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Stellar Abundances for Galactic Archaeology database for stars in dwarf galaxies

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Abstract. We present a new database for observed stars in dwarf galaxies in the local group. This is an extension of the Stellar Abundances for Galactic Archaeology (SAGA) database (Suda et al. 2008, PASJ, 60, 1159) that deals with metal-poor Galactic halo stars. The main features of the new database are the same as the database for Galactic halo stars. Users can access and select data based on various criteria, and then inspect the selected data on a diagram with user-specified axes. The database includes more than two hundred stars based on high-resolution spectra for 20 galaxies, while the number of data is more than five thousand by including the data with medium-resolution spectra. We briefly discuss the characteristics of stars in dwarf galaxies using the database.

Key words. Stars: abundances – Stars: Population II – Galaxy: dwarf galaxies –

1. Introduction

Stellar abundances are important tracers of the chemical evolution of the Galaxy and the local group. The surface abundances of observed stars possess the information about the environment of star-forming gas in which they were born, which give us an insight into the nucleosynthesis in stars and the star formation history of the host cloud. They can also tell us the effect of external pollution that may reflect the accretion of matter from their binary companion and/or interstellar gas. In order to extract the detailed signature of these chemical fingerprints, we need good samples of stars as well as sophisticated theoretical models.

We constructed the database of the stellar abundances for Galactic archaeology, the SAGA database (Suda et al. 2008; Suda et al. 2011) that compiles the data of metal-poor Galactic halo stars from the literature. The compilation of the stellar abundances enables us to compare stellar models with the observations (Nishimura et al. 2009; Suda & Fujimoto 2010) and led us to address the change of the stellar initial mass function in the early universe (Komiya et al. 2007; Suda et al. 2013; Yamada et al. 2013).

The same kind of discussion can be applicable to stars in the local group. Thanks to the large surveys of stars in the local group galaxies in the last decade using VLT/FRAMES (Tolstoy et al. 2006) and Keck/DEIMOS (Simon & Geha 2007; Kirby et al. 2009), photometric and kinematic information is available for thousands of stars in nearby galaxies. In addition, abundance determinations based on high resolution spectroscopy are also possible for more than a hundred stars using VLT/UVES, Keck/HIRES, and Subaru/HDS. These available data can give us a hint to understand the formation and evolution of the Galaxy keeping in mind that dwarf galaxies are remnants of the building blocks of the Galaxy.

In this paper, we report the extension of the database by covering stars in the dwarf spheroidal galaxies in the local group. The compilations and usage of the data are treated in the same way as the SAGA database. The outline of the database are briefly described in §2. We show some demonstrations in §3 using the data retrieval subsystem of the database.

2. The database

We have compiled data from the literature that contains spectroscopic abundances of stars in dwarf spheroidal galaxies (dSph). The initial selection criterion of candidate papers are those dealing with the observations of stars in the local group. These papers are recorded in the reference management subsystem of the SAGA database (Suda et al. 2008, hereafter Paper I). As of Nov. 2013, the number of candidate papers is 117. Then we give a priority in the compilation of the papers depending on the quality of the data. The candidate papers are divided into three groups, i.e., (1) papers containing abundance data with high resolution spectroscopy ($R \gtrsim 20,000$), (2) papers containing abundance data with medium resolution spectroscopy ($R \gtrsim 5,000$), and (3) other papers that report data with low-resolution, photometric data only, abundances of AGB stars, or data other than stellar abundances. We do not set the criterion with metallicity differently from Paper I. At present, we have compiled 45 papers in total consisting of all the papers categorised as (1) and part of the papers categorised as (2) . The total number of stars registered in the database is 5,925, but potentially includes the duplication as discussed below. At present, 18,992 records are available for element abundances.

The treatment of abundance data is the same as in Suda et al. (2008). It includes the priority based on the line and ionisations for element species and how the priority is given when multiple papers report the abundances for the same objects.

We create a new catalog of our sample by identifying objects that are identical but have different names in different papers. Identical objects are detected by the condition that two stars are located within 10 arc seconds squared each other and have brightness difference less than 0.5 mag in the V band. We identified 168 pairs of stars that are suspected to be the same object, while their names are different. Finally we have 5,758 unique stars in the database.

The stars in our sample are renamed as SAGA_XXX_YYYY where XXX stands for the shortened name of the dwarf galaxy such as "Car" or "For" for Carina and Fornax dSph, respectively, and YYYY the star ID starting from "0001" in the order of increasing the declination angle of the stellar position. The details can found in a forthcoming paper and the link from the web site of the SAGA database (http://saga.sci.hokudai.ac.jp/) that is under construction.

3. Example of the data plot

Figure 1 shows the abundance trend of magnesium with respect to metallicity for all the samples in the database. This figure was originally created by the data retrieval subsystem that enables users to plot diagrams with any specified axes. As in the case of the SAGA database for the Galactic halo stars, users can download the data and a plot script written in gnuplot format to reproduce the figure on the browser.

Figure 2 gives a correlation between sodium and nickel abundances. Tolstoy et al. (2009) argue that there is a positive correlation between these two element abundances in their sample, but the correlation appears to

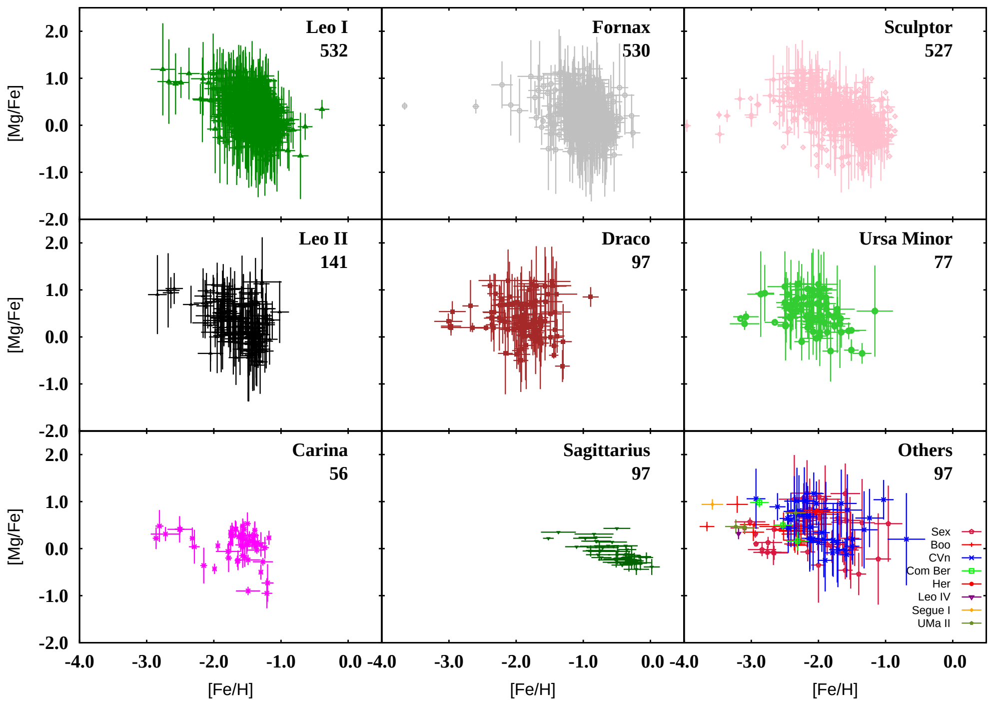

Fig. 1. The enhancement of magnesium as a function of metallicity. The number of available data for magnesium is 2112 that is the second largest next to iron. All the available abundances are plotted with different colours for different populations.

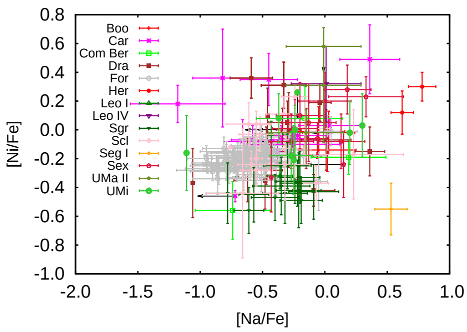

Fig. 2. Correlation between sodium and nickel abundances. The number of plotted data is 171.

be weaker if we include all the sample in the database. More discussions will be given in a separate paper (Suda et al., in prep.).

4. Summary

We reported the extension of the SAGA database by including the stars in the dwarf spheroidal galaxies in the local group. The new database adds more than 5,000 stars to existing $\sim 1,500$ Galactic stars in the database. We created a new catalog of the stars in dwarf galaxies by identifying stars with their position and brightness. All the data will be available online. The number of stars with high resolution spectra available is still limited ($\approx$ 250), but is expected to increase by future follow-up observations. More details of the database and further discussions using the database will be given in a forthcoming paper.

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