

RESULTS OF THE FIRST SEMESTER OF THE 2018 MEXICAN ASTEROID PHOTOMETRY CAMPAIGN

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We report results from the first half of the 2018 Mexican Photometry Campaign. This period consisted of a total of 42 observing nights distributed on three observatories. From these data we have obtained lightcurves and synodic rotational periods for 6 asteroids. 1491 Balduinus resulted in a period of $P = 15.3044 \pm 0.0057$ hr; 1856 Ružena, $P = 5.957 \pm 0.001$ hr; 3394 Banno $P = 7.344 \pm 0.0002$ hr; 3877 Braes $P = 5.8155 \pm 0.0005$ hr; 7430 Kogure, $P = 17.998 \pm 0.076$ hr; and for 2001 KB67, $P = 6.357 \pm 0.0012$ hr.

The Mexican Asteroid Photometry Campaign began in 2015 as an effort to study asteroids and to establish a collaborative network among researchers from different Mexican institutions. Since then, we have improved our observing techniques and processing methods; see Sada et al. (2016) and Sada et al. (2017). All our targets were selected from the MPC CALL website.

Thirty one observing nights were recorded at the Carl Sagan Observatory from Universidad de Sonora (UNISON) in Hermosillo, Sonora. This observatory operates a Meade LX-200GPS 0.41-m $f/10$ telescope equipped with a 3056×3056 pixel 12 μ m Apogee Alta F9000 CCD for imaging. The image frame was trimmed to a subframe of 2000×2000 pixels to avoid vignetting and then binned 2×2 yielding an effective 1000×1000 pixel, $\sim 20' \times 20'$ FOV with an image scale of about 1.2 arcsec/pix. The images at this site were obtained unguided (using only mount tracking) and unfiltered. The exposure time used was 240 s in all cases.

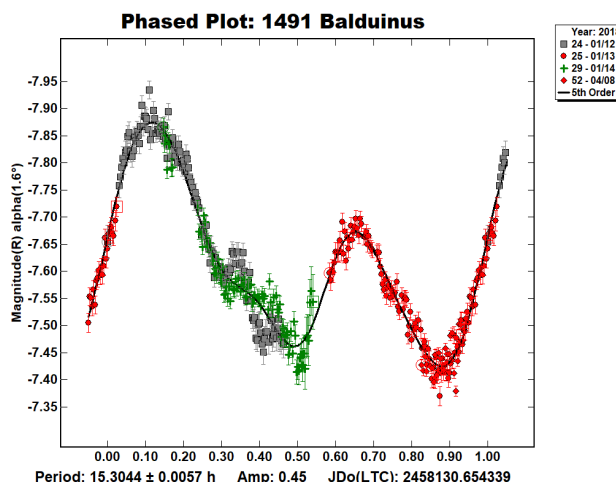
Two one-week scheduled observing runs were carried out throughout the period with the 0.84-m $f/15$ Ritchey-Chretien telescope at the Observatorio Astronómico Nacional in the Sierra de San Pedro Mártir (OAN-SPM; MPC 679) Baja California. On top of that, a few additional observing nights not originally scheduled were made available to this project. This telescope uses a 2048×2048-13.4 μ m Spectral Instruments CCD for regular imaging. This combination yields a FOV of $\sim 6.3' \times 6.3'$ with an approximate image scale of 0.185 arcsec/pix. All images were 2×2 binned, unfiltered and obtained using an off-axis guide star for stability (although the field drifted a little during the observing sessions due to telescope sag). The exposure times for each

asteroid ranged between 20 s and 480 s, depending on target brightness.

At the Universidad de Monterrey (UdeM) Observatory (MPC 720) we observed 2 asteroids on 5 nights using a Meade 0.36-m $f/8$ LX600-ACF telescope and a SBIG STL-1301E CCD. The camera uses a 1280×1024-16 μ m KAF-1301E/LE chip which covers a $\sim 26.3' \times 21.1'$ field-of-view (FOV) with an image scale of about 1.24 arcsec/pix. All asteroids were observed unfiltered for maximum SNR and the CCD images were read in 2×2 binned format for faster download time and observing efficiency. The FOV was maintained fixed on the chip by using an on-axis guide star at all times. The exposure time was 180 s. Occasionally, the telescope was slightly defocused in order to spread the object over a few binned pixels allowing slightly longer exposure times.

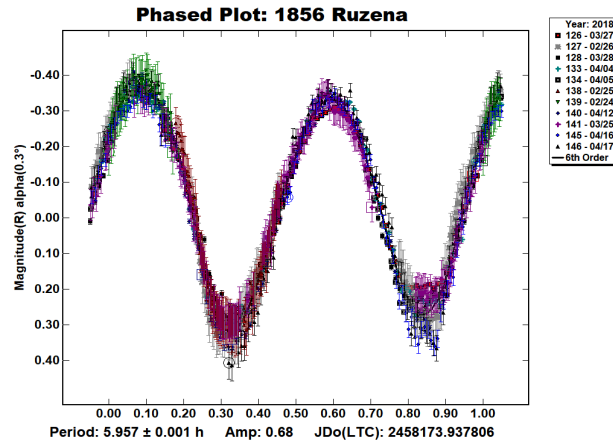
All images were processed following standard procedures for data reduction, mainly applying dark current and flat field corrections. Photometric measurements and lightcurve analysis were performed using MPO Canopus (version 10.7.3.0). Although all observations were unfiltered, differential magnitudes were calculated based on R band stellar magnitudes.

1491 Balduinus. Discovered at Uccle by E. Delporte on 1938 February 23 and named after Baudouin, then king of the Belgians as a way to honor his patronage. The asteroid was observed during 4 nights in 2018: January 12 to 14 and on April 8. Data were taken during three nights at UDEM Observatory (2018 January 12 to 14) and an additional session (2018 April 8) was taken from three nights observed at the UNISON Observatory, but the first two nights had considerably crowded star fields and were not used for the lightcurve. A period of $P = 15.3044 \pm 0.0057$ hr with an amplitude of $A = 0.45 \pm 0.08$ mag was found. This result is similar to the published result by Odden et al. (2018) of 15.315 ± 0.003 hr. The lightcurve shows a two maxima and two minima structure with the first maximum-minimum pair having considerably larger amplitude than the second. Structure in the shape of an elbow located just before the first minimum was seen at the 5th order fit. In order to obtain a more complete lightcurve, additional coverage is needed after the first minimum (between sessions 29 and 25).

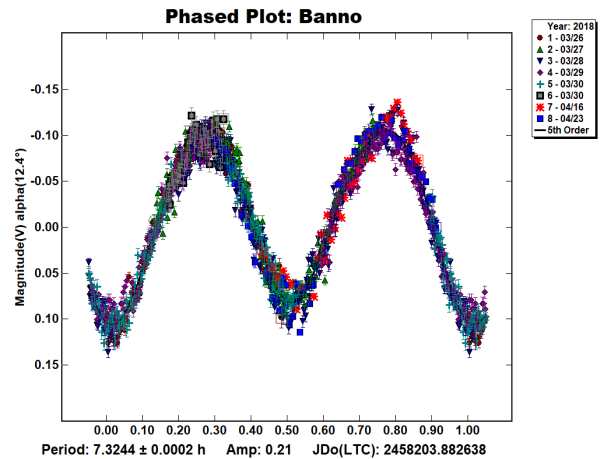


1856 Ružena. This S-Class asteroid was discovered on 1969 Oct. 8 by L.I. Chernykh of the Klet Observatory in Nauchnyj was named in honor of Miss Ružena Petrovicova (Schmadel, 2003). This asteroid was observed in the OAN-SPM Observatory (2018 February 24, 25, 26 and March 18), in the UNISON Observatory (2018 March 27, 28 and April 4, 5, 12) and in the UDEM

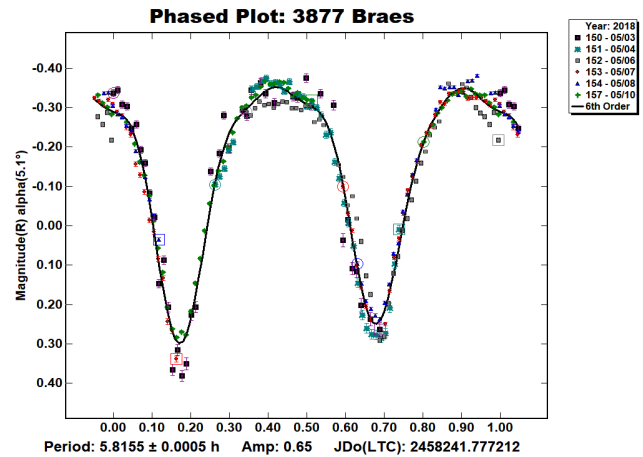
Observatory (2018 April 16 and 17) for a total of 51 h 05 m of observing time. We used a single session per night to derive a period of $P = 5.957 \pm 0.001$ hr with an amplitude of $A = 0.68$ mag. Observing the period spectrum we found a minimum of ≈ 3 hr as well as one of 5.957 hr, which along with the apparent symmetry of the lightcurve led to a possible period of 3 hr; however, the difference grew in favor of the longer period (5.957 hr) as more data were added and the two maxima and two minima structure took shape with the second maximum-minimum having a slightly lower amplitude than the first. Also, the second minima (at 0.8 - 0.9) showed a small flattening not seen in the first one. Our result concurs with a previous result for the period of 1856 Ružena obtained by Hayes-Gehrke et al. (2018a) with a value for $P = 5.96 \pm 0.003$ hr and $A = 0.65 \pm 0.09$ mag.



3394 Banno. This main-belt asteroid was discovered in 1986 Feb. 16 and was named in honor of Yoshiaki Banno (Schmadel, 2003). 3394 Banno was observed during 5 nights at OAN-SPM Observatory (2018 March 26, 27, 28, 29 & 30). Due to an adjustment in the field of view during the night of March 30, two separate data sessions are shown. Additional data were taken at UNISON Observatory on 2018 April 16 and 23. The lightcurve shows a two maxima and two minima shape, and the period derived from this data was $P = 7.3244 \pm 0.0002$ hr (the RMS error was ≤ 0.04) and an amplitude of $A = 0.21$ mag using a 5th order Fourier fit. This result is very close to the value published by Marchini et al. (2018) of $P = 7.324 \pm 0.001$ hr and $A = 0.22 \pm 0.02$ mag, a result obtained with 194 data points in a 4th order fit. The following results for 3394 Banno were found in the Minor Planet Bulletin: Zeigler et al. (2018) have $P = 7.34 \pm 0.01$ hr with an amplitude of 0.21 mag, Hayes-Gehrke et al. (2018b) reported $P = 7.321 \pm 0.025$ hr, Mollica et al. (2018) reported a period of $P = 7.324 \pm 0.002$ hr and an amplitude of 0.24 mag.



3877 Braes. This S-Class main-belt asteroid was discovered on 1960 Sept. 24 by C. J. van Houten and I. van Houten-Groeneveld at Palomar Observatory (Schmadel, 2003). Data for this object were collected during 7 nights at the UNISON Observatory (2018 May 2, 3, 4, 6, 7, 8 & 10). The data from May 2 was not used due to degrading observing conditions during the night leaving 6 nights for a total of 293 data points left after eliminating low-quality data (high air mass, etc.) covering a total of 19.53 hr observing time. After an analysis with MPO Canopus we found that the result is a period of $P = 5.8155 \pm 0.0005$ hr and an amplitude of 0.65 ± 0.1 mag with a 6th order fit showing two maximum-and-minimum pairs. The two maximum points are similar in magnitude but the two minima differ slightly. No other results were found for the period or amplitude of 3877 Braes as of writing this paper.

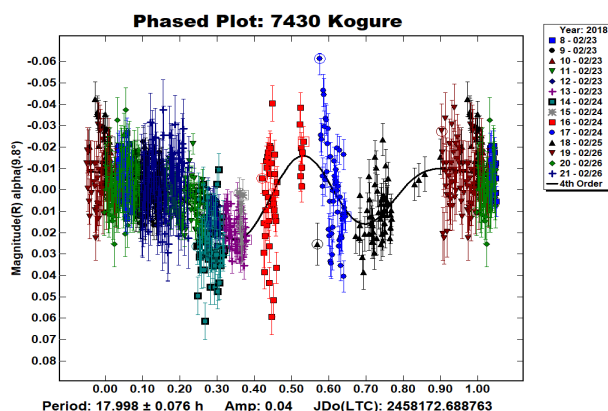


7430 Kogure. It is a main-belt asteroid and was discovered 1993 Jan. 23 by K. Endate and K. Watanabe at Kitami (Schmadel, 2003). We observed 7430 Kogure during four nights (2018

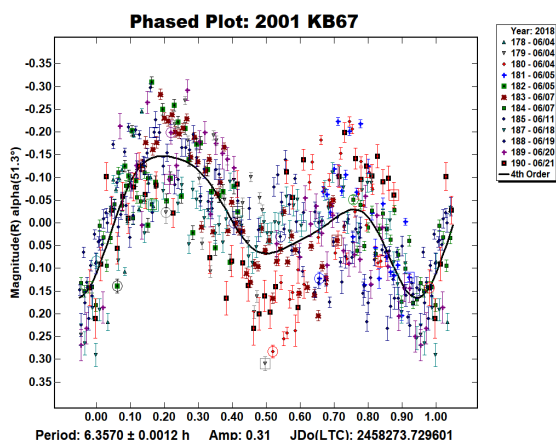
Number	Name	2018 mm/dd	Pts	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
1491	Balduinus	01/12-04/08	375	1.7, 20.6	116.6	0.7	15.3044	0.0057	0.45	0.08	EMB
1856	Ružena	02/24-04/17	1048	16.3, 11.6	186.6	-0.1	5.957	0.001	0.68	0.09	MBO
3394	Banno	03/26-04/23	1162	12.5, 5.4	203.4	1	7.3244	0.0002	0.21	0.04	MBO
3877	Braes	05/03-05/10	293	12.2, 14.0	232.6	1.7	5.8155	0.0005	0.65	0.1	MBO
7430	Kogure	02/23-02/26	896	9.7, 11.2	139.3	-4.1	17.998	0.076	0.04	0.03	MBO
68347	2001 KB67	07/04-07/21	467	10.5, 8.4	96.1	18.6	6.357	0.0012	0.31	0.14	ATN

Table I. Observing circumstances and results. 2018 mm/dd is the range of dates for the observations, Pts is the number of data points. 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). P.E. is error in the period (h). A.E. is the error in amplitude. Grp is the asteroid family/group (Warner *et al.*, 2009).

February 23, 24, 25 & 26) at AON-SPM and one at the UNISON Observatory (also on the 25th of February). In most nights we used several sessions with MPO Canopus. When a 4th order fit was made a resulting period of $P = 17.998 \pm 0.076$ hr and $A = 0.04 \pm 0.03$ mag was obtained. It is worth noting that this lightcurve is not complete and hence the period is not considered trustworthy. A clear contrast can be seen with the $P = 335.9 \pm 0.8$ hr and $A = 0.57$ mag result from Polakis (2018) which he also obtained from a partial lightcurve. From the poor alignment of the data points, Polakis (2018) suggests that 7430 Kogure is tumbling.



2001 KB67. This body was discovered in 2001 May 30 by Linear at Socorro (Park & Chamberlain, 2018), it belongs to the Aten group, and is classified as NEO and PHA. It was observed during 8 nights at UNISON Observatory (2018 July 4, 5, 7, 11, 18, 19, 20, & 21). Measurements were affected by weather resulting in a large scatter. During the first three nights (July 4, 5 & 7) several sessions were associated to many observing fields because of the high angular speed of the asteroid during closest approach. A 4th order fit was adjusted to obtain a period of $P = 6.357 \pm 0.0012$ hr and an amplitude of $A = 0.31$ mag. This result agrees closely with the $P = 6.354 \pm 0.004$ h and $A = 0.19$ obtained by Warner (2018).



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