*Setting the scene for Gaia and LAMOST*
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# Chemical tagging with Gaia-ESO Survey and Gaia-RVS data

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**Abstract.** We present a new method devoted to chemical tagging for Galactic Archeology. In the context of the Gaia-ESO Survey (GES) and the Gaia Data Processing and Analysis Consortium (DPAC), we aim at preparing the Gaia-Radial Velocity Spectrograph analysis, which will provide $\sim 2 \times 10^6$ spectra covering the IR CaII triplet domain (R $\sim$ 11 500), with sufficient SNR to perform chemical tagging. Our method will be integrated in the Gaia DPAC Apsis pipeline (CU8, Astrophysical Parameters) and we test it with GES GIRAFFE spectra (MEDUSA mode, HR10 & HR21) deriving abundances of MgI in 168 stars.

**Keywords.** methods: data analysis - techniques: spectroscopic - stars: individual abundances

## 1. Automatic individual chemical abundances determinations

We try to find the best match between an observed spectrum $O(\mathrm{T_{eff}}, \log g, [\mathrm{M/H}], \xi, [\mathrm{X/Fe}])$ and a synthetic spectra grid $S(\mathrm{T_{eff}}, \log g, [\mathrm{M/H}], \xi, [\mathrm{X/Fe}])$ with X being the chemical element studied. $\mathrm{T_{eff}}$, $\log g$, [M/H] and $\xi$ are determined and fixed in a previous step by automated parametrization algorithms both for GES and Gaia RVS (A. Recio-Blanco & GES Collaboration (2013), in preparation). It results in a 1-D grid S([X/Fe]). Then, we minimize the distance $d(O([\mathrm{X/Fe}]) - S([\mathrm{X/Fe}]))$ thanks to a Gauss-Newton optimization algorithm (Bijaoui *et al.* 2011). Only 1st order derivatives are calculated. We define a range of $\pm 0.4$ dex around the typical [X/Fe] Milky Way Discs & Halo enrichment values (step = 0.05 dex). The grid is computed once, reducing the processing time. We focus on the MgI element ($\lambda = 5\,528.405\,\mathring{A}$).

## 2. Application to Benchmark stars & GES GIRAFFE data

Testing our pipeline on the Sun and Arcturus (Hinkle *et al.* 2003) at the HR10 resolution, we found respectively $[\mathrm{Mg/Fe}]_{\odot} = +0.01$dex and $[\mathrm{Mg/Fe}]_{\mathrm{Arcturus}} = +0.34$ dex . We performed 500 noise realizations (SNR $\in [5, 100]$) and correcting the constant bias as a function of the SNR we found for both stars a standard deviation $\sigma \leqslant 0.11$ dex for SNR $\geqslant$ 20. We then applied our pipeline on 168 GES dwarf stars with $5000\,\mathrm{K} \leqslant \mathrm{T_{eff}} \leqslant 6\,250\,K$, $-2.00 \leqslant [\mathrm{M/H}] \leqslant 0.25$ and SNR $\geqslant$ 20. Comparing our results with those obtained from a classical "on the fly" method (Mikolaitis *et al.,* private communication), the agreement is very satisfactory ($\sigma = 0.066$ dex). Being a hundred times faster than the classical one, this method is therefore very well adapted to perform chemical tagging with massive spectroscopic surveys such as GES and Gaia-RVS survey.

## References

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