

Secular instability in the three-body problem

Marcel Guàrdia

Departament de Matemàtiques

Universitat Politècnica de Catalunya. *

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Abstract

Consider the spatial three-body problem, in the regime where one body revolves far away around the other two, in space, the masses of the bodies being arbitrary but fixed; in this regime, there are no resonances in mean motions. The so-called secular dynamics governs the slow evolution of the Keplerian ellipses. We show that it contains a horseshoe and all the chaotic dynamics which goes along with it, corresponding to motions along which the eccentricity of the inner ellipse undergoes large, random excursions. The proof goes through the surprisingly explicit computation of the homoclinic solution of the first order secular system, its complex singularities and the Melnikov potential. This is a joint work with Jacques Féjoz.