ANALYSIS OF THE SPECTRUM OF Hg - Mn STAR HR 4072

V. M. Dobrichev, D. V. Rajkova
National Astrophysical Observatory
4700, Smolyan,
Bulgaria

V. G. Klochkova, V. Ye. Panchuk
Special Astrophysical Observatory,
Nizhniy Arakhyz, Stavropol’skij Kraj,
357147, USSR

ABSTRACT

Hg - Mn star HR 4072 with extremely narrow lines has been studied using the spectra with reciprocal dispersion D=4.2 A/mm (spectral resolution $\Delta \lambda = 0.08$ A), obtained with the Coude spectrograph of the 2-m telescope of NAO Bulgarian Academy of Sciences. Within the wavelength region 3700-4800 A the detailed identification is fulfilled and equivalent line widths W of the primary and secondary components of this spectroscopic binary star are measured. Independent spectrum processings in SAO and NAO have shown the high precision of the measured W values and the absence of any systematic disagreements.

As a result of the investigation the possibility is shown to apply the atmosphere models with normal (solar) chemical abundance for analysis of Hg -Mn star atmospheres. This allows to plan the future fulfilment of atmosphere quantitative analysis for a large sample of this type stars in open clusters the spectra of which are obtained on the 6-m telescope by one of the authors (Klochkova V. G.).

Using the method of atmosphere models for the main component HR 4072 we determined the effective temperature, surface gravity, microturbulent velocity $V_T$, and abundances of 15 chemical elements. The iron abundance in HR 4072 is normal, $\alpha$-process elements (Mg, Si, Ca, Sc) show a weak deficit $\alpha/\text{Fe} = -0.24$ dex, for s-process elements (Sr, Y, Zr, Ba) a considerable excess is observed $\alpha/\text{Fe} = +1.15$ dex. The abundance of heavy elements ($\text{Sm, O}$, Hg) is thousand times higher than the solar one; the abundance of the peculiar Mn element ($\text{Mn/Fe} = +1.4$ dex is essentially increased, and ionization equilibrium exist for Mn and Mn$^+$. The peculiarities of abundance pattern such as excesses of heavy elements and violation of odd-even effect qualitatively agree with the hypothesis of diffuse separation of chemical elements under the conditions of stable atmosphere. At the same time...
for a number of elements the obtained results contradict the predictions of this theory. For Fe' and Mn' ions the basic condition of diffusion mechanism effectiveness is fulfilled: Mn ion spectrum is richer with lines than the Fe spectrum, but Mn initial abundance is noticeably lower than that of Fe.

The study of the effect of magnetic intensification of Ti, Fe, Fe' lines showed that there is no statistically reliable relations between Ti and Fe abundances, determined from separate lines at the fixed \( \frac{3}{2} \) value, and Lande factors.

The whole content of the paper will be published in "Astrofizicheskie Issledovaniya", v. 27, 1988.