Irregular diffusion in the bouncing ball billiard

Rainer Klages

Queen Mary University of London, School of Mathematical Sciences

Abstract

The bouncing ball billiard consists of a particle that is subject to a constant vertical force and bounces inelastically on a vibrating corrugated floor. Computer simulations show that the deterministic diffusion coefficient of this system is a highly irregular function of the driving frequency. For large friction and small curvature of circular scatterers we find an irregular enhancement of diffusion due to frequency locking related to a ball bouncing on a flat vibrating plate. For smaller friction and larger curvature there is a complicated bifurcation scenario exhibiting a very different series of resonances that again enhance diffusion in a profoundly irregular manner. This type of models is well-known to describe corrugated vibro-transporters, which are common carriers of agricultural material like grains or other granular particles. Here similar phenomena have already been observed experimentally.

[1] L.Matyas, R.Klages, Physica D **187**, 165 (2004)

[2] R.Klages, I.F.Barna, L.Matyas, Phys. Lett. A **333**, 79 (2004)