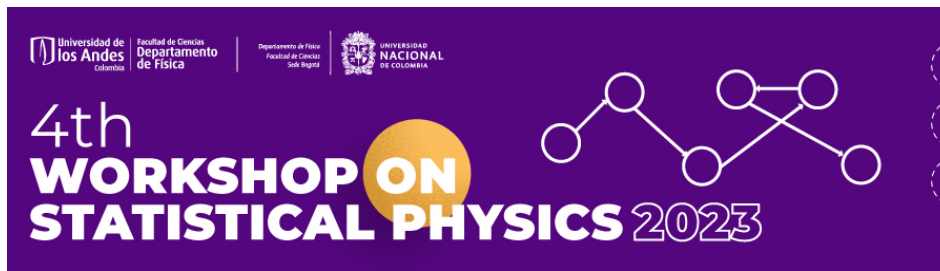


## 4th Workshop on Statistical Physics



Contribution ID: 51

Tipo: **Tutorial courses**

# Quantum thermodynamics: fluctuations and thermal machines

*lunes, 2 de octubre de 2023 16:00 (1h 30m)*

In the last decades thermodynamics have been extended to small (microscopic or nanoscopic) scales, where fluctuations play a major role pushing systems out of equilibrium, and where genuine quantum effects cannot be neglected anymore. Quantum thermodynamics is an interdisciplinary and growing field that places at the intersection of quantum information and non-equilibrium statistical physics. It aims to study quantum systems from a new perspective, emphasizing the energetic and entropic costs of quantum operations, and investigating possible enhancements of classical thermodynamic tasks by means of genuine quantum effects.

In this mini-course I will introduce some of the main concepts in quantum thermodynamics, including the definitions of work, heat or entropy production at the quantum level, but also some of their applications, such as designing quantum thermal machines that perform useful thermodynamic tasks. For that purpose I will introduce some basics of open and monitored quantum systems, that will allow us to describe fluctuations of relevant thermodynamic quantities in generic quantum processes. Using these tools we will also see how to derive universal results such as the so-called fluctuation theorems, as well as other related inequalities, altogether refining our understanding of the second law and irreversibility.

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