

period was confirmed by Pravec in his analysis of the data (private communications).

Acknowledgment

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	star c	star d	star f	star g
r' mag	14.837	14.801	14.232	13.767
J-K mag	0.683	0.817	0.379	0.683
V mag	15.19	15.24	14.40	14.13

Table 1. Carlsberg Meridian Catalogue (CMC-14) and V-magnitude data for selected comparison stars. The V magnitudes were calculated on the basis of the empirical equation derived by Dymock and Miles (2008): $V = 0.995*r' + 0.628*(J-K)$.

UT Date	RA	Dec	Phase	V
2008 Oct 25.0	02 46	+06 58	6.4	14.8
2008 Oct 28.0	02 43	+06 45	5.2	14.7
2008 Oct 30.3	02 42	+06 35	4.6	14.7
2008 Oct 31.3	02 41	+06 31	4.4	14.7

Table 2. Observation circumstances.

PERIOD DETERMINATION FOR 178 BELISANA

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Fifteen lightcurves for 178 Belisana from three widely-separated longitudes show a unique synodic rotation period of 12.323 ± 0.002 h and amplitude 0.18 ± 0.02 mag.

Harris et al. (1992) observed 178 Belisana on 5 nights from 1981 Oct. 23 – Dec. 3 showing a lightcurve amplitude of 0.16 ± 0.03 mag. Their observations were consistent with periods of both 12.3215 h and 12.40 h, with the former favored. Oey and Krajewski (2008) obtained 12 lightcurves from 2007 Apr. 28 – July 4 that equally supported respective periods and amplitudes of 12.321 h, 0.10 mag with a monomodal lightcurve or 24.6510 h, 0.13 mag with a nearly symmetric bimodal lightcurve.

New observations were made in 2008 by Pilcher at the Organ Mesa Observatory using a Meade 14-inch LX200 GPS S-C and SBIG STL-1001E CCD camera. All exposures were unguided and used a clear filter. Benishek at the Belgrade Observatory obtained images using a Meade 16-inch LX200 GPS f/10 S-C and Apogee AP47p CCD camera. Unfiltered images were obtained at Kingsgrove Observatory by Oey using a 0.25-m S-C telescope operating at f/5.2 and a SBIG ST-402 ME CCD camera. The three authors collaborated from their widely-distributed longitudes in order to cover all phases of the lightcurve in as short of time as possible. This was the best way to remove any ambiguity seen by

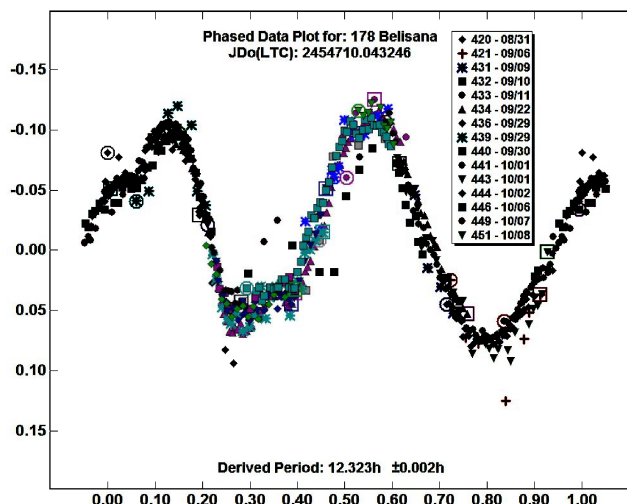
Oey and Krajewski since either period was nearly commensurate with an Earth day.

The combined data set from this collaboration shows a slightly asymmetric bimodal lightcurve with an amplitude of 0.18 ± 0.02 mag and unambiguous synodic period of 12.323 ± 0.002 h. The double period allowed by the 2007 observations is ruled out because, in the 2008 data, the coefficients of the odd harmonics in the Fourier series for the best fit are much smaller than for the even harmonics. The much smaller amplitude and monomodal lightcurve at the longitudes of the 2007 observations show that 178 Belisana was closer to polar aspect than at the time of the 2008 observations.

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CCD LIGHTCURVE ANALYSIS OF 216 KLEOPATRA

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Filtered (Ic) CCD images for 216 Kleopatra were obtained over six sessions in 2008 November. A folded lightcurve was produced and the synodic period, $P = 5.386$ h, calculated.

216 Kleopatra (124 km) is a main belt asteroid first discovered by J. Palisa in 1880. This asteroid, which can exhibit large changes in lightcurve amplitude (> 1 mag), has a dog-bone (bi-lobed) shape. Its morphology has been extensively studied by radar (Ostro et al., 2000), interferometry (Tanga et al., 2001), and ground-based adaptive optics (Hestroffer et al., 2002).

The equipment used at UnderOak Observatory included a focal reduced ($f/6.3$) 0.2-m Schmidt-Cassegrain telescope with a thermoelectrically cooled SBIG ST-402ME CCD camera operating at 5°C . Filtered (Ic) imaging was carried out on a total of six nights with unbinned, 45-second exposures taken automatically at least every 60 seconds. Image acquisition (raw lights, darks and flats) was performed with SBIG *CCDSOFT 5* while calibration and registration were accomplished with *AIP4WIN* (Berry and Burnell, 2006). Further image reduction with *MPO Canopus* (Warner, 2008) used at least two non-varying comparison stars to generate light curves by differential aperture photometry. Data were light-time corrected but not reduced to standard magnitudes.

A total of 1280 photometric readings were collected over 23.1 days. Relevant aspect parameters for 216 Kleopatra taken at the mid-point from each session are given in Table I. *MPO Canopus* provided a period solution for the folded data sets using Fourier analysis (Harris et al., 1989). The synodic period, determined to be $P = 5.386 \pm 0.001$ h is in good agreement with rotational periods for 216 Kleopatra recently published by Warner (2006) and that found at the JPL Solar System Dynamics website. Phased data are available by request at <http://underoakobservatory.com>.

Acknowledgement

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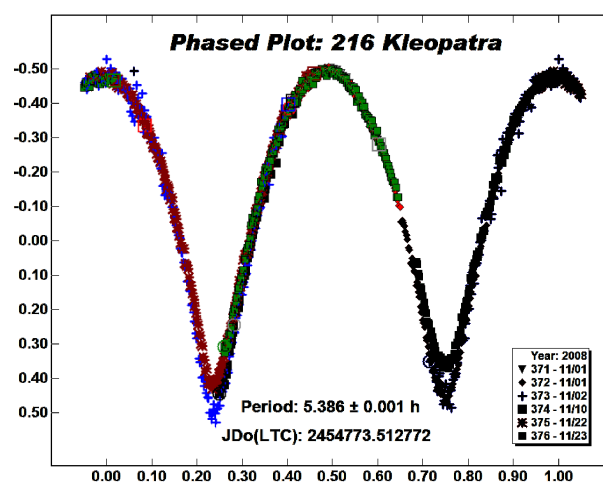
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UT Date (2008)	No. Obs.	Phase Angle	L_{PAB}	B_{PAB}
Nov 1	135	21.7	357.2	7.9
Nov 2	285	21.9	357.4	7.8
Nov 3	288	22.2	357.6	7.7
Nov 10	64	23.9	359.1	6.9
Nov 23	208	26.2	2.4	5.4
Nov 24	300	26.3	2.7	5.3

Table I. Observation circumstances for 216 Kleopatra.