

COLLABORATIVE ASTEROID PHOTOMETRY FROM UAI: 2021 JULY-SEPTEMBER

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Photometric observations of eight asteroids were made in order to acquire lightcurves for shape/spin axis modeling. The synodic period and lightcurve amplitude were found for 58 Concordia, 224 Oceana, 1046 Edwin, 2431 Skovoroda, 2824 Franke, (7822) 1991 CS, (143649) 2003 QQ47, and color index (V-R) for 790 Pretoria.

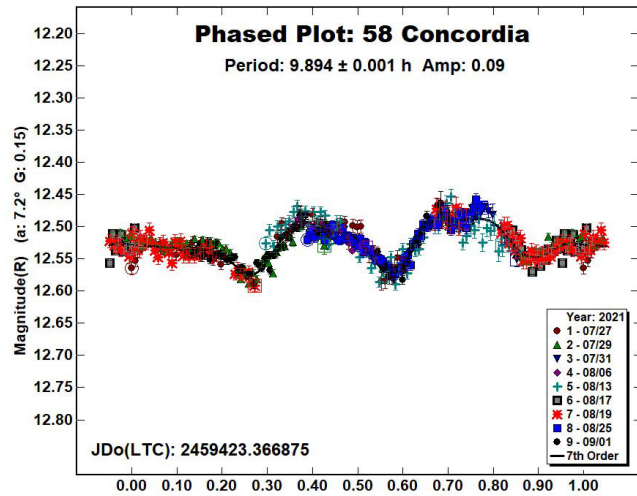
We report collaborative asteroid photometry performed by the Italian Amateur Astronomers Union (UAI; 2021). The targets were selected mainly in order to acquire lightcurves for shape/spin axis modeling. Table I shows the observing circumstances and results.

The CCD observations of eight asteroids were made in 2021 July-September using the instrumentation described in Table II. Lightcurve analysis was performed at the Balzaretto Observatory with *MPO Canopus* (Warner, 2021). All the images were calibrated with dark and flat frames and converted to R magnitudes using solar colored field stars from CMC15 catalogue, distributed with *MPO Canopus*. For brevity, the following citations to the asteroid lightcurve database (LCDB; Warner et al., 2009) will be summarized only as "LCDB".

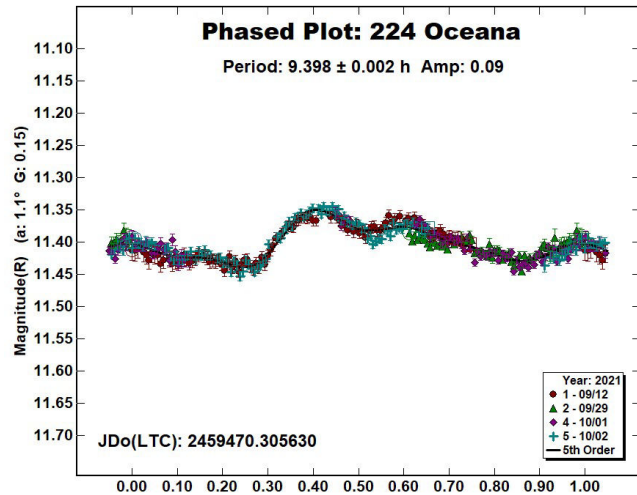
Number	Name	2021 mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
58	Concordia	07/27-09/01	*7.2, 7.9	321	2	9.894	0.001	0.09	0.02	MB-M
224	Oceana	09/12-10/02	*1.0, 7.9	352	0	9.398	0.002	0.09	0.02	MB-M
790	Pretoria	07/29	8.6	307	21					MB-O
1046	Edwin	09/09-09/24	*1.6, 5.6	348	-4	5.291	0.001	0.33	0.03	MB-O
2431	Skovoroda	08/10-09/05	*5.6, 9.7	328	0	3.128	0.001	0.17	0.05	MB-M
2824	Franke	09/04-09/27	4.2, 17.1	338	3	3.380	0.001	0.07	0.03	MB-I
7822	1991 CS	08/18-08/20	76.1, 77.5	14	4	2.390	0.001	0.35	0.10	NEA
143649	2003 QQ47	09/24	28.3	6	16	3.74	0.06	0.26	0.04	NEA

Table I. 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).

58 Concordia is a Ch-type (Bus & Binzel, 2002) middle main-belt asteroid. Collaborative observations were made over nine nights. The period analysis shows a synodic period of $P = 9.894 \pm 0.001$ h with an amplitude $A = 0.09 \pm 0.02$ mag. The period is close to the previously published results in the LCDB.



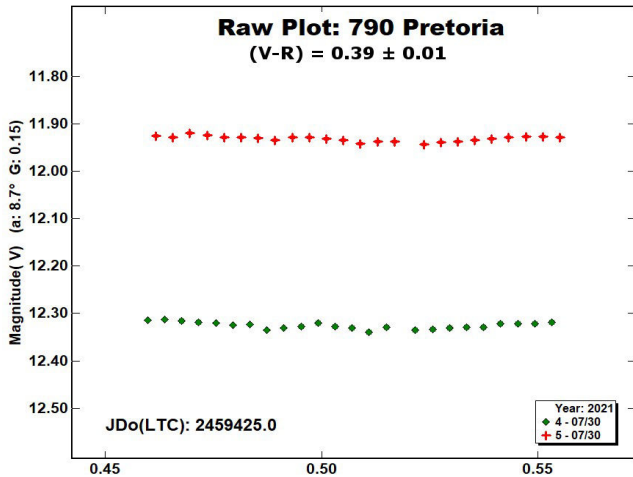
224 Oceana is an M-type (Tholen, 1984) middle main-belt asteroid. Collaborative observations were made over four nights. The period analysis shows a synodic period of $P = 9.398 \pm 0.002$ h with an amplitude $A = 0.09 \pm 0.02$ mag. The period is close to the previously published results in the LCDB.



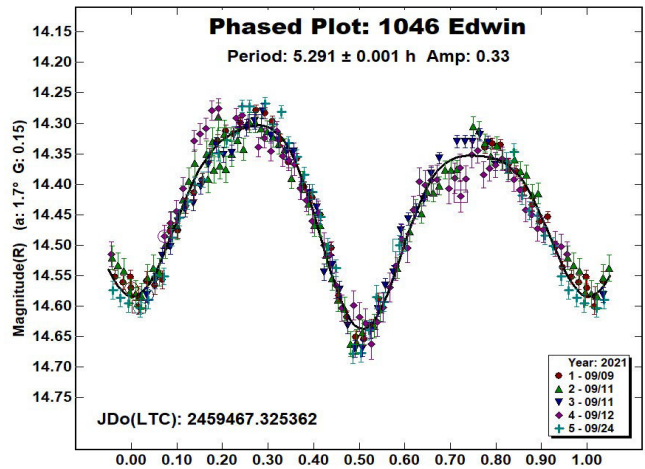
Observatory (MPC code)	Telescope	CCD	Filter	Observed Asteroids (#Sessions)
Astronomical Observatory of the University of Siena(K54)	0.30-m MCT f/5.6	SBIG STL-6303e (bin 2x2)	C, Rc	58 (6), 224 (3), 1046 (3), 2431 (3)
Iota Scorpii (K78)	0.40-m RCT f/8.0	SBIG STXL-6303e (bin 2x2)	Rc	224 (1), 790 (1), 1046 (2), 2824 (1), 7822 (3)
GAMP (104)	0.60-m NRT f/4.0	Apogee Alta	C	2431 (6), 2824 (3)
Oss. Liceo Iris Versari	0.20-m SCT f/6.3	Moravian G2-8300	Rc	58 (2), 2431 (3)
Oss. Prealpi Orobiche (A36)	0.50-m NRT f/5.0	Moravian G2-8300	Rc	58 (1), 2431 (2)
BSCR Observatory (K47)	0.25-m SCT f/7.0	DTA Discovery plus 1600	C	2431 (5)
Tavolaia Observatory (A29)	0.40-m NRT f/5.0	DTA Electra	C	2431 (2)
GiaGa Observatory (203)	0.36-m SCT f/5.8	Moravian G2-3200	C	143649 (1)

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

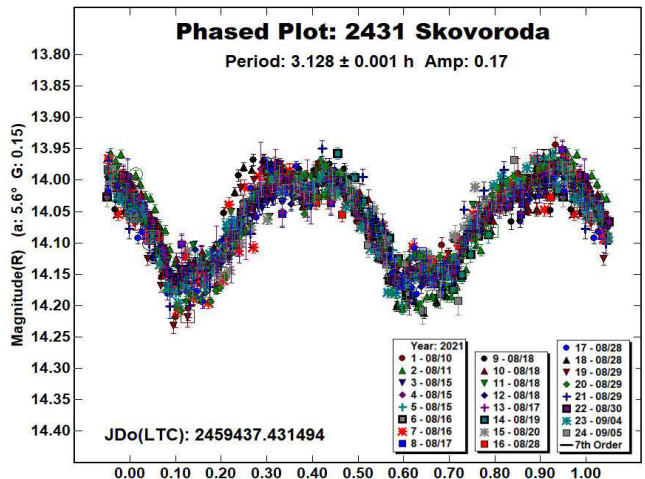
790 Pretoria is a P-type (Tholen, 1984) outer main-belt asteroid. Multiband photometry was made by G. Scarfi on 2021 July 29. We found a color index $(V-R) = 0.39 \pm 0.01$, consistent with a low albedo asteroid (Shevchenko and Lupishko, 1998).



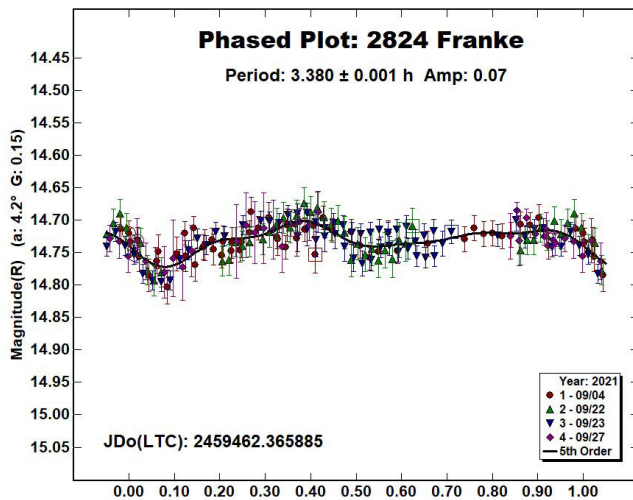
1046 Edwin is an Xe-type (Bus & Binzel, 2002) outer main-belt asteroid. Collaborative observations were made over four nights. We found a synodic period of $P = 5.291 \pm 0.001$ h with an amplitude $A = 0.33 \pm 0.03$ mag. The period is close to the previously published results in the LCDB.



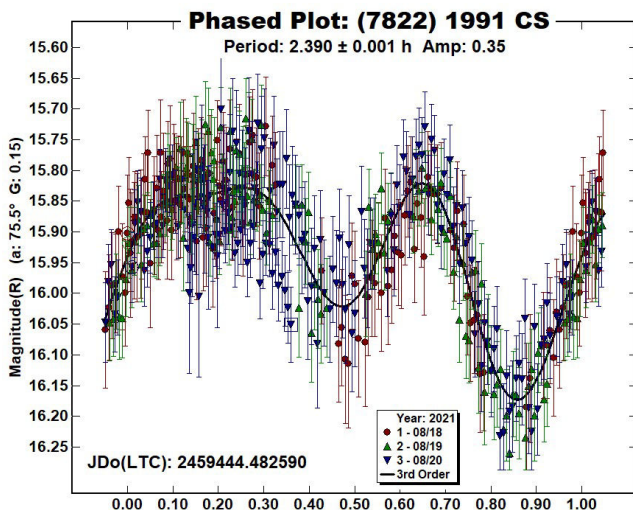
2431 Skovoroda is a medium albedo middle main-belt asteroid. Collaborative observations were made over thirteen nights. We found a synodic period of $P = 3.128 \pm 0.001$ h with an amplitude $A = 0.17 \pm 0.05$ mag. The period is close to the previously published results in the LCDB.



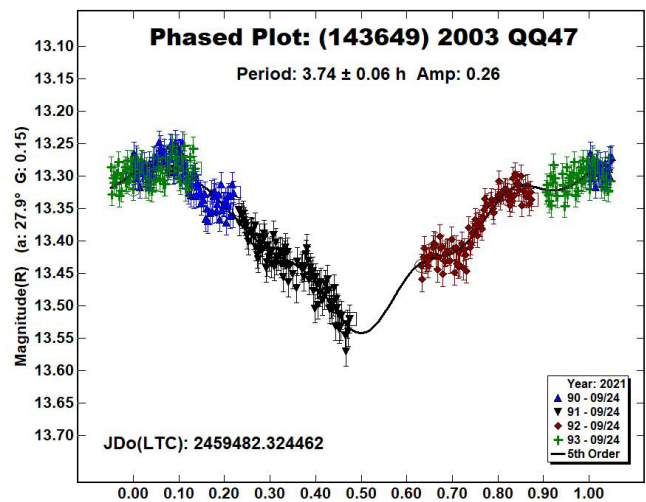
2824 Franke is an inner main-belt asteroid. Collaborative observations were made over four nights. We found a synodic period of $P = 3.380 \pm 0.001$ h with an amplitude $A = 0.07 \pm 0.03$ mag. The period is consistent with that previously published by Franco et. al. (2015).



(7822) 1991 CS is an S-type (Bus & Binzel, 2002) Amor Near-Earth asteroid classified as Potentially Hazardous Asteroid (PHA). Observations by G. Scarfi were made over three nights at Iota Scorpil Observatory. We found a synodic period of $P = 2.390 \pm 0.001$ h with an amplitude $A = 0.35 \pm 0.10$ mag. The period is close to the previously published results in the LCDB.



(143649) 2003 QQ47 is an Apollo Near-Earth asteroid classified as Potentially Hazardous Asteroid (PHA). Observations by G. Galli were made over one night at GiaGa Observatory. We found a synodic period of $P = 3.74 \pm 0.06$ h with an amplitude $A = 0.26 \pm 0.04$ mag. The period is close to the solution found by Warner (2014; 3.679 ± 0.005 h) and differ from the solution found by Carbognani (2014; 4.09 ± 0.02).



References

- Bus, S.J.; Binzel, R.P. (2002). "Phase II of the Small Main-Belt Asteroid Spectroscopic Survey - A Feature-Based Taxonomy." *Icarus* **158**, 146-177.
- Carbognani, A. (2014). "Asteroids Lightcurves at OAVdA: 2013 December - 2014 June." *Minor Planet Bulletin* **41**, 265-270.
- Franco, L.; Marchini, A.; Papini, R. (2015) "Lightcurve Analysis for 2824 Franke and 3883 Verbano." *Minor Planet Bulletin* **42**, 114.
- Harris, A.W.; Young, J.W.; Scaltriti, F.; Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gryptis." *Icarus* **57**, 251-258.
- Shevchenko, V.G.; Lupishko, D.F. (1998). "Optical properties of Asteroids from Photometric Data." *Solar System Research*, **32**, 220-232.
- Tholen, D.J. (1984). "Asteroid taxonomy from cluster analysis of Photometry." Doctoral Thesis. University Arizona, Tucson.
- UAI (2021). "Unione Astrofili Italiani" web site. <https://www.uai.it>
- Warner, B.D.; Harris, A.W.; Pravec, P. (2009) "The asteroid lightcurve database." *Icarus* **202**, 134-146. Updated 2021 Oct 11. <https://minplanobs.org/alcddef/index.php>
- Warner, B.D. (2014). "Near-Earth Asteroid Lightcurve Analysis at CS3-Palmer Divide Station: 2014 March-June." *Minor Planet Bulletin* **41**, 213-224.
- Warner, B.D. (2021). MPO Software, MPO Canopus v10.8.4.2. Bdw Publishing. <http://minorplanetobserver.com>