DY 60: Posters - Brownian Motion, Noise

Time: Thursday 17:00–19:30 Location: P1A

DY 60.1 Thu 17:00 P1A

Convex Hulls of Self-Avoiding Random Walks: A Large-Deviation Study — •Hendrik Schawe[1], Alexander K. Hartmann[1], and Satya N. Majumdar[2] — [1]Institut für Physik, Carl von Ossietzky Universität Oldenburg — [2]Laboratoire de Physique Théorique et Modèles Statistiques, Université de Paris-Sud

We study the convex hulls of different types of random walks, i.e., the smallest convex polygon enclosing the trajectory of a random walk with T steps. While the convex hulls are of interest from a pure mathematical point of view, they are also considered as a model to estimate animal territories. The convex hulls of normal random walks are decently studied [1, 2], but very little is known about the convex hulls of other important types of random walks as the Self-Avoiding Random Walk (SAW) and the Loop-Erased Random Walk (LERW). Using Markov chain Monte Carlo sampling-techniques, we can study a large part of the support of the distributions of the area A or perimeter L of the convex hulls. This enables us to reach probability densities below $P(A) = 10^{-800}$ and scrutinize large-deviation properties. Similar to normal random walks, the probability densities show a universal scaling behavior dependent on the scaling exponent ν and the dimension of the observable (e.g., $d = 2$ for the area A and $d = 1$ for the perimeter L). Further, we determined the rate function $\Phi(\cdot) = -\frac{1}{T}\log P(\cdot)$ which shows convergence to a limit shape for $T \to \infty$.

[1] G. Claussen, A. K. Hartmann, and S. N. Majumdar, Phys. Rev. E **91**, 052104 (2015); [2] T. Dewenter, G. Claussen, A. K. Hartmann, and S. N. Majumdar, Phys. Rev. E **94**, 052120 (2016)

DY 60.2 Thu 17:00 P1A

Thermoelectric Charging of a Hot Spot in Electrolyte Solution — •Martin Fränzl and Frank Cichos — Molecular Nanophotonics, Institute for Experimental Physics I, Universität Leipzig, Germany

We discuss the thermoelectric charging of a hot spot in an electrolyte solution. The underlying thermal forces depend on the temperature gradient through different mechanisms. In the last decades thermophoresis of colloids is mainly discussed in terms of thermoosmotic pressure. However, in the recent years it has become clear that, for charged systems in an electrolyte solution the thermoelectric or Seebeck effect provides a non-local driving force that presents remarkable effects. At a non-uniform temperature, positive and negative ions have the tendency to migrate in opposite directions, thus giving rise to a thermoelectric field $E = S\nabla T$ that is proportional to the temperature gradient. This field drives charged particles to the hot or to the cold, depending on the sign Seebeck coefficient S and so on electrolyte. The present work investigates the thermoelectric properties by locally heating a gold film with a focused laser beam within a colloidal suspension and investigates the resulting colloidal transport.

DY 60.3 Thu 17:00 P1A

Weak nonergodicity in a generalized Lévy walk model — •Tony Albers and Günter Radons — Technische Universität Chemnitz, Germany

In this contribution, we investigate the weakly nonergodic behavior of a generalized Lévy walk in which the velocities of the flights depend on the durations of the flights in a nonlinear way. This process essentially depends on two characteristic exponents determining the distribution of flight durations and the deterministic dependence of the flight velocities on the durations of the flights. We compare for this model of anomalous diffusion the temporal behavior of the ensemble-averaged squared displacement with the time-averaged squared displacement and quantify the randomness of the latter with a scatter distribution and the ergodicity breaking parameter. We find regions in the two-dimensional parameter space which show manifestations of weak nonergodicity which have never been observed before in the literature. Moreover, we provide a simple explanation for the observed transitions between different kinds of anomalous diffusion and weak nonergodicity by a divergence of six different characteristic quantities of the random walk.

DY 60.4 Thu 17:00 P1A

Splitting of the Universality Class of Anomalous Transport in Crowded Media — Markus Spanner-Denzer[1], Felix Höfling[2], Sebastian Kapfer[1], Klaus Mecke[1], Gerd Schröder-Turk[3], and •Thomas Franosch[4] — [1]FAU Erlangen, Erlangen, Germany — [2]FU Berlin, Berlin, Germany — [3]Murdoch University, Murdoch, Australia — [4]Universität Innsbruck, Innsbruck, Austria

We investigate the emergence of subdiffusive transport by obstruction in continuum models for molecular crowding [1]. While the underlying percolation transition for the accessible space displays universal behavior, the dynamic properties depend in a subtle nonuniversal way on the transport through narrow channels. At the same time, the different universality classes are robust with respect to introducing correlations in the obstacle matrix as we demonstrate for quenched hard-sphere liquids as underlying structures. Our results confirm that the microscopic dynamics can dominate the relaxational behavior even at long times, in striking contrast to glassy dynamics.

[1] M. Spanner, F. Höfling, S.C. Kapfer, K.R. Mecke, G.E. Schröder-Turk, and T. Franosch, Phys. Rev. Lett. **116**, 060601 (2016).

DY 60.5 Thu 17:00 P1A

Hot Brownian Motion — •Alexander Fischer and Frank Cichos — Molecular Nanophotonics, Institut für Experimentalphysik I, Fakultät für Physik und Geowissenschaften, Universität Leipzig

Hot Brownian motion describes the motion of a heated microsphere in a liquid. A temperature field is created around the heated particle decaying with 1/r. The heat transferred from the particle to the surrounding fluid spreads around three orders of magnitude faster than the particle moves. Therefore a stationary temperature field is moving with the particle through the liquid. The non-equilibrium dynamics of the particle now differs from the unheated particles and an effective temperature and viscosity is introduced to describe the system. With the development of fast detection systems in the recent years and the possibility to restrict the motion of a microscopic object using an optical tweezer, an investigation of hot Brownian motion on short time scales has become possible. Due to the increasing impact of the particle's inertia and the surrounding fluid on short time scales, the motion of the particle is not completely random anymore. The aim of this research is to understand the fundamentals of an effective temperature definition for fluctuation dissipation relations under non-equilibrium conditions.