DY 22: Critical Phenomena and Phase Transitions

Time: Tuesday 14:00–15:30 Location: H19

DY 22.1 Tue 14:00 H19

The hardness of finding ground states with simulated annealing. For Ising spin Glasses in a field. — •Hauke Fajen and Alexander K. Hartmann — Institut für Physik, University of Oldenburg, Germany

We investigated the behavior of simulated annealing for Ising spin glasses (2d planar and 3d) with and without magnetic field. Ising Spin glasses are Ising systems that introduce disorder with randomly chosen antiferromagnetic and ferromagnetic couplings, that leads to higher complexity. Simulated annealing is a process for finding the ground state of a system. For this purpose, the system is simulated with a usual Monte Carlo method at a finite temperature which is more or less slowly decreased. To evaluate the *hardness* we are looking at the time to find a ground state with a certain probability for the optimal ratio of annealing time to restarts of the annealing. We are studying whether simulated annealing has a different hardness for a planar system without magnetic field and other cases like 3d grids systems. In particular, we are interested in the influence of a magnetic field on the hardness of a realization.

DY 22.2 Tue 14:15 H19

Two- and three-point functions at criticality: Monte Carlo simulations of the improved three-dimensional Blume-Capel model — •Martin Hasenbusch — Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 19, D-69120 Heidelberg, Deutschland

We compute two- and three-point functions at criticality for the three-dimensional Ising universality class. To this end we simulate the improved Blume-Capel model at the critical temperature on simple cubic lattices of a linear size up to $L = 1600$. As check also simulations of the spin-1/2 Ising model are performed. We find $f_{\sigma\sigma\epsilon} = 1.051(1)$ and $f_{\epsilon\epsilon\epsilon} = 1.533(5)$ for operator product expansion coefficients. These results are consistent with but less precise than those recently obtained by using the bootstrap method. An important ingredient in our simulations is a variance reduced estimator of N-point functions. Finite size corrections vanish with $L^{-\Delta_\epsilon}$, where L is the linear size of the lattice and Δ_ϵ is the scaling dimension of the leading Z_2-even scalar ϵ.

DY 22.3 Tue 14:30 H19

Phase diagram of lattice bosons with cavity-mediated long-range interactions with uncorrelated disorder — Chao Zhang and •Heiko Rieger — Theoretical Physics, Saarland University, Campus E2 6, Saarbrücken, 66123, Germany

Recent experiments with ultra-cold atoms in an optical lattice have realized cavity-mediated global range and observed the emergence of a supersolid and a density wave phase in addition to Mott insulator and superfluid phases. Here we consider theoretically the effect of uncorrelated disorder on the phase diagram of this system and study the two-dimensional Bose-Hubbard model with global range interactions and uncorrelated diagonal disorder. With the help of quantum Monte Carlo simulations using the Worm algorithm, we determine the phase diagram of this model. We show that two kinds of Bose glass phases exist: one with and one without density wave order and discuss the nature of the various phase transitions that occur.

DY 22.4 Tue 14:45 H19

Quantum critical scaling and holographic bound for transport coefficients near Lifshitz points — •Gian Andrea Inkof[1], Joachim Küppers[1], Julia Link[1], Blaise Goutéraux[2], and Jörg Schmalian[1,3] — [1]Institute for Theory of Condensed Matter, Karlsruhe Institute of Technology, 76131 Karlsruhe, Germany — [2]CPHT, École Polytechnique, 91128 Palaiseau Cedex, France — [3]Institute for Solid State Physics, Karlsruhe Institute of Technology, 76131 Karlsruhe, Germany

The present study uses scaling arguments and holography to investigate universal bounds appearing in strongly coupled QFT. The analysis focuses on the critical regime of anisotropic graphene-like systems at charge neutrality. Through scaling techniques we state a generalization to the anisotropic case of both the shear-viscosity to entropy density ratio and the charge diffusivity bounds. In order to obtain scale dimensionless quantities, we take into account the electric transport for the former, while the structure of the latter is supposed to remain unchanged. We investigate the strongly coupled phase in a gravitational EMD model, where both translations and rotations are broken. The holographic computation suggests a relation between some entries of the η/s-tensor and the conductivities, similar to the one predicted with the scaling. From the IR critical geometry, we derive a recursion formula which allows us to analytically express the diffusion constants in terms of the square butterfly velocities. The proportionality factor turns out to be direction-independent, linear in the inverse temperature, and related to the anisotropic exponents of the dual field theory.

DY 22.5 Tue 15:00 H19

Nonequilibrium dynamics of the critical Casimir force — •Markus Gross[1,2], Andrea Gambassi[3], and Siegfried Dietrich[1,2] — [1]MPI für Intelligente Systeme, Stuttgart — [2]IV. Institut für Theoretische Physik, Universität Stuttgart — [3]SISSA - International School for Advanced Studies and INFN, Trieste, Italy

We discuss how the critical Casimir force, primarily investigated in equilibrium conditions, can be determined as function of time for a general Landau-Ginzburg model. We focus here on the conserved dynamics of a fluid in film geometry, described by the equations of the so-called 'model B'. Specifically, we analyze the nonequilibrium time-evolution following a rapid quench from an initial homogeneous high-temperature state to the critical temperature. Concerning the behavior at the walls bounding the film, we assume that the fluid order parameter (e.g., concentration or density) shows a strong preferential adsorption – a behavior which is typically observed in experiments. The resulting dynamics of the order parameter and the critical Casimir force are discussed within analytical as well as numerical approaches.

Ref.: M. Gross, A. Gambassi, S. Dietrich, Phys. Rev. E 98, 032103 (2018)

DY 22.6 Tue 15:15 H19

Analytic finite-size scaling functions in the anisotropic square-lattice Ising model — Hendrik Hobrecht and •Fred Hucht — Fakultät für Physik, Universität Duisburg-Essen, 47048 Duisburg

We present recent analytic results on finite-size scaling functions in the anisotropic square-lattice Ising model. We discuss different boundary conditions and analytically verify different finite-size scaling assumptions.

[1] Anisotropic scaling of the two-dimensional Ising model I: The torus, H. Hobrecht and A. Hucht, arXiv:1803.10155

[2] Anisotropic scaling of the two-dimensional Ising model II: Surfaces and boundary fields, H. Hobrecht and A. Hucht, arXiv:1805.00369