

LIGHTCURVE ANALYSIS OF ASTEROIDS FROM LEURA AND KINGSGROVE OBSERVATORY IN THE SECOND HALF OF 2008

Julian Oey

Kingsgrove Observatory

23 Monaro Ave. Kingsgrove, NSW AUSTRALIA
and

Leura Observatory

94 Rawson Pde. Leura, NSW, AUSTRALIA
julianoey1@optusnet.com.au

(Received: 2009 Jun 21)

Photometric observations of ten asteroids were completed in the last six months of 2008 from both Kingsgrove and Leura Observatories resulting in the determination of their synodic periods.

226	Weringia	11.1496 ± 0.0009 h;
677	Aaltje	16.6076 ± 0.0006 h;
929	Algunde	3.3110 ± 0.0008 h;
1122	Neith	12.599 ± 0.006 h;
1449	Virtanen	30.495 ± 0.005 h;
1836	Komarov	8.0815 ± 0.0004 h;
3576	Galina	5.910 ± 0.003 h;
4182	Mount Locke	3.0175 ± 0.0003 h;
4332	Milton	3.2978 ± 0.0003 h;
(34155)	2000 QJ22	3.0087 ± 0.0002 h.

Kingsgrove Observatory used a 0.25m Schmidt-Cassegrain telescope (SCT) operating at f/5.2 combined with an SBIG ST-402ME CCD camera operating at 1x1 binning, resulting in scale of 1.40 arcsec/pixel. Images were unfiltered and 60 s. Most of the asteroids worked at Kingsgrove were taken from the CALL website (Warner, 2008) with the selection criteria being <14.0 mag when brightest and at a relatively southerly declination. Leura observatory used a 0.35m SCT working at f/6.5 by using a 0.5x focal reducer. Combined with an SBIG ST-9XE CCD camera at 1x1 binning, the scale was 1.80 arcsec/pixel. All exposures were unfiltered with 300-second integration. The telescope was used mainly on fainter targets selected from Photometric Survey for Asynchronous Binary Asteroid (Pravec, 2008) for follow up and detection work. *MPO Canopus* v.9.4.0.1 software, which incorporates the Fourier algorithm developed by Harris (1989), was used for period analysis.

226 Weringia was observed previously by the author (Oey, 2008). Observations at this most recent apparition were made to refine the previous results. The lightcurve parameters found for 2008 were $P = 11.1496 \pm 0.0009$ h, $A = 0.20 \pm 0.02$ mag. In 2007, the

amplitude of the lightcurve was only 0.08 ± 0.04 mag.

677 Aaltje was also observed by the author previously (Oey, 2008). The period derived at that time was 11.056 ± 0.003 h. However, the asteroid was within 20° of the galactic plane at that time. As a result, numerous background stars made getting good data difficult and finding an accurate period even more so. The results from the most recent work, with much cleaner data, show a period of 16.6076 ± 0.0006 h and amplitude of 0.30 ± 0.02 mag. When the 2007 data were forced to a period near this, the result was a monomodal curve with $P = 16.46 \pm 0.02$ h, $A = 0.10 \pm 0.03$ mag.

1122 Neith was a relatively low amplitude lightcurve object. To prevent misinterpretation of the lightcurve as a long period target, a few nights of data were linked by using the same comparison stars on different nights.

1449 Virtanen. This slow sky motion of the asteroid allowed linking of two successive nights by using same comparison stars. The derived synodic period was 30.495 ± 0.005 h with a lightcurve amplitude of 0.60 ± 0.02 mag.

4182 Mount Locke. Observations of this asteroid at Leura Observatory were made after Behrend (2008) reported the possibility of it being binary. A unique period 3.0175 ± 0.0003 h was found with the amplitude being 0.15 ± 0.03 mag. The attenuation seen by the author on August 13 was later found to be due to an atmospheric anomaly. Otherwise, no evidence of a binary nature was seen.

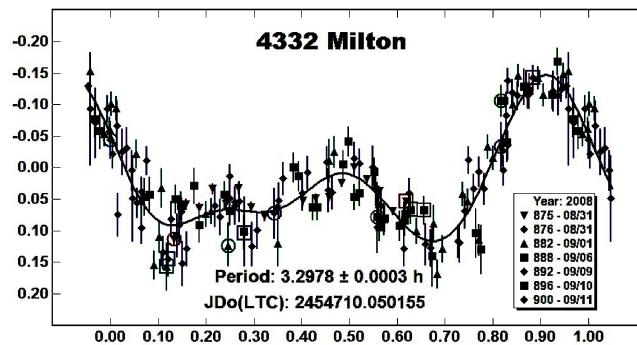
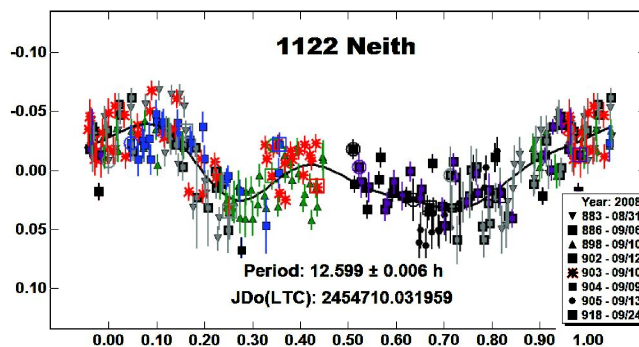
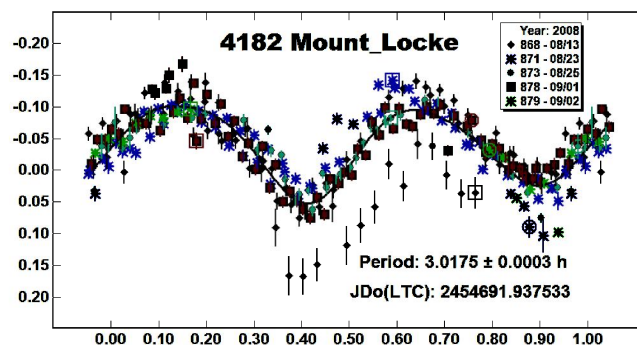
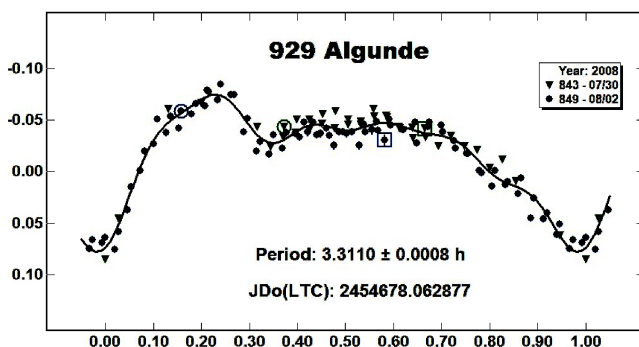
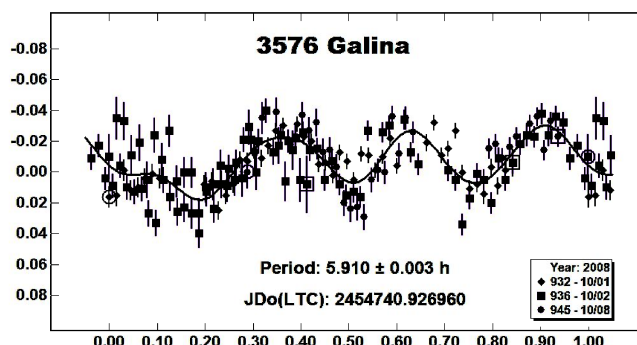
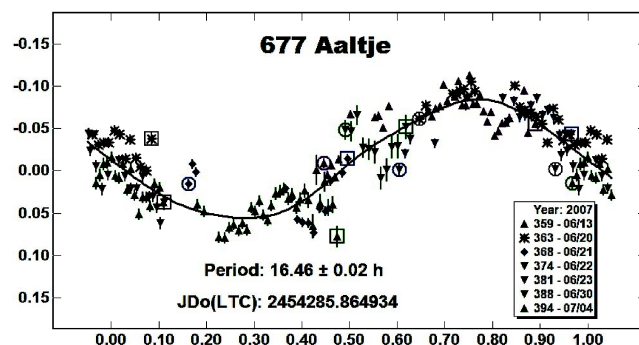
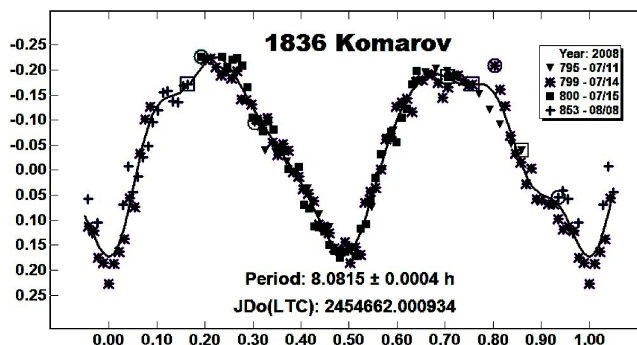
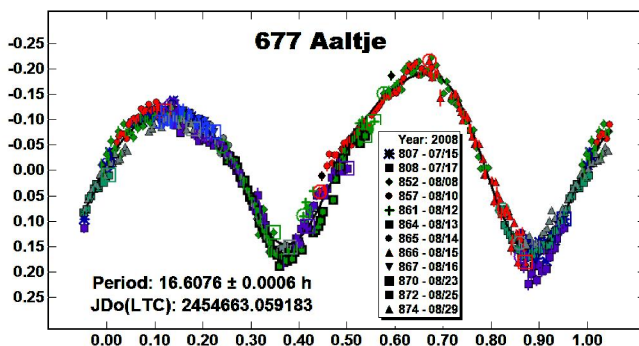
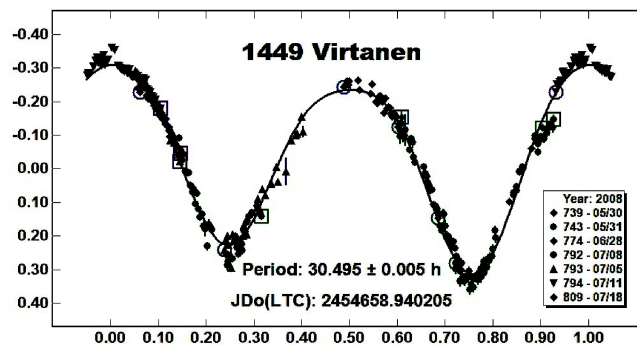
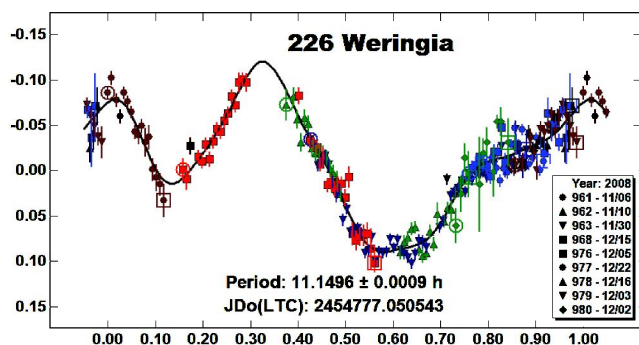
References

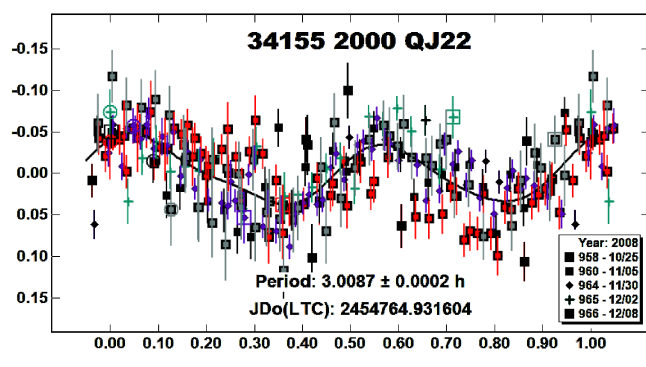
- Behrend, R. (2008), Observatoire de Genève web site. http://obswww.unige.ch/~behrend/page_cou.html
- Harris, A.W., Young, J.W., Bowell, E., Martin, L.J., Millis, R.L., Poutanen, M., Scaltriti, F., Zappala, V., Schober, H.J., Debehogne, H., and Zeigler, K.W. (1989). "Photoelectric Observations of Asteroids 3, 24, 60, 261, and 863." *Icarus* **77**, 171-186.
- Oey, J. (2008). "Lightcurve Analysis of Asteroids from Kingsgrove and Leura Observatories in the 2nd half of 2007". *Minor Planet Bulletin* **35**, 132 – 135.
- Warner, B.D. (2008). "Potential Lightcurve Targets 2008 July–September". On CALL web site: http://www.minorplanetobserver.com/astlc/targets_4q_2008.htm
- Pravec, P. (2008). "Photometric Survey of Asynchronous Binary Asteroids." <http://www.asu.cas.cz/~asteroid/binastphotosurvey.htm>

Name	Date 2008 (mm/dd)	Obs	Period (h)	Amp (mag)	PA	LPAB	BPAB
226 Weringia	11/06-12/02	K	11.1496 ± 0.0009	0.20 ± 0.02	10, 7, 11	65	-18
677 Aaltje	07/15-08/29	K	16.6076 ± 0.0006	0.30 ± 0.02	16	340	8
929 Algunde	07/30-08/02	L	3.3110 ± 0.0008	0.13 ± 0.02	15	340	8
1122 Neith	08/31-09/29	K	12.599 ± 0.006	0.08 ± 0.02	18	7	-6
1449 Virtanen	05/30-07/18	K	30.495 ± 0.005	0.60 ± 0.02	6, 23	247	5
1836 Komarov	07/11-07/15	K	8.0815 ± 0.0004	0.39 ± 0.02	3	288	2
3576 Galina	10/01-10/08	L	5.910 ± 0.003	0.04 ± 0.01	3	9	-3
4182 Mount Locke	08/13-09/02	L	3.0175 ± 0.0003	0.15 ± 0.03	5, 9	323	9
4332 Milton	08/31-09/11	K	3.2978 ± 0.0003	0.30 ± 0.05	28, 24	19	-10
(34155) 2000 QJ22	10/25-12/08	K	3.0087 ± 0.0002	0.10 ± 0.03	15, 19	47	-16

Table 1. Observatory code: K = Kingsgrove; L = Leura

Minor Planet Bulletin **36** (2009)





ANALYSIS OF THE LIGHTCURVES OF 198 AMPELLA AND 2008 SV11

Brian D. Warner
Palmer Divide Observatory/Space Science Institute
17995 Bakers Farm Rd., Colorado Springs, CO 80908 USA
brian@MinorPlanetObserver.com

Robert D. Stephens
Goat Mountain Asteroid Research Station (GMARS)
Landers, CA USA

(Received: 2009 Jun 29)

We report on our collaborations to obtain photometric data on two asteroids. 198 Ampella, a main-belt object, was observed to check previously reported periods. We found a synodic period of 20.778 ± 0.003 h, which is double that of the most reliable of those previous results. The near-Earth asteroid 2008 SV11 was observed in support of radar observations. We found a period of 32.4 ± 0.1 h. However, the shape of the lightcurve was very unusual and so the period remains in some doubt. Radar observations indicate a strongly bifurcated body.

Equipment and basic image acquisition methods used by the authors have been previously described (see Stephens, 2006; Warner, 2009). We linked our observations from night-to-night using the 2MASS (Neugebauer and Leighton, 1969) to BVRI conversions developed by Warner (2007) and applied as described by Stephens (2008).

198 Ampella. Despite its relatively large size and brightness, this main belt asteroid had only one previously published lightcurve, that by DeYoung and Schmidt (1993) who reported a period of 10.383 h. The authors observed the asteroid in 2009 April, obtaining data on 13 nights, with the intent of confirming the period and providing data for future shape modeling. Our analysis found a period of 20.778 ± 0.003 h with an amplitude of 0.13 ± 0.01 mag, or double that of DeYoung and Schmidt. The lightcurve shows our data phased to the longer period. When forced to the shorter period, the curve is monomodal and the RMS fit is significantly higher. We note that the observing runs by DeYoung and Schmidt were separated by no less than two days and sometimes a week or more. We believe this led to a “rotational uncertainty” in their solution such that they found the shorter period, which we do not believe to be correct.

2008 SV11. Photometric observations by the authors were made of this near-Earth asteroid in 2009 April to support radar observations at Arecibo by Brozovic, Benner, Nolan, and Howell. As more data became available, the solution changed dramatically, but it finally settled to something around 32 h. This seemed to agree with radar observations (low Doppler shift) that indicated a longer period and also a bifurcated body. Starting on April 19 and continuing for through April 22, the last day the asteroid could be readily observed from our location, the curve suddenly “went flat” and showed only a steady rise within the phased lightcurve. We could find no observational, systematic, or reduction causes and so must presume that the change was due to a combination of the asteroid’s shape and changing viewing aspect. Since the aspect did not change dramatically over this short interval, this explanation also has difficulties. Our data have been sent to Howell at Arecibo with the hope that the combination of optical and lightcurve data can resolve the mystery.

We also used the data to determine the absolute magnitude (H) of the asteroid, first by forcing the phase slope parameter (G) to 0.24, the default for type S (Warner et al., 2009), the presumed type of the asteroid. This gave $H = 18.4 \pm 0.1$, the same value assumed by the Minor Planet Center. We then allowed both values to float and $H = 18.0 \pm 0.2$, $G = -0.07$. We have adopted the first solution as the more likely since it relies on a more likely value for G . If we had been able to obtain data near opposition, phase angles $< 3^\circ$, it would have been possible to find a more definitive solution.

Acknowledgements

Funding for observations at the Palmer Divide Observatory is provided by NASA grant NNX 09AB48G, by National Science Foundation grant AST-0607505, and by a Gene Shoemaker NEO Grant from the Planetary Society. This publication makes use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation.

References

- Neugebauer, G. and Leighton, R.B. (1969). Two-micron Sky Survey: A Preliminary Catalog. NASA.
- Stephens, R.D. (2008). “Long Period Asteroids Observed from GMARS and Santana Observatories.” *Minor Planet Bul.* **35**, 21-22.
- Warner, B.D. (2007b). “Initial Results from a Dedicated H-G Project.” *Minor Planet Bul.* **34**, 113-119.
- Warner, B.D. (2009). “Asteroid Lightcurve Analysis at the Palmer Divide Observatory: 2008 December – 2009 March.” *Minor Planet Bul.* **36**, 109-116.
- Warner, B.D., Harris, A.W., and Pravec, P. (2009). “The asteroid lightcurve database.” *Icarus* **202**, 134-146.

Asteroid	2009	α	L_{PAB}	B_{PAB}
198 Ampella	04/08-30	11, 17	163	-11
2008 SV11	04/03-21	40, 16, 18	172, 199	7, -5

Table I. Observing circumstances. The phase angle column gives the values on the first and last date. For 2008 SV11, the middle date is the minimum phase angle. The phase angle bisector columns give the value for the first and last date of observation.