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**CONSEQUENCES OF THE DART IMPACT ON DIMORPHOS' SPIN STATE AND SURFACE MASS**

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***Keywords:*** *Dimorphos, Didymos, DART mission, Hera mission, collisions.*

##### ABSTRACT

The target of DART (Double Asteroid Redirection Test, NASA) and Hera (ESA) missions [1] is Dimorphos, the secondary of the binary Near-Earth Asteroid (65803) Didymos, an asteroid of approximately 160 m in size. In this work we investigate the possible reaction of Dimorphos to the DART collision to be performed in 2022, under the assumption that it is a spherical gravitational aggregate produced in the formation of the binary system [2, 3]. The very structure of the target is unknown; therefore we model it by (1) mono- and multi-dispersed distributions of spherical basic elements and by (2) considering irregular components.

We perform numerical simulations of the collision event by using a discrete-element *N*-body numerical code (PKDGRAV-SSDEM)*.* We concentrate on the effect of the collision on the target, *after* the shattering phase is over. Our synthetic projectile carries the same nominal momentum as the DART spacecraft does, but it delivers to the target only the small fraction of kinetic energy [4] expected to survive the shattering (non-elastic) phase.

Here we report on results obtained so far on the effects of the DART impact on Dimorphos. In particular, we focussed on: a) Changes in spin period and direction of the spin axis, and tracking of their evolution in time. b) Energy distribution of surface particles capable to lift/move over the surface. c) Change in the shape of Didymos.

Our model of the DART impact in the case of a multi-dispersed distribution of spherical particles with 100,000 (case 1) and 13,600 (case 2) particles shows that: i) spin period may be changed by up to -30’ (1), and between +8’ and -90’ (2), depending on different impact geometry. ii) The spin axis may be tilted up to 3 deg. iii) No precession of the spin axis is observed following the post-impact evolution over 150 hours. iv) The energy and momentum wave reach the surface away from the impact area so that mass lift and displacement of sizeable particles over the surface is possible. iv) Low mass escaping from antipodal impact region does not substantially affect beta estimation.

Such predictions may be of interest in the study of the post-impact dynamics of the system measured by the Hera mission. Finally, results may contribute to the interpretation of motion of boulders on the surface of Dimorphos if their tracking will be possible by a combination of DART and Hera measurement.

**References:** [1] Michel, P. et al. (2018) Adv. in Space Res., 62, 8, 2261. [2] Campo Bagatin et al. (2001) Icarus, 149-1, 198. [3] Campo Bagatin et al. (2018) Icarus, Volume 302, p. 343-359. [4] Walker, D. W. (2013) Int. J. of Impact Engin. 56, 12.

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*This paper should be included in the session on DART and Hera missions.*