Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

On energy equilibration in slow fast systems

Prof. Vered Rom-Kedar

Department. of computer science and applied mathematics
Weizmann Institute

Abstract:

In 1949, Fermi proposed a mechanism for the heating of particles in cosmic rays. He suggested that on average, charged particles gain energy from collisions with moving magnetic mirrors since they hit the mirrors more frequently with heads on collisions. Fermi, Ulam and their followers modeled this problem by studying the energy gain of particles moving in billiards with slowly moving boundaries. Until 2010 several examples of such oscillating billiards leading to power-law growth of the particles averaged energy were studied. In 2010 we constructed an oscillating billiard which produces exponential in time growth of the particles energy. The novel mechanism which leads to such an exponential growth is robust and may be extended to arbitrary dimension. Moreover, the exponential rate of the energy gain may be predicted by utilizing adiabatic theory and probabilistic models. The extension of these results to billiards with mixed phase space leads to the development of adiabatic theory for non-ergodic systems. Finally, such accelerators lead to a faster energy gain in open systems, when particles are allowed to enter and exit them through a small hole. The implications of this mechanism on transport in extended systems and on equilibration of energy in closed systems like "springy billiards" will be discussed. The latter application provides a key principle: to achieve ergodicity in slow-fast systems in the adiabatic limit, the fast subsystems should NOT be ergodic.

The talk is based on joint works with Vassili Gelfreich, Kushal Shah and Dmitry Turaev .

Date & Location:

Tuesday, December 3, 2019, 11:00
Lecture room, Physics Building (ground floor)