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Herschel observations of the Marco Polo-R asteroid 175706 (1996 FG3). L.O'Rourke[1] lorourke@esa.int, T.Müller[2], C.Kiss[3], A.Barucci[4], B.Altieri[1], B.Gònzalez-Garcìa[5], E.Dotto[6], M.Küppers[1], M.Sanchez Portal[1]

[1]European Space Astronomy Centre, Camino bajo Castillo s/n, Villanueva de la Canada, 28691, Madrid, bruno.altieri@sciops.esa.int, miguel.sanchez@sciops.esa.int
[2] Max-Planck Institut für Extraterrestrische Physik (MPE) Garching, Germany, tmueller@mpe.mpg.de
[3] Konkoly Observatory of the Hungarian Academy of Sciences, H-1525 Budapest, P.O.Box 67, Hungary, pkisscs@konkoly.hu,
[5] LESIA, Observatoire de Paris, 5 Place Jules Janssen, 92195 Meudon, France, antonella.barucci@obspm.fr,
[5] INSA at ESAC European Space Astronomy Centre, Camino bajo Castillo s/n, Villanueva de la Canada, 28691, Madrid, beatriz.gonzalez@sciops.esa.int,
[6] INAF Osservatorio Astronomico di Roma, elisabetta.dotto@oa-roma.inaf.it

Background: The Marco Polo-R mission has been selected for the assessment study phase of the ESA M3 missions. This ESA-led sample return mission to the binary asteroid 1996 FG3 (launch window between 2020 and 2024) is proposed with a design that allows it to fit within the pre-defined cost cap of a M-class mission.

The binary nature of the target will allow more precise measurements of mass, gravity, and density than for a single object, as well as additional insights into the geology and geophysics of the system.

The asteroid has been classified by Binzel et al. [1] as a C-type. It is considered to be a typical example of a primitive object [2]. Dynamically, this is an Apollo asteroid with semimajor axis a of 1.054 AU, eccentricity e of 0.35, and and inclination i of 1.98 degrees.

Measurements of the albedo derived from thermal infrared observations give a value of $pV = 0.042$ (+0.035 −0.017), and a combined diameter of $D = 1.84$ (+0.56 -0.47) km [3].

The Herschel observations : The MACH-11 (Measurements of 11 Asteroids & Comets) Programme observed this binary asteroid in two occasions in November of 2012. The observations performed had a duration of 0.6 hours with the asteroid pair moving rapidly at 6'/hr thus making removal of the background quite straightforward. The observations were performed in two observing blocks; the first block consisted of a 2 repetition blue/red map, the second block consisted of a 2 repetition green/red map, with the intention to observe the target at different phase angles.

Our Results : Our measurements will serve to update the known radiometric properties for this binary asteroid through their inclusion into a thermophysical model (TPM) [4] which has been validated against a large database of asteroids including targets of other spacecraft mission e.g. Lutetia [5], Itokawa [6].

Using existing sets of published thermal observations (Spitzer, TNG NICS), combined with our Herschel observations, applied within this thermophysical model, we will derive the radiometric properties of this target pair. The calculations are to be performed for the full range of possible shape and spin-vector solutions derived from the available sample of visual lightcurve observations, taking into account the implications of the asteroid satellites impact on the derived flux.

The output of our model will aid in deriving the asteroids thermal inertia, as well as provide important information on the surface properties of this binary asteroid; important due to their relevance in the preparation of the future Marco Polo-R spacecraft.

References: [1] Binzel, R.P. et al, *Icarus*, 2004, 170, 259 [2] Walsh, K.J, et al, 2012, *AJ*, 784:104 [3] Mueller, M., et al. 2011, *AJ*, 141, 109 [4] Lagerros, J.S.V., (1998), *Astron. & Astrophys*, 332, 1123-1132, [5] O'Rourke, L. and Müller, T. et al, (2012), Planetary & Space Science, doi.10.1016/j.pss.2012.01.004 [6] Müller, T. et al. (2005, *Astron. & Astrophys*., 443, 347-355