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PHOTOELECTRIC MINIMA AND LIGHT CURVES OF THE ECLIPSING BINARY
VZ LIBRAE

The variability of the short period eclipsing system VZ Librae ($\alpha=15^{\text{h}}30^{\text{m}}.8$, $\delta=-15^{\circ}37'$, 1980) was discovered by Tsesevich (1954). He classified this variable as a WUMa-type eclipsing binary and obtained, on the basis of his photographic measurements, the following ephemeris:

$$\text{Min I} = \text{Hel. J.D. } 2429645^{\text{d}}.010 + 0^{\text{d}}.3584501 \cdot E \quad (1)$$

Although VZ Librae has been known to be a variable star for about 25 years, little attention has been paid to it, and no photoelectric light curve of this system has yet been published.

From April 1980 to July 1981, VZ Librae was observed photoelectrically in the UBV system at the Cerro Tololo Inter-American Observatory (CTIO, Chile) and Bosque Alegre Station (BAS) of the National University of Córdoba (Argentina). The measurements were made using the CTIO 61-cm telescope, equipped with a pulse counting photometer, and with the BAS 150-cm telescope provided with a conventional design photometer. RCA 1P21 photomultipliers refrigerated with dry ice were used in both Observatories. The measurements were made differentially with respect to the comparison star HD 138187, whose spectral type is A5. All the observations have been corrected for first and second-order differential extinction.

The comparison star is located ~ 20 minutes of arc southwest from VZ Librae and, consequently, the corrections applied for differential extinction were small. The mean errors of a single differential observation in V, (B-V), and (U-B) at CTIO

are 0.008, 0.005, and 0.012, respectively, while at BAS these values are 0.015, 0.014 and 0.028.

Standard stars were observed at CTIO so that all observations could be converted to the standard UBV system. No variation in the light of the comparison star was detected. This star was found to have the following values:

$$\begin{aligned} V &= 7.689 \\ (B-V) &= 0.322 \\ (U-B) &= 0.076 \end{aligned}$$

VZ Librae was found to have the following magnitude and colors at maximum light:

$$\begin{aligned} V &= 10.130 . \\ (B-V) &= 0.612 \\ (U-B) &= 0.046 \end{aligned}$$

The location of the variable at maximum light in the Color-Color diagram is consistent with an unreddened main sequence star with spectral type F9.

From 982 observations obtained in 1980-1981 for each pass-band of the UBV system, we derived 20 times of minimum light. The bisection-of-chords method was used to determine nine times of primary minimum and eleven of the secondary one. A linear least squares solution using our photoelectric data yields the following improved ephemeris:

$$\begin{aligned} \text{Min I} = \text{Hel. J.D. } &2444788^{\text{d}}.59010 + 0^{\text{d}}.35826334 . E & (2) \\ &+0.00014 \quad +0.00000024 \end{aligned}$$

The photoelectric minima together with the epoch numbers and residuals (O-C), calculated from the ephemeris given in equation (2), are listed in Table I. As shown in the table, the differences (in heliocentric julian days) between the observed minima and those calculated from ephemeris (2), yield very small randomly distributed (O-C) residuals, all being smaller than 0.001^{d} .

Table I
Times of minimum light of VZ Librae

Min	Pass-band	Hel J.D. 2444000 +	E	(O-C)
II	U	366.7362	- 1177.5	0.0012
II	B	366.7359	- 1177.5	-0.0011
II	V	366.7339	- 1177.5	-0.0011
II	B	408.6514	- 1060.5	-0.0004
II	V	408.6509	- 1060.5	-0.0009
II	U	698.8464	- 250.5	0.0013
II	B	698.8453	- 250.5	0.0002
II	V	698.8448	- 250.5	-0.0003
I	U	787.5147	- 3.0	-0.0006
I	B	787.5154	- 3.0	0.0001
I	V	787.5154	- 3.0	0.0000
I	U	788.5901	0.0	0.0000
I	B	788.5899	0.0	-0.0002
I	V	788.5901	0.0	0.0000
I	U	789.6645	3.0	-0.0004
I	B	789.6654	3.0	0.0005
I	V	789.6654	3.0	0.0005
II	U	790.5598	5.5	-0.0007
II	B	790.5603	5.5	-0.0002
II	V	790.5608	5.5	0.0002

The new period included in ephemeris (2) appears to be about sixteen seconds shorter than given in equation (1). This change, however, is large enough as to produce a shift in the light curve of about half a period in only one year.

Orbital phases have been computed from the revised ephemeris (2) and light and color curves have been drawn. 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. There is no doubt that we are dealing with a close (contact) system. The depths of primary and secondary minima are about 0.5 mag and 0.4 mag, respectively. In particular, the secondary minimum appears to be slightly flattened (total eclipse) which will make more easy a future analysis of the star. In addition, the light curve at the maxima clearly shows the variations due to the deformation and to the reflection effect of the components.

B and U light curves show similar characteristics to those presented in Figure 1. Both (B-V) and (U-B) colors are nearly constant all over the period.

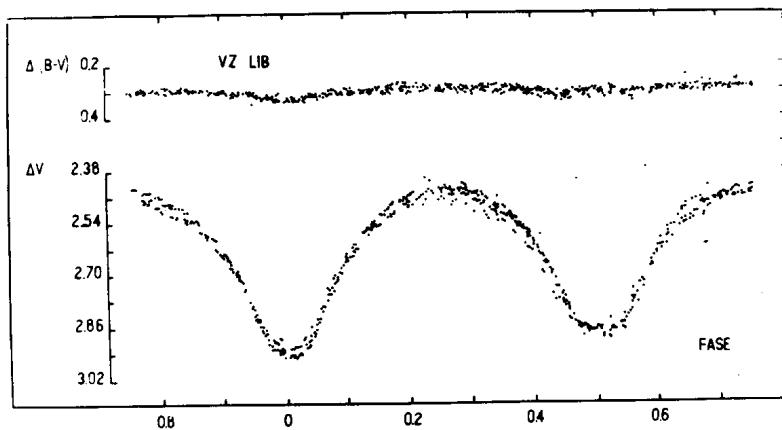


Fig. 1. V and (B-V) light curves of the eclipsing binary VZ Librae

It is interesting to note, however, that the UBV observations reveal noticeable intrinsic variations of this contact system. We have detected significant night-to-night brightness changes, particularly in the U-band, which could be indicative of abrupt changes in the structure of the system.

A detailed analysis of the light curves using the method developed by Wilson and Devinney (1971) will be published later.

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References:

- Tsevevich, B.P. 1954, Izvestia Astron.Observatory Odessa 4, 196.
Wilson, R.E. and Devinney, E.J. 1971, Astrophys. J. 166, 605.

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