

Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Many body localization: a new frontier for quantum statistical physics"

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Abstract: "The existing theory of quantum statistical mechanics describes open systems in contact with large reservoirs. However, experimental advances in the construction and control of isolated quantum systems have highlighted the need for an analogous theory of isolated systems. It has been realized that isolated quantum systems can support behavior, which has no analog in open quantum systems. A prominent example is the phenomenon of many body localization.

Many body localization occurs in isolated quantum systems, usually with strong disorder, and is marked by absence of dissipation, absence of thermal equilibration, a strictly zero DC conductivity (even at energy densities corresponding to high temperatures), and a memory of the initial conditions that survives in local observables for arbitrarily long times. Recently, my co-workers and I have demonstrated that many body localization also opens the door to new states of matter, which cannot exist in thermal equilibrium, such as topological order at finite energy density, or broken symmetry states below the equilibrium lower critical dimension. We have also uncovered a host of unexpected properties, such as a set of universal spectral features and a non-local charge response, that have striking implications for fields as diverse as quantum Hall based quantum computation and quantum control. In this talk, I review the essential features of the many body localization phenomenon, and present some of the recent progress that I have made in this field. I also discuss the implications of these results for both theory and experiment.

12:00noon
Tuesday, September 16, 2014
Duboc Seminar Room (4-331)