

## International Campaign of (162173)1999 JU3 Lightcurve Observation

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The observations were carried out at 32 nights during 2011-2012 apparition using 13 telescopes. The telescopes we used are as follows: the University of Hawaii 88-inch (2.2-m), Lulin Observatory (1.0-m), Nishi-Harima Astronomical Observatory Nayuta telescope (2.0-m), Himalayan Chandra Telescope (2.0-m), Tenagra II (0.8-m), Bosque Alegre (1.5-m), Magellan Baade (6.5-m), Calar Alto (1.2-m), Tubitak Ulusal Gozlemevi (1.0-m), MOA-I and II (0.6-m and 1.8-m), IRSF (1.4-m) and ESO/MPI (2.2m). We would like to emphasize that low solar phase angle (Sun-Asteroid-Observer's angle) data were acquired during 2011-2012 apparition which were not covered by 2007-2008 data. The new data sets enable to derive the accurate absolute magnitude and albedo.

(162173) 1999 JU3 (hereafter 1999 JU3) is a target asteroid of Hayabusa 2 sample return mission. The primary goal of the mission is to bring back samples from a C-type asteroid, which is considered to contain organics and hydrous minerals. It is scheduled to launch in 2014 and arrive at 1999 JU3 in 2018. Some physical properties of 1999 JU3 were determined during the last apparition in 2007-2008. It is classified into C-type asteroid through optical spectroscopic observations (Binzel et al. 2001; Vilas 2008). Lightcurve observations indicated that 1999 JU3 has a synodic rotational period of 7.6272 ± 0.0072 hr (Abe et al. 2008). From the mid-infrared observations, it was found that the asteroid has an effective diameter of 0.87 ± 0.03 km (Muller et al. 2011). The pole orientation derived by the lightcurve observations still has a large uncertainty (Kawakami 2009; Muller et al. 2011). We had another observational opportunity in 2011-2012 when the apparent magnitude was bright enough to derive absolute magnitude and lightcurve with 1-2 m class telescopes. Since this is the last observational opportunity before the spacecraft launch, we, Hayabusa 2 Ground-based Observation group, conducted a global observational campaign to acquire the optical magnitude. In this presentation we report the results based on the campaign data.

We analyzed the photometric data using IRAF. As the results, we firstly derived the synodic rotational period of 7.631 ± 0.0072 hr. The result coincides with the previous result to an accuracy of our measurement. We found that the amplitude of the lightcurve was subdued with an amplitude of ~0.05 mag. Because the amplitude had been always small regardless of the observing angles (parameterized by 'phase-angle-bisector'), 1999 JU3 must have nearly spherical shape, which makes it difficult to determine the pole orientation. In collaboration with experts in asteroid shape model and thermal model, Dr. J. Durech and T. Muller, some physical parameters were studied using our data. As the results, it is found that (i) the absolute magnitude is 19.20±0.12, (ii) the geometric albedo is 0.057±0.025 typical for C-type asteroids, (iii) and the thermal inertia is 200±100 [J m<sup>-2</sup> s<sup>-0.5</sup> K<sup>-1</sup>] with the combination of mid-infrared data. As of 2013 February, we could not get conclusive result for the pole orientation, although the inclined pole solutions show better match to the observational data.

