

Fermi acceleration in time dependent billiards

Edson D Leonel¹

Sylvie Oliffson Kamphorst²

Sônia Pinto de Carvalho²

Jafferson K L da Silva³

1 Departamento de Estatística, Matemática Aplicada e Computação UNESP.
Av 24A 1515 Rio Claro 13506-700 (Brasil).

2 Departamento de Matemática. UFMG. C. P. 702 Belo Horizonte 30123-970
(Brasil).

3 Departamento de Física. UFMG. C. P. 702 Belo Horizonte 30123-970 (Brasil).

Abstract

Billiards with time dependent boundaries are a natural generalization of the one dimensional Fermi accelerator model and a simple example of time dependent hamiltonian systems. Besides their interest from the point of view of dynamical systems, the fundamental question is if a particle moving inside a bounded region and undergoing elastic collisions with a moving boundary can be given unlimited energy. We will address this question, presenting some exact and numerical results which indicate that the answer depends on the shape of the boundary and on the nature of the phase space of the static model. In particular Fermi acceleration seems to be related to chaotic dynamics, while integrability seems to imply the boundedness of energy.

References

- [1] J. Koiller, R. Markarian, S. Oliffson Kamphorst, S. Pinto de Carvalho. Time dependent billiards *Nonlinearity* 8: 983-1003, 1995.
- [2] S. Oliffson Kamphorst, S. Pinto de Carvalho. Bounded gain of energy in the breathing circle billiard. *Nonlinearity*, 12: 1363-1371, 1999.
- [3] E.D. Leonel, J. K. L. da Silva, S. Oliffson Kamphorst. Time dependent oval billiards. *Preprint*, 2006.