Day 3

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Title: Quantum phase transition dynamics in the two-dimensional transverse Ising model

Abstract:
The quantum Kibble-Zurek mechanism (QKZM) predicts universal dynamical behavior in the vicinity of quantum phase transitions (QPT). It is by now well understood for the one-dimensional quantum matter. Higher-dimensional systems have, however, remained a key challenge. In this work [1], we take the first steps towards theoretically exploring the QKZM in two dimensions. We study the dynamical crossing of the QPT in the paradigmatic transverse Ising model by a joint effort of modern state-of-the-art numerical methods, including tensor networks and artificial neural networks. As a central result, we identify and quantify universal behavior close to the QPT, which can be observed already in relatively small systems. However, upon traversing deeply into the ferromagnetic regime, we observe deviations from the QKZM prediction. We attribute it to the influence of thermalization and phase ordering kinetics on the excitation energy density, with the universal power-law scaling masked behind non-universal, path-dependent contributions.

[1] M. Schmitt, M. M. Rams, J. Dziarmaga, M. Heyl, and W. H. Zurek, in preparation