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Quantum Many-body theory in the Quantum Information era

Professor Matthew P.A. Fisher
UC Santa Barbara

Wednesday, April 6, 2022
12:00 p.m.

Traditionally, quantum many-body theory has focused on ground states and equilibrium properties of spatially extended systems, such as electrons and spins in crystalline solids. In recent years "noisy intermediate-scale quantum computers" (NISQ) have emerged, providing new opportunities for controllable non-equilibrium many-body systems. In such dynamical quantum systems the inexorable growth of non-local quantum entanglement is expected, but monitoring (by making projective measurements) can compete against entanglement growth. In this talk, I will overview theoretical work exploring the behavior of "monitored" quantum circuits, which can exhibit a novel quantum dynamical phase transition between a weak measurement phase and a quantum Zeno phase, the former of which we characterize in detail. Accessing such physics in the lab is challenged by the need for post-selection, which might be circumnavigated by decoding using active error correction.