Report of the IUPAP Commission C18: Mathematical Physics
October 2015

In the year since the election of the C18 commission for 2015-2017 in November 2014, the most important activities have been the selection of the three recipients of the young scientist awards 2015-2017, and the 18th International Congress of Mathematical Physics (ICMP) at Santiago de Chile, July 27–August 1, 2015.

Instead of awarding one prize per year, the C18 tradition has been to give three prizes for the entire period for which the commission is appointed. The previous C18 commission had solicited nominations and appointed a jury, headed by Antti Kupiainen, at the time IUPAP commission member and president of the International Association of Mathematical Physics (IAMP), to select the recipients. They are

Roland Bauerschmidt

Joseph Ben Geloun

Nicolas Rougerie.

C18 has approved this choice, and the prizes have been announced on the IUPAP web page

http://iupap.org/commissions/c18-mathematical-physics/news/

as well as in the September 2015 issue of the IUPAP Newsletter. The laudations for the candidates and a short description of their background and work are attached to this report.

The prize ceremony took place at the opening of the International Congress of Mathematical Physics at Santiago de Chile on July 27, 2015. The ICMP is the triannual world congress on mathematical physics, recognized and sponsored by IUPAP. The congress at Santiago de Chile, convened by Rafael Benguria (Pontificia Universidad Católica de Chile), presented the best results in mathematical physics of the last few years, and we regard it as a full success also in furthering the IUPAP mission: after the ICMP at Rio de Janeiro, 2006, it was the second time that this meeting was held in South America. It was preceded by a young researchers' symposium and accompanied by four satellite meetings in Brazil and Chile, and has strongly boosted South American visibility and international connectedness by bringing the international mathematical physics community once more to that continent. A congress report to IUPAP is provided by Rafael Benguria. At the congress, it was decided that the next ICMP will be held in Montréal, Canada, in 2018.

C18 has so far conducted its discussions and taken decisions by e-mail. C18 has decided unanimously to use its triannual budget primarily to cover the prize winners' travel and local expenses for attending the prize ceremony and the ICMP. The allocation of the remaining funds will be decided on later.

The C18 Commission has always closely worked together with the IAMP, and we plan to continue this in the future. To this end, the commission has unanimously agreed that the current president of the IAMP, Robert Seiringer, should be added as an associate member.

Compared to other IUPAP commissions, C18 represents a smaller community, hence the meetings are also small by IUPAP standards. Nevertheless, some of the many upcoming meetings in mathematical physics are large enough to meet the criteria of IUPAP Category B conferences and have submitted funding requests, which C18 has passed on to the IUPAP Council.

Mathematical physics is an interdisciplinary field, covering the full range of phenomena in physics, as well as all subfields of mathematics in their interaction with physics. It has given rise to astonishing insights and cross-fertilization of the two disciplines. As it is a theoretical activity without big equipment and without high budgets, researchers in all countries can, and do, make important contributions. C18 will continue to further exchange of information, support of scientists all over the world, and scientific progress, as well as possible.

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The recipients of the IUPAP young scientist awards, 2015-2017

Roland Bauerschmidt has been awarded the IUPAP Young Scientist Prize in Mathematical Physics 2015-2017 for his work on self-avoiding random walks in 4 dimensions and the development of supersymmetric renormalization group techniques for their study.

Born in Hannover, Germany, Roland Bauerschmidt studied in Bonn, Germany, and Zurich, Switzerland, and received his B.Sc. and M.Sc. in Physics from ETH Zurich. His Ph.D. in Mathematics (2013) is from the University of British Columbia, Vancouver, Canada. He spent the year 2013-2014 at the Institute for Advanced Study, Princeton, before moving to Harvard University, where he is currently a Postdoctoral Researcher. In 2016, he will return to the University of British Columbia as Assistant Professor of Mathematics.

Bauerschmidt has mastered, developed and extended a renormalization group program initiated by David Brydges and Gordon Slade, and made important contributions to this area. In a strikingly original paper, he provided a simple new way to understand the finite range decompositions of Gaussian fields that underpin the renormalization group approach. His work on the structural stability of non-hyperbolic dynamical systems is an essential ingredient in the application of the renormalization group method.

Bauerschmidt's work sheds new light on fundamental aspects of statistical physics, such as the behaviour of the self-avoiding random walk in four dimensions, quantum friction, and random matrix theory.

Joseph Ben Geloun has been awarded the IUPAP Young Scientist Prize in Mathematical Physics 2015-2017 for his pioneering work on the renormalization of tensor field theories and his discovery of their generic asymptotic freedom.

Joseph Ben Geloun was born 1976 in St. Louis, Sénégal. After graduating from Cheikh Anta Diop University in Dakar, Sénégal, he received his PhD in 2007 from Université Nationale du Bénin. After visitor's and postdoctoral positions at Université Paris-Sud, France, and University of Stellenbosch, South Africa, he held a post-doctoral position at the Perimeter Institute for Theoretical Physics, Waterloo, Canada, from 2010 to 2013. Presently he is at the Albert-Einstein-Institute of the Max-Planck society in Golm, Germany.

After his PhD, Ben Geloun entered research on quantum gravity. In just a few years he became a major expert in the field. His most striking results concern a new class of non-local renormalizable quantum field theories, called tensor field theories, whose perturbative expansion sums over random geometries weighted by a discretized Einstein-Hilbert action. In his classification of these models, he discovered an unexpected property, namely their generic ultraviolet asymptotic freedom.

He has also started to direct the research work of younger scientists such as Dine Ousmane Samary and Remy Avohou. Now a Humboldt Fellow at the Albert Einstein Institute in Golm, Germany, Ben Geloun is becoming a role model for the next generation of young African scientists.

Nicolas Rougerie has been awarded the IUPAP Young Scientist Prize in Mathematical Physics 2015-2017 for his exceptional contributions to the theory of cold quantum gases, in particular the proof of the appearance of a giant vortex and vortex circles in rapidly rotating Bose gases.

Nicolas Rougerie was born in 1985 in Versailles, France, and received his PhD in Mathematics from Université Pierre et Marie Curie, Paris, in 2010. He subsequently became a post-doctoral associate at Université de Cergy-Pontoise. In 2011 he was awarded a permanent CNRS researcher position in mathematics, at Laboratoire de Physique et Modélisation des Milieux Condensés, Grenoble (the only CNRS position in mathematical physics awarded in all of France in that year).

Already his doctoral thesis contains seminal results on giant vortices and vortex circles, and he published two important papers on these topics in 2011. This work was pushed further in a series of papers together with Michele Correggi, Florian Pinsker and Jakob Yngvason, which appeared 2011-2013. Further important contributions concern the quantum Hall regime of rapidly rotating Bose gases (joint with Sylvia Serfaty and Jakob Yngvason), a new approach to the mean-field limit in quantum many-body physics, based on a quantum version of de Finetti's theorem (joint with Mathieu Lewin and Phan-Tanh Nam). He has furthermore published work on polarons in quantum crystals, on higher dimensional Coulomb gases and on the average field approximation for extended anyons.