Condensed Matter

Seminar

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"Percolative Phase Transition in the Dynamics of Quantum Entanglement"

Monday, November 5, 2018

4:00pm – 5:00pm

304 Robeson Hall

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 measure-ment 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 be-havior 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.