Stochastic modeling of diffusion in dynamical systems: three examples

Rainer Klages

Technische Universitaet Berlin, Institut fuer Theoretische Physik and

School of Mathematical Sciences, Queen Mary University of London

Consider equations of motion yielding dispersion of an ensemble of particles. For a given dynamical system an interesting problem is not only what type of diffusion is generated but also whether the resulting diffusive dynamics matches to a known stochastic process. I will discuss three examples of dynamical systems displaying different types of diffusive transport: The first model is fully deterministic but non-chaotic by showing a whole range of normal and anomalous diffusion under variation of a single control parameter [1]. The second model is a soft Lorentz gas where a point particles moves through repulsive Fermi potentials situated on a triangular periodic lattice [2]. It is fully deterministic by displaying an intricate switching between normal and superdiffusion under variation of control parameters. The third model randomly mixes in time chaotic dynamics generating normal diffusive spreading with non-chaotic motion where all particles localize [3]. Varying a control parameter the mixed system exhibits a transition characterised by subdiffusion. In all three cases I will show successes, failures and pitfalls if one tries to reproduce the resulting diffusive dynamics by using simple stochastic models.

Joint work with all authors on the references cited below.

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