ABSORPTION LINES OF CaII AND H IN THE NEAR IR REGION OF THE MAGNETIC STAR HD I52I07

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ABSTRACT. A behaviour of H lines P_{12} - P_{18} and CaII triplet of the star HD I52I07 is studied in the range λλ 8400 - 8800 Å. An analysis of the obtained data enabled us to suspect the presence of a relationship between the variation of equivalent widths of the lines of the Paschen series of Hydrogen CaII lines and that of the star's magnetic field.

The star HD I52I07 (A2p - A4p, $4^m.86$, He +830 + I430± ± 300 gauss, B-V = $0^m.08$, U - B = $0^m.05$) is an Ap star with a variable magnetic field of constant polarity. It is a relatively cool Ap star of the Sr - Cr -Eu type of the spectral pecularity with rather broad lines in the spectrum (w ~ 0.4 Å) and amplitude of light variations $0^m.0I5$. The period of its variation has been found from photometric and spectroscopic observations of the K CaII line and equals $3^d.8575$ (Wolf and Preston, I978). No essential spectral variations were found in the range λλ 3600-4800 Å. Thus it was decided to observe the members of the Paschen series of Hydrogen, formed in the higher layers of the atmosphere of the star, and analyse variations of profiles and equivalent widths of the Hydrogen lines of the Paschen series P_{12} - P_{18} and CaII triplet. The spectrograms were obtained with the diffraction spectrograph of the 50-inch reflector of the Crimian astrophysical Observatory with dispersion 240 Å/mm in the range λλ 6I00-8800 Å. Table I gives data on the obtained spectrograms.

The spectrogram measurement were carried out with the microdensitometer Joyse Loebl with a I00 times magnification. The readings were done at a ~ I.3 Å interval

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line profile plots were constructed by a routine method.

Table I

n	J.D. 2440000+	Phase	Dispersion Å mm⁻¹	Plates
I	784.8062	0.472	2 40	Kodak-IN
2	784.8785	0.49I	"	"
3	785.8639	0.746	"	"
4	785.9222	0.76I	"	"
5	785.9965	0.78I	"	""

Figure I gives average equivalent widths of all the Hydrogen lines observed both free of blending with CaII lines (P_{12}, P_{14}, P_{17}, ...) and anomalously enhanced P_{13}, P_{15}, P_{16} which are physical blends of CaII lines with Hydrogen lines. The curve of the variation of the residual intensity of P_{12} -P_{19} lines free of blending with the CaII lines is also plotted. Detection of CaII lines from blends with Hydrogen is a difficult task (Bychkov et al.,1978),because that we have only done approximate calculations. Table 2 gives mean values of equivalent widths of CaII triplet lines obtained by reducting of

Table 2

line	$\overline{W}_\lambda$(Å)	line	φ 0.48I	φ 0.763	mean	σ
CaII(8662)	0.I0	CaII(8662)	-0.65	0.87	0.3	±0.9
CaII(8542)	0.66	Call(8542)	0.85	0.40	0.6	0.4
CaII(8498)	I.I3	CaII(8498)	I.35	0.83	I.0	±0.4

average equivalent widths of P_{13}, P_{15}, P_{16} (interpolated by the curve in Figure I) from the equivalent widths of the corresponding blends.Similar calculations have been done for every observations. Values W_λ CaII =W_λ (P_m+CaII) - W_λ P_m(Table 2) are given for nightly mean phases of observations. In addition the values of the CaII (8662) equivalent width were obtained from the formula
W_λ CaII(8662) = w_λ (P_{13} + CaII)-0.5($w_\lambda P_{12}$ + w_λ P_{14}) (Table 3).The total contribution of all CaII lines to Hydrogen blends (Table 3) can be calculated from the ratios of equivalent widths of the blended lines P_{13}+ CaII, P_{15} +CaII P_{16} +CaII to equivalent widths of nonblended lines P_{12} and P_{14} from the formula (Polosukhina et al.,1978).

$$A = \left(W_\lambda(P_{13}+CaII) + W_\lambda(P_{15}+CaII) + W_\lambda(P_{16}+CaII)\right) / W_\lambda P_{12}$$

$$A' = \left(W_\lambda(P_{13}+CaII) + W_\lambda(P_{15}+CaII) + W_\lambda(P_{16}+CaII)\right) / W_\lambda P_{14}$$

$$B = 2\left(W_\lambda(P_{13}+CaII) + W_\lambda(P_{15}+CaII) + W_\lambda(P_{16}+CaII)\right) / 3\left(W_\lambda P_{12} + W_\lambda P_{14}\right)$$

Table 3

W_λ \ φ	0.481	0.763	mean	σ
$W_\lambda P_{12}$	8.0	9.5	8.9	±0.9
$W_\lambda P_{13}$	5.6	6.1	5.9	0.4
$W_\lambda P_{14}$	3.8	4.2	4.0	0.5
$W_\lambda P_{15}$	2.4	2.9	2.7	0.4
$W_\lambda P_{16}$	1.3	1.8	1.6	0.3
$W_\lambda P_{17}$	0.5	0.8	0.7	0.3
$W_\lambda P_{18}$	0.4	0.7	0.6	±0.2
CaII(8662)	-0.9	0.2	-0.2	0.9
A	1.35	1.37	1.36	0.18
A'	2.89	3.13	3.01	0.22
B	0.61	0.63	0.62	0.06

The electron concentration in the stellar atmosphere can be estimated using the Inglis-Teller limit log ne = 23.26-7.5 log nm where n_m - the number of the last observed line in the Hydrogen series. For each nightly averaged phase we have mean n_m and log n_e :

Table 4

φ	0.481	0.763	mean ± σ
n_m	19.0	21.0	20.0 ± 1.5
log n_e	13.66	13.34	13.47 ± 0.23

The analysis of the obtained results enables us to suspect an existance of correlation between variations of equivalent widths of absorption lines of the Paschen series of Hydrogen (P_{12} - P_{18}) with the phase during the time of observation the magnetic field and index CI (Wolf and Preston,1978),while the CaII lines vary reversly.The electron density changes little,within the error. The contribution of CaII lines in Hydrogen blends,i.e. A parameter did not in fact change during the observations. The dependence of this value (A) on the spectral class (Bychkov et al.,1978) gives an earlier then A2p-A4p spectral class. The spectral class of the star from the Paschen series and CaII triplet proves to be also somewhat earlier.

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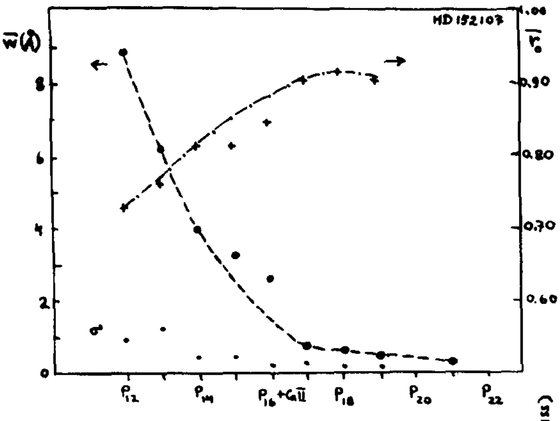

Fig.1. Dependence of mean $\overline{W}_\lambda$(Å) and mean r on values of m in Paschen series. The σ error for $\overline{W}_\lambda$(Å) measurements is indicated.

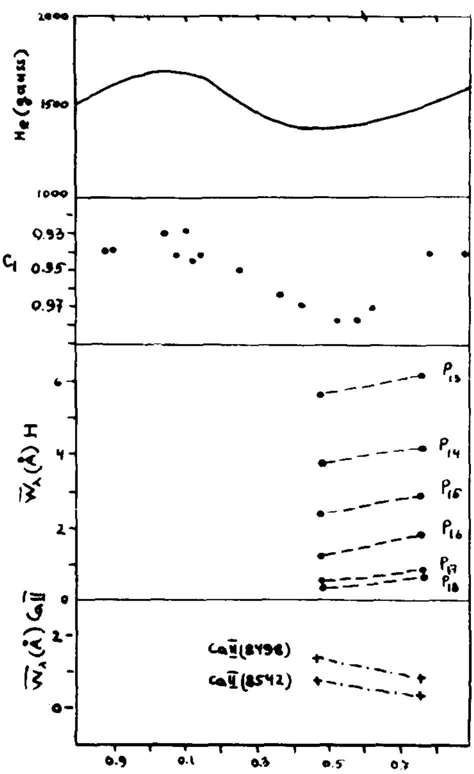

Fig.2. Behaviour of $\overline{W}_\lambda$ (Å) of P_{13} –P_{18} and CaII lines, He and C_1 with the phase.

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