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THE ESA HERA MISSION TO THE BINARY NEAR-EARTH ASTEROID (65803) DIDYMOS: READY FOR LAUNCH IN OCTOBER 2024

Abstract

The Hera mission is in development within the Space Safety Program of the European Space Agency (ESA) for launch at the baseline date of October 7, 2024 with a Falcon 9 from the Space X company. After a Mars flyby in March 2025, it will perform a rendezvous with the binary asteroid (65803) Didymos in the fall of 2026 and investigate it over 6 months.

Hera, with NASA's DART mission, will offer the first fully documented asteroid deflection test. DART successfully impacted Dimorphos, Didymos' 150 meter-sized moon on 26 September 2022 at approximately 6.1 km/s. The actual momentum transfer efficiency of this impact depends on knowledge of Dimorphos' mass, which could not be measured from DART. An initial estimate suggests a momentum enhancement by a factor more than 3 to explain the measured orbital period change.

Many questions remain about the interpretation of the DART impact outcome: (1) What is Dimorphos' mass, which will tell us the actual DART momentum transfer efficiency? (2) What are Dimorphos' internal properties? (3) What is Dimorphos' final state? Was Dimorphos globally or in large parts reshaped by the impact as some simulations predict? (4) What is Dimorphos' rotational state? Answering these questions is the only way to have an unbiased interpretation of the DART impact and to fully validate numerical impact models.

With its spacecraft, which carries four instruments including a thermal infrared imager contributed from JAXA, its two cubesats, Juventas, devoted to geophysics and Milani, devoted to mineralogy and dust analysis, and a radio science experiment, Hera will determine the DART impact outcome in detail and provide measurements that have never been obtained for an asteroid so far. Thanks to the low-frequency radar JuRa onboard Juventas, the first measurements of subsurface and internal properties of an asteroid will be performed. Hera will also perform the first landing of a Cubesat on a body as small as Dimorphos.

The mission development is ongoing nominally. The mechanical integration of the spacecraft and environment tests (TVAC and EMC) have been performed in the spring of 2024. The instrument pipeline preparation is progressing, and the various working groups of the Hera Science Team are working intensively. The mission is ready for launch at the baseline date and the team is getting prepared for the surprises that Hera will offer during its visit to Didymos in late 2026-2027.

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