Oscillatory orbits in the planar three body problem

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Abstract

The planar three body problem models the motion of three bodies under the Newtonian gravitational force. In the restricted casem we assume that one of the bodies has no mass and the other two bodies evolve in Keplerian ellipses.

Since Chazy (1922), it is known that the possible states the body $q(t)$ can approach as time tends to infinity are four:

- Hyperbolic: $\|q(t)\| \to \infty$ and $\|\dot{q}(t)\| \to c > 0$ as $t \to \pm\infty$.
- Parabolic: $\|q(t)\| \to \infty$ and $\|\dot{q}(t)\| \to 0$ as $t \to \pm\infty$.
- Bounded: $\limsup_{t\to\pm\infty} \|q\| < +\infty$.
- Oscillatory: $\limsup_{t\to\pm\infty} \|q\| = +\infty$ and $\liminf_{t\to\pm\infty} \|q\| < +\infty$.

Examples of all these types of motion, except the oscillatory ones, were already known by Chazy.

In this talk, we prove the existence of oscillatory motions for any value of the masses of the primaries assuming they move in ellipses whose eccentricity is small enough, as a consequence of the transversal intersection of the stable and unstable manifolds of periodic orbits at "infinity", and using techniques of Arnold diffusion. We also extend these results to the general case (work in progress).

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