Identifying metal-poor candidates with Gaia-DR3

Theodora Xylaki-Dornbusch[1]

1 *ZAH/LSW Universität Heidelberg*

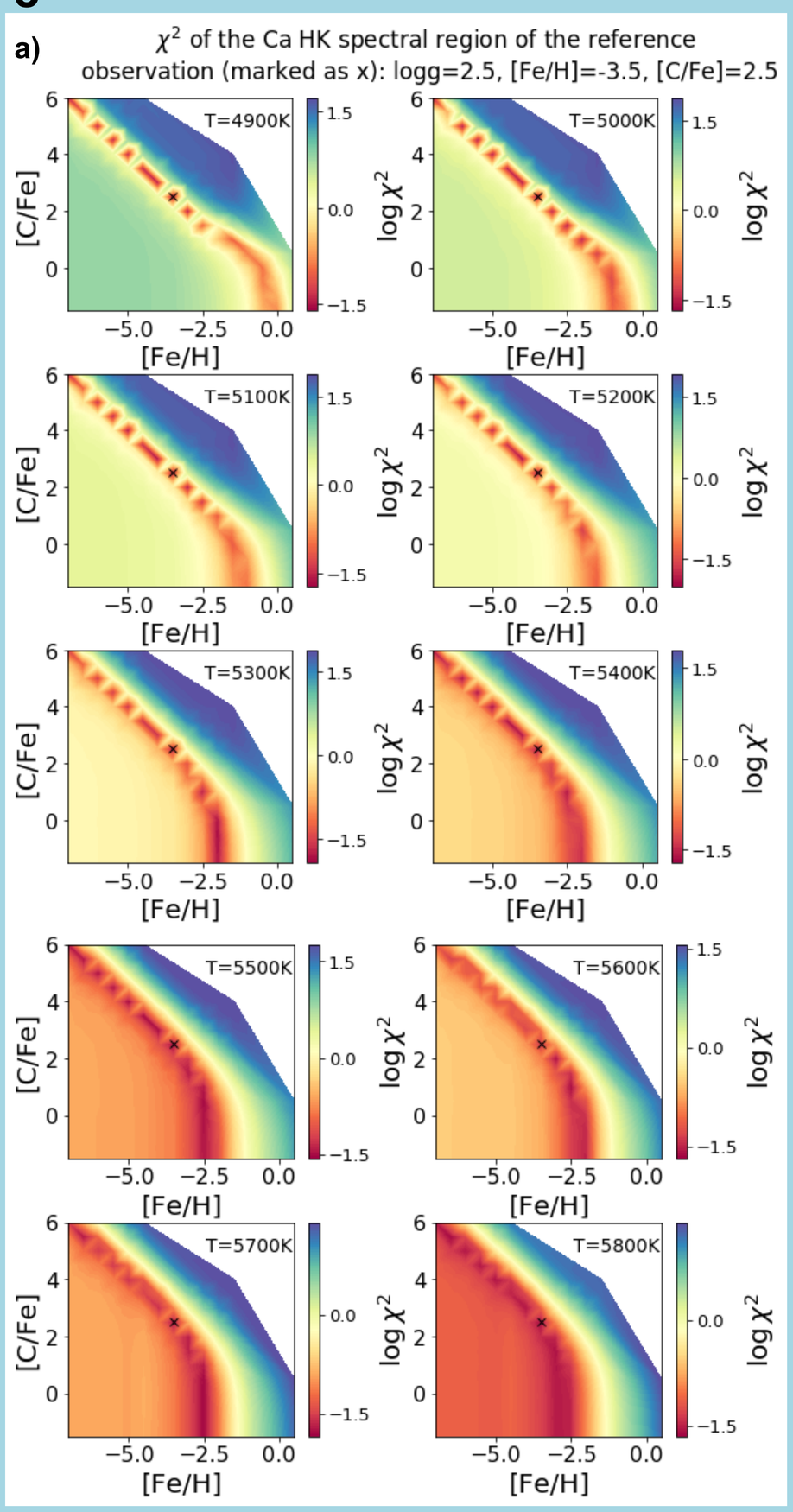
1 Introduction

The study of the oldest and most metal-poor stars in our Galaxy promotes our understanding of the cosmic chemical evolution and the beginning of Galaxy and star formation. However, they are notoriously difficult to find, with only 5 stars of [Fe/H]<-5 having been detected to date. Thus, the spectrophotometric data of ~1 billion stars which will become available with the third Gaia Data Release, comprises a very promising set for the identification of candidate metal-poor stars.

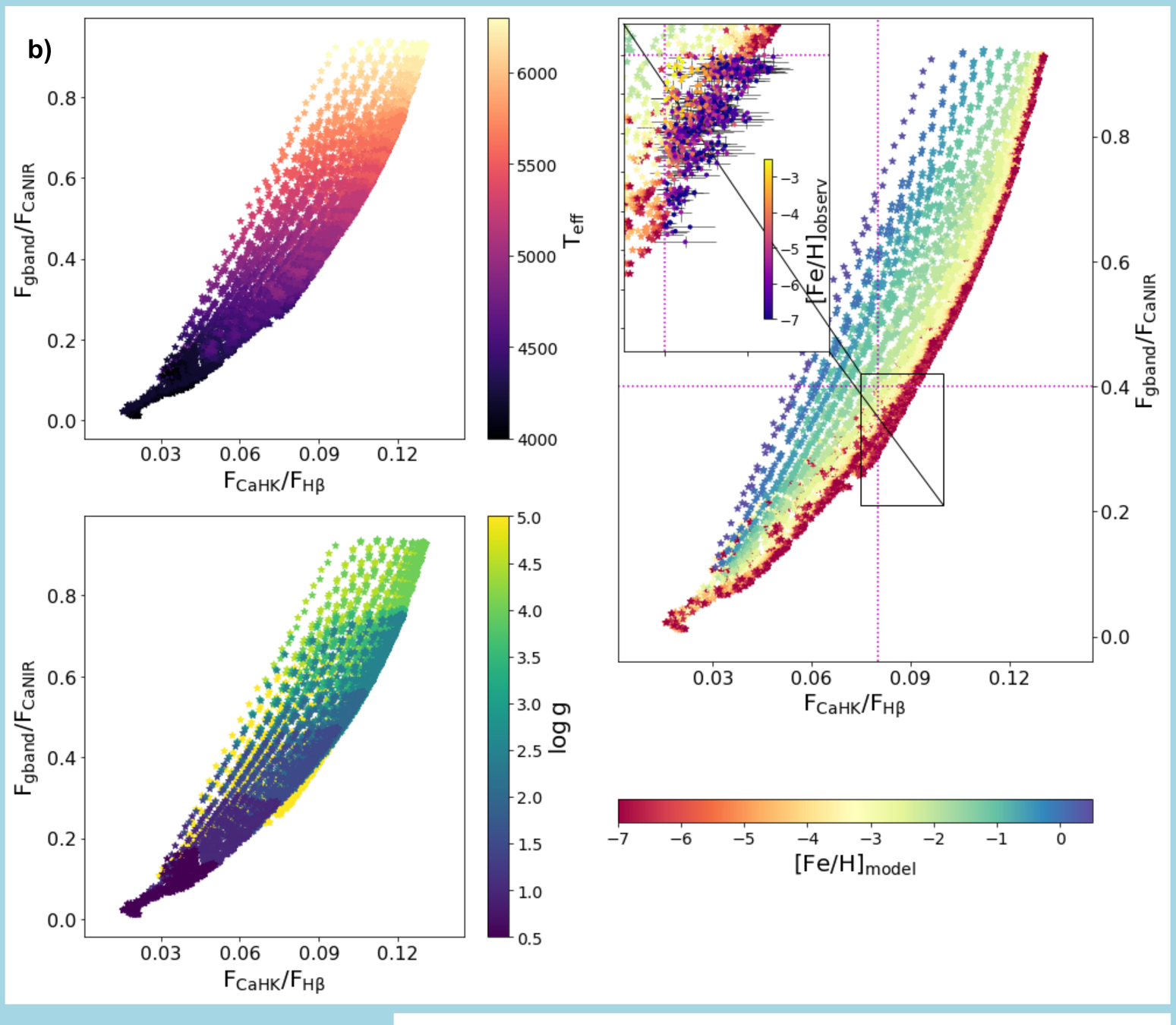
2 Method and Aims

We are developing a metal-poor candidate selection method based on flux-ratios from the BP/RP (Blue Photometer/ Red Photometer) Gaia spectra, using Gaia temperature and surface gravity information as priors. The BP/RP spectra are being generated with the help of the Ulysses Simulator [1] and metal-poor synthetic spectra [2]. Our primary aspiration is to use this method to help populate the poorly constrained tail of the metallicity distribution function of the stellar halo of the Galaxy.

3 Results



a) The χ^2 surfaces show that the Ca H & K region of the BP/RP spectra carries enough information to distinguish between an iron-poor carbon enhanced star and those that have [Fe/H]>-2.5 and various C relative abundances. This though, is true only for giants of a certain parameter space (see Result b).



b) The flux-ratios carry temperature, surface gravity and iron abundance information. The right-hand side plot shows a smooth change in metallicity for giants of M=16 mag: on the inset plot is shown how the observed (noisy) flux-ratios track the modelled ones.

c) The change in the x-flux-ratio is exponentially decreasing with increasing [Fe/H], for a constant y-flux-ratio. This behaviour starts to break down for T_{eff} < 4500 K.

Future steps

- Put a final constraint on the parameter space of application.
- Find a global relation between flux-ratio change and [Fe/H].
- Test the effect of reddening on the flux-ratios.
- Test our method on a Gaia mock catalog.

References

[1] Astraatmadja, 2015, GAIA-C8-TN-MPIA-TLA-001
[2] Nordlander, T., Bessell, M. S., Da Costa, G. S., et al. 2019, arXiv:1904.07471

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