

Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Percolative Phase Transition in the Dynamics of Quantum Entanglement"

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Abstract: When left unobserved, many-body quantum systems tend to evolve toward states of higher entanglement. Making a measurement, on the other hand, tends to reduce the amount of entanglement in a many-body system by collapsing one of its degrees of freedom. In this talk I discuss what happens when a many-body quantum system undergoes unitary evolution that is punctuated by a finite rate of projective measurements. Using numerical simulations and theoretical scaling arguments, we show that for a 1D spin chain there is a critical measurement rate separating two dynamical phases. At low measurement rate, the entanglement grows linearly with time, producing a volume-law entangled state at long times. When the measurement rate is higher than the critical value, however, the entanglement saturates to a constant as a function of time, leading to area-law entanglement. We map the dynamical behavior of the entanglement onto a problem of classical percolation, which allows us to obtain the critical scaling behavior near the transition. I briefly discuss generalizations of our result to higher dimensions, and its implications for the difficulty of simulating quantum systems on classical computers.

Reference: Skinner, Ruhman, and Nahum, arXiv:1808.05953

2:00pm
Wednesday, October 17, 2018
Duboc Room (4-331)