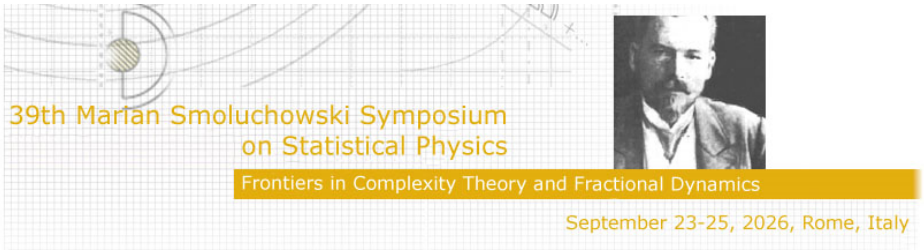

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Multimodality of stationary states in single-well potentials

Wednesday, 23 September 2026 12:00 (30 minutes)

Noise-driven dynamics in single-well potentials can produce bimodal, or more generally multimodal, stationary states. The emergence of multimodality depends sensitively on the properties of the driving noise. Such behavior is typically associated with systems subject to strong fluctuations, for example those driven by Lévy noise, or with systems driven by temporally correlated noise, such as Ornstein–Uhlenbeck noise or fractional Brownian noise.

Multimodality may also arise from the combined action of several stochastic mechanisms. In particular, dichotomous noise may randomly alter the potential landscape, while an additional driving noise spreads trajectories within the currently realized potential. As a result, the stationary probability density can develop multiple maxima even when the underlying deterministic potential has only a single well. A closely related mechanism may occur in systems with stochastic resetting. In such systems, resetting can concentrate probability mass near the reinjection points, thereby facilitating the formation of additional maxima in the stationary distribution.

In this work, we examine the formation of multimodal stationary states in various types of noise-driven systems. We focus on how the statistical properties of the noise, including its intensity, temporal correlations, and mode of coupling to the dynamics, determine whether the stationary state remains unimodal or becomes bimodal or multimodal.

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