

CCD ASTEROID PHOTOMETRY
FROM ETSCORN OBSERVATORY

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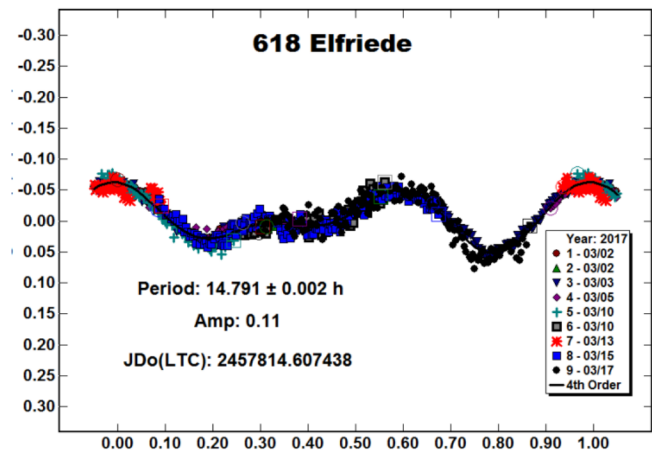
We provide lightcurves for six asteroids from the Spin/Shape Modeling Opportunities listed in the “Lightcurve Photometry Opportunities: 2017 January-March” article by Warner et al. (2017)

The asteroids for which we report results were selected from the list of shape/spin modeling (SSMO) opportunities given by Warner et al. (2017). We selected photometry opportunities based on asteroid brightness.

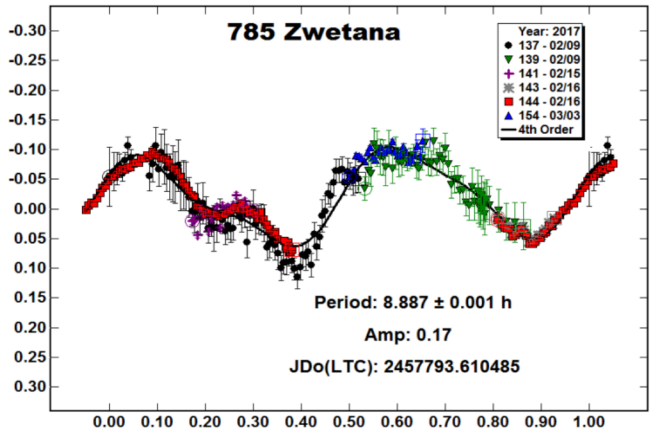
Our observations were obtained with three Celestron 0.35-m telescopes and SBIG CCD cameras at Etscorn Campus Observatory (Klinglesmith and Franco, 2016). The images were processed and calibrated using *MPO Canopus* 10.4.7.6 (Warner, 2015). The exposures were between 180 and 420 seconds through clear filters depending on the brightness of the asteroids. The multi-night data sets for each asteroid were combined with the FALC algorithm (Harris et al., 1989) within *MPO Canopus* to provide synodic periods for each asteroid.

Discovery information was obtained from the JPL small bodies node (JPL, 2017). The six asteroids were suggested as possible targets in order to derive their spin / shape models (Warner et al. 2017). Table I contains the observation circumstances and results. Table II is a compilation of the previously obtained lightcurves with their references.

618 Elfriede is a main-belt asteroid discovered by K. Lohnert at Heidelberg on 1906 Oct 17. It is also known as 1906 VZ. We observed it on seven nights between 2017 Mar 2-17 and obtained a synodic period of 14.791 ± 0.002 h and amplitude of 0.11 ± 0.03 mag.



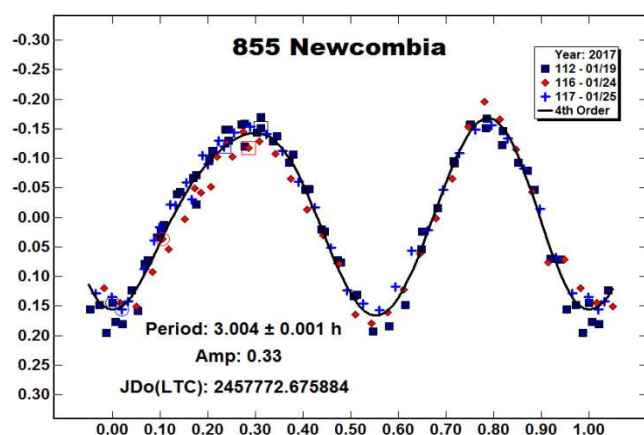
785 Zwetana is a main-belt asteroid discovered by A. Massinger at Heidelberg on 1914 Mar 30. It is also known as 1914 UN. We observed it on four nights between 2017 Feb 9 and Mar 3. We obtained a synodic period of 8.887 ± 0.001 h and amplitude of 0.17 ± 0.05 mag.



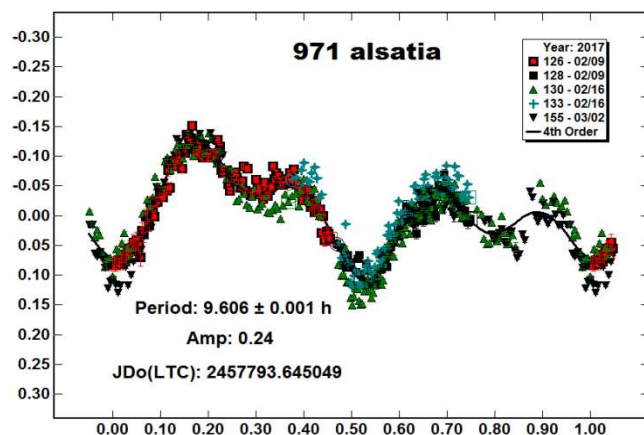
855 Newcomb is a main-belt asteroid discovered by S. Belyavskij on 1916 Apr 3. An independent discovery by 1916 Apr 28 by M. Wolf at Heidelberg was announced first. It is also known as 1916 ZP, 1935 SJ1, and 1938 KB. We observed it on three nights between 2017 Jan 19-25. We obtained a synodic period of 3.004 ± 0.001 h and amplitude of 0.33 ± 0.03 mag.

Number	Name	2017 mm/dd	Pts	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
618	Elfriede	03/02-03/17	962	5.2, 8.2	156	15	14.791	0.002	0.11	0.03	MB-O
785	Zwetana	02/09-03/03	309	9.0, 16.0	136	16	8.887	0.001	0.17	0.05	EUN
855	Newcomb	01/19-01/25	131	6.8, 8.3	112	14	3.004	0.001	0.33	0.05	MB-I
971	Alsatia	02/09-03/02	971	8.3, 12.2	142	16	9.606	0.001	0.24	0.05	EUN
1152	Pawona	01/08-02/01	1152	8.4, 2.8, 4.3	124	3	3.425	0.001	0.19	0.05	V
1602	Indiana	12/26-02/01	239	24.0, 8.8	143	5	2.601	0.001	0.15	0.03	FLOR

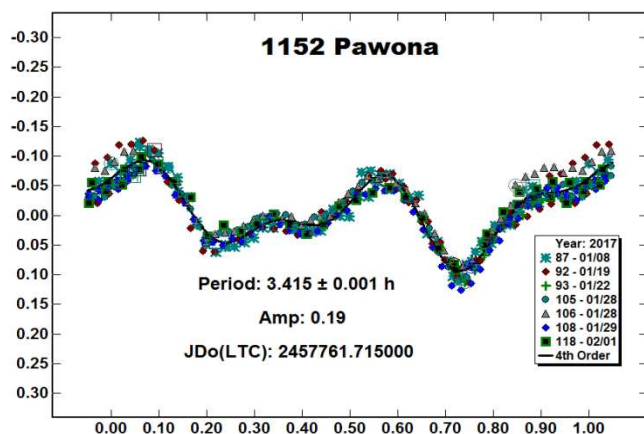
Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009). The initial observations for 1602 were in 2016 December.



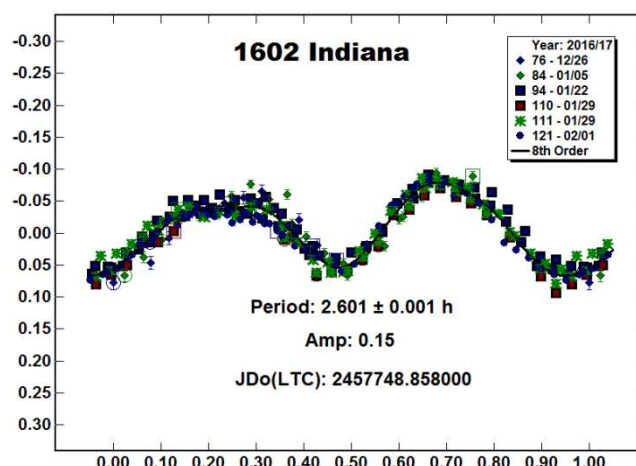
971 Alsatia is a main-belt asteroid discovered by A. Schaumasse at Nice on 1921 Nov 23. It is also known as 1921 LF, 1961 AA, and A908 UE. We observed it on three nights between 2017 Feb 9 and Mar 3. We obtained a synodic period of 9.906 ± 0.001 h and amplitude of 0.24 ± 0.05 mag.



1152 Powona is a main-belt asteroid discovered by K. Reinmuth at Heidelberg on 1930 Jan 8. It is also known as 1930 AD, 1926 AK, 1942 GE1, 1942 GY, 1969 MD, and A924 QA. We observed it on six nights between 2017 Jan 8 and Feb 1. We obtained a synodic period of 3.415 ± 0.001 h and amplitude of 0.19 ± 0.05 mag.



1602 Indiana is a main-belt asteroid discovered by the Indiana Asteroid Program on 1950 Mar 14 at Goethe Link Observatory. It is also known as 1950 GF. We observed it on five nights between 2016 Dec 26 and 2017 Feb 1 and obtained a synodic period of 2.601 ± 0.001 h and amplitude of 0.15 ± 0.03 mag.



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Number	Name	References	Date	L _{PAB}	B _{PAB}	Phase	Period	Amp
618	Elfriede	This paper	2017 Mar 10	156	15	6.6	14.7910	0.11
		Warner 2006	2006 May 22	183	19	15.9	14.8010	0.15
		Behrend 2004	2004 Dec 08	119	0	12.8	14.7500	0.17
		Carbo 2009	2008 Sep 09	340	-17	7.1	14.8500	0.12
		Marciniak 2015	2014 Oct 11	9	-21	8.6	14.8000	
		Aznar Macias 2016	2015 Dec 06	92	-8	7.1	14.7950	0.14
785	Zwetana	This paper	2017 Mar 20	139	16	21.7	8.8870	0.17
		Behrend 2005	2005 Apr 23	11	13	8.4	8.8882	0.18
		Shepard 2008	2005 May 11	211	14	18.0	8.8882	0.2
		Warner 2013	2013 Mar 04	156	18	3.5	8.8850	0.18
		Behrend 2015	2015 Oct 31	40	-9	3.5	8.8900	0.16
855	Newcombia	This paper	2017 Jan 22	112	14	7.5	3.0040	0.33
		Cooney 2007	2004 Oct 14	9	-1	5.9	3.0030	0.35
		Klinglesmith 2014	2014 Apr 01	198	0	4.3	3.0030	0.33
		Stephens 2014	2014 Mar 16	197	2	12.9	3.0020	0.41
		Klinglesmith 2016	2015 Nov 09	21	2	11.2	3.0040	0.41
971	Alsatia	This paper	2017 Mar 20	145	16	17.6	9.6060	0.24
		Stephens 2000	2000 Apr 03	167	18	14.3	6.8100	0.17
		Behrend 2005	2005 May 06	237	8	5.8	9.6000	0.21
		Warner 2012	2011 Dec 10	34	-11	20.3	9.6140	0.29
		Melton 2012	2011 Nov 04	31	-14	9.1	9.6100	0.21
1152	Pawona	This paper	2017 Jan 15	124	3	5.1	3.4150	0.19
		Koff 2002	2002 Nov 13	220	-4	3.7	3.4180	0.16
		Behrend 2006	2006 Apr 01	172	-3	10.0	3.4154	0.26
		Behrend 2011	2011 Sep 13	337	1	6.4	3.4150	0.24
1602	Indiana	This paper	2017 Jan 13	142	5	22.1	2.6010	0.15
		Fleenor 2007	2007 Mar 06	165	6	4.0	2.6100	0.12
		Pietschnig 2011web	2007 Apr 02	167	6	15.6	2.5700	0.19
		Vander Haagen 2007	2007 Apr 06	168	6	17.4	2.6010	0.17

Table II: Summation of solar bisector angles, phase angles, periods and amplitudes for the asteroids discussed in this paper.

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