

PHOTOMETRIC OBSERVATIONS OF 169 ZELIA

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We report lightcurve parameters for 169 Zelia of $P = 14.537 \pm 0.001$ h and $A = 0.14 \pm 0.03$ mag.

We independently starting observing 169 Zelia in 2009 March but, upon learning of each other's efforts, decided to combine our data into a single set of observations. Stephens obtained observations at Santana Observatory (MPC 646) with a 0.30-m Schmidt-Cassegrain (SCT) and SBIG STL-1001E CCD camera as well as at GMARS (Goat Mountain Astronomical Research Station, MPC G79) with a 0.35-m SCT and STL-1001E. Pilcher obtained observations at Organ Mesa Observatory using a 0.35-m Schmidt-Cassegrain (SCT) and STL-1001E. Pilcher's observations were obtained on March 16, 18, 23 and April 5. All others were obtained by Stephens.

All images were unguided and unbinned with no filter. Measurements were made using *MPO Canopus*, which employs differential aperture photometry to produce the raw data. Period analysis was done using *Canopus*, which incorporates the Fourier analysis algorithm (FALC) developed by Harris (1989). Both observers selected 169 Zelia from the list of asteroid photometry opportunities published on the Collaborative Asteroid Lightcurve Link website (CALL; Warner et al., 2009). Between 2009 March 16 and April 5, 1761 data points were obtained during which time the phase angle decreased from 11.4° to 2.9° . The L_{PAB} averaged 200° while the B_{PAB} was -3° .

169 Zelia was observed by Harris et al. (1992) on 1981 September 21 and 25. Their partial lightcurve suggested a period exceeding 16 h. Love (1997) observed the asteroid on four nights between 1995 July 22-28. His data fit possible periods of 13.27 or 16.2 h, the shorter period being preferred. Our observations support periods of 14.537 and 21.805 h. The 21.805 h period is a trimodal curve. We prefer the fit of the 14.537 h period which produces a bimodal curve with repeating features at 0.15, 0.55, and 0.95 phase. We also prefer the bimodal fit because the Love bimodal fit was at a somewhat different longitude of $L_{PAB} = 270^\circ$ and $B_{PAB} = -7^\circ$.

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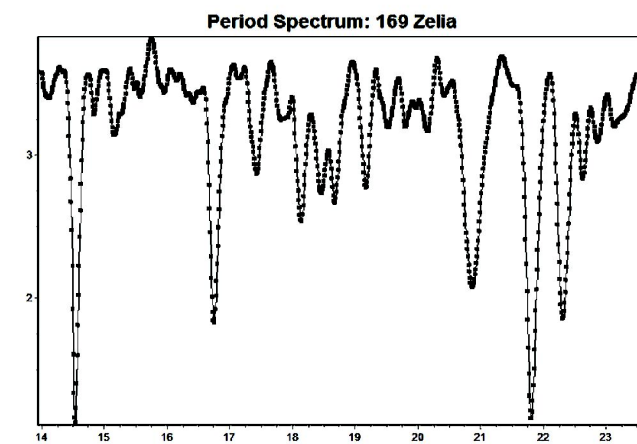
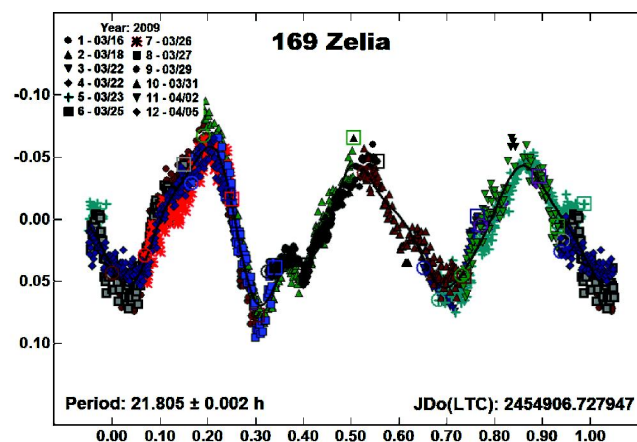
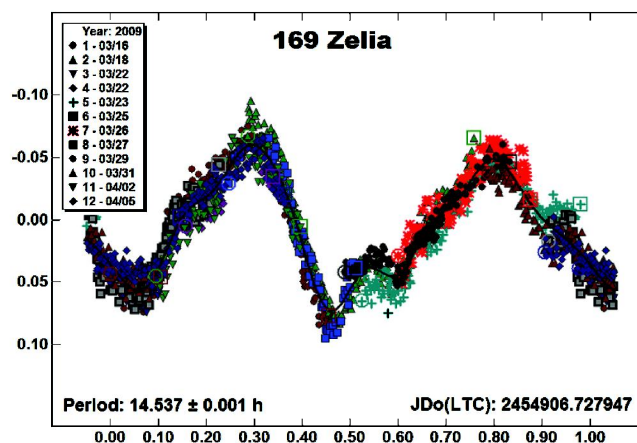
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LIGHTCURVE ANALYSIS OF ASTEROIDS FROM LEURA AND KINGSGROVE OBSERVATORY IN THE SECOND HALF OF 2008

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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.

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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	8.8015 ± 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

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