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PHOTOMETRY OF SELECTED ASTEROIDS ON THE OMT-800 TELESCOPE

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From 2016 to 2017, images of minor planets were collected to investigate their rotational lightcurve periods. Those minor planets were 3361 Orpheus, 3749 Balam, (66391) 1999 KW4, (153415) 2001 QP153, (357027) 1999 YR14, (496018) 2008 NU, and 2014 YC15.

We used an FLI 9000 camera on a 0.8-m OMT-800 telescope (Troianskyi *et al.*, 2014; MPC code 583) operating at *f*/2.67 to collect images on the nights of 2016 June 7–9, September 1-3, 5-8, 11, and of 2017 July 30-31, August 1-2, 19-21, 24-27, 29-30, September 18-20, 22, and October 17-18. The targeted minor planets were 3361 Orpheus, 3749 Balam, (66391) 1999 KW4, (153415) 2001 QP153, (357027) 1999 YR14, (496018) 2008 NU, and 2014 YC15. The images were processed using standard techniques with *MaxIm DL* and then measured and lightcurves generated with *MPO Canopus*.

Table I gives the observing circumstances and analysis results. For asteroid (153415) 2001 QP153, ours appears to be the first period found.

3361 Orpheus is an Apollo (NEO) asteroid and potentially hazardous asteroid (PHA) that was discovered on 1982 April 24 by Carlos Torres at Cerro El Roble Astronomical Station. Our period of 3.51 ± 0.03 h is in close agreement with the Skiff (2013) period of 3.532 ± 0.001 h.

3749 Balam was discovered on 1982 January 24 by American astronomer Edward Bowell at Lowell's Anderson Mesa Station near Flagstaff, Arizona. The S-type asteroid is a member of the Flora family (main-belt). Our period of 2.8033 ± 0.0008 h is in close agreement with the Marchis et al. (2008) period of 2.80483 ± 0.00002 h.

(66391) 1999 KW4. Classified as a potentially hazardous asteroid (PHA) of the Aten group, 1999 KW4 was discovered on 1999 May 20 by Lincoln Near-Earth Asteroid Research (LINEAR) at the Lincoln Laboratory's Experimental Test Site in Socorro, New Mexico. Our period of 2.776 ± 0.001 h is in close agreement with the Pravec et al. (2006) period of 2.7650 ± 0.002 h.

(153415) 2001 QP153. This Aten-type NEA was discovered on 2001 August 20 by LINEAR at Socorro. There were no previous entries in the LCDB (Warner et al., 2009) for (153415) 2001 QP153. We found period of 4.452 ± 0.005 h.

(357024) 1999 YR14. This asteroid was discovered by LONEOS at Anderson Mesa on 1999 December 31. It is an Apollo-type potentially hazardous asteroid (PHA). Our period of 4.2454 ± 0.0002 h is statistically the same as the period of 4.2477 ± 0.0005 h found by Warner (2017).

(496018) 2008 NU is an Amor (NEO) asteroid that was discovered 2008 July 1 by CSS at Catalina. The period of 4.7344 ± 0.0005 h we found disagrees with the period of 6.47 ± 0.01 h found by Warner (2018).

2014 YC15. This is classified as an Amor (NEO). Our period of 5.7635 ± 0.0001 h is statistically the same as that found by Pravec (2017): 5.7639 ± 0.0003 h.

The results will be used for numerical simulation of the motion of asteroids and asteroid systems (Troianskyi and Bazyey, 2018), taking into account non-gravitational perturbations.

References

Harris, A.W., Young, J.W., Scaltriti, F., Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gyptis." *Icarus* **57**, 251-258.

Number	Name	yyyy mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	U	Exp
3361	Orpheus	2017 10/17-10/18	93	10.5	30	-3	3.51	0.03	0.17	0.05	2	90
3749	Balam	2017 09/18-09/22	252	3.6,3.9	356	7	2.8033	0.0008	0.10	0.02	3	90
66391	1999 KW4	2016 06/07-06/09	383	72.1,73.5	276	47	2.776	0.001	0.24	0.03	2	30
153415	2001 QP153	2017 08/26-08/29	204	84.3,81.3	319	56	4.452	0.005	0.27	0.05	2	120
357024	1999 YR14	2016 09/01-09/11	1010	60.1,85.6	24	-12	4.2445	0.0002	1.37	0.05	3	60
496018	2008 NU	2017 07/30-08/21	344	12.3,20.8	315	13	4.7344	0.0005	0.18	0.03	2	120
	2014 YC15	2017 08/24-09/30	258	18.1,31.7	0	12	5.7635	0.0001	1.02	0.02	3	90

Table I. Observing circumstances and results. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984). The U rating is our estimate and not necessarily the one assigned in the asteroid lightcurve database (Warner *et al.*, 2009). Exp is average exposure, seconds.

Marchis, F., Pollock, J., Pravec, P., Baek, M., Greene, J., Hutton, L., Descamps, P., Reichart, D.E., Ivarsen, K.M., Crain, J.A., Nysewander, M.C., Lacluyze, A.P., Haislip, J.B., Harvey, J.S. (2008). "(3749) Balam." *Central Bureau Electronic Telegrams* **1297**, #1.

Pravec, P., Scheirich, P., Kusnirák, P., Sarounová, L., Mottola, S., Hahn, G., Brown, P., Esquerdo, G., Kaiser, N., Krzeminski, Z., and 47 coauthors (2006). "Photometric survey of binary near-Earth asteroids." *Icarus* **181**, 63-93.

Pravec, P., Wolf, M., Sarounova, L. (2017). *http://www.asu.cas.cz/~ppravec/neo.htm*

Skiff, B.A. (2013). Posting on CALL web site. *http://www.minorplanet.info/call.html*

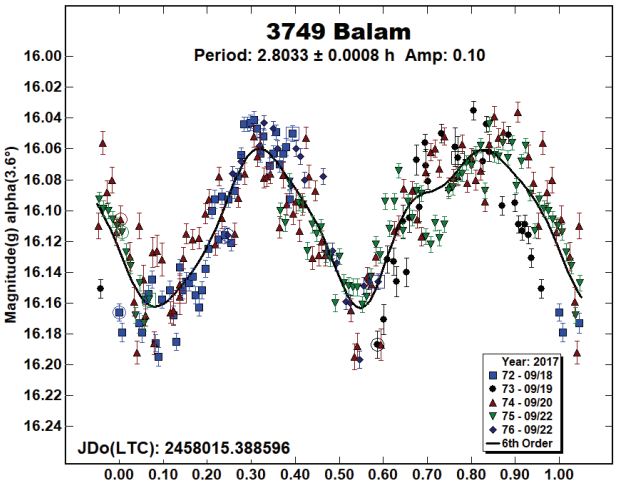
Troianskyi, V.V., Bazyey, A.A., Kashuba, V.I., Zhukov, V.V., Korzhavin, S.A. (2014). "Method for Calculating Orbits of Near-Earth Asteroids Observed with Telescope OMT-800." *Odessa Astronomical Publications* **27**, 154-155.

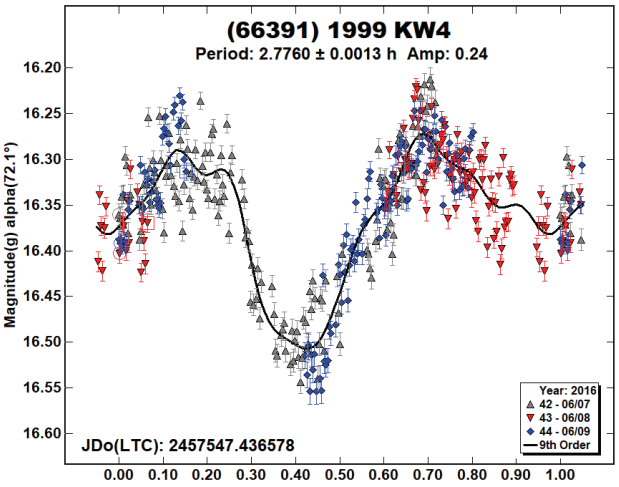
Troianskyi, V.V., Bazyey, O.A. (2018). "Numerical simulation of asteroid system dynamics." *Contrib. Astron. Obs. Skalnate Pleso* **48**, 356-380.

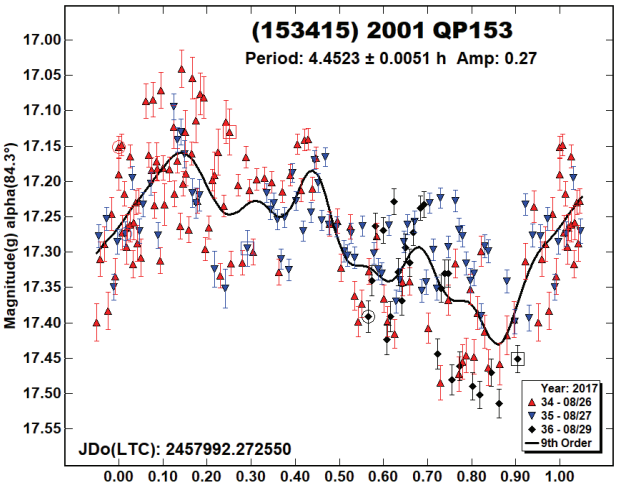
Warner, B.D., Harris, A.W., Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2016 Sep. *http://www.minorplanet.info/lightcurvedatabase.html*

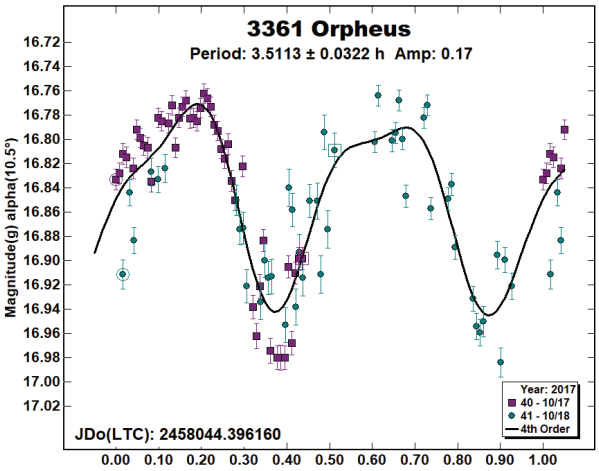
Warner, B.D. (2017). "Near-Earth Asteroid Lightcurve Analysis at CS3-Palmer Divide Station: 2016 July-September." *Minor Planet Bull.* **44**, 22-36.

Warner, B.D. (2018). "Near-Earth Asteroid Lightcurve Analysis at CS3-Palmer Divide Station: 2017 July through October." *Minor Planet Bull.* **45**, 19-34.









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Pravec, P., Wolf, M., Sarounova, L. (2017). *http://www.asu.cas.cz/~ppravec/neo.htm*

Skiff, B.A. (2013). Posting on CALL web site. *http://www.minorplanet.info/call.html*

Troianskyi, V.V., Bazyey, A.A., Kashuba, V.I., Zhukov, V.V., Korzhavin, S.A. (2014). "Method for Calculating Orbits of Near-Earth Asteroids Observed with Telescope OMT-800." *Odessa Astronomical Publications* **27**, 154-155.

Troianskyi, V.V., Bazyey, O.A. (2018). "Numerical simulation of asteroid system dynamics." *Contrib. Astron. Obs. Skalnate Pleso* **48**, 356-380.

Warner, B.D., Harris, A.W., Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2016 Sep. *http://www.minorplanet.info/lightcurvedatabase.html*

Warner, B.D. (2017). "Near-Earth Asteroid Lightcurve Analysis at CS3-Palmer Divide Station: 2016 July-September." *Minor Planet Bull.* **44**, 22-36.

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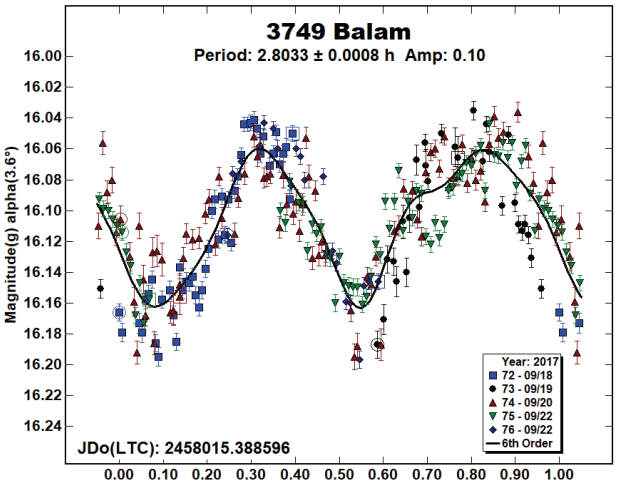

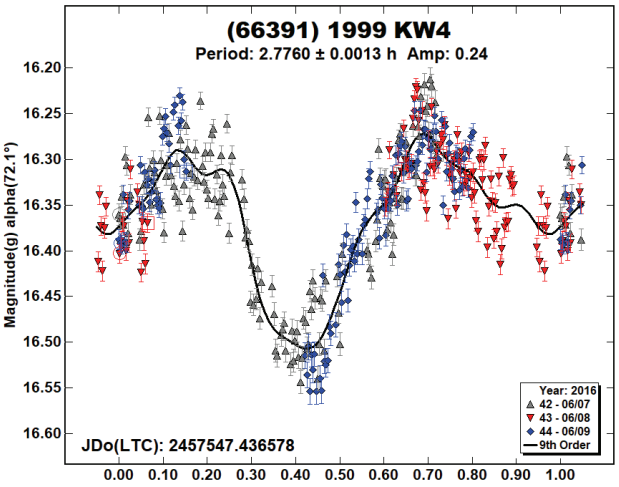

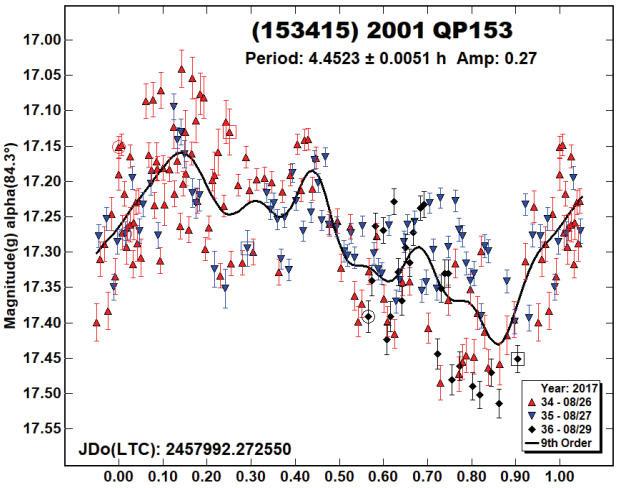

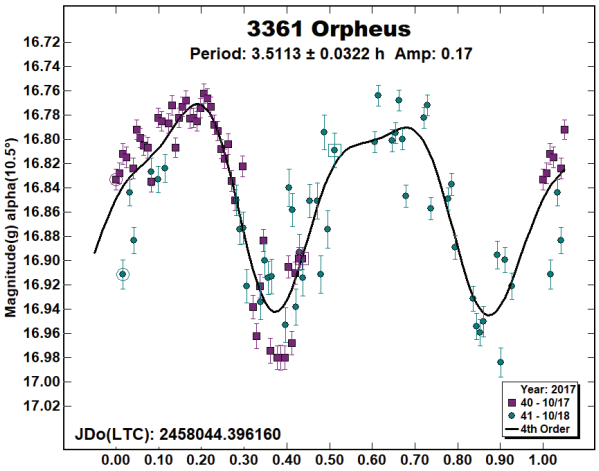

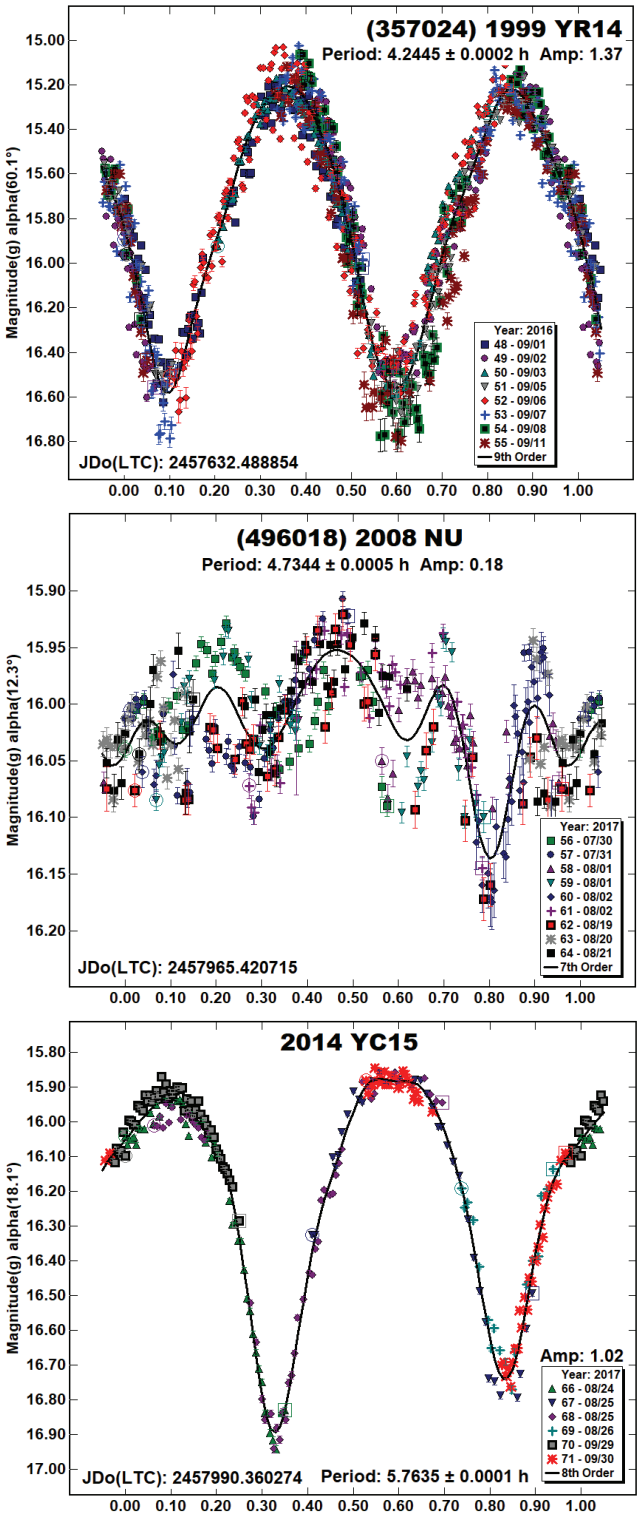

LIGHTCURVES AND ROTATIONAL PERIODS OF FIVE MAIN-BELT ASTEROIDS

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Lightcurves measurements are reported for five asteroids: 727 Nipponia, 857 Glasenappia, 1551 Argelander, 1676 Kariba, and 2556 Louise. Respectively their rotational periods are found to be 5.070 ± 0.001 h, 8.188 ± 0.006 h, 2.314 ± 0.012 h, 3.168 ± 0.002 h, 3.809 ± 0.001 h.

The purpose of this research was to determine the rotational periods of five main-belt asteroids: 727 Nipponia, 857 Glasenappia, 1551 Argelander, 1676 Kariba, and 2556 Louise. Photometric data taken over several nights were used to create lightcurves which were then analyzed to determine the rotational period and inverted to predict a shape. The asteroids were chosen because of their opposition date, declination, and apparent magnitude. Asteroids with negative declinations were selected for the southern hemisphere telescope, and the asteroids with positive declination were chosen for the northern hemisphere telescopes. For optimum signal-to-noise, asteroids with a magnitude of 16 and brighter were selected. To maximize the number of images per night, the asteroids were all observed within a week of their opposition date.

The following discovery and orbital information were taken from the JPL Small Bodies Node (JPL, 2018). 727 Nipponia was discovered by A. Massinger at Heidelberg in 1912. It has an orbital eccentricity of 0.105 and a semi-major axis of 2.566 AU. 857 Glasenappia was discovered by S. Belyavskij at Simeis in 1916. It has an orbital eccentricity of 0.088 and a semi-major axis of 2.190 AU. 1551 Argelander was discovered by Y. Vaisala at Turku in 1938. It has an orbital eccentricity of 0.066 and a semi-major axis of 2.394 AU. 1676 Kariba was discovered by C. Jackson in Johannesberg in 1939. It has an orbital eccentricity of 0.186 and a semi-major axis of 2.235 AU. 2556 Louise was discovered by N.G. Thomas at Flagstaff in 1981. It has an orbital eccentricity of 0.037 and a semi-major axis of 2.163 AU.

Three separate telescopes were used in this study. Two are part of the Southeastern Association of Research and Astronomy (SARA) Consortium. The telescope at SARA North is 0.9-m with an Apogee CCD camera and is located in Arizona at the Kitt Peak National Observatory (KPNO). SARA South is a 0.6-m telescope with an FLI CCD camera; it's located at the Cerro Tololo Inter-American Observatory (CTIO) in la Serena, Chile. The third telescope, a Meade 0.41-m LX200 Schmidt-Cassegrain with an SBIG CCD camera, was used at the Texas A&M University-Commerce Observatory in Commerce, Texas.

The images were reduced with flat, dark, and bias calibration images that were taken each night. The flat field images were taken against the twilight sky. The darks were exposed for the same duration as the respective light images, three minutes for all three telescopes. The SARA-North telescope used an IR-Blocking filter. At SARA-South, a Luminance-5 filter was used. The Texas