Finding planets using stellar chemical abundances

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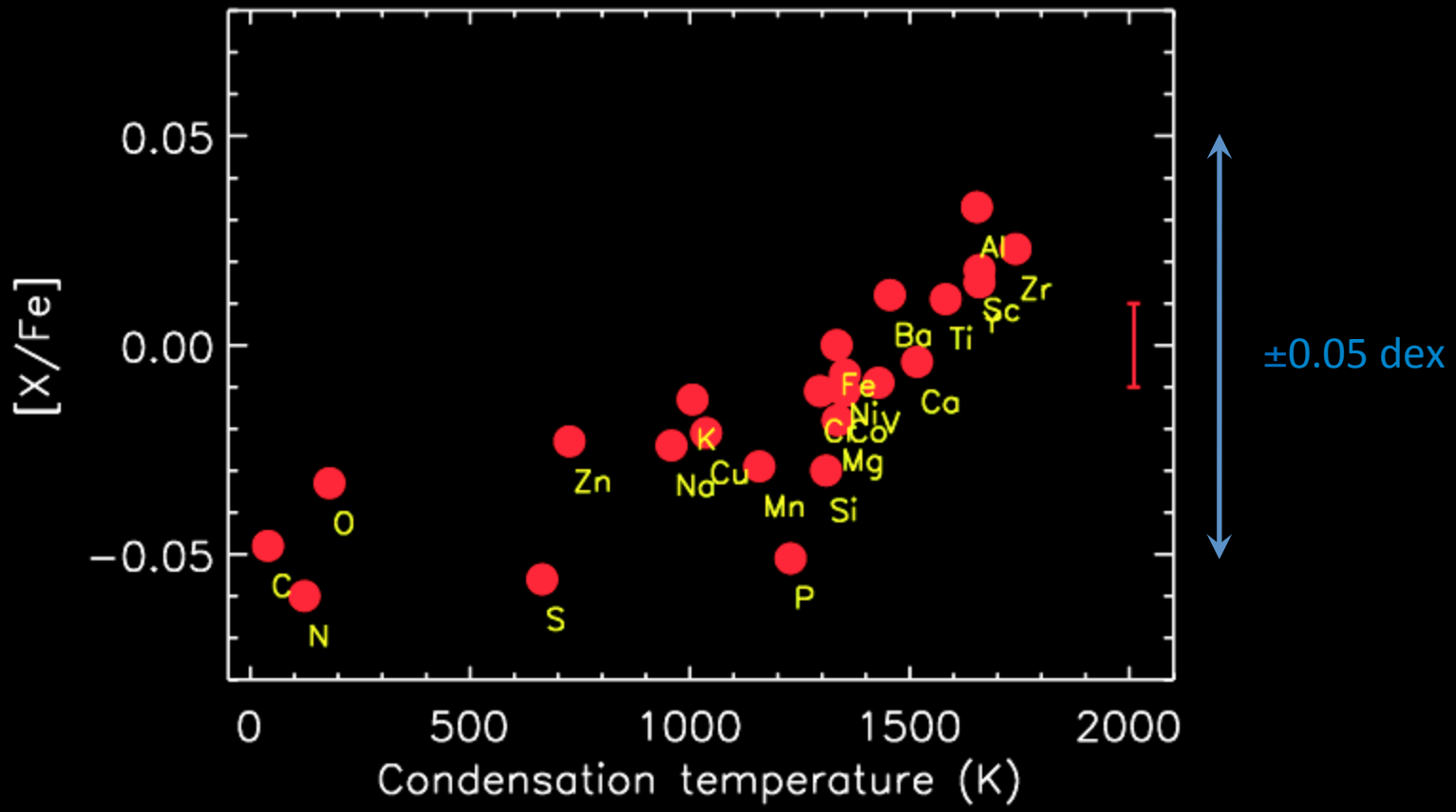
High-precision chemical abundances

Trend with condensation temperature for ***solar twin*** stars

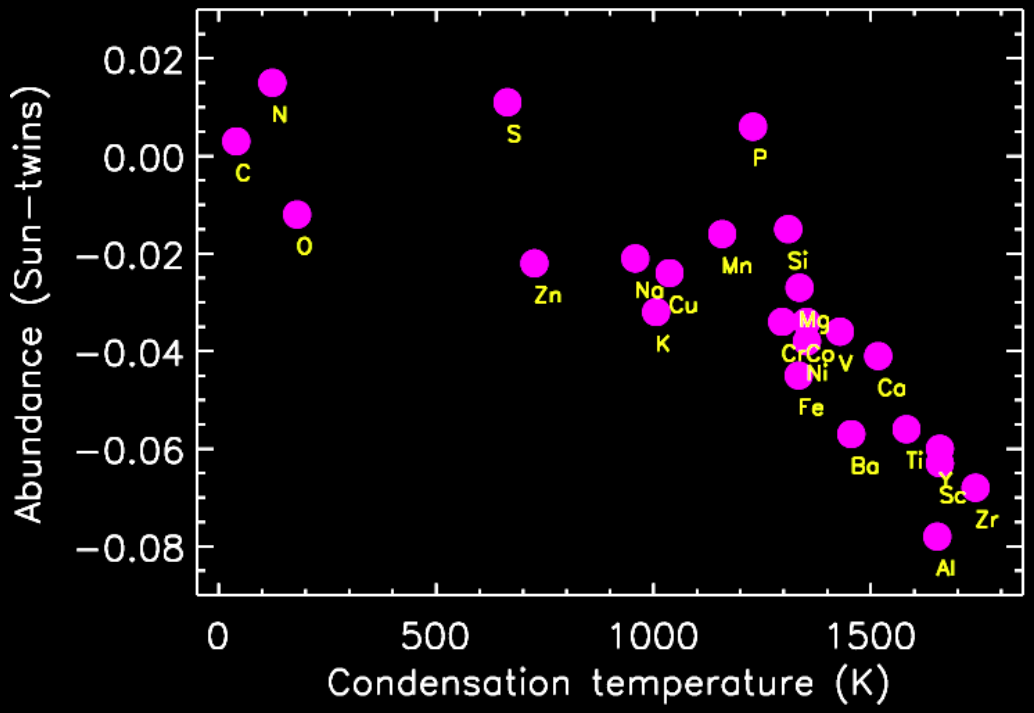


Meléndez et al. (2009)

R=60,000 ; S/N=400 ; 11 solar twins ; ~0.01 dex precision

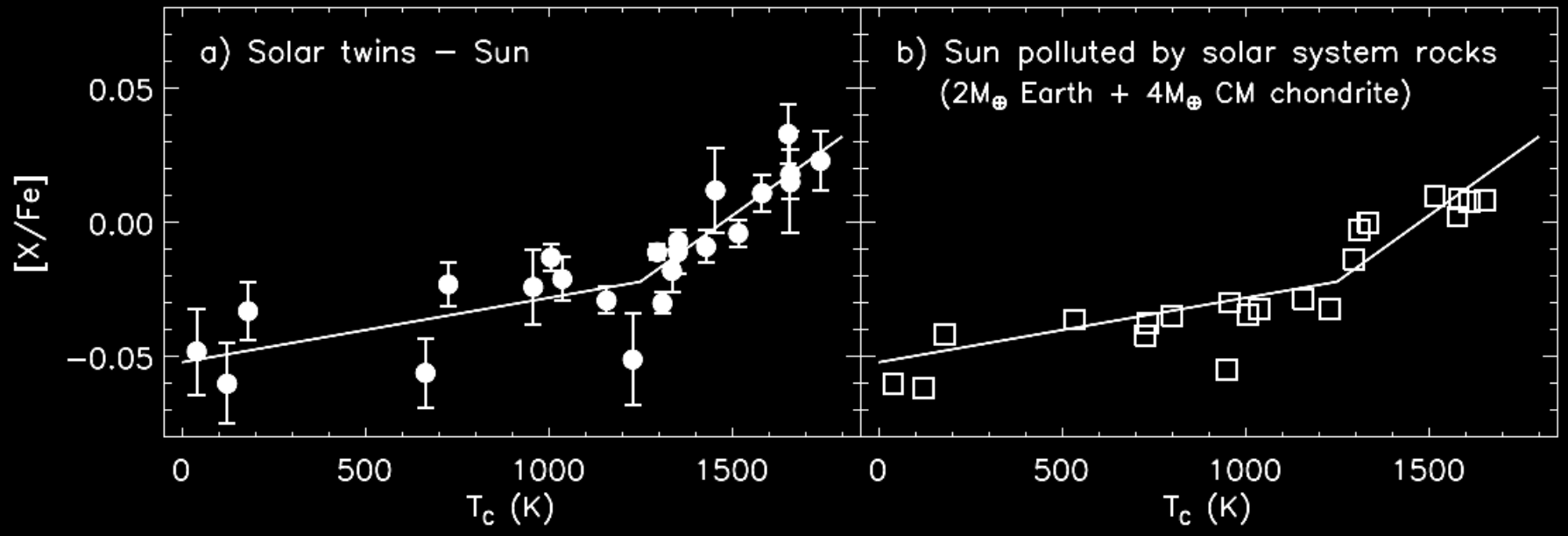
The solar abundance "anomaly"

Compared to most (~85%) solar twins, the Sun is deficient in refractories relative to volatiles (amplitude of ~0.08 dex)



Meléndez et al. (2009, 2012), Ramírez et al. (2009, 2010, 2011)
Gonzalez et al. (2010), González-Hernández et al. (2010), Schuler et al. (2011)

The solar abundance anomaly as a signature of *terrestrial* planet formation

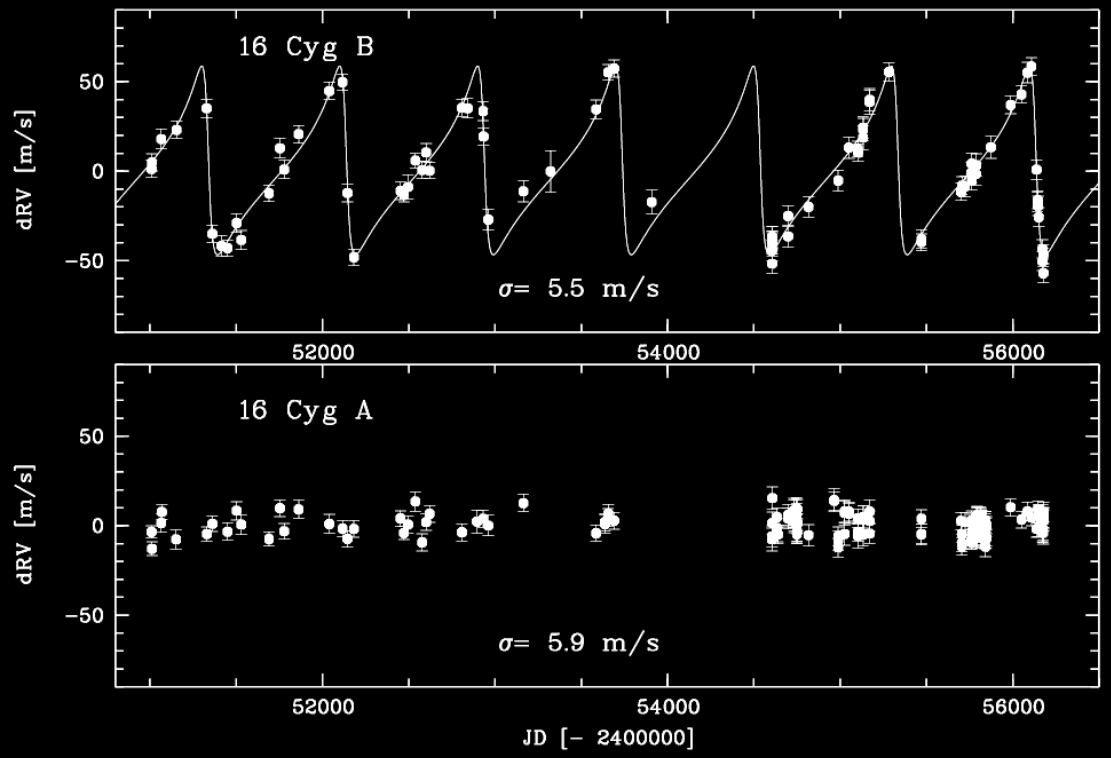


~15% of solar twins have nearly perfect solar abundances

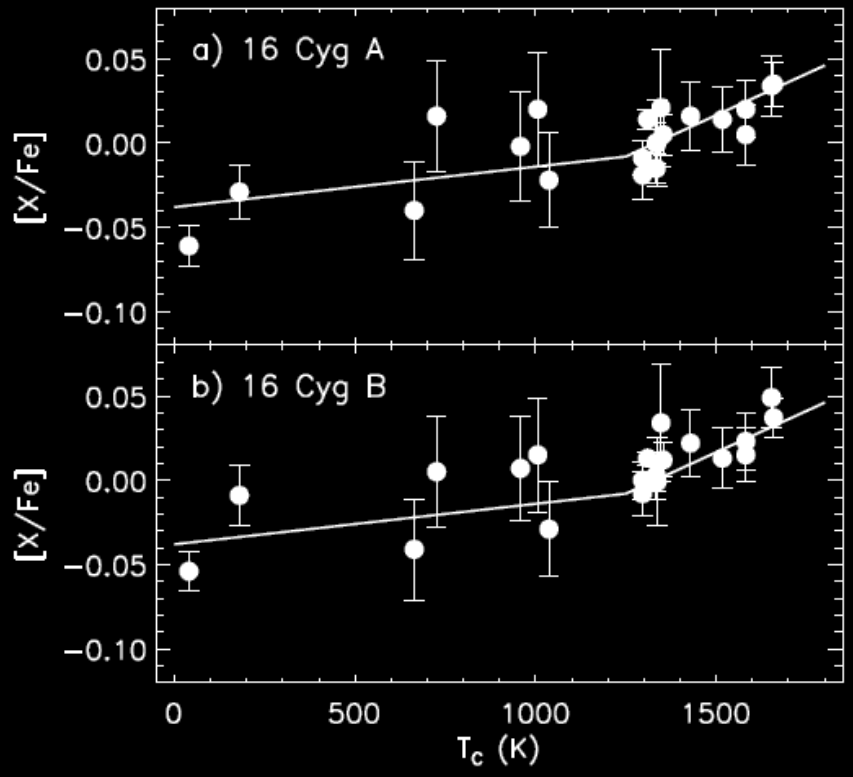
→ ~15% of solar twins formed rocky planets?

The impact of gas giant planet formation: The case of 16 Cygni

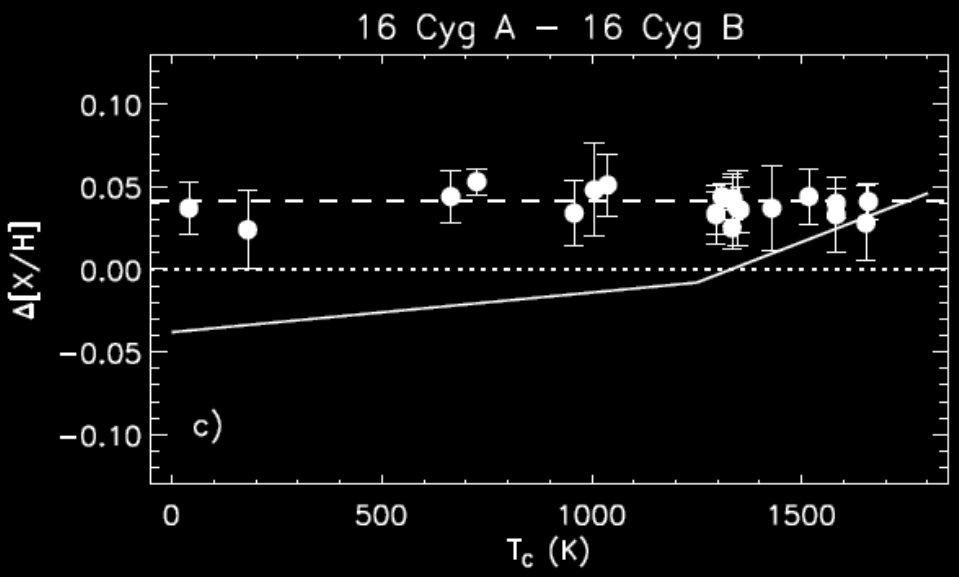
16 Cyg Bb: Msin*i* ~ 1.5M_{Jup}
(Cochran et al. 1997; M. Endl, private comm.)



The impact of gas giant planet formation: The case of 16 Cygni



No rocky planets around either one of them



Is 16 Cyg Bb responsible for this?

Ramírez et al. (2011)

Planet signatures in stellar chemical abundances: follow-up work

- Large ESO Program (HARPS): 88 solar twins
  + Magellan/MIKE spectra of S/N>500

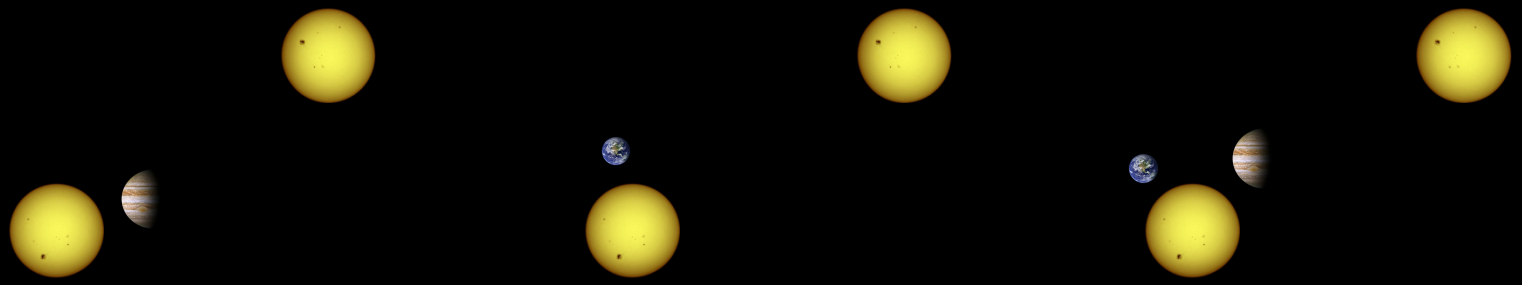
- Beyond Solar Twins: F-type dwarfs and metal-rich solar analogs
  * VLT spectra of S/N>300

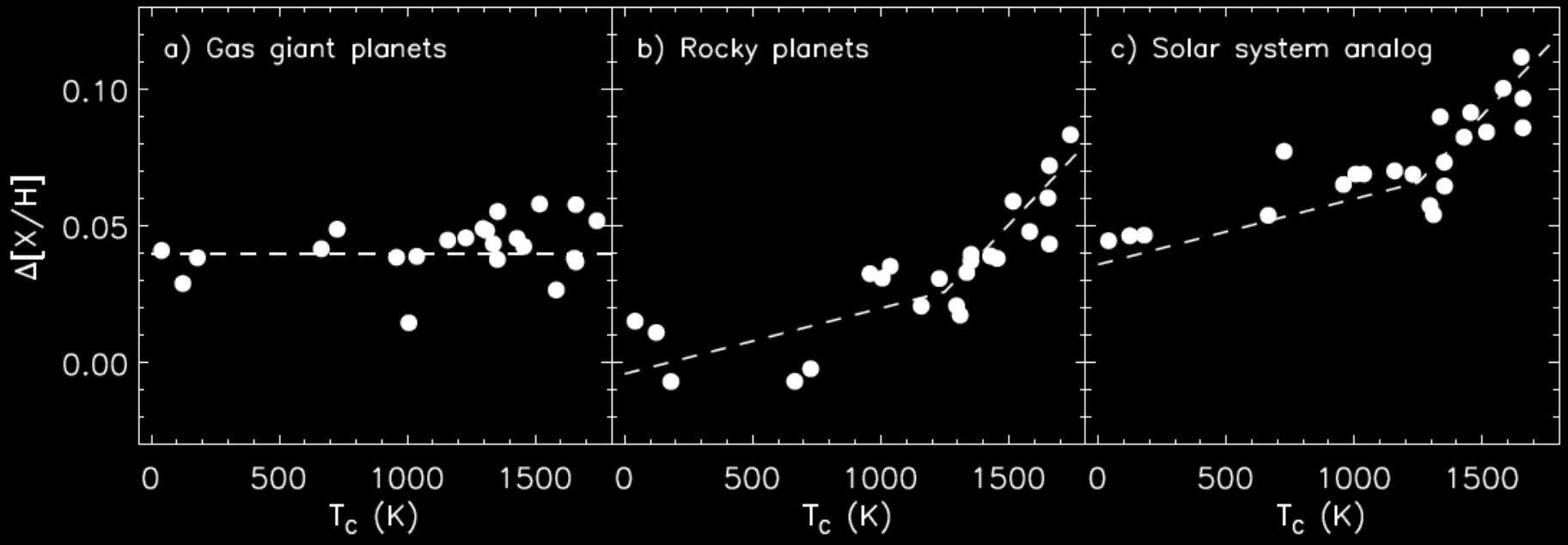
- High-precision spectroscopy of wide binaries

- Planet signatures in open cluster stars
  (Hyades, Coma Ber, Ruprecht 147, M67)

- Detailed analysis of individual stars

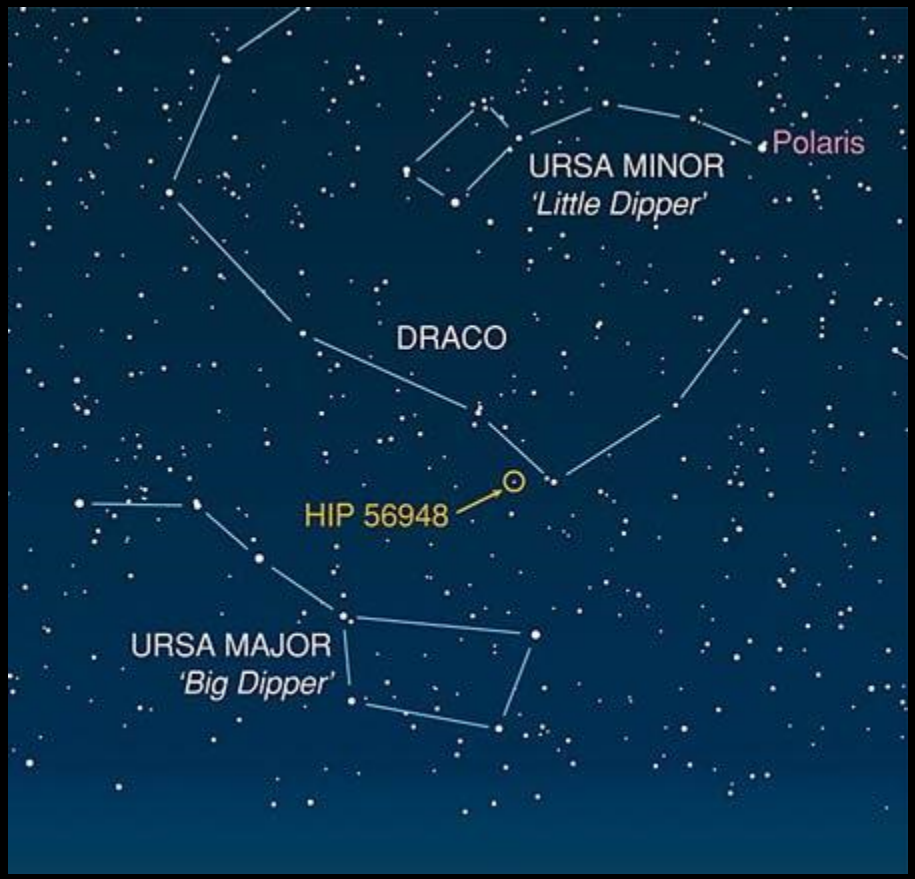
Signatures of planet formation in wide binaries with similar components

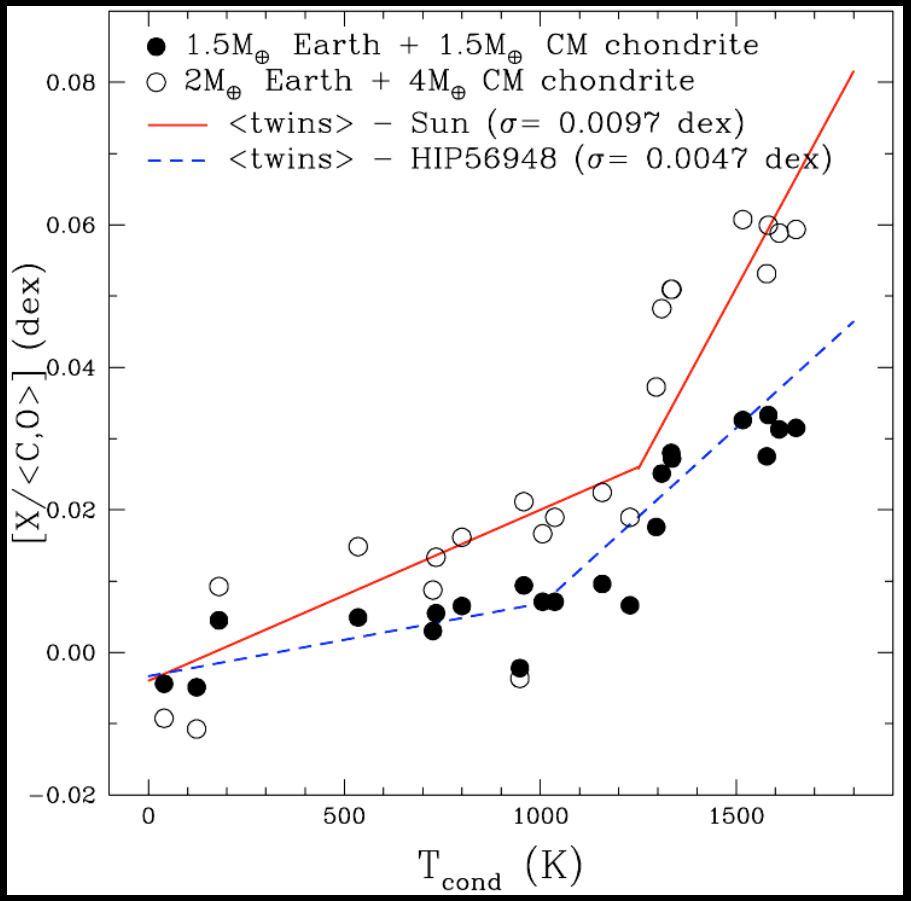




HIP 56948: best solar twin known to date

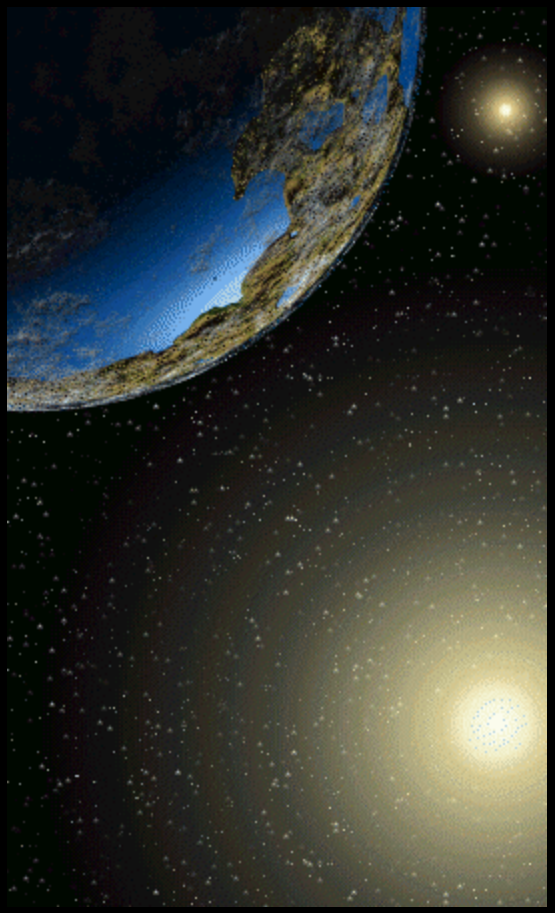
$\Delta T_{\rm eff}$ (K)	$\Delta\log g$ (dex)	Δ[Fe/H] (dex)	Δv_t (km s^{-1})	ΔLi (NLTE) (dex)	$\Delta v \sin i$ (km s^{-1})	Method	Reference
17 ± 7	$+0.02 \pm 0.02$	$+0.02 \pm 0.01$	$+0.01 \pm 0.01$	0.23 ± 0.05	$+0.01 \pm 0.03$	spectroscopy	This work

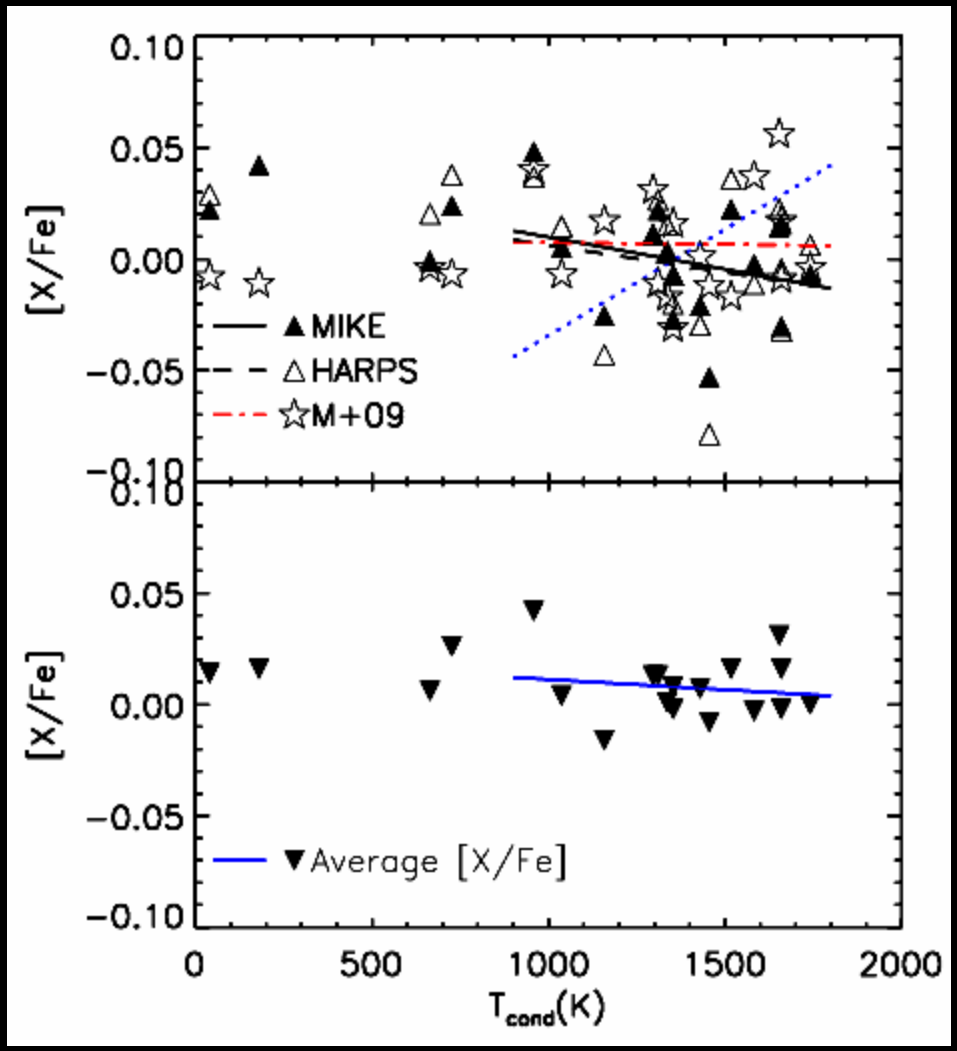




Meléndez et al. (2012)

α Cen A: also a rocky planet host?





Baumann, Ramírez, et al. (in preparation)