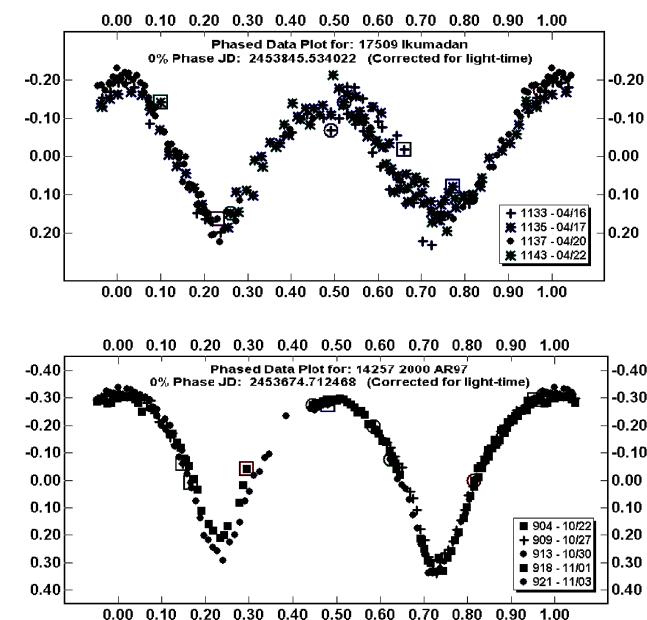




THE LIGHTCURVE OF MAIN-BELT ASTEROID 774 ARMOR

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Observations spanning more than two months reveal the synodic period of the main-belt asteroid 774 Armor to be 25.162 ± 0.002 hr with an amplitude of 0.37 ± 0.02 mag. This study affirmed the importance of both collaboration and having data from widely separated locations.

In early February and approximately one month later, authors Bennett and Fauerbach observed 774 Armor using a 0.4m Ritchey-Chretien telescope and Apogee AP7p at Florida Gulf Coast University. Assuming a period of about 22hr, their combined data covered a good portion of the entire lightcurve. However, due to the large lapses in time between runs, the possibility of aliases could not be entirely removed.

Starting in mid-April, Warner, not knowing of the earlier observations, started observing the asteroid using a 0.35m SCT and SBIG ST-9E. It became immediately clear that the period was long, possibly nearly commensurate with 24hr, which would have made resolving the lightcurve period very difficult from a single

station. Higgins, who's Hunter's Hill Observatory is located about 140° west of the Palmer Divide Observatory, was contacted and agreed to contribute observations. Despite short observing runs the first two nights, Higgins – using a 0.36m SCT and SBIG ST-8E, managed to capture an extreme point each time, which made period analysis more certain.

Table I shows the phase angle and Phase Angle Bisector values for the first and last dates of observations in the combined data set. The phase angle reached a minimum of 2.3° on February 24 and was about 3.0° on the dates of observation at the first of March.

Date	Phase	L_{PAB}	B_{PAB}
2006 Feb 01	8.2	155.6	-6.5
2006 Apr 18	15.7	155.9	-6.2

Table I. The phase and Phase Angle Bisector values for the extreme dates of observations for 774 Armor.

Fauerbach saw Warner's report on the CALL site (<http://www.MinorPlanetObserver.com/astlc/default.htm>) and suggested a collaboration. A plot using the merged data set from all three locations and phased to the adopted period is shown in Figure 1. The combination of extended coverage, about 10 weeks, and a series of sessions spaced only one day apart allowed elimination of many suspected aliases, pointing to a synodic period of 25.162 ± 0.002 hr. The amplitude of the lightcurve is 0.37 ± 0.02 mag.

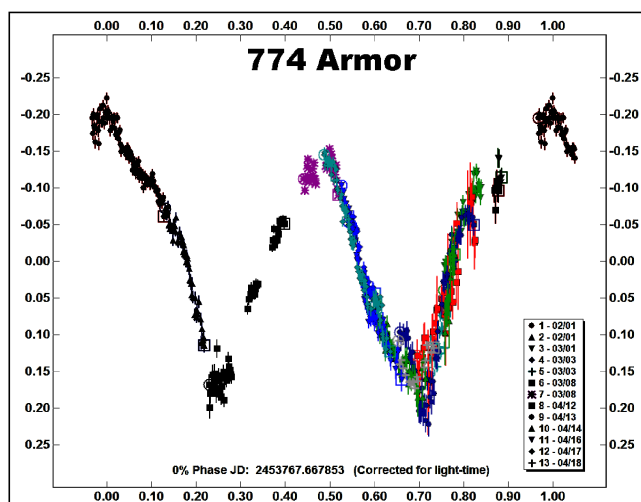


Figure 1. The lightcurve of 774 Armor phased to 25.162hr.

While the individual sets of data from Bennett/Fauerbach and Warner/Higgins arrived at similar results to the adopted period, each alone did not provide a complete and certain solution. In this case, sharing of data that covered an overall large span in time as well as extending a single run on consecutive dates provided a much higher degree of confidence in the results. This collaboration showed once again the importance in asteroid lightcurve work of making results and, more important, data openly available.

Acknowledgements

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LIGHTCURVES ANALYSIS OF 10 ASTEROIDS FROM LEURA OBSERVATORY

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Lightcurves and period solutions for 10 asteroids were obtained in the first six months of 2006.

171	Ophelia	6.6666±0.0002hr	0.50±0.02mag
291	Alice	4.313±0.002hr	0.20±0.03mag
293	Brasilia	8.173±0.002hr	0.20±0.03mag
683	Lanzia	8.631±0.001hr	0.20±0.02mag
710	Gertrud	8.288±0.002hr	0.30±0.02mag
762	Pulkova	5.8403±0.0005hr	0.20±0.02mag
2104	Toronto	8.9669±0.0002hr	0.35±0.02mag
7360	Moberg	4.699±0.001hr	0.38±0.01mag
(35369)	1997 UJ11	2.48±0.09hr	0.15±0.05mag
(85804)	1998 WQ5	3.0089±0.0001hr	0.35±0.10mag

Leura Observatory is located at an altitude of 950m in the quaint little town of Leura in the Blue Mountains, Australia. The observatory is equipped with a 0.35m f/11 Schmidt-Cassegrain telescope on a CGE mount and SBIG ST9XE camera with a Kodak KAF-0261 CCD giving 1.07 arc second/pixel for 1x1 binning. This telescope is controlled remotely from Sydney by means of broadband Internet connection. The data were downloaded for processing immediately after completion of each nightly run. Analysis was done using MPO Canopus, which employs differential aperture photometry and the Fourier period analysis algorithm developed by Harris et al. (1989).

All images were unfiltered. Dark frames and Flat Field frames were used for image calibration. Any poor quality images were discarded. Targets were chosen from the list provided from Minor Planet Observatory CALL website by Brian Warner where light curve photometry opportunities were selected. The main criteria being little or no lightcurve work done previously.

171 Ophelia. This asteroid has been previously studied by Tedesco (1979), who derived a period of 6.672 ± 0.072 hr. Works compiled in Raoul Behrend et al. of Geneva Observatory website for shape determination indicate a period of 6.66624 ± 0.00012 hr. Six nights of observation derived a period of 6.6666 ± 0.0002 hr, agreeing well with previous work above.

291 Alice. Alice has been very well studied, with Binzel and

Mulholland (1983) reporting a pole position also by Piironen et al. (1998) reported a period of 4.32hr. This asteroid was observed when it was in the same field as 293 Brasilia on the nights of June 11 and 12. The derived period is 4.313 ± 0.002 hr is in close agreement with the previous results.

293 Brasilia. No previous lightcurve work has been published for this asteroid. A regular bimodal curve was found with a period of 8.173 ± 0.002 hr.

683 Lanzia. This asteroid was selected as one of my original trial asteroids in early February. Three months later I decided to try completing the whole curve. Unfortunately, the asteroid was no longer in a favorable position. Four short sessions resulted in a reasonably overlapped but incomplete curve. The period was found to be 8.631 ± 0.001 hr. This is in agreement with previously derived value of 8.630hr by Stephens (2003).

710 Gertrud. No previous lightcurve work has been published for this asteroid. Due to unseasonable weather conditions, only short sessions were possible over a period of six consecutive nights deriving a synodic period of 8.288 ± 0.002 hr. The curve is unusual and warrants further studies in determining its shape.

762 Pulkova. The lightcurve of this minor planet is well known. Davis (2001) measured a high precision lightcurve period of 5.83923 ± 0.00004 hr. It is also a known binary system (Merline et al. 2000). The companion has an orbital period of 4.0 days. A total of 383 images taken over five nights showed a synodic period of 5.8403 ± 0.0005 hr and amplitude of 0.20 ± 0.02 mag., which agree well with the previous values. A small dip during the maximum on March 9 and 27 may be due to the satellite.

2104 Toronto. Again no previous lightcurve work has been published for this asteroid. A typical bimodal curve was obtained from six nights spanning from March 6 to April 17. The derived period is 8.9669 ± 0.0002 hr.

7360 Moberg. No previous lightcurve work has been published for this asteroid. 176 images were taken over a period of three nights. The curve shows a typical bimodal curve with a synodic period of 4.699 ± 0.001 hr and amplitude of 0.38 ± 0.01 mag.

(35369) 1997 UJ11. This asteroid was a target opportunity, being in the same field as 710 Gertrud on April 6. The period derived from only 1 session as 2.48 ± 0.09 hr.

(85804) 1998 WQ5. This asteroid was selected from the Collaborative Asteroid Lightcurve Link homepage (CALL) for its southerly position and the challenge to obtain a lightcurve for a relatively faint target. Later on I discovered that the Binary

#	Name	Date Range	Sessions	# Points	Period (h)	Amplitude (mag)
171	Ophelia	Mar 9 – Apr 5	6	435	6.6666 ± 0.0002	0.50 ± 0.02
291	Alice	Jun 11 – 12	2	130	4.313 ± 0.002	0.20 ± 0.03
293	Brasilia	Apr 18 – Jun 13	4	243	8.173 ± 0.002	0.20 ± 0.03
683	Lanzia	Feb 12 – May 25	5	226	8.631 ± 0.001	0.20 ± 0.02
710	Gertrud	Apr 6 – 12	5	246	8.288 ± 0.002	0.30 ± 0.02
762	Pulkova	Mar 17 – 27	5	383	5.8403 ± 0.0005	0.20 ± 0.02
2104	Toronto	Mar 6 – Apr 17	6	256	8.9669 ± 0.0002	0.35 ± 0.02
7360	Moberg	Apr 1 – 5	3	176	4.699 ± 0.001	0.38 ± 0.01
35369	1997 UJ11	Apr 6	1	41	2.48 ± 0.09	0.15 ± 0.05
85804	1998 WQ5	Jan 23 – Apr 26	10	332	3.0089 ± 0.0001	0.35 ± 0.10