EIGHTEEN ASTEROIDS LIGHTCURVES AT ASTEROIDES OBSERVERS (OBAS) - MPPD: 2016 MARCH - MAY

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(Received: 2016 Jun 14)

We report on the analysis of photometric observations of 18 main-belt asteroids (MBA) done by Asteroides Observers (OBAS). This work is part of the Minor Planet Photometric Database program initiated by a group of Spanish amateur astronomers. We have managed to obtain a number of accurate and complete lightcurves as well as some additional incomplete lightcurves to help analysis at future oppositions.

In this paper we publish the result of 18 asteroids analyzed under the Minor Planet Photometric Database project (*http://www.minorplanet.es*). This database is focused on collecting lightcurves of main-belt asteroids using photometric techniques and shows graphic results of the data, mainly lightcurves, with the plot phased to a given period.

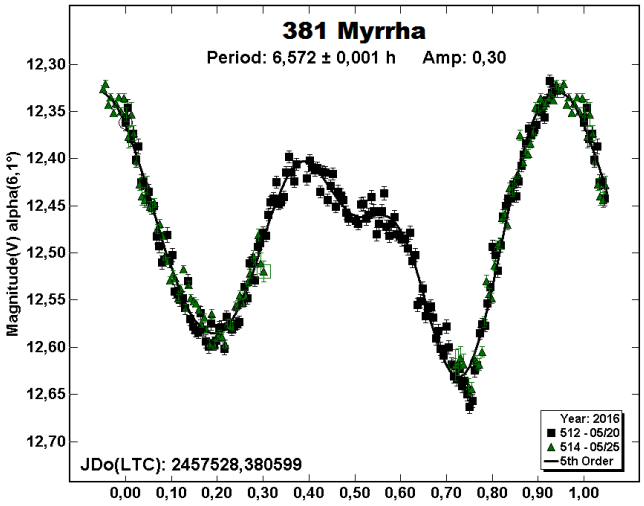
Observatory	Telescope (meters)	CCD
C.A.A.T.	0.45 DK	SBIG STL-11002
Zonalunar	0.20 NW	QHY6
Vallbona	0.25 SCT	SBIG ST7-XME
TRZ	0.20 R-C	QHY8
Elche	0.25 DK	SBIG ST8-XME
Oropesa	0.20 SCT	Atik 16I
Bétera	0.23 SCT	Atik 314L+
Serra Observatory	0.25 NW	Atik 414L+

Table I. List of instruments used for the observations. SCT is Schmidt-Cassegrain. R-C is Ritchey-Chrétien. DK is Dall-Kirkham. NW is Newton.

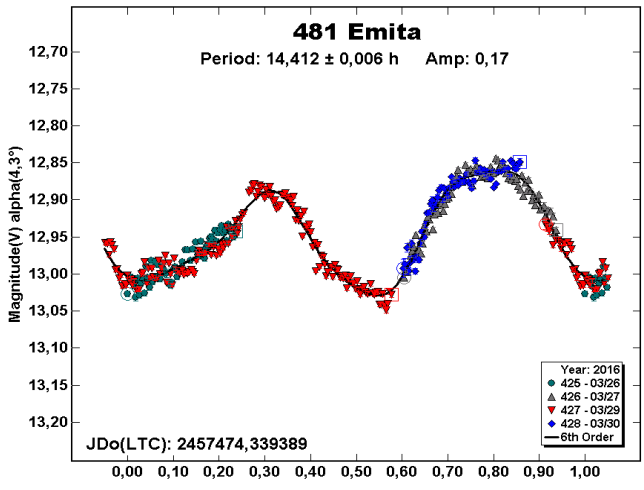
Table I shows the equipment at the observatories that participated in this work. We concentrated on asteroids with no reported period and those where the reported period was poorly established and needed confirmation. All the targets were selected from the Collaborative Asteroid Lightcurve (CALL) website at *http://www.minorplanet.info/call.html*, paying special attention to keeping the asteroid's magnitude within reach of the telescopes being used. We tried to observe asteroids at a phase angle of less than 14°, but this was not always possible. Table II lists the individual results along with the range of dates for the observations and the number of nights that observations were made.

Images were measured using *MPO Canopus* (Bdw Publishing) with a differential photometry technique. See Aznar *et al*. (2016) for details about the techniques used in this project.

381 Myrrha. The OBAS group observed this asteroid during two nights in 2016 May. Our analysis determined a period of 6.572 ± 0.001 h. This is consistent with the period reported by several observers, *e.g.*, Behrend (2015), who found a period of 6.57229 h and amplitude of 0.35 mag.

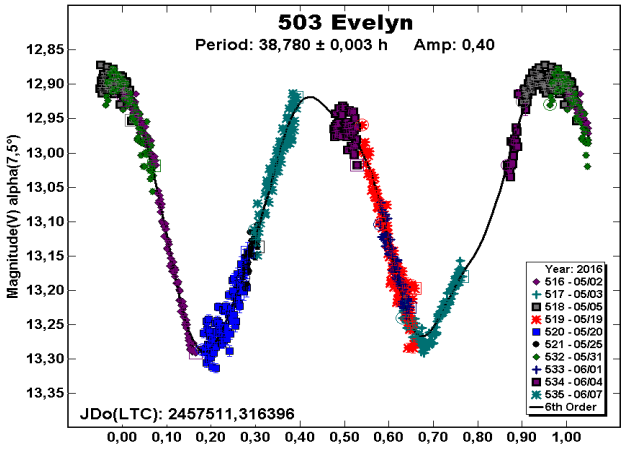


481 Emita. The OBAS group observed this asteroid during four nights in 2016 March. We obtained a rotation period of 14.412 ± 0.006 h and amplitude of 0.17 mag. This result is consistent the period of 14.35 h found by Denchev *et al*. (2000), but it differs from the 15.1 h reported by Behrend (2007).

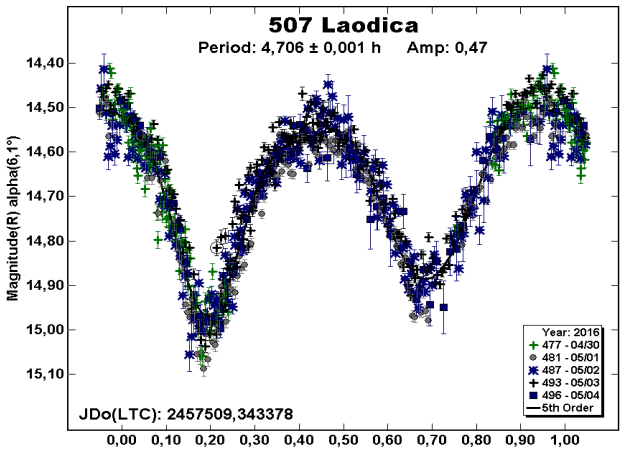


503 Evelyn. Previous results include Kamel (1999; 38.7 h, 0.5 mag), Fauerbach (2007, 38.7 h, 0.30 mag), and Behrend (2014,

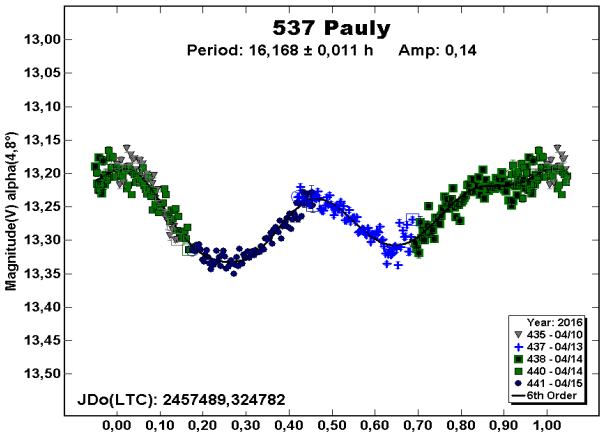
38.728 h, 0.30 mag). Based on observations from six nights, we found a period of 38.794 ± 0.009 h and amplitude of 0.40 mag.



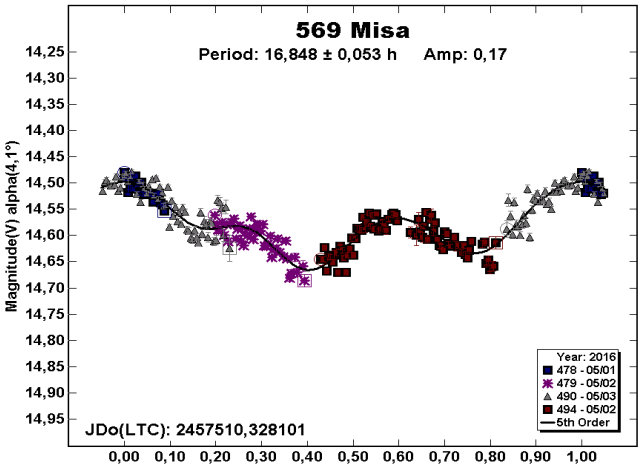
507 Laodica. Behrend (2001) found a period of 4.539 h and amplitude of 0.24 mag. Robinson (2002) found a period of 4.705 h with an amplitude of 0.22 mag. Warner (2011) found a period of 6.737 hours with an amplitude of 0.29 mag. Our analysis of data from five nights found a rotation period of 4.706 ± 0.001 h with an amplitude of 0.47 mag, which is consistent with Robinson.



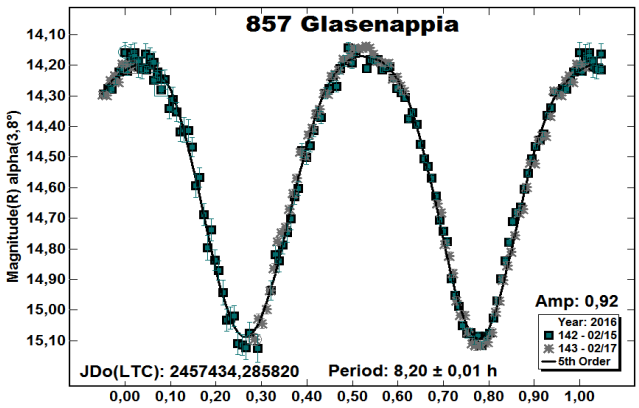
537 Pauly. The OBAS group observed this asteroid on five nights in 2016 April to get the complete lightcurve. We found a rotation period of 16.168 ± 0.011 h and amplitude of 0.14 magnitudes. This is consistent with the results from Barucci *et al.* (1992), who found a period 16.252 h and amplitude of 0.18 mag.



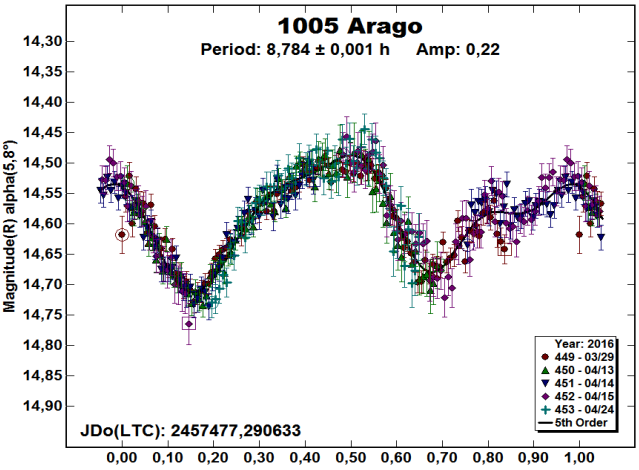
569 Misa. The OBAS group found a rotation period of 16.842 ± 0.053 h and amplitude of 0.17 mag based on observations on four nights. This result is different from the period of 13.52 h and amplitude of 0.25 mag reported by Behrend (2002).



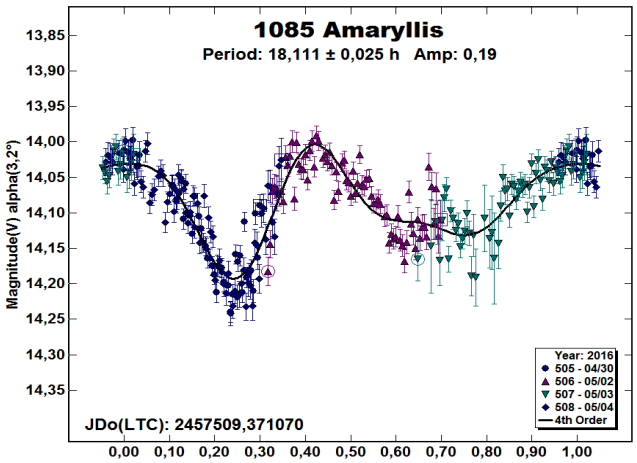
857 Glasenappia. Analysis of our data from three nights gives a rotation period of 8.20 ± 0.01 h and amplitude of 0.92 mag. The period agrees with the 8.20 h found by Behrend (2006), who reported an amplitude of 0.75 mag.



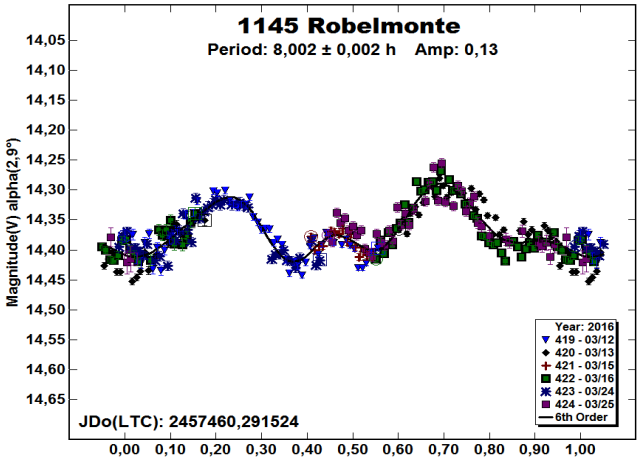
1005 Arago. Pozzoli (2002) found a period of 8.7819 h and amplitude of 0.22 mag. We found a rotation period of 8.784 ± 0.001 h and amplitude is 0.22 mag, which is identical to the earlier results.



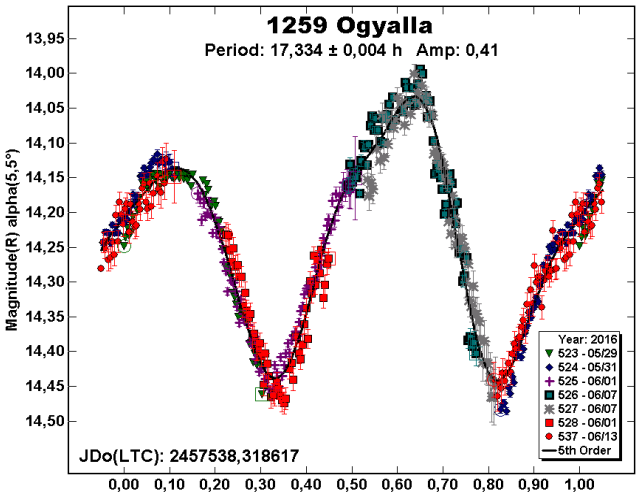
1085 Amaryllis. Using data from four nights, we found a rotation period of 18.111 ± 0.025 h. The lightcurve amplitude was 0.19 mag. This result is very similar to the one obtained by Behrend (2009) with a period of 18.2 h and amplitude of 0.20 mag.



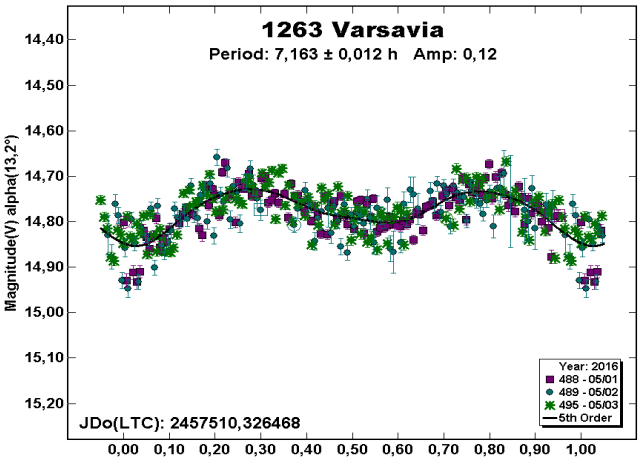
1145 Robelmonte. The OBAS group observed this asteroid on six nights in 2016 March. We found a period of 8.002 ± 0.002 h and amplitude of 0.13 mag. This differs from other results except those from Waszczak *et al.* (2015), who found a period of 7.582 ± 0.027 h and amplitude of 0.13 mag.



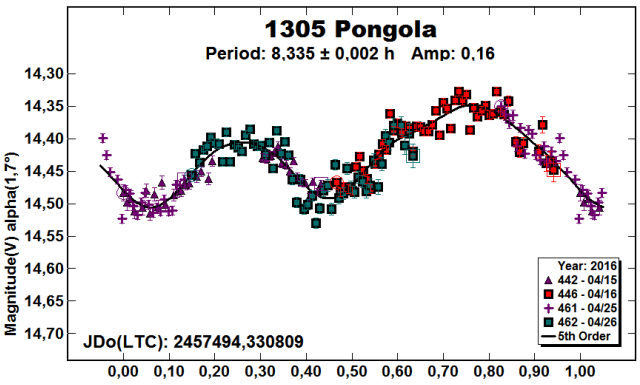
1259 Ogyalla.



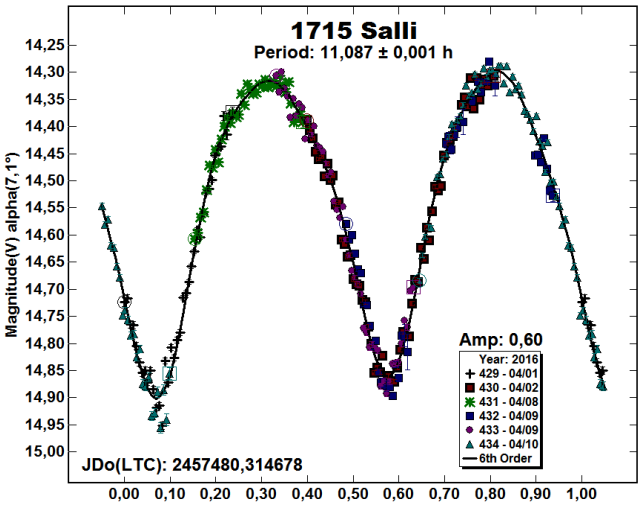
1263 Varsavia. Using data from three nights, we found a period of 7.163 ± 0.012 h and amplitude of 0.12 mag. This agrees with Warner and Stephens (2011; 7.163 h) and Wazczak *et al.* (2015; 7.165 h).



1305 Pongola. The OBAS group observed this asteroid on four nights in 2016 April. We obtained a rotation period of 8.335 ± 0.002 h and amplitude of 0.16 mag. Waszczak *et al.* (2015) found 8.0586 h and 0.17 mag.



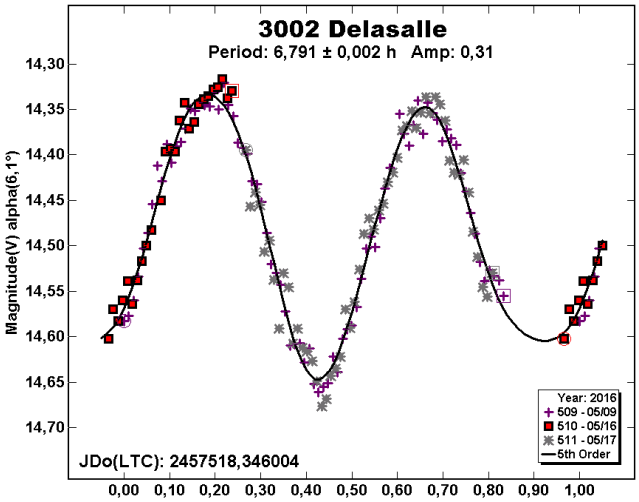
1715 Salli.



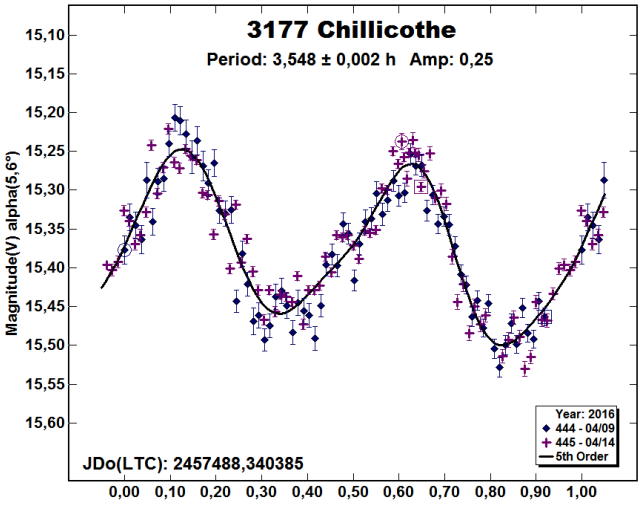
Waszczak *et al.* (2015) found a period of 11.1667 h and amplitude of 0.22 mag. We observed the asteroid on six nights during 2016

April. Our analysis determined a rotation period of 11.087 ± 0.001 h and amplitude 0.60 mag.

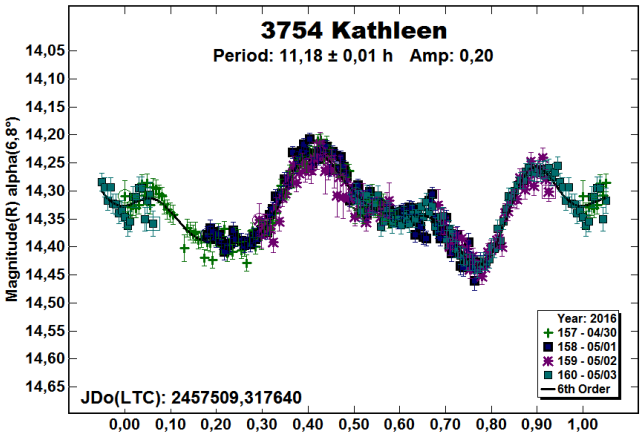
3002 Delasalle. Our analysis found a period of 6.791 ± 0.002 h and amplitude of 0.31 mag based on observations on three nights in 2016 May. The period differs a little from previous results, e.g., Waszczak *et al.* (2015; 6.5335 h, 0.39 mag)



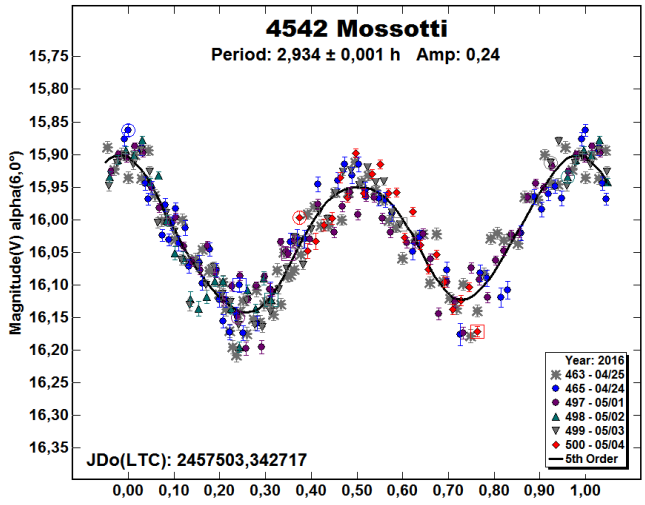
3177 Chillicothe. We observed this asteroid on two nights in 2016 April. Our analysis found a period of 3.548 ± 0.002 h and amplitude of 0.25 mag.



3754 Kathleen. This asteroid was discovered in 1931 by Clyde Tombaugh. The OBAS group observed it on four nights in 2016 April-May. We obtained a rotation period of 11.18 ± 0.01 h and amplitude of 0.29 mag. Torno *et al.* (2008) found a period of 11.2 h and amplitude of 0.13 mag. Behrend reported on the asteroid two times: 2004 (11.16 h) and 2005 (11.17 h).



4542 Mossotti. This asteroid was discovered in 1989 at Osservatorio San Vittore. The OBAS group observed it on six nights in 2016 April-May. We determined a rotation period of 2.934 ± 0.001 h and amplitude of 0.24 mag. The period is in good agreement with the 2.947 h found by Carb *et al*. (2009).



Acknowledgements

We would like to express our gratitude to Brian Warner for supporting the CALL web site and his suggestions made to the OBAS group.

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Number	Name	Date Range yy/mm/dd	Nights	Period (h)	Error (h)	Amp
381	Myrrha	2016/05/20 - 2016/05/25	2	6.572	0.001	0.30
481	Emita	2016/03/26 - 2016/03/30	4	14.412	0.006	0.17
503	Evelyn	2016/05/02 - 2016/05/25	6	38.780	0.003	0.40
507	Laodica	2016/04/30 - 2016/05/04	5	4.706	0.001	0.47
537	Pauly	2016/04/10 - 2016/04/15	5	16.168	0.011	0.14
569	Misa	2016/05/01 - 2016/05/03	4	16.848	0.053	0.17
857	Glasenappia	2016/02/15 - 2016/02/17	2	8.20	0.01	0.92
1005	Arago	2016/03/29 - 2016/04/24	5	8.784	0.001	0.22
1085	Amaryllis	2016/04/30 - 2016/05/04	4	18.111	0.025	0.19
1145	Robelmonte	2016/03/12 - 2016/03/25	6	8.002	0.002	0.13
1259	Ogyalla	2016/05/29 - 2016/06/13	7	17.334	0.004	0.41
1263	Varsavia	2016/05/01 - 2016/05/03	3	7.163	0.012	0.12
1305	Pongola	2016/04/15 - 2016/04/26	4	8.335	0.002	0.16
1715	Salli	2016/04/01 - 2016/04/10	6	11.087	0.001	0.60
3002	Delasalle	2016/05/09 - 2016/05/17	3	6.791	0.002	0.31
3177	Chillicothe	2016/04/09 - 2016/04/14	2	3.548	0.002	0.25
3754	Kathleen	2016/04/30 - 2016/05/03	4	11.18	0.01	0.20
4542	Mossotti	2016/04/25 - 2016/05/04	6	2.934	0.001	0.24

Table II. Dates of observation, number of nights, and derived periods/amplitudes.

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ASTEROIDS OBSERVED FROM CS3: 2016 APRIL - JUNE

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(Received: 11 July 2016)

CCD photometric observations of seven asteroids were obtained from the Center for Solar System Studies from 2016 April to June.

The Center for Solar System Studies "Trojan Station" (CS3, MPC U81) has two telescopes which are normally used in program asteroid family studies. During bright moon times, those targets are usually too dim to continue observations, so brighter targets are selected to keep the telescopes operating.

All images were made with a 0.4-m or a 0.35-m SCT using an FLI ML-Proline 1001E or FLI ML-Microline 1001E CCD camera. Images were unbinned with no filter and had master flats and darks applied. Image processing, measurement, and period analysis were done using *MPO Canopus* (Bdw Publishing), which incorporates the Fourier analysis algorithm (FALC) developed by Harris (Harris *et al*., 1989). Night-to-night calibration of the data (generally < ±0.05 mag) was done using field stars converted to approximate Cousins V magnitudes based on 2MASS J-K colors (Warner 2007a). The Comp Star Selector feature in *MPO Canopus* was used to limit the comparison stars to near solar color.

In the lightcurve plots, the "Reduced Magnitude" is Johnson R corrected to a unity distance by applying $-5*\log(r\Delta)$ to the measured sky magnitudes with r and Δ being respectively, the Sun-asteroid and the Earth-asteroid distances in AU. The magnitudes were normalized to the phase angle given in parentheses using $G = 0.15$.