hausdorff center for mathematics

universitätbonn

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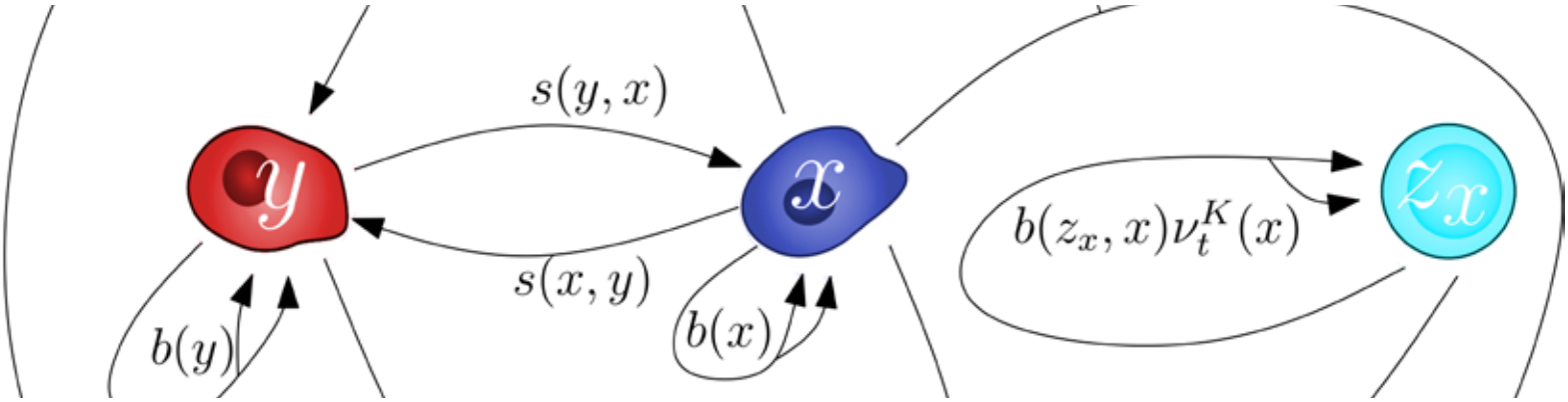
HAUSDORFF SPECIALS



Mathematics for fighting cancer

Press release of the University of Bonn from April 11, 2016

Mathematicians and physicians at the University of Bonn have developed a new model for immunotherapy of cancer. The method could help to develop new treatment strategies and to understand why some approaches do not work with certain tumors. The study is now appearing in the technical journal "Scientific Reports".

One of the greatest problems in the fight against cancer is the great hardiness of the tumors. Drug therapy often leads to initial success, which is then wiped out by a relapse. Sometimes the therapy has no affect at all against some cancer cells. Other cells develop resistance over the course of therapy.

Certain cells of the immune system, the so-called T-cells, can fight malignant tumors. Such cells are used or activated in a targeted manner to treat cancers. The research groups of Prof. Dr. Thomas Tüting and Prof. Dr. Michael Hölzel or the University of Bonn have demonstrated in their experiments on skin cancer that tumor cells can change their external appearance, if an inflammatory reaction occurs in the course of treatment. Consequently, the T-cells no longer recognize them as harmful, and the cancer can continue to spread unimpeded.

A new model from mathematicians and physicians from the Excellence Cluster of the Hausdorff Center for Mathematics

Prof. Dr. Anton Bovier with his co-authors Martina Baar, Hannah Mayer, and Loren Coquille (from the left) of the Institute of Applied Mathematics. Photo: Anna Kraut

and ImmunoSensation of the University of Bonn now describes this effect mathematically, thus making it possible to analyse it. In the future, the model could be used, among other things, for computer simulation of various therapeutic

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approaches and thus for the development of optimal treatment strategies.

„The initial results show that treatment with several types of immune cells could in fact be a promising approach“, says the lead scientist of this work, Prof. Dr. Anton Bovier of the Hausdorff Center for Mathematics. The studies are based on a stochastic model from the area of adaptive dynamics, which was developed by the mathematicians for application, for example, in cancer research. „Tumors are nothing other than populations of cancer cells, which interact with one another in a very complex manner and react to their environment in the form of the body and its immune system“, explains Prof. Bovier.

In numerical simulations by the Bonn researchers, the long-term success of a therapy, even when the starting conditions were the same, depended on random fluctuations in the population sizes of cancer and immune cells. Whether this effect also occurs in reality and not just on the computer still needs to be investigated experimentally. The virtual research of the Excellence Cluster has also showed that treatment, under certain circumstances, can even increase the probability of mutation in cancer cells. In some cases in the simulation, a therapy actually accelerated the development toward aggressive variants of cancer.

Prof. Hölzel of ImmunoSensation summarises the results of the interdisciplinary work as follows: „This project can both call the attention of mathematicians to possible applications of their work in a medical context and also sensitize physicians to the use of mathematical methods. In any case, we will continue to do joint research in the fight against cancer“. To make it possible to use the model in practice, more experimental data still needs to be developed.

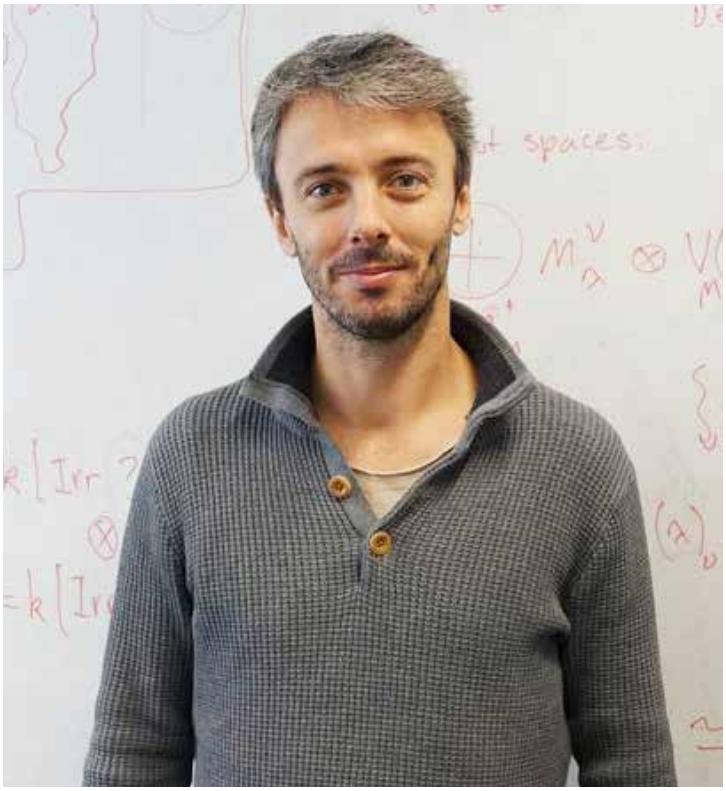
Clay Research Award 2016 for Geordie Williamson

Newsblog of the University of Bonn from April 21, 2016

Geordie Williamson from the Hausdorff Center for Mathematics at the University of Bonn receives a renowned research award for his groundbreaking work.

The prize is awarded annually by the Clay Mathematics Institute for important breakthroughs in Mathematics. The institute is a privately funded foundation which is dedicated to disseminating mathematical knowledge. Its Scientific Advisory Board selects the awardees. Some of the most world-renowned mathematicians have so far received the Clay Research Award. Beyond its high prestige, it also involves a medal and research funds. Geordie Williamson is now the second researcher from Bonn who is honored with this prize after Hausdorff Chair Peter Scholze.

With the award, the commission recognizes Williamson’s research on representation theory. Recently, he has published two important works in this field. Together with a colleague, he was able to prove a conjecture of the Freiburg mathematician Prof. Dr. Wolfgang Soergel and also disproved the expected bounds in a formula of Prof. Dr. George Lusztig (MIT).



Since 2011, Geordie Williamson does research at the Max Planck Institute for Mathematics and at the Hausdorff Center. The 34-year-old studied in Sydney, received a doctor’s degree at Freiburg and was a Research Fellow in Oxford, before coming to Bonn. “I want to use the award to contribute to a deeper understanding of representation theory and its connections to other fields of mathematics”, he says.

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ERC Advanced Grant for HCM coordinator Karl-Theodor Sturm

Press release of the University of Bonn from April 21, 2016

Prof. Dr. Karl-Theodor Sturm, coordinator of the Hausdorff Center for Mathematics at the University of Bonn, has been awarded with an ERC Advanced Grant for his own research. He will be promoted with a funding of 2.4 million Euros during the next five years.

The awardee deals with the question of how local limited information determines global behaviour. These mathematical procedures are also successfully used in the modeling of financial markets or the increase of tumors. By means of the grant the scientist wants to improve these methods.

Enthusiastically, Prof. Sturm investigates in recognizing single phenomena, which are not yet understood, as part of a larger theory. He deals with differential geometry and its recent development, the geometry of non-smooth objects. “The clou is that local information admits conclusions to global structures”, explains the scientists of the Institute for Applied Mathematics.

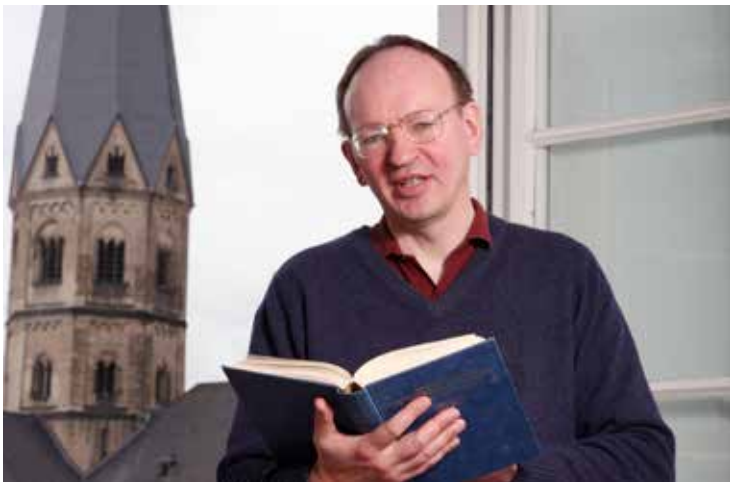
It is for example possible to derive the size of a Christmas-tree ball from a tiny broken piece of it. In this case, the Ricci curvature which allows to infer different characteristics as e.g. the diameter of a sphere, the fundamental tone of resonances, and the diffusion of heat in a room, plays a special role. Also Einstein used such concepts for his theory of relativity.

About one decade ago Prof. Sturm succeeded in the scientific competition with John Lott and future Fields medalist Cedric Villani to deduce such local-to-global conclusions also for structures with edges, borders, folds, and branchings. “In this way geometric curvature concepts – in particular the synthetic Ricci bounds introduced by ourselves – became part e.g. of the description and analysis of lattice models in solid state physics or of models of financial markets, and of tumors.”

The objective of the research project is the development of these synthetic curvature concepts for singular spaces. It concerns branchings and other special forms to which Ricci bounds are not applicable yet, and spaces whose structures are changing fundamentally in the course of time. “We absolutely break new ground of science here”, Prof. Sturm tells. “The ERC project is a starting point for far-reaching new investigations and exciting innovative results.” The ERC grant permits Prof. Sturm to concentrate extensively on the research subject, to recruit international top researchers, and to qualify excellent young scientists. It is the highest funded ERC grant a mathematician has ever received in Europe.

Prof. Sturm, born in Ansbach in 1960, studied Mathematics at the University of Erlangen-Nuremberg, where he also did his PhD and qualified as a university lecturer. After scientific stages at Leipzig and Zurich he accepted the chair offer by the Institute for Applied Mathematics at the University of Bonn. From 2007 to 2010, he was Managing Director of the institute. In spite of numerous renowned offers of a chair like e.g. by the Imperial College in London or by the Northwestern University at Chicago, the University of Bonn succeeded to keep him. For about four years he is coordinator of the Cluster of Excellence “Hausdorff Center for Mathematics”.

HAUSDORFF SPECIALS



Gerd Faltings elected as a Foreign Member Fellow of the Royal Society

May 2, 2016

Gerd Faltings, member of the HCM Board of Directors, was elected as a “Foreign Member Fellow” by the British Royal Society. Each year, the Royal Society only names ten new “Foreign Research Members” at a time out of numerous nominations. A Council of elected Fellows runs the society.

Prize of the Berlin-Brandenburg Academy of Sciences and Humanities for Peter Scholze

Pressemitteilung der Akademie vom 17. Mai 2016

This year, the Academy Prize of the Berlin-Brandenburg Academy of Sciences and Humanities which is endowed with € 50,000 and honors outstanding scientific achievements is awarded to the 28-year-old mathematician Prof. Dr. Peter Scholze from the Hausdorff Center for Mathematics at the University of Bonn. The award will be presented at the celebration of the Leibniz Day at the Academy on June 11, 2016.

Peter Scholze is one of the outstanding exceptional mathematical talents in the world. His research area lies at the interface of arithmetic algebraic geometry and the theory of automorphic forms, that is, at fields which are based on classical questions of geometry and complex analysis from the 19th century. The search for answers to the key questions of this area has led to one of the most challenging theoretic constructs of mathematics that some of the best mathematicians of our time work on to refine it. With the term of “perfectoid” spaces which was influenced and theoretically elaborated by Peter Scholze in his dissertation, it was possible to solve several important and for a long time unsolved problems. His approach which is considered as revolutionary has secured him a leading position in the top tier of his working area and raised high expectations at further developments.

The Academy Prize 2016 continues the impressive list of awards with which Peter Scholze was honored. As the first German ever, he already received the Clay Fellowship of the Clay Foundation in 2011, the Prix Peccot of the Collège de France in 2013, the Clay Research Award in 2014, and the Cole Prize for Algebra of the American Mathematical Society in 2015. In 2012, he was an Invited Speaker at “Current Developments in Mathematics” at Harvard University and he

was awarded the Hausdorff Memorial Prize. In 2013, it was followed by the Sastra Ramanujan Prize. Peter Scholze was invited to important lectures in Bombay, Princeton, Seoul and Tokyo. In 2015, he was awarded the Ostrowski Prize by the foundation of the same name in Basel and in 2016 the Leibniz Prize of the German Research Foundation. These honors point out the fact that Peter Scholze, at only 28 years of age, is already part of the worldwide trend-setting mathematicians.

Peter Scholze was born in Dresden in 1987. After taking his final exams, the Abitur, at the Heinrich-Heine-Gymnasium in Berlin, he completed his studies of mathematics in Bonn in only five semesters. He received his doctor’s degree in 2012. In the same year, he was offered one of the Hausdorff Chairs at the mathematical institute at the University of Bonn where he is currently working.

The Academy Prize honors outstanding scientific achievements in all disciplines. In 2016, the highest award of the Academy is given for the first time ever to a mathematician, Peter Scholze.

HAUSDORFF PEOPLE

Since April, **Emil Kieri** is a new postdoc in the group of André Uschmajew and does research on low-rank approximations. Before he came to Bonn, he worked on numerical methods for wave propagation problems at the Uppsala University in Sweden.

Dr. Urs Schreiber deputizes the chair of Stefan Schwede from April to September 2016. He is a permanent researcher in the group of Martin Markl at the Czech Academy of Sciences in Prague. His research focuses on the mathematical structure of quantum field theory and string theory, using tools from homotopy theory and higher category theory.

HAUSDORFF EVENTS

Mathe Slam – April 26, 2016

The Hausdorff Center presented the first Math Slam in Bonn on April 26, 2016. About 120 people listened enthusiastically to the five slammers from Bonn, Dresden and Bures-sur-Yvette at the fully packed cafe unique. The audience chose Thoralf Räsch and his entertaining presentation “Math therapy alarm” as the winner of the night. The band “Drummer Says No”, which is made up of four Math PhD students, provided music for the evening. The show will go this autumn: The two clusters of excellence in Bonn, ImmunoSensations and the HCM, are planning a joint “Excellence Slam”!

Science night – June 3, 2016

On June 3, the 10th Science Night took place in Bonn. Universities and research institutions from the region presented living science related to the topic of the night: “WaterWorlds”. At the booth of the Hausdorff Center in the main building of the university visitors learned a lot about fluid dynamics. Videos of different simulations of wave behavior and fluid flows visualized the practical relevance of the complex computations in this area. The public was also able to test the influence of obstacles in a fluid on its flow with an app from the Institute for Numerical Simulation.

Young Women in Representation Theory – June 23 - 25, 2016

As part of the event series ‚Young Women in...‘, more than 50 young researchers in representation theory met at HCM Bonn for a stimulating three-days workshop. It was centred around two lecture series by Idun Reiten and Vanessa Miemietz. Additional contributed talks and two poster sessions gave ample time for discussions and lots of networking opportunities for the PhD students and postdocs as well as direct contact with leading experts in their field.

HAUSDORFF CALENDER

Von Neumann Algebras
(Hausdorff Trimester Program)
May 2 to August 26

Moduli spaces of log del Pezzo pairs and K-stability (RiG)
June 20 to July 20

BIGS Poster Exhibition 2016
June 30 to July 1

Toeplitz Kolloquium 2016
Antony Gardiner (Birmingham)
July 4

Workshop on von Neumann Algebras
(Hausdorff Trimester Program)
July 4 to 8

Basic Notions Seminar
Federico Zerbini (MPIM Bonn)
July 6

Hausdorff Kolloquium 2016
Geordie Williamson (MPIM Bonn),
Adriana Garroni (Università di Roma)
July 13

Basic Notions Seminar
Philipp Lücke (Universität Bonn)
July 13

Follow-up Workshop to JTP "Optimal Transportation"
August 29 to September 2

SchülerInnenwoche 2016
August 31 to September 3

Topology
(Junior Hausdorff Trimester Program)
September 5 to December 22

Summer School: Paraproducts and Analysis of Rough Paths
September 11 to 16

Workshop: Interactions between operads and motives
(Junior Hausdorff Trimester Program)
September 14 to 16

Bonn Set Theory Workshop 2016: Generalized Baire spaces
September 21 to 22

Bonner Mathematikturnier 2016
September 23

HAUSDORFF MIXED

Hausdorff Wikipedia initiative

The Hausdorff Center wants to encourage all of its researchers to contribute to the quality of mathematical entries in Wikipedia with technical input. The initiative's kickoff was a Wikipedia training on June 10 offered by the Hausdorff School. Everyone who wants to contribute actively to Wikipedia and who needs an introduction may contact Astrid Slizewski.

One problem less in dimension 24

HCM PhD student Danylo Radchenko was part of the working group that solved the sphere packing problem in dimension 24. On our website we published an interview in which he explains how he got involved in this research, what the key to solving the problem was, and what it is like to be a PhD student at the Max Planck Institute for Mathematics in Bonn.

IMPRESSUM

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