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Age-Metallicity Relation, [Fe/H] and [α/Fe] vertical gradients in the Milky Way from the SDSS–DR5 spectroscopic database

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Abstract. Spectra of FGK stars were selected from the SDSS–DR5 spectroscopic database to investigate the Age-Metallicity relation and the [Fe/H] and [α/Fe] vertical gradients in the Milky Way. Atmospheric parameters and [α/Fe] were derived by comparing synthetic and measured Lick/SDSS spectral indices. Results were checked and complemented by analyzing solar neighbourhood stars. Spectroscopic distances and ages were obtained for a subsample of ∼2000 stars using theoretical isochrones via a Bayesian approach. The resulting Age-Metallicity diagram and the [Fe/H] and [α/Fe] vertical gradients are presented.

Keywords. stars: abundances, stars: fundamental parameters, Galaxy: stellar content

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In recent years, our understanding of the formation and structure of the Milky Way has been gaining importance due to the increasing availability of observational data especially for FGK stars. The Age–Metallicity Relation (AMR) is one of the most popular diagnostic tools for comparing the actual Milky Way with model predictions, since the knowledge about the epochs when stars became population members is essential, but, up to now, there is no general consensus on its shape and interpretation. Recently, Holmberg *et al.* (2007) re-analyzed the Geneva–Copenhagen photometric survey of the Solar neighbourhood (Nordstrøm *et al.* 2004) presenting improved calibrations for temperature and metallicity and an updated AMR. The analysis of FGK stars beyond the solar neighbourhood can now be accomplished using the Sloan Digital Sky Survey (SDSS–DR5, Adelman-McCarthy *et al.* 2007). Its spectroscopic stellar database represents a more extended, both in space coverage and in numbers, collection of mid–resolution spectra. We use this collection to derive the AMR and the chemical gradients at different heights above the Galactic plane; atmospheric and kinematical parameters, distances and ages are homogeneously derived. We adopt a methodology based on Lick/SDSS indices (Franchini *et al.* 2007a,b), calibrated via solar neighbourhood (SN) stars taken from ELODIE (Moultaka *et al.* 2004) and INDO–U.S. (Valdes *et al.* 2004) catalogues, for deriving $T_{\rm eff}$, log g, [Fe/H] and [α/Fe] estimates. Here we present a preliminary Age-Metallicity Diagram (AMD) and abundance vertical gradients resulting from the analysis of a sub-sample of stars whose atmospheric parameters fall in the range of calibrations.

The program data-sets comprise ∼4500 FGK stars extracted from SDSS–DR5, ELODIE and INDO–US catalogues. For about 2000 stars with parameters in the calibration range, we estimate absolute visual magnitude and age via a Bayesian approach (Franchini *et al.* 2008c). The distributions of atmospheric parameters peak at $T_{\rm eff} = 5800$ K, log $g = 4.2$ dex and [Fe/H]$= -0.7$ dex. The running average trend of [α/Fe] versus [Fe/H]

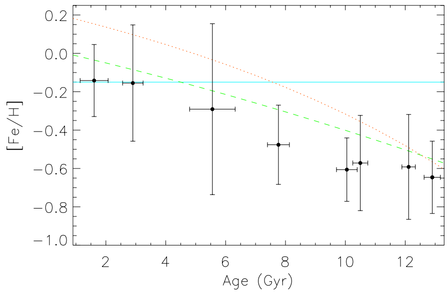

Figure 1. Age–Metallicity Diagram. Three parametric AMR's from Rocha–Pinto *et al.* (2006) are represented by solid (no AMR), dashed ("loose") and dotted ("tight") lines.

shows that our sample is a mixture of stars of different ages and birthplaces. The age distribution for the SDSS and SN samples is illustrated in Franchini *et al.* (2008c): the SDSS sample, with stellar distances in the range $370 \div 15{,}000$ pc and $|Z_{\rm Gal}| > 250$ pc, is older than the SN sample with stars concentrated around the Sun and at $|Z_{\rm Gal}| < 200$ pc.

Figure 1 presents our Age–Metallicity diagram and 3 parametric AMR's from Rocha–Pinto *et al.* (2006). Our data, computed via a running average, are distributed with a slope similar to the "loose" AMR case (dashed line). This result should be taken with caution since AMD's are, in general, affected by sample selection effects (Holmberg *et al.* 2007). As far as the vertical gradients are concerned, the trends of [Fe/H] and [α/H] versus $|Z_{\rm Gal}|$ show a clear decrease of [Fe/H] for $|Z_{\rm Gal}| > 100$ pc while the lowest [α/H] values seem to be confined to $|Z_{\rm Gal}| > 1.0$ kpc.

A work is in progress to disentangle stars of different galactic components by computing stellar orbits and kinematical properties.

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