

Title:	<i>Stochastic Thermodynamics in Open Quantum Systems</i>
Lecturers:	Giacomo Guarnieri
Duration:	20 hours
CFU:	4
Period:	April – June 2024
Content:	<p>The course will give an overview of this emerging and interdisciplinary field of research, starting from providing definitions of heat, work, entropy production and of the Laws of Thermodynamics in open quantum systems, and arriving to their stochastic characterisation along single quantum trajectories. This will lead to quantify their fluctuations and introduce milestone results such as (i) the fluctuation-dissipation theorem in linear response theory; (ii) the fluctuation relations and (iii) the Thermodynamic Uncertainty Relations.</p> <p>The main purpose of this course is to give a solid foundation for analyzing the energetics of these systems using state-of-the-art notions and techniques that are at the forefront of research in this field, critically assessing their regimes of validity and limitations and highlighting open research directions.</p> <p><i>Main Topics covered:</i> Master equations; Laws of Thermodynamics for open quantum systems; Landauer's erasure and Maxwell's demon; Two-point measurement approach; Full-counting statistics; Thermodynamics of quantum jump trajectories; Fluctuation Relations; Thermodynamic Uncertainty Relations.</p>
Notes	<p>The evaluation will be based on the presentation of a topic treated during the course, or a small project developed with the tools learned during the course.</p>