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Decay of energy and suppression of Fermi acceleration in a dissipative driven stadium-like billiard

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ABSTRACT

The behavior of the average energy for an ensemble of non-interacting particles is studied using scaling arguments in a dissipative time-dependent stadium-like billiard. The dynamics of the system is described by a four dimensional nonlinear mapping. The dissipation is introduced via inelastic collisions between the particles and the moving boundary. For different combinations of initial velocities and damping coefficients, the long time dynamics of the particles leads them to reach different states of final energy and to visit different attractors, which change as the dissipation is varied. The decay of the average energy of the particles, which is observed for a large range of restitution coefficients and different initial velocities, is described using scaling arguments. Since this system exhibits unlimited energy growth in the absence of dissipation, our results for the dissipative case give support to the principle that Fermi acceleration seems not to be a robust phenomenon.

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