DY 23 Symposium Renormalization and Scaling (SYRS) – Contributed Talks I

Zeit: Samstag 14:00–15:30 Raum: TU H3010

DY 23.1 Sa 14:00 TU H3010

Large-n expansion for m-axial Lifshitz points — •Mykola Shpot[1], Yuri Pismak[2], and Hans Werner Diehl[3] — [1]Institute for Condensed Matter Physics, 79011 Lviv, Ukraine — [2]State University of Sankt-Petersburg, 198904 Sankt-Petersburg, Russia — [3]Fachbereich Physik, Universität Duisburg-Essen, Campus Essen, D-45117 Essen, FRG

A large-n expansion is presented for m-axial Lifshitz points with an arbitrary number of anisotropy directions m in d dimensional space. The first non-trivial terms of order $O(1/n)$ are derived for two independent correlation function critical exponents η_2 and η_4 and the related anisotropy index θ. Our results conform in appropriate limits with known large-n expansions for d-dimensional isotropic Lifshitz and critical points, as well as with available dimensionality expansions about the upper and lower critical dimensions. We give numerical values of the $1/n$ coefficients of η_2, η_4, and θ for physically most relevant case of uniaxial Lifshitz point in three dimensions, as well as for some other interesting choices of m and d. The $O(1/n)$ terms of these exponents are derived in a closed form in the special case $m = 1$, $d = 4$.

DY 23.2 Sa 14:15 TU H3010

Fractal structure and critical properties of planar loops — •Adriaan Schakel and Wolfhard Janke — Institut fuer Theoretische Physik, Universitaet Leipzig, Augustusplatz 10/11, 04109 Leipzig

The fractal structure of random loops formed by the high-temperature graphs of the two-dimensional O(N) model at the critical point are investigated by means of Monte Carlo simulations. At high temperatures, the loops have a finite line tension and are exponentially suppressed. Upon approaching the critical point, they gradually grow in size until reaching the critical point where the line tension vanishes and the loops proliferate–much like the sudden appearance of a spanning cluster at the percolation threshold in percolation phenomena. De Gennes' results for polymer chains, corresponding to the limit $N \to 0$, are generalized to arbitrary $-2 \leq N \leq 2$. The fractal structure of these loops is shown to encode the entire critical behavior of the O(N) models. The loops are also studied close to their tricritical point, corresponding to the Θ point in the context of polymers, where they collapse. A close connection between the fractal structures and thus the two critical behaviors is established.

DY 23.3 Sa 14:30 TU H3010

Phase structure of anomalous Coulomb gases — •Flavio Nogueira — Institut für Theoretische Physik, Freie Universität Berlin

An anomalous Coulomb gas differs from the usual one in the sense that anomalous scaling behavior makes it to deviate from the Coulomb potential form. This special type of Coulomb gas arises in the study of Mott insulators, superconductors, quantum Hall systems, and lattice gauge theories[see for example, H. Kleinert, F. S. Nogueira, and A. Sudbø, Phys. Rev. Lett. **88**, 232001 (2002); Nucl. Phys. B **666**, 361 (2003)]. One example is a logarithmic Coulomb gas in three dimensions, which undergoes a phase transition similar to the Kosterlitz-Thouless phase transition. Unlike the two-dimensional case, here the fugacity of the gas acquires an anomalous dimension. The general theoretical discussion will be illustrated by recent Monte Carlo simulations [S. Kragset, A. Sudbø, and F. S. Nogueira, Phys. Rev. Lett. **92**, 186403 (2004)].

DY 23.4 Sa 14:45 TU H3010

Infinite-dimensional symmetries in nonequilibrium systems and nonlinear differential equations — •Malte Henkel — LPM. Université Nancy I, B.P. 239, F - 54506 Vandœuvre lès Nancy, Frankreich

Spin systems quenched into their ordered phase undergo ageing and display dynamical scaling. A formal analogy with the well-known conformal invariance of equilibrium phase-transitions suggests the extension of dynamical scaling to a larger local scale-invariance. This leads to explicit predictions for the time-dependent reponse and correlation functions, in excellent agreement with recent results of numerical simulations [1]. We show that the group of local scale-transformations is infinite-dimensional and is the dynamical symmetry group of certain nonlinear differential equations [2]. It also arises as dynamical symmetry in stochastic systems, including the simple random walk [3].

[1] M. Henkel, A. Picone and M. Pleimling, Europhys. Lett. **68**, 191 (2004). [2] R. Cherniha and M. Henkel, J. Math. Anal. Appl. **298**, 487 (2004). [3] M. Henkel and J. Unterberger, in preparation.

DY 23.5 Sa 15:00 TU H3010

Monte Carlo simulations of the 3D bond-diluted Potts model — Christophe Chatelain[1], Bertrand Berche[1], •Wolfhard Janke[2], and Pierre Emmanuel Berche[3] — [1]Laboratoire de Physique des Matériaux, Université Henri Poincaré, Nancy 1, France — [2]Institut für Theoretische Physik, Universität Leipzig, Germany — [3]Groupe de Physique des Matériaux, Université de Rouen, France

Large-scale Monte Carlo simulations of the three-dimensional bond-diluted Ising and 4-state Potts model are presented. The phase diagram and the physical properties at the phase transition are mainly studied using finite-size scaling techniques. In the Potts case, numerical evidences for the existence of a tricritical point dividing a regime where the transition remains of first order and a second regime where the transition is softened to a continuous one by the influence of disorder are briefly summarized. In the former regime, the nature of the transition is essentially clarified through an analysis of the energy probability distribution. In the latter regime critical exponents are estimated. In this talk, the main emphasis is placed on a careful analysis of rare and typical events. Their identification and role is qualitatively discussed in both regimes.

DY 23.6 Sa 15:15 TU H3010

RG flow of fermionic particle systems — •Holger Gies — Institut für theoretische Physik, Philosophenweg 16, 69120 Heidelberg

We study the renormalization flow of fermionic systems as part of (chiral) relativistic particle theories. At strong coupling, spontaneous breaking of chiral symmetry can occur, with composite bosonic fluctuations becoming important near the transition scale. We employ functional RG techniques together with a continuous transformation of fermion to bosons fields for a systematic study of symmetry breaking. In particular, we investigate how the interactions with a gauge field can induce chiral symmetry breaking in the fermionic sector.