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Quantum Critical Dynamics of Bose-Einstein Condensates in a Shaken Optical Lattice LOGAN W. CLARK, LEI FENG, LI-CHUNG HA, CHENG CHIN, University of Chicago — From condensed matter to cosmology, systems which cross a continuous, symmetry-breaking phase transition are expected to generate topological defects whose density scales universally with the rate at which the phase transition is crossed. We experimentally test the application of this universal Kibble-Zurek scaling prediction to quantum phase transitions by studying ultracold bosons in a shaken optical lattice. When the lattice shaking amplitude crosses a critical threshold, an ordinary Bose condensate transitions to an effectively ferromagnetic pseudo-spinor condensate with discrete, magnetized regions separated by domain walls. We appraise the dynamic scaling laws for both the time at which the domain structure forms and the typical size of the domains by varying the quench rate across the transition. We explore the regime in which the universal prediction applies, as well as potential deviations at extreme quench rates.

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