Dynamically active particles and escape events

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The problem of the escape from a metastable state is ubiquitous in almost all scientific fields. A lot of work has been done on passive particle escape events (i.e., in combination with an equilibrium environment) [1]. However, the case of the active (non-equilibrium) particles is less digested. The escape rate of the passive particle only depends on the potential difference [1]. We study the non-local effects of the potential on the active particle. There already are similar results in the literature [2]. We present a novel approach to the active particle dynamics: the active and passive regimes are treated with a single model. The rare events were considered, and in that case, the path-integral solution to the Fokker–Planck equation resulted in simple Hamiltonian dynamics. This is the method of Large deviations (aka optimal fluctuation) [3], where the logarithm of the transition probability is proportional to the extremal action. We could only solve the model analytically for piecewise quadratic potentials, however, we already see interesting behavior for this class of potentials. One of the notable discoveries is the dynamical phase transition depending on the steepness of the potential.

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