

The Hera mission: Sample return from three near-Earth asteroids

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Abstract

There are several indications that the next few decades will be the era of sample return. Stardust, Genesis and Muses C will return samples of cometary and interstellar dust, solar wind particles and a near-Earth asteroid. The Muses C mission is a technology development mission that will soon be launched and will return a few hundred milligrams from asteroid 1998SF36. We have been developing a mission that will return nine samples totaling 2-3 kg from three sites on three near-Earth asteroids. Our aim is to obtain samples from various geological contexts on asteroids of differing spectral class. The scientific justification for the mission is that while it is clear that primitive materials like asteroids and meteorites are instructive of processes and conditions in of early solar system, their study is handicapped by an almost complete lack of information about the geological context and by selection effects imposed by passage through the Earth's atmosphere, since only the toughest of materials can survive. Based on a study of Eros images obtained by the NEAR spacecraft, there are a broad range of geological contexts on asteroids from which it should be possible to obtain scientifically important samples. Studies of returned samples have many advantages over in situ studies, the depth and breadth of the data are superior, samples can be archived for future research, the unexpected can be better handled. It is now timely to fly a mission of this sort, since the Deep Space 1 mission validated ion propulsion, the NEAR spacecraft demonstrated that manipulating a spacecraft in the vicinity of an asteroid is technically feasible, and because the high rate of discovery of near-Earth asteroids means that targets are plentiful. Recent progress on developing the mission have focused on identifying trajectories and asteroids, and with developing and testing a sample collector.