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Small Bodies Missions and Technologies (Part 2) (4B)

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SCIENCE AND PLANETARY DEFENSE OBJECTIVES OF THE ESA HERA MISSION

Abstract

The Hera mission is in Phase C for launch in 2024 in the ESA Space Safety Programme.

Each space mission to an asteroid, whether its requirements are driven by planetary defense, science or other objectives, has a science return that is always extremely high. The reason is that our knowledge of these fascinating objects still needs major improvements, especially for the smallest ones, and the communities interested in them for very different reasons still need essentially the same knowledge.

Currently, the data obtained by the JAXA Hayabusa2 and NASA OSIRIS-REx missions turn our understanding on its head concerning carbonaceous-type Near-Earth Objects. The ESA Hera mission has definitely the potential to do the same. Hera will contribute to the first deflection test of an asteroid with the NASA DART mission, in the framework of the international NASA- and ESA supported Asteroid Impact and Deflection Assessment (AIDA) collaboration.

Once the NASA DART impact will have been performed on the small secondary of the binary asteroid Didymos, Hera will rendezvous for the first time with a binary asteroid, and in particular its secondary, of only 160 m in diameter. So far, no mission has visited such a small rock in space. Moreover, for the first time, internal and subsurface properties will be directly measured.

How do binaries form? What does a 160 m-size rock in space look like? What is the surface composition? What are its internal properties? What are the surface structure and regolith mobility on both Didymos and Dimorphos? What are the surface geophysical properties of two objects of different size and surface gravity, which probably formed from the same material? And what will be the size and the morphology of the crater left by DART, which will provide the first impact experiment at full asteroid scale using an impact speed close to the average speed between asteroids? What will be the exact momentum transferred by DART, which needs the precise measurement of the mass of the target by Hera? These questions and many others will be addressed by Hera as a natural outcome of its investigations focused on planetary defense.

The measurements performed by Hera will thus provide unique information on many current issues in asteroid science and therefore, the science legacy of the Hera mission will extend far beyond the core aims of planetary defense. Hera is, thus, the main European contribution to the current international asteroid exploration era.

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