CHEMICAL ABUNDANCES AND EVOLUTIONARY STATUS OF SOME λ Bootis TYPE STARS AND FBSwl

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ABSTRACT. Comparative analysis of chemical abundances in the atmospheres of λ Bootis type stars and FBSwl (field blue stragglers week lined) is presented. Evolutionary status of these metal deficient stars is discussed.

Key words: chemically peculiar stars, A-dwarfs, F-dwarfs, synthetic spectra, abundance, λ Bootis

1. Introduction

Group of λ Bootis type stars consists of Population I, metal poor (except C, N, O and S elements which have almost solar abundance), non-magnetic, late B to early F-type dwarfs. They fall into two classes with normal (NHL) and peculiar (PHL) hydrogen profiles with weak cores and broad but often shallow wings, have a weak λ4481 lines and high $v \sin i$. Some of them have IR excesses and strong absorption features in IUE spectra. According to Venn and Lambert (1990) accretion theory, the chemical peculiarity of λ Bootis stars originates from the presence of a circumstellar shell (most likely a remnant of the star formation). Depleted gas from the circumstellar envelope consist of CNO and S elements is accreted by the star while elements with higher condensation temperature accumulate in the dust grains.

A-component (V=6.^{m}71, A-type) of unusual visual binary system VW Ari (HD15165, BDS 1269) wide known as multiperiodically pulsating star (probably of δ Sct-type) having non-radial modes. This star shows the spectrum typical for very metal deficient star and high $v \sin i$ value, while B-component (V=8.^{m}33, F-type) possesses a solar-like chemical composition and slow rotation (Andrievsky *et al.* 1995). Such a strange difference in the chemical composition of both components could appear due to the peculiar evolution of VW Ari A as a λ Boo-type star (Chernyshova *et al.* 1998).

Olsen (1980) had applied Strömgren photometry to predict spectral classifications of faint stars and finding lists of potentially interesting objects. He has indetified a category of early F type metal-poor dwarfs (so called "week-lined field blue stragglers" (FBSwl)) among stars brighter than m_v=8^m. Their δm_1 values indicate abundances in the interval -0.9<[Fe/H]<-0.4. A spectroscopic investigation of this group of metal-deficient F dwarfs to clarify their nature was recommended. Bond (1970) and Gray (1988) suggested that FBS possibly are cool representatives of the λ Bootis class of young stars with weak metallic lines.

2. Observation and abundance analysis

In our works Paunzen *et al.* (1999) and Andrievsky *et al.* (2002) we determined accurate LTE abundances for 7 well established λ Bootis stars and 20 candidates to λ Bootis type stars. We compared abundances of our candidates with two MK standard stars and abundance pattern from Paunzen *et al.* (1999). Details of observations of 19 FBSwl are presented in Andrievsky *et al.* 1995, 1996. High resolution and high S/N CCD spectra have been obtained at six sets. The effective temperatures and surface gravities were estimated using the Strömgren photometric indices checked with additional calibrations in the Geneva system. We obtained LTE abundances and rotational velocities by using method of synthetic spectra with help of programs STARSP (Tsymbal 1996) and WIDTH9, the atmosphere models of Kurucz and atomic data from the Vienna Atomic Lines Database (Kupka *et al.* 1999).

3. Obtained results

All metals show moderate deficiency on FBS and moderate or strong deficiency on 7 λ Bootis type stars and VW Ari A. C and O are in little deficiency on all stars. Most of the stars show normal abundance of sodium. VW Ari A show distribution of elements like typical λ Bootis type star. Take into account normal hydrogen profile of star we can call it NHL type star (of course if all other main features of λ Bootis type stars will be found on this star).

After our detailed abundance analysis for test of membership of twenty λ Bootis type stars candidates we are able to confirm or establish the member-

ship for nine objects (HD23258, HD36726, HD40588, HD74911, HD84123, HD91130, HD106223, HD111604 and HD290799). Six stars (HD90821, HD98772, HD103483, HD108765, HD201184 and HD261904) can be definitely ruled out as being member of the λ Bootis group whereas no ambiguous decision can be drawn for another five stars (HD66684, HD105058, HD120500, HD141851 and HD294253).

The results of investigation of chemical abundances of FBSwl were published in Andrievsky *et al.* (1995, 1996) and Chernyshova (1999). Although most of FBSwl show slight metal deficit and some of them show abundance pattern similar to λ Bootis type stars. So we can add them to the list of candidates of λ Bootis stars.

4. Conclusions

Future investigations of λ Bootis should concentrate on establishing homogenity of the group of λ Bootis (candidates should show the most of common properties), clarification of the main physical processes responsible for its phenomenon by analysing of parameters (abundance pattern, behaviour in the infrared etc.), improving theory of λ Bootis forming by taking all observational results and evolutionary status of group's members into account. Precise IR spectroscopic and photometric observation of λ Bootis is nesessary for understanding the physico-chemical processes of accretion and diffusion in their circumstellar gas and dust discs and chemical anomalies on a surfaces, possible discovering of binaries among them.

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