

Scientific Report: Cost MP1209 Thermodynamics in the Quantum Regime
Scuola Normale Superiore, Pisa (Italy)
7th -9th October 2013

The three Working Groups of the COST Action met for the first time on the 7th & 8th October 2013. The Management Committee had its second meeting on the 9th October 2013.

The Local Organiser was Vittorio Giovannetti, Associate Professor at SNS.

The programme focused on discussion between researchers in each working group (full details of the programme are below).

Working Group 1 Report – Antonio Acin

Jens Eisert gave a presentation on the past achievements and on the current status of the Research in WG1. The sessions on WG 1 were organized as follows. Each researcher attending the WG1 meeting made a short introduction about their research. Several relevant open questions were identified. It was also noticed that people with different backgrounds and terminologies were involved in the WG1 (for instance, the word “equilibration” did not have the same implications for all the researchers). Somehow, all this discussion showed the variety of interests in the working group. Finally, it was agreed that it was better to join the rest of WG’s and avoid parallel sessions. So, in the second day, WG1 was merged with the other WG’s.

Working Group 2 Report – Eric Lutz

Eric Lutz gave a presentation on the past achievements and on the current status of the Research in WG2. The first part of the discussion was devoted to a comparison of two different approaches to quantum thermodynamics, namely the quantum informational approach and the statistical mechanical approach. A talk by Paul Skrzypczyk (Barcelona, Spain) dealt with the maximum amount of work that can be extracted from a quantum system using quantum resource theory. A talk by Massimiliano Esposito (Luxembourg) presented the stochastic thermodynamics viewpoint on the question. A lively discussion between all the members of the WG contributed to narrow the bridge between the two fields, highlighting methodological differences, and well as weaknesses and strengths of the two approaches. In the second part of the discussion, Kilian Singer (Mainz, Germany) gave a talk on the experimental realization of a heat engine using single trapped ion and on the experimental observation of the Kibble-Zurek mechanism using ion chains. The exchange between theorists and experimentalists focused on how to measure thermodynamic quantities like heat and work in the quantum regime and how to engineer arbitrary reservoirs.

Working Group 3 Report – Alberto Imparato

Alberto Imparato (AI) gave a presentation on the past achievements and on the current status of the Research in WG3. After that we had first an introductory meeting, where the participants in WG3 got to know each other. Then we had a few talks where experiments, relevant to WG3, were presented. In particular James Millen (UCL) gave a presentation on levitated microspheres in optical tweezers, and their thermodynamic properties. Kilian Singer (Mainz) gave a talk on single ion heat engines and realization of the Kibble-Zurek mechanism. Finally Jörg Schmiedmayer (Wien) discussed the experimental study of relaxation in isolated quantum systems, in particular in 1d Bose gas. Finally, we decided to have common meetings with the other groups (WG1 and WG2), where common issues were discussed, in particular the definition of thermodynamic quantities in quantum

systems.

Programme

Monday 7th Oct -- 1st WG meeting

til 10:00 registration & attendance list

10:00 start of meeting

(room: Sala Azzurra -- SNS main building second floor)

10:00-10:30 Introduction to MP1209 Thermodynamics in the quantum regime network
(Janet Anders)

10:30-11:00 Background, recent breakthroughs and key questions in WG1 (Jens Eisert)

11:00-11:30 coffee break *(SNS main building second floor)*

(room: Sala Azzurra -- SNS main building second floor)

11:30-12:00 Background, recent breakthroughs and key questions in WG2 (Eric Lutz)

11:30-12:30 Background, recent breakthroughs and key questions in WG3 (Alberto
Imparato)

12:30-14:30 lunch in SNS canteen

*(rooms: WG1 Aula Russo, WG2 Aula Mancini, WG3 Aula Contini. All the rooms are located at
the first floor of the SNS main building)*

14:30-18:30 Research discussions in WG1, WG2 and WG3

18:30 free time

19:30 conference dinner in the SNS canteen (second floor).

Tuesday 8th Oct -- 1st WG meeting

til 9:30 registration & attendance list

poster boards available for use during the whole day

9:30 start of meeting

(rooms: WG1 Aula Russo, WG2 Aula Mancini, WG3 Aula Contini)

9:30-11:00 Research discussions in WG1, WG2 and WG3

11:00-11:30 coffee break

11:00-13:00 Research discussions in WG1, WG2 and WG3

13:00-14:30 lunch canteen

(rooms: WG1, WG2, WG3 room)

14:30-17:30 Research discussions in WG1, WG2 and WG3

(rooms: WG2 room)

17:45-18:00 close

18:00 departure

Wednesday 9th Oct -- MC meeting

til 9:30 registration & attendance list

9:30 start of meeting

(room: SALA AZZURRA -- SNS main building second floor)

9:30-11:00 MC meeting with overview from network chair/vice-chair and contributions from Webmasters, STSM coordinators, Equalities representatives, and ESR representatives.

11:00-11:30 coffee break

11:30-13:00 MC meeting: new year budget, next year's event organisation

13:00 lunch and departure

The attendance was as follows:

Monday 7 October - 34 people (45% ESR, 12% female)

Tuesday 8 October - 32 people (48% ESR, 13% female)

Wednesday 9 October - 17 people (37% ESR, 25% female)

The Local Organiser Support budget was €20 per person per day. With 83 people attending over 3 days €1660 was reimbursed for Local Organiser Support.