LIGHTCURVES FOR 224 OCEANA, 359 GEORGIA, 1453 FENNIA AND 1717 ARLON

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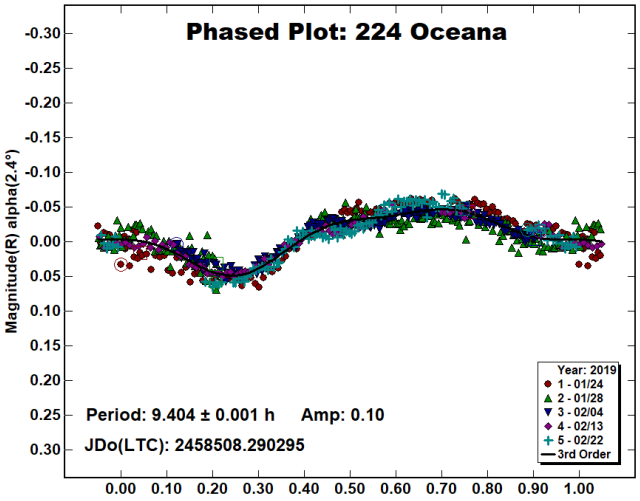
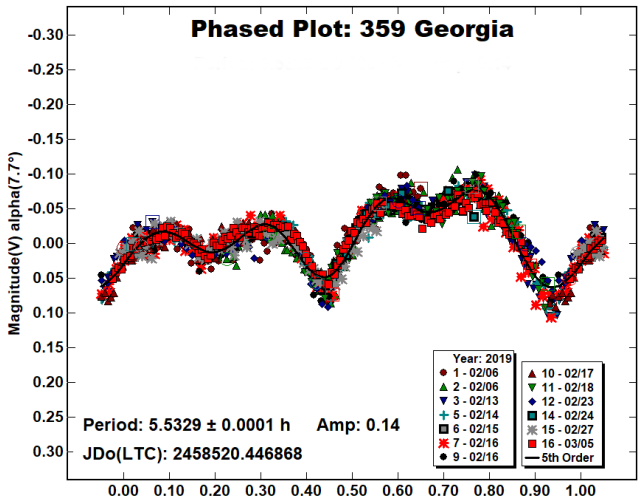
Photometric observations of four main-belt asteroids were made in order to acquire lightcurves for shape/spin axis models. The synodic period and lightcurve amplitude were found for: 224 Oceana: 9.404 ± 0.001 hr, 0.10 mag; 359 Georgia: 5.5329 ± 0.0001 hr, 0.14 mag.; 1453 Fennia: 4.4120 ± 0.0002 hr, 0.14 mag; and 1717 Arlon: 5.1448 ± 0.0004 hr, 0.10 mag.

Collaborative observations of asteroids were made inside the UAI (Italian Amateur Astronomers Union) group. The targets were selected from the Shape/Spin Modeling Opportunities list in the recent issue of the MPB. The CCD observations were made in 2019 January-March using the instrumentation described in the Table I. Lightcurve analysis was done at the Balzaretto Observatory with *MPO Canopus* (BDW Publishing, 2016). 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*. Table II shows the observing circumstances and results.

224 Oceana is an M-type middle main-belt asteroid discovered on on 1882 March 30 by Palisa, J. at Vienna. Collaborative observations were made over five nights. We found a synodic period of P = 9.404 ± 0.001 hr with an amplitude A = 0.10 ± 0.02 mag. The period is close to the previously published results in the asteroid lightcurve database (LCDB; Warner et al., 2009).

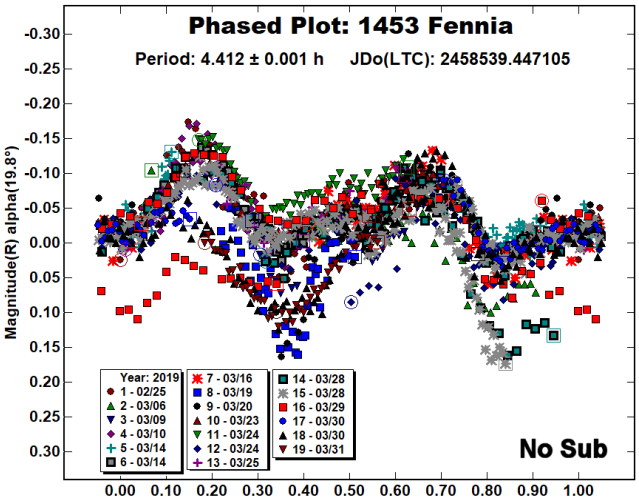


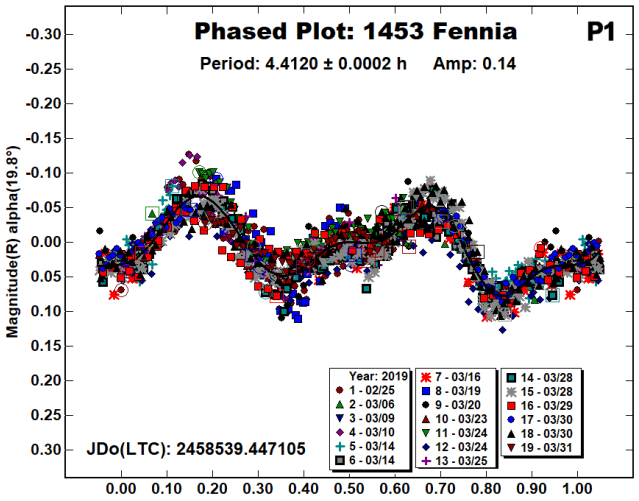
359 Georgia is an S-type inner main-belt asteroid, discovered on 1893 March 10 by Charlois, A. at Nice. Collaborative observations were made over eleven nights. We found a synodic period of P = 5.5329 ± 0.0001 hr with an amplitude A = 0.14 ± 0.03 mag. The period is close to the previously published results in the asteroid lightcurve database (LCDB; Warner et al., 2009).

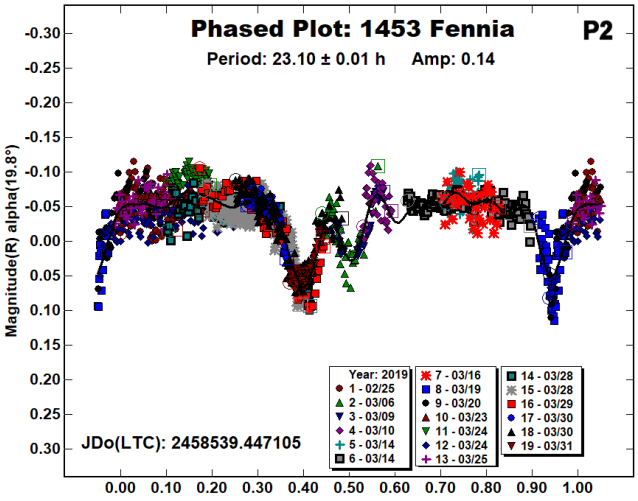


1453 Fennia is an S-type inner main-belt asteroid, member of the Hungaria family, discovered on 1920 March 10 by Reinmuth, K. at Heidelberg. The binary nature of this asteroid was discovered by B.D. Warner in 2007 (Warner et al., 2007). Collaborative observations were made over thirteen nights. The analysis was done using the dual period search function implemented in MPO Canopus. We found a primary synodic rotational period of P1 = 4.4120 ± 0.0002 hr with an amplitude A1 = 0.14 ± 0.04 mag and an orbital period of P2 = 23.10 ± 0.01 hr with an amplitude A2 = 0.14 ± 0.04 mag. That periods are consistent with the previously

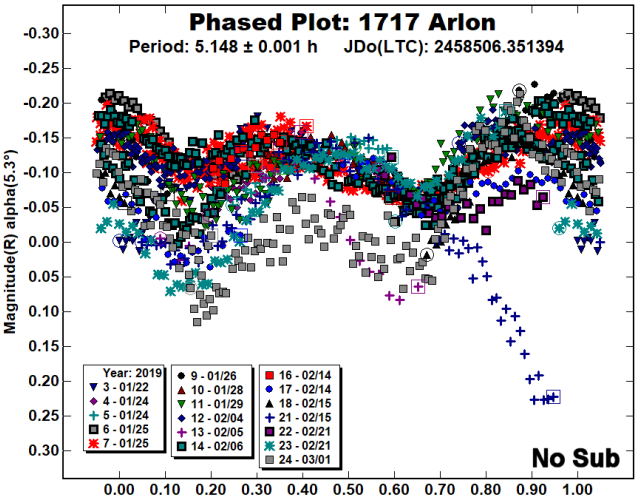
published results in the asteroid lightcurve database (LCDB; Warner et al., 2009).

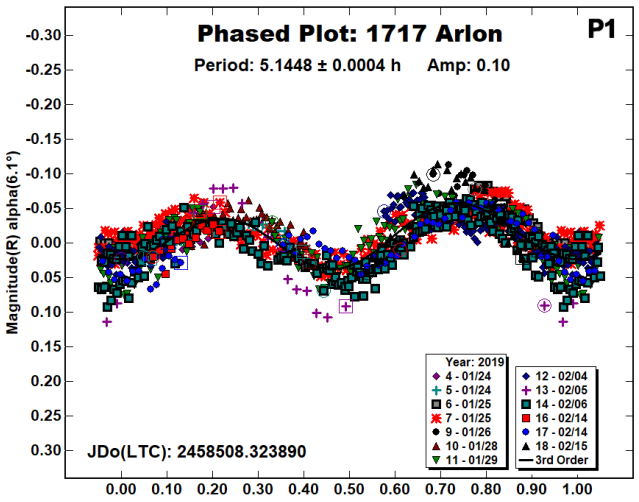


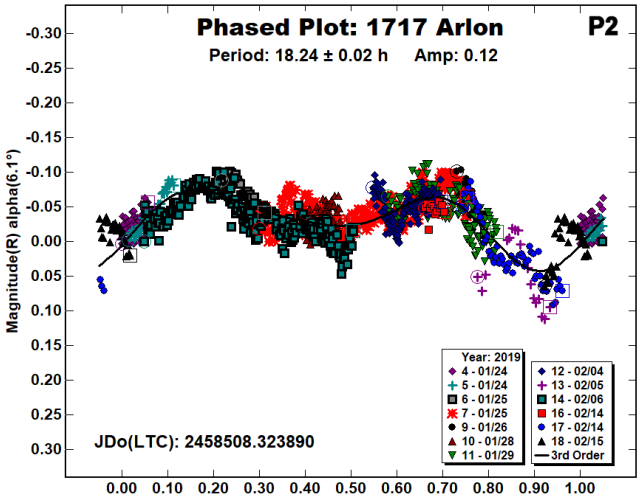




1717 Arlon is an S-type inner main-belt asteroid discovered on 1954 January 08 by Arend, S. at Uccle. This asteroid is a binary system as reported by Cooney et al. (2006a; 2006b) and Brinsfield (2009). Collaborative observations were made over thirteen nights. The analysis was done using the dual period search function implemented in MPO Canopus. We found the synodic rotational period of the two components, respectively: P1 = 5.1448 ± 0.0004 hr with an amplitude A1 = 0.10 ± 0.04 mag and P2 = 18.24 ± 0.02 hr with an amplitude A2 = 0.12 ± 0.04 mag. That periods are consistent with the previously published results in the asteroid lightcurve database (LCDB; Warner et al., 2009). Some deeper attenuation events have been detected, but insufficient to find the orbital period.







References

Brinsfield, J. W. (2009), "Asteroid Lightcurve Analysis at the Via Capote Observatory: 2008 4th Quarter" Minor Planet Bull. 36, 64-66

Cooney, W., Gross, J., Terrell, D., Stephens, R., Pravec, P., Kusnirak, P., Durkee, R., and Galad, A. (2006a). CBET 369.

Cooney, W., Gross, J., Terrell, D., Pravec, P., Kusnirak, P., Pray, D., Krugly, Yu. Kornos, L., Vilagi, J., Gajdos, S., Galad, A., Dyvig, R., Nudds, S., Nauchova, Z., Pikler, M., and Husarik, M. (2006b). CBET 504.

DSFTA (2018), Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente – Astronomical Observatory. *https://www.dsfta.unisi.it/en/research/labs-eng/astronomical-observatory*

Harris, A.W., Young, J W., Scaltriti, F., Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gyptis." *Icarus* **57**, 251-258.

Warner, B.D., Harris, A.W., Pravec, P., Stephens, R.D., Pray, D., Cooney Jr., W., Gross, J., Terrell, D., Gajdoš, Š., Galád, A., and Krugly, Yu. (2007). CBET 1150.

Warner, B.D., Harris, A.W., Pravec, P. (2009). "The asteroid lightcurve database." *Icarus* **202**, 134-146. Updated 2019 January 31. *http://www.minorplanet.info/lightcurvedatabase.html*

Warner, B.D. (2016). MPO Software, MPO Canopus v10.7.7.0. Bdw Publishing. *http://minorplanetobserver.com*

Observatory (MPC code)	Telescope	CCD	Filter	Observed Asteroids
Università Siena (K54)	0.30-m MCT f/5.6	SBIG STL-6303e (bin 2x2)	Rc	224, 359, 1453
Filzi School Observatory	0.35-m RCT f/8	QHY9 (KAF8300)	Rc	359, 1453, 1717
M57 (K38)	0.30-m RCT f/5.5	SBIG STT-1603	C	359, 1453, 1717
Iota Scorpii(K78)	0.40-m RCT f/8	SBIG STXL-6303e (bin 2x2)	Rc	224, 359, 1453, 1717
GiaGa Observatory (203)	0.36-m SCT f/5.8	Moravian G2-3200	C	1453, 1717
GAMP(104)	0.60-m NRT f/4	Apogee Alta	C	359, 1453
AAB (L19)	0.40-m NRT f/5	Atik KAI 04022	Rc	359, 1453, 1717
Margherita Hack Observatory (A57)	0.35-m SCT f/8.3	SBIG ST10XME (bin 2x2)	C	359, 1453
Santa Maria a Monte (A29)	0.40-m NRT f/5	DTA Discovery plus Kaf 260	Rc	359, 1717
G.Pascoli (K63)	0.40-m NRT f/3.2	QHY22 C 1318	C	1453, 1717

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

Number	Name	2019 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E	Amp	A.E.
224	Oceana	01/24-02/22	710	2.4,11.8	124	5	9.404	0.001	0.10	0.02
359	Georgia	02/06-03/05	1100	7.6,1.5,2.9	157	4	5.5329	0.0001	0.14	0.03
1453	Fennia	02/25-03/31	1311	19.7,0.2,2.2	187	4	4.4120	0.0002	0.14	0.04
1717	Arlon	01/22-03/01	1386	5.0,22.5	119	5	5.1448	0.0004	0.10	0.04

Table II. Observing circumstances and results. Pts is the number of data points. The phase angle values are 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).