MANGANESE ABUNDANCES IN THE ATMOSPHERE OF CLUMP GIANTS

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ABSTRACT. The manganese abundances was determined in the atmospheres of clump giants stars whose selection was made earlier based on their chemical composition and evolutionary tracks. The spectra of the studied stars were obtained using the facilities of the 1.93m telescope of the Haute-Provence Observatoire (France) equipped with the échelle spectrograph ELODIE (R = 42000, S/N = ~100–300). The Mn abundances was determined under the LTE approximation by the synthetic spectrum approach with a detailed consideration of the superfine structure. The behaviour of manganese abundances with metallicity [Fe/H] was considered.

Key words: stars: abundances

Manganese is a typical Fe-peak element. A debate is still on-going to determine the main sources and their contributors to the Mn abundances whether type II or type Ia supernovae (SNe). Wallerstein (1962) first noted that Mn is deficiency relative to Fe in low-metallicity stars unlike other elements of the iron peak. Later, Gratton (1989) showed that the behavior of manganese inverse behavior of α-elements whose content is increased with a decrease in metallicity. We studied the Mn abundances in clump giants stars whose selection and atmospheric parameters were determined earlier (Mishenina et al., 2006, Kovtyukh et al., 2006).

The Mn abundances in program stars were obtained by fitting synthetic spectra to the observational profiles. We used the STARSP LTE spectral synthesis code developed by Tsymbal (1996), Kurucz models (Kurucz, 1993), and VALD atomic data (Kupka et al., 1999) while accounting for the superfine structure (Prochaska et al., 2000) (see Fig.1).

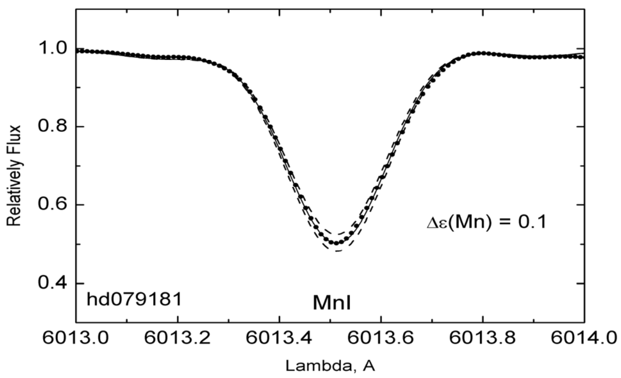

Fig.1. Spectrum synthesis fitting of observed profiles of Mn line 6113 Å.

For sixteen lines we estimated the manganese abundances in the Sun's atmosphere. The analysis resulted in the selection of three lines, viz., 5432, 6013, and 6021 Å. The abundance ratios [Mn/Fe] for each star in our set are plotted against [Fe/H] in Figs. 2, 3.

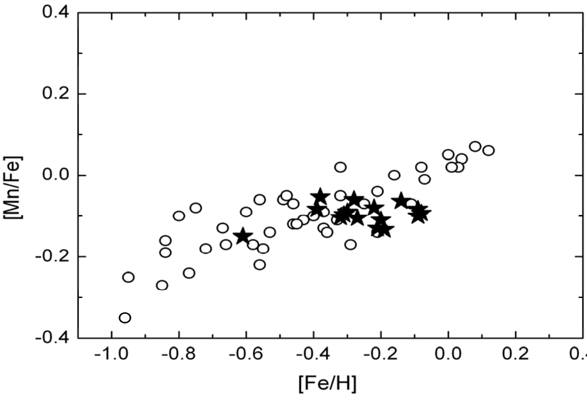

Fig.2. [Mn/Fe] ratios for our giants (asterisks), and dwarfs of the disk (open circles).

We compared the obtained Mn abundances with the results of other authors (Fig. 3).

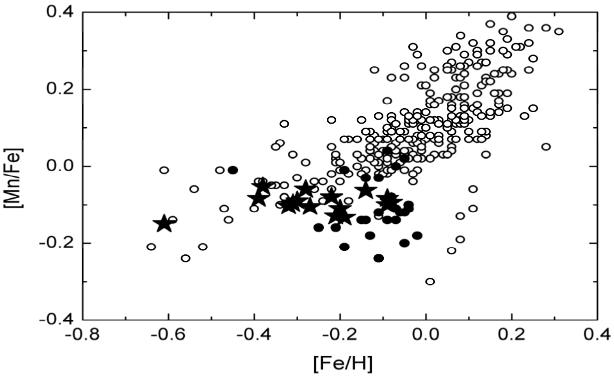

Fig.3. Comparison of our data (asterisks), with that obtained by other authors: for stars in the open clusters (Reddy, 2012, 2013) – black circles and for giants in local field (Luck, 2007) – open circles.

What is the cause of this inconsistency? We did not take the deviation from the LTE into account in the calculation of Mn content and other authors also did not account for it. Does the problem consist of the incorrect selection of lines or correct accounting for the superfine structure of the lines? To answer these and other questions, further investigations are needed.

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