Billiards in Celestial Mechanics: a model for the galactic motion

Irene De Blasi

University of Turin
irene.deblasi@unito.it

A new type of dynamical model, describing the motion of a point-mass particle in an elliptic galaxy with a massive central core (such as, for example, a Black Hole), is studied.
This kind of model belongs to the more general class of the *refraction billiards*, particularly useful as a way to describe the dynamics of particles under the action of discontinuous potentials. In our case, a refraction interface (a regular closed curve) separates a Keplerian potential with positive energy from a two-dimensional homogeneous harmonic potential.
The dynamical properties of the system depend crucially on the geometric features of the interface. In particular, using some techniques coming from the theory of classical billiards, as well as more general framework (e.g. from Aubry-Mather or KAM theory), it is possible to infer results regarding the existence and stability properties of equilibrium trajectories or the arising of chaotic behaviours.
Work in collaboration with V. Barutello and S. Terracini.

References

De Blasi I., Terracini S., Refraction periodic trajectories in central mass galaxies. *Nonlinear Analysis* (2022)
De Blasi I., Terracini, S., On some refraction billiards. *Discrete and Continuous Dynamical Systems* (2022)
Barutello V.L., De Blasi I., Terracini, S., Chaotic dynamics in refraction galactic billiards. *Nonlinearity* (2023)