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Title: Oscillatory motions and parabolic manifolds at infinity in the planar circular restricted three body problem

Abstract: In the Restricted Planar Circular 3 Body Problem, if the trajectory of the body of zero mass is defined for all time, it can have the following four types of asymptotic motion when time tends to infinity forward or backward in time: bounded, parabolic (goes to infinity with asymptotic zero velocity), hyperbolic (goes to infinity with asymptotic positive velocity) or oscillatory (the position of the body is unbounded but goes back to a compact region of phase space for a sequence of arbitrarily large times). We consider realistic mass ratio for the Sun-Jupiter pair and Jacobi constant which allows the massless body to cross Jupiter's orbit. This is a non-perturbative regime. We prove the existence of all possible combinations of past and future final motions. In particular, we obtain the existence of oscillatory motions. All the constructed trajectories cross the orbit of Jupiter but avoid close encounters with it. The proof relies on analyzing the stable and unstable invariant manifolds of infinity and their intersections. We construct orbits shadowing these invariant manifolds by the method of correctly aligned windows.

Joint work with: Marcel Guardia, Pau Martín, Tere Seara and Piotr Zgliczynski