

THE MINOR PLANET BULLETIN

BULLETIN OF THE MINOR PLANETS SECTION OF THE
ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

VOLUME 32, NUMBER 2, A.D. 2005 APRIL-JUNE

25.

PERIOD DETERMINATION FOR 463 LOLA

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(Received: 5 January)

Minor planet 436 Lola was observed on four nights over a 13 day interval in October, 2004. The synodic period was determined as 6.206 ± 0.002 hours. The peak to peak amplitude was 0.2 magnitudes.

Minor planet 463 Lola was discovered by Max Wolf at Heidelberg on October 31, 1900. It is most probably named from a character in an opera. From the book *Asteroids II* (Binzel et al., 1989), this main-belt asteroid – originally 1900 FS – has a quoted diameter of 21.5 ± 0.8 km, an albedo of 0.077 and a B-V of 0.71.

Observations of this minor planet were made as a result of a request for observations to back up radar work at Arecibo. No lightcurve or rotational period was to be found in the literature. The aspect data of the observations in 2004 are listed in Table I (PAB is the Phase Angle Bisector), which also shows the percent of the lightcurve observed each night. Due to the relatively short rotational period a complete light curve – with a short break for clouds – was observed on Oct. 13.

Using a 40cm aperture working at f/6.5, unfiltered CCD photometry was undertaken with integration times giving a S/N of 100 or better, thus yielding an internal precision of 1%. All data were light-time corrected and nightly plots were made of differential magnitude vs JD for an initial graphical analysis. This indicated a period close to 6.2 hours. This was then further refined using the “AVE” software (Barbera, 2004) and the Phase Dispersion Minimisation (PDM) method. The final result was 6.206 ± 0.002 hours, with an arbitrary epoch of minimum at JD 2453289.826 (see Figure 1). The overall peak to peak amplitude of the lightcurve at this opposition was 0.2 ± 0.01 , implying an axial ratio a/b of 1.2. These data have been forwarded to Dr. Mike Nolan and the team at Arecibo Observatory.

Acknowledgements

Brian Warner is thanked for his continuing advice and assistance.

References

Barbera, R. (2004). “AVE” Analisis de Variabilidad Estelar, version 2.51, Grup Estudis Astronòmics. <http://usuarios.lycos.es/rbarbera/AVE/AveInternational.htm>

Binzel, Richard P., Gehrels, Tom, and Matthews, Mildred Shapley (1989). *Asteroids II*. Univ. Ariz. Press, Tucson, Arizona.

Table I. Aspect data for 463 Lola in 2004.

UT	Date	PAB Long	PAB Lat	Phase Angle	% Phase Coverage
2004	Oct 11	27.60	-4.45	7.27	72
2004	Oct 13	27.79	-4.21	6.04	100
2004	Oct 22	28.37	-2.90	2.16	72
2004	Oct 23	28.64	-2.70	2.35	84

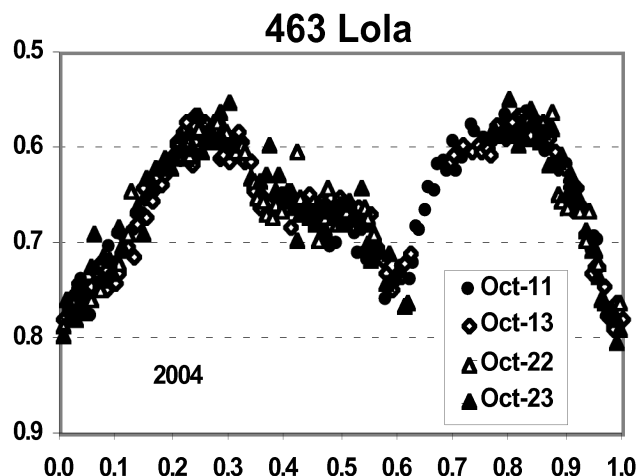


Figure 1. Composite lightcurve, Oct 2004.

REVISED LIGHTCURVE ANALYSIS FOR 1022 OLYMPIADA AND 3285 RUTH WOLFE

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(Received: 15 January)

Additional analysis of two previously published lightcurves by the author resulted in revised synodic periods for both. For 1022 Olympiada, the new synodic period is 3.833 ± 0.005 h while the revised synodic period for 3285 Ruth Wolfe is 3.94 ± 0.01 h.

Introduction

Following recent improvements in the software used to measure images and analyze lightcurves, the author re-examined several curves previously reported in past years. The selected curves were those that had marginal solutions due to lack of or poor data, or might have been misinterpreted due to a lack of experience.

1022 Olympiada. The lightcurve for 1022 Olympiada was previously reported by the author (Warner 1999) as being 4.589 ± 0.002 h. As misfortune would have it, two possible periods were found: the previously reported one and the one now being recommended. The shorter period allowed almost exactly one additional revolution in the interval between runs. In addition, remeasuring the images altered some data points that significantly affected the interpretation of the curve.

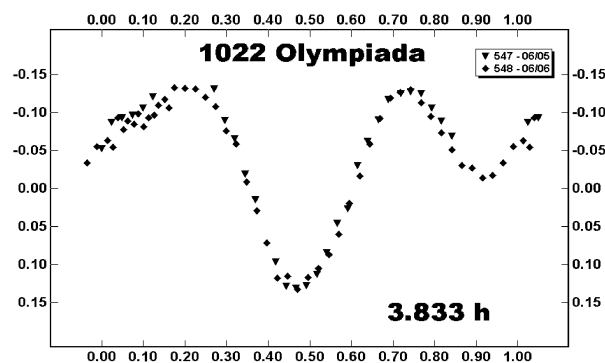


Figure 1. Data for 1022 Olympiada phased against a newly determined period of 3.833h. The amplitude is 0.24 ± 0.02 m.

Figure 1 shows the remeasured data phased against the new, shorter period. Working in favor of this solution was that the RMS value for the data fit of the Fourier analysis is smaller than for the longer period. Another factor in favor of the shorter period was that it agreed well a period reported by Zeigler from data obtained on 1999 June 11-12. (private communication to A. W. Harris).

Figure 2 shows the same data phased against 4.6 hours. This longer period was rejected based on its unusual shape. Specifically, it's nearly tri-modal and in a very unusual way. While this curve and associated period are possible, the more likely solution is the simpler bimodal curve associated with the shorter period.

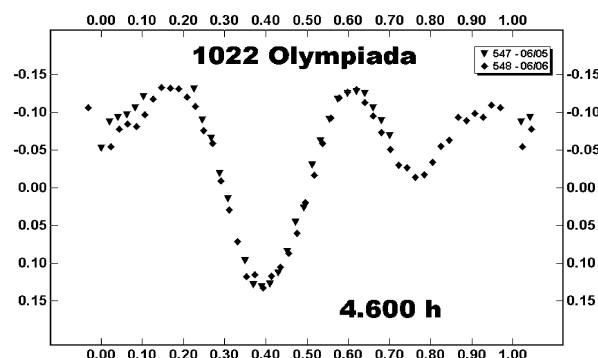


Figure 2. Data for 1022 Olympiada phased against the previous solution of 4.600h, a solution now considered less likely.

3285 Ruth Wolfe. Originally only two data sessions were used to report the previous results of 6.72 ± 0.01 h (Warner 2003). A third session was found while providing sample images to Frederick Pilcher for learning the MPO Canopus software. Pilcher's analysis gave a different result and so the author remeasured all three sets of data and obtained a new period of 3.94 ± 0.01 h. The amplitude of the new curve is 0.21 ± 0.02 m. Figure 3 shows the remeasured data against the new period. A plot of the data against the original period of 6.72h shows no correlation among the data. The Fourier analysis period spectrum showed no likely period out to 9 hours.

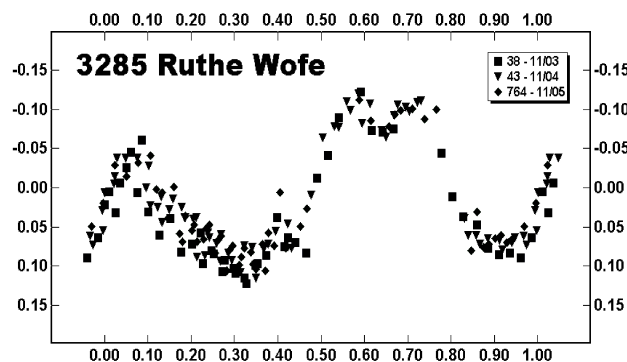


Figure 3. Data for 3285 Ruth Wolfe phased against a period of 3.94h. The amplitude of the curve is 0.20 ± 0.02 m.

Conclusion

While it seems more likely than before that the 3.833h period for Olympiada is correct, additional curves would help make that certain. They might also show a different shape and/or amplitude and so provide some clues about the shape of the Hungaria family asteroid. The next good opportunity for additional study comes in 2005 October, when the asteroid will be about 15.5 and favoring Southern Hemisphere observers at a declination of -17° .

References

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- Warner, B. D. (1999), "Asteroid Photometry at the Palmer Divide Observatory", *Minor Planet Bulletin* **26**, 31-32.
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