

# Duke University Math News

April 15, 2008

## Events

### Mathematics Department Party

At 3pm on April 24, the Mathematics Department will host its annual party for math majors and faculty. At this event, students are encouraged to chat with their professors in an informal setting as they enjoy a light meal. Those students who have distinguished themselves in math competitions or research will be honored with the new Duke Math 2008 shirt and, for some, a cash award. You may read about the accomplishments of these students in the articles in this newsletter.

### Geometry Festival

The Duke University Mathematics Department will host the twenty-third Geometry Festival during the weekend of April 25-27. This is the fourth time that the Mathematics Department has the honor of hosting this event.

The Festival is a national event with participants coming from as far as California and Montreal. This year's speakers include great mathematicians whom we believe will influence geometers in the years to come: Michael Anderson (SUNY at Stony Brook), Robert Bryant (MSRI on leave from Duke), Greg Galloway (University of Miami), Marcus Khuri (SUNY at Stony Brook), John Lott (University of Michigan), Duong Phong (Columbia University), William Minicozzi (Johns Hopkins University) and Jeff Viaclovsky (University of Wisconsin, Madison)

The Festival is supported by a grant from The National Science Foundation, by UNC Chapel-Hill, and, of course, by Duke University.

More information can be found on [www.math.duke.edu/conferences/geomfest08](http://www.math.duke.edu/conferences/geomfest08).

## Undergraduate News

### Duke Math Meet

High school students from Northern Virginia to Georgia and Alabama participated in the annual Duke Math meet on Saturday, November 17, 2007. For this event, DUMU members invite the teams, create the math problems, grade the students' papers and present awards to the winning teams and individuals. In the morning, teams were sent to dozens of classrooms on Science Drive to solve the challenging Power Problem. After a leisurely lunch on the French Science Terrace, they returned to Bio Sci auditorium for another series of contest problems, including the fast-paced Relay and Devil rounds.

The top teams this year were the Atlanta Math Club (GA), Thomas Jefferson HSST (VA), Vestavia Hills HS (AL), and Enloe HS (Raleigh). The individual winners, chosen in an exciting tie-breaker round, were John Berman from Hoggard HS in Wilmington, NC, Daniel Vitek from Enloe HS, Renjie You from Thomas Jefferson, and Vivek Bhattacharya from Enloe HS.

### Putnam Competition

The Duke team of Tirasan Khandhawit, Peng Shi, and Lingren Zhang ranked fifth among 516 colleges and universities throughout the US and Canada in the 68th annual William Lowell Putnam Mathematical Competition. Fewer than one-third of the participants correctly solved even one of the 12 problems during this six hour competition held last December. This was the tenth time in the past twelve years that a Duke team has been among the top five.

Special congratulations are due to senior Lingren Zhang for his 13th place ranking among the 3753 mathematically talented participants. Tirasan Khandhawit and Aaron Pollack each received Honorable Mention for their top 50 ranking. Also ranking among the top 200 were Wutichai Chongchit-

mate, Jason Ferguson, Tanawit Sae Sue, Peng Shi, and Jun Wu.

### Mathematics Contest in Modelling

From February 14 through 18, teams of three undergraduates from colleges and universities throughout the world participated in the 24th annual Mathematics Contest in Modeling. In the allotted 96 hours, the teams were to develop a mathematical model of one of two given problems and to submit their written solution. One problem required teams to compute the effects of the melting of the polar ice cap. The other problem asked for an algorithm to construct Sudoku puzzles of various levels of difficulty. Of the 1162 teams from 14 countries competing, nine were named Outstanding.

The team of Jason Chen '10, Joonhahn Cho '08 and Brian Choi '09 was judged Outstanding for their paper *A Convenient Truth: Model for Sea Level Rise Forecast*. In this paper, the authors model the effects of the melting of the Greenland ice sheet and the thermal expansion of the ocean waters due to the effects of global warming. Using sublimation rate equations and the heat equation with Neumann conditions, they estimated the change in mass balance of the Greenland Icesheet and, based on the estimated magnitude of the change, they simulated the rise in sea level along the coast of Florida over the next 50 years. Their model predicts that roughly 10,000 people will be displaced due to the flooding of Miami Beach and Key Largo. Much of the damage could be prevented by construction of sea walls.

The team of Andrew Tutt, Matthew Moore and Harish Srinivasin was one of the 10% of teams named Meritorious for their work on this problem. Three other Duke teams achieved Honorable Mention for their construction of Sudoku puzzles. Since 1998, 14 teams from Duke have been named Outstanding in the MCM or the companion Interdisciplinary Contest in Modeling. Outstanding papers are published in the UMAP journal.

See also <http://www.comap.com/undergraduate/contests/mcm/contests/2008/results/>

### Karl Menger

The Menger Award is awarded annually to math majors who have excelled in math competitions. Since 1992, the winners have been the Duke math majors who have scored highest on the Putnam

Competition. These are Tirasan Khandhawit, Aaron Pollack and Lingren Zhang. The Award has been extended to those math majors on a team designated as Outstanding in the Math Contest in Modeling. These winners are Joonhahn Cho and Brian Choi. In addition to \$250 from the Menger Fund, these students will receive a Duke Math shirt with their name and number.

Karl Menger exerted a strong influence on many fields of mathematics in Europe and America throughout his long life. He was a member of the Vienna Circle, a group of philosophers and mathematicians that included Carnap, Gödel, Hahn and Reidemeister. Menger's daughter established the Menger Fund in 1990 in his memory. See [www.math.duke.edu/news/awards/menger](http://www.math.duke.edu/news/awards/menger).

### Goldwater Scholar

Math and Chemistry major, Mark Hallen, has been named a B. M. Goldwater Scholar. Mark's research in biological chemistry has resulted in two coauthored publications with his mentor, Dr. Sharon Endow, and colleagues in the Department of Cell Biology. As a PRUV Fellow under the direction of Professor Anita Layton this summer, he will simulate the process of fluorescence recovery after photobleaching (FRAP), with a goal of extracting diffusion and kinetic coefficients from the experimental data. Mark anticipates pursuing a doctoral degree with mathematical modeling as his field of specialization.

This year over 300 engineering, science and mathematics undergraduates were named Goldwater Scholars and will receive a grant of \$7500. Since the program began in 1986, 67 Duke students, including 28 math majors, have been so honored.

### Julia Dale

The Julia Dale prize for excellence in mathematics will be shared this year by Tirasan Khandhawit and Charles Staats III.

A Thai Scholar, Tirasan will have completed 14 mathematics courses at the 200 level. As a sophomore PRUV Fellow, he completed a math research project with Fernando Schwartz in Symbolic Dynamics. The following summer, he studied knot theory at Williams College with Colin Adams and continued this work with Lenny Ng leading to his

senior thesis *On Legendrian and Transverse Knots*. Tirasan will pursue a Ph.D. in mathematics at MIT and will then return to teach at a university in Thailand.

Charles is a mathematics major and straight A student with minors in computer science and philosophy. His team was one of four out of 224 world-wide to receive the Outstanding designation in the 2006 Interdisciplinary Contest in Modeling. His senior thesis *Applications of discrete geometry to the construction of Laurent-rational zeros*, was written under the mentorship of Eric Katz and Shahed Sharif. Charles will attend graduate school in mathematics at the University of Chicago with his National Defense Science and Engineering Graduate (NDSEG) scholarship.

The Freshman Julia Dale Award for Excellence in Calculus, has been established this year to honor exceptional freshmen. The winners are Mikhail (Misha) Lavrov from Enloe HS in Raleigh and Tanawit (Thames) Sae Sue a Thai Scholar.

### PRUV Fellows

Summer stipends to pursue mentored mathematical research have been granted to six math majors, Brian Choi, Wutichai Chongchitmate, Yajing Gao, Mark Hallen, Aaron Pollack, and Amy Wen, for six weeks of intensive research leading to a senior thesis. Graduating PRUV Fellows, Michael Bauer, Tirasan Khandhawit, Charles Staats III, Elliott Wolf, and Lingren Zhang, presented the results of their senior theses in talks to the Duke mathematics community recently. See [www.math.duke.edu/vigre/pruv](http://www.math.duke.edu/vigre/pruv) for more details.

### Graduate Program News

#### Graduating Ph.D Students

Michael Gratton completed his Ph.D. thesis *Coarsening of Thin Film* in the Spring of 2008 under the direction of Thomas Witelski. He will be a post doctoral researcher at Northwestern University.

Anthony Narkwicz completed his Ph.D. thesis *Cohomology Jumping Loci and the Relative Malcer Completion* in the Fall of 2007 under the direction of Richard Hain.

Michael Nicholas completed his Ph.D. thesis *A Third Order Numerical Method for 3d Doubly Periodic Electromagnetic Scattering Problems* in the Summer of 2007 under the direction of J. Thomas Beale. He is currently a post doctoral researcher at Tulane University, New Orleans.

Nicholas Robbins completed his Ph.D. thesis *Negative Point Mass Singularities in General Relativity* in the Summer of 2007 under the direction of Hugh Bray. He is currently an assistant professor at St. Mary's College of Maryland.

Joseph Spivey completed his Ph.D. thesis *Twisted Cohomology of Mapping Class Groups* in the Spring of 2008 under the direction of Richard Hain. He has accepted a tenure-track position at Wofford College in Spartanburg, SC.

Feng Xu completed his Ph.D. thesis *Geometry of  $SU(3)$  Structures* in the Spring of 2008 under the direction of Robert Bryant.

### Faculty News

#### Arlie Petters

Professor Arlie Petters has been honored by Queen Elizabeth for his contributions to physics and for his services to science and education. He was featured last year on the PBS program *Nova* and cited especially for work with the Petters Research Institute in his native Belize, which trains students in mathematics, the sciences and technology. "Our institute is serving as a catalyst in Belize to promote a new track of economic growth through high-tech industries," he said. "I think people recognize the importance of having industries that draw upon the intellectual capital of the nation."

Petters also received in January an honorary Doctor of Science from his alma mater, Hunter College in New York.

#### Mauro Maggioni

Congratulations to Professor Mauro Maggioni for his Sloan Research Fellowship. These awards are intended to enhance the careers of the very best young faculty members in specified fields of science. A total of 20 fellowships were awarded in mathematics this year. Ten other Duke math professors have received this award in past years.

Mauro Maggioni is interested in studying the geometric properties of data sets in high dimensional spaces, as they arise in multiple disciplines, from imaging to gene arrays to large libraries of text documents or trajectories of proteins. The geometry of such data sets can be very complex, but it turns out that in many situations it can be uncovered and exploited in order to understand hidden structures in the data, which in turn allow for better understanding, and better predictions of functions of interest on the data. He has applied these ideas, by adapting techniques from harmonic analysis, to classification and regression problems, as well as robot planning.

### Mike Reed

Congratulations to Professor Mike Reed, for being awarded the David and Janet Vaughn Brooks Teaching Award

## Courses

### New Course

Math 211 - Applied PDE and Complex Variables. Mathematical methods for solving problems in linear partial differential equations: eigenfunction expansions, Fourier series, orthogonal functions and generalized Fourier series. Integral transforms: Fourier and Laplace. Complex variables for contour integrals and solutions via integral representations and Green's functions. This course is intended for students in applied math, science, and engineering. Instructor: Thomas Witelski.

## Math Degree Candidates, Academic Year 2007-2008

### First Majors

Alexandra Marie Balaban  
Kshipra Uday Bhawalkar  
Nathaniel Carter III  
Marc Edward Champaloux  
Joonhahn Cho

Joshua Michael Deiches  
Timothy Joseph Ducey  
Mrinalini Gupta  
Ebony Ann Harvey  
Hyun Chul Jung  
Tirasan khandhawit  
Jefferson Barrett Kist  
Ryan Huston Link  
Nader Mohyuddin  
Ciara Nugent  
Russell David Posner  
David Stephen Christopher Rademeyer  
Edward Douglas Riefkohl  
Aalok Kamlesh Shah  
Michael Manuel Sori  
Charles Edgar Staats III  
Allison Marie Stankavage  
Elliott Gerard Wolf  
Jingyuan Wu  
Shiyun Xia  
Lingren Zhang

### Second Majors

Aleksandr Andreev  
Raji Atri  
Michael Edward Bauer  
Alejandro Jose Caceres  
Andrey Fradkin  
David Kenneth Hall  
Christina Danielle Herring  
Matthew David Hoffman  
Jeffrey Alan Hussmann  
Melissa Ellen Levy  
Edward Raymon Philpot Jason Thomas Prager  
Stephen Joseph Rosenzweig  
Cheng Shao  
Peter Loundes Van Tassel

### Minors

Jason Robert Brown  
Julie Elizabeth Dexheimer  
Daniel Gross Fox  
Shuo Guan  
Qianwei Li  
Tianyi Lu  
John Walter Overcash

Stephen McGregor Raymond  
Tutanon Sinthuprasith  
James Michael Smyth  
Scott Kaylor Wagoner

### Master of Arts

Prakash Balachandran  
David Cesa  
Graham Cox  
Aaron Jackson  
Anna Little  
Michael Pruitt  
Timothy Stallman

### Ph.D

Dr. Michael Gratton  
Dr. Michael Nicholas  
Dr. Nicholas Robbins  
Dr. Anthony Narawicz  
Dr. Joseph Spivey

## Duke Math News

The *Duke Math News* is published several times a year and is distributed to those in the Duke mathematics community by campus mail. For previous editions and other news, see [www.math.duke.edu/news/](http://www.math.duke.edu/news/). We welcome items of interest for our next issue. Send them to [jones@math.duke.edu](mailto:jones@math.duke.edu) or [dkrain@math.duke.edu](mailto:dkrain@math.duke.edu)

To read about other news, honors and events concerning mathematics at Duke, visit [www.math.duke.edu/news/](http://www.math.duke.edu/news/). The on-line calendar at [www.math.duke.edu/mcal](http://www.math.duke.edu/mcal) lists both regular and special seminars and colloquia for the upcoming weeks. The department maintains video archives of talks, lecture series and special conferences at Duke, many of which are available, on-line. See [www.math.duke.edu/computing/broadcast.html](http://www.math.duke.edu/computing/broadcast.html) for more information.

—David Kraines, DMN Faculty Sponsor

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