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PHOTOELECTRIC PHOTOMETRY OF ASTEROIDS 58 CONCORDIA, 122 GERDA, 326 TAMARA, AND 441 BATHILDE

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RESUMEN

Se presenta fotometría fotoeléctrica de los asteroides 58, 122, 326 y 441. Las observaciones se hicieron durante 1991 en la Estación Astronómica "Dr. Carlos Ulrrico Cesco" del Observatorio Félix Aguilar, San Juan, Argentina. Para los planetas menores 122 y 326 se han obtenido períodos de rotación confiables, mientras que para 58 Concordia se da un período aproximado.

ABSTRACT

Photoelectric photometry of asteroids 58, 122, 326 and 441 are herein presented. The observations were made during 1991 at Estación Astronómica "Dr.Carlos Ulrrico Cesco" of Félix Aguilar Observatory, San Juan, Argentina. For minor planets 122 and 326 a reliable rotation period has been obtained, while for 58 Concordia an approximate estimate is given.

Key words: **MINOR PLANETS**

1. INTRODUCTION

Enlarging the observational data base of rotational properties of asteroids may allow significant conclusions to be drawn regarding the collisional evolution of the asteroid belt (Harris & Burns 1979; Tedesco & Zappala 1980; Farinella, Paolicchi, & Zappala 1981; Dermott, Harris, & Murray 1984) and gain insights into the cosmogonically important distribution of spin axis orientation (Magnusson 1986). Furthermore, the precise determination of rotational periods give the tool to decide about the physical reality of the Hirayama families (Gil Hutton 1993). Thus I have performed a regular program of photoelectric photometry of asteroids whose main goal is the lightcurve determination (Gil Hutton 1988). The present paper summarizes lightcurve data for asteroids 58 Concordia, 122 Gerda, 326 Tamara and 441 Bathilde from various observing runs during 1991.

2. OBSERVATIONS

The observations were made with the 76-cm Cassegrain telescope of Estación Astronómica "Dr. Carlos Ulrrico Cesco" of Félix Aguilar Observatory, San Juan, Argentina. A digital photoelectric photometer with a cooled RCA 31034A photomultiplier tube and a 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 & Shelton (1982) to secure an average uncertainty of 0.01 magnitude. Differential photometry in the standard B and V magnitudes of the Johnson system was carried out using background stars as local comparisons due to their closeness to the asteroids. These stars have been standardized using the equatorial standards of Landolt (1973, 1983). Aspect data for all observing nights are given in Table 1 including the date, geocentric longitude (λ) and latitude (β) of the asteroid, its phase angle (α) and its geocentric (Δ) and heliocentric (r) distances. The observations were corrected for light-time.

3. RESULTS

The rotational periods were determined using a method proposed by Stellingwerf (1978), which is a generalization of Lafler & Kindman (1965) method and allows an arbitrary degree of smoothing and provides complete statistical information.

The data about taxonomic classification is from Tholen (1989) and the $B-V$ colors and diameters from Tedesco (1989).

TABLE 1

OBSERVING CONDITIONS

Asteroid	Date	λ (1950.0)	β	α	Δ	r
58 Concordia	Dec 06 1991	58.24	−07.69	05.75	1.816	2.776
122 Gerda	Mar 18 1991	158.38	−00.58	05.74	2.102	3.064
	Mar 19 1991	158.20	−00.57	06.11	2.106	3.064
326 Tamara	May 17 1991	226.56	−16.51	09.29	0.959	1.946
	Jun 06 1991	221.25	−21.31	19.26	1.020	1.920
	Jun 07 1991	221.07	−21.47	19.71	1.025	1.919
441 Bathilde	Sep 06 1991	321.48	11.72	08.00	1.972	2.923
	Sep 08 1991	321.12	11.68	08.63	1.981	2.921

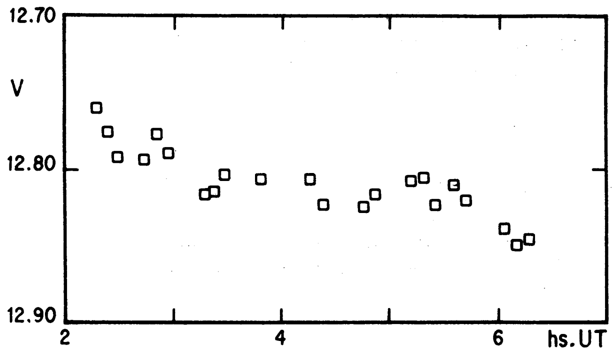

Fig. 1. *V* lightcurve for asteroid 58 Concordia. The time axis refers to UT on December 6, 1991.

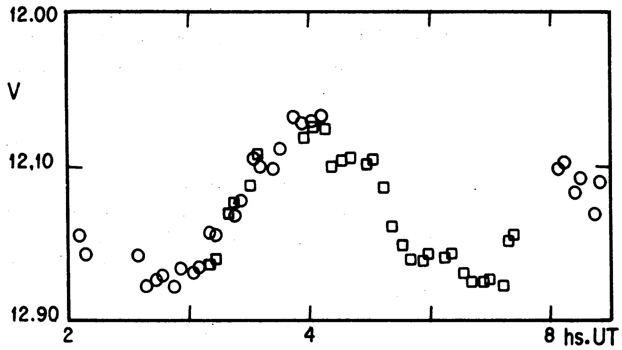

Fig. 2. Composite *V* lightcurve for asteroid 122 Gerda. The time axis refers to UT on March 18, 1991. Data for 03/18/91 are shown with squares and for 03/19/91 with circles.

3.1. 58 Concordia

This is a low-numbered asteroid of type C never observed previously. The lightcurve (Figure 1) is too short to allow a definite conclusion about the rotational period, but it is not less than 16 hours assuming a double maxima and minima lightcurve. The $B-V$ color observed is 0.67±0.01, which agrees with the published value of 0.69.

3.2. 122 Gerda

For this ST-type asteroid it was possible to construct a composite lightcurve (Figure 2) from the two nights of observations and find a period of 8.903±0.005 hours, which is the first one reported for this asteroid. The amplitude is 0.11 mag and the lightcurve shows unequal maxima. The observed $B-V$ color is 0.87±0.01 which seems to be rather high in comparison with Tedesco's (1989) value of 0.78 for which a quality code was not included; so it is possible to assume that the published value has a great uncertainty. On the other hand, the value of 0.87 reported in this paper, seems to be in a very good agreement with unpublished results (Tedesco 1993).

3.3. 326 Tamara

This C-type asteroid was observed during three nights and was possible to obtain a composite lightcurve (Figure 3) based on a period of 14.184±0.005 hours, which is the first one reported for this asteroid. Periods of the order of 16 – 18 hours are possible too, but they present only one maximum or a concentration of the maxima in few hours indicating a very irregular shape for an asteroid of 100 km of diameter. The lightcurve has an amplitude of 0.11 mag and shows unequal maxima and minima. The $B-V$ color observed is 0.71±0.01 which agrees with the value published.

3.4. 441 Bathilde

This M-type asteroid was observed during two nights, and a period cannot be deduced but the lightcurves agree very well with a period of 10.35 hours proposed by Harris & Young (1980) (Figure 4). The typical behavior of M-type objects, unequal maxima and minima, are insinuated in the lightcurves. The amplitude observed was 0.17 mag

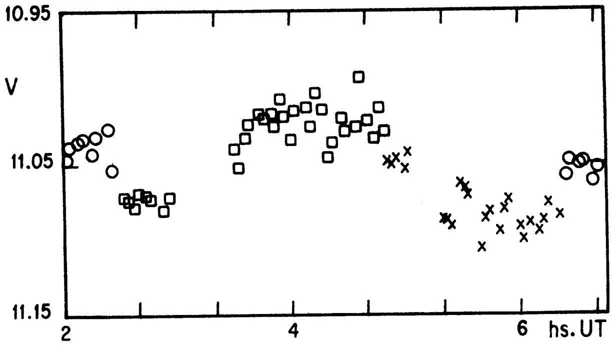

Fig. 3. Composite V lightcurve for asteroid 326 Tamara. The time axis refers to UT on May 17, 1991. Data for 05/17/91 are shown with squares, for 06/06/91 with circles and for 07/06/91 with crosses.

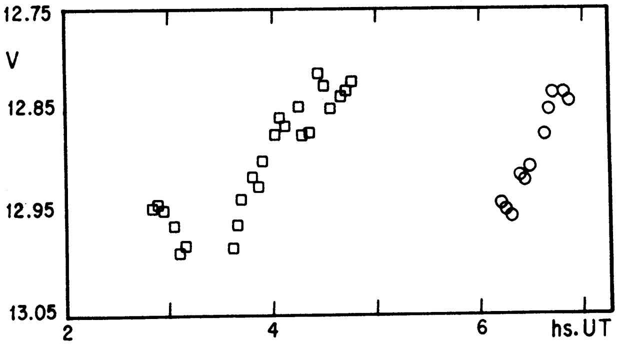

Fig. 4. Composite V lightcurve for asteroid 441 Bathilde. The time axis refers to UT on September 6, 1991. Data for 09/06/91 are shown with squares and for 09/08/91 with circles.

and the $B-V$ color is 0.68±0.01 which agrees with the published one.

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