Irreversibility in Isolated Macroscopic Quantum Systems: A General Theory and a Toy Example

Hal Tasaki

Gakushuin University

To understand the origin of irreversible behaviors in macroscopic systems, in particular, the approach to thermal equilibrium from non-equilibrium initial states, is among the most fundamental unsolved problems in theoretical and mathematical physics. Here we describe a general theory based on the large-deviation point of view and the assumption of "large effective dimension", which enables us to establish the approach to equilibrium in an isolated quantum system [1]. We then present a (very artificial) toy example in a free fermion system, which we call the "Mersenne diffuser", where an irreversible behavior can be established without any unproven assumptions.

[1] Hal Tasaki "Typicality of thermal equilibrium and thermalization in isolated macroscopic quantum systems", J. Stat. Phys. 163, 937–997 (2016), arXiv:1507.06479