THE NATURE OF THE ECLIPSES OF VZ HYDRAE

(Letter to the Editor)

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Abstract. Further study of the observed U, B, V light curves of VZ Hya reveals that the primary eclipse is an occultation.

1. On the Nature of Eclipses of VZ Hydrae

VZ Hydrae (BD − 5° 2564) is an eclipsing binary and is also a double lined spectroscopic binary. The system has been observed and studied visually spectroscopically and/or photoelectrically by various authors viz. O'Connell (1932), Wood (1946), Struve (1945), Walker (1970), Popper (1965), Padalia and Srivastava (1975). Cester *et al.* (1978) has analysed the system by means of the Wood programme.

An analysis of he UBV light curves based on our observations (29 nights during the period from February 1969 to May 1972) reveals that the primary eclipse is an occultation (larger star in front) and secondary a transit one (smaller star in front), Padalia and Srivastava (1975). However, Popper (1976; and private communication) has expressed his disagreement over our finding regarding the nature of eclipses. According to Popper the primary eclipse should be a transit (smaller star in front).

In this communication our findings are mainly based on the depths of light curves observed by us earlier and therefore analysis of light curves is not required. However, values of k (light curves analysed by means of Wood programme) given by Cester *et al.* (1978), have also been considered to find out light lost at internal tangency to study the nature of the eclipses. If one assumes that the primary eclipse is a transit and secondary an occultation, as suggested by Popper, then, at the tip of secondary minimum only the light of the brighter component is available.

The differential magnitudes in U, B, V colours from our observations at the tip (flat portion), from computed points level (Figure 1; cf. Padalia and Srivastava, 1975), are

$$\Delta U = -1^{m}.509 , \qquad \Delta B = -0^{m}.266 , \qquad \Delta V = 0^{m}.397 .$$

On the basis of these values, and incorporating UV excess $0^{m}.06$, given by Popper (1965), the colour of the brighter component comes out to be

$$U - B = -0^{m}.083 , \qquad B - V = 0^{m}.407 . \tag{1}$$

Furthermore, according to Popper (1956) the colour of light lost at any phase of either eclipse is simply the colour of the eclipsed star. Hence, from the tip of the secondary

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minimum, the light lost in different colours (based on our observations) comes out to be:

The loss of light (in intensity units): 0.315 (U), 0.345 (B), 0.370 (V). Converting these intensity values into respective magnitudes and incorporating UV excess of $0^m.06$, the colour of fainter component by usual method comes out to be

$$U - B = 1^m.259\,, \qquad B - V = 1^m.147\,. \tag{2}$$

The above values of colour in (1) and (2) for the brighter and fainter component, respectively, indicate that they fit neither in any spectral class nor do they agree with the values derived by Walker (1970) or by Wood (1946). Finally, we have also performed the test (Irwin, 1960) viz. that for a transit type primary eclipse the light lost at internal tangency should be equal to τL_g.

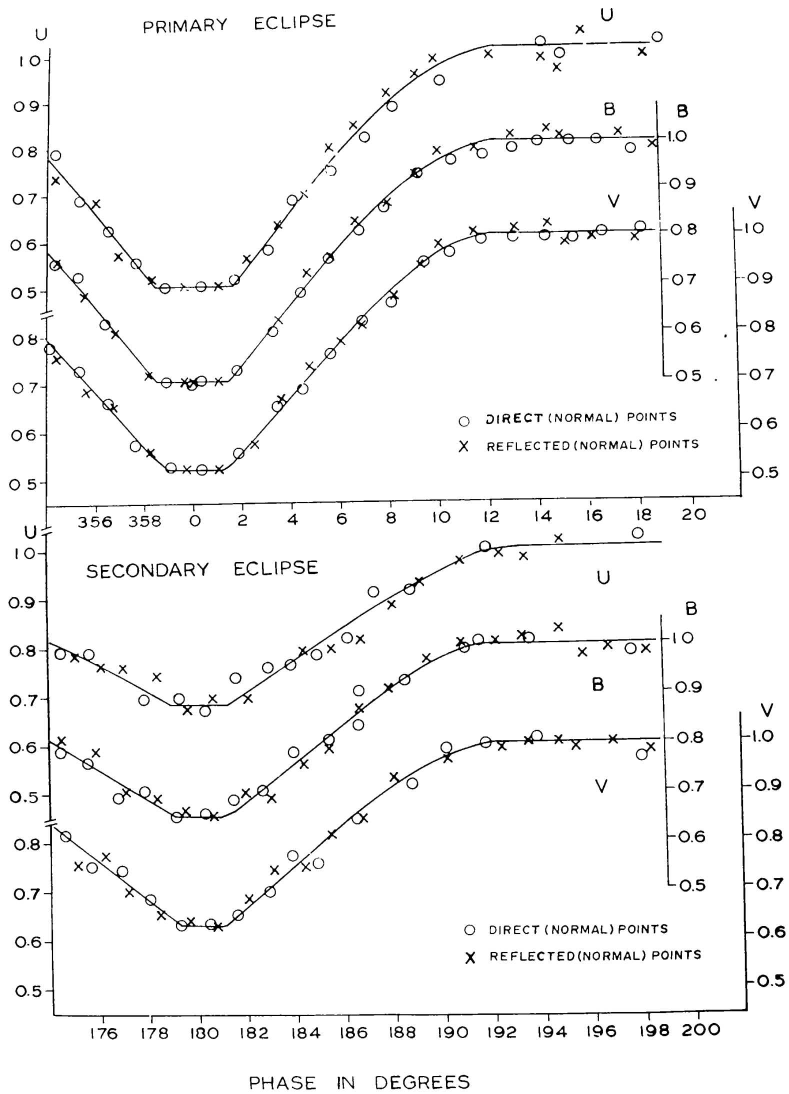

Fig. 1. Intensity curves of normal points of VZ Hya in U, B, V filters. The ordinates represent intensity in each filter. The solid line indicates free-hand curve drawn through normal points.

From the depths of secondary minimum observed by us, we have (in intensity units):

$$L_g = 0.685\,(U),\, 0.655\,(B),\, 0.630\,(V)\,;$$

whence, assuming $k = 0.90$, $x = 0.6$, $0.6\tau_9 = 0.856$, Padalia and Srivastava (1975), we get

$$\tau L_g = 0.586\,(U),\, 0.561\,(B),\, 0.539\,(V)\,. \qquad (3)$$

Adopting

$$k = \begin{matrix} 0.792\,(U), & 0.826\,(B), & 0.824\,(V) \\ \pm 0.026 & \pm 0.020 & \pm 0.013 \end{matrix}$$

and

$$x = 0.80\,(U),\, 0.77\,(B),\, 0.62\,(V)\,,$$

Cester *et al.* (1978), we get

$$\tau L_g = 0.483\,(U),\, 0.495\,(B),\, 0.464\,(V)\,. \qquad (4)$$

However, the observed light lost (Figure 1) at internal tangency comes out to be:

$$0.500\,(U),\, 0.495\,(B),\, 0.480\,(V)\,. \qquad (5)$$

The values in (1) and (2) differ from (3) as follows:

$$0.086\,(U),\, 0.066\,(B), \quad \text{and} \quad 0.059\,(V)\,, \qquad (6)$$

$$0.017\,(U),\, 0.000\,(B), \quad \text{and} \quad 0.016\,(V)\,. \qquad (7)$$

These differences are more than permissible except for B filter in (5) (accuracy ± 0.005 in terms of the intensity); and, hence, the assumption of primary eclipse being annular is not workable. Hence, on the basis of our photoelectric investigations we infer that the primary eclipse of VZ Hydrae is an occultation.

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