance.



Dr. Christine Berkesch received her Ph.D. in commutative algebra with Uli Walther in 2010. During her time at Purdue, she enjoyed building relationships with faculty and fellow graduate students, through many informal gatherings, as well as departmental events and seminar dinners. These provided her new research directions and collaborations, which she carried on to postdocs at Stockholm University, Institut Mittag-Leffler, Duke University, and MSRI. She is now an Associate Professor at University of Minnesota, where she is raising her son who was born in 2015. They enjoy playing with their puppy, doing LEGO, and reading books together. Christine was awarded the *Early Career Alumni Award* in 2019.

Send us news of **your** professional accomplishments, adventures in mathematics, and any other noteworthy items to Kristi Stroud at kstroud@purdue.edu.