

**PERIOD DETERMINATION FOR 457 ALLEGHENIA:  
LOW NUMBERED ASTEROID WITH  
NO PREVIOUSLY KNOWN PERIOD**

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(Received: 3 October)

Lightcurve analysis for 457 Alleghenia was performed using observations during its 2014 opposition. The synodic rotation period was found to be  $21.953 \pm 0.001$  h and the lightcurve amplitude was  $0.20 \pm 0.02$  mag.

457 Alleghenia is a main-belt asteroid discovered in 1900 by M.F. Wolf and A. Schwassmann at Heidelberg (Germany); it was named in honor of the Allegheny Observatory, currently an integral part of the University of Pittsburgh (USA). It appeared on the CALL web site as an asteroid photometry opportunity due to it reaching a favorable apparition in 2014 and having no defined lightcurve parameters.

Observations by Álvarez were made at Observatorio Los Algarrobos, Salto, Uruguay (OLASU, MPC Code I38) with a 0.30-m  $f/6.9$  Meade LX-200R telescope and QSI 516wsg NABG CCD camera that was off-axis guided and set to 2x2 binning. A clear filter with no infrared blocker was used for the 150-second exposures. Observations by Pilcher were made at the Organ Mesa Observatory (MPC Code G50) with a 0.35-m  $f/10$  Meade LX-200 GPS telescope and SBIG STL-1001E CCD camera that was unguided. A clear filter with infrared blocker was used for the 60-second exposures.

Our computers were 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* (Bdw Publishing) version 10.4.3.16 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).

Observations obtained on 14 nights from 2014 July 27 to September 25 are summarized in Table I. On one of these nights (Aug 24), both observers happened to image the target simultaneously for more than four hours, thus allowing a precise comparison of calibrated magnitudes of the two data sets by means of using the same calibration stars. Pilcher's data were found to be 0.15 magnitudes brighter than the extrapolation of Álvarez's data, which we attributed to different responses of the CCD sensors and to the clear filters, Pilcher's being IR-blocked and Álvarez being non IR-blocked.

More than 80 hours of effective observations and about 3,200 data points were required in order to solve the lightcurve (Figure 1).

Over the span of observations, the phase angle varied from  $17.9^\circ$  to  $7.7^\circ$  to  $9.3^\circ$ , the phase angle bisector ecliptic longitude from  $346.1^\circ$  to  $349.7^\circ$ , and the phase angle bisector ecliptic latitude from  $15.6^\circ$  to  $16.6^\circ$  to  $16.3^\circ$ . The rotation period for 457 Alleghenia was determined to be  $21.953 \pm 0.001$  h with a lightcurve peak-to-peak amplitude of  $0.20 \pm 0.02$  mag. No clear evidence of tumbling or binary companion was seen.

At the time of this study, 457 Alleghenia was the lowest numbered asteroid for which no rotation parameters were found in the literature. There are now rotation periods for all of the first 500 asteroids, although not all of these periods 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.

Session Data			UT Data		Pts
Sess	Observer	2014	UT Data		
1	FP	Jul 27	09:04 - 11:30		128
2	FP	Aug 21	03:15 - 11:28		438
3	EMA	Aug 23	01:44 - 05:53		96
4	EMA	Aug 24	01:34 - 07:24		142
5	FP	Aug 24	03:09 - 11:45		456
6	FP	Aug 25	05:44 - 11:45		320
7	FP	Aug 28	03:34 - 11:51		440
8	FP	Aug 29	02:41 - 06:28		200
9	EMA	Aug 30	01:09 - 06:39		127
10	FP	Sep 11	02:05 - 10:32		397
11	EMA	Sep 15-16	23:36 - 04:37		116
12	EMA	Sep 19-20	23:25 - 04:36		122
13	EMA	Sep 21-22	23:22 - 04:25		119
14	EMA	Sep 24-25	23:01 - 04:27		120

Table I. Observing circumstances. In the Observer column, EMA is Álvarez at OLASU, and FP is Pilcher at Organ Mesa.

#### References

- Collaborative Asteroid Lightcurve Link (CALL) Web Site at [http://www.minorplanet.info/PHP/call\\_OppLCDBQuery.php](http://www.minorplanet.info/PHP/call_OppLCDBQuery.php)
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- Stephens, R.D. (2008). "Long Period Asteroids Observed from GMARS and Santana Observatories." *Minor Planet Bul.* **35**, 21-22.
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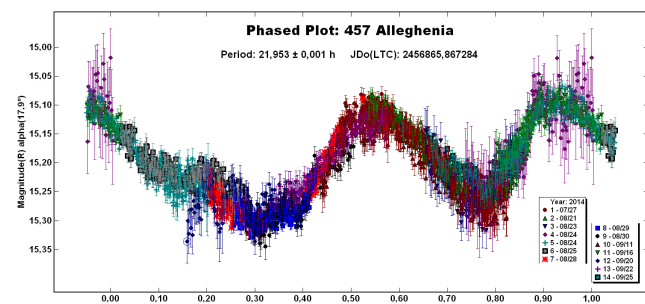


Figure 1. Composite lightcurve of 457 Alleghenia.