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ASTEROID IMPACT AND DEFLECTION ASSESSMENT (AIDA): THE DOUBLE ASTEROID REDIRECTION TEST (DART) MISSION

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ABSTRACT

The Double Asteroid Redirection Test (DART) is a small NASA mission under the auspices of the NASA Planetary Defense Coordination Office. DART completed a NASA Phase A study in 2016. DART will be the first mission to demonstrate an asteroid impact hazard mitigation technique, by using a kinetic impactor to deflect an asteroid.

DART is part of the Asteroid Impact & Deflection Assessment (AIDA) mission, an international cooperation between NASA and ESA. AIDA consists of two independent mission elements: the NASA Double Asteroid Redirection Test (DART) mission [1] and the ESA AIM rendezvous mission [2]. The primary goals of AIDA are to test our ability to perform a spacecraft impact on a potentially hazardous near-Earth asteroid and to measure and characterize the deflection caused by the impact. AIDA, with both DART and AIM, will offer the first fully documented impact deflection experiment at asteroid scale.

The DART target will be the moon of the binary asteroid (65803) Didymos, with the deflection experiment to occur in October 2022 when Didymos will be on a close approach to the Earth. The DART impact on the secondary member of the binary asteroid will alter the binary orbit period, and this change can be measured by Earth-based observatories. The DART impact on the Didymos moon changes its orbital speed by ~0.6 mm/s, which causes an orbital period change of ~7 minutes (~1% of the orbital period). This change is readily measured not only by Earth-based telescopes but also by the AIM rendezvous spacecraft.

DART's target, the secondary member of [65803] Didymos, is within the likely size range for an asteroid that humankind may try to deflect to avoid a catastrophic impact on Earth. The target body diameter of ~160 m is large enough to be a Potentially Hazardous Asteroid (PHA) in its own right if it were a single asteroid. If an NEO of this size were to impact Earth, it would release an impact energy ~400 MT TNT and would cause regional devastation over more than a metropolitan area. There are over 7,000 known NEOs as of Jan. 2017 at a size of ~140 m or larger.

The DART kinetic impactor baseline mission design has changed from that described in [1]. DART will launch as a secondary payload to geosynchronous orbit and use the NASA Evolutionary Xenon Thruster (NEXT) ion propulsion system to spiral out from Earth orbit and transfer to Didymos. The DART impact on the Didymos moon will occur on Oct. 7, 2022. With NEXT ion propulsion and launch as a commercial rideshare, DART has a robust 5 month launch window. DART will be the first mission to demonstrate the NEXT ion propulsion system.

We will present and update the program status of DART and AIDA.

[1] Cheng A. F. et al. (2016) Planet. Space Sci., 121, 27–35. [2] Michel P. et al. (2016) Adv. Space Res., *57*, 2529-2547

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