FACULTY newsletter

CPMS Physical and Mathematical Sciences

Math Professor Earns AMS Award for CURM Program

Above:. Professor Michael Dorff demonstrates concepts using visual aids.

On average, 63 percent of students involved in Professor Michael Dorff's nationwide CURM (Center for Undergraduate Research in Mathematics) program go on to graduate school.

In these same students' entire university math departments, only 18 percent of students pursue graduate studies. Comparing these percentages, it's easy to see that CURM is a game changer.

CURM was founded in 2007 by mathematics professor Michael Dorff in an effort to give students at other universities the same kind of research experience offered at BYU.

He and co-director Professor Tyler Jarvis have been so successful at meeting this goal that CURM has received the 2015 "Program that Makes a Difference" Award from the American Mathematical Society (AMS).

The AMS gives only one or two of these honors each year, and it chooses programs that have developed successful, replicable models for supporting students from minority backgrounds in earning advanced degrees.

"I feel really honored for [the award]," Dorff said. "It's a great recognition for BYU, for the college, and for the Department of Mathematics."

Discovering Infectious Ideas at TEDx BYU

When it comes to solving social issues, BYU has plenty of ideas worth spreading.

Provo once again had the opportunity to celebrate the most innovative minds in Utah Valley on April 9 at TEDxBYU, hosted and organized by the BYU Ballard Center. Audience members heard "infectious ideas" on subjects such as driverless cars, global poverty alleviation, social entrepreneurship, and compassion.

The lineup of speakers included Jani Radebaugh, an associate professor in the Department of Geological Sciences, who spoke on using exploration to increase our knowledge of the Solar System. She is the first scientist to be invited to speak at TEDxBYU.

Radebaugh is a planetary scientist, who researches the shapes and origins of landscapes in our solar system. Because it is difficult to understand landscapes in space, and we have limited information, Radebaugh studies similar geological features on Earth's surface to gain insight into how the same physical processes might have occurred on other planets.

Over her career, she has done fieldwork in such places as the Egyptian Sahara, the Arabian Peninsula, the Ethiopian Afar Rift Valley, Hawaii, the desert southwestern US, and Antarctica. Currently, her research focuses on the geological features on Saturn's moon Titan and Jupiter's moon Io. Radebaugh uses images obtained from orbiting space-

Above: Janie Radebaugh was a speaker featured at TEDxBYU.

craft to better understand the physical landscapes of these moons.

A graduate of the College of Physical and Mathematical Sciences herself, Radebaugh earned her bachelor's and master's degrees from BYU and her PhD at the University of Arizona Lunar

Teaching Moment

Dr. Kent Gee has been able to make his classroom a more exciting environment for his students by involving them and by implementing spontaneity into his teaching. Using these strategies, he has shown his students that he is not only teaching—he is learning, too.

"The single best thing that I have done is to embrace spontaneity in the classroom," said Kent. Whether he is making a spur-of-the-moment gospel connection or turning a scripted demonstration into an interactive experiment, Kent and his students are all learning together.

"The moment the students realize that you're learning right along with them while leading the discussion, they feel a powerful connection to the material."

BYU Welcomes Statistics Specialist Dr. Sudipto Banerjee

Above: Students add to their stastical knowledge.

This year at the 40th Annual Summer Institute of Applied Statistics, professors, professionals, and graduate students will have the opportunity to add to their statistical knowledge and skills.

The Summer Institute is hosted by the Department of Statistics and will be held from June 17 to June 19 in room 120 of the Tanner Building. This year's presenter is Dr. Sudipto Banerjee from UCLA.

Banerjee received his bachelors and masters of statistics in India, and his doctorate in Connecticut. His research includes statistical modeling and analysis of geographically referenced datasets, Bayesian statistics and hierarchical modeling, and statistical computing and related software development. Banerjee has received various honors and awards throughout his career.

The seminar will provide an introduction to hierarchical modeling and related statistical methods for analyzing spatially correlated data. Banerjee will begin by outlining and providing illustrative examples of the three types of spatial data: point-level (geostatistical), areal (lattice), and spatial point patterns.

Banerjee will describe exploratory data analysis tools followed by traditional modeling approaches for point-referenced data. Subsequently, the statistics department will introduce fully model-based approaches emphasizing upon Bayesian inference and computing. The department will include hierar-chical modeling for both univariate and multivariate spatial response data, a discussion of spatial point process models, and spatial modeling for large data sets (the "big N problem"). Examples from environmental sciences and public health will be illustrated using R packages such as spBayes and the Open-BUGS software.

The Summer Institute originated in 1976, after BYU statistics professors Gale Bryce and Dennis Tolley met in Durham, N.C., where they discussed the advantages of sharing research projects with peers. Since then, the statistics department has hosted Summer Institute annually.

Over the past 40 years, well-known statisticians from around the globe have presented at the Summer Institute. In the last few years, the Summer Institute has focused on expertise from faculty in the statistics department who have presented to various groups of professors, students, and professionals.

Participants need to register online before June 5, 2015. Check-ins begin on June 17 at 8:30 a.m. just outside of room 120 in the Tanner Building. The workshops will continue through June 19. Refreshments are provided, along with a dinner at Magleby's Restaurant in Springville on Thursday, June 18. A closing luncheon will be held in the Gordon B. Hinckley Alumni and Visitors Center. Check the schedule online at stastistics.byu.edu for more information.

By Camilla Stimpson

Faculty Funding & Publications Goals

Percent of Faculty with Funding/Proposals in 2015

GOAL!

*as of May 20, 2015

Percent of Faculty with Publications

GOAL!

*as of May 21, 2015

By Small and Simple Magnets Are Great Things Brought to Pass

Above: Karine Chesnel shows some of the many tools used in her research

Studying magnetic behaviors on a microscopic scale can make a gigantic impact on modern science.

Physics professor Karine Chesnel does research on the magnetic properties of nanoparticles.

"We are studying the magnetic behavior of magnetic materials at a very small scale." Chesnel said. "We are trying to understand where their magnetism is coming from."

Nanomagnets are found all around us and we may not even be aware of it. According to Chesnel, the hard drives in our computers use nanomagnetic domains in thin films to store information.

Magnetic nanoparticles are also used in medicine.

"Nowadays, nanoparticles are increasingly used in medical applications, for example they can be functionalized in order to deliver drugs in the body to treat tumors or cancers," Chesnel said. "Using an external magnetic field, one can inject nanoparticles inside the body and move them to a certain region of the body to treat a tumor."

Chesnel and her students regularly perform their research at the Stanford Linear Accelerator Center (SLAC) synchrotron. For many students, this is a once-in-a-lifetime opportunity.

"Bringing students to synchrotron facilities has been a great experience for them." Chesnel said, "Usually, it's a place where you find mostly expert scientists, not too many undergraduate students."

Chesnel has seen many of her students participate in research and experiments, analyze data, and become experts in their own field. Watching them grow is a fulfilling experience.

"Working with students and seeing them progress has been a very rewarding part of my research." Chesnel said, "I see an evolution [in my students]."

Chesnel and her students recently published an article, "Orbital and Spin moments of 5 to 11 nm Fe304 nanoparticles measured via XMCD."

"It has been rewarding," Chesnel said, "to see papers published and students being involved in those papers."

By Camilla Stimpson

AMS Award

The CURM program is funded by the National Science Foundation, and it offers grants to fund student research groups at different universities. Dorff said that he basically took the BYU research model and applied it to other schools.

"This is in some ways a service component," he said. "We're helping other universities and other professors, and we get to bring them to BYU."

For professors to apply to the program, they need to be working with a group of two or more students. In recent years, they have had as many as five times as many applicants as spots available in the program.

"We require the professors to do research in math with a group of students," Dorff said. "It's modeled like a laboratory science."

With a focus on underrepresented groups in mathematics, these grants give students opportunities they wouldn't otherwise have to become involved in meaningful research. Each student is required to write a paper and present at the CURM spring research conference at the end of the program.

Since CURM's inception, it has offered support to 304 undergraduate students from over 70 universities. These students have authored 130 joint research papers and given 311 conference presentations.

Dorff received his doctoral degree in complex analysis from the University of Kentucky in 1997. He started the BYU "Careers in Math" speaker series and has earned the BYU Maeser Excellence in Teaching Award. In 2010, he received the Mathematical Association of America's Haimo Teaching Award for successful and influential mathematics teaching.

Dorff has always loved math and problem solving and said he sees math as a puzzle or a game. He has spent his career sharing this love with students and looking for other ways to serve. Recently, he started another NSF-funded project to prepare students for industrial careers in math. His focus is always on the success of students, even those who don't attend BYU.

"What's the BYU motto? It's 'Enter to learn, go forth to serve,'" he said. "We're serving other people, helping them out, and I think that shows a good message of BYU."

By Jennifer Johnson

TEDx BYU

and Planetary Laboratory.

Radebaugh began her talk by recounting a recent expedition to Erta Ale, a large basaltic shield volcano in northern Ethiopia. Accompanied by her Ethiopian guide, who was carrying an AK-47 on his shoulder and had a belt of hand grenades around his waist, Radebaugh and her team of travelers made it to the top of the volcanic mountain to view a large lava lake in the center of the volcano.

"The smell of rotten eggs is my favorite smell because I know I'm either on a volcano or near a hot springs," Radebaugh joked.

Many have asked her why she would make such a dangerous journey just to stand on top of a live volcano. The first reason, Radebaugh said, is her love of adventure.

"We explore and endure and maybe even enjoy the journey so we can make discoveries," she said.

Radebaugh applied the knowledge she gained about volcanoes and lava lakes from Erta Ale to better understand Jupiter's moon Io, which is also covered in active volcanoes. Scientists can also use their knowledge of physical processes on Io to better understand physical processes on Earth and throughout the solar system.

"When we prioritize exploration, then we are inspired, and new and exciting discoveries can occur," she said.

Similarly, Saturn's moon Titan has an atmosphere that is so cold that the methane on its surface is contained in a liquid sea called Kraken Mare, similar to Earth's oceans. Titan also has sand dunes and deserts that can be better understood through the study of Earth's great deserts.

In our search for knowledge, Radebaugh reminded her audience to allow their goals and understanding to change over time with experience.

"We must remain open minded so we can be ready to discover whatever is there for us to see," she said. "Our own Earth has many more secrets waiting for our discovery."

By Meg Monk

College Publications

Chemistry and Biochemistry

F. Yang, C.A. Jones, & **D.V. Dearden**, "Effects of kinetic energy and collision gas on measurement of cross sections by Fourier transform ion cyclotron resonance mass spectrometry," *International Journal of Mass Spectrometry* (2015), Volume 378, pp. 143-150.

D. Henderson, "Gone but not forgotten", Condensed Matter Physcis (2015), Volume 18, Issue 1, pp. 1-7.

M.K. Transtrum, **L.D. Hansen**, & C. Quinn, "Enzyme kinetics determined by single-injection isothermal titration calorimetry", *Methods* (2015). Volume 76, pp. 194-200.

Mathematics Education

B.A. Herbel-Eisenmann, D. Wagner, **K.R. Johnson**, H. Suh, & H. Figueras, "Positioning in mathematics education: revelations on an imported theory", *Educational Studies in Mathematics*, (2015), Volume 89, Issue 2, pp. 185-204.

K.R. Leatham, "Observations on Citation Practices in Mathematics Education Research", *Journal for Research in Mathematics Education* (2015), Volume 46, Issue 3, pp. 253-269.

D. Teuscher, K.C. Moore, & M.P. Carlson, "Decentering: A construct to analyze and explain teacher actions as they relate to student thinking", *Journal of Mathematics Teacher Education* (2015), pp. 1-24.

D. Teuscher, D. Tran, & B.J. Reys, "Common Core State Standards in the Middle Grades: What's New in the Geometry Domain and How can Teachers Support Student Learning?", *School Science and Mathematics* (2015), Volume 115, Issue 1, pp. 4-13.

Physics and Astronomy

M.K. Transtrum, **L.D. Hansen**, & C. Quinn, "Enzyme kinetics determined by single-injection isothermal titration calorimetry", *Methods* (2015). Volume 76, pp. 194-200.

Statistics

M.J. Heaton, S.R. Sain, A.J. Monaghan, O.V. Wilhelmi, & M.H. Hayden, "An Analysis of an Incomplete Marked Point Pattern of Heat-Related 911 Calls", *Journal of the American Statistical Association* (2015), Volume 110, Issue 509, pp. 123-135.

K. Kaufeld, **M.J. Heaton**, & S.R. Sain, "A Spatio-Temporal Model for Mountain Pine Beetle Damage", *Journal of Agricultural, Biological, and Environmental Statistics* (2014), Volume 19, Issue 4, pp. 437-450.

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