

Hera: first rendez-vous with a binary asteroid and full characterization of the NASA DART impact outcome by ESA

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Abstract

The Hera mission [1] has passed the Phase B1 at ESA and if approved at ESA CM19+ in November 2019, it will fly to the binary asteroid Didymos in 2023 for a rendez-vous in 2026. Hera will be the first mission to fully characterize the moon of a binary, which is also the smallest asteroid visited so far (165 meters in diameter), including its internal structure. It will also measure in detail the outcome of the NASA DART impact [2] that will occur in 2022. The momentum transfer efficiency, called the beta factor, will be fully determined by a direct measurement of the moon’s mass and the crater’s dimensions and morphology will also be fully characterized, in a regime where no modeling is able to make a direct prediction yet.

Thanks to this fully documented impact experiment, with known impact conditions and early impact outcome by DART, and with known momentum transfer efficiency, target’s mass, internal structure and crater’s dimensions by Hera, our planet will be best prepared in case of a predicted impact with an asteroid in this size range. Moreover, all this information has great implications in our understanding of the formation and collisional evolution of asteroids, back to the early stages of our Solar System.

Hera is the first and only opportunity in the close future for a European mission dedicated to a small body, with requirements driven by planetary defense needs, in the framework of an international cooperation with NASA, but also with a very high science return. Internal structures, low gravity environments and collisional physics are intimately linked to the various processes and outcomes occurring in the different stages of our solar system formation and evolution.

Acknowledgements

P.M. and the Hera team acknowledge support from ESA.

References

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