

CHEmical Survey analysis System (CHESS)

Exploring the MW metallicity gradient using Open Clusters

CAMK Annual meeting
23/01/2025

John Eduard Martínez Fernández

Supervisor: Rodolfo Smiljanic

Collaborators: Özdemir, S., da Silva, A. R., Dantas, M.L.L.

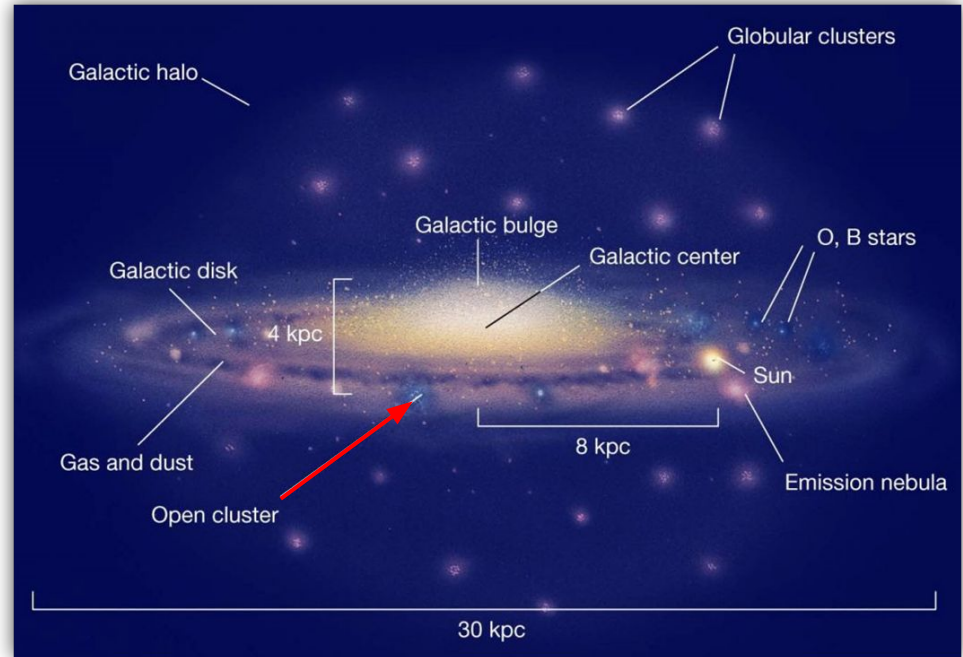


OPEN CLUSTERS (OC)

Chemical abundances reflect stellar age and birthplace.

- Stars formed from the **same molecular cloud**.
- Low star density.
- Found in the **thin disk**.
- **Mostly young** but can be old. They can have a wide range of ages.
- **Common age** and **composition**.

It can be used to study stellar evolution, the chemical evolution of the Milky Way...

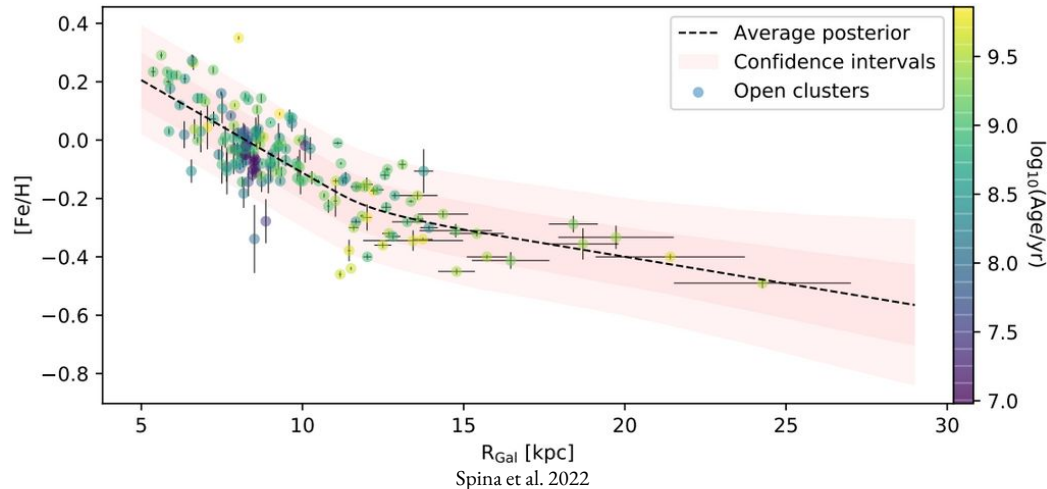


Credit: Pearson Education Inc.

METALLICITY GRADIENT

Important in the **study of the evolution and formation** of the Galaxy as it offers **observational constraints** for models of chemical evolution.

- OCs show a **slope change** in the gradient, being flatter in the outskirts.
- OCs of different ages **show us their evolution**.
- **Outer regions** in the galaxy are **underrepresented**.
- New surveys can help to increase the OC sample and better define the gradient.



CHESS PIPELINE (CHEmical Survey analysis System)

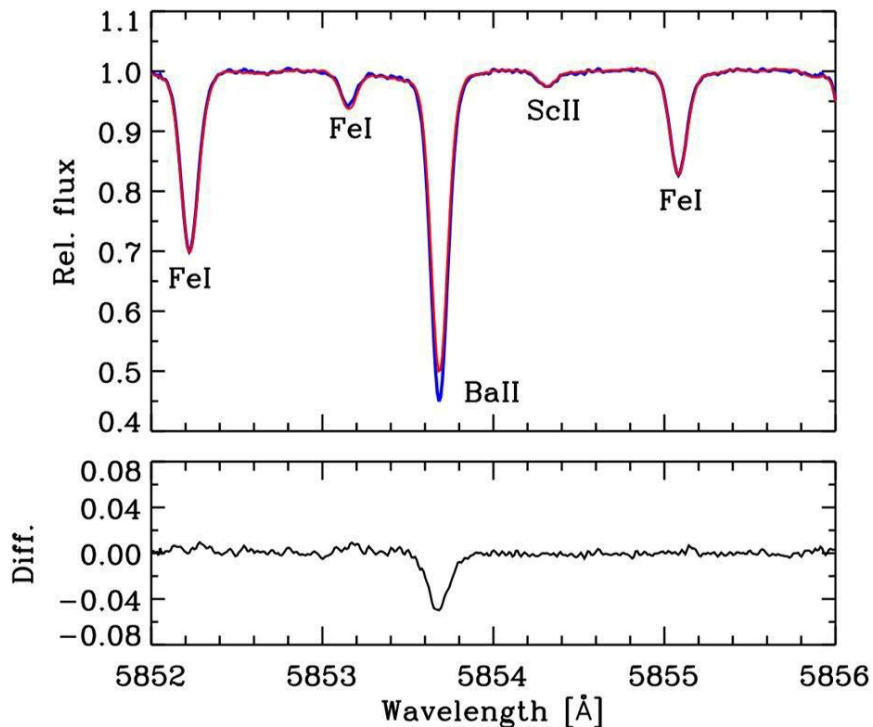
The main idea is to obtain **high-quality chemical abundances** using the **differential analysis** technique on similar stars in a large sample of data.

This technique **removes any possible systematic errors**.

CHESS uses **high-resolution** spectra from UVES. In this work we focus on OCs stars, but the final goal is to provide chemical abundances of all **F, G, K stars found in the ESO ARCHIVE**.

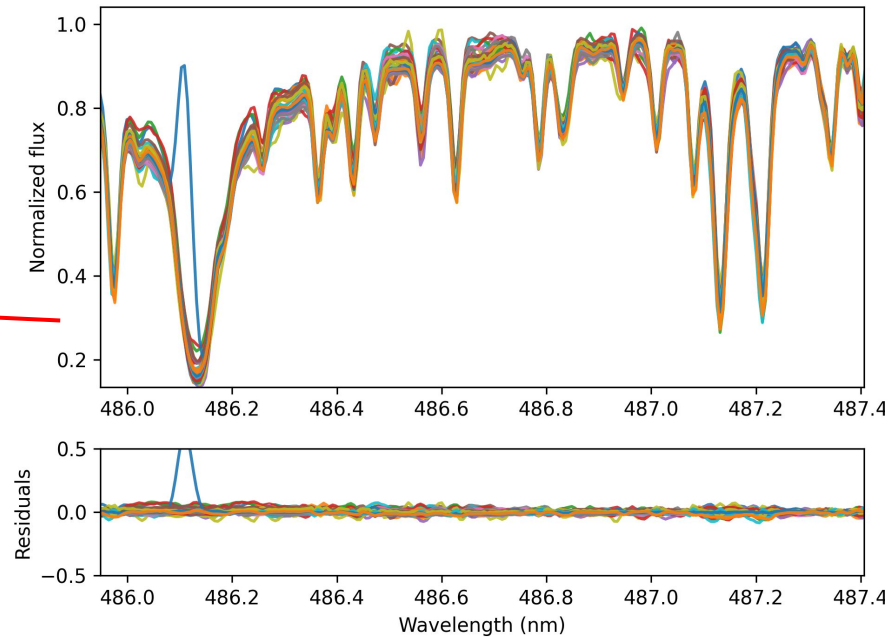
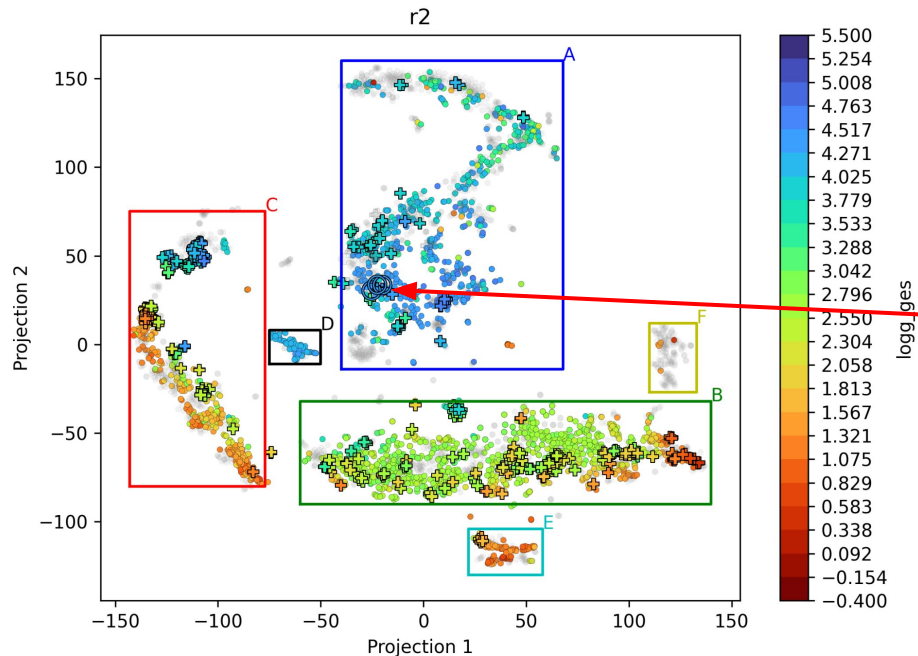
The basic workflow for the first part of the pipeline is:

- **Crossmatching** with external catalogues.
- **Homogenize** spectra.
- **Find similar groups of spectra** using ML techniques (t-SNE).



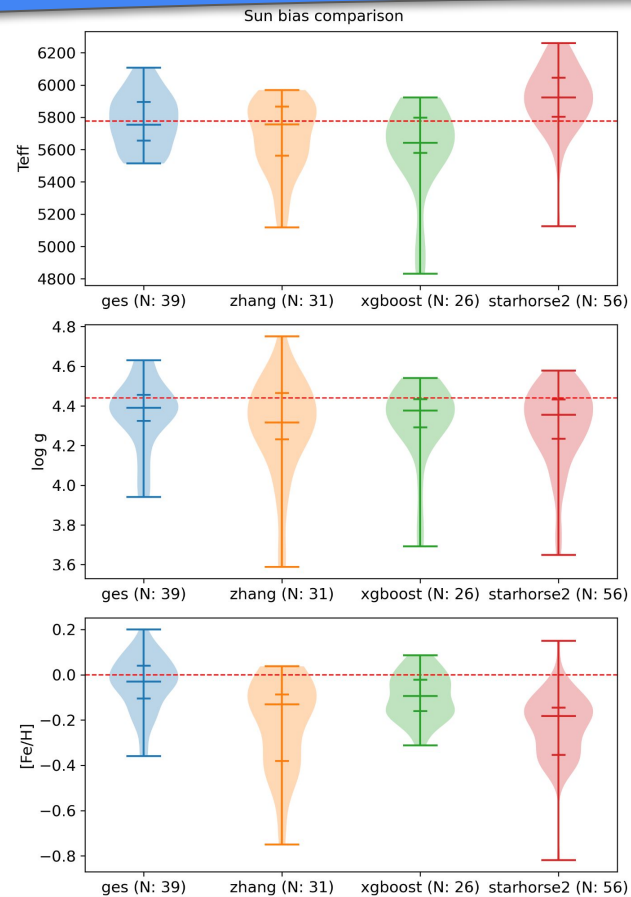
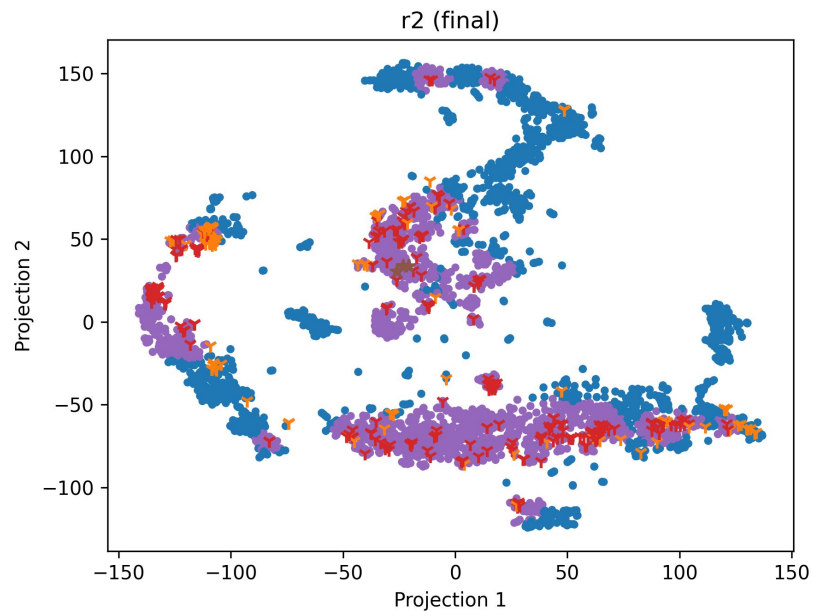
Nissen and Gustafsson, 2018

t-SNE PROJECTION MAP

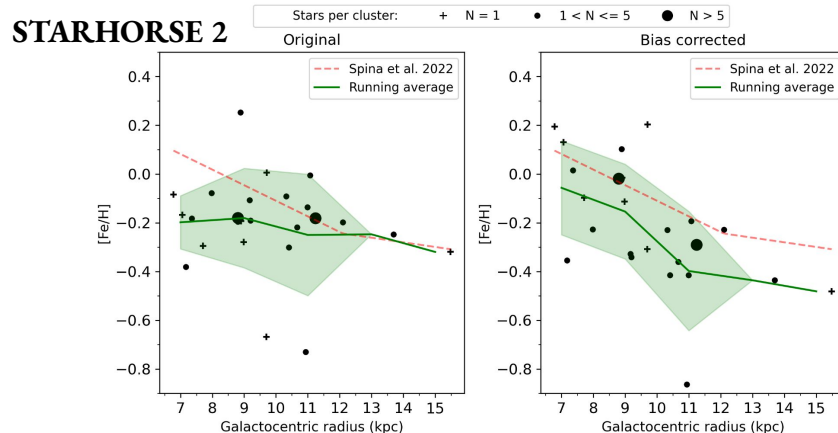
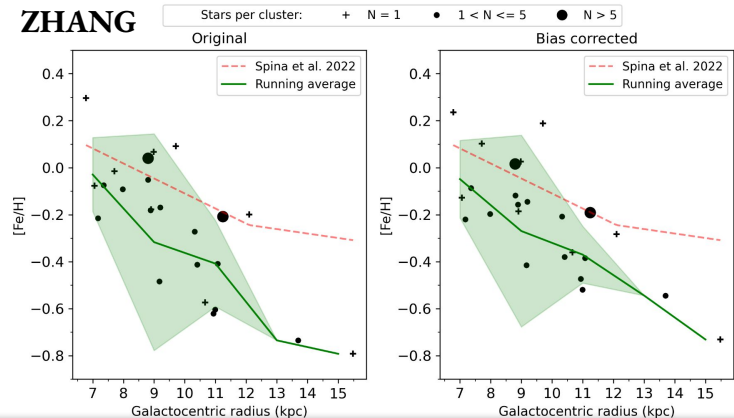
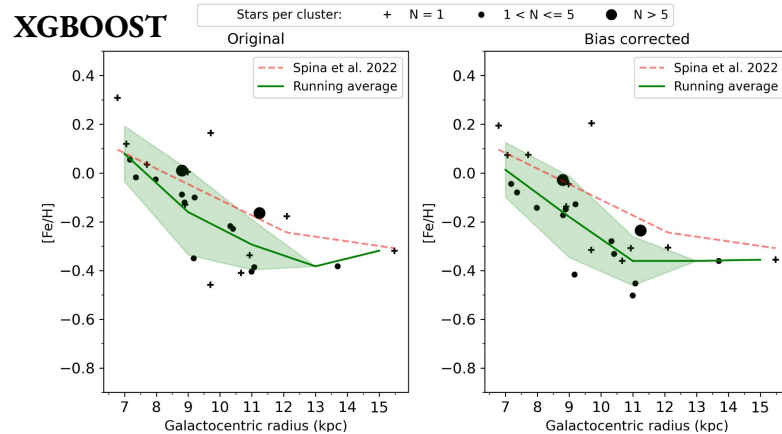
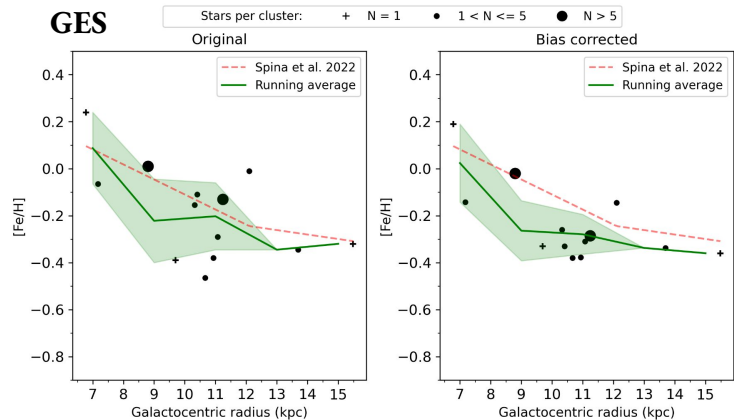


SIMILARITY ANALYSIS COVERAGE

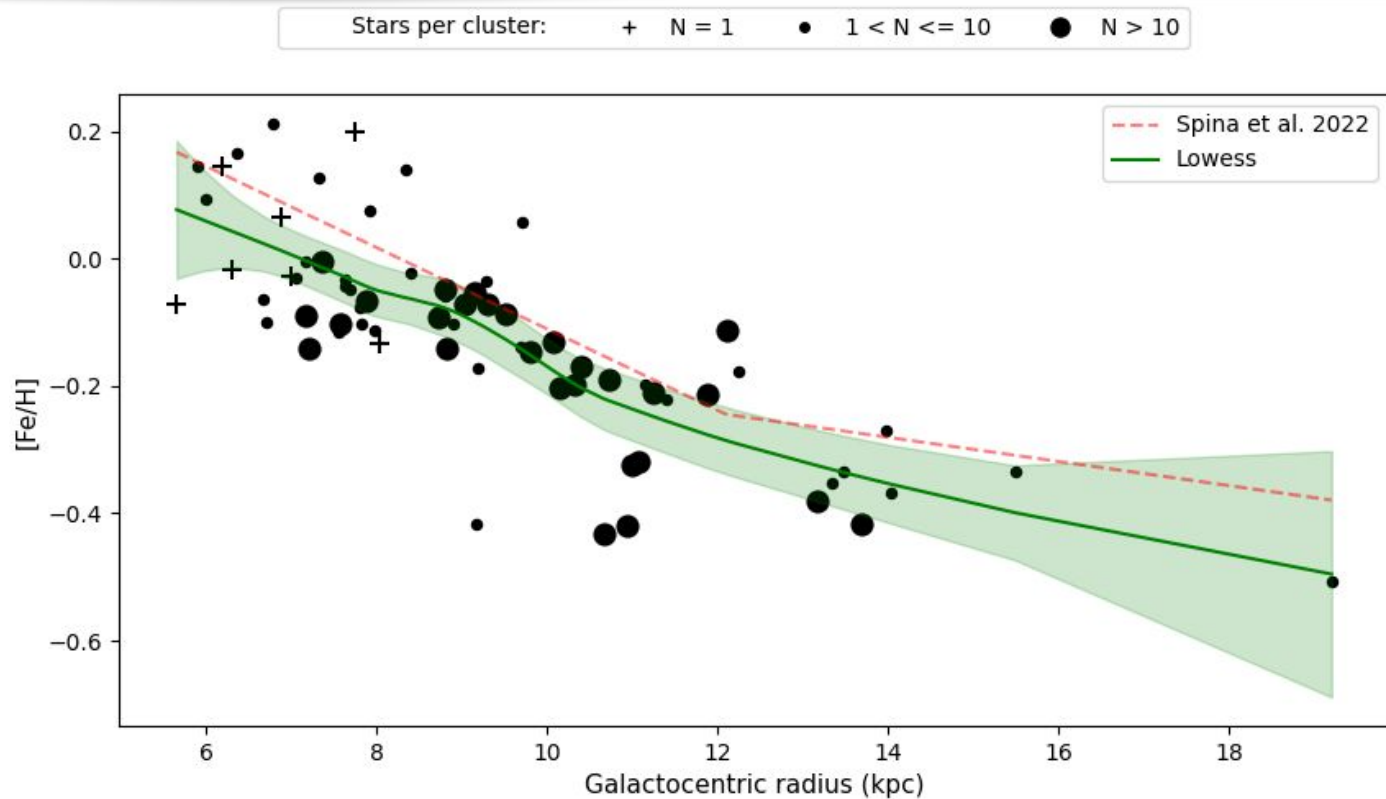
Method used to find similar stars in
J.E. Martínez-Fernández et al. (in preparation)



METALLICITY GRADIENT (BIAS CORRECTION)



METALLICITY GRADIENT (DIFFERENTIAL ANALYSIS)



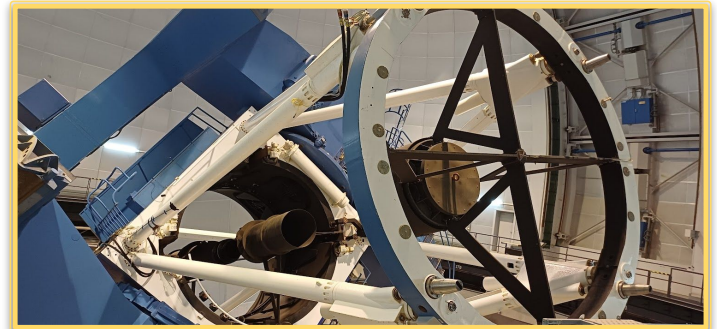
Preliminary results

OTHER ACTIVITIES

- Outreach lectures in a spanish high school
- Help with the organization of CAMK's participation in popularization activities

- Sociedad Española de Astronomía (1 talk)
- MIAPBP Abundance Gradients in the Local Universe (1 small talk)

- Joined the EAS as a junior member



**THANK YOU
FOR YOUR ATTENTION!**