Joint JQI/Condensed Matter Theory Center Seminar

Wednesday, November 6, 2013
11:00 am to 12:00 pm, CSS 2115

Norman Yao

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"Many-body Localization with Dipoles"

Statistical mechanics is the framework that connects thermodynamics to the microscopic world. It hinges on the assumption of equilibration; when equilibration fails, so does much of our understanding.

In isolated quantum systems, this breakdown is captured by the phenomenon known as many-body localization. Many-body localized phases violate Ohm's law and Fourier's law as they conduct neither charge nor heat; they can exhibit symmetry breaking and/or topological orders in dimensions normally forbidden by Mermin-Wagner arguments; they hold potential as strongly interacting quantum computers due to the slow decay of local coherence.

In this talk, I will briefly introduce the basic phenomena of many-body localization and review its theoretical status. To date, none of these phenomena has been observed in an experimental system, in part because of the isolation required to avoid thermalization. I will consider several dipolar systems which we believe to be ideal platforms for the realization of MBL phases and for investigating the associated delocalization phase transition. The presence of strong interactions in these systems underlies their potential for exploring physics beyond that of single particle Anderson localization. However, the power law of the dipolar interaction immediately raises the question: can localization in real space persist in the presence of such long-range interactions? I will review and extend several arguments producing criteria for localization in the presence of power laws and present small-scale numerics regarding the MBL transition in several of the proposed dipolar systems.

Joint work with: C. R. Laumann, S. Gopalakrishnan, M. Knap, M. Mueller, E. A. Demler, M. D. Lukin

(All are welcome to attend)

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