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Universal Quantum Dynamics of the Transverse-Field Ising Model MICHAEL KOLODRUBETZ, BRYAN CLARK, DAVID HUSE, Princeton University — The one-dimensional transverse field Ising model is a prototypical example of a quantum phase transition. While its equilibrium scaling has been known for more than half a century, we discuss the non-equilibrium quantum dynamics as the system is swept slowly through the critical point (a Kibble-Zurek ramp). Scaling is well understood for Kibble-Zurek ramps that end at the quantum critical point or deep in the ferromagnetic regime. We solve for the full finite-size scaling forms of excess heat and spin-spin correlation function for an arbitrary point along the ramp. We also confirm the postulated universality of the dynamic scaling forms by numerically simulating Mott insulating bosons in a tilted potential, an experimentally realizable model in the same universality class [Simon et. al., Nature 472, 372 (2011)]. Our numerics indicate that the time-scales necessary to see non-equilibrium scaling should already be within the reach of experiment.

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