MAKING RARE EVENTS TYPICAL IN CHAOTIC MAPS

Carlos Pérez-Espigares*
Institute Carlos I for Theoretical and Computational Physics, University of Granada, Granada, Spain

Due to the deterministic nature of chaotic systems, fluctuations in their trajectories arise solely from the choice of initial conditions. Some of these dynamical fluctuations can lead to extremely unlikely scenarios. Understanding the impact of such rare events—and the trajectories that give rise to them—is of significant interest across disciplines. However, identifying the initial conditions responsible for these events is challenging due to the extreme sensitivity of chaotic dynamics to small perturbations. In this talk, we present a framework to circumvent this difficulty by constructing an effective, topologically conjugate map whose typical trajectories correspond to atypical ones of the original system. This approach is illustrated through examples that counterbalance the instability of fixed points and periodic orbits, as well as through the characterization of a dynamical phase transition involving the finite-time Lyapunov exponent. In doing so, we bring chaotic maps into the growing class of systems whose rare fluctuations—sustaining prescribed statistics of dynamical observables—can be analyzed and controlled via a large deviation formalism.

* cpespigares@onsager.ugr.es