# High Energy of Recurrent Chaotic Trajectories in a Time-Dependent Potential Well Model

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In this numerical study, we explore the Recurrence Quantification Analysis (RQA) of chaotic trajectories, which provides a novel method for detecting uncommon dynamical behaviours. By defining an ensemble of Initial Conditions (ICs), evolving them until a specified maximum iteration time, and computing the Recurrence Rate (RR) of each orbit, we identify particular trajectories that differ significantly from the average dynamical behaviour [1]. These special trajectories are identified through a suitable statistical distribution, where peak detection reveals the respective IC that evolves into a highly recurrent orbit. Using this approach, we analyse the effects of these recurrent chaotic trajectories in a symplectic model for a time-dependent potential well [2]. We show that, for specific parameter values and initial conditions, the system can experience rare transient states of high energy, caused by temporary but sufficiently long quasi-periodic dynamics.

## References

[1] M. S. Palmero *et al.*, "Finite-time recurrence analysis of chaotic trajectories in Hamiltonian systems", Chaos: An Interdisciplinary Journal of Nonlinear Science, vol. 32, 113144 (2022).

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## Type

ORAL