DY 28: Statistical physics far from thermal equilibrium

Time: Thursday 14:30–16:00 Location: A 060

DY 28.1 Thu 14:30 A 060

Model Studies on the Quantum Jarzynski Relation — •Jens Teifel and Günter Mahler — Universität Stuttgart, Institut für Theoretische Physik I, 70550 Stuttgart, Pfaffenwaldring 57/IV

We are particularly interested in the quantum Jarzynski relation, which has been shown to hold for closed quantum systems by S. Mukamel. We discuss different models of bipartite quantum systems, such as microcanonical coupling and canonical coupling. By generalizing the proof of Mukamel we show that the Jarzynski relation holds for microcanonical coupling as well as for open quantum systems at high initial temperatures. Furthermore we want to discuss a possible alteration of the Jarzynski relation in order to avoid the ambiguous definition of work in quantum systems.

DY 28.2 Thu 14:45 A 060

Nonequilibrium work distribution of a quantum harmonic oscillator — •Sebastian Deffner and Eric Lutz — Institute of Physics, University of Augsburg, D-86135 Augsburg, Germany

We analytically calculate the work distribution of a quantum harmonic oscillator with arbitrary time–dependent angular frequency. We provide detailed expressions for the work probability density for adiabatic and nonadiabatic processes, in the limit of low and high temperature. We further verify the validity of the quantum Jarzynski equality.

DY 28.3 Thu 15:00 A 060

Interaction effects and work theorems — •Mario Einax and Philipp Maass — Institut für Physik, Technische Universität Ilmenau, 98684 Ilmenau, Germany

We present an exact waiting time Monte-Carlo algorithm (WTMC) to simulate systems that follow a dynamics given by a master equation with time-dependent rates. The algorithm can be conveniently used to investigate many particle systems driven out of equilibrium by time-dependent external fields. We illustrate the method for a one-dimensional Ising-spin system with Glauber dynamics. In particular we compute the probability distributions of the fluctuating work and heat. Our results are compared to analytical findings and tested against various non-equilibrium fluctuation theorems.

DY 28.4 Thu 15:15 A 060

Non-equilibrium transport equations for randomly interacting quantum systems — •Pedro Vidal — 1 Institut für Theoretische Physik, Universität Stuttgart, Deutschland

We analyse the dynamics of some quantum models where the Hamiltonian possesses a random part. We show them to be solvable within certain size and time scaling limit. Particularly we consider the Van-Hove limit which is the long time-weak coupling regime. In these scaling regimes we find our systems to be described by diffusion equations or rate equations.

DY 28.5 Thu 15:30 A 060

Statistical properties of disordered driven lattice gases with open boundary conditions — •Philip Greulich — Institut für Theoretische Physik, Universität zu Köln, Köln, Germany

We investigate driven lattice gases with open boundary conditions in presence of randomly distributed defect sites with reduced hopping rate. These systems can be used as models for intracellular transport systems impurified by immobile blocking molecules. In contrast to equilibrium, even macroscopic quantities in disordered non-equilibrium systems depend sensitively on the defect sample. We show that the leading behaviour in the disordered system is determined by the longest stretch of consecutive defect sites. Using results from extreme value statistics, this single bottleneck approximation gives accurate results for probability distributions and the expectation value of the maximum current at small defect densities. Corrections from bottleneck interactions can be taken into account systematically by a perturbative expansion which also yields criteria for the validity of the single bottleneck approximation.

DY 28.6 Thu 15:45 A 060

Scaling Behaviour in a Cyclic Population Model on a Lattice — •Anton Winkler, Tobias Reichenbach, and Erwin Frey — Arnold Sommerfeld Center for Theoretical Physics and Center for NanoScience, Department of Physics, Ludwig-Maximilians-Universität München, Theresienstraße 37, D-80333 München, Germany

Cyclic (rock-paper-scissors-type) population models serve as simple models of more complex species interactions. Focusing on a paradigmatic three-species model with mutations in one dimension, we show how simple renormalization group arguments yield an excellent analytical understanding of the emerging reactive steady state. Care is taken in discriminating two types of mutations, giving rise to two different renormalization group eigenvalues. The results are compared to stochastic lattice simulations. Our methods and findings are potentially relevant for the spatio-temporal evolution of other non-equilibrium stochastic processes.