Density of topological defects across phase transitions

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The state of a system taken through a phase transition is plagued with topological defects, be them domain walls, vortices, monopoles or other depending on the particular case at hand. As the system evolves after the quench their spatial distribution changes and, typically, their density decreases. The mechanisms whereby this occurs depend on the microscopic dynamics. Realizations of such "phase ordering kinetics" in condensed-matter are manifold including the relaxation of vortices in planar magnets or monopoles in magnetic spin-ice, both thermally quenched. The characterization of the density of topological defects has also been of interest in cosmology and the standard description in this context is given by the so-called Kibble-Zurek mechanism. We have critically revisited this theory in two characteristic cases: a second order phase transition with discrete spontaneous broken symmetry [1] and the Berezinsky-Kosterlitz-Thouless infinite order phase transition [2]. In this talk I shall explain our vision of this problem and make some concrete predictions on the time and cooling rate dependence of the density of defects after crossing the phase transition.

[1] Kibble-Zurek mechanism and infinitely slow annealing through critical points, G. Biroli, L. F. Cugliandolo, and A. Sicilia, Phys. Rev. E **81**, 050101 (2010).
[2] Annealing through a Kosterlitz-Thouless phase transition, A. Jelic and L. F. Cugliandolo, in preparation