

MCQM Seminar: Hal Tasaki (Gakushuin University)

Wednesday, 10 January 2024 14:15 (1 hour)

Title: What is thermal equilibrium and how do we get there? — Typicality and thermalization in isolated macroscopic quantum systems

Abstract: I discuss the foundation of equilibrium statistical mechanics based on the quantum mechanics of isolated macroscopic systems. After clarifying what the equilibrium statistical mechanics is all about, I will present the modern understanding that thermal equilibrium should be regarded as a property (or a collection of properties) that an overwhelming majority of legitimate physical states share. This typicality picture is supported by firm mathematical considerations and (in my opinion) now has been accepted by a majority of experts. I will then turn to the much more difficult (and largely unsolved) question of thermalization, i.e., the approach to thermal equilibrium by means of the quantum-mechanical unitary time evolution. I will discuss general scenarios of thermalization based on the ETH (energy eigenstate thermalization hypothesis) or the hypothesis of a large effective dimension. I will finally discuss my recent result with Naoto Shiraishi on a fully rigorous example of thermalization in (unfortunately) a free fermion chain. The main part of the talk is based on the work of various authors. The references can be found in the following two papers of ours. <https://arxiv.org/abs/1507.06479> <https://arxiv.org/abs/2310.18880>.