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**MEASURABILITY OF THE HELIOCENTRIC MOMENTUM ENHANCEMENT OF
THE DIDYMOS SYSTEM FROM THE DART IMPACT**

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ABSTRACT

The Double Asteroid Redirection Test (DART) spacecraft impacted Dimorphos, the secondary asteroid in the (65803) Didymos binary asteroid system on 26 September 2022. The impact altered the momentum of Dimorphos and reduced its mutual orbit period by about 33 minutes. This change in the momentum of Dimorphos is not simply the result of a linear momentum exchange between the asteroid and the DART spacecraft. This is because ejecta fly off the surface due to the impact and impart additional momentum change onto Dimorphos. This overall momentum transfer is characterized by the binary system momentum enhancement factor, β . However, this change in Dimorphos's orbit that is characterized by β is not the only consequence of the DART impact.

The ejecta generated by the impact can also escape the gravitational pull of the Didymos system and change its heliocentric orbit. This corresponding change is modeled by the heliocentric momentum enhancement factor, β_{\odot} . Understanding the heliocentric momentum enhancement is important because it quantifies how the binary asteroid system's motion in the solar system changed because of this kinetic impactor technology demonstration. This change in the heliocentric orbit of the binary system characterized by β_{\odot} is yet to be measured. This work explores the measurability of the heliocentric momentum under various observation scenarios in the next few years. Different combinations of ground-based radar, stellar occultation and pseudo-range measurements using ESA's Hera spacecraft are considered here. The possibility of estimating the heliocentric momentum enhancement parameter and the accuracy of the corresponding estimates is presented for each observation scenario. Specifically, observation scenarios that allow a measurement of β_{\odot} before the arrival of the Hera spacecraft will be explored. This is possible because a heliocentric beta estimate uses the system mass, which is known, rather than the Dimorphos mass, which is (so far) unknown.

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Oral presentation