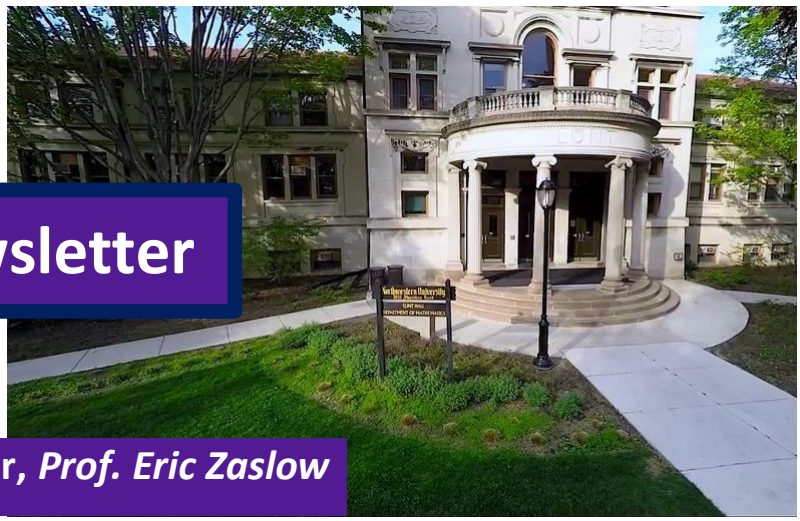
Northwestern University
Mathematics Department



Summer 2020 Newsletter

Letter from the Chair, *Prof. Eric Zaslow*

Charting Courses Through the Storm

The coronavirus pandemic wreaked devastation on the lives of millions of people and their families. Members of our community were not spared the impact of the health crisis. We wish all the best to those whose loved ones were affected.

Our community has shown remarkable strength and resilience throughout. I will say more below, but first let me express my appreciation to all who helped transplant our vibrant communities in Lunt and Locy to a virtual setting -- meeting at virtual happy hours, departmental teas, study sessions, on-line discussions and generally being "present." And thank you for the tireless efforts of everyone who continued their work, their studies, their jobs in a completely new setting.

The economic impact of this crisis is worldwide and severe, as well. Close to home, there are staff being furloughed at the university. Our staff have worked bravely throughout this period, learning new protocols and practices on the fly, and transferring their work to a remote environment. The department has stayed afloat. Before all this, we were handling admissions, hiring, course scheduling, departmental events, technology and finances with aplomb. And now we do all of that in a new paradigm. We are very supportive of our wonderful staff, and have made clear, along with other departments, that we value and want to protect them. A special thanks to you-- **Deavon Mitchell, Jenima Lyon, John Mocek, Liz Gabel, and Miguel Lerma**!

As we are all aware, the pandemic also suddenly turned education on its end. In Math, even before Illinois went into shelter-in-place restrictions, we had to plan for a finals exam week in a period of great change and uncertainty. Illinois was experiencing exponential growth in its case rate, and as mathematicians we understood this and advocated for aggressive actions. Our leadership team of **John Alongi** (Director of Undergraduate Studies), **Santiago Cañez** (Director of MENU), **Aaron Greicius** (then Acting Director of Calculus) and **Aaron Peterson** (Director of Calculus) put together a plan of policies and procedures for our faculty over the weekend before finals and shared it with the College to get its approval. The university followed on the same day, with a nearly identical policy — coincidence? Whatever the case, we were prepared for finals, and the week went as smoothly as could be hoped. The same team has offered guidance to the department and the College throughout the spring quarter, which just ended — again, as successfully as one could wish for. No doubt, it was a taxing, stressful, and difficult time for all — and for many reasons. But the department had a successful instructional quarter due to the commitment and citizenship of these and the rest of the faculty, its graduate-student TA's and staff. Thanks to all!

The US saw great political unrest during this time. The University and the College made statements in support of justice, following the killing of George Floyd at the hands of police. Mathematics did not issue a separate statement. We chose this course to avoid virtue signaling or any suggestion of comparing the issues we face in Lunt to the struggle for freedom from brutality. We lament that a chance to offer solidarity with the protesters was missed as a result of this choice, but recognize that statements (including this one) are inherently insufficient and unsatisfactory.

The Department of Mathematics is committed to inclusion in the profession. The Graduate Research Opportunities for Women annual conference, initiated at Northwestern, was recognized by the American Mathematical Society as a Program That Makes a Difference. The Department is planning to inaugurate a postdoctoral program aimed at increasing representation in doctoral programs by students from groups historically under-represented in the mathematical sciences. This effort is funded by an $850,000 grant from the National Science Foundation

(Continued on Page 3)

GROW Program Wins 2020 Mathematics 'Programs that Make a Difference' Award

The American Mathematical Society has recognized the GROW program with the 2020 Mathematical 'Programs that Make a Difference Award'.

The first iteration of the GROW series was designed by **Bryna Kra**, the Sarah Rebecca Roland Professor of Mathematics at Northwestern. Kra, along with more than 40 volunteers, led the organization of the conferences at NU from 2015-2017. Since then, GROW has taken place at the University of Michigan as well as the University of Illinois at Urbana-Champaign.

Group Photo from 2017 GROW Conference, hosted at Northwestern University

GROW, short for Graduate Research Opportunities for Women, is an annual series of conferences that nurture, mentor, and invite undergraduate women to the opportunities that await a career in mathematics. Funded by the National Science Foundation and participating universities, the GROW program is in its fifth year and has served hundreds of participants.

Prof. Eric Chang

Prof. Aaron Greicius

Prof. Maria Nastasescu

Prof. Clive Newstead

NU Math Faculty Awarded 2020 Daniel I. Linzer Grant for Innovation in Diversity and Equity

Prof. Eric Chang, Prof. Aaron Greicius, Prof. Maria Nastasescu and Prof. Clive Newstead were awarded a 2020 Daniel I. Linzer Grant for Innovation in Diversity and Equity for their work with the Northwestern Emerging Scholars Program (NESP). NESP is an active-learning community that promotes the retention of women, students from underrepresented groups, and first-generation students in Mathematics. Students in the program meet on a weekly basis and work in groups to explore new mathematical ideas and their real-world applications.

The Daniel I. Linzer Grant focuses on proposals for novel and innovative practices that will enhance our missions of education and research through improved diversity and inclusion at Northwestern University. Proposed projects demonstrate how they enhance our academic enterprise through expanded diversity, inclusion, and equity at Northwestern University including but not limited to sex, gender identity or expression, race, ethnicity, disability, socioeconomic status, age, political affiliation, religion, philosophy, or sexual orientation.

NU Mathematics Alumni Highlight

In May 2020, NU Mathematics Alumni Highlight Northwestern alumnus **Daniel Douglas** (Class of 2013) successfully defended his thesis "Classical and quantum traces coming from SLn(C), Uq(sln)", written under the supervision of Professor **Francis Bonahon** at USC. Daniel headed east to Yale University over the summer, where he will be a Gibbs Assistant Professor.

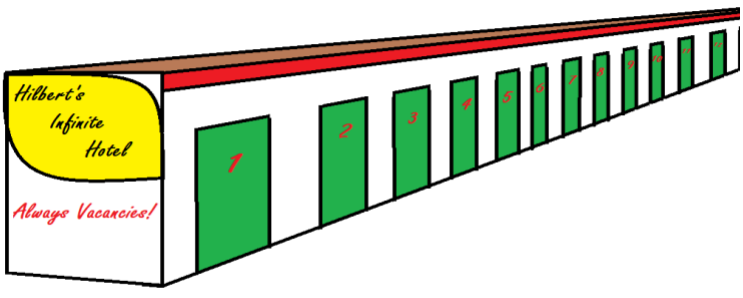


Image from NESP poster

Letter from the Chair *(continued from Page 1)*

(NSF). Co-Principal Investigators are **John Alongi, Santiago Cañez, Bryna Kra and Eric Zaslow**, with **Onnie Rogers** [Psychology] as senior personnel. An additional $850,000 commitment was made by the Office of the Provost. The Northwestern Emerging Scholars Program is an effort to bring a wider group of students into the major -- students who might not have thought of themselves as mathematicians. This program was once again recognized with a Linzer Diversity and Inclusion Grant, awarded to **Eric Chang, Aaron Greicius, Maria Nastasescu, and Clive Newstead**. Other activities are listed on the department homepage: see About>Inclusion at NU Math. Faculty members **Ezra Getzler, Bryna Kra and Florian Richter** are also involved in the Prison Education Program.

I sometimes say lightheartedly that mathematicians, because of their work, have a keen sense of what equality means. In times like these, my colleagues remind me that there is some deeper truth to this remark.

Despite the grave times we face, there has been cause for celebration — before, during, and surely after the pandemic. Some life does go on. Our graduates have managed to steady their focus and pass their defenses, prepared to enter the fellowship of scholars. Congratulations to **Khashayar Filom, Anh Le, Sebastian Olano, Nick McCleerey, Shuyi Weng, and Kitty Yang**! More are expected to graduate this summer. I won't put anyone on the spot, but congrats to them, too! In addition, our graduates were celebrated at our on-line awards ceremony, where we named **Ruoyu Wang** Outstanding graduate TA, **Khashayar Filom and Nick McCleerey** won Best Thesis, **Clive Newstead** was named Outstanding postdoctoral instructor, and **Anthony McCormick** was given the Gelfand Award for his numerous contributions to departmental life, all of which seem to stem from his insatiable curiosity for mathematics! Congratulations! You can read more about the graduate and undergraduate programs in the letters by Profs. **Auffinger and Alongi**.

The Department joined with other departments at Northwestern, University of Chicago, University of Illinois Chicago and University of Illinois Urbana-Champaign to propose the Institute for Mathematical and Statistical Innovation (IMSI). A $15.5M grant from the NSF will support its creation. The institute will connect theoreticians and applied practitioners working in mathematics and statistics in order to help address grand societal challenges: global health, climate models, economic theory, to name a few. IMSI will be housed at University of Chicago. At Northwestern, Math and Statistics were involved in the planning, and we hope that many other units within the university will be involved: economics, applied math, Q-Bio, NICO, ... More specifically **Bryna Kra** serves as co-PI on the grant, Larry Hedges (Statistics) was part of the proposing team and a member of the Scientific Advisory Committee, **Jared Wunsch** will serve as a future Associate Director, and **Eric Zaslow** senior personnel on the grant and will serve on the Board of Directors. We hope this proves to be a lasting resource not just for department members, but for researchers nationwide.

Among the faculty, Assistant Professor **Ilya Khayutin** was awarded an AMS Centennial Fellowship. Associate Professor of Instruction **Santiago Cañez** was named to a Charles Deering McCormick Lectureship. The Deering McCormick positions are the highest teaching honors that the university bestows upon its faculty. In another signal achievement, **Laura DeMarco** was named to the National Academy of Sciences. She joins colleague **Bryna Kra,** who was elected to the NAS last May. In addition to all this, **Emmy Murphy** won the 2019 New Horizons Prize in Mathematics by the Breakthrough Foundation. Congratulations to all!

This year also saw the passing of a longtime former colleague and emeritus professor, **Kenneth Mount**. Ken worked in algebra, having received his PhD from Fary in Berkeley in 1960. He later did work on complexity in information theory and economics. We offer our condolences to those who knew Ken.

We wish the best of luck to two valued colleagues and friends — **Laura DeMarco and Mihnea Popa** — who are leaving Northwestern for professorships at Harvard. Laura and Mihnea made the department and those around them better. We wish them continued success in their new positions. As our faculty profile grows, it is not lost on any of us that our peer competitor institutions now include the very top departments in the world. In that regard, we are delighted to welcoming incoming faculty members. **Xiumin Du** is a harmonic analyst whose two Annals papers have established some of the very best smoothness bounds for solutions to the Schroedinger equation. She joins us as an Assistant Professor in the fall. **Ben Antieau's** recent works explore new connections between algebraic geometry and algebraic topology. He joins us as Professor this fall. And **Yuchen Liu** is an algebraic geometry whose work on K-stability has been essential for understanding families of Fano varieties and their special metrics. He will be joining the department in September, 2021. Welcome!

These times continue to be a period of great uncertainty, but there is every reason to be hopeful the future, as the department has repeatedly shown its resilience and strength -- in teaching, in administration, in research, and as a community. To anyone reading this note, we thank you for your interest in Northwestern Mathematics and for your continued support.

To Direct a Gift to the Department of Mathematics, go to www.northwestern.edu/giving/index.html.

Earmark your gift for "Department of Mathematics" in the Gift Designation "Other" Box

NU Mathematics Faculty News Highlights

Prof. Santiago Cañez

Prof. Santiago Cañez Named a Charles Deering McCormick Distinguished Professor of Instruction

The Charles Deering McCormick distinguished professorships are the highest teaching honor that the university conveys. Santiago runs the Math Circle, teaches at ETHS, teaches in the summer Bridge program, directs MENU, and is a co-creator of the Causeway postbac program scheduled to start this summer.

Prof. Laura DeMarco

Prof. Laura DeMarco Elected to the National Academy of Sciences

Established by an Act of Congress, signed by President Abraham Lincoln in 1863, the NAS is charged with providing independent, objective advice to the nation on matters related to science and technology. Scientists are elected by their peers to membership in the NAS for outstanding contributions to research.

Prof. Katrina Morgan

Prof. Katrina Morgan Wins an NSF Postdoctoral Fellowship

The National Science Foundation funds research and education in most fields of science and engineering. This award was made as part of the FY 2020 Mathematical Sciences Postdoctoral Research Fellowships Program. The title of the project for this fellowship to Prof. Katrina Morgan is " Global analysis of waves on asymptotically flat backgrounds."

Prof. Emmy Murphy

Prof. Emmy Murphy Receives 2020 New Horizons Prize in Mathematics

Winners of the 2020 Breakthrough Prize in Life Sciences, Fundamental Physics and Mathematics have been announced. Prof. Emmy Murphy received this prize "for contributions to symplectic and contact geometry, in particular the introduction of notions of loose Legendrian submanifolds and, with Matthew Strom Borman and Yakov Eliashberg, overtwisted contact structures in higher dimensions."

Dr. Mark Piraino

Dr. Mark Piraino Wins 2019 University-wide Best Thesis Prize from the University of Victoria, the Governor General's Gold Medal

Dr. Mark Piraino is the recipient of the 2019 Governor General's Gold Medal. This University-wide award is given in recognition of an outstanding dissertation. Mark was co-supervised by Professor Anthony Quas and Professor Chris Bose and his research is in dynamical systems and ergodic theory.

Prof. Valentino Tosatti

Prof. Valentino Tosatti Receives the 2019 Renato Caccioppoli Prize

The Renato Caccioppoli Prize is awarded every four years by the UMI to an Italian mathematician of established international reputation and who has not exceeded 38 years of age in the year preceding the award. The winner is nominated by a committee of five mathematicians appointed by the Main Office of the UMI.

Prof. Sandy Zabell

Prof. Sandy Zabell Appointed to Two-Year Term as a Member of the Expert Working Group on Human Factors in Forensic DNA Interpretation

The Expert Working Group on Human Factors in Forensic DNA Interpretation is jointly sponsored by the National Institute of Standards and Technology and the National Institute of Justice. Prof. Zabell was appointed in January 2020.

Letter from Director of Undergraduate Studies, *Prof. John Alongi*

Traditionally, the end of the academic year is a time to recognize the accomplishments of our students and faculty. This year we expect the Class of 2020 to include 53 mathematics majors and 11 mathematics minors, but a few of our graduating seniors deserve special mention.

Justin Lin discovered a new lower bound for the Ramsey number R(3,3,3,6) in his senior thesis Ramsey Theory. This fall Justin will begin a doctoral program in mathematics at Indiana University. **Owen MacDonald** wrote a senior thesis Random Walks on Infinite Groups: Entropy, Speed, and Spectral Radius and has served as an undergraduate teaching assistant in several courses. Owen will enter the doctoral program in mathematics at the University of Arizona this fall. **Fiona Brady** began taking mathematics courses at Northwestern when she was 13 years old and has credit for 14 graduate-level mathematics courses. Fiona will pursue a doctorate in mathematics at Princeton University.

Among our faculty, **Professor Santiago Cañez** won a Charles Deering McCormick Distinguished Professorship, Northwestern's highest honor for teaching excellence. Santiago's courses emphasize a unified approach to problem solving in an interactive classroom environment. Through his teaching at Evanston Township High School and as an organizer of the Causeway Postbaccalaureate Program Santiago has played a central role in our outreach and diversity initiatives. Also in pursuit of building a more inclusive mathematical community at Northwestern, Professors **Aaron Greicius**, **Maria Nastasescu**, **Eric Chang**, and **Clive Newstead** won a Daniel I. Linzer Grant for Innovation in Diversity and Equity for their work with the Northwestern Emerging Scholars Program (NESP).

The COVID-19 pandemic struck just as Northwestern prepared for Winter quarter final examinations. In four days our program pivoted to administering remote final examinations, and in under three weeks we adapted 49 sections of 31 different courses for remote instruction during Spring quarter.

Our undergraduate program was a leader in Northwestern's response to the crisis, anticipating and solving problems in ways that guided the rest of the University. Many faculty, graduate students, and staff participated in this massive effort, but Professors **Eric Zaslow, Santiago Cañez, Aaron Greicius, and Aaron Peterson** deserve special praise for their outstanding work.

Had it not been for the COVID-19 pandemic, surely our biggest news of the year would have been the successful launch of our new calculus curriculum, led by Director of Calculus **Aaron Peterson.** Our new curriculum is the culmination of four years of development and provides students with deeper courses at a slower pace that better illuminate the beauty of calculus.

After four years as Director of Undergraduate Studies I will be stepping down in September to devote more time and energy to teaching and writing. Reflecting on my time as Director of Undergraduate Studies (DUS), an assistant dean recently wrote, "You started your tenure as DUS with a major curriculum overhaul and you are finishing in the middle of a pandemic. I think The Universe owes you a set of Powerball lottery winning numbers." Now, let me calculate the odds of winning the Powerball jackpot…

We are grateful to all of the alumni who donate to the department, especially as budgets tighten in response to the financial impact of the COVID-19 pandemic. Donations help fund our undergraduate awards as well as initiatives that support the department's undergraduate teaching mission. As an alumnus myself, I hope that you will join me in contributing to the Department.

Letter from Director of Graduate Studies, *Prof. Antonio Auffinger*

As a unique academic year ends, our graduate program is proud to celebrate our students resilience and accomplishments. Eight of our graduate students will earn their PhDs in 2020: **Khashayar Filom, Peter Kleinhenz, Anh Ngoc Le, Nicholas McCleerey, Sebastian Olano Espinosa, Kitty Yang, Yu Wang, Yuxiang Wang and Shuyi Weng**.

Khashayar Filom and **Nicholas McCleerey** shared the annual Best Thesis Award. Khashayar worked under the guidance of Prof. Laura DeMarco. His research is focused on the complex moduli space of rational maps on P^1 and the dynamics of the real maps within this space. Nick was supervised by Prof. **Valentino Tosatti**. His research lies at the intersection of complex geometry, geometric analysis and differential geometry, studying singularities of plurisubharmonic functions. They have one more thing in common: they will both hold post-doctoral positions at the University of Michigan next academic year. Congrats, Khashayar and Nick!

The Gelfand Award, which recognizes a graduate student who has achieved outstanding progress in their own research or made extraordinary contributions to the research goals of the department's graduate community, went to **Anthony McCormick**. Anthony received several nominations from his fellow graduate students. He is seen as ``a pillar of light and sympathy'', ``always willing to chat about interesting and marvelous perspectives on all sorts of math'', a graduate student

(Continued on Page 6)

Letter from Director of Graduate Studies, Prof. Antonio Auffinger *(continued from Page 5)*

that is always ready to bring ``inspiration and courage to more mathematically shy peers'', and a great organizer of several seminars. Anthony, congrats and, please, continue.

Congratulation also to **Ruoyu Wang** who won the Department Teaching Assistant award. According to his students, Ro has a great and unique sense of humor, and his encouragement and kindness are his trademark. His teaching is nothing short of extraordinary and his availability is appreciated by all his students.

After a small and fantastic incoming class of graduate students in 2019 (they all passed their prelims in June! Yay!), our incoming class in 2020 has 18 new students. Joining our family next year are: **Zhenyi Chen** (UCLA), **Micah Darrell** (UIC), **Javier Echevarria Cuesta** (Stanford), **Diogo Fonseca** (Cambridge), **Mingyuan Hu** (Peking), **Yuxuan Hu** (Peking), **Pavel Javornik** (CUNY), **Alex Karapetyan** (Toronto), **Deven Lahoti** (MIT), **Kiril Magidson** (HSE, Moscow), **Daniel Mallory** (U.Nevada, Reno), **Elchanan Nafcha** (Hebrew), **Sebastian Ørsted** (Aarhus), **Shelby Silaski** (Texas State), **Hanru Sun** (JHU), **Joshua Tomlin** (ANU), **Kai-Hsiang Wang** (National Taiwan), and **Jiaqi Zang** (Tsinghua). We can't wait to meet you all remotely and (eventually) in person!

I wanted to end this short letter by thanking the efforts of our graduate students, staff, and faculty, that helped our graduate community remain connected as ever. Special kudos to our graduate students who brought their cats, dogs, goats(!) and turtles to our virtual tea. It was a nice touch. High school was a while ago but we are all in this together!

2020 UG Awards and Graduation Celebration

Every year the Mathematics Department celebrates our graduating Math Majors as well as awards prizes for both outstanding achievement in mathematics and contributions to the mathematics community within Northwestern University.

This year's awards and graduation event was celebrated via our Zoom on June 17th, with featured guest speaker, Prof. **Francis Su** of Harvey Mudd College. Prof. Su's speech, "Mathematical Virtues in a Post-Pandemic World", centered on what our graduates can expect to retain from their college math degree and how their mathematical training has shaped their character for the world today.

Prof. Francis Su, of Harvey Mudd College, was the featured speaker at the 2020 UG Awards and Graduation Celebration

Congratulations to all 2020 Award Winners and Graduating Math Majors and Minors on Your Academic Achievements!

2020 Graduate Student Award Winners

Gelfand Award in Mathematics
Anthony McCormick

Best Thesis Award in Mathematics
Khashayar Filom
Nicholas McCleerey

Best Teaching Assistant Award
Ruoyu Wang

2020 Undergraduate Award Winners

Robert R. Welland Prize for Outstanding Achievement in Mathematics
Justin Lin

Senior Career Award in Mathematics
Owen MacDonald
Jinming Zhang

Junior Career Award in Mathematics
Nicholas Karris

Award for Outstanding Contributions to Undergraduate Mathematical Life
Yintian Zhan

Award for High Achievement on the William Lowell Putnam Examination
Hoan Nguyen

Excellence as an UG Teaching Assistant
Peter Guan

UG Teaching Assistant Service Award
Owen MacDonald

Award for Excellence by a First-Year Student
Daniel Luo, Gwen Cooke, Anxin (Bob) Guo, Akhil Kalghatgi, Nikhil Kalghatgi, Xander Struyk, Zening (Tony) Luo, Yizhou (Rosalind) Wang, Alyssa Connor, Yixin (Carina) Liu, Andrew Laeuger

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