

Using the shallower event of 0.05 mag and

$$Ds/Dp = \sqrt{1 - 10^{0.4m}}$$

where m is the depth of the shallower event in magnitudes, gives $Ds/Dp \geq 0.22 \pm 0.02$. Since neither event was total, the estimate is a minimum value and could be larger.

Outside the events, the lightcurve was displayed a faint signal of a third period. Petr Parvec (private communication) looked at the data set and found a possible third period of 6.2847 h. This might possibly belong to a third body.

Each observing run covered about eight hours, sufficient to cover most of the orbital period. It's likely that the 2012 Warner observations found the orbital period which was reported as the primary period. The 2008 observations might have been a 2:1 alias of the primary period.

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SPIN-SHAPE MODEL LIGHTCURVES

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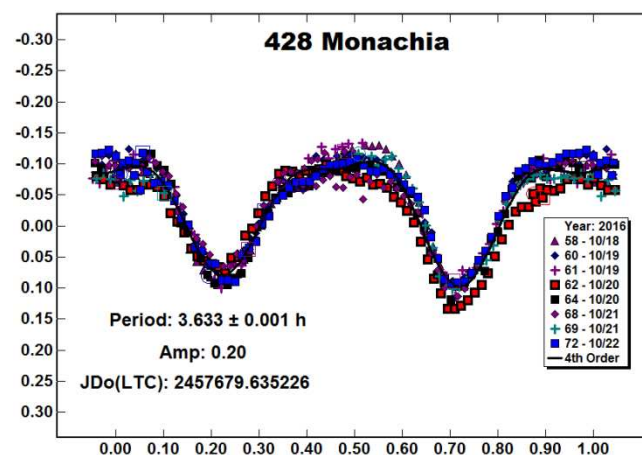
We obtained lightcurves for five asteroids from the Spin/Shape Modeling Opportunities listed in the "Lightcurve Photometry Opportunities: 2016 October-December" article by Warner et al. (2016).

The asteroids for which we report results were selected from the list of shape/spin modeling (SSMO) opportunities given by Warner et al. (2016). We selected photometry opportunities based on asteroid brightness and the modeling opportunities based on known periods of less than eight hours. This allowed the possibility of at least one cycle to be obtained per night provided we could observe the object all night.

Our observations were obtained with three Celestron 0.35-m telescopes and SBIG CCD cameras at Etsorn 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, 2016). The five asteroids were suggested as possible targets in order to derive their spin / shape models (Warner et al. 2016). Table I contains the observation circumstances and results. Table II is a compilation of the previously obtained lightcurves with references. The data for observations other than in this paper were obtained from the Asteroid Lightcurve Data Exchange Format (ALCDEF) web site (<http://www.alcdef.org>).

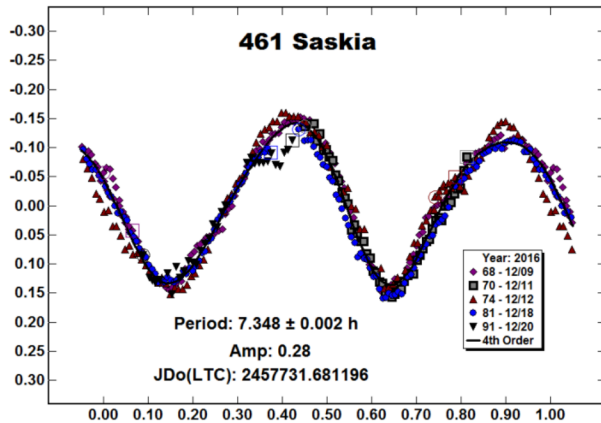
428 *Monachia* is a main-belt asteroid discovered by W. Villiger at Munich on 1897 Nov 18. It is also known as 1897 DK. We observed it on five nights between 2016 Oct 18-22. We obtained a synodic period of 3.622 ± 0.001 h and amplitude of 0.20 mag.



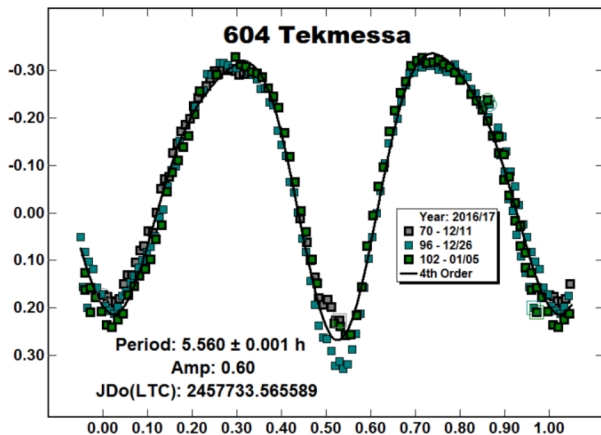
Number	Name	20yy/mm/dd	Pts	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
428	Monachia	16/10/18-16/10/22	515	7.0, 9.5	15	0	3.633	0.001	0.20	0.05	FLOR
461	Saskia	16/12/09-16/12/20	475	5.3, 0.9	89	-2	7.348	0.002	0.28	0.03	MB-O
604	Tekmessa	16/12/11-17/01/05	244	9.5, 17.6	60	5	5.560	0.001	0.60	0.01	MB-O
1777	Gehrels	16/12/18-17/01/08	260	3.0, 11.7	81	4	2.836	0.001	0.22	0.05	MB-M
1848	Delvaux	16/10/04-16/10/20	129	3.9, 10.0	2	1	3.639	0.001	0.64	0.10	KOR

Table I. Observing circumstances and results. Pts is the number of data points used in the analysis. The solar phase angle values are for the start and end of the single night of observations. L_{PAB} and B_{PAB} are the average phase angle bisector longitude and latitude (see Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009).

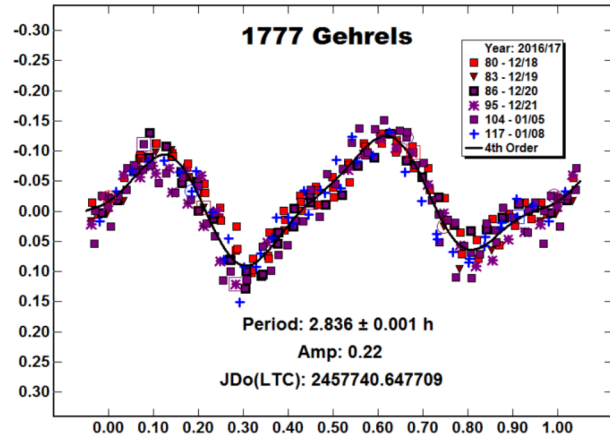
461 Saskia is a main-belt asteroid discovered by M. Wolf at Heidelberg on 1900 Oct 22. It is also known as 1900 FP. We observed it on five nights between 2016 Dec 9-20. We obtained a synodic period of 7.348 ± 0.002 h and amplitude of 0.28 mag.



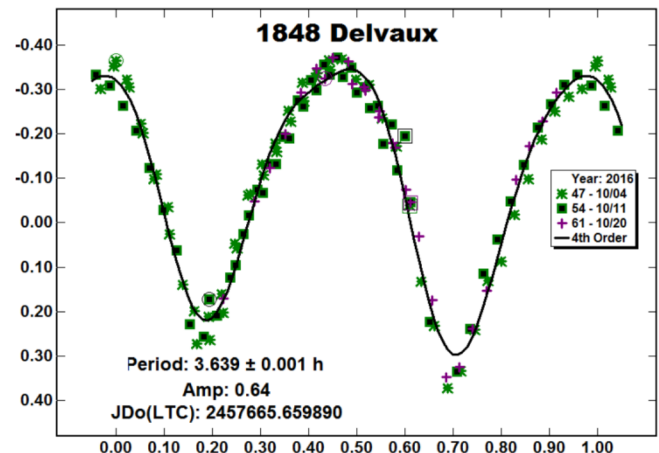
604 Tekmessa is a main-belt asteroid discovered by J.H. Metcalf at Taunton on 1906 Feb 16. It is also known as 1906 TK. We observed it on three nights between 2016 Dec 11 and 2017 Jan 5. We obtained a synodic period of 5.560 ± 0.001 h and amplitude of 0.60 mag.



1777 Gehrels is a main-belt asteroid discovered by PLS at Palomar on 1960 Sep 24. It is also known as 4007 P-L. We observed it on six nights between 2016 Dec 18 and 2017 Jan 8. We obtained a synodic period of 2.836 ± 0.001 h and amplitude of 0.22 mag.



1848 Delvaux is a main-belt asteroid discovered by E. Delporte at Uccle on 1933 Aug 18. We observed it on three nights between 2016 Oct 4-20. We obtained a synodic period of 2.639 ± 0.001 h and amplitude of 0.64 mag.



Acknowledgements

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Number	Name	References	Date	L_{pab}	B_{pab}	Phase	Period	Amp
428	Monachia	This paper	2016 Oct 20	15	0	8.3	3.633	0.20
		Wisniewski 1997	1998 Sep 15	22	-1	19.6	3.63384	0.26
		Behrend 2007	2007 Jan 21	124	8	5.2	3.6335	0.29
		Kryszczyńska 2012	2009 Oct 31	19	1	12.7	3.6342	0.29
		Warner 2014	2014 Mar 18	127	-1	22	3.633	0.34
		Behrend 2016	2016 Oct 04	14	-1	2	3.6335	0.18
461	Saskia	This paper	2016 Dec 14	89	-2	1.6	7.348	0.28
		Buchheim 2006	2006 Jan 08	96	-2	5.3	7.34	0.25
		Behrend 2007	2007 Apr 20	197	1	4.8	7.348	0.36
		Klinglesmith 2013	2013 May 12	230	2	0.7	7.349	0.26
604	Tekmessa	This paper	2016 Dec 24	60	5	14.2	5.560	0.60
		Behrend 2006	2006 Jan 15	80	5	14.6	5.55959	0.52
		Baker 2011	2010 Sep 17	3	1	4.2	5.5596	0.49
		Klinglesmith 2013	2013 May 17	190	0	12.4	5.560	0.49
1777	Gehrels	This paper	2016 Dec 28	81	4	7.2	2.836	0.22
		Wisniewski 1997	1990 Nov05	29	3	6.5	2.840	0.27
		Stephens 2005	2005 Mar 12	169	-1	1.3	2.8358	0.26
		Behrend 2005	2005 Mar 12	169	-1	1.3	2.837	0.24
		Behrend 2007	2007 Nov 24	27	3	14.8	2.83552	0.26
		Behrend 2010	2010 Jul 09	252	-4	14.8	2.83	0.21
		Pravec 2005	2005 Mar 12	169	-1	1.3	2.8356	0.23
		Pravec 1990	1990 Nov 05	29	3	6.5	2.8356	0.21
1848	Delvaux	This paper	2016 Oct 12	2	1	7.1	3.639	0.64
		Behrend 2004	2004 Feb 15	140	0	2.2	3.638	0.62
		Slivan 2008	2003 Mar 19	140	0	13.8	3.639	0.68
		Behrend 2011	2011 Oct 15	350	1	12.5	3.65	0.69
		Arredondo 2014	2014 Mar 04	163	0	0.1	3.639	0.57

Table II. Previous results for the SSMO asteroids observed for this paper. The date is the approximate mid-date of the observing run as reported in the respective papers.

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