

Scientific Report: Cost MP1209 Winter school on thermodynamics of small quantum systems: thermal and topological phenomena

12th-16th January 2015, Tuusula, Finland

The chairman of the organizing committee was Prof. Tero Heikkilä from University of Jyväskylä, Finland.

The school consisted of long lectures given by 5 distinguished lecturers, each having three hour-long lectures (except Mika Sillanpää two hours), one-hour exercise sessions related to each topic of the lectures, 8 20-minute talks given by the trainees, and two poster sessions, where the trainees presented their work. The exercises were done in 8 different groups, and the lecturer of each topic was present to help with difficult cases.

In total 57 trainees and 5 organizers attended the school in addition to the lecturers.

The lecturers and their topics were

- [Piet Brouwer](#), Freie Universität Berlin: *Topological superconductors*
- Charles Grenier, ETH Zürich: *Thermal effects in ultracold atom systems*
- [Takahiro Sagawa](#), University of Tokyo: *Quantum thermodynamics*
- [Mika Sillanpää](#), Aalto University: *Fast measurements*
- [André Xuereb](#), University of Malta: *Optomechanics*

Charles Grenier replaced Prof. Corinna Kollath (university of Bonn), who had to cancel her trip 1.5 weeks before the school due to personal reasons.

The lecturers had strived to make links between their topics, and with their topics to the (quantum) thermodynamics. They also had 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 winter school was a successful event and the organizers thank the EU COST program for making it possible.

Programme

Monday 12.1.

- 18 Arrival
- 19-21 Reception dinner, restaurant Gustavelund

Tuesday 13.1.

- 9-9:03 Opening, Tero Heikkilä
- 9:03-11:03 Piet Brouwer, Freie Universität Berlin
Lecture: *Topological superconductors*
- 11-11:30 *coffee break + start of exercises*
- 11:30-12:30 Piet Brouwer, Freie Universität Berlin
Exercise session: *Topological superconductors*
- 12:30-14 *lunch*
- 14-15 Charles Grenier, ETH Zürich
Lecture: *Thermal effects in ultracold atom systems*
- 15-15:20 Brian Michael Tarasinski, Universiteit Leiden
Short talk: *Scattering theory of topology in discrete-time quantum walks*
- 15:20-15:40 Laura Ortiz, Universidad Complutense de Madrid
Short talk: *Rashba spin-orbit interaction in a two-dimensional topological insulator*
- 15:40-16 *coffee break*
- 16-17 Piet Brouwer, Freie Universität Berlin
Lecture: *Topological superconductors*
- 17-17:20 Sneidera Hernandez, IFCO, Barcelona
Short Talk: *Local temperature in interacting spin systems*
- 17:20-18 free
- 18-20 first poster session with poster presentations

20-22 *dinner (Mauri's hall and sauna (20:30:22*

Wednesday 14.1.

9-10 Takahiro Sagawa, University of Tokyo
Lecture: *Quantum thermodynamics*

10-11 Charles Grenier, ETH Zürich
Lecture: *Thermal effects in ultracold atom systems*

11-11:30 *coffee + start of exercises*

11:30-12:30 Charles Grenier, ETH Zürich
Exercise session: *Thermal effects in ultracold atom systems*

12:30-14 *lunch*

14-15 Charles Grenier, ETH Zürich
Lecture: *Thermal effects in ultracold atom systems*

15-15:20 Ivan Savenko, Aalto University
Short talk: *Temporal coherence properties of coupled dissipative two-dimensional quantum oscillators*

15:20-15:40 Alessandro Braggio, CNR-SPIN, Genova
Short talk: *Heat exchange statistics in driven open quantum systems*

15:40-16 *coffee*

16-17 Takahiro Sagawa, University of Tokyo
Lecture: *Quantum thermodynamics*

17-17:20 M. Hamed Mohammady, Instituto de Telecomunicações
Short talk: *Minimising the heat dissipation of maximal information erasure*

18-19:30 *social activity: laavu challenge*

20-22 *dinner (Mauri's hall and sauna (19:30:22:00)*

Thursday 15.1.

- 9-11 André Xuereb, University of Malta
Lecture: *Optomechanics*
- 11-11:30 *coffee and start of exercises*
- 11:30-12:30 Takahiro Sagawa, University of Tokyo
Exercise session: *Quantum thermodynamics*
- 12:30-14 *lunch*
- 14-15 Takahiro Sagawa, University of Tokyo
Lecture: *Quantum thermodynamics*
- 15-16 André Xuereb, University of Malta
Exercise session: *Optomechanics*
(*coffee served during the exercise session*)
- 16-16:20 Short break
- 16:20-17:20 Mika Sillanpää, Aalto University
Lecture: *Fast measurements*
- 17:20-17:40 Cyril Elouard, Institute Néel, Grenoble
Short talk: *Information thermodynamics in a hybrid opto:
mechanical system*
- 17:40-18:00 Tuomo Tanttu, Aalto University
Short talk: *Single:electron Pump for Current Metrology*
- 18:30-20 second poster session
- 20- *dinner, Restaurant Gustavelund*
- Friday 16.1.**
- 8:45-9:45 André Xuereb, University of Malta
Lecture: *Optomechanics*
- 9:45-10:45 Mika Sillanpää, Aalto University
Exercise session: *Fast measurements*
Coffee served during the exercises
- 10:45-11 Check-out from the hotel
- 11-12 Mika Sillanpää, Aalto University

Lecture: *Fast measurements*

12-13:30 *lunch*

13:30 last shuttle departs

Attendance

The Training School was attended by 59 trainees (100% ESR, 12% female), 5 lecturers and 5 organisers.

COST supported 29 of the trainees and 4 of the lecturers.