Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Universal quasi-steady states in periodically-driven many-body systems"

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Abstract: At very high driving frequencies, energy absorption in a periodically driven many-body system may be suppressed, opening an exponentially long time window in which the system "prethermalizes" as if its dynamics were governed by an effective, local, time-independent Hamiltonian. Here we uncover a new regime of prethermalization, occurring for low-frequency driving in systems with multiple intrinsic energy scales (e.g., continuous bands separated by a large gap). In this case, the system rapidly absorbs energy from the driving field and heats the low-energy degrees of freedom to a restricted infinite-temperature-like state, which only gives way to full mixing with the high energy degrees of freedom on a timescale that is exponentially long in the inverse of the driving frequency. Such states offer a new paradigm of topological transport in non-equilibrium many-body systems: in the calculation of observables such as the Hall conductivity in 2D or the pumping current in 1D, the infinite temperature state restricted to low-energy bands yields uniform momentum space averages over the Berry curvature and Floquet-Bloch band group velocity, respectively, yielding universal results proportional to corresponding topological invariants. Here we focus on the case of a partially-filled (and therefore gapless) version of the Thouless pump in one dimension, and show that rapid heating indeed leads to a universal current-carrying quasi-steady state for low-frequency driving. Recently developed cold atom systems offer a promising platform for investigating this new type of topological transport in interacting many-body systems, far from equilibrium.

2:00pm
Wednesday, April 12, 2017
Duboc Room (4-331)

Host: Leonid Levitov