# NEW LIGHTCURVES OF 40 HARMONIA AND 105 ARTEMIS

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Abstract. Lightcurves obtained 2010 May to July yield synodic rotation periods and amplitudes for: 40 Harmonia 8.909 ± 0.001 h, 0.18 ± 0.01 mag; and 105 Artemis 37.150 ± 0.001 h, 0.16 ± 0.02 mag.

All of these reported observations have been made at the Organ Mesa Observatory. Equipment consists of a 35 cm Meade LX200 GPS S-C, SBIG STL-1001E CCD, R filter, unguided, instrumental magnitudes only. The lightcurves have been drawn with the large number of data points acquired for each target in this study binned in sets of three with a maximum of five minutes between points.

40 Harmonia. Harris et. al. (2010) state a secure period of 8.910 hours based on several independent and mutually compatible studies. Additional lightcurves were obtained on 5 nights 2010 May 30 – June 14 to contribute to spin/shape modeling. These show a period 8.909 ± 0.001 hours, amplitude 0.18 ± 0.02 magnitudes, fully compatible with previous studies.

105 Artemis. The long period and irregular lightcurve caused several early observers to obtain widely differing periods. Tedesco (1979) obtained one 6 hour irregular lightcurve with amplitude 0.02 mag and guessed a period of 20 hours. Debehogne et. al. (1982) obtained a single lightcurve showing an increase of 0.05 mag in 4 hours. Schober et. al. (1994) published a period 16.84 h, amplitude 0.14 mag, with 0.08 mag scatter in the data. Shevchenko et. al. (2002) obtained a period 19.65 h. Tungalag et. al. (2002) combined all previous observations to obtain a period 18.54998 h. Le Crone et. al. (2004) obtained a period 17.80 h. Higgins (2010) obtained 2006 Mar. 18 – May 22 the most dense data set to date in support of Arecibo radar observations and found a period 37.2 ± 0.1 h. Higley et. al. (2008) used all the data listed above to obtain a spin/shape model with period 37.15506 h. New observations on 15 nights 2010 May 12 – July 10 show a period 37.150 ± 0.001 hours, amplitude 0.16 ± 0.02 magnitudes with an irregular lightcurve.

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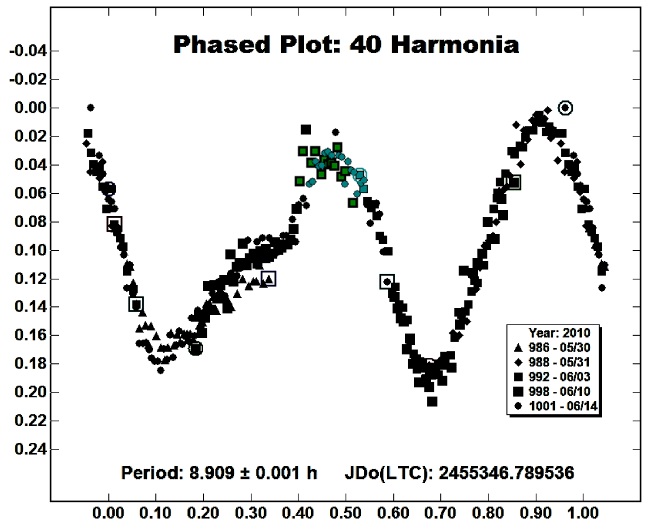


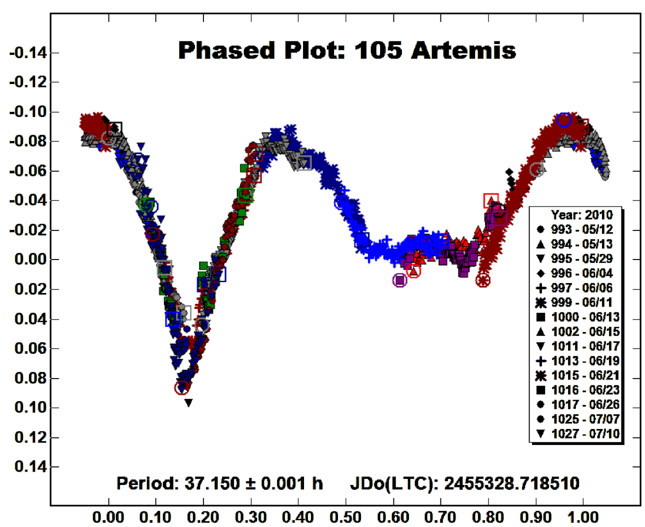

# LIGHTCURVE ANALYSIS OF 279 THULE

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A campaign involving asteroid observers from the US, Australia, and New Zealand was established to determine the rotation period of the outer main-belt asteroid, 279 Thule. Several conflicting periods had been reported as well as the possibility of the object being binary. Neither this campaign nor one conducted in 2008 by Pravec et al. found evidence of a satellite. We find a period of 15.962 ± 0.003 h. While there is good confidence in the result, despite it contradicting all previous periods, the matter of the asteroid's true rotation period may still be open.

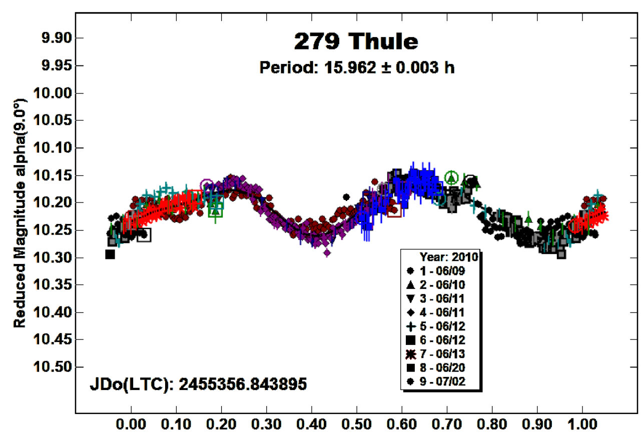
Despite what many might think, a large number of low-numbered asteroids, those below 1000, do not have well-determined rotation periods. In the Asteroid Lightcurve Database (LCDB; Warner et al., 2009), there are summary line entries for 944 of the first 1000 numbered objects. Of these only 683 have well-determined periods (U = 3 or 3- in the LCDB rating system); 177 have ratings that indicate a probable but still not certain period (U = 2+, 2, or 2–); while 46 have very poorly determined periods (U = 1 or 1+, "may be wrong"); and 10 have no periods at all, just an indication that some data have been obtained but not even a rough estimate of a period can be made. One of the 177 asteroids currently listed with a rating in the 2 range is 279 Thule.

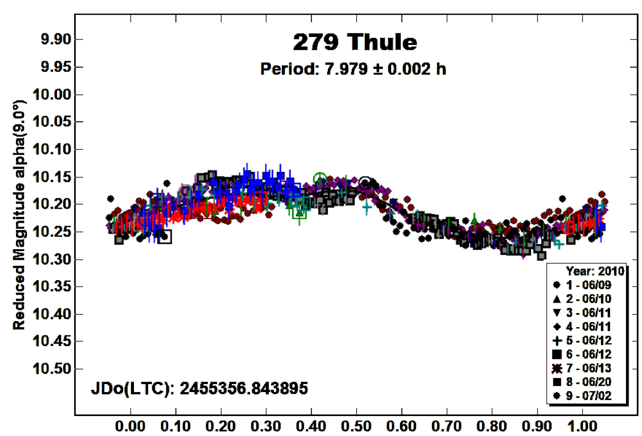
As a result of discussions via email regarding the uncertainty of the period and some suspicion of a satellite due to data from Hamanowa and Hamanowa (2010), an observing campaign was organized involving observers principally from Australia and New Zealand since the asteroid was well south of the equator and the Southern Hemisphere winter was approaching. This would allow prolonged observing runs that would be critical in resolving the asteroid's rotation period. Observers from the US (Coley and Stephens) provided additional observations. While these were shorter runs, they were from significantly different longitudes, thus helping further with resolving period ambiguities.

The campaign generated more than 1600 data points in 9 sessions from 2010 June 9 through July 2. Data were combined into a single set and analyzed by Warner using *MPO Canopus*, which employs the FALC Fourier analysis algorithm developed by Harris (Harris et al., 1989). The result was a synodic period of $P$ = 15.962 ± 0.003 h and amplitude $A$ = 0.10 ± 0.01 mag. The data were binned 3x in the plots below to make them easier to review.

This differs from the period by Pravec et al. (2010) of $P$ = 11.942 h based on observations from 2008 that had $A$ = 0.04 mag and is about double the period found by Zappala et al. (1989). Behrend (2010) found a period of 5.75 h using the Hamanowa data. We checked the fit of the 2010 data to the other periods. While the differences are subtle, the long sessions from the Southern Hemisphere observers allowed us to exclude the previously reported periods. A plot using the 2010 data phased to the half-period of ~7.9 h shows the subtlety involved in discriminating among solutions.

While we are confident in our solution of 15.96 h, the fact that the lightcurve amplitude is always very small (< 0.1 mag) means that a protracted campaign with all data put onto a common system to within 0.01 mag may be needed to remove all doubt.

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