

Librational KAM tori in the secular dynamics of the ν -Andromedae planetary system

Chiara Caracciolo

Università degli Studi di Roma “Tor Vergata”

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Abstract

We investigate the stability of the secular motion of the two most massive planets in the ν -Andromedæ planetary system. Such a system has some remarkable characteristics: both the major planets move in rather eccentric orbits ($e \simeq 0.3$) with a relevant mutual inclination ($\simeq 30^\circ$); moreover, since their masses are about ten times larger than the Jupiter one and the mutual distance is relatively short (being the semi-major axes $\simeq 0.8$ AU and $\simeq 2.5$ AU, resp.), there is a strong interaction between them. We study the secular approximation at order 2 in the masses of the planetary three-body problem. In this framework, using a normal form approach, we show the existence of librational KAM tori, whose configuration is such that the arguments of the pericenters of the two planets are in libration around the alignment. In practice, we start from the construction of a suitable elliptic lower dimensional torus, i.e., a solution where the pericenters stay completely aligned; then, we construct tori of maximal dimension, by focusing on the one which corresponds to initial conditions compatible with the observations.

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