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STRATEGY TO ACHIEVE GRAVITATIONAL CAPTURE AT CALLISTO

Abstract

Laplace (or Europa – Jupiter System Mission) is an L-class candidate mission for the Cosmic Vision 2015-2025 programme. It would be a joint project carried on by ESA, NASA and JAXA, aiming at the study of the Jupiter environment and its moons. ESA is coordinating the outer moons phase, whose primary scientific goal is represented by Ganymede.

Concerning Callisto, the available fuel does not allow to insert into an orbit around it and thus it has been developed a pseudo-orbit solution, which takes advantage of resonances and swing-by at Callisto.

In this work, we show a different option that can be adopted in order to obtain zero-cost observational data of Callisto. We exploit the Circular Restricted Three – Body Problem and the low-energy trajectories associated with this model, pointing out drawbacks and benefits brought by this choice.

The most crucial point in this approach consists in the low value of velocity with respect to the moon, say v_∞, that the probe must meet for being captured. We demonstrate how this constraint can be fulfilled, thanks to subsequent gravitational perturbations of Callisto on the spacecraft. This means that starting from a perijove as low as the Ganymede – Jupiter distance and a v_∞ of about 1.5 km/s, we are able to increase the perijove and decrease v_∞ up to the range admitted by the weak capture.

The End-Game we follow turns out to be a very effective method also in other situations. We provide some examples which apply in different planet-moon systems.