DY 23: Finite size effects at phase transitions III (session accompanying the symposium of the same name)

Time: Wednesday 15:45–17:15 Location: H3

DY 23.1 Wed 15:45 H3

Probing surface characteristics of diffusion-limited aggregation clusters with particles of variable size — •Lev Shchur — Landau Institute for Theoretical Physics, 142432 Chernogolovka, Russia

We develop a technique for probing harmonic measure of the diffusion limited aggregation (DLA) cluster surface with the variable size particle and generate one thousand clusters with 50 million particles using original off-lattice killing-free algorithm. Taking, in sequence, the limit of the vanishing size of the probing particles and then sending the growing cluster size to infinity, we achieve the unprecedented accuracy determining the fractal dimension, $D = 1.7100(2)$ crucial to characterization of geometric properties of the DLA clusters.

DY 23.2 Wed 16:00 H3

Phase transition in optimal foraging of bats — •Magnus Jungsbluth and Alexander K. Hartmann — Institut für Theoretische Physik, Georg-August-Universität Göttingen

Phase transitions have been found in many combinatorial optimization problems. The phase transitions can be analyzed using statistical mechanics methods like finite-size scaling. We study the so-called optimal foraging problem, which arises in biology. The aim is to find optimal ways how animals find their food. In collaboration with the biologists group of York Winter (Bielefeld) we got extensive data for a system of bats that eat nectar from flowers. We introduce a model for the biological system and solve it with a genetic algorithm. We observe a phase transition when varying the amount of nectar each bat has to collect per night. Using finite-size scaling we obtain a critical exponent for the correlation length $\nu = 1.7(3)$ similar to the traveling salesman problem. Other results include the emergence of two different length scales when looking at clustered resources and flight-time distributions that match with those measured in nature.

DY 23.3 Wed 16:15 H3

Finite-size scaling study of the six-vertex F model on regular and random lattices — •Martin Weigel[1] and Wolfhard Janke[2] — [1]Department of Mathematics and the Maxwell Institute for Mathematical Sciences, Heriot-Watt University, Edinburgh, EH14 4AS, UK — [2]Institut für Theoretische Physik, Universität Leipzig, Augustusplatz 10/11, 04109 Leipzig, Germany

Finite-size scaling (FSS) has been established as a powerful standard technique for the analysis of phase transitions, in particular from numerical simulation data. While in the common situation of a second (or even first) order phase transition, FSS techniques easily lead to high-precision estimates, more care is needed in some special circumstances such as the case of infinite-order Berezinski-Kosterlitz-Thouless phase transitions, where the power laws are replaced by exponentials *and* logarithmic corrections occur. We consider FSS in the six-vertex F model representative of this universality class, using high-precision, cluster-update Monte Carlo simulations [1]. The availability of an *exact solution* for the thermodynamic limit of this model allows for a rather detailed investigation of the occurring corrections. Extending on this, a further complication is introduced by considering this model coupled to a class of random lattices with a non-trivial fractal dimension, confining the analysis to very small effective linear system sizes [2].

[1] M. Weigel and W. Janke, J. Phys. A **38** (2005) 7067.
[2] M. Weigel and W. Janke, Nucl. Phys. B **719** (2005) 312.

DY 23.4 Wed 16:30 H3

Bosonic Nature of the Meissner Transition at finite magnetic Field — •Thomas Neuhaus — NIC, FZ-Jülich, Jülich

We study the low temperature 3d finite size rounded Meissner transition at finite magnetic field i.e., in vicinity of the lower critical field. For a type II superconductor one has a line of continuous phase transitions, which at magnetic field zero terminates in the well known 3d XY superfluid critical point. At finite field, the transition is however not of the superfluid kind, but of bosonic nature. The finite size scaling at the tranistion differs from Fisher scaling. This has its origin in the fact, that two length scales : the mean distance of vortices, and the size of vortex line orthogonal fluctuations, are both relevant at the transition.

DY 23.5 Wed 16:45 H3

Out-of-equilibrium processes in confined geometries — •Florian Baumann[1,2] and Michel Pleimling[3] — [1]Laboratoire de Physique des Matériaux (CNRS UMR 7556), Université Henri Poincaré Nancy I, B.P. 239 — [2]Institut für Theoretische Physik I, Universität Erlangen-Nürnberg, D – 91058 Erlangen, Germany — [3]Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0435, USA

Non-equilibrium dynamics have attracted considerable attention in recent years. Most of the studies however have been restricted to systems with an infinite geometry. A first step towards a more realistic situation is to consider a semi-infinite system, in which one is particularly interested in the behavior close to the surface. I present here some analytical and numerical results, both for quenches below and onto the critical point. It turns out that certain known statements about critical exponents do not necessarily hold for the corresponding surface exponents.

DY 23.6 Wed 17:00 H3

Jamming Transition in Two-Dimensional Shear-Driven Aggregation — •Daniel Rings and Klaus Kroy — Institut für theoretische Physik, Universität Leipzig, Vor dem Hospitaltore 1, 04103 Leipzig

Aggregation of colloids has an impact on various technological as well as biological systems. Examples range from accumulation of dust in bearings to clotting within blood vessels. While percolation theory describes the thermodynamic limit, we are interested in the specific features of such finite systems.

We study the shear-induced jamming transition within a toy model for colloidal suspensions. Implementing the rather novel simulation method of Collision-Driven Dynamics (CD) powered by Interval Arithmetics, we find a transition from kinetic aggregation to percolative behavior above a critical density in finite systems. Intriguingly, different density regimes show distinct structure formation encoded in fractal dimension and jamming time. A kinetic model has been developed in order to predict that time based on the specific density-dependent clustering mechanism.