Paper ID: 29323
oral
student

ASTRODYNAMICS SYMPOSIUM (C1)
Orbital Dynamics (1) (3)

Author: Mr. Marc Jorba-Cuscó
University of Barcelona, Spain

Dr. Ariadna Farrés
University of Barcelona, Spain
Prof. Angel Jorba
University of Barcelona, Spain

A STUDY ON THE EFFECT OF SOLAR RADIATION PRESSURE ON THE STABILITY REGION NEAR THE EARTH-MOON TRIANGULAR POINTS

Abstract

The Solar Radiation Pressure (SRP) is the pressure exerted by the electromagnetic radiation emitted by the Sun upon a body. It is known that this physical phenomenon plays an important role on the description of the motion of certain bodies. For instance, SRP has a significant impact on the motion of space dust and it is the underlying physical phenomenon that allows spatial navigation with a Solar Sail. The purpose of this work is to study the existence of a stability region near the triangular point, L_4, of the Earth-Moon system when both, Sun's gravitational potential and SRP effects are considered. The model we use is the Bicircular Problem with an extra term corresponding to the SRP, which we call SRPBCP. Both the Bicircular Problem and the SRPBCP can be seen as a time dependent perturbation (due to the Sun) of the Earth-Moon Restricted Three Body Problem (RTBP).

It is well known that the RTBP has five equilibrium points (L_i, $i = 1, \ldots, 5$). We focus on L_4 (and L_5) which are linearly stable. When the periodic perturbation corresponding to the Sun is added, the Lagrangian points are no longer equilibria, they are replaced by periodic orbits with the same period as the Sun. If the SRP effect is neglected and we only consider the perturbation due to the gravitational field of the Sun, there are three periodic orbits with the same period as the Sun in the vicinity of the geometrical L_4. Analogously, in the Bicircular Problem, the vertical families of periodic orbits of the RTBP are replaced by 2-dimensional invariant tori with two basic frequencies: one of the corresponding vertical orbit and the other corresponding to the periodic motion of the Sun. These invariant tori lead to an effective stability region located at some distance from the triangular point, that seems to persist in the real model.

We will investigate how these invariant tori vary when we include the effect of the SRP in our model, and show how this affects the stability region. We will consider different area-to-mass ratios to understand what kind of objects are expected to be found in these regions.