

ASTEROIDS OBSERVED FROM CS3: 2018 APRIL - JUNE

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CCD photometric observations of 8 main-belt asteroids were obtained from the Center for Solar System Studies from 2018 April to June.

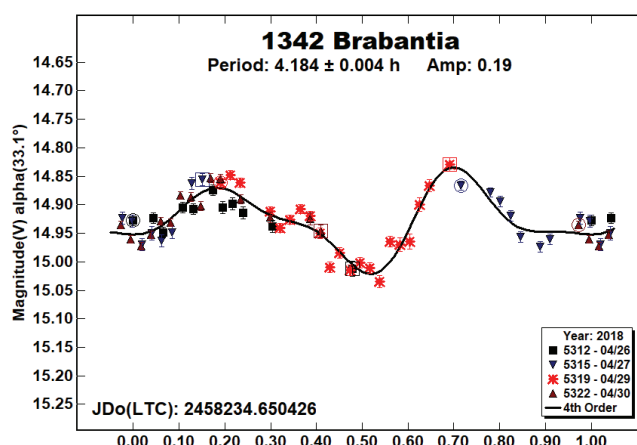
The Center for Solar System Studies “Trojan Station” (CS3, MPC U81) has two telescopes which are normally used in program asteroid family studies such as MBAs, Jovian Trojans and Hildas. During the 2nd quarter of 2018 the targets which are normally studied were either out of season, or the Moon was too close. In these cases targets of opportunity amongst the main-belt families were selected.

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 (generally $< \pm 0.05$ mag) was done using field stars from the CMC-15 catalog. The Comp Star Selector feature in *MPO Canopus* was used to limit the comparison stars to near solar color.

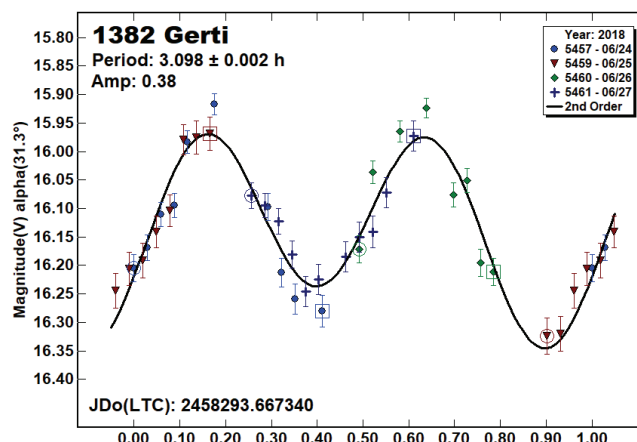
In the lightcurve plots, the “Reduced Magnitude” is Johnson V corrected to a unity distance by applying $-5 \cdot \log(r\Delta)$ to the measured sky magnitudes with r and Δ being, respectively, the Sun-asteroid and the Earth-asteroid distances in AU. The magnitudes were normalized to the phase angle given in parentheses using $G = 0.15$. The X-axis rotational phase ranges from -0.05 to 1.05. The amplitude indicated in the plots (e.g. Amp. 0.20) is the amplitude of the Fourier model curve and not necessarily the adopted amplitude of the lightcurve.

For brevity, only some of the previously reported rotational periods may be referenced. A complete list is available at the lightcurve database (LCDB; Warner et al., 2009).

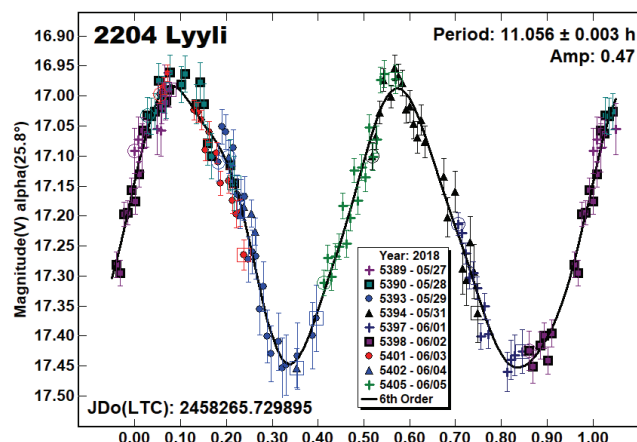
1342 Brabantia. This Phocaea family member was studied several times in the past. Behrend (2018), Franco et al. (2011, 2018) and Owings (2011) each reported periods near 4.18 h. This result is in good agreement with those results.



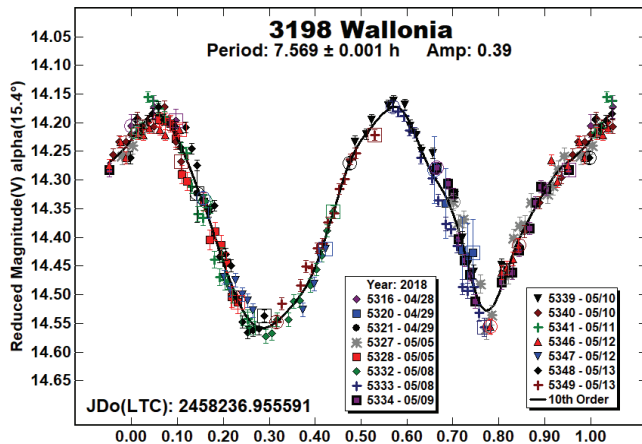
1382 Gerti. This member of the Flora family has been studied several times in the past and has a sidereal period of 3.081545 h and pole determination (Hanas et al. 2011). The result found this year is consistent with those findings.



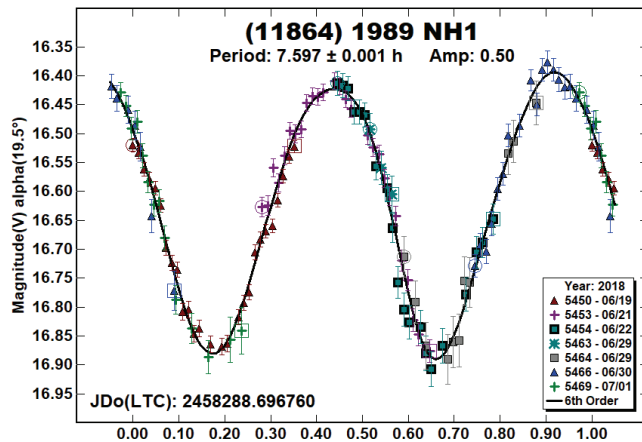
2204 Lyyli. Warner (2010, 2016) twice determine rotational periods near 11.06 h for this Mars Crosser. This year's result is in good agreement with those findings.



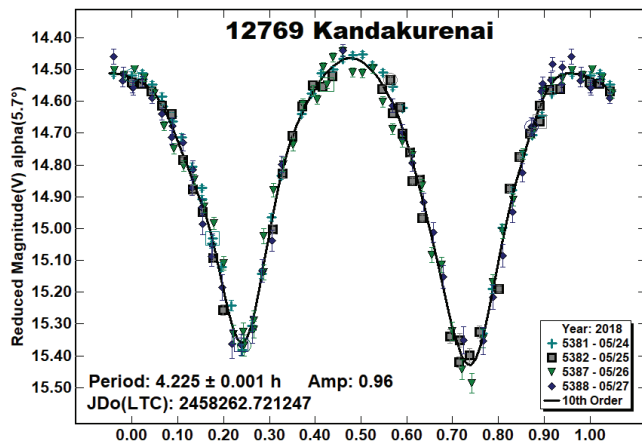
3198 Wallonia. Behrend (2018) and Warner (2008) reported periods near 7.6 h for this Mars Crosser. This year's finding is in good agreement with those results.



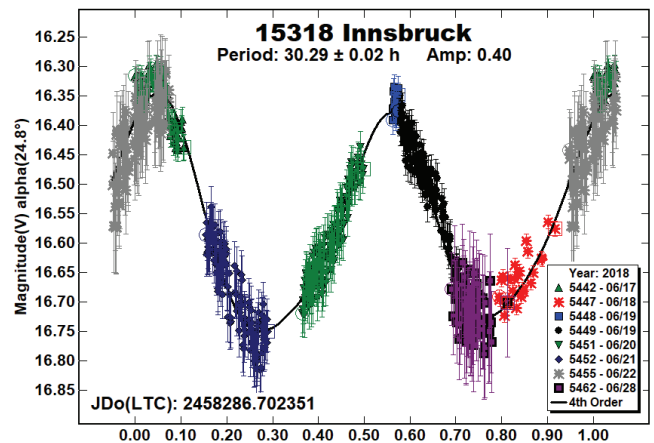
(11864) 1989 NH1. Waszczak et al. (2015) reported a period of 7.597 h using data obtained from the Palomar Transient Factory Survey. This result agrees with that finding.



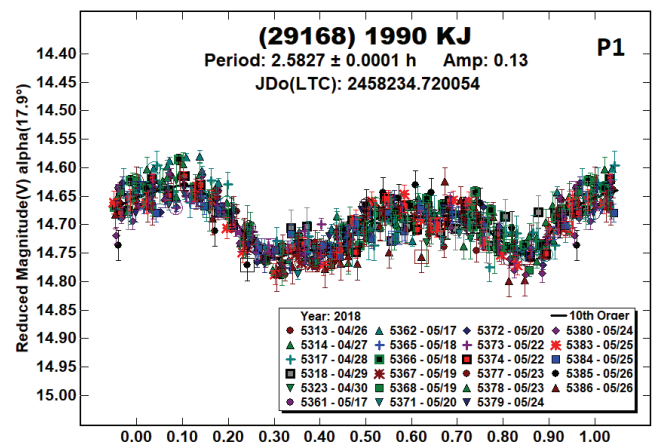
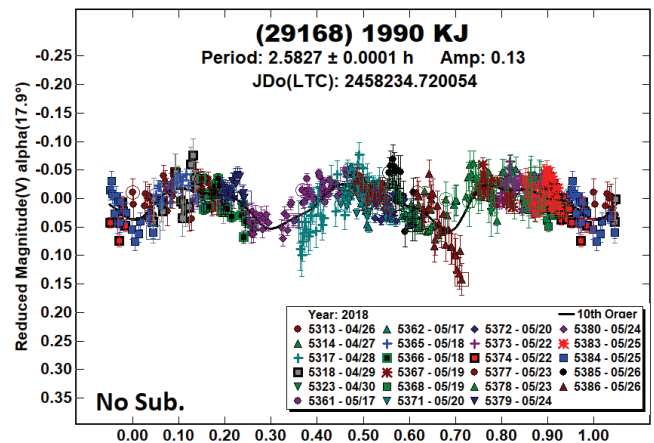
12769 Kandakurenai. Using data obtained from the Palomar Transient Factory Survey, Waszczak et al. (2015) reported a period of 4.222 h. This result is in good agreement.

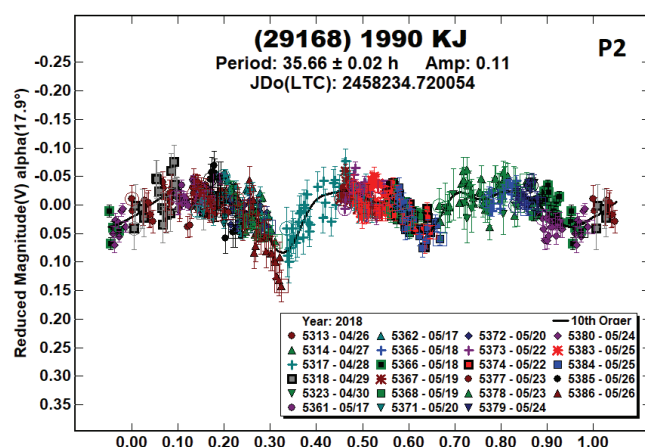


15318 Innsbruck. No entry was found in the lightcurve database (LCDB; Warner et al., 2009) for this Phocaea family member.



(29168) 1990 KJ. Pravec (2018) reported this member of the Phocaea family as a suspected binary asteroid with a primary rotation of 2.587247 h and an orbital period of 34.4 h from the Photometric Survey for Asynchronous Binary Asteroids. Observations this year spanned a month. The raw lightcurve ("No Sub." Plot) showed what appeared to be a couple of attenuation events. The dual period analysis found a primary lightcurve of $P_1 = 2.5827 \pm 0.0001$ h, $A_1 = 0.13 \pm 0.01$ mag ("P1" plot). As suspected, subtracting this lightcurve from the data set and doing a period search found a solution that showed what seems to be *mutual events* (occultations and/or eclipses) due to a satellite ("P2" plot). The lightcurve has a period of $P_2 = 35.66 \pm 0.02$ h, $A_2 = 0.20$ mag. The data for this possible satellite was sent to Petr Pravec for analysis and proved to be inconclusive, so it remains a suspected binary. A good opportunity for follow up is in 2019 November.





Acknowledgements

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Number	Name	mm/dd	Pts	Phase	LPAB	BPAB	Period	P.E.	Amp	A.E.	Grp
1342	Brabantia	04/26-04/30	61	33.1, 33.3	147	-13	4.184	0.004	0.19	0.01	PHO
1382	Gerti	06/24-06/27	39	31.3, 31.5	207	-1	3.098	0.002	0.38	0.05	FLOR
2204	Lyyli	05/27-06/05	135	25.8, 25.3	171	9	11.056	0.003	0.04	0.03	MC
3198	Wallonia	04/28-05/13	204	15.5, 8.8	245	10	7.569	0.001	0.39	0.02	MC
11864	1989 NH1	06/19-07/01	124	19.5, 24.6	241	6	7.597	0.001	0.50	0.02	FLOR
12769	Kandakurenai	05/24-05/27	178	5.7, 5.9	243	8	4.225	0.001	0.96	0.02	FLOR
15318	Innsbruck	06/17-06/28	655	24.8, 27.4	228	20	30.29	0.02	0.4	0.03	PHO
29168	1990 KJ	04/26-04/30	189	17.9, 17.4	225	28	2.5827	0.0001	0.13	0.03	PHO

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle values are for the first and last date. LPAB and BPAB 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).