NOTES FROM OBSERVATORIES

PHOTOELECTRIC OBSERVATIONS OF THE ECLIPSING BINARY 32 CYGNI

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Photoelectric observations of 32 Cygni during its most recent eclipse were obtained at Naini Tal in co-operation with the international programme of observations of this star initiated by Dr. K. Gyldenkerne. The observations were carried out with a 1P21 photomultiplier attached to the 10-inch refractor. We used yellow and blue filters of the same type as those employed by Johnson and Morgan to define the *U*, *B*, *V* system. The comparison stars chosen were θ Cygni (spectral class F5) and 20 Cygni (spectral class K2); 26 Cygni, originally planned to be a comparison star, could not be used since it had a close-by star which could not be avoided in the 110″ diameter focal plane diaphragm of the photometer. Both comparison stars were measured each night. The magnitude differences between θ and 20 Cygni were not constant during the period of this investigation. An erratic fluctuation of the order of $0^{m}\cdot02$ occurred. We believe that the light of 20 Cygni is not constant and hence all measures made of 32 Cygni are referred to θ Cygni. The blue and yellow instrumental magnitudes have been transformed to the *B*, *V* system with the aid of measures of six stars* listed by Johnson and Morgan[1]. These standards were measured on three nights.

The observations are given in Table I. The colour and light variations are

TABLE I

Observed magnitudes and colours for 32 Cygni on the B, V *system*

Date April 1959	Julian Day	*B−V*	*V*	*B*
		m	m	m
2	2436660·44	1·546	4·127	5·673
7	2436665·44	1·622	4·131	5·753
8	2436666·44	1·653	4·128	5·781
9	2436667·44	1·630	4·143	5·773
11	2436669·44	1·634	4·141	5·775
12	2436670·44	1·620	4·128	5·748
13	2436671·44	1·621	4·127	5·748
14	2436672·44	1·595	4·133	5·728
15	2436673·44	1·589	4·130	5·719
16	2436674·44	1·562	4·124	5·686
17	2436675·44	1·555	4·122	5·677
22	2436680·44	1·537	4·117	5·654
27	2436685·44	1·541	4·112	5·653

* These are (1) i Her, B3 V; (2) δ Her, A3 IV; (3) 72 Her, G0 V; (4) 110 Her, F6 V; (5) β Oph, K2 III; and (6) γ Dra, K5 III,

shown in Fig. 1. From the above data the following values have been derived for the K and B components of this system:

K component $V = 4^{m}{\cdot}14$, $B - V = 1^{m}{\cdot}64$; B component $V = 8^{m}{\cdot}24$, $B - V = -0^{m}{\cdot}26$.

Because of the small range of variation in the V ($\sim 0^{m}{\cdot}025$) and the large disparity between the magnitudes of the K and B components, it is difficult to assign an accurate value to the colour of the B component. However,

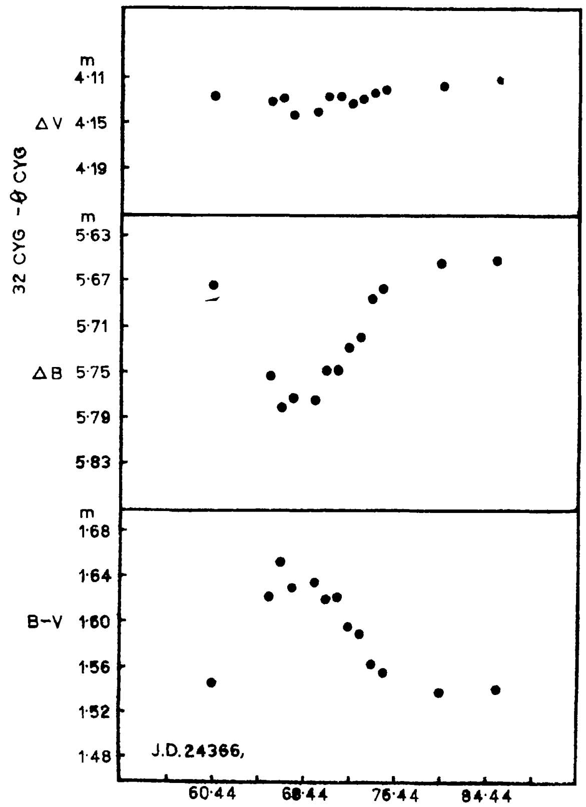

FIG. 1

it is not very far from $-0^{m}{\cdot}26$ which gives the spectral type B1 V. The K component is about 4 magnitudes brighter than the B component and hence is of a high luminosity class. The spectral type that may be assigned to it on the basis[2] of its $B - V$ colour is K3 Ib. These values are obtained on the assumption that the B component is totally eclipsed. There is evidence that the eclipse is grazing in which case the values relating to the K and B components derived above may not depict the correct picture.

The time of mid-eclipse is 1959 April 9·56 (JD 2436668·06), and using Botsula's value for the 1956 mid-eclipse, *viz.* JD 2435523·15, the interval between two successive mid-eclipses is $1144^{d}{\cdot}91$. This value is slightly shorter than the value of $1149{\cdot}^{d}85$ obtained for the duration between the 1952 and 1956 mid-eclipse times as given by Wellman[3, 4] and Botsula[5] respectively.

Our observations indicate depths of minima of $0^{m}{\cdot}12$ and $0^{m}{\cdot}025$ in B and V respectively. The amplitudes derived by Wood[6] for the 1952 eclipse are much greater than ours while Botsula[5] for the 1956 eclipse finds a depth of minimum of $0^m{\cdot}20$ in the blue and $0^m{\cdot}02$ in the yellow. Such varying depths of minima for the different eclipses may be interpreted in terms of varying chromospheric opacities at the different eclipses. If such an interpretation is possible it is obvious that estimates of the brightness and spectral type of the companion are judged best from spectroscopic investigations such as those carried out by Wellman[4], who assigns a type K5 Ib for the cool component and B3 V for the hot companion.

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The Short Period Variable RZ Pyxidis

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RZ Pyxidis (HD 75920) was found to be a short period variable by Hoffmeister[2]. Later Kaho[3] derived the following elements from visual observations:—

$$\text{J.D. max.} = 2428548{\cdot}162 + 0{\cdot}4888\,E,$$

concluding that it is an RR Lyrae type variable. Spectra of this star were taken recently with the 74-inch Radcliffe reflector and show that the spectral type is constant (B7 V). Photoelectric observations at the Royal Observatory, Cape with the 24-inch Victoria refractor and 18-inch reflector show that the colours are also nearly constant:

$$B-V = -0{\cdot}08; \quad U-B = -0{\cdot}52 \text{ (Johnson system)}$$

and

$$(u-b)_c = 1{\cdot}31 \text{ (Cape ultra-violet index).}$$

Using the Q method and standard two colour plots[1], these colours correspond to a spectral type of B5–B7 with a reddening of 0·07 to 0·08.

The following ephemeris has been derived from the photoelectric magnitudes:

$$\text{J.D. max. hel.} = 2436589{\cdot}809 + 0{\cdot}65627\,E.$$

The magnitude (B) and colours are shown plotted with this period in Fig. 1. It is seen that the star is a close eclipsing binary and not an RR Lyrae variable. It is found that the light curve of a system with equal components having $a = 0{\cdot}43$, $b = 0{\cdot}39$ and $c = 0{\cdot}38$ orbital radii with an inclination of 80° (shown by a curve in Fig. 1) will approximately reproduce the present observations,