



UNIVERSITY of DENVER

NATURAL SCIENCES & MATHEMATICS
Department of Mathematics

Winter 2020



Mathematics Alumni Newsletter



A Note from the Chair

Dear friends of the Mathematics Department,

While Denver is the center of the Universe for many of us, we have to admit to a certain geographical isolation – indeed, Denver is the largest metro area in the radius of 585 miles. However, I am happy to report that we will soon find ourselves in the center of the *mathematical* universe.

The Joint Mathematics Meeting of the American Mathematical Society and the Mathematical Association of America (<http://jointmathematicsmeetings.org/jmm>) will take place at the Denver Convention Center on January 15-18, 2020. The event is being promoted as the largest ever mathematics meeting, with an expected record-breaking attendance of well over 6000 people.

DU Math will be well represented at the meeting. Thanks in part due to your generous donations, the department will pay for registration fees of all interested graduate students and all presenting faculty. Moreover, seven special sessions at the meeting will be organized by our faculty (see inset).

University of Denver -
Department of Mathematics

Knudson Hall 300

2390 S York Street

Denver, CO 80208

Chair: Petr Vojtěchovský

Grad Coordinator:

Natasha Dobrinen

UG Coordinator:

Mei Yin

Asst to Chair: Susan Bolton

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JMM 2020 Sessions Organized by DU Math Faculty

- Experimental and Computer Assisted Mathematics (Shashank Kanade)
- Interactions Among Partitions, Basic Hypergeometric Series, and Modular Forms (Chris Jennings-Shaffer)
- Mathematical Aspects of Conformal Field Theory (Shashank Kanade and Andrew Linshaw)
- Noncommutative Geometry and Applications (Frédéric Latrémolière)
- Recent Trends in Semigroup Theory (Michael Kinyon)
- Self-Distributive Structures, Knot Theory, and the Yang-Baxter Equation (Petr Vojtěchovský)
- Symbolic Dynamics (Ronnie Pavlov)

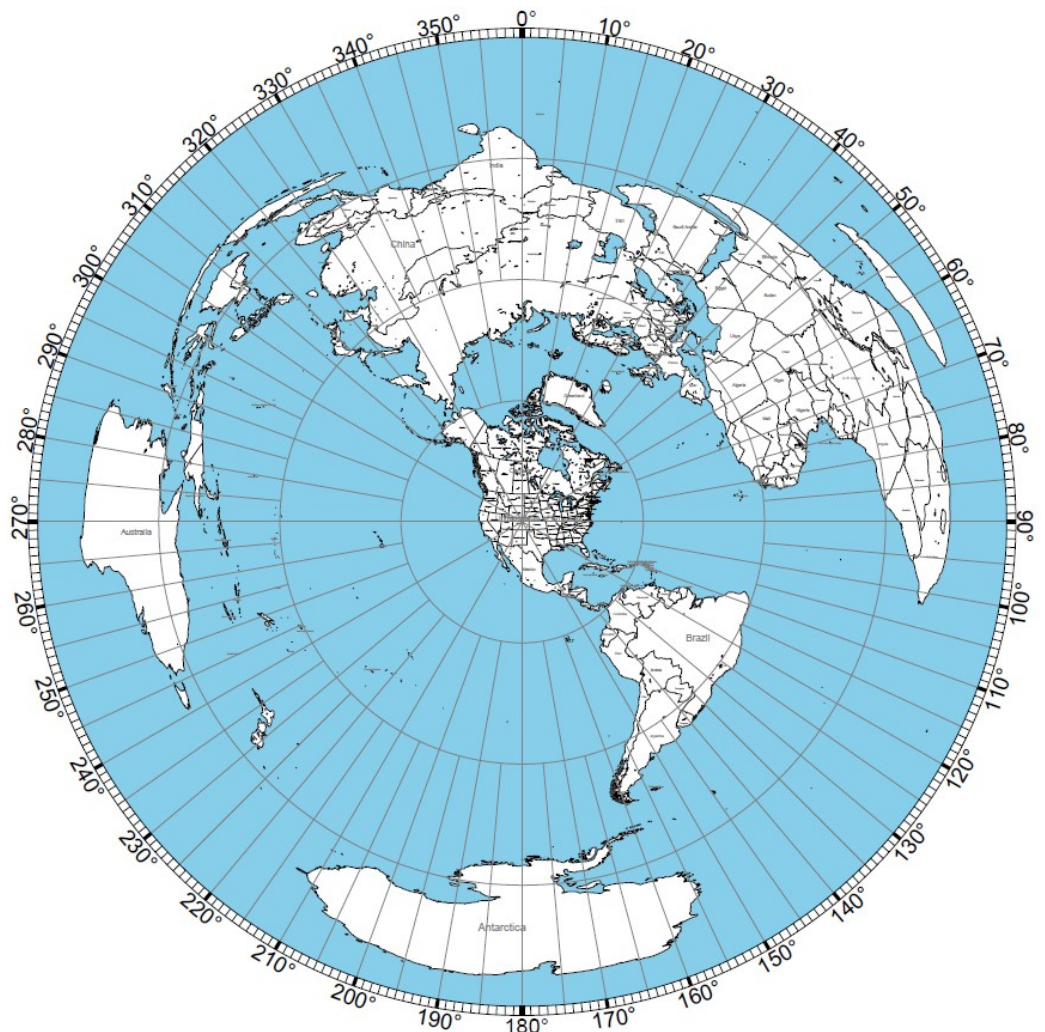
(A Note from the Chair Cont...)

In other news: The Division of Natural Sciences and Mathematics is no more – say hello to the College of Natural Sciences and Mathematics. The new Chancellor of DU is a mathematician! The Math Club is going strong and we would very much welcome participation from our alums. The annual Hockey Night is on Saturday, February 1, 2020 – I hope to see many of you there.

As always, we love hearing from you. Please contact Susan Bolton (susan.bolton@du.edu) if you have news to share.

Best regards,
Petr Vojtěchovský

The Denver-centered Earth. Create your own at <https://ns6t.net/azimuth/azimuth.html>. What are the odds that a centered azimuthal map of the Earth will have an all-water boundary? No, really, what are the odds?



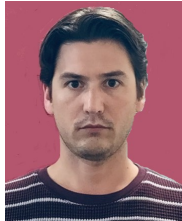
New Faculty

Post Doctoral Scholars



Sara Andrade

Sara Andrade works in functional analysis, specifically in phase retrieval and quantum error correction. At the University of Missouri, she worked as a student researcher at the Frame Research Center. Sara enjoys teaching students of varying interests and ability levels. This is Sara's first academic job after receiving her PhD.



Christopher Jennings-Shaffer

Christopher Jennings-Shaffer most recently worked as a postdoctoral researcher at the Mathematics Institute of the University of Cologne, following a visiting assistant professor position at Oregon State University. He published over 20 papers on partition functions in number theory and co-organized two special sessions at AMS conferences.



Scott Schmieding

Scott Schmieding is joining us from Northwestern University where he was an RTG Postdoctoral Fellow. He works in several related fields of mathematics including symbolic dynamics, algebraic k-theory, topological dynamics, ergodic theory and aperiodic tilings. Scott co-organized an American Mathematical Society special session on dynamical systems.

Visiting Teaching Assistant Professor



Wojciech Kossek

Wojciech Kossek is an experienced college instructor with previous appointments at University of Colorado Denver, University of Colorado Colorado Springs and Colorado Technical University. He was an adjunct at DU during the 2018-2019 academic year. He works in math education and is the author of the textbook *Calculus for the Forgetful: How to understand more and memorize less*.

Promotions

Mei Yin was promoted to the rank of Associate Professor with Tenure. Congratulations! (See summer 2018 newsletter for an article about Dr. Yin's research.)

Nic Ormes is the Associate Dean for the College of Natural Sciences and Mathematics, replacing Dr. Sasaki from the Department of Biological Sciences. We are looking forward to working with Nic in his new capacity.

Math Club

Math Club Officers

President:

Anne Maloney

Interim External VP:

Abby Boussetta
(Alysse Glasner
resumes position
Winter Q)

Internal VP:

Leah Huzjak

Treasurer:

Kaitlyn Shafer

2018-2019 Officers

President :

Anne Maloney

External VP:

Alysse Gasner

Internal VP:

Leah Huzjak

Treasurer:

Toni Hinskton

The Math Club enjoyed huge success last year under the leadership of Dr. Kelly Flaherty. The participants worked on a monthly math problem and the club hosted numerous events throughout the year, including: Undergraduate Research in Mathematics, Math Trivia Night (both hosted by Dr. Nic Ormes), Study Nights, Pi Day Celebration, Thanksgiving Dinner, Math Movie Night, and the End of the Year Barbeque.

The Math Club kicked off this fall with A Hike with Dr. Flaherty and the Math Club Thanksgiving Dinner. **The Undergraduate Research in Mathematics Night** will be held on **Monday, January 13, 2020**.



Math Club BBQ 2019

Seeking Alumni for Panel Discussion:

The Math Club is planning to host a panel discussion with Math Alumni to share what they have done or what they are doing with their mathematics degree.

If you are interested, contact kelly.flaherty@du.edu or susan.bolton@du.edu.



Laura Dean

Executive Director for the College of Natural Sciences and Mathematics and the Ritchie School of Engineering and Computer Science

Alumni Engagement

Laura Dean is the executive director of alumni engagement for the College of Natural Sciences and Mathematics and the Ritchie School of Engineering and Computer Science. Her key responsibilities include:

- Managing all alumni engagement programming, activities and events for Natural Sciences and Mathematics as well as the Ritchie School of Engineering & Computer Science.
- Collaborating with the manager of communications on unit-based communications and invitations sent to alumni.
- Cultivating, stewarding, and recruiting alumni volunteers for events in support of students.

Laura welcomes suggestions for engaging alumni with faculty and students, so please share your ideas for future activities!

You can reach Laura at: Laura.Dean@du.edu | 303.871.3208

Math Events

Department Fall Picnic



The Math Department Fall Picnic brought together faculty, emeriti, staff, GTAs, families and friends. We enjoyed games, food, socializing, some rain and a rainbow.

DU Math Alumni Hockey Night

The Annual DU Math Alumni Hockey Night is on Saturday, February 1, 2020 against the Minnesota Duluth Bulldogs.

If you are able to join us, or would like more information, contact Susan Bolton at susan.bolton@du.edu or visit: <https://rsvp.du.edu/9aVmKG> to register. Alumni can purchase up to 5 additional tickets (6 total) for \$7.50 per ticket.

Ticket includes: Pre-Game reception 5-6:30pm (appetizers, beer, wine, coffee, tea, sodas) and ticket to the game. Parking is an additional fee.

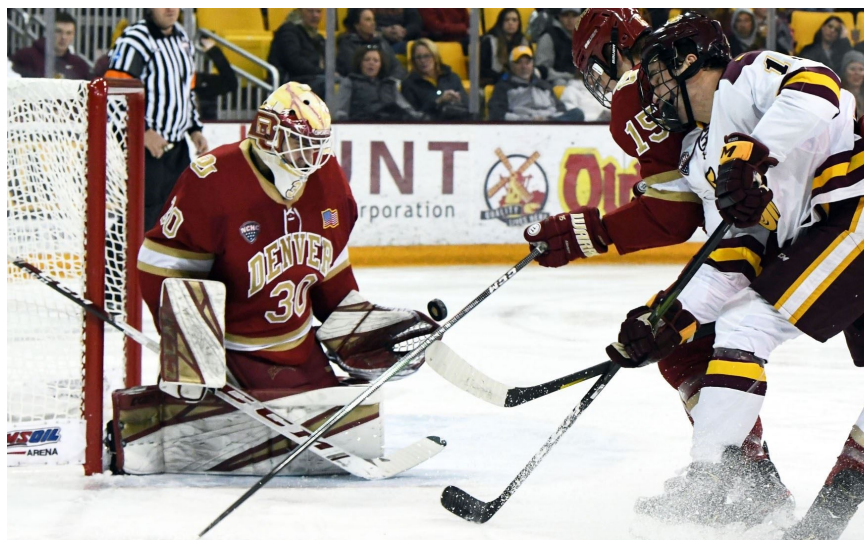


Photo: DU Pioneer



Research Spotlight

Associate Professor Ronnie Pavlov

I've been interested in mathematics from an extremely young age, and I also always enjoyed helping/tutoring classmates, so ever since I found out that mathematics and teaching could be combined into a career, I knew that's what I wanted to do.

My general research area is dynamical systems, which examines the long-term behavior of a deterministic system (such as a billiard ball bouncing on a frictionless table, or a satellite orbiting a planet). Within this area, I work mostly in symbolic dynamics, where the system consists of infinite one-dimensional sequences or multi-dimensional arrays of letters from a finite alphabet.

"I love symbolic dynamics because of the unexpected connections that arise."

Ronnie Pavlov

Associate Professor

PhD (Ohio State)

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Email:
Ronald.pavlov@du.edu

Website:
cs.du.edu/~rpavlov/

Research interest:
Ergodic theory and dynamical systems

I love symbolic dynamics because of the unexpected connections that arise. The original motivation came from physically motivated dynamical systems (like the examples above), which can often be modeled symbolically via a technique called symbolic encoding. However, symbolic dynamics has turned out to have applications in many areas outside of dynamical systems, including information theory (channel capacity), coding theory (error-correcting codes), physics (the Ising model for magnetism), and theoretical computer science (algorithmic complexity). The last connection is my favorite, and so I'll explain it a bit further.

Suppose that you're given a finite alphabet and a finite set of adjacency rules between letters (e.g. 2 can't appear to the left of 1, and a 3 can't appear next to another 3), and you want to know if there exists any way at all to create a sequence/array of letters from your alphabet which follows the adjacency rules. In one dimension, this question can be answered very simply. However, it's actually proved that in two dimensions, there absolutely cannot exist any algorithm which can decide the answer!

Rather than letting this end the study of multidimensional symbolic dynamics, this unexpected connection has yielded an entirely new direction of research using the theory of algorithmic complexity to quantify the level of computability/non-computability for various aspects of these systems.

I have been fortunate enough to receive multiple sources of funding for my research, including a National Science Foundation grant from 2015-2018 and an ongoing grant from the Simons Foundation from 2019-2024. This funding supports both my work with departmental colleagues such as fellow dynamicist Nic Ormes and with my collaborators from countries around the world, including Canada, Mexico, France, Chile, Israel, China, and South Korea.

Recent Grant Awards

Natasha Dobrinen

Title: Logic, Ramsey Theory, and Relational Structures

National Science Foundation

\$158,476.

Ramsey Theory is a central area of mathematics aptly characterized by Motzkin's motto "Complete disorder is impossible." Ramsey's Theorem states that given any coloring of all pairs of natural numbers into finitely many colors, there is an infinite subset in which all pairs have the same color. Since its inception, Ramsey theory has developed in multiple directions, often appearing as the core content in solutions to deep problems from a wide range of mathematical disciplines. This project utilizes techniques in mathematical logic to more fully develop Ramsey theory of infinite relational structures. A major motivation is to find dividing lines between those infinite structures which act like the natural numbers in the sense of possessing analogues of Ramsey's theorem, and those which do not. This research program will develop the Ramsey theory of infinite relational structures, especially those with forbidden configurations, an area which had been largely impervious to investigations prior to the PI's recent solution for the universal homogeneous triangle-free graph. These new techniques will be used to obtain better bounds for finite structural Ramsey theory. The techniques developed, involving simultaneous uses of logic, combinatorics and topology, will create new pathways between these areas of mathematics.

Ronnie Pavlov

Symbolic Dynamics

Simons Foundation

\$42,000

As the title indicates, my research area is symbolic dynamics, which is the study of dynamical systems on a space of functions from a group G to a finite set A , called the alphabet. Most commonly, G is \mathbb{Z} , the set of integers, and then the space is just a set of sequences of letters from A , which become a dynamical system under shifts to the left or right. This funding from the Simons Foundation will allow me to travel to conferences and collaborate with mathematicians around the world on a variety of work within this area.

Shaskank Kanade

Representation theory, Tensor Categories and Number Theory

Simons Foundation

\$42,000 USD

My research deals with the representation theory of vertex operator algebras, affine Lie algebras. This study is related to tensor categories and also to number theoretic/combinatorial objects such as integer partitions. The proposal asks for travel funds required to collaborate with various experts in these fields.

Andrew Linshaw

W -algebras and the coset construction

Simons Foundation

\$42,000

In my recent joint work with T. Arakawa and T. Creutzig, the longstanding conjecture on the coset construction of principal W -algebras of A , D , and E types was established in full generality. This result is the key starting assumption in the conformal field theory to higher spin gravity correspondence in physics, and it has several striking applications. For example, it implies the unitarity of the discrete series principal W -algebras, the rationality of many families of coset vertex algebras, and the existence of modular tensor categories of modules for admissible level affine vertex algebras. It is a fundamental problem to find similar coset constructions of principal W -algebras of B , C , F , and G types, as well as W -superalgebras and non-principal W -algebras.

New Chancellor

The 18th chancellor of DU, Rebecca Chopp, stepped down for health reasons at the end of the 2018/2019 academic year. Jeremy Haefner was appointed by the Board of Trustees as the 19th chancellor. Dr. Haefner joined DU in Fall 2018 as Provost and Executive Vice Chancellor, as we reported in the Winter 2018 issue of this newsletter. Jeremy holds a PhD in Mathematics from the University of Wisconsin-Madison. For more, see

<https://www.du.edu/news/university-denver-announces-19th-chancellor>



*Jeremy Haefner, 19th Chancellor
Photo : DU Pioneer*

University of Denver

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