Invited Speaker 6

A Resource-Theoretic Approach to Quantum Thermodynamics

Nelly Ng Huei Ying

Nanyang Technological University

Short Abstract:

Recent years have enjoyed an overwhelming interest in quantum thermodynamics, a field of research aimed at understanding thermodynamic tasks performed in the quantum regime. Further progress, however, seems to be obstructed by the lack of experimental implementations of thermal machines in which quantum effects play a decisive role. In this talk, I describe a blueprint of quantum field machines, which fills this gap by constructing several modularized components in one-dimensional ultra-cold atomic gases. These models are derived within Bogoliubov theory, which allows us to study the operational primitives numerically in an efficient way. By composing the numerically modelled operational primitives we design complete quantum thermodynamic cycles that are shown to enable cooling and hence giving rise to a quantum field refrigerator. The active cooling achieved in this way can operate in regimes where existing cooling methods become ineffective.

As an alumnus of the CNYang scholars program in NTU, I will also share some of my memories of key experiences in the program, and how they have shaped my values as an academic.

Short Bio:

Nelly received her B.Sc. (Hons) from the physics department of SPMS, Nanyang Technological University in 2012. She worked as a research assistant at the Centre for Quantum Technologies for a few years. In 2017, she received her PhD on the study of quantum information theory and thermodynamics from Delft University of Technology. From November 2017 - March 2020, Nelly was hosted at the Free University of Berlin, first as an Alexander von Humboldt Postdoctoral Research Fellow, and then subsequently as a postdoctoral fellow. She joins the Physics faculty at SPMS, NTU in November 2020 as Nanyang Assistant Professor.