Chemically peculiar stars of spectral type A

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Химически пекулярни звезди от спектрален клас А

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Unique place of A-type stars among the others allows to study unique phenomena and processes like stellar magnetic fields, tidal interactions, radiatively driven diffusion, and abundance diversity of stellar atmospheres. The dissertation contains results from an extended study of λ Bootis type stars, cool Ap stars and Am stars in binary systems. It contains four chapters. Basic spectroscopic characteristics of λ Bootis type stars have been discussed in the first chapter. The results obtained support the conclusion that these objects form a homogeneous group of non-magnetic Population I stars with normal (solar) abundances of C, N, O, and S.

Evolutionary status of λ Bootis type stars is discussed in the second chapter. In contrary to the existing models λ Bootis type stars fill the entire width of the main sequence strip with evolutionary ages between 100 Myr and 1 Gyr. Orbital elements of two binary systems which components both are λ Bootis type stars, and especially their mass-ratio have ruled out the suggestion that λ Bootis phenomenon occurs during the pre-main sequence stage of stellar evolution. A comparison between fundamental stellar parameters as masses, ages, effective temperatures, and rotational velocities of λ Bootis type stars, and apparently "normal" A-stars have revealed that there is no statistically significant difference between both groups. A conclusion has been made that low metal content observed in the atmospheres of λ Bootis type stars can be created by the interaction with the circumstellar matter surrounding stars during the main sequence stage of stellar evolution. Such a mechanism is suggested to produce typical for the λ Bootis type stars abundance pattern.

Magnetic field makes the puzzle of Ap stars extremely variegated. Results that have been reported in the third chapter exhibit different pieces of that puzzle and include mapping the distribution of chemical elements over the surface of rare HoDy star HD 51418 - this distribution is connected with the magnetic field geometry, studying line spectrum variations, magnetic field, and improving the rotational period of SrCr star HD 5797, magnetic curve and overall magnetic field of ϵ UMa that survives till the end of star's evolution on the main sequence, extraordinary excess of uranium (up to 4 dex) in the atmosphere of Ap star 73 Dra, and, at last, weak-magnetic Ap star

HD 220825 and its abundance showing that even small magnetic fields are quite enough to provoke chemical anomalies.

Almost all Am stars are found in binary systems. Tidal interaction in those systems can play crucial role in determining atmospheric structure and thus controlling the radiatively driven diffusion, thought to be the main reason for the observed elemental abundances. The fourth chapter contains results on examination of the hypothesis that the observed anomalies will depend on the orbital elements as well; they will be more pronounced in systems with larger eccentricities, and longer periods. More than 30 Am stars in binary systems have been spectroscopically studied. It is found that the deficit of Li is stronger in binary systems with large eccentricities, the same is true for the Ca/Fe anomalies. Observed abundance anomalies can be thoroughly interpreted only if the orbital elements are taken into account. Signs of the secondaries have been discovered in the spectra of five binary stars, one of them - HD 216608 is newly found triple system.

Finally, it is concluded that chemically peculiar stars of spectral type A are unique key for understanding the stellar evolution on the main sequence.

Key words: stars: diffusion, chemically peculiar stars, Am stars, Lambda Bootis type stars

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