MASTER: A DISCOVERY-CLASS ORBITER FOR THE DETAILED STUDY OF 1 ARGE MAINBELT AS-I E ROIDS

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Abstract

MAS1 ER (Mainbelt Asteroid Exploration/Rendezvous) focuses on the comprehensive global study of important large mainbelt asteroids. A three-instrument, four-investigation payload can be placed into orbit around 4 Vesta within the cost/complexity envelope of the Discovery program using a Delta-n launch vehicle. The detailed global study of such an object will provide essential new data on the present state and past evolution of asteroids, including information not obtainable by fast flybys or by rendezvous with mere asteroidal shards such as the tiny Earth-approaching asteroids.

INTRODUCTION

Galileo has given us our first glimpses of two mainbelt **asteroids and** NEAR (Near-Earth Asteroid Rendezvous) promises to provide a detailed study of a near-Earth asteroid, but large asteroids in the main belt remain unexplored. They differ from near-Earth asteroids and objects such as Ida and Gaspra in a fundamental way, almost certainly representing protoplanets which have survived since the beginning of the solar system at or near their formation location. Large mainbelt asteroids provide the unique opportunity to investigate a surface chronology dating back to the very early solar system and to determine the mineralogy and elemental abundances of protoplanetary materials in well-defined places within the zone separating the inner and the outer planets. Ida, Gaspra, and Eros (the target of NEAR), being fragments of once larger objects, do not allow us to reconstruct with certainty the identity or the formation location of the parent bodies,

The Mainbelt Asteroid Exploration/Rendezvous (MASTER) mission represents the next major step toward characterizing the asteroids and their context as remnant planetesimals. MASTER will send a spacecraft to rendezvous with Vesta, one of the most important large mainbelt asteroids. Measurements of its mineralogy and elemental abundances, during a one-year orbiting phase, will establish the chemistry and formation conditions at a specifically known location within the protoplanetary nebula. Almost certainly, the investigation of this asteroid will reveal evidence of processes such as volcanism which cannot be studied on smaller objects. T"he MASTER mission can be accomplished within the cost and complexity envelope of the Discovery Program.