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Critical dynamics of non-equilibrium phase transitions

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In context of the search for the QCD critical endpoint in heavy-ion collisions, a deep understanding of the out-of-equilibrium dynamics of the system is necessary to make well-grounded predictions for signatures in final states. To this end, we investigate the dynamic critical behavior of a classical scalar field theory with Z_2 symmetry in the dynamic universality class of Model A in two and three spatial dimensions. The critical dynamics of the system are studied under a linear quench protocol, in which the external symmetry breaking field is changed at a constant rate through the critical point. We discuss the connection to the Kibble-Zurek mechanism and determine the dynamic critical exponent □ as well as universal scaling functions. These fully describe the non-equilibrium evolution of the system near the critical point for all quench rates under consideration. We find that, while the scaling functions are non-trivial, the corresponding scaling exponents are fully determined by the static critical exponents and the dynamic critical exponent. Finally, we perform a finite-size scaling analysis and observe good collapse of the data onto universal finite-size scaling functions.

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