The Chemical Homogeneity of Sun-like Stars in the Solar Neighborhood

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79 stars
30 elemental abundances
0.01 dex precision
HARPS Solar Twin Planet Search
5 years, 100 nights, 68 stars
P.I. Jorge Melendez

Coadded spectra: median SNR ~ \textbf{1000} pix$^{-1}$ @ 600nm

Exoplanets: see Bedell+2015; Melendez, Bedell+2016
The limiting factor in a high-resolution, high-SNR spectroscopic abundance analysis is not in the data but in the stellar models employed.

Brewer+2016

Valenti & Fischer 2005

Adibekyan+2012
We can side-step this problem with twin stars* and achieve 0.01 dex or 2% precision on abundances (a factor of 5 better than a typical spectroscopic analysis!)

* Typical definition of a “twin”:
  \[ \Delta \text{Teff} \lesssim 100 \text{ K}, \]
  \[ \Delta \log(g) \lesssim 0.1 \text{ dex}, \]
  \[ \Delta [\text{Fe/H}] \lesssim 0.1 \text{ dex} \]
Age uncertainty
\(~ 0.5 \text{ Gyr} \)
What is the dimensionality of abundance space?

(preliminary) work with David W. Hogg
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How do age & composition relate to kinematics?

Beane, Ness, & Bedell arxiv:1807.05986
Galactic chemical evolution

Chemical tagging prospects

79 stars
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0.01 dex precision

Nucleosynthetic yields

Elemental age-dating
EXTRA SLIDES
How do these data constrain galactic evolution models?

With Jan Rybizki (very preliminary work):

Chempy best-fit single-zone model for each star
Variance (dex²)