PERIOD DETERMINATION FOR THE SLOW ROTATOR 930 WESTPHALIA

Eduardo Manuel Álvarez
OLASU (I38)
Costanera Sur 559, Salto 50.000, URUGUAY
olasu@adinet.com.uy

(Received: 14 April)

Lightcurve analysis for 930 Westphalia was performed using observations during its 2015 opposition. The synodic rotation period was found to be 100.66 ± 0.12 h and the lightcurve amplitude was 0.15 ± 0.02 mag.

Minor planet 930 Westphalia is a main-belt object discovered in 1920 by Walter Baade at Bergedorf (Germany) prior to moving to USA where his most known and notable research was done; it was named in honor of the region where the discoverer had been born 27 years earlier. It appeared on the CALL web site as an asteroid photometry opportunity due to it reaching a favorable apparition in 2015 and in the appealing short list of 3-digit asteroids still having no defined lightcurve parameters (Alvarez, 2015).

Unfiltered CCD photometric images were taken at Observatorio Los Algarrobos, Salto, Uruguay (OLASU; MPC Code I38) in 2015 from March 27 to April 14. The telescope was a 0.3-m Meade LX-200R reduced to *f*/6.9. The imager was a QSI 516wsg NABG (non-antiblooming gate) with a 1536x1024 array of 9-micron pixels and 23x16 arcminutes field-of-view. The exposure time was 120 seconds. 2x2 binning was used, yielding an image scale of 1.77 arcseconds per pixel. The camera was set to –10°C and off-axis guided by means of an SX Lodestar camera and *PHD2 Guiding* (Stark Labs) software. Image acquisition was done with *MaxIm DL5* (Diffraction Limited). The computer was synchronized with atomic clock time via Internet NTP servers at the beginning of each session.

All images were dark and flat-field corrected and then measured using *MPO Canopus* version 10.4.3.16 (Bdw Publishing) with a differential photometry technique. The data were light-time corrected. Night-to-night zero point calibration was accomplished by selecting up to five comparison stars with near solar colors according to recommendations by Warner (2007) and Stephens (2008). Period analysis was also done with *MPO Canopus*, which incorporates the Fourier analysis algorithm developed by Harris (Harris *et al*., 1989).

A total of 14 nights were devoted to observe this asteroid exclusively over a total span of 19 days. More than 75 hours of effective observation and about 2,200 data points were required in order to solve the essentially flat lightcurve (Figure 1). Over the span of observations, the phase angle varied from 7.6º to 6.0º to 6.8º, the phase angle bisector ecliptic longitude from 197.9º to 197.7º, and the phase angle bisector ecliptic latitude from –11.5º to –12.7º. The rotation period for 930 Westphalia was determined to be 100.66 ± 0.12 h with a lightcurve peak-to-peak amplitude of 0.15 ± 0.02 mag. No clear evidence of tumbling was seen in the lightcurve.

At the time of this study, 930 Westphalia was one of only 18 three-digit numbered asteroids for which no rotation parameters were found in the literature. However, not all of the already measured 982 rotation periods for the first 1000 asteroids are reliable (i.e., many still have U < 3; see Warner *et al*., 2009), so that ongoing investigations to verify, refine, or revise their values remains an important and pending endeavor.

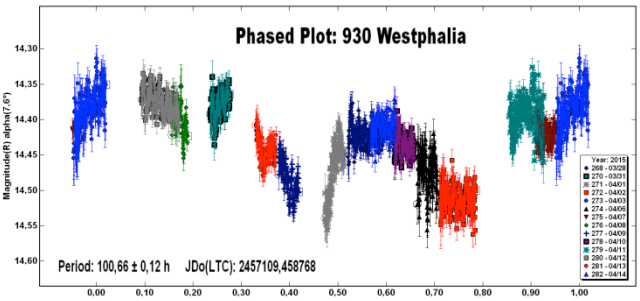

Figure 1. Composite lightcurve of 930 Westphalia.

References

Álvarez, E.M. (2015). "Voids and Question Marks in the Present-Day Data Concerning the Rotation Period of the First 1000 Numbered Asteroids." *Minor Planet Bul*. **42**, 127-129.

Collaborative Asteroid Lightcurve Link (CALL) Web Site. *http://www.minorplanet.info/PHP/call_OppLCDBQuery.php*

Harris, A.W., Young, J.W., Bowell, E., Martin, L.J., Millis, R.L., Poutanen, M., Scaltriti, F., Zappala, V., Schober, H.J., Debehogne, H, Zeigler, K. (1989). "Photoelectric Observations of Asteroids 3, 24, 60, 261, and 863." *Icarus* **77**, 171-186.

Stephens, R.D. (2008). "Long Period Asteroids Observed from GMARS and Santana Observatories." *Minor Planet Bul*. **35**, 21-22.

Warner, B.D. (2007). "Initial Results from a Dedicated H-G Project." *Minor Planet Bul*. **34**, 113-119.

Warner, B.D., Harris, A.W., Pravec, P. (2009). "The asteroid lightcurve database." *Icarus* **202**, 134-146. Updated 2014 Sep 7. *http://www.minorplanet.info/lightcurvedatabase.html*