Duke University
Math News
October 21, 2009

Welcome

Welcome to the Duke University Department of Mathematics. I especially want to welcome all newcomers and visitors to our department, as well as returning faculty, staff, and students.

As many of you know, Mark Stern completed a three-year term of service as Department Chair on June 30, 2009, and I began as Chair on July 1. Les Saper is continuing as Associate Chair; Tom Beale is continuing as Director of Undergraduate Studies; Lewis Blake is continuing as Supervisor of First-year Instruction, and Tom Witelski has been appointed Director of Graduate Studies. The officers of the Department look forward to working with the members and students.

I want to make special note of (almost) newcomers Jim Nolen and Ezra Miller who joined our faculty in January 2009. Short biographies will be found in the pages below.

Also, I welcome Ms Monique Brown, who recently joined our Math Office Staff. Previously, Monique served in Duke's Office of Research Support.

I hope that all the participants in our department's multifaceted activities will enjoy an academic year replete with accomplishment.

—*H*arold Layton, Chair

Lectures and Events

This summer we held the "First Annual Summer Lecture Series in Geometry" from August 10-14, 2009. Our speaker was Michael Eichmair from MIT who spoke on the Jang Equation, an important partial differential equation involved in the proof of the Positive Mass Theorem in General Relativity. Each talk was 1.5 hours long, allowing the audience to effectively receive a minicourse on this fascinating topic. Talk to Hubert Bray for suggestions for speakers for next year.

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Active since 2006, the Geometry Forum provides an informal setting for department members to hear about a topic of contemporary interest in geometry. The range of areas covered has been quite broad, including geometric analysis, general relativity, gauge theory, knot theory, and combinatorial geometry. The primary purpose is to foster our collective mathematical growth and expand on our existing knowledge in a dynamic, discussion-oriented environment. The lack of a set time limit encourages tangential questions and discussions. Graduate students, postdocs, and faculty are all active in the forum, both as speakers and audience members. In 2008 and 2009, the Geometry Forum has held meetings during the summer. Contact Jeff Jauregui for more information.

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Jonathan Mattingly, Jim Nolen, and Tom Witelski helped organize a workshop on Theory and Applications of Multiscale Methods, through the Center for Theoretical and Mathematical Sciences (CTMS) on September 11 and 12. There were 10 speakers, from mathematics, chemistry, biology, physics, and materials science. The speakers each explained important problems from their field of research involving multiple spatial and temporal scales.

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CTMS will be hosting other workshops in the near future, including a workshop about Large Data Sets on November 13, co-organized by Mauro Maggioni. See `http://ctms.phy.duke.edu/wp/event/workshops/multiscale-methods/` for more information.

Undergraduate News

DUMU

The Math Club, the Duke University Math Union, sponsors events ranging from math contests and speakers to games nights and basketball contests. At the year's first social event on Saturday, September 19, nearly 50 students came to partake of Thai food while they enjoyed conversation and Frisbee. Thanks especially to Peng Shi and Top Chongchit-mate for organizing this fun dinner and arranging for the food.

Among other activities, DUMU organizes the Duke Math Meet, to be held on Halloween this year, and participates in a party for math faculty and students to be held in April. See below for details. We welcome your participation and suggestions for other activities. For more information or to get on the DUMU mailing list, contact DUMU secretary Yingyi Shen (`ys53`).

Competitions

All undergraduates are eligible to participate in various mathematical competitions. The Virginia Tech Math Contest will take place from 9 to 11:30 on Saturday, October 24. The more challenging W. L. Putnam Mathematical Competition will be held on Saturday, December 5, the day after classes end. These competitions require creative insight and rigorous proofs more than technical knowledge of higher math. A Problem Solving Seminar is held in Math Physics 119 each Wednesday evening from 7:30 to 9:30. All interested students are invited to attend these practice sessions. Contact Matt Rognlie or Peng Shi for more information.

The Mathematics Contest in Modeling and the Interdisciplinary Contest in Modeling consumes a four day weekend in early February. Teams of three students are given open-ended, real-life problems and are expected to produce a major research paper during this 96 hour contest. Since 1998, 14 Duke teams have been named Outstanding and their papers have been published in the UMAP journal.

For more information about these contests, contact contest coordinator David Kraines (`dkrain@math.duke.edu`) and see `www.math.duke.edu/news/awards/competitions.html`.

Duke Math Meet

A record crowd of nearly 300 high school students from Alabama to New Jersey participated in the annual Duke Math Meet on Saturday, October 31. The forty nine teams who came to Duke for the ARML style meet worked on team problems in the morning and individual problems in the afternoon. Over forty Duke students volunteered their time and effort to create and grade challenging problems, serve breakfast and lunch, and escort teams to their contest sites. Because of the large number of participants, the awards ceremony had to be moved to Reynolds Theater.

The Academy for the Advancement of Science and Technology, a magnet school in Bergen County New Jersey, sent the largest contingent of 7 teams to the meet. AAST mu A and mu B teams placed first and fifth respectively in the team competition. Thomas Jefferson School of Science and Technology sent four teams this year and their A and B teams ranked second and third. A team from the North Carolina School of Science and Math ranked third. The highest individual in the meet was Allen Yang from Cary Academy. Tied for second were Ben Gunby from Georgetown Day School, Bruce Taylor from NCSSM, Calvin Deng from Enloe and Xinke Guo-Xue from Vestavia Hills, AL.

Special thanks are due to Math Meet coordinator Vivek Bhattacharya and DUMU president Matt Rognlie.

Halloween Duke Math Meet shirts pictured in this issue are on sale in Math Physics 117 for $7.00.

Summer research opportunities

The PRUV Fellow program provides summer stipends for sophomores and juniors to engage in a mathematical research project leading to a senior thesis and Graduation with Distinction honors. Each summer since 2000, five to eight undergraduates have been paired with faculty mentors and given stipends for six weeks of intensive research. The 2009 PRUV Fellows, Wutichai Chongchitmate, Hans Kist, Jason Lee, Tanawit SaeSue, Jeremy Semko and Max Tabachnik each presented short talks on their research re-

cently. For more information and an application, see `www.math.duke/vigre/pruv/` or contact David Kraines `dkrain@math.duke.edu`.

Even in these tight economic times, internships and research opportunities are available throughout the country for math and math related activities. Over the past decades, Duke students have attended many of the NSF sponsored Research Experience for Undergraduates programs in math. See `http://www.ams.org/employment/reu.html` for a list of the summer 2009 REU programs. The 2010 list should appear in early January.

Faculty Scholar

Congratulations to Matthew Rognlie on being named a 2009-10 Faculty Scholar. A math and economics major, Matt has already excelled in 16 courses numbered 200 and above in Math, Computer Science and Economics.

Alumni News

Craig Gentry '95 has been featured recently in Forbes, Barron's, the Wall Street Journal and Business Week among other venues for his breakthrough ideas in computer security. As a math major, Craig was a Putnam Fellow and member of Duke's first winning Putnam team in 1993. Several years after Harvard Law School, Craig became bored working on intellectual property law and so, in 2005, he entered the graduate program in computer science at Stanford. As an intern at IBM in the summer of 2008, Craig developed a method he calls fully homomorphic encryption that enables one to interact with encrypted data while maintaining the encryption. Craig is now a Research Scientist at IBM.

Melanie Wood - After graduating from Duke in 2003 as an AB Duke, Goldwater, and Faculty Scholar, Melanie attended Cambridge University as a Gates Scholar for a year and then entered the math graduate program at Princeton University. She received her doctorate in mathematics from Princeton this spring and is currently a Szegö Assistant Professor at Stanford University on an American Institute of Mathematics Five-Year Fellowship.

Adam Chandler - After graduating from Duke in 2006 as a Rhodes Scholar, Adam Chandler studied mathematics at Oxford for two years while maintaining his wide ranging interests. He is now a second-year student at Yale Law School and an Editor of the Yale Law Journal. Adam is a member of Yale's Supreme Court Advocacy Clinic, which provides pro bono representation in cases before the U.S. Supreme Court. His writings on the Supreme Court have appeared in Slate and on SCOTUSblog (a news site providing analysis of the Court) and have been cited in the New York Times. Adam is also a member of an expert witness team providing the statistical basis for a challenge to Connecticut's death penalty regime. Outside the law school, Adam is a Teaching Fellow in Yale's Chemistry Department and hosts a public affairs talk show on WYBC New Haven.

Graduate Program News

We are happy to welcome the new graduate students:

- **Benjamin Gaines** from the University of Pennsylvania

- **Andrew Goetz** from Princeton University

- **Kevin Kordek** from Old Dominion University

- **Sean Lawley** from Carnegie Mellon University

- **Junchi Li** from Peking University (China)

- **Christopher O'Neill** from San Francisco State University

- **Hwa Yeon Ryu** from Korea University (South Korea)

- **Ioannis Sgouralis** from National Technological University (Greece)

- **Anil Venkatesh** from the University of Pennsylvania

- **Tatsunari Watanabe** from the University of California, Berkeley

- **Brandon Wilson** from Brigham Young University

- **Hangjun Xu** from Zhejiang University. (China)

—*T*om Witelski, DGS

Excellence in Teaching Award

The 2008-2009 winners of the L. P. and Barbara Smith Award for Excellence in Teaching are Tiffany Kolba and Jeff Jauregui. Both Tiffany and Jeff have provided our students with fine teaching in a variety of courses. Tiffany has taught courses as varied as Math 31L and Math 135. Jeff has shown that he can succeed equally well in both Math 32 and Math 32L. Their students often comment on their ability to explain mathematics well, on their helpfulness, on their organization, and on their concern for the success of their students. Their talents and hard work have been a benefit to our students, and their willingness and ability to handle a variety of courses have been a benefit to our Department.

This award is an appropriate way for us to honor the memory of Capt. L. P. and Barbara Smith, whose generous donation provided the funding for this award. L. P. Smith was a former Navy pilot, who came to Duke after he retired from the Navy. He served as the Supervisor of First-year Instruction for many years, and it was during this time when he decided that our Department needed a tangible way to recognize those graduate students who excel in their teaching. At the time of his retirement from Duke–that is, his second retirement, he and Barbara made the donations that today provide us the means to reward those graduate student who excel in teaching.

Tiffany and Jeff have demonstrated the commitment and the success in the classroom which L. P. and Barbara valued so much and wanted to recognize. It is fitting that the generosity of L. P. and Barbara have enabled our Department to give Tiffany and Jeff substantial awards for their successful teaching. We congratulate both Tiffany and

Jeff, and as we remain thankful for what L.P. did for this department, we also continue to honor the memory L.P. and Barbara as we once again express our appreciation for their friendship and their contributions to the Mathematics Department.

—*Lewis Blake*

Faculty News

New Faculty

The following professors and research associates have joined the department recently:

- **Ezra Miller**, Professor - Ezra Miller joined the department in Spring 2009. He received his Ph.D. in Mathematics from the University of California at Berkeley, working under Bernd Sturmfels on commutative algebra and combinatorics. Subsequently, Miller spent two years at MIT and one at the Mathematical Sciences Research Institute in Berkeley as an NSF postdoctoral fellow. While a junior professor at the University of Minnesota, Miller received several prestigious awards including an NSF CAREER Award.

  Miller's research interests lie in combinatorial aspects of geometry and algebra and their interfaces with other disciplines, such as biology, chemistry, physics, computer science, statistics, and operations research. He is currently mentoring undergraduate, graduate, and postdoctoral researchers on projects in computational game theory, hypergeometric series in representation theory, combinatorics related to coding theory, algebraic geometry in theoretical physics, and nonlinear optimization on spaces of phylogenetic trees. Miller has lectured at scores of institutions in the US and around the world and served as an organizer of several high-profile events, such as an IAS/PCMI summer school (Geometric Combinatorics, 2004), the once-a-decade Summer Institute in Algebraic Geometry (Seattle, 2005), and an MSRI yearlong program on Commutative Algebra (2012–2013). He has coauthored graduate-level textbooks on combinatorial commutative algebra

and on local cohomology and serves on the editorial boards of several journals concerned with combinatorics, geometry, algebra, and their applications.

- **James Nolen**, Assistant Professor - Jim Nolen, who is originally from Houston, Texas, graduated from Davidson College in 2000 with a B.S. in Physics. He then worked in Austin, Texas for a small consulting firm for a year before starting graduate study in mathematics. In 2006 he completed his Ph.D. at the University of Texas at Austin. He was awarded an NSF postdoctoral research fellowship and moved to Stanford University, were he was a postdoctoral scholar and instructor. His research interests are in partial differential equations and probability, for example, how random variations in the coefficients of an equation affect the behavior of the solution.

- **Instructor**
  Rann Bar-on, winner of the LP and Barbara Smith Award in 2008 and Ph.D. from Duke in Spring 2009.

- **Research Associate**
  Jing Chen from Tufts University will be working with Harold and Anita Layton.

- **Assistant Research Professors**:
  Badal Joshi from Ohio State University

  Sonja Mapes from Columbia University

- **Visiting Assistant Professors**:
  Jake Bouvrie from MIT will be working with Mauro Maggioni.

  Guangliang Chen from the University of Minnesota will be working with Mauro Maggioni.

  Oliver Diaz Espinosa from the University of Toronto, is a joint appointment with SAMSI

  Ye Li, from Princeton

  Bruce Rogers from Arizona State University is a joint appointment with SAMSI

  Ravi Srinivasan, most recently from Brown

University, conducting research with Jonathan Mattingly

Marcus Werner from Cambridge University

Faculty Endowed Chairs

Professor Arlie Petters is the most recent mathematics professor to be granted an endowed chair, the Benjamin Powell Professorship (joint with Physics and Fuqua). This professorship was named to honor Benjamin Powell, the University Librarian from 1946-1975.

Other professors in the department holding endowed chairs are:

Robert L. Bryant, J. M. Kreps Professor of Mathematics on leave as director of the Mathematical Sciences Research Institute in Berkeley, CA.

David Schaeffer, James B. Duke Professor of Mathematics.

The department's first endowed chair, the James B. Duke Professor of Mathematics, was awarded to Leonard Carlitz in 1964.

Duke Math News

The *Duke Math News* is published several times a year and is distributed to those in the Duke mathematics community. For previous editions and other news, see `www.math.duke.edu/news/`. We welcome items of interest for our next issue. Send them to `dept@math.duke.edu` or `dkrain@duke.edu`

To read about other news, honors and events concerning mathematics at Duke, visit `www.math.duke.edu/news/`. The on-line calendar at `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` for more information.

—*David Kraines, DMN Faculty Sponsor*

Duke Math Meet 2008

Duke Math Meet 2009