Planetary rings with shepherds: generic aspects

L. Benet[1]

[1]*Max Planck Institut für Kernphysik*
Postfach 103980, D-69029 Heidelberg, Germany.
E-mail: Luis.Benet@mpi-hd.mpg.de

We consider the system of planetary rings with shepherds as a reduced four-body problem neglecting interaction between ring particles. A scattering billiard model is introduced in this context to show that the appearance of stable narrow rings is generic for such systems. A saddle-center bifurcation is responsible for the relevant appearance of elliptic regions in phase space, that will generally assume ring shapes in the synodic frame, which in turn will precess in the sidereal frame. The generic character of this mechanism, as well as the extension to the case involving $1/r$ potentials is discussed.