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A MULTIPLE ASTEROID RENDEZVOUS MISSION IN THE MAIN BELT

Abstract

The research of asteroids has gained momentum in the past two decades. With the developments in observation techniques and the launch of space telescopes, the available possibilities to watch the sky have led to a steadily increasing discovery rate. The data collected and conclusions drawn have allowed a tremendous jump in the knowledge on spectral classes, physical conditions, the history and collision evolution of the asteroids in our solar system. Nevertheless, there are still more questions unanswered than riddles solved and the third century of asteroid science starts with the demand of spacecraft encounters to aim for the next leap. Small body missions are studied and conducted by space agencies in order to feed the obtained observational data with in-situ measurements.

The multiple asteroid rendezvous mission is an exploration mission to investigate the physical characteristics and composition of several main belt asteroids. From a dedicated parking orbit at 2.8 AU, the composite spacecraft Titius-Bode will depart to study a sequence of three asteroids and their environments. It consists of an orbiter Titius and a lander with full steering capabilities Bode. The science payload of both entities will provide detailed information on the origin and evolution of asteroids, which are remnants from the early foundation phase of the solar system, as well as their composition and potential resource value. The science objectives focus on the global and local characterization of each object including several landing sites on the surface. Bode will be released in the low-gravity environment to perform bi-static radar and radio-tomography for thorough research of the physical parameters such as bulk density and compositional structure. Bode's design enables a controlled landing, ascent and re-docking with Titius in order to leave to the next target. The paper gives a detailed overview on the Titius-Bode mission profile and its spacecraft design, the trajectory profile and target selection. It describes the scientific instrumentation suites and science goal of the mission.