FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
NATURWISSENSCHAFTLICHE FAKULTÄT

Department für Physik

Physikalisches Kolloquium

24.10.2016, 16 Uhr c.t. **Hörsaal E**

Topology matters! Kosterlitz-Thouless-Halperin-Nelson-Young universality beyond equilibrium: Kibble-Zurek mechanism in colloidal monolayers

Peter Keim
Fachbereich Physik, Universität Konstanz

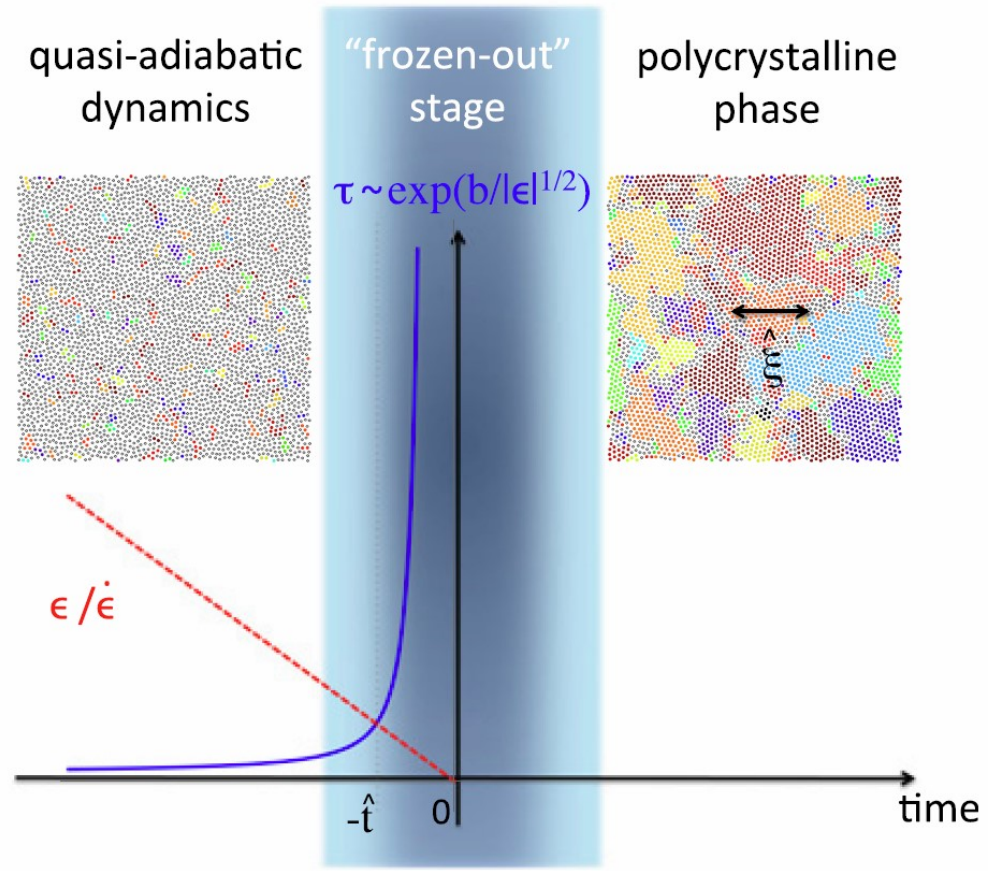
The Kibble-Zurek mechanism describes the evolution of defects and domains when a system is forced through a phase transition with spontaneously broken symmetry. It is used to describe transitions on such different scales like the Higgs field in the early universe shortly after the Big Bang [1] or in condensed matter systems like quenched quantum fluids [2]. Cooling at a finite rate, a domain structure naturally arises for a system with continuous phase transition. Since diverging correlation length are accompanied with critical slowing down, the system has to fall out of equilibrium for any non-zero rate in the vicinity of the transition. At this so called fall out time, a fingerprint of critical fluctuations is taken before the symmetry can switch globally.

Within this picture, we investigate the non-equilibrium dynamics in a soft-matter analogue, a two-dimensional ensemble of colloidal particles which in equilibrium obeys the Kosterlitz-Thouless-Halperin-Nelson-Young melting scenario with continuous phase transitions [3-7]. The ensemble is exposed to finite cooling rates of the pair-interaction parameter (being an inverse system temperature) at very different rates from deep in the isotropic fluid into the poly-crystalline phase. We analyze defect configurations as well as the evolution of orientationally ordered domains quantitatively via video microscopy and show that their frozen-out length scale follows an algebraic decay as function of the quench rate as predicted [8].

[1] T. Kibble, J. Phys. Math. Gen. **9** 1387 (1976)
[2] W. Zurek, Nature **317** 505 (1985)
[3] J. Kosterlitz, D. Thouless, J. Phys. C **5** 124 (1972)
[4] J. Kosterlitz, D. Thouless, J. Phys. C **6** 1181 (1973)
[5] B. Halperin, D. Nelson, Phys. Rev. Lett. **41** 121 (1978)
[6] D. Nelson, B. Halperin, Phys. Rev. B **19** 2457 (1979)
[7] Young AP, Phys. Rev. B 19 1855 (1979)
[8] S. Deutschländer, Proc. Natl. Acad. Sci. **112** 6925 (2015)

FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG
NATURWISSENSCHAFTLICHE
FAKULTÄT

Department
für Physik



Kontakt: Dr. Sebastian Kapfer: sebastian.kapfer@fau.de