LMU | LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

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Non-equilibrium Relaxation and Aging Kinetics

If systems characterized by slow (algebraic) relaxation are prepared in an out-of-equilibrium initial state, one can observe a "physical aging regime" in the ensuing approach to equilibrium that is governed by broken time translation invariance and non-trivial, often universal scaling laws. Dynamical systems near a critical point constitute prototypical and now well-understood examples. Indeed, measuring critical exponents in the intermediate aging rather than the asymptotic stationary temporal regime is now a standard numerical tool. In this talk, I will first apply these concepts to simple driven lattice gases that relax towards non-equilibrium stationary systems displaying generic scale invariance. The expected simple aging behavior in the two-time density auto-correlation function is verified through Monte Carlo simulations in one, two, and three dimensions. Next I shall address the continuous non-equilibrium phase transition in driven Ising lattice gases in two dimensions. Whereas the temporal scaling of the density auto-correlation function in the non-equilibrium steady state does not allow a precise measurement of the associated critical exponents, these can be accurately determined from the aging scaling of the two-time auto-correlations and the order parameter evolution following a quench to the critical point. In the second part of the talk, I will present numerical results for the non-equilibrium relaxation kinetics of interacting magnetic flux lines in disordered type-II superconductors at low temperatures and low magnetic fields, represented by means of a three-dimensional elastic line model. Investigating the vortex density and height auto-correlations as well as the flux line mean-square displacement allows us to carefully disentangle different relaxation mechanisms (e.g., vortex line fluctuations and positional relaxation), and to assess their relative impact on the kinetics of dilute vortex matter at low temperatures. We observe the emergence of genuine glassy dynamics, caused by the competing effects of vortex pinning and long-range repulsive interactions between the flux lines. We contrast the effects of random point-like pinning centers and correlated columnar defects. We also compare data from Monte Carlo simulations with results from Langevin molecular dynamics.

Wednesday, 12 December 12, 16:15 h, Room 348 / 349, Theresienstr. 37 / III

Prof. E. Frey