

LIGHTCURVE PHOTOMETRY OF ASTEROID 705 ERMINIA

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Lightcurve period and amplitude results from a collaborative study are reported for asteroid 705 Erminia. The period was determined to be 53.96 ± 0.01 h with an amplitude of 0.13 ± 0.01 mag.

Asteroid 705 Erminia was included in a list of upcoming targets for the late 2005 Arecibo planetary radar program. According to Harris (2005), DiMatrino previously reported a period of 7.22hr. This was considered a tentative result.

The participating observatories were: Antelope Hills Observatory, see Koff (2004) for a description of equipment and instrumentation; Linhacera Observatory, see Goncalves and Behrend (2006); Bédoin (Vaucluse), France, where the instrumentation includes an 0.30m f/3.5 Schmidt-Cassegrain and KAF400ME camera; and Carbuncle Hill Observatory. Details of this observatory are available in Pray (2006).

Observations were initially started at Antelope Hills Observatory. It became apparent that the published period was incorrect, and anomalies were observed in the lightcurve indicating a possible binary system. At this point, assistance was sought from Petr Pravec. Further observations over a total of eleven nights indicated that the asteroid was not a binary system, but that it did have a long period with a number of features. The nightly observations were linked by comparing the nightly comparison star instrumental magnitudes to those from the first night. Thus, the first night's comparison stars were used as an artificial standard. All except one of the linked nights fit within 0.01mag, using a $G=0.04$. The remaining night was taken 16 degrees from the Moon, and required a shift of 0.026mag. Using this procedure, a unique period was determined.

The results from eleven night's observations at Antelope Hills were sent to E. Howell at the Arecibo Observatory. Howell

indicated that she had received results from other sources, and these results were subsequently sent by the respective observers to Pravec for inclusion in the analysis. Goncalves provided four nights of observations while Antonini and Behrend contributed three nights. In addition, Pray observed the object for one night.

The synodic period of the lightcurve was found to be 53.96 ± 0.01 h and its amplitude to be 0.13 ± 0.01 mag. Over the range of dates of observation, the phase angle dropped from 10.9° to 6.1° and then back up to 8.6° . The PAB_1 ranged from 29.9 – 29.4° and the PAB_2 from 12.1 – 16.0° .

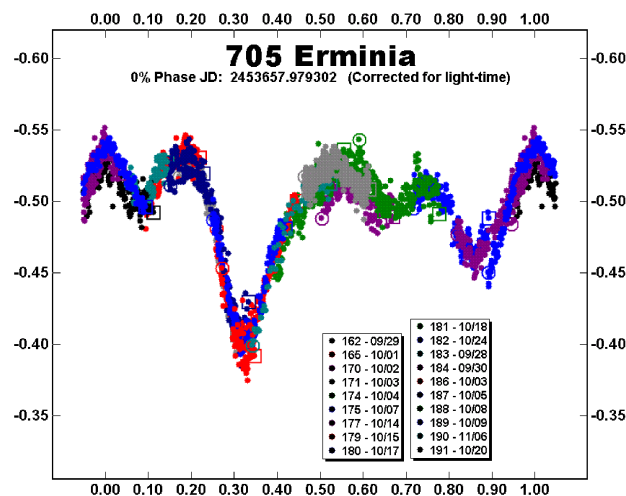


Figure 1. Lightcurve of 705 Erminia based on a period of 53.96h.

Acknowledgments

Many thanks to Brian Warner for his continuing work on the CALL website and MPO Canopus, which has made it possible for amateurs to analyze and share lightcurve data. Thanks also to Alan Harris for his input into the Arecibo target list, defining the accuracy and usability of the currently available periods.

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LIGHTCURVE FOR HUNGARIA ASTEROID 1600 VYSSOTSKY OVER SEVERAL APPARITIONS

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Photometric observations of the Hungaria asteroid 1600 Vyssotsky were previously reported by Warner (1999). Those data were reanalyzed to confirm and, if possible, refine the original results. In addition, analysis was performed on previously unpublished data obtained during the 2004 and 2005 apparitions. The average synodic period for the three apparitions was found to be 3.2011 ± 0.0004 h, with the periods for each apparition within 1-sigma of the average. The amplitude of the lightcurve varied from 0.16–0.18m but most notable was the change in the shape of the curve.

Observations of 1600 Vyssotsky made at the Palmer Divide Observatory used a 0.20m SCT and ST-8E (1999) or a 0.35m SCT and ST-9E (2005). Images from Carbuncle Hill were obtained using a 0.35m SCT and ST-10XME (2004) or a 0.25m Schmidt-Newtonian and ST-7ME (2005). The observations at Badlands Observatory (2004) were made with a 0.66m reflector and AP-8.

The table below shows the average phase angle and PAB values for each apparition. These are important for understanding the changing shape of the lightcurve.

Date	Phase	L_{PAB}	B_{PAB}
1999	19.8	204.3	15.2
2004	17.7	196.8	20.8
2005	2.6	60.2	0.5

In order to make comparisons among the lightcurves easier, they were forced to have a maximum at 0% phase. Figure 1 shows the data from 1999 apparition. Warner (1999) originally reported the period to be 3.20 ± 0.01 h. After re-measuring the images and additional analysis, the period was refined to 3.2011 ± 0.0004 h. The revised total amplitude of 0.18 ± 0.02 m differs from the value 0.13m previously reported. The secondary amplitude, that from first minimum to second maximum, is 0.11 ± 0.01 m.

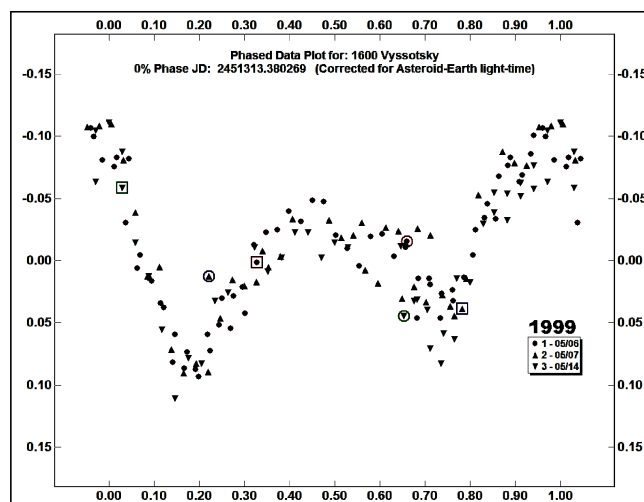


Figure 1. The lightcurve of 1600 Vyssotsky in 1999.

Figure 2 shows the data from the 2004 apparition. Note how the curve is similar in shape to that in Figure 1. This makes sense since the viewing aspects for the two data sets were nearly identical, i.e., the phase angle and Phase Angle Bisector (PAB) values were approximately the same. The period using only 2004 data was found to be 3.2010 ± 0.0002 h. The total amplitude was 0.16 ± 0.02 m while the secondary amplitude was 0.10 ± 0.02 m.

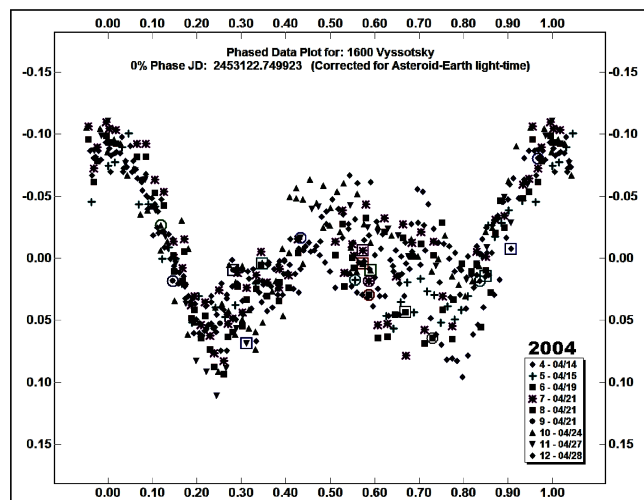


Figure 2. The lightcurve of 1600 Vyssotsky in 2004.

Figure 3 shows the data from the 2005 apparition. Here the shape of the curve differs significantly from the previous two, most notable is that the two maxima are now about the same amplitude, implying the presentation areas of the whole disc at the two maxima were similar. The period using only the 2005 data was determined to be 3.2012 ± 0.0004 h and the amplitude 0.18 ± 0.02 m. The secondary amplitude is larger than in previous years, 0.15 ± 0.01 m.

Assuming the Z-axis (or c) of a triaxial ellipsoid to be 1.0, the two amplitudes in 1999 and 2004 imply an a/c ratio of 1.18:1 and a b/c ratio of 1.11:1. In 2004, the ratios were 1.16:1 and 1.10:1. In 2005 they were 1.18:1 and 1.15:1 respectively. These results and the data sets will be used by Reddy in further analysis to determine the shape and spin axis parameters of the asteroid.