A NEW LIGHTCURVE OF 357 NININA

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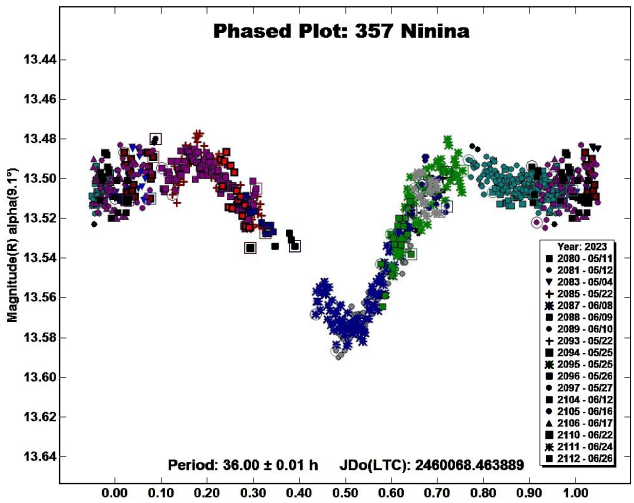
An international collaboration of observers from North America and Europe presents a lightcurve of the Earth commensurate asteroid 357 Ninina that shows a synodic rotation period 36.00 ± 0.01 hours, amplitude 0.08 ± 0.01 magnitudes with a single deep minimum in an otherwise nearly flat lightcurve.

Five previously published values of the rotation period of 357 Ninina, as presented in Warner et al. (2009), are all within 0.1 hours of the accepted best value of 35.983 hours. A new lightcurve was desired at a celestial longitude different from all those at which the previous observations were made to facilitate a lightcurve inversion study. With a rotation period almost exactly 1.5 Earth days, it is not possible to sample the entire lightcurve near a single opposition at a single observatory location. Therefore, the several authors of this paper, from both North America and Europe, agreed to collaborate. Their equipment is listed in Table I. Photometric image measurement and lightcurve construction were with *MPO Canopus* software with calibration star magnitudes for solar colored stars from the CMC15 catalog reduced to the Cousins R band. Zero-point adjustments of a few × 0.01 magnitude were made for best fit. To reduce the number of points on the lightcurves and make them easier to read, data points have been binned in sets of 3 with a maximum time difference of 5 minutes.

Eighteen sessions 2023 May 4 - June 26 can be fitted to a lightcurve with period 36.00 +/- 0.01 hours, amplitude 0.08 +/- 0.01 magnitudes, with one deep minimum in each rotational cycle. The period is consistent with previously published periods. The monomodal lightcurve shape and small amplitude are encountered for many asteroids at near polar aspect. These new data will be useful for future LI modeling.



Observatory (MPC code)	Telescope	CCD	Filter
Organ Mesa Observatory (G50)	0.35-m SCT f/10	SBIG STL-1001E	C
Astronomical Observatory, University of Siena (K54)	0.30-m MCT f/5.6	SBIG STL-6303e(bin 2x2)	Rc
Iota Scorpii(K78)	0.40-m RCT f/8	SBIG STXL-6303e (bin 2x2)	Rc
HOB Astronomical Observatory (L63)	0.20-m SCT f/6.0	ATIK 383L+	C
Osservatorio Astronomico Nastro Verde (C82)	0.35-m SCT f/6.3	SBIG ST10XME (bin 2x2)	C
GAMP (104)	0.60-m NRT f/4	Apogee Alta	Rc
Osservatorio Astronomico Margherita Hack (A57)	0.35-m SCT f/8.3	SBIG ST10XME (bin 2x2)	Rc

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

Number	Name	2023/mm/dd	Phase	LPAB	BPAB	Period(h)	P.E	Amp	A.E.
357	Ninina	05/04 - 06/26	*10.7, 9.6	251	17	36.00	0.01	0.08	0.01

Table II. Observing circumstances and results. The phase angle is given for the first and last date, and the * indicates that a minimum (second value) was reached between these dates. LPAB and BPAB are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris et al., 1984).

References

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. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2023 June 23. *https://minplanobs.org/MPInfo/php/lcdb.php*

LIGHTCURVES ANALYSIS OF THREE MAIN-BELT ASTEROIDS: 3602 LAZZARO, 10468 ITACURUBA AND (53437) 1999 WL2

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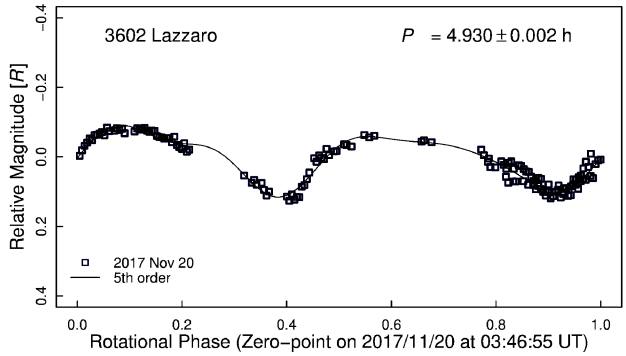
We present rotational lightcurves for three main-belt asteroids, 3602 Lazzaro, 10468 Itacuruba and (53437) 1999 WL2, obtained at the Observatório Astronômico do Sertão de Itaparica (OASI, MPC code Y28). For 3602 Lazzaro, we found a rotation period of 4.933 ± 0.002 h, for 10468 Itacuruba a period of 13.040 ± 0.002 h and for (53437) 1999 WL2 a period of 8.573 ± 0.004 h.

CCD photometric observations of three main-belt asteroids, 3602 Lazzaro, 10468 Itacuruba and (53437) 1999 WL2, were carried out at the Observatório Astronômico do Sertão de Itaparica (MPC code Y28, Nova Itacuruba). Images were obtained with the 1.0-m *f*/8 telescope (Astro Optik, Germany) of the IMPACTON project and a CCD Astra Apogee Instruments (2048×2048 pixels) that was binned 2×2. This configuration gave a field-of-view of 11.8×11.8 arcmin and an image scale of 0.343 arcsec/pix. More details on the available instrumentation at OASI are given in Rondón et al. (2020). All the observations were performed using sidereal tracking and an R-Johnson-Cousins filter. The exposure time varied depending on the asteroid's brightness and sky motion.

For the three asteroids, data processing and differential photometry measurements were performed using *MaxIm DL* package following the standard procedures of flat-field correction and sky subtraction. Relative magnitudes were computed to obtain the lightcurves and the rotation periods were determined using a Fourier series analysis method (Harris et al., 1989). In the figures below is given, for each asteroid, the composite lightcurve with different colors representing different nights and the line best fit.

The observational circumstances for each observed asteroid are given in Table I along with the results, which are discussed individually below. In this table we give for each obtained rotation period a reliability code (Warner et al., 2009).

3602 Lazzaro. This asteroid was discovered at Siding Spring Observatory, Australia, by S.J. Bus on 1981 February 28. It has about 4.0 km of diameter and an albedo of 0.27 (Masiero et al., 2012). Lazzaro was observed on one night in April 2017 and two nights in January 2018. The April lightcurve fits a synodic period of $P = 4.930 \pm 0.002$ h. It has a small dispersion and small amplitude of 0.19 ± 0.01 mag, but it lacks a few points for complete coverage.



Number	Name	yyyy mm/dd	Exp	Phase	LPAB	BPAB	Period	P.E	Amp	A.E.	U
3602	Lazzaro	2017 11/20	90	10,5,10.4	75	-1	4.930	0.002	0.19	0.01	2
		2018 01/16-01/17	100	21.5	80	-3	4.933	0.001	0.25	0.02	3
10468	Itacuruba	2017 04/20-05/02	100	9.5,3.2	225	-3.4	13.04	0.002	0.25	0.02	1
53437	1999 WL2	2014 05/23-05/31	100	20.0,19.6	220	2.5	8.573	0.004	1.00	0.01	3

Table I. Observing circumstances. Exp is average exposure time, seconds. The phase angle (α) is given at the start and end of each date range, unless it reached a minimum, which is the second of three values. If a single value is given, the phase angle did not change significantly and the average value is given. LPAB and BPAB are each the average phase angle bisector longitude and latitude. The U rating is our estimate and not necessarily the one assigned in the asteroid lightcurve database (Warner et al., 2009).