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Stability of circular orbits in the 3 body problem

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The 3 body problem has been studied for the last few centuries. While there are some known particular solutions, like the Euler and Lagrange solutions, and some specific cases, like the restricted 3 body problem, that have been more thoroughly studied, our knowledge about this topic is far from complete.

The N body problem can be reduced to a system of equations whose only parameters are the masses of the bodies involved. These equations show that in a limit where masses are small, the orbits tend to become Keplerian. This work will focus on identifying stability conditions for the parameters that allow the existence of stable periodic orbits in a general 3 body problem configured as a planetary system, i.e., 2 bodies (planets) orbiting the 3rd one (a star). Preliminary results already suggest the existence of a limited interval for the masses for which the systems are stable.

Results obtained from this study will serve as a foundation for a cornerstone of this work, the search for stable orbits in the N body problem, in order to shed some light on the structure of our Solar System, on the formation of planetary systems and planets by accretion, and on empirical and unexplained observations such as the Titius-Bode law.

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