Rev. Mexicana Astron. Astrof., **21**, 593-596 (1990)

PHOTOELECTRIC PHOTOMETRY OF ASTEROID 100 HEKATE

Ricardo Gil Hutton
Observatorio Astronómico de Mercedes
Mercedes, Argentina

RESUMEN. Se ha estudiado fotoeléctricamente en los colores B y V la curva de luz del asteroide 100 Hekate y, a partir de cinco fragmentos de curva observados durante la oposición de septiembre de 1988, se determinó un perùodo de 13.333±0.005 hs., una amplitud máxima de 0.11±0.01 mag., un valor para el parámetro G de 0.45.

ABSTRACT. The lightcurve of the asteroid 100 Hekate has been studied photometrically in B and V colors. From five fragments of curve, observed during the September 1988 opposition, a period of 13.333±0.005 hs., a maximum amplitude of 0.11± 0.01 mag., a (B-V) color index of 0.878±0.014 and a value for the G parameter of 0.45 were obtained.

Key words: ASTEROIDS

I.- INTRODUCTION

The precise determination of rotation periods of asteroids allows the derivation of some important physical paramenters for these objects, such as the orientation of their spin axes, shapes and bulk densities (Taylor 1971, Magnusson 1986, Weidenschilling et al. 1987) and can help to constrain our knowledge of the collisional evolution of asteroids. The asteroid 100 Hekate was included in a regular observing program because it had not a definite period. Only one previous observation was available according to the Asteroid Lightcurve Catalogue (Lagerkvist et al. 1985). 100 Hekate has been observed by Tedesco (1979) who cannot derive a rotational period but proposed a tentative one of more than 20 hours, and reported an amplitude of 0.05 magnitude.

II.- OBSERVATIONS

100 Hekate was observed during five nights in the September 1988 opposition. The observing conditions of the asteroid are shown in Table 1. The ephemerides have been calculated from the orbital elements of the Ephemerides of Minor Planets for 1988 (1987).

Table 1. Observing Conditions of 100 Hekate

Date	long (1950) °	lat °	r(AU)	(AU)	α
Sep 07	341.34	-5.90	2.679	1.676	2.45
Sep 08	341.13	-5.94	2.680	1.677	2.67
Sep 09	340.34	-5.96	2.691	1.680	2.94
Sep 10	340.93	-5.96	2.682	1.682	3.24
Sep 11	340.53	-6.02	2.683	1.685	3.57

The observations were made with the 76 cm. Cassegrain telescope of the "El Leoncito" station of Félix Aguilar Observatory, San Juan, Argentina. A digital photoelectric photometer with a cooled RCA 31034A photomultiplier tube and pulse counting system was employed. A diaphragm with a 30" aperture was used for all measurements and the integration time was calibrated by means of the method proposed by Fitzgerald and Sheldon (1982) to secure an average uncertainty of 0.01 magnitude. Differential photometry in the standard B and V colors of the Johnson system was carried out using the star SAO 165451 and SAO 165423 as comparison stars due to their closeness to the asteroid and adequate spectral type (G0 according to the SAO catalgue). both comparison stars have been standarized using the nearby Equatorial Selected Area 114 (Landolr 1973). The observations were corrected by light-time.

III. RESULTS

Five fragments of the lightcurve, corresponding to 5 consecutive nights, were obtained. Periods producing good fits to the observations were determined by Fourier analysis. The best coupling was found to occur for a period of 13.333±0.005 hours. The result are shown in Figure 1 for V and in Figure 2 for (B-V), where the data of the last four nights were superposed on the first one. In the construction of these composite lightcurves, the variations in the V magnitude and (B-V) color on different nights due to changing phase angle were adjusted minimizing the data dispersion.

The lightcurve shows two maxima and two minima per rotational cycle, with a lightcurve maximum amplitude of 0.11±0.01 magnitude, and the asteroid was observed brighter during one lightcurve maximum and minimum than at the others. The average (B-V) color of 100 Hekate was found to be 0.878±0.014, which is higher than the value reported by Bowell et al. (1979). It is

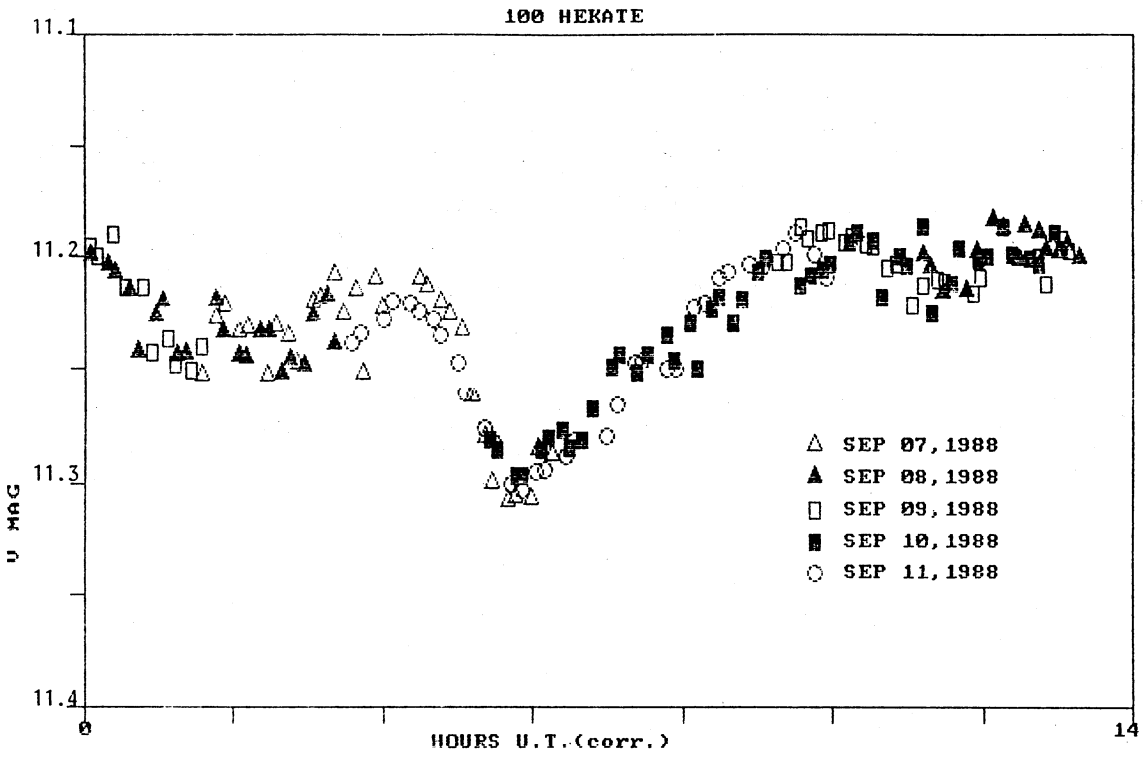

Fig. 1.- Lightcurve in V.

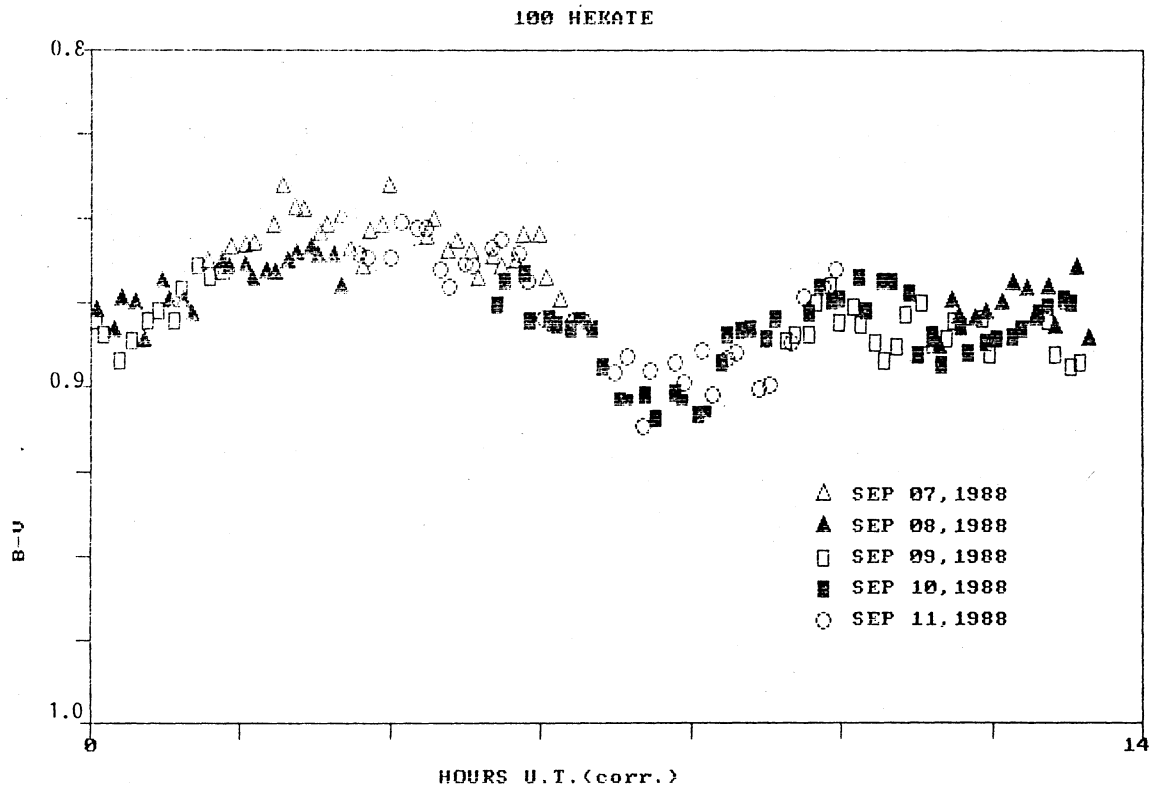

Fig. 2.- Lightcurve in B-V.

important to note the sharp maximum at 2:30 UT and minimum at 7:30 UT in the (B-V) lightcurve. These changes are observed to recur at the same rotational phases and, probably, represent true variations due to albedo changes.

For each day the average $V(r,\Delta,\alpha)$ and $V(1,\alpha)$ observed magnitudes and the $V(1,\alpha)$ theoretical magnitude were calculated with the formula proposed by the Commitee on Magnitude Ephemerides of the IAU Commission 20 (MPC 10193-10194, 1985). The absolute magnitude, H, and the slope parameter, G, were those given in the Ephemerides of Minor Planets for 1988 (1987). The results are shown in Table 2. The large differences in the (O-C) values is due to the low quality of the adopted G-value (0.25). In spite of the small variation of the phase angle, the slope parameter G=0.45, obtained by least squares, gives a better fit to the data.

Table 2. Average Magnitude Values for H = 7.79

Date	Ooserved		Calculated G=0.25		Calculated G=0.45	
	$V(r,\Delta,\alpha)$	$V(1,\alpha)$	$V(1,\alpha)$	(O-C)	$V(1,\alpha)$	(O-C)
Sep 07	11.242	7.981	8.027	-0.046	7.964	0.017
Sep 08	11.247	7.984	8.040	-0.056	7.974	0.010
Sep 09	11.254	7.986	8.055	-0.069	7.985	0.001
Sep 10	11.260	7.989	8.072	-0.083	7.998	-0.009
Sep 11	11.267	7.991	8.089	-0.092	8.011	-0.020

IV.- CONCLUSIONS

A synodic rotational period of 13.333±0.005 hours, a maximum amplitude of 0.11±0.01 magnitude, a (B-V) average color index of 0.878±0.014 and a slope parameter G of 0.45 has been found for the asteroid 100 Hekate. The computed rotational period is the first completely reported.

The author wishes to thank Ing. José A. López and the staff of Félix Aguilar Observatory for the observing time and kindness during the course of this research program, and to Dr. Juan C. Forte for his useful suggestions.

REFERENCES

Bowell et al. 1979, in *Asteroids*, ed. T. Gehrels, (University of Arizona Press, Tucson), pp 1108-1129.
Ephemerides of Minor Planets for 1988 1987, (Institute of Theoretical Astronomy, Academy of Science, U.R.S.S.)
Fitzgerald, M. P. and Sheldon, I. 1982, *J.R.A.S.*, 76, 337.
Lagerkvist, C.-I. et al. 1985, *Uppsala Astron. Observ. Rep.* Nx36.
Landolt, A. U. 1973, *Astron.J.*, 78, 959.
Lumme, K. and Bowell, E. 1981, *Astron. J.* 86, 1705.
Magnusson, P. 1986, *Icarus*, 68, 139.
Taylor, R. 1971, in *Physical Studies of Minor Planets*, ed. T. Gehrels, NASA sp-267, pp 117-132.
Tedesco, E. F. 1979, in *Asteroids*, ed. T. Gehrels, (University of Arizona Press, Tucson), pp 1098-1107.
Weidenschilling, S. J. 1987, *Icarus*, 70, 191.

Ricardo Gil Hutton: Observatorio Astronómico de Mercedes, Calle 29 No. 575-6600, Mercedes, Argentina.