

*Duke University
Math News
May 11, 2014*



• ♦ • *Graduation 2014 Edition* • ♦ •

Duke University Math News

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GRADUATION
EDITION

Class of 2014

Congratulations to the math majors and minors graduating this spring. You and your class will pursue a variety of career paths ranging from graduate study in mathematics to business consulting and innovative start-ups.

At the Graduation Luncheon in the LSRC dining hall following the University Commencement on May 11, first majors in math have the opportunity to introduce their families to their classmates and professors. Following the lunch, they will receive their diploma in a short ceremony.

To the parents: your sons and daughters have each succeeded in one of the University's most challenging programs. This experience will prepare each of them for a rewarding career.

To those of you who are leaving Duke, we wish you continued success. Do send Duke Math News a note from time to time.

Events

Exam Week Break

Math majors, graduate students and faculty enjoyed a welcome break from their studies on Thursday April 24, the day after classes ended. This was the department's annual occasion for students and faculty to share food and conversation in an informal setting. Graduating students, contest participants and research students were recognized for their hard work and special accomplishments. Pictures of the event will be posted at <http://fds.duke.edu/db/aas/math/ugrad/news>

The fourth annual Southeastern Probability Conference will be held in the Math-Physics Building on

May 12 and 13. Speakers will be: Louigi Adriano-Berry (McGill), Nayantara Bhatnagar (Delaware), Xia Chen (Tennessee), Jim Fill (Johns Hopkins), Carl Mueller (Rochester), David Herzog (Duke), and Elchanan Mossel (Berkeley). <http://www.math.duke.edu/rtd/SEPC14/SEPC2014.html>

Undergraduate News

With a generous travel grant from Professors Anita Layton and Ezra Miller, five undergraduate students were able to present their research at national math conferences this spring.

Nebraska Conference for Undergraduate Women in Mathematics (January 31-February 2):

- Tracy Qi Dong: Bayesian Methods for Causal Inferences
- Rowena Jingxing Gan: Mathematical Ideas on Impressionist Music
- Mollie Breen: Impacts of Mentoring Women in Mathematics

MAA Southeastern Sectional Meeting: Tennessee Tech University (March 14-15):

- Carmen Cox: Metacognitive Writing in Mathematics Classes
- Anne Talkington: Modeling Interactions among Migrating Species

New Courses

Two new courses are being introduced this fall as part of the Focus program in mathematical modeling.

Math 404 - Mathematical cryptography - Paul Aspinwall

Mathematics of cryptography and some applications. Topics include finite fields, discrete logarithms, integer factorization and RSA, elliptic curve cryptography, hash functions, digital signatures, DES and AES. <http://www.cgtp.duke.edu/psa/cls/404/>

Math 465 - Introduction to high dimensional data analysis - Mauro Maggioni

Data sets include large collection of images, web pages, videos, audio signals, text documents, and arise in a wide variety of applications, from recommendation systems (such as those used by Amazon, Netflix, Ebay...) to voice and face recognition. Data sets are often modeled as point clouds in high-dimensional spaces or as graphs. The geometry of such point clouds may be used for many tasks, such as constructing dictionaries for data, denoising, modeling, and inference. This course will focus on techniques for analyzing quantitatively geometric properties of data sets and graphs, for constructing representations and dictionaries for the data, and for using both to perform inference tasks such as regression or classification. Themes for the course include quantitative analysis of point clouds, graph- and diffusion-based techniques, and computational considerations. We only assume knowledge of linear algebra and basic probability, and we will introduce ideas from graph theory, function spaces, and numerical linear algebra as needed.

Math Union

The Duke University Mathematics Union is an organization for undergraduate students interested in mathematics and its applications. DUMU sponsors the Duke Math Meet, other math contests, guest speakers, informational panels, games nights, and many other events.

For 2014-15 Brett Schnobrich will be President and Akshay Save will be Vice President. Steven Yuzhe Shi and Kang Ni will be Treasurer and Secretary respectively. The organizers for the Duke Math Meet will be Anne Talkington, Andrew You, and Alex Milu. Yajing Gao will continue as Webmaster.

David Kraines and Heekyoung Hahn will serve as

faculty advisors.

Many thanks to past President and Vice President, David Hemminger and Daniel Vitek.

Mathematics Contest in Modeling

For 96 hours this February, over 6500 teams throughout the world including four teams of Duke students successfully competed in the annual Mathematical Contest in Modeling sponsored by COMAP. Three open-ended problems are posted at 8:00 pm on Thursday evening and teams must research, create a model, write up their solutions, and then submit them to COMAP the following Monday at 8:00 pm. <http://www.comap.com/undergraduate/contests/mcm/>

One problem asked teams to evaluate traffic rules on multi-lane freeways: what are the pros and cons for requiring slower cars to move to the right-most lane. Another asked for criteria to identify the “best all-time college coach”. Two Duke teams successfully analyzed each of these problems. The team of Lindsey Brown and Anne Talkington were declared Meritorious - among the top 10% - and the team of Henry Hao, Steven Shi, and Ruolei Wang received Honorable Mention. They each developed ingenious algorithms for identifying the best coach. Remarkably Mike Krzyzewski did not lead either team’s list.

Putnam Competition

The team of Alex Milu '16, Tony Qiao '17 and Daniel Vitek '15 finished 8th among 557 colleges and universities in the 74th W.L Putnam Competition. Daniel Vitek ranked among the top 100 of the 4113 participants, Leslie Lei and Tony Qiao were among the top 200 while Alex Milu made the top 300.

This was the 20th time in the past 24 years, that the Duke Putnam team placed among the top ten among the universities participating. These years also includes 3 first place finishes, 2 seconds and 6 thirds for Duke teams. See more at <http://www.math.duke.edu/news/awards/competitions.html#putnam>

MIT won the contest this year followed by Carnegie Mellon, Stanford, Harvard and Cal Tech. The median score was 1 and the top quartile break was at 11 points.

Congratulations to all who participated.

Duke Math Meet

The 2013-2014 Duke Math Meet took place on Saturday, February 15th, 2014. In spite of severe weather causing school closings in the three days leading up to the meet, nearly 200 high school students came to compete. Many teams from the DC area were allowed to participate remotely due to the difficulties associated with traveling in this weather. For the second consecutive year, two teams from China participated.

The top individuals this year were Sreenath Are of Thomas Jefferson HSST in first, Michael An of NCSSM in second, Angela Deng of Enloe High School in third, David Stoner of Columbia Math Circle in fourth, and Ildoo Kim of Thomas Jefferson HSST in fifth. The winning teams were Thomas Jefferson A, Columbia Math Circle A, NCSSM 1, Thomas Jefferson B, and Enloe A in that order.

Thanks to Brett Schnobrich and Akshay Save for coordinating the Meet and to the many Duke student volunteers who devoted long hours creating problems, registering students, serving meals, and grading solutions.

Undergrad Research Programs

Twenty-four undergraduates will receive stipends for participating in math and math-related research this summer. These students will be supported by the PRUV Fellow program, the Math Biology REU, the Data RTG, Mellon Mays fellowship, and by individual faculty research grants. Below are the names, classes, and programs or mentors.

- Now in its fourth year, the Mathematical Biology REU will support research by eight Duke students during the first summer term.
Freshmen Neda Jamshidi-Azad and David Zhou, sophomores Lindsey Brown, Muhammed Tayyab Wasim and Andrew You, and juniors Ray Lee, Rod Shayesteh and Michael Zhang will participate under the direction of Michael Reed.
- Through a training grant from the NSF, the Structure in Complex Data provides stipends for 9 weeks of summer research.

Marshall Ratliff '15, Carmen Cox '16, Derick Nowak '17, and Alex Pieloch '17 will be mentored by Paul Bendich and John Harer while Joshua Vogelstein (Stat) and Guillermo Sapiro (ECE) will mentor Joy Patel '17, Roger Zou '16, and Julia Ni '14. <https://www.mathprograms.org/db/programs/181>.

- Nettie Song '17 and Jennifer Zou '15 will conduct research under the guidance of Anita Layton.
- Freshmen Ethan Levine, Henry Hao Yan and junior Rowena Gan will assist Ingrid Daubechies on an art project related to the analysis of digitized art paintings.
- The following rising juniors will work on projects supported by PRUV or covered by grants from professors.

David Builes with Dick Hodel

Alex Milu with Lenny Ng

Will Victor with Hugh Bray

Paul Ziquan Yang with Robert Calderbank

Honors Theses

Eight graduating math majors have written Honors Theses on their Mathematical research this year. Ivy Shen finished her thesis last year. Each will graduate with distinction this May.

- Aashiq Dheeraj - *A Stochastic Spatial Model for Tumor Growth*
- Josh Izzard - *Rank p^2 Representations of Semisimple Lie Algebras*
- Kathleen Lan - *Coalescing random walks on n -block Markov chains*
- Leslie Lei - *Infinite Swapping Simulated Tempering*
- Julia Ni - *A convex approach to tree-based wavelet compression*
- Ivy Jiarou Shen - *Merge times and hitting times of time-inhomogeneous Markov chains*

- Daniel Stern - *Low Order Lagrangians Depending on a Metric and a Matter Field of Arbitrary Rank*
- Daniel Vitek - *Knot Contact Homology and the Augmentation Polynomial*
- Alex Wertheim - *Complex Multiplication on Elliptic Curves*
- Luxi Wei - *Modeling Credit Risk using Rating and Environmental Factors*

Awards

Faculty Scholar and Goldwater Scholar

Congratulations to Eugene Rabinovich, one of two Faculty Scholars at Duke for 2013-14. This is the highest award given by the faculty to undergraduates. The criteria for selection include impressively high overall grade point average, independent research, potential for innovative scholarship and intention to pursue a scholarly career. <http://academiccouncil.duke.edu/faculty-scholars/> Eugene was the 28th math major selected as a Faculty Scholar since 1989.

Eugene was also one of two Duke students to receive the national 2014 B.M. Goldwater Scholarship. <http://goldwater.scholarsapply.org/index.php>

Eugene is currently researching string theory with associate professor of physics Ronen Plesser, focusing on understanding physical models of string theory through the use of similar, non-physical models. He plans to attend graduate school in either physics or math and to ultimately become a professor and researcher. <http://www.math.duke.edu/news/awards/scholarships.html#duke>

Karl Menger Award

Daniel Vitek '14, Leslie Lei '14, and Tony Qiao '17 are the winners of the Menger Award given for excellence in mathematical competitions. <http://www.math.duke.edu/news/awards/menger/index.html>

Julia Dale Prize

The Julia Dale winners for 2013 are Daniel Stern and Daniel Vitek. Each have excelled in over six graduate level math courses and completed major research projects. Both Daniel Stern and Daniel Vitek plan to continue their study of mathematics at the graduate school of Princeton University. They look forward to careers in teaching and research.

Five years ago, the Julia Dale Prize was extended to recognize exceptional first year students in mathematics. From the many nominees, the following students were selected: Jacob Lettie, Derrick Nowak, Tony Qiao and Liaowang Zou. We wish each continued success as they continue their education.

Julia Dale taught at Duke for several years before her untimely death in 1936. Friends and relatives established a fund in her name to honor the most distinguished students in mathematics. <http://www.math.duke.edu/news/awards/dale/index.html>

Graduate Student News

Congratulations to Anil Venkatesh, the 2014 recipient of the Dean's Award for Excellence in Teaching http://gradschool.duke.edu/prof_dev/awards/deans_teach/.

Graduating Ph.D. Students 2013-14

Congratulations to the following graduate students who are receiving the doctorate in mathematics:

- Miles Crosskey:

Thesis: *Atlas Simulation: A Numerical Scheme for Approximating Multiscale Diffusions Embedded in High Dimensions*, Advisor: Mauro Maggioni

- Sean Lawley:

Thesis: *Stochastic Switching in Evolution Equations*, Advisor: Michael Reed

- Junchi Li:

Thesis: *Axelrod's Model in Two Dimensions*, Advisor: Richard Durrett

- Christopher O'Neill:

Thesis: *Monoid Congruences, Binomial Ideals, and Their Decompositions*, Advisor: Ezra Miller

- Hwayeon Ryu:

Thesis: *Feedback-Mediated Dynamics in the Kidney: Mathematical Modeling and Stochastic Analysis*, Advisors: Anita Layton and James Nolen

- Ioannis Sgouralis:

Thesis: *A Dynamical Nephrovascular Model of Renal Autoregulation*, Advisor: Anita Layton

- John Steenbergen:

Thesis: *Towards a Spectral Theory for Simplicial Complexes*, Advisor: Sayan Mukherjee

- Hangjun Xu: Thesis:

Uniformly Area Expanding Flows in Spacetimes, Advisor: Hugh Bray

Faculty News

Lewis Blake

Congratulations to Lewis Blake, the recipient of the 2014 Alumni Distinguished Undergraduate Teaching Award. The Alumni Association established the ADUTA in 1970 as the highest form of recognition a professor could receive from students. Blake was chosen from among 59 professors who were nominated.

Blake entered Duke graduate school in mathematics in 1975 as a Teaching Assistant and has taught for our department ever since. He served as Supervisor of First Year Instruction from 1985 until 2011.

James Nolen

James Nolen was awarded an NSF CAREER Grant in January 2014. <http://www.math.duke.edu/news/awards/facaward.htm>

Math Degree Candidates, Academic Year 2013–2014

First Majors

Ms. Maria Arias De Saavedra Benitez
 Ms. Kristen Amelia Brown
 Mr. Nicholas Michael Calabro
 Mr. Scott Benjamin Cara
 Mr. Mark William Carrabine
 Mr. Andrew Jordan Chinn
 Mr. Julian Edwin Lovett Cooper
 Mr. Aashiq Dheeraj
 Mr. Christian Lawrence Drappi
 Ms. Katherine Iverson Fraile
 Mr. Matthew Evan Gordon
 Mr. Joseph Lewis Graves III
 Mr. Nathan Hsieh
 Mr. Billy Haoyang Huang
 Mr. Joshua Michael Izzard
 Mr. Brian Timothy Knierim
 Mr. Jayanth Kocherlakota
 Ms. Kathleen Lan¹
 Mr. Lei Lei
 Ms. Veronica Marie Lepa
 Ms. Hanna Lencer Mar
 Ms. Christine Lynn McConnell
 Ms. Julia Ni
 Mr. Kevin Ward Rozell
 Mr. Alessio Santoro
 Ms. Jiarou Shen
 Mr. Amudan Mayram Srinivasan
 Mr. Daniel Leeco Stern
 Mr. Justin Louis Summerville
 Mr. Siyang Sun
 Mr. Kwang Jae Sung
 Mr. Scott Douglas Valentine
 Mr. Daniel Robert Vitek
 Mr. Taariq A. Watson
 Ms. Luxi Wei
 Mr. Alexander Joseph Wertheim
 Mr. Jonathan David Yach

¹Graduated December 2013

Second Majors

Mr. Brian Anderson Bullins
 Mr. Jerren Roderic Chang
 Ms. Melissa Jessica Dalis
 Ms. Rebecca Ann DeNardis²
 Ms. Qi Dong
 Mr. Cameron Michael Kim
 Mr. Justin Henry Leder
 Mr. David Liu
 Mr. Ryan Alexander McGeehan
 Mr. Yi Pan
 Mr. Taylor Gene Pospisil
 Mr. Nikhil C Prakash
 Mr. Alexander Franke Stevens
 Mr. Benjamin Andrew Stone
 Mr. Andy Hoang Tran

Minors

Mr. Alexander Wyatt Bloedel
 Mr. Ali Habib Bootwala
 Mr. Robert James Collopy
 Mr. Steven Meyer Demers
 Ms. Sarah Madeline Eade
 Ms. Dana Elizabeth Fenster
 Mr. Nicholas John Gordon
 Mr. Soroush Jamali Pour
 Mr. Keerthighaan Kanagasegar
 Mr. Alexander G Kazandjian
 Mr. Ang Li
 Mr. Nathan Xilong Li
 Mr. Jonathan Liu
 Mr. Jaisal Kohli Mariwala
 Mr. Joshua Samuel Miller
 Mr. Michael Robert Potts
 Mr. Patrick Allen Royal
 Ms. Angelica Beth Schwartz
 Ms. Kelsey Irene Siman
 Mr. Lucas Joseph Spangher
 Mr. Bradley Thomas Stankey
 Mr. Volodymyr Zavidovych
 Ms. Yuci Zhang

²in memoriam

Doctors of Philosophy

Dr. Miles Martin Crosskey
 Dr. Sean David Lawley
 Dr. Junchi Li
 Dr. Christopher David O'Neill
 Dr. Hwayeon Ryu
 Dr. Ioannis Georgiou Sgouralis
 Dr. John Steenbergen
 Dr. Hangjun Xu

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/mca1> 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

FACULTY SPONSOR

David Kraines dkrain@math.duke.edu

PRODUCTION MANAGER

Bonnie E. Farrell bef@math.duke.edu

Department of Mathematics

Box 90320

Durham, NC 27708-0320

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