

LIGHTCURVE AND ROTATION PERIOD ANALYSIS FOR FOUR MINOR PLANETS

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Photometric measurements of CCD observations on four main-belt asteroids were made from 2024 September through 2024 October. Phased lightcurves were created for each one. All the data have been submitted to the ALCDEF database.

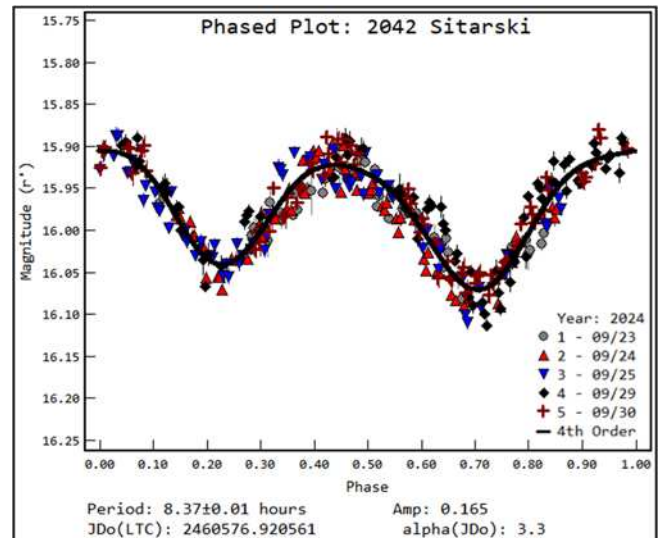
Photometric CCD observations of three main-belt asteroids were performed at Chiricahua Skies Observatory (MPC V43) near Sunizona, AZ. Images were taken using a 0.35m f/4.69 Corrected Dall-Kirkham telescope and Teledyne CCD47-10 sensor yielding an image scale of 1.61"/pixel. Table I shows observing circumstances and results. All images for these observations were obtained between 2024 September and 2024 October.

Data reduction and period analysis were done using *Tycho* (Parrott, 2023). The asteroid and five or more comparison stars were measured. Comparison stars were selected with colors within the range of $0.5 < B-V < 0.95$ to correspond with color ranges of asteroids.

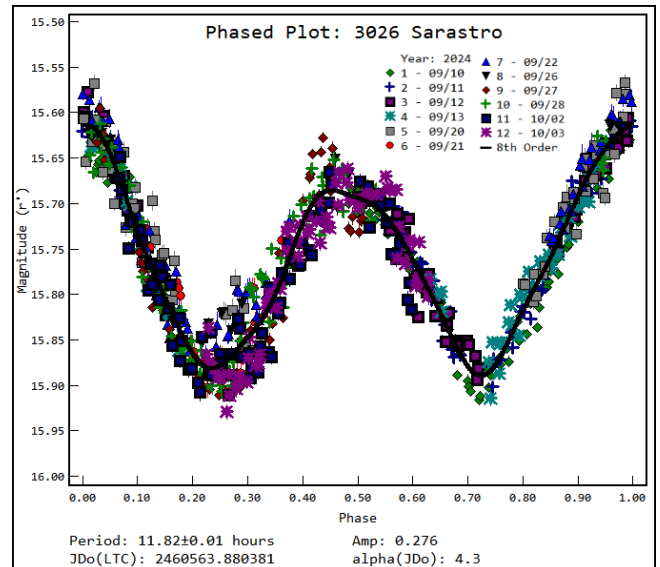
Comparison star magnitudes were obtained from the ATLAS catalog (Tonry et al., 2018), which is incorporated directly into *Tycho*. A measuring aperture equal to $4 \times$ FWHM of the target was used for asteroids and comp stars. This was typically a radius of 5 pixels on the measuring aperture. Interference from field stars resulted in the exclusion of affected observations. Period determination was done using *Tycho*.

Asteroids were selected from the CALL website (Warner, 2011), either for having uncertain periods or no reported period at all. In this set of observations, all three asteroids had previously reported periods. The Asteroid Lightcurve Database (LCDB) Warner et al. (2009) was consulted to locate previously published results. All new data for these asteroids has been submitted to the ALCDEF database.

2042 Sitarski was observed on five nights in an eight-day period near opposition during its 2024 apparition. 356 observations were used to determine the rotation period of the asteroid. Searching the LCDB one previous period of 2.63 ± 0.01 hours has been reported by Warell (2017). The author calculated a period of 8.37 ± 0.01 hours, disagreeing with Warell. The amplitude of the light curve is 0.165 ± 0.19 magnitude.



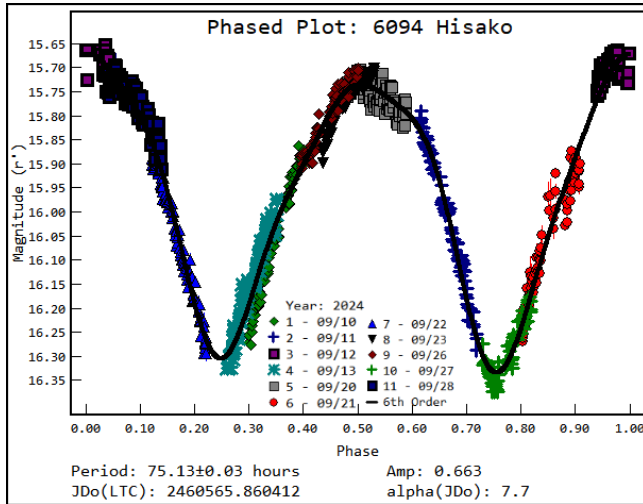
3026 Sarastro has a single reported period in the LCDB. Chang et al. (2016) reported a period of 7.87 ± 0.13 hours and assigned a quality code U=2 indicating some ambiguity. The referenced period was derived from data that did not cover a complete period. The author observed the minor planet over twelve nights in 2024 September and 2024 October and calculated a period of 11.82 ± 0.01 hours, disagreeing with Chang's result.



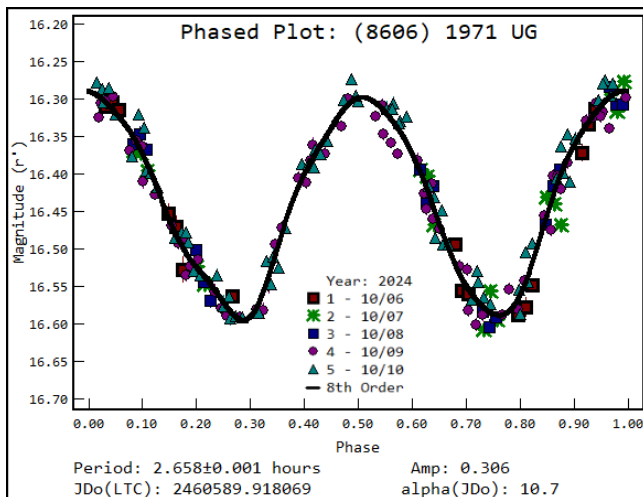
Number	Name	yyyy mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
2042	Sitarski	2023/09/23-09/30	0.6, 3.5	7	0	8.37	0.01	0.165	0.019	Merxia
3026	Sarastro	2024/09/10-10/03	4.2, 10.7	343	9	11.82	0.01	0.276	0.023	MB-O
6094	Hisako	2024/09/10-09/28	5.3, 8.4	1	11	75.13	0.03	0.663	0.027	Eunomia
8606	1971 UG	2024/10/06-10/10	9.1, 10.7	38	1	2.658	0.001	0.306	0.019	MB-O

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).

6094 Hisako was observed in a dense dataset of 884 observations on eleven nights in an eighteen-night period in 2024 September. Two previously reported periods were found in the LCDB. Behrend (2015web) reported a period of 16.4 ± 0.1 h and Klinglesmith III et al. (2016) reported a period of 4.05 ± 0.002 h. In the report Klinglesmith noted low confidence in the result because of the large scatter in the data. The author computed a period of 75.13 ± 0.03 h and an amplitude of 0.663 ± 0.027 magnitude. This disagrees with the two previously reported period solutions.



8606 1971 UG was observed over five consecutive nights in 2024 October. This outer main-belt asteroid has a low eccentricity orbit inclined 11.8° to that of the orbital plane of the solar system. No previous periods have been reported in the LCDB for this target. From a total of 192 observations a period of 2.658 ± 0.001 hours was determined with an amplitude of 0.306 ± 0.019 magnitude.



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References

- Behrend, R. (2015web). Observatoire de Geneve web site. <http://obswww.unige.ch/~behrend/page5cou.html>
- Chang, C.; Lin, H.; Ip, W.; Prince, T.; Kulkarni, S.R.; Levitan, D.; Laher, R.; Surace, J. (2016). "Large Super-fast Rotator Hunting Using the Intermediate Palomar Transient Factory." *Astrophys. J.* **227**, 20C.
- Harris, A.W.; Young, J.W.; Scaltriti, F.; Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gypsis." *Icarus* **57**, 251-258.
- JPL (2023). Small Body Database Lookup. https://ssd.jpl.nasa.gov/tools/sbdb_lookup.html
- Klinglesmith III, D.; Hendrickx, S.; Madden, K.; Montgomery, S.; (2016). "Asteroid Light Curves from Estorn Observatory." *Minor Planet Bull.* **43**, 234.
- Parrot, D. (2023). Tycho software. <https://www.tycho-tracker.com>
- Tonry, J.L.; Denneau, L.; Flewelling, H.; Heinze, A.N.; Onken, C.A.; Smartt, S.J.; Stalder, B.; Weiland, H.J.; Wolf, C. (2018). "The ATLAS All-Sky Stellar Reference Catalog." *Astrophys. J.* **867**, A105.
- Warell, J. (2017). "Lightcurve Observations of Nine Main-belt Asteroids." *Minor Planet Bull.* **44**, 304.
- Warner, B.D.; Harris, A.W.; Pravec, P. (2009) "The asteroid lightcurve database." *Icarus* **202**, 134-146. Updated 2024 Oct. <https://minplanobs.org/alcdef/index.php>
- Warner, B.D. (2011). Collaborative Asteroid Lightcurve Link website. <http://www.minorplanet.info/call.html>