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Escape and Synchronization of a Brownian Particle

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Brownian movement is a classic of statistical physics. In his seminal work, Kramers[1] developed a theory on the thermally activated escape from a potential well. In a recent letter,[2] we present a visualization of the escape of a 1-μm Brownian particle at room temperature in water and show that the theory is quantitatively verifiable in the overdamped regime. Using the technique of optical traps, we localize the particle in a double potential well created by two optical traps and study its escape. We then enrich the dynamics by temporal modulation of the well[3] and observed the proposed stochastic synchronization of Benzi *et al.*[4]

This is a model system for a wide range of phenomena in nature, from neuronal action potentials to muscular motility, and even climate change. The concept invoked is always synchronization of a stochastic escape within a double potential well. As far as we know, this is the first experiment directly analyzing the process for a particle in a double well, subjected to intrinsic thermal activation.

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