center for nanophysics and advanced materials

Condensed Matter Colloquium

Thursday, May 8, 2014

2 pm, Room 1201

Dmitry Abanin

Perimeter Institute

Ergodicity, entanglement, and many-body localization: a fresh look

We are used to describing systems of many particles by statistical mechanics. However, the basic postulate of statistical mechanics – ergodicity -- breaks down in so-called many-body localized systems, where disorder prevents particle transport and thermalization. In this talk, I will present a theory of the many-body localized (MBL) phase, based on new insights from quantum entanglement. I will argue that, in contrast to ergodic systems, MBL eigenstates are not highly entangled. I will use this fact to show that MBL phase is characterized by an infinite number of emergent local conservation laws, in terms of which the Hamiltonian acquires a universal form. Turning to the experimental implications, I will describe the response of MBL systems to quenches: surprisingly, entanglement shows logarithmic in time growth, reminiscent of glasses, while local observables exhibit power-law approach to "equilibrium" values. I will support the presented theory with results of numerical experiments. I will close by discussing experimental implications and other directions in exploring ergodicty and its breaking in quantum many-body systems.

Refreshments at 1:30 pm in Room 1305F

HOST: Vladimir Manucharyan

physics University of Maryland