## LIGHTCURVE ANALYSIS OF 22 KALLIOPE

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Lightcurves for 22 Kalliope were obtained over five nights in January and February 2007 using a CCD camera. Filtered (I-band) photometric exposures were used to calculate the synodic period (4.148288 hr) and estimate the axial ratio (a/b ≥ 1.51).

22 Kalliope (~181 km) was first detected by Hind in 1852. Margot and Brown (2003) discovered that Kalliope is orbited by a companion satellite, since named Linus. Although the original objective of this photometric campaign was to capture eclipse events (1E2 and 2E1) that were predicted for this binary system from late February through early April, poor weather conditions precluded this possibility.

Equipment utilized included a 0.2-m Vixen VC200L catadioptric (f/6.4) with an SBIG ST 402ME CCD camera mounted at the primary focus running at –10° C and B, V and I filters based upon the Bessell specification. I-band imaging was carried out on a total of seven nights, five of which produced acceptable light curves and are reported herein. Multiple bandwidth (V, B, and I) filtered images were taken only on a single evening (February 10, 2007). Exposures were unbinned and 15 sec for each filter. A typical session lasted from 2.5 to 4 hours with exposures automatically taken at least every 90 seconds. Image acquisition (raw lights, darks and flats) was performed using CCDSOFT 5 (SBIG) while calibration and registration were accomplished with AIP4WIN (Berry and Burnell 2005). Further image reduction with MPO Canopus (Warner 2006) was achieved using at least four non-varying comparison stars to generate light curves by differential aperture photometry. Instrumental readings were light-time corrected but not reduced to standard magnitudes.

A total of 1283 photometric readings in I-band produced lightcurves that spanned three weeks. Relevant aspect parameters for Kalliope taken at the mid-point from each session are shown in the table. Lightcurves exhibited the expected bimodality consistent with an asteroid having a triaxial ellipsoid shape. MPO Canopus provided a period solution for the folded data sets using Fourier analysis (Harris 1989). The synodic period, determined to be 4.148288 ± 0.000001 hr, was in excellent agreement with rotational periods for 22 Kalliope published by Michalowski and Velichko (1990) and Trigo-Rodríguez and Caso (2003). Periodograms produced using "Peranso" (Vannmunster 2006) by applying periodic orthogonals to fit observations and analysis of variance (ANOVA) to evaluate fit quality, confirmed this period determination.

The estimated peak-to-peak maximum change in magnitude (0.445 mag) suggests an axial ratio (a/b) of at least 1.51 where a/b ≥ $10^{0.4 \cdot \Delta mag}$. This value falls within the range (1.32 – 1.6) reported by other investigators (Michalowski and Velichko 1990). V-, B-, and I-band filtered images of Kalliope showed no notable color effects.

Acknowledgement

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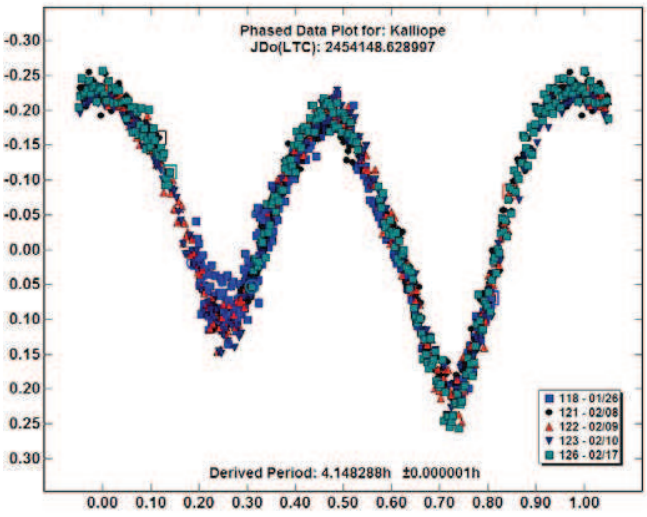


| UT Date (2007) | No. Obs | Phase Angle | $L_{PAB}$ | $B_{PAB}$ | %Phase Coverage |
|---|---|---|---|---|---|
| Jan 26 | 322 | 15.4 | 88.5 | 8.5 | 63.2 |
| Feb 8 | 250 | 18.5 | 89.9 | 8.9 | 88.9 |
| Feb 9 | 251 | 18.7 | 90.1 | 8.9 | 87.1 |
| Feb 10 | 209 | 19 | 90.3 | 9.0 | 105.5 |
| Feb 17 | 251 | 20 | 91.2 | 9.1 | 85.5 |