How do Stellar Surveys Like GALAH and GAIA Improve Our Understanding of Planetary Systems?

Jake Clark
PhD Candidate & Fulbright Scholar
University of Southern Queensland and the Southwest Research Institute

jake.clark@usq.edu.au

Credits: ESA/Hubble, M. Kornmesser
Icons made by Roundicons from Flaticon
6600+
Candidates waiting to be confirmed
Link between stellar and planetary properties

Observables: transit depth, radial velocity amplitude

- Planet: Mass, Radius, Density, Composition, Period, au, HZ etc.
- Stellar: $T_{\text{eff}}$, log $g$, $[X/H]$, Mass, Radius, Distance, Luminosity

Transit Depth
Radial Velocity
+ models

Mass, Radius, Density, Composition, Period, au, HZ etc.
GAIA DR2
parallax, G, BP, RP
2MASS
J, H, Ks

GALAH DR2
Teff, log g, [Fe/H], [alpha/Fe]

Mass, Radius, Luminosity, Age, HZs, [X/H], X/Y
GALAH-TESS Catalog

47k + stars, 23 abundances, 4 key abundance ratios
Choice of Stellar Parameters MATTER!!!
Stellar abundances help with composition

EXOPLANETS WILL BE COMPOSITIONALLY DIVERSE FROM THE SOLAR SYSTEM

Might be more complex

Adibekyan+ 21, Plotnykov & Valencia 20, Wang+ 18
GALAH DR3
Teff, log g, [Fe/H], [alpha/Fe]

GAIA EDR3
parallax, G, BP, RP

2MASS
J, H, Ks

Mass, Radius, Luminosity, Age, HZs, [X/H], X/Y
New Stellar Parameters + Weighted Mean = More Precise Exoplanets

![Graph showing the relationship between Planetary Radius and Planetary Mass for various exoplanets. The graph includes data points for CoRoT-7 b, K2-131 b, WASP-47 e, K2-314 b, K2-216 b, and K2-106 b. The graph also highlights different compositions such as 100% H₂O, 50% H₂O 50% MgSiO₃, 100% MgSiO₃, Earth-Like, and 100% Fe.]
Ultra Hot Neptunes Favour Iron-Rich Stars?

Dai+ 20
Confirming candidates will be tough....
But not impossible ;)
Characterising Exoplanets

Characterising Stars

Characterising The Milky Way

Carrillo+ 20
Large-stellar galactic archaeology surveys are vital for exoplanetary science.

Used both a weighted mean approach to archival data and GALAH data to refine fundamental properties of exoplanets.

Some signs that Ultra Hot Neptunes might favour iron-rich stars compared to their smaller rockier counterparts.

High stellar rotational velocities will make mass confirmation challenging for most GALAH candidates.