Chez Pierre

Presents ...

Monday, February 8, 2016
12:00PM
MIT Room 4-331

Special Chez Pierre Seminar

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” Non-equilibrium quantum phases and critical phenomena in isolated systems“

Advances in quantum optics based measurements in cold atoms, trapped ions, NV centers in diamond, and related systems open the door to the experimental investigation of coherent quantum many-body dynamics isolated from their environment. Despite the absence of external sources of dissipation like phonons, isolated quantum many-body systems typically exhibit chaotic, ergodic dynamics that rapidly produce featureless patterns of entanglement, and leads to a steady-state equilibrium described by familiar thermal statistical mechanical principles.

The addition of strong random disorder can produce a strikingly different scenario -- Many-body localization (MBL) -- in which ergodicity breaks down due to the localization of excitations that produce thermalization. Far from being just trivially localized, I will describe how MBL systems exhibit phenomena typically associated with zero-temperature quantum matter, such as coherent quantum information storage, topological phases, and quantum criticality, despite being effectively at very high "temperature" (i.e. large micro-canonical entropy).

Thermalization and MBL represent two sharply distinct fates for macroscopic, isolated quantum systems, and are separated by a dynamical phase transition between a thermal equilibrium fluid with classical dynamics, and a quantum coherent state that violates statistical mechanical principles. Such transitions are conceptually distinct from any previously studied class of critical phenomena, and I will describe some recent progress in understanding their universal properties.