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F-G-K stars from SDSS-DR5 as tracers of Galactic disks and halo

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Abstract. Spectra of F, G and K stars were selected in the INDO-US, ELODIE, and SDSS-DR5 spectroscopic databases to investigate the metallicity distributions and gradients and to derive the Age-Metallicity relation in the different Galactic components. The atmospheric parameters $T_{\rm eff}$, log g, [Fe/H] and [α/Fe] ratios were derived by comparing synthetic and measured Lick-like spectral indices. Spectroscopic distances were obtained for more than 2000 stars up to z ∼ 6 kpc, and ages were computed for a sub-sample of about 550 stars by using theoretical isochrones with the appropriate [Fe/H] and [α/Fe] values. Full 3D kinematics were derived by means of proper motions and radial velocities and, eventually, stars were divided in four groups belonging to the MW disks and inner and outer Halo according to the stellar orbit properties. The resulting [Fe/H] and [α/Fe] distributions of Thin Disk, Thick Disk, and Halo stars are discussed.

Key words. Galaxy: stellar content – stars: abundances – stars: late–type – stars: kinematics

1. Introduction

Our observational data-sets comprise about 2600 F-G-K stars extracted from the SDSS-DR5 (Adelman-McCarthy et al. 2007), the ELODIE collection (Moultaka et al. 2004) and the INDO-US catalogue (Valdes et al. 2004). For all the stars we derived homogeneously log g, $T_{\rm eff}$ and [Fe/H] values by using nine α-independent Lick/SDSS indices (G4300, Fe4383, Ca4455, Hβ, Fe5335, Fe5406, Fe5709, Fe5782 and NaD). Estimates of [α/Fe] are then inferred by using the α-dependent Lick/SDSS indices Ca4227, Mg2, Mgb. We estimate also absolute visual magnitude, M_V, and age, τ, via a Bayesian approach described in Franchini et al. (2007). The SDSS sample consists, mainly, of metal poor G type dwarfs spanning different [α/Fe] values while ELODIE and INDO-US stars have, in general, [α/Fe]=0.0. As far as age is concerned, the SDSS sample is older than the other one which spans a quite large but younger range in age.

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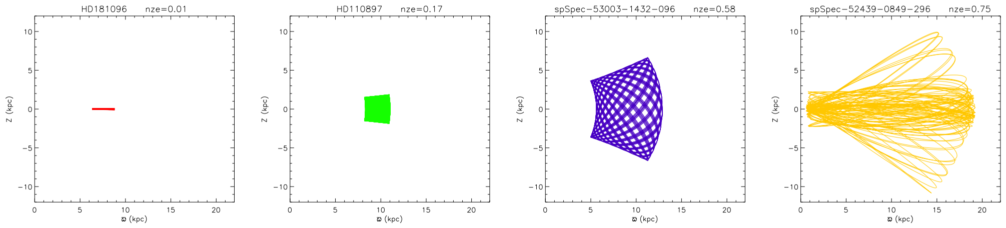

Fig. 1. Four exemplary meridional plots of orbits of stars belonging to the four Groups: Thin Disk, Thick Disk, Inner Halo and Outer Halo

2. Galactic components

In an attempt to disentangle the role of age and of membership to different Galactic structures, we computed stellar Galactic velocities ($U_{\rm LSR}$, $V_{\rm LSR}$, $W_{\rm LSR}$) in the Galactic Euclidean coordinate system. The computations are based on our determinations of radial velocities and distances, and on literature proper motions (CDS–Simbad and Munn et al. 2008, private communication). Eventually, we computed stellar orbits by back-integrating the equation of motion and evaluated the parameters of each stellar orbit, in particular, the normalized z-extent $nze = Z_{\max}/\varpi(Z_{\max})$ (de Boer et al. 1997) and the mean value of the circular velocity $< \Theta >$ in the Galactic Cylindrical coordinate system. The derived kinematical properties prompt us to confidently assign stars to four distinct Galactic Groups identified as Thin Disk, Thick Disk, Inner Halo and Outer Halo (see Fig. 1).

2.1. Analysis of the Galactic components

The main results from the analysis of the four Galactic groups can be summarized as follows:

- Thin Disk stars: they are young, span a range in [Fe/H] from -0.60 to +0.22 peaked at -0.10, and show practically no α–enhancement;
- Thick Disk stars: they span a broad range in age with a dominance of 6 Gyr stars, a range in [Fe/H] from -1.20 to -0.25 peaked at -0.7, and show an intermediate α–enhancement centered at +0.2;
- Inner Halo stars: they are old with an age distribution peaked at 10 Gyr, span a range in [Fe/H] from -1.5 to -0.4 and show a significant α–enhancement with the [α/Fe] distribution marginally peaked at 0.3;
- Outer Halo stars: relatively young stars are present in higher percentage than in the Inner Halo. They span a range in [Fe/H] from -0.5 to -1.7 with two peaks at -0.7 (as the Inner Halo stars) and at -1.0, and their [α/Fe] distribution shows a flat top between 0.0 and +0.4. It is worth noticing that our data, even if limited to [Fe/H]> -1.5, confirm the tendency of lower metallicity in the Outer Halo with respect to the Inner one as already found by Carollo et al. (2007).

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References

Adelman-McCarthy, J.K. et al., 2007, ApJS, 172, 634
Carollo, D. et al., 2007, Nature, 450, 1020
de Boer, K. S. et al., 1997, A&A, 327, 577
Franchini, M. et al., 2007, Proceedings IAU Symp. 248, in press
Moultaka, J. et al., 2004, PASP, 116, 693
Valdes, F. et al., 2004, ApJS, 152, 251