DY 14 Statistical Physics far from Thermal Eqilibrium

Time: Monday 14:30–16:15 Room: HÜL 186

Invited Talk

DY 14.1 Mon 14:30 HÜL 186

Exploring out-of-equilibrium systems — •Luca Peliti — Dipartimento di Scienze Fisiche and Unita' CNR-INFM, Universita' "Federico II", I-80126 Napoli (Italy)

I describe a new approach for the simulation of systems in a steady state out of equilibrium. The approach is inspired by the Diffusion Monte Carlo technique for the solution of the Schroedinger equation, and allows for the evaluation of the large deviation functional as a function of (spatially local or global) observables which are local in time. The method is illustrated with the current fluctuations of the Totally Asymmetric Exclusion Process and with the entropy production distribution of a driven Lorentz gas.

DY 14.2 Mon 15:00 HÜL 186

Entropy Production of a Single Two Level System. Experimental Proof of a Fluctuation Theorem — •Carsten Tietz[1], Sebastian Schuler[1], Thomas Speck[2], Udo Seifert[2], and Jörg Wrachtrup[1] — [1]3. Physikalisches Institut, Universität Stuttgart — [2]II. Institut für Theoretische Physik, Universität Stuttgart

The entropy of small systems – e.g. from a single two-level-system (TLS) as used in this work – seems to be not obviously defined in Boltzmann's definition of entropy. Nonetheless, in the last decade the concept of entropy was expanded to entropy along single trajectories. So called fluctuation theorems valid for systems driven out from equilibrium quite generally relate the probability of entropy generation to entropy annihilation.

In this work we use the fluorescence trajectories of a single defect centre in diamond to experimentally determine the entropy along a trajectory of a single TLS driven out of equilibrium. We visualise the entropy evolution along a trajectory of the pure system and the entropy production of the surrounding medium, respectively. The total entropy obey several fluctuation theorems which relate the entropy producing trajectories to the entropy annihilating ones. We proof a Jarzynski like integral fluctuation theorem as well as the more general transient fluctuation theorem.

[1] S. Schuler, T. Speck, C. Tietz, J. Wrachtrup, U. Seifert Phys. Rev. Lett. 94, 180602 (2005).

DY 14.3 Mon 15:15 HÜL 186

Ageing without detailed balance: The bosonic contact and pair-contact processes — •Florian Baumann[1,2], Malte Henkel[2], Michel Pleimling[1], and Jean Richert[3] — [1]Institut für Theoretische Physik I, Universität Erlangen-Nürnberg, Germany — [2]Laboratoire de Physique des Matériaux, Université Henri Poincaré Nancy I, France — [3]Laboratoire de Physique Théorique, Université Louis Pasteur Strasbourg I, France

Ageing phenomena and scaling behaviour have been considered in many systems with detailed balance such as simple magnetic systems. Therefore it is an interesting question to extend these studies to systems without detailed balance, paradigmatic examples of which are reaction-diffusion systems. In these systems particles undergo diffusion on a lattice and in addition particle creation and annihilation occurs. In recent numerical investigations of a specific system of this type, dynamical scaling behaviour was found, and it turned out that an equality between two critical exponents, known from systems with detailed balance, does not hold true any more.

In order to shed more light on this, we look at two exactly solvable systems without detailed balance: The bosonic contact and pair-contact processes. Two-time quantities are computed in the scaling limit and ageing exponents and scaling function are determined. In particular we confirm the result that two mentioned critical exponents can indeed be different from each other.

[1] F. Baumann, M. Henkel, M. Pleimling, and J. Richert, J. Phys. A: Math. Gen. **38**, 6623 (2005)

DY 14.4 Mon 15:30 HÜL 186

Reentrance during nonequilibrium relaxation — •Michel Pleimling[1], László Környei[2], and Ferenc Iglói[2,3] — [1]Institut für Theoretische Physik I, Universität Erlangen-Nürnberg, Germany — [2]Institute for Theoretical Physics, Szeged University, Hungary — [3]Research Institute for Solid State Physics and Optics Budapest, Hungary

In nonequilibrium critical dynamics the system under consideration is prepared in some initial state from which it is quenched to the critical temperature and then let to evolve in time according to the given dynamical rules. Generally one is interested in the relaxation of the magnetization and in the behavior of the autocorrelation function. In most of the studied cases the initial state is of two kinds: it is either the (completely) ordered one or the (completely) disordered one. In this talk we show that an intriguing reentrance in time is encountered in critical relaxation measurements which start from a non-trivial initial state given by a ground state of the random field Ising model. Competition between two different mechanisms, the dissolution of the compact cells forming the initial state and the usual domain growth, is responsible for this novel feature in nonequilibrium critical dynamics.

[1] L. Környei, M. Pleimling, and F. Iglói, cond-mat/0509372

DY 14.5 Mon 15:45 HÜL 186

Quantitative description of self-organised patterns in ac gas-discharge — •Hans-Georg Purwins[1], Lars Stollenwerk[1], Shalva Amiranashvili[1], and Jean-Pierre Boeuf[2] — [1]Institut für Angewandte Physik, Corrensstaße 2/4, 58239 Münster — [2]CPAT, 118 route de Narbonne, 31 062 Toulouse Cedex, France

In this work we report on the experimental observation of the evolution of a filamentary pattern in a planar dielectric barrier gas-discharge system. The experimental results are described theoretically in terms of three variables: the electron and ion charge carrier concentration and the electric field. The corresponding set of equations consists of two equations of drift-diffusion type and the Poisson equation. This set of equations is solved numerically. Parameters and boundary conditions are taken from experiment. We find quantitative agreement between experiment and theory. This is the first time that a self-organised pattern in a planar gas-discharge system can be described theoretically in a quantitative manner.

DY 14.6 Mon 16:00 HÜL 186

What is hidden behind memory effects ? — •K. Morawetz[1,2] and P. Lipavsky[3] — [1]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [2]Max-Planck-Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany — [3]Faculty of Mathematics and Physics, Charles University, Ke Karlovu 5, 12116 Prague 2

The finite duration of the collisions in Fermionic systems as expressed by the retardation time in non-Markovian Levinson-type kinetic equations is discussed in the quasiclassical limit. We separate individual contributions included in the memory effect resulting in (i) off-shell tails of the Wigner distribution, (ii) renormalization of scattering rates and (iii) of the single-particle energy, (iv) collision delay and (v) related non-local corrections to the scattering integral. In this way we transform the Levinson equation into the Landau-Silin equation extended by the non-local corrections known from the theory of dense gases. The derived nonlocal kinetic equation unifies the Landau theory of quasiparticle transport with the classical kinetic theory of dense gases.

[1] K. Morawetz, P. Lipavský, and V. Špička, Ann. of Phys. **294**, 134 (2001)

[2] P. Lipavský, K. Morawetz, and V. Špička, *Kinetic equation for strongly interacting dense Fermi systems*, Vol. 26,1 of *Annales de Physique* (EDP Sciences, Paris, 2001), ISBN: 2-86883-541-4.