DIMORPHOS LIKELY RESHAPED BY THE DART IMPACT

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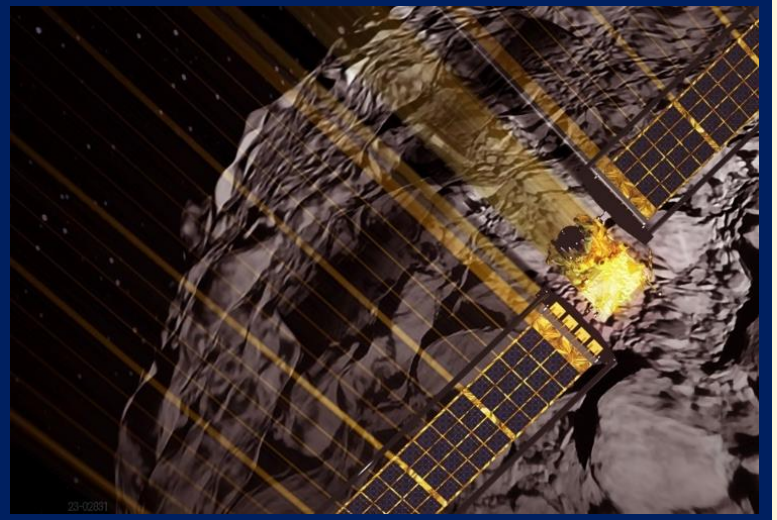

DART's Impact into Dimorphos: This graphic combines the DART spacecraft and the topography of the asteroid Dimorphos to show an artistic depiction of DART's impact moments before it occurred. The asteroid topography and the impact location are based on data obtained by the DRACO instrument prior to impact. [Credit: NASA/Johns Hopkins APL/Jon Emmerich]

The researchers from CAB, Jens Ormö and Isabel Herreros, participate in this study led by S. Raducan (UNIBE), reconstructing the impact of the DART spacecraft on Dimorphos, which may help with the planning of future defense missions and could contribute to predict the outcomes with more certainty. They also describe the properties of Dimorphos as derived from the DART impact simulations.

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The global reshaping of the asteroid Dimorphos could be a result of the impact caused by NASA's Double Asteroid Redirection Test (DART), as suggested in a recent publication in Nature Astronomy, in which two researchers from CAB, Jens Ormö and Isabel Herreros, are coauthors.

This discovery hints at the possibility that Dimorphos is essentially a weak rubble pile composed of material dislodged from its parent asteroid Didymos.

On September 26, 2022, the DART planetary defense test successfully executed its mission by colliding with Dimorphos, the moon orbiting the near-Earth asteroid Didymos. This impact led to a reduction of Dimorphos's orbital period around Didymos by 33 minutes. While DART primarily serves planetary defense purposes, it also furnished valuable insights into the internal structure of asteroids and the repercussions of an impact on their properties.

The authors of this study, led by Sabina Raducan at Bern University, employed an advanced shock physics code to model the DART impact, incorporating realistic constraints derived from DART's initial findings regarding Dimorphos's mechanical and compositional properties. Simulations that closely aligned with observations of the impact suggest that Dimorphos possesses a weak, cohesive strength akin to asteroids Bennu and Ryugu, with a noticeable absence of large boulders on its surface. The researchers propose that Dimorphos might be a rubble pile formed through rotational shedding and subsequent re-accumulation of ejected material from Didymos. Furthermore, the model indicates that the DART impact possibly did not create a distinct impact crater but rather induced a global reshaping of the asteroid relocating material from its interior.

These findings provide additional insights into the formation and characteristics of binary asteroids with implications for planetary defense and upcoming space missions, such as the European Space Agency's Hera mission.

S. RADUCAN ET AL., NATURE ASTRONOMY, 2024; HTTP://DX.DOI.ORG/10.1038/S41550-024-02200-3