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THE Be BINARY HR 2142: NO 0.13^m BRIGHTNESS DECREASE IN JANUARY 1983

HR 2142 (HD 41335, BD-6°1391, MWC 133; B2 IVe) is a well-known bright Be star ($V=5.22^m$, $B-V=-0.07^m$, $U-B=-0.83^m$) and a suspected variable. Peters (1971) discovered that the object exhibits recurrent strong short-lived shell phases each 81 days. Later on, she found that it is in fact an interacting binary (for a complete story see Peters 1976, 1983 and references therein) in which the Be star is the mass-gaining component and that the shell phases are projections of gas streams between the components against the disk of the Be primary. Measuring the wings of the broad stellar lines, she obtained a circular velocity curve of the primary with the semiamplitude K=9.4 km/s. The exact morphology of the shell phases is such that each primary shell phase, lasting 5 days, is - after a one-day gap - - followed by a secondary shell phase (of roughly the same intensity) which lasts only 2 days. This morphology is perfectly confirmed by an extended series of Ondřejov coudé spectrograms of the star. The most recent ephemeris for the time of the maximum intensity of the primary shell phase is (Peters 1976):

$$T_{prim.shell} = \text{JD } 2440855.5 + 80.860^d \times E \ .$$

The primary shell phase lasts from 0.975 to 0.043^P, the secondary one from 0.056 to 0.080^P, with a maximum strength at 0.068^P.

HR 2142 is one of the objects selected for long-term photoelectric monitoring in a program started by a group of ESO observers. Recently Baade (1983, preprint) and Sterken (1983) reported the first results of its ESO observations. The star was observed in the uvby system and was found to be essentially constant but on two different levels. Sometime between JD 2445323 and JD 2445354 (January 1983) it got about 0.13^m fainter in all four filters. According to the report, it may be either a phase-dependent behaviour or a long-term change. The authors do not publish the photometric data but only a phase diagram in b colour which, by mistake, is computed with a slightly incorrect value of the period, 80.82 days instead of 80.860 days.

Even before the ESO program began, HR 2142 was selected as one of 154 bright Be stars for long-term photoelectric monitoring in the international campaign organized by the Working Group on Be Stars of the IAU Commission 29 (Harmanec et al 1980). In the years 1979-1983 it was observed by three groups of the campaign observers and here we report the first results of these observations. Basic information about our observations is summarized in Table I. The obligatory campaign comparison HR 2205 and check stars HR 2154 and HR 2344 were used in all cases. Their Johnson's et al.(1966) UBV values are given in Table II. Our nightly normal B observations, overlapping partly with the ESO observations, are plotted

Table I

Basic information about present observations of HR 2142

Observatory	Instrumentation	Epoch of obs.(JD)	No. of nights
Skalnaté	0.60-m refl.	2444203 - 296	5
Pleso	UBV	2444625 - 662	6
		2444983 - 994	2
Kitt Peak	0.4-m refl.No.4	2444207 - 211	4
National	b	2444556 - 563	5
Observatory		2444918 - 925	6
Hvar	0.65-m refl.	2444902 -5030	8
	UBV	2445309 - 359	7

in Fig.1, together with the data for both check stars (the KPNO b observations were transformed to the Johnson B magnitude).

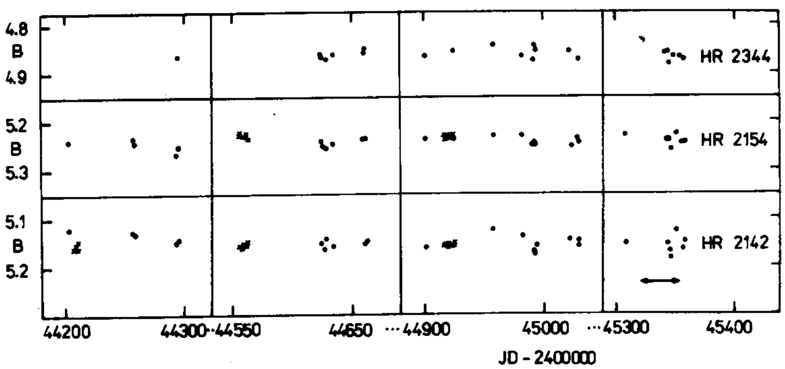

Figure 1

The interval in which the brightness decrease of 0.13^m should occur according to the ESO observations is indicated by an abscissa with arrows. It is clearly seen that no such decrease occured in fact. As the ESO observers used one of our check stars, HR 2344 as their comparison, it is even certain that the variations observed cannot be accounted for by some changes of HR 2344. It is therefore highly probable that the reported ESO observations of HR 2142 represent some observational or reduction error, not a real change in the star. This view is further strengthened by the finding that the light curve of another Be star, 10 CMa, reported in the same ESO observations, shows a similar drop of brightness between JD 2445280 and 2445310. It is easy to verify that the correct magnitude of HR 2142 corresponds to the lower level of the ESO observations.

Table II

Johnson's et al. (1966) standard UBV data for comparison and check stars

Star	V	B	U	B-V	U-B
HR 2205	5.05	4.85	4.07	-0.20	-0.78
HR 2154	5.38	5.25	4.71	-0.13	-0.54
HR 2344	5.05	4.87	4.11	-0.18	-0.76

Concerning possible real light variations of HR 2142, already Percy (1981) suspected slight rapid variations. This view is supported by Fig.1 which shows that the scatter of the points for HR 2142 is greater than that for both check stars, in spite of the fact that the air-mass difference with respect to comparison is usually greater for both check stars than for the variable. We thus suspect that some minor variations on a time scale of days may be present but this conclusion needs further verification because HR 2142 is usually observed at rather large zenith distances at Hvar and Skalnaté Pleso. It is true however that the ESO observations do show also a scatter of about 0.05 - 0.06^m on both levels, quite comparable to the scatter of our observations.

The star was monitored for about 0.12^d during one night at Skalnaté Pleso. No variations in excess of $\pm 0.01^m$ were detected on a time scale of hours (c.f. Fig.2).

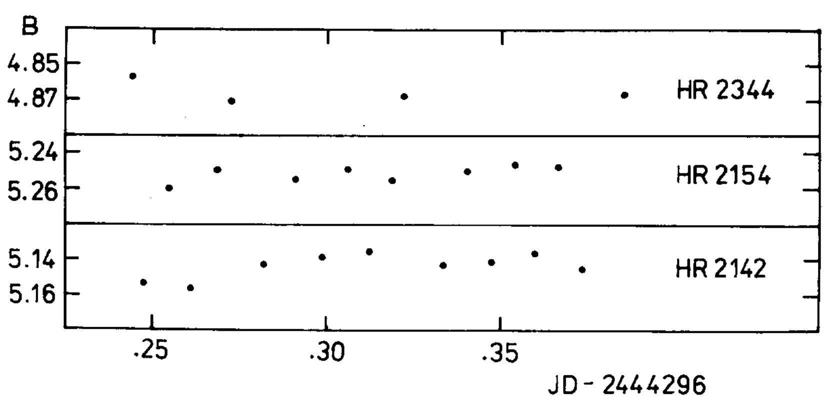

Figure 2

A plot of all our B observations against the phase of the 80.860-day orbital period is shown in Fig.3. It is clearly seen that no phase-dependent variations were detected. It is important to stress however that so far we have not been lucky enough to obtain photometric observations during the primary shell phases. However one Skalnaté Pleso observation obtained on JD 2444661.320 has a phase 0.067^P, i.e. coincides almost perfectly with the maximum strength of the secondary shell phase. Yet, it does not indicate any light change either in magnitudes or in colours. We thus arrive at a rather surprising

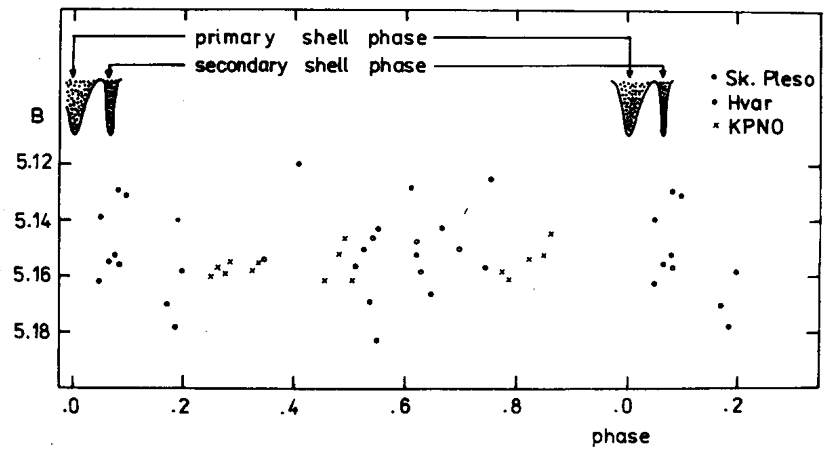

Figure 3

conclusion that the gaseous material responsible for the (at least secondary) shell phase (producing extremely strong and deep H I shell lines) is optically thin in the continuum in all optical wavelengths! This finding should be verified by further observations during the forthcoming shell phases. The next such opportunity is during the week around January 8, 1984.

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