MATHEMATICS DEPARTMENT

NORTHWESTERN UNIVERSITY • THE JUDD A. AND MARJORIE WEINBERG COLLEGE OF ARTS AND SCIENCES • DEPARTMENT OF MATHEMATICS

SPRING 2013 NEWSLETTER

FROM THE CHAIR p1/10

DEPARTMENT NEWS p2/11

DEPARTMENT TRANSITIONS p3/10

UNDERGRADUATE NEWS p4/5

PHOTO GALLERY p6/7

GRADUATE NEWS p8/9

FROM THE CHAIR

Jared Wunsch, *Chair, Department of Mathematics*

How do you tell if a homotopy theory conference is a success? Punch lines for this joke are hereby solicited. In practice the way we could tell that our recent conference on *Equivariant, Chromatic, and Motivic Homotopy Theory*, organized by Anna Marie Bohmann, John Francis, and Paul Goerss, was a smashing success was that the racket made by the assembled homotopy theorists was so loud that the staff in the Psychology building, where lectures were held, complained. This was clearly a group with a lot of exciting mathematics to convey to one another, and we were excited to host them.

The homotopy theory conference was the biggest single event in the current emphasis year in Algebraic Topology, and is one of a somewhat dizzying number of exciting things that went on in the department this spring. We had Ingrid Daubechies, the 2012 Nemmers Prize winner, visiting for the spring quarter; Daubechies gave a minicourse on wavelets as well as a spectacular public lecture *"The Masters Hand:" can image analysis detect the hand of the master?* on the application of wavelet methods in art history. Other spring events included this year's installment of the Mark and Joanna Pinsky Lectures, given by Fields Medalist Andrei Okounkov, as well as the inaugural run of a new lecture series generously endowed by professor emerita Alexandra Bellow; the first Bellow lecturer was the eminent probabilist Alice Guionnet, of MIT.

The department's research profile continues to evolve in new ways, some predictable and some completely unforeseen. In 2013 the department was joined by two complex geometers, Valentino Tosatti and Ben Weinkove; together with Steve Zelditch, these new hires form a powerful group in this very exciting and fast moving field. With the arrival of Nir Avni, we have new strength in the theory of discrete groups, a whole new field for us. John Francis, a homotopy theorist, will help carry the department's longstanding strength in this field in the 21st century; he is a rare candidate hired from "within," having been a Boas Assistant Professor until last year. And Xinwen Zhu brings us a long sought after expertise in arithmetic algebraic geometry.

Among notable faculty honors this year, I would especially point to Kevin Costello's inauguration as Wayne and Elizabeth Jones Professor of Mathematics. Valentino Tosatti was awarded a Sloan Fellowship before even arriving at NU, while Xinwen Zhu won an AMS Centennial Fellowship right after getting here. It's been a fantastic year for recognition of our department's excellence in teaching: Eric Zaslow was named Charles Deering McCormick Professorship of Teaching Excellence in 2012 and John Alongi was awarded a Charles Deering McCormick Distinguished Lectureship starting in 2013. Ursula Porod received an Arts and Sciences Alumni Teaching Award and Boris Hanin

continued on page 10

NORTHWESTERN UNIVERSITY

WEINBERG COLLEGE OF ARTS & SCIENCES

Departmental News Highlights

Kevin Costello and **Eric Zaslow** were named *Simons Fellows in Mathematics for 2012-13.*

Kevin Costello was named the *Wayne and Elizabeth Jones Professor in Mathematics.*

Congratulations to **Northwestern's Putnam team**, which ranked 10th in the 2012 Putnam Mathematical Competition. Northwestern received a Team Honorable Mention and team member, **Ewain Gwynne**, received an Individual Honorable Mention.

Ingrid Daubechies was awarded the *2012 Frederic Esser Nemmers Prize in Mathematics* for her numerous and lasting contributions to applied and computational analysis and for the remarkable impact her work has had across engineering and the sciences. She delivered her public lecture, *"The Master's Hand:" can image analysis detect the hand of the master?* on April 24, 2013.

Professor emerita **Alexandra Bellow** has endowed a new lecture series beginning June 2013. The first Bellow Lectures were delivered by **Alice Guionnet** on June 5-7, 2013.

The 2012-13 **Mark and Joanna Pinsky Lectures** were delivered by **Andrei Okounkov** on May 1-3, 2013.

Congratulations to new Fellows of the AMS, professors **John Franks, Ezra Getzler, Bryna Kra, Clark Robinson, Mike Stein, Jared Wunsch, Steve Zelditch** and professors emeriti **Eric Friedlander, Mark Mahowald, Stewart Priddy**, and **Donald Saari**.

Valentino Tosatti was awarded a 2012 Sloan Research Fellowship.

Ewain Gwynne has been awarded an NSF Graduate Fellowship.

A reception honoring the new installation of the **George P.A. Healy portrait of Orrington Lunt** was held on March 15, 2013.

Ellen Goldstein was selected as a 2012-13 Project NExT Fellow.

Department Assistant **Cheryl Albiniak** won a WCAS Meteor Award for Excellence in a New Position. Graduate Program **Melanie Rubin** was recognized for 35 years of service in WCAS. Program Assistant **Nancy Hickey** was awarded her 2nd Service Excellence Commendation.

Business Administrator **Greg Jue** took a position in WCAS Dean's Office as Senior Research Administrator. **Cheryl Albiniak** became the new Business Administrator for math. Additionally, **Nancy Hickey** accepted a Program Assistant 3 position in the department.

John Alongi was awarded a Charles Deering McCormick Distinguished Lectureship beginning September 1, 2013.

Northwestern University awarded an honorary degree to math department alumnus **Michael Hopkins**. Hopkins, a distinguished topologist who holds both undergraduate and graduate degrees in math from NU, was honored at the NU commencement ceremony on Friday, June 21.

Xinwen Zhu was awarded the Centennial Fellowship of the American Mathematical Society.

Department Transitions

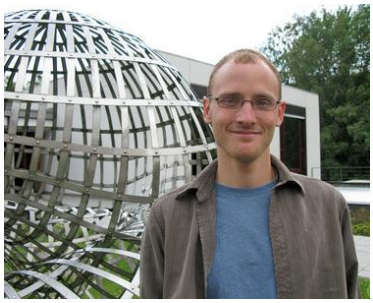
New Math Faculty joining Northwestern

We are happy to welcome the following new mathematics faculty who are joining us in the new academic year.

Kate Juschenko

Kate Juschenko works in the field of operator algebras and group theory. She obtained Ph.D. in 2011 from Texas A&M University. She did one year postdoc in EPFL, Switzerland and was an assistant professor in Vanderbilt University during one year.

Aaron Naber

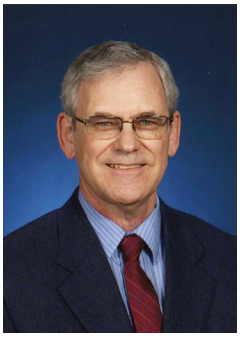


Aaron Naber's current research interests focus on the study of geometrically motivated equations and their applications. His work primarily focuses on the study of manifolds with Ricci curvature bounds, whether it be lower or upper, and their possible denegenerations in limit spaces. He also works in the other areas of interest, primarily regarding sectional curvature, minimal varifolds, Ricci solitons, harmonic maps between riemannian manifolds, mean curvature flow, Ricci flow, and elliptic equations.

Ben Weinkove

Originally from Manchester (England), Ben Weinkove obtained his bachelor's degree from Oxford University. After receiving his Ph.D. from Columbia University in 2004, he was a Benjamin Peirce Assistant Professor at Harvard University and a Royal Society Research Assistant at Imperial College London. He received a Sloan Fellowship in 2008. He held a faculty position at the University of California, San Diego before arriving at Northwestern in the Fall of 2012. In Winter 2013, Ben was appointed full professor. His research is in the area of geometric analysis and complex geometry.

Math Faculty Retiring in 2013



Clark Robinson was born in Seattle and received his B.S. degree from the University of Washington and his Ph.D. in Mathematics from the University of California at Berkeley.

He joined Northwestern University as an Assistant Professor in 1969 right out of graduate school. He spent the year 1970-71 on leave at the Instituto de Matematica Pura e Aplicada in Rio de Janeiro. He became an Associate Professor in 1973 and Professor in 1978. He served as Chair of the Mathematics Department from 1984 to 1987 and from 1996 to 1999.

During his 44 years on the faculty at Northwestern and an active participant in the mathematical community, he has authored over 60 research articles and both a graduate and undergraduate textbook on dynamical systems. He has given numerous talks at conferences around the world. His research interests concern the mathematical aspects of chaotic dynamical systems. These systems are deterministic so there is no uncertainty or chance in how they evolve. However, even though they usually have simple equations, they can exhibit complex dynamics. He has worked on such aspects of dynamical systems as structural stability, applications of symbolic dynamics and stable manifold theory to celestial mechanics and Hamiltonian systems, and chaotic attractors.

Clark was very involved with the Midwest Dynamical Systems group that organized conferences for researchers in the field. Although concentrated in the midwest, this group drew together people from around the country and even internationally. He was involved from the early years of this group's existence and has maintained the mailing list as it evolved from mailing labels to email lists.

In recent years, he has taught a variety of courses serving students interested in economics, including game theory and a course he developed on optimization.

Undergraduate News

2012 - 2013 Undergraduate Prize Winners in Mathematics

Robert R. Welland Prize for Outstanding Achievement in Mathematics by a Graduating Senior
Ewain Nathanael Gwynne

Outstanding Achievement in Mathematics by a Junior
John Devine Klein

Outstanding Achievement in Mathematics by a Sophomore
Andrew Jeehyun Ahn

Excellence in Mathematics by a Freshman
Joseph Breen • Fanming Dong • Matthew Du Sam Garcia • William Krinsman • Wen Long Lu Lu • Blake Mandel • Yujia Qiu • Xiwen Wang Yang Yu • Jingjing Zha • Andy Zhou

Outstanding Achievement in Mathematics by a High School Student in 300-level Math Classes
Fiona Brady

Outstanding Contributions to Undergraduate Mathematical Life
Daniel Beagan Kaplan

Outstanding Achievement on the William Lowell Putnam Examination
Siyuan Cai • Ewain Nathanael Gwynne

High Achievement on the William Lowell Putnam Examination
Edward Kim • Zeyu Wang

Excellence as an Undergraduate Teaching Assistant
Anthony John Woldeit

Math Majors Elected to Phi Beta Kappa

The following Math majors were elected to Phi Beta Kappa this year. Congratulations to all!

Elected as juniors:
Jordan William Jones

Elected as seniors:
Ian Alexander Coley • Tianchi Gao Michelle H Kim • Jacob C Peters Christopher Wallace Rowe • Maria Schiopu Nektarios Vasilottos • Sibo Wang Jincai Zhang • Xipeng Zhang

Above:
Dr Valentino Tosatti delivered the keynote talk at the Undergraduate Awards Ceremony.

All Photos: 2012 Mathematics Undergraduate Awards Ceremony, 2012 Math Undergraduate Dinner at Thai Sookdee. Photo credit: Tina Letsou.

Undergraduate News

by Mike Stein, Director of Undergraduate Studies

Accomplishments. This was an exciting year for our undergraduates. Perhaps most satisfying was the performance of our Putnam team in the 2012 Putnam Mathematical Competition. They ranked 10th nationwide (our best previous showing was 23rd), good enough for a Team Honorable Mention. Team member Ewain Gwynne, ranked 49th out of approximately 4300 students who took the test, received an Individual Honorable Mention. Our other team members, Siyuan Cai (who took the test while spending Fall in Budapest) and Zeyu Wang scored in the top 350, as did sophomore Ed Kim.

Math majors Zeyu Wang and Xuchen Han were 2/3 of the team which received honorable mention in the 2012 Mathematical Contest in Modeling

Four graduating seniors – Ian Coley, Daniel Douglas, Ewain Gwynne, and Daniel Kaplan – wrote honors theses this year. Three of them will continue into math PhD programs (at UCLA, MIT, and the University of Texas-Austin). Other seniors will be attending grad school in math-related fields.

Curricular changes. Several years ago, a small committee of undergraduates examined our course offerings and made suggestions for changes. We have taken a major step towards implementing their recommendations by developing a new MENU course in Probability and Stochastic Processes to be offered for the first time in 2013-14. This new sequence will covers more topic at a faster pace, and in greater depth, than 310-1,2,3.

At the request of the economics department, we will also begin teaching a new one-quarter course in probability and statistics to prepare students for 300-level econometrics.

Numbers. As this newsletter goes to press, we have 214 math majors and 25 minors. We expect those numbers to increase by about 10% before the end of the year, as freshmen come into declare their majors.

Photo Gallery

Photos this page clockwise from top left: 2012 Graduation reception; Nabil Kahouadji teaches math concepts at Take Our Daughters and Sons to Work Day 2013; Clark Robinson at Lunt Hall; Nemmers Prize recipient Ingrid Daubechies delivering public lecture; Martina Bode and Ursula Porod teaching math concepts at Take Our Daughters and Sons to Work Day 2013; Gabriel Drummond-Cole and Boris Hanin at Lunt Hall.

Photos this page clockwise from top left: John Alongi awarded a Charles Deering McCormick Distinguished Lectureship; Audience attending Nemmers Prize public lecture; 2012-13 beginning of the year reception; Ingrid Daubechies and Patrick Allen installing art in Lunt Hall; staff members Jane Miller, Nancy Hickey, Melanie Rubin and Cheryl Albiniak at 2012 Holiday party.

Mathematics and Dance: Reggie Wilson's Moses(es)

by Jesse Wolfson,
fourth year graduate student

Over the last year, I have been working with the choreographer Reggie Wilson to assist him and his dancers to understand and work with the formal structures they encounter as they engage with African and Africanist performance cultures. My involvement arose thanks to Wilson's dramaturge, Professor Susan Manning of Northwestern's English department, as well as thanks to Wilson's encounter with the work of Ron Eglash, an ethno-mathematician at Rensselaer Polytechnic Institute. While researching his latest project, *Moses(es),* Wilson discovered Eglash's book, *African Fractals*, which documents and analyzes extensive use of fractal symmetries in a range of African material cultures. Wilson surmised that African performance cultures likely made a similar use of fractals, and he asked Manning to find a mathematician who could help him understand the structures he was encountering. Manning (who is also my wife's thesis adviser) invited me to meet with Wilson in February of 2012, and I have been consulting with him and his dancers since.

Working with Wilson and his dancers has been a great pleasure. The sophistication and ubiquity of the deployment of fractal structures in African cultures is fascinating, and it has been eye opening to encounter abstract mathematics used to communicate and reinforce specific social meanings. In a striking example, cities in one Bantu culture are constructed as a large ring of family enclosures, each enclosure comprises a ring of houses, each house is itself circular, and inside each house is a miniature ringed city, representing the dwellings of ancestors. The self-similarity of the urban design embodies social values such as communality, reciprocity and interconnectedness. My project has been to identify similar uses of fractals in African performance cultures, and to help Wilson and his dancers understand when these fractals appear, how they are generated, and to what effect they are and can be deployed.

...it has been eye opening to encounter abstract mathematics used to communicate and reinforce specific social meanings...

Prior to this project, I had no training in artistic dance. On the other hand, my mathematical training means that I am attuned to formal structures, to the ways they can be put together or broken apart, and to ways we might vary or play with them. This means I tend to see different aspects of the choreography than Wilson and his dancers, and I tend to respond to a piece in different ways. By helping Wilson and his dancers to recognize and gain fluency with mathematical ideas, I have helped them to develop new strategies for organizing and directing bodies in motion. In turn, by teaching me to see and understand dance as they do, they have helped me to better understand and more richly experience an activity and art form that I love.

Wilson and his dancers will be premiering *Moses(es)* in the fall of this year in Philadelphia. From there, *Moses(es)* will go to New York, where it will be performed in December 2013 at the BAM Next Wave Festival. In the Spring of 2014 it will come to Chicago, when Wilson and his dancers will be performing at the Dance Center at Columbia College. It has been a privilege to work so closely with such talented and creat artists, and it has been deeply satisfying to do so using mathematics and mathematical ideas.

Graduate Student News

by Paul Goerss, Director of Graduate Studies

The Department of Mathematics is an exciting and vibrant community of scholars. There are over a hundred of us, all working on a multi-faceted project of research and teaching. Nearly half of the members of this community are graduate students, and they make important contributions to all aspects of the program.

The 2012-13 academic year began when we welcomed the first-year class of thirteen new graduate students. They are a diverse and accomplished group from top institutions: eight received their undergraduate degrees in the US, two from China, and one each from the Netherlands and France. In addition, another new student already has a Ph.D. in physics from Wisconsin, but was so taken by the mathematics of that field that he elected to go on for a degree in math!

The year will end with graduation of nine new Ph.D.s. Of particular note are Hiro Tanaka, who will be a Benjamin Peirce Instructor at Harvard, and Agnès Beaudry and Ian Le, who will go on to Dickson Instructorships at Chicago.

In between these beginnings and endings, the ongoing students have a remarkable impact, both in the department and nationally. Hiro Tanaka holds Presidential Fellowships, the most prestigious award Northwestern bestows on graduate students, and gave a presentation to the Society of Fellows this last fall. No fewer than four of the new students are NSF Fellows: Lauren Bandklayder, Nicole Looper, Brian Williams, and Dylan Wilson.

Inside the department, we recognized the accomplishments of our students. Owen Gwilliam and Austin Ford shared the Best Thesis Prize in 2012; Owen is now an NSF Postdoctoral Fellow at Berkeley and Austin is now an NSF Postdoctoral Fellow at Stanford. A newer award, created through the generosity of Professor David Nadler, is the Gelfand Award for extraordinary contributions to the research goals of the community of graduate students. This year's winner was Boris Hanin. Boris was a double winner this year, as he also won the Outstanding Graduate Student Teaching Award.

Finally, in other alumni news, Bohan Fang (Columbia), Renjie Feng (McGill/Maryland), Renji Nicolo Sibilla (Bonn/UBC), and Vesna Stojanoska (MIT) are among our graduates with top notch postdoctoral positions. Both Bohan and Vesna have recently been awarded NSF grants.

Photos from top: Richard Moy receives a Graduate Teaching Assistant Award from Professor Ursula Porod. Robert Legg receives a Graduate Teaching Assistant Award from Professor Ursula Porod. Paul Goerss, Director of Graduate Studies, delivers opening speech at 2013 Deaprtment Awards Reception.

Thanks Melanie!

Melanie Rubin, the department's Graduate Program Assistant is retiring this year after 35 years of service. Below are two short articles from members of the department looking back on Melanie's career at Northwestern.

In the late 1970's, our venerable, beloved Lunt Hall was in a state of utter disrepair, but on the second floor, in the Math Office, we had a fresh new face: it was Melanie with her winning smile. Melanie wore her human empathy on her sleeve. She cared about everyone connected with the Math Department, graduate students, undergrads, staff, faculty. She was up to date on our problems, she advised, comforted us, helped us.

It was many years later that I discovered another facet of Melanie's unusual personal appeal. It was her sense of adventure. When she was very young, she fell in love with the freedom of the open skies. She learnt how to fly an airplane and she became a licensed pilot in her early twenties. The young man who was courting her, the admirable Arnold, must have been absolutely dazzled when she invited him to take a ride with her in her plane. She wanted to test his mettle. He passed the test and the rest is a familiar story...

Alexandra Bellow

Melanie Rubin came to work in the department in 1979 after raising a family of three and serving an initial stint in math (years unknown). Her attention to detail coupled with her human sensitivities created a feeling of warmth and friendship throughout the department; for example, she learned the names of ALL of the graduate students in less than a week; while faculty make the final decisions she had photographic memory of folders of applicants -- sometimes more than 200 candidates.

From her vantage point on the second floor, at the top of the stairs, she had spontaneous knowledge of which department faculty and students were here in the building and which had not yet arrived. Her two Presidential Awards represent a small token of her level of service to the university.

On the lighter side, we recall the day Melanie shouted "Eureka" after opening a file drawer. Several people throught that she had solved the Riemann Hypothesis!! In fact her discover was more local - namely the identity of her birthday with that of a recently tenured colleague.

The department is now challenged to develop a new set of staff responsibilities without Melanie Rubin. We expect some potholes in the beginning, with a new set of duties developing over the course of time - hopefully a smooth roadway for some years to come.

Mark Pinsky

From the Chair

continued from front page

an Outstanding Graduate Student Teaching Award.

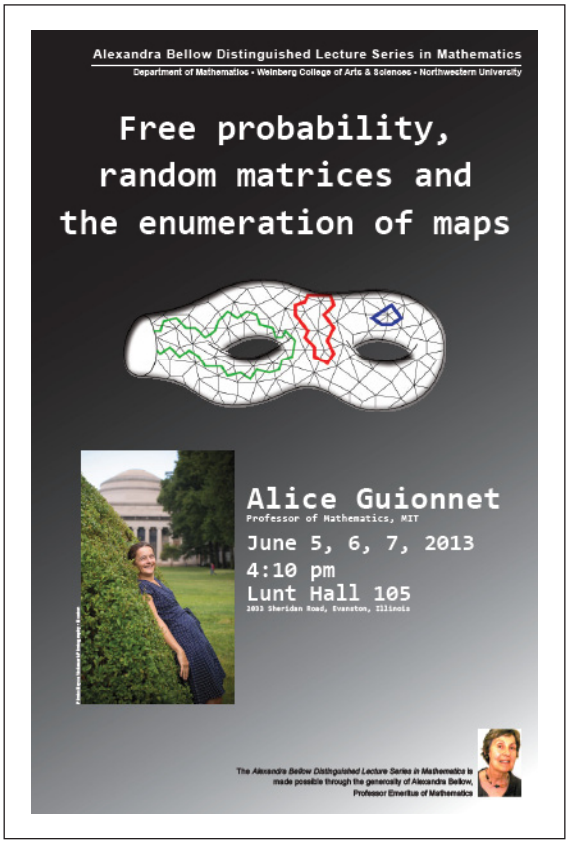
Another exciting recognition of one of our own is coming up at Commencement this June, when Mike Hopkins (Northwestern B.A. 1979 and Ph.D. 1974) will receive an honorary degree. Hopkins is a visionary leader in algebraic topology, and has been recognized with the 2001 Veblen Prize in Geometry as well as the 2012 National Academy of Sciences Award in Mathematics; he is a professor at Harvard.

Challenges facing us include the ever-present problem of space: we have given up our annex in 619 Emerson and have been upgraded to a new annex space on the second floor of Locy Hall. The office space in Locy is excellent, but of course is still not in Lunt Hall, and the splitting of the department is problematic for our unity of purpose and our morale. Barring a costly extension on the back of Lunt – clearly the ideal solution to our problems – we more realistically hope to obtain space to replace Locy much closer to home in the Jacobs Center when it is vacated by the Kellogg School of Business a few years hence.We did celebrate the magnificence of Lunt Hall itself this year, in a ceremony dedicating a portrait of Orrington Lunt by George P.A. Healy (an eminent portraitist of the day, who also painted every US president from John Quincy Adams to Ulysses Grant). The painting, generously donated by Caroline Lunt Starbuck, Lunt's great granddaughter, now hangs over the main staircase, lending our daily arrival at work a new gravitas. We celebrated with a wine and cheese reception attended by a number of Lunt descendents. Lunt himself, described by no less than Frances Willard as "a typical Methodist of the old regime," might not have wholly approved of our style of celebration, but the intellectual legacy of Lunt Hall would surely have pleased him.

Alexandra Bellow Distinguished Lecture Series in Mathematics

In 2012, the mathematics department received a generous gift from Professor Emerita Alexandra Bellow to endow an annual lecture series. Alexandra studied Mathematics at the University of Bucharest, receiving her M.S. in 1957. From there she continued her graduate studies at Yale University and received her Ph.D. under the direction of Shizuo Kakutani in 1957. Alexandra was appointed Professor in the Department of Mathematics at Northwestern University in the fall of 1967. She was 32 years old and was the first female full professor in the department. She taught and performed research at Northwestern for nearly three decades in the field of Ergodic Theory and Probability. Before the advent of the computer and internet, research was often a solitary enterprise and if done in collaboration it required the presence of other mathematicians. Because of this, Alexandra spent time as a visiting professor at various institutions such as: the University of Minnesota, MIT, Brandeis, Caltech, the University of Victoria – BC, UCLA, Hebrew University in Jerusalem and Goettingen University in Germany.

Our first lecture series was delivered by Alice Guionnet, MIT, on June 5-7th, 2013. Her lecture was titled, "Random matrices, free probability and the enumeration of maps."



Decendents of Orrington Lunt attend ceremony dedicating a portrait of Orrington Lunt by George P. A. Healy generously donated by Caroline Lunt Starbuck, Lunt's great granddaughter.

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