ROTATION PERIOD DETERMINATION FOR THE MAIN-BELT ASTEROID 1517 BEOGRAD

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New photometric data on the main-belt asteroid 1517 Beograd were obtained during the period 2014 March-May, covering a relatively wide range of phase angles. Analysis of the data indicates a synodic rotation period solution of 6.9490 ± 0.0006 h.

The main-belt asteroid 1517 Beograd was discovered by Serbian astronomer Milorad B. Protitch at the Belgrade Astronomical Observatory on 1938 March 20. The only prior rotation period determination result was published by Behrend (2005), who reported a period of 6.943 h based on observations obtained by L. Bernasconi in 2005. This solution has been characterized with an uncertainty flag of U = 2 on the CALL website (2014), which indicates a fairly high degree of its unreliability.

Guided by this fact, Benishek began the initial observations 3 days before the opposition date on 2014 March 11 in order to test the previously determined rotation period. The observations were made using a 0.35-m Meade LX200GPS Schmidt-Cassegrain (SCT) operating at *f*/6.3 and SBIG ST-8XME CCD camera in 2x2 binning mode. The exposures were unfiltered and unguided. As of 2014 March 23, Benishek obtained a total of 5 data sets covering phase angles from 2.8-5.7 degrees. Another group of 7 photometric data sets were obtained at significantly higher phase angles (18.9-21.3 deg) from 2014 May 6-27. The last data set of May 27 was contributed by Frederick Pilcher using a 0.35-m *f*/10 Meade LX200 GPS SCT and an unguided SBIG STL-1001E CCD camera with clear filter.

Data sharing between the authors, photometric measurements, and period analysis were performed using *MPO Canopus* software (Warner, 2012). The unfiltered observations were reduced using the Comparison Star Selector feature in *MPO Canopus* and applying the V-band magnitudes derived from the MPOSC3 hybrid catalog (Benishek) and R-band magnitudes derived from the CMC-15 catalog (Pilcher). To achieve the best match between the different data sets based on a minimum Fourier RMS residual, additional zero-point adjustments were performed.

The resulting composite bimodal lightcurve consisting of 825 data points that represent all phase angles covered by our observations shows period of 6.9490 ± 0.0006 hours (Fig 1). The calculated Fourier fit amplitude is 0.24 ± 0.02 mag. In addition to this clearly distinguished solution, its double value of 13.898 hours (the quadramodal solution) almost equally stands out in the period spectrum (Fig 2). After simple inspection of the obtained quadramodal lightcurve, the longer solution was completely ruled out as the two halves of the lightcurve appear nearly the same (Fig 3).

There was a significant increase (~0.1 mag) in the amplitude of the lightcurve with increasing phase angle throughout the interval of nearly three months. For this reason, the authors considered it necessary to construct and analyze two separate lightcurves related to the groups of data sets obtained at low (March 2014) and high phase angles (May 2014). These particular lightcurves are shown in the Figures 4 and 5. The rotation period values obtained by analyzing both low (6.949 ± 0.004 h) and high (6.949 ± 0.002 h) phase angle data sets independently are consistent with each other. As in the case of the analysis that comprises all the sessions obtained in a wide range of phase angles, the analogous quadramodal solutions appear as the results of the separate analyses of both low and high phase angle data. These were rejected for the reasons stated above. The Fourier fit amplitudes found for the low and high phase angle lightcurves are 0.20 ± 0.02 mag. and 0.31 ± 0.02 mag., respectively.

Our synodic rotation period solution of 6.9490 hours determined from the new photometric data collected over an almost three-month interval is found to be consistent with the result previously found by Behrend and, therefore, should indicate a much higher degree of its reliability.

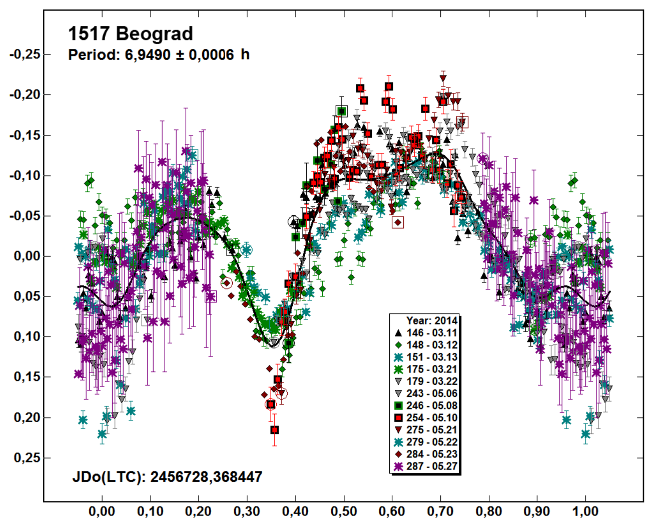

Figure. 1. The lightcurve for 1517 Beograd using all data.

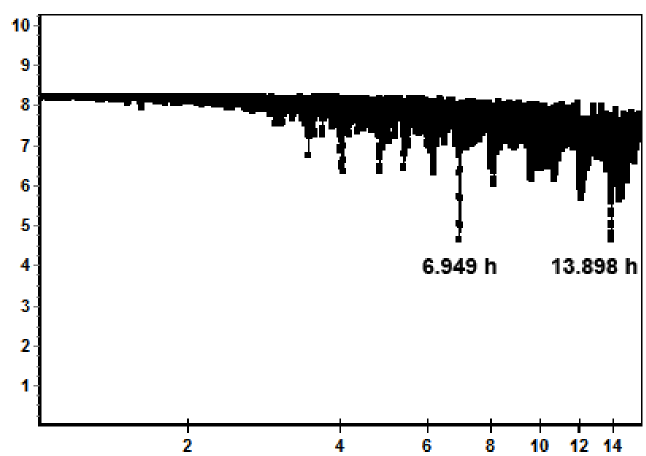

Figure 2. The period spectrum using all data.

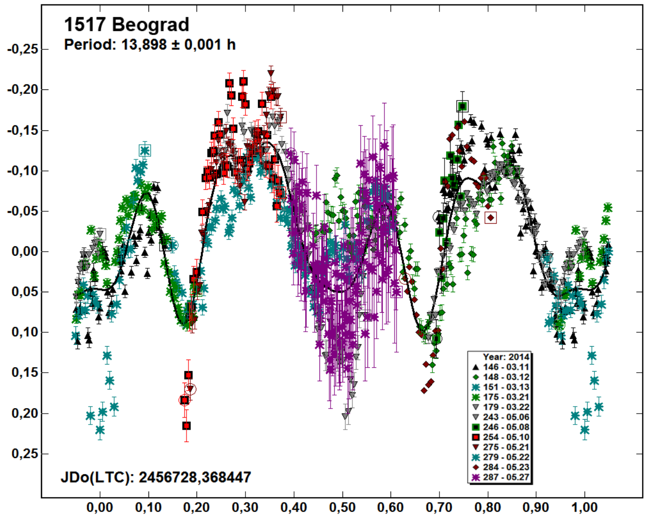

Figure 3. The lightcurve using all data assuming a period of 13.898 hours.

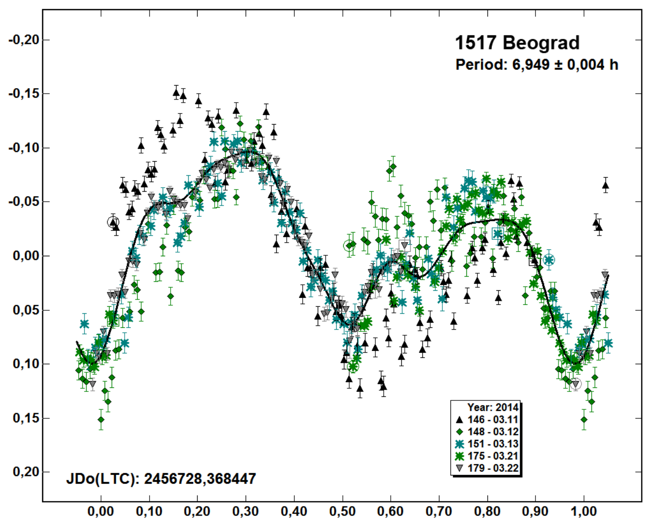

Figure 4. The lightcurve for 1517 using data from 2014 March.

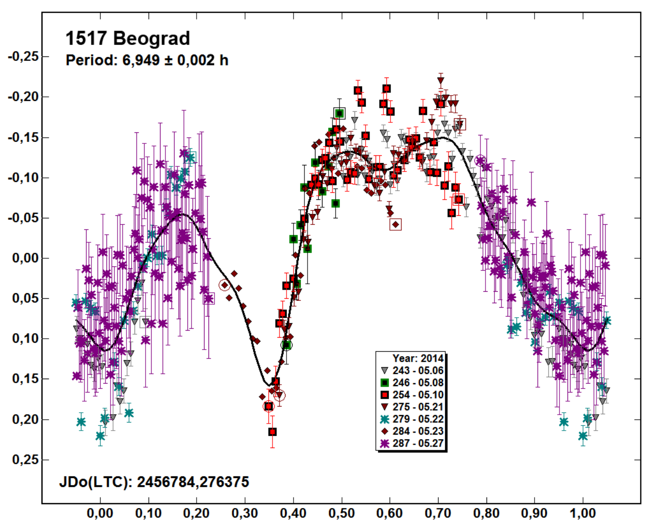

Figure 5. The lightcurve for 1571 using data from 2014 May.

References

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Warner, B.D. (2012). MPO Software, *MPO Canopus* version 10.4.1.9. Bdw Publishing. *http://minorplanetobserver.com/*

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