

172 BAUCIS — A SLOW ROTATOR

C.S. Bembrick
PO Box 1537, Bathurst, NSW 2795, Australia
bembrick@ix.net.au

T. Richards
8 Diosma Rd, Eltham, Vic 3095, Australia

G. Bolt
295 Camberwarra Drive, Craigie, WA 6025, Australia

B. Peregry
37 Hatfield St, Blakehurst, NSW 2221, Australia

D. Higgins
7 Mawalan St, Ngunnawal, ACT 2913, Australia

W. H. Allen
83 Vintage Lane, RD 3 Blenheim, NZ

(Received: 14 March)

Lightcurve measurements of 172 Baucis in 1985 and 1999 were inconclusive in determining the period of rotation. However in 2003 a combined effort by Southern Hemisphere observers derived a synodic rotation period of 27.417 ± 0.013 hours. The overall variation was 0.25 magnitudes in 2003, but appears to have been 0.4 in 1999 and 0.35 in 1985.

Introduction

Minor planet 172 Baucis was discovered by A. Borrelly at Marseilles in February, 1877. Baucis is an inner main belt, S-type asteroid with an estimated diameter of 64.5 km. The albedo is quoted as 0.12 and the B-V = 0.9 (Binzel et al. 1989). The latest list of Harris (2003) indicates that the rotation period is probably more than 16 hours and the lightcurve amplitude is at least 0.23 magnitude. However, a reliability code of only one is assigned to these data.

Baucis has been the subject of a number of investigations, including six nights of photoelectric photometry by Zeigler in 1985 who proposed a period of 51.25 hours (Zeigler, 1999). Weidenschilling et al. (1990) suggested a period of either 13 or 26 hours based on two single night lightcurves in 1984 and 1989. Observations over three nights by Bembrick and Peregry in 1999 (unpublished) indicated that a period near 26 hours was possible.

Observations and Results

In 2003 Baucis was well placed at southerly declinations so Southern Hemisphere observers from Western Australia to New Zealand (spanning nearly 60 degrees of Longitude) undertook a joint observing program. The names and locations of the observers are listed in Table I. In all, some eight nights of good data were acquired over a time span of 33 days. The observational circumstances are summarized in Table II, which also shows the phase coverage of the light curve on individual nights.

Data from each night were plotted as differential instrumental magnitude vs JD. No light-time corrections were applied. Initial attempts to do a quick phase stack by graphical and “eyeball” methods failed – largely due (in hindsight) to the evolution of the

lightcurve (particularly the minima) over the observing period of more than one month. A number of initial trials were done between 1.5 and 2.25 days as Zeigler (1999) had listed a period of 51.25 hours. It rapidly became apparent that our data could not be phased with that period.

A subset of the data was compiled using the six best nights and the “AVE” software (Barbera 2004) was used for a period search utilizing the Phase Dispersion Minimisation (PDM) method. Searching between 1.0 and 2.0 days yielded a distinct minimum in the “periodogram” between 1.140 and 1.143 days – and also an alias at 1.7 days. Further refinement narrowed this to 1.142 days. A number of trial phase plots, gradually folding in the additional data, showed that 1.1424 days (27.417 hours) was the best fit to the data.

The phase stacked composite lightcurve for the 2003 observations is displayed in Figure 1 – with arbitrary zero phase (JD 2452852.80) to best display the data on the phase plot. Magnitudes from individual nights were adjusted by an additive constant to give a “best fit” to the phase stack. Note the varying depths of the minima which have changed over the observing period. The overall peak-to-peak variation between extrema was 0.25 magnitudes in 2003. To a first approximation (using a tri-axial ellipsoid model), this implies a ratio a/b of 1.26, where a , b and c are the semi-axes of the ellipsoid and rotation is about the shortest axis, c .

Data from other years were then individually folded at the derived period. Zeigler’s 1985 data are compatible with this period although the lightcurve is fragmentary. The total variation appears to be 0.35 magnitudes. Similarly for our unpublished 1999 data, where the overall variation appears to be 0.40 magnitudes. Both of these data sets show a deep minimum in the light curve which could be compared to the first minimum of Figure 1.

The 1989 data (Weidenschilling, et al. 1990) when phased with our period produces a deep minimum (0.2 mag. in depth) not dissimilar to the first minimum in Figure 1 and also similar to the 1985 data. However, 0.2 magnitudes is almost certainly not the maximum variation for that opposition as the observations sample only 45% of the lightcurve. If we rely on data from 1985, 1999 and 2003, then a plot of Heliocentric Longitude vs maximum delta magnitude suggests that the Longitude of the rotational pole lies at 55 or 235 degrees.

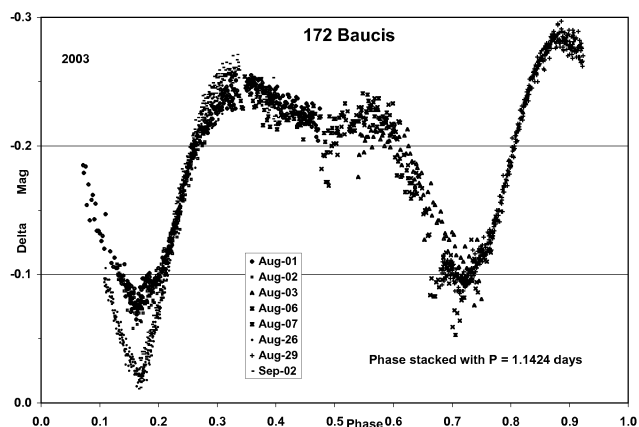


Figure 1. Composite lightcurve for asteroid 172 Baucis.

Conclusions

Minor planet 172 Baucis is a slow rotator, with a synodic rotation of 27.417 ± 0.013 hours. Although observations spanned more than a month, the 2003 data when phase stacked cover only 85% of the complete lightcurve. The overall variation was 0.25 magnitudes, but in previous years appears to have been more than this, suggesting that 2003 was not an equatorial aspect. The axial ratio a/b is at least 1.26 and may be as much as 1.44. For these reasons and to confirm the period, Baucis deserves observing at future oppositions.

Acknowledgements

The assistance of Alan Harris in providing original unpublished data obtained by Ken Zeigler in 1985 is gratefully acknowledged.

References

Barbera, R. (2004). "AVE" Analisis de Variabilidad Estelar, version 2.51. Grup d'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, Tuscon, Arizona.

Harris, A.W. and Warner, B.D. (2003). "Minor Planet Lightcurve Parameters." Updated Dec 15, 2003 & posted on <http://cfa-www.harvard.edu/iau/lists/LightcurveDat.html>

Weidenschilling, S. J., Chapman, C. R., Davis, D. R., Greenburg, R., Levy, D. H., Binzel, R. P., Vail, S. M., Magee, M., and Spaute, D. (1990). "Photometric Geodesy of Main-Belt Asteroids. III Additional Lightcurves." *Icarus* **86**, 402-447.

Zeigler, Kenneth, W. (1999). "Astronomical Research Involving Junior High and High School Students." In the proceedings of the *1999 Minor Planet Amateur/Professional Workshop* (Paul Comba, Ed.), pp 70-73.

Table I. Observer Locations — 2003

Observer	Lat. (S)	Long. (E)	Alt. (m)
C. Bembrick	33.4348	149.7576	880
T. Richards	37.7156	145.1673	100
G. Bolt	31.7906	115.7571	45
D. Higgins	35.1624	149.1100	655
W.H.Allen	41.50	173.85	30

Table II. Observational Circumstances

Date of Obs	Heliocentric		R (AU)	Solar Phase Angle	Phase Coverage (%)
	Lat. (B°)	Long. (L°)			
Aug 01	-4.25	307.317	2.125	4.08	40
Aug 02	-4.19	307.648	2.125	4.25	16
Aug 03	-4.14	307.979	2.124	4.48	22
Aug 06	-3.98	308.978	2.123	5.48	30
Aug 07	-3.93	309.305	2.122	5.88	32
Aug 26	-2.88	315.625	2.114	14.70	28
Aug 29	-2.71	316.626	2.113	15.99	23
Sep 02	-2.48	317.962	2.112	17.62	24

346 HERMENTARIA – ANOTHER SLOW ROTATOR?

C. Bembrick

PO Box 1537, Bathurst, NSW 2795, Australia
bembrick@ix.net.au

B. Pereghy

37 Hatfield St, Blakehurst, NSW 2221, Australia

A. Ainsworth

28 Lansdowne Pde, Oatley, NSW 2223, Australia

G. Bolt

295 Camberwarra Drive, Craigie, WA 6025, Australia

(Received: 18 March)

Observations of minor planet 346 Hermentaria in 2003 indicate that it has a probable synodic rotation period of 28.43 ± 0.06 hours. The lightcurve amplitude at this opposition was 0.2 magnitude, similar to that of 1998. Further work is needed to refine this suggested period.

Introduction

Minor planet 346 Hermentaria was discovered by A. Charlois at Nice in November, 1892. It was probably named after the village of Herment in the Auvergne region of southern France. This S-type, main-belt asteroid has an estimated diameter of 110 km, and albedo of 0.13 and a B-V of 0.85 (Binzel et al. 1989). In the latest list of Harris and Warner (2003) the probable period is quoted as 19.408 hours and the lightcurve amplitude as 0.07 magnitude. A reliability of 2 is assigned to these values. However, a previous suggested period of 28.33 hours is given a reliability of only 1.

Hermentaria has been observed on a number of oppositions, including 1980 (Harris and Young, 1989), 1981 (Harris et al. 1992), 2001 and 2002 (Wang and Shi, 2002). In addition, the first three authors above have unpublished data over five nights from the 1998 opposition. Largely because of the long period, the previous observations have all produced partial light curves from which assumptions have been made to interpret a rotation period.

The first suggested period was 28.326 hours (Harris and Young, 1989), on the basis of nine nights in 1980. Two further nights of observations in 1981 were not inconsistent with this period (Harris et al. 1992). The 1998 data indicated that a period close to 28 hours was possible, but other periods such as 22 and 37 hours were not ruled out. On two nights in 2001 and two nights in 2002 Wang undertook observations and these were composited to derive a period of 19.408 hours (Wang and Shi, 2002).

Observations and Results

In 2003 Hermentaria was favourably placed at southerly declinations – although in crowded star fields. Consequently a further effort was made to try to pin down the rotation period. Due to the long period, the crowded fields and the weather constraints, only a few partial light curves were obtained in 2003. A summary of the observational circumstances is presented in Table I, which also shows the phase coverage of the lightcurve on individual nights.

Data from each night were plotted as differential magnitude vs JD. No light-time corrections were applied. From inspection of the