Exploring noisy quantum Kibble-Zurek physics with superconducting transmon qubits

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In this talk, we discuss using superconducting transmon qubit-based IBM quantum hardware to explore the quantum Kibble-Zurek (QKZ) mechanism. In particular, we focus on the well-studied transverse-field Ising (TFI) model as one quenches the Hamiltonian across its quantum critical point. Theoretically, we investigate how standard QKZ predictions are modified for the TFI model in the presence of noise by focusing on an idealized model of decoherence using continuous quantum non-demolition measurements. From this we show how the strength of noise directly effects universal critical exponents. We conclude by discussing our efforts to observe such physics in IBM quantum hardware.

Figures

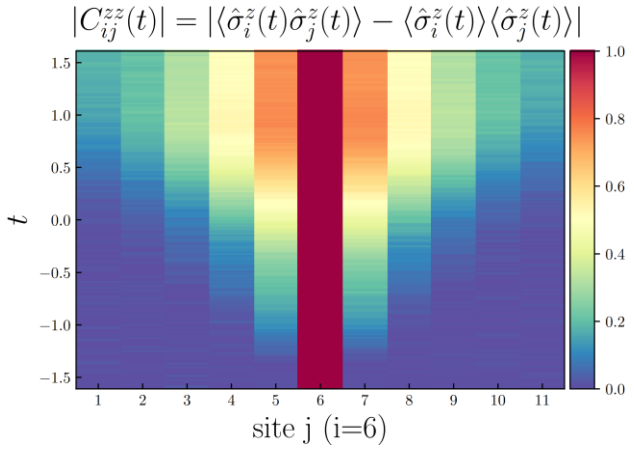

Figure 1: Qiskit simulation of the connected two-point correlation function plotted as a function of space and time as one quenches a small number of qubits across the transverse-field Ising model's quantum critical point.

References

[1] W.-T. Kuo, D. Arovas, S. Vishveshwara, and Y.-Z. You, SciPost Phys. 11, 084 (2021).