THE VARIABLE SHELL PHASE OF HD 184279 BETWEEN 1976 AND 1980

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Abstract. The variable shell (H, HeI, FeIII and once ionized other metals) B0.5 star HD 184279 presents variations of radial velocity and line profiles with a cycle of about 4 years. Some correlations between photometric and spectroscopic data are found. A comparison with 48 Lib and ζ Tau is given.

1. INTRODUCTION

HD 184279, of spectral type B0.5 (Jaschek et al, 1980) and v sin i = 230 kms^{-1} (uesugi, 1978) was first studied in 1929 by Merrill and Burwell (1932) who noticed dark and narrow hydrogen lines and two very weak bright edges in Hβ. Swings and Struve (1943) observed broad H and HeI lines with normal intensity without emission at Hβ in 1942, and concluded that the shell had completely disappeared. Merrill (1951) saw extremely weak and diffuse H and HeI lines on a spectrum taken that year while Lynds (1959) found variations in brightness over 3 months. Svolopoulos (1975) from observations made in 1971, gave an H_α profile, some equivalent widths and estimated some shell' parameters. Tempesti and Patriarca (1976) noted photometric variations from 1968 to 1976, and we see three distinct phases in the recent life of this star in the Hubert-Delplace and Hubert' Atlas (1979): 1956-60: B phase, 1963-70: faint Be phase, 1973-1976: strong Be and shell phase.

2. OUR OBSERVATIONS

Since 1976, 13 spectrogramms of HD 184279 have been taken at 12 Amm^{-1} in the blue region (Observatoire de Haute Provence). The radial velocities exhibit large variations over four years. The six first spectra were reduced and traced in intensity to obtain well defined line profiles, equivalent widths and central depths.

3. RADIAL VELOCITIES

The lines of all elements present variations of RV with a cycle of about 4 years. From 1973 to 1977, the shell is essentially seen in H, HeI and

M. Jaschek and H.-G. Groth (eds.), Be Stars, 171–175.

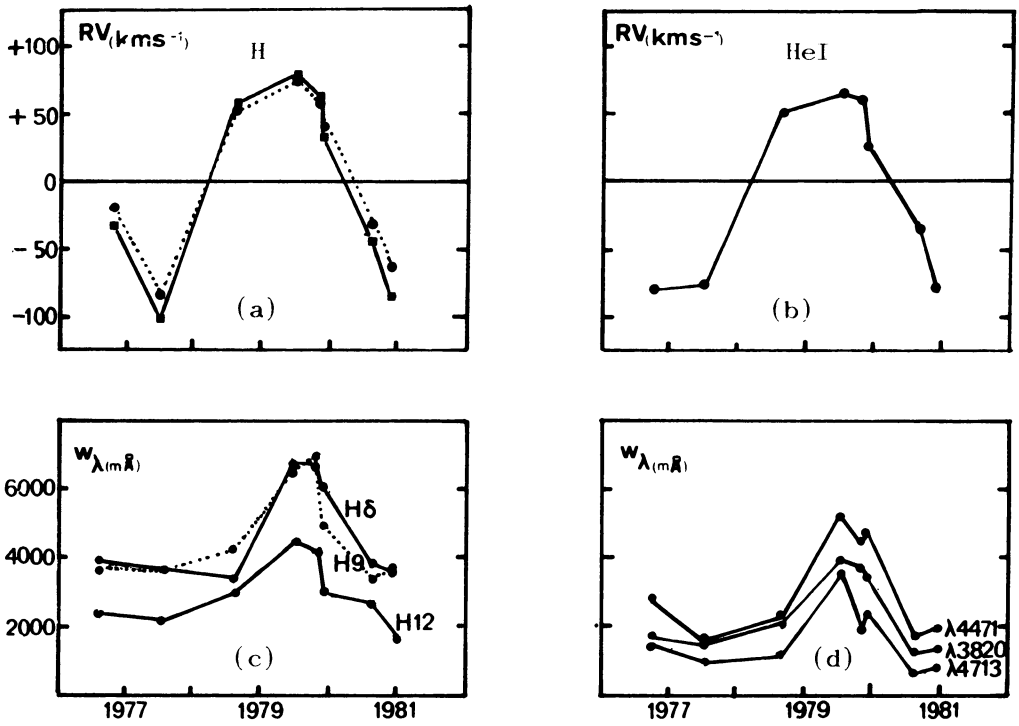

Figure 1-a. Radial velocity of the hydrogen lines between 1976 and 1980 averaged over $H\gamma H\delta H\varepsilon$ (solid line) and over H10H11H12 (dashed line). Figure 1-b. Radial velocity of HeI averaged over the main lines, between 1976 and 1980. Figure 1-c. Equivalent widths of some hydrogen lines (in mA) between 1976 and 1980. Figure 1-d. Equivalent widths of some HeI lines (in mA) between 1976 and 1980.

FeIII, the lines of these elements being strengthened in 1975 when an inverse P Cyg profile was observed in Hβ. From 1978 we observe MgII and FeII in addition to the former shell lines; then in 1979-80, MgI, NiII, CaII and SiII. We give in figure 1-a the RV of hydrogen averaged over $H\gamma H\delta H\varepsilon$ and over H10H11H12 for eight epochs. It is clear that as for ζ Tau (B2IIIe) and 48 Lib (B3IIIe), the higher Balmer line velocity amplitude is larger than that of the lower members. Also, we note a Balmer progression in 1980, when the RV's are negative. Figure 1-b gives the HeI RV averaged over the main lines. The other elements (FeIII, FeII, MgII, CaII, SiII, NiII) exhibit similar RV variations.

4. BEHAVIOUR OF THE LINE PROFILES

From September 1976 to November 1979, the H and HeI line profiles show important changes. We give in figure 2 the line profiles of Hβ and in figure 3 the line profiles of HeI 4471A and MgII 4481A at the following epochs: 3-9-76, 1-7-77, 1-7-78, 6-6-79, 21-10-79, 28-11-79. We see a P Cyg profile in Hβ in 1976-77 when the RV's of the shell lines are negative, then an inverse P Cyg profile in 1978-79 when the RV are

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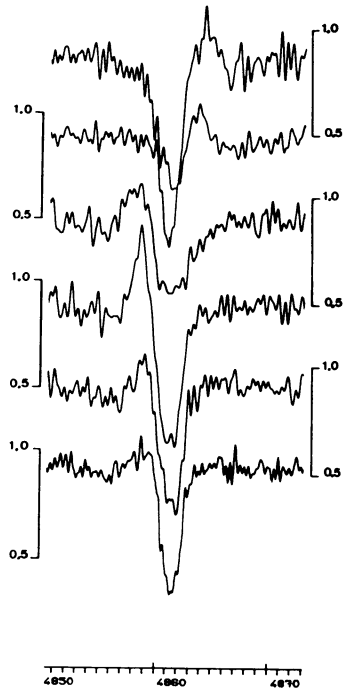

Figure 2. Intensity tracing of the Hβ line profile between 1976 and 1979.

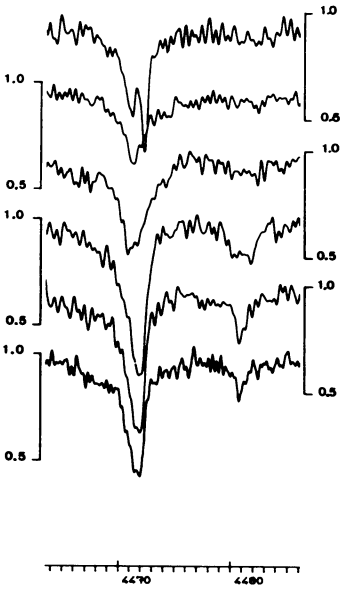

Figure 3. Intensity tracing of the HeI 4471A and MgII 4481A between 1976 and 1979.

positive, with a strong emission peak in July 1979. Later in 1980, Hβ presents a P Cyg profile again. We see a fainter emission component in Hγ which is absent in Hδ. The higher members of the Balmer series are more asymmetric than the lower ones, especially in 1979 when RV are very positive.

The HeI lines originating from the 2^1S, 2^3S, 2^1P^0, 2^3P^0 terms are in very strong and sharp absorption during the whole cycle; λλ4471A, 4026A, 3965A, 3888A, 3820A are particularily enhanced. The profile variations are similar to those of the higher Balmer lines. The FeIII lines (a^5P-z^5P^0 for example) are well observed and exhibit a similar behaviour to the HeI's.

We note that in October 1976 all the hydrogen and helium lines are double. The fainter and the blue shifted secondary component is more visible in the near UV region. This component is very distinct for H9, H10 and HeI 4471A. The difference of RV between these two components is 76 kms^{-1}.

5. EQUIVALENT WIDTHS AND CENTRAL DEPTHS

These two quantities have a similar behaviour. In figure 1-c and 1-d, we see that they decrease from the middle of 1976 to the middle of 1977 to reach minima, when the RV are at minimum. Then, they increase by a factor up to two in the middle of 1979 and after decrease again. Between the middle of 1978 and the middle of 1979, HeI decreases more rapidly than H. The variations of the central depths are similar to those of RV and the equivalent widths.

6. COMPARISON WITH PHOTOMETRIC DATA

Tempesti and Patriarca (1976) have published the photometric variations of this star from 1950. Their measurements show a decrease of brightness between 1968 and 1975 with a pronounced minimum in 1973. At that epoch, we observe a strengthening of emission and the appearance of a shell with H,

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HeI and FeIII. In 1975-76, brightness increases again without reaching the former value.
Alvarez and Schuster (1981) measured a decrease of 0.4 magnitude in brightness (filter 0.58 μm) between June 1977 and May 1978, to reach 7.2. Between these two epochs, our RV increases from a minimum (-100 kms^{-1}) to strong positive value (+50 kms^{-1}).

7. CONCLUSIONS

a- HD 184279 is an early B type star presenting a temporary HeI shell as has been observed for stars having the same spectral type (γCas, 59 Cyg).
b- Conspicious correlations between RV, line profiles, equivalent widths and central depths occur, as for ζ Tau and 48 Lib.
c- The correlation between RV and the magnitude (M58) given by Alvarez and Schuster (1981) was also noted as in the case of ζ Tau (M58 increases when the RV's are strongly positive).
d- Having a similar period, the amplitude of RV variations is larger than for ζ Tau' (Delplace et Chambon, 1975).
e- Having a similar amplitude, the period of HD 184279 is much shorter than that of 48 Lib.
f- The decrease of brightness in 1973 reported for HD 184279 by Tempesti and Patriarca (1976) is to be compared with the decrease of about 0.5 magnitude in the B filter reported by Sharov and Lyuty (1975) in the case of Pleione for which a shell phase similarly appeared.

star	a	p
HD 184279	90 kms^{-1}	4 years
HD 372 o2	60 kms^{-1}	7 years
HD 142983	60 kms^{-1}	10 years

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DISCUSSION

Andrillat: What is the behaviour of the HeI metastable line λ 3889A with respect to other HeI lines (triplets and singulets).

Ballereau: At this dispersion HeI λ 3889A is blended with H8, but the central depth and the width at half intensity of the blend indicate that the contribution of HeI 3889 ($2^3S - 3^3P^o$) is very important. However HeI λ 3965 ($2^1S - 4^1P$) and mainly the triplet lines($2^3P - n^3D$) are also prominent in the spectrum.

Viotti: Did you find any variation of the intensity ratio of singulet and triplet HeI lines?

Ballereau: The triplet lines are always enhanced relative to the singulet lines mainly when the RV's are negative. However, when the RV's are strongly positive all HeI lines are deep and sharp.

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