Indiana University Department of

Mathematics Alumni Newsletter

College of Arts & Sciences Alumni Association

Chair's Corner

Kevin Pilgrim

It has been an interesting year.

We began, as usual, by welcoming our new faculty and students to our community. We were quickly swept up in all of the usual things related to our missions of research, teaching, and service. Our new chair (me), new Director of Graduate Studies **Matthias Strauch**, new Associate Chair **Chris Judge**, new Scheduling Officer **Chris Parks**, new Accounts Associate **Mandie McCarty**, and new Accounts Representative **Andi Patterson**, all got used to our new roles and teammates. Clay Collier was kept busy dealing with a record number of grant proposals. We got excited pursuing a possible faculty hire. After the winter break we returned to start another term as usual, and we barely took notice of the news reports about a "novel coronavirus".

How quickly things changed.

By early March we were in the midst of preparations to swiftly move every one of our classes online. Some of us got sick. All of us got scared. Our faculty did an incredible job of rising to this unprecedented challenge. We learned how to turn our phones into webcams. Our scheduling officer, **Chris Parks**, working under intense time pressure to get ready for summer enrollment, converted all our summer offerings in the Schedule of Classes to all-online-format; we nearly doubled the number of students in our summer courses. Stay-at-home orders came–Rawles Hall went dark, its faculty, staff, and students hunkered down–and were gradually lifted (Rawles is still mostly dark...). Clorox wipes disappeared, then reappeared, in stores. The University released its Fall restart report, giving guidelines for bringing students and faculty back to campus in the Fall. Travel and visa processing halted, severely impacting our ability to bring new (and some current) faculty here from Europe. Budgets collapsed and staff hiring froze, leaving us short-handed.

"We can–because we must.", said our Provost, Lauren Robel. Research must go on, and our society needs mathematics more than ever. Just the other day on the radio was a clear discussion of the importance of accuracy and specificity in the context of sars-cov-2 antibody testing: that's a basic example in our Finite Math course. The "models" so often referred to on tv are examples of dynamical systems. Understanding the evolution of the virus involves phylogenetics, statistics, and probability. Oscillations in virus capsid coating have been modeled by systems of ordinary differential equations.

And then George Floyd was killed. About two weeks later I shared a first draft of our department's Statement on Diversity with faculty and students. This generated both intense feelings of disappointment in its substance and tone, and many constructive comments. Why did three Black Ph.D. students leave our program in recent years? Why is there no highlighted image or other recognition in our department of IU undergrad math alum Elbert Cox, the first African-American to earn a Ph.D. in mathematics? Why does our department continue to struggle to recruit and retain Black, other underrepresented, and female graduate students? female faculty? Are our support programs for all new students adequate?

As I write this, our faculty and students have started many conversa-

tions in the search for answers to these and other questions. A group of graduate students–on their own–held anti-bias training sessions, facilitated by our Center for Innovative Teaching and Learning, and are just now laying the groundwork for a peer-mentoring program. Our faculty are developing an action plan with timelines and concrete steps.

The Fall will be an enormous exercise in being flexible, creative, and patient. Under social distancing guidelines, our seminar rooms will have a capacity of three, including the speaker, and our first and second year graduate students will have to time-share their offices. Several of our new graduate students, unable to come in person, will take their first classes remotely. We will all have to learn and do things that are unfamiliar. We will have conversations that make us uncomfortable. All these things we do in order that research, teaching, and service can continue–we can do this, because we must.

Kevin Pilgrim '89, Chair

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Department News

David Fisher awarded Simons Fellowship

Ruth N. Halls Professor of Mathematics David Fisher will be a Simons Fellow in the Mathematical Sciences for the upcoming academic year. The award is based on the scientific accomplishments in the previous five years and on the potential scientific impact of the work to be done during the coming year. The program extends sabbatical leaves, providing

funding for extending the leave to the whole year. In Fall 2020 he will be a Simons Research Professor at the Mathematical Sciences Research Institute in Berkeley, California. In Spring 2021 he will be a Miller Research Professor at The University of California, Berkeley.

David Fisher

Kevin Zumbrun elected to American Association for the Advancement of Science

Kevin studies physical phenomena, particularly flow in gas and fluid dynamics, using nonlinear partial differential equation and dynamical system techniques. His lab is also known for the marriage of abstract mathematics with physical intuition and numerics, including computer-aided proofs to understand complex phenomena. This work has resulted in the successful determination of shock and detonation wave stability in gas dynamics and, more recently, stability and behavior in periodic "roll waves" in inclined shallow water flow, a phenomenon observable in canals, waterways or even streets on a rainy day!

Kevin Zumbrun

Roll waves, *image courtesy K. Zumbrun*

Dylan Thurston elected as Member at Large of the AMS Council

Dylan's term will be 1 February 2020 – 31 January 2023. A professional society since 1888, the AMS advances research and connects the diverse global mathematical community through publications, meetings and conferences, the MathSciNet math reviews database, professional services, advocacy, and awareness programs. Recently, Dylan has also contributed to the Covid Tracking Project, a volunteer organization dedicated to collecting and publishing the data required to understand the outbreak in the United States.

Dylan Thurston

Zorn Postdoctoral Fellow Colleen Delaney awarded NSF postdoctoral fellowship

Colleen will work with IU mathematics faculty member **Noah Snyder**. The purpose of the Mathematical Sciences Postdoctoral Research Fellowships is to support future leaders in mathematics and statistics by facilitating their participation in postdoctoral research environments that will have maximal impact on their future scientific development. The program provides awardees with two years of funding support to concentrate on research.

Linda McKinley wins 2020 Indiana MAA Teaching Award

Senior Lecturer **Linda McKinley** has been chosen as the 2020 recipient of the Indiana Section of the Mathematical Association of America Distinguished Teaching Award.

The award recognizes the accomplishments and contributions of Section members who have been identified as extraordinary teachers in the mathematical sciences and whose teaching effectiveness has been shown to have had influence beyond their own institutions. The committee noted especially her work with first generation college students and in mentoring future college mathematics teachers.

Linda McKinley

Distinguished lecture series

The past year featured three special events. In early October, Rodrigo Bañuelos of Purdue University delivered the Fall's first Seymour Sherman Memorial lecture, titled "Projections of Martingale transforms". In early November, Carolyn Gordon of Dartmouth College gave the second, speaking on "Hearing the shapes of manifolds: a partial survey." The Fall's capstone was a series of three lectures by Hee Oh of Yale University. She spoke on geometric generalizations of the prime number theorem, the distribution of planes in hyperbolic manifolds, and counting problems in Apollonian circle packings. And our last event before the shutdown was a series of three lectures by Vlad Markovic of the California Institute of Technology, who spoke on the surface subgroup problem, harmonic maps in geometry and topology, and the geometry and dynamics of moduli spaces of Riemann surfaces. How we miss the standing-room-only crowd these attracted to room Swain East 105!

New Faculty

Our department maintains its research vitality thanks in part to the excellent Zorn Postdoctoral Fellows we have been fortunate enough to recruit early in their careers. Our good fortune on that score continued this year with the hiring of five new Zorns.

The Zorn Postdoctoral Fellowship is a 3-year position targeted at mathematicians no more than 2 or 3 years into their careers. Not everyone we hire stays for the full 3-year term, so the number of openings varies year to year, but we had five such positions to fill this year, and we're very pleased with the talent we were able to recruit:

Martino Fassina studies complex analysis in several variables, complex geometry, and CR geometry. He received his Ph.D. from UIUC under the guidance of John P. D'Angelo. He will work with **Norm Levenberg** and **Sergey Pinchuk**.

Daniel Lopez Neumann earned his degree from U. Paris Diderot under Christian Blanchet. He studies quantum invariants of knots and 3-manifolds and will work with Boucher Professor **Vladimir Touraev**.

Paolo Piersanti studies PDEs and earned his Ph.D. last year at the City University of Hong Kong. His thesis earned the Hong Kong Math Society's best thesis award. He is finishing a postdoc at KFU Graz in Austria, and will work with Distinguished Professor **Roger Temam**.

Salman Siddiqi comes to us from U Michigan. He received his Ph.D. from Ralf Spatzier, and works in dynamical systems and ergodic theory. He will work with **Chris Connell**.

Chaojie Yuan has special interests in stochastic models for biochemical reaction networks and their dynamic properties. He earned his Ph.D. at U Wisconsin and will work with junior faculty member **Louis Fan**.

Unfortunately, as of this writing, the pandemic-related travel bans have made it impossible for some of our international visitors to come to the US.

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Outreach

Matthias Weber provided mathematical images that were used to create art and other items for sale at the Science Night Out Gala, a fundraiser to support our local science museum, Wonderlab. Coasters, wall art, and others featured images such as the ones below:
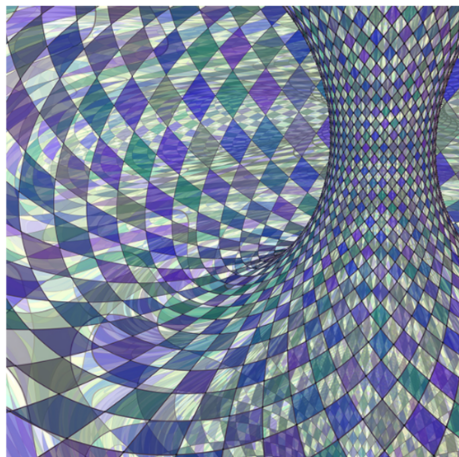

And here is some explanation, which Matthias calls "How to Cut a Bagel".

Take a circle and a line in a common plane, with the line outside the circle, and imagine rotating the circle around this line. You get a surface called a *torus*; like the surface of a bagel. As such, it has two families of circles on it: the ones coming from the generating circle, and the orbits of the rotation. This allows you to slice the torus open using vertical or horizontal cuts, with the cross sections being perfectly round circles,
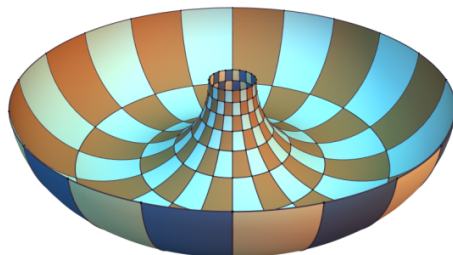

Of course, when you do this to your bagel, you do not really expect circles. But neither would you expect the bagel to be hollow.

The surprise, however, is that there is yet another way to slice a torus, still with perfectly circular cross sections. These are the Villarceau circles.
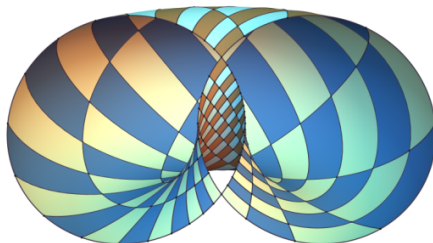

Here is how to do it. Looking at a vertical cross section, cut along a plane that's perpendicular to your cross section and touches the two circles just above and below. The intersection of this plane with the torus is a circle. Rotating the plane about the axis yields the family of Villarceau circles. The deeper reason for their existence lies in the Hopf fibration of the 3-dimensional sphere; these curves are stereographic images of Hopf circles.
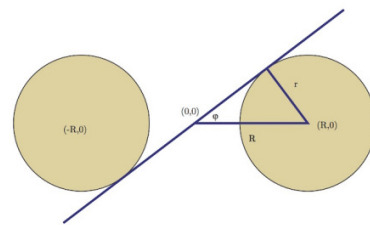
Even more surprising is that among a special class of surfaces, called *cyclides*, one can find examples with six families of circles on them. The image below may be the first one ever made of these circles.

Graduate Program
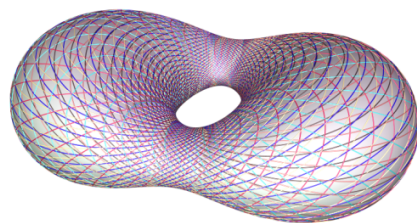
Matthias Strauch, Director of Graduate Studies

Kate Forrest leaving the graduate office

Kate Forrest   Susan Palmiotto

This being my first contribution to the Alumni Newsletter, I wish to begin by acknowledging the tremendous help I got from outgoing director of graduate studies Prof. **Mike Mandell**, who, even after I took over as graduate director in the summer of 2019, was always available with expert advice on all sorts of topics. In addition to Mike's help I was glad to have Kate Forrest as my assistant who, with nearly 13 years of experience, guided me through my first sixth months with great certitude. We have had an excellent working relationship, and she was well-liked too by our graduate students. I am deeply grateful to Kate, who became the Assistant to the Dean of the School of Nursing in January 2020, for her outstanding service, and I wish her plenty of success in her new position.

Susan Palmiotto is new Graduate Services Assistant

We were very fortunate to quickly find a splendid successor to Kate in **Susan Palmiotto** who started in late January. Those first months had a steep learning curve, including a new admissions process and a new university-wide awards system. And just when we thought we were well on track came the disruptions caused by the Coronavirus pandemic. Susan rose to meet these huge challenges, and kept everything running smoothly.

20 new students admitted

Despite the disruptions mentioned above we admitted a class of 20 new students, with a 50/50 split between domestic and international students. Many of these earned their Bachelor's or Master's degree at distinguished institutions, for example Columbia University, New York University, University of Michigan, Northwestern University, Washington University in St. Louis, Indian Institute of Technology (New Delhi), Seoul National University, and the National Autonomous University of Mexico (UNAM). Our new international students come from China, Colombia, India, Korea, and Russia.

Graduates 2020

We congratulate our students who graduated in 2019-20:

Jordyn Harriger, **Steven Hussung**, **Chuck (Changdong) Jia** (now Research Scientist in Machine Learning at Facebook Inc.), **Mengda Lei** (now postdoc at Tsinghua University), **Geunho Lim** (now Visiting Assistant Professor at UC Santa Barbara), **Didac Martinez-Granado** (now Krener Assistant Professor at UC Davis), Casey Noll (MA), **Xuqiang Qin** (now postdoc University of North Carolina at Chapel Hill), **Robert Rose** (now postdoc at Wesleyan University Connecticut), **Kursat Sozer** (now postdoc at the University of Lille, France), **Pengfei Tang** (now postdoc at Tel Aviv University), **Sisi Tang** (now quantitative analyst at Jefferies), **Brady Thompson** (now data scientist at C. H. Robinson near Minneapolis), **Yu Cao** (now postdoc at Florida State University), **Cong Zhou** (now postdoc at University of San Francisco).

Outstanding Thesis Award

The Mathematics Department Outstanding Thesis Award has been given this year to three students:

Didac Martinez-Granado, for his thesis "Smoothings: a study of curve functionals", written under the direction of **Dylan Thurston**.

Kursat Sozer, for his thesis "Two-dimensional extended homotopy quantum field theories", written under the direction of **Vladimir Touraev**.

Pengfei Tang, for his thesis "Bernoulli Percolation and uniform Spanning Forests on nonunimodular transitive graphs", written under the direction of **Russell Lyons**.

—Matthias Strauch

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Undergrad Program

Ayelet Lindenstrauss, Director of Undergrad Studies

Earlier in the year, I wondered what I would write about for the newslet-

ter. And then everything changed—none of us have experienced anything like this semester before. I had actually used Zoom before for a specialized seminar for people from different universities—the seminar website told you to press a button and download some software, and then I could see the seminar when I wanted to; since the software worked fine, I even forgot its name. But suddenly we were Zooming all the time: Zoom classes, Zoom office hours, Zoom reading courses, Zoom help sessions, Zoom committee meetings...

I was so impressed by how everyone in the department made it work. Everything was harder. We lost a full week of teaching when Spring Break was extended to two weeks to enable everyone to find their bearings; for many of us teaching online just went more slowly than teaching in person. Assignments and evaluation methods had to be re-invented. But we saved the semester! Students basically learned the great majority of the material they needed to learn in each class, and they will be able to continue their studies on schedule.

We managed to get through the semester and then George Floyd was horrifically killed. And this was clearly part of a general problem of racism. IU in general, and the Math Department in particular, have been talking a lot since this happened about how we can help fight this problem. We have had wonderful students of all kinds in our department, of all races, and genders, and ethnicities. But had we been more inclusive in various ways, would we have been able to have more proportionate representation of the different groups? We have different ideas, being discussed as I write, both for attracting more diverse students and for retaining them.

We are thinking of that as we are using our online experience to try to plan for the Fall 2020 semester, a hybrid semester where a lot of teaching will still have to be online. And we are very eagerly awaiting a vaccine (or any other way) that would enable us to go back to teaching our classes in person, talking to our students directly! A wonderful privilege that we took for granted as recently as last February.

I actually did decide what I wanted to write about in the newsletter, in those distant pre-pandemic days. I wanted to talk about all the times I heard about "that strong freshman who is doing so well in their 300-level course". It turns out that the people talking to me were referring to many different such freshmen, many of them female. It got a little confusing, in a really good way. And I've heard about lots of excellent sophomores too. I think our students are getting stronger and stronger! I am leaving this job in the very capable hands of **Shouhong Wang**, but I look forward to watching from the sidelines what all these freshmen and sophomores will be doing.

We have had some good news this semester, too. Our special programs, the Directed Reading Program and the Laboratory of Geometry, continued through the pandemic and the students did good work at a distance. Two of our majors, **Liz Dietrich** (who wants to get a Ph.D. in applied mathematics and do research in mathematical biology) and **Kelli Michaels** (who wants to get a Ph.D. in physics and be an experimental physicist) received Goldwater scholarships this spring. Math major **Tom Sweeney** was among the 46 students nationwide to receive a Marshall Scholarship. And thanks to the generosity of our donors, many of our

majors got departmental awards, including **Dalton Sconce** who received a Corey M. Manack Memorial Scholarship (named after Corey who got his Ph.D. in our department in 2010) for his promise in mathematical research. Dalton, Emma Cai and Abe Leite were the team that was about to represent us in the Indiana Collegiate Mathematics Competition—I was very excited to have them, being sure that they would do extremely well, but that competition was one of the first things that were cancelled this spring...

Stay safe and be well!

—Ayelet Lindenstrauss

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Bruce Solomon Retires . . .

Bruce grew up in Southern California and began his mathematics studies at UCLA. He received his doctorate from Princeton in 1982. He joined our faculty the following year, and retired on December 31, 2019. His contributions to our research, teaching, and service missions will be sorely missed.

Bruce is an expert in geometric measure theory, a relatively young branch of mathematics that sits be-

tween geometry and analysis. For example: nature likes to minimize energy—a wire loop dipped in soapy water and removed will form a soap film whose surface attempts to minimize area. Geometric measure theory provides the mathematical foundation for making these and related notions precise. A central challenge is to show that mathematical notions of solutions to equations correspond to actual nice geometric objects.

Several of Bruce's works deal with surfaces that are either minimal, have constant mean curvature, are harmonic, or satisfy some other extremal condition. In some of his most influential work, Bruce and collaborators sought to classify minimal surfaces based upon the asymptotic behavior of the surface far from the origin. He is also the co-author, with Brian White, of a well-known maximum principle that precludes the possibility that two minimal surfaces, one smooth, one perhaps not, could touch each other just at a point.

As a colleague, Bruce is known as a deep thinker. His presence in seminars always enhances the experience for all involved, through thought-provoking, on-target questions and observations. As an attendee in faculty meetings, Bruce is known for his integrity and for bringing common sense perspectives to even the most difficult discussions.

Bruce is also well-regarded for his substantial contributions to our teaching mission. After teaching our linear algebra course many times, he developed his own text, Linear Algebra, Geometry, and Transformation. He similarly developed materials for our undergraduate and graduate courses in differential geometry. More recently, he gave a guiding hand to our faculty working group that built our new Math of Decision and Beauty course and he contributed a chapter on perspective drawing. Quite fittingly, he was recognized four times in his career with teaching awards.

Supporting undergraduate research has long been an area in which Bruce showed special interest. He served for two years on the College's REU grant board and was co-PI on one of our recent NSF REU grants. The impact of his energies is felt around our state: his most recent REU student, Nick Edelen, just started a tenure-track position at Notre Dame.

Bruce is admired in our department as an academician who has always strived for balance in his life. He is a devoted father to three daughters and a devoted grandfather to their children. He and his wife Sue are avid travellers and we look forward to hearing from them.

—*Kevin Pilgrim and Peter Sternberg*

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. . . and Staff News

Susan Palmiotto joined our department in mid-2019 as our Digital Imaging Specialist. After our Graduate Services Administrator Kate Forrest took a new position in the School of Education Dean's Office, Susan stepped into that role. Susan's previous experience as a small business owner helps her manage the many aspects related to our graduate students, from payroll to training to tracking progress, and she greatly enjoys being part of their lives. She also brings creative problem-solving skills to the role. For example, she figured out how to fit 112 students into 31 offices of varying sizes while respecting a minimum square footage of 60 square feet per occupant and the students' preferences for schedules.

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Alum News

With hundreds of our majors and graduate students earning their degrees each year, it's hard to know where to begin reporting their news.

Carlo Angiuli '11 earned his Ph.D. in computer science from Carnegie-Mellon University. His thesis earned the Best Dissertation Award in Computer Science.

Domino Birze '17 is now a Product Analyst at Qualtrics, a leading provider of software for surveys. She works closely with development and support to triage and, if needed, escalate product issues based on the impact to the client.

Domino Birze

Grace Jimenez '16 earned double degrees in Math and Chemistry and later a masters degree in biostatistics from IUPUI. She is currently a data scientist for UES, Inc., at Wright-Patterson Air Force Base.

Manasse Kwete '19 entered IU as a Groups summer STEM scholar; his

research with faculty member Kevin Pilgrim was also supported by the Louis Stokes Alliance for Minority Participation program. He is now working on his masters degree in mathematics at Purdue University Fort Wayne.

Najja Marshall '14 is a Ph.D. Candidate in Neuroscience at Columbia University in the City of New York.

Doryan Miller '19 earned double degrees in Math and Astronomy and Astrophysics, doing extensive research with current Astronomy chair Caty Pilachowski. He is currently a calibration technician for ENI Labs in the Fort Wayne, Indiana area. Describing his interview with that firm, he recalled how the recruiters were impressed with his really hands-on skills, like doing his own car repairs, as well as his impressive coding and other technical abilities. Said Doryan, "I figured out pretty fast that the ability to do even simple differential calculus in just a couple variables is an indispensable skill outside academia!"

Manasse Kwete   Doryan Miller

William Yu '09 is an assistant professor of applied mathematics at the University of Toronto.

If you too have news to share or a story to tell, visit `https://math.indiana.edu/forms/alumni-stories.html`

and let us know!

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Career Spotlight

Madilynn Werbianskyj

On December 4, 2019, Crane Naval Surface Warfare Scientist **Madilynn Werbianskyj '18** paid a visit to our Math Club. She received dual bachelor of science degrees in math and physics, and a dance minor. The following is an edited summary of questions from the audience.

What was the transition like? I was hired originally to do statistics, but my division quickly learned I was more valuable doing modeling. I was used to high pressure, like lots of homework deadlines, and was surprised by the somewhat more relaxed, though longer project-based, atmosphere. I also had to travel a lot; I can now navigate through both Washington DC and San Diego without my GPS.

What else was unexpected? Crane likes its scientists to be well-rounded. So, I took training courses in welding, construction, electronics, and "combat stitching", which is what you call sewing when talking to Marines.

What's it like? Though our mission is to protect the warfighter, I'm a civilian. I dressed like this—jeans and t-shirt—for work today (though we do have to dress for the position we aspire to...). I work with guys who build stuff and then blow it up. I also have two programmers who

work with me. Almost all our work is in teams, some as big as 10 people. In our modeling, we're doing stuff that's never been done before. Sometimes we fail, and have to start over.

Were there special challenges because you're a woman? Yes. I'm the only woman on our team. I've been talked over a lot; told to calm down. There was the extra challenge of being the youngest person in the room sometimes. But I gained their trust: I'm now lead for two projects, and my teams are sad to see me leave. I'm starting a new job in Orlando with the Navy at the end of the year—my dream job.

What was your dream? I've always loved aerospace stuff. My new job at NavAir is the closest to NASA without being actually in NASA. Yeah, the Navy does planes!

Any advice to prepare? A bit of coding experience really helps. At IU I took one python class, and when writing up lab reports I learned a bit of java, matlab, even latex. Here python, java, C++ are helpful.

Does Crane have internships? Absolutely. The three divisions (Expeditionary, Electronic, and Global Warfare) are a bit different. Take a look at usajobs.org .

Did you consider grad school? I did but I steered away from grad school at first because I wanted to figure out how I wanted to focus by getting some industry experience first. With some programs, the government will pay for advanced degrees. I may go back to school someday.

—Kevin Pilgrim

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Awards

Like usual, we held our annual awards ceremony and reception on the last Friday of instruction last April. Like unusual, the ceremony was via Zoom webinar! We did our best; you can watch the video and download the program from the News section of our website. We proudly list the winners here.

Undergraduate Awards

THELMA ABELL PRIZE
Mallory Smith
Greta Stephenson
Zayn Karim
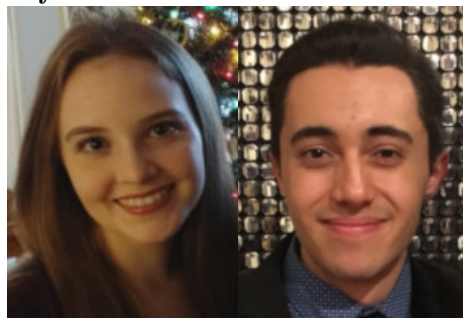
Greta Stephenson   Franco Storino

GAIL HOMAN ADELE SCHOLARSHIP
Lucy Lippman
Gabbie Moreno
Christina Duffieldl

CIPRIAN FOIAS PRIZE
Preston Sayers

RUTH E. GILLIATT SCHOLARSHIP
Yunping Wang
Franco Storino

TRULA SIDWELL HARDY SCHOLARSHIP
Abe Leite

CORA B. HENNEL SCHOLARSHIP
Arryington Ladd
Alex Ratcliffe
Iona Pfingston
Jared Roush

Arryngton Ladd   Parice Burris

JEFFREY AND DEBORAH KING SCHOLARSHIP
Daniel Rickert
Isaak Mount

RAINARD BENTON ROBBINS PRIZE
Jiongran Wang

SHABANI BOOK FELLOWSHIP
Parice Burris

DONALD OTTO KOEHLER SCHOLARSHIP
Arthur Hertz
Zachary Lichtenstein
Andrew Morgan
Andrew Smith

MARIE S. WILCOX SCHOLARSHIP
Bethany Brinson
Yijia Chen
Kelli Michaels
Somi Kang
Samanwita Samal

WILLAM P. ZIEMER STUDENT ASSISTANCE FUND
Daneil Freese
Akash Jena
Hongki Jung
Mark Ossouren
Tianshu Yu

M118 UGI AWARD

Kurumi Narasaki

COREY M. MANACK MEMORIAL SCHOLARSHIP
Dalton Sconce

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Graduate Awards

HAZEL KING THOMPSON FELLOWSHIP
Vinicius Ambrosi, Seok-Hyun Byun, Noah Kaufmann, Dominique Kemp, Anuj Kumar, Cemile Kukoglu, Homin Lee, Peter Marek, Insung Park, Noah Riggenbach, Sean Sanford, Dylan Spence, Kruitka Tawri, Aric Wheeler

COLLEGE OF ARTS AND SCIENCES FELLOWSHIP
Andrew Davis, Caroline Davis, Ayca Durmaz, Nicolás Escobar Velásquez, Robert Glickfield, Zitian Liu, Joshua Meyers, Thomas Pharis, Nai-Heng Sheu, Boyuan Xiong, Xinwu Yang, Yifan Yang

ROBERT E. WEBER AWARD
Boyuan Xiong

JAMES P. WILLIAMS AWARD
Caroline Davis, Nicolas Escobar Velasquez, Joshua Meyers, Xinwu Yang

ROBERT K. MEYER FELLOWSHIP
Robert Rose

JOSEPH & FRANCES SWAIN FELLOWSHIP
Hayley Bertrand

WILLIAM B. WILCOX AWARD
Sailun Zhan

GLENN SCHOBER TRAVEL AWARDS

Sanjana Agarwal, Vinicius Ambrosi, Hayley Bertrand, Seok Hyun Byun, Adnan Cihan Cakar, Kelvin Guilbault, Aranya Lahiri, Xuqiang Qin, Emily Rudman, Ryan Stees, Krutika Tawari, Brady Thompson, Cong Zhou

COLLEGE OF ARTS AND SCIENCES TRAVEL AWARD
Steven Hussung, Homin Lee

ROTHROCK TEACHING AWARD
Joshua Seidman

OUTSTANDING THESIS AWARD
Didac Martinez-Granado, Kursat Sozer, Pengfei Tang

MURIEL ADAMS STAHL GRADUATE FELLOWSHIP
Sanjana Agarwal

COLLEGE OF ARTS AND SCIENCES DISSERTATION RESEARCH FELLOWSHIP
Didac Martinez-Granado

Faculty Awards

ROTHROCK FACULTY TEACHING AWARD
Matthias Weber

IU TRUSTEES' TEACHING AWARDS
Elizabeth Housworth
Greg Kattner
Noah Snyder

DEPARTMENTAL LECTURER AWARD
Zhixu Su

ZORN POSTDOC TEACHING AWARD
Graham White

In Memoriam

Arlen Brown

Emeritus Professor H. Arlen Brown passed away in May of this year. A native of Goshen, Indiana, he served in the merchant marine in World War II, and was a Ph.D. student at the University of Chicago where he obtained his degree in 1952. He wrote two distinct theses, under the direction of Paul Halmos (who also taught at IU for 15 years) and Irving Kaplansky. Both results were published and are still cited in the current literature. Arlen taught at Rice University (1952–63) and the University of Michigan (1963–67) before coming to IU where he became Emeritus in 1991. His Ph.D. students were Jim Scroggs, Carl Pearcy, Donald Deckard (at Rice), James Williams—who also served in our department—, Don Rhodes (at Michigan), and Tin Wong (at Indiana).

Arlen's work is characterized by elegance, both in mathematical ideas and in exposition, His most cited work is a joint paper with Halmos in which they establish (among other things) a simple algebraic equation whose solutions constitute the important class of Toeplitz operators. He is also known for the English translation of Pontryagin's book on topological groups that appeared in

two editions (1966 and 1986).

Arlen was an active member of the analysis group and also became an honorary Romanian, taking part in lively discussions at a weekly lunch in the Tudor room. After his retirement, he maintained his mathematical interests and collaborated on several books on various aspects of analysis, the most recent of which appeared in 2016.

—Hari Bercovici

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Ciprian Foias
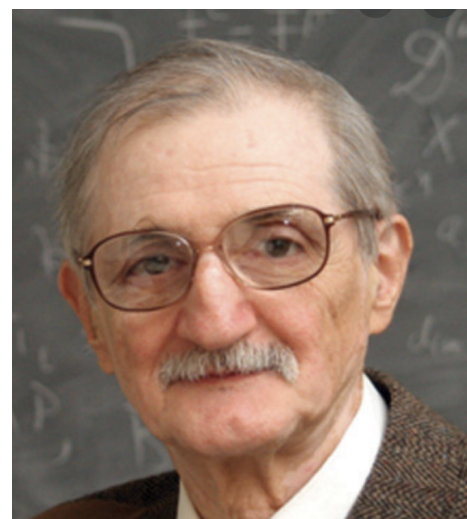
Courtesy Texas A&M

Distinguished Professor Emeritus Ciprian Ilie Foias passed away March 22, 2020 at his home in Arizona. He had a long and truly distinguished career, having authored more than 500 research papers and 10 monographs (some of which were translated into several languages) and advised numerous postdoctoral associates, doctoral students, undergraduate students, and even highschool and younger students. Ciprian put passion into all of his endeavours and his enthusiasm for mathematics, and indeed for all intellectual pursuits, was contagious. He was generous with his ideas, which is one reason why he collaborated with more than 100 people and was always the focus of an active research group. As mentioned above, his

interests extended beyond mathematics and he contributed to areas as far afield as geology, biology, and economics.

Many details of Ciprian's life along with numerous anecdotes can be found in the obituary prepared by his family (`https://www.richardsonfuneralhome.org/obituary/Ciprian-Foias`) and the introductions of two issues of the IU Mathematics Journal dedicated to him (vol. 42, no. 3 and vol. 57, no. 8; see also the special issue of vol. 50). Here we provide just a brief outline of his professional career. Born on July 20, 1933, in Resita, Romania, Ciprian studied in the Mathematics Department at the University of Bucharest. Between 1954 and 1978, he worked in that department (as a professor after 1966) and at the Institute of Mathematics of the Romanian Academy. During this time he obtained his Ph.D. degree as well as the higher degree of 'doctor docent' in recognition of his scientific accomplishments and international recognition. He left Romania in a daring escape at the Helsinki International Congress in 1978. After a brief appointment at the University of Paris in Orsay, Ciprian accepted an appointment at IU where he taught, eventually as a Distinguished Professor from 1980 to 2000. From 2000 to 2016, he worked at the Texas A & M University, where he also became a Distinguished Professor in 2007. In addition to the distinctions mentioned above, Ciprian's accomplishments were recognized in many ways. He gave invited addresses at International Mathematics Congresses in 1970 and 1978. He was a member of the Romanian and Hungarian Academies, and received honorary doctorates from the Vrije Universiteit in Amsterdam and the University of Timisoara. For his work in applied mathematics, he was awarded in 1995 the Norbert Wiener prize by the AMS and the SIAM. Ciprian's teaching at IU was recognized by the Rothrock Faculty Teaching Award. In 2000, he was the first recipient of the Bela Szokefalvi-Nagy Memorial Medal from the University of Szeged. The Mathematics Department at the Texas A& M University has created the Foias lecture series, funded by donations from his colleagues. Ciprian's support for his students and love for teaching were also recognized at IU where the Ciprian Foias Prize was established in 1995 by Paul and Miriam Biss, to reflect "appreciation for Professor Ciprian Foias and the Mathematics department for their generosity and talent in guiding the mathematical education of their son, Daniel Biss".

Mathematics lost an exceptional talent and many of us have lost a cherished friend.

—*Hari Bercovici*

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Bob Glassey
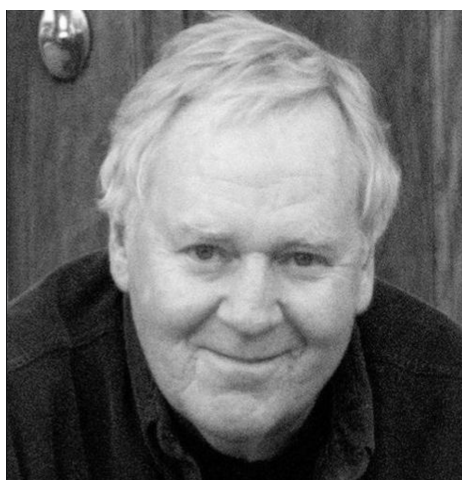
This winter the Math Department lost a vital member of our faculty when Bob Glassey passed away.

Bob joined the Math Department at Indiana in 1972, after graduating with a Ph.D. from Brown University. For the next 37 years, he was a mainstay of the group in partial differential equations (PDE), rising quickly to the ranks of associate and full professor.

Bob's thesis advisor at Brown, Walter Strauss, inspired in Bob a keen interest in the study of nonlinear wave equations. Accordingly, a big part of Bob's early career research focused on nonlinear wave equations and nonlinear Schrodinger equations. Later in his career, Bob shifted his focus to the notoriously difficult Vlasov-Maxwell system of PDE, a model for the behavior of charged components in plasma. In both areas, he emerged as one of the most highly regarded researchers in the world, producing over 60 articles in top journals. He also wrote two books, one on kinetic theory and one on numerical computation using C.

Bob was a giant in the world of PDE. His landmark 1977 paper showing that solutions to one of the most important PDE's, the nonlinear Schrodinger equation, could 'blow-up,' that is, could become infinite in a finite amount of time, stands to this day as a prototype for this kind of result in the field. In recognition of his status as an international leader, Bob was elected as a member of the inaugural class of Fellows of the American Math Society in 2012.

During his four decades in our Department, Bob served as graduate director, managing editor of the IU Math Journal and chaired the Department in the mid 1990's. In the classroom, Bob taught the full range of courses during his time at IU, from freshman calculus up through advanced graduate courses in nonlinear PDE. He also directed nine Ph.D. students during his career.

Bob was always self-effacing with his colleagues, and to those who worked with him or studied under him, he was tough, clear, doggedly determined, but also warm, utterly unpretenious and unfailingly kind.

Outside of mathematics, Bob had wide interests, including tennis, racquetball, golf and bike riding. He loved both playing and listening to music, and was an avid reader. To his wife Betsy and children Tom and Molly, he was a loving and devoted husband and father. He will be missed by all of us.

—*Peter Sternberg*

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Andrew Lenard

Chris Howell | Herald-Times

It is with sadness that we note the passing of Andrew Lenard (92) on March 17. Andrew was born in Balmazujvaros, Hungary. He survived—barely—the chaos of World War II. With members of his family, he was shipped in a cattle car bound for Auschwitz which was later misdirected to a labor camp near Vienna. He subsequently came to America at age 19 through New York. His family settled in northern Indiana with Andrew completing a B.A.(1949) and Ph.D. (1953) in theoretical physics at the University of Iowa. He joined Indiana in 1966 with an appointment jointly in Mathematics and Physics.

Andrew's research covered an unusually broad area with the core of his work on quantum many-body problems and statistical mechanics. In 1964, he gave a highly non-trivial proof that the hard-core one-dimensional Bose gas has no Bose-Einstein condensation, answering a question that had evaded previous attempts. Following this, a major scientific impact came with his collaboration with Freeman Dyson at IAS in Princeton during 1965-1966 on the Coulomb Stability Theorem for ordinary matter. This occurs only due to Fermi statistics for electrons. The Uncertainty Principle of quantum mechanics prevents electrons from collapsing into the positive nucleus but their fermionic rather than bosonic nature accounts for the size of a solid of many atoms increasing and not decreasing in size. Dyson and Lenard (1967 & 1968) were the first to rigorously prove this from first principles thus opening a new horizon in mathematical physics both in terms of concepts and techniques. Their work was instrumental in leading to the extensive results by Lieb and Lebowitz on the existence of the thermodynamic limit for Coulomb systems (1969 & 1972).

During the summer of 1967, while revisiting the Princeton Plasma Physics Laboratory, where he had been a member of the Applied Mathematics group before Indiana, Andrew was in a discussion on wave stability in the KdV equation involving Martin Kruskal who asked whether there was a systematic way of generating more equations with similar properties. Within a short period of time, Andrew came up with a generating function for an infinite number of KdV-like equations with the same conservation law behavior. Even though this result was never published, it is part of the standard framework for bi-Hamiltonian systems and was extended to finite dimensional systems by Gel'fand and Dorfman in 1979. Also in 1967 during a discussion with Elliott Lieb who had calculated the number of 'ice' configurations for a square lattice of size N to be $(4/3)^{3N/2}$, Andrew recognized this as the number of ways to color the squares of a checkerboard with 3 colors (no adjacent squares with the same color) thus solving one of the few non-trivial coloring problems. With Andrew's modesty, it was left to others to make this known.

While at Indiana, Andrew collaborated with colleagues in the department, particularly Seymour Sherman, and mentored physics graduate student Sanford Levy on a thesis in statistical mechanics. Andrew also delighted on providing interesting problems on quantum mechanical spin systems for the physics qualifying examination in addition to teaching undergraduate and graduate courses in mathematics. His early years laid the foundation for him to become a highly skilled pianist which he enjoyed throughout his life and a fluent speaker of Hungarian, German, French and English. His papers are exceptionally well written as one can learn from his foreword to the Battelle Seattle 1971 Rencontres on statistical physics.

Earlier on reviewing his paper on the Miquelian Moebius plane, K. Strambach commented 'the style of the paper gives it the rank of a piece of German literature'. Andrew was profoundly grateful for the chance to come to America and begin his life anew and he ended his life caring for Veronica, his wife of 67 years, in a room they shared at Autumn Hills Special Care Center in Bloomington.

For more on Andrew Lenard's contributions to research, please see Elliott H. Lieb's article "In Memoriam: memories of Andrew Lenard", IU Math Journal, vol. 69 issue 4, pp. 1505-1506, which you can find online at the IUMJ website https://www.iumj.indiana.edu/.

—John Challifour

More Department News

Fourier Restriction book published
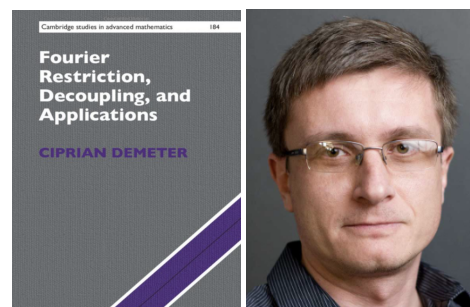
Cambridge U. Press   Ciprian Demeter

IU math faculty member Ciprian Demeter's new book, *Fourier Restriction, Decoupling, and Applications*, was published early this year by Cambridge University Press. Ciprian, a world-leader in this topic, spoke at the 2018 International Congress of Mathematicians. From the publisher's description: "The last fifteen years have seen a flurry of exciting developments in Fourier restriction theory, leading to significant new applications in di-

verse fields. This timely text brings the reader from the classical results to state-of-the-art advances...". And from reviewer Pertti Mattila, "This book deals with the spectacular recent developments in modern Fourier analysis, with an emphasis on restriction theory and decoupling. Some of the results are new and many are just a few years old, notably the breakthrough theorems of Bourgain and Demeter on decoupling and their many applications. It is wonderful that this material is available in book form so soon...".

Zhixu Su departs

Lecturer Zhixu Su joined us in the Fall of 2014 and was promoted to Senior Lecturer this past year. Su served as our inaugural Director of General Education Studies. This involved major responsibilities for oversight of issues relating to our general education courses, which enroll several thousand students each year. She dealt with transfer course articulation, recruiting undergraduate interns and graders, policy development, AI training, and general education assessments. Our Math Club attendance increased significantly under her leadership. Su will be leaving us for a new position at the University of Washington, and we wish her well.

Math for Human Flourishing

This Spring, I had the opportunity to savor a new book, *Mathematics for Human Flourishing*, by Francis Su. Reading the book was quite nourishing. It is the best distillation of why I do mathematics that I have ever read. The book is organized around virtues, like "Truth", "Beauty", and "Play". Reading it, I was reminded of how much I get out of doing mathematics, and how much Truth, Beauty, and Play mean to me. Each book chapter is an elegant meditation on one key aspect of the mathematical experience.
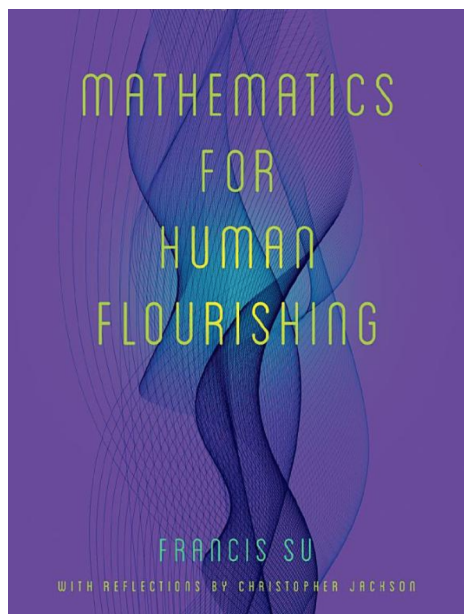
Yale University Press

The book also reminded me of issues within the mathematics world. While accepting the Steele Prize in 2012, my father spoke movingly about "the warm, welcoming community" within mathematics. And indeed mathematicians can be quite accepting of many differences. But as Francis Su reminds us in "Community", building and maintaining community requires care and attention, and not everyone has felt welcomed within the profession. We need to continue to work here to let mathematics fully flourish.

–Dylan Thurston

A problem to ponder...

Early in the season, your free throw percentage is less than 80%. Later on, it is greater than 80%. Question: must there have been a moment in time in between when your free throw percentage is = 80%? No, this is not a trick question. You can try it out yourself. Start shooting some hoops and keep track...

–From the 2004 William Lowell Putnam Mathematics Competition

On the web. . .

Curious about our deep departmental history? Check out our evolving annotated timeline at `https://math.indiana.edu/about/history.html`

Acknowledgements

This newsletter is a department-wide effort. Thanks to all the colleagues who supplied ideas, facts, and copy for it—and to our Undergrad Advisor, **Elizabeth Smith**, for some of the photos.

Giving

The Department of Mathematics is grateful for all of the support it receives from its generous donors. The Department has several funds to which you can give. Donations may be made using the attached Indiana University Foundation Donation Form or through the Give Now link at

http://www.math.indiana.edu/

found by following first "About" and then "Alumni and Giving".

- Mathematics Enrichment Fund (I380008688): Gifts to this fund will be used for the general support of the Mathematics Department, in the College of Arts and Sciences.

- William P. Ziemer Student Assistance Fund (P370013557): Gifts to this endowment are used to support both undergraduate and graduate students in the department.

- Glenn Schober Memorial Fellowship Fund (I380008692): Gifts to this fund support fellowships in the department. The fellowship may support such things as travel and registration fees for students attending national meetings.

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It is greatly appreciated!