Scientific report of the workshop: **"Topological phases in correlated quantum system" (TCQS14)**

The combined workshop and seminar program was held from 14 July — 08 August 2014. The main goal was to bring together scientists working on topological phenomena in condensed matter systems, with an emphasis of such phenomena which arise due to inter-particle interactions. As the field of topological phases in correlated quantum system is a very young one, many of the participants and speakers were young scientists — either faculty before tenure, postdocs, or even graduate students.

Important progress was reported on several topics:

- Classification of topological phases in the presence of interactions. Major progress on the classification of interacting topological phases has been reported by several of the speakers including Lukasz Fidkowski (Stony Brook University), Titus Neupert (Princeton University), Michael Levin (University of Chicago), Andrew Essin (California Institute of Technology), and Fiona Burnell (University of Minnesota).
- Significant new developments on the field of symmetry protected topological phases has been presented by several speakers including by Shinsei Ryu (University of Illinois at Urbana-Champaign), Michael Levin (University of Chicago), Fiona Burnell (University of Minnesota), Masaki Oshikawa (University of Tokyo), Michael Zaletel (University of California, Berkeley), Keisuke Totsuka (Kyoto University), and Shigeki Onoda (RIKEN).
- New discoveries on how topologically ordered states could be realized in cold atom systems or be in newly designed materials. Key contributors included Gunnar Möller (University of Cambridge), Moty Heiblum (The Weizmann Institute of Science), Loren Aycock and Mohammad Hafezi (both from the University of Maryland).
- Non-abelian excitations in topologically ordered systems — which might be the basis for fault tolerant quantum computing. Contribution by Johannes Knolle (MPIPKS), Roger Mong (California Institute of Technology), Kirill Shtengel (University of California), Adiel Stern (The Weizmann Institute of Science), Seyyed Mir Abolhassan Vaezi (Cornell University), Jason Alicrea (Caltech), and Yidun Wan (Perimeter Institute for Theoretical Physics).
- Progress on the fractional quantum Hall effect and fractional topological insulators. Bulk-Edge correspondence in topologically ordered states was discussed in talks by Bernd Rosenow (Universität Leipzig), Andrea Young (Massachussetts Institute of Technology), Victor Gurarie (University of Colorado), Nicolas Regnault (École Normale Supérieure de Paris), and Steve Simon (University of Oxford).
- Entanglement and Many-Body Localization was covered in talks by Gil Refael (California Institute of Technology), Jens H Bardarson (MPIPKS), Dmitry Abanin (Perimeter Institute), and Ehud Altman (The Weizmann Institute of Science).

A very pedagogical introduction to "Topological Order" for non-specialists was given in a colloquium by Steve Simon (University of Oxford).

To summarize, the combined workshop and seminar program achieved its goal of bringing together a wide range of leading scientist. Active discussions (especially during the seminar weeks) stimulated further work and collaborative research in new directions.