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α-ABUNDANCE IN THE MILKY WAY'S THIN AND THICK DISKS : AUTOMATED DETERMINATION OF T_{EFF}, LOGG, [Fe/H] AND [α/Fe]

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Abstract. I present TGMETα, a method developed in order to determine T_{eff}, logg, [Fe/H] and [α/Fe] for large samples of FGK stars at various spectral resolutions. TGMETα is a minimum distance algorithm based on the χ^2 comparison of an observed spectrum to a grid of synthetic spectra. The results of TGMETα have been extensively tested against several hundreds spectra of reference stars with atmospheric parameters and abundances known from the literature. Typical rms precisions at high resolution are σ_{Teff} ∼140 K, σ_{logg} ∼0.27, $\sigma_{[Fe/H]}$ ∼0.14 and $\sigma_{[\alpha/Fe]}$ ∼0.05. The algorithm was run on nearly 2000 ELODIE echelle spectra in order to build a large sample of stars with kinematics, metallicity and [α/Fe]. This new sample was used to investigate the properties of Milky Way's thin disk and thick disk.

1 The method

The observed (target) spectrum is submitted to severals operations: wavelength calibration, straightening, removing of telluric lines and cosmics. Each synthetic spectrum is transformed in order to fit the target spectrum: convolution at the same resolution, radial velocity shift, resampling, flux adjustement by least-squares. TGMETα computes the distance between the target spectrum and each synthetic spectrum (reduced χ^2). The atmospheric parameters of the target spectrum are computed by averaging those of the nearest synthetic spectra.

2 Results of Teff, logg, [Fe/H] and [α/Fe] determinations

TGMETα has been tested with ELODIE spectra at nominal resolution (R=42 000). We compared values with those from several reference catalogues in the literature (Fig. 1).
The rms precisons are: rms_{Teff}= 138 K ; rms_{logg}= 0.27 ; $\mathrm{rms}_{[Fe/H]}$= 0.13 ; $\mathrm{rms}_{[\alpha/Fe]}$= 0.05.
A linear correction has to be applied to Teff and logg in order to take into account the different scales of the synthetic grid versus the literature determinations. TGMETα has been also tested with ELODIE degraded spectra at R=10 000 and R=1 000 with similar performances.

3 Application to a large sample of 1500 stars

Thanks to TGMETα run on 1500 stars we have assembled a large sample of disk stars with (U,V,W), [Fe/H] and [α/Fe]. A kinematical classification of the thin/thick disks has been performed (Soubiran & Girard 2005) and we have observed abundance trends. The Fig. 2 shows parallel trends and overlap in metallicity with an offset of 0.10 dex in [α/Fe]. A change of slope in the thick disk appears at [Fe/H]≈ -0.35 dex. These metal-rich stars with [Fe/H]>-0.3 dex are real thick disk stars or thin disk stars ? Their origins (streams, accretion ?) have to be investigated.

4 Perspectives

The next step is to test other grids of synthetic spectra with a wider range of [α/Fe] and to run TGMETα on large samples of stars observed from various spectrographs with different wavelength ranges and resolutions.

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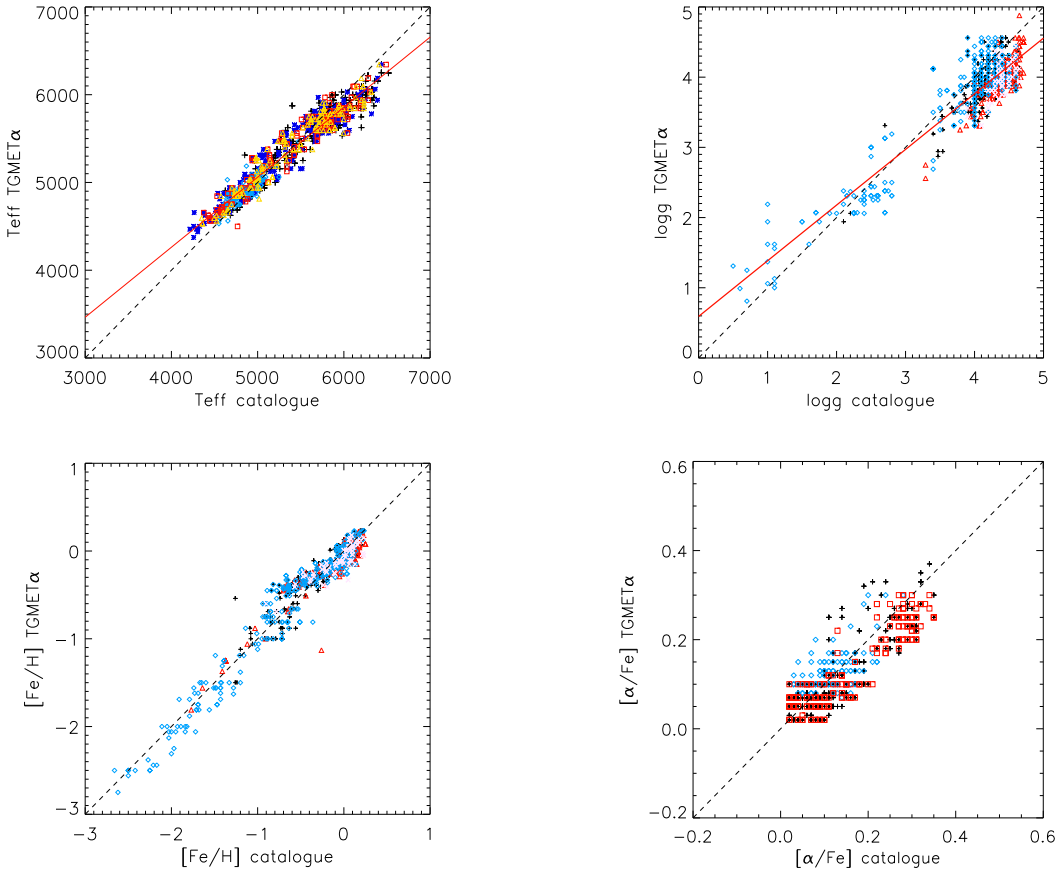

Fig. 1. Comparison to reference values compiled from the literature.

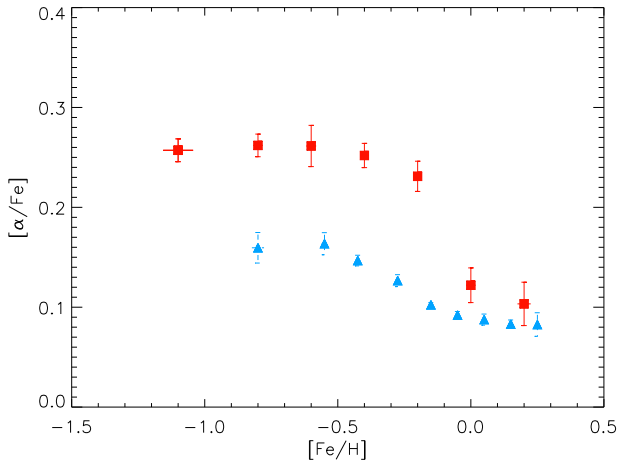

Fig. 2. [α/Fe] vs [Fe/H] per bin of metallicity. The thick disk is shown in red and the thin disk in blue.

References

Soubiran, C. & Girard, P. 2005, A&A, 438, 139