DY 52 Statistical Physics far from Thermal Equilibrium

Zeit: Mittwoch 12:30–14:00 Raum: TU H3010

DY 52.1 Mi 12:30 TU H3010

Aging Properties of Critical Systems: the Renormalization-Group Approach — •Andrea Gambassi — Max-Planck Institut fuer Metallforschung, Heisenbergstr. 3, 70569 Stuttgart

In recent years much interest has been attracted by systems that cannot reach thermodynamic equilibrium because of their slow dynamics. During this everlasting nonequilibrium evolution aging phenomena are observed. A simple instance of such a behaviour is provided by the dynamics that takes place when a system is quenched from its high-temperature phase to the critical point. In the talk I focus on the renormalization-group approach to determine the relevant (universal) quantities, such as the fluctuation-dissipation ratio, associated with the nonequilibrium critical dynamics.

DY 52.2 Mi 12:45 TU H3010

Diffuse-interface model for rapid phase transformations in nonequilibrium systems — •Peter Galenko[1] and David Jou[2] — [1]Institute for Space Simulation, DLR, Cologne, D-51170, Germany — [2]Departament de Fisica, Universitat Autonoma de Barcelona, 08193 Bellaterra, Catalonia, Spain

A thermodynamic approach to rapid phase transformations within a diffuse interface in a binary system is developed. Assuming an extended set of independent thermodynamic variables formed by the union of the classic set of slow variables and the space of fast variables, we introduce finiteness of the heat and solute diffusive propagation at the finite speed of the interface advancing. To describe the transformation within the diffuse interface, we use the phase-field model which allows us to follow the steep but smooth change of phases within the width of diffuse interface. The governing equations of the phase-field model are derived for the hyperbolic model, model with memory, and for a model of nonlinear evolution of transformation within the diffuse-interface. The consistency of the model is proved by the condition of positive entropy production and by the outcomes of the fluctuation-dissipation theorem. A comparison with the existing sharp-interface and diffuse-interface versions of the model is given

DY 52.3 Mi 13:00 TU H3010

Hysteresis in One-Dimensional Reaction-Diffusion Systems — •Attila Rakos, Matthias Paessens, and Gunter M. Schuetz — Institut fuer Festkoerperforschung, Forschungszentrum Juelich, D-52425 Juelich

We introduce a simple nonequilibrium model for a driven diffusive system with nonconservative reaction kinetics in one dimension. The steady state exhibits a phase with broken ergodicity and hysteresis which has no analog in systems investigated previously. We identify the main dynamical mode, viz., the random motion of a shock in an effective potential, which provides a unified framework for understanding phase coexistence as well as ergodicity breaking. This picture also leads to the exact phase diagram of the system.

DY 52.4 Mi 13:15 TU H3010

Infinite reflections of shock fronts in driven diffusive systems with two species. — •Vladislav Popkov[1] and Gunter Schütz[2] — [1]Institut für Theoretische Physik, Universität zu Köln — [2]Institut für Festkörperforschung, Forschungszentrum Jülich

We study interaction of a domain wall with boundaries for several stochastic driven particle models, which have two species of particles. Reflection maps are introduced for the description of this process. We show that, generically, a domain wall reflects infinitely many times from the boundaries before a stationary state can be reached. This is in an evident contrast with one-species models where the stationary density is attained after just one reflection.

Adequate hydrodynamic description of driven systems with open boundaries is achieved when boundary conditions act like effective reservoirs of particles with fixed particle densities. We show how to define the respective stochastic dynamics introducing projection measures. From this point of view, we analyse reflections of domain walls in a hydrodynamic limit for a model exhibiting spontaneous symmetry breaking (SSB). We argue that SSB happens where hydrodynamic description breaks down.

DY 52.5 Mi 13:30 TU H3010

Paradoxical directed diffusion due to temperature anisotropies — •Ralf Eichhorn and Peter Reimann — Universität Bielefeld, Fakultät für Physik, D-33615 Bielefeld

An analytically tractable, but still experimentally realistic model dynamics is investigated, describing the Brownian motion of a particle in a “meandering” periodic potential landscape under the simultaneous influence of two different heat baths. The main characteristics of the resulting far from equilibrium environment is an anisotropy of the ambient temperature. When an external static force F is applied, the particle moves in the direction opposite to that force (absolute negative mobility), and this even for arbitrarily large forces $|F|$. Moreover, even when the “meandering” potential exhibits a broken spatial symmetry, no preferential direction of motion arises for $F = 0$.

DY 52.6 Mi 13:45 TU H3010

Phase separation in binary mixtures: Oscillatory instabilities under continuous cooling or heating — •Doris Vollmer[1], Jürgen Vollmer[2], and Günter Auernhammer[3] — [1]MPI for Polymer Research, Mainz — [2]Physics Department, Philipps University, Marburg — [3]Laboratoire de Dynamique des Fluides Complexes, Universite Louis Pasteur, Strasbourg, France

The kinetics of phase separation of binary mixtures under slowly ramping the temperature is discussed. For a broad range of compositions and heating rates the mixtures show pronounced oscillations in the turbidity. It hardly matters if phase separation is induced by cooling or heating, and whether the liquids are of low molecular weight or if a polymer solution is investigated. The oscillations in the coexisting liquid phases can be analysed separately. By choosing an appropriate temperature ramp the time averaged flux across the meniscus is kept constant in the experiments. For all investigated systems the oscillations can be observed over a wide temperature range, as far as 25 degrees away from the transition temperature. From simultaneous shadow graph imaging it can be shown that convection is always present, however amazingly, convection hardly influences the period of the oscillations. The oscillations are generic, of thermodynamic origin and caused by repeated cycles of nucleation, coarsening and sedimentation.