

#### hausdorff center for mathematics



# hcn NEWS 1/2022

The 2021 Fields Medal Symposium Public Opening



## PETER SCHOLZE

Featuring an interview with Megumi Harada, a live panel discussion and much more.

### **Great Honor for Peter Scholze – Fields Medal Symposium**

It is undoubtedly something very special when the crème de la crème of pure mathematics come together to hold a symposium for a living mathematician. This extraordinary honor has now been bestowed upon Peter Scholze. During the public (virtual) opening of the Fields Medal Symposium in October, Jared Weinstein, after numerous words of welcome from international celebrities, introduced the importance of Peter Scholze's work – as far as this was possible – to a worldwide (lay) audience and gave a short introduction to p-adic geometry, which came across as quite digestible and very entertaining. This was followed by an interview by Megumi Harada with Peter Scholze and a panel discussion about the work of Peter Scholze, in which Ramla Abdellatif, Hélène Esnault, Eugen Hellmann, and Peter Scholze himself participated. A really successful event, which undoubtedly would have deserved even more audience! You can still watch the recording **here**.

#### HAUSDORFF PEOPLE

## Welcome!



Jürgen Dölz joined the Institute of Numerical Simulation at the University of Bonn in Mai 2020 as a W2-Professor. He obtained his PhD from the University of Basel in 2017 and received an SNSF Early Mobility scholarship to join the department of electrical engineering at the Technical University of Darmstadt as a postdoc. After that, he did a second postdoc in the department of mathematics at the same university and held an assistant professorship at the University of Twente. His research interests include the uncertainty quantification of partial differential equations with random input data, the efficient treatment of non-local operators, and the application of these fields to electromagnetic problems, inverse problems, and collaborations with applied scientists. Jürgen Dölz currently focuses on the modeling and mathematical analysis of random shape perturbations and their influence on solutions of partial differential equations. He uses sampling-based methods from statistics, tools from asymptotic analysis, global and local low-rank methods, multi-level methods, and tools from Bayesian inverse problems to develop and implement efficient algorithms for quantifying uncertainty in the solution of partial differential equations.



Sebastian Hensel joined the HCM as a postdoc in the research group of Tim Laux. He obtained his PhD under the supervision of Julian Fischer at IST Austria in September 2021. Sebastian is fascinated by various topics in the analysis of nonlinear partial differential equations with a current focus on geometric evolution equations and free boundary problems in fluid mechanics. He is also interested in problems at the intersection of probability theory, for instance, stochastic homogenization.



Tim Jahn is a new postdoc at HCM, working in the group of Michael Griebel. In 2021 he earned his PhD at the University of Frankfurt under the supervision of Bastian von Harrach with a thesis titled "Regularizing Linear Inverse Problems Under Unknown Non-Gaussian Noise". Tim's research is on the interface between inverse problems and stochastic optimization. This includes for example the development and analysis of data-driven iterative methods in regularized learning.



Rosina Rodriguez Olivera joined the Hausdorff Center for Mathematics as a postdoctoral fellow in September. In 2021, she obtained her PhD in Economics from the University of Michigan, Ann Arbor. Rosina's research interests are in microeconomic theory, specifically in information economics. Her dissertation titled "Essays on Information Economics in Games" was awarded the University of Michigan Michael Moore Dissertation Research Prize and her paper "Optimal Disclosure of Private Information to Competitors" the Uruguayan National Prize of economics.



Lorenzo Portinale joined the HCM as a postdoc in September 2021 and he's now working in the group of Karl-Theodor Sturm and Franca Hoffmann. He obtained his PhD at IST Austria, under the supervision of Jan Maas. His research focuses on the theory of optimal transport, with particular attention to discrete transport problems and their connection to evolutive equations and gradient flows. His interests also include topics such as noncommutative optimal transport, optimal control, and interacting particle systems.



Adrien Schertzer joined the Hausdorff Center for Mathematics in September. He is a postdoc working in the group of Anton Bovier. The topic of his PhD was "First Passage Percolation in the Mean Field Limit". He is interested in the so-called first passage percolation on Euclidean spaces both in the directed and in the undirected case. During his postdoc, he would like to continue this research but also expand his field of research in the theory of disordered systems.



**Dongxiao Yu** is a new postdoc at Hausdorff Center for Mathematics starting from October 2021. His research is in nonlinear wave and dispersive equations, and his mentor at Bonn is Prof. Dr. Herbert Koch. In May 2021, Dongxiao Yu obtained his PhD from the University of California, Berkeley, under the supervision of Prof. Daniel Tataru. His dissertation deals with the modified scattering theory for a scalar quasi-linear wave equation.

#### **HAUSDORFF PEOPLE**

## The Gay Lussac Humboldt Award Goes to Véronique Gayrard

Close cooperation with Anton Bovier

Véronique Gayrard, research director ("directrice de recherche") at CNRS (Centre Nationale de la Recherche Scientifique) in Marseille, is this year's recipient of the Gay Lussac Humboldt Award. The prestigious award is bestowed annually jointly by the French Ministry of Higher Education and Research and the Alexander von Humboldt Foundation to outstanding scientists who exemplify the cooperation between the two countries.

The research of Véronique Gayrard is focused on the mathematical analysis of random models in statistical physics. She is internationally known for outstanding contributions to neural networks, to metastability in random dynamics, and to the analysis of long-term dynamics of disordered systems, a phenomenon known as ageing in the physics literature. The Gay Lussac Humboldt Award is linked to a research stay in Bonn, which Véronique Gayrard will probably start at the beginning of February for an initial period of 6 months. During this stay, she will focus on this latter area and investigate these problems in more complex and realistic models.



Véronique Gayrard was nominated for the Gay Lussac Humboldt Award by Anton Bovier of the Institute of Applied Mathematics. The two have been working closely together since 1992 and have already written about 37 papers together. Together, the two have supervised a binational doctorate ("Cotutelle Promotion") and exchanged ideas during many mutual research visits.

The Gay Lussac Humboldt Award was first awarded in 1983 and is endowed with 60,000 euros. It is awarded annually to four to five excellent researchers. The Gay Lussac Humboldt Prize is bestowed by the French Ministry of Higher Education and Research to German researchers who are nominated by French scientists. Conversely, it is bestowed by the Alexander von Humboldt Foundation to French researchers who are nominated by German scientists.



## **Double Honor for Sergio Albeverio** Election to two Academies

Sergio Albeverio, an associate member of HCM and professor emeritus but still very active at our Institute of Applied Mathematics, has received a double honor: he was recently elected to two academies. He is now a member of the Academia Europaea and a Foreign Fellow of the Accademia Nazionale dei Lincei. Sergio Albeverio has published almost 1000 articles in scientific journals or conference proceedings and is diversely interested, with a focus on probability theory, analysis, and mathematical physics, but also with many papers on other areas. Congratulations!

#### HAUSDORFF PEOPLE



In the academic year 2020/2021, the Institute for Numerical Simulation at the University of Bonn awarded the Ada Lovelace Prize to Uta Seidler. The prize for the best master's thesis is endowed with 1,000 euros and serves to promote young women in numerics. Uta Seidler deals with the solution of partial elliptic differential equations with uncertainties in the data, such as can occur in the diffusion coefficients. The diffusion coefficient is a measure of the mobility of particles. The master thesis relies - after applying the Karhunen-Loève development for stochastic diffusion and corresponding truncation of the associated series to finite dimension – on the so-called method of thin lattices. Finally, she applies the dimension-adaptive thin grid combination method developed by Seidler to a practical problem of groundwater flow simulation. Michael Griebel supervised the master's thesis "Sparse Grid Methods for High-Dimensional Problems in Uncertainty Quantification".

The Ada Lovelace Prize was established in 2010 by the Institute for Numerical Simulation (INS) at the University of Bonn and has been awarded annually since then. It serves to promote young women in numerics. Outstanding bachelor and master theses, as well as dissertations, are considered for the award. The prize money ranges from 500 euros for the best bachelor's thesis to 1,000 euros for the best master's thesis and 2,000 euros for the best dissertation by young female scientists at INS.

#### **HAUSDORFF EVENTS**

## **Celebration for the Completion of the Hausdorff Edition**

On November 2, 1996, a working group met for the first time at the Mathematical Institute in Bonn under the direction of Egbert Brieskorn, with the aim of writing an edition of the works of Felix Hausdorff. This Hausdorff edition was finalized with the completion of volume VI in 2020. At that time, the festive event, unfortunately, had to be canceled due to corona and has now been caught up. All the collaborators on the edition were thanked, especially the initiator, Egbert Brieskorn, who passed away in 2013, and the coordinator of the overall project, Walter Purkert, who dedicated half his working life to the edition. In his lecture, Wolfgang Lück looked back on 25 years of hard work and also paid tribute to the impressive life and work of Felix Hausdorff. Moritz Epple then gave a lecture on the intellectual development of Felix Hausdorff, starting with his idea of transcendental nihilism. It was particularly exciting to see how Hausdorff's philosophical and mathematical works influenced each other. Afterward, Valentin Blomer gave a sample of his versatile



talent and interpreted the "Variations sérieuses op. 54" by Felix Mendelssohn Bartholdy on the grand piano in an impressive way. An absolute highlight of the evening was the play "Mathematische Spaziergänge mit Emmy Noether" (Mathematical Walks with Emmy Noether), a co-production of portraittheater Wien and Freie Universität (FU) Berlin – Central Women's Office, directed by Sandra Schüddekopf and featuring the great actress Anita Zieher as Emmy Noether. Thoralf Räsch emceed the evening and inspired old and young – indeed: In addition to the invited guests and HCM members, a gratifyingly large number of students had also come.



Together with the Cluster Mathematics Münster (MM), we organized a "math night" for the second time; for us from Bonn it was already the fourth virtual math night. Already at the very first workshop starting at 3 p.m., 70 elementary school children were present, and the two other student workshops on mathematical modeling in sports and on fractals were also well attended. In Antje Kiesel's interactive hands-on workshop, young and old math lovers participated enthusiastically and playfully tested their mathematical intuition. In the panel discussion, as always moderated confidently by Thoralf Räsch, Franca Hoffmann, Mario Ohlberger and Dirk Hartmann clearly showed their enthusiasm for mathematical modeling. With a peak of more than 150 and a constant audience of more than 100, exciting talks followed from Ralf Schindler on infinity, Stephan Held on chip design, and Theresa Simon on pattern formation, with repeated excursions to very recent research results. Finally, Arunima Ray gave us an amazing lecture on possible three- and four-dimensional worlds. With her and the help of topology, we learned that the universe can have only 10 possible three-dimensional forms if it is finite and its curvature is 0. If the curvature is slightly positive, it might be Poincaré space, a kind of dodecahedron with glued facets. With all these impressions we looked into the night sky and were once more amazed at what can be explored with the help of math.

#### HAUSDORFF EVENTS

In November, as part of the ESERO project, we held an in-service training "Geometry and Astronomy on the Sphere" for teachers (and gifted student teachers), which was fully financed by third-party funds. In this in-service training, teachers\* gained insight into geometry and astronomy on the sphere and thus experienced a deeper understanding of geometry. The formal-theoretical consideration of mathematical phenomena of spherical geometry were interlaced with the consideration of historical and modern objects of celestial observation. Rainer Kaenders and Ysette Weiss, professors for mathematics didactics at the Universities of Bonn and Mainz, introduced the mathematical background of spherical geometry. The guest lecturers Michael Korey and Frederik Nehm from the Mathematical-Physical Salon in Dresden provided analog and digital objects (e.g. an armillary sphere and an app for exploring astronomical constellations) as well as handicraft materials (astrolabe) to encourage the participants to actively engage with the topic. A total of 25 people (15 active teachers, eight students and two retired teachers) took part in the teacher training. This marks the end of four years of successful work in the ESERO Germany project. During this time, we have organized a math tournament, a student week, two events for girls and two teacher trainings with the topic "Mathematics and Space". We wish much success to the **ESERO project**.

A Successful Teacher Training on Spherical Geometry!

#### **HAUSDORFF MIXED**

## Geordie Williamson uses Machine Learning to find new Proofs

Geordie Williamson is working with colleagues at Oxford using DeepMind's artificial intelligence to develop fundamentally new techniques in mathematics. A detailed and very interesting article has been published about this. Geordie Williamson himself describes the development as follows: "While mathematicians have used machine learning to assist in the analysis of complex data sets, this is the first time we have used computers to help us formulate conjectures or suggest possible lines of attack for unproven ideas in mathematics."



From 2011 to 2016, Geordie Williamson was an Advanced Researcher at the Max Planck Institute for Mathematics. Since 2017, he is Professor for Mathematics at the University of Sydney and, since 2018, he is also Bonn Research Fellow at HCM.



## Prize Trip of the Bonn Math Tournament

With the four winning teams of our Bonn Math Tournament and the three winning teams of the parallel tournaments from the Netherlands and Belgium, we went on a joint prize trip to Valkenburg in the Netherlands. We did a lot together: Summer tobogganing, visiting a mine, scavenger hunt (city rally), guided tour through the castle ruins, laser tag and a lot of games (mostly Tichu), and we talked with the participants about their student and professional future. The four German teams were accompanied by two student assistants from the HCM school team, Laura Caspers and Julia Rötten, and Stefan Hartmann. A great event! Many thanks to the great organization team of our European partners.

#### HAUSDORFF MIXED



Violence against women and girls is one of the most widespread, persistent and devastating human rights violations in our world today and is a threat to millions of girls and women online and offline. It affects women regardless of their age, background, or level of education. This violence takes many forms, including physical, sexual, or psychological violence, as well as economic abuse and exploitation. 25th of November has been designed as the Orange Day. The color orange symbolizes a brighter future, free of violence. It also serves as a means of demonstrating your solidarity in eliminating all forms of violence and it is therefore used as the color of the International Day for the Elimination of Violence against Women. As a show of solidarity, the UNESCO globe will be illuminated in orange, and many buildings worldwide as well. We at the Hausdorff Center joined this campaign for the first time this year and lit up the entrance portal of the Math Center in orange. An "Orange Tea Time" with the topic "Against Gender-Specific Disadvantage in STEM Studies" also took place at the same time. The speaker, Amma Yeboah, gave an interesting keynote presentation explaining the problems and obstacles women may encounter in their studies and careers in STEM subjects, and how they can identify and effectively overcome these obstacles to realize the full potential of their careers. The next Tea Time with Women in Mathematics will be held on January 15 on the topic of "Networks and Career Pathways." More information and an online registration form can be found on the new **website** for the fantastically well-received series.

#### IMPRINT

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