

## COLLABORATIVE ASTEROID PHOTOMETRY FROM UAI: 2020 OCTOBER-DECEMBER

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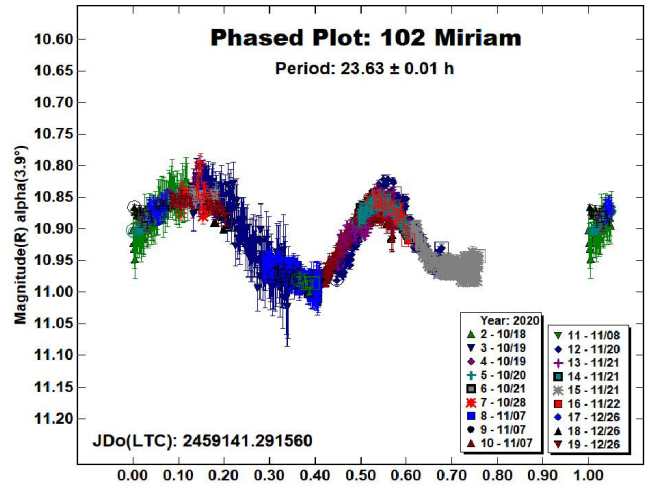
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Photometric observations of five asteroids were made in order to acquire lightcurves for shape/spin axis modeling. The synodic period and lightcurve amplitude were found for 102 Miriam:  $23.63 \pm 0.01$  h, 0.14 mag; 635 Vundtia:  $11.784 \pm 0.004$  h, 0.20 mag; 1342 Brabantia:  $4.175 \pm 0.001$  h, 0.13 mag; 2346 Lilio:  $3.0290 \pm 0.0005$  h, 0.18 mag; (153201) 2000 WO107:  $5.026 \pm 0.001$  h, 1.14 mag.

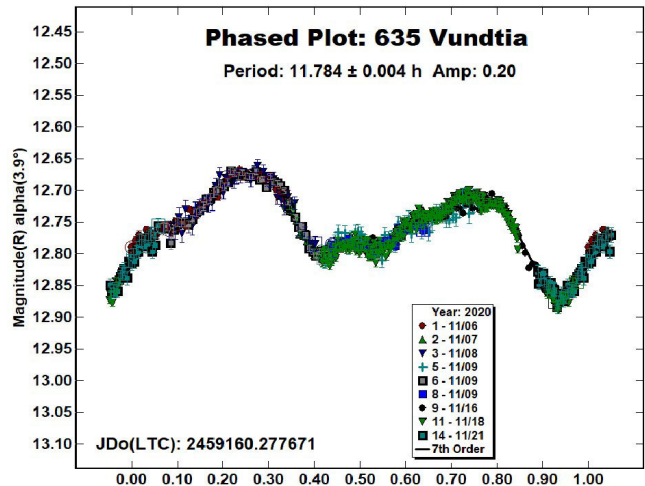
Collaborative asteroid photometry was done inside the Italian Amateur Astronomers Union (UAI; 2020) group. The targets were selected mainly in order to acquire lightcurves for shape/spin axis modeling. Table I shows the observing circumstances and results.

The CCD observations were made in 2020 October-December using the instrumentation described in the Table II. Lightcurve analysis was performed at the Balzaretto Observatory with *MPO Canopus* (Warner, 2019). 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".

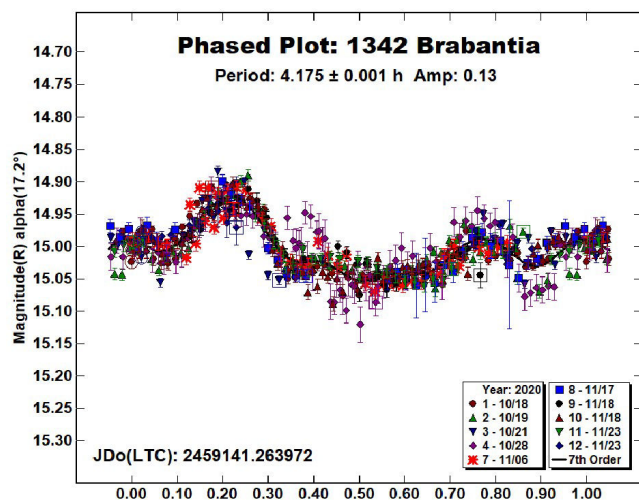
102 Miriam is a C-type (Bus & Binzel, 2002) middle main-belt asteroid discovered on 1868 August 22 by C.H.F. Peters at Clinton. Collaborative observations were made over eleven nights. The period analysis shows a synodic period of  $P = 23.63 \pm 0.01$  h with an amplitude  $A = 0.14 \pm 0.02$  mag. The period is close to the previously published results by Pilcher (2008, 2013).



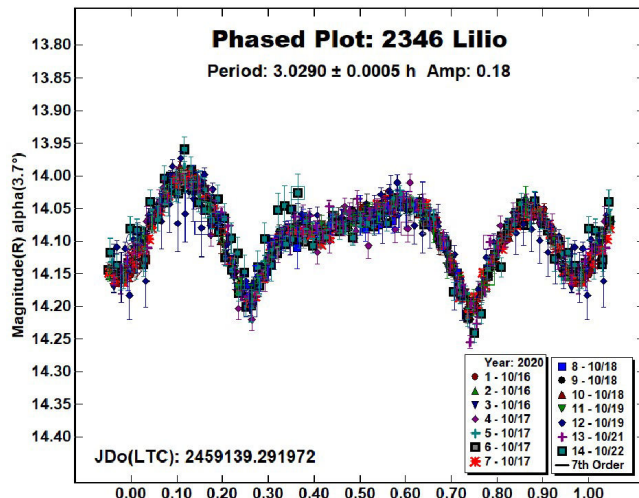
635 Vundtia is a C-type (Bus & Binzel, 2002) outer main-belt asteroid discovered on 1907 June 9 by K. Lohnert at Heidelberg. Collaborative observations were made over six nights. The period analysis shows a synodic period of  $P = 11.784 \pm 0.004$  h with an amplitude  $A = 0.20 \pm 0.02$  mag. The period is close to the previously published results in the LCDB.



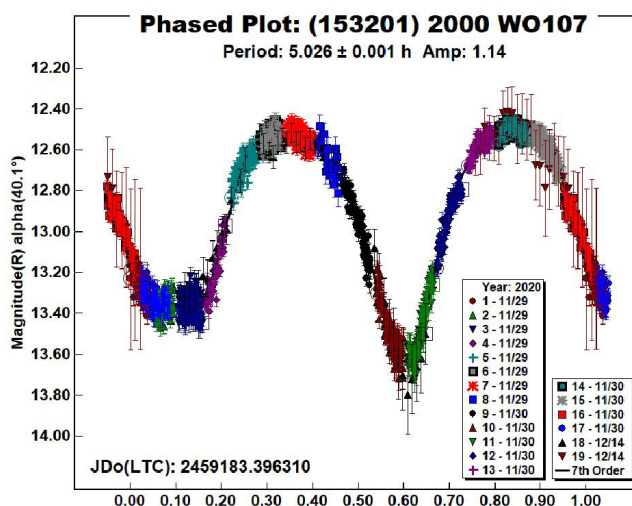
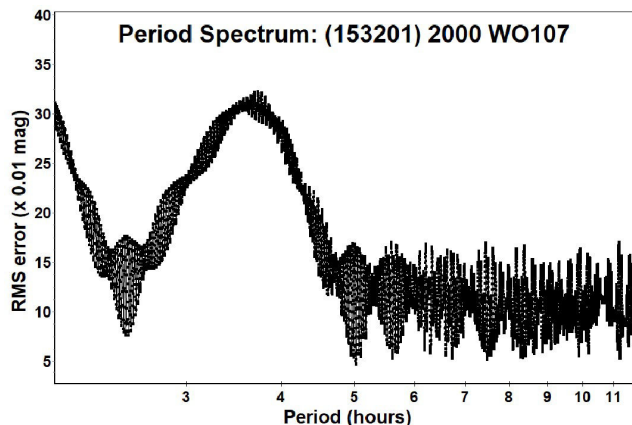
1342 Brabantia is an X-type (Tholen, 1984) inner main-belt asteroid discovered on 1935 February 13 by H. Van Gent at Johannesburg. Collaborative observations were made over eight nights. We found a synodic period of  $P = 4.175 \pm 0.001$  h with an amplitude  $A = 0.13 \pm 0.03$  mag. The period is close to the previously published results in the LCDB.



2346 Lilio is a C-type (Bus & Binzel, 2002) inner main-belt asteroid discovered on 1934 February 5 by K. Reinmuth at Heidelberg. Collaborative observations were made over six nights. We found a synodic period of  $P = 3.0290 \pm 0.0005$  h with an amplitude  $A = 0.18 \pm 0.04$  mag. The period is close to the previously published results in the LCDB.



(153201) 2000 WO107 is an X-type (Bus & Binzel, 2002) Aten near-Earth asteroid discovered on 2000 November 29 by LINEAR at Socorro. Observations were made at Filzi School Observatory (D12) during the close approach to Earth and at GAMP (104) Observatory in the following days. We found a bimodal solution with a synodic period of  $P = 5.026 \pm 0.001$  h and an amplitude  $A = 1.14 \pm 0.16$  mag. Radar images from Goldstone radio telescope revealed that it is a contact binary asteroid (Goldstone, 2020)



Number	Name	2020 mm/dd	Phase	$L_{PAB}$	$B_{PAB}$	Period(h)	P.E.	Amp	A.E.	Grp
102	Miriam	10/18-12/26	3.9, 26.3	24	0	23.63	0.01	0.14	0.02	MB-M
635	Vundtia	11/06-11/21	3.9, 8.3	41	-9	11.784	0.004	0.20	0.02	MB-O
1342	Brabantia	10/18-11/23	17.1, 12.4	58	26	4.175	0.001	0.13	0.03	MB-I
2346	Lilio	10/16-10/22	3.6, 4.7	24	6	3.0290	0.0005	0.18	0.04	MB-I
153201	2000 WO107	11/29-12/14	*37.8, 30.3	63	3	5.026	0.001	1.14	0.16	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).

Observatory (MPC code)	Telescope	CCD	Filter	Observed Asteroids (#Sessions)
Balzaretto Observatory (A81)	0.20-m SCT f/5.0	SBIG ST7-XME	Rc	102 (3)
Parco Astronomico Lillio (K96)	0.50-m RCT f/8.0	FLI PL1001	r'	102 (3) , 2346 (2)
WBRO (K49)	0.235-m SCT f/10	SBIG ST8-XME	Rc	102 (1) , 635 (1) , 1342 (2) , 2346 (1)
Iota Scorpii (K78)	0.40-m RCT f/8.0	SBIG STXL-6303e (bin 2x2)	Rc	102 (1) , 635 (1) , 1342 (1) , 2346 (1)
Astronomical Observatory of the University of Siena (K54)	0.30-m MCT f/5.6	SBIG STL-6303e (bin 2x2)	Rc	635 (2) , 2346 (2)
Osservatorio Astronomico Nastro Verde (C82)	0.35-m SCT f/6.3	SBIG ST10XME (bin 2x2)	C	1342 (2) , 2346 (2)
GiaGa Observatory (203)	0.36-m SCT f/5.8	Moravian G2-3200	Rc	102 (3)
Osservatorio Astronomico Margherita Hack (A57)	0.35-m SCT f/8.3	SBIG ST10XME (bin 2x2)	Rc	1342 (2)
GAV	0.20-m SCT f/6.3	SXV-H9	Rc	102 (2)
Seveso Observatory (C24)	0.30-m SCT f/6.3	SBIG ST9	Rc	102 (1)
M57 (K38)	0.30-m RCT f/5.5	SBIG STT-1603	C	635 (1)
Filzi School Observatory (D12)	0.35-m RCT f/8.0	QHY9 (KAF8300)	C	153201 (1)
GAMP (104)	0.60-m NRT f/4.0	Apogee Alta	C	153201 (1)
Serafino Zani (130)	0.40-m RCT f/5.8	SBIG ST8 XME (bin 2x2)	C	635 (1)
Osservatorio Astronomico Monte San Lorenzo	0.53-m RCT f/6.7	SBIG ST8 XME (bin 2x2)	C	1342 (1)

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

#### 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.

DSFTA (2020), Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente – Astronomical Observatory, University of Siena. <https://www.dsfta.unisi.it/en/research/labs/astronomical-observatory>

Goldstone (2020). Goldstone Radar Observations Planning: (7753) 1988 XB, 2017 WJ16, and 2000 WO107. <https://echo.jpl.nasa.gov/asteroids/1988XB/1988xb.2020.goldstone.planning.html>

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

Pilcher, F. (2008). "Period Determination for 84 Klio, 98 Ianthe, 102 Miriam 112 Iphigenia, 131 Vala, and 650 Amalasantha." *Minor Planet Bulletin* **35**, 71-72.

Pilcher, F. (2013). "Rotation Period Determinations for 102 Miriam, 108 Hecuba, 221 Eos 225 Oppavia, and 745 Mauritia, and a Note on 871 Amneris." *Minor Planet Bulletin* **40**, 158-160.

Tholen, D.J. (1984). "Asteroid taxonomy from cluster analysis of Photometry." Doctoral Thesis. University Arizona, Tucson.

UAI (2020), "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 2020 Oct. <http://www.minorplanet.info/lightcurvedatabase.html>

Warner, B.D. (2019). MPO Software, MPO Canopus v10.8.1.1. Bdw Publishing. <http://minorplanetobserver.com>