

## Photometric Properties of (162173) 1999 JU3 in Preparation for JAXA Hayabusa 2 Sample Return Mission

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A near-Earth asteroid, (162173) 1999 JU3 (hereafter 1999 JU3), is a primary target asteroid for Hayabusa 2 sample return mission. We conducted a worldwide campaign to make photometric observations of the asteroid to determine the physical properties. 1999 JU3 is classified into C-type asteroid having a nearly spherical shape and the synodic rotational period of  $7.6312 \pm 0.0010$  hr.

In this presentation, we will report further information about 1999 JU3 determined since last JpGU meeting in 2013. We investigated the magnitude-phase angle relation. We obtained the parameters for IAU H-G formalism,  $H = 19.20 \pm 0.12$  and  $G = 0.077 \pm 0.011$  (V-band, 550nm), respectively. In combination of our result with infrared photometry, the geometric albedo is updated to be 0.05 (Mueller et al. in preparation), which is typical to but slightly smaller than the average of C-type asteroids in main-belt. We found that the magnitude-phase angle relation has a linear behavior in a wide range of the phase angles (5-80 degree) and show a possible non-linear opposition brightening within the phase angle of  $< 5$  degree. The phase slope is consistent to those of tens-km C-type asteroids, that is,  $0.04 \text{ mag degree}^{-1}$ . The opposition effect amplitude,  $\approx 10\%$  or less, is slightly weaker than that of a precursor C-type mission target body, (253) Mathilde, but the difference seems to reflect the diversity of C-type asteroids. Recently, Shevchenko & Belskaya (2010) reported that  $\sim 20\%$  of all studied low albedo asteroids did not show detectable opposition effect. We explore the significance of 1999 JU3 data with remote-sensing devices in terms of the opposition effect.

Keywords: Hayabusa 2, 1999 JU3, Ground-based observations