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THE ESA HERA MISSION TO THE NEAR-EARTH ASTEROID BINARY (65803) DIDYMOS: PLANETARY DEFENSE AND SCIENCE

Abstract

The Hera mission is in development in the Space Safety Program of the European Space Agency (ESA) for launch in October 2024 with an Ariane 6. It will perform a rendezvous with the binary asteroid (65803) Didymos in early 2027 and investigate it over 6 months.

With the NASA DART mission, it will contribute to the first fully documented asteroid deflection test. DART was launched on 24 November 2021 at 06:21 UTC and will perform an impact at about 6 km/s on the 170 meter-sized moon called Dimorphos of Didymos on 26 September 2022 at approximately 23:14 UTC. Before the impact, it will deploy the Italian LICIACube that will observe the impact and the 130 seconds following it. A campaign of observations from Earth will then be devoted to the measurements of the change of the orbital period of Dimorphos around Didymos as a result of the impact.

The Hera mission will perform the first rendez-vous with a binary asteroid, arriving at Didymos about 4 years after DART. With its mother spacecraft and its two cubesats, it will measure in great detail the DART impact outcome, which will not have changed after this time. In particular, it will measure the properties of the crater produced by the DART impact as well as the momentum transfer efficiency that relies on the mass of Dimorphos measured by Hera. In addition, it will measure the compositional and physical characteristics of Dimorphos that play a big role in its response to the impact. In particular, thanks to the low-frequency radar JuRa onboard the Juventas Cubesat, the first measurements of subsurface and internal properties of an asteroid will be performed.

Hera will thus not only contribute greatly to the planetary defense effort by documenting entirely the DART impact, so that numerical impact models can be validated at the real asteroid scale and so that this knowledge can be extrapolated to other scenarios. It will also contribute greatly to our understanding of asteroid processes in the very low gravity regime of one of the (if not the) smallest asteroid (Dimorphos) ever visited and to our knowledge of binary asteroids and asteroid geophysics. The mission development is ongoing nominally and the various working groups of the Hera Science Team are working intensively to support this development and be best prepared to the surprises that Hera will offer during its visit to Didymos in 2027.