"Energetics in the quantum regime"

Prof. Dario Ferraro

Lecture 1
- Definitions of work and heat at the quantum level.
- Work fluctuations in the classical case: Jarzynski equality and Crooks relation.
Sections 2.1, 3.1, 3.2 of
S. Vanjanampathy and J. Anders, "Quantum Thermodynamics", Contemporary Physics, 57, 545 (2016).

Lecture 2
- Quantum Jarzynski equation.
- Dynamics of open quantum systems: general aspects.
Sections 3.5, 3.6, 4.1 of
S. Vanjanampathy and J. Anders, "Quantum Thermodynamics", Contemporary Physics, 57, 545 (2016).

Lecture 3
- Dynamics of open quantum systems: static and periodic case.
Sections 3.2; 3.3 of
S. Bhattacharjee and A. Dutta, "Quantum thermal machines and batteries", Eur. J. B 94, 239 (2021).

Lecture 4
- Collisional model for dissipative systems.
Section 4.1; 4.2; 4.4; 4.6; 4.7; 5.1; 5.3; 5.4; 5.6 of
F. Cicciarello, S. Lorenzo, V. Giovannetti . G. M. Palma, "Quantum collision models: Open system dynamics from
repeated interaction", Phys. Rep. 954, 1 (2022).

Lecture 5
- Thermodynamics and information: Maxwell's demon, Landauer's erasure and Szilard's engine.
P. S. Pal, A. M. Jayannavar, Resonance 26, 443 (2021).
- Three-level maser as a continuous heat-engine.
- Quantum Carnot cycle for a particle in a box.
Sections 2.1; 2.2 of S. Bhattacharjee and A. Dutta, "Quantum thermal machines and batteries", Eur. J. B 94, 239 (2021).

Lecture 6 (by Prof. Fabio Cavaliere)
- Quantum Otto engine.

Lecture 7
- Introduction to Quantum Batteries.
- Work extraction and ergotropy.
F. Campaioli, F. A. Pollock, S. Vanjanampathy, "Quantum Batteries", arXiv:1805.05507.
- Quantum speed limit and averaged charging power.

Sections 2.1, 2.2; 2.3 of S. Deffner and S. Campbell, J. Phys. A: Math. Theor. 50, 453001 (2017).

Lecture 8 (by Alba Crescente)
- Classical and quantum charging of a quantum battery.

Lecture 9 (seminar by J. Quach)
- Experimental evidences of quantum batteries.