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INTRODUCTION: In the past few decades, the study of the physical properties and origin of small bodies in near-Earth orbits has acquired not only scientific, but also social significance, since the consequences of a collision with such bodies can have a global character and pose a threat to all mankind. In addition to the asteroid hazard, near-Earth asteroids are a promising source of mineral raw materials.

On September 26, 2022, the Didymos' satellite Dimorphos was impacted by the NASA DART spacecraft to test the possibility of a kinetic impact for the deflection of hazardous asteroids. This successful experiment showed the possibility of changing the orbital motion and rotational state of a small natural body [1]. As a result of the impact, a dust cloud was formed near the asteroid and a prominent dust tail was appeared and remains visible during several months. Changes have occurred both with the orbital rotation of the satellite and with its surface and shape. We present simultaneous ground-based photometric and polarimetric observations of Didymos system carried out after the impact and aimed to search for possible surface changes of Didymos after impact of the spacecraft with its satellite.

PHOTOMETRIC OBSERVATIONS: Our photometric observations of Didymos were carried out in the end of October 2022 using telescopes at three observatories: the 70-cm telescope at Abastumani (MPC code 119), the 60-cm telescope in Rozhen (MPC code 071) and 40-cm telescope at Cerro Tololo (MPC code 807). The observations were carried out in Johnson-Cousins filter R, except for the last telescope, where the Luminance filter used or unfiltered observations were made. One of the obtained lightcurves is shown in Fig.1. We confirmed the value of rotation period of Didymos $P=2.260$ hours, which remained unchanged after the impact. The lightcurve has an irregular shape with a maximal amplitude of 0.14 mag.

PHOTOMETRIC LIGHTCURVE OF DIDYMOS ON OCTOBER 29/30, 2022

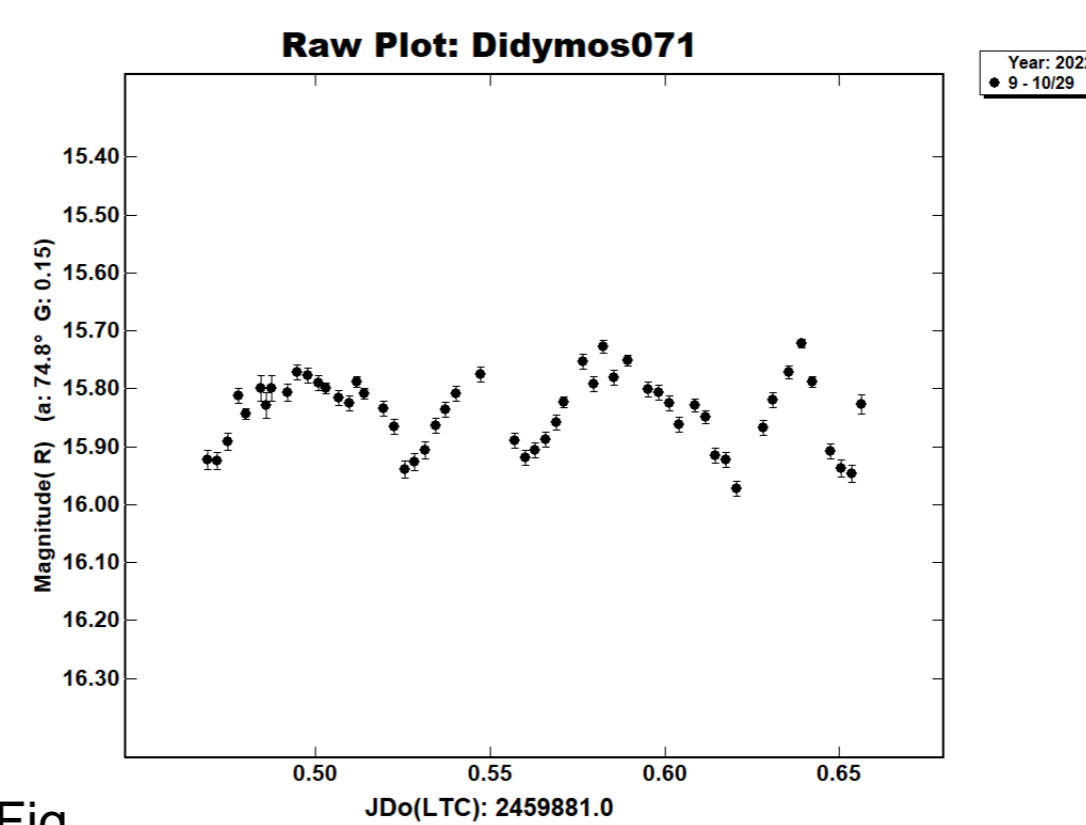


Fig. 1

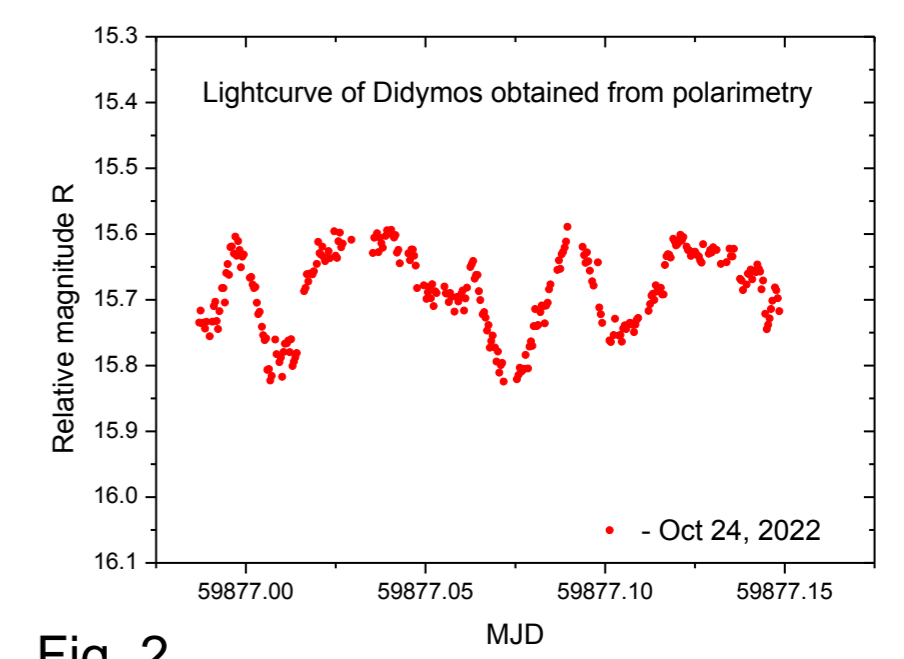


Fig. 2

POLARIMETRIC OBSERVATIONS: The observations were carried out with 2 m telescope at the Rozhen Observatory using the two-channel polarimeter at Cassagrain focus which included a retarder wave plate and a Wollaston prism [2] during 3 nights on October 22-24 2022. The observations and the calculation of the degree of polarization are done according to the scheme described in [3]. During each night, Didymos was observed as long as it was possible because of the asteroid visibility on the sky and the weather conditions. Measurements of asteroid and standard star brightness were done by aperture photometry. The diameter of aperture used to measure the asteroid was optimized to achieve maximum SNR and limited to 5 arcsec to reduce the contribution of the dust coma and the tail of Didymos. Also, we extracted photometric lightcurve from our polarimetric observations of Didymos on Oct 24 (Fig.2).

POLARIMETRIC AND PHOTOMETRIC LIGHTCURVE OF DIDYMOS ON OCTOBER 24/25 2022

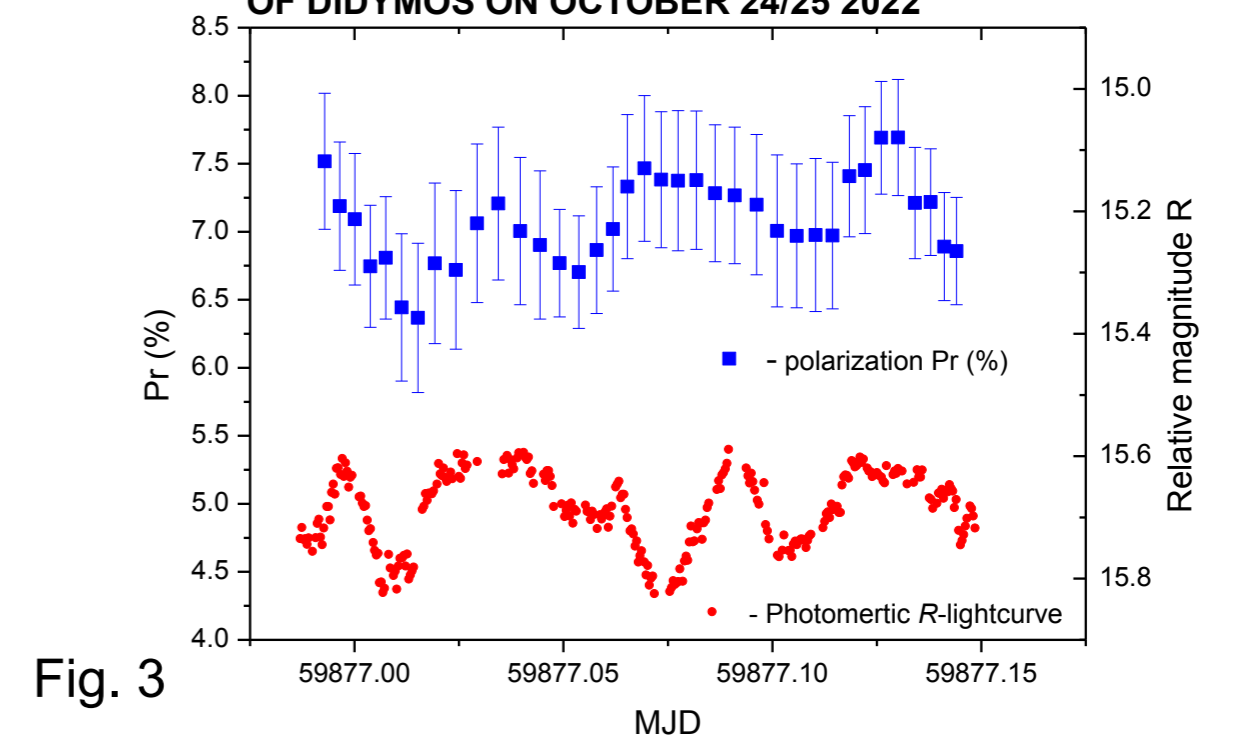


Fig. 3

RESULTS We detected variations in the degree of polarization of Didymos on each observed night. The polarization lightcurve observed on Oct. 24 is shown in Fig. 3 together with photometric lightcurve. The composite polarimetric lightcurve for 3 observed nights, folded with a rotation period 2.260 hours of the main Didymos body, is presented on Fig. 4. The variation of polarization degree over the Didymos' surface is about 0.5%. They tend to anticorrelate with the magnitude lightcurve of Didymos (showed below). It means that there are albedo variations over Didymos' surface which need to take into account in its modeling.

COMPOSITE LIGHTCURVE OF DIDYMOS FOR POLARIMETRY AND PHOTOMETRY

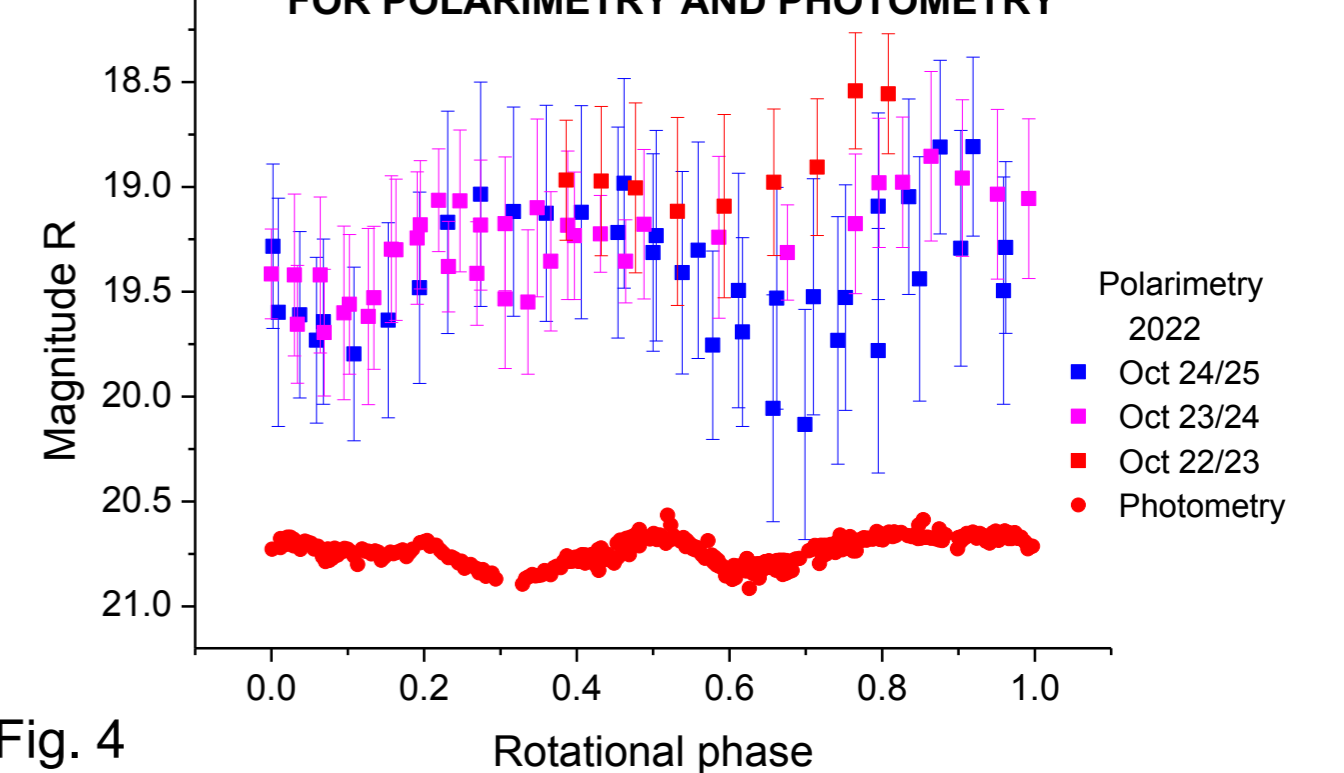


Fig. 4

The determined mean value of polarization Pr is in an excellent agreement with Bagnulo et al. 2023 [4] data. The dependence of polarization of Didymos vs the phase angle is showed at Fig.5.

CONCLUSIONS: Polarimetry of Didymos at the high phase angle 76 degrees showed the higher polarizations than typical for S-type asteroids. The results of the joint analysis of the polarimetric and photometric observations show that the Didymos' surface is heterogeneous.

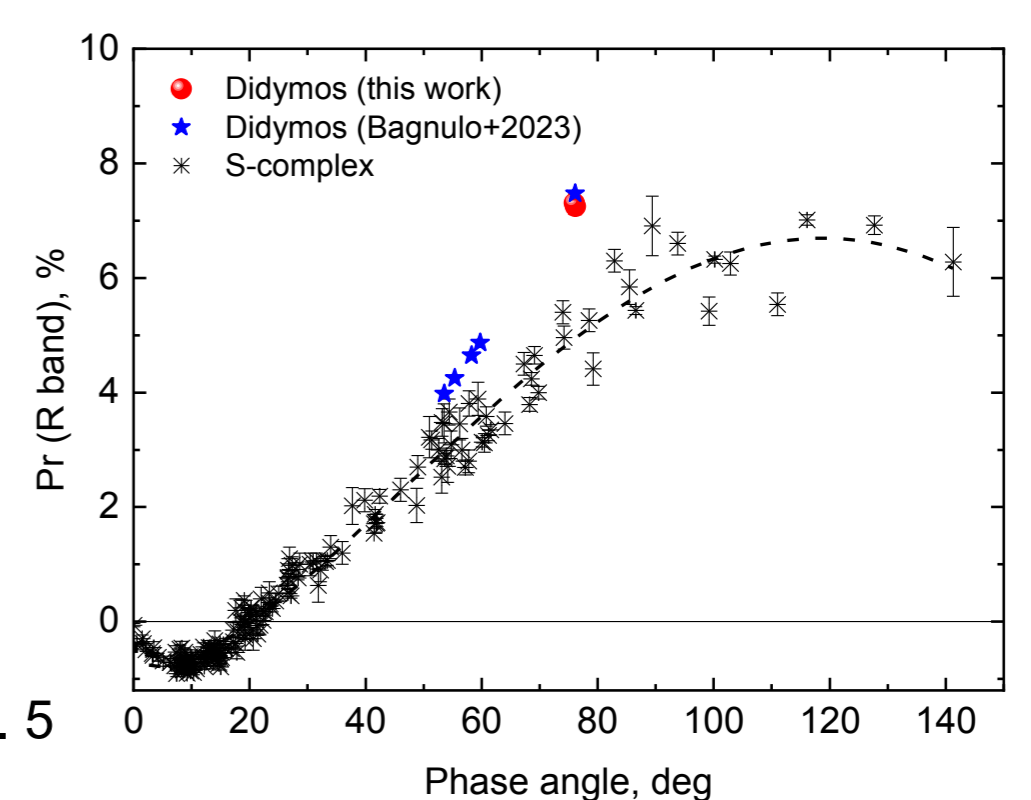


Fig. 5

REFERENCES: [1] Statler et al. Planet. Sci. J. 3, 244, 2022; [2] Jockers et al. Kinematika i Fiz. Nebesnykh Tel Suppl., 3, 13, 2000; [3] Bagnulo et al. A&A, 450, 1239, 2006; [4] Bagnulo et al. ApJL 945 L38, 2023.