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PHOTOELECTRIC ELEMENTS AND REVISED SPECTRAL TYPES OF XX Cas

In this communication, photoelectric elements of the eclipsing binary system XX Cas in U, B and V filters and revised colour indices have been presented. In the absence of good photoelectric observations and complete set of photoelectric elements in the literature, and in order to remove the uncertainties regarding the nature of eclipses, duration of totality, if any, spectral classes of the components, apsidal motion, ellipticity and reflection effects, the UBV photometry of the system XX Cas was carried out by the author during the period December 1972 to February 1975. The observational details and some results were published earlier (Srivastava, 1983). The light outside the eclipses shows continuous variation, hence the rectification of

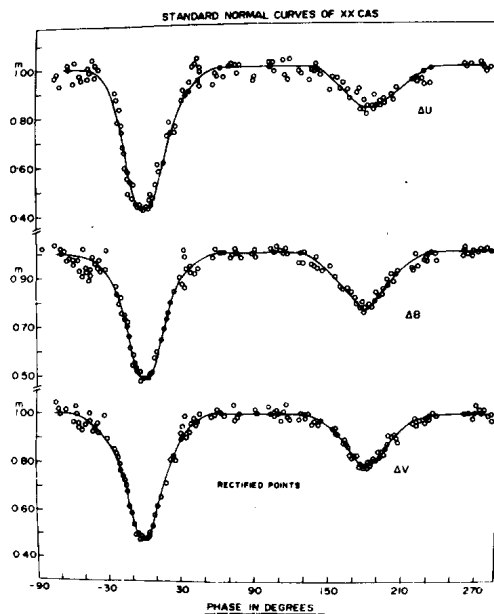


Figure 1 Rectified light curves of XX Cas. The solid lines depict the smoothed light curves through the rectified normals.

the light curves has been done in each filter following the graphical method of Russel and Merrill (1952). The rectified observations and smoothed light curves are shown in Figure 1

The rectification coefficients, given in Table I, rule out the possibility of significant ellipticity and reflection effects.

Table I  
Rectification coefficients of XX Cas.

Coefficients	U filter	B filter	V filter
$A_0$	1.0220	0.9970	0.9740
$A_1$	-0.0285	-0.0222	-0.0043
$A_2$	0.0007	0.0009	0.0006
$B_1$	-0.0018	0.0027	0.0000
$B_2$	0.0040	-0.0040	0.0000
$C_0$	0.0372	0.0372	0.0372
$C_1$	0.0285	0.0222	0.0043
$C_2$	0.0124	0.0124	0.0124
Z	0.0181	0.0182	0.0192

The elements of the system have been derived using the method of Russell and Merrill (1952) and Merrill's (1950) tables. A nomographic solution was tried with assumed values 0.8, 0.6 and 0.4 for the limb-darkening coefficients ( $\kappa$ ). The solution could only be obtained with  $\kappa = 0.4$ , when the primary eclipse was considered to be a total (occultation) in all the three colours. This finding of ours is contrary to the suggestion by Pierce (1938) that the eclipses are partial. However, Pierce has not ruled out the possibility of a total eclipse. The value of  $k$  has been arrived at after several trials. The light elements are:

$$\kappa = 0.4 \text{ (assumed)}, \quad k = 0.73, \quad p_0 = -1.0, \quad \alpha_0^{oc} = 1.0 \text{ and } \alpha_0^{tr} = 1.0257.$$

Table II  
Geometrical elements of XX Cas

Elements	U filter	B filter	V filter	Mean of U, B and V filters
$1-\lambda_1$	0.570	0.510	0.510	--
$1-\lambda_2$	0.180	0.235	0.220	--
$L_1$	0.570	0.510	0.510	--
$L_2$	0.430	0.490	0.490	--
$r_1$	0.278	0.267	0.269	0.271
$r_2$	0.380	0.366	0.369	0.372
$i$	$84^{\circ}.1$	$84^{\circ}.2$	$84^{\circ}.2$	$84^{\circ}.2$
$\theta_e$	$40^{\circ}.8$	$39^{\circ}.0$	$39^{\circ}.3$	$39^{\circ}.7$
$\theta_i$	$3^{\circ}.4$	$1^{\circ}.6$	$1^{\circ}.7$	$2^{\circ}.2$

Elements	U filter	B filter	V filter	Mean of U, B and V filters
$J_1/J_2$	2.58	1.95	1.95	2.16
Pr	0.392	0.346	0.350	--
Sec	0.364	0.335	0.337	--

The geometrical elements are given in Table II, wherein the subscripts 1 and 2 refer to the primary and the secondary components, respectively. The  $\Psi$  - method has been used to obtain the computed light curves in U, B and V filters shown as the solid lines in Figure 2.

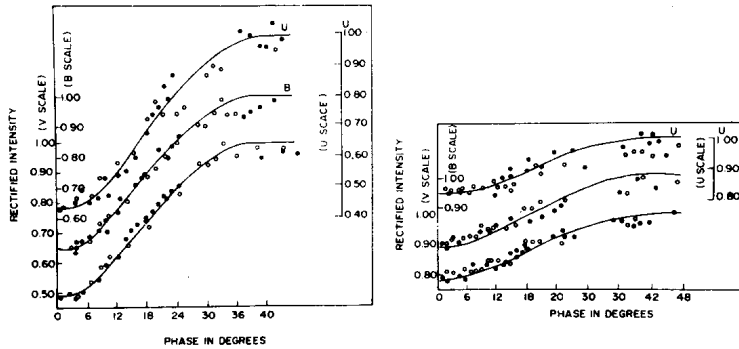


Figure 2

Intensity curves of normal points of XX Cas. The direct points are shown as filled circles and the reflected points as open circles. The solid lines represent the computed light curves.

The interstellar extinction (reddening) has been determined using Q parameter and employing the relations given by Golay (1974). The intrinsic colour indices and revised spectral types of XX Cas have been obtained, and are listed in Table III along with the colour excesses.

Table III  
Colours of XX Cas

Star	$Q$	(B-V)	(U-B)	E(B-V)	E(U-B)	Sp.
Primary	-0. <sup>m</sup> 98	-0. <sup>m</sup> 32	-1. <sup>m</sup> 13	0. <sup>m</sup> 68	0. <sup>m</sup> 42	BOV
Component						

Secondary Component	-0.72	-0.24	-0.80	0.60	0.35	B2V
Maximum (combined colour of both the components)	-0.86	-0.29	-0.98	0.65	0.39	B1V
Comparison star	-0.22	-0.07	-0.17	0.54	0.30	B9V

The average interstellar extinctions come out to be  $E(B-V) = 0.62^m$  and  $E(U-B) = 0.37^m$ , and the revised spectral types stand as B0V and B2V as against F2V and F2V reported earlier (Srivastava, 1983).

Our results are important in the following respects :

- (1) The rectification coefficients show that the reflection and ellipticity effects are insignificant in comparison to the findings of Pierce, and hence the components are non elliptical.
- (2) The eclipses are total and not partial as suggested by Pierce.
- (3) Present spectral types are closer to those given by Hilditch and Hill (1975), but are slightly different to those of Wyse (1934), Gaposchkin (1935), and Hill et al. (1975).
- (4) The interstellar reddening is appreciably present in the system.

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R.K. SRIVASTAVA,

Uttar Pradesh State Observatory  
Manora Peak - 263 129,  
Naini Tal, INDIA

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