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A Study of the Chemical Composition of Halo Stars

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Abstract

We have determined the chemical composition of 43 halo stars, ranging in metallicity from [Fe/H]=–3.2 to [Fe/H]=–0.6. The abundances of the species O I, Na I, Mg I, Al I, Si I, Ca I, Sc II, Ti I, V I, Cr I, Fe I, Fe II, Ni I and Ba II have been analyzed with LTE atmospheric models calculated with the MARCS code.

1.1 Introduction

The abundance analysis of stars is a key to understanding the Universe. It gives clues to almost every aspects of the evolution of the Universe, the galaxies and of course the stars themselves and their orbiting planets. The information gathered up to date has given us marvelous insights, and more is to come. Here is another investigation of the abundances of stars. This time the task was to do a chemical analysis of Pop. II dwarf and subgiant stars in the halo of our Galaxy.

1.2 Project Data

The investigation is a collaboration between the author and these astronomers:
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Project data in short as follows:

- 43 stars
- Data taken with ESO 1.4 m CAT/CES telescope
- 4 wavelength-regions: 5695 Å, 6153 Å, 7785 Å and 8745 Å
- 62 lines of measured equivalent widths
- 14 species: O I, Na I, Mg I, Al I, Si I, Ca I, Sc II, Ti I, V I, Cr I, Fe I, Fe II, Ni I, Ba II
- MARCS LTE model atmospheres
- Temperature calculated from eq. (9) in Alonso et al. (1996)
- Surface gravities calculated from Hipparcos parallaxes and evolutionary tracks
- Metallicities iterated until consistency with derived [Fe/H]
- Astrophysical log(gf) calculated from the Holweger-Müller model atmosphere

1.3 Results

See figure 1.1 for the results.

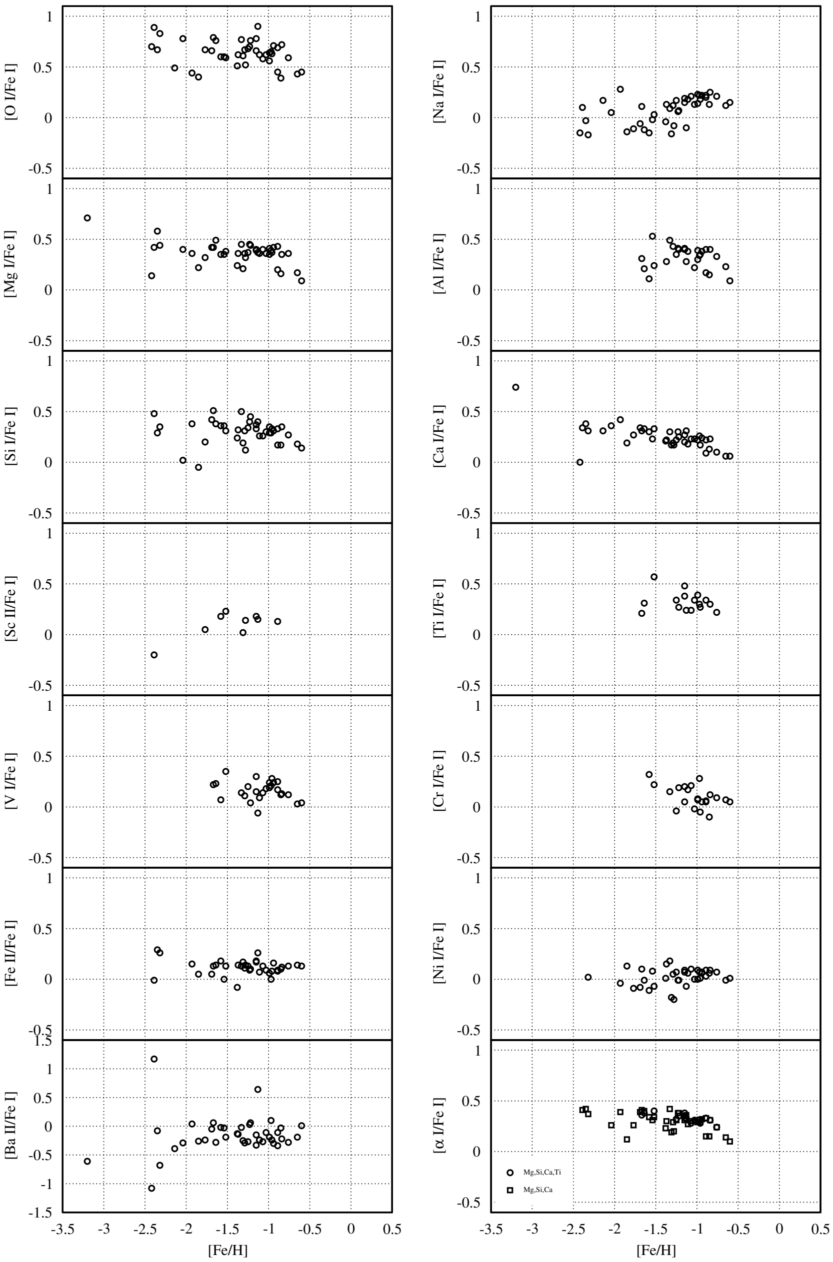

Fig. 1.1. The abundances relative to iron, [X/Fe I] for all species in the program viewed against the iron abundance, [Fe I/H]. $[\alpha_{\circ}/\mathrm{H}]=\frac{1}{4}([\mathrm{Mg}/\mathrm{H}]+[\mathrm{Si}/\mathrm{H}]+[\mathrm{Ca}/\mathrm{H}]+[\mathrm{Ti}/\mathrm{H}])$ and $[\alpha_{\square}/\mathrm{H}]=\frac{1}{3}([\mathrm{Mg}/\mathrm{H}]+[\mathrm{Si}/\mathrm{H}]+[\mathrm{Ca}/\mathrm{H}])$.

1.4 Conclusions

The oxygen abundances were determined from the OI triplet 7774Å lines. The resulting abundances show a pattern with [O/Fe] staying roughly constant at about 0.6 dex for [Fe/H]<-1.0, in contrast to the increasing [O/Fe] with decreasing [Fe/H] obtained by Boesgaard et al. (1999) and Israelian et al. (1998) from OH lines. The trends in the diagrams of the other elements is roughly a confirmation of what others have found. Further discussion of the result will appear in the coming article.

References

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