Seminar and Workshop

Quantum many body systems out of equilibrium (QSOE13)

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Background. The three-week programme was conceived as an extended meeting on the topic of non-equilibrium situations in quantum many-body systems, treated as an emerging coherent field of study. It was intended that the programme would bring together several communities interested in quantum dynamics in systems out of equilibrium. These communities include experimentalists working with laser-cooled trapped atomic systems, pump-probe spectroscopy of correlated solid-state materials, non-equilibrium transport, and theoreticians addressing fundamental conceptual issues that arise out of equilibrium.

The programme was very successful in fulfilling this goal.

The event was well-timed for this purpose. In very recent years, the topic of out-of-equilibrium evolution has started to be recognized as an important subfield of condensed matter physics, quantum optics and quantum information theory. The explosive growth of interest in the topic makes it difficult to cover the important issues in a one-week meeting. The extended three-week format allowed the meeting to obtain a snapshot of a significant fraction of current activity in the field. It was widely recognized as the most important meeting of 2013 on the topic of non-equilibrium dynamics, as indicated by the prominent speakers and participants.

Format. The central week was a higher-intensity "Workshop week" with about a hundred participants. The first and third weeks were lighter "Seminar weeks" with lighter programmes, more time for discussion and collaboration, and 35-40 participants each.

In the central "Workshop week", there were 36 regular talks (each of 25-minute duration), one colloquium, and an after-dinner talk. The first week had fifteen regular 40-minute research talks and a special overview talk. The final week had 13 regular 40-minute research talks and two special sessions. In addition, each week had two poster sessions.

The poster sessions were held two afternoons each during the Seminar weeks, and as after-dinner sessions during the Workshop week. The poster sessions were well-attended, and the accompanying vibrant discussions continued well beyond the scheduled time. There were more than 60 posters presented in total.

The sessions were not organized by subtopic; instead different subtopics were mixed into each session. This seemed to work well as participants at each session got exposure to a variety of emerging themes.

Scientific highlights. As intended, a number of themes were addressed in the workshop. We mention a few here:

A significant fraction of presentations addressed cold-atom experiments on non-equilibrium phenomena, including transport, Bloch oscillations, soliton dynamics, matter-wave scattering, and spin dynamics. There were also a few talks on pump-probe spectroscopy experiments. Among the theory talks, many addressed particular types of existing or feasible experimental systems, such as cold atom experiments, cavity and polariton experiments, and non-equilibrium transport. A number of theory talks addressed conceptual issues such as the nature of thermalization in isolated systems, interaction quenches in Luttinger liquids and other correlated systems, the role of integrability and conservation laws, many-body localization, open quantum systems, etc.

Special talks and sessions. Several special sessions were incorporated into the programme in order to highlight the different communities brought together in this meeting. In the first and second weeks, there were one-hour Symposia providing broad overviews of pump-probe spectroscopy and cold atom experiments, delivered respectively by J. Demsar and D. Weiss, two internationally leading experts. During the second (workshop) week, the institute colloquium (by H.-P. Breuer) addressed dynamics in open quantum systems. During the third week, there was a special session on the role of integrability in non-equilibrium dynamics, featuring an overview talk by F. Essler on quenches in integrable systems and several short talks on other aspects of integrability. The third week also contained a session on short talks by junior physicists.

Summary. The workshop collected and attracted a large number of researchers interested in the rapidly growing field of quantum matter out of equilibrium. The overwhelming interest in attending the programme (many applicants had to be rejected) and the participation of many leading researchers showed that a multi-week event was appropriate and useful. The meeting was characterized by an overall high quality of talks and a lot of discussions and interaction between different communities. We believe that the programme was successful in its goals, and that it will positively stimulate further growth of the field.