

NEW LIGHTCURVES OF 1027 AESCULAPIA AND 3395 JITKA

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We present measurements for the rotation periods of two near-Earth asteroids: 1027 Aesculapia and 3395 Jitka. Our measured period for 1027 Aesculapia is 9.791 ± 0.002 h and amplitude of 0.09 mag, which is inconsistent with the previously published measurement of 6.83 ± 0.10 h. We measure the period of 3395 Jitka to be 18.276 ± 0.005 h with an amplitude of $A = 0.41$ mag.

Observations of the near-Earth asteroids 1027 Aesculapia and 3395 Jitka were taken with the 0.5-m telescope owned by the NASA Meteoroid Environment Office (MEO) located at the New Mexico Skies observatory in Mayhill, New Mexico. This telescope was equipped with an Apogee U42 CCD camera. The Johnson V band filter was used for all observations. On a given night, the telescope had dedicated imaging of a single target for as long as the weather allowed, resulting in up to ~8 hours of continuous imaging of each asteroid. Individual image exposures were set to 60 sec.

Images were corrected for bias noise, dark current, and flat-fielding using the MEO's telescope image analysis pipeline software. All lightcurve photometry and period measurements were performed using *MPO Canopus* version 10.4.3.17 (Warner, 2006; Warner 2012), using the standard Fourier series based fitting algorithm (Harris *et al.*, 1989) provided by *MPO Canopus*. All of our data were fit to this model using six orders.

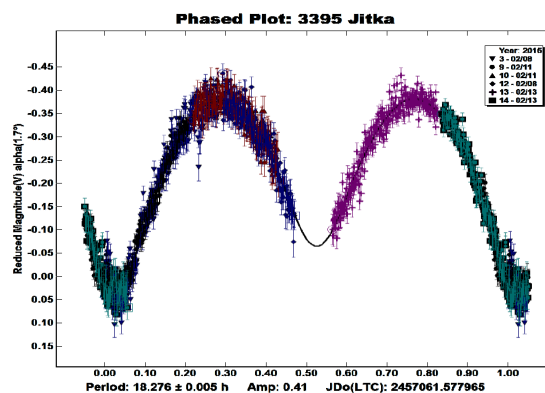
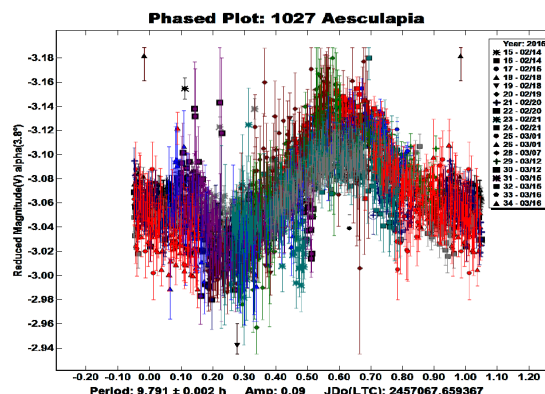
1027 Aesculapia. Observations of the asteroid 1027 Aesculapia were taken starting the night of 2015 February 14 and went through the night of March 16. In total, 5034 images were analyzed from observations taken on eleven separate nights.

Photometric conditions between nights and over the course of each individual night varied greatly, but all of these data are consistent with a rotation period of 9.791 ± 0.002 h, as shown in the figure below. The amplitude of variation was measured at $A = 0.09$ mag. These measurements are in strong tension with a previously measured period for this asteroid made by Maleszewski and Clark (2004) of 6.83 ± 0.1 h and amplitude of $A = 0.15$ mag. Attempts to fit our data with a model that assumes a 6.83 h period were shown to provide a poorer fit. Differences between the analysis procedures of this work and the previous measurement are likely responsible for this disagreement, and further observations will be needed to resolve these discrepancies.

3395 Jitka. Observations of the asteroid 3395 Jitka were taken between the nights of 2015 February 8-13. In total, 2636 images were analyzed from observations taken over three separate nights. Photometric conditions for the three nights of observations were more stable than those for 1027 Aesculapia.

The best-fit period for these data is measured to be 18.276 ± 0.005 h, with amplitude of $A = 0.41$ mag. The phase-folded

lightcurve is shown in the figure below. Marchini and Salvaggio (2015) report a period of 18.293 ± 0.006 h, in excellent agreement with this measurement.



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PERIOD DETERMINATION FOR THE SLOW ROTATOR 930 WESTPHALIA

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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 (Álvarez, 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 7.6° to 6.0° to 6.8° , the phase angle bisector ecliptic longitude from 197.9° to 197.7° , and the phase angle bisector ecliptic latitude from -11.5° to -12.7° . 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.

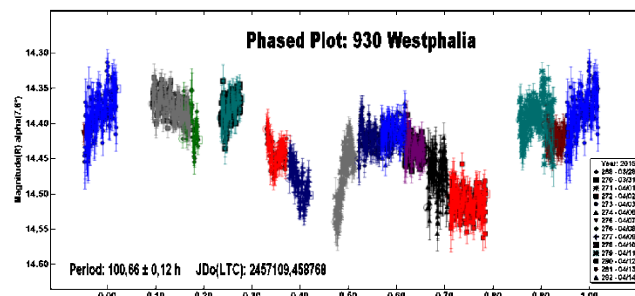


Figure 1. Composite lightcurve of 930 Westphalia.

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