

Scientific Report: Cost MP1209 Training School on 'Thermodynamics and non-equilibrium phenomena at quantum interfaces of light and matter'

19th-24th September 2016, Cambridge, United Kingdom

The organizing committee was Prof Mete Atature (University of Cambridge, UK) and Prof Hakan Türeci (Princeton University, USA)

The school consisted of long lectures (1-2 hours) given by the distinguished invited lecturers, one-hour exercise sessions related to each topic of the lectures, eight 20-minute talks given by the trainees, and two poster sessions, where the trainees presented their work. The lecturers were present for a significant part of the school to discuss the lecture topics and the relevant scientific problems with the attendees. The lectures were broadcast over the internet publicly and Istanbul Technical University (Turkey) arranged a public viewing with two-way communications in a conference hall for their students.

In total 49 trainees and 13 lecturers attended the school.

The lecturers were

- [Howard Carmichael](#), University of Auckland, New Zealand,
- [Darrick Chang](#), ICFO, Barcelona, Spain,
- [Sebastian Diehl](#), Technical University of Dresden, Germany,
- [Steve Girvin](#), Yale University, USA,
- [Zoran Hadzibabic](#), University of Cambridge, UK,
- [Austen Lamacraft](#), University of Cambridge, UK,
- [Benjamin Lev](#), Stanford University, USA,
- [Florian Marquardt](#), Max Planck Institute for Light, Germany,
- [Giovanna Morigi](#), University of Saarland, Germany,
- [Anatoli Polkovnikov](#), Boston University, USA,
- [Hakan Türeci](#), Princeton University, USA,
- [Janet Anders](#), University of Exeter, UK.

In addition, there was a public talk by Malcolm Longair on the history of Theoretical Physics at the Cavendish Laboratory, and a Tribute talk by Nir Navon on the work and life of the late Deborah Jin.

The lecture topics were

- Quantum optics and quantum stochastic processes
- Quantum thermodynamics & quantum heat engines
- Quantum measurement of systems far from equilibrium
- Nonequilibrium quantum optomechanics
- Interacting Photons In Confined Geometries – From Cavities to Waveguides
- Driven-dissipative phenomena in Bose Einstein condensates

- Exciton and Polariton Condensation Dynamics
- Collective Phenomena in Multi-Emitter Systems
- Quantum adiabatic processes and topology
- Synthetic gauges, chemical potentials and quantum Hall States of light
- Quantum heat engines in biological systems

The lecturers had strived to make links between their topics, and linking their topics to (quantum) thermodynamics. They also worked hard to make their lectures accessible for the graduate students attending the school. Their lecture slides and model solutions to the exercises were presented to the school participants on the school website (under password).

The format was successful: the lecturers had enough time to tell about the details of their topics in a way that students could follow, the exercise sessions activated the students and also allowed creating a good atmosphere for learning, and the short talks gave some fresh variation to the schedule, and also showed what kind of topics are being studied related to the topics of the lectures. After the initial transient period the trainees also started actively asking questions during the lectures.

In all, the summer school was a successful event and the organizers thank the EU COST MP1209 Action for making it possible.

Programme

Monday 19th September 2016

09:00-11:00	Howard Carmichael (University of Auckland, New Zealand)
11:00-11:30	Coffee Break
11:30-12:30	Janet Anders (University of Exeter, UK)
12:30-14:30	Lunch
14:30-16:30	Florian Marquardt (Max Planck Institute for Light, Germany)
16:30-17:00	Coffee Break
17:00-18:00	Free

Tuesday 20th September 2016

09:00-11:00	Howard Carmichael (University of Auckland, New Zealand)
11:00-11:30	Coffee Break
11:30-12:30	Darrick Chang (ICFO, Barcelona, Spain)
12:30-14:30	Lunch
14:30-16:30	Steven Girvin (Yale University, USA)
16:30-17:00	Coffee Break
17:00-18:00	Florian Marquardt (Max Planck Institute for Light, Germany)
19:00-22:00	School Banquet: St John's College Great Hall

Wednesday 21st September 2016

09:00-11:00	Steven Girvin (Yale University, USA)
11:00-11:30	Coffee Break
11:30-12:30	Sebastian Diehl (Technical University of Dresden, Germany)
12:30-14:30	Lunch
14:30-16:30	Giovanna Morigi (University of Saarland, Germany)
16:30-17:00	Coffee Break
17:00-18:00	Benjamin Lev (Stanford University, USA)

Thursday 22nd September 2016

09:00-11:00	Malcolm Longair "History of Cavendish" (Public Talk)
11:00-11:30	Coffee and Cake Reception
11:30-14:30	Free time
14:30-16:30	Social event: Fitzwilliam Museum

16:30-17:00 Social event: Punting Tours on the River

17:00-18:00 Social event: Historic pub crawl

Friday 23rd September 2016

09:00-11:00 Anatoli Polkovnikov (Boston University, USA)

11:00-11:30 Coffee Break

11:30-12:30 Nir Navon "The work of Deborah Jin" (a tribute session)

12:30-14:30 Lunch

14:30-16:30 Anatoli Polkovnikov (Boston University, USA)

16:30-17:00 Coffee Break

17:00-18:00 Austen Lamacraft (University of Cambridge, UK)

Saturday 24th September 2016

09:00-11:00 Zoran Hadzibabic (University of Cambridge, UK)

11:00-11:30 Coffee Break

11:30-12:30 Student Session

12:30-14:30 Lunch

14:30 Training School Completed

Attendance

The Training School was attended by 49 trainees (94% ESR, 12% female) and 13 lecturers.

COST supported 10 of the trainees and 6 of the lecturers.