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Dynamical quantum phase transitions on random networks

We investigate dynamical quantum phase transitions (DQPTs) in the transverse field Ising model on ensembles of random Erdős-Rényi networks of size N. We analytically show that dynamical critical points are independent of the edge generation probability p, and matches that of the integrable fully connected network ($p = 1$). This is due to the $O(N^{-1/2})$ bound on the overlap between the wave function after a quench and the wave function of the fully connected network after the same quench. For a DQPT defined by the rate function of the Loschmidt echo, we find that it deviates from the $p = 1$ limit near vanishing points of the echo. Our analysis suggests that this divergence arises from persistent non-trivial global many-body correlations absent in the $p = 1$ limit.

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