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Alpha-enhancement in the MW: results from the SDSS spectroscopic stellar database

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Abstract. We analyzed a sample of about 2500 stars extracted from the Sloan Digital Sky Survey with $T_{\rm eff}$ in the range 4750÷6500 K and log g greater than 1.5. Atmospheric parameter estimates are obtained by comparing observed and synthetic spectral indices. The dependence of the α-enhancement phenomenon on stellar metallicity and on Galactic position is investigated.

Keywords. Galaxy: stellar content, stars: abundances, stars: late-type

1. The observational data-set

The observational data-set was extracted from SDSS-DR5 (Adelman-McCarthey *et al.* 2007) which contains 154,925 spectra classified as STARs. Since we are interested in finding G and early K stars belonging to the Galactic disks and halo, we selected from the total set of spectra classified as STARs those with $0.7< g-r <1.3$ mag and $(g+r)/2$ <21 mag. Colors were dereddened by using the extinction map by Schlegel *et al.* (1998). A set of constraints based on SNR, accuracy of radial velocity determination, consistency of the calculated SDSS spectrophotometric color indices $(g-r)$ and $(r-i)$ with the photometric values was applied to select stars with specific quality characteristcs.

2. Results and discussion

We present preliminary results for a sample of 2347 stars whose atmospheric parameter values $T_{\rm eff}$, $\log g$, and [Fe/H], are derived by comparing observed indices with synthetic ones. The latter are derived from an *ad hoc* library of high resolution synthetic spectra (Malagnini *et al.* 2005) computed either with Solar-Scaled Abundances (SSA grid) or α-enhanced ones (NSSA grid). The models and the synthetic spectra are at fixed [Fe/H] in the range $+0.5 \div -2.5$ with $[\alpha/\mathrm{Fe}]$=+0.0 or +0.4. In order to derive the atmospheric parameters we use the following set of Lick/SDSS indices which are only marginally dependent on α-element abundances: G4300, Fe4383,Ca4455, Hβ, Fe5335, Fe5406, Fe5709, Fe5783 and NaD (definitions in Worthey *et al.* 1994). Then, we estimate the $[\alpha/\mathrm{Fe}]$ values by comparing the observed α-dependent Lick/SDSS indices Ca4227, Mgb, $\mathrm{Mg_2}$ with the corresponding theoretical values computed by using the derived atmospheric parameters and $[\alpha/\mathrm{Fe}]$=0 or $[\alpha/\mathrm{Fe}]$=0.4. A linear interpolation was applied to derive the value of $[\alpha/\mathrm{Fe}]$ for each star. In Franchini *et al.* (2004) we introduced four Lick/IDS index-index diagrams, (NaD vs Ca4227, NaD vs $\mathrm{Mg_2}$, NaD vs Mgb, and NaD vs CaMg), which allow us to identify different loci representative of SSA and NSSA stars regardless of $T_{\rm eff}$, $\log g$,

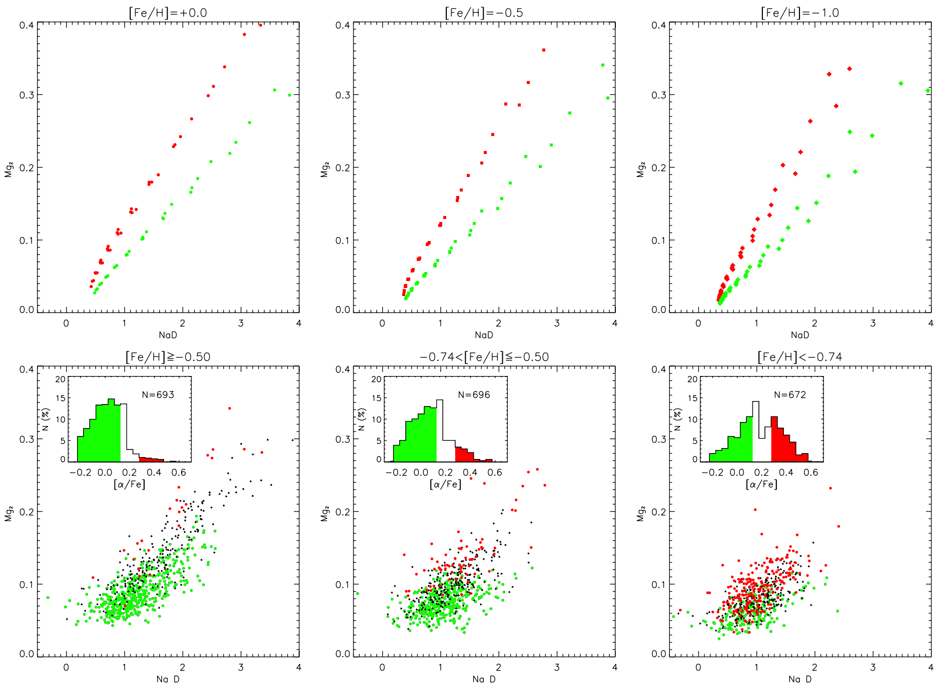

Figure 1. Mg_2 vs NaD Lick/SDSS index-index diagrams. Upper panels: theoretical predictions; lower panels: Lick/SDSS indices for stars in different ranges of [Fe/H] (see text).

and [Fe/H]. Equivalent diagrams for NaD vs Mg_2 built with Lick/SDSS indices are shown in Figure 1. The upper panels show the positions of synthetic points computed for log g from 3.5 to 5.0, $T_{\rm eff}$ in the range 4750÷6500 K, and [Fe/H] = 0.0, -0.5, and -1.0. Indices computed with $[\alpha/\mathrm{Fe}]$=0.4 are represented by red points while those with $[\alpha/\mathrm{Fe}]$=0.0 are indicated by green points. The lower panels show observational indices for 3 sub-samples of our SDSS stars at different [Fe/H]values. Red points correspond to stars for with derived $[\alpha/\mathrm{Fe}]$>+0.3 while green points represent stars with $[\alpha/\mathrm{Fe}]$<0.1. The consistency of the lower panels with the predictions of the upper panels states the statistical reliability of our determinations of atmospheric parameters and $[\alpha/\mathrm{Fe}]$. In each panel the inset plot shows the distribution of $[\alpha/\mathrm{Fe}]$ of the corresponding stars: as can be seen, a higher percentage of stars with $[\alpha/\mathrm{Fe}]$>+0.3 is found, as expected, at lower [Fe/H] value. A similar analysis using sub-samples of our SDSS stars grouped according to different distances from the Galactic plane, $\mid Zgal \mid$, shows an increase in the percentage of NSSA stars ($[\alpha/\mathrm{Fe}]$>+0.3) with increasing $\mid Zgal \mid$.

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