

Massachusetts Institute of Technology  
Department of Physics

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Condensed Matter Theory Seminar

“Quantum ergodicity breaking beyond many-body localization”

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**Abstract:** Many-body localization (MBL) provides a mechanism to break ergodicity in disordered, quantum many-body systems. MBL systems are characterized by a robust emergent integrability and an area-law entanglement of excited eigenstates. In this talk, I will describe our recent investigations of other non-ergodic phases of matter which are distinct from the MBL phase. The first route is based on the observation that continuous non-Abelian symmetries are inconsistent with the conventional MBL, since they impose lower bounds on entanglement of eigenstates. Using the example of a disordered Heisenberg chain, I will show that a broad non-ergodic regime emerges at strong disorder. In this regime, excited eigenstates can be constructed using strong-disorder, real-space renormalization group, and exhibit larger than area-law, but strongly sub-thermal entanglement. I will also describe other routes to breaking quantum ergodicity: long-range, frustrated interactions in a quantum spin glass, and quantum many-body scars which do not require disorder at all.

**12:00pm noon**  
**Tuesday, December 3, 2019**  
**Duboc Room (4-331)**

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Host: Leonid Levitov