ROTATIONALLY-RESOLVED CHARACTERIZATION OF THE NEAR-EARTH DIDYMOS-DIMORPHOS BINARY SYSTEM AFTER THE NASA/DART IMPACT

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Introduction: Didymos-Dimorphos system is a Potentially Hazardous Asteroid (PHA) target of the NASA/DART [8] and ESA/HERA space missions as part of an international planetary defense program (Asteroid Impact & Deflection Assessment - AIDA). The NASA Double Asteroid Redirection Test (DART) actively impacted on the small moon Dimorphos of the Didymos-Dimorphos binary system on 26th September 2022 causing a variation in its orbital period around Didymos of about 32 minutes.

Despite Didymos-Dimorphos binary system has been observed in the last few apparitions (2003, 2019 and 2021), its physical characterization is still somewhat puzzling. Binzel et al. ([1]), originally classified the system as an Xk-type using only visible data. de Leon et al. ([2],[3]) extended the classification using NIR data and classified it as a potential S-type. Dunn et al. ([4]) confirmed its silicate nature and its consistency with ordinary chondrites, with an affinity for L/LL-type meteorites. However, a few anomalies are present around 2 μm with a 1.9 μm band shallower than the typical silicate type ([7]).

Visible observations at different rotational phases prior to the DART impact ([5]) have evidenced a small but persistent spectral variability that could be interpreted as due to a heterogeneous surface composition of Didymos or, in an alternative case, that Dimorphos is composed of different materials and in the occurrence of the mutual events, the contribution of Dimorphos could alter the spectral characterization of the primary.

The rotationally resolved spectroscopy is extremely interesting to investigate possible variegation and inhomogeneities throughout the surface (e.g. [6]). Using the combined analysis of the observing geometry of the system (aspect angle and rotation axis inclination) together with a good rotational coverage of the spectra it is also possible to better identify the surface regions corresponding to different compositions.

Methodology: As members of a wide international observing campaign, we obtained a set of spectra in the visible range using two telescopes located in Asiago (VI), Italy, on the nights of 17th, 18th and 19th October 2022, less than one month after the impact, and on the nights of 18th November 2022, 20th, 26th and 27th December 2022.

Asiago telescopes have diameters of 1.22 and 1.82 cm and are equipped with spectrometers in the ranges from 340 to 750 nm and from 400 to 950 nm, respectively. We covered the full rotational period of Didymos (2.26h) during three of the observed nights and partially covered during the other nights. The asteroid was bright enough (15.5 V mag) to obtain good S/N data despite the high airmasses and the vicinity to the galactic plane which made the observations more challenging. The sky condition was good with <2" seeing. Other observational runs are planned for the next months.

Conclusion: We searched for possible observable differences throughout the surface and with respect to pre-impact spectra. We will present the results of Didymos-Dimorphos rotationally-resolved spectroscopic characterization.

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