

The Gaia Spectroscopic Catalogue of Exoplanets and Host stars



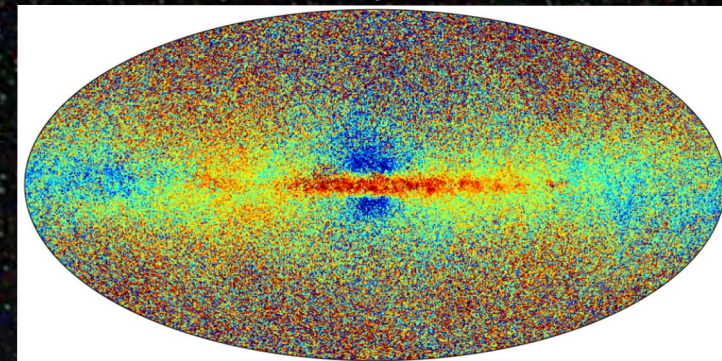
Patrick de Laverny

Observatoire de la Côte d'Azur (Lab. Lagrange)

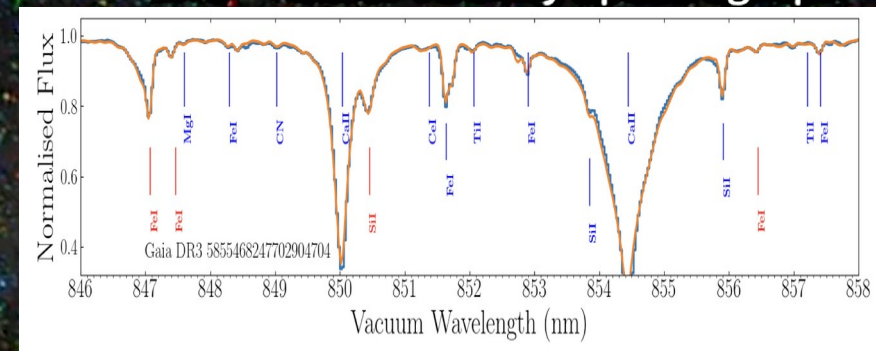
With : R. Ligi, A. Crida, A. Recio-Blanco, P.A. Palicio,

L. Araujo & D. Taniguchi

Galactic Chemical Map



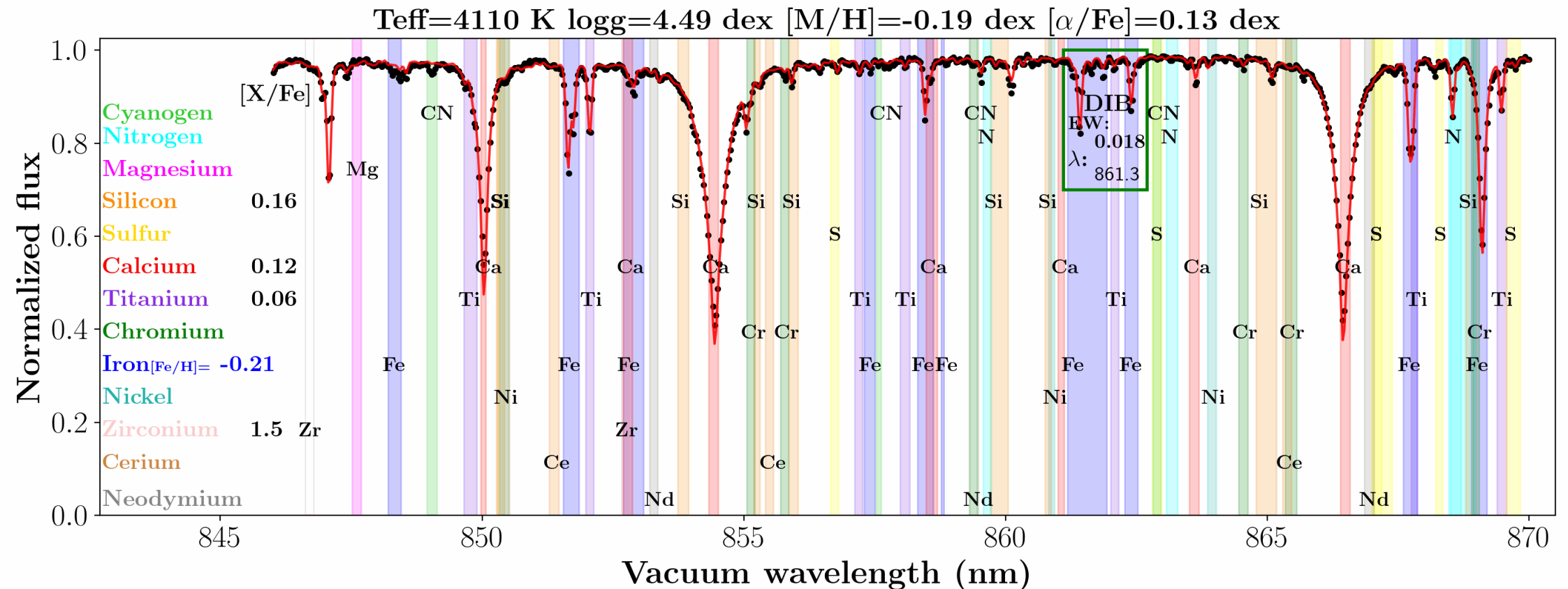
RVS = Radial Velocity Spectrograph



Gaia/GSP-Spec: a space spectroscopic survey



5.6 million stars parametrized in Gaia DR3 from their RVS spectra



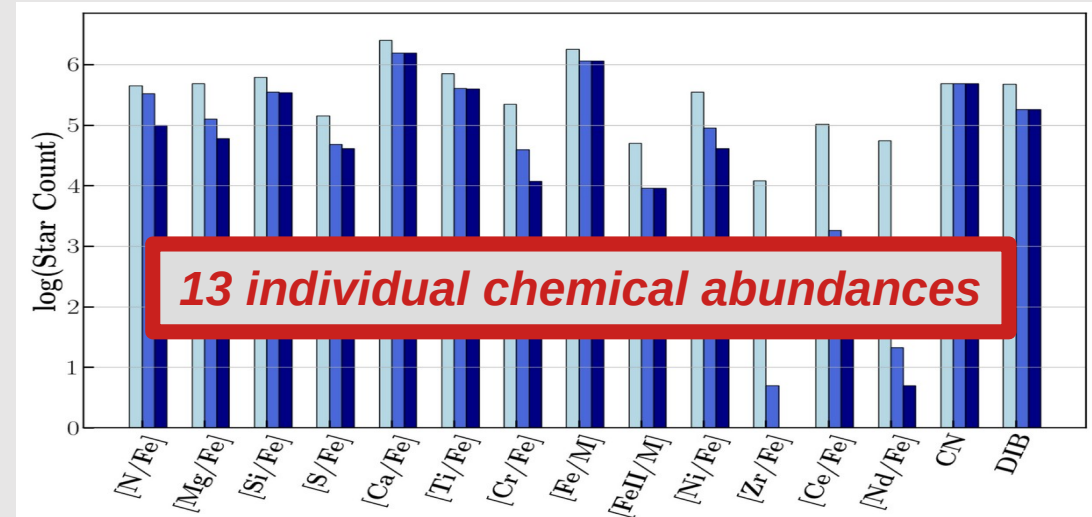
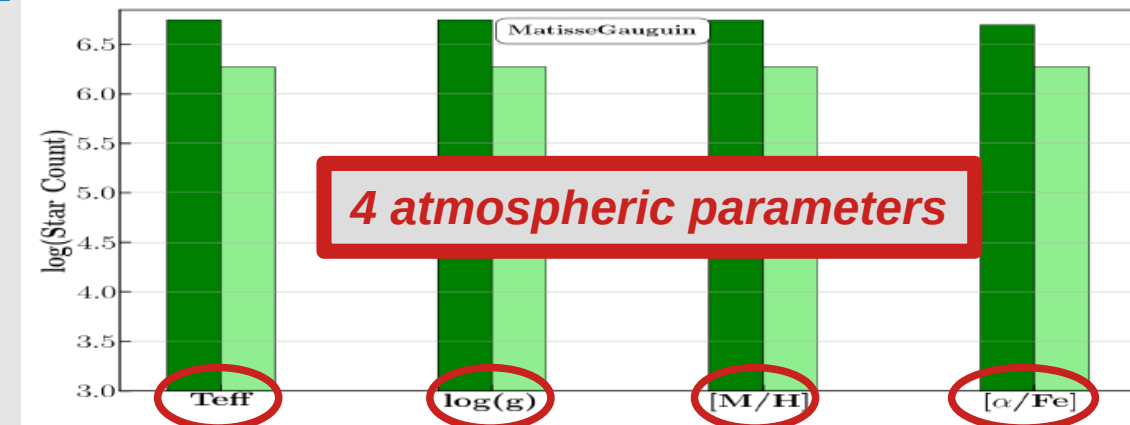
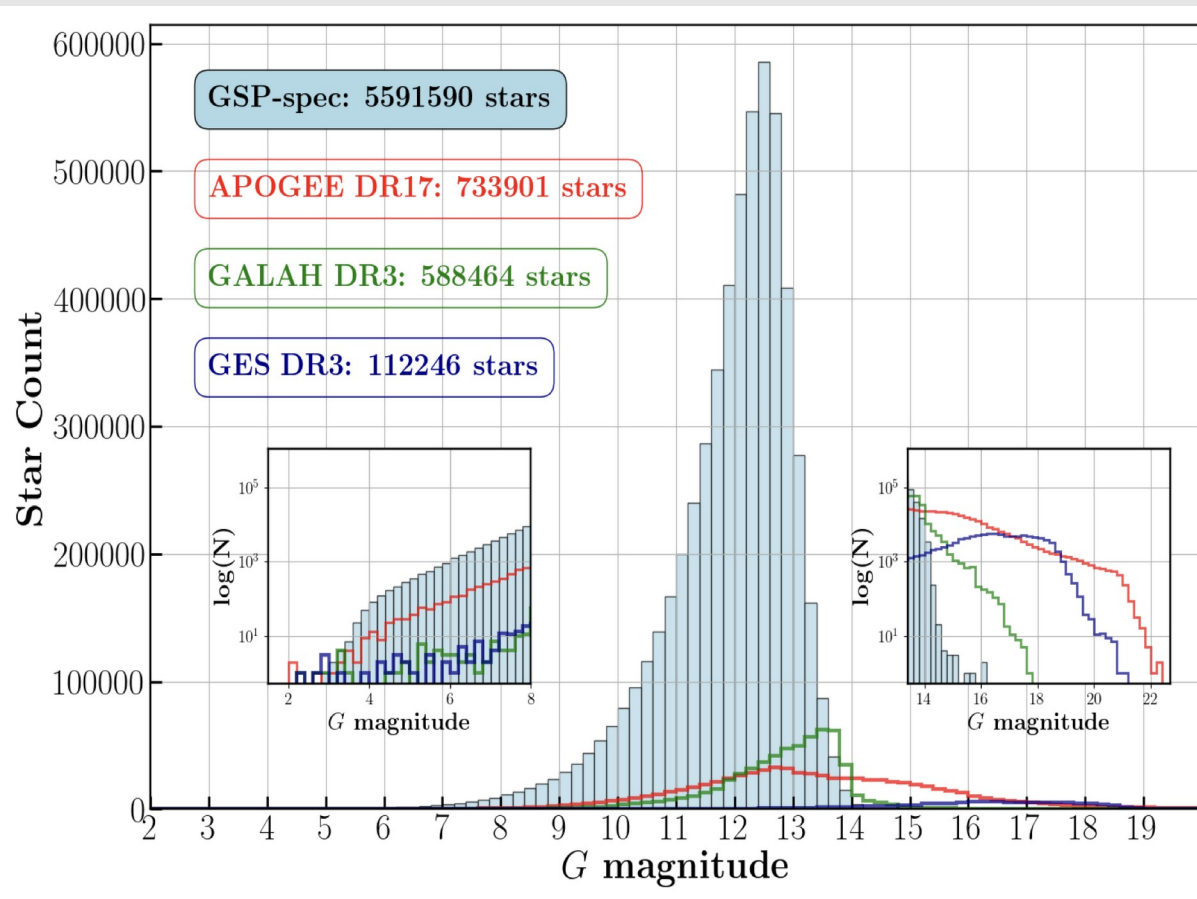
GSP-Spec/DR3 articles: Recio-Blanco+23 & Gaia Collab., Recio-Blanco+23

Gaia/GSP-Spec: a space spectroscopic survey



Space spectroscopy: Stability, Precision, Huge statistics,...

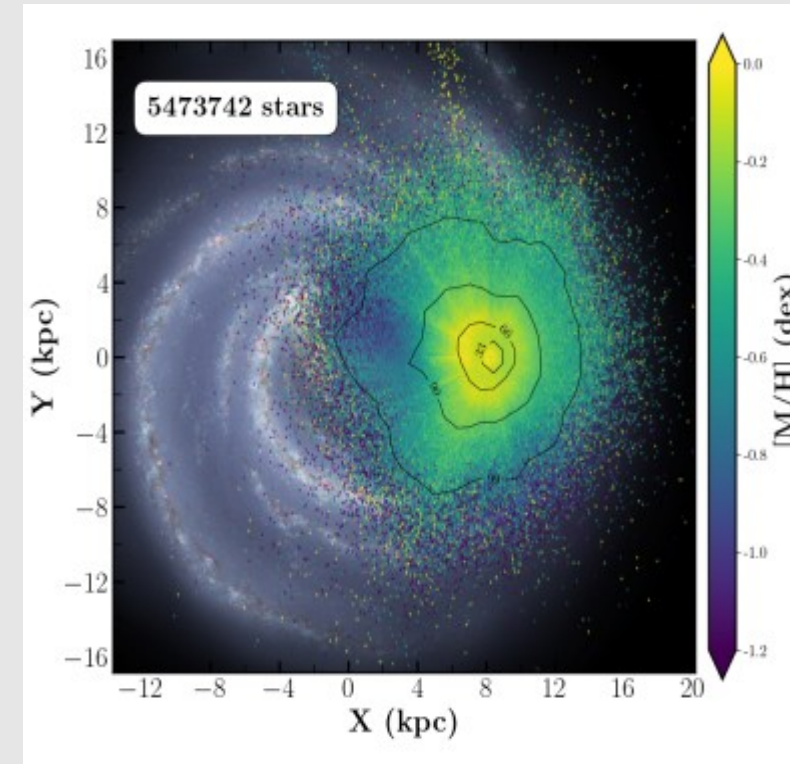
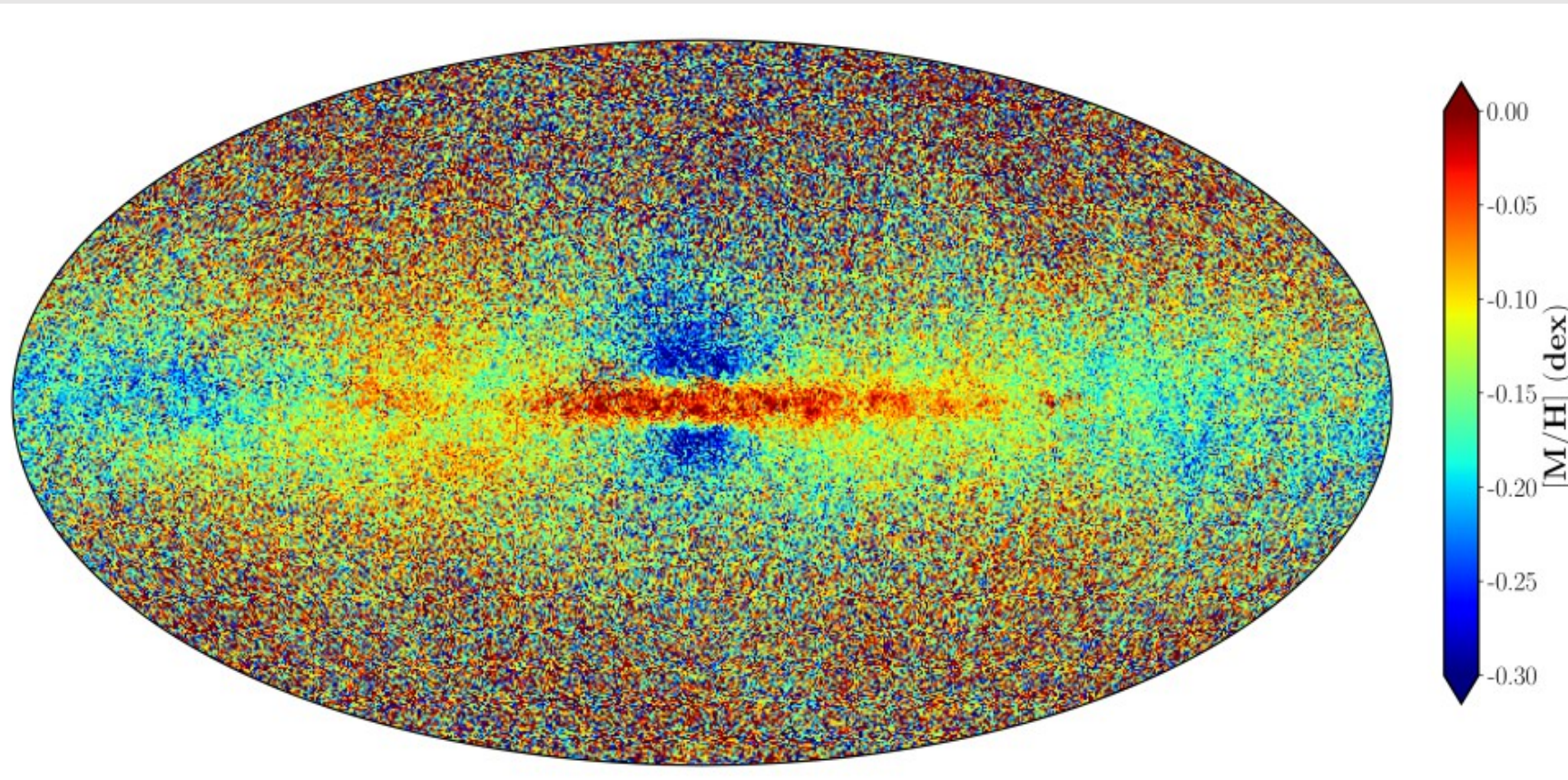
Chemo-physical stellar atmospheric parameters for ~5.6 million stars



Gaia/GSP-Spec: a space spectroscopic survey



Chemical cartography of the Milky Way



Gaia/GSP-Spec: a space spectroscopic survey

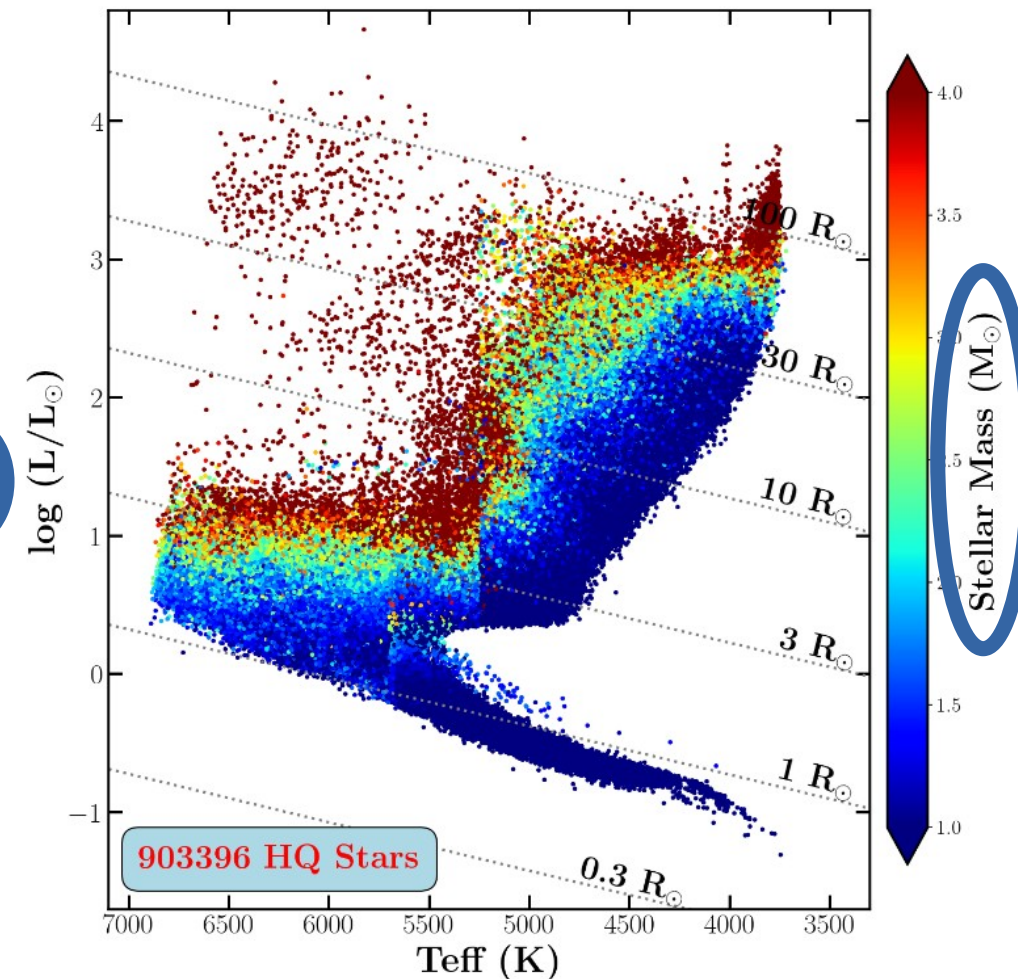
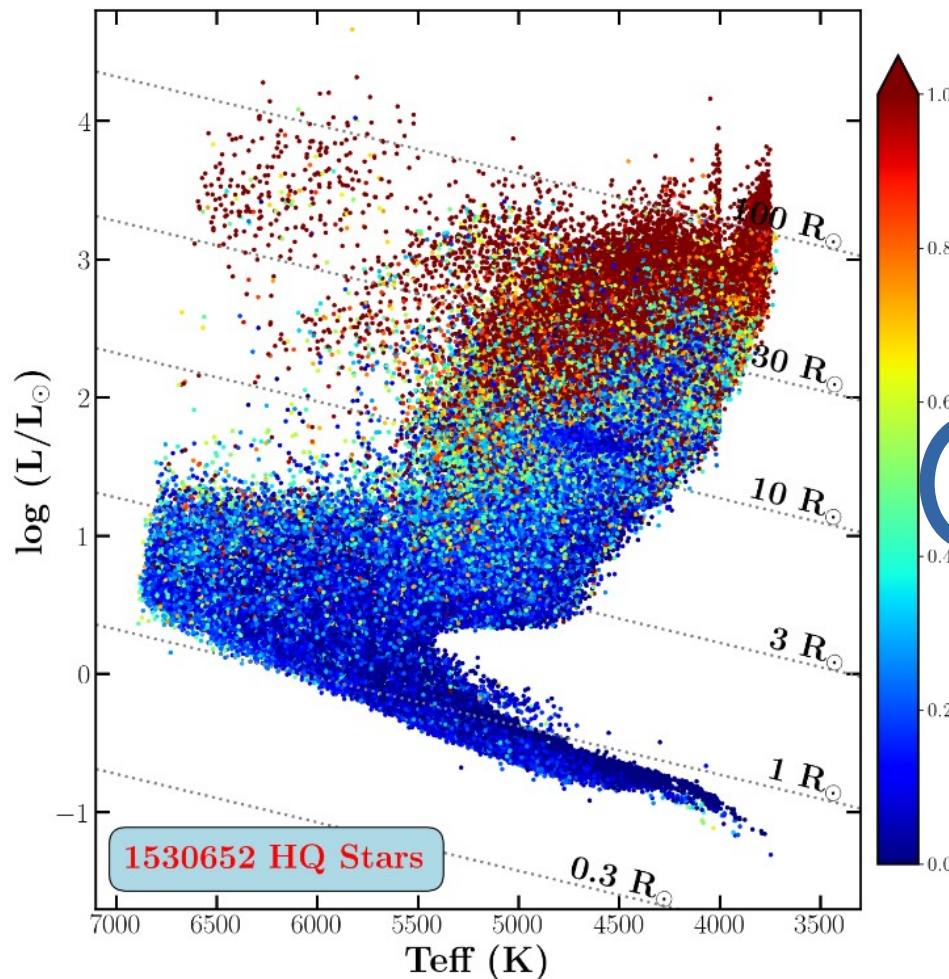


From the GSP-Spec stellar atmospheric parameters

→ Interstellar Extinctions towards ~4.6 million stars

de Laverny+26

→ Luminosity
Radius
Mass
~4 million stars



Gaia/GSP-Spec Exoplanets & Host stars

New Planet & Host star parameters thanks to Gaia/DR3

de Laverny+25

→ EU + NASA Exoplanet Databases & Gaia/DR3: **Homogenous & Large Statistics**

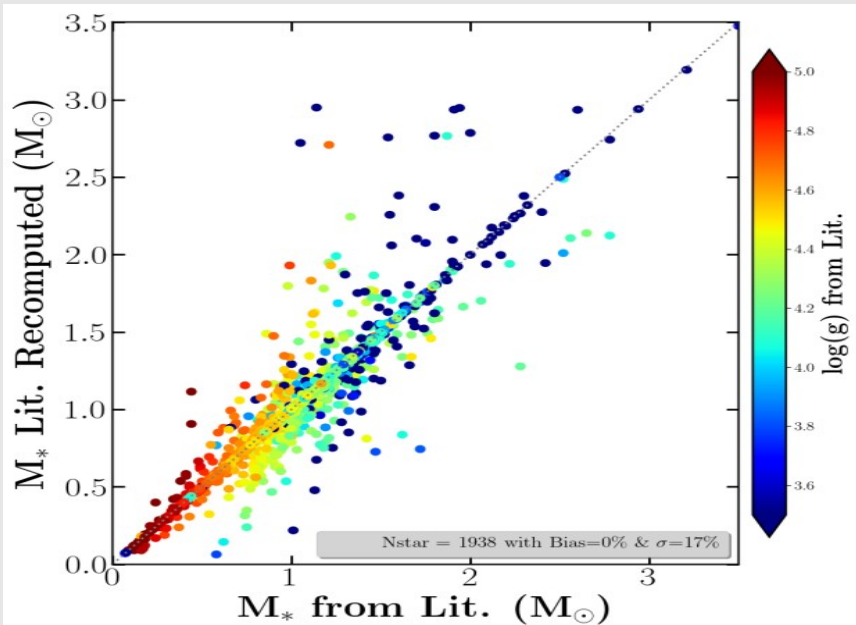
- 2573 host stars: New R_{\star}^{Gaia} & M_{\star}^{Gaia}
- 3556 exoplanets: New R_p^{Gaia} & M_p^{Gaia}

Transit: $R_p^{\text{Gaia}} = R_p^{\text{Lit}} \times \left(\frac{R_{\star}^{\text{Gaia}}}{R_{\star}^{\text{Lit}}} \right)$

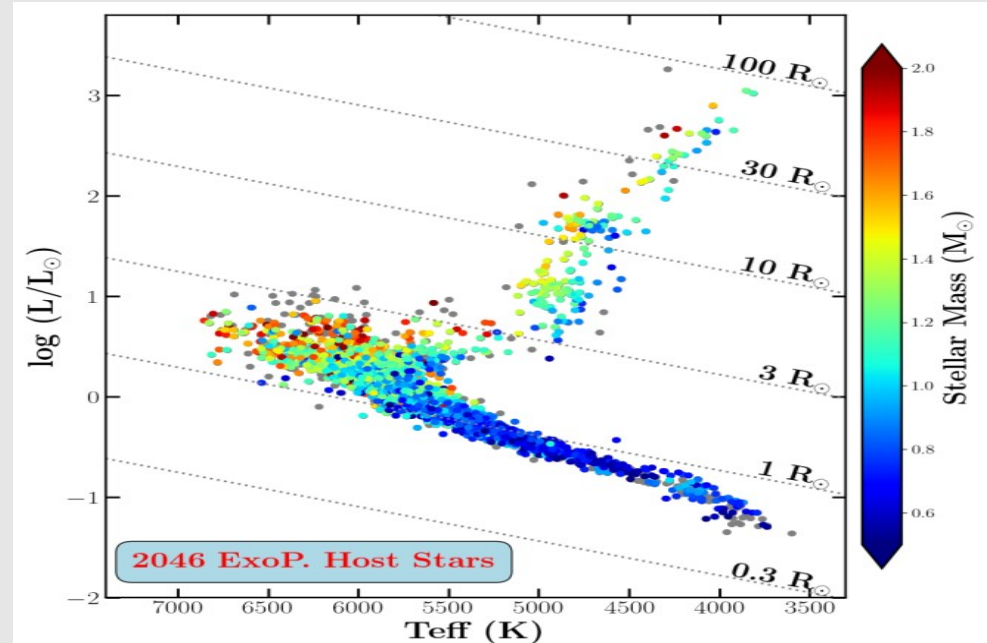
$M_p^{\text{Gaia}} \approx (M_{\star}^{\text{Gaia}} / M_{\star}^{\text{Lit}})^{1/3}$

Vrad: $M_p^{\text{Gaia}} \approx (M_{\star}^{\text{Gaia}} / M_{\star}^{\text{Lit}})^{2/3}$

→ Literature parameters: Heterogenous & Inconsistent



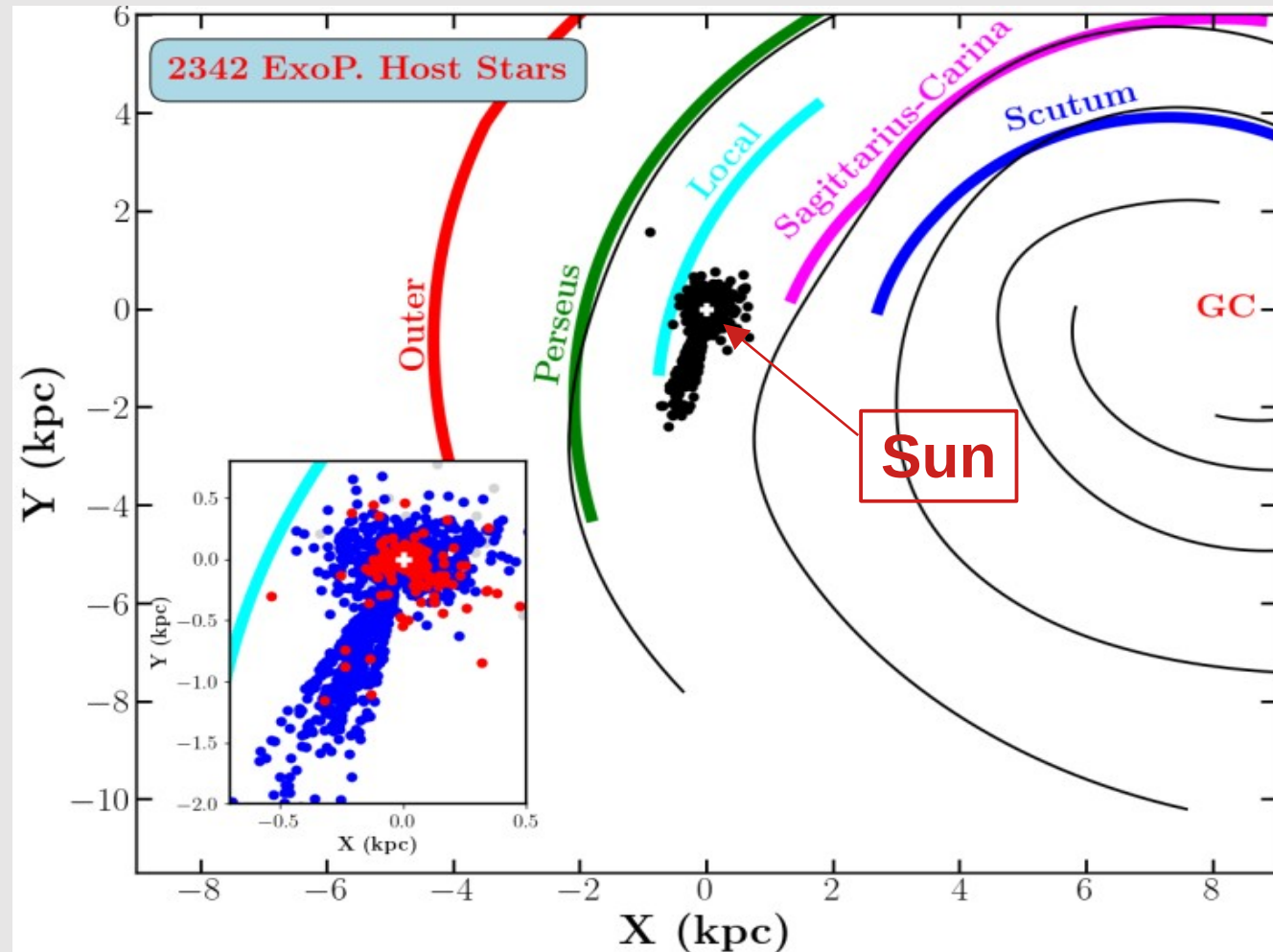
Gaia



Gaia/GSP-Spec Exoplanets & Host stars

Host stars in the Milky Way

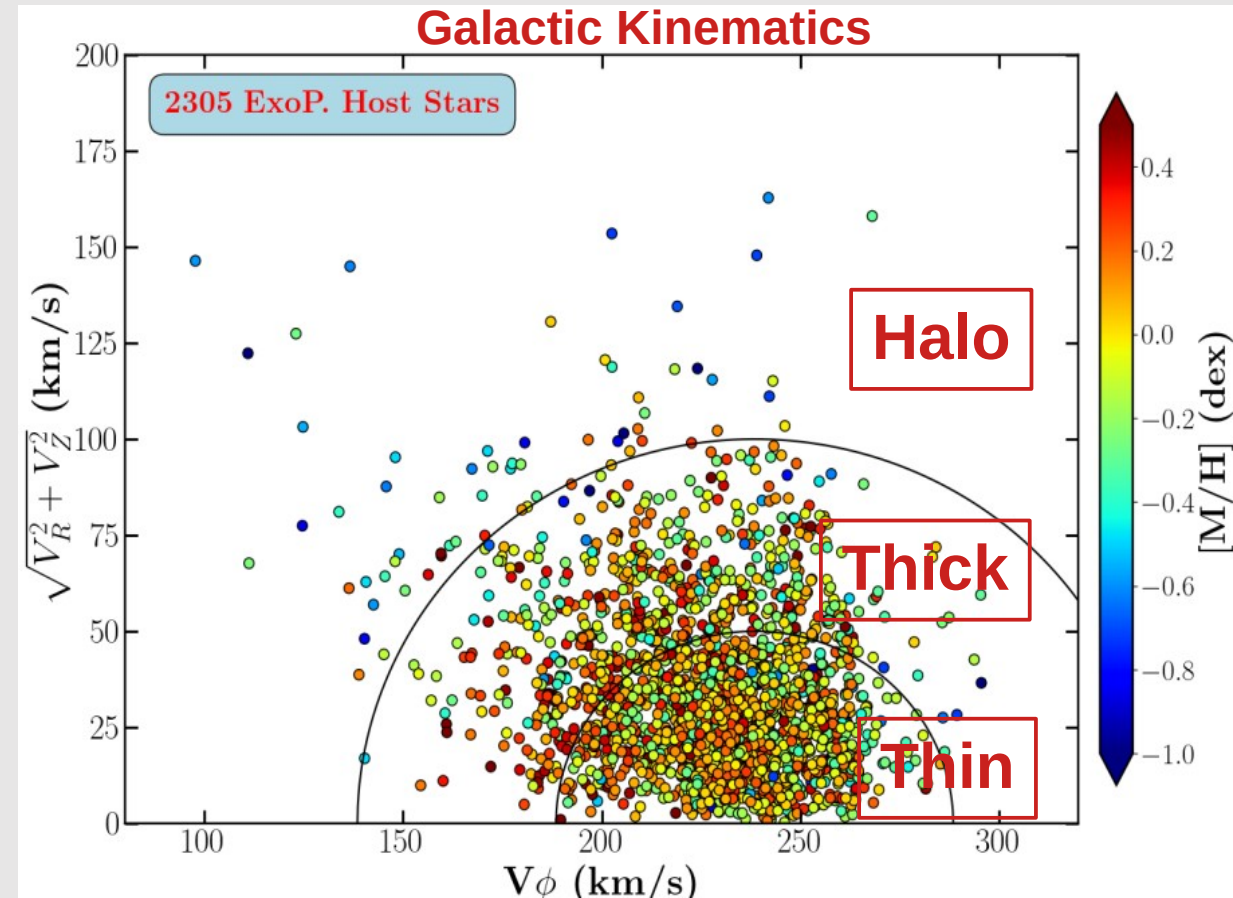
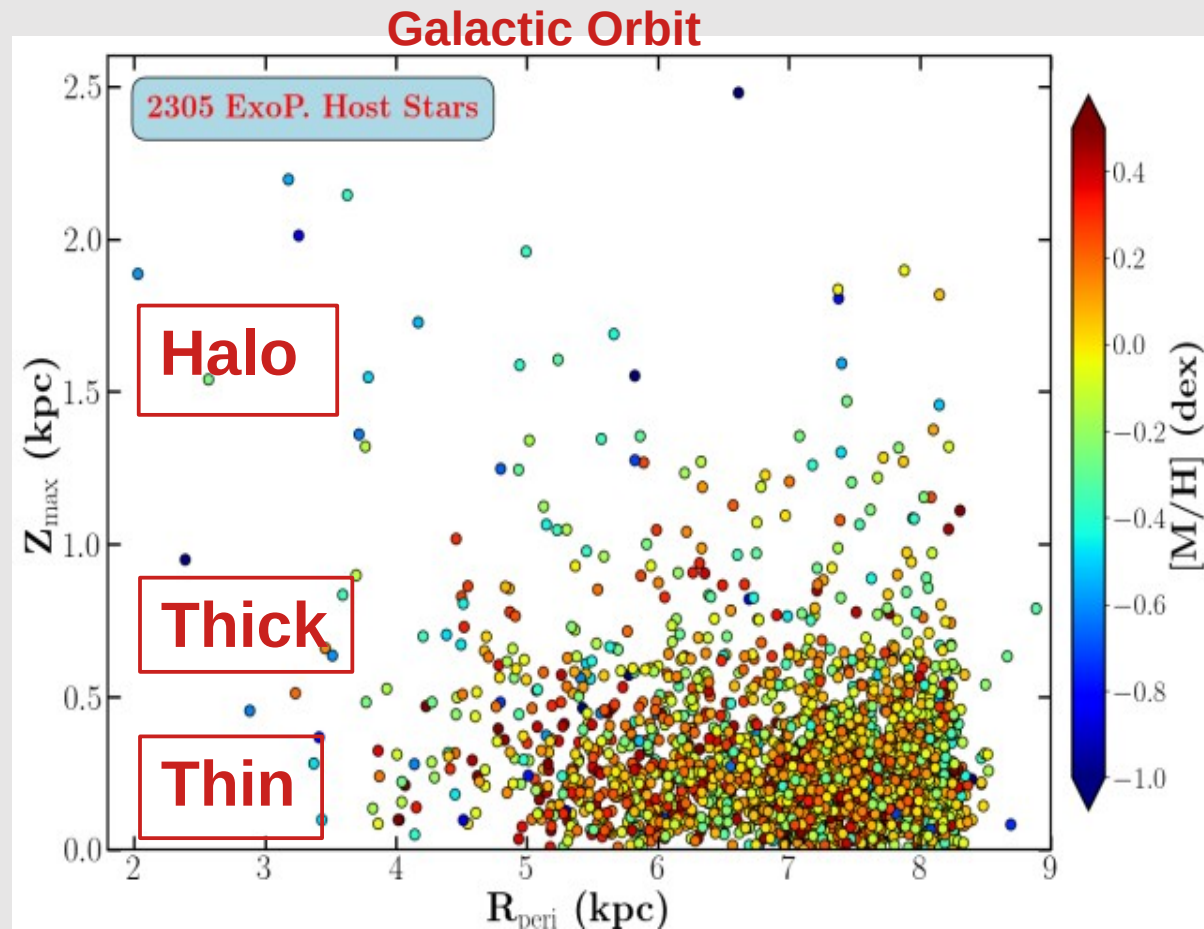
→ Solar vicinity (Local arm) & Kepler field



Gaia/GSP-Spec Exoplanets & Host stars

Host stars in the Milky Way

→ **Solar vicinity (Local arm) & Kepler field:** Most in the Galactic Thin Disc
Some in the Galactic Halo & Thick Disc

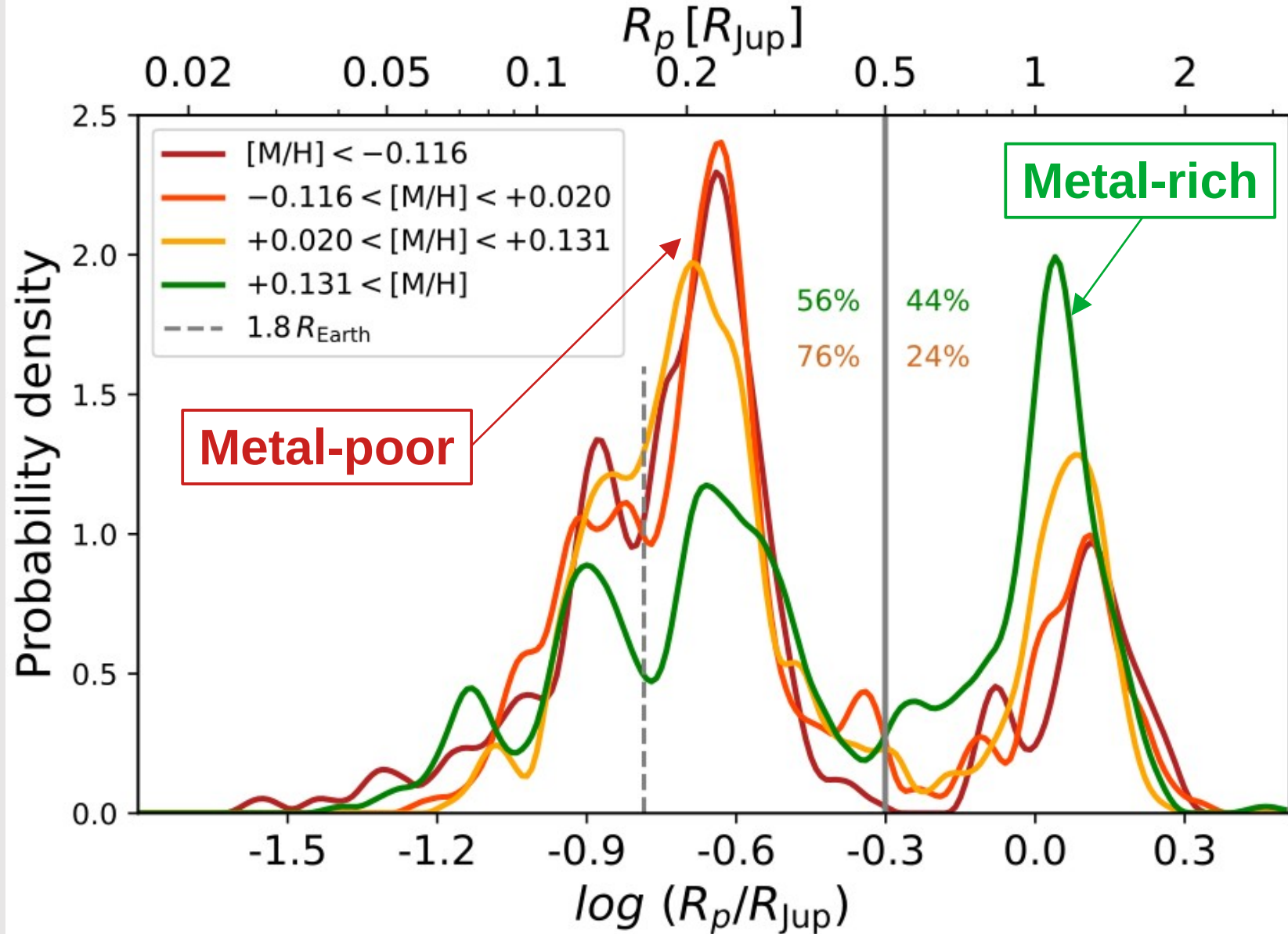


Gaia/GSP-Spec Exoplanets & Host stars

Exoplanet properties

→ Radius distribution

More giant planets around metal-rich stars

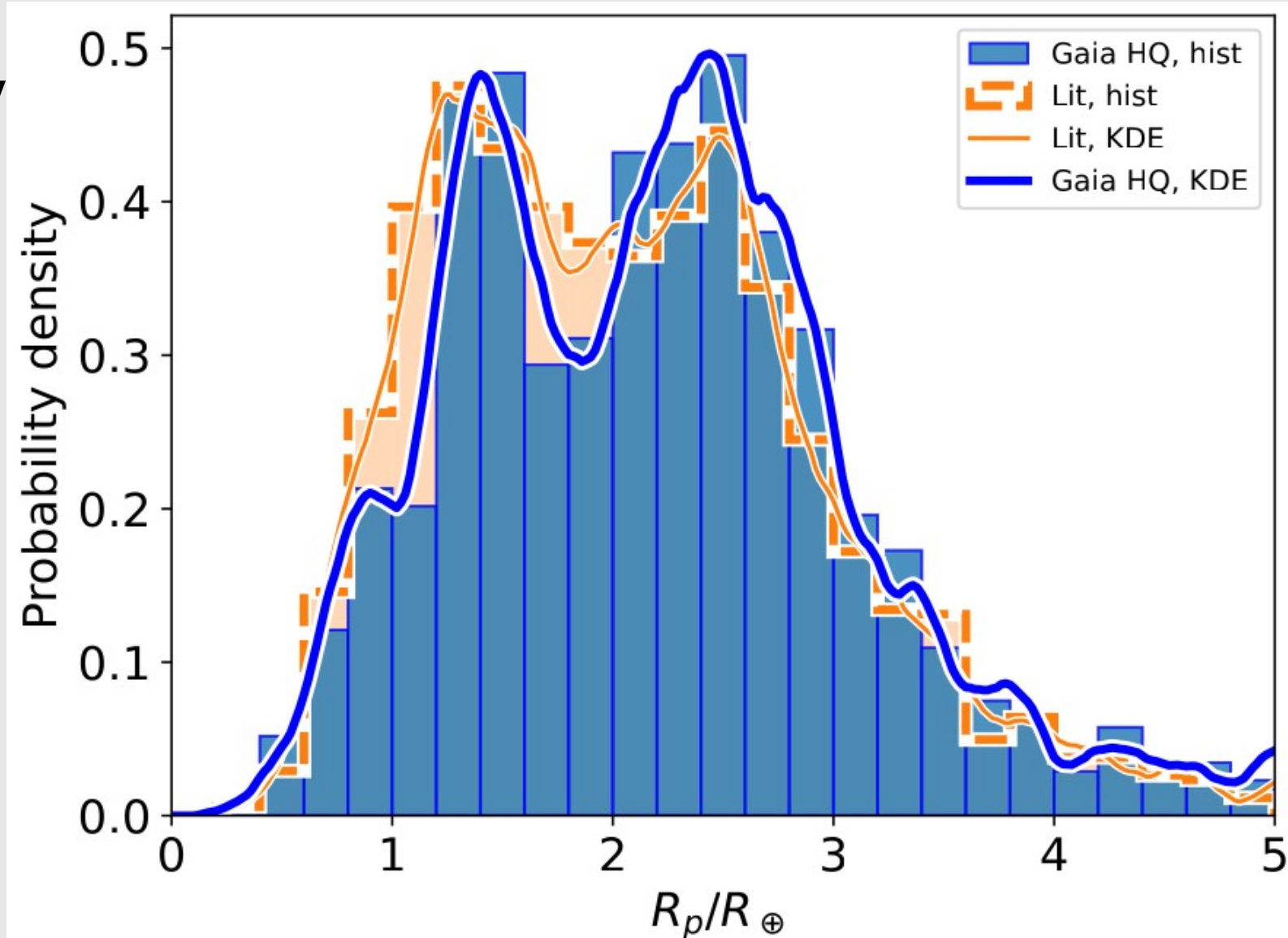


Gaia/GSP-Spec Exoplanets & Host stars

Exoplanet properties

→ Radius (evaporation) Valley

Better defined than in the literature at $\sim 1.8 R_{\oplus}$



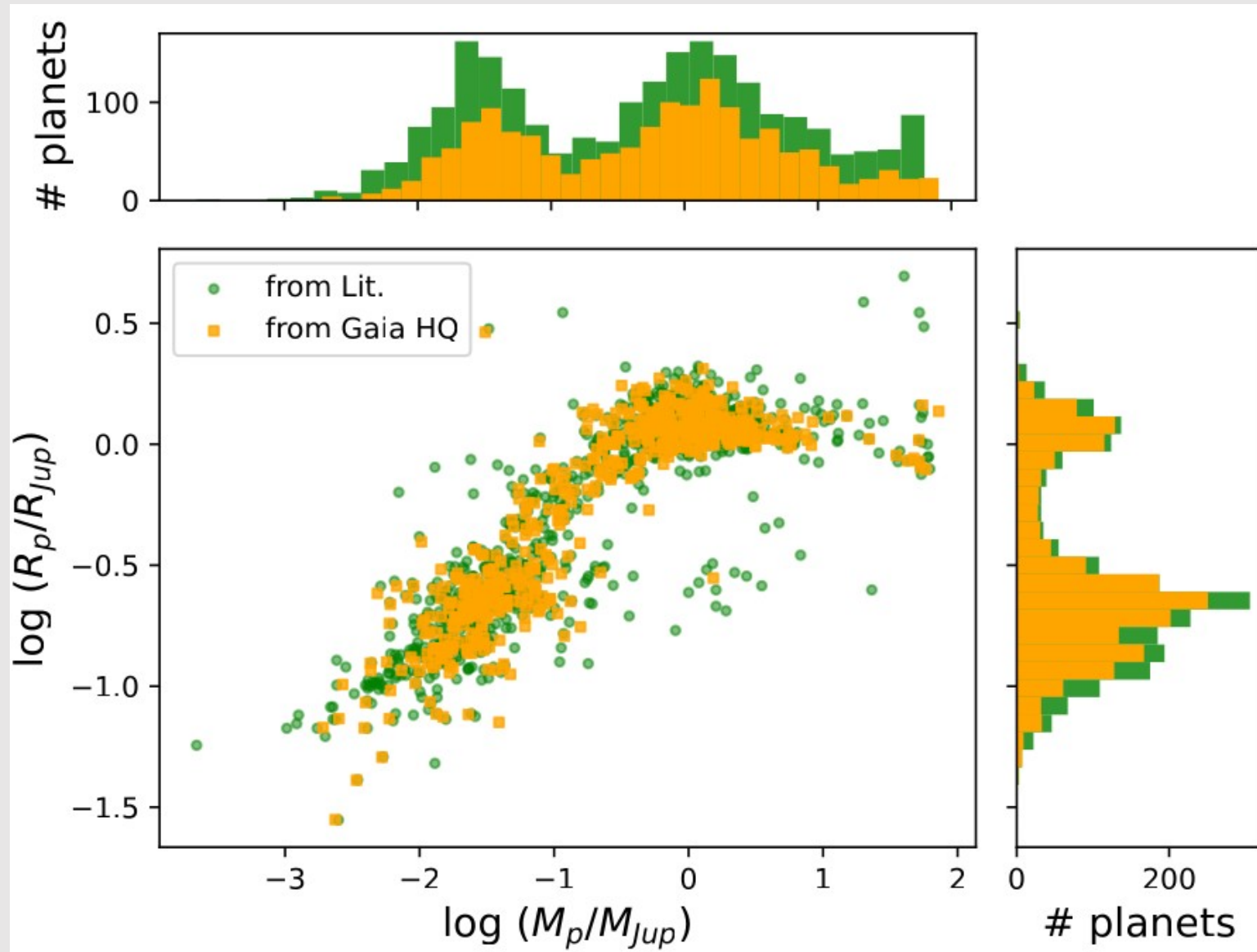
Gaia/GSP-Spec Exoplanets & Host stars

Exoplanet properties

→ Mass-Radius distribution

Global shape not changed
with our catalogue

But less dispersion



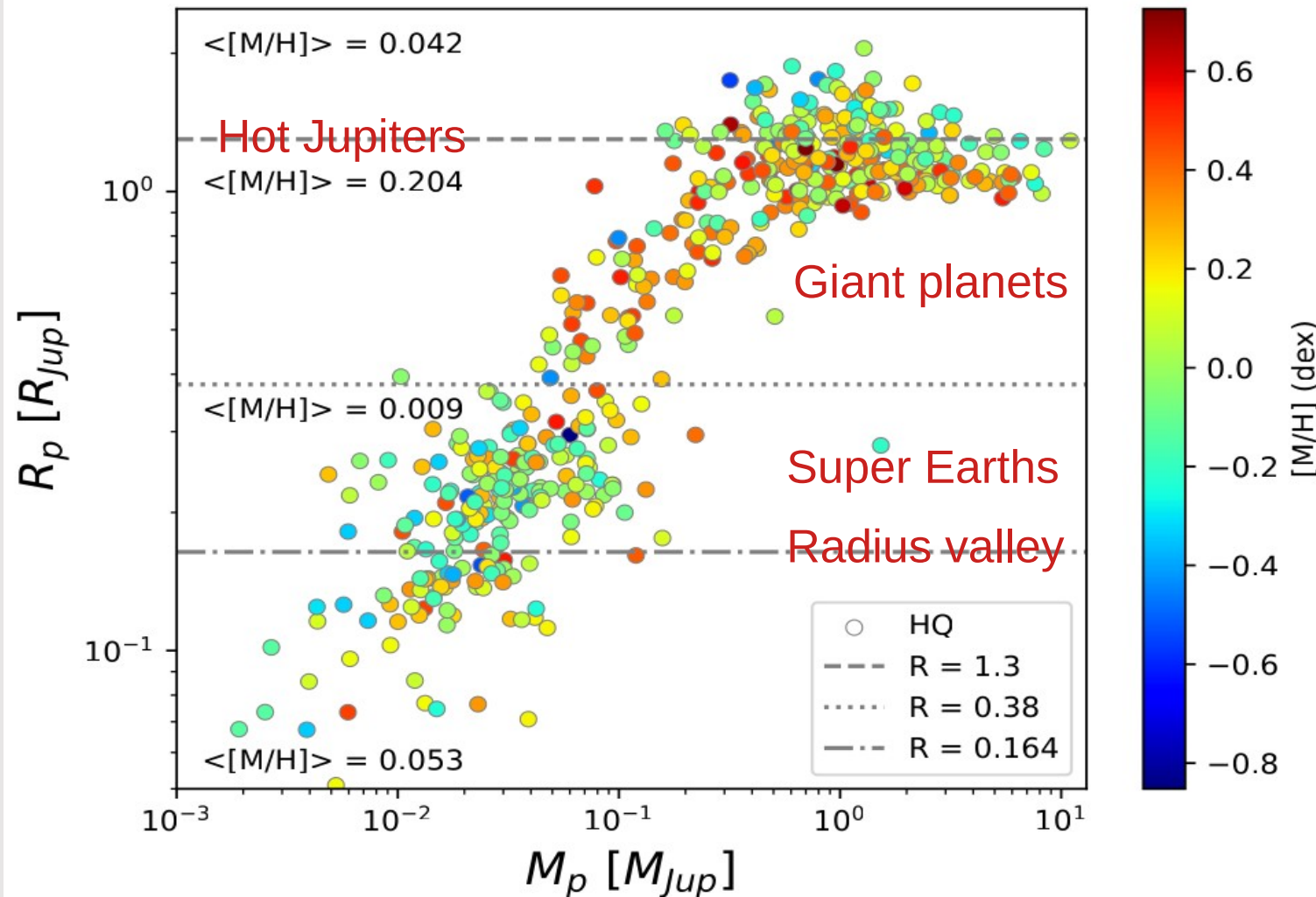
Gaia/GSP-Spec Exoplanets & Host stars

Exoplanet properties

→ Mass - Radius - Metallicity distribution

- Small planets: any metallicities
- Giant planets: around more metal-rich stars

But most inflated planets around more metal-poor stars



Gaia/GSP-Spec Exoplanets & Host stars

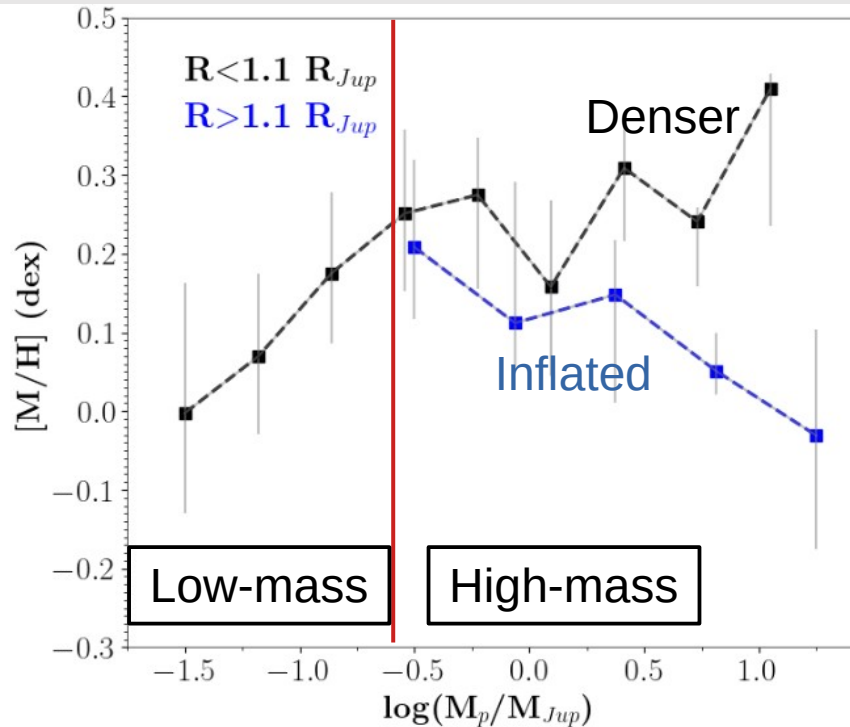
Exoplanets in the Milky Way

→ Massive planet birth location: Stellar Migration acts

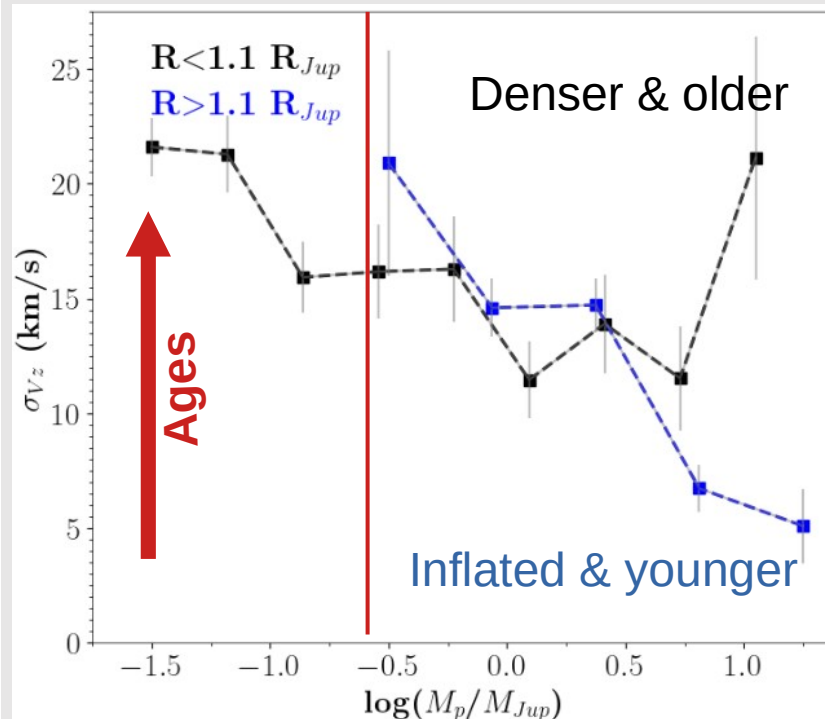
Dense planets: more metal-rich & older & larger ecc. ⇒ **Inner Galactic Disc**

Inflated planets: more metal-poor & younger & lower ecc.

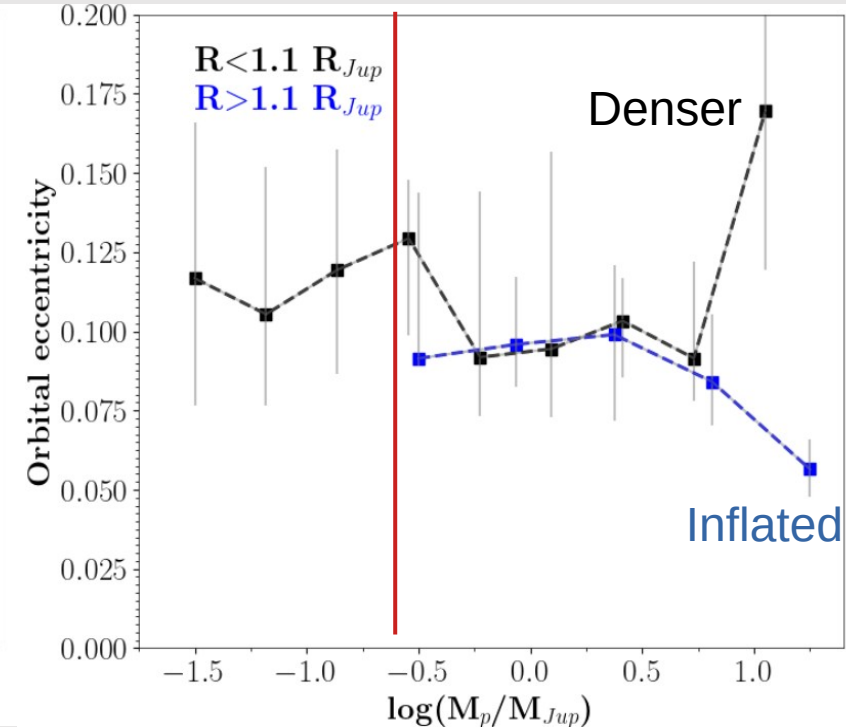
Host star mean metallicity



Galactic velocity dispersion ~ Ages



Galactic orbital eccentricity



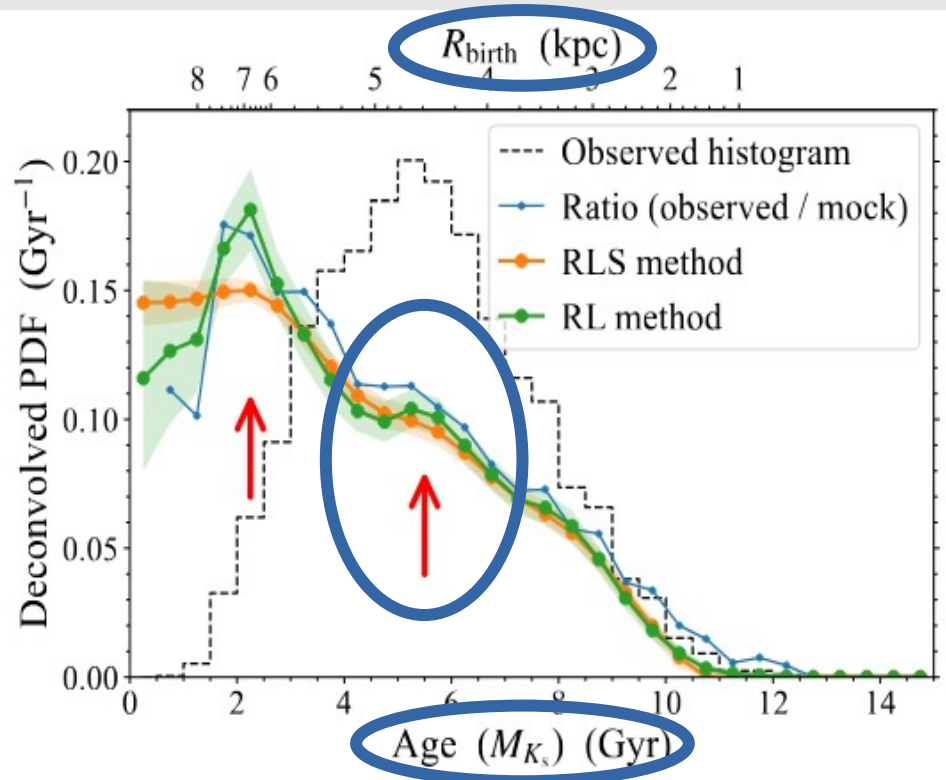
Gaia/GSP-Spec Exoplanets & Host stars

Exoplanets in the Milky Way

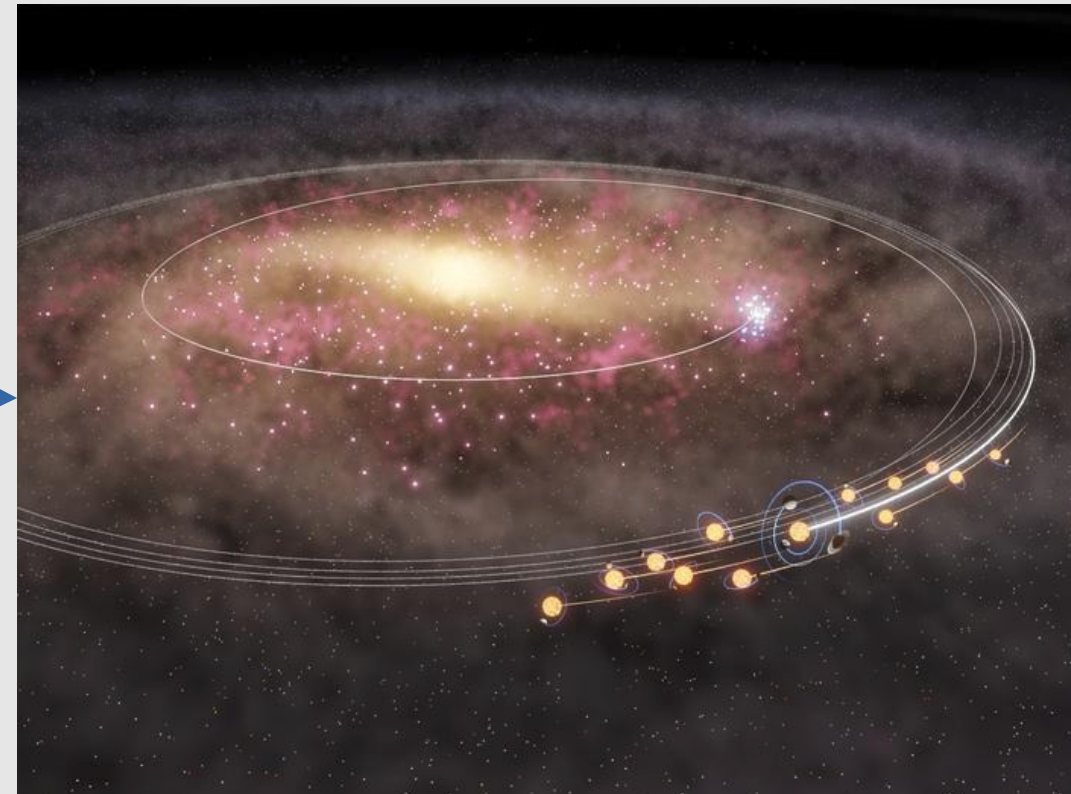
→ **Solar system birth location:**

- Largest catalogue of **Solar Twins** in our vicinity (~6,600 from GSP-Spec)
 - ⇒ Group of 4-6Gyr Twins more metal-rich than the Solar vicinity
 - And born in the **Inner Galactic disc** (as the Sun !)

Taniguchi+26
Tsujiimoto+26



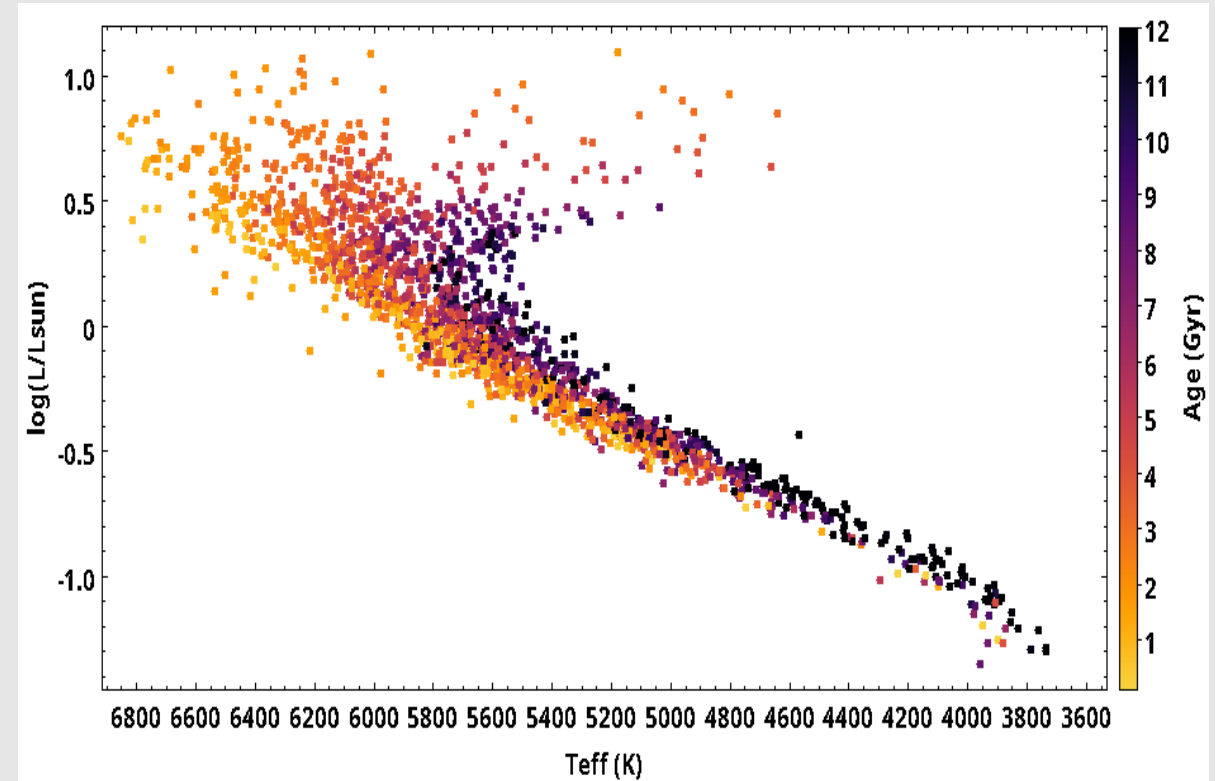
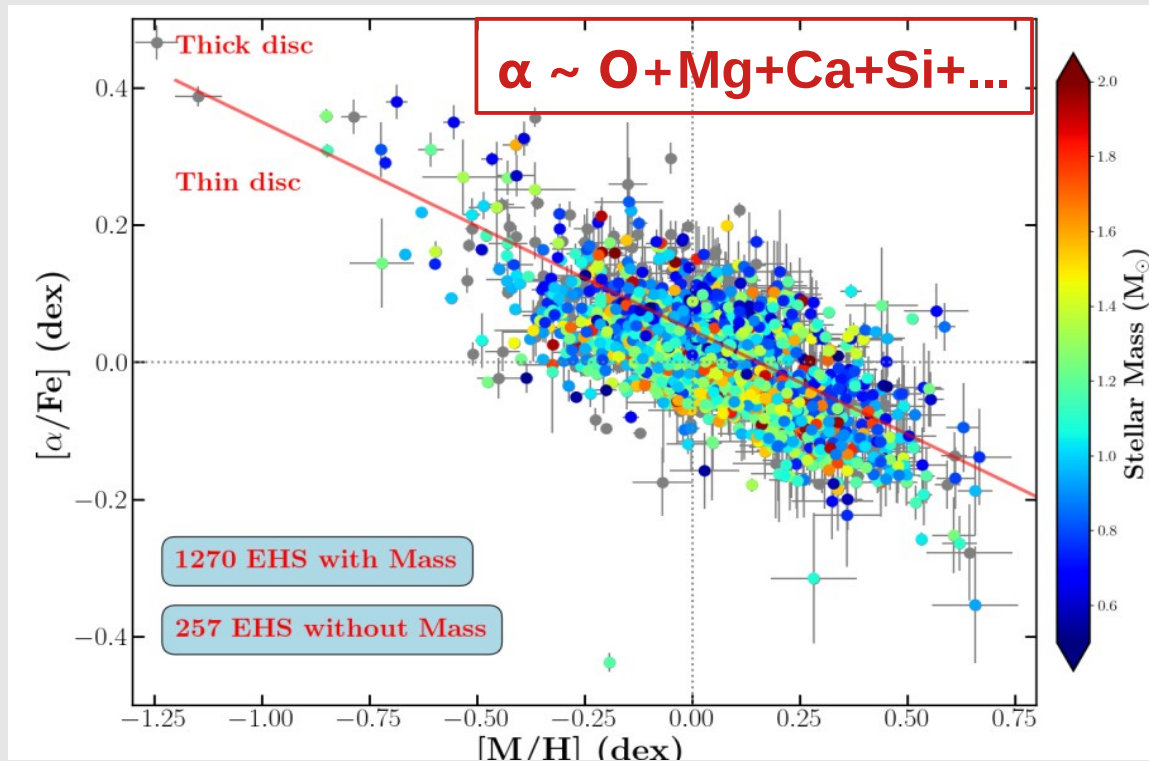
Migration wave
~5Gyr ago



Gaia/GSP-Spec Exoplanets & Host stars

Host stars : chemistry & ages

- Exploring the host star chemical composition & Ages (PhD thesis of L. Araujo)
- Individual abundances from GSP-Spec + APOGEE + GALAH
 - Ages as in Taniguchi+26



GSP-spec/DR4 perspective for Exoplanets & Host stars



From Gaia/DR3 (06/2022) to DR4 (12/2026)

→ Larger Statistics

⇒ All Host Stars will be in GSP-spec (~35 million stars with $G < 16$)

→ Improved Parameterisation Pipeline

⇒ Better treatment of M & A-type and rotating stars

→ Higher SNR RVS spectra: 2.5yr (DR3) → 5.5yr (DR4) of observation

⇒ ~3.4 million stars with $\text{SNR} > 50$ (DR5: ~6 million stars)

⇒ More precise Stellar and Planet parameters (including new chemical elt.)

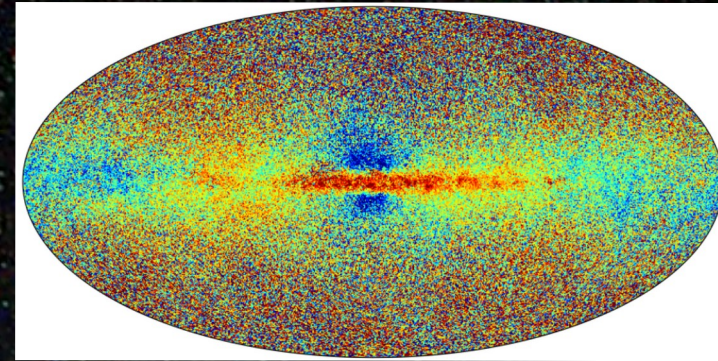
→ Revised catalogue after DR4: even more complete & precise & ages

The Gaia Spectroscopic Catalogue of Exoplanets and Host stars

Thank you



Galactic Chemical Map



RVS = Radial Velocity Spectrograph

