LIGHTCURVE AND ROTATION PERIOD DETERMINATION FOR 4678 NINIAN

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Photometric observations of the main-belt asteroid 4678 Ninian performed by the authors in Italy and Ireland in 2014 October and November revealed the bimodal light curve phased to 56.72 ± 0.01 hours as the most likely solution representing the synodic rotation rate for this asteroid.

Asteroid 4678 Ninian (1990 SS4) is a typical member of the main-belt that was discovered on 1990 September 24 by R. H. MacNaught. The orbit has a semi-major axis of about 2.26 AU, eccentricity 0.21, and period of about 3.41 years (JPL, 2014). It was selected from the "Potential Lightcurve Targets" web site (Warner, 2014).

At the Astronomical Observatory of the University of Siena, data were obtained with a 0.30-m *f*/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera (binned 2x2), and clear filter; the scale was 2.20 arcsec/pixel. Exposures were 180 seconds. At Saronno Observatory, data were obtained with a 0.235-m *f*/10 (SCT) telescope and SBIG ST8-XME NABG CCD camera with 2x2 binning; the scale was 1.6 arcsec/pixel. The unfiltered exposures were 150-300 seconds.

Observations from Cherryvalley Observatory were conducted with a 0.2-m *f*/7.6 SCT using an SBIG STL-1301E CCD camera and R-band Bessel photometric filter. The scale was 2.15 arcsec/pixel, unbinned. Carpione Observatory employed a 0.25-m *f*/10 SCT. The camera was an SBIG ST9 CCD camera with a 512x512 array of 20-micron pixels. The unfiltered exposures were 300 seconds.

The collaborative observations resulted in 25 sessions over a span of 22 days and a total of 843 data points. The phase angle ranged from 6.1° before to 25.4° after the opposition.

All data images were calibrated with bias, flats, and darks. Data processing, including reduction to R band, and period analysis, were performed using *MPO Canopus* (BDW Publishing, 2012). Differential photometry measurements were performed using the Comp Star Selector (CSS) procedure in *MPO Canopus* that allows selecting of up to five comparison stars of near solar color. Subsequently, the additional adjustments of the magnitude zero-points for the particular data sets were carried out in order to achieve the best alignment between them i.e. to reach the minimum RMS value from the Fourier analysis.

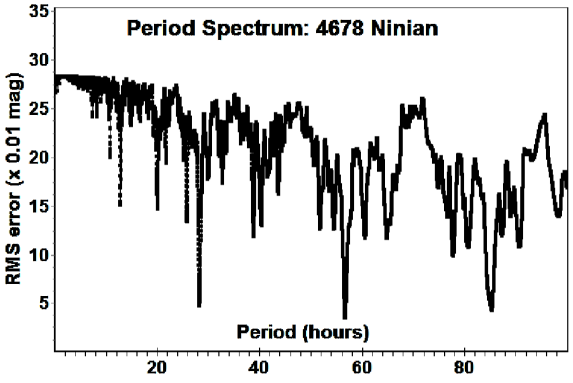

Figure 1. The period spectrum for 4678 covering 1 to 100 hours.

The period analysis found a few possible solutions with nearly comparable RMS errors. These clearly stand out in the period spectrum that plots RMS vs. period (Fig. 1). We concluded that the most likely value of the synodic period for 4678 Ninian is associated with a bimodal lightcurve phased to 56.72 ± 0.01 hours with an amplitude of 1.04 ± 0.03 mag (Fig. 2).

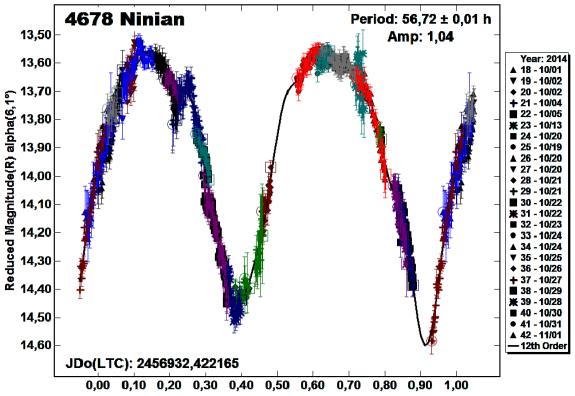

Fig. 2. The lightcurve for 4678 Ninian phased to the adopted period of 56.72 hours.

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ROTATIONAL PERIOD OF 1511 DALERA

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Photometric observations of the asteroid 1511 Dalera were made on three nights in 2015 February and March. Analysis of the data has allowed to draw a lightcurve with a synodic period P = 3.880 ± 0.001 h with amplitude A = 0.18 mag.

The main-belt asteroid 1511 Dalera was selected from the "Potential Lightcurve Targets" web site (Warner, 2015) and observed on three nights: 2015 Feb 27, Mar 6, and Mar 10. Observations were carried out from Franceschini Observatory in Rome (Italy), using a 9.25 in. Schmidt-Cassegrain *f*/6.2 equipped with an ATIK 314L CCD camera. The exposures were unfiltered. All images were calibrated with dark and flat-field frames. Differential photometry and period analysis was done using *MPO Canopus* (Warner, 2012).

The derived synodic period was *P* = 3.880 ± 0.001 h (Fig.1) with an amplitude of *A* = 0.18 mag.

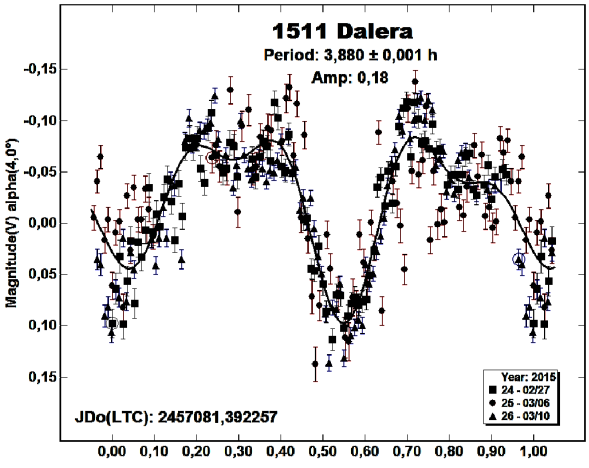

Figure 1.The lightcurve of 1511 Dalera with a period of 3.880 ± 0.001 h and amplitude of 0.18 mag.

References

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DISPATCHES FROM THE TROJAN CAMP – JOVIAN TROJAN L5 ASTERIODS OBSERVED FROM CS3: 2014 OCTOBER – 2015 JANUARY

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Rotational periods were determined for 35 members of the Jovian L5 Trojan group. Data were obtained by the Center for Solar System Studies from 2014 October to 2015 January.

During this calendar quarter, the Center for Solar System Studies (CS3, MPC U81) focused on studying Jovian Trojan asteroids. The Jovian Trojan asteroids are found in orbits librating around the stable L4 and L5 Lagrange points of Jupiter's orbit. They are believed to have formed further from the Sun than main belt asteroids and their composition and collisional history appears to be different. In a study of small Jovian Trojans, we show they could incorporate bulk ice and resemble the nuclei of short-period comets (French *et al* 2015). A recent study (Fernandez *et al* 2009) found there were fewer Trojans in the L4 and L5 swarms as previously calculated because the average albedo for smaller Trojans was found to be brighter resulting in an overestimation of the population of smaller Trojans. As yet, the rotation properties of Trojan asteroids are poorly known relative to those of main-belt asteroids, due to the lower albedo and greater distance of the Trojans. During this calendar quarter, the L5 (Trojan Camp) region was well placed for observing. Here we report lightcurve data for 35 Trojans. Most are in the 30 – 50 km diameter size range.

All images were made with a 0.4-m or a 0.35-m SCT using an FLI-1001E, a SBIG STL-1001E, or a SBIG ST-9e CCD camera. Images were unbinned with no filter and had master flats and darks applied to the science frames prior to measurement. Measurements were made using *MPO Canopus*, which employs differential aperture photometry to produce the raw data. Period analysis was done using *MPO Canopus*, which incorporates the Fourier analysis algorithm (FALC) developed by Harris (Harris *et al*., 1989). Night-to-night calibration of the data (generally < ±0.05 mag) was done using field stars converted to approximate Cousins V magnitudes based on 2MASS J-K colors (Warner 2007). The Comp Star Selector feature in *MPO Canopus* was used to limit the comparison stars to near solar color. The results are summarized in Table 1. Diameters (Dia) are from the WISE/NEOWISE database (Grav 2012).

884 Priamus. Priamus has been well observed over the years. We observed it (French *et al* 2011b) finding a period of 6.8605 h. Mottola observed it twice (Mottola *et al* 2011) finding periods of 6.866 h and 6.894 h. Shevchenko (Shevchenko *et al* 2011) found a period of 6.815 h. We observed Priamus again to attempt to get