

Figure eights with three bodies

Richard Montgomery
UC Santa Cruz

ABSTRACT

Recently, Alain Chenciner (Paris 7 and Bureau des Longitudes) and the speaker discovered a surprisingly simple periodic orbit for the Newtonian three body problem : three equal masses chase each other around a fixed curve in the plane with the shape of a figure eight. From many points of view this is the simplest periodic solution for the problem, after those of Lagrange and Euler. It is also as dynamically stable as can be expected for a high degree of freedom Hamiltonian system, and persists over a range of masses. We outline our existence proof, which combines the direct method of the calculus of variations, the use of discrete symmetries and a detailed knowledge of the geometry of space of oriented congruence classes of planar triangles. We end with a brief tour of dynamics around the figure eight, courtesy of numerical investigations by C. Simo (Barcelona) and a report on a flurry of recent generalizations to more masses.