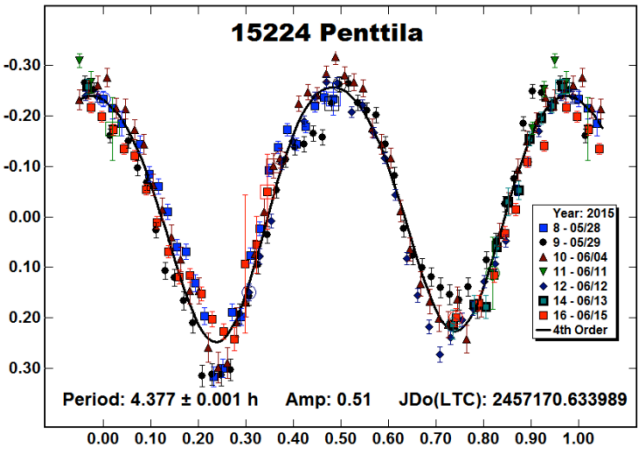
15224 Penttila is a main-belt asteroid discovered by E. Bowell at the Anderson Mesa Station, Lowell Observatory on 1985 May 15. It is also known as 1985 JG, 1970 HB, and 2000 HR19. We observed Penttila on seven nights between 2015 May 28 and Jun 15. We used four orders in the Fourier series to obtain a period of 4.377 ± 0.001 h with an amplitude of 0.51 mag.



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ROTATION PERIOD AND H-G PARAMETERS DETERMINATION FOR 910 ANNELIESE

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Lightcurve analysis for 910 Anneliese was performed using observations during its 2015 opposition. The synodic rotation period was found to be 11.2863 ± 0.0002 h and the lightcurve amplitude was 0.16 ± 0.02 mag; the absolute magnitude was H_R = 9.974 ± 0.028 mag and the slope parameter was G = 0.107 ± 0.030. These lead to an estimated diameter of 46.3 ± 3.5 km.

Minor planet 910 Anneliese is a main-belt object discovered in 1919 by Karl W. Reinmuth at Heidelberg (Germany); it was named in honor of a dear friend of the German astronomer, Julius Dick. It appeared on the CALL web site as an asteroid photometry opportunity due to it reaching in 2015 a favorable apparition (*i.e.*, one of the five brightest apparitions from 1995 to 2050) and in the short list of those 3-digit asteroids still having no defined lightcurve parameters (Alvarez, 2015).

CCD photometric images were taken at Observatorio Los Algarrobos, Salto, Uruguay (OLASU, MPC Code I38) in 2015 from May 5 to July 9. 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. Clear, V, and R filters were used. The exposures increased from 90 to 150 seconds as the asteroid faded past opposition. 2x2 binning was used, yielding an image scale of 1.77 arcseconds per pixel. The camera was set to –15°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* (Bdw Publishing) version 10.4.3.16 with a differential photometry technique. The data were light-time corrected. Catalog magnitudes were taken from the MPOSC3 catalog, which is based on the 2MASS catalog converted to the BVRcIc system using formulae developed by Warner (2007). 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). The nightly zero points have been found to be consistent to about ± 0.06 mag or better, except for the last two sessions (respectively requiring –0.09 and –0.14 mag). Period analysis was also done with *MPO Canopus*, which incorporates the Fourier analysis algorithm developed by Harris (Harris *et al*., 1989).

A total of 23 nights were devoted to observe this asteroid exclusively over a total span of 64 days. More than 106 hours of effective observation and about 3,200 data points were required in order to solve the essentially flat lightcurve (Figure 1). Over the span of observations, the phase angle varied from 1.5º to 0.3º to 21.6º, the phase angle bisector ecliptic longitude (*i.e.*, the viewing aspect) varied from 227.0º to 232.4º, and the phase angle bisector

ecliptic latitude from +0.7º to –2.5º. The rotation period for 910 Anneliese was determined to be 11.2863 ± 0.0002 h with a lightcurve peak-to-peak amplitude of 0.16 ± 0.02 mag.

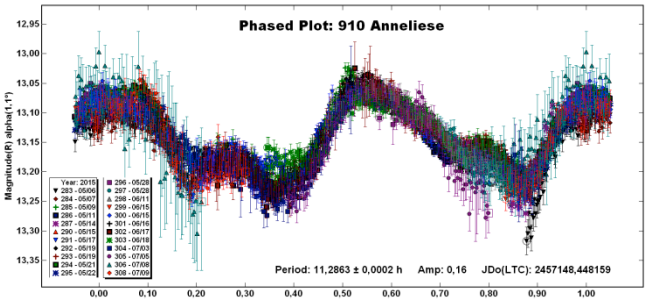

Figure 1. Composite lightcurve of 910 Anneliese.

The absolute *R*-band magnitude (H_R) and slope parameter (G) were found using the H-G Calculator tool of *MPO Canopus*, which is based on the FAZ algorithm developed by Alan Harris (1989). Two pre- and 21 post-opposition data were used (Figure 2), all of them representing the maximum of the curve for each observing session. The absolute *R*-band magnitude was determined to be 9.974 ± 0.028 mag and the slope parameter 0.107 ± 0.030. Such a low G parameter is typical of low albedo asteroids (Lagerkvist and Magnusson, 1990).

The color index was determined to be V-R = 0.369 ± 0.020 mag (mean of 28 values found from the session of May 14). Adding the mean V-R color index to the H_R value gives H = 10.343 ± 0.050. This H value is slightly lower than the one published at the JPL Small-Body Database (H = 10.4).

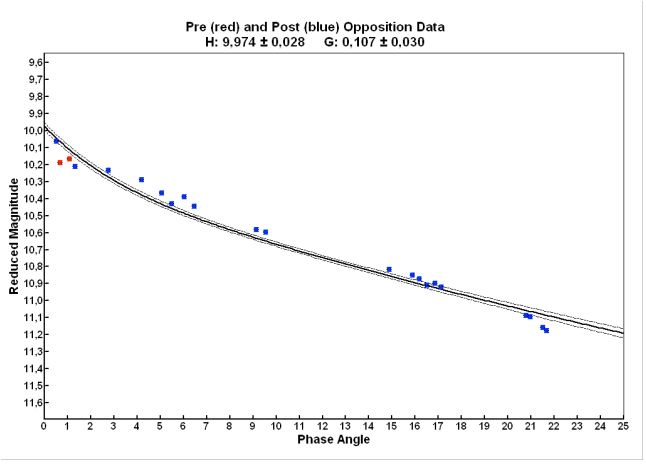

Figure 2. H-G plot in R-band for 910 Anneliese.

According to Shevchenko and Lupishko (1998), the measured V-R color index (0.369 mag) is very close to the value that has been determined to correspond to *carbonaceous* asteroids (0.38 mag). For such C-type asteroids (the largest taxonomical class), the geometric albedo on the Johnson V band (p_V) is 0.06 ± 0.02. Applying the formula by Pravec and Harris (2007) for the asteroid diameter (D) in kilometers

$$D = \frac{1329}{\sqrt{p_V}} 10^{-0.2H}$$

gives an estimated diameter of D = 46.3 ± 3.5 km.

At the time of this study, 910 Anneliese was one of only 17 three-digit numbered asteroids for which no rotation parameters were found in the literature. However, not all of the already measured 983 rotation periods for the first 1000 asteroids are reliable (*i.e.*, many still have U < 3; see Warner *et al*., 2009). Therefore, ongoing investigations to verify, refine, or revise their values remains an important and pending endeavor.

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