

Measurement Induced Phase Transitions: From Theory to Observability

S. Diehl

Institut für Theoretische Physik, Universität zu Köln, D-50937 Cologne, Germany

The quest for phases and phase transitions in general non-unitary quantum dynamics has been spotlighted by the recent discovery of measurement-induced phase transitions. They result from the competition of deterministic Schrödinger and random measurement dynamics, and surface in a qualitative change of the entanglement structure.

Here we first introduce instances of entanglement transitions in fermion systems, between a regime of logarithmic entanglement growth, and a quantum Zeno regime obeying an area law. We identify the relevant degrees of freedom driving the phase transition in terms of an effective field theory. This yields a physical picture in terms of a depinning from the measurement operator eigenstates induced by unitary dynamics, and places it into the BKT universality class.

In standard quantum mechanical observables however, these transitions are masked due to the degeneracy of measurement outcomes. We then point out a general route of gently breaking this degeneracy -- pre-selection -- which makes such transitions observable in state-of-the-art quantum platforms without modifying any of the universal properties. It reveals an intriguing connection to quantum absorbing state transitions.