ROTATION PERIOD DETERMINATION FOR ASTEROIDS 4988 CHUSHUHO AND 7393 LUGINBUHL

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Photometric observations of two main-belt asteroids were conducted in order to determine their synodic rotation periods. For 4988 Chushuho we found P = 3.170 ± 0.001 h, A = 0.15 ± 0.02 mag; for 7393 Luginbuhl we found P = 2.602 ± 0.001 h, A = 0.08 ± 0.03 mag.

CCD photometric observations of two main-belt asteroids were carried out in 2021 October and November at the Astronomical Observatory of the University of Siena (K54), a facility inside the Department of Physical Sciences, Earth and Environment (DSFTA, 2022). We used a 0.30-m *f*/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera, and clear filter; the pixel scale was 2.30 arcsec when binned at 2×2 pixels and all exposures were 300 seconds.

Data processing and analysis were done with *MPO Canopus* (Warner, 2018). All images were calibrated with dark and flat-field frames and the instrumental magnitudes converted to R magnitudes using solar-colored field stars from a version of the CMC-15 catalogue distributed with *MPO Canopus*. Table I shows the observing circumstances and results.

A search through the asteroid lightcurve database (LCDB; Warner et al., 2009) indicates that our results may be the first reported lightcurve observations and results for 4988 Chushuho, while for 7393 Luginbuhl we found a solution in good agreement with the recent literature.

4988 Chushuho (1980 VU1) was discovered on 1980 November 6 at the Purple Mountain Observatory and named after David Chu, Shu Ho (b. 1950), who lives in Hong Kong and has devoted his energies to physical education in China [MPC 55719]. It is a main-belt asteroid with a semi-major axis of 2.406 AU, eccentricity 0.214, inclination 2.138°, and an orbital period of 3.73 years. Its absolute magnitude is H = 13.83 (JPL, 2022). The WISE/NEOWISE satellite infrared radiometry survey (Masiero et al., 2012) found a diameter D = 3.58 ± 0.19 km using an absolute magnitude H = 13.6.

Observations were conducted over four nights and collected 231 data points. The period analysis shows a bimodal solution for the rotational period of P = 3.170 ± 0.001 h with an amplitude A = 0.15 ± 0.02 mag.

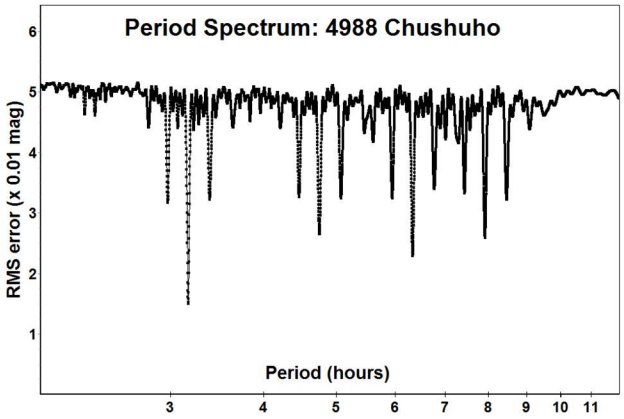

Figure 1: Period spectrum of 4988 Chushuho.

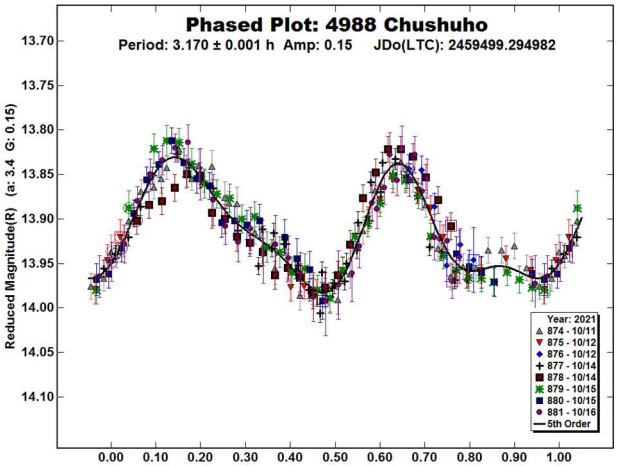

Figure 2: Phased lightcurve of 4988 Chushuho.

7393 Luginbuhl (1984 SL3) was discovered on 1984 September 28 by B.A. Skiff at the Anderson Mesa Station of the Lowell Observatory and named after Christian B. Luginbuhl (b. 1955), of the U.S. Naval Observatory's Flagstaff Station, who was largely responsible for the enactment and continued enforcement of ordinances preserving the dark skies of northern Arizona. With the discoverer, he co-authored the Observing Handbook and Catalogue of Deep-Sky Objects (Luginbuhl and Skiff, 1998). [MPC 36127] It is a main-belt asteroid with a semi-major axis of 2.240 AU, eccentricity 0.200, inclination 6.731°, and an orbital period of 3.35 years. Its absolute magnitude is H = 13.29 (JPL, 2022). The WISE/NEOWISE satellite infrared radiometry survey (Masiero et al., 2011) found a diameter D = 5.306 ± 0.242 km using an absolute magnitude H = 12.9.

Observations were conducted over two nights and collected 71 data points. Despite the first session being carried out under bad sky conditions, the period analysis using a subset of the data that excluded an apparent large attenuation (Figure 4), shows a result for the rotational period of P = 2.602 ± 0.001 h with an amplitude A = 0.08 ± 0.03 mag as the most likely bimodal solution for this asteroid. It is in good agreement with the solution found by Warner and Skiff (2019) who discovered the binary nature of this asteroid. We also recorded an anomaly in the lightcurve (Figure 5), which may have been due to an eclipse or occultation event in the binary system.

Number	Name	2021/mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
4988	Chushuho	10/11-10/16	3.4,0.9	23	-1	3.170	0.001	0.15	0.02	MB
7393	Luginbuhl	11/02-11/13	*5.3,3.8	47	4	2.602	0.001	0.08	0.03	MB

Table I. Observing circumstances and results. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).

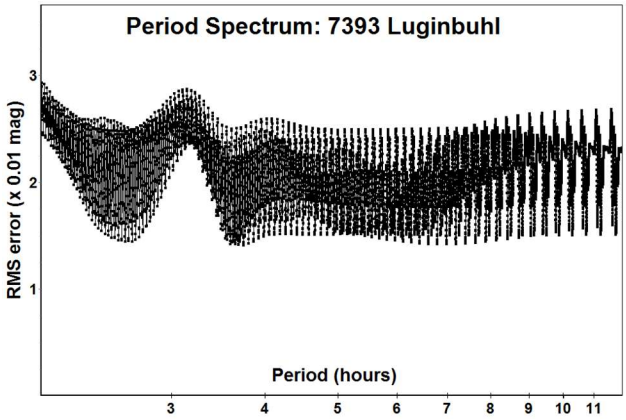

Figure 3: Period spectrum of 7393 Luginbuhl.

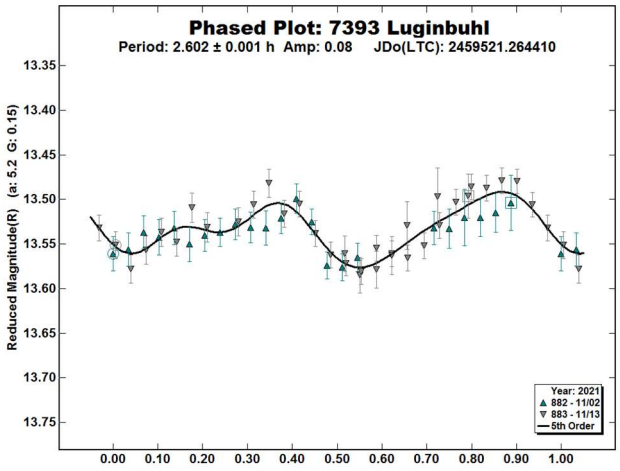

Figure 4: Phased lightcurve of 7393 Luginbuhl cleaned of the points due to a probable event.

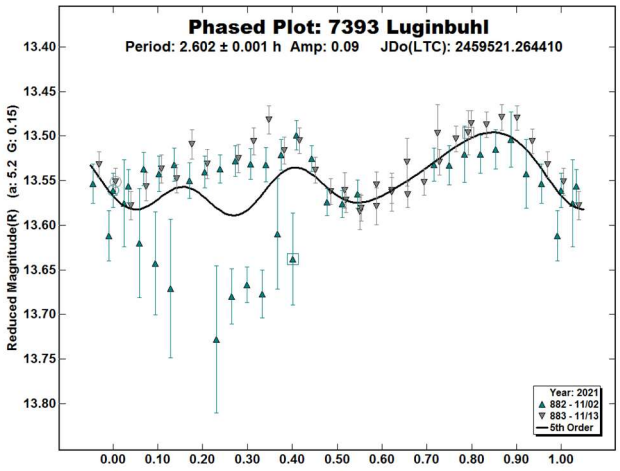

Figure 5: The phased lightcurve of 7393 Luginbuhl with all the collected points shows a probable eclipsing or occultation event.

Acknowledgements

Minor Planet Circulars (MPCs) are published by the International Astronomical Union's Minor Planet Center.
https://www.minorplanetcenter.net/iau/ECS/MPCArchive/MPCArchive_TBL.html

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