LIGHTCURVES AND ROTATIONAL PERIODS OF FOUR MAIN BELT ASTERIODS

Allan Teer
Kent Montgomery
Texas A&M University–Commerce
P.O. Box 3011
Commerce, TX 75429-3011
Kent.Montgomery@tamuc.edu

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Lightcurves and rotational periods were determined for the following four asteroids: 1120 Cannonia: 3.810 ± 0.003 h; 6801 Strekov: 6.171 ± 0.016 h; (28885) 2000 KH56: 3.326 ± 0.001 h; and 87312 Akirasuzuki: 3.0439 ± 0.0007 h.

Introduction

The purpose of this research was to determine the rotational period of four main belt asteroids; 1120 Cannonia, 6801 Strekov, (28885) 2000 KH56 and 87312 Akirasuzuki. The method used lightcurves created from photometric data taken over several nights. The lightcurves were then analyzed to determine the rotational periods.

Asteroid 1120 Cannonia was discovered by Shajn, P. at Simeis in 1928. It has an orbital eccentricity of 0.156 and a semi-major axis of 2.215 AU (JPL). Asteroid 6801 Strekov was discovered in 1995 by Moravec, Z. at Klet. This asteroid has an orbital eccentricity of 0.130 and a semi-major axis of 2.207 AU (JPL). Asteroid (28885) 2000 KH56 was discovered in 2000 by Lincoln Near-Eath Asteroid Research (LINEAR) at Socorro, New Mexico. It has an orbital eccentricity of 0.161 and a semi-major axis of 2.775 AU (JPL). Asteroid 87312 Akirasuzuki was discovered in 2000 by the Bisei Asteroid Tracking Telescope for Rapid Surveys (BATTeRS) at the Bisei Spaceguard Center in Okayama, Japan. It has an orbital eccentricity of 0.146 and a semi-major axis of 2.585 AU (JPL).

Method

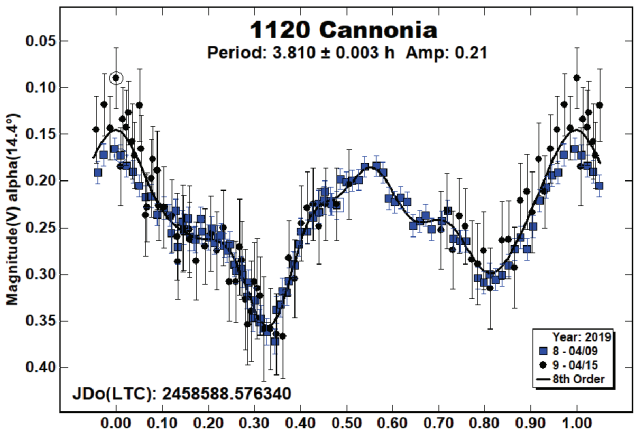
Two separate telescopes were used for this research. One of the telescopes is part of the Southeastern Association for Research in Astronomy (SARA) consortium. The telescope at SARA-North is a 0.9-m telescope located at the Kitt Peak National Observatory (KPNO) in Arizona. It is equipped with a CCD camera manufactured by Astronomical Research Camera, Inc. (ARC). The second is a 0.7-m telescope with an Andor Technologies camera at Texas A&M University-Commerce (TAMUC) in Commerce, Texas. Both cameras used CCDs that were cooled to around -60ºC to reduce background noise in the images.

In order to reduce the images, flats, bias, and dark calibration images were taken each night. The flat field images were taken against the twilight sky. The darks were exposed for the same time as the respective light images, three minutes for both telescopes. The SARA-North telescope used an IR-blocking filter and on the TAMUC telescope a Luminance filter was used. Both filters transmit the visible portion of the spectrum but block the infrared.

The software *MaxIm DL* was used to reduce and align the images. Afterward, the program *MPO Canopus v10.4.0.8* (Warner, 2011) was used to perform differential photometry on the reduced data. For each data set, five stars within the image were used for brightness comparison to the asteroid. Aperture photometry was used to determine the brightness of these comparison stars and the asteroid. The average of the difference in mag. between the stars and the asteroid was found for each image and then plotted in a phased plot, mag. versus time, to create a lightcurve. A Fourier transform was then applied to the lightcurve to determine the rotational period and error in the period.

Results

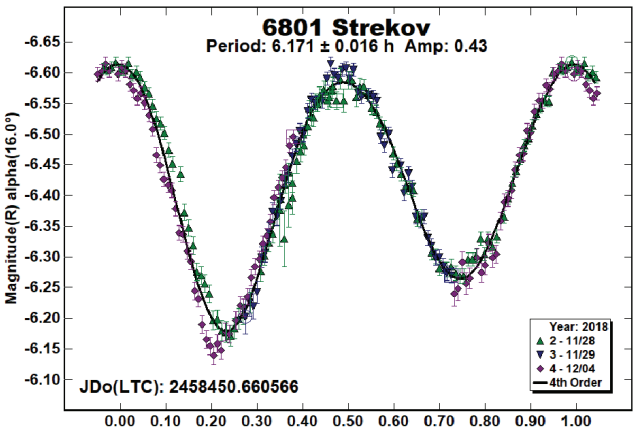
1120 Cannonia. The asteroid 1120 Cannonia was imaged 95 times on 2019 April 8 and 93 times on 2019 April 14. Both nights used the TAMUC telescope. A rotation period of 3.810 ± 0.003 h with an amplitude variance of 0.21 mag was found. A previous study found a similar rotation period of 3.8096 ± 0.00033 h with an amplitude variance of 0.15 mag. (Valeau et al., 2017).



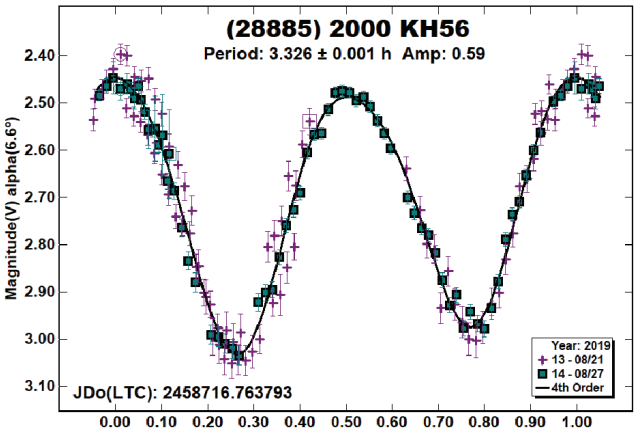
6801 Strekov. The asteroid 6801 Strekov was observed over three nights. It was imaged 117, 75, and 77 times on 2018 November 27, 28, as well as 2019 December 4, respectively. The images were taken with the TAMUC telescope and the resulting lightcurve produced a rotational period of 6.171 ± 0.016 h with an amplitude variance of 0.43 mag. A previous study found a similar rotation period of 6.173 ± 0.008 h with an amplitude variance of 0.17 mag. (Carbo et al., 2009).

Number	Name	yyyy mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.
1120	Cannonia	2019 04/08-04/14	14.0, 16.0	167.3	+1.4	3.810	0.003	0.21	.02
6801	Strekov	2018 11/27-12/04	15.4, 18.6	41.0	+0.7	6.171	0.016	0.43	.03
28885	2000 KH56	2019 08/20-08/27	6.3, 7.8	323.9	+11.1	3.326	0.001	0.59	.01
87312	Akirasuzuki	2019 03/09-03/27	14.9, 20.6	140.7	+5.6	3.0439	0.0007	0.16	.02

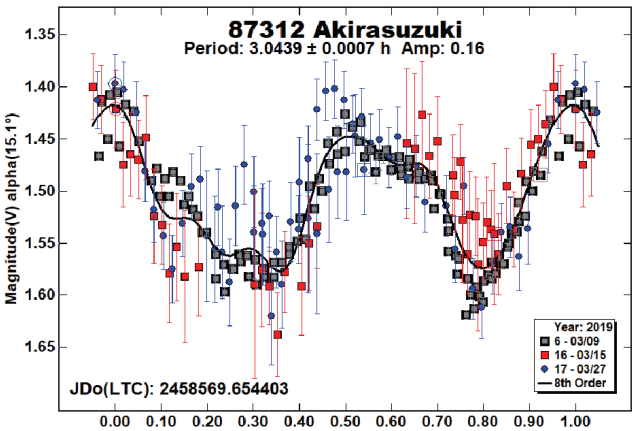
Table I. Observing circumstances and results. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984).



(28885) 2000 KH56. The asteroid (28885) 2000 KH56 was imaged 105 times on 2019 August 20 and 76 times on 2019 August 27, both nights on the TAMUC telescope. The resulting lightcurve produced a rotational period of 3.326 ± 0.001 h with an amplitude variance of 0.59 mag. A previous study found the same rotational period of 3.325 ± 0.0004 h with an amplitude variance of 0.58 mag. (Waszcak et al., 2015).



87312 Akirasuzuki. Asteroid 87312 Akirasuzuki was observed over three nights. It was imaged 116 times on 2019 March 9 using the SARA-North telescope. On March 15 2019 70 images were taken, and 66 images were taken on 2019 March 27 using the TAMUC telescope. These observations resulted in a rotational period of 3.0439 ± 0.0007 h and an amplitude variation of .16 mag. Another study produced a rotational period of 3.25 ± 0.025 h and an amplitude variation of 0.14 mag. (Chang et al., 2016)



Acknowledgements

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