Abstract

Let $(X_t)_{t\geq 0}$ be the stochastic process solution to the overdamped Langevin dynamics

$$dX_t = -\nabla f(X_t)\, dt + \sqrt{h}\, dB_t$$

and let $\Omega \subset \mathbb{R}^d$ be the basin of attraction of a local minimum of $f : \mathbb{R}^d \to \mathbb{R}$. Up to a small perturbation of Ω to make it smooth, we prove that the exit rates of $(X_t)_{t\geq 0}$ from Ω through each of the saddle points of f on $\partial\Omega$ can be parametrized in the limit $h \to 0$ by the celebrated Eyring-Kramers laws.

This provides firm mathematical grounds to jump Markov models which are used to model the evolution of molecular systems, as well as to some numerical methods which use these underlying jump Markov models to efficiently sample metastable trajectories of the overdamped Langevin dynamics.

(From works in collaboration with G. Di Gesù, T. Lelièvre, and B. Nectoux)