

*Duke University
Math News
October 10, 2012*



• ◆ • *FALL 2012 EDITION* • ◆ •

Duke University Math News

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Welcome

As Director of Undergraduate Studies in the Mathematics Department it is my pleasure to welcome you back for the new academic year. Clark Bray, the Associate Director of Undergraduate Studies and Supervisor of Freshman Instruction, is working closely with me to assist you.

Let me mention a few resources available to you. There is lots of information at our web site, www.math.duke.edu, under the heading *For Current and Prospective Undergraduates*. Click on *undergraduate mathematics* for information about courses, transfer credit, study abroad and (at the bottom of the page) summer research programs. Information about social activities is available through the link to the Duke University Mathematics Union.

You will also find the online version of the Handbook for Majors and Minors, which contains information about major/minor requirements and course prerequisites. Clicking on *Why major in math?* in the middle of the page brings up a brief discussion of career opportunities for math majors. Much more information is at <http://www.ams.org/programs/students/undergrad/undergrad> towards the bottom of the page under *Careers*. It is never too early to think carefully about what you might be doing after graduation!

If you are planning to take an independent study in Spring 2013, fill out the Independent Study Permission Form available at <http://trinity.duke.edu/academic-requirements?p=independent-study> For the most part this form is straightforward. However item 1 at the bottom of page 2 requires additional guidance. See <http://www.math.duke.edu/undergraduate/independent-study.html>

Your departmental adviser and I are here to try to answer your questions and offer advice. The best way to contact me is by e-mail: schoen@math.duke.edu.

Let's make this an enjoyable and productive school year!

—Chad Schoen, D.U.S.

EVENTS

Art and Mathematics

The Departments of Mathematics, Art, Art History and Visual Studies presents a series of lectures this fall *Where Art and Math Intersect* at the Nasher Museum and other locations on campus. See aahvs.duke.edu/news-events/artplus for further information.

- Mathematics Inspiring Art. On September 13, mathematician and sculptor George W. Hart gave a lecture on his mathematically inspired creations. The following day, he led a number of students and others through the construction of a regular dodecahedron made out of playing card. See georgehart.com for illustrations of some of his work.
- Mathematics Revealing Art. On September 27, Charlotte Caspers and Ingrid Daubechies explained their wavelet based mathematical analysis used to determine whether paintings are original or not.
- Mathematics Reconstructing Art. On October 11, Massimo Fornasier will describe his mathematical analysis used to reconstruct frescos destroyed during the second world war.
- Mathematics Studying Art. On October 25, C. Richard Johnson has organized a successful workshop series, *Image Processing for Art Investigation*, a collaboration between art historians, computer algorithms and others.

Workshop for Women in Probability

The third workshop on Women in Probability will be held at Duke from October 14 through 16 in the French Science Building. The previous conferences were held at Cornell in 1994 and 2008.

The workshop will feature one hour talks by Janet Best (Ohio State), Alexandra Chronopoulou (UCSB), Cindy Greenwood (Arizona State), Alice Guionnet (MIT), Kay Kirkpatrick (UIUC), Chia Lee (UNC), Nevena Maric (Missouri), Dana Randall (Georgia Tech), Amandine Véber (CMAP), and Amy Ward (USC).

Other young women probabilists will present posters on their research.

The conference is sponsored in part by the Cornell RTG in Probability. For more information, see <http://www.math.duke.edu/rtd/wwp12/WWP2012.html>

Gergen Lectures

On Wednesday and Thursday, October 17 and 18, Alice Guionnet of MIT will lecture on the spectrum of non-normal matrices:

In these talks we will give an introduction to spectral properties of non-normal matrices, that is matrices which do not commute with their adjoint. A well known example of non-normal random matrices is simply given by a square matrix with independent and equidistributed entries. It was shown in a series of papers by Girko, Bai and culminating with a work by Tao and Vu that the spectrum of such matrix is asymptotically distributed according to the uniform measure on the disc.

In the first talk, we will discuss the properties of the spectrum of more general non-normal random matrices. In particular we will consider those whose law is invariant under multiplication by unitary matrices and show that the support of the spectrum is then always a ring, as conjectured by Feinberg and Zee. No previous experience with random matrices is needed to follow this talk.

In the next talk, we shall describe the natural candidate for the limit of the empirical

measure of the eigenvalues of non-normal matrices, the so-called Brown measure. We will give some details about how to prove convergence towards such a limit, but also discuss the instability of such convergence.

—Alice Guionnet

The Gergen Lecture Series was established in 1969 to honor John Jay Gergen who served as department chair from 1937 until 1966. For more details about this series, see <http://www.math.duke.edu/info/gergen.html>

Undergraduate News

DUMU

The Duke University Mathematics Union is an organization for undergraduate students interested in mathematics and its applications. DUMU sponsors math contests, guest speakers, informational panels, games nights, and many other events. On Saturday, September 8th, DUMU hosted its traditional Freshman Social on East Campus. Over 40 students gathered to enjoy Thai food from Twisted Noodles and to learn more about both DUMU and the Math Department.

If you would like to join the DUMU mailing list, please contact DUMU's secretary, James Tian (yt58). We also welcome any ideas for activities and events.

Job Search in High Gear for Seniors

September and October are the months in which employers looking to hire graduating seniors visit campus to conduct interviews. Many of you attended the Fall Career Fair in the Bryan Center on September 12, at which 100 companies were represented.

However this represents only about a quarter of the potential employers who visit Duke during the September/October recruiting season. Visits are coordinated by the Duke Career Center, which also performs the very important task of helping prepare seniors for a successful job hunt.

The career center offers valuable advice from help writing a strong resume to interviewing tips. Seniors should start soon on

their job search. By November things will have largely quieted down. Appointments to help with the particulars may be made online <http://studentaffairs.duke.edu/career/career>

—Chad Schoen, D.U.S.

Duke Math Meet

DUMU is making preparations for the 2012 Duke Math Meet, to be held on Saturday, November 10th. About 300 high school students across the nation are expected to attend. For the first time, several teams from China plan to participate.

Student volunteers are needed to help the event run smoothly. Volunteers assist with registration, escort teams to contest rooms, organize breakfast and lunch, and distribute awards to top teams and individuals. Each volunteer will receive a Duke Math shirt as well as breakfast and a box lunch. If you are willing to volunteer or have any questions about the event, please contact David Hemminger (drh22) or TongTong Zhan (sz37).

Please contact your high school math teachers and encourage them to participate. Information about the contest and registration can be found online at www.math.duke.edu/dumu/mathmeet [www.math.duke.edu].

PRUV

Each year, up to 8 sophomores and juniors with the sincere desire and background to carry out research in the mathematical sciences will be selected to be PRUV Fellows. Each Fellow will be paired with an appropriate mentor in mathematics or a related department. Fellows receive a stipend of \$3,300 for six weeks of intensive research during the summer leading to a senior thesis and graduation with distinction in mathematics.

For more details, see <http://www.math.duke.edu/vigre/pruv/index.html>

The following PRUV Fellows who have worked on projects this past summer gave talks on their research project recently:

- Bryan Jacobson *Fast Approximation for Persistent Local Homology*
- Mandy Jiang *Stochastic Disease Transmission Process*
- Kathleen Lan *Coalescing Random Walks on n -block Markov Chains*
- Ivy Shen *Merge Times of Markov Chains*

- Daniel Stern *Classification Problems for Certain Gravitational Theories*
- Daniel Vitek *Augmentation Polynomials of $(2,k)$ -Torus Knots*

Competitions

We encourage all interested undergraduates to participate in various mathematical competitions throughout the year. The Virginia Tech Math Contest will be held on Saturday, October 27, 2012 from 9:00 am to 11:30 am. The more challenging W. L. Putnam Contest will be held on Saturday, December 1, 2012 from 10 am to 6 pm with a two-hour break for pizza lunch.

Both these contests are proof-based and require creative insight and careful rigor rather than knowledge of especially advanced mathematics. The weekly problem solving seminar helps to prepare interested students for these contests. The seminar meets on Thursday evenings in Math-Physics 119 from 6:30 to 8:00. Please contact Ivan Matic (matic@math.duke.edu) for more information.

The Mathematical Contest in Modeling is held every February. Students work in teams of three for 96 hours to develop a model for an open-ended real-world problem and then write up their results in a paper. Over 3,000 teams compete worldwide, and Duke students have had much success in the past.

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's Noetherian Ring

2012-2013 will see the return of the Duke Math Department Noetherian Ring, an informal network of mathematicians dedicated to promoting the presence of women in math. This year's president is Liz Munch (emunch@math.duke.edu) and vice president is Caitlin Leverson (cleverson@math.duke.edu). The group hosted its kickoff meeting on Monday, Sept 10th, 2012, and will host monthly events for the undergraduate and graduate student members. To join the listserve, contact Liz Munch or see www.math.duke.edu/noetherian.

The Ring is also running an all-female "mentoring pyramid" with faculty mentoring post docs, postdocs mentoring advanced graduate students, and advanced

graduate students mentoring the beginning graduate students. For more information on the mentoring, please contact Sarah Schott (schott@math.duke.edu).

Graduate Student News

We welcome the following new graduate students. Together with their undergraduate universities and areas of interest, they are:

- Yuhao Hu /Zhejiang University/geometry
- Ma Luo/Peking University/geometry
- Zhiyong Zhao/Chongqing University and University of Science and Technology/geometry
- Jieren Xu/University of Science and Technology/geometry, PDE
- Yu Pan/Nankai University/topology
- Rachel (Rujie) Yin/Shanghai Jiaotong University/High dimensional data, image processing
- Ian Drayer/UCLA/Math biology, stochastics
- Chao Xu/Zhejiang and Indiana Universities/applied math
- Hangjie Ji/Zhejiang University/PDE and scientific computing
- Chi Zhang/University of Florida

We recognize recent awards by current graduate students:

Andrew Goetz, Hangjun Xu and Alan Parry received awards supporting their participation in the 2012 MSRI Summer Graduate Workshop in Mathematical General Relativity.

Andrew Goetz, Hangjun Xu and Philip Andreae were awarded Summer Research Fellowships from the Duke Graduate School.

In recognition of the contributions by Harrison Potter in the Workshop on Mathematical Problems in Industry last June, Potter was awarded a \$6,000 fellowship for the Fall.

—Bill Pardon

L. P. and Barbara Smith Award for Excellence in Teaching

The 2011-2012 winners of the L. P. and Barbara Smith Award for Excellence in Teaching are Esteban Chavez and Chris O’Neill. Each of these excellent teachers has received a substantial monetary award from a fund provided by the Smiths, and they have received well-deserved recognition and appreciation from the Mathematics Department.

Chris has demonstrated a patience and talent for working with undergraduates who need extra attention in their math studies. His ability to “connect with” these students has inspired them to learn and to improve their performance. He fosters an atmosphere in the classroom that is conducive for learning, even among the less-motivated math students. His teaching talents have been much appreciated by this department and by his students.

Esteban Chavez has taught a variety of courses with unwavering success, including upper-level summer courses in which he has had to take on more than the usual responsibility with regard to course planning. Indeed, on several occasions he has stepped up to help the Department with special staffing needs. The students consider him to be an excellent, helpful teacher—a view certainly shared by the Mathematics Department.

Both Esteban and Chris have demonstrated a commitment to undergraduate teaching and have achieved a level of success in the classroom which L. P. and Barbara Smith felt should be appropriately recognized by our Department. It is through the dedication and generosity of L. P. and Barbara that the Mathematics Department has the financial means to recognize Esteban and Chris with these awards. It is important that we also take this occasion to honor the memory of L.P. and Barbara, whose friendship and generosity still touch us today.

—Lewis Blake

Faculty News

Duke is pleased to welcome several new faculty this year.

New Regular-Rank Assistant Professors

Jayce Getz (from McGill University) Jayce Robert Getz obtained his PhD in 2007 from the University of Wisconsin at Madison under the direction of Ken Ono. His thesis, based on joint work with Mark Goresky, received the 2011 Ferran Sunyer i Balaguer book prize. After graduating he took a postdoctoral position as a Veblen Research Instructor at Princeton University and the Institute for Advanced Study. After a stint as an assistant professor at McGill University, Getz is happy to join the faculty at Duke University as an assistant professor.

Getz is a number theorist interested in automorphic forms and arithmetic geometry. More specifically he is interested in limiting forms of the trace formula and their application to cases of Langlands functoriality. He is also interested in relative trace formulae and their application to the geometry of special cycles on certain moduli spaces called Shimura varieties.

Jianfeng Lu joined the department as an assistant professor Fall 2012. He received his Ph.D. in applied mathematics in 2009 from Princeton University. Before coming to Duke, he was a Courant Instructor in the Courant Institute of Mathematical Sciences at New York University for three years.

Jianfeng Lu's research interests lie in mathematical understanding and algorithm development for problems arising from physics, material science and computational chemistry. He also has a broad interest in other fields to which mathematics is applied. His current research topics include electronic structure theory, multiscale methods, pattern formation, rare events, and wave propagation.

He was awarded the Porter Ogden Jacobus Fellowship from Princeton University for his thesis research.

New Assistant Professors of the Practice:

Emily Braley (from UNC-CH) - Emily grew up just outside of Worcester, Massachusetts and graduated from UMASS Amherst in 2007. Emily attended graduate school in North Carolina, and graduated in May 2012 with a Ph.D. in Mathematics from UNC Chapel Hill. She studied algebraic geometry and combinatorics while at UNC and focused on questions related to eigencone problems. Emily is a Project NExT Fellow (New Experiences in Teaching) with the MAA this year and is volunteering time to write content for the opening of the Museum of Mathematics in Queens, NY this December. This semester, Emily is teaching Math 111L on East campus and enjoying getting to know the new graduate students while co-teaching the Teacher Training Seminar with Sarah Schott and Jack Bookman.

Sarah Schott (from Duke) Although Sarah Schott is a new Assistant Professor of the Practice, she is no stranger to Duke and our department. She first arrived here in 2006 as a graduate student and obtained her PhD this past May. During her graduate studies, she worked in probability and randomized algorithms under the guidance of Mark Huber. Before arriving at Duke, Sarah was a mathematics major and women's studies minor at the University of Florida. She hopes to combine her passion for math and women's studies in working to increase the number of women present in the mathematics community. Her efforts so far have included the creation of the Noetherian Ring and the co-creation of the Math Mentoring program here at Duke. She is currently teaching two sections of MATH 122L and co-teaching the Teacher Training seminar with Professor Bookman and Professor Braley.

New Assistant Research Professors:

- **Nicholas Addington** (recently from Imperial College London) (Ph.D. from U. Wisconsin) will be working with Paul Aspinwall
- **Omer Bobrowski** (Technion-Israel Institute of Technology) will be working with John Harer

Visiting Assistant Professors:

- **Samuel Gerber** (University of Utah) will be working with Mauro Maggioni
- **Heekyoung Hahn** (McGill University) continues her research in number theory
- **David Lawlor** (Michigan State University) (SAMSI postdoc: SAMSI = Statistical and Applied Mathematical Sciences Institute) Working with Mauro Maggioni
- **Stanislav Minkser** (Georgia Tech) will be working with Mauro Maggioni and David Dunson
- **Robert Moss** (University of Evry, France; Australian) will be working with Anita Layton
- **Andrew Thompson** (University of Edinburgh) will be working with Robert Calderbank
- **Joshua Vogelstein** (Johns Hopkins University) will be working with David Dunson, John Harer, and Mauro Maggioni
- **Yi Grace Wang** (University of Minnesota; SAMSI postdoc) will be working with Ingrid Daubechies

Visiting Scholars:

- **Charlotte Caspers** is visiting Ingrid Daubechies.
- **Professor Dino Lorenzini** (from the University of Georgia) will be working with Hain, Saper, Schoen, others in Algebraic Geometry group

Arlie Petters was selected to be the 2012 Grand Marshal for the Central American Day parade on Sunday, September 23rd. He was chosen to lead the seven-nation parade, featuring many representative floats from Central and South America, to honor his many contributions to his native Belize. This annual parade is one of the largest in Los Angeles. See <http://www.cofeca.org/>

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 <http://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 <http://www.math.duke.edu/news/>. The on-line calendar at <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 <http://www.math.duke.edu/computing/broadcast.html> for more information.

—*David Kraines, DMN Faculty Sponsor*

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