

"Breakdown of Thermalization in Disordered Quantum Systems: Many Body Localization and its Consequences"

The question of whether isolated interacting quantum many body systems can "thermalize", namely approach thermal equilibrium under their own unitary dynamics, is a venerable one in quantum statistical mechanics. Recent theoretical and experimental investigations triggered a new wave of interest onto this fundamental problem suggesting that quenched random disorder can provide a generic and robust mechanism for thermalization-breakdown, via the phenomenon of Many Body Anderson Localization (MBL). While some intriguing properties of this non-ergodic phase of quantum matter have been explored, specifically concerning entanglement growth, broken symmetry phases or persistent memory of initial conditions, many questions remain wide open.

The goal of this internship is to investigate specifically the dynamical consequences of MBL, by studying models of disordered quantum systems out of equilibrium. Different theoretical tools will be used, depending on the strength and expertise of the candidate, ranging from numerical methods (exact diagonalization and its variants) to analytical approaches on simplified models.