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Double Asteroid Redirection Test

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ABSTRACT

NASA's Double Asteroid Redirection Test (DART) mission will be the first space experiment to demonstrate asteroid impact hazard mitigation by using a kinetic impactor. Under an international investigation effort (herein referred to as AIDA), ESA and NASA extensively collaborate. ESA continues to study (currently in Phase B1) a rendezvous mission to contribute to AIDA, to measure outcomes of the kinetic impact and to characterize the target body. This mission (known as Hera), is preparing for funding review in the up-coming 2019 ESA Ministerial Conference.

The AIDA target is the near-Earth binary asteroid 65803 Didymos. The DART spacecraft is designed to impact the Didymos secondary at 6 km/s to demonstrate the ability to modify its trajectory through momentum transfer. The primary goals of DART are (1) to perform a full-scale demonstration of the spacecraft kinetic impact technique for deflection of an asteroid; (2) to measure the resulting asteroid deflection; and (3) to study hyper-velocity collision effects on an asteroid, validating models for momentum

transfer in asteroid impacts based on measured physical properties of the asteroid, and including long-term dynamics of impact ejecta. The DART mission is a strategic technology demonstration as the first planetary defense flight. The DART impact on the moon of the Didymos binary system will change the orbital period of the secondary member. This change will be measured by supporting Earth-based optical and radar observations. The DART impact will furthermore release a large volume of particulate ejecta that may be directly observable from Earth or even resolvable as a coma or an ejecta tail by ground-based telescopes. The baseline launch readiness date for the DART mission is in June, 2021 to impact the Didymos secondary in October, 2022, at the time of its closest approach to Earth.

The Italian Space Agency has proposed a CubeSat to be carried by DART to Didymos, as an international collaboration opportunity to document the DART impact. The CubeSat would be released prior to the impact, so as to perform a separate flyby and to image the impact ejecta.

DART will provide the first measurements of momentum transfer efficiency from a kinetic impact at full scale on an asteroid, where the impact conditions of the projectile are known, and physical properties of the target asteroid are also characterized.