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Particle acceleration in non-autonomous billiards

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This talk presents a survey of recent results on the evolution of particle energy in a mathematical billiard inside a time-dependent domain. Assuming that the particle moves much faster than the boundary, we discuss sufficient conditions for the exponential growth of the energy. If the dynamics in the frozen domain is ergodic the evolution of the energy can be described by the adiabatic theory, which leads to conclusions similar to the adiabatic theory of an ideal gas. The ergodic adiabatic theory can be extended to systems with mixed phase space where the ergodicity condition is violated, this extension leads to a probabilistic model for the particles dynamics. This approach takes into account transition of the phase volume between ergodic components of the frozen billiard and leads to a quantitative prediction for the acceleration rate. This rate is in good agreement with results of numerical simulations. Finally, we discuss the problem of energy equilibration. This is a joint work with V. Rom-Kedar, K. Shah and D. Turaev.