

ASTEROID PHOTOMETRY USING A REMOTE, COMMERCIAL TELESCOPE: RESULTS FOR ASTEROIDS 808, 1225, AND 28753

Richard Ditteon
Eric Tollefson
Andrew Twarek
Rose-Hulman Institute of Technology
CM 171
5500 Wabash Avenue
Terre Haute, IN 47803
richard.p.ditteon@rose-hulman.edu

(Received: 13 May Revised: 7 August)

CCD images taken with the Tenagra Observatory 0.81-m telescope were used to plot lightcurves for three main-belt asteroids. A period of 4.993 ± 0.001 h was found for asteroid (28753) 2000 HA. A period of 5.505 ± 0.002 h was found for 1225 Ariane. Also, a period of 30.631 h was confirmed for 808 Merxia.

Over the years, my students and I (Richard Ditteon) have often tried to use Rose-Hulman's Oakley Observatory (MPC code 916) during the winter. But, from the middle of November until the middle of March the skies in Indiana are almost constantly cloudy. On those rare occasions when we do get a clear night, it is both very clear and very cold. Unfortunately for asteroid photometry work, it is necessary to get several clear nights in a short span of time to get adequate data for a light curve and we just can't count on that happening.

I've long wished for access to an observatory somewhere with clear skies during the winter. When Michael Schwartz, Director of Tenagra Observatories (MPC code 926), announced that he was selling time on his telescope in Arizona, I jumped at the opportunity.

The Tenagra telescope is an 0.81 m, F/7, Ritchey-Chretien telescope. The camera uses a SiTe chip with 1024 by 1024 pixels. Pixel size is $24 \mu\text{m}$, which gives a pixel field-of-view of 0.87 arcseconds. The camera is liquid cooled to -45°C . All of the images I requested used a V filter (Schwartz, 2003).

To make observations, I simply e-mailed Paulo Holvorcem, Director of Minor Planet and Comet Studies, a list of targets with the exposure duration and frequency. I also specified a reference star field for use during processing. Paulo would send an e-mail back when the images were available for download via ftp. Tenagra also included master bias, dark, and flat-field frames with the data images. Initially, images made use of the full resolution of the camera, but the download times were very long. Later images were 2×2 binned, with no apparent affect on the results. Table I summarizes the observations made.

Standard image processing was done using the supplied bias, dark and flat-field frames and MaxIm DL. Photometry and lightcurves were constructed using MPO Canopus.

With one exception, targets were selected by consulting the "CALL" website (Warner, 2003). The exception was 761 Brendelia, which was targeted simply because it was close to 808 Merxia at the time the observations were made.

One of the first targets was (28753) 2000 HA. This turned out to be an easy target with a large amplitude and short period. Figure 1 is based on a period of 4.993 ± 0.001 h. (28753) 2000 HA was only observed for three nights.

The second target, 808 Merxia, also showed a large amplitude, but it was clear from the very first night that the period was much longer. As shown in Table I, data were collected on this asteroid on nine nights over a period of more than a month to get a complete light curve. Unfortunately, while we were collecting

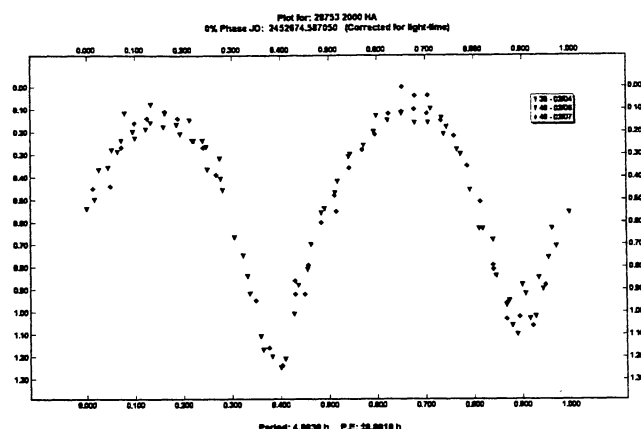


Figure 1. Lightcurve for (28753) 2000 HA based on a period of 4.993 ± 0.001 h.

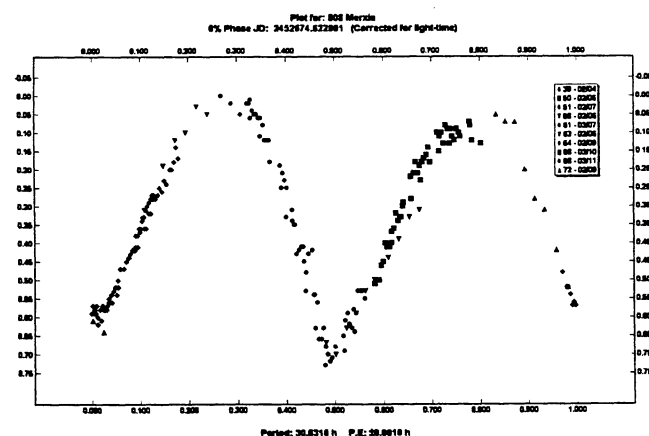


Figure 2. Lightcurve for 808 Merxia based on a period of 30.631 h as derived by Bob Koff.

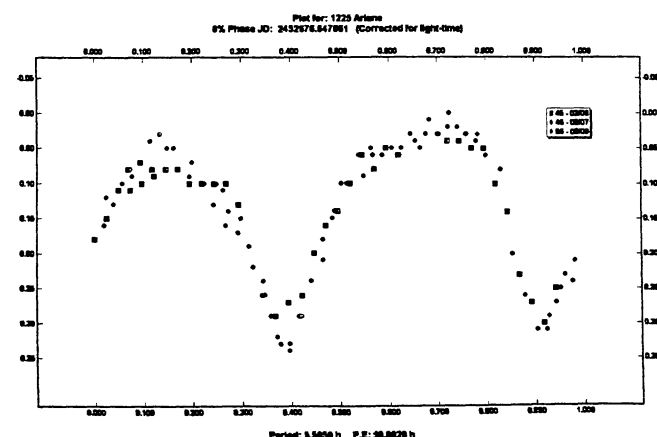


Figure 3. Lightcurve for 1225 Ariane based on a period of 5.505 ± 0.002 h.

data on 808 Merxia, I didn't think about checking the "CALL" website to see if anyone else was observing 808 Merxia. When I did finally check, I found that Bob Koff and Janel Brown of Antelope Hills Observatory were interested in 808 Merxia. Bob informed me (Koff, 2003) that they had determined a period of 30.631 h for this asteroid and had already submitted a paper to the Minor Planet Bulletin. Figure 2 is based on their period. I'm not convinced that our data alone would have been sufficient to determine this period, but it certainly fits their results well.

Another success was 1225 Ariane. After three nights of observation, a period of 5.505 ± 0.002 h was found (Figure 3).

We did not get clean light curves on the remaining three asteroids, 761 Brendelia, 5399 Awa, and 7887 1993 SU2. To conserve our limited funds, I stopped requesting observations on these asteroids as soon as it became clear that they were going to be difficult targets.

Acknowledgments

This research was supported in part by NASA through the American Astronomical Society's Small Research Grant Program. Matching funds were provided by Rose-Hulman Institute of Technology and Tenagra Observatories.

We also want to thank Michael Schwartz and Paulo Holvorcem for making remote observing with their telescope both possible and enjoyable.

References

Schwartz, M. (2003). "Tenagra Observatories, Ltd." <http://www.tenagraobservatories.com/>

Warner, B. D. (2003). "Potential Lightcurve Targets, 2003 January March." http://www.minorplanetobserver.com/astlc/targets_1Q_2003.htm

Koff, R. (2003). Personal communication.

Table I. Summary of observations.

Date	Asteroid	# images taken	used	exp (s)	bin
2003-02-04	808 Merxia	49	40	30	1x1
	28753 2000 HA	51	41	60	1x1
2003-02-06	808 Merxia	37	37	30	1x1
	1225 Ariane	37	37	60	1x1
	5399 Awa	37	37	60	1x1
	7887 1993 SU2	37	34	60	1x1
	28753 2000 HA	37	36	60	1x1
2003-02-07	808 Merxia	44	44	30	1x1
	1225 Ariane	40	39	60	1x1
	5399 Awa	44	37	60	1x1
	7887 1993 SU2	44	41	60	1x1
	28753 2000 HA	44	40	60	1x1
2003-02-09	808 Merxia	38	37	30	1x1
	1225 Ariane	39	39	60	1x1
	5399 Awa	39	39	60	1x1
	7887 1993 SU2	37	35	60	1x1
2003-03-06	761 Brendelia	11	9	90	2x2
	808 Merxia	11	11	30	2x2
	5399 Awa	11	11	80	2x2
2003-03-07	761 Brendelia	11	11	90	2x2
	808 Merxia	10	10	30	2x2
	5399 Awa	10	10	80	2x2
2003-03-08	808 Merxia	10	7	30	2x2
2003-03-09	808 Merxia	10	10	30	2x2
2003-03-10	808 Merxia	10	10	30	2x2
2003-03-11	808 Merxia	10	10	30	2x2

CCD PHOTOMETRY OF 934 THURINGIA

W. E. Worman, Sherry Fieber, G. Matthew Newman¹,
and Monica Kirby
Dept. of Physics and Astronomy
Minnesota State University Moorhead
Moorhead, MN 56563
worman@mnstate.edu

(Received: 27 June)

The asteroid 934 Thuringia was observed for two nights using CCD Photometry during the month of October 1998. The period of rotation was 8.166 ± 0.006 hours, and the lightcurve had amplitude of 0.66 ± 0.03 magnitudes.

Observations

Observations of 934 Thuringia were made at the Paul Feder Observatory, which is located on the Buffalo site of Minnesota State Regional Science Center. This facility is located 15 miles east of Moorhead, Minnesota, and is adjacent to the Buffalo River State Park. Data was collected on the nights of October 24, 1998 and October 28, 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. Seventy images were taken of 934 Thuringia over the two nights. Of these 69 were used in the analysis. The other was discarded because the exposure was taken too close to dawn.

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 night. 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. The slope of the least squares fit was typical (-2.6) on the first night, but about (-1.1) on the second of the two nights. We adopted a model for the second night which used the same slope as the first night. When that was done the light curves for the two nights matched well as they should. There was also an adjustment made in the form of an additive constant for the second night as the comparison stars were different for the two nights. See Figure 1. We feel that the problem was the magnitudes given for the comparison stars. 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 two nights of usable data. Relative magnitudes from night to night were uncertain as different comparison stars were used. This was dealt with by

¹ currently at Physics Department, University of Washington, Seattle, WA