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# PHOTOELECTRIC PHOTOMETRY OF ASTEROIDS 184 DEJOPEJA, 498 TOKIO AND 690 WRATISLAVIA

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RESUMEN

Se presenta fotometría fotoeléctrica de los asteroides 184, 498 y 690. Las observaciones se hicieron durante 1992 en la Estación Astronómica "Dr. Carlos Ulrrico Cesco" del Observatorio Félix Aguilar, San Juan, Argentina. Para el planeta menor 184 se ha obtenido un período de rotación confiable, mientras que para 498 y 690 se dan períodos aproximados.

ABSTRACT

Photoelectric photometry of asteroids 184, 498 and 690 are herein presented. The observations were made during 1992 at Estación Astronómica "Dr.Carlos Ulrrico Cesco" of Félix Aguilar Observatory, San Juan, Argentina. For minor planet 184 a reliable rotation period has been obtained, while for 498 and 690 approximate estimates are 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 insight into the cosmogonically important distribution of spin axis orientation (Magnusson 1986). Furthermore, the precise determination of rotational periods provide a tool to decide about the physical reality of the Hirayama families (Gil Hutton, Licandro, & Gallardo 1995). 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 184 Dejopeja, 498 Tokio and 690 Wratislavia from various observing runs during 1992.

## 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 ($\lambda$) and latitude ($\beta$) of the asteroid, its phase angle ($\alpha$) and its geocentric ($\Delta$) and heliocentric (r) distances. The observations were corrected for light-time.

## 3. RESULTS

The rotational periods were determined using the Phase Dispersion Minimization (PDM) method proposed by Stellingwerf (1978), which is a generalization of Lafler & Kindman (1965) method and allows an arbitrary degree of smoothing providing complete statistical information. The data about taxonomic classification is from Tholen (1989) and the $B$–$V$ colors from Tedesco (1989).

TABLE 1

OBSERVING CONDITIONS

| Asteroid | Date | $\lambda$ (1950.0) | $\beta$ | $\alpha$ | $\Delta$ | r |
|---|---|---|---|---|---|---|
| 184 Dejopeja | Apr 03 1992 | 203.85 | −01.28 | −03.75 | 1.937 | 2.924 |
| | Apr 06 1992 | 203.27 | −01.30 | −02.57 | 1.930 | 2.925 |
| | Apr 07 1992 | 203.07 | −01.31 | −02.17 | 1.928 | 2.925 |
| 498 Tokio | Jul 30 1992 | 294.34 | −07.08 | 06.63 | 1.134 | 2.133 |
| | Aug 01 1992 | 293.93 | −07.25 | 07.62 | 1.137 | 2.130 |
| | Aug 03 1992 | 293.53 | −07.41 | 08.62 | 1.140 | 2.127 |
| 690 Wratislavia | Jul 06 1992 | 283.53 | 08.81 | 02.98 | 1.982 | 2.991 |

### *3.1. 184 Dejopeja*

For this X-type asteroid it was possible to construct a composite lightcurve (Figure 1) from the three nights of observations and find a period of 6.455 ± 0.008 hr, which is close to a previous period of 6.7 hs reported by Tedesco (1979) based in only one night. The amplitude is greater than 0.28 mag and the lightcurve shows unequal maxima and minima. The observed $B-V$ color is 0.688 ± 0.012 which agrees with the value published.

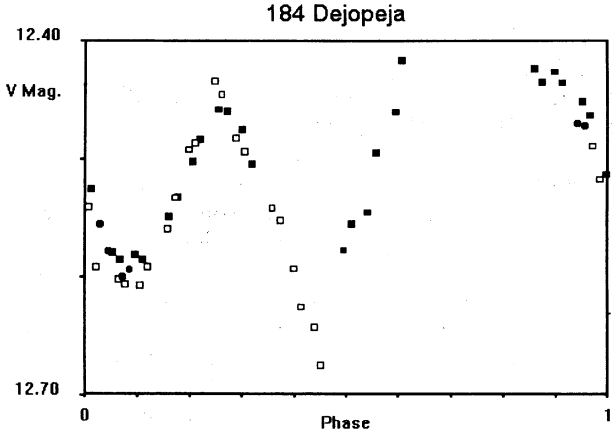


Fig. 1. Composite $V$ lightcurve for asteroid 184 Dejopeja. Data for 04/03/92 are shown with filled squares, for 04/06/92 with squares and for 04/07/92 with filled circles.

### *3.2. 498 Tokio*

This M-type asteroid was observed previously by Gil Hutton (1989) who reported a period longer than 20 – 30 hr. From three nights of observations was impossible to obtain a reliable rotational period, but testing the PDM solutions against the 1988 lightcurves periods shorter than ~ 30 hr were ruled out. A composite lightcurve based on a 30 hr period is shown in Figure 2 with an amplitude of 0.18 mag. The $B-V$ color observed is 0.742 ± 0.020 which agrees with the value published.

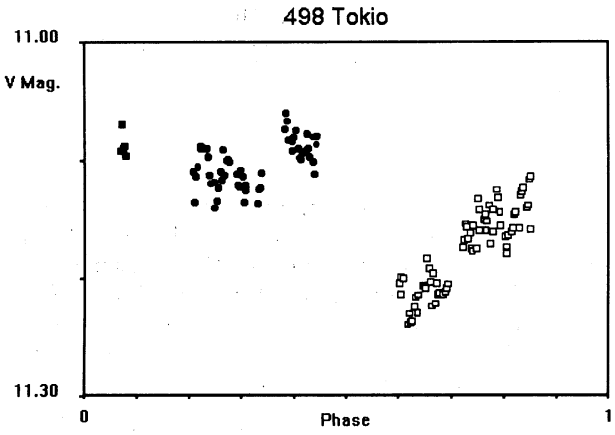


Fig. 2. Composite $V$ lightcurve for asteroid 498 Tokio. Data for 07/30/92 are shown with filled squares, for 08/01/92 with squares and for 08/03/92 with filled circles.

### *3.3. 690 Wratislavia*

This CPF-type asteroid was observed during one night but instrumental problems produce significant gaps in the lightcurve (Figure 3). There are not enough data to deduce a period, but they clearly show that the previous reported period (Gil Hutton 1988) of 6.31 hr is not correct. The lightcurve shows two unequal maxima with a large magnitude difference between them and separated by 5.2 hr. This was

ısed to search for a new period with the 1987 obser-ʼations and the best choices are 9.906 and 12.621 hr. The $B-V$ color observed was 0.663 ± 0.012 which ıgrees with the value published.

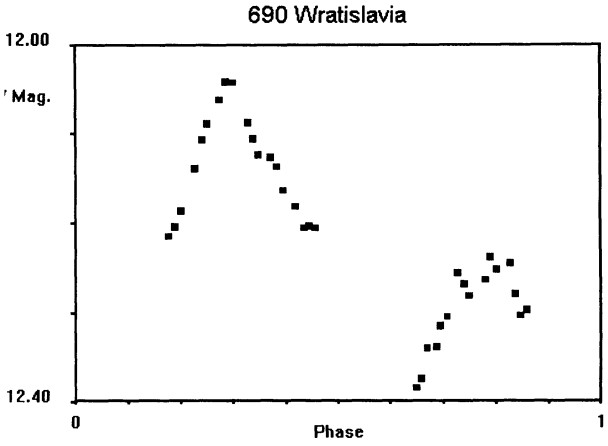


Fig. 3. $V$ lightcurve for asteroid 690 Wratislavia. The lata are shown assuming a rotational period of 10 hr.

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