Angkana Rüland to receive illustrious New Horizons Prize

Angkana Rüland is to be presented with the illustrious New Horizons Prize for her outstanding work on applied analysis. The high-caliber $100,000 award is conferred by the Breakthrough Prize Foundation. The 35-year-old researcher was only appointed to one of its prestigious Hausdorff Chairs at the start of the year. In her research, she draws inspiration from problems encountered in the natural sciences.

"I was taken completely by surprise and I am extremely happy," Angkana Rüland says, describing her initial reaction to the message from the chairperson of the awards committee. He then made time for a video call in order to chat to the newly crowned winner in person. As to how she plans to use the $100,000 that comes with the award, Angkana Rüland is yet undecided. "I would like to donate part of the prize money to the Bonn Math Club, which I used to work for as a student myself and which supports young math talents." The researcher is receiving the New Horizons Prize in Mathematics for her work on applied analysis, more specifically on investigating microstructures in solid-solid phase transitions in certain materials and her research on inverse problems.

In her research into microstructures, she is particularly interested in a class of alloys that have shape-memory properties. This means that, for example, a severely bent paper clip made of such a material will return to its original state as if by magic when it is heated up. The secret lies in special lattice structures that are combined in different ways, just like individual building blocks, and thus influence the material's behavior. "This opens up many highly fascinating and challenging questions from a mathematical perspective."

The mathematician also studies what is known as inverse problems, which is about reconstructing information from indirect measurements—such as is done with X-ray tomography or ultrasound scans, for instance. "This indirect information lets you infer information on someone's body without having to take any tissue samples," Angkana Rüland explains. Phenomena like this can also be found in nature, such as the ultrasound echolocation of bats. "My research is primarily concerned with a specific class

of these problems, the so-called Calderón problem, and nonlocal versions of it."

Angkana Rüland's New Horizons in Mathematics Prize is the third Breakthrough Prize Foundation award in the last two years to go to female mathematicians at HCM. Last year, Ana Caraini also received a New Horizons in Mathematics Prize and Vera Traub was awarded a Maryam Mirzakhani New Frontiers Prize.

HAUSDORFF PEOPLE

Jessica Fintzen wins Cole Prize

Jessica Fintzen, is to receive the prestigious Frank Nelson Cole Prize in Algebra for 2024. She will be presented with the award at the Joint Mathematics Meetings in San Francisco, California in January 2024.

"Since the prize is only awarded every three years and doesn't have any geographical or age restrictions, receiving it is a great honour and at the same time a big encouragement for me," 'Jessica Fintzen says. The $5,000 prize money is definitely of secondary importance. Much more important, she feels, is to thank all those who, in numerous discussions over the past few years, have joined her in advancing her field – the representation theory of p-adic groups – and those who supported her at various stages of her career.

Jessica Fintzen is already considered among the world's leading mathematicians in this area despite her tender age. She is being recognized for her research in this subdiscipline of algebra including her paper entitled "Types for Tame P-Adic Groups." Published in the high-profile journal "Annals of Mathematics" in 2021, it unlocks a deeper understanding of the representations of p-adic groups with the help of some advanced techniques.

"Groups" in this context are sets whose elements can be composed such that certain rules such as associativity are satisfied. One example of such a group is the symmetry group of a cube, which contains all the operations that keep the cube invariant. Representation theory describes groups as matrices, i.e. as linear representations between vector spaces. Starting from the field of rational numbers, it is possible to extend and complete it in various different ways to obtain larger fields. One very well-known way of doing this yields the field of real numbers. Another route leads to the "p-adic" numbers for each prime number p. Jessica Fintzen's research is about using matrices to describe groups over these fields of p-adic numbers and to "represent" them. There are still many open questions in the representation theory of p-adic groups, especially for small prime numbers p.

Lisa Sauermann receives the von Kaven Award

Lisa Sauermann has been honored with the von Kaven Award 2023 for her outstanding scientific achievements. The award is presented by the von Kaven Foundation, which is managed by the DFG. Lisa Sauermann was appointed as one of the prestigious Hausdorff Chairs only a few months ago. She has been carrying out research and teaching at the Institute for Applied Mathematics at the University of Bonn since August. The von Kaven Award includes prize money of 10,000 euros and was presented on November 17, 2023, at the Gauß Lecture organized by the German Mathematical Society (DMV). The prizewinner was informed about her upcoming award by email by the German Research Foundation. I am of course delighted to receive the award and feel very honored that my scientific work is recognized in this way," says Lisa Sauermann. "My family and I have not yet decided what we will do with the prize money."

Lisa Sauermann's main field of research is so-called probabilistic combinatorics, in which combinatorial problems are investigated with the aid of techniques found in probability theory. This subdiscipline of discrete mathematics focuses on, for example, the maximum possible number of sets or other objects under certain conditions. There are many applications for this research not only in the field of mathematics but also in neighboring disciplines such as coding theory or computer science.

Two ERC Consolidator Grants for Bonn Mathematics

Another big success in securing grants from the European Research Council (ERC), with two Bonn mathematicians receiving an ERC Consolidator Grant: **Jan Hasenauer** of HCM's Interdisciplinary Research Unit (IRU) Mathematics and Life Sciences and **Evgeny Shinder** of the Mathematical Institute.

Using simulation technology in oncology

Every tumor is unique and its response to therapies is determined by innumerable changes within cells and their interactions. "Therapies tailored to specific mutations of a tumor can effectively extend, and in some cases even save, the lives of cancer patients," reports Jan Hasenauer of the Life and Medical Sciences Institute (LIMES) at the University of Bonn. Newly

cancer patients in order to achieve better treatment outcomes," he explains.

Interactions between equations and shapes

The project initiated by Evgeny Shinder of the University of Bonn Mathematical Institute is titled "Motivic invariants and birational geometry of simple normal crossing degenerations". Evgeny Shinder is a mathematician in the field of algebraic geometry, a branch of pure mathematics that studies the interaction between algebraic equations and geometric shapes. As part of his project, Evgeny Shinder will develop a new framework of birational types and

emerging immunotherapy approaches in particular hold tremendous potential. Until now, decisions as to which therapy to pursue for a given individual have been made on the basis of simple statistical models, but these do not allow for a reliable prediction of therapeutic success. Jan Hasenauer is therefore working to develop simulation models for predicting tumor treatments in his project "INTEGRATE", which has received roughly 1.9 million euros in funding. The project concentrates on breast, stomach and kidney cancers – which account for approximately 30% of cancer cases in Europe. To improve the prediction accuracy, Jan Hasenauer will use machine learning to render more data available for training the simulation models. These data sets will come from clinical practice, clinical studies and projects like The Cancer Genome Atlas. "My vision is to create digital twins of the

invariants of simple normal schemes. Shinder aims to apply this new framework to revisit longstanding fundamental problems in algebraic geometry. The nearly 2 million euros in funding forthcoming under the ERC Consolidator Grant will enable Evgeny Shinder to form a research group, staffed by three postdocs and two doctoral students. "I now have five years just to do research - I will use this time to tackle challenging problems in algebraic geometry," he commented.

Sven Rady appointed Fellow at the Econometric Society

Sven Rady, Hausdorff Chair and professor at the Department of Economics of the University of Bonn, has been elected Fellow of the Econometric Society.

The Econometric Society is an international society for the advancement of economic theory in its relation to statistics and mathematics. The main activities of the Society are publication of the journals Econometrica, Quantitative Economics, and Theoretical Economics, publication of a research Monograph Series, organization annually of scientific meetings in six regions of the world, and a World Congress once every five years. For more than 90 years, the Society has been electing Fellows. Candidates for Fellow are nominated by members, Fellows, and a Fellows Nominating Committee (FNC) and elected by the Society's active Fellows.

Since 1931, only 1,188 total fellows have been elected. To date, 8 fellows of the Econometric Society are or were members of the Department of Economics in Bonn.

Bonn PhD student Paolo Climaco is the winner of the Dataperf Vision Selection Challenge

Paolo Climaco, PhD student at the Bonn Institute for Numerical Simulation (INS) and member of our BIGS (Bonn International Graduate School of Mathematics), was announced as the winner of the Dataperf Vision Selection Challenge.

The challenge consisted of developing an algorithm to select the most effective training set, with at most one thousand points, from a large pool of more than three million images to maximize the performance of binary classifiers for various visual concepts.

The algorithm, which Paolo developed, is based on farthest point sampling, a fill distance minimization approach with some interesting properties, some of which Paolo and his supervisor Jochen Garcke analyzed in their research paper "Investigating minimizing the training set fill distance in machine learning regression". The research paper was presented at theDMLR workshop as part of the ICML conference last July 2023 in Honolulu, HI.

The challenge was organized by members of the Dataperf community, which consists of researchers from industry and academia focused on data-centric AI. Data-centric AI is an emerging field of research that has gained much attention in the machine learning community, and is characterized by a shift in research focus from improving the learning model design to improving data quality.

Welcome!

Philip Engel has joined the HCM as a W2 professor in the Bonn Junior Fellow program. He received his PhD from Columbia under the supervision of Robert Friedman in 2015, and was a postdoc at Harvard until 2018. From 2018 to 2023 he was an assistant professor at the University of Georgia. He received an NSF postdoctoral fellowship, was the principal investigator on an NSF standard grant, and was a research member of the MSRI in 2019.

Engel's primary focus of research is complex algebraic geometry, especially in concrete and simple objects like curves and surfaces. He enjoys employing techniques from a wide variety of mathematical areas, including representation theory, symplectic geometry, dynamics, analysis, and combinatorics. He has a passion for geometric visualization that extends beyond theoretical math, and has collaborated with textile artist Victoria Manganiello on the interaction of weaving and mathematics. His hobbies include visual art, cooking, classical, piano, and travel. Engel will teach a course on Hodge theory this term.

Outside of work, Phil enjoys exploring new places, meeting new people, trying new food, and having a beer.

Laura Vargas Koch joined the HCM and the Research Institute for Discrete Mathematics as Bonn Junior Fellow in October 2023. After her PhD at RWTH Aachen under supervision of Britta Peis, she was a postdoc at ETH Zürich in the group of Rico Zenklusen and at CMM in Santiago de Chile with Jose Correa. In her work she treats questions from algorithmic game theory and combinatorial optimization. She likes clean theoretical questions that are motivated by real world problems. One aspect of her work is to improve the understanding of dynamic routing games, which are motivated by real world traffic simulation tools. This year Laura Vargas Koch teaches a selected topics course in discrete mathematics on flow problems and she will organize the Computational Game Theory Day in Bonn in 2024 together with Thomas Kesselheim. She looks very much forward to joining the amazing math community in Bonn.

Beside mathematics, Laura Vargas Koch is a Olympic medalist in judo.

Giles Gardam has joined the Mathematical Institute as Bonn Junior Fellow. He did his doctorate at Oxford and was a postdoc at the Technion and in Münster with a 3-month stay in Bonn for a program at the Hausdorff Institute in between.

His research area is geometric group theory, the study of infinite groups using geometry and topology. A distinguishing feature of his work is its computational flavor.
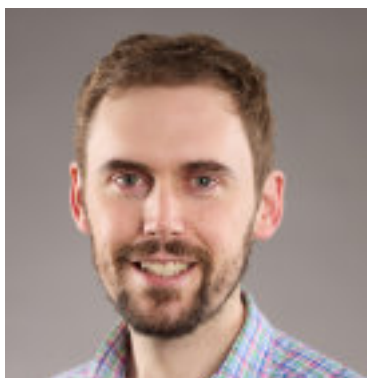

His research in Bonn is supported by an ERC grant to apply tools from computer science to fundamental questions about group rings. This winter semester Giles Gardam has been teaching an advanced topics course on group rings of infinite groups. He is excited to work at a leading international institute.

Outside of mathematics he likes to spend time with his family, cook and run.

Gregor Gantner joined the Institute for Numerical Simulation as a Bonn Junior Fellow in November 2023. He completed his doctorate sub auspiciis praesidentis at TU Wien in 2017 and worked there for two more years as a postdoc. He then moved to the University of Amsterdam as a postdoc with a Erwin-Schrödinger Fellowship funded by the Austrian Science Fund (FWF).

In 2022, he began a Starting Faculty Position at research institute Inria in Paris. His research area is the numerical analysis of partial differential equations.

He develops adaptive algorithms to approximate the unknown solutions of these equations. His focus is on the mathematical proof that these algorithms converge optimally, i.e., that they can achieve any given accuracy at minimal computational cost.
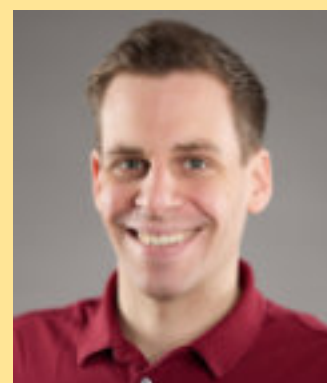
Wilhelm Kroschinsky joined the Institute for Applied Mathematics of the Hausdorff Center for Mathematics in August 2023. He is now working in the group of Dr. Christian Brennecke. He obtained his PhD in Physics from the University of São Paulo in February 2023. During his PhD, he worked with fermionic renormalization group. He is now changing topics to study many-body quantum mechanics. More specifically, he is interested in the analysis of highly diluted Bose gases, the emergence of the so-called Bose-Einstein condensation, and the time stability of this condensate in the Gross-Pitaevskii scale regime.

Ujjwal Kumar joined the HCM in August, 2023 as a Postdoc in the group of Benny Moldovanu. He completed his bachelors (in Mathematics), masters (in Mathematics) and PhD (in Quantitative Economics) at Indian Statistical Institute. His interests lie in Mechanism Design, Game Theory, Social Choice Theory and related areas. During his PhD, he worked on providing the theoretical characterization of preference domains on which local incentive compatibility is equivalent to global incentive compatibility. Recently, he has also started working on problems in fair division and elicitation of type-spaces. In general, he is interested in working on problems which arise from economics and computer science that are mathematical in nature.

Alexis Langlois-Rémillard joined the HCM in October 2023 as a Hausdorff postdoc working with the group of Eveliina Peltola. He did his PhD at Ghent University in Belgium under the supervision of Hendrik De Bie, Roy Oste and Joris van der Jeugt and his MSc and BSc at Université de Montréal. His research concentrates in representation theory, mathematical physics, quantum groups, and Hecke type algebras, always with a fondness for diagrammatic calculus. Before coming to Bonn he did a short research stay at Leipzig working on extremal combinatorics problems and designing outreach experiences from contemporary mathematical research. Apart from maths, he is an avid chess player, a voracious reader, and he likes to experiment with languages.

Michel Alexis joined Christoph Thiele's group at HCM as a postdoc in September 2023. During his PhD at the University of Wisconsin - Madison, he studied Orthogonal Polynomials on the Unit Circle using harmonic analysis under the supervision of Sergey Denisov. Then during his first postdoc at McMaster University, he studied Singular Integral Operators between weighted spaces under Eric Sawyer. Currently, as a postdoc in Thiele's group, he continues to take interest in topics related to both his thesis work and his previous postdoc work.

Alice Marveggio joined the Hausdorff Center for Mathematics in October 2023 as a Postdoc in the group of Sergio Conti. She obtained her PhD at the Institute of Science and Technology Austria (ISTA) under the supervision of Julian Fischer. Her research interests lie at the intersection of partial differential equations and calculus of variations, with a particular focus on interface evolution problems arising in continuum mechanics. Her PhD thesis concerns the study of weak-strong stability and phase-field approximation of multiphase mean curvature flow. During her time as a Postdoc, she would like to continue working on these topics as well as to explore new research directions.

Panorama of Mathematics II

Our "Panorama of Mathematics II" conference took place at the beginning of October. In total, more than 300 participants informed themselves about the various mathematical subfields, across all borders. in a relaxed and constructive atmosphere. Internationally renowned anf distinguished mathematicians, including several Fields Medallists, presented new trends, results and challenges from their respective research areas.

All the lecture recordings have now been edited and published on our YouTube channel. Between the lectures, we conducted several video interviews with the renowned speakers. These interviews can also be found on our YouTube channel.

The Panorama Conference is almost unique in the world. But it is more important than ever to better connect the mathematical subfields and to get an overview of the panorama of mathematics. We hope that all participants enjoyed the three fascinating days and that we will repeat a conference of this kind in a few years' time.

We would like to sincerely thank all the helpers who contributed to the success of Panorama II, especially Theodor Sturm for leading the organization and Rabea Steinbach for her tireless efforts during the months of preparation!

Bonn Math Tournament

Our Bonn Mathematics Tournament took place at the end of September. Once again, over 60 schools and 300 high-school students participated. As always, the tournament also took place in the Netherlands and Belgium at the same time – and for the first time in Hanover. In the first part of the competition, the "relay", our HCM dream team took part with a much younger team than in previous years: Antje Kiesel, Iris Hebbeker, Lars Becker, Jonas Walter and Paul Müller competed for Bonn Mathematics - and scored (out of competition) significantly more points than all the schools.

The topic in the second part of the competition was the mathematics of voting procedures. We had invited a real expert on this topic, Friedrich Pukelheim, the inventor of "double proportional representation". Thoralf Räsch, who moderated the tournament as usual in a dream duet with Julia Rötten, talked to him not only about personal matters but also about the role of a mathematician in such processes. This gave the young spectators a different perspective on the topic. Ysette Weiß held an exciting teacher training session on the topic of gifted education. As always, the tournament was organized by the HCM school team. Numerous volunteer student helpers on site ensured that everything went smoothly and quickly.

The first three places were achieved by:

1st place: Schillergymnasium, Köln
2nd place: CJD Christophorusschule, Königswinter
3rd place: Stiftisches Gymnasium, Düren

In the meantime, we took these three schools and the winning teams from the Netherlands and Belgium on an exciting prize trip to Aachen. In addition to a visit to the cathedral, the program also included bouldering, a city rally and a pub quiz.

A Dies Academicus full of mathematics

There were so many mathematical lectures at the Dies Academicus this year that it was possible to take an exciting journey through numerous areas of mathematics almost without a break throughout the whole day. Five mathematics professors from Bonn gave their inaugural lecture: Johannes Alt, Lisa Sauermann, Vera Traub, Eva Kopfer and Angkana Rüland. Once again: woman power in mathematics in Bonn! We have already been able to persuade some of the speakers to give these great lectures again in a different context, for example at a Bonn Math Night.

Math Night from Berlin, Bonn and Münster

For the second time together with Berlin and Münster and for the eighth time in total, we held a math night at the beginning of December. At the end of the eight-hour (!) program, we were given a very special treat. Mirko Mauri, guest researcher at HIM and group leader of our Junior Trimester Program on Algebraic Geometry, gave a breathtaking talk at HIM in hybrid mode, in which he covered a wide range from Dante's spherical worldview and the place of God in it to current research results (which he recently found together with our HCM member Daniel Huybrechts) and repeatedly pointed out cross-connections to literature, art, architecture and philosophy. Absolutely fantastic, many thanks to Mirko!

HAUSDORFF MIXED

Congratulations to Eva Viehmann for receiving the Leibniz Prize

Eva Viehmann from the University of Münster has been awarded the Gottfried Wilhelm Leibniz Prize 2024 by the German Research Foundation (DFG) for her excellent research. With a prize money of 2.5 million euros, the Leibniz Prize is the most highly endowed German research award. Eva Viehmann has a close relationship to Bonn: she studied, completed her PhD and habilitation in Bonn and worked for a long time in the Arithmetic Geometry Group at the Mathematical Institute of the University of Bonn.

In its statement, the DFG referred in particular to Eva Viehmann's influential work on arithmetic algebraic geometry as part of the Langlands program. She has already received several awards for her scientific achievements. The European Research Council (ERC) recognized her in 2011 with an ERC Starting Grant and six years later with a Consolidator Grant. She has been awarded the von Kaven Prize for outstanding scientific achievements in mathematics, and the Felix Hausdorff Memorial Prize of the University of Bonn. In 2018, she was a speaker at the International Congress of Mathematicians in Rio de Janeiro. The German National Academy of Sciences Leopoldina accepted her as a member in 2021.

New website

We are pleased to announce that Bonn Mathematics has a new website. It has been available for a few days at https://mathematics.uni-bonn.de. The new web pages of the HCM (and all subunits) can be found at https://hcm.uni-bonn.de. The website is based on Plone 5 and its design is based on the pages of the University of Bonn. The pages of the institutes remain under their responsibility. The development of the new website was a complex, huge project, to which numerous employees of Bonn Mathematics contributed with great commitment.
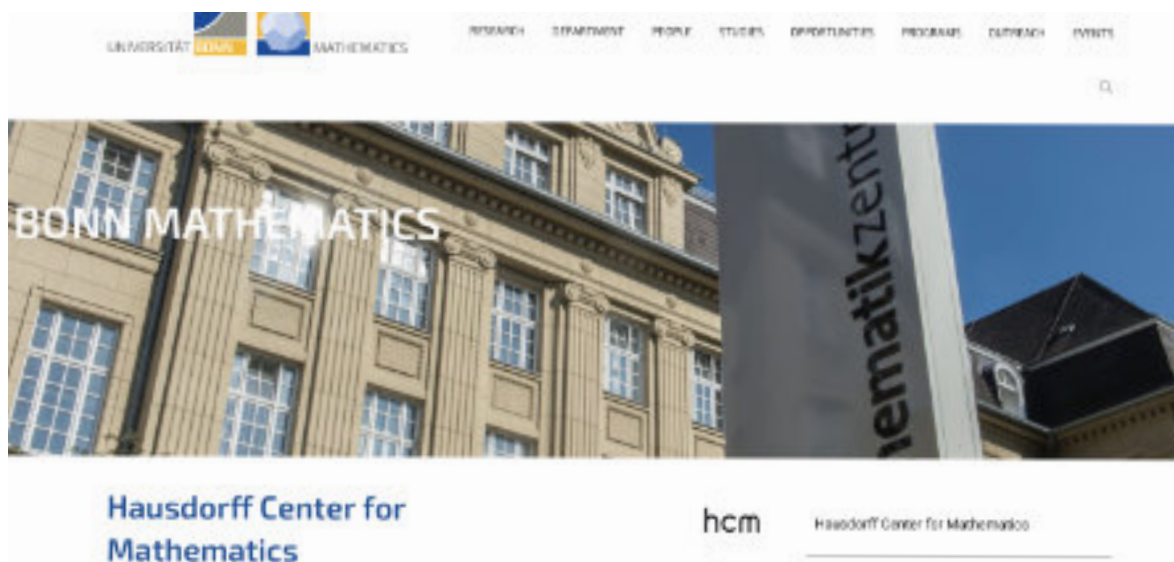
News from the Bonn Math Club

The Bonn Math Club took part in the **FEMO (Fizmat Elementary Math Olympiad)** for the third time. In this winter round, ten children from Bonn in grades 2 and 3 and four children in grades 4 and 5 took part in presence. The participants had to solve 10 to 15 exercises and puzzles of varying degrees of difficulty and had 1 or 1.5 hours to solve them, depending on the grade level. There were different exercises for each grade level, but in some cases the exercises overlapped. In the FEMO, no solutions have to be submitted, but the pure numerical results are sufficient.

The first FEMO was organized in 2016 by the National School of Physics and Mathematics in Nur-Sultan (Kazakhstan). Two years later, the Olympiad was then extended to other

changes on the tablet if, for example, the ice surfaces continue to melt (albedo effect).

And – last but not least – there was our **Christmas party** with an **escape room game** and numerous mathematical puzzles, where 40 children and young people had a lot of fun! A big thank you to all the tutors for organizing this event!

countries such as Georgia, Kyrgyzstan and Uzbekistan. Since 2022, Germany has also been taking part in this competition thanks to the Bonn Math Club. We would like to thank the tutors who translated and prepared the exercises and/or contributed to their success on site, as well as to all the parents who helped.

We went on a trip to Münster with some students from the Bonn Math Club in grades 8-10. There we visited the exhibition "The Climate" at the Natural History Museum and attended a wonderful **math workshop entitled "The Mathematics of Climate"**, which was competently led by student assistants from the Cluster of Excellence Mathematics Münster. Many thanks for that! We learned about the Navier-Stokes equation, possible grids on a sphere, simple weather models to predict the temperature with the help of air currents and ambient temperatures, and were able to simulate possible climate

HAUSDORFF Inside HCM

What actually is ... the General Assembly?

The ordinary General Assembly. of the HCM is a meeting of all members of the HCM with voting rights. It is convened by the spokesperson of the HCM and is one of the three executive bodies of the HCM: General Assembly. Board of Directirs, Spokesperson. The General Assembly takes place once per semester and is convened at least 14 days in advance. At least once a year, the General Assembly is held as an Extended General Assembly, to which all associate members and HCM administrative staff without voting rights are invited in addition to all members with voting rights.

The General Assembly. is held in conjunction with the BIGS Annual General Assembly.

The tasks of the General Assembly include, among others:

☐ Preparation of a proposal to amend the HCM statutes,
☐ Resolution on the admission and exclusion of members with voting rights on the recommendation of the Board of Directors,
☐ Election and deselection of the board, spokesperson, deputy spokesperson, management of HSM and HIM

and preparation of a proposal for the election and deselection of the BIGS management.
☐ Election of the members of the commission for the selection of HCM-financed positions for the BIGS,
☐ Presentation of the report of the spokesperson of the HCM and the HCM Board of Directors and the reports of the directors of BIGS, HSM and HIM,
☐ Establishment of new or dissolution of existing Research Areas and their allocation to Research Sections and establishment or dissolution of Research Sections or Interdisciplinary Research Units.

The reports provide members with an up-to-date insight into the HCM's current programs and measures, as well as the opportunity to ask questions.

The next HCM General Assembly will take place on January 31, 2024 at 2 pm in the Lipschitz Hall.
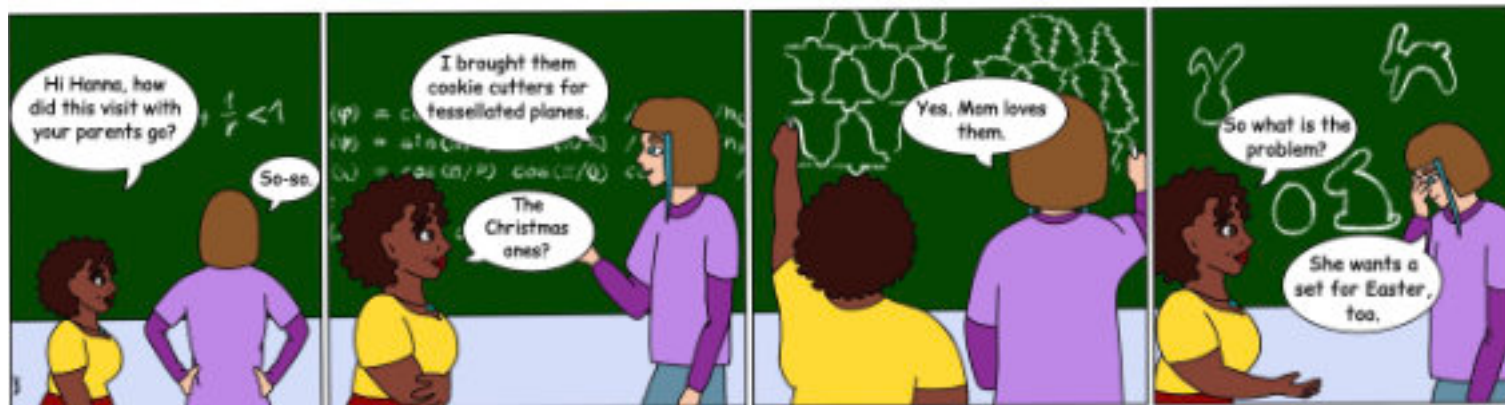
We wish all our readers a merry and peaceful Christmas!

Who can help Hanna?

We collect ideas for tessellated Easter cookie cutters at daniela.schmidt@hcm.uni-bonn.de.