COLLABORATIVE ASTEROID PHOTOMETRY FROM UAI: 2020 JANUARY-MARCH

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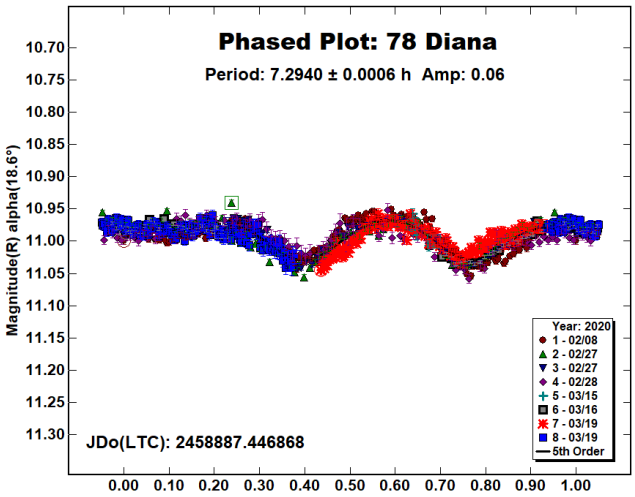
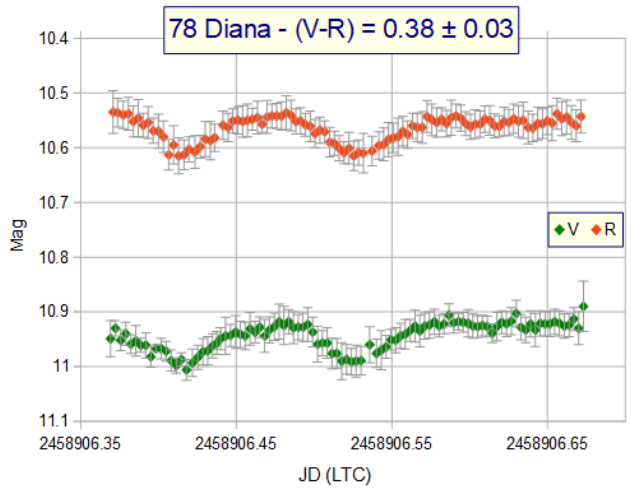
Photometric observations of eight main-belt and one near-Earth asteroid were made in order to acquire lightcurves for shape/spin axis models. The synodic period and lightcurve amplitude were found for 78 Diana: 7.2940 ± 0.0006 h, 0.06 mag; 81 Terpsichore: 10.946 ± 0.002 h, 0.14 mag; 118 Peitho: 7.8066 ± 0.0006 h, 0.23 mag; 755 Quintilla: 4.550 ± 0.001 h, 0.04 mag; 782 Montefiore: 4.0726 ± 0.0002 h, 0.51 mag; 1052 Belgica: 2.7094 ± 0.0001 h, 0.08 mag; 3998 Tezuka: 3.08 ± 0.01 h, 0.49 mag; 7132 Casulli: 3.5238 ± 0.0002 h, 0.14 mag; (52768) 1998 OR2: 4.111 ± 0.001 h, 0.30 mag. We also confirmed the binary nature of the asteroid 1052 Belgica and detected the binary nature of the asteroid 7132 Casulli.

Collaborative asteroid photometry was made inside the Italian Amateur Astronomers Union (UAI; 2020) group. The targets were selected mainly in order to acquire lightcurves for shape/spin axis models. The CCD observations were made in 2020 January-March using the instrumentation described in Table I. Lightcurve analysis was performed at the Balzaretto Observatory with *MPO Canopus* (Warner, 2016). All the images were calibrated with dark and flat frames and converted to R magnitudes using solar-colored field stars from the CMC15 catalogue distributed with *MPO Canopus*. Table II shows the observing circumstances and results.

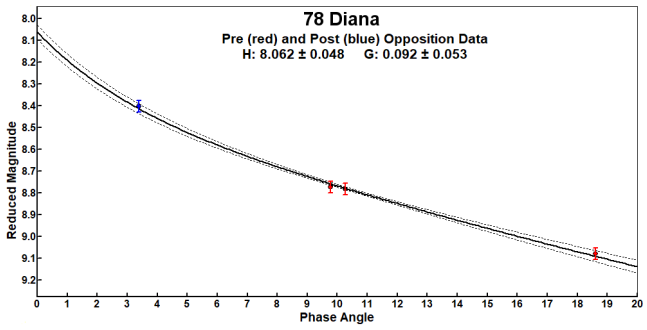
78 Diana is a Ch-type (Bus & Binzel, 2002) middle main-belt asteroid discovered on 1863 March 15 by R. Luther at Dusseldorf. Collaborative observations were made over five nights. DSFTA (2020) on 2020 February 27 acquired images in the V and R bands. This allowed us to determine the color index (V-R) = 0.38 ± 0.03 mag.



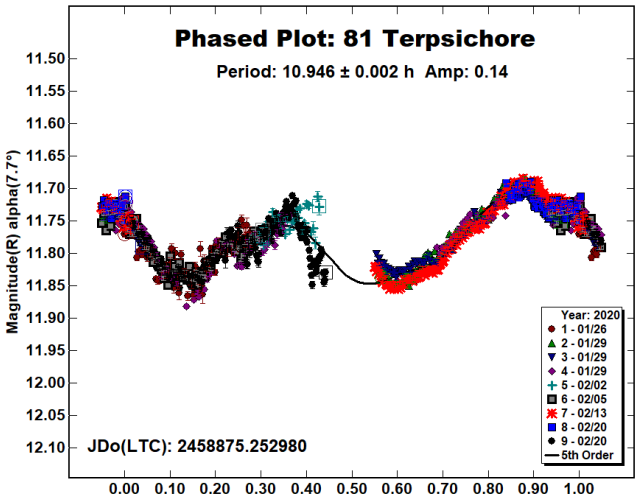
The period analysis shows a synodic period of $P = 7.2940 \pm 0.0006$ h with an amplitude $A = 0.06 \pm 0.03$ mag. The period is close to the previously published results in the asteroid lightcurve database (LCDB; Warner et al., 2009).



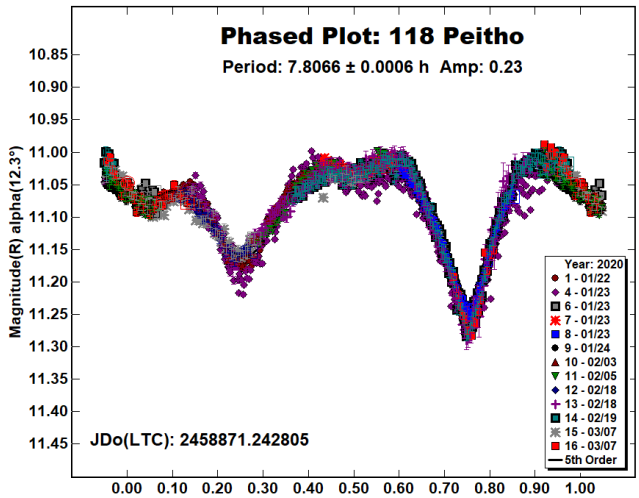
For each lightcurve, we measured the half peak-to-peak R mag and derived the V mag by adding the color index (V-R) = 0.38, previously determined. Using the H-G Calculator function of *MPO Canopus*, we derived $H = 8.06 \pm 0.05$ mag and $G = 0.09 \pm 0.05$. These values are close to results found in the LCDB.



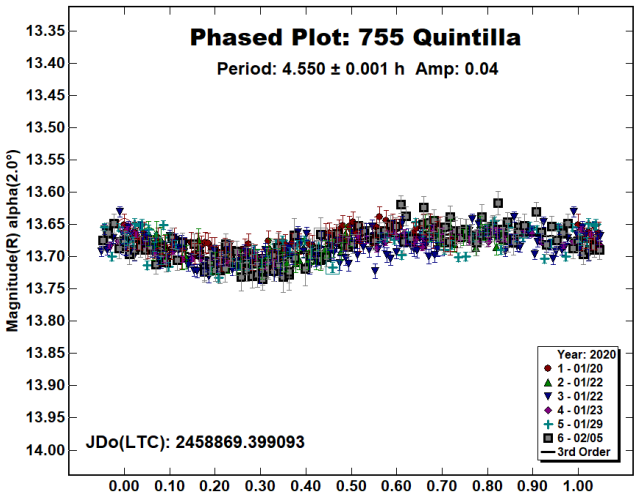
81 Terpsichore is a Cb-type (Bus & Binzel, 2002) outer main-belt asteroid discovered on 1864 September 30 by E. W. Tempel at Marseille. Collaborative observations were made over six nights. We found a synodic period of P = 10.946 ± 0.002 h with an amplitude A = 0.14 ± 0.03 mag. The period is close to the previously published results in the LCDB (Warner et al., 2009).



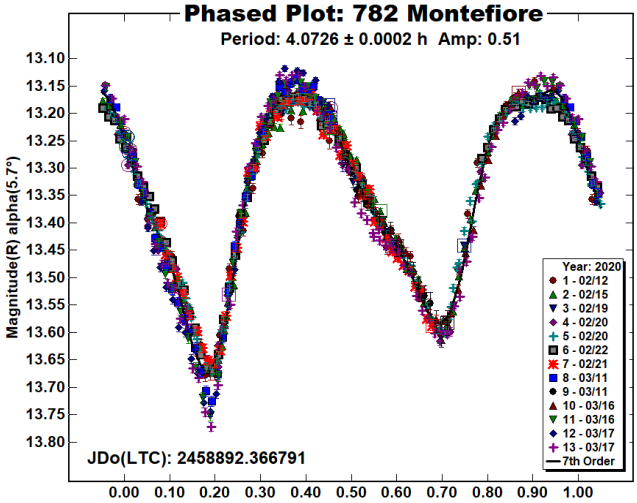
118 Peitho is an S-type (Bus & Binzel, 2002) inner main-belt asteroid discovered on 1872 March 15 by R. Luther at Dusseldorf. Collaborative observations were made over seven nights. We found a synodic period of P = 7.8066 ± 0.0006 h with an amplitude A = 0.23 ± 0.04 mag. The period is close to the previously published results in the asteroid lightcurve database (Warner et al., 2009).



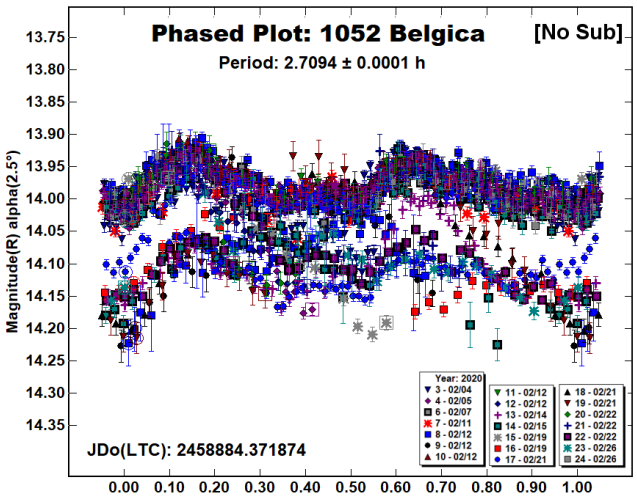
755 Quintilla is an M-type outer main-belt asteroid discovered on 1908 April 6 by J. H. Metcalf at Taunton. Collaborative observations were made over five nights. We found a synodic period of P = 4.550 ± 0.001 h with a low amplitude A = 0.04 ± 0.03 mag. The period is close to the previously published results in the asteroid lightcurve database (LCDB; Warner et al., 2009).

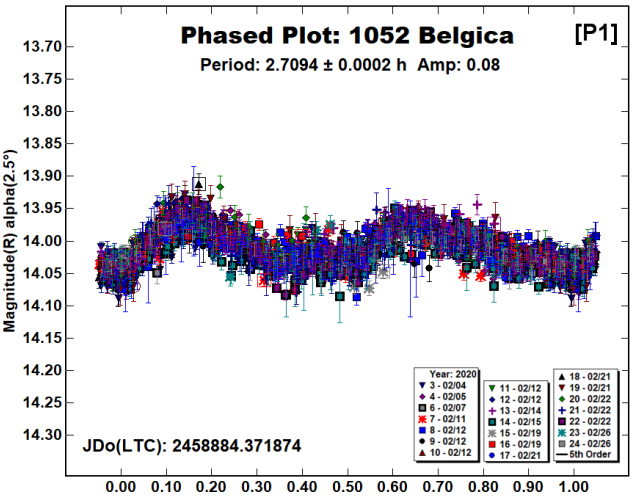


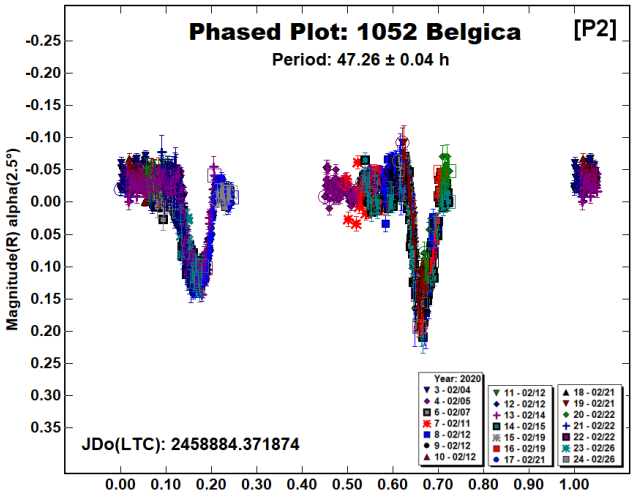
782 Montefiore is a Sl-type (Bus & Binzel, 2002) member of the Flora family; it was discovered on 1914 March 18 by J. Palisa at Vienna. Collaborative observations were made over nine nights. We found a synodic period of P = 4.0726 ± 0.0002 h with an amplitude A = 0.51 ± 0.05 mag. The period is close to the previously published results in the asteroid lightcurve database (LCDB; Warner et al., 2009).



1052 Belgica is an S-type (Bus & Binzel, 2002) member of the Flora family; was discovered on 1925 November 15 by E. Delporte at Uccle. This asteroid is a binary system as reported by Franco et al. (2013). Collaborative observations were made over twelve nights.



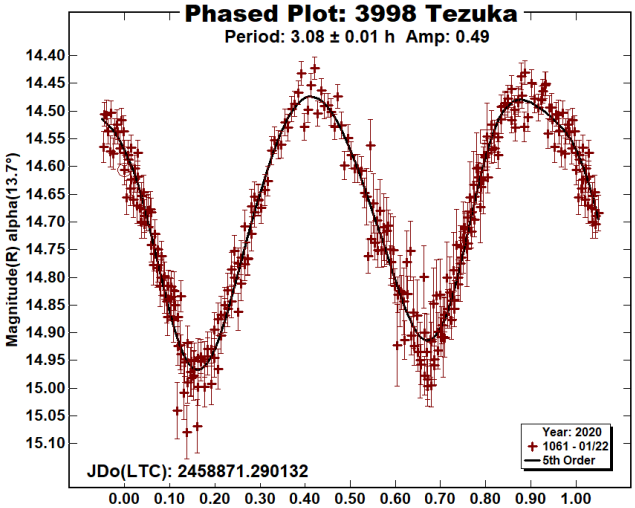




We found a primary synodic rotational period of $P1 = 2.7094 \pm 0.0001$ h with an amplitude $A1 = 0.08 \pm 0.04$ mag and orbital period $P_{ORB} = 47.26 \pm 0.04$ h. Mutual eclipse/occultation events that are 0.16 to 0.28 mag deep gives a lower limit to the secondary-to-primary mean-diameter ratio of $Ds/Dp \geq 0.34 \pm 0.04$. All these results are consistent with those previously published by Franco et. al. (2013).

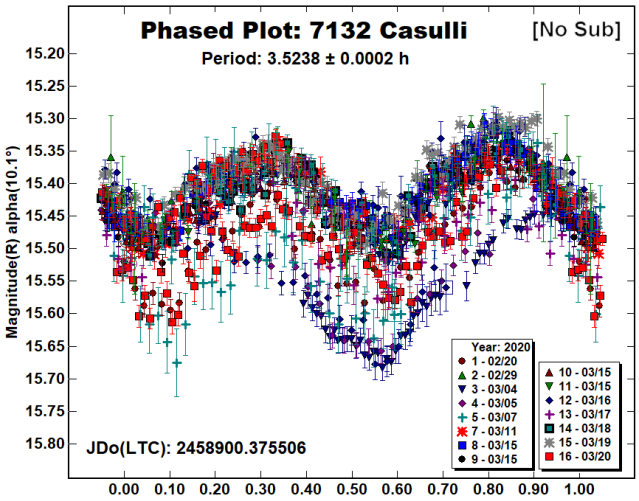
3998 Tezuka is a medium albedo inner main-belt asteroid discovered on 1989 January 1 by T. Kojima at Chiyoda. This asteroid was observed at DSFTA (2020) on 2020 January 22 in the same field of the asteroid 118 Peitho.

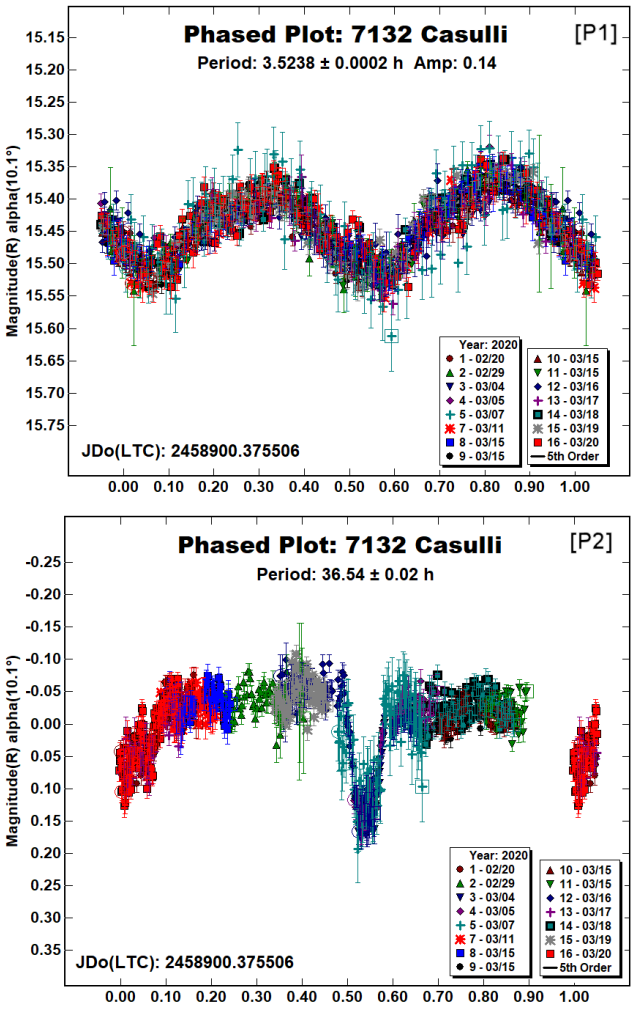
We found a synodic period of $P = 3.08 \pm 0.01$ h with an amplitude $A = 0.49 \pm 0.04$ mag. The period is close to the previously published result by Omae et al. (2016).



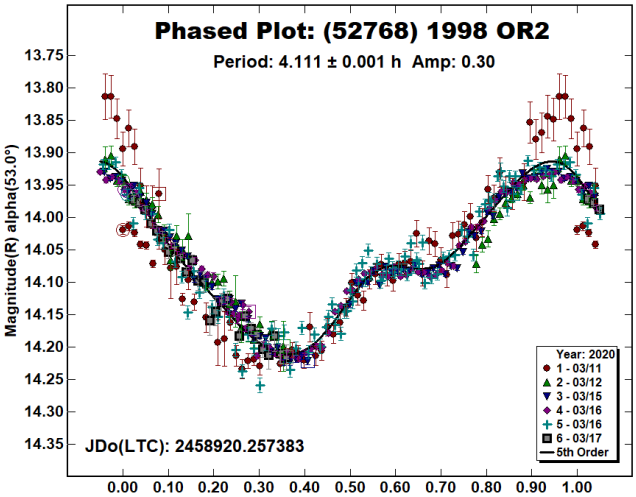
7132 Casulli is a low albedo inner main-belt asteroid discovered on 1993 September 17 by A. Vagnozzi at Stroncone. Collaborative observations were made over twelve nights. Some attenuation events made us hypothesize it was a binary system, as suspected by Behrend (2013), intensifying our observing sessions in order to fix the orbital period of the satellite.

We found a primary synodic rotational period of $P_1 = 3.5238 \pm 0.0002$ h with an amplitude $A1 = 0.14 \pm 0.04$ mag and orbital period $P_{ORB} = 36.54 \pm 0.02$ h. Mutual eclipse/occultation events that are 0.11 to 0.16 mag deep gives a lower limit to the secondary-to-primary mean-diameter ratio of $Ds/Dp \geq 0.21 \pm 0.04$. The new binary system was announced through the ATel 13590 (Franco et. al., 2020).





(52768) 1998 OR2 is an Amor near-Earth asteroid classified as Potentially Hazardous Asteroid (PHA); it was discovered on 1998 July 24 by NEAT at Haleakala. Collaborative observations were made over five nights during the approach phase to Earth. We found a synodic period of $P = 4.111 \pm 0.001$ h with an amplitude $A = 0.30 \pm 0.05$ mag. The period is close to the previously published result by Koehn et al. (2014).



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Observatory (MPC code)	Telescope	CCD	Filter	Observed Asteroids (#Sessions)
Astronomical Observatory of the University of Siena (K54)	0.30-m MCT *f/5.6*	SBIG STL-6303e(bin 2x2)	Rc, C	118 (4), 78 (4), 782 (2), 3998 (1), 7132 (6)
GiaGa Observatory (203)	0.36-m SCT *f/5.8*	Moravian G2-3200	Rc	782 (3), 118 (3), 1052 (8)
M57 (K38)	*0.30-m* RCT *f/5.5*	SBIG STT-1603	C	81 (2), 118 (4), 782 (1), 1052 (1), 52768 (1)
Osservatorio Astronomico Nastro Verde (C82)	*0.35-m* SCT *f/6.3*	SBIG ST10XME (bin 2x2)	C	1052 (1), 7132 (2), 52768 (5)
Osservatorio Astronomico Margherita Hack (A57)	*0.35-m* SCT *f/8.3*	SBIG ST10XME (bin 2x2)	Rc	78 (1), 782 (1), 1052 (4), 7132 (1)
GAV	0.20-m SCT *f/6.3*	SXV-H9	Rc	81 (4), 118 (1), 1052 (1)
Iota Scorpii(K78)	0.40-m RCT *f/8.0*	SBIG STXL-6303e(bin 2x2)	Rc	81 (1), 755 (1), 782 (1), 1052 (2), 7132 (1)
Seveso Observatory (C24)	*0.30-m* SCT *f/6.3*	SBIG ST8-XME (bin 2x2)	Rc	81 (1), 782 (1)
Felizzano Observatory	*0.20-m* SCT *f/6.3*	Moravian KAF8300	Rc	78 (1), 1052 (1)
GAMP (104)	0.60-m NRT *f/4.0*	Apogee Alta	C	1052 (2), 7132 (2)
WBRO (K49)	0.235-m SCT *f/10*	SBIG ST8-XME	C	755 (1), 7132 (2)
Hypatia Observatory (L62)	*0.*25-m NRT *f/4.9*	SBIG ST8-XE	C	755 (2), 1052 (1)
BSCR Observatory (K47)	*0.25-m* SCT *f/5.1*	DTA DISCOVERY PLUS 1600	C	118 (1)
Filzi School Observatory (D12)	0.35-m RCT *f/8.0*	QHY9 (KAF8300)	C	755 (1)

Table I. Observing Instrumentations. MCT: Maksutov-Cassegrain, NRT: Newtonian Reflector, RCT: Ritchey-Chretien, SCT: Schmidt-Cassegrain.

Number	Name	2020 mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
78	Diana	02/08-03/19	*18.2,3.4	175	-4	7.2940	0.0006	0.06	0.03	MB-M
81	Terpsichore	01/26-02/20	7.6,16.1	114	9	10.946	0.002	0.14	0.03	MB-O
118	Peitho	01/22-03/07	12.3,25.9	107	10	7.8066	0.0006	0.23	0.04	MB-I
755	Quintilla	01/20-02/05	2.0,7.4	116	-3	4.550	0.001	0.04	0.03	MB-O
782	Montefiore	02/12-03/17	*5.7,15.7	150	7	4.0726	0.0002	0.51	0.05	FLOR
1052	Belgica	02/04-02/26	2.5,12.9	133	4	2.7094	0.0001	0.08	0.04	FLOR
						47.26	0.04	0.28	0.02	
3998	Tezuka	01/22	13.6	105	9	3.08	0.01	0.49	0.04	MB-I
7132	Casulli	02/20-03/20	*10.1,8.9	167	-4	3.5238	0.0002	0.14	0.04	MB-I
						36.54	0.02	0.16	0.02	
52768	1998 OR2	03/11-03/17	53.1,59.0	139	14	4.111	0.001	0.30	0.05	NEA

Table II. Observing circumstances and results. The first line gives the results for the primary of a binary system. The second line gives the orbital period of the satellite and the maximum attenuation. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).