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NEOTωIST: A RELATIVELY INEXPENSIVE KINETIC IMPACTOR DEMONSTRATION MISSION CONCEPT

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ABSTRACT

Mission concept: NEOTωIST stands for Near-Earth Object Transfer of angular momentum (ω·I) Spin Test, and is a concept for a kinetic impactor demonstration mission, which aims to change the spin rate of an asteroid by impacting it off-center (Drube et al. 2016, Engel et al. 2016). The change would be measured by means of lightcurve measurements with Earth-based telescopes. In contrast to most other kinetic impactor demonstration mission concepts, NEOTωIST does not require a reconnaissance spacecraft to rendezvous with the target asteroid for orbit change and impact-effect measurements, and is therefore a relatively inexpensive alternative.

The NEOTωIST mission would determine the efficiency of momentum transfer (the β-factor) during an impact, and help mature the technology required for a kinetic impactor mission, both of which are important precursor measures for a future space mission to deflect an asteroid by collisional means in an emergency impact hazard situation.

Target: Clearly the lack of a reconnaissance spacecraft in this relatively inexpensive alternative mission would reduce the scientific return of the mission. However, using a previously visited asteroid as a target would partially compensate for this, since some scientific context for the mission would already be available. Possible targets in this case could include (25143) Itokawa, (101955) Bennu, and (162173) Ryugu. Of these 3 asteroids only Itokawa has been visited to date, and as Itokawa's elongated shape is highly advantageous for the mission proposed here, Itokawa has been chosen as the target for a mission study performed by the NEOShield and NEOShield-2 Consortia in 2014-2017. The study includes mission and system design, trajectory calculations, post-impact risk analysis and impact modeling.

The presentation includes an overview of the mission and the technical and scientific rationales, and discussion of the angular and linear momentum transferred during the impact, the ejecta cloud, the spacecraft trajectories, choice of impact area, and the observability of the impact.

See also the NEOTωIST abstracts by K. Engel et al. and S. Eggl et al..

References

L. Drube et al. (2016) The NEOTωIST mission (Near-Earth Object Transfer of angular momentum spin test), Acta Astronautica 127, 103–111 http://dx.doi.org/10.1016/j.actaastro.2016.05.009

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