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○ **New NEO Characterization Results**

CHARACTERIZATION OF HERA FLYBY CANDIDATES

B. Carry[a,*], A. Sergeyev[a], P. Pravec[b], M. Mahlke[a], M. Marsset[c], D. Kiersz[d], A. Fitzsimmons[d], J.P. Rivet[a], J. Berthier[e], P. Kušnirák[b], K. Hornoch[b], P. Fatka[b], H. Kučáková[b], P. Bendjoya[a], D. Vernet[a], M. Küppers[f], F. E. DeMeo[c]

[a] *Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, Laboratoire Lagrange, France*
[b] *Astronomical Institute, Academy of Sciences of the Czech Republic, Fričova 1, Ondřejov CZ-25165, Czech Republic*
[c] *Department of Earth, Atmospheric and Planetary Sciences, MIT, 77 Massachusetts Avenue, Cambridge, MA 02139, USA*
[d] *Astrophysics Research Centre, Queen's University Belfast, Belfast, BT7 1NN, UK*
[e] *IMCCE, Observatoire de Paris, PSL Research University, CNRS, Sorbonne Universités, UPMC, Univ. Lille, France*
[f] *European Space Agency (ESA), European Space Astronomy Centre (ESAC), Madrid, Spain*

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ESA's Planetary Defense mission Hera will encounter and orbit the binary asteroid system (65803) Didymos, composed of Didymos itself and its satellite Dimorphos. While demonstrating new technology in deep space, Hera will carry out a complete characterization of the binary system, four years after the impact of the NASA DART mission on Dimorphos.

Scheduled for launch in 2024, Hera will encounter Didymos system in 2026. During its two-years interplanetary journey to its main objective, Hera has the possibility to encounter an asteroid. The flight dynamics team as ESA/ESOC released in 2019 a list of a hundred candidate asteroids, based on a maximal distance of 0.02 au with Hera [1].

Unfortunately, almost nothing beyond osculating elements was known for these targets. We thus started an observing campaign to characterise both the surface composition and physical properties (rotation period, binarity) of these candidates, to guide the selection of **the** flyby target. For that, we acquired optical lightcurves from the 1m C2PU telescope (Observatoire de la Côte d'Azur) and the 1.54 m Danish telescope (La Silla Observatory). We also used the NASA IRTF 3m telescope with SpeX to acquire near-infrared spectra and the 8m ESO VLT/FORS2 to obtain visible spectra. Finally, we searched the archive of the Sloan Digital Sky Survey (SDSS) for serendipitous observations, not listed in the SDSS Moving Object Catalog [2, 3]. In October 2020, the initial candidate list was trimmed to seven candidates, based on operational constraints, by ESA/ESOC.

We will report on the properties of the seven candidates in this final list (preliminary results are listed in Table 1). While more lightcurve observations are scheduled for early 2021, we already have measured the rotation period of three candidates, including a very slow rotator (Randytung). The data reduction and analysis of the spectroscopic observations are still on-going, but we have already classified three targets [in the Bus-DeMeo taxonomic scheme 4]. These candidates are neither S- nor C-types, the two taxonomic type most-visited by spacecraft. Asteroid 2001 TJ72 is a Q-type, hence similar in composition to ordinary chondrites and S-type asteroid, but with a "young" surface, i.e., little affected by space weathering [5]. Asteroid 2000 HJ89 is a V-type, hence likely an ejected fragment of asteroid (4) Vesta

*Corresponding author
Email address: benoit.carry@oca.eu (B. Carry)

[6], recently visited by the NASA Dawn mission [7]. Asteroid Randytung is classified as X, however, no albedo measurement is available for this asteroid. We thus cannot determine if it is a P-, M-, or E-type [the subclasses of X complex 8]. The ESA Rosetta mission encountered the E-type (2867) Šteins and the M-type (21) Lutetia on its way to comet 67P. The NASA missions Lucy and Psyche will respectively flyby and encounter P-types and the M-type (16) Psyche.

Table 1: The seven flyby candidates, with rotation period and taxonomy, whenever determined.

Number	Designation	Rotation period (h)	Taxonomy	Method
29886	Randytung	132	X	NIR spectroscopy
42532	1995 OR	4		
54212	2000 HJ89	19	V	SDSS photometry
88992	2001 TJ72		Q	SDSS photometry
95802	Francismuir			
122764	2000 SX69			
169549	2002 EG105			

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