ROTATION PERIOD DETERMINATION FOR 185 EUNIKE

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Previous attempts at rotation period determination for 185 Eunike have yielded values of 10.83, 11.02, 14.56, and 21.807 hours, respectively. An aliasing situation appears in which the shorter periods are very near 1/2 and 2/3 of the 21.8 hour period. New observations show a period of 21.797 ± 0.001 hours, amplitude 0.15 ± 0.02 magnitudes, and rule out all of the shorter periods.

Determining the rotation period of asteroid 185 Eunike has been problematic. Debehogne et al. (1978) published a period of 10.83 hours. No further photometric observations were made until Ruthroff (2010) published a lightcurve consistent with an 11.20 hour period. Ruthroff (2011) reevaluated his 2010 data and found them consistent also with 14.56 hours. Based also on data from the 2010 apparition Behrend (2011) obtained a lightcurve with full phase coverage and phased to 21.807 hours. First author Pilcher noted that periods of 11.20 hours, 14.56 hours, and 21.807 hours were all obtained based on year 2010 observations, and that these are very close to a ratio 3:4:6.

To resolve this ambiguity first author Pilcher made observations on 8 nights 2011 June 21 – July 21 at the Organ Mesa Observatory. Equipment consists of a 35 cm Meade LX200 GPS Schmidt-Cassegrain, SBIG STL-1001E CCD, 60 second exposures with R filter, unguided, differential photometry only. These indicated a period near 21.80 hours, and definitively ruled out all of the shorter periods. An examination of the lightcurve by Debehogne et al. (1978) suggested that their data are also compatible with twice their 10.83 hour period. Given these findings Pilcher contacted John Ruthroff, author of the suggested 11.20 hour and 14.56 hour periods. Ruthroff obtained a good fit of all of his year 2010 observations to a 21.80 hour period, but with only 65% phase coverage. Ruthroff, with a 0.3 m Schmidt-Cassegrain operating at f/6.1, SBIG ST9 CCD with image scale 2.2 arcseconds/pixel, SBIG AO-8 adaptive optics unit, unfiltered, 20 second exposures, then obtained data on 5 more nights 2011 Aug. 1 – 10 which confirm a period near 21.8 hours.

Conclusions. We present here lightcurves of the Ruthroff 2010 data phased to a period of 21.80 hours, and of the combined new data by both observers. The 2011 data show a period 21.797 ± 0.001 hours, amplitude 0.15± 0.02 magnitudes, and an irregular lightcurve with one principal maximum and minimum per cycle. It can be stated definitively that all data obtained to date are consistent with the 21.797 hour period of the most dense data set, and that all shorter periods can be ruled out.

References

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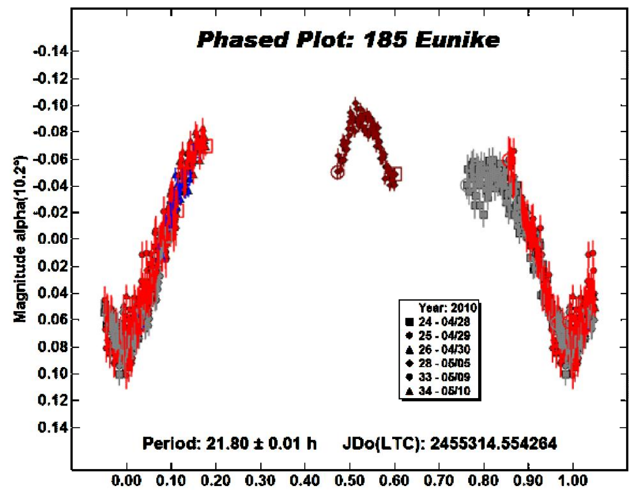

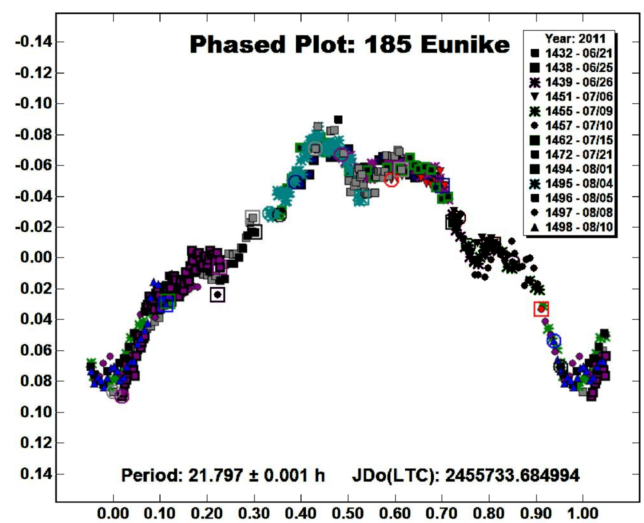

5088 TANCREDI: ROTATION PERIOD AND PHASE COEFFICIENTS

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The main-belt asteroid 5088 Tancredi was observed during a period of 42 days close to the 2009 opposition. The data were collected with a clear filter on 15 different nights. R-magnitudes were calculated using the MPOSC3 Catalog. The observations covered a range of phase angles from 0.35° to 16°. The phase coefficients in the H-G system (R-mag) are: HR = 12.36 HR = 12.36 [12.30, 12.43]; G = 0.058 [–0.036, 0.153], with 95% confidence range presented within the brackets. Based on the low value of G, the asteroid can be tentatively classified as a C-type asteroid. A precise estimate of the rotation period is computed as P = 5.05909 ± 0.00014 h. The amplitude is A = 0.31 mag.

The main-belt asteroid 5088 Tancredi was observed during the 2009 opposition, one of the more favorable in recent years. Perihelion passage and opposition occurred in 2008 Oct. 12 and 2009 Jan 15, respectively. The asteroid reached a minimum apparent magnitude of R~15.5, allowing us to obtain an acceptable lightcurve with our 35-cm telescope. We could find no photometric data of this asteroid published in the literature.

The observations were done at the Observatorio Astronómico Los Molinos (IAU code 844), in the north of Montevideo, the capital of Uruguay, and so under moderately-strong light pollution conditions. Images were taken on 15 different nights from 2009 Jan 15–Feb 26, spanning a period of 42 days. The observational details are given in Table I. We used a 0.35-m f/5.08 Newtonian (modified Cassegrain) with an SBIG ST-7 CCD camera and clear filter. The field of view was 16.5x11 arcminutes with a scale of 1.29 arcsec/pixel. The images were acquired with *Maxim DL*. Bias and dark frames were collected every night, but dome flat fields were collected on only a few nights. The images were calibrated using the *Maxim DL*. The photometric reduction was done with *MPO Canopus* V10. The photometric reference catalog was MPOSC3, provided with MPO software, which includes a large subset of the Carlsberg Meridian Catalog (CMC-14) as well as the Sloan Digital Sky Survey (SDSS). Only stars that are about the same color as the Sun were used as comparison stars. The values of the R-mag were used for reference.

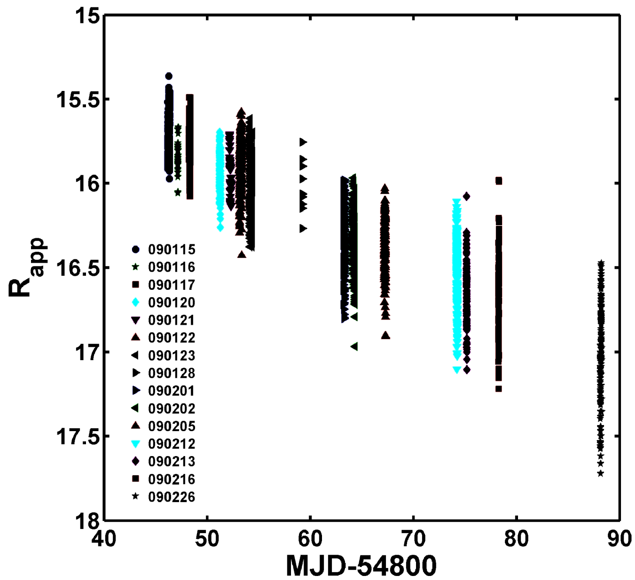

Figure 1. The apparent R magnitude as a function of date (Modified Julian Date – 54800).

Figure 1 shows the apparent R magnitude plotted as a function of date. As seen in Table I, the phase angle was increasing over the span of observations. This and the increasing distance from Earth explain the decline in apparent brightness over time. We computed the median value of the apparent R magnitude each night. These values were corrected for heliocentric and geocentric distance to obtain the reduced magnitude R(1,1,α). The results are listed in Table I and plotted as a function of the phase angle (α) in Figure 2. The phase function adopted by the IAU (Bowell *et al.*, 1989) was fitted to the R(1,1,α) magnitudes using the nonlinear least-squares *fit* function in *Matlab R2008b*.

UT Date	R.A.	Dec.	r	Δ	α	δT	N	R(1,1,α)	σ_R	δR
2009 Jan 15	07 47	+22 02	2.655	1.672	0.33	4.4	257	15.71	0.004	0.36
2009 Jan 16	07 46	+22 04	2.656	1.673	0.60	0.7	34	15.83	0.024	0.24
2009 Jan 17	07 45	+22 06	2.657	1.674	1.01	3.3	205	15.79	0.008	0.35
2009 Jan 20	07 43	+22 12	2.658	1.678	2.34	3.2	171	15.89	0.008	0.29
2009 Jan 21	07 42	+22 14	2.659	1.680	2.79	3.4	39	15.91	0.018	0.35
2009 Jan 22	07 41	+22 16	2.660	1.683	3.23	5.5	252	15.90	0.006	0.38
2009 Jan 23	07 40	+22 18	2.660	1.686	3.68	6.1	327	16.01	0.007	0.46
2009 Jan 28	07 36	+22 26	2.664	1.703	5.86	0.2	10	16.06	0.081	0.40
2009 Feb 01	07 33	+22 33	2.666	1.722	7.54	3.2	203	16.30	0.012	0.46
2009 Feb 02	07 32	+22 34	2.667	1.728	7.95	4.7	248	16.29	0.010	0.41
2009 Feb 05	07 30	+22 38	2.669	1.746	9.15	2.2	152	16.34	0.015	0.42
2009 Feb 12	07 26	+22 44	2.675	1.796	11.75	1.8	185	16.48	0.020	0.53
2009 Feb 13	07 25	+22 45	2.675	1.804	12.10	1.1	122	16.67	0.027	0.48
2009 Feb 16	07 24	+22 47	2.678	1.829	13.11	1.4	122	16.68	0.035	0.65
2009 Feb 26	07 22	+22 48	2.686	1.926	16.04	2.9	144	16.99	0.027	0.80

Table I - Observation details. The ephemerides are computed at 03h UT of the corresponding day. r - heliocentric distance (AU), Δ - geocentric distance (AU), α - phase angle (º), δT - time interval of the observation (hr), N - number of data points, R(1,1, α) - median value of the distance reduced R-mag. for the night, σ_R - error of the mean value (computed as the square root of the sum squares of the individual errors divided by N), δR - magnitude range during the night (computed as the difference between the magnitude in the 90% percentile minus the one in the 10% percentile of the sorted R-mag).