

ASTEROID PHOTOMETRY AT SUNFLOWER OBSERVATORY: RESULTS FOR 507 LAODICA AND 1147 STAVROPOLIS

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Lightcurves for two asteroids were measured in August and September 2001 at the Sunflower Observatory located in Olathe, KS. The period of 507 Laodica was found to be 4.705 ± 0.02 h with an amplitude of 0.22 ± 0.02 m. 1147 Stavropolis was determined to have a period of 5.66 ± 0.01 h and the amplitude measured was 0.45 ± 0.02 m.

Sunflower Observatory is a participant in the Center for Asteroid Physical Studies (CAPS), a goal of which is to determine accurate lightcurves on the 1000 – 1500 brightest asteroids. Target selection is made from the Collaborative Asteroid Lightcurve Link (CALL) web site maintained by Brian Warner (<http://www.MinorPlanetObserver.com/astlc/default.htm>). All planned targets are posted to avoid duplication of effort unless needed for collaboration and results are posted when obtained.

The current instrumentation at Sunflower Observatory is a 0.30-m Meade LX-200 SCT and Santa Barbara Instruments Group ST9E CCD camera. The effective focal ratio of the system is f7.2 yielding a pixel size of 2.3 arc sec. square. During August and September the camera is cooled to -5°C and the usual exposure is 120 sec. using the tracking feature of the SBIG camera. The objective is to reach a S/N ratio ≥ 50 for the target. Exposures are generally started at 300 second intervals while the target is ≥ 30 degrees elevation. All images are unfiltered. All images are dark subtracted and flat fielded before measurement. Usually four comparison stars are chosen in the same field and selected on the basis of similar magnitude and spectra to the target.

Canopus software is used to measure the images and determine best fit of a lightcurve to the data. More information on this software may be obtained at <http://www.MinorPlanetObserver.com>.

507 Laodica

Discovered 1903 February 19 by R. S. Dugan at Heidelberg. Named for a daughter of Priam and Hecuba. She fell in love with Acamas, son of Theseus and Phaedra, when he and Diomedes came from the Greeks to demand the restoration of Hellen. The minor planet was not named by the discoverer. It had previously been observed by A. Charlois in Nice, but later lost. The name appeared when an ephemeris was published.

A total of 152 observations were used from data acquired on August 12, 17, 18, 19, 20, and 29 covering the entire lightcurve with no gaps. The period of the lightcurve was determined to be 4.705 ± 0.005 h. The curve is somewhat asymmetrical with a maximum amplitude of 0.22 ± 0.02 m.

1147 Stavropolis

1929 LF was discovered 1929 June 11 by G. N. Neujmin at Simeis. Numbered 1147 and named by the discoverer, it honors the city of Stavropol' in northern Caucasus region. Between 1936 and 1946 the city was named Woroschilovsk.

A total of 150 observations were used from data acquired on September 2, 3, and 5 covering the entire lightcurve with no gaps. The period of the lightcurve was determined to be 5.66 ± 0.01 h. The curve is asymmetrical with a maximum amplitude of 0.45 ± 0.02 m.

References

Schmadel, Lutz D. (1999). *Dictionary of Minor Planet Names* Springer-Verlag.

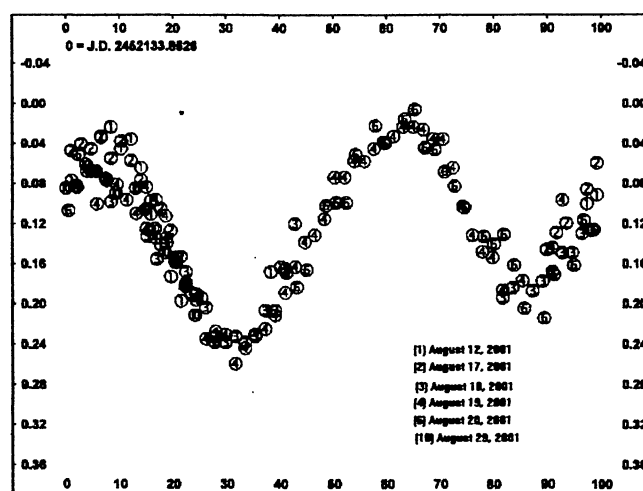


Figure 1. The lightcurve for 507 Laodica. The period is 4.705 ± 0.005 h with an amplitude of 0.22 ± 0.02 m.

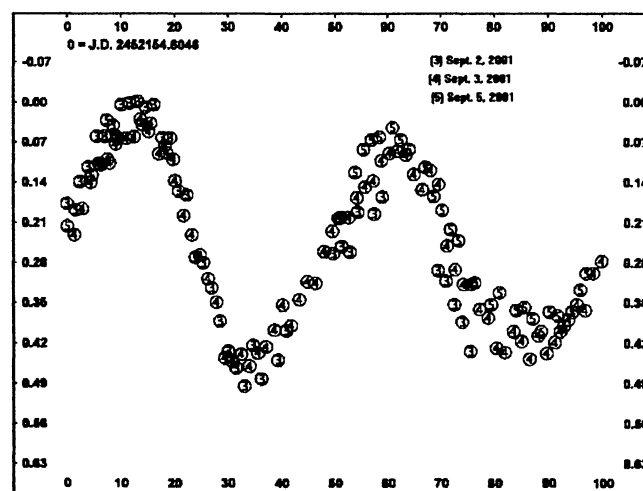


Figure 2. The lightcurve for 1147 Stavropolis. The derived period is 5.66 ± 0.01 h; the amplitude is 0.45 ± 0.02 m.

ASTEROID PHOTOMETRY AT THE PALMER DIVIDE OBSERVATORY: RESULTS FOR 573 RECHA, 1329 ELIANE, AND 8041 MASUMOTO

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Lightcurves for three asteroids were measured in 2001 January, April, and August at the Palmer Divide Observatory located near Colorado Springs, CO. The period of 573 Recha was found to be 6.53 ± 0.05 h with an amplitude of 0.25 ± 0.05 m. 1329 Eliane was determined to have a period of 8.0 ± 0.1 h with an amplitude of 0.08 ± 0.02 m. For 8041 Masumoto, the period was found to be 14.10 ± 0.02 h and the amplitude 0.30 ± 0.02 m.

The goal of the initial Palmer Divide Observatory asteroid photometry program is to measure the lightcurves for as many asteroids as possible. A successful measurement is considered when the period has been determined to within 0.05h or better and 0.02m or better for the amplitude. The current instrumentation is a 0.5m Ritchey-Chretien working at f/8.1. The camera is a Finger Lakes Instrumentation camera using the Kodak KAF-1001E non-antiblooming CCD chip working at -30°C and 2×2 binning (0.48 μm pixels). This yields a scale of about 2.4 arcseconds per pixel. Given that the average seeing at the Palmer Divide Observatory is on the order of 4-5 arcseconds, this is usually a satisfactory match. All observations for this paper were unfiltered with unguided exposures of either 60s or 70s. All images were dark subtracted and flat-fielded before measuring.

Initial targets are determined by referring to the list of lightcurves maintained by Dr. Alan Harris (Harris 2001) as well as those posted on the Collaborative Asteroid Lightcurve Link (CALL) web site maintained by the author (<http://www.MinorPlanetObserver.com/astlc/default.htm>). At least two nights are dedicated to the initial run for every target. Depending on the preliminary analysis of the lightcurve data from those two nights, additional runs are allocated as necessary to assure full coverage of the lightcurve with no significant gaps, if possible. For asteroids with periods approaching and exceeding 24 hours or with aliases close to 24 hours, this becomes difficult.

Custom software written by the author, *MPO Canopus*, is used to measure the images since it allows automatic storage of the measured magnitudes of the comparison stars and targets. It uses aperture photometry with magnitudes determined by calibrating images against field or, preferably, standard stars. The package includes a Fourier analysis routine, the original FORTRAN code for which was supplied by Alan Harris (Harris et al, 1989) and converted to Delphi Pascal. If the data from a single night appears to cover at least half a period or more, then an estimate based on a plot of the raw data is used to help narrow the possibilities when using data from two or more nights.

For two of the measured asteroids, 573 Recha and 1329 Eliane, the old adage "If at first you don't succeed, try, try again" comes to mind. The data for these targets was gathered in early 2001, initially measured, and no satisfactory results determined. During a cleanup of the computer's hard drive to archive images and data

reduction files to CD-ROM, I was determined to give these two and a couple of other unresolved asteroids another try. Eventually, all the images for all the asteroids were remeasured, taking care to avoid measuring images where field stars may have affected the data. This effort paid off in the case of Recha and Eliane as the new data allowed reasonable solutions to be determined. Part of the success can also be attributed to refinements in the code for determining the centroid and total flux made after discussing the topic with a number of professional and amateur photometrists.

573 Recha

This 39km unclassified asteroid was discovered by Max Wolf in 1905 September. It is named after a character in Lessing's *Nathan the Wise*. The semi-major axis of 3.017AU places the asteroid towards the outer main belt. The inclination is about 9° and the eccentricity 0.109. Observations were obtained on the nights of 2001 January 1 (my way of celebrating the 200th anniversary of Ceres' discovery) and January 4. Data were also obtained on January 5 but suffered from excessive noise due to less than ideal conditions and so the data were not used in the final solution, which included about 135 observations from the nights of January 1 and 4. In the original measurements, the data from all three nights showed considerable noise and no solution could be found. The remeasuring "quieted" the data for two of the nights and so lead to a least a preliminary and apparently reasonable solution.

The observations are plotted in Figure 1, which is phased against the period of 6.53 ± 0.05 h. The amplitude of the curve is 0.25 ± 0.05 . While the extrema of the plots matched well, there was a decided difference in the amplitude of the curve between the two nights, with the data from January 4 showing a smaller amplitude by about 0.06-0.08m.

1329 Eliane

E. Delporte found Eliane in 1933 March. It was subsequently named after the daughter of astronomer Paul Bourgeois. The asteroid is of type SU and about 26km in size. The semi-major axis of the asteroid's orbit is 2.615AU, the inclination 14.5° , and the eccentricity is 0.175.

Data from the nights of 2001 April 27 and 28 were used to find a period of 8.0 ± 0.1 h. The amplitude of the curve is 0.08 ± 0.02 m. Figure 2 shows the data phased to this period. There is a considerable gap in the data. However, prior to remeasuring the original images, no solution could be found at all. In addition, based on a typical double maximum/minimum curve, the data from April 27 agree fairly well with the eight-hour period. Assuming this is the correct value, the with the period having an integral alias close to twenty-four hours, any single observer would have to spend a considerable amount of time and effort to obtain sufficient data to cover the entire curve. This asteroid presents an excellent opportunity for collaborative efforts at future apparitions. The next is in 2002 September when the asteroid will be at -16° when at its brightest of about 14.1. Unfortunately for Northern Hemisphere observers, Eliane is generally at its brightest when at or south of the celestial equator.

8041 Masumoto

There was no lack of data for this asteroid, with observations being made on the nights of 2001 August 12, 17, 18, and 19. Figure 3 shows a phased plot on the derived period of 14.10 ± 0.02 h. The amplitude of the curve is 0.30 ± 0.03 m. The curve shows a decided asymmetry between the first and second minima, with the latter having a markedly smaller amplitude and different shape.