

LIGHTCURVE AND ROTATION PERIOD ANALYSIS FOR TWENTY-FIVE MINOR PLANETS

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Photometric measurements of CCD observations on twenty-five minor planets were made from 2024 April through 2025 January. Phased lightcurves were created for each one. All data has been submitted to the ALCDEF database.

Photometric CCD observations of twenty-five main-belt asteroids were performed at Chiricahua Skies Observatory (MPC V43) near Sunizona, Arizona. Images from 2024 April through 2024 November 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. In 2024 December the 0.35m Corrected Dall-Kirkham was reconfigured to operate at its native f/7.3 focal ratio and a QHY-268 CMOS camera was installed yielding an image scale of 0.3"/pixel. Table I shows observing circumstances and results. All images for these observations were obtained between 2024 December and 2025 January.

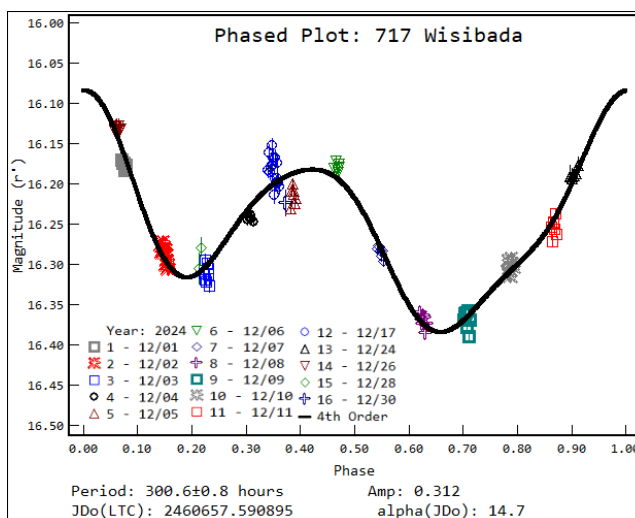
Data reduction and period analysis were done using *Tycho* (Parrott, 2024). The asteroid and five or more comparison stars were measured. Comparison stars were selected with colors within the range of $0.5 < B-V < 0.95$ to correspond with color ranges of asteroids.

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

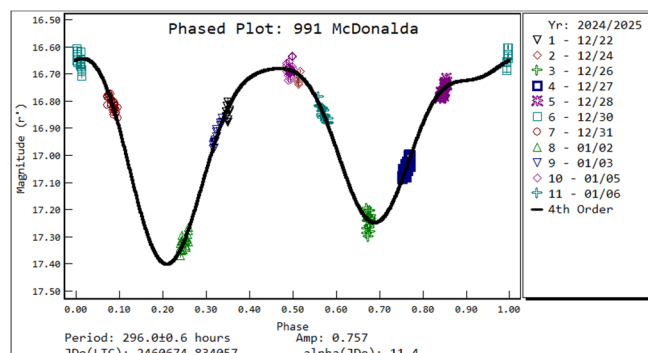
used for asteroids and comp stars. Interference from field stars resulted in the exclusion of affected observations. Period determination was done using *Tycho*.

Asteroids were selected from the CALL website (Warner, 2011), either for having uncertain periods or no reported period at all. 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.

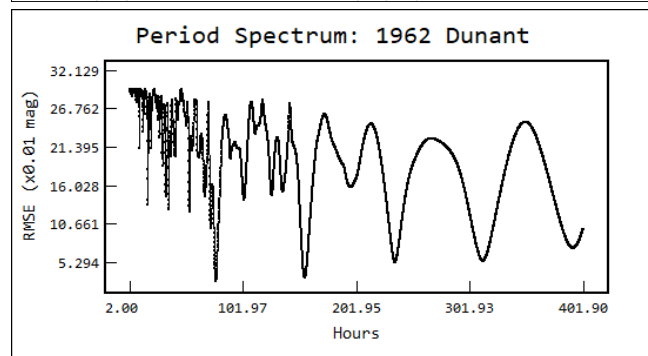
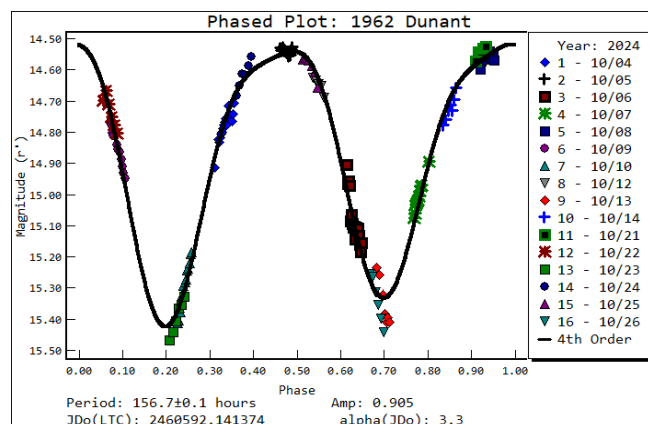
717 Wisibada is an outer main-belt asteroid with an estimated diameter of 27.66 km. A search of the LCDB revealed three separate period solutions reported during the 2023 apparition. Dose (2023) reported a period of 609.06 ± 0.49 h; Polakis (2024) reported a period of 480.8 ± 2.2 h and Colazo et al. (2023) reported a period of 1250 ± 35 h. In 2024 December observations were obtained during sixteen nights of a thirty-night period and used to calculate a period solution of 300.6 ± 0.8 h, disagreeing with all previously published solutions. The amplitude of the lightcurve is 0.312 ± 0.018 magnitude.



991 McDonald has a single period published in the LCDB by Pilcher (2024) of > 16 hours. He notes that only a single night of data was obtained and that a large amount of telescope time would be required to determine an accurate period solution. From 2024 December to 2025 January, the author committed telescope time to make 218 observations on eleven different nights. This data was used to determine that 991 McDonald is a slow rotator with a large amplitude. The calculated period is 296.0 ± 0.6 hours and the amplitude is 0.757 ± 0.022 magnitude.

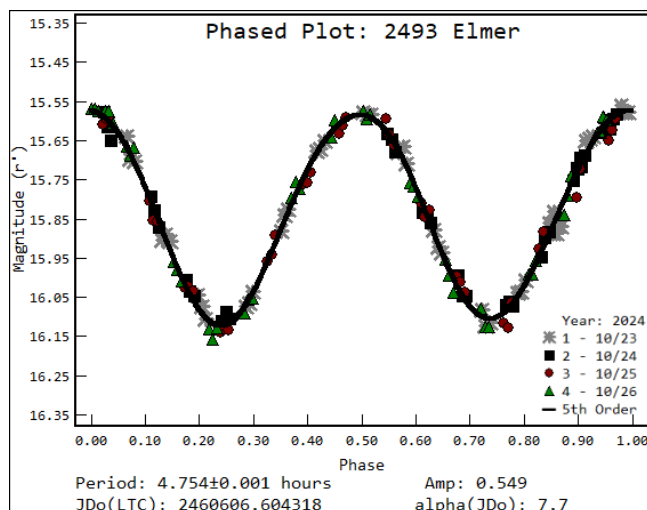


1962 Dunant is an outer main-belt asteroid with no published periods in the LCDB. Observations were conducted over a three-week period in 2024 October and 429 images were captured in sixteen observing sessions. A monomodal period of 78.4 h produces a slightly better fit, but the bimodal period solution is preferred and reported here. That period is 156.7 ± 0.1 h with an amplitude of 0.905 ± 0.019 mag.

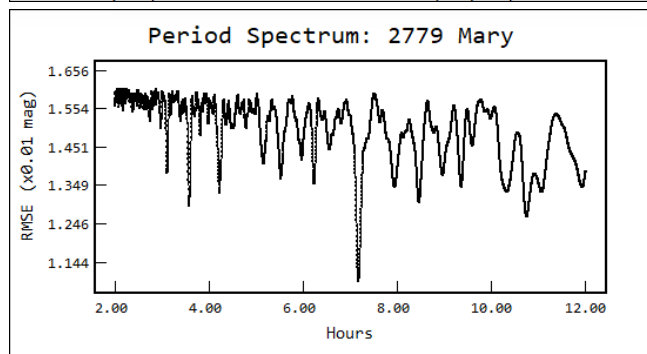
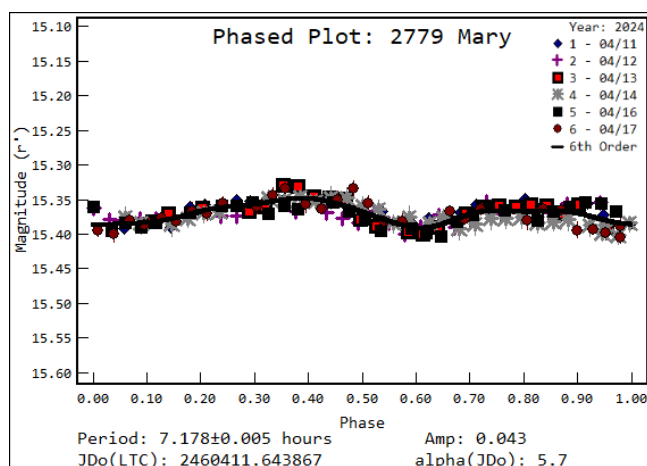


2493 Elmer was imaged on four consecutive nights in 2024 October resulting in 169 observations for period analysis. Durech et al. (2019) reported a period of 4.75449 ± 0.000002 h for this asteroid.

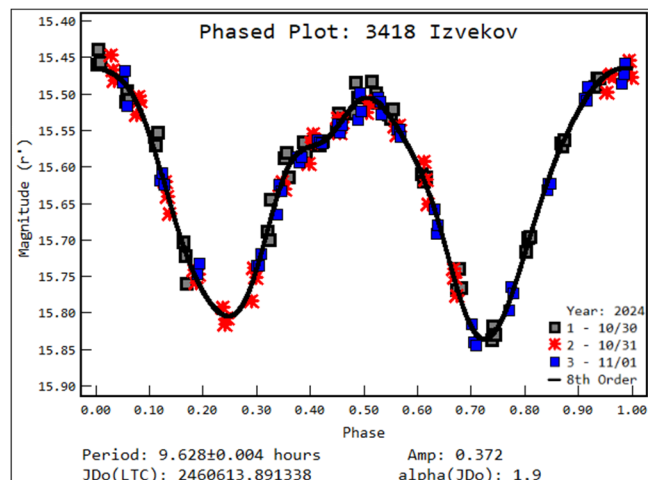
The author calculated a period solution of 4.754 ± 0.001 h in agreement with Durech's previous result. The amplitude of the lightcurve is 0.549 ± 0.019 magnitude.



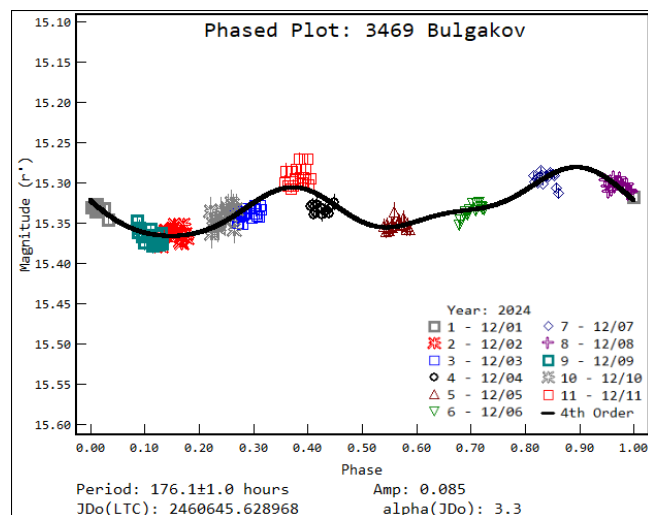
2779 Mary was observed on six consecutive nights in 2024 April. Behrend (2006web) reported a provisional period of 3.36 ± 0.05 h based on a single night of data in 2006, and Pilcher (2021) reported a period of 3.583 ± 0.001 h. 366 observations were made by the author and a period solution of 7.178 ± 0.005 h was calculated. The period spectrum shows a strong minimum at 7.178 hours. The period shown here is twice the period reported by Pilcher – disagreeing with previous observations of this asteroid. The amplitude of the lightcurve is 0.043 ± 0.011 magnitude.



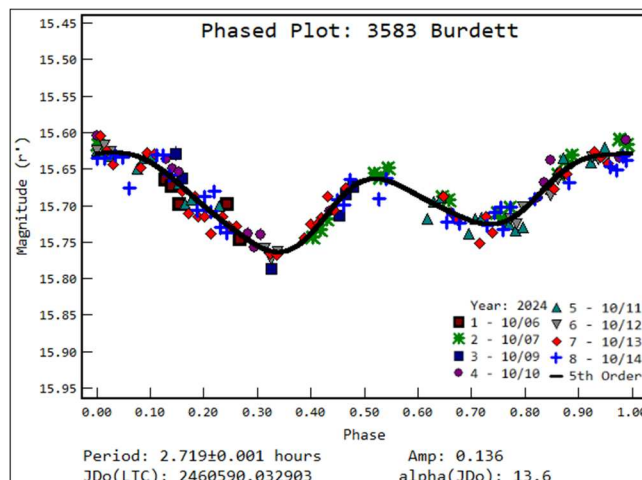
3418 Izvekov is a member of the Themis family of asteroids. A search of the LCDB revealed no reported solutions. During three consecutive nights, 149 images were gathered, producing a period solution of 9.627 ± 0.003 h. The amplitude of the lightcurve is 0.372 ± 0.013 magnitude.



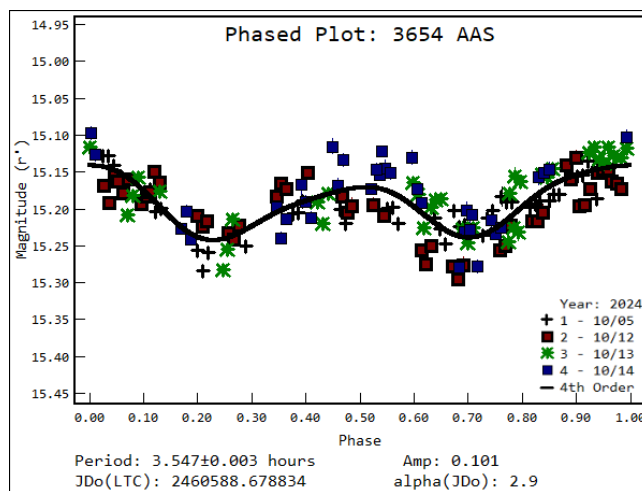
3469 Bulgakov is an Eos family asteroid with an estimated diameter of 18.86 km. Two period solutions were found in the LCDB. The earliest reported period by Behrend (2011web) is 6.48 ± 0.05 h; Durech et al. (2020) reported a period of 180.76 ± 0.01 h. A lightcurve was constructed from 511 data points obtained during an observing run of eleven consecutive nights in 2024 December. The calculated period of 176.1 ± 1.0 h is in agreement with the period published by Durech. The amplitude of the lightcurve is 0.085 ± 0.011 mag.



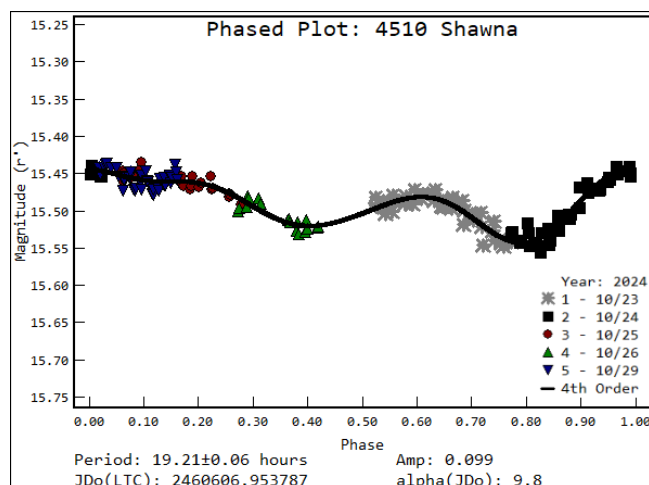
3583 Burdett is a Hertha family asteroid with no published period solutions in the LCDB. Observations were taken over eight nights in 2024 October. These resulted in a calculated period solution of 2.719 ± 0.001 h with an amplitude of the lightcurve is 0.136 ± 0.014 magnitude.



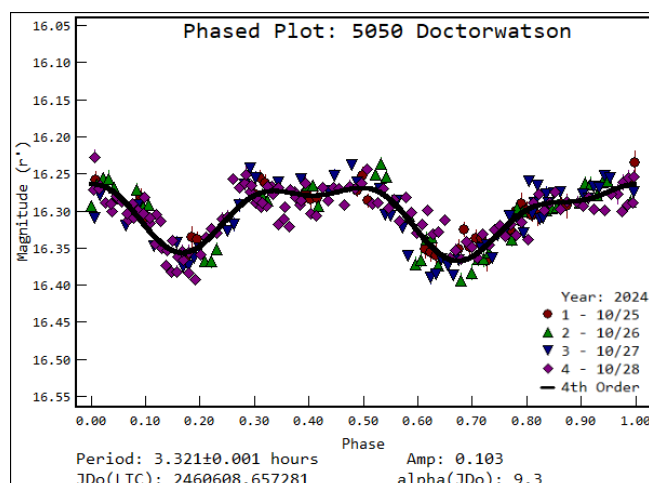
3654 AAS was observed over 4 nights in 2024 October. This inner main-belt asteroid has no published period solutions noted in the LCDB. 165 observations were made and used to determine a period solution of 3.547 ± 0.003 h. The amplitude of the lightcurve is 0.101 ± 0.027 magnitude.



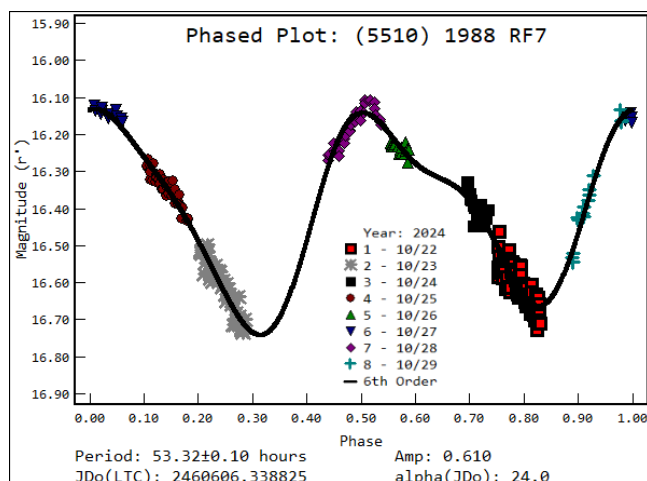
4510 Shawna is a Vesta family asteroid with no published periods in the LCDB. The author observed the asteroid on five nights in 2024 October and determined a period of 19.21 ± 0.06 h. The amplitude of the lightcurve is 0.099 ± 0.009 magnitude. Additional observations could refine the shape and period of the asteroid since the author was unable to obtain full coverage of its rotational period.



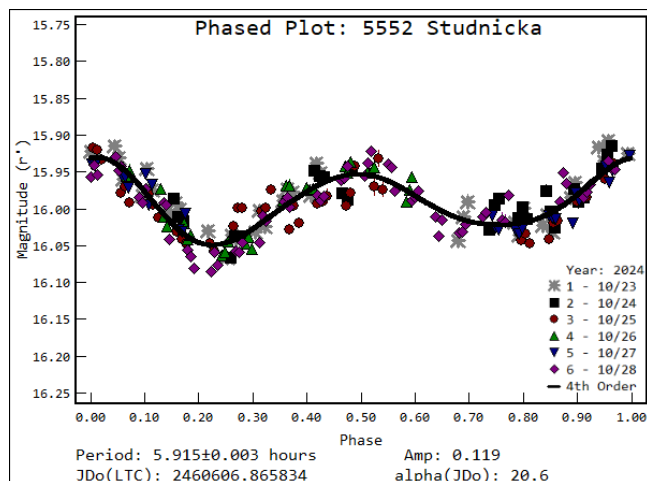
5050 Doctorwatson, a main-belt asteroid, was observed over four consecutive nights in 2024 October. In that time, 285 observations were made to derive a period solution of 3.321 ± 0.001 h and an amplitude of 0.103 ± 0.019 magnitude. No period solutions for this asteroid were found in the LCDB.



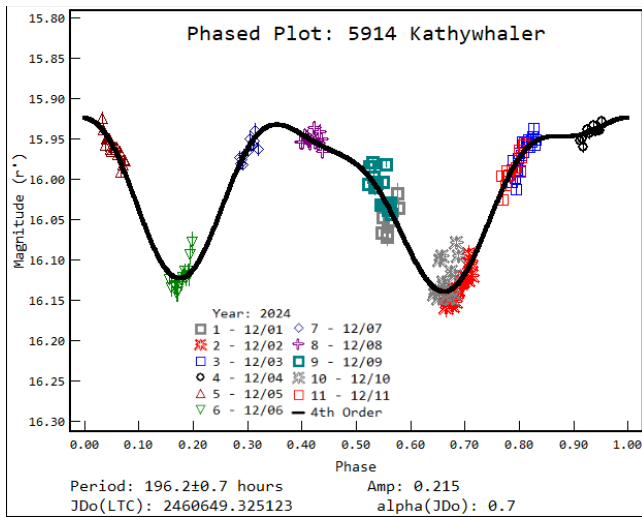
5510 1988 RF7 is an asteroid with a Mars-crossing orbit that lists a single period in the LCDB. Oey (2016) observed the asteroid on a single night when it shared the field with a different target. His comments note that the period of 3.2 ± 0.4 h is not conclusive and is based on sparse data. The author observed this target for eight consecutive nights and a period determination was made from the 273 images collected in that period. The author calculates a period of 53.32 ± 0.10 h with an amplitude of 0.610 ± 0.026 magnitude based on the more extensive data available for analysis.



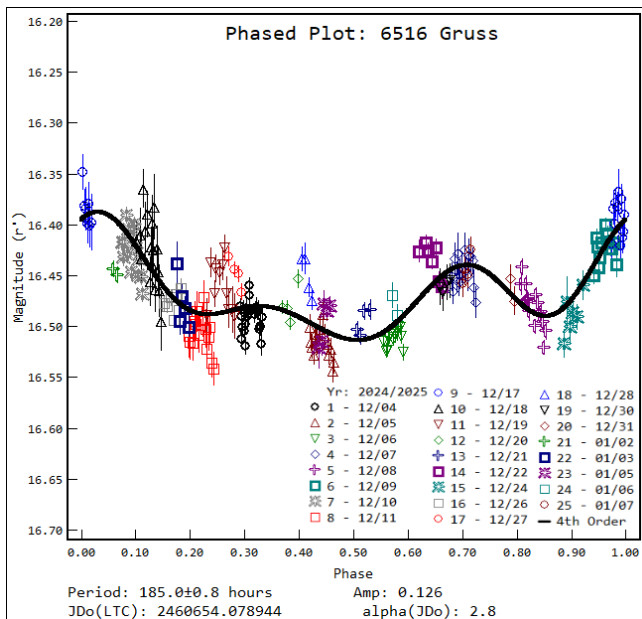
5552 Studnicka was observed on six consecutive nights in 2024 October. This outer main-belt asteroid has no published period solutions noted in the LCDB. During the 2024 apparition 230 observations were made and used to determine a period solution of 5.915 ± 0.003 h. The amplitude of the lightcurve is 0.119 ± 0.018 magnitude.



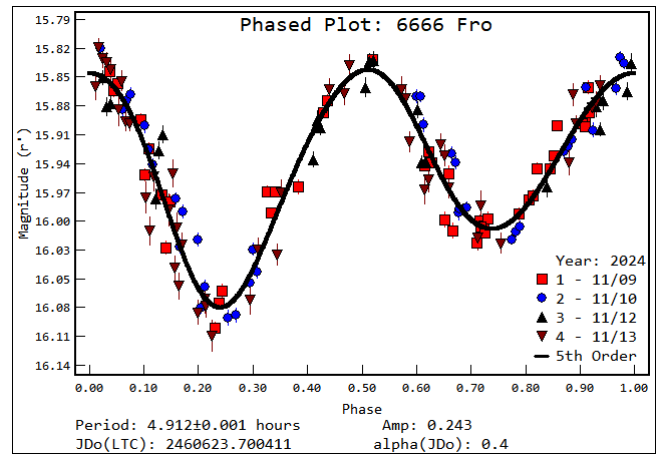
5914 Kathywhaler is a Sylvia family asteroid observed on eleven consecutive nights in 2024 December. Waszczak et al. (2015) reported a period of 38.73 ± 0.0725 h. A total of 457 data points obtained during the 2024 apparition and used to calculate a period solution of 196.2 ± 0.7 h, providing a different result from Waszczak. The period solution was only determined after iterating on multiple values for G . Using a value of $G=0.60$ provided the solution reported here. The amplitude of the lightcurve is 0.215 ± 0.014 magnitude.



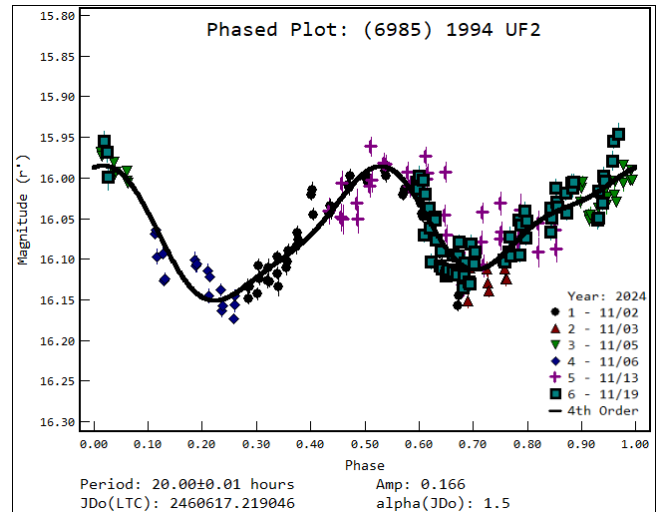
6516 Gruss is an inner main-belt asteroid with a single previously reported period listed in the LCDB. Clark (2014) reported a period of 13.003 ± 0.008 h. Data was obtained by the author over twenty-five nights between 2024 December and 2025 January to calculate a period solution of 185.0 ± 0.8 h, differing from the previous result. The amplitude of the lightcurve is 0.126 ± 0.023 magnitude.



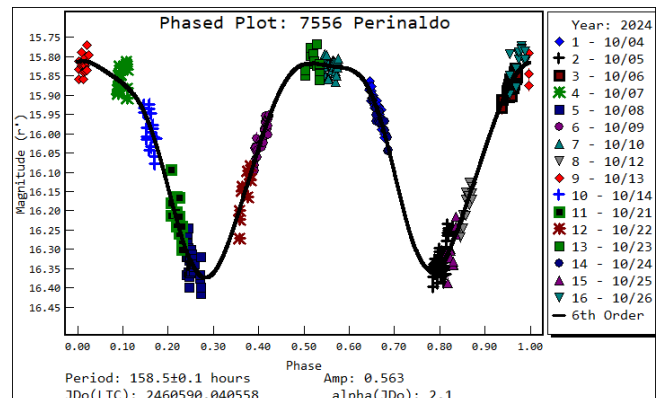
6666 Fro is an inner main-belt asteroid with an estimated diameter of 4 km. No period solutions exist in the LCDB. In 2024 November a total of 169 data points were obtained during four nights and used to calculate a period solution of 4.912 ± 0.001 h. The amplitude of the lightcurve is 0.243 ± 0.023 magnitude.



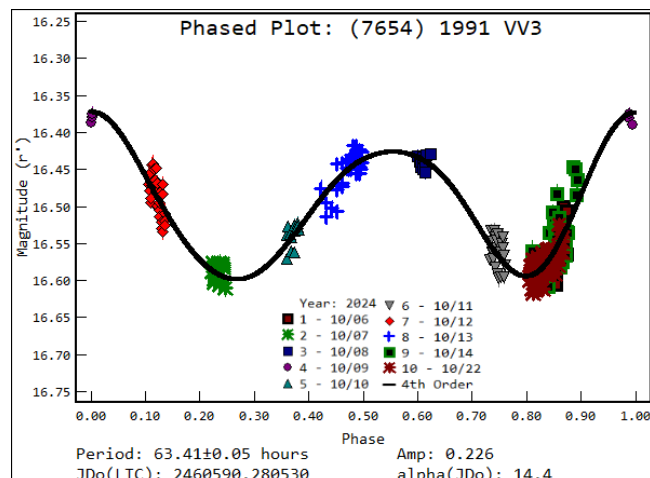
6985 1994 UF2, a Vesta family asteroid, was observed on six nights in 2024 November. A search of the LCDB revealed no published periods. The author calculated a period of 20.00 ± 0.01 h with an amplitude of 0.166 ± 0.025 magnitude.



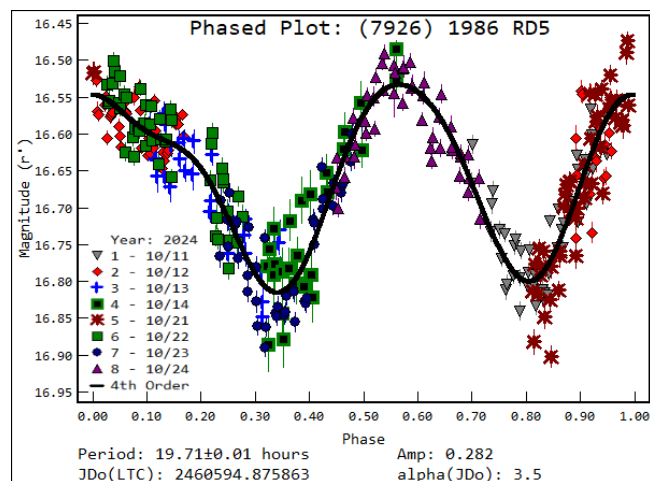
7556 Perinaldo was imaged on sixteen nights in 2024 October for the purpose of determining its rotation period. One previously reported period was found in the LCDB. Durech et al. (2019) reported a period of 159.102 ± 0.002 h for this asteroid. The author calculated a period of 158.5 ± 0.1 h for this slow rotator in agreement with Durech's result. The amplitude of the lightcurve is 0.563 ± 0.027 magnitude.



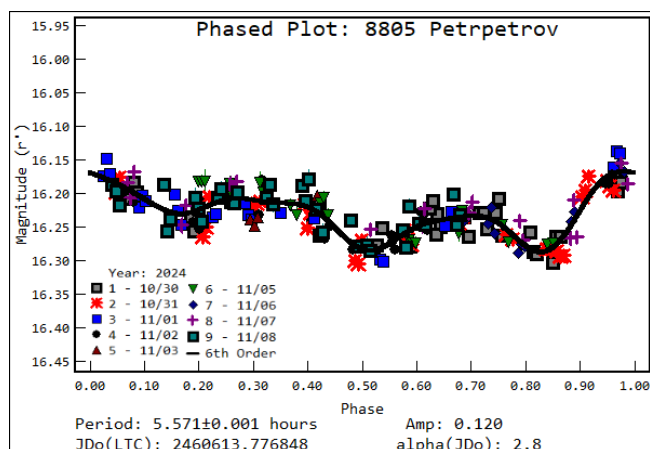
7654 1991 VV3, a Hertha family asteroid, was observed over ten nights in 2024 October. In that time, 234 observations were made to derive a period solution of 63.41 ± 0.05 h and an amplitude of 0.226 ± 0.020 magnitude. No period solutions for this asteroid were found in the LCDB.



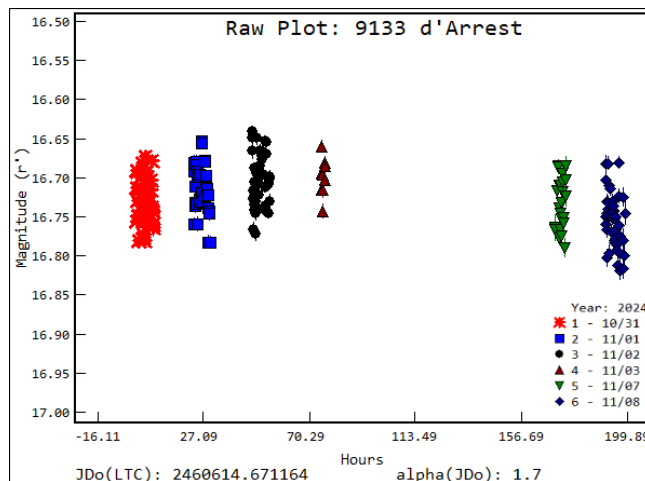
7926 1986 RD5 was observed on 8 nights in 2024 October. This main-belt asteroid has no published period solutions noted in the LCDB. During the 2024 apparition 350 observations were made and used to determine a period solution of 19.71 ± 0.01 h. The amplitude of the lightcurve is 0.282 ± 0.039 magnitude.



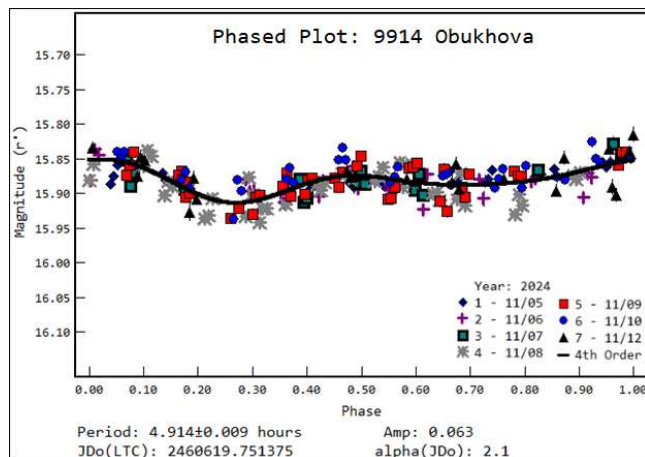
8805 Petrpetrov is an inner main-belt asteroid with no published period solutions in the LCDB. Observations were taken over nine nights in 2024 October and 2024 November. These resulted in a calculated period solution of 5.571 ± 0.001 h. A tri-modal solution was the only reasonable lightcurve calculated by *Tycho* over a wide range of possible solutions. The amplitude of the lightcurve is 0.120 ± 0.019 magnitude.



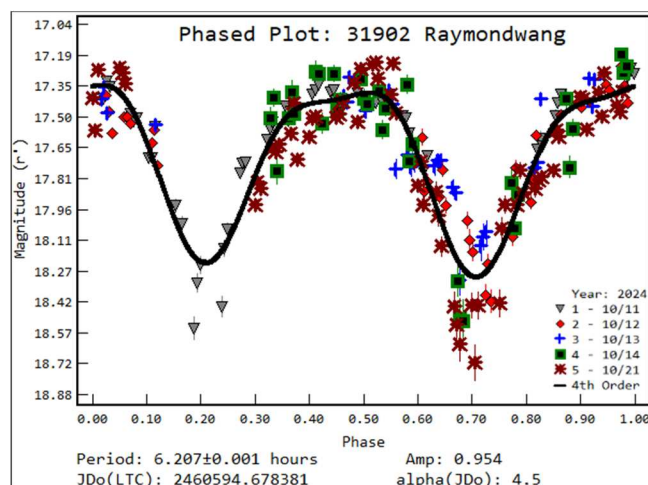
9133 d'Arrest was observed over six nights in 2024 November. Due to a large amount of scatter in the data the author was unable to confidently identify a period solution. The raw plot is published here to provide a baseline for future observations. It indicates that this asteroid is likely a slow rotator. There are no published periods for this target in the LCDB.



9914 Obukhova, a Misa family asteroid was observed on seven nights in 2024 November. A search of the LCDB revealed no published periods. The author calculated a period of 4.914 ± 0.009 h with an amplitude of 0.063 ± 0.018 magnitude.



31902 *Raymondwang* is an inner main-belt asteroid with an estimated diameter of 2.157 km. No period solutions exist in the LCDB. In 2024 October a total of 219 data points were obtained during five nights and used to calculate a period solution of 6.207 ± 0.001 h. The amplitude of the lightcurve is 0.954 ± 0.133 magnitude.



Acknowledgements

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