Small eigenvalues and mean transition times
for irreversible diffusions

Barbara Gentz, Bielefeld

Abstract: The spectral theory of reversible diffusions in the small-noise limit is well understood. The small eigenvalues of the generator have been analyzed by a number of different methods, including large deviations, semiclassical analysis and potential theory. However, the study of the irreversible case, which involves a non-selfadjoint generator, is substantially more difficult. We will discuss an approach based on Laplace transforms of hitting times for Markov chains with continuous state space. These Markov chains arise from random Poincaré maps.

The proposed approach provides information on the exponentially small eigenvalues of the generator, and on mean transition times between attractors. As an illustration, we will present a detailed analysis of the asymptotic behaviour of the first-passage time of a planar diffusion through an unstable periodic orbit in the small-noise limit.
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