Exploring the Origin of the Solar's Chemical Anomalies with Planet-Hosting Solar-Type Stars

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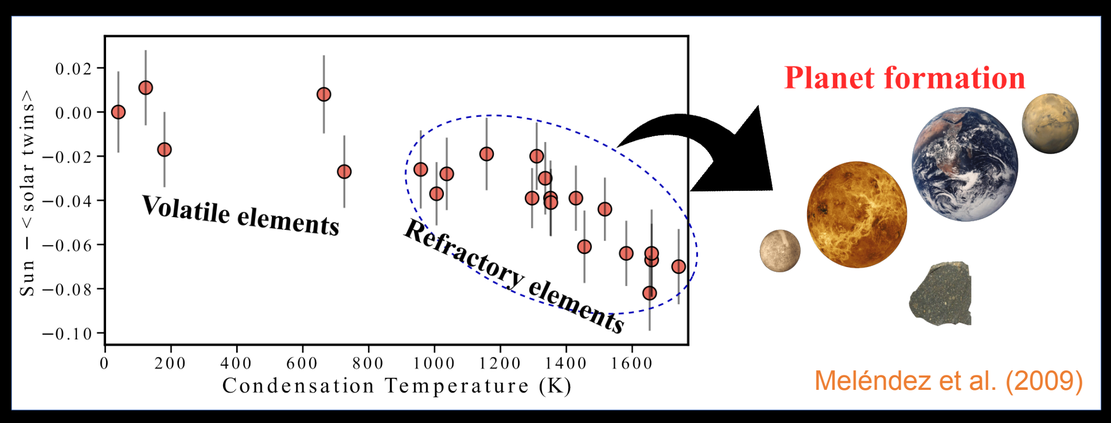
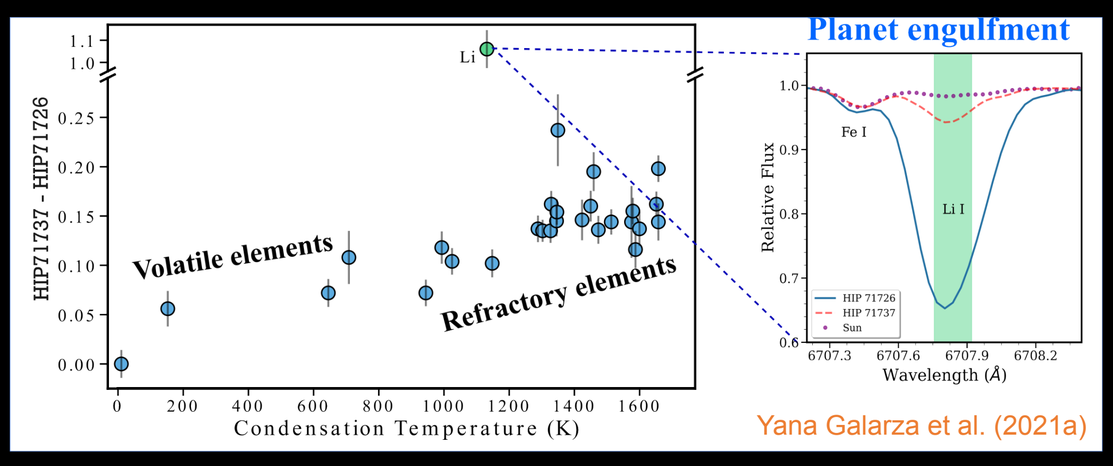
MOTIVATION

When comparing the Sun with the majority of solar-type stars, it exhibits a deficit of refractory elements (negative slope), which is attributed to the formation of rocky planets in the solar system.



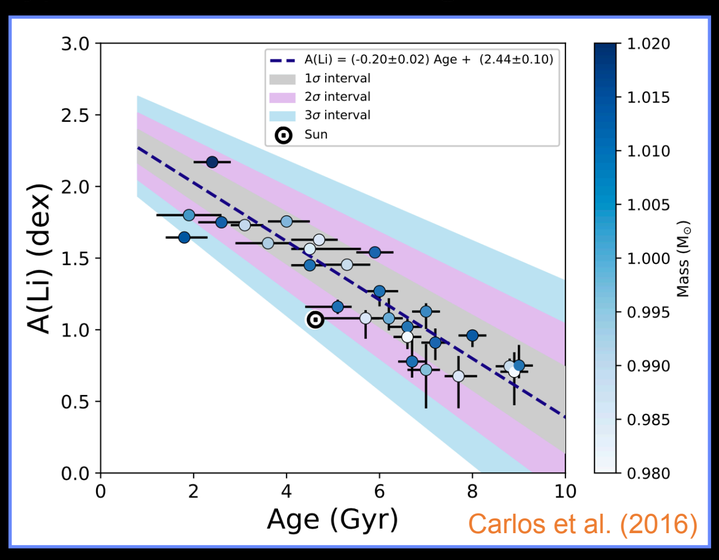
Meléndez et al. (2009)

Recent studies have shown that some binary systems are chemically inhomogeneous, where one component is enhanced in refractory elements (positive slope), which is attributed to planet engulfment events.



Yana Galarza et al. (2021a)

The Sun is also unusually depleted in lithium relative to solar-type stars of the same age.

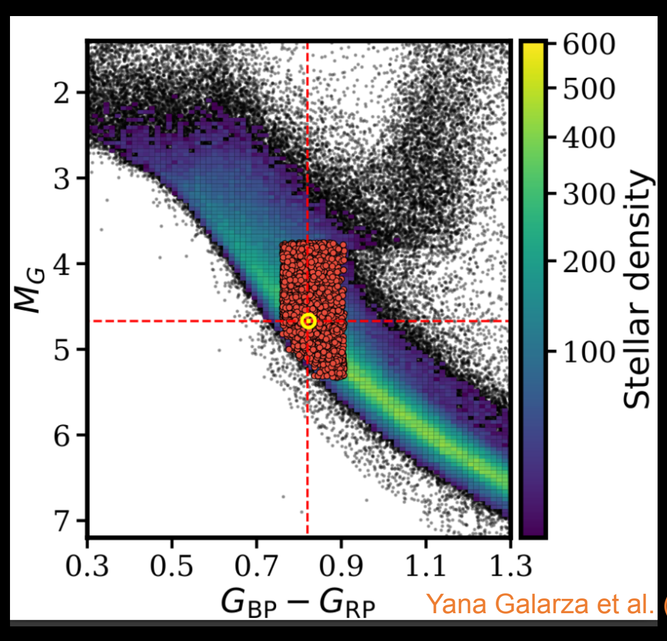


Carlos et al. (2016)

All these findings argue for the idea that the Sun is an oddball.

SAMPLE SELECTION

Our sample comes from the 17,000 solar twin candidates reported in Yana Galarza et al. (2021b), which were cross-matched with HARPS data and the NASA Exoplanet Archive.

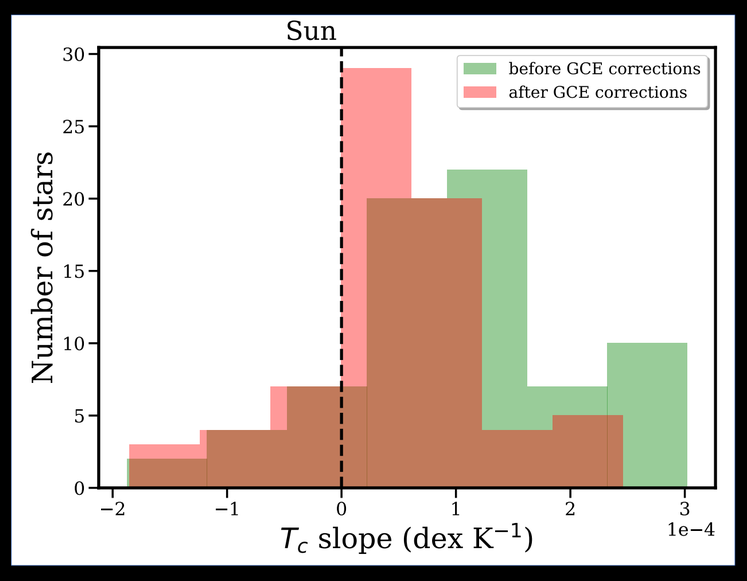


Yana Galarza et al. (2021b)

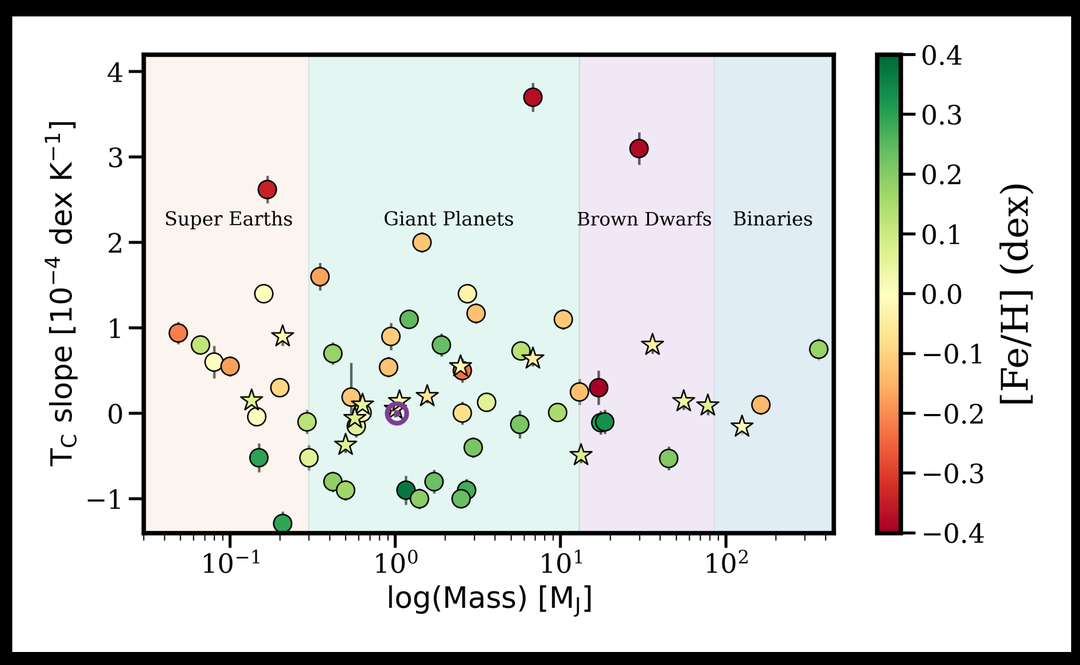
As a result, we found 200 planet-hosting stars, from which 41 are solar twin candidates.

PRELIMINARY RESULTS

In our preliminary results, we find that the Sun is deficient in refractory elements (after correcting by Galactic Chemical Evolution effects) compared to the ~70% of planet-hosting solar-type stars, which was already observed in stars without exoplanets.

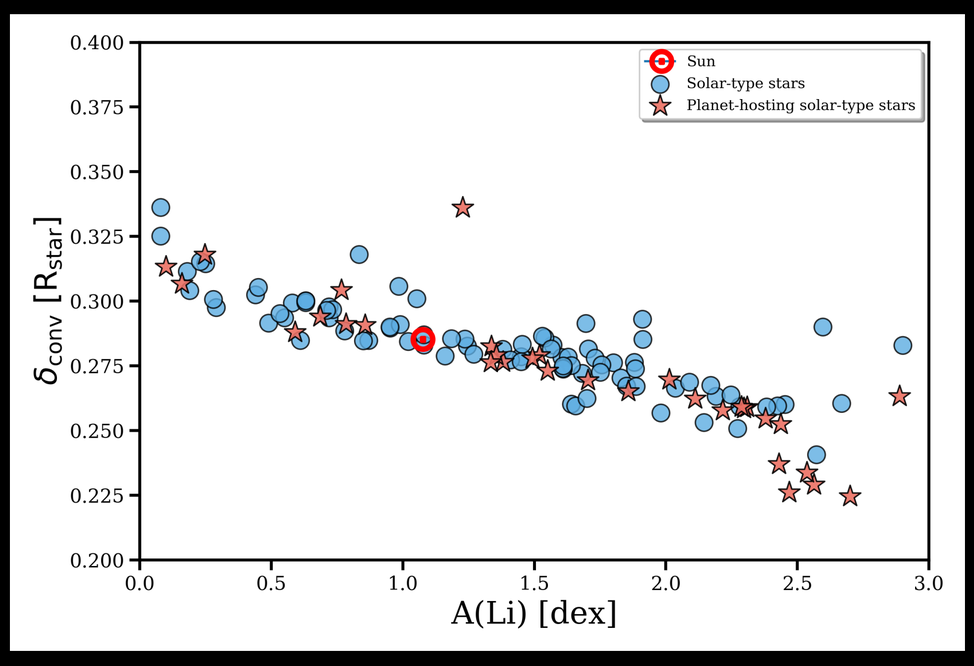


We find no correlation between the Tc-slopes and exoplanetary masses in the systems (from super-Earths to super-Jupyters).



We observe that metal-poor stars ([Fe/H]~-0.3 dex) exhibit positive refractory slopes, while metal-rich stars ([Fe/H]~0.3 dex) exhibit negative slopes, indicating a correlation with metallicity.

The Sun is similarly depleted in Li compared to solar-type stars both with and without exoplanets. Thus, planets would not influence the Li content of stars as previously suggested.



Whether the Sun is an oddball is still under debate. Our Li result suggests that the Sun differs from solar-type stars only in refractory elements, likely due to the formation or engulfment of exoplanets, as has been reported in other stars.