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## The ESA Hera mission to the binary asteroid (65803) Didymos: Planetary Defense and Science

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The impact of the NASA DART spacecraft on the 160 m-diameter natural satellite called Dimorphos of the binary asteroid 65803 Didymos on 26 September 2022 will change its orbital period around Didymos. The change can be detected by Earth-based observers. Before impact, DART will deploy the Italian LICIACube that will provide images of the first instants after impact. ESA's Hera spacecraft will rendezvous Didymos four years after the impact.

Hera will characterize in detail the properties of a Near-Earth Asteroid that are most relevant to planetary defense:

- Measuring the mass of Dimorphos to determine the momentum transfer efficiency from DART impact.
- Investigating in detail the crater produced by DART to improve our understanding of the cratering process and the mechanisms by which the crater formation drives the momentum transfer efficiency.
- Observing subtle dynamical effects (e.g. libration imposed by the impact, orbital and spin excitation of Dimorphos) that are difficult to detect for remote observers.
- Characterising the surface and interior of Dimorphos to allow scaling of the momentum transfer efficiency to different asteroids.

Hera will also provide unique asteroid science. It will rendezvous for the first time with a binary asteroid. The secondary has a diameter of only 160 m, the smallest asteroid visited so far. Moreover, for the first time, internal and subsurface properties will be directly

measured. From small asteroid internal and surface structures, through rubble-pile evolution, impact cratering physics, to the long-term effects of space weathering in the inner Solar System, Hera will have a major impact on many fields. How do binaries form? What is the surface composition of the asteroid pair? What are its internal properties? What are the surface structure and regolith mobility on both Didymos and Dimorphos? And what will be the size and the morphology of the crater left by DART? These questions and many others will be addressed by Hera as a natural outcome of its investigations focused on planetary defense.

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