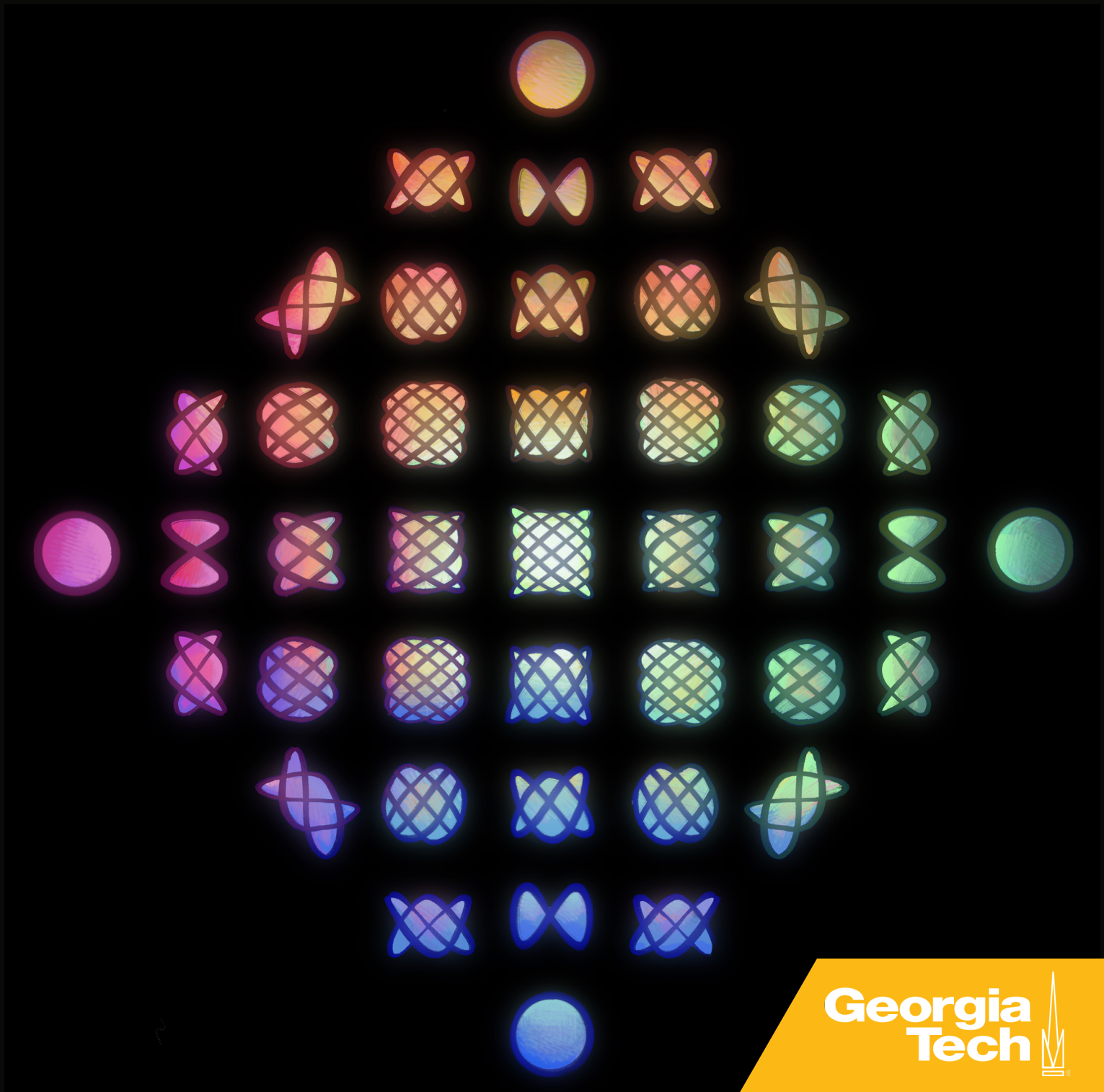
SCHOOL OF MATHEMATICS
PROOFREADER

FOR ALUMNI AND FRIENDS



Georgia Tech

LETTER FROM THE CHAIR

JULY 28, 2022 | ATLANTA, GA

SoM Chair Mike Wolf

A few weeks ago, I moved into the chair's office at the School of Mathematics. Of course, I have much to learn about the school, its people and programs, but I was excited to be offered the position because of the tremendous strength of the school and especially the promise and potential of SoM at the moment.

The Beauty of Mathematics

Let me take a step back. I don't have to tell this audience that mathematics is a wonderful subject. Mathematics has an unparalleled richness and complexity that comes from millennia of human thought and discourse across cultures; math has a scope of effect that touches all scientific and engineering disciplines, and now math reaches ever further into the social sciences as well.

The student body is growing in size and diversity and we need to find ways to make sure that all are supported as they reach towards their ambitions.

While perhaps somewhat less visible than the research in the other sciences, mathematics is beautiful and significant - in this issue, you may read of the breakthroughs of Alex Blumenthal on Batchelor's law, Jinyoung Park on the expectation conjecture, and Svetlana Jitomirskaya on quantum mechanics, as well as the ongoing pioneering efforts of Rachel Kuske to harvest unused vibrational energy in bridges.

What is remarkable about the Georgia Tech School of Mathematics - actually rather rare in the nation - is that these deep contributions occur across such a vast intellectual landscape and also touch so many other fields.

SoM Chair Mike Wolf

About the School of Mathematics

The school is increasingly prominent: you will also read in this edition of the ProofReader of our rapid ascent in the U.S. News rankings: not only did the school jump from 26 to 21 in the most recent poll, but we were also ranked in four specialized areas, which is in itself a testament to the breadth and depth of the program. Faculty gained a great deal of international recognition: there are few math departments that can claim three invited addresses (here by Jen Hom, Michael Loss, and Konstantin Tikhomirov) at the International Congress of Mathematicians (ICM) for work they did while at the school. In addition, our incoming Hubbard Chair Svetlana Jitomirskaya delivered a plenary address at the ICM and was recently awarded the inaugural Ladyzhenskaya prize by the International Mathematics Union.

Georgia Tech College of Sciences

School of Mathematics

The Impact of SoM

At the same time that mathematicians drive mathematics forward, they influence vast numbers of students at all levels. Just about all Tech students take a math course and most take several: as one cumulative measure, last year the school awarded roughly sixty-five thousand credit-hours for undergraduate and graduate classes. Beyond the numbers, the instruction is first-rate: please take note of all the pedagogical awards garnered by the faculty.

What is remarkable about the Georgia Tech School of Mathematics - actually rather rare in the nation - is that these deep contributions occur across such a vast intellectual landscape and also touch so many other fields.

The school also reaches beyond its own students with several outreach programs: there are articles in this issue on the Atlanta Science Festival and the High School Math Competition. Not mentioned here is the longstanding Distance Learning program which sends Georgia Tech courses to high school students across Georgia who have progressed beyond calculus and are ready for more.

Also in this newsletter, you'll see a reflection of the contributions of our wonderful staff, who with little celebration just make everything work. Both Kimberly Stanley and Lea Marzo were recognized for their efforts beyond what any of us had the right to expect. It is greatly empowering to a new chair to inherit a staff that is both effective and invested in the future of the school.

The Future of SoM

There are of course challenges. Our excellence invites competition from other programs, so we must constantly try to advance our research presence, defending our strengths and growing into newly important areas. The student body is growing in size and diversity and we need to find ways to make sure that all are supported as they reach towards their ambitions. What can be wonderful about mathematics is that, ideally, it is only the truth and significance of what you say that matters, rather than what your background is. But to fully realize that ideal, we must be welcoming and encouraging to all, including mathematicians of exceptional potential from groups we haven't focused on as much as we could. That goal of broad and comfortable participation from all corners of society is both the imperative of today and also the promise of mathematics for the future.

Share Your Story!

I am trying to learn from as many people from the School of Mathematics community as I can. I ask the alumni to please share your stories of what you did with your mathematics education: our students greatly benefit from having models of where their studies can take them. More broadly, if you wish to partner with us as we move forward, please get in touch: I would love to hear your ideas. It's a wonderful time to join the School.

To reach us, please email
Sal Barone the
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the School of Mathematics:

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More information, a Donate page,
and web versions of all the stories
in this edition of the ProofReader
can be found on our website:

https://math.gatech.edu

Table of Contents

RESEARCH EXPERIENCES FOR UNDERGRADUATES

HOW I SPENT MY SUMMER: NSF REUs

AUGUST 20, 2021 | ATLANTA, GA

In 2021, all six schools in Georgia Tech's College of Sciences offered a summer NSF Research Experiences for Undergraduates (REU) program. Students attending the year's REUs recounted what they learned, and how it will impact their academic careers.

That was the situation for Meredith Clayton, who is set to graduate this December from Stephen F. Austin State University (enrollment: 13,000) in Nacogdoches, Texas. She attended the 2021 Research Experiences for Undergraduates REU at Georgia Tech.

"It was great just to meet other math majors from different universities. Georgia Tech's a great environment and campus — all the faculty are awesome that I've met. It's just been a really good time."

All about our REUs - and their leaders:

REUs are sponsored and funded for science and math programs in higher education by the National Science Foundation (NSF).

Some of the College of Sciences REUs accept Georgia Tech students, while others are limited to out-of-state students. Check the links for acceptance requirements of each REU.

David Collard, senior associate dean in the College, who previously led the REU program in the School of Chemistry and Biochemistry for more than a decade, shares that "NSF REU programs in the College of Sciences have a long record of engaging diverse cohorts of participants in cutting edge research."

School of Mathematics REU participants present their findings

"Since most of the undergraduate participants are recruited from institutions that do not have extensive research infrastructure, the immersive research experience available to them in these programs can be transformational," he says. "A measure of success of the REU programs in the College of Sciences is that many of the undergraduate participants subsequently go on to complete their Ph.D., some at Georgia Tech, and others elsewhere.""

"In each school, there is very much a team effort in running these programs," he adds, "and the coordination of these efforts between the schools is a particularly important feature in allowing us to provide high quality programs."

RESEARCH EXPERIENCES FOR UNDERGRADUATES

REUs 2021

JULY 22, 2022 | ATLANTA, GA

By Dan Margalit

In 2021 the School of Mathematics continued its long running summer REU (Research Experiences for Undergraduates) program. The organizers were Professors Igor Belegradek, Rachel Kuske, and Dan Margalit. This summer the mentors and topics were:

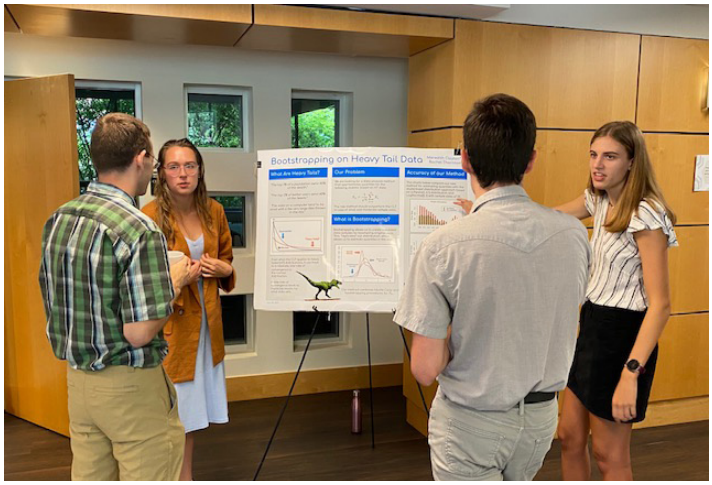
- **Anton Bernshteyn** - Graph coloring
- **Jianbo Cui, Luca Dieci and Haomin Zhou** - Numerical simulations in optimal transport
- **Jorge Gonzales** - Dynamical Systems with computer assistance
- **Siddhi Krishna and Marissa Loving** - Braids, surfaces, and low-dimensional phenomena
- **Rachel Kuske** - Dynamical modeling for sustainable energy
- **Wenjing Liao** - High-dimensional data analysis and neural networks
- **Doron Lubinsky** - Inequalities for polynomials
- **Cheng Mao** - Comparison of Ranking Systems
- **Mayya Zhilova** - Resampling methods for statistical models involving heavy-tailed distributions
- **Dan Margalit, Wade Bloomquist, Nancy Scherich, Roberta Shapiro, and Yvon Verberne** - Curves on Surfaces
- **Dan Margalit** - Complex dynamics

After a summer in 2020 where the entire program was virtual, SoM was happy to welcome some students back in person. The students were especially excited to be back on campus, leading to an energetic atmosphere in Skiles. Overall, there were 35 undergraduate participants, with 21 working in person on campus.

Besides the research projects, which form the cornerstone of the program, students also participated in a professional development seminar, which covered topics such as: applying to graduate school, writing and delivering talks and posters, and the basics of LaTeX and Inkscape. The seminar was organized by Dan Margalit, Wade Bloomquist, Nancy Scherich, Roberta Shapiro, and Yvon Verberne. The students also participated in tea time, regular social activities, as well as an REU-wide colloquium series.

This year also saw the introduction of the GRE Math bootcamp, a two-month test preparation program, which was well attended by the REU and metro Atlanta students. This program was organized by the graduate director Xingxing Yu and taught by Hyunki Min, a graduate student.

There were two poster sessions, one in Skiles and one online. Both featured outstanding projects and even more outstanding posters and presentations. Among the awards earned by this year's cohort was an MAA Outstanding Student Paper Session Presentation Award at Mathfest. Students presented their work in the SoM Graph Theory Seminar and at the Tech Topology Conference. Papers from the summer's research were published in ***Acta Mathematica Hungarica*** and ***Transactions of the American Mathematical Society***.

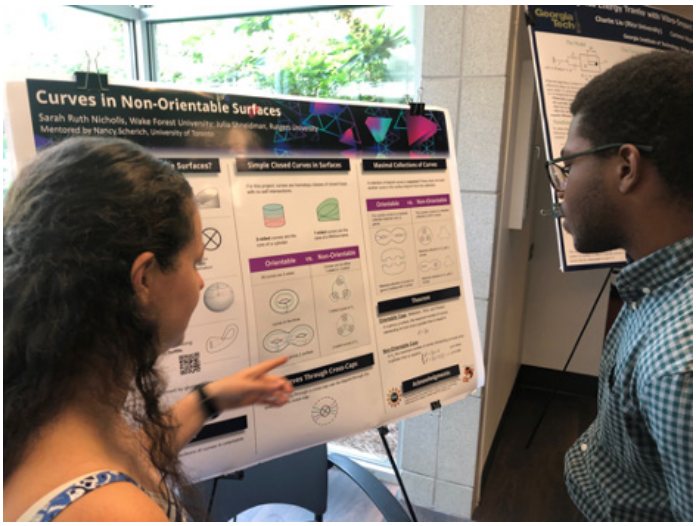


Rachel Thorton and Meredith Clayton explain their REU research in the Skiles atrium

One student, Lily Li, won honorable mention for the Alice T. Schafer prize from the Association for Women in Mathematics, a national prize awarded to "an undergraduate woman for excellence in mathematics." This was Lily's second REU in the School.

Based on the REU exit survey, the REU was a great success. Here is one anonymous comment from a participant:

> This REU has really made me want to stay in the field of mathematics. Before I did this REU, I had no real idea of what field of math I wanted to explore further. However, this REU has made me want to pursue higher levels of mathematics and learn more about the multiple intersections that math has with other fields, because I found that it was possible to do that in our own research. I would like to learn about higher levels of mathematics moving forward and I am grateful that now I have 5 more people to help me along the way.
>
> -Anonymous survey response



Undergraduate researchers presenting their findings

SoM is wrapping up a 5 year REU grant from the National Science Foundation. We plan to apply for more funding to continue this program, and hope to inspire many more students to pursue a career in mathematics.

Tech Trolley at Tech Square

Aerial view of Tech campus with Midtown skyline

From L to R: Madison Cochran, Eduardo Ramirez Velez, Sydney Bules, and Anna Cobb put together Silly Putty kits. (Photo: Olivia Gravina)

BRINGING TECH TO ATLANTA'S YOUNGEST SCIENTISTS AND ENGINEERS

LITTLE EINSTEINS ORGANIZATION

JANUARY 27, 2022 | ATLANTA, GA

Tech students are creating at-home science kits, collaborating with K-5 schools and local libraries, and using Zoom to keep Atlanta's youngest scientists and engineers engaged in STEM.

Little Einsteins Organization (LEO) is a chartered Georgia Tech campus organization that conducts science, technology, engineering, and math focused activities with children in Atlanta.

The past two years have presented many challenges for those involved in education, but that hasn't stopped Georgia Tech's Little Einsteins Organization from helping provide students in K-5 schools with instruction and activities focused on STEM.

Each week, LEO works with more than 150 kids at various elementary schools in Atlanta. The organization has more than 100 Georgia Tech student members and nearly 2,000 followers on Instagram. Membership is open to all undergraduate and graduate Georgia Tech students.

They've accomplished that by changing how they bring science and engineering to the kids — either in their homes or masked and socially distanced in libraries — where they can perform experiments found in do-it-yourself kits assembled by Georgia Tech volunteers.

"I think they have done wonderful outreach activities, and have been so creative and committed to reach out, despite the very different pandemic landscape," says Pamela Pollet, LEO academic advisor and senior academic professional in the School of Chemistry and Biochemistry.

At-home science kits prepared by Little Einstein Organization volunteers at Georgia Tech. (Photo: Olivia Gravina)

"This project is unique because it gives Georgia Tech students the opportunity to support the education of young children in Atlanta during a time of isolation and online schooling."

Pollet says the pandemic hasn't kept LEO student and instructor volunteers from keeping their commitment to Atlanta's students, especially those in underserved communities.

And before Covid, Pollet saw firsthand LEO's impact when volunteers helped the younger students conduct experiments in their schools. "Their friend's volcano erupted much more than theirs. Why? What was different? 'How come my catapult is not working?' It is okay if it does not work — let's take a look and think how we can make it work," she shares. "LEO members created a welcoming and vibrant atmosphere in which students were so engaged and curious."

Olivia Gravina, a fourth-year undergraduate in the School of Mathematics, served as LEO president for the 2021-22 school year. Gravina says one of the group's latest efforts to get creative during Covid challenges involved putting together at-home STEM kits for kids involved in Hands On Atlanta's "Disco" program, formerly known as the Discovery program. Disco is a Saturday morning enrichment program which currently offers STEM, social emotional learning, fitness, and health-related activities to K-5 youth across nine Atlanta-area schools.

Teams of LEO members made instructional videos for each of the activities which included explanations of the science behind them. Then, Tech's LEO members joined Zoom calls with students from schools involved in the Disco program.

"The young students had the opportunity to ask questions,

An Atlanta K-5 student joins a Georgia Tech LEO volunteer to learn about the science behind making slime (Photo: 2020)

and Georgia Tech students were able to encourage the younger students and see the impact of the kits they had provided," Gravina shares.

Another recent activity, a collaboration with Fulton County Libraries, saw LEO members assembling kits for building small catapults, which also included instructional videos.

"We delivered 620 catapult-making kits, which translates to 20 kits in each of the 31 branches of the Fulton County Library System"

"It was absolutely brilliant to use the libraries, kits and videos to maintain the excitement of hands-on experimenting," Pollet adds.

Little Einstein Organization volunteers Paige Holland (left) and Grace May prepare at-home science kits for Atlanta K-5 students. (Photo: Olivia Gravina)

MATH LAB SOLVES THE TUTORING SUPPORT EQUATION

OCTOBER 27, 2021 | ATLANTA, GA

Monday through Friday, nestled in the breezeway under the Skiles Classroom Building, mathematics students scribble away on rolling white boards, deep in discussion, while others sit at tables, writing on worksheets and chatting with another.

For these students, understanding equations is no longer an individual problem to be solved on one's own, online. With the new outdoor Math Lab, students can now work in collaboration with teaching assistants and each other to reach solutions.

As director of the Math Lab for the School of Mathematics, student success and fulfillment are Stephanie Reikes' main priorities. And with the return to full in-person learning this fall, Reikes also wanted to provide full tutoring services to students, while also offering flexible hybrid options.

The solution to this tricky equation? Take it outdoors — and offer online options.

> "During the past year, we have learned that students like the flexibility of being opened more hours," says Reikes. "While the Outdoor Math Lab closes at 6 p.m., we are offering limited virtual hours after 6 p.m. As of early October, we have already had 600 student visits to the Math Lab," she adds.

Teaching assistant Brennan Dolson, second-year Ph.D. student in mathematics, also notices that in-person help has renewed relationships between younger students and older advisors.

Stephanie Reikes

> "In-person help, in my opinion, feels more personal, and allows instructors the flexibility to help multiple students at once by circulating around a group, suggesting students from the same class work on a problem together, and generally gauge how well advice is being received," Dolson says. "Virtual instruction, for me, tended to devolve into lecturing, rather than having a conversation, which was not as beneficial for students."

Dolson also says the Math Lab offers a comfortable space for students and TAs to ask questions they may be too nervous to ask in class, and to work with trusted mentors and classmates.

That comfortable environment can help build comradery and shared support, too.

> "I had a Linear Algebra graduate version midterm the same day that a group of math lab students had a Linear Algebra midterm, so that was a nice piece of solidarity," Dolson adds.

Collaboration with teaching assistants

Learning in a free and unstructured setting

FACULTY HONORED AT 2021 DIVERSITY SYMPOSIUM

SEPTEMBER 16, 2021 | ATLANTA, GA

The 2021 Diversity Champion Awards recognize members of the faculty, staff, and student body who are advancing the principles of diversity, equity, and inclusion within the Georgia Tech community.

During the Sept. 15th event, seven College of Sciences faculty and staff were named Faces of Inclusive Excellence including:

Wenjing Liao
Assistant Professor

Prof. Liao won a prestigious National Science Foundation (NSF) award in deep neural networks for structured data as a principal investigator in 2020, representing the third NSF award and fourth award overall she has won since becoming an assistant professor at Tech in 2017.

Stephanie Reikes
Lecturer

Dr. Reikes received the Center for Teaching and Learning (CTL) Undergraduate Educator Award in 2021 for her many contributions supporting at-risk students. Dr. Reikes is known for actively fostering classroom environments in which diversity and inclusion are respected by all.

Mayya Zhilova
Assistant Professor

Prof. Zhilova was the recipient of the 2021 National Science Foundation Faculty Early Career Development Program Award (CAREER) for research in statistical analysis, outreach, and mentorship of students and high schoolers from underrepresented communities.

"When you dive deeper to explore the source of Georgia Tech's greatness, you discover that this diverse group of faculty, staff, and students reveals the true faces of inclusive excellence."
-Archie Ervin

All honorees featured in Faces of Inclusive Excellence share one thing in common: they epitomize excellence in their research, teaching, leadership, and service, or have been honored and otherwise recognized by their peers within their respective fields of endeavor," says IDEI Vice President Archie Ervin.


Wenjing Liao


Stephanie Reikes


Mayya Zhilova

CLASS OF 1934 CIOS HONOR ROLL

SEPTEMBER 1, 2021 | ATLANTA, GA

Spring 2021 Student Recognition of Excellence in Teaching: Class of 1934 CIOS Honor Roll

Several SoM faculty were named in the Spring 2021 Student Recognition of Excellence in Teaching: Class of 1934 CIOS Honor Roll -- honoring instructors who have at least a 70% response rate and place in the top 25% of the composite CIOS scores for each size group of large and small classes.

Large Classes: Spring 2021

- Neha Gupta
- Sung Ha Kang
- Siddhi Krishna
- Miriam Kuzbary

Small Classes: Spring 2021

- Gary Lavigne
- Dan Margalit
- Lutz Warnke

Large Classes: Spring 2020

- Alex Blumenthal
- Hector Banos
- Klara Grodzinsky
- Miriam Kuzbary
- Michael Lavigne
- Wenjing Liao
- Marissa Loving
- Dan Margalit
- Greg Mayer
- Stephanie Reikes
- Victor Vilaca Da Rocha
- Zhiyu Wang

Small Classes: Fall 2020

- Lutz Warnke

For more details on the Honor Roll:
https://ctl.gatech.edu/hg/item/645854

Outdoor Math Lab

Students studying outdoors on Tech campus

DAN MARGALIT AND GARY LAVIGNE RECEIVE TEACHING HONORS

FEBRUARY 28, 2022 | ATLANTA, GA

Prof. Dan Margalit and Visiting Assisting Professor Gary Lavigne have been awarded the Student Recognition of Excellence in Teaching: 2021 CIOS Award. The award comes with a $1000 prize and recognition of the recipients at the Mach 15th Celebrating Teaching Day on campus.

About the CIOS Award

Funds for the award this year have been provided by the Class of 1934 and the Jack and Frances Mundy endowment accounts. Fifty awards are being made to recognize instructors with exceptional response rates and scores on the Course Instructor Opinion Survey (CIOS). CIOS scores were based on the sum of three scale items: Instructor's respect and concern for students; Instructor's level of enthusiasm about teaching the course; and Instructor's ability to stimulate my interest in the subject matter. Ties were broken by response rate.

Courses taught during Spring 2021, Summer 2021, and Fall 2021 were considered for this award. Each semester, instructors who met the base criteria of 70% response rate and placed in the top 25% of the composite CIOS scores for each size group were eligible for recognition on the Honor Roll. Now 50 members of the Honor Roll with the highest response rates and CIOS scores are being recognized with the 2021 CIOS Award, including two SoM faculty.

Dan Margalit

Professor Margalit's research lies in the intersection of low-dimensional topology and geometric group theory, with a focus on mapping class groups of surfaces, i.e., the symmetries of surfaces. Prof. Margalit has a long history of excellence in teaching, and he is a previous recipient of several teaching awards including the Eichholz Faculty Teaching Award in 2021 and the Fulmer Award in 2019. Prof. Margalit is also a renowned researcher who recently gave the Maryam Mirzakhani Lecture at the JMM in 2022, and is a recent winner of the Conant Prize in 2021 as well as being named a Fellow of the American Mathematical Society in 2019. Prof. Margalit is also an extremely active mentor in the School of Mathematics, helping to guide graduate students and postdocs to successful careers in mathematics, as well as mentoring undergraduates in Research Experiences for Undergrads (REUs) with four successful REU programs with co-mentors Wade Bloomquist, Yvon Verberne, and Nancy Scherich, in the Summer of 2021 alone.

Gary Lavigne

Dr. Michael Gary Lavigne is the assistant director of Communication, Education, and Outreach for the Southeast Center for Mathematics and Biology (SCMB) and a visiting assistant professor in the School of Mathematics. Dr. Lavigne has research interests at the intersection of mathematics and biology, especially reaction-diffusion systems, cellular automata, and spatial strategies of the interferon response. Dr. Lavigne received his PhD in Applied Mathematics at North Carolina State University in 2020. Dr. Lavigne was also the recipient of the Class of 1934 CIOS Honor Roll Awards for Spring 2021.

Dan Margalit

Gary Lavigne

For information about the CIOS Award and other faculty honors please visit: https://www.ctl.gatech.edu/faculty/awards/

SPRING SCIENCES CELEBRATION HONORS FACULTY AND STAFF

APRIL 15, 2022 | ATLANTA, GA

The 2022 Spring Sciences Celebration (Photos: Jess Hunt-Ralston)

As the end of the school year approaches, recognition of exceptional work across research, teaching, administration, and community building took center stage at Harrison Square on April 14 at the College of Sciences Spring Celebration.

> "Our annual celebration is a welcomed tradition in the College," shared Susan Lozier, dean and Betsy Middleton and John Clark Sutherland Chair. "As we greet new members of faculty, recognize excellence and service in research and teaching, and affirm our special community of staff and faculty, we thank the generous alumni and friends who help make these awards possible."

In addition to annual awards honoring faculty development and mentoring, this year's ceremony featured new accolades for staff members, made possible by funding from the Betsy Middleton and John Sutherland Dean's Chair endowment — as well as a trio of awards recognizing exceptional contributions from postdoctoral fellows and research scientists, established through the advocacy of the College's Research Faculty Advisory Council.

Faculty Development Awards

The Cullen-Peck Fellowship Award

This scholarship was established by Frank Cullen and Elizabeth (Libby) Peck, to recognize mid-career faculty pursuing highly innovative research:

» **Molei Tao**
Associate Professor, Mathematics

The Faculty Mentor Award

This award was established jointly by the College of Sciences and the Georgia Tech ADVANCE Program and presented to exemplary senior faculty who help new faculty advance in their careers as they learn to balance their roles as researchers, teachers, and advisors to their own graduate students and postdoctoral researchers:

» **Sung Ha Kang**
Professor, Mathematics

Staff Leadership and Excellence Awards

The newly established **Staff Excellence Awards** recognize staff who exemplify outstanding performance above and beyond the call of duty:

» **Lea Marzo**
Assistant to the Chair, Mathematics

The inaugural **Leadership in Action Staff Award** recognizes staff who have made exceptional contributions to the College through innovative and strategic leadership, change management, business process improvement, and special project leadership:

» **Kimberly Stanley**
Assistant Director of Business Operations, Mathematics

Inaugural staff awardees with Kristin Berthold and Susan Lozier

KIMBERLY STANLEY WINS LEADERSHIP IN ACTION AWARD

APRIL 12, 2022 | ATLANTA, GA

Congratulations to Kimberly Stanley who has won the CoS Leadership in Action Award for her innovative and strategic leadership in the school.

Leadership in Action Award

One $1,500 cash award and one or more $500 cash awards for exceptional contributions in one or more of the following areas:

- Innovative and Strategic Leadership
- Change Management
- Business Process / Continuous Improvement
- Special Project Leadership
- Similar Accomplishment to above

An Interview with Kimberly Stanley

Edited by April McCruel

In 2013, I accepted the position as Administrative Manager in the School of Mathematics and within a year, I was promoted to Assistant Director of Business Operations. My decision to accept this position has proven to be very meaningful to me both personally and professionally. Throughout my time in the School of Math, I have had the opportunity to work with wonderful and dedicated faculty and staff. It is truly the people in the School of Mathematics that have enabled us to grow and thrive in spite of the many challenges we faced during a global pandemic and its after effects.

As the Assistant Director of Business Operations, I am responsible for the day to day business and administrative functions in the School of Mathematics. I oversee the financial, payroll, hiring, and HR components within the School of Mathematics. I supervise a staff of 11 motivated professionals whose commitment to the school inspires me daily. During the global pandemic, it was very apparent that business operations within the School of Mathematics would undergo major changes. Starting in 2020, the staff transitioned to a mostly remote working platform: however, the demands and obligations of the department were mostly unchanged. Financial reconciliation and tracking were still required, payroll was still being processed bi-weekly and monthly and HR transactions were still occurring daily. I needed an innovative plan in order to meet the needs of our faculty, keep up with the demands of the department, and ensure that the staff could thrive in a remote and virtual environment. I decided to enact a three-pronged approach: communication, accessibility and flexibility.

Communication was definitely the foundation of my three-pronged approach. One of the challenges of moving to a mostly remote working environment is that it increases the chances that people will feel cut off and isolated. Communication was key to connectivity. For the past two years, I have met with each staff member weekly to check in with them, listen to their concerns, and make sure that weekly goals were realistic and manageable.

Kimberly Stanley

Accessibility was also a key component to my approach during the pandemic. I have always believed in an open door policy and being accessible during the pandemic was more important than ever. For the past two years, I have been accessible to faculty and staff via Microsoft Teams, Bluejeans, Zoom, and cell phone. Even though I did not have many face to face meetings during the pandemic, I made sure that faculty and staff knew that I was (and continue to be) ready and available to address any business related issue.

Flexibility has also been essential to the success of our team during this challenging time. During the past two years, my staff and I have been very flexible and open to new ideas, suggestions, and ways of conducting business. Change can be difficult but it's oftentimes flexibility that can change one's perspective and enable us to embrace change.

The Leadership in Action Staff Award is a College of Sciences recognition awarded to individuals who have shown innovation and strategic leadership. Receiving this award and the recognition at the annual College of Sciences Spring Sciences Celebration was an honor and one of the highlights of my career at Georgia Tech. I would like to thank Dr. Rachel Kuske and Dr. Michael Lacey for their unwavering support over the years and especially during the pandemic. I would also like to thank my staff for their dedication and willingness to work with me to ensure that the School of Mathematics thrived during challenging conditions. Without teamwork and dedication, our successes would not have been possible.

MOLEI TAO WINS CULLEN—PECK AWARD

APRIL 1, 2022 | ATLANTA, GA

Congratulations go to Molei Tao for being recognized with the CoS Cullen—Peck Award.

This award is given in recognition of Molei's research encompassing many topics in applied and computational mathematics, especially his recent work in machine learning.

Cullen—Peck Scholar Award

The Cullen-Peck Scholar Award recognizes research accomplishments led by College of Sciences faculty at the associate professor or advanced assistant professor level.

The award recognizes innovative research that is in a direction that is relatively new to the faculty member.

The Cullen—Peck award is made possible by a generous gift to the College of Sciences from alumni Frank H. Cullen and Libby Peck.

Molei Tao

Molei Tao

Associate Professor Molei Tao's research is primarily concerned with control systems characterized by multiple scales, geometric structures, and randomness. Prof. Tao's group addresses both scientific curiosity and engineering practicality, from studying extrasolar and Solar planetary dynamics, the engineering problems of energy transfer and harvest, rare events quantification, the resonant control of microscopic systems, to the interplay between dynamics and machine learning.

Previous recipients of the Cullen-Peck Scholar Award include:

- *2014 Sung Ha Kang*
- *2017 Anton Leykin*
- *2018 Jen Hom*
- *2019 Greg Blekherman*

Campus evening with Tech Staduim

Tech Tower with Downtown skyline

SUNG HA KANG WINS CoS MENTORING AWARD

APRIL 1, 2022 | ATLANTA, GA

It is our pleasure to announce that Prof. Sung Ha Kang is being recognized for her important contributions to mentoring junior faculty in the School of Mathematics with the CoS Faculty Mentor Award.

> Prof. Kang has provided information that played a vital role in speeding up my research development and collaborations. Prof. Kang is a role model of professorship too, which means so much more than being just a great researcher.
>
> Molei Tao

CoS Faculty Mentor Award

The College of Sciences and Georgia Tech's ADVANCE program jointly established the College of Sciences Faculty Mentor Award to recognize exceptional efforts and achievements by College faculty members engaged in the mentoring of other faculty.

> I feel Sung Ha is very encouraging and empathetic, and I can feel a strong support and caring from her!
>
> Beibei Liu

Prof. Sung Ha Kang

Sung Ha Kang

Sung Ha is a Professor in the School of Mathematics whose research interests include numerical methods and scientific computing: new modeling of functionals, mathematical analysis and numerical simulations for applied problems; mathematical approaches to image processing; variational functional and PDE based methods for various problems arising in image restorations and segmentation: denoising, deblurring, inpainting, color image, video, shape analysis, texture, multiphase image segmentation and various extensions.

Sung Ha is also the Computational Sciences and Engineering (CSE) Coordinator for the School of Mathematics and an organizer for GT Mathematics and Applications Portal (GT MAP).

Previous recipients of the CoS Faculty Mentor Award include:

- *2021 John Etnyre*
- *2021 Ronghua Pan*
- *2019 and 2014 Christine Heitsch*
- *2018 Prasad Tetali*
- *2018 Haomin Zhou*
- *2016 Luca Dieci*
- *2014 Brett Wick*

LEA MARZO WINS STAFF EXCELLENCE AWARD

APRIL 12, 2022 | ATLANTA, GA

Lea Marzo has won the CoS Staff Excellence Award for her phenomenal work in SoM. Congratulations to Lea and thank you for everything that you do for SoM!

Staff Excellence Award:

There is one $1,500 cash award and two or more $500 cash awards each year for demonstrated excellence in each of the following areas:

- Outstanding performance above and beyond the call of duty (Commitment)
- Exemplary teamwork
- Impact on the strategic goals of the College (Building Communities of Excellence, Catalyzing Discovery and Solutions and Amplifying Impact)
- Consistently excellent service to the School or College

An Interview with Lea Marzo

by Cheng Mao

Can you tell us about your journey so far?

People beam at me with envy when I tell them I grew up in beautiful southern California which is mainly seen as a place for tourists. However, in my small neighborhood, there are approximately 15 different gangs within a 15-mile radius. Inequality is not just seen, it is felt. As a first-generation student, I have always felt different. I was raised by a single mother of four in a Filipino and Native American family in a predominantly African American community in Southeast San Diego. The backdrop of my community and the public school I attended during the summers starkly contrasted with the predominantly white, affluent, cultural-capital rich Catholic school that I attended on a scholarship during the academic year. It was in my immersion in these completely different socioeconomic environments that not only taught me to critically navigate through various cultural environments, but also heightened my interest in how marginalized students find ways to be successful while dealing with institutionalized racism.

Lea Marzo

Being a biracial other in a black working-class community gave me the perfect ethnographic lens to analyze social stratification, poverty, race, and culture. In high school, I left two hours early to take the trolley and bus to the other side of town. On this ride, you can notice the shift as the graffiti lined walls and broken windows gradually change to manicured sidewalks and well-maintained businesses as you rode from one part to the other. In addition to my scholarship, my mother worked out some deal with the principal to get "two for the price of one," so my brother and I could get a better education. She worked bingo every Friday night as well as a full-time teacher's aide to pay for our tuition. During summers, I attended the local public school where my mother worked and learned early on that not everyone is afforded a "good" education. This realization has fueled my passion for helping underrepresented communities have access to higher education.

I became a single mother at the age of 20. Determined to achieve my goals and make sure my daughter had a bright future, I decided to finish my Bachelor's degree. While working as full-time as an academic advisor the Education Studies Department at the University of California, San Diego I completed my general education courses at San Diego Mesa Community College and transferred to UCSD, working out a schedule with my job to be a full-time student as well. It was during this time that I became an institutional agent for my students as well as politically active in my community. I organized a student group called "Teachers 4 Change." This group worked to recruit STEM students to get their teaching credential and work in low-income K-12 schools. I mentored high school students at the UCSD Preuss school and scored senior projects. I volunteered at UPTE, a national union to work for better wages for administrative positions. I also created "Preps for Success" that mentored known gang members and ex-offenders in my community. This involved preparing resumes and helped people complete the necessary applications for GED programs and community colleges.

During my Master's program at San Diego State I was the treasurer for the Sociology student group. I mentored incoming master's students and was a teacher's assistant. I taught Sociology 101 to incoming freshmen students using a critical caring pedagogy. This combines a feminist, non-hierarchal teaching approach where the students and instructor sit in a circle and there is reflexive teaching and auto-ethnographies. The teacher learns about the students, their lives, and backgrounds as well as shares their background. Being from a low-income community myself allows students from similar backgrounds relate to me and feel comfortable sharing. Once students feel cared for, we can foster a learning environment of trust and encouragement. I hope to be able to utilize this style of teaching from entire career.

Currently, I work full-time as the Assistant to the Chair II at the Georgia Institute of Technology in the School of Math and teach classes online for Post University. I recently completed my Ph.D. in Sociology with a concentration in Race and Urban Studies at Georgia State University. I also got married last October! My current goal is to work in Higher Education Administration focusing on Diversity, Equity, and Inclusion.

What is your work in the SoM?

I work at the Asst. to the Chair II for the School of Math. In this role I assist the chair in administrative duties as well as oversee the front desk staff and the Visiting Honors Program.

Can you tell us about your other efforts at Georgia Tech?

I routinely collaborate with campus leaders to spearhead and prioritize diversity, equity, and inclusion (DEI) efforts at the Georgia Institute of Technology. Specifically, I strategize with college leadership to develop and implement initiatives such as a college-wide Code of Conduct, conflict resolution training, DEI best practices, and student-focused events. I was recently invited by the Dean of the College of Sciences to join the Budget Reform Diversity, Equity, and Inclusion working group. This group created 12 budget recommendations focused on diversity reform and hiring initiatives and presented to the President of Georgia Tech and DEI stakeholders.

Additionally, I currently serve as a member of the College of Sciences Staff Advisory Council where we promote staff engagement by arranging monthly speakers, host staff engagement events, and offer professional development opportunities.

How about your work in the DEI Committee?

Serving as the co-Chair for the DEI Committee is a rewarding experience. It allows me to bridge my academic background with my current position. I hope that I can continue this work throughout my career.

Can you tell us about your Ph.D. thesis work?

San Diego, "American's Finest City", is also home to approximately 91 gangs and over 4000 gang members (Burks 2014). That was my lived reality growing up in Southeast San Diego. In my neighborhood alone, there are approximately 15 different gangs within a 10-mile radius. Growing up, I knew several young men and women who died or became incarcerated as a result of gang-related violence.

When I moved away from San Diego to work on my doctorate, I was hoping to escape that life and embrace a new chapter. However, after reading Victor Rios's ***Punished: Policing the Lives of Black and Latino Boys***, I was inspired to do my dissertation on San Diego gangs. Something Rios wrote shook my core. As he reflects on his ethnography of gangs in Oakland, California, he writes, "One of my graduate-school professors warned me, 'Go native, but make sure to come back.' When I returned from the field, I told him, 'I took your advice and went native in the academy, but I made sure to go back to the community where I come from.'" Being disconnected from my neighborhood allowed me to reflect. I no longer wanted to escape; instead, I yearned to be engaged in the community with the hope of affecting change. In this moment I realized that becoming a sociologist is not just a personal goal, but can also be a vehicle through which I enrich my community.

Although I write this work and submit it to the academy, I want it to be accessible for mass consumption. I write this work for my participants. My hope is to be the vehicle through which my participants tell their stories. Being back in my community has allowed me to reflect on the

Continued from previous page...

importance of empowering others and keeping the door open for those behind me. The purpose of this study is to challenge the governing narratives, to challenge those in power who label these young men and women, and to allow their stories to be told from their standpoint.

How did you manage to earn a Ph.D. while doing excellent work in the SoM?

It was not without difficulty 🙂

Honestly, I'm not really sure. There were a lot of long nights and long days. I worked on my dissertation whenever I had free time, weekends and late nights. I just figured it out. I learned early on how to be resilient and to juggle many hats.

Lea Marzo's Ph.D. Thesis Work

Set Trippin': An Intersectional Examination of Gang Members

Abstract

Typically, when most people hear the word "gangs," the usual connotation is that of boys and men. However, recent studies show that women and girls make up about 30% of the gang population and that most gangs are mixed gender (Curry 1998, Miller and Brunson 2000, Sutton 2017). The experiences of gang-affiliated women remain under-theorized and understudied. Moreover, studies in criminology often dehumanize gang members and advance archaic ideas of inherent criminality. By utilizing a critical race theory (CRT) framework, I analyze how gang membership results from the intersection of racist practices and U.S. laws (Bell 1995, Crenshaw 1995, Ladson-Billings and Tate 1995, Solórzano, Ceja and Yosso 2000). This exploratory study demonstrates the complexities of how minoritized neighborhoods create a climate ripe for gang membership. By centering gang narratives, I highlight the myriad ways that people living in Southeast San Diego navigate gang culture and identity, gender expectations, and criminalization. Through a feminist standpoint lens, I employ the "docent method," a qualitative place-based approach, to accompany 30 men and women gang members and affiliates on a walking or driving interview (Chang 2017). This unique methodology facilitates participant-led, ethnographical analysis, and in-depth interviews. My work challenges the one-sided, male-dominated research seen in gang literature. Providing gang members the opportunity to share their stories helps them to reclaim their identities. Findings from this study indicate that Black gang members share "Black extraordinary adolescent trauma" within hyper-segregated gang communities, often resulting in a collective identity. Black women gang members use their gang-affiliated identities as a tool to navigate violence within their neighborhoods. Furthermore, family socialization is an underutilized approach to understanding gang membership. I argue that place-identity, shared gang identity, and "Black extraordinary adolescent trauma" bond young men and women into "gang kinship networks." In addition, I offer alternative narratives to the stereotype of violent gang members. While on the one hand, there are instances where men gang members adopt conventional patriarchal norms of masculinity, on the other hand, they can exhibit caring attitudes towards people within their gang kinship network. Finally, I argue that low-income minoritized youth are subject to "legal violence" routinely practiced by local law enforcement and probation officers (Menjívar and Abrego 2012). The legal jurisdictions of gang documentation, gang injunctions, and policing practices interlink with social conditions to cause social suffering (Menjívar and Abrego 2012). These punitive laws create additional barriers and obstacles for documented gang members, trapping them in the cycle of re-offending, and blocking Black and Latinx youth from upward mobility. Therefore, I call for sociologists to include gang membership as a neighborhood effect and to fund more research utilizing a critical race theory lens.

SoM MEMBERS EARN TOP ANNUAL AWARDS

APRIL 28, 2022 | ATLANTA, GA

Joyce Nickelson and John C. Sutherland Undergraduate Research Award

This award was created by the endowment gift of Joyce E. Nickelson and John C. Sutherland to honor Joyce's late mother, alumna A. Joyce Nickelson, and Sutherland. The scholarship recognizes excellence at the interface of mathematics and physics.

Nickelson—Sutherland award winner **Sarah Eisenstadt** is completing majors in physics and mathematics, and also studies applied languages and intercultural studies.

Eisenstadt has completed research with Michael Loss in the School of Mathematics on mathematical physics and the development of an energy functional to describe superconductivity, and with Stephanie Boulard on the artist Marc Chagall. She has also served as a teaching assistant for linear algebra and multivariable calculus.

Larry O'Hara Graduate Scholarship

This honor is provided by an endowment bequeathed by alumnus Larry O'Hara. It is presented to outstanding graduate students in the College of Sciences. All of the 2022 winners have established a strong record of research with multiple publications in peer-reviewed journals, as well as multiple conference presentations:

» **Youngho Yoo**
Ph.D. Candidate, Algorithms, Combinatorics, and Optimization in Mathematics

Yoo is currently studying graph theory with Xingxing Xu and holds a prestigious NSERC Postgraduate Scholarship to support her doctoral studies.

Herbert P. Haley Fellowship

This graduate fellowship recognizes significant accomplishments and outstanding academic achievements for students at Georgia Tech.

The 2022 winners included:

» **Christopher DuPre**
Mathematics

Teaching Assistant Awards

These awards are presented annually by the Center for Teaching and Learning to celebrate contributions to teaching excellence at Georgia Tech made by graduate and undergraduate teaching assistants.

Outstanding Senior Research Faculty Award

» **Youngho Yoo**
Ph.D. Candidate, Algorithms, Combinatorics, and Optimization in Mathematics

Tech to Teaching Certificates

Tech to Teaching Certificates are designed to prepare Georgia Tech graduates and postdoctoral associates for college teaching positions. Through this certificate program, develop a thorough understanding of teaching and learning, and will demonstrate their ability to apply these skills in the classroom. The College of Sciences students who were awarded Tech to Teaching Certificates included:

» **Pedro Márquez-Zacarias**
Mathematics

» **Alperen Ozdemir**
Mathematics

Center for the Integration of Research, Teaching, and Learning (CIRTL) Certificates

As a member institution in the CIRTL national network, Georgia Tech joins with 37 other universities on a mission to improve undergraduate education through the preparation of future faculty.

Participants in these certificate programs learn about how students learn, how differences among students affect their learning, evidence-based teaching and assessment practices, and teaching with technology. Participants who complete these foundation-level learning outcomes through a combination of coursework, workshops, or online learning, receive the CIRTL Associate certificate.

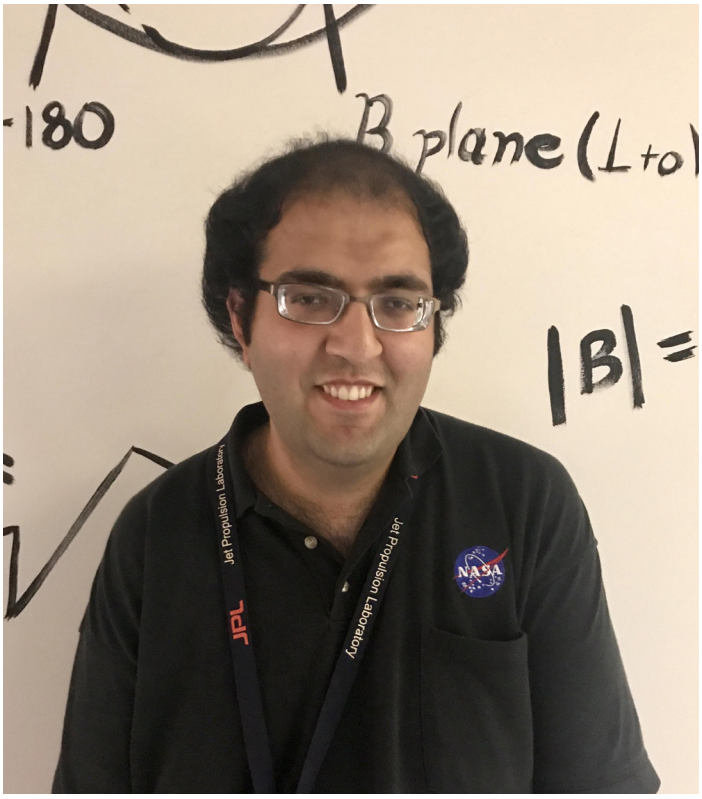
The following College of Sciences students were awarded CIRTL Certificates:

» **Sierra Knavel**
Mathematics

» **Alexandra Newton**
Mathematics

BHANU KUMAR AWARDED PRESTIGIOUS NSF POSTDOCTORAL FELLOWSHIP

APRIL 4, 2022 | ATLANTA, GA



Bhanu Kumar

Bhanu Kumar has been awarded an NSF Postdoctoral Fellowship for work in dynamical systems applied to celestial mechanics and applied astrodynamics for space mission design.

Bhanu is a Ph.D. candidate and a NASA Space Technology Research Fellow (NSTRF) in the School of Mathematics, working with his advisor Prof. Rafael De la Llave at the cutting edge of the field of dynamical systems. Bhanu also does research as M.S. student in the Daniel Guggenheim School of Aerospace Engineering at Georgia Tech, and as an NSTRF visiting technologist at the NASA Jet Propulsion Laboratory, California Institute of Technology, where he works with his mentor and research collaborator Dr. Rodney Anderson.

Research Interests

> At a broad level, my interests lie in the application of tools and results from mathematical dynamical systems theory, both analytical and computational, to various problems in celestial mechanics and applied astrodynamics for space mission design. In particular, there are geometric structures, such as periodic orbits, invariant tori, and stable and unstable manifolds, which govern many of the important dynamical properties of multi-body celestial systems. I am interested in developing fast and accurate methods for computing these objects as well as for investigating the dynamics induced by them. I am also working on applications of these methods to current and relevant problems in astrodynamics, with a current focus on tour design in the Jovian system (although our tools are general and applicable to other systems as well).
>
> Bhanu Kumar

Previously, Bhanu had been supported by a prestigious NASA graduate fellowship and he has participated in several international conferences in Celestial Mechanics in USA, Italy, and Spain. His advisor, Prof. De La Llave, has also used advanced grants from NASA to help fund travel and to support Bhanu throughout his PhD. An accessible description of Bhanu's research, with some references to more advanced material, can be found in the ProofReader 2020.

To view the ProofReader 2020:
https://math.gatech.edu/sites/default/files/images/proofreader2020.pdf

CENTER FOR TEACHING AND LEARNING RECOGNIZES EDUCATIONAL EXCELLENCE

NEARLY 50 COLLEGE OF SCIENCES FACULTY RECEIVING CENTER FOR TEACHING AND LEARNING AWARDS

APRIL 4, 2022 | ATLANTA, GA

Georgia Tech's Center for Teaching and Learning (CTL) is recognizing College of Sciences faculty members for their excellence in teaching during the 2021-2022 school year.

41 College of Sciences faculty have won Student Recognition of Excellence in Teaching: CIOS Awards based on student evaluations during the annual Course Instructor Opinion Survey (CIOS). Eight faculty are the recipients of CTL Faculty Teaching Awards.

The CIOS honors, given for the full calendar year, are based on student-provided CIOS responses about their instructor's "respect and concern for students, level of enthusiasm about teaching the course, and ability to stimulate interest in the subject matter."

> "It's impressive to see the many ways that faculty in the College of Sciences are contributing to student learning at Georgia Tech," says Joyce Weinsheimer, CTL director. "The College's award-winning teachers are excelling in the classroom, laboratory instruction, co-curricular education, online teaching, academic outreach, and the scholarship of teaching. They are providing exciting learning environments and experiences to students on our campus and beyond."

College of Sciences recipients of the 2022 Faculty Teaching Awards within the School of Mathematics include:

Student Recognition of Excellence in Teaching: CIOS Awards

Small Classes:

- **Gary (Michael) Lavigne**, Visiting Assistant Professor, School of Mathematics; and Assistant Director of Communication, Education and Outreach for the Southeast Center for Mathematics and Biology
- **Dan Margalit**, Professor, School of Mathematics

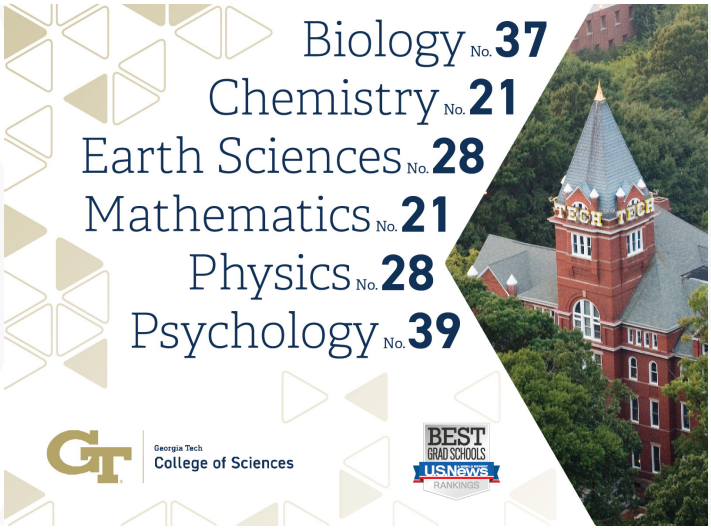
Student Recognition of Excellence in Teaching: Honor Roll

Small Classes:

- **Neha Gupta**, Senior Academic Professional and Director of Scheduling
- **Gary (Michael) Lavigne**, Visiting Assistant Professor, School of Mathematics and Assistant Director of Communication, Education and Outreach for the Southeast Center for Mathematics and Biology
- **Dan Margalit**, Professor
- **John Olinde**, Ph.D. student

Large Classes:

- **Neha Gupta**, Senior Academic Professional and Director of Scheduling
- **Sung Ha Kang**, Professor
- **Siddhi Krishna**, former NSF Research Training Groups (RTG) Postdoctoral Associate
- **Miriam Kuzbary,** NSF Postdoctoral Fellow
- **Gary (Michael) Lavigne**, Visiting Assistant Professor and Assistant Director of Communication, Education and Outreach for the Southeast Center for Mathematics and Biology
- **Michael Loss**, Professor
- **Gregory Mayer**, Academic Professional and Director of Online Learning



SCHOOL OF MATHEMATICS ADVANCES IN U.S. NEWS BEST GRADUATE SCHOOL RANKINGS

MARCH 29, 2022 | ATLANTA, GA

U.S. News ranks all six schools in CoS among the best in the nation for graduate studies, with Mathematics going up five spots this year.

The School of Mathematics continues to make progress in the graduate school rankings published by U.S. News and World Report.

> "I was very happy to see that several of our schools in the College of Sciences moved up in the rankings, in some cases quite significantly," shares Matt Baker, Professor in the School of Mathematics and Associate Dean for Faculty Development in the College.

- *Biology – No. 37*
- *Chemistry – No. 21*
- *Earth Sciences – No. 28*
- ***Mathematics – No. 21***
- *Physics – No. 28*
- *Psychology – No. 39*

Mathematics advanced by five, up from No. 26 in a tie with Carnegie Mellon, Johns Hopkins, UC-San Diego, and University of Illinois Urbana-Champaign.

> "This clear upward trajectory in the rankings, with even sharper growth in recent years, reflects the School's consistent recruitment of outstanding faculty at all ranks and across all areas. Whether recent additions or long-time School members, the faculty have shown exceptional dedication to growth in quality, quantity, and diversity in its graduate training, able to leverage support from Georgia Tech as well as external resources to expand graduate and postdoctoral programs in both core and cross-disciplinary fields."
>
> -Rachel Kuske, Professor and former SoM Chair

Among specialty graduate programs, previously unranked **Applied Math** climbed into the top 16 to No. 11.

> "Being at a leading technological university, the Applied Math program benefits tremendously in a supportive environment. Its growth is reflected in many aspects of research, education, and community building. The recruitment of exceptional faculty, postdoc, and students has been vital. Our junior faculty members have received national recognition including NSF CAREER Awards in the past few years. The ever-growing number of joint projects within math and across campus helps create a

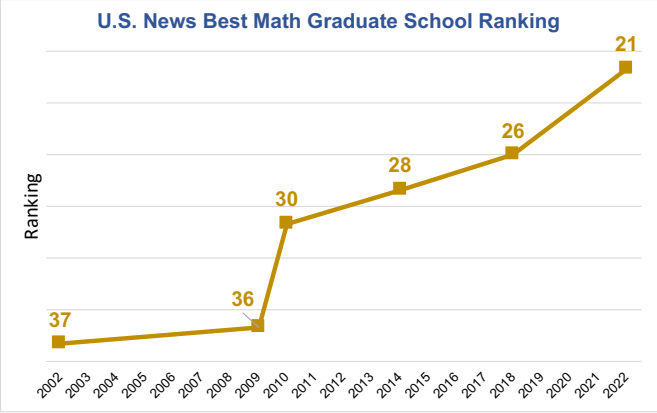
collaborative atmosphere which further enhances the interdisciplinary nature of the program. The richness in class selection and diverse career prospective play key roles for the success of students. Postdocs and PhD students in Applied Math have been hired in excellent positions both in academic and industrial settings. In addition, and perhaps more importantly, collegiality such as teaching-coordination, Friday lunch with everyone, working seminar, and year-end-gathering makes the program more personal, inclusive, and attractive."

-Professor Haomin Zhou, Applied Math

Mathematical Analysis and **Topology** tied for No. 18 and No. 15, respectively.

"It is exciting to see Georgia Tech's Topology program being recognized as one of the top programs in the country. It is a testament to the hard work and creativity of our faculty, postdocs, and students. For some time we have been able to increase our visibility due to the high quality of research being done and the many conferences and workshops we run, but thanks to the support of the National Science Foundation Research Training Grant we recently received, we have been able to increase these activities and bring in many more excellent postdoctoral fellows and graduate and undergraduate students."

-Professor John Etnyre, Topology



- *Analytical Chemistry – No. 17*
- ***Applied Math – No. 11***
- *Condensed Matter – No. 18*
- ***Discrete Math and Combinatorics – No. 5***
- ***Mathematical Analysis – No. 18***
- ***Topology – No. 15***

Tech remains top five in the nation for **Discrete Math and Combinatorics**. Uniquely organized across the Colleges of Sciences, Computing, and Engineering, the Institute's **Algorithms, Combinatorics, and Optimization** program has previously held a rank of No. 2.

"I was very pleased to learn that our discrete math and combinatorics program was again ranked in the top 5 in the US. This reflects the strength and breadth of our program. We have many faculty members affiliated with the ACO program, whose expertise covers broad areas of discrete mathematics. With support from the School's leadership and new hires in the core areas of ACO program, I am optimistic that our discrete mathematic and combinatorics program will remain a top ranked program in the future."

-Xingxing Yu, Professor and Graduate Chair, Discrete Math and Combinatorics

Sources for ranking chart:

- *https://www.mitbbs.com/mwap/forum/article.php?board=Mathematics&groupid=3106825&content_type=all*
- *https://worldranking.blogspot.com/2009/01/mathematics-ranking-by-us-news-2009.html?m=1*
- *https://www.1point3acres.com/bbs/thread-4465-1-1.html*
- *https://web.archive.org/web/20170602002256/https://www.usnews.com/best-graduate-schools/top-science-schools/mathematics-rankings/page+2*
- *https://web.archive.org/web/20180602114347/https://www.usnews.com/best-graduate-schools/top-science-schools/mathematics-rankings/page+2*
- *https://www.usnews.com/best-graduate-schools/top-science-schools/mathematics-rankings*

SEPTEMBER SCIENCES CELEBRATION:

CELEBRATION HONORS NEW FACULTY, AWARD RECIPIENTS, AND MATH SCHOLARSHIP WINNER

SEPTEMBER 10, 2021 | ATLANTA, GA

Held outdoors at Harrison Square this week, the inaugural September Sciences Celebration highlighted excellence in research and teaching across the College of Sciences, while also giving guests a chance to welcome new faculty and meet the donors and alumni who support the awards program.

The honors for seven faculty members and a student in the School of Mathematics were originally to be presented in fall 2020, but the recognition event was postponed due to the pandemic. The annual awards for faculty development and a scholarship are funded through the generosity of College of Sciences alumni and friends.

Here are the 2020-2021 College of Sciences awards and recipients, as shared by the College of Sciences Office of Development:

Frances O. Hite Memorial Scholarship

This scholarship is established in memory of Frances Orr "Fran" Hite (1950-2019), B.S. Mathematics, Vanderbilt University, by Bruce Hite ('72 Building Construction). The endowment fund provides scholarships to women studying mathematics at Georgia Tech.

» **Esther Gallmeier**, 4th year student, School of Mathematics.

Gallmeier is the first recipient of the Hite Memorial Scholarship. Gallmeier attended Oak Ridge High School in Oak Ridge, Tennessee, and decided to attend Georgia Tech based on the experiences of a friend who attended the School of Mathematics.

> "He loved it here," Gallmeier says about her friend. "Also, Georgia Tech is incredible at providing opportunities for undergraduates in research and internships. We are definitely well-connected with companies from all over."

Eric R. Immel Memorial Award for Excellence in Teaching

The Immel Memorial Award, supported by an endowment fund given by Charles Crawford ('71 Math), recognizes exemplary instruction of lower division foundational courses.

» **Chris Jankowski**, Director of Graduate Advising and Assessment and Assistant Director of Teaching Effectiveness, School of Mathematics.

Jankowski mentors postdoctoral faculty in teaching during their first year, and participates in organizing and running professional development events for them. He also provides a broad range of administrative duties for the graduate program, including serving on the Graduate Committee, writing annual student evaluations, and handling comprehensive exams.

New College of Mathematics Faculty (Joined in 2020 and 2021)

» Cheng Mao
» Rebecca George
» Anton Bernshteyn
» Benjamin Jaye
» Hannah Choi

2nd from right: Esther Gallmeier (Photo Renay San Miguel)

On the right: Chris Jankowski (Photo Renay San Miguel)

XU-YAN CHEN AWARDED 2021 SOM FULMER PRIZE

DECEMBER 2, 2021 | ATLANTA, GA

Congratulations go to Associate Professor Xu-Yan Chen, the 2021 recipient of the SoM Fulmer Prize.

The prize recognizes Xu-Yan's work over a number of years, contributing significantly to student success with a broad impact on engineering students at Georgia Tech.

2021 School of Mathematics Fulmer Prize

We thank the late Howard Woodham (Georgia Tech alumnus, Engineering '48) for the establishment of the Herman K. Fulmer Faculty Teaching Fund Endowment for the School of Mathematics, in memory of Professor Herman Fulmer, his former mathematics professor. Each year this award recognizes one of our faculty who exhibit genuine regard for undergraduate students during the first few years of their engineering studies at Georgia Tech.

2021 Fulmer Prize: Xu-Yan Chen

The prize recognizes Xu-Yan's significant contributions to student success, concentrated in engineering students. Over the past decade, Xu-Yan has been teaching a large number of students, particularly from engineering, in Differential Equations, Linear Algebra, and Calculus. In recent years he has taken on the role of Course Coordinator for Differential Equations (MATH 2552), also providing valuable materials for the other instructors in that course. His section is regularly requested by students, a further recognition of his dedication to student success.

Xu-Yan Chen is an associate professor in the School of Mathematics, who specializes in Differential Equations and Dynamical Systems.

Past Fulmer Prize Winners:

- *2020 Michael Lacey and Greg Mayer*
- *2019 Dan Margalit and Joe Rabinoff*
- *2018 Sung Ha Kang*

SIGMA XI AWARD GOES TO YUCHEN HE

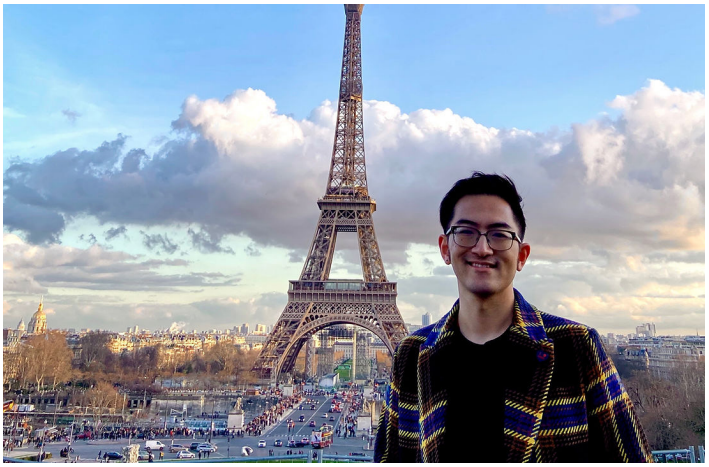
MARCH 9, 2022 | ATLANTA, GA

Yuchen He, a recent Ph.D. from the School of Mathematics, is among six College of Sciences researchers and 19 Georgia Tech faculty and students receiving 2022 Research Awards from the Georgia Tech chapter of Sigma Xi, the Scientific Research Society.

> Sigma Xi's mission is "to enhance the health of the research enterprise, foster integrity in science and engineering, and promote the public's understanding of science for the purpose of improving the human condition."

Best Ph.D. Thesis Awards:

- **Yuchen He, School of Mathematics**
  Advisor: Sung Ha Kang
  Title: "Mathematical and data-driven pattern representation with applications in image processing, computer graphics, and infinite dimensional dynamical data mining"



Yuchen He

WENJING LIAO WINS NSF CAREER AWARD

FEBRUARY 14, 2022 | ATLANTA, GA

Wenjing Liao, an assistant professor in the School of Mathematics who researches high dimensional data analysis and machine learning, has won a National Science Foundation (NSF) Faculty Early Career Development Program (CAREER) Award.

The CAREER Award provides funding for five years and is one of the most significant grants that a scientist can receive early in their profession.

The CAREER program offers the National Science Foundation's most prestigious awards in support of early career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization.

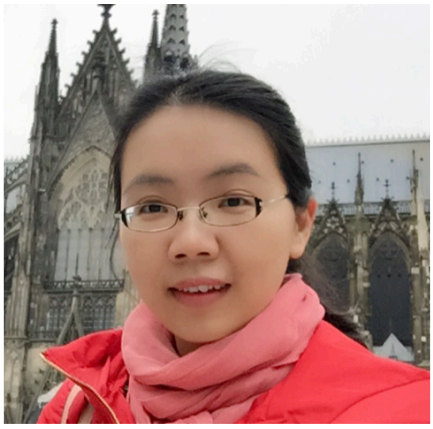
Activities pursued by early career faculty build a firm foundation for a lifetime of leadership in integrating education and research.

> "I am very grateful to the NSF for its support," Liao says. "This CAREER Award will not only support my team's efforts in the area of computational math and data analysis, but it will also support the training of the future data analysis workforce by involving graduate and undergraduate students."

Liao's project for the grant is "Exploiting Low-Dimensional Structures in Data Science: Manifold Learning, Partial Differential Equation Identification, and Neural Networks." Liao says many real-world datasets are high dimensional (more features than observations) but exhibit low dimensional structures (a small number of important features).

> "Low dimensional structure is the opposite of high dimensional. For example, a high resolution image may have millions of pixels, but images of similar objects in a dataset may contain very few important features to represent an object, Liao says.

Reducing dimensionality can narrow down datasets to workable numbers by removing redundancies and inessential features. "The success of many modern methods suggests that exploiting low-dimensional structures in data often leads to outperforming results." For the educational aspect of the CAREER proposal, Liao would like to help build an undergraduate "Bridge" program for math and data science students to assist with the transition from Georgia Tech to careers in academia and industry.



Wenjing Liao

Liao also proposes to recruit math undergraduates from diverse backgrounds in the greater Atlanta area, and design special math and data science research projects for students in the NSF's REU (Research Experiences for Undergraduates) program.

Liao won a 2020 NSF award in deep neural networks for structured data as a principal investigator, representing the third NSF award and fourth award overall she has won since becoming an assistant professor at Georgia Tech in 2017.

> "Professor Liao is an expert in analyzing data presented to us in high dimensions, but actually being closely identified with surfaces of much smaller dimension. This is a surprising, and essential, aspect of modern data analysis," says Michael Lacey, professor and interim chair of the School of Mathematics. "We are very pleased that this award recognizes both Professor Liao's worldwide expertise in this subject, but also her great successes in training people in modern data analysis. The grant gives her recognition, and support for her further research."

Past NSF CAREER recipients:

- *1997 Dana Randall*
- *2002 Robert Ghrist*
- *2003 John Etnyre*
- *2003 Mohammad Ghomi*
- *2006 Chongchun Zeng*
- *2007 Hao-Min Zhou*
- *2008 Yuri Bakhtin*
- *2010 Brett Wick*
- *2010 Dan Margalit*
- *2010 Maria Westdickenberg*
- *2012 Anton Leykin*
- *2014 Greg Blekherman*
- *2015 Karim Lounici*
- *2016 Esther Ezra*
- *2016 Jen Hom*
- *2016 Kirsten Wickelgren*
- *2016 Michael Damron*
- *2017 Zaher Hani*
- *2018 Galyna Livshyts*
- *2019 Yao Yao*
- *2019 Molei Tao*
- *2019 Shahaf Nitzan*
- *2020 Lutz Warnke*
- *2021 Mayya Zhilova*

ROBERTA SHAPIRO WINS 2022 HALEY FELLOWSHIP

JULY 22, 2022 | ATLANTA, GA

by Dan Margalit

Herbert P. Haley Fellowship

This graduate fellowship recognizes significant accomplishments and outstanding academic achievements for students at Georgia Tech.

Roberta has written three papers on quite different topics within the theory of mapping class groups. As an undergraduate, she was a co-author on a paper called "Automorphisms of the k-curve graph." This paper was completed as part of the Summer@ICERM program. The project pushes in a new direction the metaconjecture of Ivanov, which says that any graph naturally associated to a surface should have automorphism group isomorphic to the mapping class group. There are many papers on this topic. This is only the second one that deals with infinitely many different graphs for each surface.

Recent Winners of the Haley Fellowship include:

- *Chris Dupre (2022)*
- *Ian Lewis (2021 while an MS student)*

Roberta Shapiro

More broadly, Roberta has been a leader in the graduate program as a whole. She has volunteered for many panels. She and Katherine Booth have also been working hard to revitalize the AWM chapter in SoM. She has mentored a first year student two years in row. She also is organizing the Graduate Student Topology and Geometry Conference at Georgia Tech in a few weeks. This is a high profile, annual national conference.

HANNAH CHOI AWARDED COVETED SLOAN FELLOWSHIP

FEBRUARAY 16, 2022 | ATLANTA, GA

Hannah Choi is one of two Georgia Tech professors to receive a coveted Sloan Research Fellowship, and is one of only 118 early career researchers across the United States and Canada named as 2022 Sloan Fellows, an award bestowed upon "scientific leaders of tomorrow" for research excellence.

> "Today's Sloan Research Fellows represent the scientific leaders of tomorrow," says Adam F. Falk, president of the Alfred P. Sloan Foundation. "As formidable young scholars, they are already shaping the research agenda within their respective fields — and their trailblazing won't end here."

Sloan Research Fellowships are some of the most competitive and prestigious awards available to early career researchers.

Sloan Fellows are often seen as a marker of the quality of an institution's science faculty — and proof of an institution's success in attracting the most promising junior researchers to its ranks.

Since the first Fellowships were awarded in 1955, nearly 50 faculty from Georgia Institute of Technology have received the honor.

> "I am extremely excited and honored to be named a Sloan Fellow," Choi says. "I am deeply grateful to my research group members, mentors, colleagues and collaborators who made this possible, and I appreciate support from the School of Mathematics and the College of Sciences very much."

Hannah Choi

Choi plans to use the grant to expand on current research projects on biological neural networks. "Specifically, with this grant, I hope to investigate computational roles of network complexities manifested by diverse neural dynamics and intricate connectivity among different types of neurons, in data-driven, functional neural networks across multiple scales, modalities, and systems. This study, therefore, will help us better understand how robust and efficient computation emerges from the unique complexity of biological neural networks, which then can be applied to innovate neuromorphic computing."

The Choi Research Group in Mathematical Neuroscience's primary goal "is to understand how efficient and adaptable neural coding emerges from complex connectivity structure and rich neural dynamics in both biological and artificial neural networks at multiple scales."

Beyond Sloan Research Fellowships, the Sloan Foundation awards approximately 200 grants per year, totaling roughly $80 million dollars in annual commitments in support of research and education in science, technology, engineering, mathematics, and economics.

Former recipients of Sloan Fellowships:

- *2020: Yao Yao*
- *2019: Konstantin Tikhomirov*
- *2018: Lutz Warnke*

DAN MARGALIT GIVES AMS MARYAM MIRZAKHANI INVITED ADDRESS AT JMM 2022

NOVEMBER 12, 2021 | ATLANTA, GA

Prof. Dan Margalit gave an invited lecture at the AMS Special Session AMS Maryam Mirzakhani Lecture at the Joint Math Meetings (JMM), in April 2022.

The Maryam Mirzakhani Lectures

The AMS Council established this lecture in 2018 to honor Maryam Mirzakhani (1977-2017), the first woman and the first Iranian to win a Fields Medal. Mirzakhani was a professor at Stanford University and a highly original mathematician who made a host of striking and influential contributions to hyperbolic geometry, complex analysis, topology, and dynamics.

Title: Mixing surfaces, algebra, and geometry
Abstract: Taffy pullers, lab stirrers, and paint mixers are complicated dynamical systems. To any such system we can ascribe a real number, called the entropy, which describes the amount of mixing being achieved. Which real numbers arise, and what do they say about the dynamics of the system? We will explore this question through the lens of topological surfaces, making unexpected connections to algebra and number theory. Our tour will take us from the work of Max Dehn and Jakob Nielsen a century ago, to the revelations of the Fields medalist William Thurston in the 1970s, to the breakthroughs of Fields medalist Maryam Mirzakhani in the 21st century.

About Maryam Mirzakhani

Maryam Mirzakhani was an Iranian mathematician and a professor of Mathematics at Stanford University. Her research topics included Teichmüller theory, hyperbolic geometry, ergodic theory, and symplectic geometry. In 2005, as a result of her research, she was honored in Popular Science's fourth annual "Brilliant 10" in which she was acknowledged as one of the top 10 young minds who have pushed their fields in innovative directions.

On August 13, 2014, Mirzakhani was honored with the Fields Medal, the most prestigious award in mathematics, becoming the first Iranian to be honored with the award and the only woman to date. The award committee cited her work in "the dynamics and geometry of Riemann surfaces and their moduli spaces".

On 14 July 2017, Mirzakhani died of breast cancer at the age of 40.

An Excerpt From the Talk

I'd like to tell one story about my personal interaction with Maryam. She invited me to give a seminar talk at Stanford. I didn't know she was already sick. Still she came in an hour before the seminar to discuss my work. She sat down next to the board, pen and paper ready to go. We both quickly realized that I couldn't answer her questions in the depth that she wanted. I saw her slowly put down her pen and her pad. She shifted gears and steered the conversation to things I knew a little better, and when I gave the talk she was smiling the whole time and full of enthusiastic comments. Given the situation, her positivity was such a generous act of grace, and I will always appreciate her for that.

About JMM

The Joint Mathematics Meetings (JMM) is the largest meeting of the year, bringing together researchers from every corner of the country and from every disicpline.

INAUGURAL HUBBARD CHAIR TO BE FILLED BY SVETLANA JITOMIRSKAYA

contributions by Jean Bellissard and Leonid Bunimovich
edited by Sal Barone

Elaine M. Hubbard's Legacy

In September 2003, not long after retiring from her 28-year career as a mathematics professor at Kennesaw State University with a known passion for teaching, Elaine M. Hubbard, PhD Math '72, included a provision in her estate plans to establish the Elaine M. Hubbard Endowed Chair in the School of Mathematics — the School's first endowed faculty chair. This fund serves to support robust, leading-edge mathematics education and research at Georgia Tech.


Elaine Hubbard

Dr. Svetlana Jitomirskaya Receives Inagural Appointment

Dr. Svetlana Jitomirskaya, a Distinguished Professor at the University of California Irvine, will be the inaugural Hubbard Chair Professor at the School of Mathematics at Georgia Tech, starting in the Fall of 2022.

> There is no better choice than Svetlana Jitomirskaya to occupy this inaugural Chair as she is both a worldwide recognized expert in Analysis, and widely appreciated, among her students and her University, for her dedication to teaching Mathematics at the highest level of excellence.
>
> Prof. Jean V. Bellissard, School of Mathematics

Biographical Information

Prof. Jitomirskaya was born in Kharkiv, Ukraine in 1966, at a time when Ukraine was still part of the Soviet Union. Her parents were both mathematicians, and she describes both of them as survivors, having barely escaped the German invasion of Kyiv which was a death sentence for Jews in 1941. Her mother managed to become the only female professor of Mathematics in Ukraine for twenty years after she received her PhD. Her father persisted all the way to the top of the academic ladder despite facing multiple obstacles, one after the other, in the antisemitic atmosphere of the 1950s in Soviet Union. Fortunately, Svetlana escaped their fate, coming of age during the perestroika.

A Highly Impactful Career in Mathematics

Prof. Jitomirskaya graduated from Moscow University under the supervision of Yaklov G. Sinai. Sinai was himself a student of Kolmogorov, who was a student of Lusin, the scientific ancestor of some of the best Mathematicians and Theoretical Physicists produced by the Soviet Union after 1916.

> [Prof. Jitomirskaya] brings to GaTech a brilliant scientific genealogy which is really hard to match.
>
> She is a scientific granddaughter of A.N. Kolmogorov (the greatest Russian mathematician ever - who is also by all accounts among the top five mathematicians of the 20th century) and her advisor Y. Sinai is an Abel (analog of Nobel) prize winner. The spirit of this school is that mathematics is a rigorously proved (i.e. a true) common sense. In other words, mathematicians should not just prove what scientists and engineers already understood but uncover why their ideas are right and show them the way further, and even bring in new ideas, which mathematicians must rigorously justify, especially in cases when these new ideas contradict "preexisting" physics intuition.
>
> Prof. Leonid Bunimovich, School of Mathematics

By a turn of events, Prof. Jitomirskaya became a master of the small divisors problem, one of the most difficult problems in modern analysis, relating herself to a long tradition of fine analysts at Kharkov University.

The small divisors problem is an obstacle in astronomy to predict the long-term movement of multiple, interacting, celestial bodies. It also one of the causes for the strange fractal structure of the rings of Saturn. It comes from a resonance phenomenon between conflicting incommensurate periods of rotation.

> [Prof. Jitomirskaya's] work on the small divisors problem for Schödinger's equations with quasiperiodic potential in dimension one is absolutely amazing. Her breakthrough attracted the attention of two Fields Medalists, Jean

Svetlana Jitomirskaya

> Bourgain and Artur Avila, who collaborated with her. She is invited at ICM '22 for a plenary talk, and she recently became a correspondent of the American Academy of Arts and Sciences. ... I met her for the first time in the early 1990's in Vienna at the Erwing Schrödinger Institute. It was already obvious to me that she was outstanding.
>
> Prof. Jean Bellissard, School of Mathematics

Prof. Jitomirskaya works at the intersection of Analysis, Mathematical Physics, Dynamical Systems, and Probability theory. Her major area of research is initiated by the Mark Kac question: "Can one hear the shape of a drum?", and she has under her belt a variety of outstanding results culminating with solution of the "ten martini problem."

One domain of application for Prof. Jitomirskaya's work is Quantum Mechanics, dealing with paradigmatic Schrödinger equation for one-dimensional systems, and especially the so-called 'Almost Mathieu Model'. There, interferences between two or more waves of matter having incommensurate spatial periods produce several types of complex patterns which are even harder to master in detail. Her work focused on finding methods to solve this problem. She achieved that goal masterfully, for the cases of the paradigmatic equations, starting with her 1999 Annals of Mathematics paper and onward. This work attracted the attention of two Fields Medalists with whom Prof. Jitomirskaya collaborated.

International Recognition

Prof. Jitomirskaya was awarded the Ruth Lyttle Satter Prize from the American Mathematical Society in 2005, and the Dannie Heineman Prize for Mathematical Physics awarded by the American Physics association and the American Institute of Physics in 2020. She is a Member of the American Academy of Arts and Sciences (AAAS) since 2018. And she has been chosen to deliver a Plenary Lecture at the International Congress of Mathematics in 2022.

> Very recently [Prof. Jitomirskaya] was invited to deliver a plenary address at the Internation Congress of Mathematicians. Already an invitation to give a talk in ICM is a high honor but a plenary address is something exceptional.
>
> The hiring of Professor Jitomirskaya does not only raise the level of the School of Mathematics, but it raises the level of the Institute.
>
> Prof. Leonid Bunimovich, School of Mathematics

Tech Tower, Spring 2022
(Photo: Jess Hunt-Ralston)

In addition, Prof. Jitomirskaya has dedicated a large part of her career to teaching. She received the UCI Chancellor's Award for Excellence in Fostering Undergraduate Research in 2018. She has advised many graduate students and post-doctoral researchers, who eventually found positions in the academic world.

In May of 2022, it was also announced that Prof. Jitomirskaya has been elected to the National Academy of Sciences, one of the world's most respected scientific organizations.

THE SCHOOL OF MATHEMATICS IS PLEASED TO ANNOUNCE

MICHAEL WOLF APPOINTED SoM CHAIR

NOVEMBER 15, 2021 | ATLANTA, GA

The School of Mathematics is pleased to announce the appointment of **Michael Wolf** as the new SoM chair, effective Summer 2022.

"Dr. Wolf plans to assume his new post on July 1, 2022," shares Susan Lozier, dean of the College of Sciences and Betsy Middleton and John Clark Sutherland Chair. "I look forward to working with him to advance the teaching and research missions across the School of Math and of the College of Sciences — and to the energy, creativity, and strategy that he will bring as we welcome him to the Georgia Tech community."

"I was thrilled to be invited to chair the School of Math," Wolf says. "Georgia Tech's Mathematics faculty is world-renowned for its strength and scope, and it is an honor to participate in its leadership. Mathematics is an engine for modern science and technology — from codes for cybersecurity, to differential equations that explain black holes and the interfaces of materials, to machine learning and mathematical neuroscience, and through beautiful advances whose applications will only be revealed to our grandchildren. Mathematics is everywhere, and Georgia Tech's mathematicians are at the frontier."

"What's also wonderful about the School is the unusual extent of the connections between the research in the School and the rest of campus," he adds. "Of course, mathematics is central to most fields of inquiry, and all fields grow increasingly quantitative over time, but at Tech, one sees the interactions on personal levels."

"Simultaneously, the nation's student population is at a moment of change," Wolf notes. "The population is more diverse than ever before, with income distributions more attenuated than at any other time in our lifetimes, with shortages of STEM professionals in the millions in the coming decade. Almost all of those students will pass through our mathematics classrooms multiple times, so we need to find ways to support all of these young people so they can achieve their ambitions in science and engineering," he explains. "Georgia Tech is already in the leadership of programs that welcome their students into the community of mathematicians, scientists, and engineers. I look forward to participating in building on that success."

Wolf's position took effect in July 2022 (Photo Simons Foundation)

Meet Mike Wolf

Wolf received his Ph.D. in Mathematics at Stanford University as an Alfred P. Sloan Fellow after completing math and philosophy studies at Yale University as an undergraduate. In 1986, Massachusetts Institute of Technology named Wolf a C. L. E. Moore instructor, a role for recent Math Ph.D.s who show promise in pure mathematics research.

Two years later, Wolf joined the faculty at Rice University, where he served most recently as Milton B. Porter Professor. During his one-third of a century at Rice, Wolf has held many positions, including two periods as chair of the Department of Mathematics, head of a residential college, and co-founder and co-director of the Rice Emerging Scholars Program.

The scope of Wolf's tenure at Rice and beyond stretches through mathematics research and education, to diversity and equity, undergraduate admissions and life, to strategy and development.

"There are very few offices on the Rice campus I haven't interacted with in a meaningful way," he shares.

Vertically integrated student support: NSF VIGRE

Wolf has also served as PI and co-I of the Rice VIGRE Program, an NSF-funded initiative whose primary goal is to "increase the number of well-prepared U.S. citizens, nationals, and permanent residents who pursue careers in the mathematical sciences and to broaden their background and perspective" through sustained mentoring, education, and training.

VIGRE stands for Vertical InteGration of Research and Education and in the NSF program's context, "vertical means across academic ranks: faculty, graduate students, and undergraduates." Under Wolf's leadership, Rice secured two five-year VIGRE grants, and when that program became more targeted as the NSF Research Training Grant program, Wolf was part of a team that secured two more five-year grants.

"During the second VIGRE grant, I was department chair, and a consequence of that grant was that I was able to permanently grow our Instructorship pool from five to eight lines; those extra lines — quite a jump for a department in a small school — enhanced our ability to teach and are attractions when we recruit," he says, also noting that "graduate education in the science and technical areas in this country must change. Our current systems obstruct us from welcoming into the best STEM post-baccalaureate programs whole cohorts of students with amazing potential."

Research, Recognition, Outreach

An active teacher and scholar, Wolf's research lies in geometry, at the intersection of the study of families of surfaces and geometric variational problems. His work which has garnered the most popular attention is a proof, with Weber and Hoffman, of the existence of a minimal surface — an idealized soap film — of a 'helicoid with a handle.' This shape, announced in the Proceedings of the National Academy of Sciences with a full proof in the Annals of Mathematics that ran for more than 100 pages, was the first example since the 18th century of a topologically simple minimal surface that was infinitely twisted.

Over 34 years, Wolf has also served as investigator on a number of grants and programs with the NSF; his educational work has been supported by the Chao Foundation, Hearst Foundations, Doris Duke Charitable Foundation, and Alkek Foundation. He has delivered talks at dozens of universities and conferences spanning five continents, has co-authored several publications on STEM education and Bridge programs, and delivers occasional talks to groups of teachers and the general public.

> "We once offered a course to the public on the hardest unsolved problems in mathematics. Outreach at Rice was convinced that no one would ever want to pay $79 to listen to math lectures," he shares. "They were astonished when the course filled to capacity and was one of the most popular courses they had ever produced."

"There is a tremendous interest in mathematics in the community, and a tremendous need for the scientific community to find ways to explain — to both school children and the general community — what scientists and mathematicians do and why it is interesting, as well as important," Wolf says. "One of the attractions of Georgia Tech to me is its interest in engaging in such critical partnerships."

With a particular focus on geometric analysis and geometry and topology, Wolf has also long-served on several journal editorial boards including Proceedings of the American Mathematical Society and Bulletin of the American Mathematical Society.

A past member of the AMS Committee on National Speakers, Wolf is also a frequent NSF panelist and co-organizer of international math conferences, colloquia, and congresses, including serving as national lecturer for the Sigma Xi society.

THREE RESEARCHERS RECEIVING "VERY HIGH PRESTIGE" INVITATIONS:

SoM TO PRESENT AT THE INTERNATIONAL CONGRESS OF MATHEMATICIANS

JULY 21, 2021 | ATLANTA, GA

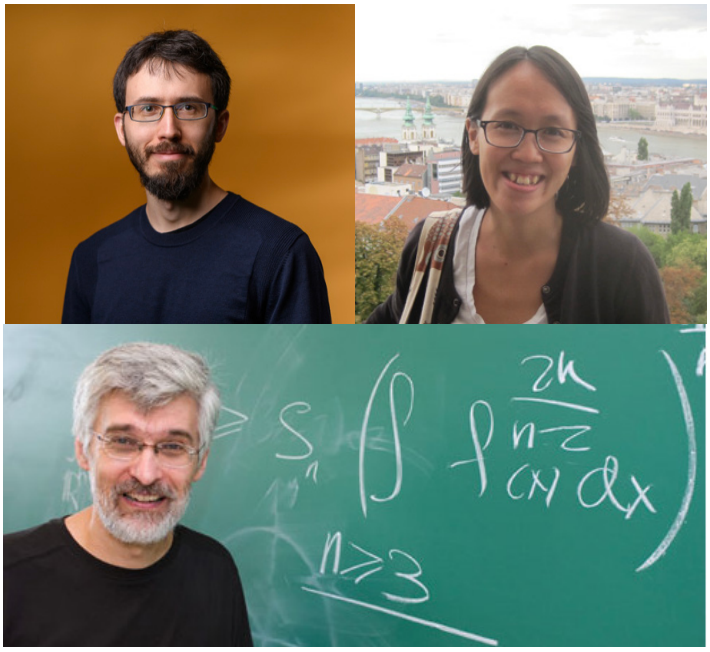
Jennifer Hom, Konstantin Tikhomirov, and Michael Loss will present on topology, discrete probability, and mathematical physics at the 2022 International Congress of Mathematicians.

Like the Olympics, the International Congress of Mathematicians only meets once every four years. Like that global athletic competition, medals are presented to those who excel. In this case, they're presented to those with breakthrough research on subjects like topology, random matrices, combinatorics.

A lot of high school math is focused on getting you to calculus, and that's a small part of the really cool math that's out there. -Jen Hom

Simply being asked to present research at an ICM is, as Davide Castelvecchi wrote in a 2015 Nature story, "the equivalent, in this community, of an induction to a hall of fame." So imagine the pride at the School of Mathematics when it learned that it will have not one, but three lecturers at the 2022 ICM, scheduled for July 6-14 virtually. Associate Professor Jennifer Hom, Assistant Professor Konstantin Tikhomirov, and Professor Michael Loss have accepted invitations from ICM committees to speak at the conference.

> "The ICM speaker invitations are a major news item in the mathematics community every four years. The invitations carry very high prestige, selected with extreme diligence to highlight leading breakthroughs across all of mathematics," explains Rachel Kuske, professor and former chair of the School of Mathematics. "An invitation signals innovative research that is driving future discovery. A single invitation in any cycle is a source of great pride for the home department of the speaker, and more than one is particularly noteworthy, reflecting the impressive talent joining the School in recent years. Of course, we are well aware that our pioneering colleagues Jennifer and Konstantin are leading the world in their fields, but we are very pleased by the community's agreement, via this exceptional international recognition."



Tikhomirov, Hom, and Loss (clockwise from top-left)

"It was a very pleasant surprise to get the email," says Hom. "It wasn't something that was on my radar. Most mathematicians do math because they find it interesting and challenging and fun, and things like this are the icing on the cake."

The invitation also came as a surprise to Tikhomirov. "I was extremely happy, of course, and I didn't expect it," he says. "People usually get invited earlier. I was not really expecting this because it's a hard thing, it's a very rare event, once every four years."

Hom echoes Kuske when she says having two Georgia Tech researchers speaking at ICM "speaks highly of the quality of math being done at the School of Mathematics."

Hom hasn't decided the specific topic of her lecture, but her mathematical research focuses on low-dimensional topology. Topology is the study of shapes and spaces that can be

stretched, twisted, and otherwise deformed, but never broken or torn. These spaces are called manifolds; for example, the surface of a donut is a two-dimensional manifold. Low-dimensional topology is the sub-discipline interested in topological spaces of four or fewer dimensions. The study of manifolds can help bring simplicity to the understanding of more complex structures in math and physics.

"I'm lucky enough to sit and think about totally abstract things just for the sake of finding patterns," she says. "There's so much more to math than what people see in high school, or what average college students see in the math class. A lot of high school math is focused on getting you to calculus, and that's a small part of the really cool math that's out there."

Tikhomirov's research is in discrete probability, which tries to bring structure and predictability to chance in the form of modeling. Take a coin flip, for example. "If I could measure the parameters of the coins, and figure out how much muscle you use to flip the coin, and figure for the activity of neurons, I would be able to predict the outcome — heads or tails," he explains. "But that's too complicated" to compute outcomes in that way. "Probability, in that respect, is designed to model things. So you have a complicated system, and then you can construct a model that inherits some properties of real physical systems, but at least you can make some predictions."

Michael Loss is a mathematician and mathematical physicist. With Elliott H. Lieb he is the author of the textbook Analysis (Graduate Studies in Mathematics 14. American Mathematical Society, 1997; 2nd ed., 2001). In 2012, he became one of the inaugural Fellows of the American Mathematical Society, and was elected as a Foreign Corresponding Member of the Chilean Academy of Sciences. He is also one of the 2015 winners of the Humboldt Prize. Recently, Prof. Loss was asked to serve on the Executive Committee of the International Association of Mathematical Physics (IAMP).

Editor's Note: The Inaugural Hubbard Chair, Prof. Svetlana Jitomirskaya who is arriving in Fall 2022, will also be speaking at ICM this year as a plenary speaker. For more information about Prof. Jitomirskaya and this exceptional honor to give a plenary talk at ICM, see our featured story on Page 31.

ICERM SEMESTER ON BRAIDS

NOVEMBER 12 , 2021 | ATLANTA, GA

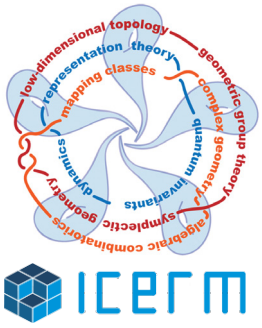
An ICERM semester-long program was organized by Prof. John Etnyre and others, which focused on braid groups, mapping class groups, and their generalizations.

Abstract

Braid groups were introduced by Emil Artin almost a century ago. Since then, braid groups, mapping class groups, and their generalizations have come to occupy a significant place in parts of both pure and applied mathematics. In the last 15 years, fields with an interest in braids have independently undergone rapid development; these fields include representation theory, low-dimensional topology, complex and symplectic geometry, and geometric group theory.

Braid and mapping class groups are prominent players in current mathematics not only because these groups are rich objects of study in their own right, but also because they provide organizing structures for a variety of different areas.

For example, in modern representation theory, important equivalences of categories are organized into 2-representations of braid groups, and these same 2-representations appear prominently in parts of geometry and mathematical physics concerned with mirror dualities; in low-dimensional topology, manifolds are presented and related to each other via braids and mapping classes. Computational applications and questions about braid groups have also emerged in disparate mathematical contexts; in some cases, these coalesce around the same computational problem. For example, developing fast machine-based calculations of link homology invariants is a goal shared by representation theorists, low-dimensional topologists, symplectic and algebraic geometers, and string theorists. The semester program brought together researchers working in diverse areas through the common thread of their interaction with braid and mapping class groups. The overarching goals of the program was to establish and clarify the key questions driving each field, and to improve each group's understanding of the tools, techniques, and perspectives of the others.



The multidisciplinary Algorithms, Combinatorics, and Optimization program focuses on the interplay between graph theory, algorithms, discrete optimization

MEET SANTOSH VEMPALA: DIRECTOR OF THE ALGORITHMS, COMBINATORICS, AND OPTIMIZATION PROGRAM

MARCH 11, 2022 | ATLANTA, GA

As one of the best discrete mathematics and combinatorics graduate programs in the country, Georgia Tech's Algorithms, Combinatorics, and Optimization (ACO) doctoral program has long been known for its excellence and rigor.

Newly appointed director Santosh Vempala plans to both "ensure that the program maintains its high quality — and make it desirable for a diverse student population."

> "The ACO program is special both at Georgia Tech and in the world," shares Vempala, who serves as Distinguished Professor and Frederick G. Storey Chair in the College of Computing with appointments across the School of Computer Science, School of Mathematics, and the H. Milton Stewart School of Industrial and Systems Engineering (ISYE). "The community of students, thanks to the dedicated and insightful work of previous directors, is thriving, both while they are here at Georgia Tech and after they graduate. They have been exceptionally successful."

Founded in 1991 and formerly directed by SoM professors Robin Thomas and Prasad Tetali, the ACO program is housed jointly across the College of Computing, the School of Mathematics in the College of Sciences, and ISYE in the College of Engineering. Focused on topics like graph

theory, algorithms, discrete optimization — and the interplay between the three — the program has deeply embraced its multidisciplinary nature, essentially eliminating "the traditional walls that usually separate academic units" by encouraging faculty members to advise students regardless of departmental affiliation.

ACO "brings together three disciplines that are fundamentally related," Vempala explains. "Its course structure enables students to understand phenomena from all three perspectives and learn to use tools from all of them."

Vempala has been involved with the ACO program since he joined the Georgia Tech faculty in 2006, advising many students in ACO, as well as serving on committees within the program.

"Professor Vempala's experience at Georgia Tech, including his prior service as associate director of the ACO program, means that he is uniquely qualified to serve as director," shares David Collard, professor in the School of Chemistry and Biochemistry and senior associate dean in the College of Sciences. "The program is highly regarded nationally and internationally. It attracts superb students from around the world and provides exceptional educational opportunities. "I look forward to its continued success under Professor Vempala's leadership."

Meet Santosh Vempala

Vempala received his Ph.D. in Algorithms, Combinatorics, and Optimization at Carnegie Mellon University before spending a year as a Miller Fellow at University of California, Berkeley and a decade as a professor of Mathematics at the Massachusetts Institute of Technology. Upon joining the faculty at Georgia Tech, Vempala served as the founding director of Tech's Algorithms and Randomness Center. He is a fellow of both the Association for Computing Machinery and the American Mathematical Society.

Describing his research as "studying the nature of computation, and its limits," Vempala's work ranges from theoretical to applied. Often entailing searching for efficient algorithms to solve fundamental mathematical and computational problems, his work also has applications such as trying to understand the problem-solving capabilities of the brain. "The best possible algorithms for basic problems — such as solving linear systems and linear programming — are still waiting to be discovered," he says.

Santosh Vempala, Distinguished Professor and Frederick G. Storey Chair, and director of the ACO program at Georgia Tech

Along with continuing ACO's longstanding record of research and academic excellence, Vempala is also keen to foster community and another 'factor' across the ACO community.

> "I am looking forward to working with my colleagues in Computer Science, Mathematics, and ISyE, to building an atmosphere of scientific collegiality and open curiosity for faculty and students, and to having more social events with a high fun factor."

In addition to research and leading ACO, Vempala is an active instructor who teaches Computability and Algorithms, Machine Learning Theory, Optimization and Sampling, and Computation and the Brain courses across campus.

> "Teaching takes a lot of effort for me with an hour of lecture needing several hours of preparation, but it is consistently rewarding — each lecture is an opportunity to understand something better; each student is an opportunity to see something from a new angle."

To learn more about the Algorithms, Combinatorics, and Optimization (ACO) Ph.D. program at Tech, visit: https://aco.gatech.edu/admissions/admission-aco-program

GEORGIA TECH PROFESSORS RECEIVE NEARLY $14 MILLION IN MURI FUNDING

USING MOTHS FOR INNOVATIVE DEFENSE RESEARCH

APRIL 18, 2022 | ATLANTA, GA

Georgia Tech has received two Department of Defense (DoD) 2022 Multidisciplinary University Research Initiative (MURI) awards totaling almost $14 million.

The highly competitive government program supports interdisciplinary teams of investigators developing innovative solutions in DoD interest areas. This year, the DoD awarded $195 million to 28 research teams across the country.

Georgia Tech's MURIs are both primarily within the School of Physics. First, Simon Sponberg, a Dunn Family Associate Professor of Physics and Biological Sciences, leads a team discovering how animals strategically use sensing and cognition to make decisions in complex environments.

> "We have all these great, sophisticated algorithms for processing big data, but an animal doesn't have time to process a million samples of its environment and then figure out what's a predator," said Sponberg.

Studying moths for their agile, sophisticated flying and complex sensing abilities, the team will record electrical activity in the brain to determine how the moths make decisions and use natural language processing techniques to see how a moth derives meaning from sensory cues and movements.

The goal is to develop an information processing framework that enables quick, flexible decision-making that could facilitate the next generation of autonomous bio-inspired systems and better integrate living systems with engineered technologies.

The interdisciplinary nature of the team makes complex research possible. Half the team is made of experimentalists: Sponberg specializes in sensors connected to motor systems with precisely timed signals; Jeff Riffell, a professor at the University of Washington, studies how the nervous system processes sensory signals to control behavior; and as a vision neuroscientist at Florida International University, Jamie Theobald, determines how animals parse complex

Hawkmoth

environments. The other half of the team will build the framework: Duke Professor Vahid Tarokh models complex datasets, Georgia Tech **School of Mathematics Assistant Professor Hannah Choi** focuses on neural networks, and Cornell Professor Silvia Ferrari ties it all together as a control theorist embedding control in neural structures.

> "MURIs were originally training grants for the DoD to develop the next generation of scientists who would make progress," said Sponberg. "This funding will allow us to have postdocs and graduate students across all six labs and disciplines working together tightly and creating a community."

Hannah Choi is an assistant professor in the School of Mathematics at Georgia Tech. Her research focuses on mathematical approaches to neuroscience, with primary interests in linking structures, dynamics, and computation in data-driven brain networks at multiple scales. She is also the recipient of a 2022 Sloan Research Fellowship.

SPECIAL SESSION ON "MATHEMATICAL MODELS FOR BIOMOLECULAR AND CELLULAR INTERACTIONS" AT JMM

NOVEMBER 22, 2021 | ATLANTA, GA

Daniel Cruz and Margherita Maria Ferrari hosted a Special Session titled "Mathematical Models for Biomolecular and Cellular Interactions" at the Joint Mathematical Meeting 2022 in Seattle, WA, January 5–8, 2022.

Their session occurred on Friday, January 7, 2022, and included a featured talk by Dr. Suzanne Sindi (Chair of the Applied Mathematics Department at UC Merced) and talks by junior members from each of the four NSF-Simons Research Centers for Mathematics of Complex Biological Systems. Their intention for this session was not only to highlight the diverse areas of mathematics related to models involving biomolecular and cellular interactions, but also the diversity of the researchers involved in these areas.

JMM Special Session

January 7, 2022

Abstract

Understanding biomolecular and cellular interactions is at the heart of vital questions in biology because such interactions have far-reaching effects on larger, fundamental processes. Mathematical models for these phenomena continue to provide new insights into open biological questions and serve as catalysts for advancing both biology and mathematics. In recent years, techniques from algebra, topology, and combinatorics have complemented more traditional approaches involving ordinary and partial differential equations in the development of tools describing biomolecular and cellular structures and dynamics. This session focused on current advancements and open problems involving such methods. To highlight the breadth of these mathematical approaches, topics included models for neuroscience, cancer evolution, genome sequence analysis, regulatory networks, and RNA/DNA structures. Moreover, we invited junior and senior speakers from under-represented minorities in order to promote inclusivity and diversity within the associated research communities.

Daniel Cruz

Margherita Maria Ferrari

For information on the session and about JMM visit:

https://www.jointmathematicsmeetings.org/meetings/national/jmm2022/2268_program_ss75.html

Speakers and panelists included:

- *Mario Banuelos (CSU Fresno)*
- *Veronica Ciocanel (Duke)*
- *Keisha Cook (Clemson)*
- *Adriana Dawes (OSU)*
- *Stephanie Dodson (UC Davis)*
- *Joel Dokmegang (Northwestern)*
- *Lina Fajardo-Gomez (USF)*
- *Alvaro Fletcher (UC Irvine)*
- *Abdulmelik Mohammed (USF)*
- *David Murrugarra (U Kentucky)*
- *Asja Radja (Harvard)*
- *Alexander Ruys de Perez (GaTech)*
- *Suzanne Sindi (UC Merced)*
- *Luis Sordo Vieira (U Florida)*
- *Imelda Trejo (Los Alamos National Lab)*
- *Bin Xu (Clarkson)*
- *Nora Youngs (Colby)*

GRADUATE STUDENT TOPOLOGY AND GEOMETRY CONFERENCE

APRIL 22, 2022 | ATLANTA, GA

A topology and geometry conference organized by graduate students took place in April at Georgia Tech. The organizers of the conference were Katherine Booth, Sally Collins, Sierra Knavel, Daniel Minahan, Anubhav Mukherjee, Agniva Roy, Thomas Rodewald, Roberta Shapiro, Weizhe Shen, Hugo Zhou, and Xingyu Zhu. Prof. Jen Hom was the faculty advisor and PI for the NSF grant, and help was also provided by SoM staff Melissa Raine and April McCruel.

There were more than 130 participants, and over twenty students were given the opportunity to speak, while several others either presented posters or gave virtual talks that were featured on the conference website. There were also nine invited speakers, faculty or early career researchers that are well established in their fields who presented their work. These faculty were also available via virtual office hours or in-person interactions with participants. Graduate students were given a great opportunity to form connections with peers and personally interact with pioneering researchers in their fields. There were also many subfields that were represented, opening opportunities for conversations and collaboration between participants.

We had an opportunity to speak with two of the organizers, Agniva Roy and Roberta Shapiro, and ask a few questions about the importance of the event.

Roberta Shapiro

What will it mean for the students who participate in the conference?

There haven't been any in-person conferences for the last couple years, which is nearly half of what students spend in grad school. That means that people had fewer chances to connect with others, get to know the community, and network. In the past, students have made connections at GSTGC that led to collaborations. I'm hoping that this year, students have the chance to do this but also meet other grad students in their area – the same grad students who will soon be postdocs, professors, lecturers, and generally coworkers at potentially the same institutions.

What does it mean for your career to be able to organize a conference at this level?

Any future career – academic or otherwise – will involve a massive amount of organization and paperwork. I feel lucky to have had the chance to, for example, learn to write a grant before my livelihood depends on it. Moreover, I feel like we, as a group, have a chance to improve on past years' conferences and make potentially make the GSTGC more useful and enjoyable for participants.

The Topology and Geometry Conference is one of the only conferences that are organized by, attended by, and feature primarily graduate students in geometry and topology.

Agniva Roy

What does it mean for your career to be able to organize a conference at this level?

For me it has been a fulfilling experience thus far, forming connections both inside the department and outside with faculty we are inviting. My short career thus far has been really helped by conferences I have been able to attend, and it is good to learn what goes into putting one together. Organizing conferences and events is a big part of being a professional mathematician, and the opportunity to do this now is an avenue to learn how to balance research and this aspect of our work.

What support have you received from SoM faculty or staff to help with the organization?

Faculty and staff have been immensely helpful. Prof Jen Hom, who is the PI for the NSF grant we have applied for, has been readily available with answers and advice. The staff have been unbelievably helpful, enthusiastic, and patient, notably Melissa Raine, April McCruel, and Kimberly Stanley, who have been helping with space booking, grant writing, and general organizational issues.

What will it mean for the students who participate in the conference?

This is one of the only conferences that are organised by, attended by, and feature, primarily graduate students in geometry and topology. 24 students will get the opportunity to speak, while several others will either present posters or give virtual talks that will be featured on the website. Further, 9 invited speakers, who are faculty or early career researchers, who are well established in their fields. will present their work. They will also be available via virtual office hours or in-person for students to interact with them. Thus this presents graduate students a great opportunity to form connections with peers and personally interact with pioneering researchers in their fields. We expect many subfields to be represented, opening opportunities for conversations and collaboration.

About the Conference

The aim of the conference is to expose graduate students to current research in topology and geometry, to provide graduate students a venue to give talks (either original research or expository), and to give graduate students a chance to network among themselves as well as to speak with experts in their fields.

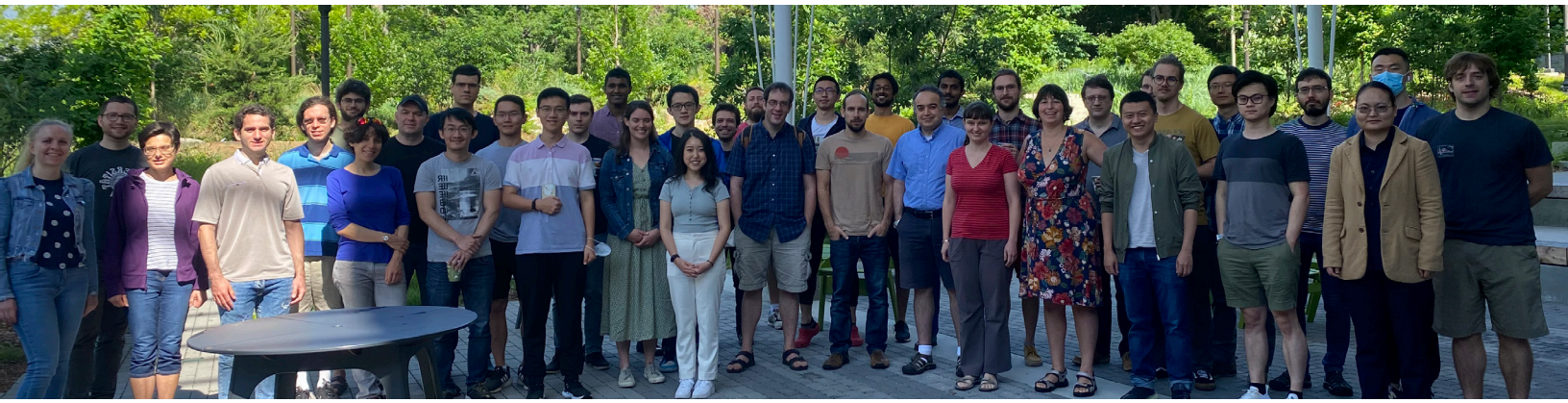
Plenary Speakers:

Bruce Kleiner (Courant Institute of Mathematical Sciences)
Kirsten Wickelgren (Duke University)
Ian Zemke (Princeton University)

Young Faculty Speakers:

Roger Casals (UC Davis)
Tyrone Ghaswala (Université du Québec à Montréal)
Christy Hazel (UCLA)
Aaron Mazel-Gee (Caltech)
Maggie Miller (Stanford University)
Jiayin Pan (Fields Institute)

Supported by the NSF and the Georgia Institute of Technology



WORKSHOP IN CONVEXITY AND HIGH-DIMENSIONAL PROBABILITY

MAY 23, 2022 | ATLANTA, GA

The workshop featured six three-hour lecture courses. Several hours a day were allocated for research discussions in groups, on the topics broadly related to the lecture courses. The participants proposed problems for discussion before and during the conference. Researchers at early stages in their career, such as graduate students, postdocs, and tenure track professors, were particularly encouraged to attend. There were also short talks by junior participants; view the abstracts on our website. The previous edition of this workshop was held in December 2019.

Organizers: Galyna Livshyts, Orli Herscovici, Han Huang.

STELSON LECTURE 2022

APRIL 1, 2022 | ATLANTA, GA

About the Stelson Lecture Series

Thomas Stelson was a distinguished Civil Engineer who served as the dean of Georgia Tech's College of Engineering from 1971 to 1974, as Vice President for Research from 1974 to 1988, and as Executive Vice President from 1988 to 1990.

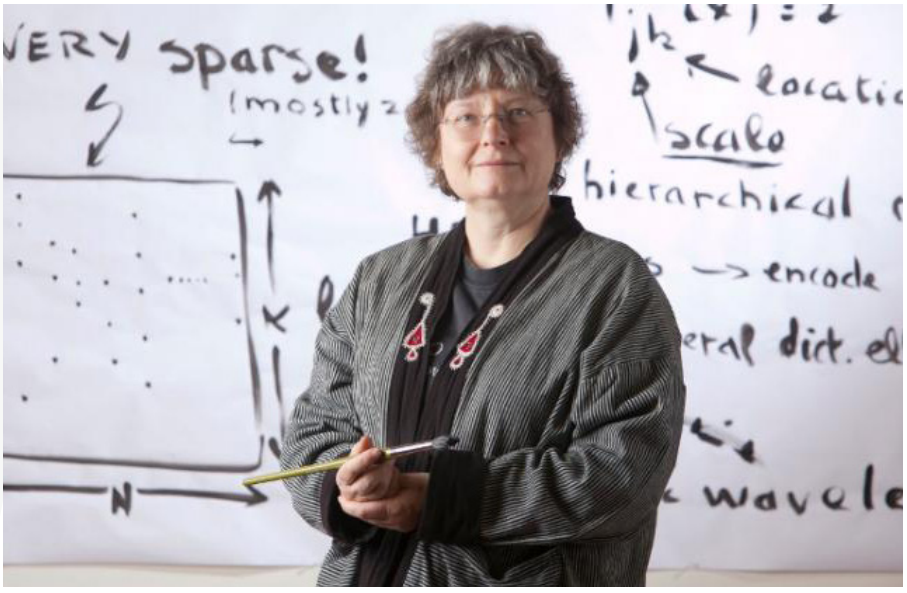
During the 70s and 80s, he oversaw a vast expansion in Tech's research expenditures during an era when Tech went from being primarily teaching-oriented university to a major research institution.

Stelson helped the School of Mathematics create the Center for Dynamical Systems and Nonlinear Studies, and he endowed the School's Stelson lectures in 1988 in honor of his father, Hugh Stelson, who was a mathematician. Hugh Stelson earned his doctorate from the University of Iowa in 1930 and went on to teach at Kent State University and Michigan State University. He worked on problems related to interest rates, annuities, and numerical analysis.

About The Speaker

Ingrid Daubechies is a James B. Duke Distinguished Professor of Mathematics and Electrical and Computer Engineering at Duke University, and is known for her work with wavelets in image compression and the mathematical methods that enhance image-compression technology, and for developing sophisticated image processing techniques used to help establish the authenticity and age of some of the world's most famous works of art, including paintings by Vincent van Gogh and Rembrandt. Daubechies is a member of the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences.

Daubechies also serves on the board of directors of Enhancing Diversity in Graduate Education (EDGE), a program that helps women entering graduate studies in the mathematical sciences.



Ingrid Daubechies

Stelson Lecture Abstract

Combining the mathematics of digital image processing with the history, craftsmanship, and science of art conservation, my research team at Duke University, Bass Connections Image Processing Algorithms for Art Conservation, spent a year working with the NC Museum of Art to study, restore, and exhibit a 14th-century altarpiece that hadn't been displayed in its entirety for over a century.

Recent Stelson Lectures

- Cryptography: From Ancient Times to a Post-Quantum Age **- Jill C. Pipher** *(3/1/2018)*
- The Complexity of Random Functions of Many Variables **- Gérard Ben Arous** *(8/31/2016)*
- How Quantum Theory and Statistical Mechanics Gave a Polynomial of Knots **- Vaughan Jones** *(9/25/2014)*
- Riemann, Boltzmann and Kantorovich Go to a Party **- Cedric Villani** *(4/19/2013)*
- Role of Mathematics Across Science and Beyond **- James Glimm** *(11/22/2010)*
- Multiscale Modeling and Simulation: The Interplay Between Mathematics and Engineering Applications - **Thomas Y. Hou** *(10/26/2009)*

Poster for Stelson Lecture 2022

For more information about the Stelson Lecture Series please visit:

https://smartech.gatech.edu/handle/1853/31161

TECH TOPOLOGY SUMMER SCHOOL 2021

NOVEMBER 3, 2021 | ATLANTA, GA

Tech Topology Summer School

The inaugural Tech Topology Summer School was held in Summer 2021, organized by Wade Bloomquist, John Etnyre, Jen Hom, Miriam Kuzbary, and Beibei Liu. Originally intended as an in-person event, the organizers decided to hold the summer school online due to the pandemic, allowing a much larger audience: over 200 registered participants, spanning four continents, with many of the talks having over 100 people in attendance.

The topic for the week-long event was 4-manifolds. A 4-manifold is a space that locally looks like $\mathbb{R}^4$, in the same way that a sphere locally looks like $\mathbb{R}^2$. One surprising phenomenon is that there is a 4-manifold M that is homeomorphic to $\mathbb{R}^4$ but not diffeomorphic to $\mathbb{R}^4$ (meaning that we can identify M and $\mathbb{R}^4$ through continuous functions but not differentiable functions). In fact, there are uncountably many different such M. Even more surprisingly, this only works for $\mathbb{R}^4$ and no other $\mathbb{R}^n$.

Major open questions in the field are: Which 4-manifolds admit multiple smooth structures (like $\mathbb{R}^4$)? If the algebraic topology of a 4-manifold is simple, is the 4-manifold also geometrically simple?

The summer school featured mini-courses given by leaders in the field from MIT, Max-Planck-Institut für Mathematik in Bonn, and the Alfréd Rényi Institute of Mathematics in Budapest. The mini-courses featured a blend of pre-recorded material and synchronous lectures, as well as Zoom office hours led by TAs. The videos of the mini-courses are available online, and to date have hundreds (or in some cases, thousands!) of views.

The mini-courses were complemented by research talks given by researchers from across the country. In addition, junior participants were invited to submit lightning talks, 5 minute pre-recorded talks giving an introduction or overview of their research. During the summer school, there were several different breakout room sessions, allowing participants to discuss material ranging from the mini-courses to the research and lightning talks, as well as whatever else was on people's minds.

There were over 200 registered participants and many of the talks had 100 or more people in attendance.

"Math is so collaborative, and one of the things that got somewhat lost during the pandemic was the opportunity for spontaneous conversation and collaboration," said co-organizer Jen Hom. "One of our main goals when pivoting to the online format was to capture a small part of that magic that happens at conferences, when people from different institutions and with different perspectives on a topic come together and combine their knowledge to lead to new directions of research."

The next Tech Topology Summer School will be held in-person in Summer 2023.

Tech Topology was focused around mini-courses given by:

- Lisa Piccirillo (Massachusetts Institute of Technology)
- Aru Ray (Max-Planck-Institut für Mathematik in Bonn)
- András Stipsicz (Alfréd Rényi Institute of Mathematics)

There was also a number of research talks given by:

- Paul Melvin (Bryn Mawr)
- Allison Miller (Rice University)
- Maggie Miller (Massachusetts Institute of Technology)
- Sümeyra Sakalli (University of Arkansas)
- Hannah Schwartz (Princeton University)

EXTERNAL NEWS

ALEX BLUMENTHAL IN SIAM NEWS FOR UNIFORM-IN-DIFFUSIVITY CHAOTIC MIXING AND THE BATCHELOR SPECTRUM

OCTOBER 20, 2021 | ATLANTA, GA

Alex Blumenthal

SIAM (Society for Industrial and Applied Mathematics) News recently published research from Alex Blumenthal, Assistant Professor in the School of Mathematics, along with colleagues from the University of Maryland and Tulane University. The study validates Batchelor's Law, which is a prediction of ratios for large-scale phenomena involving fluid mechanics. Despite the success of Batchelor's prediction, no mathematical justification existed outside of highly restrictive settings or toy models. Blumenthal and his colleagues report their recent mathematical results on passive scalar mixing, and the first proof of Batchelor's Law.

About SIAM

Society for Industrial and Applied Mathematics (SIAM) is an international community of over 14,000 individual members. Almost 500 academic, manufacturing, research and development, service and consulting organizations, government, and military organizations worldwide are institutional members. SIAM was incorporated in 1952 as a nonprofit organization to convey useful mathematical knowledge to other professionals who could implement mathematical theory for practical, industrial, or scientific use.

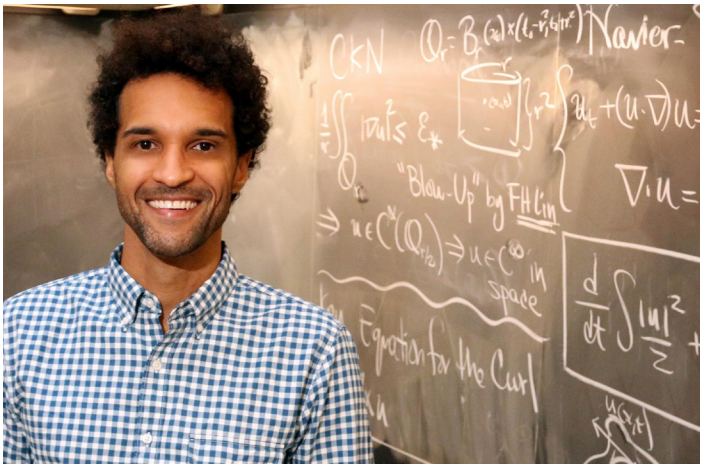
See the full article on the SIAM News website here:
https://sinews.siam.org/Details-Page/uniform-in-diffusivity-chaotic-mixing-and-the-batchelor-spectrum

Chaos

ALUMNI NEWS

RYAN HYND RECEIVES 2022-2023 CLAYTOR–GILMER FELLOWSHIP

MARCH 15, 2022 | ATLANTA, GA



Ryan Hynd

Ryan Hynd, a Georgia Tech SoM alumnus, was awarded a Claytor–Gilmer Fellowship. Ryan was a graduate in the B.S. Applied Mathematics program and completed his MSc in mathematics at Georgia Tech in 2004, he then went on to receive his PhD from UC Berkeley in 2010, studying under Lawrence Evans.

From the AMS News

Ryan Hynd, an associate professor of Mathematics at the University of Pennsylvania, has been awarded the AMS Claytor–Gilmer Fellowship for the 2022–2023 academic year.

Hynd researches partial differential equations arising in mathematical models for fluid mechanics, control theory, and finance, as well as eigenvalue problems. During his fellowship year, he will visit the Mittag–Leffler Institute in Sweden for collaborations in the fall and continue consulting with various mathematicians in the spring. He will investigate the Blaschke–Lebesgue problem, seeking to characterize minimum-volume bodies of constant width.

> "This has been an outstanding problem in convex geometry for a number of years," Hynd said. "My current hunch is that a time-dependent flow can be used to deform shapes in a way that leads to some new insight."

Hynd earned his PhD in 2010 from the University of California, Berkeley, advised by Craig Evans. After a postdoc at the Courant Institute of Mathematical Sciences at New York University, Hynd joined the Penn faculty in 2012. In 2016–2017 he was a Dr. Martin Luther King, Jr. Visiting Assistant Professor at the Massachusetts Institute of Technology.

In addition to his outstanding research, Hynd is a passionate teacher dedicated to promoting diversity in STEM. He helped create and coordinate the Bridge to PhD program at Penn, and he was a research leader for the 2020 African Diaspora Joint Mathematics Workshop (ADJOINT).

About the Claytor–Gilmer Fellowship

The AMS Claytor–Gilmer Fellowship aims to further excellence in mathematics research and to help generate wider and sustained participation by Black mathematicians. Awardees may use the fellowship in any way that most effectively enables their research—for instance, for release time, participation in research programs, travel support, childcare, etc. The most likely awardee is a mid-career Black mathematician based at a US institution whose achievements demonstrate significant potential for further contributions to mathematics.

The fellowship is named for Dr. William Schieffelin Claytor, the first African American man to publish a research article in a peer-reviewed mathematics journal, and Dr. Gloria Ford Gilmer, the first African American woman to publish a research article in a peer-reviewed mathematics journal.

See the full article on the AMS News website here:
https://www.ams.org/news?news_id=6981

EXTERNAL NEWS

INCOMING FACULTY JINYOUNG PARK PROVES KAHN–KALAI EXPECTATION THRESHOLD CONJECTURE

APRIL 12, 2022 | ATLANTA, GA

Jinyoung Park, an incoming faculty member for Fall 2023, together with her coauthor Huy Tuan Pham have proven the Expectation Threshold Conjecture of Kahn and Kalai from 2006.

Jinyoung Park

Article Excerpt

The 2006 expectation threshold conjecture gives a justification for a naive way to estimate the threshold probability of a random graph property. Suppose that you are asked about the critical probability for a random graph in G(n,p) for having a perfect matching (or a Hamiltonian cycle). You compute the expected number of perfect matchings and realize that when p is C/n this expected number equals 1/2. (For Hamiltonian cycles it will be C'/n.) Of course, if the expectation is one half, the probability for a perfect matching can still be very low; indeed, in this case, an isolated vertex is quite likely but when there is no isolated vertices the expected number of perfect matchings is rather large.

Our 2006 conjecture boldly asserts that the gap between the value given by such a naive computation and the true threshold value is at most logarithmic in the number of vertices. Jeff and I tried hard to find a counterexample but instead we managed to find more general and stronger forms of the conjecture that we could not disprove.

Jinyoung Park

Jinyoung Park is a Szegö Assistant Professor at Stanford University, working with her mentor Jacob Fox. Previously a postdoctoral member of Institute for Advanced Study (CSDM program, led by Avi Wigderson), Dr. Park will be joining SoM as an incoming faculty member in 2023.

Dr. Park's research interests include:

- Extremal and probabilistic combinatorics
- Asymptotic enumeration
- Graph theory

To explore the full article, please visit our News archive: https://math.gatech.edu/news-archive

ALUMNI NEWS

ALUM BEN ELKINS' TRANSLATION OF FELIX HAUSDORFF'S POEM "DEN UNGEFLÜGELTEN" PICKED UP BY THE JOURNAL OF HUMANISTIC MATHEMATICS

AUGUST 23, 2021 | ATLANTA, GA

Abstract / Synopsis

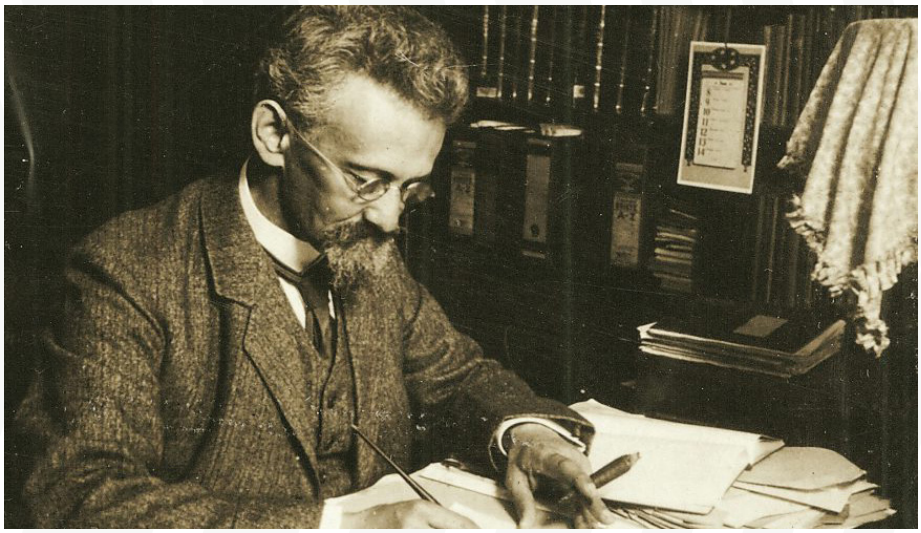
In 1900, Felix Hausdorff published Ekstasen (Ecstasy) under the pseudonym Paul Mongré. The book is comprised of 157 poems (70 sonnets, 32 rondels, 25 "mixed poems"), where Hausdorff effortlessly combines different types of poetic styles, and 30 more poems). Den Ungeflügelten (To The Wingless Ones) is the first poem in this book and provides an interesting self-portrait of Hausdorff as he embraces his muse with confidence. Here I [Ben Elkins] present an English translation of this poem without (much) commentary.

About the Journal of Humanistic Mathematics

The term humanistic mathematics could include a broad range of topics; for our purposes it means "the human face of mathematics." Thus our emphasis is on the aesthetic, cultural, historical, literary, pedagogical, philosophical, psychological, and sociological aspects as we look at mathematics as a human endeavor. More broadly, we aim to provide a forum for both academic and informal discussions about matters mathematical.

The Journal of Humanistic Mathematics was inspired by the work of Alvin White, a former professor of Mathematics at Harvey Mudd College. Dr. White was the founding editor of the Humanistic Mathematics Network Journal (HMNJ), a work of love that he almost single-handedly edited and produced for 15 years.

See the JHM webpage for more info:
https://scholarship.claremont.edu/jhm/vol11/iss2/23/



Felix Hausdorff

EXTERNAL NEWS

PROF. KUSKE AND COLLEAGUES CITED IN PRESS RELEASE FROM HERIOT-WATT UNIVERSITY

AUGUST 16, 2021 | ATLANTA, GA

Prof. Rachel Kuske and colleagues were cited in a press release from Heriot -Watt University "Bridge Energy to Be Harvested in Pioneering Research Project".

The multidisciplinary project, entitled, Stochastic Nonsmooth Analysis For Energy Harvesting, is due to complete in 2024.

Professor Rachel Kuske, former chair of the School of Mathematics at Georgia Tech, said:

> "While the device has nonlinear behaviour, which is beneficial in generating more energy than is used to power the device, the same nonlinearity can result in a range of complex responses to the vibrations.

Rachel Kuske

"We will use dynamical analyses to predict the different types of responses, as well as to select design choices for responses that optimise energy output. As the bridge vibrations are also inherently noisy, the analysis will also identify how to leverage noise sources that are beneficial and mitigate effects from detrimental noise sources."

For the full story please see:
https://www.hw.ac.uk/news/articles/2021/bridge-energy-to-be-harvested-in-pioneering.htmhtml

EXTERNAL NEWS

AMS TRIBUTE FOR THE LEGACY OF ROBIN THOMAS

JUNE 14, 2022 | ATLANTA, GA

Legacy of Robin Thomas

by Chun-Hung Liu
Communicated by Notices Associate Editor Emilie Purvine

Robin Thomas, a renowned mathematician, passed away on March 26, 2020, following a long struggle against Amyotrophic Lateral Sclerosis (ALS). He was born in Czechoslovakia in 1962 and earned his doctoral degree in 1985 from Charles University. Following the invitation of Neil Robertson and Paul Seymour, Robin arrived in the United States in 1988 and had positions at Ohio State University and Bellcore. He joined Georgia Tech in 1989 as a faculty member and was appointed a Regent's Professor in 2010. In 2016, he received the Class of 1934 Distinguished Professor Award, the highest honor for a professor at Georgia Tech.

Robin's research was in combinatorics, especially in structural graph theory, with applications to different branches of mathematics and computer science. He was awarded the Fulkerson Prize twice: in 1994 for the proof of the 5-color case of Hadwiger's conjecture and in 2009 for the proof of the Strong Perfect Graph Theorem. In 2011, he was awarded the Karel Janeček Foundation Neuron Prize for Lifetime Achievement in Mathematics. He became an inaugural fellow of the American Mathematical Society in 2012 and a fellow of the Society for Industrial and Applied Mathematics in 2018.

In addition to his prominent achievements in research, Robin's remarkable leadership had a profound influence in education. Robin served as the director of the Algorithms, Combinatorics, and Optimization (ACO) program at Georgia Tech from 2006 to 2019. The ACO program at Georgia Tech, founded around 1991, is an elite interdisciplinary doctoral program that combines three rapidly growing research areas in computer science, mathematics, and industrial engineering. Robin was involved in the founding of the ACO program and was the second director of the program. His long-term service preserved and enhanced the prestigious reputation of the program.

Sadly, in 2008, Robin was diagnosed with ALS which gradually decreased his muscle strength, resulting in difficulty moving, speaking, and breathing. But he never gave up working. He delivered a very encouraging commencement address at Georgia Tech in 2016. He kept doing research, teaching, advising students, and leading the ACO program until a few months prior to his tragic passing in 2020. Indeed, he accomplished this all with truly remarkable diligence and passion.

Chun-Hung Liu

Graph Coloring

Arguably one of the most famous problems in graph theory is the Four Color Problem, which asks whether every planar graph is 4-colorable (i.e., the vertices can be colored with 4 colors so that any two adjacent vertices receive different colors), raised by Guthrie in 1852. Even though this question looks elementary, it is equivalent to numerous statements in different branches of mathematics and is surprisingly difficult to prove. Robin made significant contributions on graph coloring, mainly related to the Four Color Problem and its variants.

A proof of the Four Color Problem was published by Appel and Haken in the 1970s. Even though this proof represents a major breakthrough, it was not fully accepted for two reasons: one is that part of the proof uses a computer and cannot be checked by hand, and the other is that the part of the proof that is supposed to be checked by hand is extremely complicated and tedious. Robertson, Sanders, Seymour, and Robin tried to read this proof, but very soon gave up. They decided to make their own proof, and they did it in the 1990s. Though their proof still relies on a computer, it is significantly simpler and has been independently verified (including the computer part) by different groups of people. Due to this work, now it is safe to call it the Four Color Theorem.

Leadership and Mentorship

Besides Robin's remarkable mentorship witnessed by prolific work joint with his students and postdocs mentioned in previous sections, we briefly remark on Robin's long-term leadership for the ACO program.

The Algorithms, Combinatorics, and Optimization (ACO)

program at Georgia Tech is the oldest interdisciplinary PhD program at Georgia Tech founded around 1991. It is one of only two programs of their named genre in the United States. (The other ACO program is at Carnegie Mellon University created one or two years earlier than the one at Georgia Tech.) The ACO program highlights three rapidly growing areas of research: analysis of algorithms, combinatorics, and discrete and combinatorial optimization. As we have seen in previous sections, Robin's work spans all three areas and shows that the boundary line between those areas is vague. Many faculties in different departments of Georgia Tech had worked on related areas since the 1970s, motivating the creation of the ACO program with a unique curriculum design that spans three academic units in Georgia Tech.

In 1993, Robin's student, Daniel Sanders, became the first graduate of the ACO program. Robin was the second director of the ACO program, serving from 2006 to 2019. When Robin took over the position from the first director, Richard Duke, the ACO program was already well-established in the sense that the concerns about its viability and appeal to applicants with the highest quality had essentially resolved. Robin not only maintained the prestige of the ACO program but also elevated it. By 2011, the ACO program was considered an elite academic program by any of the usual metrics. Today, 30 years after its establishment, the ACO program remains strong and thriving. Robin's long-term service and extraordinary contributions from other affiliated faculties definitely played important roles. ACO alumni gathered at Georgia Tech in 2017 to celebrate the 25th anniversary of the ACO program and gave public talks. Many of them recalled their days at Georgia Tech and the graph theory course taught by Robin. Indeed, Robin was part of the daily life of an ACO person.

We close this article by including contributions from some of Robin's former students and postdocs that highlight his excellent mentoring.

Luke Postle

As his PhD student, Robin taught me how to think about research. An excellent researcher, Robin had a wonderful taste in problems. While we both shared a love of graph coloring, particularly the Four Color Theorem and all its extensions and generalizations, Robin was always open to a new problem if it was natural and well-motivated. Robin taught me to never shy away from the hard problems of mathematics but instead to embrace them, to believe that problems worth working on are their own reward.

Robin also taught me the importance of communicating

Robin Thomas

mathematical ideas. Through Robin's guidance during our many collaborations, I learned how to write mathematics professionally, to understand that technical writing was not about persuasion but precision. I learned that a colleague reading my paper had to be able to reconstruct exactly what I was doing without having me there to walk them through it. For presentations, Robin instilled in me that each slide should carry its own weight. Since I graduated in 2012, I have taken to heart all the lessons I learned from Robin. Robin shaped how I think about mathematics and how I approach research, writing, and presentations. To this day, I still find myself asking what would Robin say?

Robin was the best mentor I ever had. I can honestly say I would not be where I am today as a tenured professor if it were not for Robin; indeed, I wonder sometimes if I would even be in math. Robin literally changed my life but he also changed me. He taught me many things but most of all he taught me by example with his constant courage, perseverance, and enthusiasm in the face of adversity.

Luke Postle is an Associate Professor at University of Waterloo. His email address is lpostle@uwaterloo.ca.

Dan Král'

I first met Robin in 1999, during the symposium on Graph Drawing in Prague where he gave an invited plenary talk on graph planarity and related topics. I still remember his talk today, which was given with crystal clarity whilst covering so many deep results from the theory of graph minors, a rapidly emerging area at that time. In 2001, Robin gave an invited talk at the first workshop of the GROW series and during this workshop, I became engrossed in a detailed discussion with Robin concerning the extension of Erdős-Posa type results on planar graphs (that I had obtained earlier) to surfaces of higher genus. It was extremely impressive how broad and

Continued from previous page...

deep Robin's knowledge was, not only of graph theory, but across the entire field of mathematics. This made me realize the importance of seeing mathematics in its unity and led me to devote a significant amount of time while working on my PhD to learning topics from other areas of mathematics and computer science, even if I did not intend to do any research in those areas. In 2005, I was honored to become Robin's postdoc and the year that I spent at Georgia Tech really changed the direction of my research career. Of course, I learnt a lot from graph theory while working with Robin but it was his open-minded approach to mathematics, graph theory in particular, and the routine involvement of computers in his work which have served as a huge source of inspiration during my academic career. However, Robin was not only an outstanding researcher but also an excellent teacher as I witnessed during my postdoc stay and frequent subsequent visits to Georgia Tech. He paid extreme attention to the delivery of material in his classes and I am sure he would not mind me sharing a brief story related to this. Once whilst having lunch with Robin, a student that Robin had taught a couple of years earlier came to thank him for conducting the class in such a way that he could build so much upon it in his forthcoming years at Georgia Tech. Certainly in my view, this is one of the greatest accolades a teacher can receive! Robin was, and still is, a source of inspiration for my academic work and, until his untimely passing, I continued to consult him for scientific advice on various matters. I stay very much indebted to Robin for the amount I learnt from him, his overall support and a great deal of inspiration, all of which are impossible to comprehend in words.

Dan Král' is a Donald Ervin Knuth Professor at Masaryk University and a honorary professor at University of Warwick. His email address is dkral@fi.muni.cz.

Acknowledgment

The author thanks Sigrun Andradottir, Luke Postle, and Petr Hliněný for some suggestions when preparing this article.

EXTERNAL NEWS

SANTOSH VEMPALA RECOGNIZED IN CLASS OF FELLOWS OF THE AMS 2022

NOVEMBER 3, 2021 | ATLANTA, GA

Class of Fellows of the American Mathmatical Society 2022

Santosh Vempala, Frederick G. Storey Chair and Distinguished Professor in the College of Computing who is also an adjunct professor in the School of Mathematics, has been named to the 2022 class of American Mathematical Society Fellows.

Vempala is recognized for contributions to research of randomized algorithms, high-dimensional geometry, numerical linear algebra, and service to the profession.

Fellowship in the AMS recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics.

Vempala, who is the director of Georgia Tech's Algorithms, Combinatorics,and Optimization program, is also an adjunct professor in the H. Milton Stewart School of Industrial and Systems Engineering.

Visit the AMS page for more info:
http://www.ams.org/cgi-bin/fellows/fellows_by_year.cgi

EXTERNAL NEWS

SANTOSH VEMPALA IN QUANTA MAGAZINE FOR ACM-SIAM BEST-PAPER AWARD

SEPTEMBER 1, 2021 | ATLANTA, GA

New Algorithm Breaks Speed Limit for Solving Linear Equations

An Incredible Feat

By harnessing randomness, a new algorithm achieves a fundamentally novel — and faster — way of performing one of the most basic computations in math and computer science.

> "This is one of the most fundamental problems in computing," said Mark Giesbrecht of the University of Waterloo. "Now we have a proof that we can go faster."

The new method, by Richard Peng and Santosh Vempala of the Georgia Institute of Technology, was posted online in July, 2020, and presented in January, 2021, at the annual ACM-SIAM Symposium on Discrete Algorithms, where it won the best-paper award.

> "Linear systems are the workhorse of modern computation," said Vempala.

The new proof finds a quicker way of solving a large class of linear systems by sidestepping one of the main techniques typically used in the process. That technique, called matrix multiplication, previously set a hard speed limit on just how quickly linear systems could be solved. It still features in the work, but in a complementary role. The authors couple it with a new approach that, in essence, is a form of trained divination.

Santosh Vempala

Santosh Vempala, along with Richard Peng, came up with a new, faster way of solving certain linear equations, "the workhorse of modern computation" according to Vempala.

> "There's no reason for this problem of solving linear systems to be dependent on improvements in matrix multiplication," said Vempala.

For information and to learn more, please check out the full article below:

https://www.quantamagazine.org/new-algorithm-breaks-speed-limit-for-solving-linear-equations-20210308/

RECENT PROMOTIONS IN SoM

MAY 20, 2022 | ATLANTA, GA

From L to R: Michael Damron, Josephine Yu, Mayya Zhilova, Sal Barone, and Neha Gupta

Five SoM faculty will receive promotions, with successful promotions at all levels.

Michael Damron, Promoted to Full Professor

Dr. Michael Damron came to Georgia Tech as an assistant professor in 2015 and became an associate professor in 2017. Prof. Damron's research is in probability theory, with interests in percolation and particle systems and with research supported by an NSF grant and an NSF CAREER award.

Josephine Yu, Promoted to Full Professor

Dr. Josephine Yu first joined SoM in 2010 as an NSF Postdoctoral Research Fellow and became an assistant professor the following year. Prof. Yu's research lies in the area of Tropical Algebraic Geometry and its applications to combinatorics, matroid theory, and analytic and computational geometry, and since arriving at Tech her work has been continually supported by the NSF.

Prof. Yu has organized many conferences since 2011 including the Meeting on Applied Algebraic Geometry in 2019, and the Computational Tropical Geometry Minisymposium at the SIAM Algebraic Geometry meeting in 2017.

Mayya Zhilova, Promoted to Associate Professor with Tenure

Dr. Mayya Zhilova began work at the School of Mathematics at Georgia Tech in 2016, and is an affiliate faculty member of the Center for Machine Learning at Georgia Tech and the Transdisciplinary Research Institute for Advancing Data Science (TRIAD).

Prof. Zhilova was awarded an NSF CAREER award in 2021 with a project which seeks to address challenging open questions in high-dimensional and nonparametric statistics motivated by practical applications in finance, engineering, and life sciences.

Sal Barone, Promoted to Senior Academic Professional

Dr. Sal Barone first arrived at Georgia Tech in 2013 as a Hale Postdoctoral Fellow doing research in Real Algebraic Geometry, and became the school's first Director of Communications (DoCSoM) as an academic professional in 2017. With a clear passion for teaching, Dr. Barone has contributed to the service mission of SoM by coordinating Math 1554 Linear Algebra since Spring 2020, and has been the course coordinator for Math 1552 Calculus II as well as the lead instructor for nearly all the first year courses offered in SoM.

Neha Gupta, Promoted to Senior Academic Professional

Dr. Neha Gupta came to SoM in 2018 as Director of Scheduling and an academic professional. Dr. Gupta has taught several service level courses such as Math 1712 Survey of Calculus and GT1000, and has been the course coordinator for Math 1551 since Fall 2018.

Dr. Gupta received several teaching awards including the CoS Student Recognition of Excellence in Teaching: Honor Roll in 2022 and the CIOS Student Recognition of Excellence in Teaching: Class of 1934 Award in 2020. Dr. Gupta was also the first academic professional to fill the recently appointed AP position on the Faculty Advisory Committee (FAC) for the School of Mathematics.

ENID STEINBART, YOU CAN'T RETIRE FROM BEING GREAT!

JUNE 14, 2022 | ATLANTA, GA

A sad day is approaching when SoM will say farewell to **Enid Steinbart** after an impressive 22 years as an academic professional in the School.

Dr. Steinbart joined Georgia Tech in 1999, and has been SoM's Director of Undergraduate Advising and Assessment since 2000. Before joining Georgia Tech, she received her Ph.D. in Mathematics from the University of Illinois at Urbana-Champaign, after which she progressed to full professor at the University of New Orleans. Twice recognized with GT's Outstanding Undergraduate Academic Advising Award, Dr. Steinbart has also received the Outstanding Academic Advisor -Certificate of Merit from the National Academic Advising Association (NACADA), and the Class of 1940 Course Survey Teaching Effectiveness Award.

Dr. Steinbart has taken leadership roles in many activities that advance undergrad success at GT, including leadership of Club Math, implementation of SoM's new Math Major, developing the Math Undergraduate Seminar in 2008, and twice chairing GT Advising Network's Academic Advisor Best Practices Conference.

Dr. Steinbart was promoted to Principal Academic Professional, the highest possible rank of AP, in 2020. The rank of Principal AP is the highest in the GT academic professional career ladder, awarded to those demonstrating superior performance and recognized by peers, with successful and measurable related experience, including but not limited to supervision of others' work, significant responsibility and authority within program area, and demonstrated impact.

We in the SoM wish Enid all the best of luck in her future. We will miss you, Enid!

Klara Grodzinsky

Enid Steinbart

Dr. Enid Steinbart has been a wonderful colleague for the past 23 years. The undergraduate math program has grown, improved, and expanded thanks to Enid's hard work. In addition to recruiting a larger number of majors, Enid has worked to create a community for our students through activities such as Club Math, the AWM, and a math-specific section of GT 1000. In her teaching role, Enid has traveled to Barcelona to support the study abroad program, earning a course survey award from her students, and has served many times as the course coordinator for Math 2551. In her administrative role, Enid has been instrumental in creating a bond among all the academic professionals: providing us with meaningful advice, creating a positive support network, and inspiring each of us in our own professional journeys. I am grateful to have had the opportunity to work with Enid, and I wish her all the best in her retirement!

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SoM AT THE ATLANTA SCIENCE FESTIVAL

JULY 22, 2022 | ATLANTA, GA

Written by Evans Harrell, Lew Lefton, and Dan Margalit

The School of Mathematics made its presence felt at the Atlanta Science Festival in 2022, with a variety of performances, workshops, and artistic creations.

Mathematics in Motion

On March 13, Professor and Assoc. Dean Emeritus Evans Harrell hosted an event of his creation, called ***Mathematics in Motion***. This event was held in the theater at the Drew Charter School. From the flyer:

> Mathematics and the performing arts? Yes, absolutely! Join us during the Atlanta Science Festival to experience how dance and circus arts can interpret math through the beauty of movement!

The show started with a unicycle demonstration by Georgia Tech student Anthony Limiero and recent grad Ziggy Zaptacular. They rode many unicycles of various shapes and sizes while Harrell, acting as emcee, described the various geometric properties of the unicycles and their wheels. Then Harrell (dressed in a clown nose and rainbow wig) showed the audience - with the help of an adorable volunteer - how a non-circular wheel could be used to make a smooth ride on the flat stage. A working model of a unicycle with such a wheel, built by Paul Hartman, was in the building. Its premiere ride in public was accomplished by Anthony, much to the delight of the crowd.

Many in the audience were struck by the way that mathematics interfaced with art in so many surprising ways.

The shape used for Hartman's unicycle wheel is called a Reauleaux triangle. This is a curved triangle that has an amazing property: it has the same height no matter how it is rotated. This shape is named for the 19th century engineer Franz Realeaux, although the shape was known earlier, for instance to Leonardo Da Vinci.

After the unicycling, Professor Dan Margalit took the stage to give a juggling demonstration and an explanation of the mathematics behind siteswap notation, a kind of sheet music for juggling that was invented independently by three separate groups in the early 1980s.

Mathematics in Motion - *Hypercube*

The third act, ***Hypercube***, was a modern-dance performance in which the dancers manipulated a very large, and very flexible hypercube created by Atlanta artist Julia Hill. This piece was created by Atlanta choreographer Rose Shields, with the collaboration of Sarah Pritchard, one of our star undergraduates in the School. Ms. Shields is an artist in residence at Mathematics in Motion, Inc.

The fourth and final act was a piece called ***Shape of Reflection***, created by Julie Galle Baggenstoss, an instructor in the Emory Dance Program and another resident at Mathematics in Motion, Inc. While guitarist José Chirinos played flamenco music, the dancers played off the inherent asymmetry of the ellipse using both flamenco and hip-hop dance moves.

The performance ended with a question and answer session, hosted by Harrell. Audience members stayed for almost an hour after the performance, and children and adults got a chance to interact directly with the performers. Many were struck by the way that mathematics interfaced with art in so many surprising ways.

Mathematics in Motion - *Shape of Reflection*

Lew Lefton performs in *Jazz Hands*

Science Improv

What happens when improv comedy gets geeky? Just ask Prof. Lew Lefton (also Assoc. VP for Research and CoS Asst Dean of IT), who hosted an Atlanta Science Festival event called Science Improv on March 16 at Whole World Improv Theater. This event, which puts short-form improv games into a Math and Science context, has been an Atlanta Science Festival favorite, returning every year since the first festival in 2013! The ensemble cast varies from year to year, but frequently includes Georgia Tech faculty and students playing with experienced improvisers. Do you want to see a press conference where Issac Newton announces he's invented an AI powered lawn mower? Come suggest it at the next Science Improv show.

Jazz Hands: A Science Comedy Event

Prof. Lefton also produced and hosted a stand up comedy showcase on March 23, in partnership with the nonprofit Science for Georgia. Here, Lefton takes advantage of his decades of experience as a stand up and improv comedian to combine a Science Communication course with a Stand up comedy course. Participants learn the basics of comedy and then take a scientific topic and build a 5-7 minute stand up comedy set about it. This year's cohort performed their "final exam" at Zoo Atlanta and the event was a big success. We had faculty from Emory talking about "Chuck Norris Antibodies" and Ph.D. candidates from Morehouse School of Medicine who were "vaxxed, waxed, and can't relax!". The event was also a fundraiser for Science for Georgia which is a nonprofit that works to build stronger bridges between Science and the public through communication, engagement and public policy.

> Scientists are funny! And because we're scientists, we've got data to back that statement up! Back by popular demand, and *in 3D*...come see scientists do comedy at Science Jazz Hands! Learn the answers to all of life's mysteries, like "how can you make a math pun that bad?" and "how is religion like nuclear physics?"

MindCraft! participants exploring at the ***Crocheting Hyperbolic*** Space table

MindCraft!

In the new, environmentally friendly Kendeda Building on campus, the College of Sciences hosted an event called MindCraft! The Science of Crafting. This event was organized on March 12 by Jennifer Leavey, assistant dean in the College of Sciences. From the advertisement:

> Are you a maker or a crafter? Ever given much thought to some of the science and technology secrets behind your favorite hobby? Or maybe you haven't picked your pandemic hobby yet and want some inspiration!

Continued from previous page...

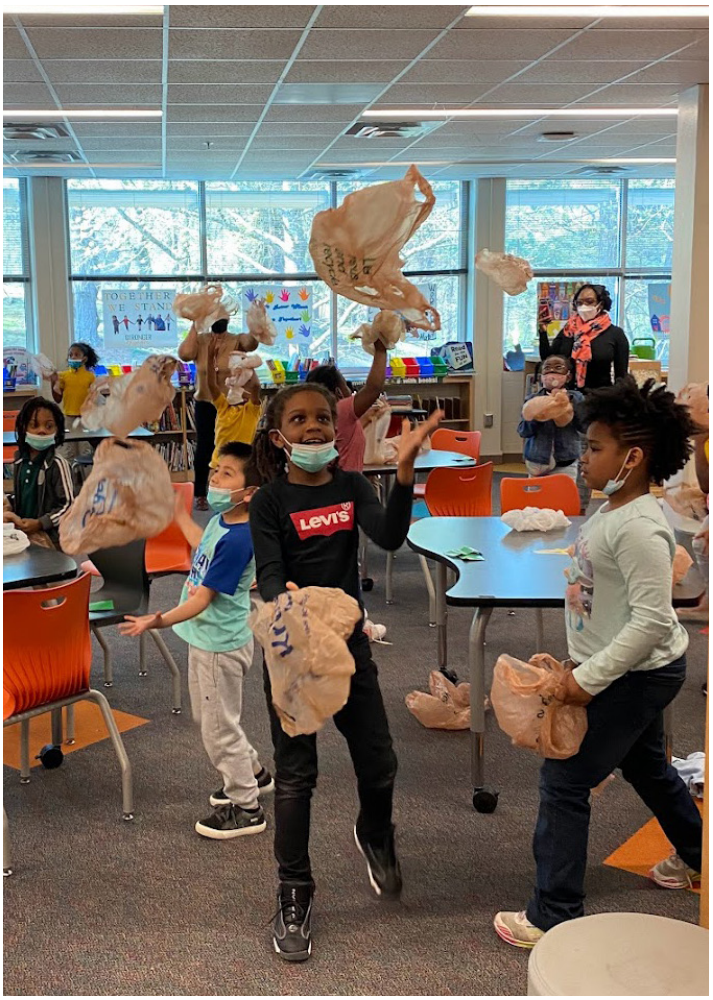
> Make your own mini-crafts and learn about the science of materials in knitting, origami, flower pressing, pottery, and more.

Among the many tables at this science fair-type event, School of Mathematics ran a table called ***Crocheting Hyperbolic Space***. Hyperbolic space is a space that looks like a Pringles potato chip or like certain types of coral. Second-year graduate student Katherine Booth and Professor Dan Margalit taught participants to crochet a hyperbolic plane out of yarn. They explained the phenomenon that on a sphere (which is positively curved) triangles have interior angles greater than π, while in hyperbolic space (which is negatively curved) triangles have interior angles less than π. Children and adults had a blast learning to crochet and discovering the world of negative curvature.

Imagining the Future

Another event run by the Atlanta Science Festival is ***Imagining the Future***, a program that pairs STEM professionals with elementary and secondary school classrooms. The STEM professionals visit with students in their classrooms. The goal is to expose students to aspects of science and academia that they might not be aware of, and to give students a chance to interact with scientists and engineers.

This year, Professor Dan Margalit was paired with Boyd Elementary School, on the west side of Atlanta. He gave a juggling demonstration to second and third grade students and give a basic introduction to siteswap, emphasizing the distinction between even and odd numbers in the siteswap patterns. Students then got to ask questions. At the end, the students practiced their juggling skills with plastic bags from the grocery store. They were very excited!



Elementary students juggling with shopping bags during *Imagining the Future*

Science.Art.Wonder

Science.Art.Wonder is a student organization run by undergraduates at Georgia Tech. In their words:

> Science.Art.Wonder matches artists and researchers to create art based on and inspired by scientific research.

This year, Professor Dan Margalit was paired with Olena Buriakova, a third-year Computer Science major from Kyiv. Olena's painting is titled "The squared lantern relation." It illustrates an equality in the braid group on three strands. The equality is illustrated as two different braids in the hair of two twin sisters. The painting was exhibited on campus and at the Atlanta Science Festival Exposition on March 26.

Dan Margalit and Olena Buriakova at *Science.Art.Wonder*

HIGH SCHOOL MATH COMPETITION

APRIL 30, 2022 | ATLANTA, GA

The 2022 High School Math Competition took place online on April 30.

A total of 69 students from 18 different schools partici-pated in the event, including a handful of international participants. The event was organized by SoM graduate student Trevor Gunn, together with 10 volunteers who assisted in running the event.

Trevor Gunn

Some sample problems from the event included:

Find all prime numbers p such that p + 28 and p + 50 are also primes.

How many binary strings are there of length 10 which do not contain either '101' or '010' as a substring?

All of the problems - and solutions! - are posted on the HSMC website https://hsmc.gatech.edu/exams for anyone interested in seeing what the participants were up against.

The top five scores in each category were:

Top 5 (Multiple Choice)

- Eric Sun (Alpharetta High School)
- Hwidong Jeon (Chattahoochee High School)
- Cyrus Zhou (not registered)
- Edward Ju (Chattahoochee High School)
- and a 5-way tie for 5th place
  - Ashley Lu (Alpharetta High School)
  - Ethan Chen (Wheeler High School)
  - Christopher Lee (not registered)
  - Emily Abigail Schierts (Forsyth Central High School)
  - Richard Kang (Wheeler High School)

Top 5 (Proofs)

- Daniel Lin (Walton High School)
- Zinnun Malikov (not registered)
- Sagnik Nandi (South Forsyth High School)
- Emily Abigail Schierts (Forsyth Central High School)
- Christopher Lee (not registered)

HSMC Organizer Trevor Gunn

I have been helping to run the High School Math Competition for 5 years now—as a volunteer for 4 and now as the organizer. I started contributing problems and volunteering to run the competition because it involves different kinds of problems than I normally see in my usual studies/research. But the biggest draw for me is that it gives me the opportunity to work with others—both other graduate students and the high schoolers. We have very knowledgeable, intelligent graduate students in the program but I never interact with any of them mathematically except within a narrow area of specialization.

The high school math competition is one such opportunity. For the high schoolers, I try to include some problems that are not what I would consider "standard" math competition problems. There are plenty of those in the competition, sure, but I also like to give problems that connect to courses or subjects that I find interesting. For example, in 2019 I gave the following proof problem:

Given a set of points in the plane, not all on the same line, prove that the number of lines which can be formed by the points (where a line contains two or more points) is always greater than the number of points.

This is one of those facts which is apparent but for which is hard to put into words exactly why this is true. I first came across this problem in a talk that June Huh gave at Georgia Tech for the Georgia Algebraic Geometry Symposium (GAGS) about the top-heavy conjecture. The top-heavy conjecture is a statement about the distribution of the number of points, lines, planes, etc. which are formed when you have a set of points in an n-dimensional space. The hint for the problem was a theorem of Tibor Gallai from 1944 which states that you can always find a line through just two points. I really liked that problem because not only because it connects to research that I am interested in but it also shows to the students that math is a living subject—not too many students see math newer than the 18th or 19th century in high school and usually the math is even older.

MEET THE GRADS - NOAH CAPLINGER

JUNE 14, 2022 | ATLANTA, GA

Noah Caplinger is a graduating senior who is intent on pursuing a career in mathematics. Having been accepted into the University of Chicago graduate program, one of the top programs in the world, we wanted to take one last opportunity to speak with Noah before he continues on his path.

Interview by Dan Margalit

What made you interested in majoring in mathematics?

Initially I wanted to be a chemist, but my 11th grade chemistry class put a stop to that pretty quick. That semester, I was taking calculus at my local university with a great professor, Dr. Hu. He was always happy to entertain my questions and I spent a lot of time in his office hours talking to him about math. Because of him, I took as much math as my dual enrollment program would allow, and here I am. I'm not sure I knew what I was getting into at the time, but I'm quite happy where I ended up.

Favorite class?

I'll give you two answers. The most rewarding was MATH 1564, "Linear algebra with abstract vector spaces" with Shahaf Nitzan---it was my first "real" math class and I learned tons of linear algebra. It set the tone for the rest of my math degree. The most fun was Dan Margalit's special topics class in geometric group theory, which I think is the topic I'll end up specializing in.

Favorite math-related activity?

The mapping class group lunch with Dan Margalit's research group. Once a week, everyone who studies mapping class groups in the department gets together to eat lunch. It's a great little social group, and I've learned quite a bit when the conversations inevitably turn to math.

What are you most proud of?

Two things come to mind. First, there is my research paper with Nick Salter, a professor at Notre Dame. In the paper (called "Totally Symmetric sets in the General Linear Group"), we classified totally symmetric sets in the general linear group (totally symmetric sets are a relatively new concept used for understanding group homomorphisms). I have hope that some of the ideas we developed will be used and built upon in the future, which is very exciting.

My other big project was my book, "Chess Algorithms". Chess programming was one of my hobbies in high school.

Noah Caplinger

I was very frustrated by the quality of chess exposition available on the internet, so I decided to write some notes. I initially planned for only 40 pages, but I ended up with a book, which is available on Amazon. It was a massive project that I'm quite proud of.

Favorite non-math activity?

Badminton Club for sure. I've played three times a week for almost all of the past four years. Friday nights usually involved playing until they kick us out of the CRC, then going out for Chinese food and Boba.

I heard you like writing. Is that right?

Yup. I always hated my English classes, but eventually I figured out that writing is lots of fun when you actually care about the topic. Chess Algorithms was just the start – my summer project is to write some notes on group theory solely from the perspective of group actions. Hopefully one day it'll turn into a book!

Future plans?

The dream is to go pro – into academia as a research mathematician. I want to do and write and talk about math for the rest of my life.

DONATE TO SoM

Stay in Touch!

We look forward to future opportunities to stay in touch with you. We're very grateful for help in all forms, large and small, from our friends. Here are some ways you can stay involved with the School of Math, along with our Friends of the School of Math and our Alumni.

Share your story

We ask all alumni, past visitors, and friends of the School to please update your contact information along with your news, with an email to comm@math.gatech.edu. More info on our webpage. We hope to hear from you soon!

Create an Endowed Chair

The professors and academic professionals at the School of Mathematics mentor the students, create the programs, design the classes, define the culture and envision the mathematics that will shape the future. The work of SoM professors and academic professionals impact the undergraduates, graduate students, postdoctoral associates, and the wider community. Through an endowed professorship, a donor creates an enduring tribute that realizes their vision of mathematical excellence and effect.

Give to the School of Math

Beyond creating an endowed chair, there are many other ways to support the school. Your support will make a large impact on the education and research efforts of the School of Mathematics through scholarships or our outreach programs. Below are some of the many ways this can happen.

Support the Bright Future of Mathematics

Undergraduate Scholarships: Everyone knows that college affordability is a serious issue for many families. Funds for undergraduate scholarships help support deserving students as they work toward a Math degree, a very valuable degree whose worth increases every day.

Graduate and Postdoctoral Fellowships

Our graduate students and postdoctoral researchers are the future of the discipline, integral to all of the efforts of the School—from teaching to research to outreach. Supporting them with fellowships, thesis/research prizes, travel-and professional-expense funds or other types of support has a large impact on their professional development, the School, and the discipline. The School's increased quality and quantity in postdoc and graduate recruitment illustrates how a named fellowship attracts and promotes top talent.

Connect with High Schools

The High School Mathematics Competition is an inspiring event where students gather with others interested in mathematics and compete for scholarships. It is run entirely by undergraduate and graduate student volunteers, with scholarships to bring these talented high school students to Georgia Tech. Contributions toward prize money or operating expenses ensures and expands the on-going inspiration and impact of this event (for registration and other details see http://hsmc.gatech.edu). The School also runs a large distance learning program for High School students, with potential for many areas of growth.

Recognize Teaching, Research, and Leadership in Mathematics

A central part of the mission of the School of Mathematics is teaching, with very talented and dedicated teaching faculty, as well as an extensive training program in teaching for our graduates and postdocs. Recognizing the best of them through awards for excellent teaching and mentoring underlines the importance of these efforts and encourages increased excellence. A named award would be a great way to remember an alumnus, former faculty member, or previous instructor who had a big impact on your life. Likewise, School members are leading research efforts, events, and training at Georgia Tech and around the world, so you may want to recognize their impact.

Visit us!

Or even better, deliver your story in person by visiting the School. We especially welcome opportunities for visits from alumni to stop by and connect with our students and School members.

CREATING THE NEXT®

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