



Doing the Math: Department Uses Blended Teaching Approach



Diane Rivard, (left) and Shirin Malekpour, (right) help Math 112 students with individual assignments.

Sarah Bocking-Conrad's lesson begins with a reminder about an upcoming exam.

Then it's on to a handful of example problems dealing with sequences and geometric series. She moves from white board to white board — they form the perimeter of the classroom — as her students look on from six-seat computer pods.

After about a half hour, Bocking-Conrad is finished with her material and turns the reins over to the students: the remaining 45 minutes of class is theirs to spend working on their computer-based homework. But Bocking-Conrad is still present, available to consult with anyone who runs into a particularly challenging question.

This is how Math 112 and two other introductory-level mathematics courses are taught at the University of Wisconsin-Madison these days. The combination of computer-based learning and

classroom discussion is quite a departure from how UW-Madison students previously achieved basic math proficiency.

Bocking-Conrad, the teaching assistant's coordinator for Math 112, describes the course's previous format — small sections taught in a 50-minute lecture format three times a week — as a race to cover all the material.

"It was a grueling course for both the students and the instructors," she says.

But the Department of Mathematics wanted to create a more active learning experience for students and began piloting the new format several years ago.

That effort, spearheaded by Shirin Malekpour and Diane Rivard, the co-coordinators of the three courses, coincided with the construction of the WisCEL (Wisconsin Collaboratory for Enhanced Learning) on the third floor of College Library. WisCEL spaces at

College Library and Wendt Commons Library opened in February. This is the first semester when all sections of Math 95, 101 and 112 have operated under the revamped structure.

The core components of the new approach are the WisCEL space, which promotes a spirit of collaboration and discussion; and the computer software, a customized version of MyLabsPlus by Pearson Education, the third piece of software that the department tested during the pilot phase. The web-based software — students can access it from anywhere via the Internet — allows for instant feedback and increased accountability.

Students immediately see whether or not they've answered a problem correctly and are offered options for help if they're stumped. (For example, if students click the "Help me solve this" button, the software will run through a similar problem.) They must solve 80 percent of their homework problems to progress to quizzes, ensuring that they've sufficiently understood the material.

When it comes time to study for exams, the software even generates an individualized "study plan" based on topics they've struggled with — say, linear inequalities or quadratic equations — in their homework. Malekpour and Rivard are also able to mine that data when meeting with students, drafting lesson plans for their teaching assistants, or creating exams.

First-year student Alicia Dominy, who's taking Math 112 this semester, admits she was skeptical about the computer-based nature of the course, but has found the software easy to use. "It's going a lot better than I thought it would," she says.

These aren't online classes, though;

Continued on page 2

From the Chair

Dear Alumni and Friends,

I am very happy to be back in the chair's office once again, and proud to report on the many exciting developments taking place in the Department of Mathematics.

It is both an exciting and an uncertain time in higher education, but one thing that seems clear is that the rigorous training in quantitative and logical thinking that a math major provides will continue to be in demand. That's clearly how UW students see it: the number of math majors at Wisconsin has more than doubled, from 170 to more than 350 in just a few years. Many of these majors are double majors, reflecting the extent to which mathematical techniques have become intertwined with other fields. Our aim, as always, is to offer an undergraduate program that can train not only academic mathematicians but also leaders in industry, government, and science who bring the ideas of mathematics to bear on their respective fields.

We are especially proud of the WisCEL program, a blended learning center where we instruct students via a combination of online materials, discussion, and traditional lectures. Thanks to the leadership and dedication of Shirin Malekpour and Diane Rivard, the wish for a more accessible Math 095-101-112 sequence is now a reality, and student achievement is higher than ever.

Shirin Malekpour notes that the real "aha" moment came when the staff changed "office hours" to lab hours. Suddenly students saw the WisCEL lab as less of a place where they could only go for help to a place where they

could study, and help would be available should they need it. This made the lab hours very well attended. Students enjoyed the availability of TAs for one-on-one interactions, and the instructors enjoyed the ability to personally interact with their students.

The outcome has been very positive: the center's mastery-based approach is increasing minority student grades substantially in comparison to their non-minority cohorts, reversing a long trend. This approach will certainly impact mathematics education at this university for years to come. Read more about this on our front page.

The department is also expanding its global reach as part of our deepening partnership with Shanghai Jiao Tong University (SJTU). The reputation of the University of Wisconsin math department is already very high in China, with close to one hundred Chinese students applying for our Ph.D. program every year. Now we are extending our educational partnership to the advanced undergraduate level.

In Fall 2013, about 20 undergraduate seniors from SJTU will join the department as Visiting International Scholars through a partnership between the UW-Madison and SJTU math departments and the UW-Madison Division of Continuing Studies. It is expected that some of the SJTU seniors will spend a second year at UW-Madison as students in the master's program Foundations of Advanced Studies (inaugural year 2014–15), before continuing on to Ph.D. programs. The path for the partnership was paved by Shi Jin during his tenure as chair (2008–11).

Our successes in training students are not limited to just undergraduate

instruction. A group of faculty members led by Sasha Kiselev recently won a Research and Training Grant (RTG) from the NSF in order to continue and enlarge their success in training new researchers in analysis and applications. They join the number theory and algebraic geometry group, which is applying for a renewal of a RTG that ends next fall. In this era of diminished state funding, we are doing everything we can to find outside sources to support the educational and research missions of the department.

We continue to reach out to the community and to students outside of our department. With the Wisconsin Talent Search (now in its 50th year of operation!), we help cultivate mathematical talent among young people all around the state, some of whom eventually come to the UW to study, and others of whom are launched to college elsewhere. Locally, we continue to run the Mega Math Meet for middle school students in and around Madison, and of course, we educate many local high school students in our undergraduate courses, which are open to any student in the state who has exhausted the mathematical curriculum of his or her high school.

Sadly, we say adieu to one of our great leaders... Emeritus Professor Mary Ellen Rudin was a great resource and wonderful mentor to both our emerging and established faculty. Her personal touch with every member of the department will be greatly missed.

Sincerely,



Leslie Smith, Chair

Math, from page 1

rather, they follow a blended learning model. Instructors cover select homework problems, chosen by Rivard to ensure uniformity across sections, during the "lecture" portion of class. The bulk of the time is budgeted for students to begin their homework while they have resources — their instructors and their peers — available for help.

"The students do the math," Rivard says. "They don't watch somebody, so it's very active. Usually, when you are in a lecture and it's an hour and 15 minutes, you watch somebody doing it for you. Here, most of the time should be spent on doing the problems and asking questions."

— Tom Ziemer

The Vector was printed using gifts from alumni and friends.

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A Taste of MCM

This is the first year when teams from UW-Madison competed in the Mathematical Contest in Modeling (MCM). In this contest, two real-world problems are released worldwide at the same moment in late January. Teams of three undergraduates choose one of these problems and have only 96 hours to develop a mathematical model, derive and/or compute solutions, and present the results in a formal paper.

The problems are designed to be open ended, so clarity, analysis, and design are of critical importance. Competing in the MCM is a great opportunity and a real challenge: more than 4,000 teams from 17 countries participate in the contest each year! The contest results will be released in late April. Five teams of three undergraduate students represented the Badgers this year. Min Zhang, Yiding Xu, and Xinyun Rong worked on the problem of optimizing water treatment, storage, and conservation strategies for the projected needs of Saudi Arabia in 2025. Min Zhang shares her experience below.

Endless Excitement

It was my first time competing in such a contest. None of my teammates had experience in modeling. Even though we knew we were facing dramatic challenges, we just took a second to decide we were all in, because we have passion in mathematics and are also interested in using math to solve real-life problems. From the moment we saw the problem, we became very excited. Without passion, we could not have finished a polished, 30-page paper in 96 hours. Without excitement, we could not have slept for less than five hours per day throughout the competition.

Creative Brainstorming

The MCM was not only about using our knowledge to solve a problem, but was also about being creative. In this contest, we chose a problem about determining an effective and cost-efficient water strategy for Saudi Arabia to address water storage, movement, desalinization, and conservation. Based on our knowledge and research, we designed models



COURTESY OF MIN ZHANG

From left: Yiding Xu, Xinyun Rong, and Min Zhang competed in the Mathematical Contest in Modeling (MCM).

in different areas, including economics, statistics, mathematics, geography, and computer science. It was challenging to dig out everything we know from various fields.

Effective Cooperation

I understand better now how important cooperation can be. From the preparation stage to the action stage, we were focused on enhancing our effectiveness by cooperating well as a team. In preparation for the contest, we formed a clear plan about assigning different tasks to different people based on our backgrounds and strengths. I was our team's lead writer because I am a logical person, and I am good at explaining things clearly. During the competition, we were

constantly in contact to make sure we were all on the same page. In addition, my teammates and I established a profound friendship through such a great cooperation. Competing in the MCM gave me a great learning experience and offered me a picture of how math can be applied to every aspect of our lives. It is definitely a valuable contest for more college students at UW-Madison to experience. In the end, I want to thank Professor Spagnolie for informing us about the opportunity and supporting us in the contest. For more information, visit <http://go.wisc.edu/2wdy2w>.

by (Jasmine) Min Zhang
UW-Madison, Class of 2013
Majors: Mathematics and Economics

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New Faculty

Dima Arinkin

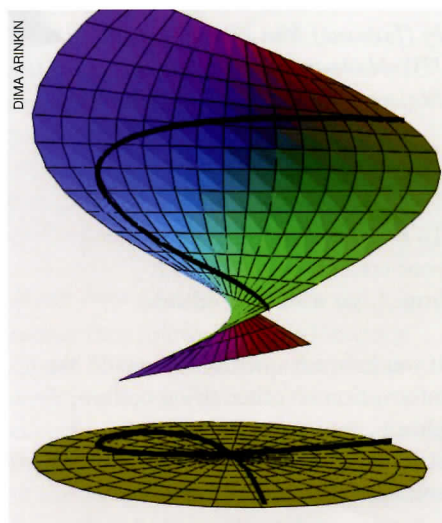
Dmytro “Dima” Arinkin is the son of two physicists, so it’s no surprise that he became interested in mathematics at a young age. He won a gold medal with a perfect score at the 1992 International Mathematical Olympiad before studying math at Kharkov State University in his home city of Kharkov, the second largest city in Ukraine.

Arinkin came to the United States for graduate school and earned his Ph.D. from Harvard in 2002. Since then, he’s made stops at the University of Chicago, California Institute of Technology, North Carolina-Chapel Hill, and the Institute for Advanced Study before joining the UW-Madison Department of Mathematics in August.

He works in the field of algebraic geometry. It is exciting because of the way it combines several points of view: it originated as a combination of algebra and geometry, and now there are insights coming from physics, number theory, representation theory, and other areas.

Sebastien Roch

Sebastien Roch joins the UW-Madison Department of Mathematics after spending three years as an assistant professor at UCLA. Prior to that, Roch completed his Ph.D. at California-Berkeley and served as a postdoctoral researcher at Microsoft Research.



Dmytro “Dima” Arinkin works in the field of algebraic geometry.

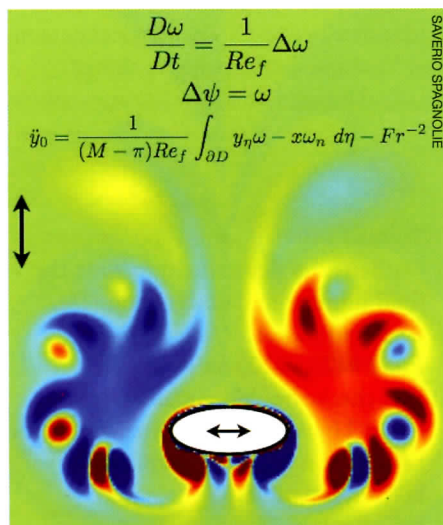
Roch also holds degrees in engineering from the École Polytechnique in Palaiseau, France, and in engineering physics and applied mathematics and operations research from the École Polytechnique de Montréal in Montréal. His work is supported by two National Science Foundation grants and an Alfred P. Sloan Research Fellowship.

His research involves chance. Chance plays a key role in evolution. Using techniques from probability theory, he studies the role of randomness in evolution through mathematical modeling and the development of statistical and computational methods to reconstruct evolutionary history.

Saverio Spagnolie

Saverio Spagnolie arrives at the University of Wisconsin-Madison as an assistant professor of mathematics after a year at Brown University’s School of Engineering as a postdoctoral research associate. Before his time at the Ivy League school in Providence, Rhode Island, the Colorado native spent three years at the University of California-San Diego as a postdoctoral researcher in the school’s Department of Mechanical and Aerospace Engineering.

Spagnolie, who obtained his bachelor’s degree from the University of Colorado and his master’s degree and Ph.D. from New York University, was



Saverio Spagnolie is interested in solving problems related to biological propulsion, cell mechanics, and fluid-body interaction systems.

hired with funding from the Madison Initiative for Undergraduates.

He is interested in solving problems related to biological propulsion, cell mechanics, and fluid-body interaction systems. He approaches these problems using a number of techniques, from the application of classical methods of applied mathematics to the development of novel numerical methods.

Betsy Stovall

Stovall has joined the Department of Mathematics as an assistant professor after living in either Georgia or California for her entire life. Stovall, who was hired using funding from the Madison Initiative for Undergraduates, comes to the University of Wisconsin-Madison after three years as an associate adjunct professor at the University of California-Los Angeles. She completed her undergraduate studies at Emory University in Atlanta and obtained her Ph.D. from the University of California-Berkeley.

Her research field is analysis, and many of the things she studies are very closely connected to the mathematics covered in multivariable calculus. More specifically, she studies partial differential equations as well as integrals along curves (think of a circle in the plane or a slinky in space) and surfaces (think of the surface of a globe).

Bing Wang

After four years away, Bing Wang is back at the University of Wisconsin-Madison, this time as an assistant professor in the Department of Mathematics.

Wang earned his Ph.D. in mathematics from UW-Madison in 2008. He worked as an instructor at Princeton University from 2008 to 2011, then spent a year as a research assistant professor at Stony Brook University’s Simons Center for Geometry and Physics.

His research focuses on geometric flows and their applications. Geometric flows are guided by some evolution equations. They evolve the spaces into good shapes, which are easier to understand. For example, a Ricci flow is a successful geometric flow.



Mary Ellen Rudin Recalls the 1963 Dedication of Van Vleck Hall

— Yvonne Nagel

In a recent conversation, Mary Ellen Rudin recalled the dedication ceremony for Van Vleck Hall in May 1963. This event was celebrated with an international symposium. Distinguished guests included Richard Brauer, Jean Dieudonne, Joseph Doob, Shizuo Kakutani, Hans Rademacher, Raphael Salem, and Stanislaw Ulam. It was not common at that time to have foreign visitors such as Dieudonne and Salem, and according to Mary Ellen, everyone in the math department was very excited about the talks and the new building.

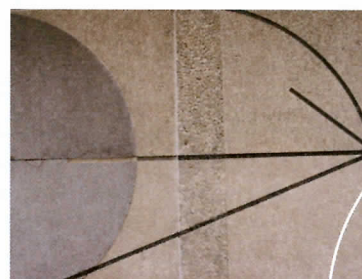
Walter and Mary Ellen Rudin looked forward to the event and especially to meeting old friends such as Brauer, Kakutani, and Salem, whom they had known when they were at Yale and MIT. Walter had worked with Salem on several occasions, including at a celebrated meeting at Montpelier in 1958 with Kahane, Katznelson, Helson, and Herz. The Rudins were Salem's hosts, and they enjoyed showing him around Madison. He was a very lively and generous guest, who often treated others to lunch. He had been a banker before deciding to become a mathematician and was wealthier than most of the others. Sadly, he died in June 1963 in Paris at the age of 64, about a month after the dedication of Van Vleck Hall.

According to Mary Ellen, at the time of the dedication, everyone thought of Van Vleck as Kleene's building. He had been very active as chair of the building committee. He attended to even the smallest details, such as the furniture on the ninth floor and the kitchen, and the locations of the women's rest rooms. The women in the department particularly appreciated this. When the department was still located in North Hall, all of the women in the department who taught shared a large, common room on the top floor, while the sole women's rest room was located in the basement. Mary Ellen recalled that Kleene's obsessiveness could also be annoying. He insisted that the coffee cups (which were all made of breakable china) be kept in the kitchen, and he would not allow people to carry them to the lounge or to other rooms on the ninth floor. However, Kleene's vision has served the department well. People still enjoy the views from the ninth floor, and the lounge has been a favorite place for mathematical discussions for 50 years.

YVONNE NAGEL



Mary Ellen Rudin died on March 18, 2013. We were privileged to work alongside her in this department for so many years. She left us so much richer.



BARB ERLÉNBOHN

Math Circles

The Madison Math Circle is in its seventh year of providing outreach to middle school students in the Madison area. Each week, a different member of the department presents a new topic to the students and guides them through solving related problems. This year, the Math Circle is being organized by Lalit Jain, Phillip Matchett Wood, and Betsy Stovall, and has a core group of 10 parents and students who attend every week, though meetings are often attended by 15 or more students.

The topics selected are often related to the presenters' research, and are always close to their mathematical hearts! During one session, Jean Luc Thiffeault, one of our applied mathematicians, told students about the mathematics of making taffy, and even showed them some videos from his own research! During another, Phillip Matchett Wood, a probabilist, helped students to understand some of the statistics and combinatorics involved in flipping coins.

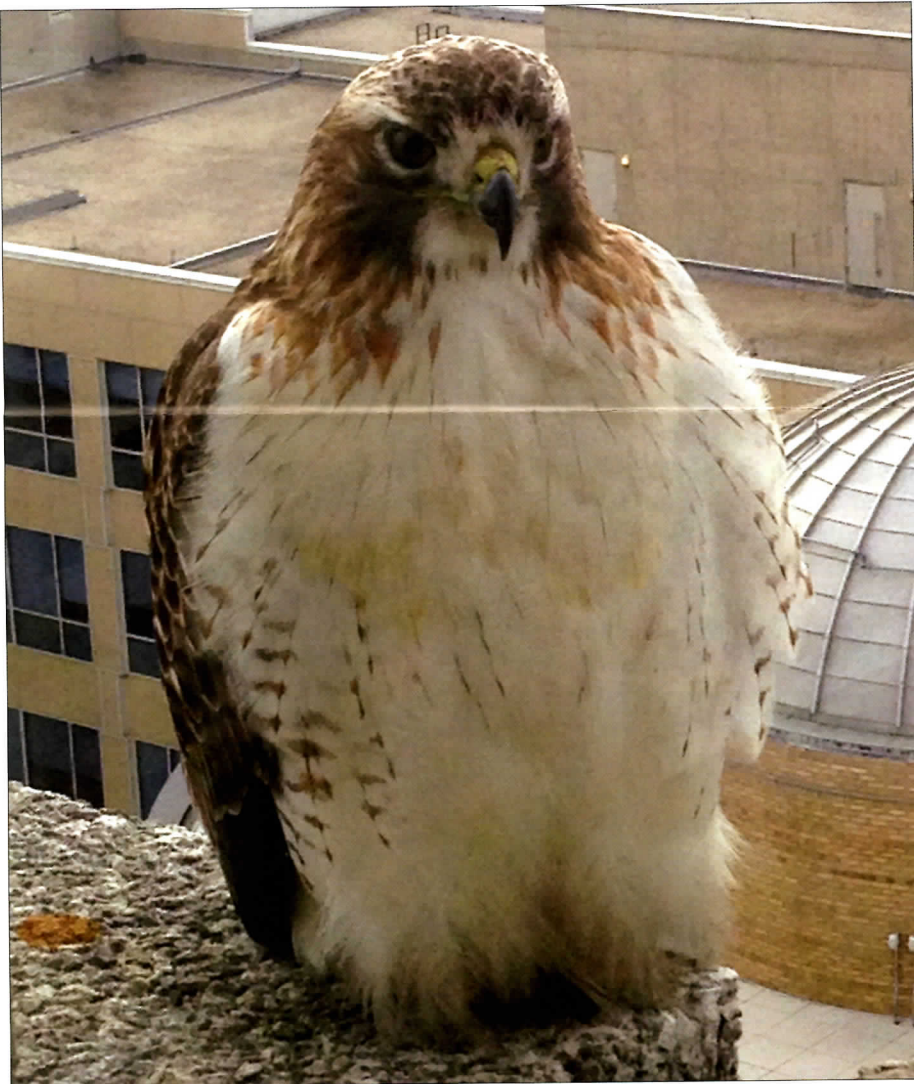
The Madison Math Circle is always free and open to everyone, so if you know of any middle school students who may be interested, be sure to let them know about this great opportunity! More information can be found at www.math.wisc.edu/circle. The Madison Math Circle is part of a national network of Math Circles, and general information about math circles can be found at www.mathcircles.org.

Cooperation across the World

The math department just approved a new initiative called the Visiting International Scholars Program (VISP). This program will bring senior undergraduate students from Shanghai Jiao Tong University to us for their final year of instruction. They'll then work with a team of advisers at both locations to coordinate their senior theses, and if they are successful, they'll come back to the UW to complete their M.A. in mathematics.

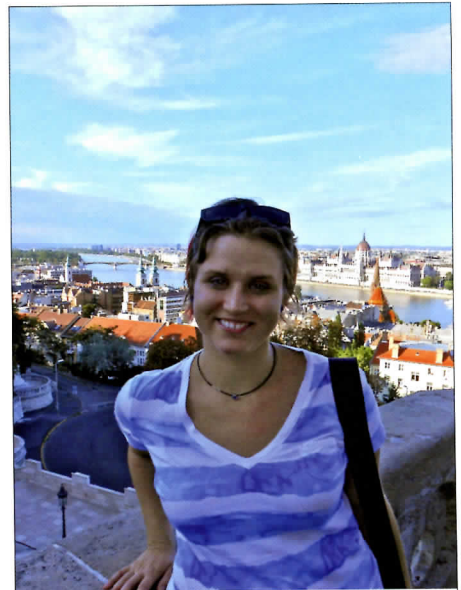
This program promises to be a much more comprehensively guided senior year and graduate program than most study-abroad experiences, and is the first program of its kind to foster a cross-cultural cooperation between two world-class institutions. The first students will arrive next fall, and we look forward to what they will add to our department.

LAURENTIU MAXIM



The math department has been entertaining a guest recently. This red-tailed hawk has been sighted multiple times on the edge of both Van Vleck and neighboring buildings. He seems particularly interested in the Geometry and Topology seminar, where Laurentiu Maxim took this picture.

COURTESY OF JOANNA NELSON



Meet Joanna Nelson

Grad Student Travel Grants Expand Opportunities

If you want to excel in a particular field, you need to study what you love. That's what graduate student Joanna Nelson has done throughout her graduate career. Using gift funds, she's been able to travel abroad to present at prestigious institutions such as Ludwigs-Maximilians University in Germany and the Alfred Reyni Institute of Mathematics in Budapest, Hungary.

Travel-abroad opportunities are a showcase for our graduate students to meet and mingle with the top mathematicians around the world, and to prepare them to join the job market.

Joanna's experiences have enabled her to win a prestigious NSF postdoctoral fellowship, which will fund her during the next few years as a visiting fellow at Barnard College, Columbia University, and the Institute for Advanced Study. She is grateful to the people she met during these travels for helping her career dreams to come true.



Sidewalk Math: 20 Years of Finals Week Help

This spring marked the 20th anniversary of the Sidewalk Math program to help undergraduates prepare for their final exams. Each day that it was offered, free tutoring and free lemonade were available to everyone who wanted to freshen their math knowledge for their final exams.

Benjamin C. Collins (Ph.D. 1996, professor of mathematics at UW-Platteville) imported the Sidewalk Math concept from the University of Michigan in 1992. It was his first year as a student in Madison, and with his friend, Garth Dickie (Ph.D. 1995), they organized an impromptu, drop-in, last-minute tutoring session during finals week.

That first time, they held it on Library Mall for maximal visibility. In 1994, they moved to the Van Vleck plaza area, and since then the graduate-student community has been planning and passing on the responsibility of providing this service in the beautiful May weather.

Thornton Fry, Ph.D. 1920, was head of the mathematics department at Bell Labs. In the book *The Idea Factory*, the author notes that this department was more of a consulting shop for the engineers and scientists, who couldn't be trusted to do complicated math!



Not Just about Chalkboards

Math is no longer just about chalkboards and calculators. Most math students learn how to use mathematical software packages to perform various functions, and those software packages are very expensive. There are some free, open-source tools, however, and this January, a group of ambitious number theorists got together for SAGE Days, an open-code improvement exercise, with the aim of improving the open-source product SAGE.



Gabriele Meyer, a senior lecturer in the Department of Mathematics, exhibited a hyperbolic surface at the joint meeting of the American Mathematical

Society and the Mathematical Association of America in San Diego in January 2013. The specific piece was a hyperbolic disk.

This surface was crocheted using yarn and shaped line, which gives the piece its firmness.

These hyperbolic surfaces can also take the shape of large algae structures, or they can shape the light if used as a lamp shade.

Gabriele will also be exhibiting in the Memorial Union galleries from September 27 to October 29, 2013.



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Faculty Awards

- **Alexander Kiselev** has been awarded a 2012 Guggenheim Fellowship for his research into fluid dynamics (<http://tinyurl.com/bbd94wr>).
- **Gloria Mari-Beffa** is on a sabbatical this year courtesy of a Simons fellowship from the Simons Foundation. Gloria is working on discrete moving frames and applications.
- With support from the Simons Foundation, Professor **Jeff Viaclovsky** spent the Fall of 2012 in Paris at Institut Henri Poincaré, where he organized the program Trimester in Conformal and Kähler Geometry and did research on critical metrics on connected sums of Einstein manifolds. In the Spring of 2013, he was a visiting professor at Rice University and Osaka University.
- **Jean-Luc Thiffeault** won the Outstanding Paper Prize from the Society of Industrial and Applied Mathematics (SIAM) for his paper on stirring devices.
- **Yong-Geun Oh** has been awarded the Kyung-Ahm Prize (<http://tinyurl.com/b8zno9e>).
- Dove Soap selected **Melanie Matchett Wood** as a Role Model for Young Girls (<http://tinyurl.com/a93sajs>).
- Twenty-two members of our department were named in the inaugural class of American Mathematical Society fellows.
- For more news, visit <http://www.math.wisc.edu/news>.