Day 1

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Title:Probing the Universality of Topological Defect Formation in a Quantum Annealer

Abstract:
The number of topological defects created in a system driven through a quantum phase transition exhibits a power-law scaling with the driving time. This universal scaling law is the key prediction of the Kibble-Zurek mechanism (KZM), and testing it using a hardware-based quantum simulator is a coveted goal of quantum information science. Here we provide such a test using quantum annealing. Specifically, we report on extensive experimental tests of topological defect formation via the one-dimensional transverse-field Ising model on two different D-Wave quantum annealing devices. We find that the quantum simulator results can indeed be explained by the KZM for open-system quantum dynamics with phase-flip errors. In addition, we probe physics beyond the KZM by identifying signatures of universality in the statistics of kinks. To check whether an alternative, classical interpretation of these results is possible, we used the spin-vector Monte Carlo model, and show that the D-Wave data favors a quantum description of the device. Our work provides an experimental test of quantum critical dynamics in an open quantum system, and paves the way to new directions in quantum simulation experiments.