LINE SPECTRUM VARIATIONS IN THE AP STAR HD 51418

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ABSTRACT. Line spectrum variations in Ap star HD 51418 were studied. The intensities of the Eu II lines vary by about three times. Radial velocity measurements show remarkable variability of the Eu II lines with an amplitude of 16 km/s, but the Sr II and Fe II lines do not show significant changes.

1. INTRODUCTION

The star HD 51418 has been classified as a member of the Eu-Sr-Cr subgroup with one of the largest known V-magnitude variation (Gulliver et al., (1972). Gulliver and Winzer (1973) have found the spectrum of HD 51418 to be as a whole quite crowded. The maximum of the Sr II lines is shifted by about 0.35P from Eu II maximum. In contrast to many others Ap stars variations of Cr II are in phase with the rare-earths. Jones et al. (1973) pointed out the presence of lines of heavy rare-earths such as holmium and dysprosyum. The amplitude of the velocity curve from Eu II lines is somewhat larger than 10 km/s. All authors have pointed out that furter observations near the rare-earths maximum would be desirable.

2. OBSERVATIONAL DATA AND RESULTS

Thirteen spectrograms of HD 51418 were obtained with the Coude-spectrograph of the two-meter telescope of the Bulgarian National Astronomical Observatory. The plates are on IIaO emulsion and have a dispersion of 9 A/mm. The phases of observations were calculated using the ephemeris given by Gulliver and Winzer (1973).

Thirty six least blended lines of EU II, Dy II, Fe II

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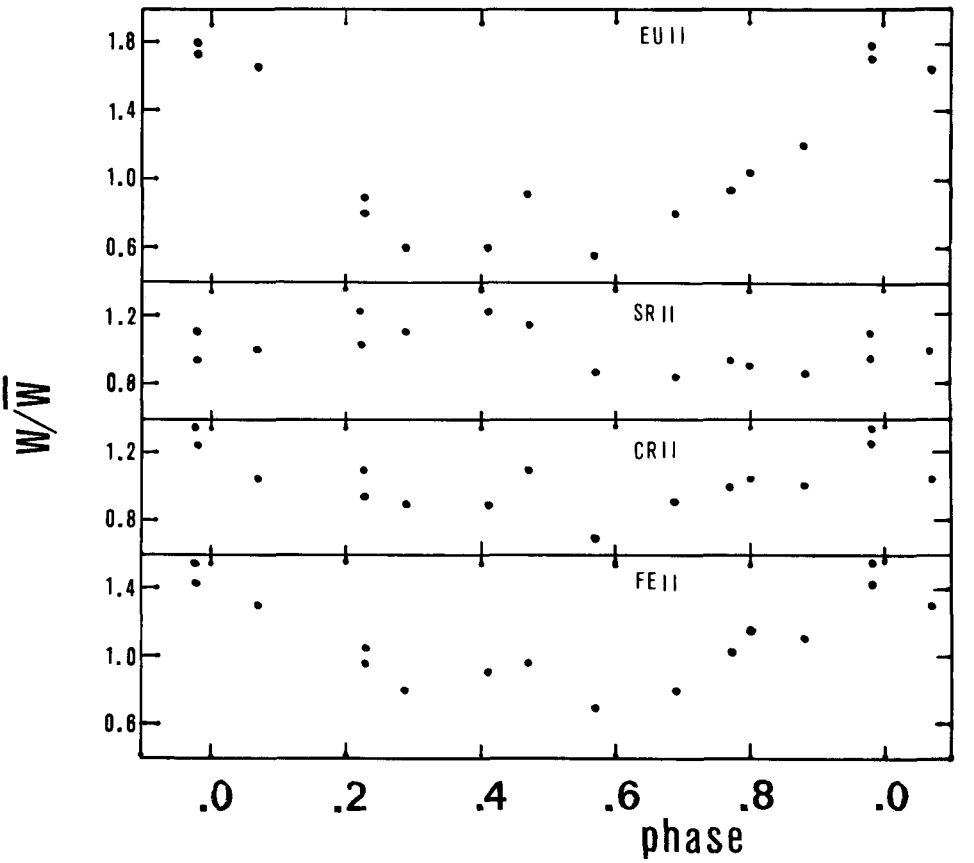

Fig. 1. Equivalent widths variations for the Eu II, Sr II, Cr II and Fe II lines.

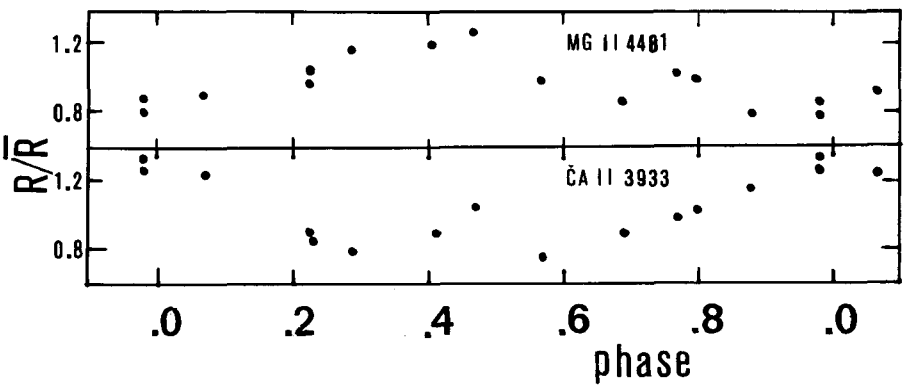

Fig. 2. Central depths variations for the Mg II 4481 and Ca II 3933 lines.

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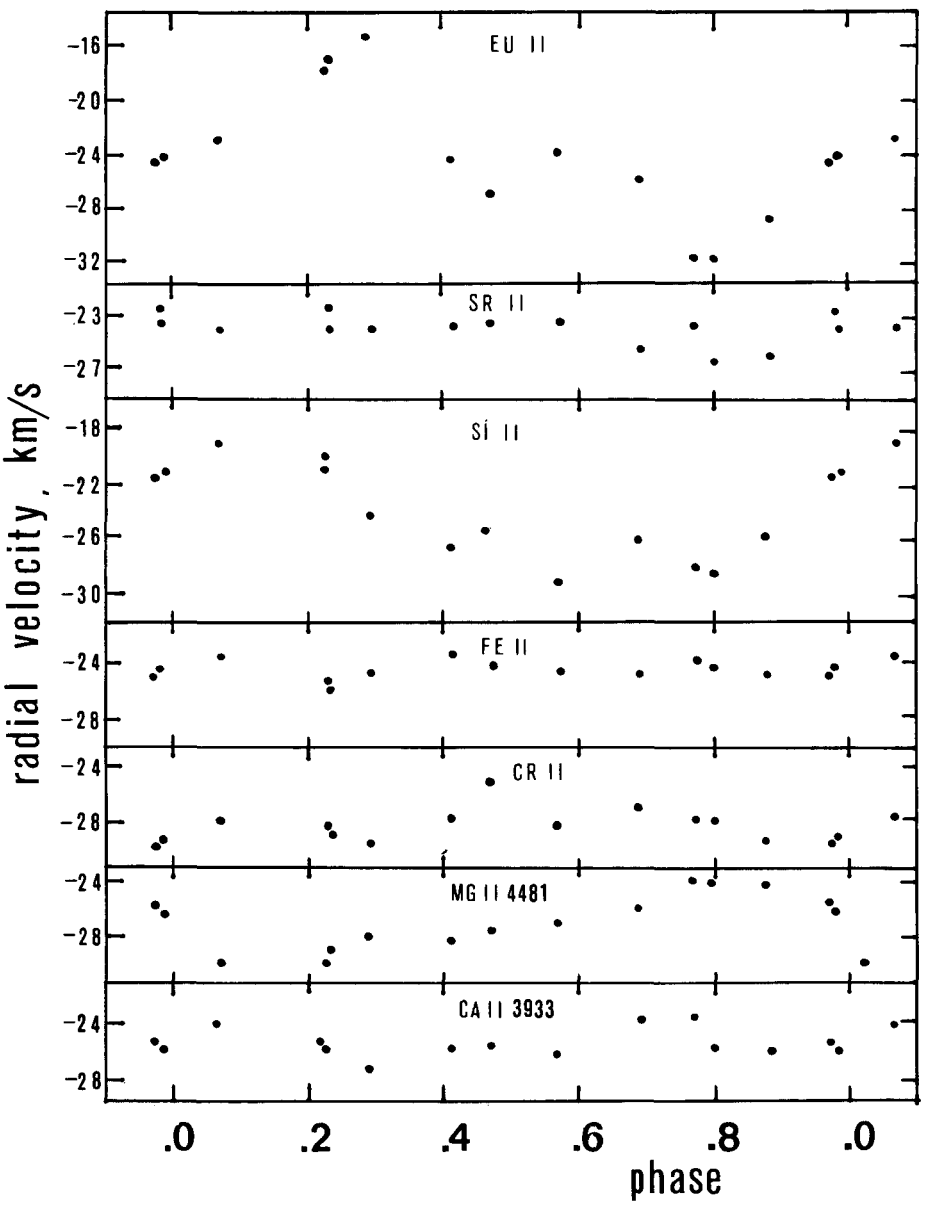

Fig.3. Radial velocity variations for Eu II, Sr II, Si II, Fe II, Cr II, Mg II 4481 and Ca II 3933

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Cr II, Sr II, Si II, Ca II and Mg II were measured for equivalent widths. The typical error in the equivalent widths W of a single line are about 15 percent, but the errors in the mean equivalent widths $\overline{W}$ averaged over the period and over all the lines of the same element are close to 8-10 percent. With the exception of Ca and Mg for the rest elements from 2 to 7 lines were used. The ratio $W/\overline{W}$ for Eu II, Sr II, Fe II and Cr II is ploted versus phase in fig.1. The central depths ratio $R/\overline{R}$ for the Ca II 3933 and Mg II 4481 lines versus phase is shown in fig.2.

For twenty seven lines of several elements radial velocities were derived. The typical error of a individual line are about 2-3 km/s. The radial velocities for each element were averaged in the same manner as the line intensities. The velocity curves are shown in fig.3.

3. DISCUSSION AND CONCLUSIONS

As shown in fig.1, both the phase shift of Sr II lines by about 0.3P-0.4P and the unusual variations of the Cr II in phase with the Eu II lines are confirmed. The variation of Dy II lines are not shown in fig.1 but are similar to those of the Eu II. The intensities of these rare-earths vary by about three times. According to fig.2 Mg II 4481 is the only line with antiphase variations.

Radial velocity measurements exhibit appreciable variations for the Eu II lines with an amplitude of about 16 km/s against 10 km/s obtained from Jones et al. (1973). The amplitude of the velocity curve for the Si II lines is also large and reaches 10 km/s. There are no significant radial velocity variations of the Fe II, Sr II and Ca II 3933 lines.

As a whole the obtained pattern of the line spectrum variability of the Ap star HD 51418 seems to reflect a complex structure of the surface inhomogenities in this star. Probably there exist two different kinds of distribution of the elements - rare-earths and Si in spots, Fe, Cr and Sr in belts.

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