

Long-time asymptotics for open classical systems

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In this talk I will present some recent results on the long time asymptotics of a small Hamiltonian system (the "distinguished particle") coupled to a heat bath which is modeled as an infinite dimensional Hamiltonian system with random initial conditions. After elimination of the heat bath variables, the dynamics of the distinguished particle can be described using a stochastic integrodifferential equation, the generalized Langevin equation (GLE). The GLE can then be approximated by a degenerate Markov process in an extended phase space. For this Markov process we prove exponentially fast convergence to equilibrium, a homogenization theorem (invariance principle), estimates on derivatives of the associated Markov semigroup and we also study several distinguished limits of physical interest. Applications of our results to MCMC (Markov Chain Monte Carlo) techniques are also discussed. Our proofs are based on a careful analysis of the spectrum of the generator of this Markov process, which is a hypoelliptic operator, and extensive use of the recently developed theory of hypocoercivity is made. This is joint work with Michela Ottobre and Karel Pravda-Starov.