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CCD PHOTOMETRY OF ASTEROIDS AT THE BELGRADE ASTRONOMICAL OBSERVATORY: 2008 JANUARY–SEPTEMBER

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Lightcurves for seven minor planets were obtained at the Belgrade Astronomical Observatory in the period 2008 January–September: 541 Deborah, 956 Elisa, 1022 Olympiada, 1071 Brita, 1724 Vladimir, 5010 Amenemhet, and (8567) 1996 HW1.

During the period 2008 January–September, lightcurves of seven asteroids were obtained at the Belgrade Astronomical Observatory (BAO) using a 16-inch Meade Schmidt-Cassegrain telescope operating at $f/10$. This was coupled with an Apogee AP47p back-illuminated CCD camera with $13\ \mu\text{m}$ square pixels operating at 1×1 binning, producing an image scale of 0.66 arc seconds per pixel. A new equatorial mount installed in 2007 eliminated limitations of the old alt-az setup, enabling longer exposures and observations of fainter targets. All observations were made without filters. Image processing and calibrations were done using *MaxIm DL3* software by Diffraction Limited. Differential aperture photometry with five comparison stars and lightcurve period analysis were conducted in *MPO Canopus* by BDW Publishing. Target selections were made using the Collaborative Asteroid Lightcurve Link (CALL) web-site and “Lightcurve Opportunities” articles from the *Minor Planet Bulletin*. Asteroids having uncertain or unknown lightcurve parameters as well as those with favorable opposition brightness and higher declination (due to horizon restrictions) were crucial criteria for target selection. Objects observed at the BAO during the nine-month period whose lightcurves were obtained in collaboration with other observatories and authors are not presented in here.

541 Deborah. An uncertain ($U = 1$), previously known rotation period of 4.25 hours (Behrend, 2008) was cited in the Potential Lightcurve Targets: 2008 July–September list. Data were gathered from 2008 August 19–September 3 resulting in 9 sessions. A bimodal solution of $P = 13.91 \pm 0.02$ h based upon Fourier

analysis of our observations in *MPO Canopus* represents, undoubtedly, the most reliable result for period (see the period spectrum, Fig. 1.). A relatively small value of amplitude was derived from the lightcurve: $A = 0.07 \pm 0.02$ mag.

956 Elisa. Photometric observations of this target were conducted over 13 nights from 2008 July 11–August 11 with the intention of revising a previously known rotation period of 3.9 hours (Behrend, 2008) but stated as uncertain ($U = 1$) on the CALL web-site (Potential Lightcurve Targets: 2008 July–September). As a result, a bimodal lightcurve phased to 16.5075 ± 0.0007 h, with an amplitude of 0.37 ± 0.02 mag was obtained. A new lightcurve published recently based on Matthieu Conjat’s observations (Behrend, 2008), shows a period of 16.492 ± 0.006 h, which is fully consistent with ours.

1022 Olympiada. This minor planet was listed as a potential target on the CALL web-site (Potential Lightcurve Targets January–March 2008) with a remark that the period can be in error by up to 30% or that the period has an ambiguous solution when $U = 2$. The first photometric observations of this object were carried out by Warner (1999), who originally published value of $P = 4.589$ h. This was subsequently revised due to better symmetry of the lightcurve with a shorter period of $P = 3.83 \pm 0.01$ h (Warner, 2005). Our intention was to check the previous values for the period to see which of the two, if either, was correct. Two observing runs were made on 2008 March 26 and 28. Our analysis found $P = 3.8331 \pm 0.0006$ h and $A = 0.35 \pm 0.02$ mag. There is also a good consistency between our result and the values found recently by Warner et al. (2008a) from the single night observations ($P = 3.822 \pm 0.006$ h, $A = 0.34 \pm 0.02$ mag).

1071 Brita. This asteroid was selected from the list of potential targets for the period 2008 January–March on the CALL web-site as a bright object during the opposition, marked with $U = 1$ and only preliminary parameters reported. The previously found amplitude was quite large, $A = 0.38$ mag. Our observations started on 2008 January 28 when the object was $V \sim 13.6$. Eight observing sessions were performed, densely covering the full rotation period. Some observations were carried out in very unfavorable sky conditions – intense moonlight and thin cirrus clouds, which made the final lightcurve noisier than expected. The last session was performed on 2008 March 9. Our analysis of the lightcurve gives $P = 5.8169 \pm 0.0003$ h and $A = 0.20 \pm 0.04$ mag.

1724 Vladimir. No parameters have been published previously for this asteroid. As a relatively faint target of about 15th magnitude, it was a real challenge for observing. A composite bimodal lightcurve was constructed from the data gathered in 5 sessions

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from 2008 March 30 to May 2. From this we found $P = 12.57 \pm 0.01$ h and $A = 0.14 \pm 0.03$ mag. A monomodal solution was also found with $P = 6.29 \pm 0.01$ h. Unfortunately, it was not possible to observe the asteroid longer than approximately 5 hours during a single night due to local observing circumstances. This, combined with the interval between sessions, results in an uncertainty about the number of rotations between sessions. Given the amplitude, the longer period seems more likely but the shorter period cannot be formally excluded. We strongly recommend photometry of this object in the future.

5010 Amenemhet. An unsecure solution for the rotation period of this asteroid ($U = 1$) was the primary reason to select it from the Potential Lightcurve Targets for 2008 April-June list despite its relatively faint opposition brightness ($V \sim 14.9$). Data were collected from 2008 May 12–15 resulting in 4 data sets. Our analysis of the obtained lightcurve suggests the rotational period of $P = 3.390 \pm 0.002$ h, which is close to the previously found period of $P = 3.2$ h (Angeli et al., 2001). The amplitude derived from the lightcurve is $A = 0.18 \pm 0.03$ mag. Nevertheless, insufficient coverage of the period with the observations (only one session covers the entire obtained period) and relatively sparse data point out the necessity for further photometric analysis of this object.

(8567) 1996 HW1. This is an Amor-type NEO asteroid that passed within 53 lunar distances of the Earth on 2008 September 12. Photometry of this target as a fairly bright “Radar-Optical Opportunity”, easy to reach within longer period of time, was recommended in the *Minor Planet Bulletin* (Warner et al., 2008b). Higgins et al. (2005) previously reported $P = 8.7573$ h and $A = 0.25$ mag. Observations of (8567) 1996 HW1 were carried out at the BAO over 4 consecutive nights from 2008 August 11–15. Each single-night dataset was divided into two sessions due to relatively fast apparent motion of the asteroid in the small field of view ($\sim 12 \times 12$ arc minutes). Our data show $P = 8.7553 \pm 0.0006$ h, which confirms the previously determined result. However, the amplitude, $A = 0.82 \pm 0.04$ mag, differs considerably from the value found by Higgins et al., probably due to a different viewing aspect during our observations.

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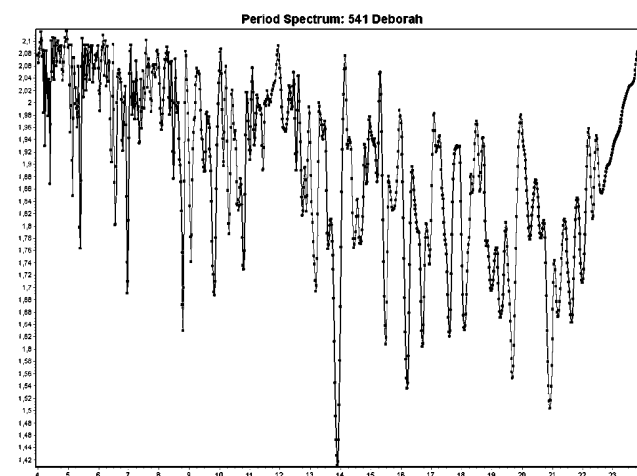


Figure 1. Period spectrum for 541 Deborah

