DY 16: Statistical Physics II

Time: Wednesday 10:30–11:30 Location: HÜL 186

DY 16.1 Wed 10:30 HÜL 186

Investigation of the Structure of the Energy Landscape Making Use of a Clustering Approach — •Johannes Josef Schneider and Michael Kwasnicki — Department of Physics, Mathematics, and Computer Science, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany

Recently, we have introduced the Traveling Salesman Problem with Clustering [1], in which we extended the original Traveling Salesman Problem with the constraint that nodes close to each other should be visited contiguously in the tour, if the detour for fulfilling this constraint is not too long. In this talk, we apply this approach to the ordering of quasi optimum configurations of the SK model, the Traveling Salesman Problem, and a multidisperse packing problem [2,3]. The distances between the quasi optimum configurations are given by the inverse overlaps between the configurations. We show that this approach leads to a block structure in the permuted overlap matrix, similarly to Parisi's block structure.

[1] Johannes J. Schneider, Thomas Bukur, and Antje Krause, Traveling Salesman Problem with Clustering, J. Stat. Phys. 141, 767-784, 2010.

[2] Johannes J. Schneider, Andre Müller, and Elmar Schömer, Ultrametricity property of energy landscapes of multidisperse packing problems, Phys. Rev. E 79, 031122, 2009.

[3] Andre Müller, Johannes J. Schneider, and Elmar Schömer, Packing a multidisperse system of hard disks in a circular environment, Phys. Rev. E 79, 021102, 2009.

DY 16.2 Wed 10:45 HÜL 186

Real-Time Monte Carlo Simulations for a two-level-system within a Sub-Ohmic environment — •Denis Kast[1], Charlotte Escher[2], and Joachim Ankerhold[1] — [1]Institut für Theoretische Physik, Universität Ulm — [2]Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The two-level system (TLS) coupled to a dissipative environment (spin-boson-model) is studied within the numerically exact path integral Monte-Carlo (PIMC) approach. Well studied in all ranges of parameter space (e.g. temperature, coupling strength, cut-off frequency) is the real-time dynamics for ohmic spectral bath densities including a phase transition from a delocalized to localised regime at T=0. Much less is known for the sub-ohmic case which has recently gained considerable interest. Most studies, however, have been restricted to properties at T=0. Here we present real-time PIMC simulations for finite temperatures over a wide domain of parameters. Out of the TLS-dynamics estimates for the critical coupling strengths of the transition delocalized/localized are derived. Comparisons with alternative methods at T=0 are discussed.

DY 16.3 Wed 11:00 HÜL 186

Apollonian Breath Figures — •Johannes Blaschke, Tobias Lapp, and Jürgen Vollmer — Max Planck Institute for Dynamics and Self-Organization, 37073 Göttingen

The formation of dew droplets on planar surfaces is often referred to as Breath Figures. A scaling theory by Family and Meakin [1] predicts that the size distribution of the small droplets takes the form of a power law with exponent $-5/3$. Simulations show a clear deviation from this exponent by $\delta \simeq 0.1(0)$. This deviation had not been explained so far.

Taking insight from fractal packings [2], we have developed an extension to Family and Meakin's theory, which determines the correction to the size distribution for the small droplets. Knowing the fractal dimension of breath figures, d_f, we demonstrate how the correction, δ, is related to d_f: $\delta = 1/3(2 - d_f)$. This fractal dimension was subsequently measured from simulations to be $d_f = 1.6(9)$. Resulting in: $\delta = 0.103$

The case of breath figures forming on the underside of a horizontal surface constitutes another interesting, and previously unexplored, scenario: When droplets reach a critical size, they are distorted by gravity and eventually fall off the substrate. The previously published theories cannot be applied to this case. We report the results from our simulations and compare these to a kinetic theory.

[1] Family and Meakin. Phys. Rev. Lett. **61** (1988) 428-431
[2] Herrmann *et al.* Phys. Rev. Lett. **65** (1990) 3223-3226

DY 16.4 Wed 11:15 HÜL 186

How to describe bursty reaction kinetics? — •Stephan Eule — Max-Planck-Institut fuer Dynamik und Selbstorganisation

We introduce a generalization of the chemical master equation which is capable to describe reaction kinetics with non-Poissonian reaction statistics. Deviations from Poissonian reaction patterns have been observed in various systems ranging from reactions in cells to reactions involving polymers. Another application is the mathematical description of spreading rumors and infections that are usually modeled by simple reaction schemes. The corresponding dynamics is closely related to the interaction patterns of humans which are known to happen in bursts. We provide methods of solving the generalized chemical master equation and present an exact solution for a simple reaction scheme. Furthermore we show how the generalized chemical master equation can be extended to include reactions following Poissonian statistics and apply it to a reaction where the production of a reactant happens in sudden bursts while the degradation is normal.