Investigation of depressions in the continuous spectra of CP stars

Yu.V. Glagolevskij, V.G. Elkin, G.A. Chountonov

Special Astrophysical Observatory of the Russian AS, Nizhnij Arkhyz 369167, Russia

The depressions in the continuous spectra of CP stars have been poorly studied, and up to now there has been no conclusive explanation of their origin. To clarify their nature is the first point of the problem. The second task consists in using the depressions in searching for magnetic chemically peculiar stars and preliminary assessment of their magnetic fields. There is sufficiently reliable evidence for assuming that stars with a magnetic field weaker than the normal detection limit (200-300 G) possess conspicuous depressions at λ5200. Searching out and studying of stars with very weak magnetic fields are of vital importance for the range of smooth transition from strongly magnetic to normal stars is completely unexplored.

The depression at λ5200 is known to be proportional to the magnitude of the mean surface magnetic field B_s and the degree of spectrum metallicity (Cramer, Maeder, 1980; Glagolevskij, 1994) up to 4-5 kG. It is not yet known how depressions at the wavelengths 4200 and 6300 Å behave.

The filter technique for estimating the depression intensity currently applied has an essential disadvantage: we cannot derive information about the structure of the bands and can examine the intensity of only the given band.

To solve the problems, a spectrometer based on a transparent grating and a CCD of 1040 x 1160 pixels has been made. The spectrometer is equipped with a TV guide for pointing to a star and guiding. The resolution of the spectrometer is 10-30 Å, depending on the seeing (the spectrometer is slitless). The dispersion is D = 2.57 Å/pix. The spectrum region recorded simultaneously extends from 4000 Å to 7000 Å, thus allowing all the known depressions, 4200 Å, 5200 Å and 6300 Å, to fall concurrently within this spectral region, which is of special importance for comparing their properties. The spectrometer is used with the Zeiss-1000 telescope to study stars as faint as 14^m with a signal-to-noise ratio of up to 100.

We do not present here the results of investigation, but give examples to illustrate the capabilities of the new facility. The records provided show the distribution of brightness in the spectra of several CP stars against the brightness of normal stars. The vertical bars stand for the positions of the depressions 4200 Å, 5200 Å and 6300 Å. From the presented examples and from other observational data the following can be noted.

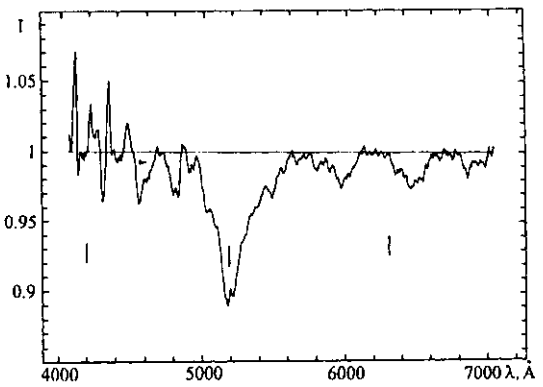

Figure 1: *The spectrum brightness ratio HD 215441/HD 171301 (Sp=B8).*

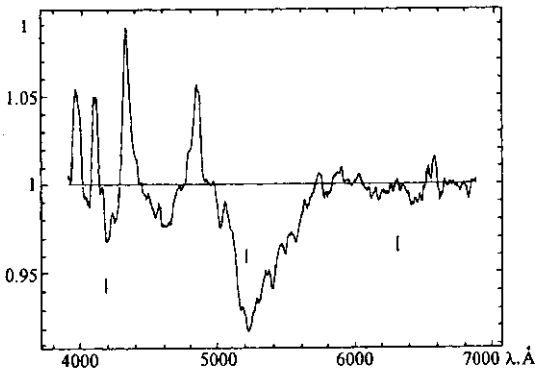

Figure 2: *The spectrum brightness ratio HD 153882/HD 169358 (Sp=A2).*

1. The main depression at λ5200 Å consists of several components, but not of two, as believed by some authors, the contribution of each of them being different in different stars.

2. The same is true for the λ6300 Å depression.

3. The intensities of all the depressions are

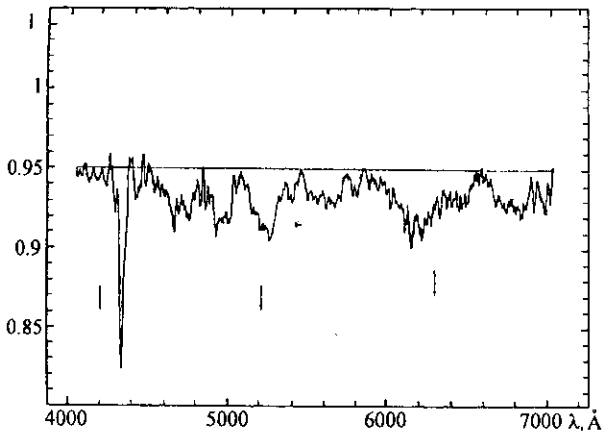

Figure 3: *The spectrum brightness ratio HD 215913/HD 174262 (Sp=A0).*

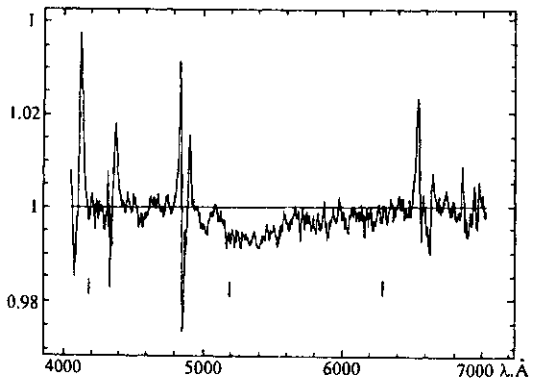

Figure 4: *The spectrum brightness ratio of two normal stars of the same spectral class Sp=A0: HD 206538/HD 174262.*

unrelated to one another.

4. Other depressions, besides the three known ones, are noticeable. It is not unlikely that most of them are produced by superposition of the spectral lines of redundant elements (Phylips et al., 1975; Maitzen & Muthsam, 1980; Zboril et al., 1993), although the most intensive of them, λ 5200 Å, may be superposed by the autoionization silicon band as well. Preliminary attempts to construct synthetic spectra around the depression λ 5200 Å have revealed that the shape of the depression in some stars does not fit to the computed one under any assumptions of abundance of chemically peculiar elements.

5. Normal stars of spectral classes near AO also possess weak depressions, as it is seen from the record for the star HD 206538 displayed in Fig. 4. In fact, a great number of stars with weak depressions and slightly chemical peculiar, which are not classified as CP stars because of the low threshold of detection, are likely to exist. It is hoped that the spectroscopic technique will prove to be more sensitive than the methods applied previously.

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