LIGHTCURVE AND ROTATION PERIOD DETERMINATION FOR 5813 EIZABURO AND (11745) 1999 NH3

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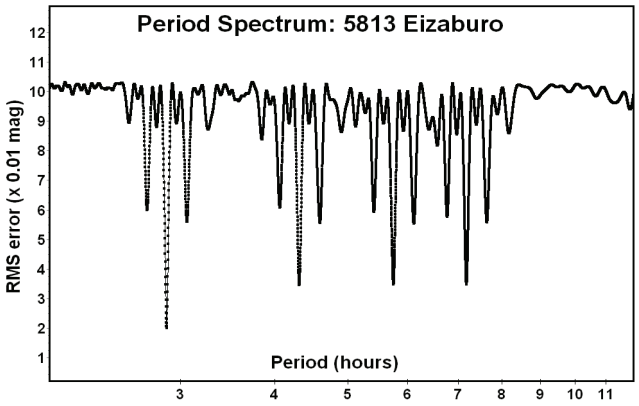
Photometric observations of the main-belt asteroids 5813 Eizaburo and (11745) 1999 NH3 performed made in 2017 August revealed a bimodal lightcurve phased to 2.876 ± 0.002 h for 5813 Eizaburo and 3.280 ± 0.001 h for (11745) 1999 NH3 as the most likely synodic rotational periods for these asteroids.

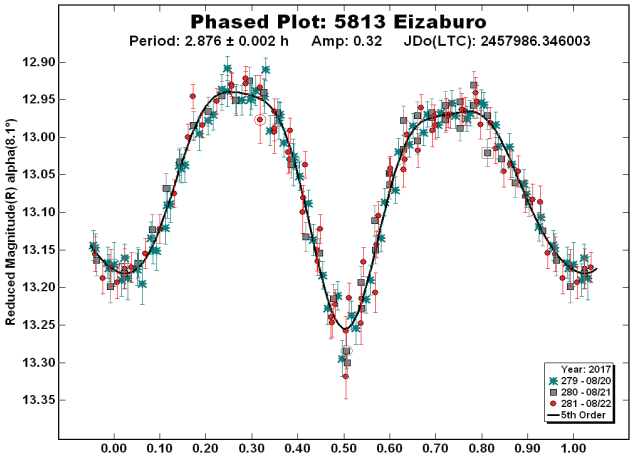
Lightcurve analysis for main-belt asteroids 5813 Eizaburo and (11745) 1999 NH3 was done using images obtained in 2017 August at the Astronomical Observatory of the University of Siena (Italy) and at the Wild Boar Remote Observatory (K49).

At the Astronomical Observatory of the University of Siena, data were obtained with 0.30-m *f*/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera, and clear filter; the pixel scale was 2.26 arcsec in binning 2x2. Exposures were 300 seconds. At the Wild Boar Remote Observatory (K49), data were obtained with a 0.235-m *f*/10 (SCT) telescope, SBIG ST8-XME NABG CCD camera, unfiltered; the pixel scale was 1.6 arcsec in binning 2x2. Exposures were 300 seconds.

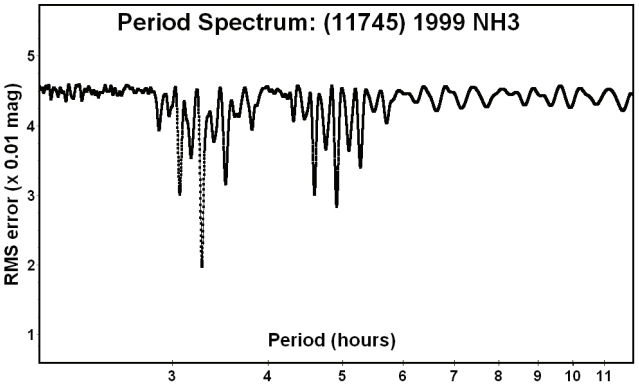
MPO Canopus (Warner, 2013) was used to measure the images, do Fourier analysis, and produce the lightcurves. Table I lists the asteroids that were observed and the results of our analysis. Orbital data and discovery circumstances were taken from the JPL Small Bodies Node (JPL, 2017).

5813 Eizaburo (1988 VL) is a main-belt asteroid discovered on 1988 Nov 3 by Kojima T. at Chiyoda. The orbit has a semi-major axis of about 2.60 AU, eccentricity 0.172, and orbital period of about 4.19 years. We observed this asteroid from 2017 August 20-22. The collaborative observations resulted in three sessions with a total of 190 data points. The result features a trimodal lightcurve phased to 2.876 ± 0.002 h and amplitude of 0.32 ± 0.02 mag.



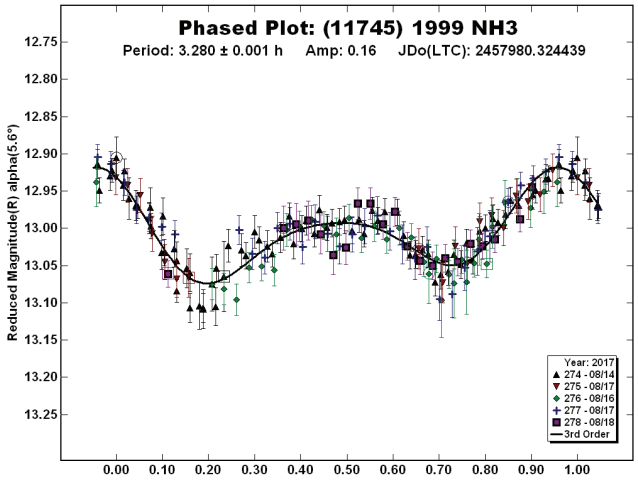


(11745) 1999 NH3 is a main-belt asteroid discovered on 1999 July 13 by LINEAR at Socorro. The orbit has a semi-major axis of about 2.70 AU, eccentricity 0.179, and orbital period of about 4.56 years. We observed this asteroid from 2017 August 14-18. The collaborative observations resulted in five sessions with a total of 182 data points. The result is a bimodal lightcurve phased to 3.280 ± 0.001 h and amplitude of 0.16 ± 0.02 mag.



Number	Name	2017 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
5813	Eizaburo	08/20-22	190	8,5,7,7	337	10	2.876	0.001	0.32	0.02	EUN
11745	1999 NH3	08/14-18	182	6.1,4.1	331	4	3.280	0.002	0.16	0.02	EUN

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009): EUN = Eunomia.



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REEXAMINING THE ROTATION PERIOD OF 576 EMANUELA

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Sixteen sessions on 576 Emanuela 2017 Feb. 17 – Apr. 4 provide equally good fits to synodic rotation periods of 20.404 ± 0.003 hours with one maximum and minimum per cycle and 40.812 ± 0.004 hours with a nearly symmetric and somewhat irregular bimodal lightcurve, with amplitude 0.13 ± 0.01 magnitudes.

This writer (Pilcher, 2017, with references to earlier works therein) published the first dense lightcurve of 576 Emanuela and claimed a rotation period of 40.812 ± 0.004 hours, amplitude 0.13 ± 0.01 magnitudes. B. Warner (personal communication) noted that the two halves of the bimodal lightcurve upon which the 40.812 hour period was claimed were nearly identical. He suggested that the period might be only half of this value with one maximum and minimum per cycle. Following this suggestion the author has reexamined his original data. Lightcurves phased to 20.404 hours and 40.812 hours are published here for the reader's comparison (Figs. 1 and 2).. The fit to 20.404 hours is even better if data points for the noisy March 8 session 2520 are removed. A period spectrum between 15 hours and 55 hours shows nearly the same rms values to fits of both 20.4 hours and 40.8 hours (Fig 3). A split halves plot phased to 40.812 hours shows that the two sides of the bimodal lightcurve are slightly different (Fig. 4). These distinctions may arise from photometric errors or changes of lightcurve shape with phase angle. But the present study cannot rule out the possibility that the distinctions may indicate a 40.812 hour period for an asteroid that is not quite symmetric about a 180 degree rotation. The period of 576 Emanuela as found from this study should be considered ambiguous, either 20.404 ± 0.003 hours or 40.812 ± 0.004 hours, with the 20.404 hour period preferred. Further studies at future oppositions are required to definitively remove the ambiguity.

References

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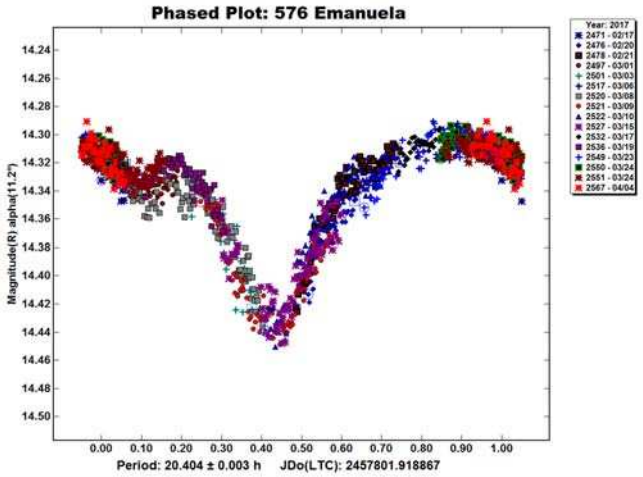

Figure 1. Lightcurve phased to 20.404 hours.

Number	Name	yyyy/mm/dd	Pts	Phase	LPAB	BPAB	Period(h)	P.E	Amp	A.E.
576	Emanuela	2017/02/17-2017/04/04	3493	11.2, 3.8, 5.3	184	-11	40.812	0.004	0.13	0.01

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date, unless a minimum (second value) was reached. LPAB and BPAB are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984).