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PHOTOELECTRIC MINIMA OBSERVATIONS OF THE ECLIPSING BINARY ST CARINAE

The eclipsing character of the tenth photographic magnitude star ST Carinae (HD 89234, CD-59°2985, CPD-59°2007, HV 1270, AO + F6) was discovered photographically by Pickering (1906) from Harvard patrol plates. The system was later observed photographically by Leavitt (1908) who described it as an Algol-like eclipsing binary and found a period of $0^d.901652$. Shapley (1915) obtained a preliminary orbital solution based on photographic data. Further photographic observations carried out by Hertzsprung (1925) confirmed the existence of a secondary minimum of about $0^m.06$ in depth predicted by Shapley (1912). Hertzsprung obtained the following ephemeris:

$$\text{JD Hel Min I} = 2423901^d.675 + 0^d.9016498\ E \qquad (1)$$

More recently Gaposchkin (1953) obtained new photographic minima from which he found the following revised ephemeris:

$$\text{JD Hel Min I} = 2428915^d.756 + 0^d.9016495\ E \qquad (2)$$

So far, no photoelectric light curve of ST Car has been obtained. During the period from February 1980 to March 1981, we made 650 UBV photoelectric observations at the Bosque Alegre Station (BAS) of the National University of Córdoba (Argentina).

The measurements were carried out with the BAS 154-cm telescope provided with a conventional design photometer. These data were supplemented with 100 photoelectric observations in each color, obtained during April-May 1980 with the 61-cm Lowell telescope at the Cerro Tololo Inter-American Observatory (CTIO, Chile). RCA 1P21 photomultipliers refrigerated with dry ice were used in both observatories. All the observations of ST Car were made differentially in relation to HD 89234, whose spectral type is AO. Mean atmospheric extinction coefficients were used to correct for first and second-order differential extinction. No variation in the light of the comparison star was detected.

Using the bisection-of-chords method we derived a total of 17 new times of minimum light. A linear least squares solution, including the above photoelectric minima and three older photographic ones, leads to the following improved ephemeris:

$$\text{JD Hel Min I} = 2444317^{d}.7292 + 0^{d}.90164965\ E \qquad (3)$$
$$\pm.0004 \quad \pm.00000004$$

Table I

Times of minimum light of ST Carinae

JD Hel. 2440000 +	E	(O-C)	Reference
-25739.666	-33336.0	-0.002	A
-16098.325	-22643.0	-0.001	B
-11084.244	-17082.0	0.006	C
4282.5654	-39.0	0.0006	D
4282.5653	-39.0	0.0005	D
4282.5636	-39.0	-0.0012	D
4317.7288	0.0	-0.0004	D
4317.7290	0.0	-0.0002	D
4317.7290	0.0	-0.0002	D
4365.5156	53.0	-0.0010	D
4365.5155	53.0	-0.0011	D
4365.5155	53.0	-0.0011	D
4647.7330	366.0	0.0001	D
4647.7333	366.0	0.0004	D
4647.7328	366.0	-0.0001	D
4675.6850	397.0	0.0009	D
4675.6844	397.0	0.0003	D
4675.6846	397.0	0.0005	D
4698.6733	422.5	-0.0028	D
4698.6785	422.5	0.0023	D

References to Table I

A: Leavitt (1908)

B: Hertzsprung (1925)

C: Gaposchkin (1953)

D: This study

It is clearly seen that the period of ST Car does not seem to have varied over the past seventy years. Table I gives in succession the available times of minima, epoch numbers, residuals (O-C) computed from equation (3), and sources of reference.

Orbital phases have been calculated from the revised ephemeris given in equation (3) and light and color curves have been obtained. The differential light curves in the V-magnitude and (B-V) color are shown in Figure 1. The differences ΔV and $\Delta(B-V)$ are in the sense variable minus comparison star. The light curve in the V-magnitude reveals partial eclipses; the depths of primary and secondary minima are about 1.2 and 0.3, respectively. In addition, the variation in the maxima due to ellipticity and reflection effects is also evident.

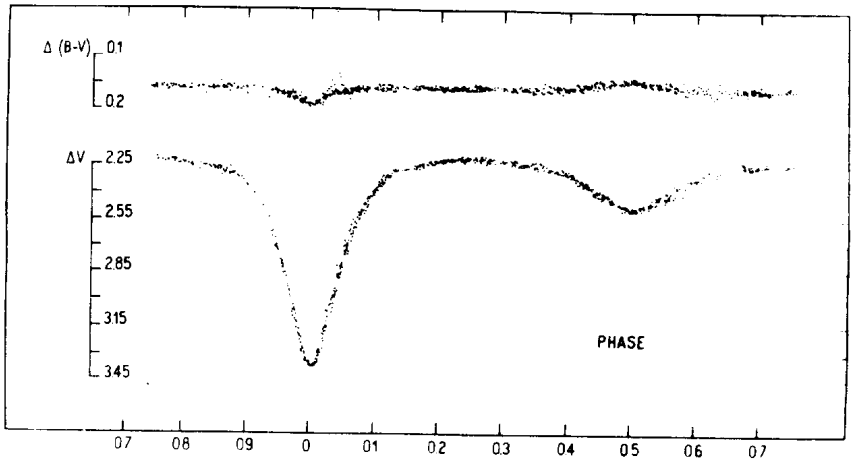

Figure 1: V and (B-V) light curves of the eclipsing binary ST Carinae

A detailed analysis of ST Carinae by means of the classical Russell-Merrill procedure will be published elsewhere.

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