Speaker: Cenke Xu

Title: When Topology and Criticality Meet quantum information

Abstract: Decoherence is the bridge between the quantum and classical worlds. We discuss the effect of decoherence/weak measurement on strongly entangled quantum many-body systems. Decoherence or WM turn a pure state into a mixed state density matrix, and the effect of decoherence can be mathematically mapped to a boundary problem. There are two classes of quantum many-body systems with well-known nontrivial boundary effects: (1) states with nontrivial topology, and (2) quantum critical points. For the states with nontrivial topology, the effect of decoherence is mathematically equivalent to turning on nonlocal interactions between physical topologically protected boundary states, and we design the so-called type-I and type-II "strange correlator" to diagnose the mixed state density matrix. We demonstrate that usually the type-II strange correlator still "remembers" the information of the SPT even after decoherence. We also consider 2+1d Wilson-Fisher fixed point under decoherence. The boundary effect of 2+1d quantum critical points have attracted a lot of theoretical and numerical efforts in the last few years, and we demonstrate that under decoherence we may observe some exotic physics such as the "extraordinary-log" physic that was proposed recently.