

CCD PHOTOMETRY OF 625 XENIA

W. E. Worman
Sherry Fieber
Dept. of Physics and Astronomy
Minnesota State University Moorhead
Moorhead, MN 56563
worman@mnstate.edu

Mary A. Creason
Dept. of Physics and Astronomy
Minnesota State University Moorhead
[Currently Dept. of Physics, Duke University
Durham, NC 27708]

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625 Xenia was observed for eight nights using CCD Photometry during the months of April and May 1998. The period of rotation was 21.101 ± 0.032 hours, and the lightcurve had amplitude of 0.50 ± 0.05 magnitude.

Observations

Observations of 625 Xenia were made at the Paul Feder Observatory, which is located on the Buffalo River site of Minnesota State University Moorhead Regional Science Center. This facility is located 15 miles east of Moorhead, Minnesota, and is adjacent to the Buffalo River State Park. Data were collected on the nights of April 17, 1998, April 20, 1998, April 21, 1998, April 23, 1998, April 26, 1998, April 29, 1998, and May 4, 1998.

The Paul Feder Observatory has a sixteen-inch computer controlled DFM telescope with an associated Photometrics Star 1 CCD camera system. The CCD camera was used to collect data. One hundred sixty eight images were taken of 625 Xenia over the eight nights. Of these 140 were used in the analysis. The others were discarded because the asteroid was too close to a star, passed in front of a spiral galaxy, or the exposures were taken too close to dusk or dawn. The images taken on April 29, 1998 were rejected due to the sky clouding over after the second exposure was taken.

The exposures were five minutes long, and were generally taken every fifteen minutes. A filter was not used when taking the exposures. Dark current and flat field corrections were made to the data. Five stars were selected as magnitude standards for each image, but on the nights of April 21, 1998, April 29, 1998, and May 4, 1998 four comparison stars were used, and on April 26, 1998 three stars were used. The difference in the number of comparison stars arises from the fact that the stars fell out of view at some point in the night or the stars had varying counts. The magnitudes of the comparison stars were taken from the Guide 7 program (Hubble Guide Star Catalog). A least squares fit was done and the relation between the magnitudes and the log of the

total count determined from this relationship. A circular aperture of thirteen-pixel diameter was used and an equal sized region of nearby background was used for the background correction.

Results

Times were corrected for the time it takes the light to travel from the asteroid to the earth, and were taken at the center times for the image. Lightcurves were plotted for the seven nights of usable data. Relative magnitudes from night to night were uncertain as different comparison stars were used. This was dealt with by using additive constants for the second-eighth night magnitudes to bring them into agreement with the first. A single lightcurve for the seven nights was then least squares fit with a Fourier series including 10 harmonics. The additive constants for nights 2-8 and the period were adjusted so the fit minimized the sum of the squares of the residual. The resulting values were a period of 21.101 ± 0.032 hours. The additive constants for the second was 0.337, for the third night was 0.251, for the fourth night was 0.16, for the fifth night was 0.399, for the seventh night was 0.765, and for the eighth night was 1.323. The standard deviation of the residuals was 0.033 magnitudes, which should be a good measure of the uncertainty in the relative magnitudes.

A period of 21.101 ± 0.032 hours was found, and the second-eighth night was translated to fall on the first night of data to give the composite light curve shown in Figure 1. The time scale is given in phase. There are two maxima per period. The amplitude of the lightcurve is 0.50 ± 0.05 magnitudes. The absolute magnitudes given on the graph must be considered to be uncertain by ± 0.40 magnitudes, while the relative magnitudes are uncertain by about ± 0.03 magnitudes. The phase angles during observations varied between 9.10 degrees and 13.92 degrees.

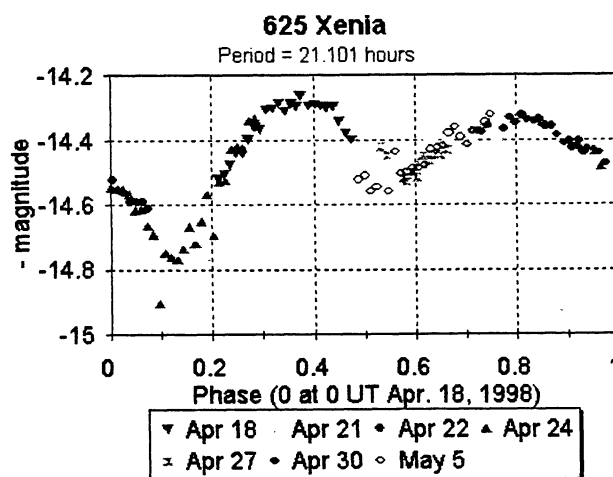


Figure 1. Rotation lightcurve for 625 Xenia assuming a period of 21.101 hours. The V magnitude scale is approximate owing to the typical 0.4 magnitude uncertainty of the Hubble Guide Star Catalog.

LIGHTCURVE ANALYSIS FOR ASTEROIDS 607 JENNY, 1177 GONNESSIA, 4440 TCHANTCHES, 4896 TOMOEGOZEN, AND (4995) 1984 QR

Brian D. Warner
17995 Bakers Farm Rd.
Colorado Springs, CO 80908
Brian@MinorPlanetObserver.com

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Lightcurve measurements and analyses of five asteroids were performed at the Palmer Divide Observatory at various times in 2002. The results, all synodic periods, were: 607 Jenny, 7.344 ± 0.002 h and amplitude of 0.22m; 1177 Gonnessia, 6.81 ± 0.01 h and amplitude of 0.12m; 4440 Tchantches, 6.83 ± 0.1 h and amplitude of 0.32m; 4896 Tomoegozen, 8.869 ± 0.004 h and amplitude of 0.65m; and (4995) 1984 QR, 26.37 ± 0.01 h and amplitude of 0.82m.

Asteroid lightcurve work has been the main focus at the Palmer Divide Observatory since 1999 April. Since that time the period and amplitudes of more than 50 asteroids have been measured. The current instrumentation consists of two telescope/camera combinations. First (Scope A) is a 0.5m Ritchey-Chretien working at f/8.1 equipped with a Finger Lakes Instrumentation camera using the Kodak KAF-1001E non-antiblooming CCD chip working at -30°C and 2x2 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. The second combination (Scope B) is a 0.25m f/10.3 Schmidt-Cassegrain using an SBIG ST-9E working at 1x1 binning. This yields a scale of about 1.6 arcseconds per pixel. All observations for this paper were unfiltered. 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), with additions made by the author to include findings posted in subsequent issues of the Minor Planet Bulletin. In addition, reference is made to the Collaborative Asteroid Lightcurve Link (CALL) web site maintained by the author (<http://www.MinorPlanetObserver.com/astlc/default.htm>) where researchers can post their findings pending publication.

MPO Canopus, a custom software package written by the author, 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 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.

[Reference Note: References to diameters are from Tedesco et al (1982). See Tholen (1989) for references to taxonomic classification. Asteroid names and discovery information are from

Schmadel (1999). Data about asteroid oppositions and date of brightest for the period 1995-2050 are from Warner (2002).]

607 Jenny

A. Kopff discovered this 42km unclassified asteroid on 1906 September 18. It is named after the wife of a friend of Koff on the occasion of her engagement. Her full name was Jenny Adolfine Kessler. Of interest is that her middle name was given to asteroid 608, also discovered by Kopff on the same date. All opposition magnitudes through 2050 for Jenny are in the lower 13s, which made the 2002 apparition no particularly better or worse than any other. The primary orbital elements are: semi-major axis 2.85 AU, inclination 10° , and eccentricity is 0.078. A total of 209 data points were used from those obtained on 2002 August 15, 16, 25, and 26. Scope B (0.25m) was used for all observations with an exposure of 120s. The resulting lightcurve is plotted in Figure 1. The synodic period was found to be 7.344 ± 0.002 h and the amplitude 0.22 ± 0.02 m.

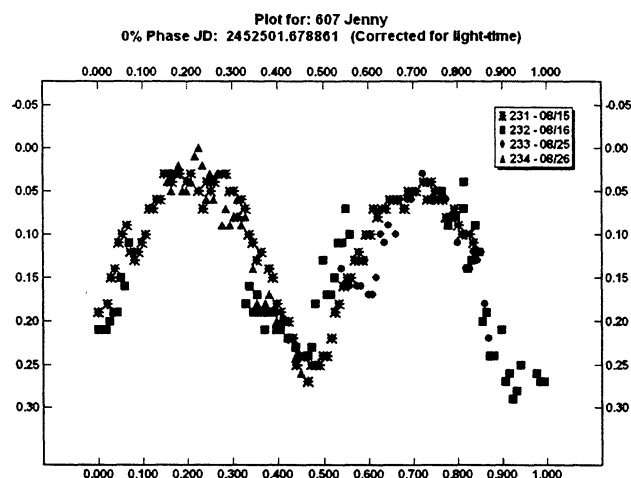


Figure 1 – The lightcurve for 607 Jenny. The data is plotted against a period of 7.344 ± 0.002 h and has an amplitude of 0.22 ± 0.02 m.

1177 Gonnessia

1177 Gonnessia is a discovery of L. Boyer at Algiers. He found the asteroid (designation 1930 WA) on 1930 November 24. The name is after a director of the Algiers Bouzareah and Quito Observatories, Francois Gonnessiat (1856 – 1934). The asteroid is a member of the rare X class and has a size of about 95km. As with 607 Jenny above, the 2002 apparition was not of particular note since all those through 2050 are similar in brightness. The semi-major axis is 3.35 AU, the inclination 15° , and the eccentricity 0.02, which puts the asteroid towards the outer regions of the main belt. A total of 140 data points, obtained on 2002 July 13-16, and 18, were used to analyze the lightcurve's period and amplitude (see Figure 2). Exposures of 45s were used on Scope A (0.5m). The synodic period was found to be 6.81 ± 0.01 h and the amplitude to be 0.12 ± 0.02 m. Despite S/N values well over 100, the data showed more scatter than expected. This may have been in part due to poor seeing conditions on most of the nights. However, while S/N has a definite theoretical effect on scatter, it has been found from several years of experience that it is not the sole determiner. Sometimes asteroids with S/N values of 50 and less have shown "smoother" data than those with much higher S/N values.