THE MOST IRON-DEFICIENT MANGANESE STAR HR562

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ABSTRACT. Abundances of 11 elements are determined in the atmosphere of the manganese star HR562 = HD11905 (B8III, T_e=14000 K, log g=3.5). The deficit of iron of 0.9 dex is extreme among HgMn stars. The excess of mercury abundance amounts to 4.8 dex.

1. INTRODUCTION

In their search for iron variations in Population I late B and early A stars Cowley et al. (1982) have suspected some stars to be iron-deficient. One of these stars, HD204754, turned out to have normal chemical composition (Ptitsyn and Ryabchikova, 1985). In this paper we present results of preliminary chemical analysis of another star, HR562=HD11905 (B8III). Wolff and Wolff (1974) classified HR562 as a manganese star. Later Wolff and Preston (1978) found variations of radial velocities of hydrogen lines with a period of 5.1 days, that they considered as an indication of the binary nature of the star. They found no lines of secondary component and concluded that they might be very broad. The lines of the primary component seemed to be slightly weaken as if the radiation from the secondary component would contribute to the continuum.

2. OBSERVATIONS

One 9 Å/mm-dispersion spectrogram of HR562 was taken with the 2-m telescope of the National Astronomical Observatory of Bulgarian Academy of Sciences on September 9, 1982 (2^h09^m UT). This spectrogram was measured with the 3CS Joyce Loebl microdensitometer. About 100 lines were identified in the 3800-4700 Å range, nearly half of which belong to the MnII spectrum.

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3. MODEL ATMOSPHERE

From Genéva photometry (Rufener, 1981) using the calibration of Cramer and Maeder (1979) we obtained T_e=13930 K. The $(b - y)_o$ index from Philip et al. (1976) with calibration of Relyea and Kurucz (1978) gave T_e=14100 K. Finally the effective temperature of 14000 K was adopted.

The surface gravity log g=3.5 was obtained from the H_γ profile. We couldn't estimate the microturbulent velocity by usual way from comparing strong and weak lines of a given element because the observed lines are weak or not numerous for all elements except Mn, while for Mn lines the scattering is large due to uncertainties in the oscillator strength values. The value v_t=2 km/s, typical of HgMn stars (Dworetsky, 1971), was adopted.

4. ABUNDANCES OF ELEMENTS

The chemical composition was determined by the model atmosphere technique. Theoretical intensities of lines were computed for the Kurucz et al. (1974) model atmosphere with T_e=14000 K and log g=3.5 by means of the programme written by N.E.Piskunov at the Astronomical Council of the USSR Academy of Sciences.

The chemical composition derived is given in Table I.

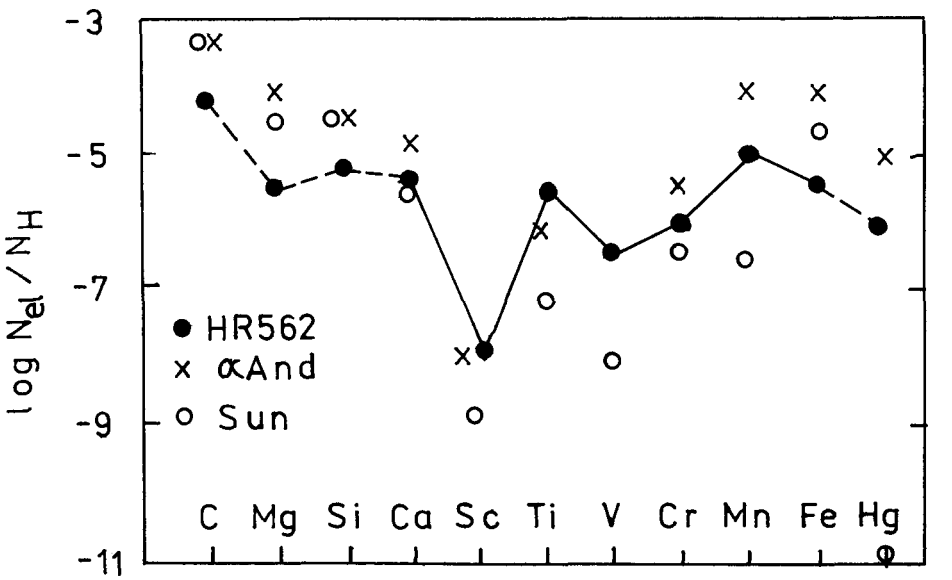

Fig.1. Abundances of HR562 with those of αAnd for comparison and solar abundances.

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Table I. Abundances of HR562

Element	$\log \frac{N_{el}}{N_H}$	Number of lines	Source of gf-value
CII	-4.23	4	1
MgII	-5.58	1	2
SiII	-5.22	5	2
CaII	-5.36	1	2
ScII	-7.90	1	3
TiII	-6.48	12	4
VII	-6.49	4	5
CrII	-5.91	6	6
MnII	-4.92	29	7
FeII	-5.41	7	8
HgII	-6.06	1	9

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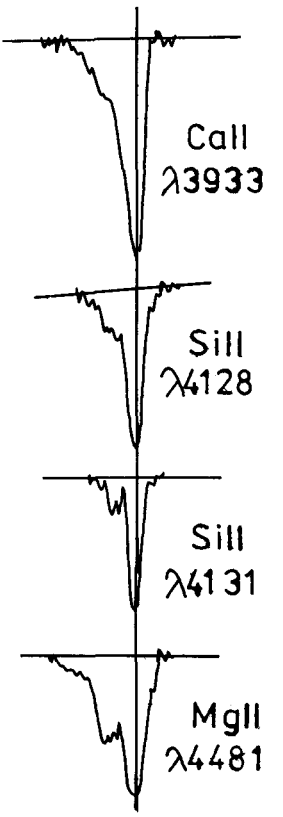

Fig.2. Line asymmetries.

The number of lines used in the analysis as well as the sources of oscillator strengths are also indicated. We didn't take into account a possible contribution to the continuum from the secondary component, but according to rough estimates it wouldn't effect essentially our results.

Logarithmic abundances relative to hydrogen for HR562, solar atmosphere and well studied manganese star αAnd are shown in Fig.1. With respect to solar abundances, C, Mg, Si are deficient by ~1 dex, Ca is normal, iron-peak elements with the exception of Fe itself are in large excess, Hg is by 4.8 dex enhanced. The content of Fe is 0.9 dex below normal, therefore HR562 turns out to be a HgMn star with

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extreme deficit of iron. So the range of iron abundance variations in these stars amounts to 1.5 dex, exceeding such variations in other types of CP stars. The comparison with αAnd, another HgMn star having nearly the same T_e and log g, reveals the similarity of relative abundances, the absolute values in HR562 being lower by $\gtrsim 0.5$ dex. The ratio Mn/Fe in HR562 is definitely greater than unity, that evidences against the nuclear origin of anomalies. High mercury abundance in HR562 gives one more example of manganese stars with weak Fe lines which have enhanced Hg. This emphasizes the uniqueness of the 53 Tau phenomenon.

5. LINE ASYMMETRY

In our spectrogram of HR562 the profiles of some lines appear to be asymmetric. Fig.2 illustrates this effect for some strong lines. Rough estimation of radial velocity from the displacement of blue component is in accord by its absolute value and sign with that predicted from ephemeris given by Wolff and Preston (1978).

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