

Editorial: Laureates Meet Young Researchers In Heidelberg

Helge Holden (Norwegian University of Science and Technology, Trondheim, Norway), Hans Munthe-Kaas (University of Bergen, Norway) and Dierk Schleicher (Jacobs University Bremen, Germany)

Young scientists have a chance to meet some of the most successful mathematicians and computer scientists at the newly established “Heidelberg Laureate Forum” (HLF), a week-long event that brings together Abel laureates, Fields medallists and Turing awardees with “leading scientists of the next generation”, that is, university students, doctoral students and postdocs. We all know that personal encounters can have a decisive impact on our personal lives – and what can be more exciting for a young and aspiring scientist than a face-to-face meeting with the most prominent scientists in their area? This is the idea of the forum. It was launched in September 2013 and will take place annually.

The highly successful Lindau Nobel Laureate Meetings have taken place for more than 60 years, providing a forum where young researchers and Nobel Laureates from physics, chemistry and life sciences meet for inspiring scientific discussions and social interaction. In this sense, the Heidelberg Laureate Forum fills a void for the oldest scientific discipline: mathematics, and one of the youngest: computer science. It was initiated by the Klaus Tschira Foundation (KTS) and the Heidelberg Institute for Theoretical Studies (HITS) in 2011 in collaboration with the sponsors of the three prizes: the International Mathematical Union (IMU), the Norwegian Academy of Science and Letters and the Association for Computing Machinery (ACM). The programme and the selection of participants are overseen by a scientific committee that includes representatives from the IMU, the Norwegian Academy of Science and Letters, the ACM (including one laureate of each prize), Oberwolfach and Schloss Dagstuhl, as well as the Tschira foundation and the HITS.

The format of the HLF is a week-long symposium where laureates of the Abel Prize, the Fields Medal (including the Nevanlinna prize) and the ACM Turing Award join with young researchers of undergraduate, graduate and post-graduate levels. The first meeting took place 22–27 September, when an unprecedented assemblage of 38 laureates and more than 200 young scientists gathered in Heidelberg. Plenary lectures were given by many of the laureates and workshops were organised by the younger researchers. Panel discussions, with laureates on the panel and active participants in the audience, covered various topics of mathematics and computer science. The mathematics laureates present were Sir Michael Atiyah, Gerd Faltings, Curt McMullen, Stephen Smale, Endre Szemerédi, Srinivasa Varadhan, Cédric Villani, Vladimir Voevodski, Avi Wigderson and Efim Zelmanov; moreover, among Turing awardees, there were “household names” in mathematics present such as Ronald Rivest

and Adi Shamir (the “RS” from the “RSA algorithm”), as well as Stephen Cook and Richard Karp, pioneers of complexity theory.

The plenary talks covered a broad range of themes. Sir Michael Atiyah gave his advice to young mathematicians based on his experiences of a long life in mathematics and continued his enthusiastic interaction with the younger generation in the informal parts of the forum and the social events.

Curtis McMullen discussed new connections between motions of billiard balls, Riemann surfaces and moduli spaces. Blogger Dana Mackenzie summarised his impressions of McMullen’s talk in his Scientific American blog Dances, Billiards and Pretzels: “When I came to the Heidelberg Laureate Forum, I expected a feast for my mind. I didn’t expect a feast for my eyes! Take a look at this incredible video, by Diana Davis, which was featured in today’s lecture by Fields medalist Curtis McMullen.” The video at <http://vimeo.com/47049144> is highly recommended for anyone seeking inspiration in communicating their research to a broader audience!

Vladimir Voevodsky gave a talk entitled Univalent Foundations of Mathematics. Despite a title and abstract which perhaps did not generate much buzz in advance among the young scientists, the talk was highly inspiring to both the mathematics and computer science sections of the audience. Blogger Julie Rehmeyer wrote in her Scientific American blog Voevodsky’s Mathematical Revolution: “On last Thursday at the Heidelberg Laureate Forum, Vladimir Voevodsky gave perhaps the most revolutionary scientific talk I’ve ever heard. ... Voevodsky told mathematicians that their lives are about to change. Soon enough, they’re going to find themselves doing mathematics at the computer, with the aid of computer proof assistants. ... Oh, and by the way — just in case the computer scientists in the crowd think that this has nothing to do with them — he also showed that the theory of programming languages is in fact the same thing as homotopy theory, one of the most abstruse areas of mathematics.”

Just about all mathematicians that we talked to embraced the fact that this was a joint event between mathematics and computer science, and they enjoyed the opportunity to interact with computer scientists both among the speakers and the young participants. Many interesting talks were on the interface between mathematics and computer science, by speakers from both communities. For instance, in one of the computer science talks, Turing awardee William M. Kahan described the errors that can appear in floating-point operations and sometimes hardly be found. He called for a better way of handling numeri-



Perhaps the most special feature of the Heidelberg Laureate Forum is the immediate contact between young scientists and laureates such as Cédric Villani (first picture), Srinivasan Varadhan (second picture) and Avi Wigderson (third picture) during the excursion day.

cal and computation errors and argued that improved schemes could have, among other things, prevented the crash of Air France #447 in June 2009. In another talk, on “zero knowledge”, Michael O. Rabin presented novel algorithms enabling an auctioneer to prove to bidders, without revealing any bid values, who had won a sealed bid auction. Zero knowledge proofs are very important in cryptography; in particular, these methods allow one to solve the important open problem of prevention of collision in auctions.

For the afternoon sessions, postdocs were invited to organise by themselves several workshops on mathematics or computer science where they described their own

research and its perspectives. Besides young researchers, many laureates attended these workshops and actively participated in these discussions, giving their points of view on the topics and related questions. One of the most attended and active workshops was on “How to balance your life?” organised by Matthias Hagen, a postdoc from Weimar/Germany, with Avi Wigderson as a participating laureate representative. The key question of the workshop was how to balance at least some of the four areas of life: (1) yourself, (2) your partner and family, (3) your job/career, and (4) your friends and society, throughout different stages of your career. Participants and the laureate shared their experiences and tried to at least formulate the problems that one needs to address to become successful, not only in your research career but in your personal life as well.

In addition, there were two panel discussions: one among computer science laureates, one among mathematics laureates. These treated topics such as expectations of the development of their fields and also the future interaction between mathematics and computer science, as well as how they personally developed in the way they did. A final panel discussion, with laureates, young researchers, organisers and members of the scientific committee, was an occasion to review the entire programme and to define the direction for future development of the Heidelberg Laureate Forum. Luckily, for the most part, it was confirmed that the organisers and the scientific committee had already made good choices.

The ambitious scientific programme was embedded in a very enjoyable setting. Heidelberg is a most beautiful environment for any event and the organisers (who had worked for more than a year on the project with a very competent and substantial team) missed no opportunity to make this a most enjoyable week for everyone. The programme included an evening party at the Neckar river, a boat cruise, a reception at the famous Heidelberg castle, one day at the modern “European Molecular Biology Laboratory” on the Heidelberg hills and a fancy dinner at the “Villa Bosch” for the laureates (on which Klaus Tschira commented: “having studied physics myself, I realised that the next best thing to having a Nobel prize myself was to be able to invite the laureates to my house that used to be the home of a Nobel laureate”). In addition, there were excursions for the young scientists to nearby scientific institutions and meetings of the laureates with local high school students. No effort or expense was too much to create a wonderful ambience for the laureates and the young scientists. To top it off, luck was with the organisers: while the week before was cold and rainy, the forum itself took place during a warm and sunny late summer week!

One of the guiding principles was that many events were created for informal interaction between laureates and young scientists (and we heard from many of them what a significant difference these made to them!) but also interaction between the laureates, as well as interaction between the young scientists from many different countries and with different educational backgrounds. Participation was free of charge to the young scientists; room and board were provided in nice Heidelberg downtown hotels.



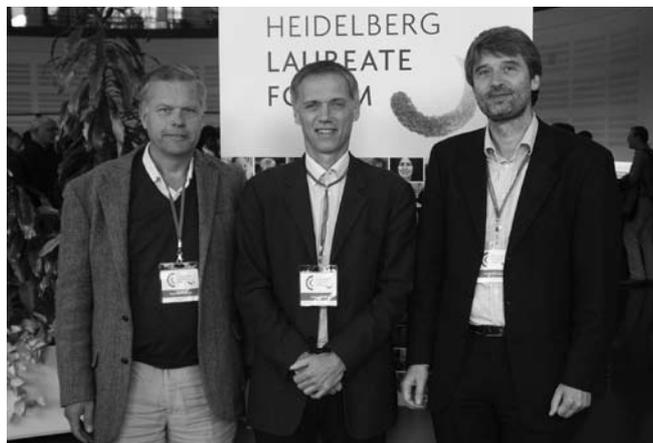
The laureates as well as representatives of the IMU, the ACM and the Norwegian Academy of Science and Letters and the Klaus Tschira Foundation.

The invitation of a group of scientific bloggers to the HLF was a clever idea, which contributed to communicating the meeting outside the meeting hall and furthermore served as an inspiration among the participants. These blogs, together with a rich picture gallery, are available from the HLF forum website <http://www.heidelberg-laureate-forum.org>.

In at least two ways, lasting values were created. For one, all plenary lectures were recorded and made available to the public almost immediately afterwards, so that many interested people from all over the world could join in (as the public was not included in the actual event). These videos are still available on the HLF website. And for another, a most beautiful book “Masters of Abstraction” was created for the occasion: the photographer Peter Badge had visited virtually all living laureates and taken very memorable pictures of each of them. This collection, together with a very brief text about them, was assembled in a book that was given as a present to all participants, young and old.

For the first edition of the “Heidelberg Laureate Forum”, more than 600 young scientists, from undergraduates to postdocs, applied for participation. It was one of the tasks of the scientific committee to select from these the young people that would gain the most from participating. This was done separately in mathematics and in computer science. In mathematics, we had a team of 25 prominent mathematicians from all over the world who evaluated the application files carefully and compared them with respect to educational age and background. We would like to use this opportunity to thank all those who helped us in this substantial effort! Over time, we expect more applications to come in. In order for this to happen, we would like to encourage the mathematics community to pass on the information to their students and postdocs so that the message reaches the desired people.

The Heidelberg Laureate Forum is an annual event that will take place in the last week of September; application is possible online until the end of February. Many young participants said they would very much like to come again; since new young scientists are being invited every year, the only chance to do so is to come again as a laureate. We all hope that the event will provide enough inspiration to some of them so that indeed they will one day be among the laureates of the Abel Prize, the Fields Medal, the Nevanlinna Prize and the Turing Award!



Helge Holden (center) received his PhD from the University of Oslo. Since 1986, after a postdoc period at the Courant Institute, he has been a professor at the Norwegian University of Science and Technology in Trondheim, Norway. He has served as Secretary and Vice-President of the EMS and is currently Chair of the Abel Board, which oversees all activities in connection with the Abel Prize.

Hans Munthe-Kaas (left) has a PhD from the Norwegian Institute of Science and Technology (1989). He has been a professor of computer science and is now a professor of mathematics at the University of Bergen, Norway. His main research interests are nonlinear partial differential equations, where he has focused on hyperbolic conservation laws, completely integrable systems, and flow in porous media. In particular, he is interested in the interplay between numerical methods and analytical tools. His main interests are at the borderland between computational mathematics, computer science and pure mathematics. In particular he works on applications of group theory and representation theory in structure preserving discretisation of differential equations, approximation theory and applied harmonic analysis. Munthe-Kaas has served as secretary for the Society for the Foundations of Computational Mathematics and is a member of the Abel Board.

Dierk Schleicher (right) obtained his PhD in mathematics at Cornell University, USA. After years in Berkeley, Stony Brook and Munich, he is now a professor at Jacobs University, Germany. His main research interests are in dynamical systems, especially complex dynamics and the dynamics of the Newton iteration. He is engaged in activities to support young mathematical talent, for instance as co-organiser of the 2009 International Mathematical Olympiad and as co-initiator of the “Modern Mathematics” Summer School series in Bremen and Lyon since 2011.

Helge Holden and Dierk Schleicher are members of the HLF scientific committee and, together with Hans Munthe-Kaas, were involved in the selection of the participating young mathematicians.

The authors would like to thank Mikhail Hlushchanka for contributing the participants’ points of view to this report.