

Physical parameters of space mission asteroid targets

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Ground-based characterization of asteroids that are planned or potential targets of space missions provides important data on their physical parameters and properties. Knowledge of the properties of mission targets is important especially during mission preparation and planning, as it serves to select best or suitable targets for specific purpose of a given mission, to prepare mission plans, to constrain possible mission scenarios, and to design mission experiments. Such characterization efforts may be particularly critical for flyby missions that take only limited data during the high-speed flybys of their target asteroids, but they also provide very crucial data for targets of rendezvous missions. Moreover, long-term observations taken from Earth also allows the modelling of, or constraining, processes acting on the asteroids over extended time scales.

Over the past years and decades we have obtained rich data on physical parameters of 82 asteroids that are planned or potential targets of space missions. Our primary observing technique is time-resolved (lightcurve) photometry, but we use also data obtained with other techniques, such as spectroscopy, thermal or radar observations. 15 of the 82 characterized asteroids are planned or possible targets of several space missions that are in flight or preparation, such as ESA's Hera, RAMSES and PRIAMOS, NASA's OSIRIS-APEX, JAXA's Hayabusa2#, DESTINY+ and Next Generation Sample Return (NGSR), the Emirates Mission to Asteroids (EMA), and Karman+'s High Frontier, but we have also characterized 67 asteroids that are potential targets of space missions for their low delta-V's and were announced as being "of interest to NASA" in the Small-Bodies-Observations-NASA mailing list or listed on the NHATS page of "Accessible NEAs" [1, 2]. The sample of asteroid targets span 3 orders of magnitude in size, with absolute magnitudes H from 12.57 to 26.8, corresponding to diameters from about 10 m to about 10 km. The sample contains a variety of taxonomic types and physically or dynamically interesting objects. Among them, we have identified 5 binary asteroids and 20 tumblers (i.e., asteroids in excited, non-principal axis rotation states). Rotation periods of the characterized asteroids range from 1.45 min to 280 h, reflecting diversity of their properties and formation/evolution paths. We will present an overview of the data set and highlight several representative cases.

References

1. Barbee B.W., Abell P.A., Adamo D.R., et al., "The Near-Earth Object Human Space Flight Accessible Targets Study: An Ongoing Effort to Identify Near-Earth Asteroid Destinations for Human Explorers," 2013 IAA Planetary Defense Conference, Flagstaff, AZ, April 15-19, 2013.
2. Abell P.A., Barbee B.W., Chodas P.W., et al., Human Exploration of Near-Earth Asteroids. In Asteroids IV (pp. 855-880). Ed. P. Michel, F. E. DeMeo, W. F. Bottke, Tucson, AZ: The University of Arizona Press, 2015.