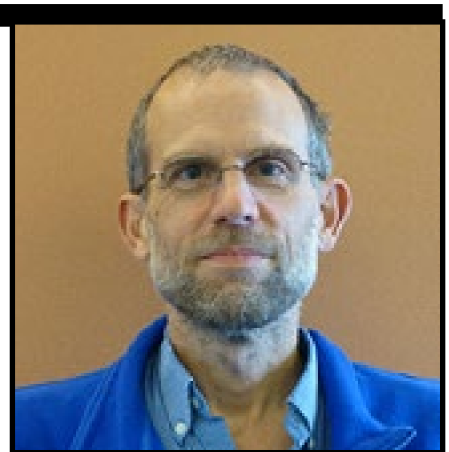
3:30 pm • Friday October 17, 2014 • 2241 Chamberlin Hall • Coffee at 4:30 pm

David Huse

Princeton University



Quantum thermalization, many-body Anderson localization, and the entanglement frontier

Department of Physics Colloquium

WISCONSIN

Progress in physics and quantum information science motivates much recent study of the behavior of extensively-entangled many-body quantum systems fully isolated from their environment, and thus undergoing unitary time evolution. What does it mean for such a system to go to thermal equilibrium? I will explain the Eigenstate Thermalization Hypothesis (ETH), which posits that each individual exact eigenstate of the system's Hamiltonian is at thermal equilibrium, and which appears to be true for most (but not all) quantum many-body systems. Prominent among the systems that do not obey this hypothesis are quantum systems that are many-body Anderson localized and thus do not constitute a reservoir that can thermalize itself. When the ETH is true, one can do standard statistical mechanics using the `single-eigenstate ensembles', which are the limit of the microcanonical ensemble where the `energy window' contains only a single many-body eigenstate. These eigenstate ensembles are more powerful than the traditional statistical mechanical ensembles, in that they can also "see" the quantum phase transition in to the localized phase, as well as a rich new world of phases and quantum phase transitions within the localized phase.

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