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**Universality of Phase Transition Dynamics: Topological Defects from Symmetry Breaking**

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As a result of the critical slowing down (the divergence of the relaxation time near the critical point) the dynamics of the non-equilibrium second order phase transition ceases to be adiabatic in the vicinity of the critical point. This results in a local choice of the broken symmetry of the order parameter, and can lead to the formation of topological defects. The Kibble-Zurek mechanism uses equilibrium scalings of the relaxation time and healing length in the vicinity of the critical point to describe the associated non-equilibrium dynamics of symmetry breaking and to estimate the density of topological defects as a function of the quench rate through the transition. Originally developed for classical phase transitions, it has been by now extended to quantum phase transitions (where local symmetry breaking is seeded by quantum rather than classical—e.g., thermal—fluctuations). During recent years, several new experiments investigating formation of defects in phase transitions induced by a quench both in classical and quantum mechanical systems were carried out, and more are on the way. At the same time, some established results were called into question [1]. I will review [2,3] Kibble-Zurek mechanism focusing in particular on this recent surge of activity, and suggest possible directions for further progress.

[1] Zurek, W. H., Topological relics of symmetry breaking: winding numbers and scaling tilts from random vortex-antivortex pairs, JOURNAL OF PHYSICS-CONDENSED MATTER Volume: 25 Issue: 40 Article Number: 404209 (2013).
[2] del Campo, A.; Kibble, T. W. B.; Zurek, W. H., Causality and non-equilibrium second-order phase transitions in inhomogeneous systems, JOURNAL OF PHYSICS-CONDENSED MATTER Volume: 25 Issue: 40 Article Number: 404210 (2013).
[3] del Campo, A.; Zurek, W. H., Universality of Phase Transition Dynamics: Topological Defects from Symmetry Breaking, arXiv:1310.1600 (2013).