COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2668

Konkoly Observatory
Budapest
18 February 1985
HU ISSN 0374 - 0676

PHOTOMETRY OF THE 1984 ECLIPSE OF 22 VULPECULAE

The well-known spectroscopic binary 22 Vul (HD 192713, $\alpha = 20^h15^m.5$, $\delta = 23°31'$ (2000)), was found by Parsons and Ake (I.B.V.S. 2334, 1983) to show eclipses of its hot component, one of which was predicted by their ephemeris to occur in late August - early September 1984, centred at JD 2,445,940.4. Due to the large difference in visual luminosity between the components the eclipse was expected to be quite shallow in V, but the large temperature difference was predicted to yield a deeper eclipse in the U band.

We obtained UBVRI photometry of this event using the 0.5 m telescope and multichannel photometer of the Climenhaga Observatory. Since the observations described by Scarfe et al (I.B.V.S. 2545, 1984) were made, the EMI 6256 tube has been replaced by an EMI 9658, enabling observations in R and I to be made. Mean coincidence, extinction and transformation coefficients were used to correct the differential magnitudes to the standard system defined by the work of Landolt (A.J. 88, 439, 1983).

Since early 1984 the photometer operations, including filter dwell-time, star-sky switching, and data logging, have been controlled by a Commodore 64 micro-computer, using programs written by one of us (R.M.R.).

Unfortunately we did not get any observations before the eclipse, nor any during the partial phases. However we are able to make a few deductions from even such fragmentary observations as ours, and we felt it would be useful to publish them, and the observations as well, as a contribution to future studies of the light curve.

The comparison star used was HD 192712, and the check star was HD 192342, for which UBV photometric data are available from the USNO Catalogue (Blanco et al., Pub. U.S. Naval Obs. 2nd Ser., 21, 1968). Data for 22 Vul itself, which must have been obtained outside eclipse, are obtained from Comm. L.P.L. 4, pt3, 1966. The data are:

	V	B-V	U-B	V-R	R-I
22 Vul	5.15	1.04	0.71	0.74	0.48
HD 192712	7.15	1.04	0.72		
HD 192342	6.50	0.26	0.06		

Our observations of 22 Vul are given, differentially with respect to HD 192712, in Table I. Each is an average of two to five individual integrations, each of which in turn involved four or five full cycles of the filter wheel, for a total of about 10 seconds per colour per integration.

Table I: The observations

J.D. 2445900 +	ΔU	ΔB	ΔV	ΔR	ΔI
37.84	-1.64	-1.79	-1.95		
38.77	-1.65	-1.79	-1.96	-2.00	-2.05
40.77	-1.64	-1.77	-1.95	-1.99	-2.03
41.82	-1.66	-1.83	-1.97	-2.00	-2.08
42.77	-1.65	-1.82	-1.95		
45.75	-1.64	-1.79	-1.95		
50.79	-2.05	-1.96	-2.02		
52.69	-2.01	-1.93	-2.01	-2.03	-2.06
53.75	-1.99	-1.93	-1.99		
57.73	-2.00	-1.94	-2.01		
72.70	-2.01	-1.94	-2.00		

It is clear that on the first six nights the hot component was in eclipse but that it was not on the remaining nights. Parsons and Ake (B.A.A.S. 17, 913, 1985) found the time of mid-eclipse to be J.D. 2445942.3 ± 0.2, somewhat later than previously predicted. Using this we find, on the assumption of symmetrical eclipses:

1. Duration of totality > $9^d.0$
2. Duration of partial phases < $4^d.0$
3. Duration of eclipse < $17^d.0$

These are in reasonable agreement with the results of Parsons and Ake.

We derive the following depths of the eclipse in each band (in magnitudes) by averaging the individual observations.

$$\Delta U = 0.367 \pm 0.007$$
$$\Delta B = 0.142 \pm 0.006$$
$$\Delta V = 0.052 \pm 0.004$$
$$\Delta R = 0.031 \pm 0.006$$
$$\Delta I = 0.010 \pm 0.015$$

To get UBV colours for the components we may adopt the published data for either HD 192712 or for 22 Vul out of eclipse. The latter are for a brighter star and we adopt them as probably being more reliable, as well as including R and I observations. From them we obtain the following results for the cool (G3 Ib-II) and hot (B9) components and for the comparison star, but our observations of the check star are insufficient for this to be done reliably for it too.

	G	B	Comparison
V	5.20 ± 0.01	8.47 ± 0.09	7.16 ± 0.01
B-V	1.13 ± 0.01	0.00 ± 0.10	0.97 ± 0.01
U-B	0.94 ± 0.01	-0.21 ± 0.06	0.78 ± 0.01
V-R	0.76 ± 0.01	0.18 ± 0.24	0.73 ± 0.01
R-I	0.50 ± 0.02	-	0.44 ± 0.02

The results for the B star are in satisfactory agreement with those for an unreddened B9V star, or for a B8V star reddened by E(B-V) = 0.09 magnitudes. The absolute V magnitudes of such stars are close to 0.0 mag., and indicate that of the G star to be about -3.3 mag., in good agreement with its luminosity class. The distance of the system must be about 500 pc.

Finally we note that the good agreement between observations taken about 20 days apart after the end of the eclipse suggests that the light curve outside eclipse should be fairly flat and not greatly affected by circumstellar matter in the system.

We hope to observe future eclipses, and ultimately obtain full multicolour light curves. We thank D.W. Forbes for drawing our attention to 22 Vul.

C.D. SCARFE

R.M. ROBB

Climenhaga Observatory
University of Victoria
Victoria, BC Canada