

## Report of the IUPAP Commission C18: Mathematical Physics

Since the previous C18 report in October 2015, two conferences within the scope of C18 have received IUPAP support, viz. *IMSE 2016: The 14th International Conference on Integral Methods in Science and Engineering* in Padova, Italy, July 25-29, 2016, and *QMATH 2016: The 13th International Conference on Mathematical Results in Quantum Physics*, at the Georgia Institute of Technology in Atlanta, USA, October 8-11, 2016.

We have already received the report from IMSE 2016, which had 128 attendees from 24 countries, including 104 attendees from outside Italy. Unfortunately, 11 participants from Turkey could not attend the conference due to political turmoil at the time. 26% of the participants and 33% of the invited speakers were female. Regretfully, many invitations to female speakers were rejected due to double bookings, while all invited male speakers attended. 27 scientists from developing countries and countries with a lack of national funding received travel support.

The organizers provided an impressive list of important new work presented at the conference. Highlights of particular interest to the physics community include theoretical studies of resonances of plasmonic nanoparticles, singular perturbation problems, new developments in the solution of boundary value problems through integral equations with applications to the heat equation, and applications of operator theory in magneto-hydrodynamics and in photonic crystals. The organizers provided a considerably longer list which also includes advancements in applied mathematics and in the mathematical analysis of engineering problems.

We have not yet received the report from QMATH 2016, which has just concluded. However, C18 secretary Rainer Dick from the University of Saskatchewan attended QMATH 2016 as a regular participant (fully funded from his own research funds) and gave a talk in the session on New Topics in Mathematical Physics. The secretary's impression of that meeting was very positive. Both plenary and parallel sessions at the conference were very well attended, with certainly more than 200 participants attending the plenary sessions, and each of the parallel session talks attended by about 25-50 participants. While most presenters were mathematical physicists, there were also well-received presentations from experts in quantum information, quantum control, and condensed matter physics.

We do not yet have statistical data on female speakers or international participation at QMATH 2016. However, we would like to mention that Yoshiko Ogata from the University of Tokyo gave a very interesting and well-received plenary talk on the class of asymmetrically gapped Hamiltonians. This is a class of Hamiltonians which Dr. Ogata introduced to advance our understanding of equivalence classes of gapped Hamiltonians. Her work combines the physical motivation to understand gapped Hamiltonians in condensed matter physics with mathematical advancements in the understanding of quantum spin chains, and may in return lead to an improved understanding of emergence and classification of energy gaps in band structures of materials. It is also noteworthy that many of the other presentations at the conference were also motivated by advancements in condensed matter physics or quantum information. Several talks at QMATH 2016 addressed topological phase transitions or the classifications of topological materials. This is apparently very timely and remarkable, given that the participants submitted their abstracts before the announcements of this year's Nobel Prize to Haldane, Kosterlitz and Thouless.

The support by IUPAP has been greatly acknowledged. Mathematical physics represents a relatively small subgroup of the international physics community, but it certainly does not live, nor could it thrive, in isolation. Mathematical physics has always had mutually beneficial, and often seminal, exchange with other areas of physics, including statistical physics, parti-

cle physics, gravitational theory, and string theory. In recent years, this exchange has been particularly strong in the areas of condensed matter physics and quantum information science.

In the year since the last report of C18, the main activity of the C18 commission has been the monitoring of events in mathematical physics that could potentially be eligible for support by IUPAP, in particular in developing countries. We have been in contact with a number of people organizing such events. However, there will be no meetings in 2017 that satisfy the IUPAP conditions for funding under Category B, because the number of participants in topical mathematical physics meetings rarely reaches 100, hence is below the current IUPAP threshold.

The next major conference in mathematical physics will be the 19th International Congress on Mathematical Physics (ICMP 2018), which takes place at Montreal, Canada, from July 23 to 28, 2018.

The exchange within the C18 commission is being done mainly by e-mail. Individual commission members meet in person at conferences, but there has not been a meeting of the commission as a whole this year.

Manfred Salmhofer, C18 commission chair, October 20, 2016