Stellar populations in the GALAH Survey

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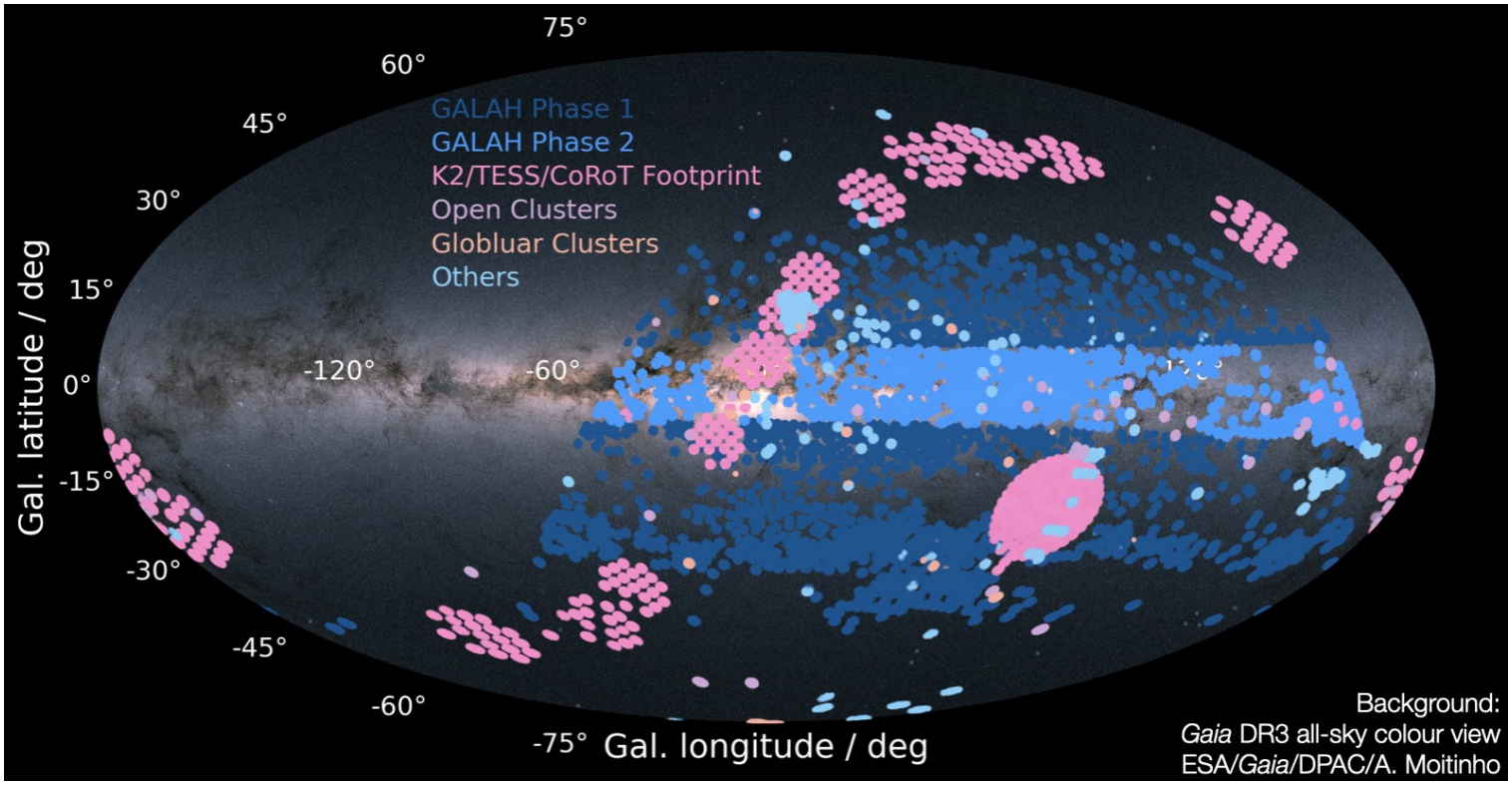
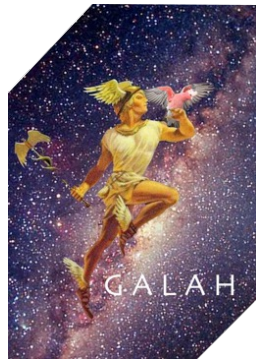
ASTRO 3D

GALAH at a glance

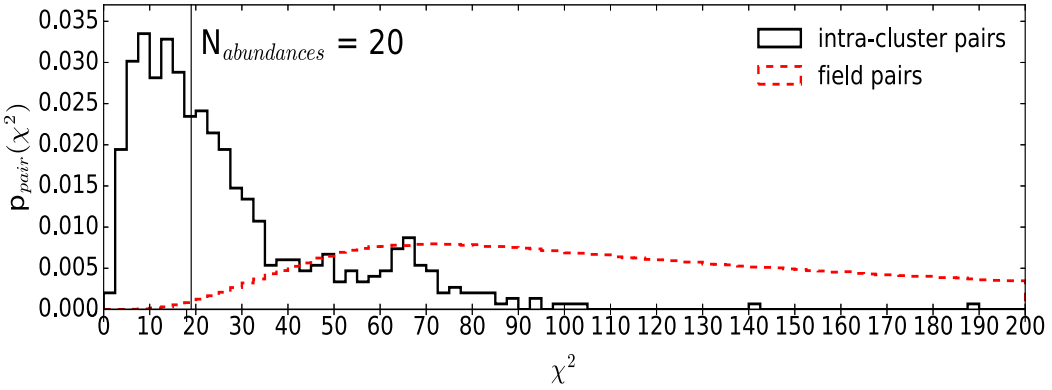




- Simple selection function(s)
- Thorough sample of the local 3 kpc (giants to 8 kpc)
- Abundances of 32 elements across all nucleosynthetic channels

GALAH and stellar populations: chemical evolution

Even among Solar-metallicity, thin disk stars there are “doppelgängers” – as similar to each other in abundance as stars from the same open cluster

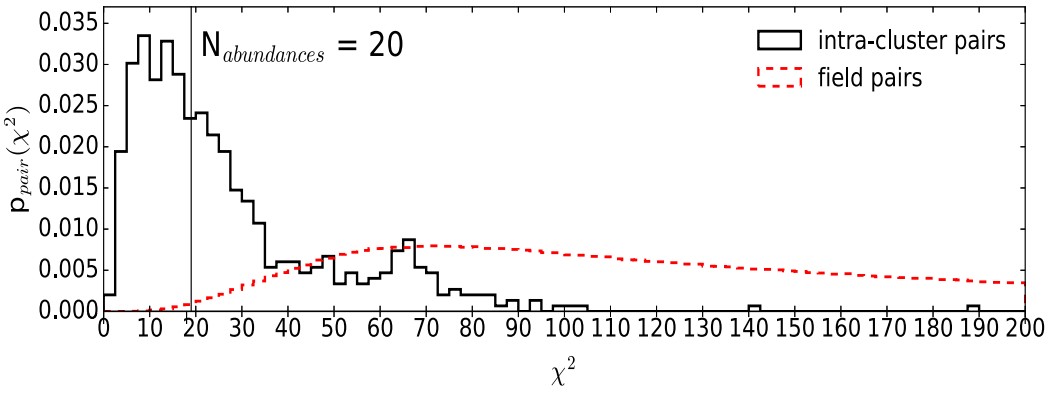


Ness et al. 2018

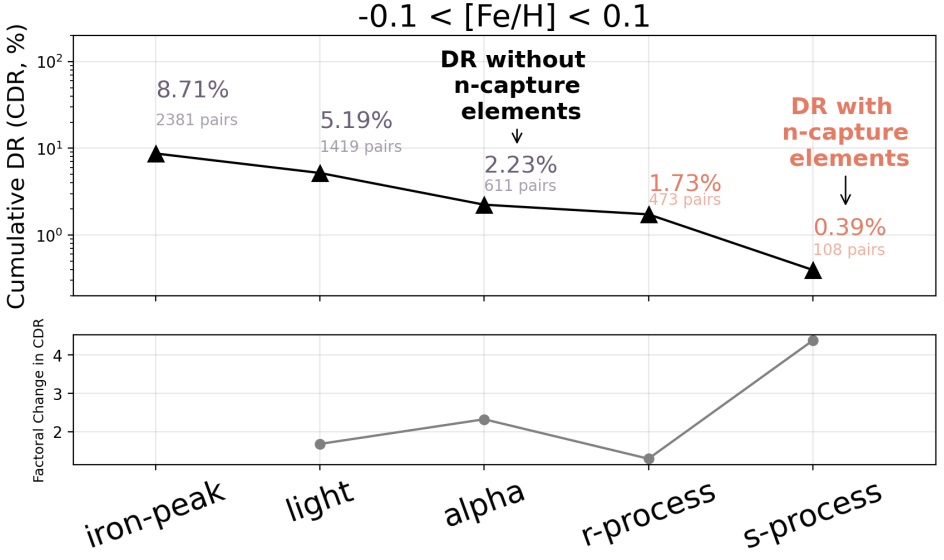
GALAH and stellar populations: chemical evolution

Even among Solar-metallicity, thin disk stars there are “doppelgängers” – as similar to each other in abundance as stars from the same open cluster

This fraction drops when you include r- and s-process elements in the abundance difference metric



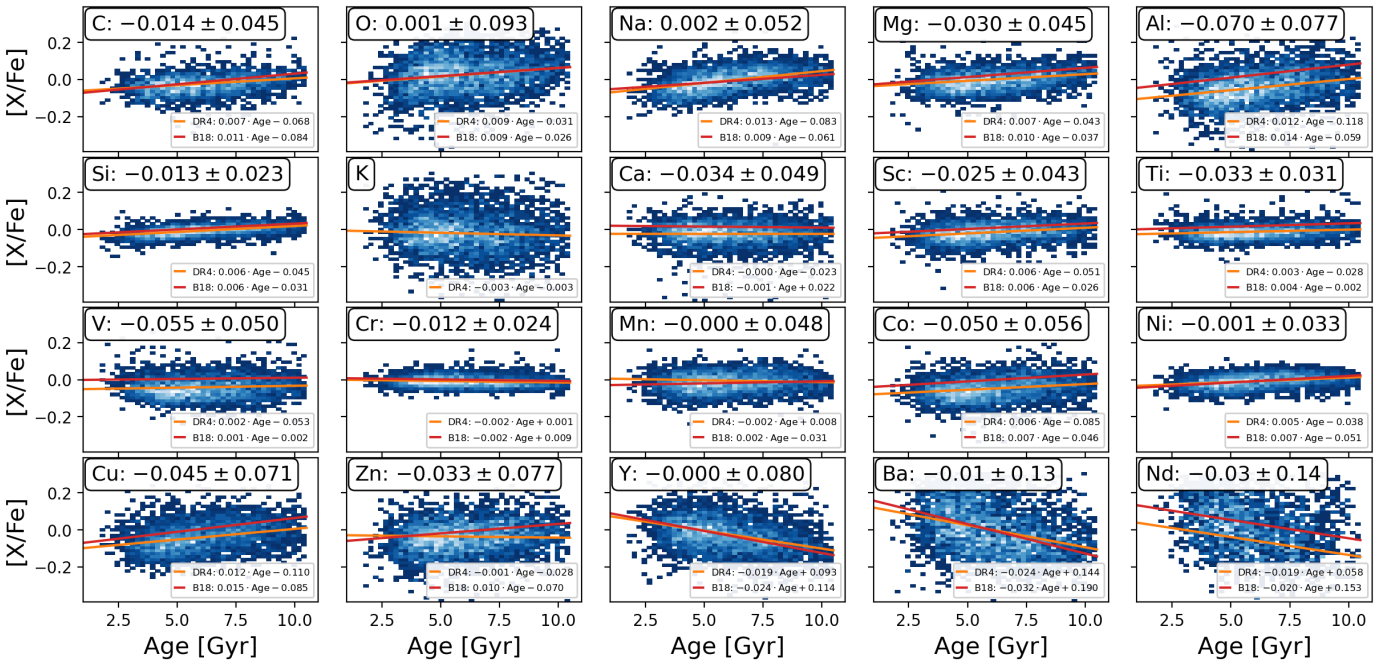
Ness et al. 2018



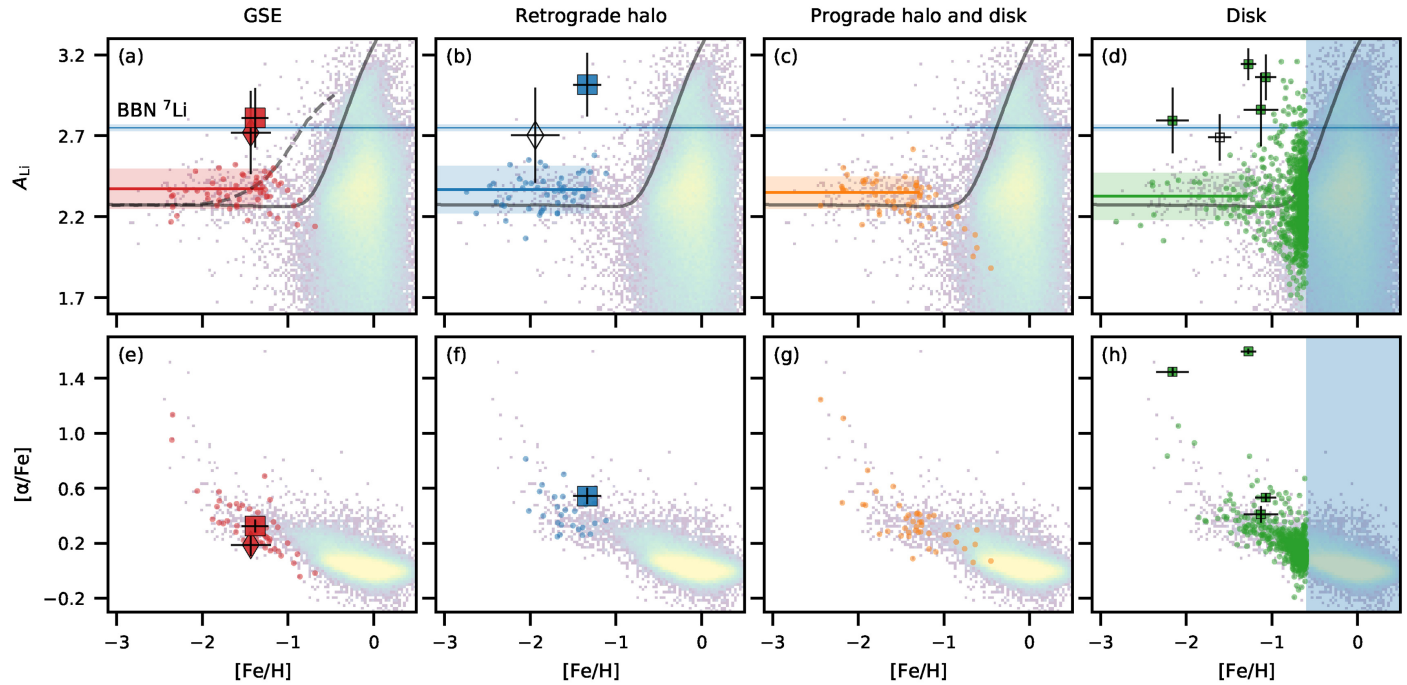
Manea, SLM et al. 2024

GALAH and stellar populations: chemical evolution

Age trends across elements – here based on Solar twins in DR4



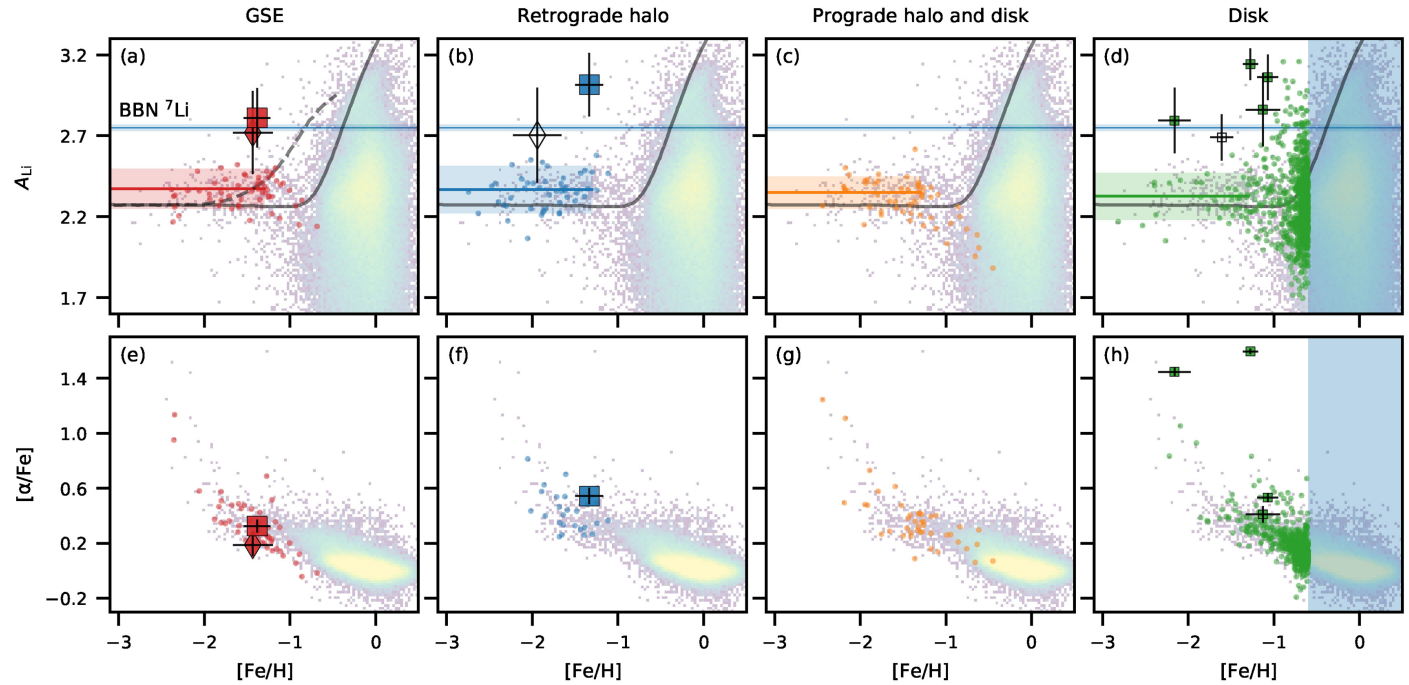
GALAH and stellar populations: dwarf galaxy stars



Simpson, SLM et al. 2021

We can use G-E stars in the Solar neighbourhood to compare Li evolution in dwarf galaxies to models

GALAH and stellar populations: dwarf galaxy stars



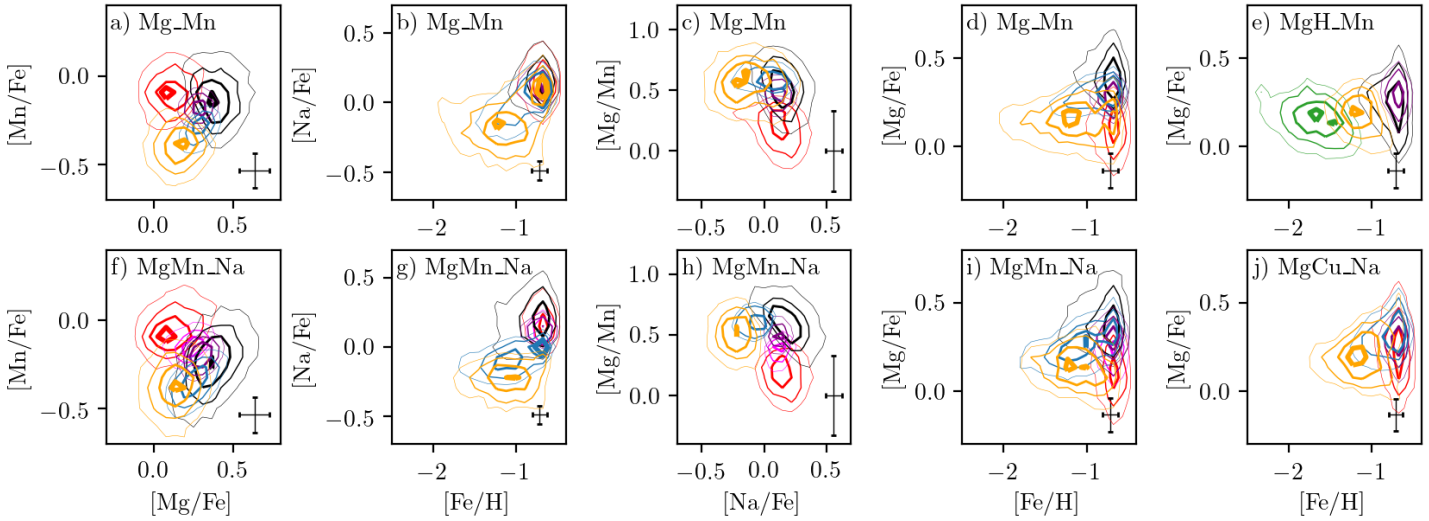
Simpson, SLM et al. 2021

We can use G-E stars in the Solar neighbourhood to compare Li evolution in dwarf galaxies to models

Good news! We've found a property of lithium that isn't a problem

GALAH and stellar populations: dwarf galaxy stars

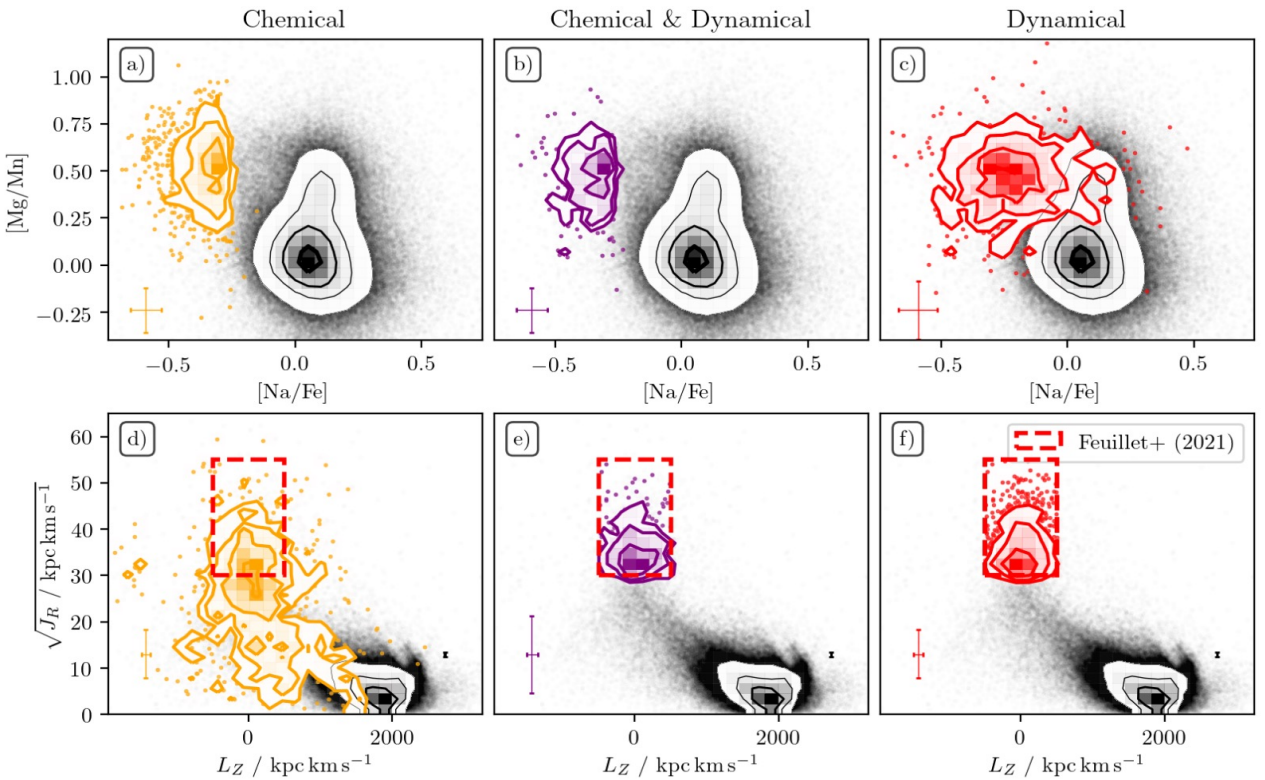
- Designing the best tools for identifying stars with extragalactic origins
  - Depends on the available information



Buder, SLM et al. 2022

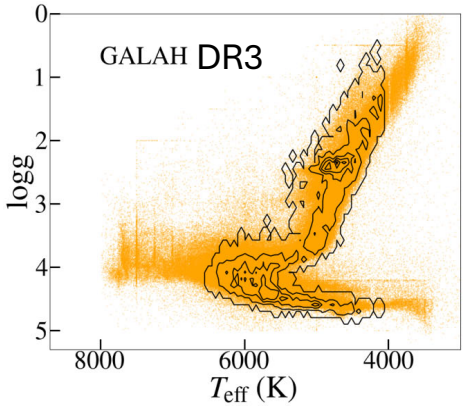
GALAH and stellar populations: dwarf galaxy stars

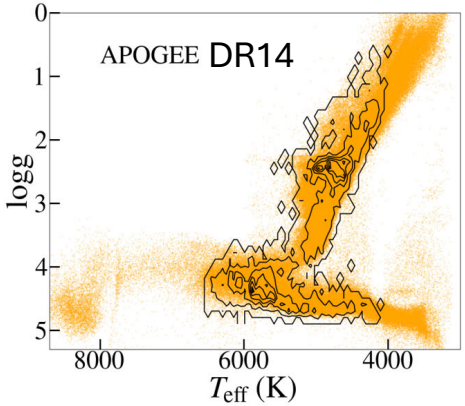
- Designing the best tools for identifying stars with extragalactic origins
  - Depends on the available information
- Elemental abundances and orbital properties both carry information - but they don't completely agree
  - Is this contamination? Complex chemical or kinematic evolution?



Buder, SLM et al. 2022

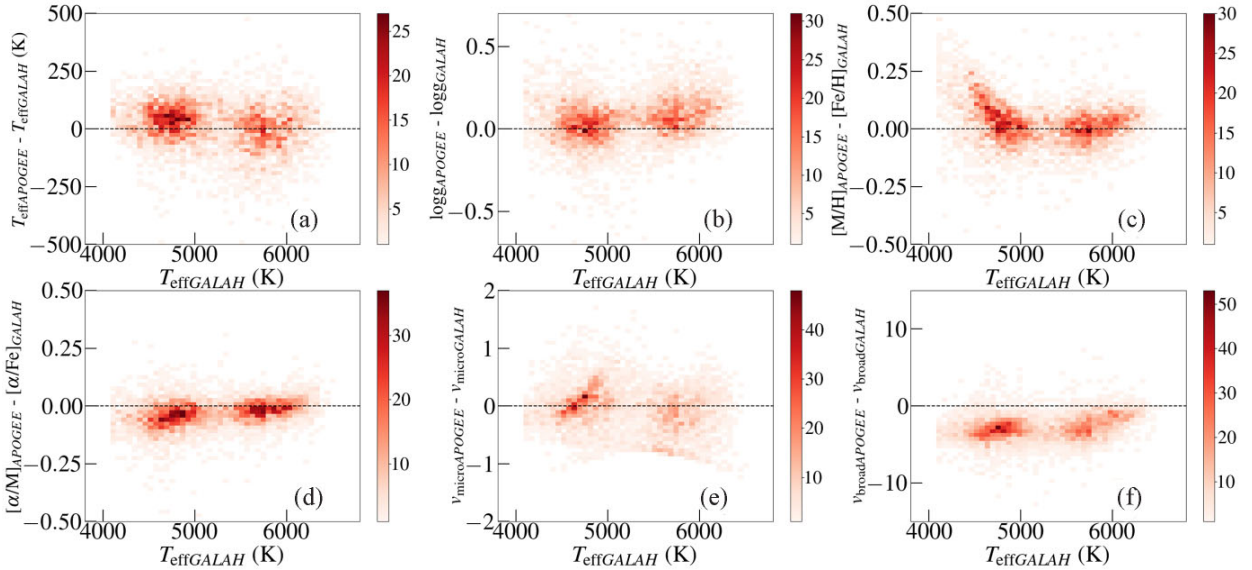
GALAH and stellar populations: supercatalogs





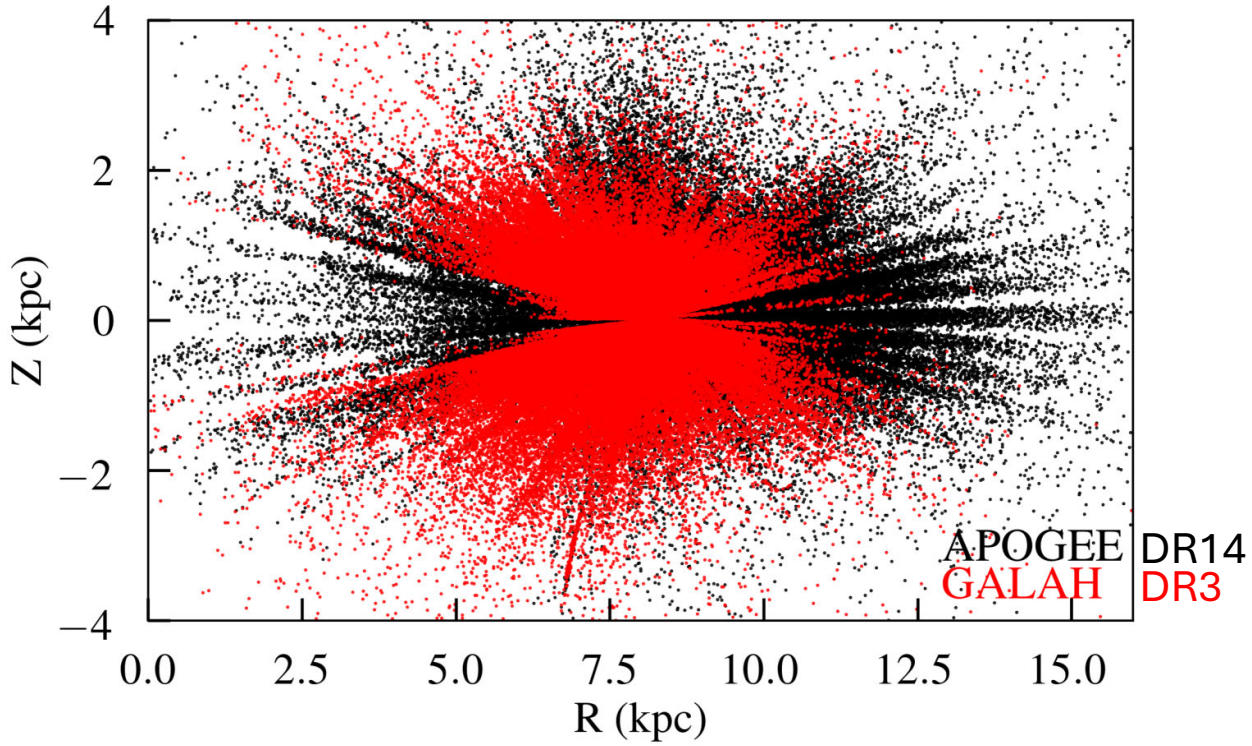
Different observing strategies and analysis methods create offsets in the results, even for the same stars

Nandakumar et al. 2022 used The Cannon to shift them to a common scale



Nandakumar, SLM et al. 2022

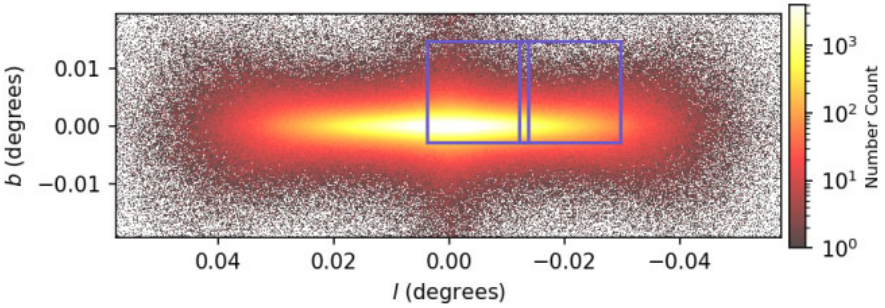
GALAH and stellar populations: supercatalogs



Nandakumar, SLM et al. 2022

Connecting to extragalactic stellar populations

Wang et al. 2024

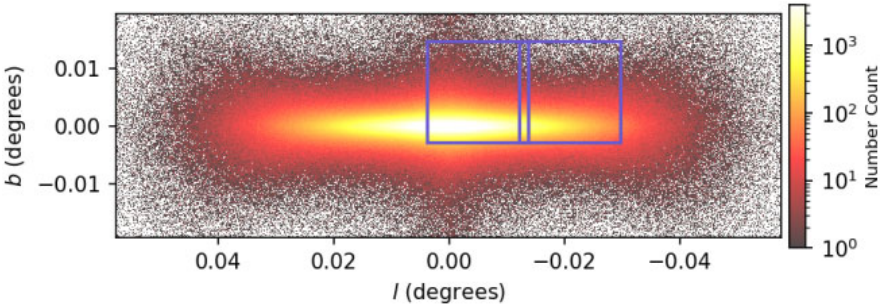


Using the Milky Way as a benchmark for spiral galaxies requires some translation

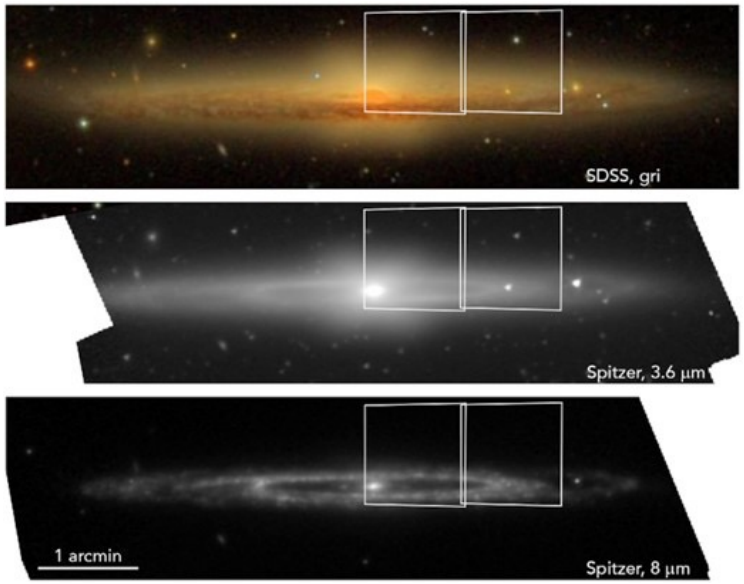
GalCraft: converting the E-Galaxia model of the Milky Way into mock IFU data

Connecting to extragalactic stellar populations

Wang et al. 2024



Martig et al. 2021

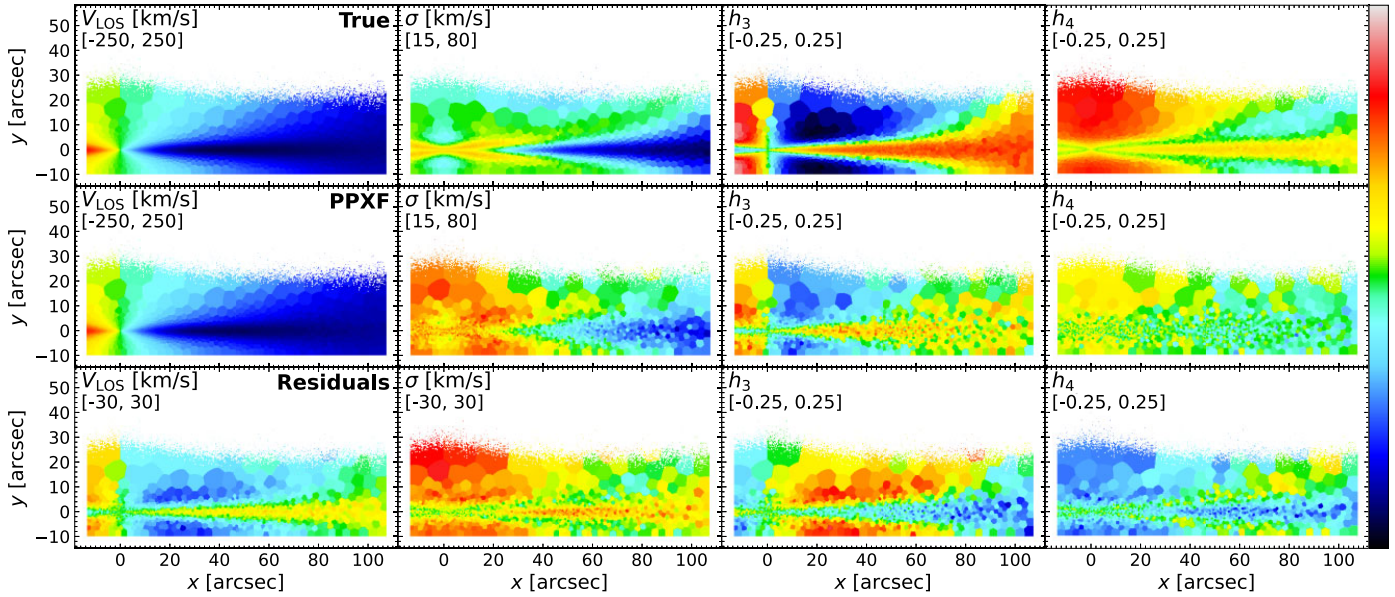


Using the Milky Way as a benchmark for spiral galaxies requires some translation

GalCraft: converting the E-Galaxia model of the Milky Way into mock IFU data

Distance (26.5 Mpc) and inclination (86°) set to match NGC 5746

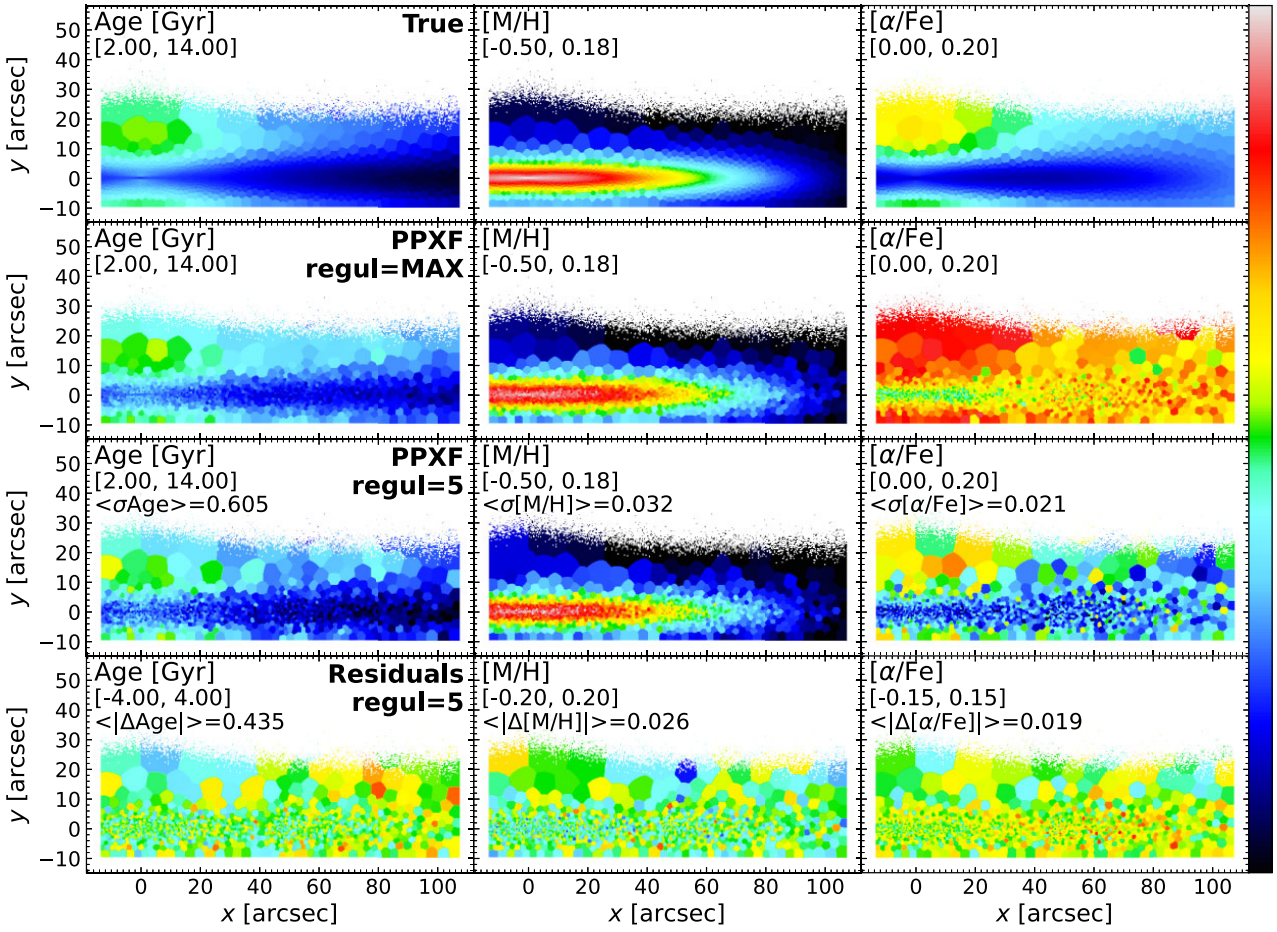
Connecting to extragalactic stellar populations



Analysing the mock cube like it was a real galaxy tests the accuracy of the results

Kinematics: there is clear structure in the residuals (bottom row)

Connecting to extragalactic stellar populations

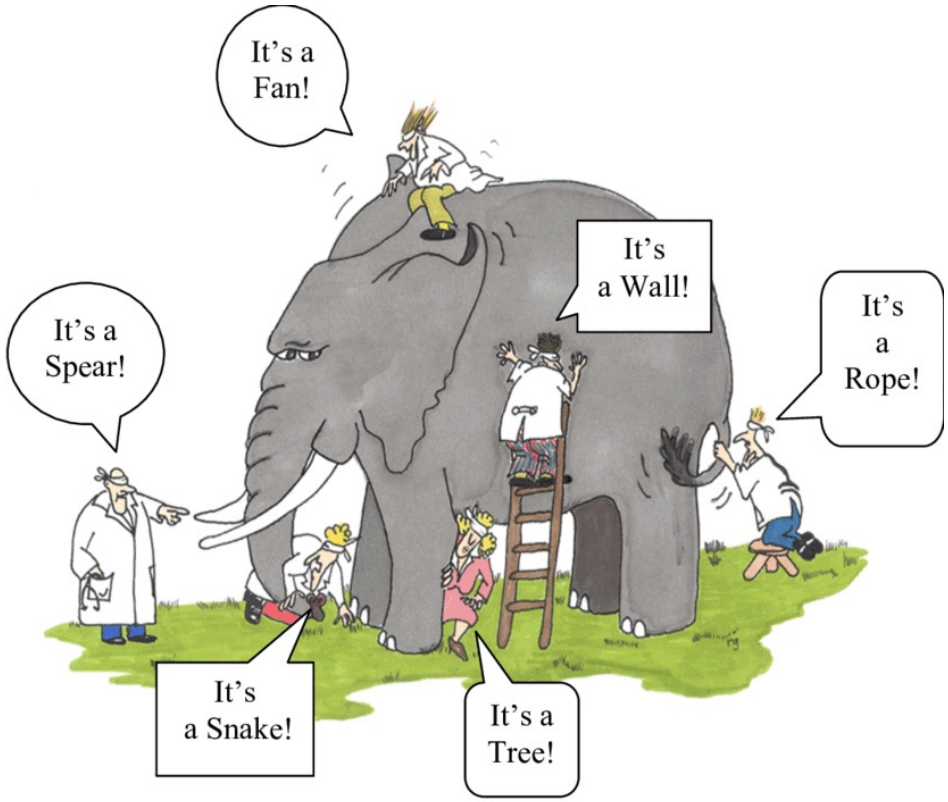


Wang et al. 2024

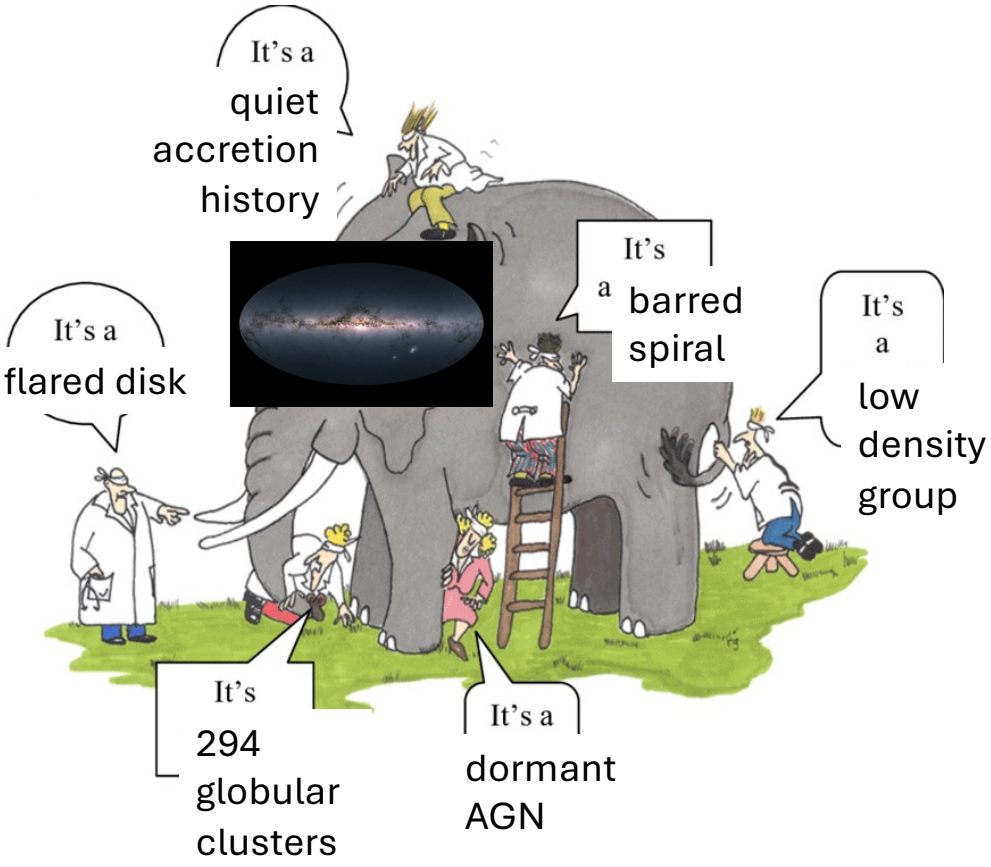
Analysing the mock cube like it was a real galaxy tests the accuracy of the results

Age, metallicity, alpha are very dependent on regularization and light-weighted vs mass-weighted mappings

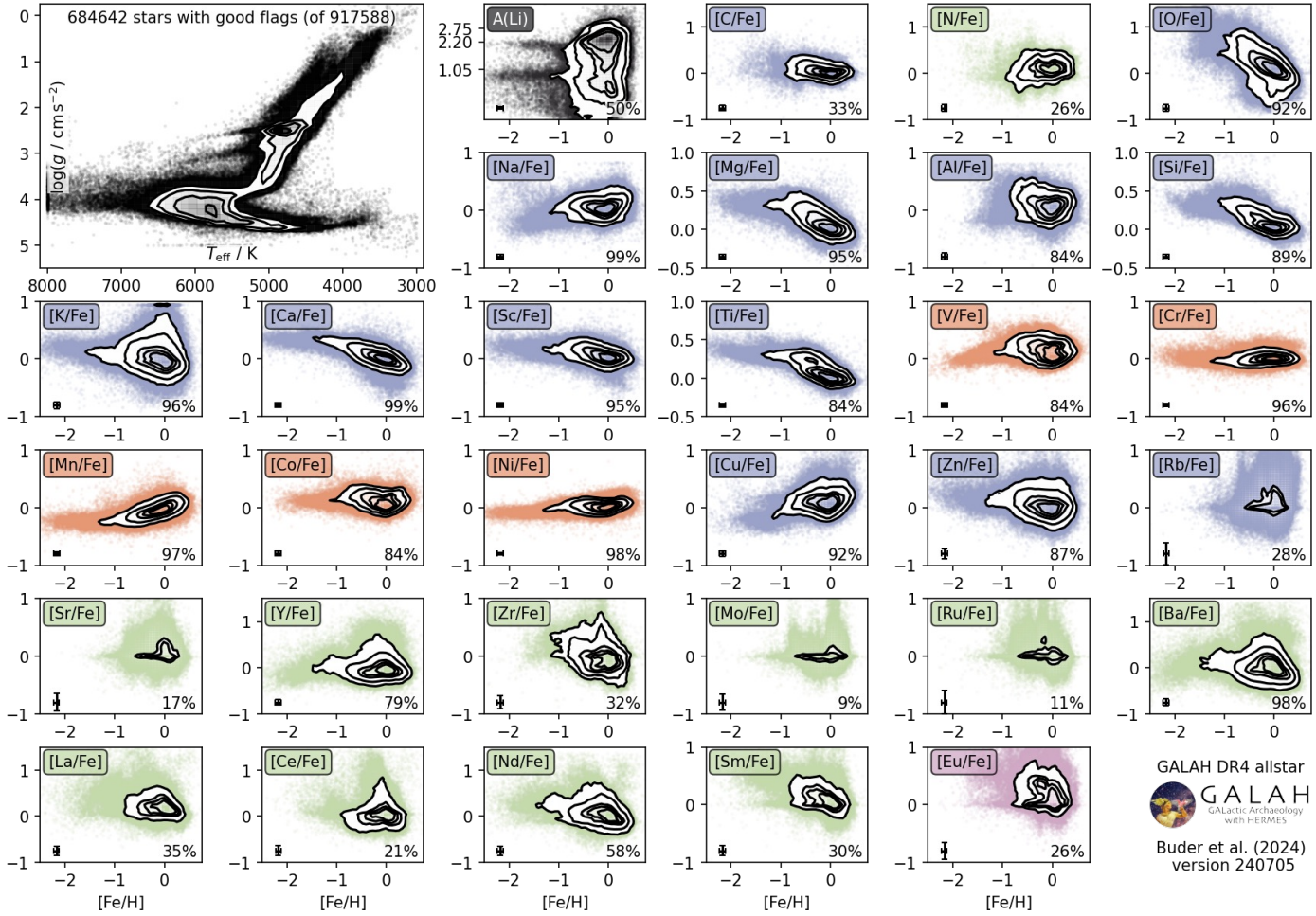
The Milky Way is a reference for many aspects of galaxies



The Milky Way is a reference for many aspects of galaxies



GALAH DR4: ready for you to use

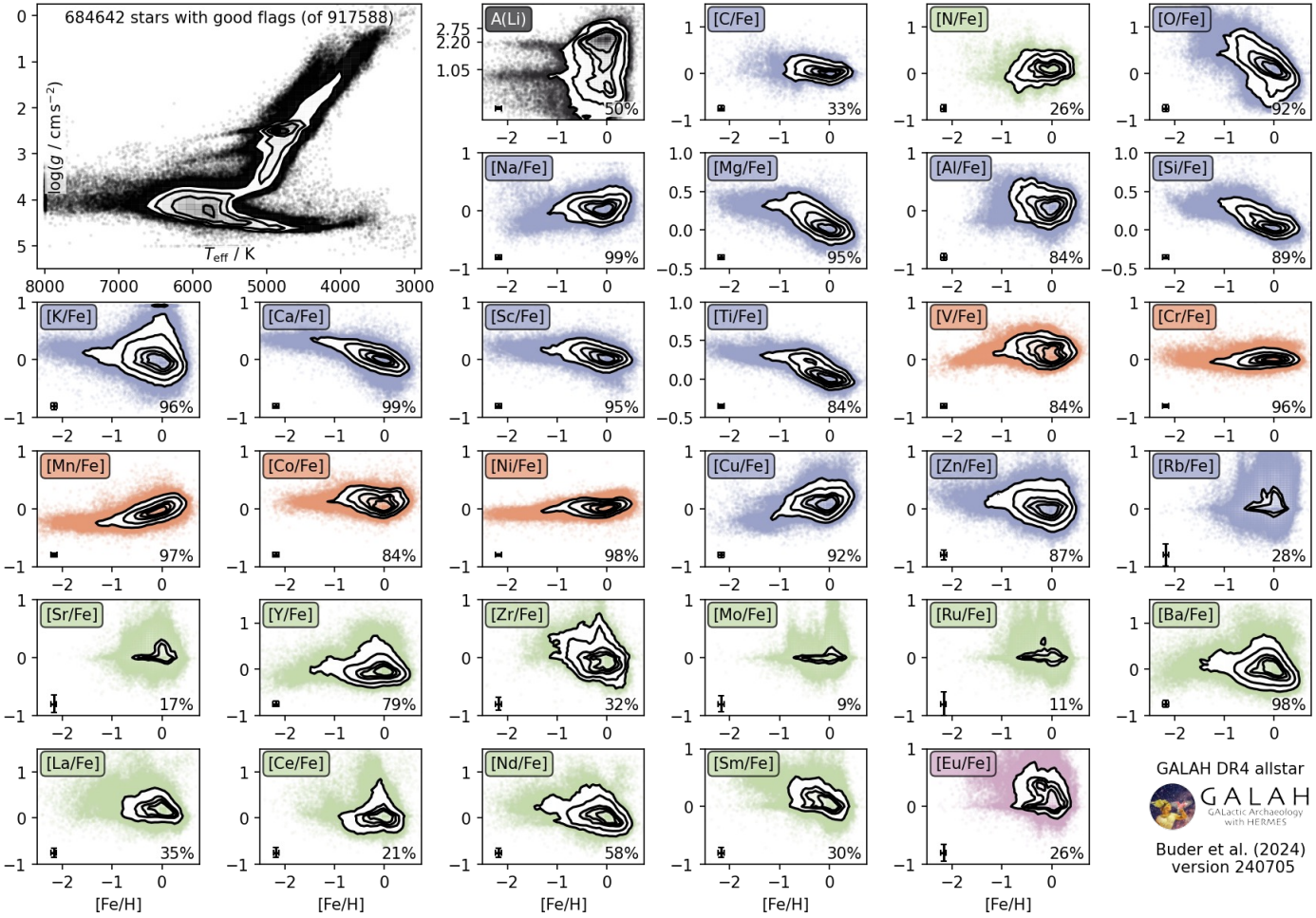


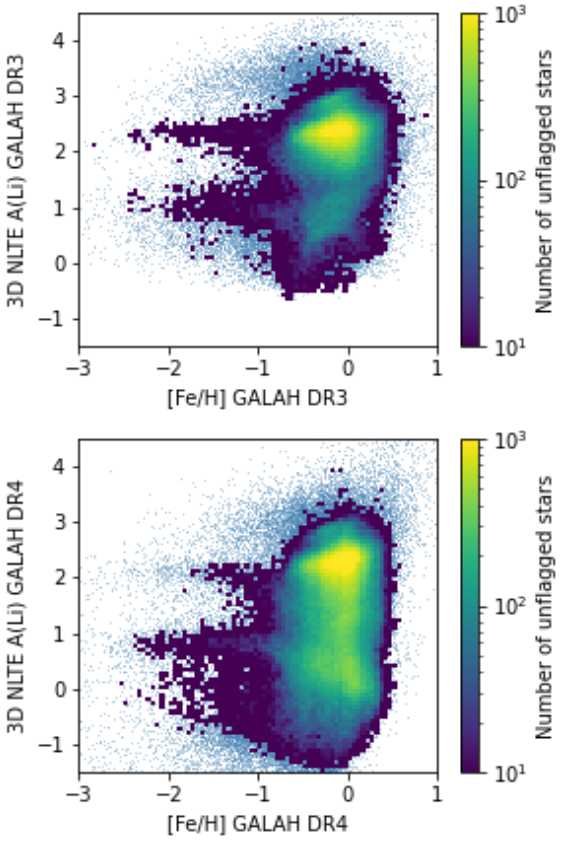
GALAH DR4 allstar

GALAH
GALactic Archaeology with HERMES

Buder et al. (2024)
version 240705

GALAH DR4: ready for you to use





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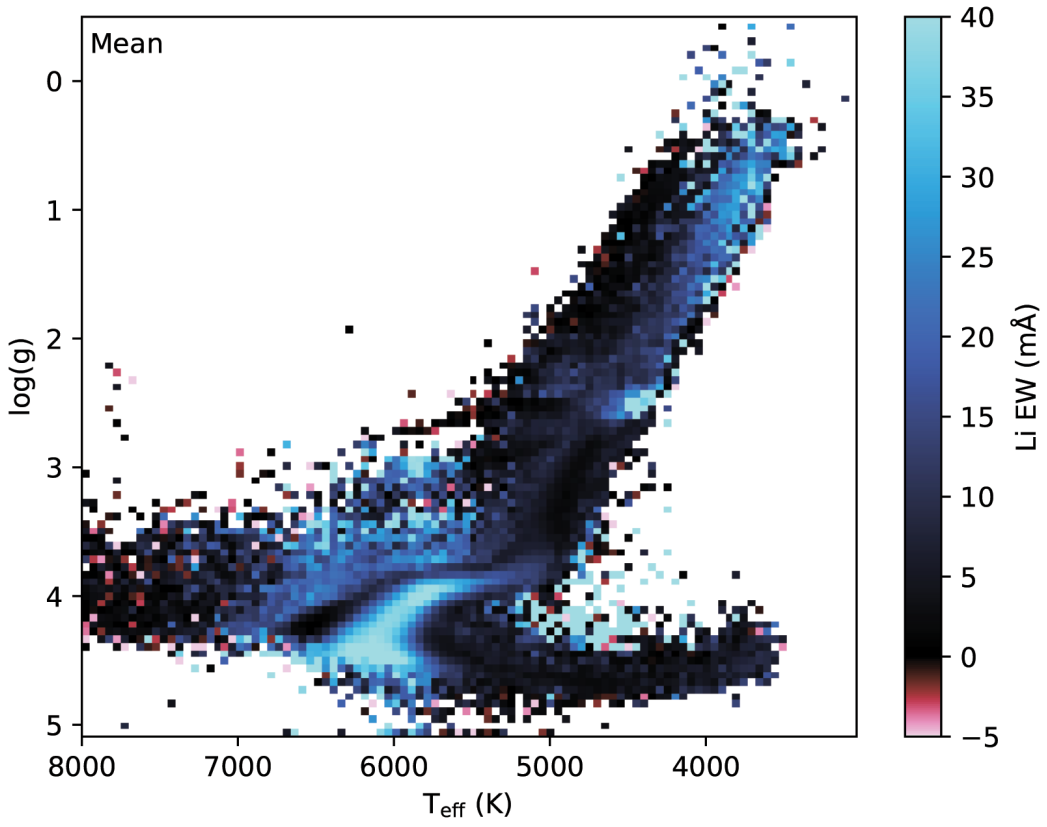

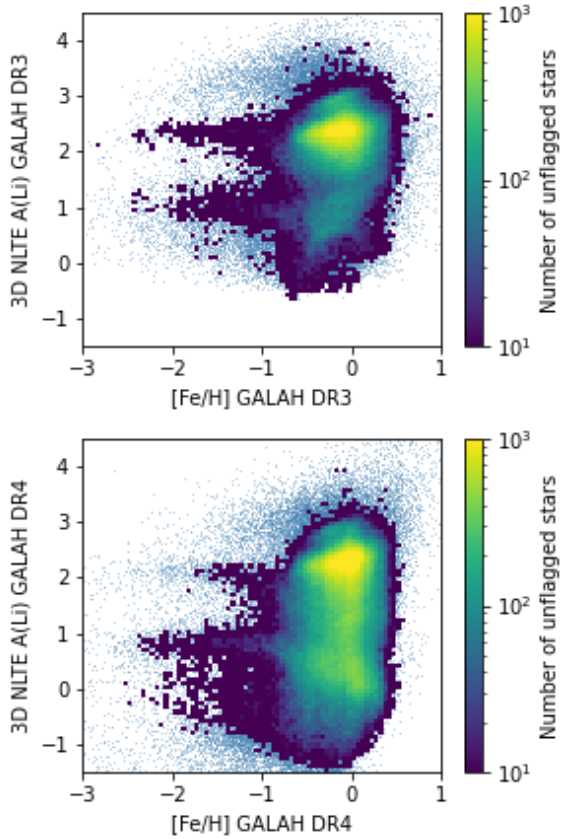

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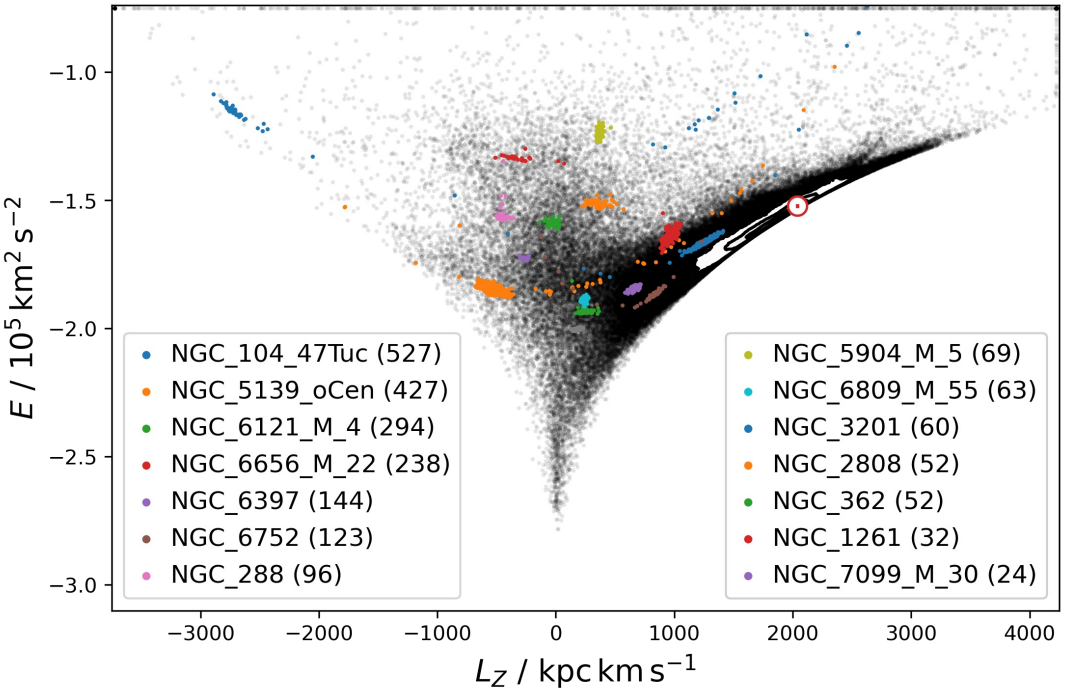

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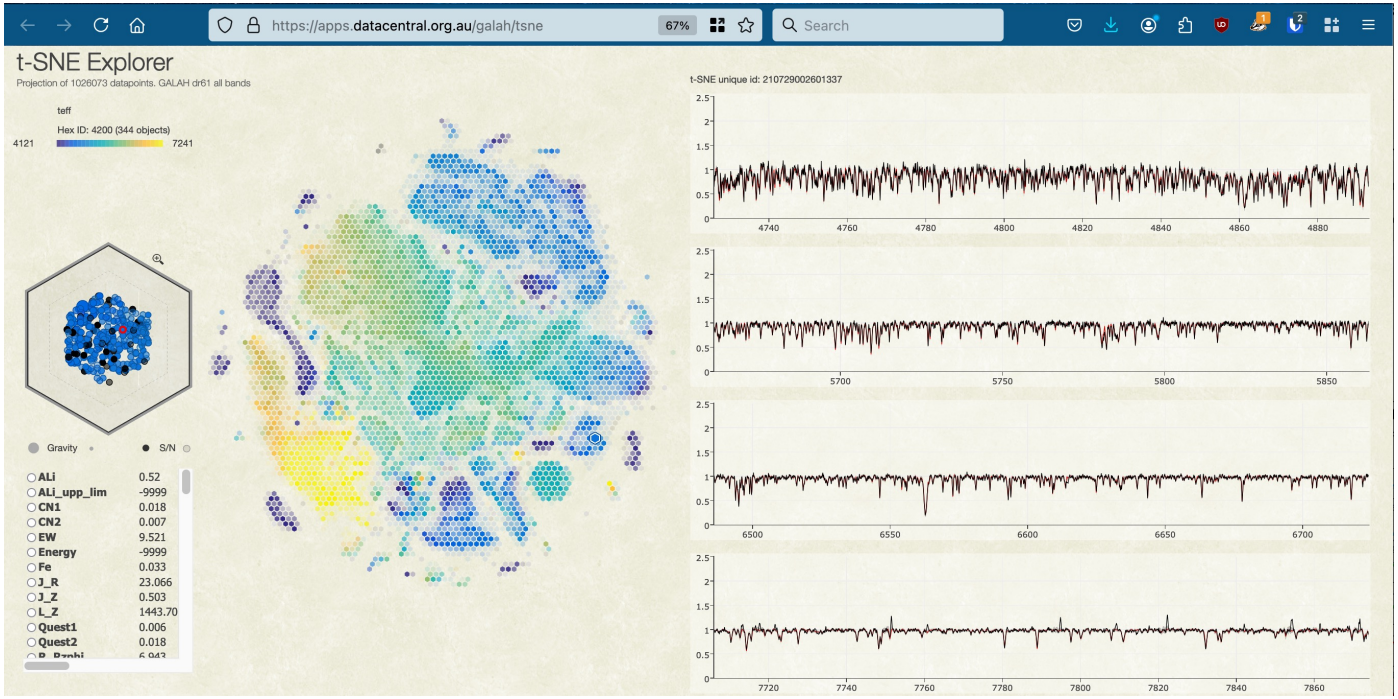

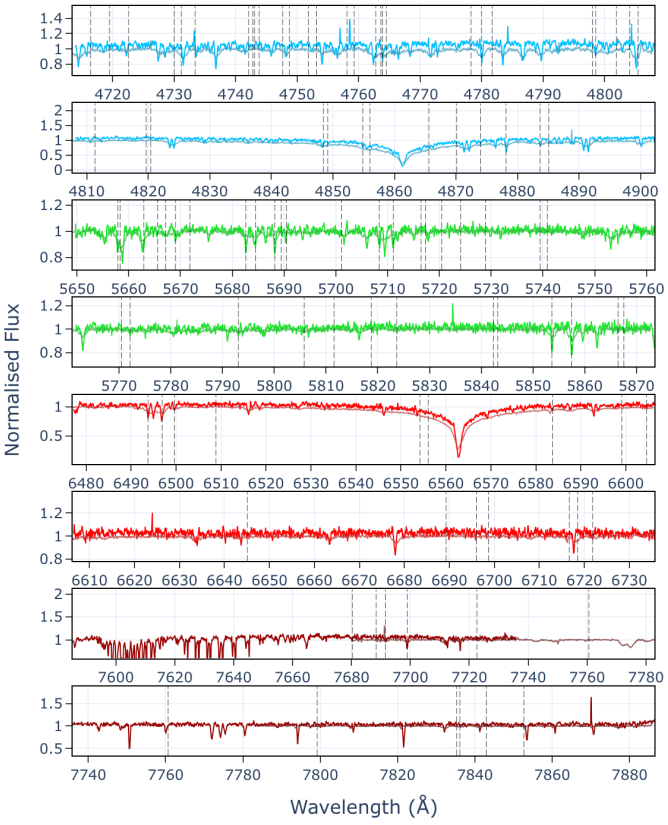

datacentral.org.au has the data

galah-survey.org has the details