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Title: “Dynamical entanglement and localization in disordered oscillator systems”.

Abstract: Many-body localization (MBL) is the analogue of Anderson localization for large quantum systems when both disorder and interactions are present. Many-body localized systems do not thermalize under their own dynamics, i.e., they suppress transport. Hence they can be used as quantum storage devices.

In this talk, we discuss (briefly) the current understanding of the MBL phenomena from a physical and mathematical point of view. Then we present recent MBL results for a class of disordered oscillator systems. In particular, we study the non-equilibrium dynamics of a disordered quantum system consisting of coupled harmonic oscillators in a d-dimensional lattice. If the system is sufficiently localized, we show that, starting from a broad class of initial product states that are associated with a tiling (decomposition) of the d-dimensional lattice, the dynamical evolution of entanglement scales like the surface area of the subsystem (an area law) in all times after averaging the disorder. Such weak evolution of entanglement is considered as a crucial indicator of MBL. Moreover, for dimensions $d\geq 2$, we discuss how our entanglement bound hints a dependency on the geometry of the subsystems.

Research Areas: Mathematical Physics: Disordered Quantum Many Body Systems, Many-Body Localization, Quantum Information Theory; Operations Research/Simulation; Monte Carlo methods.