

PHOTOELECTRIC PHOTOMETRY OF ASTEROID 394 ARDUINA

Ricardo Gil Hutton¹

Observatorio Astronómico de Mercedes, Argentina

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RESUMEN

La curva de luz del asteroide 394 Arduina se ha estudiado fotoeléctricamente en los colores B y V ; a partir de cuatro fragmentos de curva observados durante la oposición de septiembre de 1990, se determinaron el período de 16.53 ± 0.01 hs, la amplitud máxima de 0.54 ± 0.01 mag y el índice de color ($B-V$) de 0.840 ± 0.014 .

ABSTRACT

The lightcurve of the asteroid 394 Arduina has been studied photometrically in B and V colors. From four fragments of curve, observed during the September 1990 opposition, a period of 16.53 ± 0.01 hs, a maximum amplitude of 0.54 ± 0.01 mag and a ($B-V$) color index of 0.840 ± 0.014 were obtained.

Key words: **ASTEROIDS – PHOTOMETRY**

I. INTRODUCTION

The precise determination of rotation periods of asteroids allows the derivation of some important physical parameters 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 394 Arduina was included in a regular observing program because a definite period has not been established for it.

II. OBSERVATIONS

394 Arduina was observed during four nights in the September 1990 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 1990 (1989).

The observations were made with the 76-cm Cassegrain telescope of Dr. Carlos U. Cesco 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

1. Present address: Observatorio Astronómico "Félix Aguilar", Chimbass, San Juan, Argentina.

calibrated by means of the method proposed by Fitzgerald and Shelton (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 two background stars (see Table 1) as comparison stars due to their closeness to the asteroid. Both comparison stars have been standardized using the nearby Equatorial Selected Area 114 (Landolt 1973, 1983). The observations were corrected for light-time.

III. RESULTS

Four fragments of the lightcurve, corresponding to 4 consecutive nights, were obtained. Periods

TABLE 1

OBSERVING CONDITIONS FOR 394 ARDUINA

Date	α	δ	l	b	ϕ	Comp. ^a Star
Sep. 12	22 ^h 52 ^m	19°47'	336.6°	11.6°	7.69°	1
Sep. 13	22 51	19 50	336.4	11.5	8.06	1
Sep. 14	22 50	19 52	336.3	11.5	8.44	1
Sep. 15	22 49	19 54	336.1	11.5	8.83	2

a. Coordinates of the comparison stars (1950) are: 1) 22^h50.8^m; $-20^{\circ} 03'$. 2) 22^h50.3^m; $-20^{\circ} 00'$.

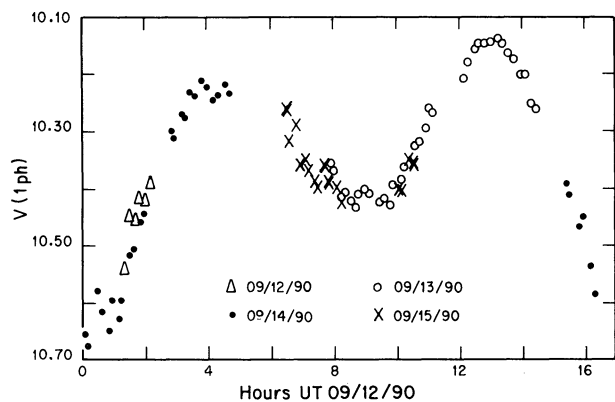


Fig. 1. $V(1,ph)$ lightcurve for 394 Arduina.

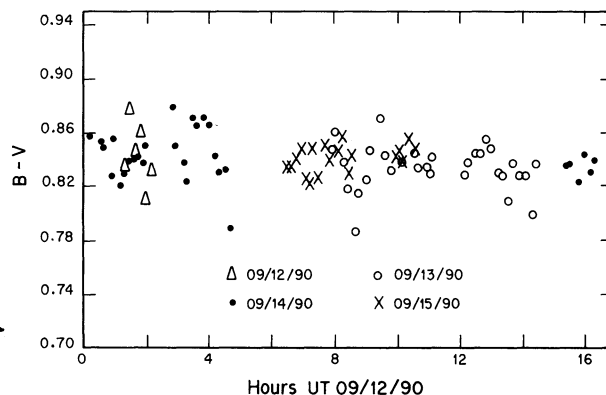


Fig. 2. $(B-V)$ lightcurve for 394 Arduina.

producing good fits to the observations were determined using a method proposed by Stellingwerf (1978), a useful generalization of the technique proposed by Lafler and Kinman (1965). The best coupling was found to occur for a period of 16.53 ± 0.01 hs. The results are shown in Figure 1 for $V(1, ph)$ and in Figure 2 for $(B-V)$, where the data of the last three nights were superposed on the first one. In the construction of these composite lightcurves, the variations in the V magnitude 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 0.54 ± 0.01 mag, and the asteroid was observed brighter during one lightcurve maximum and minimum than at the others. The average $(B-V)$ color of 394 Arduina was found to be 0.840 ± 0.014 , which agrees with the value of 0.83 reported by Tedesco (1989).

IV. CONCLUSIONS

A synodic rotational period of 16.53 ± 0.01 hs, a maximum amplitude of 0.54 ± 0.01 mag and $(B-V)$ average color index of 0.840 ± 0.014 has been

found for the asteroid 394 Arduina. The computed rotational period is the first one to be completely reported.

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