

The parabolic RTBP. Interchange of mass after a close encounter between galaxies

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We consider the motion of the Parabolic restricted three body problem (PRTBP). The goal of this problem is to study the motion of a massless body attracted, under the Newton's law of gravitation, by two masses moving in parabolic orbits all over in the same plane. The PRTBP may be regarded as a simplified model for the motion of two galaxies, taken as the primaries, and an infinitesimal mass. In order to discuss possible motions for the particle, first we consider a rotating and pulsating frame where the primaries remain at rest. For the system of ODE obtained we apply dynamical systems tools. More precisely, this system of ODE is gradient-like and has exactly ten hyperbolic equilibrium points lying on the boundary invariant manifolds corresponding to escape of the primaries in past and future time. The invariant manifolds of the equilibrium points play a key role in the dynamics and we study some trajectories described by the particle before and after a close encounter between the primaries. Finally some numerical simulations are done, paying special attention to capture and escape orbits.

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