IN THIS ISSUE

page 2
Message from the Chair

page 3
Everything is Math

page 4-11
Biographies

page 4
UA-TRIPODS

page 5
STEM in HSIs

page 6
Mathematics of Swimming

page 8
MAA Haimo Teaching Award

page 10
Supporting Diversity and Inclusivity

page 12
UA Mathematics Master and Ph.D. Recipients, 2017

THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
Mathematics

MATHEMATICS

Fall 2017
Volume XVII, Single Issue

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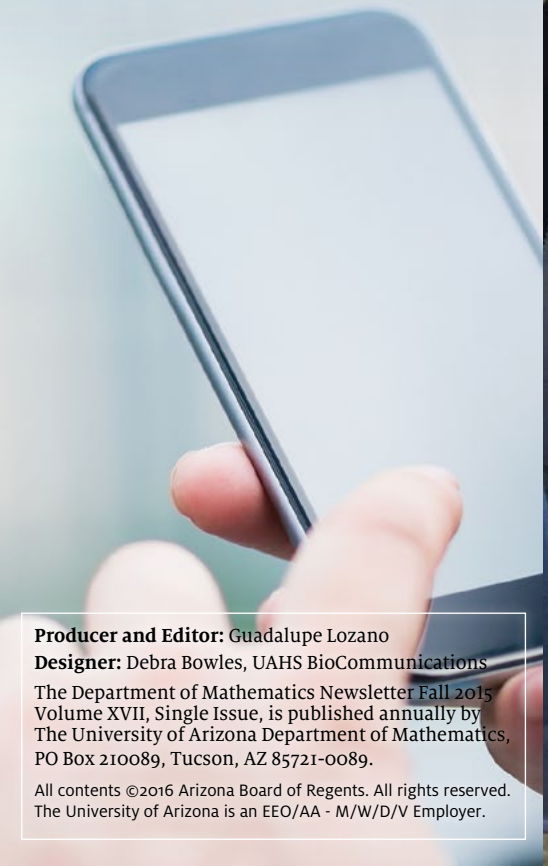

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Message from the Department Head

By Doug Ulmer

After an eight-year detour to Atlanta and Georgia Tech, I am very happy to be back at the University of Arizona as Head of the Department of Mathematics. Some of the things that enticed me back are the high level of research, the dedication to quality education, and the impactful outreach taking place in the department. This is truly a wonderful place for mathematics. I am looking forward to working with our faculty, staff, and students as well as the College of Science and a dedicated group of alumni and friends to move the department to new levels of excellence.

Here are three big projects we will be working on this year:

A strategic hiring plan. We expect to be able to appoint about 10 new faculty members in the next few years, some due to retirements and others representing growth in the size of the faculty. In order to make the most of this important opportunity, the faculty will be developing a strategic plan to guide our hiring. We will be thinking hard about priority research areas, the distribution of our teaching efforts, and the unique features that make Arizona a great place to work and grow.

A new and expanded undergraduate administrative team. The previous two-person team has been expanded to three in order to handle our ever-increasing teaching mission. The new team will be working on initiatives such as deeper mentoring and development of our entry-level faculty, stronger connections to other departments, and a new undergraduate major in Statistics and Data Science.

A newly vibrant School of Mathematical Sciences Advisory Board. The support and advice of our friends and alumni are more crucial than ever to our success and impact. We look forward to growing deeper connections with local industry, K-12, and other loyal advocates, through a hands-on advisory board group with an enhanced mandate for meaningful change.

Please see the rest of this newsletter for updates on exciting research directions, faculty and staff accomplishments, and student initiatives and degrees. ▲

Doug Ulmer *is a mathematician whose research emphasizes fundamental, curiosity-driven problems in number theory and algebraic geometry. He also enjoys building academic programs and research institutions with lasting impact.*

Contact him at **ulmer@math.arizona.edu**

2017 LECTURE SERIES

Everything is MATH

Public Lectures

MAYNARDS

Drawing Room

400 N Toole Ave., Tucson, AZ 85701

6:30pm

October 18, 2017

Matti Morzfeld

Probably not: *using mathematics, statistics, and computers to predict the future*

November 15, 2017

Janek Wehr

Mathematics of cooperation: *sending swarming microbots on a search and rescue mission*

THE UNIVERSITY OF ARIZONA
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School of Mathematical Sciences

math.arizona.edu/outreach/

*The annual **Duncan Buell Everything is Mathematics Lecture Series** gives the Tucson community a window into the mathematical research our UA faculty do here in Tucson.*

*The lecture series is made possible in part by a generous endowment by UA mathematics alumnus **Duncan Buell**, now **Professor of Computer Science and Engineering at the University of South Carolina**.*

Buell, a public intellectual himself, believes in the value of raising public awareness about the relevance, beauty, and applicability of mathematics in its many forms. ▲

Professor Duncan Buell

To give or find out more about this project and other giving opportunities please visit: math.arizona.edu/outreach/give/

Give!

http://kaywa.me/mB9YK

BIOGRAPHIES

Tenure-track Faculty

Brandon Levin is a Tenure-track Assistant Professor. He grew up in Toledo, Ohio and did his undergraduate work at Duke University. He received his Ph.D. from Stanford University in 2013. Before coming to UA, Brandon held postdoctoral positions at the Institute for Advanced Study in Princeton and at the University of Chicago. He works at the intersection of number theory, arithmetic geometry, and representation theory in the Langlands' program. In his spare time, he enjoys reading, hiking, and spending time with his four-year old daughter.

Instructional Faculty

Jeffrey Craig earned his Ph.D. in Mathematics Education at Michigan State University in 2017. His research focuses on the ideas of quantitative literacy and numeracy as relevant general education goals. He wants to understand the potential for quantitative literacy to entangle mathematics and statistics with thinking about difficult social problems of the world. Jeff is maintaining his research and publications while teaching mathematics at the University of Arizona. Jeff is an avid reader and aspiring author, mostly in the fantasy genre. He also enjoys soccer and other sports, as well as finding great local spots in Tucson for food, comedy, and trivia.

DeAnna McDonald is a native Tucsonan and former high school math teacher who earned both Bachelor's and Master's degrees from the University of Arizona in Mathematics and Teaching. She has graded statistics exams for the Advanced Placement (r) program since 2006, and serves as a table leader, helping to develop rubrics and training materials that prepare others to grade those exams. In addition, she is an editor for an AP (r) Statistics exam prep book and a contributor of materials for a high school statistics textbook. Her granddaughters are in line to be fifth generation Wildcats and if you want to see one of her quilts, drop by her office in the math building.

David Rockoff, Instructor, is originally from the New York area. He earned his Master's Degree in Statistics at Iowa State University, and should be earning his Ph.D. aaaany day now from the University of Arizona's Statistics Graduate Interdisciplinary Program. His research interests include psychometrics, data visualization and sports analytics. His non-research interests include baseball, ultimate, and playing the harmonica.

continued on page 6

UA-TRIPODS: Building Theoretical Foundations for Data Sciences

Principal Investigator: ***Helen Zhang***
Co-Principal Investigators: Dave Glickenstein, Stephen Kobourov, and Joe Watkins

The UA-TRIPODS team. From left to right: Dave Glickenstein, Stephen Kobourov, Joe Watkins, and Helen Zhang.

Modern algorithms leading to new theoretical statistical approaches are often grounded in machine learning, and substantively informed by a variety of mathematical disciplines—from probability theory to geometry. Thus, **transdisciplinary** principles in data science are ever more necessary to make new discoveries.

This past August, the National Science Foundation (NSF) announced the recipients for its new initiative, TRIPODS, Transdisciplinary Research in the Principles of Data Science. The University of Arizona (UA) was one of only 12 recipients of Phase I of this multi-million-dollar national effort.

UA-TRIPODS is a far-reaching integrated research and workforce enhancement institute, focusing on theoretical foundations for data sciences. Most existing data science institutes focus on **applications of data science**, hence promoting collaborations between theoretical researchers and field scientists. Different from these, UA-TRIPODS aims to build the **theoretical foundations of data science** and establish deep-level collaborations between three core fields: theoretical computer science, mathematics, and statistics.

During Phase I, UA-TRIPODS will seek to (1) identify fundamental areas where theoretical foundations are imperative, (2) form research working groups (RWGs) which harness multi-disciplinary expertise and operate with a strong communication mechanism, and (3) develop mathematical and algorithmic principles of data science. Principal investigator Helen (Hao) Zhang and her team hope to do work that positions UA competitively to secure a Phase 2 award.

Each of the eight multi-disciplinary RWGs will tackle identified key problems within its theme. Network science for example, concerns the analysis of social, intellectual, biological, and financial networks. The **theory of large scale networks and graphs** RWG will develop novel, theoretically-grounded graph analysis and visualization algorithms designed to search networks at multiple scales – from the micro (individual) level to the macro (population) level.

Imaging science, essential in medicine, neuroscience, engineering, and astronomy, faces persisting image interpretation challenges despite ever-increasing image resolution and precision thanks to advanced techniques like CT, fMRI, and PET. A goal of the t**heoretical research for imaging sciences** RWG, is to reconstruct 3D models of a scene using images obtained from multiple cameras at approximately the same time. Solving this problem requires developing high-performance parallel algorithms, and understanding their numerical and theoretical properties.

To disseminate and support the work of its eight RWGs, UA-TRIPODS will offer weekly seminars and annual summer workshops bringing together researchers, experts, industry scientists, and those who wish to learn more about the initiative.

UA-TRIPODS will also design and provide better training programs for next-generation data scientists at all levels, from undergraduates to graduates to postdocs. In particular, UA-TRIPODS and UA Mathematics will collaborate in creating an undergraduate degree in Statistics and Data Science. Special effort will be made to diversify data sciences by recruiting underrepresented minorities and women, and developing novel vehicles for community outreach.

For ***more information on UA-TRIPODS,*** you may search ***nsf.gov***, visit the site **tripods.arizona.edu**, or contact PI *Helen Zhang* at **hzhang@math.arizona.edu**.

GRANT SNAPSHOT

STEM in HSIs

The University of Arizona presents

The Southwest Conference on Transforming STEM Education in Hispanic-Serving Institutions (HSIs)

November 18 – 20, 2017 | The University of Arizona

This regional conference, **with support from the National Science Foundation (NSF)**, will host faculty, students, administrators, and community partners from across five Southwestern States (AZ, CA, NM, NV, TX) to identify critical challenges and opportunities for transforming undergraduate STEM education in HSIs.

Participants will focus on the following five key themes:

- Transitions from 2- to 4-year HSIs
- Role of Research 1 (R1) HSIs in undergraduate STEM education
- Innovative pedagogies and curricula
- Challenges to recruitment, retention, and persistence
- Role of culturally-responsive STEM education at the college-level

steminhsi.arizona.edu | steminhsi@email.arizona.edu | #STEMinHSI

Bringing together stakeholders from over 45 HSIs in the Southwest, across five states including these collaborators:

Arizona Western College · The University of Texas Rio Grande Valley · CNM Central New Mexico Community College · Pima Community College · Glendale Community College, A Maricopa Community College · NSF · Channel Islands California State University · The University of Arizona · Mt. SAC Mt. San Antonio College · NMSU

Conference participants representing 42 HSIs, and visiting NSF program officers, on November 18, 2017.

Congressman Raul Grijalva welcomed participants, together with UA's Sr. V.P. for Research Dr. Kim Espy, Assos. V.P. for Research, Dr. John Mester, and the PI Team.

HSI Conference: Transforming STEM Education in Hispanic Serving Institutions - Regional Insights from the Southwest

Principal Investigator:
Guadalupe Lozano

Co-Principal Investigators: Vignesh Subbian, Marla Franco, Bill Velez, Anna O'Leary

The University of Arizona (UA) was one of four universities selected by NSF to lead the charge of informing the design of the new NSF Hispanic Serving Institutions (HSI) program, through the organization of national conferences.

NSF's new program, which will "focus on undergraduate STEM education at HSIs" is set to be launched in fiscal year 2018. UA's 100K award aims to gather and deliver transformational insights that can help change the landscape of STEM education at the ever-increasing number HSIs in the Southwestern US.

For **more information on Southwest STEM in HSI Conference,** you may search **nsf.gov,** visit the site **steminhsi.arizona.edu,** or contact PI *Guada Lozano* at **guada@math.arizona.edu**.

GRANT SNAPSHOT

BIOGRAPHIES

Visiting Assistant Professors

Yongtao Cheng received her Ph.D. in Applied Math from the University of Wisconsin at Madison. Her research focuses on numerical methods for Hyperbolic systems, in particular the Kinetic systems and Electromagnetic systems. After obtaining her Ph.D. she was a postdoc in the Department of Electrical and Electronic Engineering at the University of Hong Kong. At the University of Arizona, she hopes to extend her work to data-driven approaches with more realistic applications. Outside of work, she likes cooking, music, and traveling.

Lynette Guzmán is a mathematics education researcher and teacher educator. She earned her Ph.D. in mathematics education at Michigan State University, and is a former National Science Foundation Graduate Research Fellow and University Enrichment Fellow. Her scholarship centers on addressing inequities in education for historically marginalized students with attention to identity and power. Lynette's commitments to equity and justice in education are grounded in her experiences as a student and educator constrained by narrow epistemological and ontological perspectives on mathematics teaching and learning that often exclude students of color. She works with prospective and practicing K-8 teachers to transform their classrooms with equity-oriented and humanizing practices that value young people as knowers and creators. As a UA alumna, Lynette enjoys watching Arizona basketball, exploring local Tucson bars and restaurants, and spending time outside in the sunshine.

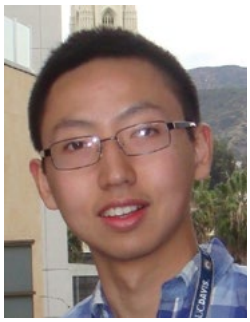
Postdoctoral Research Associates

Rachel Neville grew up outside of Denver, Colorado and spent the last decade at Colorado State University, completing both an undergraduate degree and ultimately a Ph.D. in the summer of 2017. Her research interests lie in using topological and geometric techniques to characterize and better understand spatio-temporally complex patterns. A few favorite applications have come from melting snow fields, ion bombarded compounds, and chaotic advection models, and she is always on the lookout for interesting models/datasets to study. She also enjoys painting, hiking, and backpacking, and is looking forward to learning about the desert!

continued on page 7

Mathematics of Swimming: Why do the Limbs of Krill Move like a Wave?

By Calvin Zhang



Antarctic krill spend the majority of their life swimming across the ocean. It has been estimated that about 70% of their daily energy expenditure is spent on swimming. These beautiful creatures, along with other long-tailed crustaceans, swim with a remarkable stroke pattern known as the **metachronal** propulsion. Unlike people in a rowing team in which each person moves the paddle in-phase with one another, neighboring pairs of swimming limbs in crustaceans move with a 20-25% phase delay, with the posterior limb leading the cycle. This frequency-invariant coordinated motion resembles a traveling wave. Why and how do crustaceans do this? The "why" is a fluid mechanical question, whereas the "how" is a neurophysiological one, and both questions are mathematical ones!

It turns out that for animals the size of crustaceans with appropriately-spaced limbs, a back-to-front wave-like coordination is much more effective and efficient compared to the in-phase coordination. Specifically, the natural back-to-front metachronal wave produces a 60% increase in the volume of water displaced per unit time over that of the in-phase rhythm leading to a significantly more effective stroke pattern. To show this, we constructed a computational fluid dynamics model to study the interactions between the crustacean and the fluid. In this simulation the crustacean is modeled as a rigid plane equipped with four or five free-rotating flat paddles. All the crustacean mechanical structures are immersed in a 3D fluid. The **Navier-Stokes equations**, a set of well-known partial differential equations which govern the movement of the fluid, are carried out on a fixed mesh grid (a **Eulerian grid**), whereas the relatively simpler set of ordinary differential equations that describe the dynamics of the "crustacean," is carried out on a flexible grid that adapts to the motion of the swimmer (a **Lagrangian** grid).

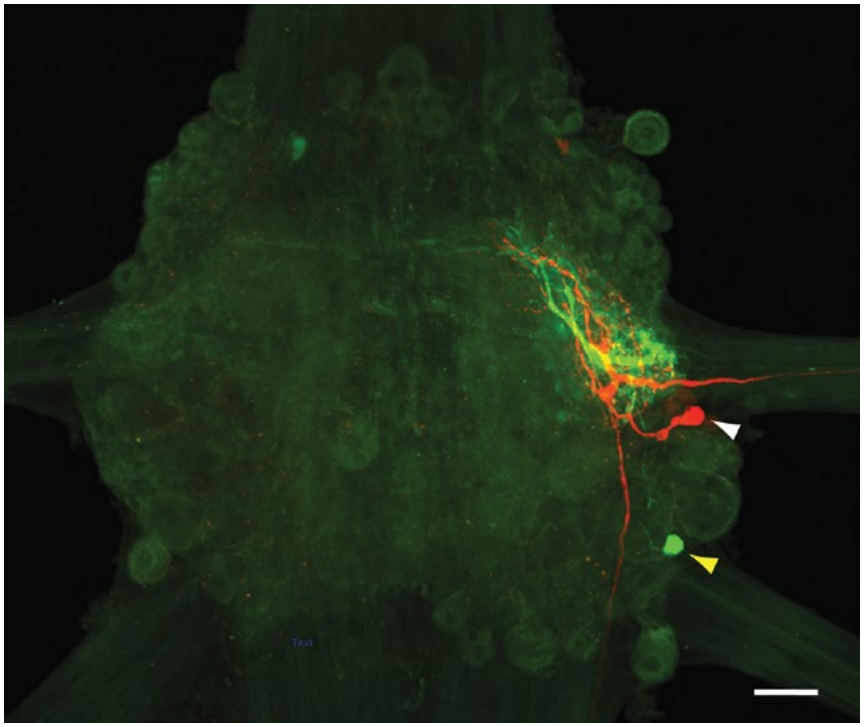
In this "two-grid" modeling framework the Eulerian grid does not need to conform to the geometry of the crustacean, a key modeling advantage. Being represented on different grids, the two forces (the fluid's on the fish, and fish's on the fluid) are then "matched" by interpolating using a smoothening technique. This framework for modeling fluid-structure interactions is known as the **immersed boundary method**, originally developed by Charles Peskin (Courant Institute) in 1972 to simulate blood flow in the heart. Its application to a growing list of ever more diverse and challenging applications includes a stochastic version for microscopic problems in which Brownian motion (the random motion of particles suspended in a liquid or gas) plays an important role.

Effective locomotion, such as the wave-like propulsion in crustaceans, requires a system of neural control and a bio-mechanically efficient musculoskeletal periphery. Energy intensive locomotion, such as steady swimming, walking, and flying, provides important model systems for studying **optimality**. This is because the goal of the behavior is clear and has likely been optimized for **evolutionary advantage**. Because of the distinct frequency-invariant stroke pattern and the relative simplicity of their neuronal circuits, limb coordination of long-tailed crustaceans during steady swimming provides an ideal model system for examining the neural underpinnings of optimal motor behavior. Using **nonlinear dynamics** and approximation methods such as **asymptotic analysis**, I showed that the organization of the neuronal circuit underlying the crustacean limb coordination provides a robust mechanism for generating this metachronal propulsion. Specifically, the wave-like limb coordination emerges robustly from the internal structure and the network topology of the neuronal circuits that drive the movements of each limb. In other words, the neurons

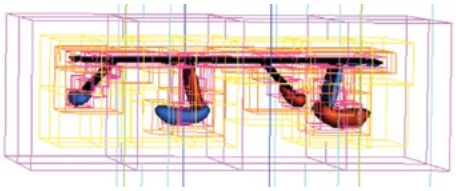
FEATUREARTICLE

underlying the crustacean swimming system do not have to be fined-tuned to enable their bio-mechanically advantaged stroke pattern.

We might pose two curious questions in neuroscience. First, how do animals move? Second, how do we learn, and make intelligent decisions? The first question distinguishes us from plants. The second distinguish us from crustaceans! My work on crustacean swimming concerns the movement of animals, or the first question, and my research on how neuronal signals might travel in the brain (discussed elsewhere), contributes toward the second. Using mathematics, physics and computing, my research group, in rich collaboration with **neuroscientists**, aims to provide insight and methodologies to elucidate mechanisms of various living systems. This kind of research benefits greatly from the interplay of biological and mathematical perspectives upon the same problem. In my case, this work is a result of close collaborations with **biologists** Brian Mulloney (UC Davis) and Carmen Wellmann (University of Cologne) who study neurophysiology.



A fluorescent confocal image of a segment of the central nervous system of a crayfish. The neuron dyed green helps produce rhythmic control signals that coordinate the motion of crayfishes' swimming limbs. The neuron dyed red is a downstream power-stroke motor neuron; it innervates the muscle activities. Scale bar: 1 micrometer. Image courtesy of Dr. Carmen Wellmann (University of Cologne)



A snapshot of a 3D fluid-structure interaction simulation using the immersed boundary method with adaptive mesh refinement (IBAMR). Each cell in the mesh adapts its size automatically so that smaller cells are used in areas with higher vorticity.

Calvin Zhang *is a tenure-track assistant professor working on mathematical biology. He received his Ph.D. from UC Davis, and taught at the Courant Institute of Mathematical Sciences, NYU, prior to joining our department in 2016. His current research interests include mathematical aspects of synaptic transmission, and rhythmic motor pattern generation.*

Contact him at **calvinz@math.arizona.edu**

FEATUREARTICLE

BIOGRAPHIES

Guanying Peng grew up in northeast China and attended high school and college in Beijing. He completed his Ph.D. at Purdue University in 2014. Before joining the University of Arizona, he spent three years as a Visiting Assistant Professor at the University of Cincinnati. His research interests are in nonlinear partial differential equations and calculus of variations, with a focus on understanding models describing defects in certain materials. In his spare time, he enjoys traveling and playing board games.

Dulip Piyaratne grew up in Sri Lanka - the small island known as the pearl of the Indian Ocean. He studied in Sri Lanka and in England for his undergraduate studies. He obtained his Ph.D. in Mathematics at the University of Edinburgh, Scotland in 2014. After his doctoral studies, Dulip spent almost 3 years in Japan as a postdoc at the Kavli IPMU of the University of Tokyo. From Japan, he moved directly to the University of Arizona to start his second postdoctoral research position. Dulip's main research interests lie in Algebraic Geometry. In particular, he is interested in studying geometry of algebraic varieties using homological algebraic methods. Outside of mathematics, he enjoys hiking, cycling, and playing badminton.

Eugenia Rosu grew up in Iasi, Romania. She pursued an undergraduate degree in Bremen, Germany and completed her Ph.D. in 2017 at UC Berkeley. Her research lies in the area of number theory, with a focus on elliptic curves and automorphic representations. In her free time, Eugenia enjoys rock climbing, hiking, painting, reading, and going to live music concerts.

Jianfei Xue grew up in Jiangsu, China. He obtained his Ph.D. from the University of Missouri in the spring of 2017. Jianfei's research interests are mainly in fluid dynamics and probability theory. Outside of work, he enjoys reading, hiking, and running.

Minh Kha was born and grew up in Ho Chi Minh City, Vietnam. He completed his Ph.D. at Texas A&M University in August 2017. His research focuses on spectral theory of differential equations with applications in other fields such as mathematical physics and material sciences, especially in studying spectral properties of periodic operators on manifolds and graphs. Outside of mathematics, he enjoys reading books, playing video games and soccer, listening to good music, and traveling.

continued on page 11

Donna Krawczyk, MAA Haimo Teaching Award Winner 2017 (Southwestern Section)

By Deb Hughes Hallett

On April 7, 2017, Donna Krawczyk was awarded the Southwestern MAA section's Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching.

Donna has shaped and inspired our department's teaching for many years.

Starting at the level of the individual student, Donna's ability to convert math sceptics into math aficionados, or even into math majors is legendary. How does she do this? By truly understanding her students' thought processes, and by having the skill to intervene. She takes students who have, until then, learned mathematics by rote and converts them into conceptual thinkers. In the classroom, she guides her students with calmness and respect through the thinking process—all with a freshness as though she has never done it before. The results have been startling for decades. By showing students they can reason mathematically, Donna greatly increases students' confidence.

Donna Krawcyzk receiving 2017 MAA Haimo Teaching Award, Southwestern Section, for distinguished university teaching.

In addition to being a superb teacher, and an equally superb teacher of teachers, Donna is a tireless innovator. Her goal is always to do better for our students. She was using group work and creating interactive classrooms before most faculty discovered either one.

Years ago, she designed ways to use graphing calculators to deepen students' understanding. More recently, she responded to the needs of students at a distance by designing an online calculus sequence. This was done with the enthusiastic backing of the university, but a budget of zero. She did it all with the people and tools we have, plus public domain software. Two areas of the course required particular innovation: giving the common final online, and providing video substitutes for lectures. She converted the exams and made all the videos herself, showing students how to think through the ideas and solve problems. The videos are remarkable for their calm clarity. Jason Hung, who took calculus online, wrote

"The videos by Prof. Donna Krawczyk are incredibly helpful... I believe because of these videos, Calculus instruction over the internet is possible."

Professor Scott Williams, now at the University of Central Oklahoma (UCO), but previously a graduate student at the University of Arizona, writes "I strive to be the Donna at UCO". Professor Francie Bostwick at Southern Oregon University, herself recognized for leadership by Nation Council of Teachers of Mathematics (NCTM), describes how she uses her experience in Donna's class to inspire her current student teachers.

UA Mathematics is honored to have had Donna as a lecturer since 1986. Congratulations Donna.

Deb Hughes Hallett *is a professor in the Department of Mathematics at the University of Arizona and at the Harvard Kennedy School of Government. She is a pioneer of calculus curriculum reform, and the lead author of the Calculus Consortium textbook series.*

Contact her at **dhh@math.arizona.edu**

Southwest Center
for Arithmetic Geometry
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Modular curves and cyclotomic fields
Christopher Skinner
Iwasawa theory, modular forms,
and elliptic curves
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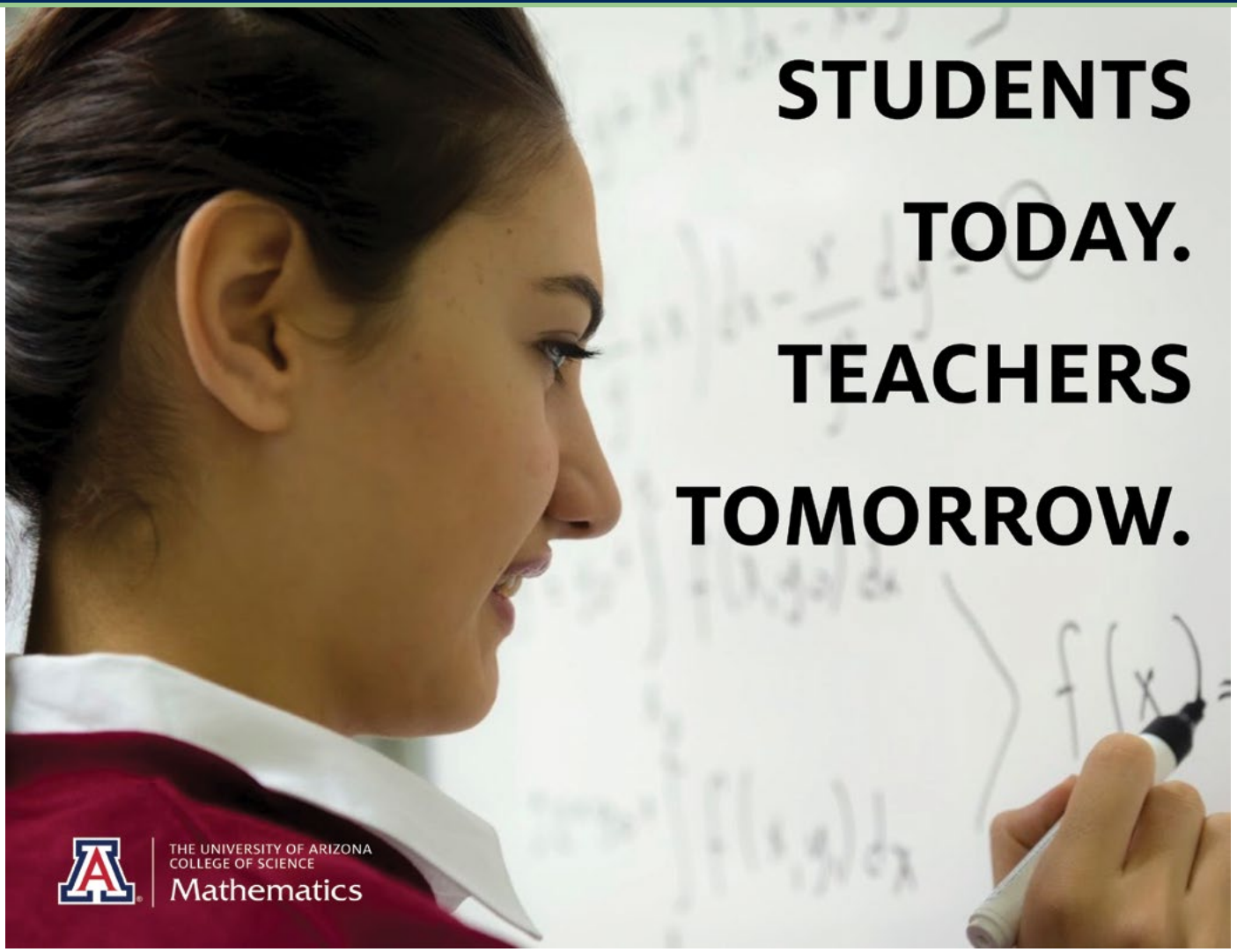

SUPPORT THE SECONDARY MATHEMATICS EDUCATION PROGRAM (SMEP), THE *ONLY* UNDERGRADUATE PROGRAM PREPARING ARIZONA MATH MAJORS TO BECOME CERTIFIED TEACHERS AT THE SECONDARY LEVEL.

At UA Mathematics, we're educating the teachers of tomorrow. Through SMEP, future teachers gain a strong foundation in mathematics and teaching, and upon graduation, are thoroughly prepared to inspire students wherever they teach. This has never been more important. The U.S. has an alarming shortage of mathematics teachers, and in Arizona, many schools fail to fill their classrooms with qualified candidates. The result? Thousands of students that struggle to thrive in our increasingly mathematics-driven world.

Unlike most programs, ours emphasizes both mathematics and teaching, giving future teachers a deep understanding of core concepts to teach effectively and with full engagement. The program culminates in action, with students interning as full-time teachers in the secondary classroom. But we do more than educate the best teachers. We're visiting high school mathematics classes, attending career fairs, and encouraging young people to pursue futures in the critical field of STEM education. By casting this wide net, we ensure that talented individuals consider a rewarding career in teaching.

PHILANTHROPIC OPPORTUNITIES

FUND A FUTURE TEACHER—Becoming a dynamic teacher is demanding. Support relieves student expenses, allowing full dedication of their hearts and minds to teaching. **$15K** supports one student annually. An endowment of **$375K** extends that support into perpetuity.

SUMMER INTERNSHIPS—Delivering intensive internships that elevate the teaching experience. **$4K** provides two student internships.

AFTERSCHOOL PROGRAM—Our students work with middle schoolers, leading engaging activities and exploring their passions for teaching. **$3K** implements one afterschool program.

PROFESSIONAL DEVELOPMENT SEMINARS—Sending future teachers to professional teaching seminars, enriching their experience, and connecting them with teachers and school districts across the state. **$1K** provides seminars for 12 students annually.

"Behind every exceptional person, there is an exceptional teacher." —Stephen Hawking

QUICK STATS

- 100% of our graduates receive offers for employment!
- The majority of graduates stay to work in Tucson, a community deeply in need of more qualified mathematics teachers.
- We've graduated 161 exceptional math teachers since 2003.
- The best and only Secondary Teacher Education program in the UA College of Science

TO LEARN MORE, CONTACT:

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Director, External Relations & Evaluation
School of Mathematical Sciences
guada@math.arizona.edu
520.621.1562

COLLEGE OF SCIENCE
Mathematics
Secondary Mathematics Education Program

Supporting Diversity and Inclusivity: UA's New Chapter of the Association for Women in Mathematics

By Hannah Biegel

From left to right: Hannah Biegel (Secretary), Rachel Oliver (President), Angela Kraft (Treasurer), and Angelica Gonzalez (Vice President)

In August 2016, Mathematics Ph.D. student Angelica Gonzalez and a few postdocs worked hard to start a new student chapter of the Association for Women in Mathematics (AWM). "We wanted to start a program that would support women and underrepresented groups in the department. We wanted everyone - undergraduates, graduate students, postdocs, etc. - to be visible to each other and we wanted to provide the professional support to our members. We also wanted to promote an inclusive mathematics community within our department," said Angelica.

Since its creation, UA's Chapter of AWM has been working towards these goals of inclusivity. In April 2017, AWM hosted a gender-bias workshop facilitated by Dr. Rosalie Belanger-Rioux from Harvard University. During the workshop, diverse faculty and student participants discussed hypothetical situations that addressed gender bias in the university workplace. Since the workshop, these conversations have continued among members of AWM and the greater math community.

AWM is also a presence outside of the university. During the Tucson March for Science event in April 2017, Rachel Oliver, Mathematics Ph.D. student and president of the chapter, organized a booth geared at engaging children with fun math-related activities. With face painting and math puzzles, AWM's booth was enjoyed by both young and old. This interaction with the broader Tucson community, also helped AWM establish contacts in industry and schools citywide.

Some of the UA Chapter's other events include a meet-and-greet during the recruitment weekend for prospective graduate students, and tea and cookie events with invited colloquium speakers from other universities. More recently, AWM has begun monthly brown-bag lunches open to all people affiliated with the Department of Mathematics. In addition to these events, AWM is organizing a graduate school panel for the undergraduate students in the math department and an industry jobs panel for undergraduate and graduate students.

Even though the UA Chapter of AWM is less than two years old, its members have already begun to create an environment that supports the organic development of relationships among members of the Department of Mathematics at UA as well as mathematicians across the country.

In the future, UA's Chapter of AWM hopes to become a resource for professional development and networking and a forum where conversations about diversity in mathematics can continue to safely take place.

If you would like to hear more about AWM and their events, we encourage you to contact us. ▲

Hannah Biegel *is a third year graduate student in the Mathematics Ph.D. program at the University of Arizona. She is currently serving as the Secretary for UA's Chapter of AWM.*

Contact her at **hbiegel@math.arizona.edu**

BIOGRAPHIES

continued from page 7

Faryad Sahneh received a doctoral degree in electrical engineering in 2014 from Kansas State University. In August 2014, he joined the ECE department at K-State as a Research Assistant Professor. From July 2016 to August 2017, he was a visiting faculty member and lecturer at the school of computing at the Georgia Institute of Technology. He has recently joined the math department at University of Arizona as a part of the TRIPODS project, a multidisciplinary endeavor on developing theoretical foundations for data science. His research interests are on large-scale analysis of network data, spectral and algorithmic graph theory, and mathematical modeling of biological systems.

Appointed Personnel

Rodrigo Gutiérrez, originally from Venezuela, has committed the past 20 years to mathematics education for English learners and Latino students. He previously taught middle and high school mathematics and directed an educational non-profit for under-served students of color. After receiving his doctorate from UA as a fellow for the Center for the Mathematics Education of Latinos/as (CEMELA), he spent 6 years as Clinical Faculty with University of Maryland's Center for Mathematics Education, where he partnered with school districts to provide professional development on teaching mathematics with English learners. Rodrigo recently returned to UA as Co-Director for the Center for Recruitment and Retention of Mathematics Teachers, which provides numerous services to local classroom teachers, including the largest AZ conference on mathematics education (MEAD Conference). When not at work, Rodrigo and his wife (UA College of Education faculty) spend all of their time chasing after their three lovely daughters.

Staff

Melanie Bowman is the Program Coordinator for the Statistics GIDP. She is originally from Minnesota but has lived near Albany, NY for the last 22 years. Melanie completed her BS in Business from The College of Saint Rose in Albany while working as Assistant to the Dean of Arts & Humanities and Director of the Pre-College Experience. Melanie and her husband enjoy traveling and hiking.

Michelle Ort grew up in the Midwest and received her BA in foreign languages from the College of Wooster in 2009, followed by an MA in math from Indiana University in 2015. In between, she has lived everywhere from California to China, exploring interests in outdoor work, linguistics, education, and more. She decided to settle down for a while in the Southwest and couldn't be happier to be a part of the UA Math Department.

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• Employer: Samsung Insurance, Seoul, Korea.

Gleb Zhelezov
Coalescing Particle Systems. Applications to Nonlinear Fokker-Planck Equations.
• Advisor: Ibrahim Fatkullin.
• Employer: Case Western Reserve University, Cleveland, OH.
• Position: Postdoctoral Researcher, Department of Biology.

Master Degrees

Arias Hathaway Turner
Understanding Reform: A Study of the Standards Movement in Mathematics Education.
• Advisor: Marta Civil.