



HAUSDORFF SPECIALS

The new proposal of the Hausdorff Center for Mathematics within the Excellence strategy for the period 2019-2025 has been submitted to the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG).

Important dates:

The review of HCM will take place on April 27 in Cologne.

The decision about the funding will be announced on September 27.

Closer to the optimal route

Bonn mathematicians are honored for a new “traveling salesman problem” algorithm

Press release of the University of Bonn (slightly modified) of January 9, 2018

PhD student Vera Traub and her supervisor, Jens Vygen, a professor at the Research Institute for Discrete Mathematics in Bonn, received a Best Paper Award at the Symposium on Discrete Algorithms (SODA), one of the foremost conferences in its field, in New Orleans. With their newly developed algorithm, routes along any number of cities can be determined that come „as close as possible“ to the shortest route.

The “traveling salesman problem” is world-famous and was formulated for the first time in the year 1930: One is given a starting point, an end point, and a set of other points, which are to be visited in between. The goal is to find the shortest route by optimizing the order. Applications can be found in logistics or trip planning: For example, the question may arise how to travel in the fastest way from Kiel to Munich, visiting all the other 14 capitals of the federal states of Germany along the way. When the number of points is very low, one can enumerate all possible orders, but even the tour of state capitals mentioned above gives rise to over 80 billion options.



Prof. Dr. Jens Vygen, Prof. Dr. Artur Czumaj (Program Committee Chair of SODA 2018), and Vera Traub (from the left)

An NP-hard problem

The problem of finding the best order for such a tour is considered as particularly hard. Problems that can be solved “relatively fast” with algorithms (in so-called polynomial time) belong to class P. Problems whose given solutions can be verified “relatively fast” belong to the class NP. To this day, no one knows whether one can solve problems of the class NP „relatively fast“, that is, whether $P = NP$ holds. This so-called “P versus NP problem” is one of the seven Millennium Prize Problems selected by the Clay Mathematics Institute. In the class NP, there are certain distinguished problems that are

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particularly difficult to solve. All other problems of the class NP can be reduced to these problems. Problems that are at least as hard to solve as these distinguished problems are referred to as “NP-hard”. The “traveling salesman problem” is one such “NP-hard” problem.

A new algorithm

For the special case where the starting and the end point of the route are identical, the Cypriot mathematician Nicos Christofides found an effective algorithm in 1976. The resulting route is at most one and a half times as long as the optimal route. This guarantee of the route’s efficiency constitutes a kind of natural threshold. To reach this threshold with different starting and end points has turned out to be much more difficult. With a new „recursive dynamic programming“ approach, Vera Traub and Jens Vygen were now able to come as close to this threshold as possible: Tours determined with the new algorithm are at most x times as long as the optimal tour, where x is arbitrarily close to 1.5. The new

algorithm might also be used in other optimization problems in the future.

The work was honored on January 8th, 2018 with the “Best Paper Award” of the ACM-SIAM Symposium on Discrete Algorithms (SODA). SODA is the world’s leading conference on discrete algorithms. 180 of the 547 works submitted were accepted this year, and only two of them received the “Best Paper Award”.

Excellent research

The main focus of the Research Institute for Discrete Mathematics lies in the field of discrete mathematics and its applications, especially in combinatorial optimization and chip design. The Research Institute for Discrete Mathematics is an institute of the Hausdorff Center for Mathematics (HCM), a Cluster of Excellence at the University of Bonn. Here, scientists from Germany and abroad are investigating numerous topics in mathematics and mathematical economics.



State Secretary Storsberg visits HCM

January 24, 2018

Annette Storsberg, the State Secretary at the Ministry of Culture and Science of the German State of North Rhine-Westphalia, visited the Hausdorff Center for Mathematics (HCM) at the University of Bonn. She talked with members of the rectorate of the University of Bonn, the University’s administration, and the Hausdorff Center about the Cluster of Excellence. In conversations with Bonn Junior Fellows and Hausdorff Chairs, she was informed in detail about the promotion of young scientists, interdisciplinary research, and internationalization at HCM.

Back: Prof. Dr. C. Thiele, Prof. Dr. P. Scholze, Prof. S. Rady, Prof. Dr. C. Stroppel, Dr. M. Meier *Managing Director of HCM*, Prof. Dr. M. Gubinelli, **Middle:** Prof. Dr. S. Schwede, Prof. Dr. M. Rumpf, H. Gottschalk *Chancellor of the University of Bonn*, Prof. Dr. S. Müller, Prof. Dr. S. Conti *Prodekan für die Mittelplanung und -verwaltung*, **Front:** Prof. Dr. K.-T. Sturm *Coordinator of HCM*, State Secretary A. Storsberg *MKW*, Prof. Dr. h. c. M. Hoch *Rector of the University of Bonn*, Prof. Dr. J. Beck *Dean of the Faculty of Mathematics and Natural Sciences*, Prof. Dr. A. Zimmer *Vice Rector for Research and Innovation*



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Dr. Martina V. Baar



Wiktorija Zaton, Prof. Dr. Ingo Lieb (president of the Bonn Mathematical Society), Lennart Ronge (from the left)

Awards for best bachelor students and the Hausdorff Memorial Prize

January 24, 2018

Every year the Bonn Mathematical Society awards a prize for the best graduating Bachelor students in mathematics. The Fachgruppe Mathematik rewards the best dissertation of the year with the Hausdorff Memorial Prize.

In the academic year 2016/2017, the three graduating Bachelor students Kaan Öcal, Lennart Ronge, and Wiktorija Zaton were awarded the Bachelor award.

- Kaan Öcal: “Symplectic Singularities and Convolution Algebras” (advisors: Dr. C. Blohmann, Prof. Dr. C. Stroppel)
- Lennart Ronge: “Unbeschränkte Operatoren in Hilbertmoduln” (advisors: Prof. Dr. M. Lesch, Dr. B. Mesland)
- Wiktorija Zaton: “Parametrisierung der Radon-Maße auf quasi-metrischen Räumen mit Verdopplungseigenschaften” (advisors: Prof. Dr. C. Thiele, Dr. P. Zorin-Kranich)

Dr. Martina Vera Baar received the Hausdorff Memorial Prize for her thesis on “Stochastic individual-based models of adaptive dynamics and applications to cancer immunotherapy” (advisor: Prof. Dr. Anton Bovier).



Patrik Ferrari receives the first Alexanderson Award

March 5, 2018

Jointly with Ivan Corwin (Columbia University) and Alexei Borodin (MIT), the HCM member Patrik Ferrari has received the inaugural Alexanderson Award for the article “Free energy fluctuations for directed polymers in random media in 1+1 dimensions”.

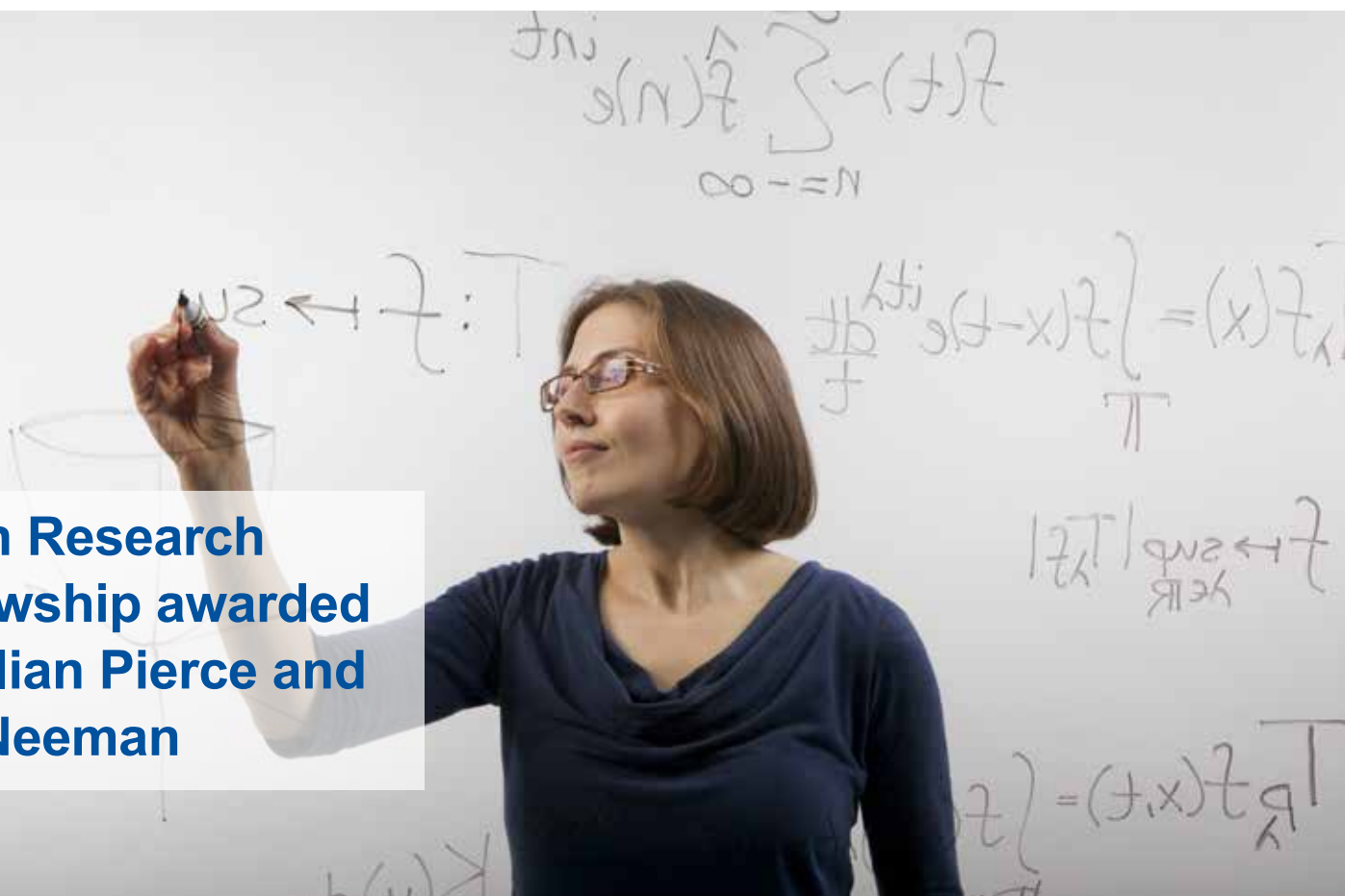
In the winning paper, the authors study the effect of disorder on the configuration and energy of polymers. They discovered that the behavior of such polymers is governed by a universal law that has been observed in other models of the Kardar-Parisi-Zhang universality class. This class includes the “Kardar-Parisi-Zhang equation”, a non-linear stochastic partial differential equation modeling growth processes. The statistical distributions, related to the “Tracy-Widom distributions”, studied in this paper in relation to these models have implications in physics, engineering, materials science, biology, ecology, and other application fields.

The Alexanderson Award is awarded by the American Institute of Mathematics (AIM) and recognizes outstanding research articles arising from AIM activities that have been published within the past three years. It is given in honor of Gerald Alexanderson, professor of Mathematics at Santa Clara University and founding chair of the AIM Board of Trustees.

You can find further information on the Alexanderson Award [here](#).

HAUSDORFF SPECIALS

Sloan Research Fellowship awarded to Lillian Pierce and Joe Neeman



March 14, 2018

Two former Bonn Junior Fellows and new Bonn Research Fellows, Lillian Pierce and Joe Neeman, were honored with the Sloan Research Fellowship 2018 awarded by the Alfred P. Sloan Foundation.

Lillian Pierce, now at Duke University, and Joe Neeman, now at the University of Texas, Austin, each received the two-year, \$65,000 fellowship to further their research. They are 2 of 20 scientists in mathematics who were honored with this distinction.

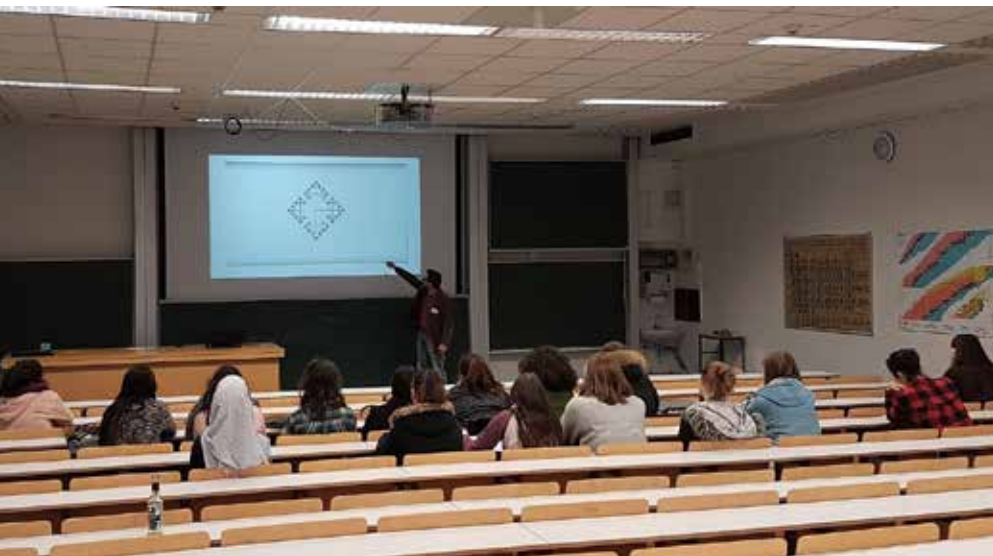
Since 1955, the Alfred P. Sloan Foundation has awarded the fellowship to 126 outstanding early-career researchers each year, who have been selected by an independent panel of senior scholars in their field. The selection is based on their research accomplishments, their creativity, and their potential to become a leader in their field. Candidates must be nominated by fellow scientists and hold a tenure track (or equivalent) position at a college, university, or other degree-granting institution in the United States or Canada with teaching requirements. This year, the Sloan Research Fellows were drawn from 53 colleges and universities across the United States and Canada. The fellowship is granted in eight scien-



tific fields: chemistry, computer science, economics, mathematics, computational and evolutionary molecular biology, neuroscience, ocean sciences, and physics.

You can find further information on the Sloan Research Fellowship and the Alfred P. Sloan Foundation [here](#).

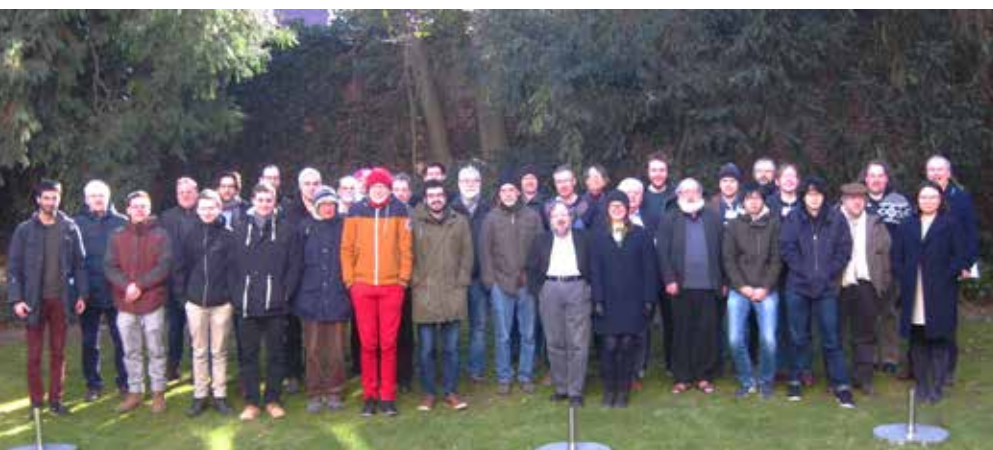
HAUSDORFF EVENTS



Program „Perspektive Math-Nat!“ for female pupils

February 6, 2018

As part of the University's program "Perspektive Math-Nat!", Dr. Olaf Schnürer (former HCM member, now in Münster) and Dr. Thoralf Räscher got female pupils in their final years of school excited about mathematics. During the event, which takes place once a year, female pupils who are interested in science can learn about such careers at the University of Bonn.



HIM: Joint trimester program with MPIM

January 3 to April 20, 2018

The current HIM trimester program "Periods in Number Theory, Algebraic Geometry and Physics" is organized together with the Max Planck Institute for Mathematics. Because of the joint organization, more scientists attended than are usually able to attend a trimester program. It will run until April 20. You can find an overview of the upcoming events [here](#). The picture was taken during the workshop "Amplitudes and Periods".

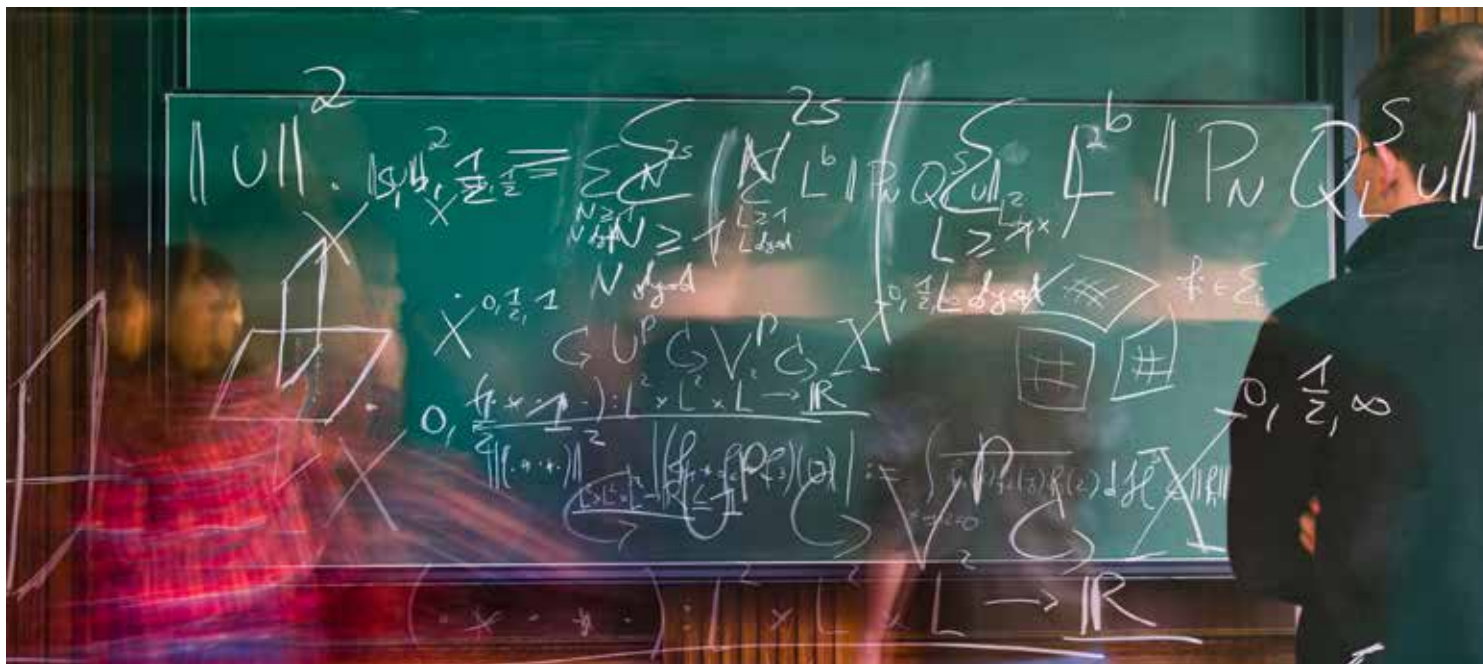


Ouroboros: Formal Criteria of Self- Reference in Mathematics and Philosophy

February 16 to 18, 2018

During the event "Ouroboros: Formal Criteria of Self-Reference in Mathematics and Philosophy" the participants tried to analyze different approaches towards the intuitive notion of self-reference. Approximately 50 participants and 13 speakers from 13 countries and from the fields of mathematics and philosophy came together to discuss the role of self-reference in their fields. 10 talks and 3 workshops gave stimulating insights during the three-day meeting, which was designed as a cross between winter school and research conference. The workshop was organized with the generous support of the Hausdorff Center for Mathematics (HCM), the Gesellschaft für Analytische Philosophie (GAP), the Association for Symbolic Logic (ASL), and the Deutsche Vereinigung für Mathematische Logik und für die Grundlagenforschung der Exakten Wissenschaften (DVMLG). Two of the five organizers were Ana Njegomir, a current BIGS graduate student, and Dr. Regula Krapf, a former BIGS graduate student.

HAUSDORFF CALENDAR



Periods in Number Theory, Algebraic Geometry and Physics

Trimester Program
January 3 to April 20

Workshop: Picard-Fuchs Equations and Hypergeometric Motives

Trimester Program Activity
March 26 to 30

The hyperbolic Yang-Mills equation by Daniel Tataru

Felix Klein Lectures
April 10 to 25

Toeplitz Kolloquium 2018

Tilman Sauer (Mainz)
April 16, 4 p.m.

Hausdorff Kolloquium 2018

3.15 p.m. Eduard Feireisl (Academy of Science in Prag)
4.45 p.m. Marc Burger (ETH Zürich)
April 18

9th Colloquium of Research Area KL

April 20, 3.45 p.m.

Follow-up Workshop to JTP „Algebraic Geometry“

April 23 to 27

Girls' Day 2018

April 26, 9 a.m. to 3 p.m.

Types, Sets and Constructions

Trimester Program
May 2 to August 24

Summer School on Types, Sets and Constructions

Trimester Program Activity and Hausdorff School
May 3 to 9

Toeplitz Kolloquium 2018

Gert Schubring (Rio de Janeiro)
May 14, 4 p.m.

Workshop: Types, Homotopy Type theory, and Verification

Trimester Program Activity
June 4 to 8

Toeplitz Kolloquium 2018

Wolfgang Riemer (Köln)
June 4, 4 p.m.

Log-correlated Fields

Hausdorff School
June 11 to 14

Colloquium in commemoration of Felix Hausdorff

June 15, 4.15 p.m. to 6 p.m.

L-functions: Open Problems and Current Methods

Hausdorff School
June 25 to 29

Hausdorff Kolloquium 2018

3.15 p.m. Wilfried Sieg (Carnegie Mellon University)
4.45 p.m. Guido de Philippis (SISSA Trieste)
June 27

HAUSDORFF MIXED

Lisa Hartung has been awarded the DMV “Fachgruppe Stochastik” prize

March 13, 2018



© Amini Photography

Our former PhD student Lisa Hartung has been awarded the **DMV Probability & Statistics Group prize** for her outstanding PhD thesis “Extremal Processes in Branching Brownian Motion and Friends” (supervisor: Prof. Dr. Anton Bovier).

Lisa Hartung’s thesis is centered around the topic of branching Brownian motion (BBM). BBM is a classical probabilistic object, and the properties of its maximum at time t have been a fascinating object of study since the work of Bramson and McKean, who discovered its connection to the KPP-equation (KPP = Kolmogorov – Petrovsky – Piskunov). Among other

results, she found a new universality class of extremal processes in so-called variable speed branching Brownian motion. Lisa Hartung’s thesis presents several interesting and technically demanding contributions to an area of probability theory that is currently very active and very competitive.

Lisa is working as Courant Instructor at the Courant Institute of Mathematical Sciences of New York. She completed her PhD in the Probability Theory group at Hausdorff Center for Mathematics, working under the supervision of Professor Anton Bovier.

New event mailing list

As of now, you can subscribe [here](#) to our new event mailing list.

If you subscribe, you will receive information about events of the Hausdorff Center for Mathematics, which are targeted at a broad public audience. Also, we will inform you about video recordings of events. (The information and most of the events will be in German.)



Events for the 200th anniversary of the University of Bonn



As part of the festivities for the 200th anniversary of the University of Bonn, a series of public

events is being organized by Bonn Mathematics. These events will take place in the third quarter of the anniversary year from July to September 2018, which has the main focus on the “World of Numbers” (“Welt der Zahlen”). You can find an overview of the mathematics program [here](#).

IMPRESSUM

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