FACULTY EARN NATIONAL RECOGNITION:

Lewis named AAAS Fellow; Walker joins AMS Board of Trustees; Wiegand is inaugural AWM Fellow

FACULTY NEWS *Pages 8 and 9*



{ Math News }

Fall 2017

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VIEW FROM THE CHAIR

Tom Marley

It is my pleasure once again to bring you up to date on many of the wonderful happenings in 2017 (being a prime number, after all!) among our students, faculty, staff, and alumni. In my 15 months as chair of the department, I have gained a broader and deeper appreciation for all of the accomplishments and successes of our department's community.

We celebrate victories both large and small in this newsletter. I enjoy seeing productive collaboration and support, such as when a graduate instructor helps a student work through struggles and grasp difficult concepts, or when a staff member helps put the finishing touches on the budget for a faculty grant proposal.

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Math in the City:

Local businesses partner with students to analyze data from new perspective

Dealing with large amounts of data can be complicated, and finding data sets that are usable in the classroom is especially problematic. For 10 years, the Department of Mathematics' innovative course, Math in the City, has provided student-led mathematical modeling projects to help bridge that gap.

Math in the City, started by Associate Professor Petronela Radu in 2006, gives students the opportunity to partner with local businesses and government organizations and analyze their data from a new perspective. Students engage in a hands-on learning experience around current societal issues of local and national interest.

Partner organizations provide data in a usable form and are consulted by the students throughout the course, thus creating strong connections between academia and industry.

Students learn the basics and backgrounds of their projects, as well as any needed programming skills, in lectures and then begin small-group work. Each group has about three to

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Research News

COMMUTATIVE ALGEBRA

Walker resolves Betti number conjecture

Mathematicians have been fascinated with polynomials for centuries. Surely you have fond memories of those critters, expressions like $f(x) = x^2 - 1$ or $h(x, y) = 5x^2 + 3y^2 - 2xy$ that you spent countless hours graphing, factoring, differentiating, and integrating back in calculus. It turns out, there are many questions about polynomials to which we still don't know the answers. But, thanks to the efforts of Professor of Mathematics Mark Walker, that list of open questions is now slightly shorter.

To describe Walker's work, we'll need a little bit of background in algebra. Note that if you add, subtract, and multiply polynomials, you get new polynomials. (You can't, however, divide them and expect a polynomial in return, as all exponents appearing in polynomials should be positive integers.) Such a collection in algebra is called a *ring*, and the set of all polynomials in a given set of variables (say $\{x, y, z\}$) is called a *polynomial ring*.

Polynomial rings as an object of study goes back at least 130 years to the seminal work of David Hilbert. Two of Hilbert's most famous theorems, the Hilbert Basis Theorem and Hilbert's Syzygy Theorem, both proved in 1890, concern properties of polynomial rings. These results ushered in a new area of research in mathematics now known as *commutative algebra* (the word "commutative" here refers to the fact that the multiplication is commutative in these rings) and thrives to this day. In fact, over the past two years there have been a remarkable number of breakthroughs on several long-studied problems concerning polynomial rings, with Walker's result being among them.

Before going further, we firm up notation a bit. We'll let $k[x_1, \ldots, x_n]$ denote the polynomial ring in the variables $x_1, \ldots, x_n$ where the coefficients in front of the variables come from a field k, which for our purposes will be either the real numbers or the complex numbers. A *module* over $k[x_1, \ldots, x_n]$ is the analogue of a vector space, and can be represented as a matrix (not necessarily square) whose entries are elements of $k[x_1, \ldots, x_n]$. One might hope to classify all modules over the ring $k[x_1, \ldots, x_n]$ up to isomorphism, much as the Jordan Canonical Form classifies all matrices (with entries from k) up to similarity. But this is known to be impossible for polynomial rings. Instead, one hopes to understand other invariants of such modules, and first and foremost among these are the *Betti numbers*.

Betti numbers of modules are the algebraic analogues of the invariants of a topological space that go by the same name. In topology, the i-th Betti number $\beta_i(T)$ of a topological space T refers, loosely speaking, to the number of cells of dimension i that are needed to build a space.

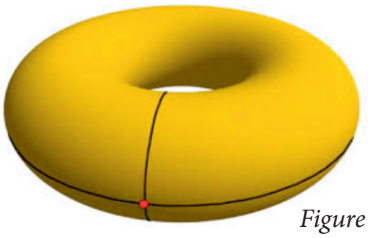

Figure 1.

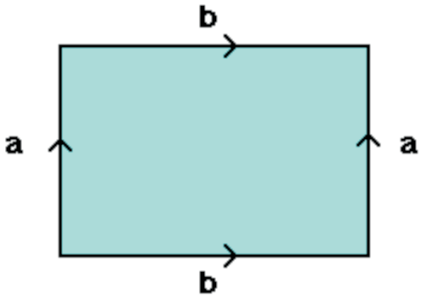

Figure 2.

For example, the representation of the torus (see Figure 1) as the result of making edge identifications on a rectangle as in the picture (see Figure 2) shows that we need one point, two edges and one two-dimensional piece (the rectangle itself) to build a torus, and the Betti numbers of the torus T are indeed

$$\beta_0(T) = 1, \beta_1(T) = 2, \text{ and } \beta_2(T) = 1.$$

In algebra, the Betti numbers $\beta_0(M), \beta_1(M), \ldots$ of a module M are the ranks of the free modules occurring in its minimal free resolution; that is, they are the smallest natural numbers $\beta_0, \beta_1, \ldots$ such that there exist an exact sequence of modules of the form

$$\cdots \to R^{\beta_1} \to R^{\beta_0} \to M \to 0,$$

where R^β denotes the direct sum of β copies of $R = k[x_1, \ldots, x_n]$.

As an example, suppose $n = 2$ so that we are talking about modules over the polynomial ring in two variables. Consider the module M over $k[x_1, x_2]$ represented by the matrix $[x_1\ x_2]$. The minimal free resolution of M takes the form

$$0 \to k[x_1, x_2]^1 \to k[x_1, x_2]^2 \to k[x_1, x_2]^1 \to M \to 0$$

so that its Betti numbers are

$$\beta_0(M) = 1, \beta_1(M) = 2, \text{ and } \beta_2(M) = 1.$$

The fact that this list is identical to the list of topological Betti numbers of the torus is no coincidence — there is a very real sense in which the module M we have described here is an algebraic representation of the torus.

The Hilbert Basis Theorem and the Hilbert Syzygy Theorem, mentioned above, imply that

- the free modules occurring in the minimal resolution of M have finite rank, so that the list of Betti numbers of

See BETTI *on Page 6*

Lai leads NSF grant's research team

A $2 million collaborative research grant from the National Science Foundation (NSF) aims to improve the mathematical education of future high school teachers nationwide.

Yvonne Lai, assistant professor of mathematics at the University of Nebraska-Lincoln, leads the research team for this five-year grant, alongside collaborators from the Association of Public and Land-grant Universities, Eastern Michigan University, Middle Tennessee State University, the University of Arizona, and Utah State University.

Mathematics of Doing, Understanding, Learning, and Educating for Secondary Schools (MODULE(S^2)) will create curricular modules in four specific areas and investigate the impact of using these modules, with the goal of informing nationwide efforts in teacher education. This collaboration coordinates a research team, a professional development team, and curriculum writing teams.

The curricula in algebra, geometry, modeling, and statistics will be piloted by more than 40 institutions over the next five years. At Nebraska, these materials will be tested in courses such as Math 407 and Math 408.

TRENT BALLARD/UNL

Yvonne Lai leads the research team for NSF collaborative grant MODULE(S^2), which aims to improve the mathematical education of future high school teachers.

To teach mathematics well, evidence shows that teachers need to possess understandings of content that are specifically applied in the work of teaching, referred to as mathematical knowledge for teaching (MKT). To develop MKT, pre-service teachers need opportunities to apply mathematical knowledge to teaching. MODULE(S^2) examines how undergraduate coursework impacts pre-service teachers' development of MKT, as well as what makes for effective professional development for instructors who teach these courses.

NSF MODULE(S^2)

"The MODULE(S^2) research team will study the implementation of the curricula to determine how instructors make decisions based on data about their students' responses to mathematically rich teaching simulations," Lai said. "Results will be used, multiple times per year, to improve the MODULE(S^2) materials during Networked Improvement Community revision cycles throughout the project."

This project builds on efforts by the Mathematics Teacher Education Partnership. Also, the Robert Noyce Teacher Scholarship program is providing co-funding for MODULE(S^2) in recognition of its alignment with the broader teacher preparation goals of the Noyce effort.

– Lindsay Augustyn

Sixth KUMUNUjr draws broader audience

The sixth annual KUMUNUjr conference was held April 8-9, 2017, at the University of Nebraska-Lincoln.

Inspired by the KUMUNU conference for commutative algebra (so named because the conference rotates among the Universities of Kansas, Missouri, and Nebraska), the KUMUNUjr conference is designed to shine a spotlight on the ongoing research efforts of graduate students and postdocs in commutative algebra and related areas.

Although the conference was initially attended mainly by participants from Midwestern universities, it has grown to include participants from the University of Arkansas, Colorado State, the University of Utah, and West Virginia University, among others.

This year the conference hosted about 30 participants, including nine speakers with research interests in the areas of commutative algebra, algebraic geometry, local cohomology, and characteristic p methods:

- Andrew Bydlon - University of Utah
- Alessandra Costantini - Purdue University
- Zach Flores - Colarado State University
- Jenny Kenkel - University of Utah
- Andrew McCrady - University of Missouri-Columbia
- Jonathan Montaño - University of Kansas
- William Taylor - University of Arkansas
- Ashley Wheeler - University of Arnaksas
- Andrew Windle - University of Nebraska

Funding for this conference was made possible by NSF grant DMS-1708544 and the Office of Graduate Studies.

– Seth Lindokken

CITY *From Page 1*

five students, who choose their group based on the topic, so those with similar interests are working together. The small groups meet weekly with the instructor and also keep in regular contact with the local business partner.

Each team constructs a model that captures the prominent features of the proposed problem; populates the model with the data provided by the local collaborator, transformed as necessary; analyzes the model using appropriate computer software; and draws conclusions from the model that addresses the proposed problem. To conclude each project, the students prepare a detailed written report and give a public presentation describing their work in front of an audience of mathematics faculty members, undergraduate and graduate students, and the local collaborator.

"Our Math in the City students and postdoc instructors become highly employable and more visible because they are doing something different. People look at their applications more carefully," said Radu, the department's chief undergraduate adviser.

Katie Beth Pawlowski, a student in the Fall 2013 course, said Math 435 was fundamental in helping her earn her job at Experian as a statistical analyst.

"In the interview process, one of the first questions was: 'Have you ever worked with big data?' " Pawlowski said. "Because of Math in the City I was able to not only say yes, but also to provide examples and situations that showed them I was capable of coping and analyzing big data."

Justine Yeo, one of the Fall 2012 students, discovered how much she enjoyed working with data, which led her to pursue a graduate degree focusing on survey research and statistics and become a statistical research analyst for the Nebraska Department of Education.

"The majority of my time is spent on developing surveys, cleaning and managing data, performing statistical analyses, creating reports, and presenting results to clients for making informed decisions," Yeo said.

The first project tackled in Math in the City in 2006 was medical trial analysis with the University of Nebraska Medical Center, and original findings resulted from the students' efforts.

NEBRASKA GAME AND PARKS

The crew applies a chemical called rotenone to Pawnee reservoir to eradicate white perch and gizzard shad.

"The first offering of the course had a project that looked at the three key risk factors for heart disease. They used a sample set of data from a UCLA study. The students began analyzing the data in several different ways and wound up splitting the data by men versus women. The data didn't match. The three key factors were different for men versus women. UCLA didn't split the data this way, and therefore didn't find those results," Radu said.

In 2009, Radu and former UNL faculty member Stephen Hartke received an NSF Course, Curriculum, and Laboratory Improvement grant to develop the course as a model for export to other universities. From 2010 to 2012, they held three Math in the City workshops on campus to share their materials and students' presentations. See more at: http://www.math.unl.edu/~math-mitc/.

The current semester's projects analyze the invasive species of white perch fish, with 30 years of data from Nebraska Game and Parks collected from the Branched Oak reservoir. Professor Richard Rebarber, who is teaching this course for the second time, said the students look at the following questions: How do we control the white perch? What is an evolutionary stable strategy? and How will the fish respond to changes in the environment?

"White perch are very problematic to our fisheries in eastern Nebraska," said Aaron Blank of Nebraska Game and Parks. "Because these fish are not in their historic range, they avoid their historic predators and other biotic and abiotic factors that would keep population size in check. In this partnership, we will be seeing the data analyzed in a completely different way. I'm very excited to see what they come up with and how we can use the information in future projects."

When Rebarber first taught the course in Fall 2015, the students partnered with Dr. Tucker Zeleny of Husker Athletics. The students analyzed college football scenarios of when to blitz, when to go for a two-point conversion after a touchdown, and what to do on fourth down.

"Some of the work the students did verified preliminary results that we had previously found ourselves, and some of it was quite original," Zeleny said. "At the time, our Sports Analytics department was very new, so the extra manpower provided by the class to investigate a few of our ideas was helpful. It's always great to get some fresh eyes on a problem, and the students did not disappoint with their creative approaches."

Other local partners over the years have been Nebraska Global and Beehive, and city, county or state government offices, such as the health department, recycling, and the assessor/register of deeds.

Mentoring students in these semester-long research projects attracts faculty to teach the course.

"Math in the City is unlike any lecture-homework-quiz-exam class I had taught before," said postdoc Yuan Pei, who taught the course in Fall 2016. "Once the semester started I could feel the passion, higher than any other courses before, from students as they were eager to participate in real-world project using math and statistics."

Each fall, the class is in high demand, Radu said. Students enjoy taking the lead on the projects, which are related to current events.

"I learned that real life can get pretty messy. Learning this, ironically, was also what I enjoyed most about the course," Yeo said. "From working with imperfect data, to learning an entirely new programming language, to finding value in understanding real-world circumstances, this course was worth five courses and more to me."

Contact Radu if your business would be interested in being a partner on a future project.

– Lindsay Augustyn

PI MU EPSILON LECTURE

Where bridges, nanomechanics & Maxwell's legacy meet

The 11th Annual Pi Mu Epsilon Lecture was given by Dr. Ileana Streinu on Nov. 1, 2017.

Streinu is the Charles N. Clark Professor of Computer Science and Mathematics at Smith College. She became a fellow of the American Mathematical Society in 2012 and has been awarded the 2010 Robbins Prize of the American Mathematical Society as well as the 2004 Moisil Prize of the Romanian Academy. In addition, she heads the Laboratory for Research in Kinematics and Geometry, which combines her research in combinatorial and computational geometry with biology and robotics.

Following the induction of 11 new undergraduate members into the Nebraska Alpha chapter of Pi Mu Epsilon, Streinu gave the 11th annual Pi Mu Epsilon address "Maxwell's Problem, 150 years later: from bridges to nano-mechanics."

While the physicist James Clerk Maxwell is best known for his contributions to electromagnetism, Maxwell the mathematician is notable for writing two geometry papers. Maxwell's papers form the basis for the study of bar and joint frameworks and the interplay between rigidity and flexibility. These frameworks can be represented as graphs, and their rigidity or flexibility refer to the possible embeddings of the graphs in space. While redundant rigidity is desirable for architectural structures like bridges, flexibility is essential for nano-structures appearing in biology. In fact, some flexible structures can model the behavior of viruses, which must have enough flexibility to release their toxic load. In dimensions 1 and 2, a necessary and sufficient condition can be given for minimal rigidity of frameworks based solely on the density of edges. While this necessary condition holds in higher dimensions, it is not sufficient, which leaves

CORBIN GROOTHUIS/UNL MATH

Eleven students were inducted into the Nebraska Alpha Chapter of Pi Mu Epsilon (PME) on Nov. 1, 2017; seven of whom are pictured here. Back row, left to right: Ileana Streinu (PME lecturer), Micah Holmes, Jared Ott, Lawrence Seminario-Romero (PME chapter president), Derek Chew, Xuehua (Diana) Zhong (PME chapter vice-president), Alexandra Seceleanu (PME faculty advisor); front row: Zoe Fu, Claire Kamas, Carolyn Davis, Nora Breen. Inductees not pictured: Shannyn Bird, Andrew Daehling, Michael Purcell, and Elizabeth Spaulding.

LINDSAY AUGUSTYN/UNL CSMCE

Ileana Streinu, Professor of Computer Science and Mathematics at Smith College, gave the 11th annual Pi Mu Epsilon address on Nov. 1, 2017.

Maxwell's problem, now a 150-year-old problem, still open to this day.

Streinu also discussed her own extension of this problem to infinite periodic structures. By solving an analogue of Maxwell's problem for period and symmetry group respecting embeddings, Streinu and her collaborators were able to find a family of designs for auxetic materials, special structures that expand in a perpendicular direction as they are stretched. This property, while somewhat rare in nature, is familiar to children worldwide as a property of the Hoberman sphere, a colorful toy which expands from a star to a sphere via movement in one direction.

One of the important objectives of the Pi Mu Epsilon lecture series is to provide an opportunity for math major undergraduates to meet a distinguished professor from another university who can provide a glimpse into their area of mathematics. The series is organized by the Nebraska Alpha Chapter of Pi Mu Epsilon, currently celebrating the 89th anniversary of its founding, and is supported by the Department of Mathematics and the Nebraska Math Scholars program.

– Corbin Groothuis and Alexandra Seceleanu

CAREER PERSPECTIVES IN MATHEMATICS

Amen connects math, health care

The fourth Career Perspectives Lecture was presented by department alumna Lisa Amen on Feb. 23, 2017. Amen delved into how mathematics is used in her career in the health care technology field.

A Lincoln native, Lisa graduated from Lincoln East High School in 2008 and graduated with High Distinction from Nebraska in 2012, majoring in mathematics and minoring in Spanish. While Amen said she did not declare a major in mathematics until her junior year, she had been consistently taking math classes because "they made sense, and I liked the sense of accomplishment I always felt at the end of a semester," Amen said.

During her time at Nebraska, Amen was a grader for the math department, worked in the Math Resource Center on the weekends, and tutored trigonometry for a semester. She also spent six weeks in Guatemala the summer after her sophomore year, teaching and working on construction for a house. She soon learned about

Lisa Amen

an opportunity to be an elementary and middle-school mentor in math and language arts, and during her junior and senior years, she was a mentor to a second-grader, fifth-grader and sixth-grader in math as well as to a sixth-grader in language arts.

After graduation, Amen considered joining the Peace Corps or becoming a high school mathematics teacher, but Epic, a privately held healthcare software company, found her resume on Husker Hire Link, requested to interview her, and ultimately offered her a job.

Epic, located just outside Madison, Wisconsin, has four career paths: Developer, Quality Assurance, Implementation Services, and Technical Services. Amen worked in Technical Services on software called Tapestry, which was designed to support managed-care organizations.

Amen explained in her presentation to undergraduates how she used math at Epic for logical problem solving, troubleshooting (being able to evaluate multiple variables and test multiple inputs), and explaining workarounds or solutions.

After nearly four years at Epic, Amen left in February 2016 and moved to the San Francisco Bay Area. She started working as a Project Manager with Stanford Health Care on the Advantage product. Stanford Health Care Advantage is a Medicare health plan currently offered to Medicare beneficiaries residing in Santa Clara County. Amen now works on the business side rather than the technical side. She manages projects that will either increase membership volume or improve member experience with the plan.

This lecture series is funded by The Bares Family Fund for Excellence in Mathematics.

BETTI *From Page 2*

a module really is a list of integers, and

- the list terminates after $n + 1$ steps, where n is the number of variables.

Thus, attached to any finite length module M over the ring $k[x_1, \ldots, x_n]$ is a finite list of positive integers

$$(\beta_0(M), \beta_1(M), \ldots, \beta_n(M)) \in \mathbb{N}^{\times n+1}$$

which describes, roughly, the sizes of the various free modules needed to build M. This stands in analogy (and it is actually more that just an analogy) with the situation in topology, where a compact CW complex of dimension n can be built from finitely many cells of dimensions 0 through n.

In the 1970s, David Buchsbaum and David Eisenbud and, independently, Geoffrey Horrocks, formulated a basic question about the smallest possible values of Betti numbers of finite length modules over the ring $k[x_1, \ldots, x_n]$:

Conjecture 0.1 (BEH Conjecture, 1970s). *The Betti numbers of a non-zero, finite length module M over the ring $k[x_1,\ldots,x_n]$ satisfy $\beta_i(M) \geq \binom{n}{i}$.*

Since by the binomial Theorem, $\sum_{i=1}^{n} \binom{n}{i} = 2^n$, the BEH Conjecture immediately suggests a weak version of it, which is sometimes called the "Total Rank Conjecture."

Conjecture 0.2 (Avramov's Total Rank Conjecture, 1985). *The sum of the Betti numbers of a non-zero, finite length module M over the ring $k[x_1, \ldots, x_n]$ satisfies $\sum_i \beta_i(M) \geq 2^n$.*

UNL's Lucho Avramov promoted the notion that the weak form of the BEH Conjecture is actually the more plausible conjecture, in part because of its relationship with the well-known *Toral Rank Conjecture* in topology.

There was little progress on either conjecture over the years, and

Mark Walker

it was thus a great surprise to many when, in December 2016, Walker presented a proof of the Total Rank Conjecture when char(k) $\neq 2$ at a conference in Oberwolfach, Germany. The paper presenting his solution, "Total Betti numbers of modules of finite projective dimension," was published in Annals of Mathematics, one of the top journals in mathematics, in August 2017. His paper can be viewed in full here: https://arxiv.org/abs/1702.02560.

Those attending the joint meeting of the AMS-MAA in January of 2018 can learn more about Walker's result in Craig Huneke's talk "How Complicated are Polynomials in Many Variables?" which is part of the Current Events Bulletin Session on Jan. 12.

Roger & Sylvia Wiegand's Journal

Nepal: Math & Mountains

Long ago, longtime friend Jugal Verma (Purdue Ph.D., now professor and dean at IIT–Mumbai) said if we were ever interested in trekking in the Himalayas, to ask him about it. In 2013, we asked.

His response: "Contact Michel Waldschmidt" (ultrarunner, climber, and number theorist at Paris VI). Michel's response: "Contact Ajaya Singh" (professor at Tribhuvan University in Kathmandu). Ajaya immediately invited us to give math talks at Tribhuvan and also contacted Gyanu Maharjan, a Nepali graduate student in rural development and informal travel agent.

In 2014, after a few delightful days at IIT–Mumbai, we moved on to Kathmandu. Nobody knew much algebra, so we just tried to communicate the beauty of the subject, omitting elaborate technical details. The audience was receptive, and Ajaya convinced us to organize the first International Workshop and Conference in Commutative Algebra (FIWCCA) at Tribhuvan in April 2015.

After our visit to Tribhuvan, we followed a trek itinerary from Gyanu, up the Khumbu Gorge to Namche Bazaar, a bustling town perched on a hillside at about 11,500 feet with no access other than on foot, then to Tengboche; we attended a service in the famous monastery. Next stop: Pangboche (hot showers at 13,000 feet!), then up to Amadablam Basecamp (15,000 feet) — amazing views of Ama Dablam, one of the iconic peaks of the range. (It is shaped like the Matterhorn, but half again as high. Roger had toyed with the idea of climbing it, but decided that staying alive is preferable.) Then a quick two-day descent to Lukla (an hour's flight from Kathmandu), retracing our steps of the five-day ascent. The landing strip in Lukla is one of the scariest in the world – less than 1,500 feet long and inclined at an angle of 12 degrees. Once the plane turns into the canyon, there's no turning back; you have to land at Lukla.

COURTESY PHOTO

Sylvia and Roger Wiegand in Tadapani, view of Annapurna South (7,273 m) and Hiuchuli (6,441 m).

In 2015 we trekked before FIWCCA with both Ajaya and Gyanu. Our goal was Gokyo Ri (17,600 feet), with some of the best views of the Everest range. In Machhermo, still a day's hike from our goal, Ajaya had mild altitude sickness. He checked out OK at the health post there but was advised to take a rest day. The next morning, 2 feet of new snow ended our trek.

FIWCCA attracted mathematicians from the Czech Republic, India, Italy, Korea, UAE, and USA. Most speakers communicated interesting mathematics without blowing away the audience. Jugal's talk was the last on the morning of the last day of the conference, April 25. At 11:56, four minutes before the scheduled end of his talk, a 7.8 earthquake struck, and over 9,000 people died in the catastrophe.

Miraculously, all 60 conference participants escaped safely under the fragile-looking concrete canopy over the entrance to the math building. (If we had been physicists, a similar canopy on the nearby physics building that collapsed in a huge pile of rubble would have killed us. Fortunately the physicists were on holiday.)

The Nepali students were wonderful; they escorted us to an empty field near the math building, then to a lunch (in a tent) only two hours after the first earthquake.

After four scary days (64 aftershocks in the first 24 hours) of camping outside, dropping to the ground during major aftershocks, and avoiding buildings, we managed to catch a flight home.

Meanwhile, Francesco Pappalardi (Roma III) and Michel organized and secured funding for the Nepal Algebra Project (NAP), a six-year program (2016-2021) of yearly 10-week graduate courses on fields and Galois theory, divided into five two-week modules. The course is part of the M-Phil program at Tribhuvan and also carries credit at Roma III.

We taught the first module of Year 1 on May 8-20, 2016. The students were engaged, asked good questions, and worked hard on the assigned homework (graded by graduate students in Rome). We taught on Tuesdays, Wednesdays, and Thursdays to fit in a quick trip to the Khumbu on Friday-Monday: a brisk hike up to Namche (normally two or three days), then a circuit up to the so-called Everest View Hotel ("Cloud View" that day), over to the Village of Khumjung (site of the famous Hillary School), then back to Namche. The next day, one hour into the long hike back to Lukla, the clouds broke, and we had a fabulous view of Everest. The clouds returned though, and planes were not flying out of Lukla. Desperate to get back to our classes, we hired a helicopter for about a zillion dollars.

In October 2016, we trekked to Gokyo Ri, and saw amazing views of Everest and its satellites. Ajaya accompanied us again, along with Rosi Rissner, an algebraist from Graz and a participant in our second IWCCA, at Tribhuvan, Oct. 17-28. No earthquakes this time, but a stellar cast,

See NEPAL *on Page 8*

Lewis named AAAS Fellow

Jim Lewis is one of four Nebraska faculty members who has been named a fellow of the American Association for the Advancement of Science, the largest general scientific society in the world.

Jim Lewis

Fellows are selected by peers for scientifically or socially distinguished achievements that advance science or its application. Lewis, Aaron Douglas Professor of Mathematics, was selected for distinguished contributions to mathematics and mathematics education, particularly his leadership and ability to bring diverse stakeholders together in support of positive change in mathematics teaching and learning. Read more at https://go.unl.edu/math-aaas.

Lewis also became the Acting Assistant Director for Education and Human Resources at the National Science Foundation (NSF) in January 2017. Lewis joined NSF in January 2015 as the Deputy Assistant Director of EHR. While at NSF, Lewis has served as co-chair of the P-12 Education Interagency Working Group, tasked with coordinating efforts to improve P-12 STEM instruction through efforts across federal agencies.

COURTESY PHOTO

The Symposium for South Asian Women in Mathematics (group photo shown here from October 2017) in Kathmandu, Nepal, at Tribhuvan University was organized by Sara Faridi (Dalhousie), Dhana Thapa (Tribhuvan) and Sylvia Wiegand.

NEPAL *From Page 7*

from Austria, Canada, France, Iran, Romania, Saudi Arabia, UAE, UK, and the USA. A few speakers hit the mark, but many talks were too high-level for the local audience. If we do a third IWCCA we'll try a "summer school" model: a week of instruction followed by a week of gentle research talks.

In May 2017 we taught Module II of Year 2 (NAP) and had another quick trip to the mountains, this time to the Annapurna Sanctuary. A landslide and road closures delayed us a day, so we could not reach Poon Hill, reputably the best viewpoint in the Annapurna range.

In October 2017, we enjoyed eight beautiful days in the Annapurna range, including sunrise at Annapurna Basecamp, with throngs of trekkers all clamoring for the best views, then a tough three days across to Ghorepani and Poon Hill; amazing views indeed. We were not alone: many hundreds of trekkers joined the sunrise jaunt. Then down, down, down – about 15,000 difficult, slippery, uneven steps to a jeep, which drove us to Pokhara and our 45-minute flight back to Kathmandu. The 80 miles and 80,000 steps were murderous for us old folks with bad knees and Roger with a sprained ankle.

Next, we attended the Symposium for South Asian Women in Mathematics (SSAWM), organized by Sara Faridi (Dalhousie), Dhana Thapa (Tribhuvan) and Sylvia. SSAWM was a great success and inspired the women of Nepal who long to get math Ph.Ds. We hope we can help them.

Our other math-and-mountains trips in the last few years included travels to Austria, Brazil, Catalonia, the Czech Republic, Italy, and Iran. Stay tuned! In Spring 2018, we teach NAP Module I; we may try the "Three Passes" trek and high point of Kala Patthar (18,500 feet). Wish us luck!

CHAIR *From Page 1*

The point being, every member of our team is critical to the department's success, and I believe this message comes through in this newsletter.

In these pages you'll read about national honors bestowed on our faculty, in addition to cutting-edge research and innovative curriculum development made by members of our department. You'll learn about the achievements and experiences of our students, both undergraduate and graduate, as well as recognition for our staff. And you'll catch up on some of the marvelous activities and career trajectories of our alumni. Do you know what an "emirp" is, and who first coined the term? If not, read Lindsay Augustyn's wonderful profile of alumnus Jerry Farrell on Page 11. It truly is a pleasure to lead such an outstanding department and alumni community.

Lastly, I would like to give a warm "thank you" to all of our generous friends for their many donations, both large and small, over the years. Your contributions are critical to our success, providing scholarships for our students, helping support our outreach programs, providing funds for student awards, and supporting travel for students and faculty to meetings and conferences. One of the true joys of this job is the opportunity to visit with alumni and friends of the department. If you plan to be on campus in the future and wish to stop by Avery Hall, I would be more than happy to visit with you and show you around the department.

I wish you all happy holidays and best wishes for 2018.

AWARDS AND PROMOTIONS


Susan Hermiller

Professor of Mathematics **Susan Hermiller** was awarded a Willa Cather Professorship. Hermiller is a leading expert in geometric group theory and has supervised nine Ph.D. students. She has been graduate chair of the department since 2013.


Tom Marley

The Office of the Executive Vice Chancellor is sponsoring the participation of 10 faculty members in the Big Ten Academic Alliance Leadership Development program for the 2017-18 academic year, including **Tom Marley**, department chair and professor of mathematics, in the leadership development area of Department Executive Officers. Each year, approximately 75 department heads and chairs from Big Ten universities come together for this leadership development seminar. Read more at https://go.unl.edu/math-bigten.

Judy Walker has been elected as a Trustee of the American Mathematical Society for a term


Judy Walker

of five years. The term begins officially on Feb. 1, 2018. The Board of Trustees has complete fiduciary responsibility for the Society. Among other activities, the trustees determine the annual budget of the Society, prices of journals, salaries of employees, dues (in cooperation with the Council), registration fees for meetings, and investment policy for the Society's reserves. Election results may be found here: http://www.ams.org/about-us/governance/elections/election-results. Walker, Aaron Douglas Professor of Mathematics, is also Nebraska's associate vice chancellor for faculty and academic affairs. She previously held the position on an interim basis. Her duties are described at https://go.unl.edu/math-walker-avc.


Sylvia Wiegand

Sylvia Wiegand has been named a member of the inaugural class of the Association for Women in Mathematics (AWM) Fellows Program, which recognizes individuals who have demonstrated a sustained commitment to the support and advancement of women in the mathematical sciences. Wiegand will be honored on Jan. 10, 2018, at the AWM Reception and Award Ceremony at the Joint Mathematical Meetings in San Diego. Read more at https://go.unl.edu/math-awm.


Alex Zupan

Assistant Professor of Mathematics **Alex Zupan** was awarded a FIRST Award from Nebraska EPSCoR in 2016. The FIRST Award program is designed to help early career faculty initiate their research programs and compete more effectively for NSF CAREER grants. Approximately six FIRST Award grants (limited to $25,000 each) are awarded each year. Zupan has used the funds to provide summer research support for a graduate student and a postdoc, fund summer REUs for two students, and purchase a 3D printer to make mathematical models of concepts related to his research. In 2017, Zupan was awarded an NSF Focused Research Group grant.

Additional research grants:

Mark Brittenham: Simons collaboration grant

Mikil Foss and Petronela Radu: joint NSF investigator grant

Brian Harbourne: Simons collaboration grant

Adam Larios: NSF individual investigator grant

NEW POSTDOCS

Alessandro De Stefani

Dale Jansen Postdoctoral Fellow Alessandro De Stefani was born and raised in Genova, Italy. He earned a bachelor's degree and a master's degree in mathematics from the University of Genova. He earned a master's degree from the University of Kansas, and his Ph.D. in mathematics from the University of Virginia. His research interests are in commutative algebra, with particular focus on singularities and methods in positive characteristic.

Pelin Güven Geredeli

Pelin Güven Geredeli, originally from Ankara, Turkey, obtained her Ph.D. in mathematics from Hacettepe

University (Ankara). She has held postdoc positions at the University of Virginia and Politecnico di Milano (Italy). Pelin's research interests concern the longtime and qualitative behavior of linear and nonlinear systems of partial differential equations.

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Contributions to the math department funds can be made at http://www.math.unl.edu/department/giving or through the mail (see Page 12 for donation form). We invite friends of the department to contribute to an existing fund or to contact Chair Tom Marley to discuss creating a new fund for a specific purpose. **Thank you for supporting the activities of the Nebraska Department of Mathematics.**

Toundykov accepts position in 'big data analytics'

Daniel Toundykov, former associate professor of mathematics, has accepted a position in the Management Analytics unit at the State Employees' Credit Union in Raleigh, North Carolina. Toundykov said his new position may be broadly described as "big data analytics."

"In fact, despite it being a new field for me, data analysis and statistical inference are founded in areas closely related to my research background: mathematical analysis, measure theory and nonlinear optimization," he said.

Toundykov was at Nebraska for 10 years, the first three as a postdoc. His research dealt with models, both theoretical and numerical, of elasto-dynamics, acoustics and fluid flow, as well as some application-related results concerning robotics, hydrogeology, and aeroelasticity. He taught a variety of courses and advised Math Club along with Nebraska's Pi Mu Epsilon Chapter.

Toundykov will hold an adjunct faculty status in the department to remain on the Ph.D. committees of his students Jessie Jamieson and co-advisee Andrew Becklin. The department will miss him greatly.

CROSSWORDS *& collections*

Early on in life, Jeremiah (Jerry) Farrell discovered his passion for experimentation. The Hastings, Nebraska, native can recall blowing up a neighbor's fence with a test apparatus that involved 10,000 volts when he was in grade school. At the time, he found chemistry and physics much more exciting than arithmetic.

While Farrell was a student majoring in mathematics, chemistry, and physics at the University of Nebraska-Lincoln in the early 1960s, he came under the influence of Martin Gardner's "Mathematical Games" column in Scientific American magazine. An avid solver of crossword puzzles, Farrell's passion for puzzles and recreational mathematics took off.

Farrell, professor emeritus of mathematics at Butler University in Indiana, maintains a vast personal collection of the works of Gardner, who is best known for creating and sustaining interest in recreational mathematics throughout the latter half of the 20th century. "Mathematical Games" ran for 25 years and was read avidly by a generation of mathematicians and physicists who grew up in the years 1956 to 1981.

"I have all of Gardner's works, signed by him, since he was 16 years old," Farrell said. "This includes his earlier stories in Esquire and Humpty Dumpty magazines."

Farrell corresponded with Gardner in the 1970s, and Farrell and his wife, Karen, visited Gardner 20 to 30 times. In the September 1980 Scientific American, Gardner quoted Farrell on his invention of the term "emirp" (an emirp is a prime whose reversal is a prime).

In 1993, Farrell and his wife and their late friend Tom Rodgers formed the biannual "Gatherings for Gardner," which meets in Atlanta and started as an invitation-only event for people connected with Gardner. Next April will be the 13th meeting, and Farrell is one of about six persons who has been at them all. The 450 participants exchange essays and puzzles.

Colleagues Jeremiah Farrell and Steve Bloom at the 2016 "Celebration of Mind" at Butler University

Since Gardner's death in May 2010, Farrell has participated in another annual group called "Celebration of Mind," which meets all over the world to celebrate Gardner's birthday (Oct. 21, 1914).

Farrell, who has taught at Butler since earning his master's degree in mathematics at UNL in 1966, teaches at least one course while in retirement. This fall, he is teaching a course on Gardner with Dr. Steve Bloom.

Farrell is well known in his own right for having designed the 1996 "Election Day" crossword in The New York Times. One of the words had the clue "lead story tomorrow", with the answer being 14 letters long. However, the puzzle had two correct solutions: One could be "Bob Dole elected", and the other could be Bill "Clinton elected". All of the "crossing" words were designed such that they could be one of two different words, to make either answer as needed.

"I got the idea for an election-day puzzle for the 1980 election, pitting Reagan against Carter, and composed one. I sent it to New York Times editor Eugene Maleska, but he was concerned that the independent candidate Anderson might win and so rejected it. I then sent it to Games Magazine but then editor Will Shortz had already prepared that magazine's November issue," said Farrell, who, during the 1970s, sold many puzzles to periodicals such as the Saturday Evening Post and Los Angeles Times. "Then, in 1996, Will and I were at a party, and he reminded me of the 1980 puzzle. I quickly prepared the 1996 election puzzle and sent it to Will, who was now editor of the New York Times puzzle. He loved it and ran it and praised it for many years."

The Election Day crossword was discussed at length in Allan Connor's The Crossword Century. Farrell's most recent puzzle ran in the MAA Journal in May 2017 and was composed with his current chairman Bill Johnston. See the puzzle at: https://www.maa.org/amm_supplements.

Farrell has written puzzles for many other books and newspapers, such as Scott Kim's puzzle column for Discover magazine. He also was featured in the New York Sun for solving the Washington Square Park puzzle in 2006. He and his wife also edit and publish Word Ways: The Journal of Recreational Linguistics, which is now in its 50th year.

In addition, Farrell and Butler professor Matt Maurer have done much work with the Indiana School for the Blind, teaching the students problem solving with mathematical games and puzzles. Farrell also has been active for over 20 years in the annual International Puzzle Party.

Farrell credits geometry for showing him that mathematics could be as exciting as science experiments.

"It was amazing to be able to construct proofs on my own," Farrell said. "In 1952, I obtained a copy of Kai Nielsen's book 'Problems of Plane Geometry' and worked every problem in it. In 1973, after I was teaching at Butler, Dr. Nielsen became my chairman and signed his book for me. I still have it."

For more on Farrell's works see, https://works.bepress.com/jeremiah-farrell.

– Lindsay Augustyn

Class Notes

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Dan Augustyn (BS '99) is using his experience in mathematics to draft future NFL players. Of the 796 names recognized by the NFL Players Association as active agents, he is the only one certified in the state of Nebraska. Augustyn is an attorney and owns Augustyn Law Office in Lincoln. His admiration and love for the game started with his grandfather who played football at Northern Colorado and later went on to referee and coach in small Nebraska and Kansas towns. Read more in the April 28, 2017, Lincoln Journal Star article: https://tinyurl.com/y8ygfcmt. Dan lives in Lincoln with his wife, Lindsay, and they have two young sons who keep the family busy with their love for soccer.

Kurt Meyer (BS '88) went on to earn his master's degree in Astronautics from George Washington University and a Ph.D. in Physics from the University of Colorado ('97.) He has worked as an aerospace engineer for the Aerospace Corporation in El Segundo, California, and provided technical support for the U.S. Air Force Space Program. He sustained a traumatic brain injury while mountain biking in Colorado in 1998, which prompted him to move back to Nebraska and re-enroll in the teachers' college. He has a broad background in tutoring mathematics and physics. After attaining his teaching certificate, he spent five years at LPS tutoring math and physics to highly gifted elementary and middle school students. He worked for six months as an online tutor for tutor.com, and has also tutored college students face-to-face. He lives near his parents' farm in Avoca, but makes it to Lincoln almost once a week. He stays involved at the University by participating in the German Speaking Table and tutoring ROTC students.

Amy Parrott (Ph.D. '09) is the recipient of the 2017 Distinguished Teaching Award from the Wisconsin Section of the Mathematical Association of America. She received the award in April for her great success in teaching mathematics. She is currently teaching mathematics courses to future elementary teachers and middle-school specialists at the University of Wisconsin Oshkosh. She is described by her peers as "a dedicated teacher who is deeply interested in the preparation of our future teachers." One of her favorite things about teaching is helping students overcome any fears they have about math; she considers it a great success when any of her students can tell her that they learned to love math because of her class. Read more at: https://tinyurl.com/y7vrhbax

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☐ **I would like my gift to support the Mathematics Department Fund.** This is an expendable fund that is used to support department priorities such as faculty and student professional travel and outreach activities.

☐ **I would like my gift to support the Math Teachers for the 21st Century Expendable Fund.** This is an expendable fund used for tuition fellowships for Nebraska mathematics teachers (K-12) for graduate courses.

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Contributions also can be made at http://www.math.unl.edu/department/giving

COURTESY PHOTOS

Scholarship sends Schroeck back to China

Thrill rides on a tower, sailing on the Pearl River, and staying in a five-star hotel: These adventures were but a few of the things Alex Schroeck, a Nebraska undergraduate math major, experienced in his studies in China so far this year.

Schroeck is the recipient of the Boren Scholarship, an award focused on providing American students with resources and encouragement to acquire language skills and experience in countries critical to the future security and stability of the United States. He arrived in China in May 2017 and will return to Nebraska in July 2018.

The Boren Award is sponsored by the National Security Education Program, which is a major federal initiative to build a broader and more qualified pool of U.S. citizens with foreign language and international skills. Schroeck's interactions with the Chinese exchange students at Nebraska complemented his classroom lessons, and provided him with an insight into cultural norms, the language, and the fostering of intercultural relationships.

Schroeck's interests in math, foreign language, and national security have led him to study in China more than once. He previously attained his Teaching English as a Foreign Language certificate in Beijing, where he lived with Russian roommates and worked with people from England, Cyprus, Angola, and Costa Rica. Schroeck was eager to return to China.

"I revisited the Forbidden City, Tiananmen, the Great Wall, ancient temples, and even an abandoned theme park that was meant to copy Disney in the 1980s," Schroeck said.

He also spent some time in Hong Kong, where he experienced first-hand the hostility between Hong Kong residents and the "mainlanders," who made sure to distinguish themselves from each other by language. Schroeck realized that these experiences were tastes of the real culture, which tourists don't usually get to see.

Schroeck seized opportunities to get out of the hostels and explore as often as he could, and he was rewarded with some incredible experiences. Schroeck treated himself to a few nights in a five-star hotel, since they are much cheaper in China than in the U.S. He also rode the Canton Sky Drop on Canton Tower in Guangzhou, climbed the White Cloud Mountain, and sailed across the city on the Pearl River. He even traveled to the small city of Yulin, which is famous for its dog-meat festival. Schroeck never tried the meat, but he was treated to other meals by citizens who had never seen a foreigner before.

Schroeck was one of three English-speaking students in his classes in Nanjing, but found that the students' knowledge of and ability to speak Mandarin was their unifying factor.

"The only common language I have with my classmates is Mandarin," said Schroeck, who knows that the mastery of Mandarin, along with his international exposure, will be a selling point when he looks for a job. "This has worked wonders for my language skills because both in and out of class, Mandarin is the only useful language in daily life."

Schroeck took his learning into his own hands when he reached out to a graduate student to learn how to discuss higher math in Chinese, giving the student English lessons in return.

"By the end of the year I expect I'll be able to sit in on an undergraduate math lecture in Chinese and be able to follow along," Schroeck said.

Schroeck knows that his selection for the Boren Award was only made possible with the help of his friend and mentor, Jia Lu, and his mathematics professor, Yvonne Lai, who provided helpful advice while Schroeck was in her Modern Algebra course.

While in Nanjing, Schroeck said he was "having the time of his life" and added, "I am thrilled to have received the Boren [Award] to make it all possible."

– Alli Davis

Miller's work earns pre-journal award

Graduate student Erica Miller was selected as the winner of the pre-journal award for the 2017 SIGMAA on RUME conference for her paper, "A New Methodological Approach for Examining Mathematical Knowledge for Teaching at the Undergraduate Level: Utilizing Task Unfolding and Cognitive Demand."

SIGMAA on RUME was formed in 2001 for the purpose of encouraging quality Research in Undergraduate Mathematics Education (RUME) and its application and teaching practices. Members of the 2017 Conference Program Committee, along with another senior researcher in the field, reviewed Miller's work and suggested it for consideration for the pre-journal award. Miller's paper was selected for the award because of its strong, clear and extensive support of all claims and the potential importance to the field.

Erica Miller

The award recognizes the strengths of Miller's work, but to help Miller prepare her paper for publication in a high-quality outlet, she has been paired with experienced mathematics educator Megan Wawro, an associate professor at Virginia Tech University, who has numerous refereed publications.

Miller's award will be presented at the next annual conference of the SIGMAA on RUME at the annual awards banquet. The conference will be held Feb. 22-24, 2018, in San Diego, California.

Undergraduate Awards

Chair's Prize *Awarded to an outstanding senior mathematics major*
Cashous Bortner

Special Scholarships Awards
Note: 48 scholarships were awarded for the 2017-18 academic year.

Dean H and Floreen G Eastman Memorial Scholars
(for Nebraska high school graduates)
Moriah Barta, Derek Baumfalk, Nora Breen, John Chrostek, Grace Dickas, Matthew Dunn, Julianne Faur, Elizabeth Galliart, Brandon Geren, Alex Heitzman, Claire Henrichsen, Chun Yin Ho, Ian Howell, Alexandra Janvrin, James Janvrin, Zachary Keck, Naomi Kirkvold, Jared Ott, Jacob Piccini, Ethan Romery, Lawrence Seminario-Romero, Edwin Schooler, An Tran, Elizabeth Tyler, Elizabeth Vandergriend, Brook Verbik, Nicholas Verdoni, Collin Victor, Marc Wade, Zach Warneke, Brady Wilkerson, Caitlin Wilkins

Irwin Dubinsky Memorial Scholars
Tyler Bienhoff

Senior Honors Thesis and Graduated with Distinction *(directed by)*:
Christopher Beeman (Wendy Smith)

Joel Stebbins Fund Scholarship
Henry Bauer

Putnam Participants
Tyler Bienhoff, Derek Chew, John Chrostek, Alex Heitzman, Caprianna Keeler, Zachary Warneke, Xuehua (Diana) Zhong

Renneman/Luebbers Scholarship
Shannyn Bird

Drusilla Winchester Scholarship
Samuel Carrasco

Ruby Matzke Wittemore Scholarship
Yi Xie

Dr. Hubert Schneider Scholarship
Yuance He

Sylvia and Hans Jeans Mathematics Scholarship
Henry Recker and Karl Shaffer

Chancellor's Scholars
Andrew Peterson, Anna Rolf

Superior Scholars
Jaron Ahmann, Terran Merriman-Honerkamp

Graduate Program Awards & Fellowships

Chancellors Fellowship
Erica Musgrave

Don Miller Award for Outstanding Teaching by a Graduate Student
Andrew Becklin and Erica Miller

Grace Chisholm Young and William Henry Young Award
Ben Drabkin and Rachel Zigterman

Steven Haataja Award for Outstanding Exposition
Jessalyn Bolkema

Outstanding Qualifying Exam
Jie Kang

Walter Mientka Teaching Award
Kody Holmes

Outstanding First-Year Student Award
Erica Musgrave

Bill Leavitt Award
Su Ji Hong

Lloyd Jackson Award
Marla Williams

Emeritus Faculty Fellowship
Gary DeClerk and Mohsen Gheibi

Othmer Graduate Fellowship
Laila Awadalla

Staff Awards/News

Nan Cai joined the department in June 2017 as the computer systems specialist.

Tom Danaher earned an Applause Award from the College of Arts and Sciences in April 2016 and also was one of six recipients of the Annual Applause Award in December 2016.

Marilyn Johnson received an Applause Award in September 2017.

Degrees

2017 Doctorates

Ahrendt, Kevin (Colorado School of Mines) *Solving Initial and Boundary Value Problems for a Self-Adjoint Difference Equation Involving Fractional Derivatives,* Al Peterson

Akesseh, Solomon (Yale Law School, J.D. candidate) *Ideal Containments under Flat Extensions and Interpolation on Linear Systems in P^2,* Brian Harbourne

Falahola, Brittney (Stephen F. Austin State University) *Characterizations of Gorenstein Rings Using Frobenius,* Tom Marley

Ferraro, Luigi (Wake Forest University) *Stable Cohomology of Local Rings and Castelnuovo-Mumford Regularity of Graded Modules,* Luchezar Avramov

Franke, Maranda (Center for Communications Research) *Languages, geodesics, and HNN extensions,* Mark Brittenham and Susan Hermiller

McKain, Brent (National Indemnity, Omaha) *Antichains and Diameters of Set Systems*, Jamie Radcliffe

Myers, John (State University of New York at Oswego) *Characterizations of Minimal Multiplicity via Ext-Algebras*, Lucho Avramov

Russell, Travis (United States Military Academy) *Abstract characterizations of ordered operator spaces*, Allan Donsig

Tomlinson, Charles *Extremal Problems for Graph Homomorphisms and Automata*, Jamie Radcliffe

Windle, Andrew (Rockhurst University) *Cohomological Operators on Quotients by Quasi-Complete Intersection Ideals*, Mark Walker

Master's degrees

2017 (MAT): Desiree Anderson, Elizabeth Crabtree, Alexander Dostal, Kyle Ediger, Cody Gregory, Kaitlin Habermeyer, Masake Kane, Danielle Malson, Andrew Moser, Celia Newman, Mary Nuckolls, Scott Toovey, Ryan Treat, Brett Troyer

2017 (MS): Gary DeClerk, Paula Egging, Kody Holmes, Su Ji Hong, Eric Hopkins, Robert Huben, Vince Longo, Aurora Marks, Amadeus Martin, JD Nir, Matthew Reichenbach, Alyssa Whittemore, Rachel Zigterman

2016 (MAT): Ben Darling

Bachelor's degrees

December 2016: Westin Edrington, Erik Eitzman, Jared Gaston, Zhaoyuan Gu, Daniel Gutierrez, Colton Howell, Andrew Huffman, Wenhao Lin, Mackenzie Martin, Hangquan Qian, Davis Rempe, Tyler Riggle, Lucas Snethen, Kyle Stewart, Erik Wiedel, Gary Wright, Kangqi Zhang, Xiaoyu Zhong

May 2017: Jaron Ahmann, Sydni Bechler, Christopher Beeman, Nathaniel Benes, Cashous Bortner, Westley Carpenter, Michael Courtney, Simon Deng, Kenny Dobberpuhl, Steven Emmerich, Brant Haupt, Roman Haynatzki, Nantu Hu, Joshua Hurlbert, Alexander Johnson, Schuyler Judds, LeeAnn Kabler, Avi Knecht, Terran Merriman-Honerkamp, Mackenzie Metcalf, Tyler Minchow, Robert Moore II, Zhiving Mu, Fengji Nie, Marcus Pasell, Kathleen Pfankuch, Tanner Pfeiffer, Jordan Pitcher, Erica Pribil, Zach Rouzee, Christiana Spicer, Brooke Stelly, Veronica Telega, Claire Tunakan, Austin Vornhagen, Bicheng Wang, Qingheng Zhang, Xiaotian Zhang, Kaivuan Zhao

August 2017: Andrew Apprich, Westley Carpenter, Jennifer Hamblin, Jaewon Lee, Muhammad Hazmi Mohd Ramli, Jack Rodenburg, Dalin Sun, Olivia Thiel

MATH GRADUATE STUDENTS:

By the Numbers

Over the past five years...

27 graduate students at Nebraska received **internships** nationwide

115 **conference talks** were given nationally and internationally by our graduate students

27 students **presented posters** at national and international conferences

41% of our Ph.D. graduates were **women**

12 students were awarded external **grants**

29 graduate students **published** research papers

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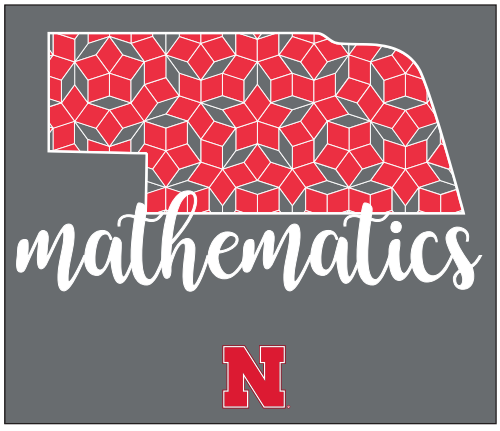
New Mathematics shirts for sale

The graphic shows the state outline, filled with a penrose tiling modeled after the wooden wall piece in Avery Hall (see photo on Page 5) constructed by Earl Kramer, artist and emeritus professor of mathematics.



Design on front of shirt

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Unisex Jersey T-shirt by Bella+Canvas

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Color: Dark Grey
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Unisex Jersey Long-Sleeve Hoodie Shirt (Soft, Thin Material) by Bella+Canvas

Price: $12.65 (plus tax and shipping)
Color: Charcoal Black
Sizes: XS, S, M, L, XL, 2XL

Note: Once the online order form closes on Jan. 12, then all orders will be processed and shipped.

Math News is a newsletter published for the Nebraska Department of Mathematics community. To receive Math News via email, please register online. Comments regarding newsletter content should be sent to Tom Marley (tmarley1@unl.edu), Chair, Nebraska Department of Mathematics, 203 Avery Hall, Lincoln, NE, 68588-0130.

Math News is produced and edited by Lindsay Augustyn and Alli Davis of the Center for Science, Mathematics, and Computer Education.

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