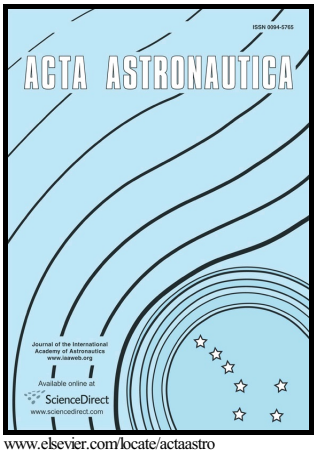

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MAGNETOUR: Surfing Planetary Systems on Electromagnetic and Multi-Body Gravity Fields

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ABSTRACT

A comprehensive tour of the complex outer planet systems is a central goal in space science. However, orbiting multiple moons of the same planet would be extremely prohibitive using traditional propulsion and power technologies. In this paper, a new mission concept, named Magnetour, is presented to facilitate the exploration of outer planet systems and address both power and propulsion challenges. This approach would enable a single spacecraft to orbit and travel between multiple moons of an outer planet, without significant propellant or onboard power source. To achieve this free-lunch 'Grand Tour', Magnetour exploits the unexplored combination of magnetic and multi-body gravitational fields of planetary systems, with a unique focus on using a bare electrodynamic tether for power and propulsion. Preliminary results indicate that the Magnetour concept is sound and is potentially highly promising at Jupiter.

Keywords:

Electrodynamic tether; circular restricted three-body problem; multi-moon tour; propellantless propulsion; Jupiter

1. INTRODUCTION

A full study of the giant, complex outer planet systems is a central goal in space science. Exploring these systems can help us understand better our solar system as a whole. According to the Decadal Survey [[1]], a full exploration of planetary moon systems of Jupiter, Saturn and Uranus are top priorities for the next flagship class tour and orbiting mission. In particular, a comprehensive visit of the four large moons of Jupiter, known as the "Galilean moons", is important to search for liquid water and extraterrestrial life.

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