Stellar Populations - Planning for the Next Decade
Proceedings IAU Symposium No. 262, 2009
G.R. Bruzual, & S. Charlot, eds.

DOI: 00.0000/X000000000000000X

The Mg/Fe characterization of the MILES library for stellar populations studies

André Milone[1,2], Anne E. Sansom[2] and Patricia Sánchez-Blázquez[3]

[1]Divisão de Astrofísica, Instituto Nacional de Pesquisas Espaciais, Brazil
email: acmilone@das.inpe.br

[2]Jeremiah Horrocks Institute, University of Central Lancashire, United Kingdom
[3]Instituto de Astrofísica de Canarias, Spain

Abstract. We have obtained [Mg/Fe] for around 77% of the stars of the MILES library of stellar spectra in order to include this important information into simple stellar population (SSP) models. The abundance ratios, which were carefully calibrated to a single uniform scale, were obtained through a compilation from high spectral resolution works plus robust spectroscopic analysis at medium resolution. The high resolution data provided an extensive control sample. Average uncertainties (0.06 and 0.12 dex for the high and medium resolution samples respectively) and the good coverage of the stars with [Mg/Fe] over the MILES's parameter space will permit us to semi-empirically build up new SSP models with accurate α-enhancements for ages older than 1 Gyr. This will open new prospects for evolutionary stellar population synthesis.

Keywords. astronomical data bases: miscellaneous, techniques: spectroscopic, stars: abundances

1. Introduction

One current limitation of the SSP models that are based on empirical stellar specta is that they rely on Galactic stars whose detailed chemical properties are not well known. For example, the stars in the different components of the Galaxy show distinct patterns of alpha-elements reflecting different star formation histories. The models usually only take into account the iron abundance, but stellar spectra may change considerably if the ratios between other elements and Fe are different.

Accounting for well known element abundances will make an empirical spectral stellar library particularly useful for modeling stellar populations with different formations. In this work, we present Mg/Fe ratios for 758 MILES Sánchez-Blázquez *et al.* (2006)'s stars. The values are a combination of a literature compilation and our own measurements.

2. Mining Mg abundances and the [Mg/Fe] scale

In a first step, we obtained published Mg abundances from high resolution spectra of the MILES's stars. We adopted the Borkova & Marsakov (2005)'s compilation for defining a consistent scale of [Mg/Fe] that was based on weighted averages. Calibration of the ratios from a given work to this scale relies on a statistically representative linear relation by using stars in common between two samples.

We used 219 stars from that compilation and also collected abundance ratios for another 89 stars from high resolution analyses, thus covering ∼1/3 of the library having 248 dwarfs and 60 giants. Sixteen stars from duplicated sources helped us to evaluate the calibration process as well as estimate the final errors of [Mg/Fe], which are around 0.06 dex. This step was extremely useful in defining a representative reference sample for calibrating our measurements.

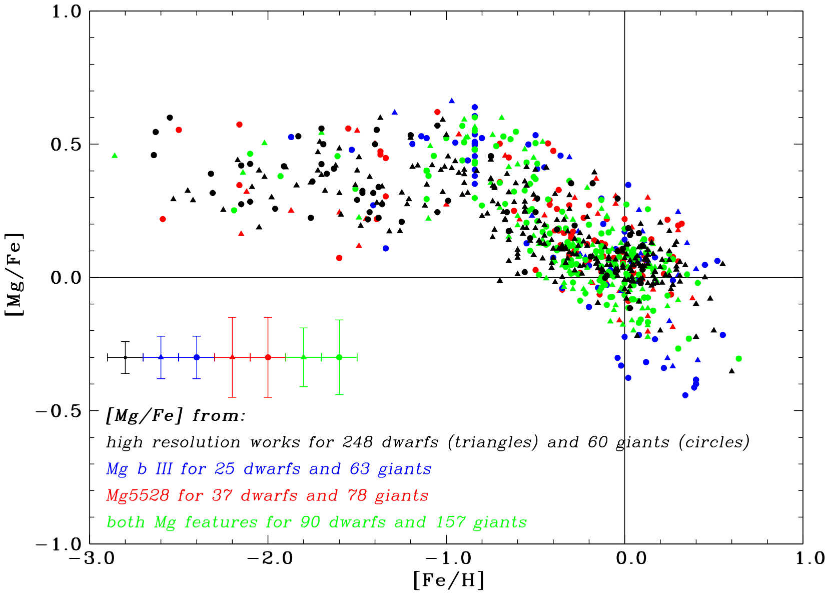

Figure 1. [Mg/Fe] *vs.* [Fe/H]: high and medium resolution measurements onto uniform scales.

3. Mg abundances measured at medium resolution

Our Mg abundance measurements were based on a spectral synthesis computed with the MOOG LTE code (Sneden 2002, http://verdi.as.utexas.edu/) applied to MILES spectra through an automatic process using both pseudo equivalent widths and line profile fits of two Mg features (MgIλ5528.40 Å and the Mg b triplet). We adopted linearly interpolated model atmospheres over the most recent MARCS grid (Gustafsson *et al.* 2008) and accurate atomic/molecular line lists in order to compute a reliable set of synthetic spectra for five values of [α/Fe], for each star. Our measured [Mg/Fe] values cover about 46% of the MILES stars (152 dwarfs and 298 giants), with errors ranging from 0.08 to 0.15 dex (weighted average of 0.12 dex). See them as a function of [Fe/H] in Figure 1.

4. Results and further applications

We have obtained [Mg/Fe] for ∼3/4 of MILES (400 dwarfs and 358 giants, respectively 74% and 82% of them). The results cover the MILES's parameter space quite well. Specifically, we recovered at medium resolution the Mg abundances for a lot of subgiants and red giants although a lack still remains on the stars cooler than 3500 K.

We will use these abundances to compute semi-empirical SSPs (older than 1 Gyr) with different [Mg/Fe]. These refined SSP models will be tested against globular clusters.

References

Borkova, T.V. & Marsakov, V.A. 2005, *AZh*, 82, 453
Gustafsson *et al.*, 2008, *A&A*, 486, 951
Sánchez-Blázquez *et al.* 2006, *MNRAS*, 371, 703

Acknowledgements

A. Milone thanks the Brazilian foundations CAPES and FAPESP.