GROW@Bonn 2023: Schedule and information

March 30-31, 2023
Venue: Max Planck Institute for Mathematics, Vivatsgasse 7, 53111 Bonn

Thursday, March 30

0930-1015	Registration
1015-1030	Welcome
1030-1200	*Panel discussion*: What is research in mathematics like? (with Junxian Li, Peter Scholze, Vera Traub, and Mauro Varesco)
1200-1400	Lunch
1400-1450	*Research talk*: Vera Traub
1500-1600	*Plenary talk*: Karen Vogtmann
1600-1630	Coffee
1630-1800	*Panel discussion*: Nuts and bolts of applying to masters/PhD programs (with Valentin Blomer, Dominique Mattei, Arunima Ray, Florian Richter, and Justin Sawon)
1900-	Conference dinner at Brauhaus Bönnsch

Friday, March 31

0940-1030	*Research talk*: Florian Richter
1030-1100	Coffee
1100-1200	*PhD student talks*: Iulia Cristian, Laura Wakelin, Mingjia Zhang
1200-1400	Lunch with mentors at Hofgarten Mensa and tour of the institute
1410-1500	*Research talk*: Bernd Sturmfels
1500-1530	Coffee
1530-1700	*Panel discussion*: What to do with a PhD in mathematics? (with Theo Raedschelders, Martin Rumpf, Anna Silvanus, and Bernd Sturmfels)
1700-1730	Goodbye

Practical information

On Friday there will be an opportunity to meet local mathematicians over lunch, in small groups of participants coupled with at least one senior mathematician per table. This is an opportunity to informally ask any questions you might have about graduate programs or a career in mathematics. Your **name tag** will provide you with a free lunch (on both days).

On Thursday before the plenary talk, we will take a **conference photo**. In addition, pictures will be taken throughout the conference and afterwards shared with the attendees as well as used on social media and newsletters. Please let us know in writing if you would prefer not to be included in these pictures.

Plenary speaker

Karen Vogtmann has made notable contributions to the areas of topology and algebra. She is known especially for introducing new topological and geometric models for the study of infinite discrete groups. Her work is related to several mathematical disciplines, including algebraic K-theory, homotopy theory, and tropical algebraic geometry, as well as to the study of phylogenetic trees and perturbative quantum field theory.

She is currently a professor of mathematics at the University of Warwick and Goldwin Smith professor of mathematics emerita at Cornell University. She was awarded the Polya prize, a Humboldt research prize, a Royal Society Wolfson research merit award, and an honorary doctorate from the University of Copenhagen. In 2012 she became a fellow of the American Mathematical Society. She was elected Fellow of the Royal Society in 2021 and became a member of the U.S. National Academy of Sciences in 2022. Before moving to Warwick, she served as the Vice President of the American Mathematical Society.

Speakers and panelists

Valentin Blomer is a professor at the University of Bonn. He was previously a professor at the University of Göttingen and the University of Toronto. He received his PhD in 2002 from the University of Stuttgart. He is interested in number theory, in particular analytic number theory, automorphic forms, L-functions, and quadratic forms.

Iulia Cristian is a PhD student at the University of Bonn in the group of Juan Velázquez. She also received her masters degree from the University of Bonn and her bachelor degree from the University of Bucharest. She is interested in the analysis of partial differential equations.

Junxian Li is a postdoc at the University of Bonn in the group of Valentin Blomer. She received her PhD in 2018 from the University of Illinois from Urbana-Champaign. She is interested in analytic number theory, in particular primes, exponential sums, automorphic forms, harmonic analysis, and dynamical systems.

Dominique Mattei is a postdoc at the University of Bonn in the group of Daniel Huybrechts. He received his PhD in 2021 from the University of Toulouse. He is interested in algebraic geometry.

Arunima Ray is a research group leader at the Max Planck Institute for Mathematics in Bonn. She received her PhD in 2014 from Rice University and was a postdoc at Brandeis University. She is interested in low-dimensional topology.

Theo Raedschelders is a computer security specialist working for FalconForce in the Netherlands. He received his PhD in 2017 from the Free University Brussels, and was a postdoc in Glasgow and Brussels, working in noncommutative algebraic geometry, before switching to industry.

Florian Richter is a professor at the École Polytechnique Fédérale de Lausanne. He received his PhD in 2018 from the Ohio State University, and was a postdoc at Northwestern University and the Institute for Advanced Study. He is interested in dynamical systems and ergodic theory.

Martin Rumpf is a professor at the University of Bonn. He received his PhD in 1992 from the University of Bonn. He has previously a postdoc at the University of Freiburg and a postdoc at the University of Duisburg–Essen. He is interested in numerical methods for partial differential equations and visualisation.

Justin Sawon is a professor at the University of North Carolina at Chapel Hill. He received his PhD in 2000 from the University of Cambridge. He was previously a postdoc at the University of Oxford and the State University of New York at Stony Brook, as well as a professor at Colorado State University. He is interested in algebraic geometry and topology.

Peter Scholze is a professor at the University of Bonn and a director at the Max Planck Institute for Mathematics in Bonn. He also received his PhD in 2012 from the University of Bonn. He received the Fields Medal in 2018 for his work in arithmetic geometry.

Anna Silvanus is a research and development engineer in chip design at Synopsys. Before switching to industry, she received her PhD in 2021 from the University of Bonn, working in discrete mathematics. During her bachelor and master degrees, which she also completed at the University of Bonn, she worked in topology.

Bernd Sturmfels is a professor at the University of California in Berkeley and a director at the Max Planck Institute for Mathematics in the Sciences in Leipzig. He received his PhD in 1987 from the University of Washington and the Technische Universität Darmstadt. He was previously a postdoc at the University of Minnesota, as well as a professor at the University of Linz and Cornell University. His interests include algebraic geometry, combinatorics, and computational biology.

Vera Traub is a professor at the University of Bonn. She received her PhD in 2020 from the University of Bonn, and was a postdoc at ETH Zürich. Her interests are in combinatorial optimisation and approximation algorithms.

Mauro Varesco is a PhD student at the University of Bonn in the group of Daniel Huybrechts. He received his masters degree from ETH Zürich and bachelor degree from University of Trento. He is interested in algebraic geometry.

Laura Wakelin is a PhD student at Imperial College London in the group of Steven Sivek. She received her master degree from the University of Cambridge. She is interested in topology.

Mingjia Zhang is a PhD student at the University of Bonn in the group of Peter Scholze. She also received her master degree from the University of Bonn. She is interested in arithmetic geometry.

Abstracts

Iulia Cristian: Gel formation - a PDE perspective

Abstract: Coagulation equations are used to describe the evolution of the size distribution of a system of particles as they interact. One can think of blood coagulation or polymerization. Ideally, the mass of the system will be preserved over time. However, it can be shown that if particles interact too quickly, some mass may be lost, sometimes even immediately (that's where the math part comes in). This phenomenon is directly linked to the formation of a gel in the case of polymerization. I will introduce the model used for coagulation equations and discuss specific examples available in the literature in which mass loss occurs.

Florian Richter: Ergodic Methods in Number Theory

Abstract: Number theory is the study of the arithmetic properties of the integers. It has captivated mathematicians for centuries, and many of the most fundamental questions and open conjectures in mathematics are of number-theoretic origin. To tackle these complex problems, it is beneficial to draw upon methods from other areas. The field of ergodic theory, in particular, has been a great source of new ideas and techniques, leading to remarkable advancements in number theory in recent years. Ergodic theory deals with the statistical properties of time-dependent processes. It allows us to study the distribution of different arithmetic structures in the integers from a dynamical perspective. In this talk we will provide an overview of the different connections between ergodic theory and number theory and learn more about some of the recent breakthroughs achieved at the interface of these fascinating areas.

Bernd Sturmfels: Subspaces fixed by a nilpotent matrix

Abstract: I will discuss recent work with Marvin Hahn, Gabi Nebe and Mima Stanojkovski on a problem in linear algebra. It concerns the linear subspaces that are fixed by a given nilpotent $n \times n$ matrix. We classify these for small n, using computer algebra. Mutiah, Weekes and Yacobi conjectured that their radical ideals in the Grassmannian are generated by linear forms known as shuffle equations. We prove this conjecture for n at most 7, and we disprove it for $n = 8$. It remains open for nilpotent matrices arising from the affine Grassmannian.

Vera Traub: Approximation Algorithms for Traveling Salesman Problems

Abstract: In this talk we consider the path version of the famous traveling salesman problem. It asks for a shortest tour through a given set of cities with fixed start- and endpoint. In contrast to the classical traveling salesman problem (TSP), the start and end of the tour might be different.

While for the classical TSP a 3/2-approximation algorithm has been known since the 1970's, it took more than four decades to find such an algorithm also for the path version. In this talk we present a black-box reduction from Path TSP to TSP, which implies that the approximability of Path TSP is the same as for TSP, up to an arbitrarily small error. This avoids future discrepancies between the best known approximation factors achievable for these two problems.

This talk is based on joint work with Jens Vygen and Rico Zenklusen.

Laura Wakelin: Dehn surgery on knots in S^3

Abstract: Dehn surgery on a knot K in the 3-sphere S^3 is the process of drilling out a tubular neighbourhood of K and then filling it back in to obtain a new 3-manifold, $S^3_K(p/q)$, where the

fraction p/q describes the gluing map used in the construction. In this talk, we will explore the geometry and topology of the 3-manifold $S^3_K(p/q)$ for different choices of K and p/q. This is the focus of many interesting open questions in low-dimensional topology, such as the cosmetic surgery conjecture and the Dehn surgery characterisation problem.

Mingjia Zhang: p-adic modular curves

Abstract: Modular curves parametrize elliptic curves with level structures. They have played an important role throughout the development of arithmetic geometry. I will explain how in recent works new insigts were obtained by studying their p-adic geometry.