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PHOTOMETRY OF THE BINARY Be STAR HR 2142 FROM NOVEMBER 1983 TO JANUARY 1984

We present Strömgren y, b and v photometry of the binary Be star HR 2142 (HD 41335, BD-6°1391) obtained on five nights during the interval November 1983 to January 1984. The single observation in January was made during the primary shell phase. The paucity of data is due to bad weather at the observing site. Nevertheless the observations are of interest because of the current controversy about the variability of this star.

HR 2142 (B IV-Ve, $\bar{V} = 5^{m}.22$) is a Be star in an 80.86 day orbit. There are no eclipses. The system exhibits shell phases which are periodic with the binary period. The primary shell phase lasts 5½ days from phase 0.975 to 0.043, where the phase is computed according to the ephemeris:

$$T_0 = \text{JD } 2440855.5 + 80^{d}.86 \cdot E$$

in which T_0 is the time at which maximum strength of the Balmer shell lines occurs. A secondary shell episode, lasting two days, takes place shortly after. The shell lines are strongest at 0.068 phase (Peters, 1976).

The model for the system consists of a Roche lobe-filling secondary transferring material to the primary Be star. The shell lines appear when the gas streams are seen projected against the photosphere of the primary (Peters, 1981, and refs. therein).

Photoelectric photometry of this star was obtained in 1982 and 1983 by an ESO group (reported by Sterken, 1983), whose Strömgren b-band observations showed a brightness decrease of 0.13 mag occurring about 30 days before the shell phases. The brightness remained approximately constant thereafter, apparently returning to its previous level shortly after the shell episodes. At each level of brightness the light was

constant to within about 0.06 mag. Recently, this result has been questioned by Harmanec et al. (1984). These authors monitored HR 2142 photoelectrically from 1979 to 1983. The last set of these observations overlaps with the ESO data. No significant decrease in light was seen at the time that the ESO observers reported the 0.13 mag decrease. All their observations are consistent with a constant stellar brightness, apart from a scatter of about 0.06 mag in the B-band. No periodic variations were detected. Neither group was able to observe HR 2142 during the primary shell phase, which is where significant light variations are expected to occur.

Our observations were made with the 61 cm reflector of National Central University, Taiwan, using Stromgren vby filters. The pulse-counting photometer is equipped with an RCA C31034 Ga As photocell refrigerated to -20°C. The comparison star was HR 2205 (= HD 42690, B2 V, V = $5^{m}.05$), which is the same as that used by Harmanec et al. (1984) and is the one chosen for the International Campaign (Harmanec et al. 1980). Observations were made in the pattern *sky-comparison-variable-comparison-sky*, with each integration lasting 30s on the first two nights and 40s thereafter. Typically two such sets were obtained each night in the three filters. The data were corrected for the effects of differential atmospheric extinction, and nightly means were formed. The observations are listed in Table I, which includes the number of points forming each normal (n), and the standard deviation (σ). The observations are in the instrumental system. The data are shown in Figure 1.

By chance, a long spell of bad weather was temporarily broken on January 8, 1984, which allowed us to obtain a data point during the primary shell phase. Unfortunately, this is an isolated point, with no observations during the preceding 30 days, nor any afterwards. It is also an observation made at a relatively large zenith distance (sec $z \sim 3$) so some caution has to be exercised in evaluating it.

From the figure it can be seen that there is no decrease in brightness indicated by the January point, which is at phase 0.015 i.e. within the primary shell phase. Over the whole observing interval the light appears to remain approximately constant, but the data are too few for a definite conclusion. We note that the comparison star

Table I
Photoelectric photometry of HR 2142

Julian Date (hel.) 2440000 +	Phase	Δ mag (V-C) (σ)			n
		y	b	v	
5656.23	0.37	0.196 (0.009)	0.300 (0.005)	0.340 (0.019)	12
5657.19	0.38	0.180 (0.008)	0.293 (0.010)	0.341 (0.015)	8
5673.29	0.58	0.178 (0.005)	0.283 (0.007)	0.339 (0.006)	5
5678.19	0.64	0.169 (0.010)	0.285 (0.010)	0.336 (0.017)	5
5708.28	0.015	0.160 (0.014)	0.270 (0.014)	0.340 (0.028)	4

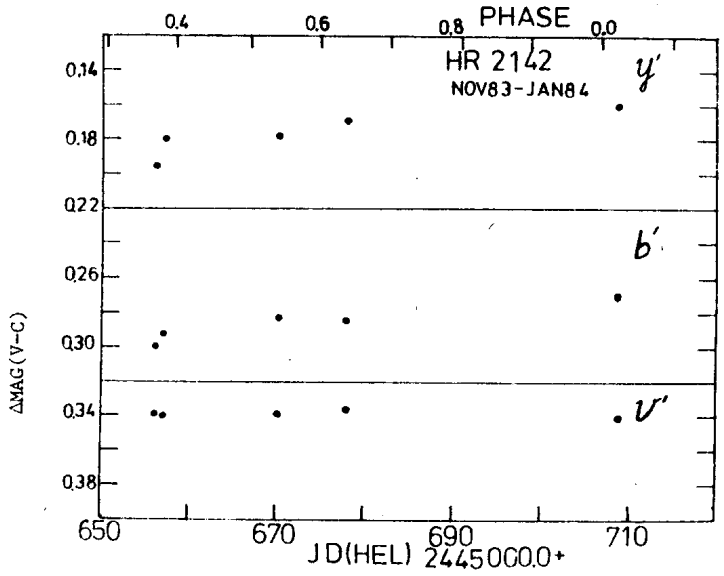

Figure 1
The ybv light curves of HR 2142 for the interval November 1983 to January 1984

is located to the east of the variable, and an overcorrection for extinction would result in this last point being too high but we estimate that, at worst, this error would be only ~0.03 mag in b. We conclude that there is no evidence for the star being significantly fainter at this phase. Our observations do not cover the phases at which the ESO group observed the 0.13 mag brightness drop, but at least near phase zero there is no evidence for a decrease of this order.

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