



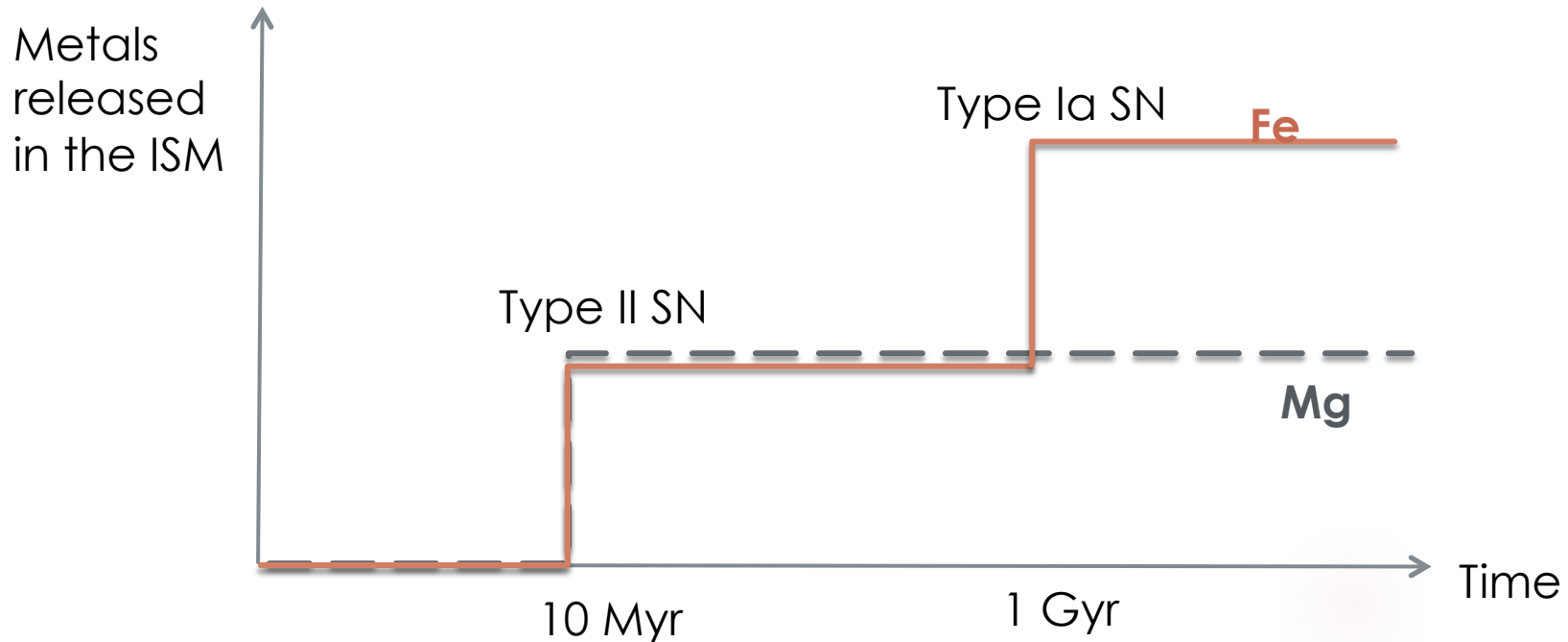
Young alpha rich stars in the solar neighbourhood

(MNRAS in press, arXiv:1412.3453)

MARIE MARTIG (MPIA), with the
APOKASC team

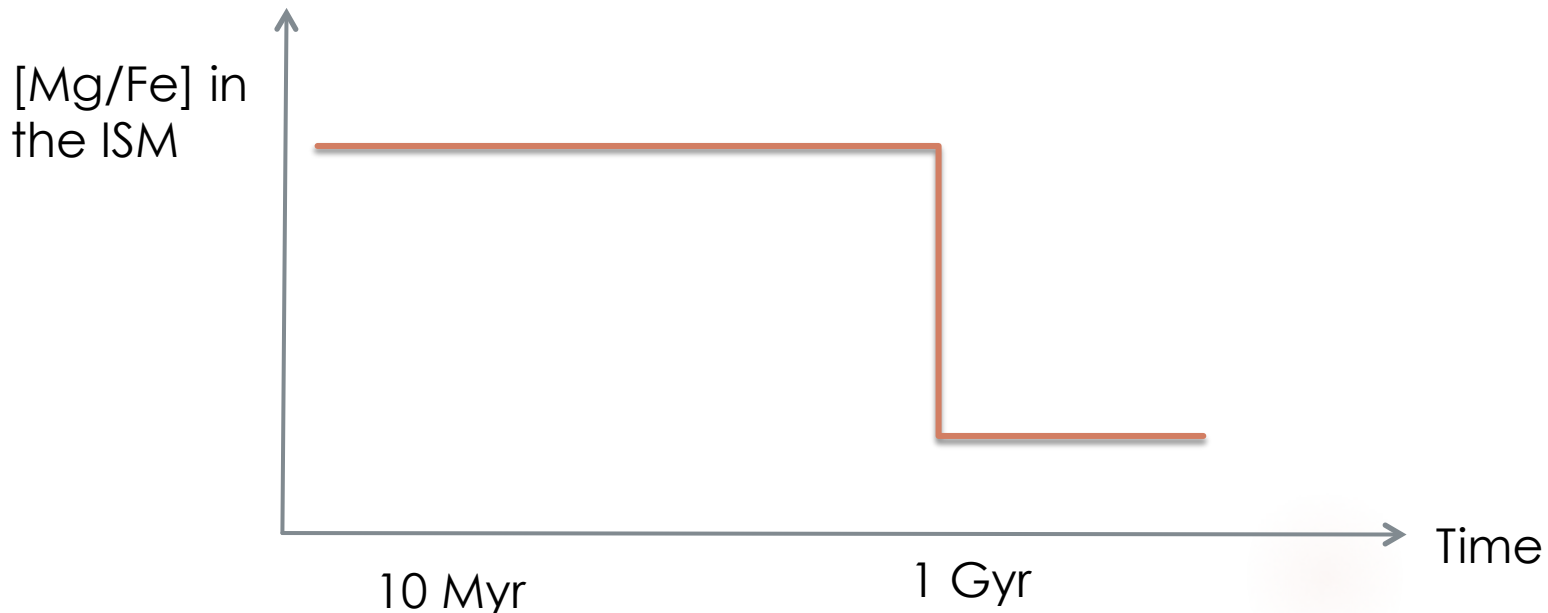
alpha rich stars are expected to be old

- ▶ Nucleosynthesis in Type II vs Type Ia supernovae



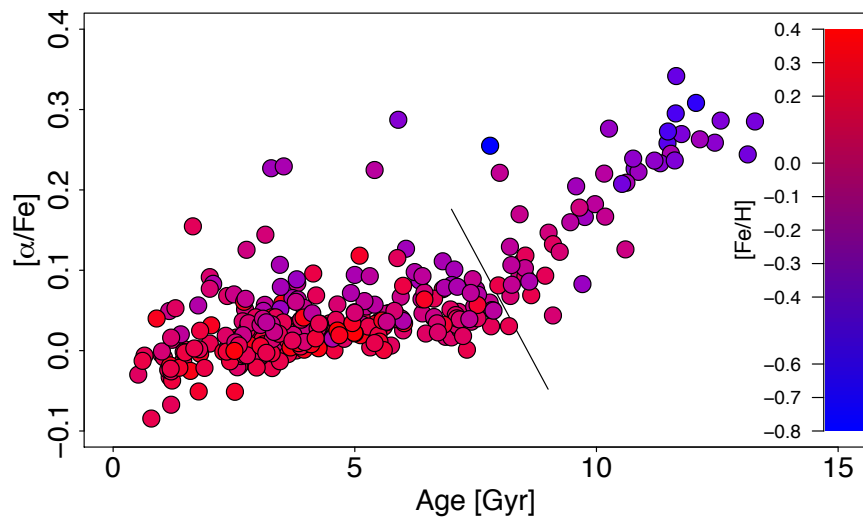
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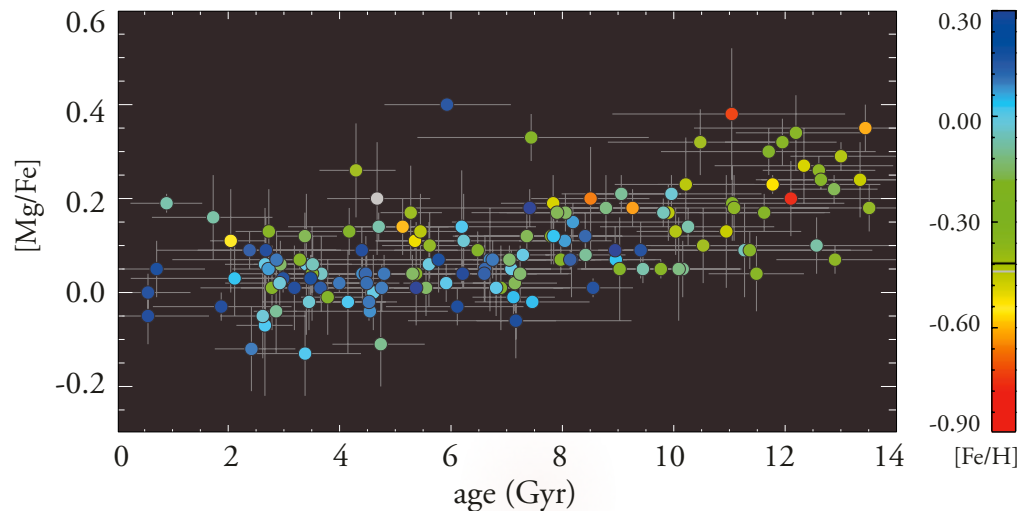


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- ▶ alpha rich stars are old

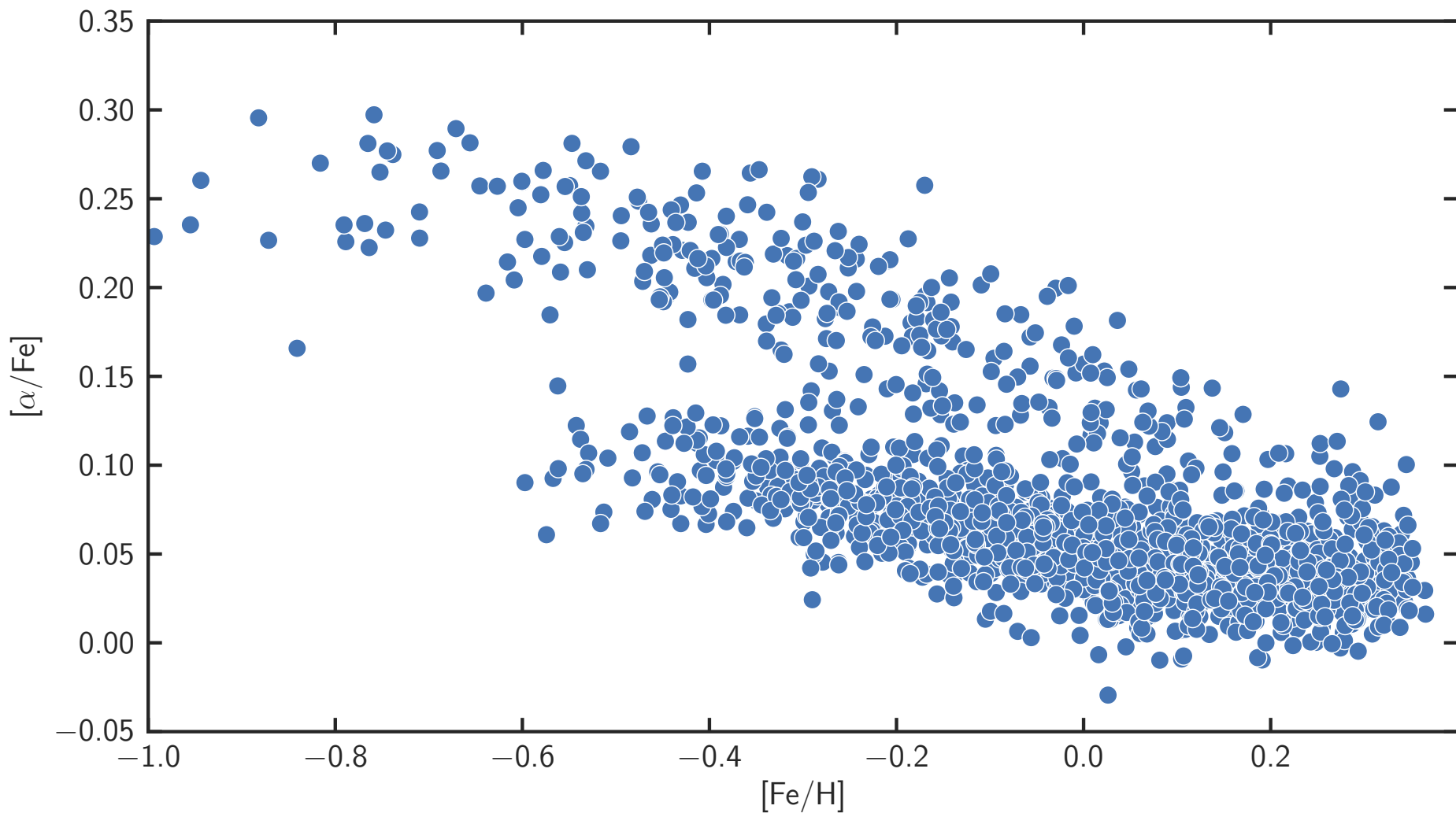


Haywood et al 2013



Bergemann et al 2014

1600 stars in the APOKASC sample (APOGEE + Kepler)

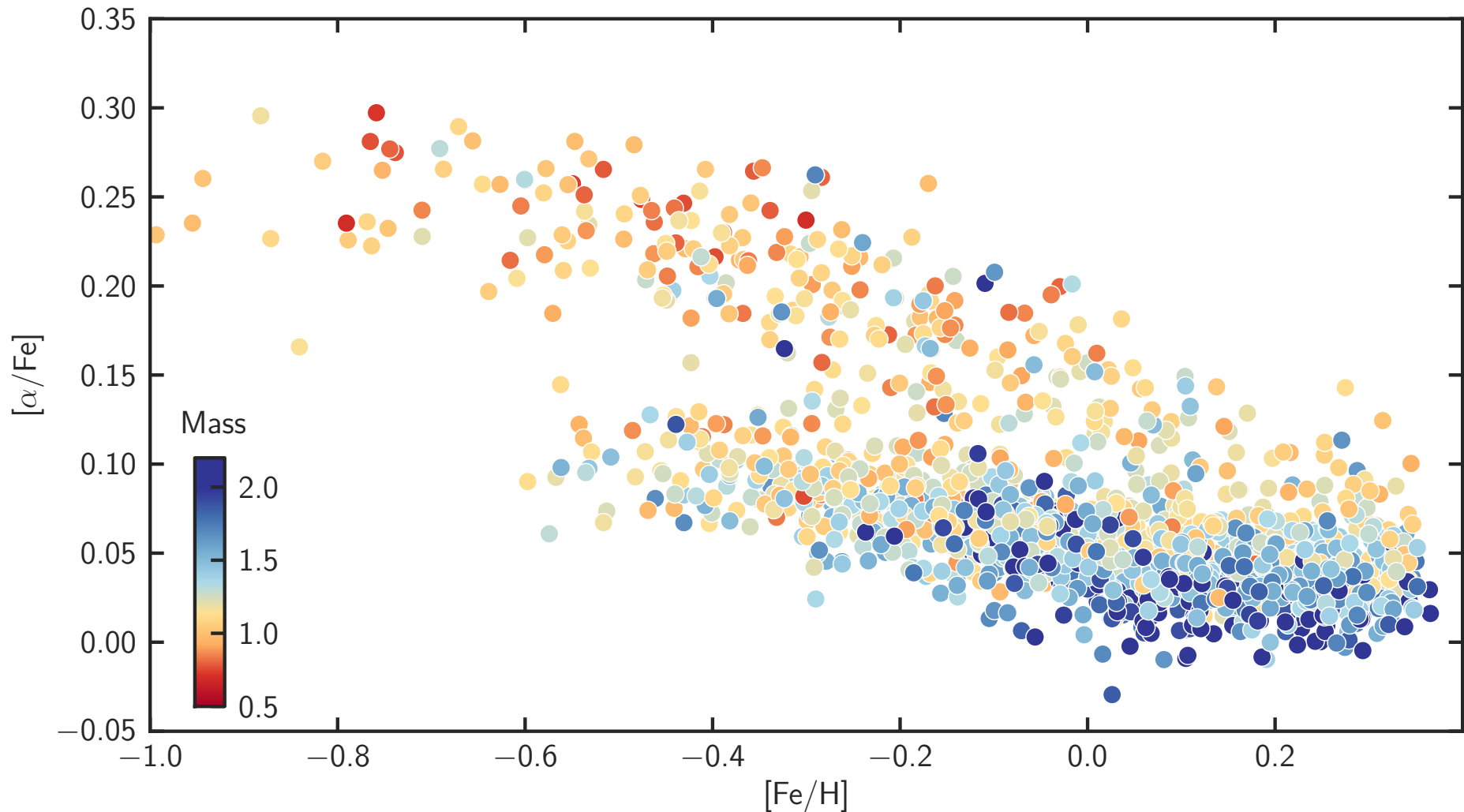


Seismic scaling relations

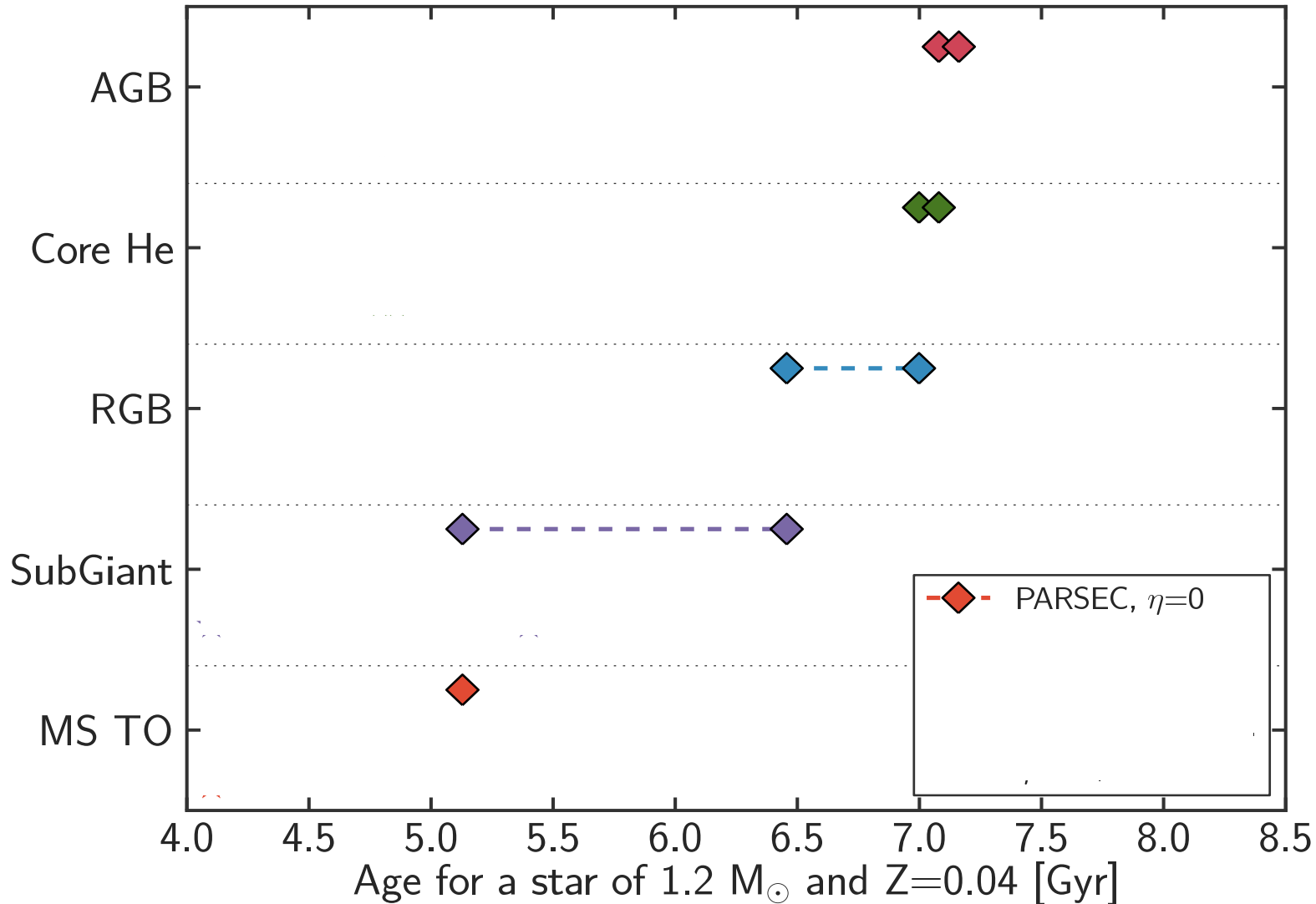
$$\left\{ \begin{array}{l} \nu_{\max} \propto g T_{\text{eff}}^{-1/2} \propto M R^{-2} T_{\text{eff}}^{-1/2} \\ \Delta\nu \propto \rho^{1/2} \propto M^{1/2} R^{-3/2} \end{array} \right.$$

$$\longrightarrow M = \left(\frac{\nu_{\max}}{\nu_{\max,\odot}} \right)^3 \left(\frac{\Delta\nu}{\Delta\nu_{\odot}} \right)^4 \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{1.5}$$

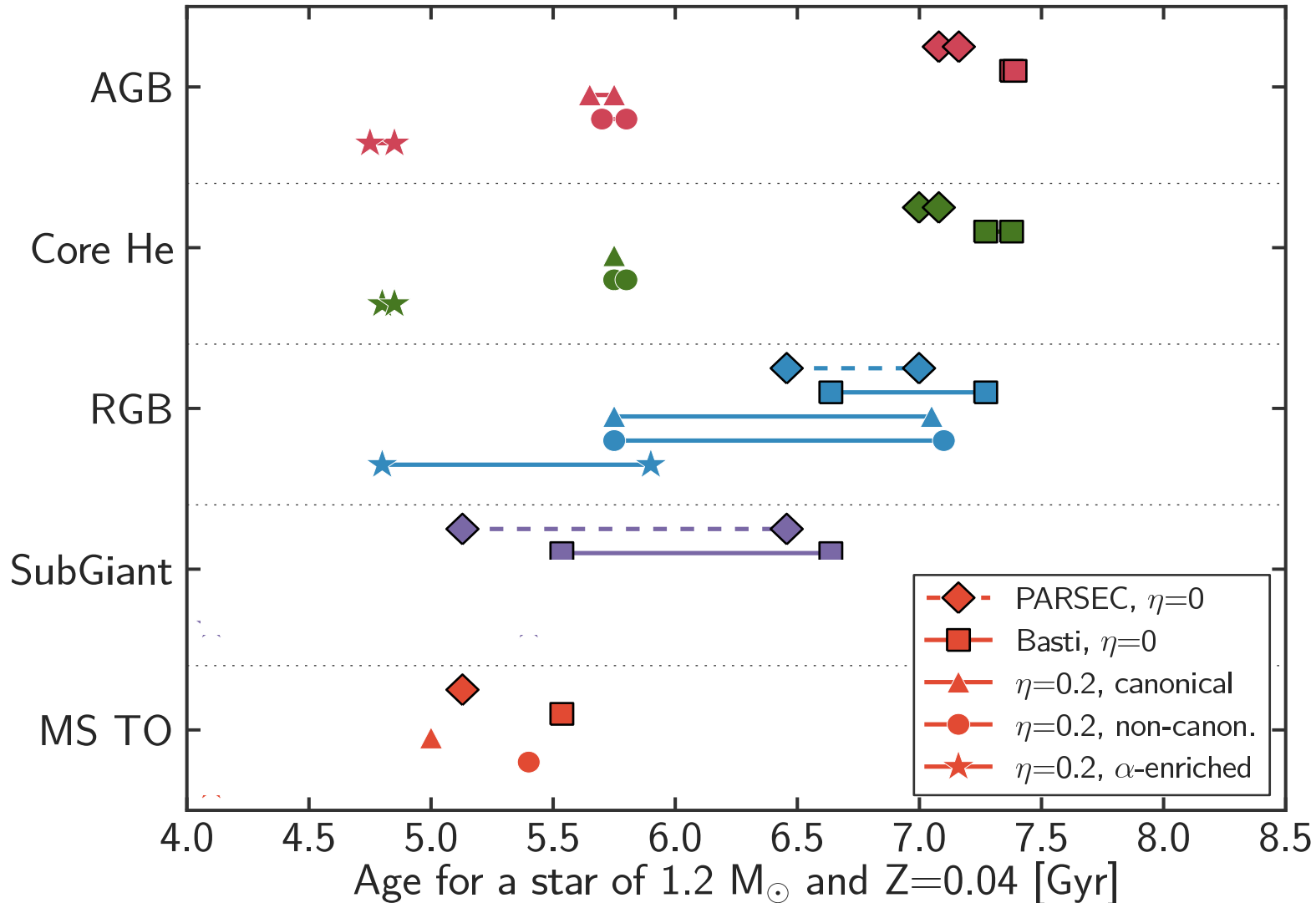
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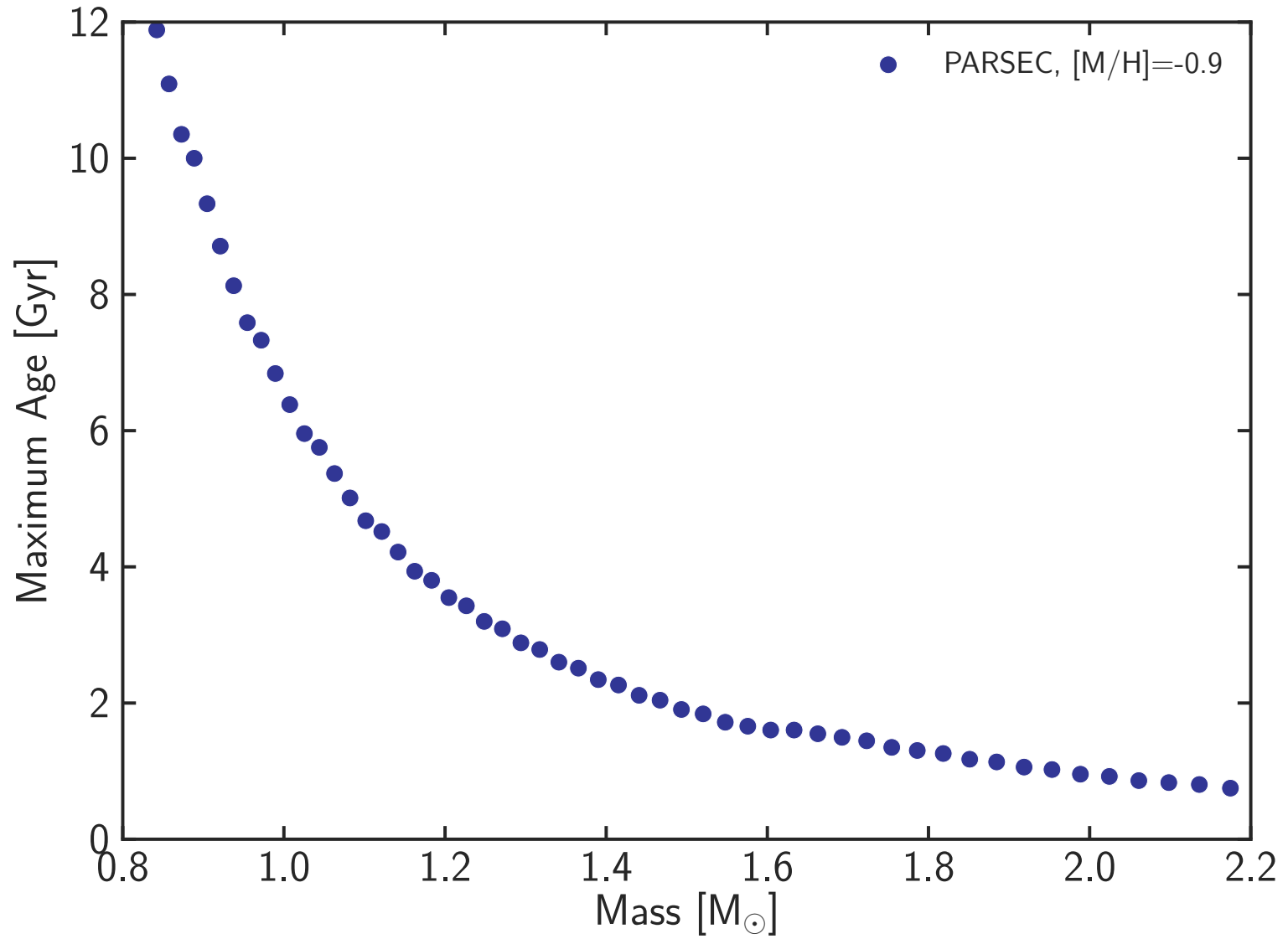
From mass to age



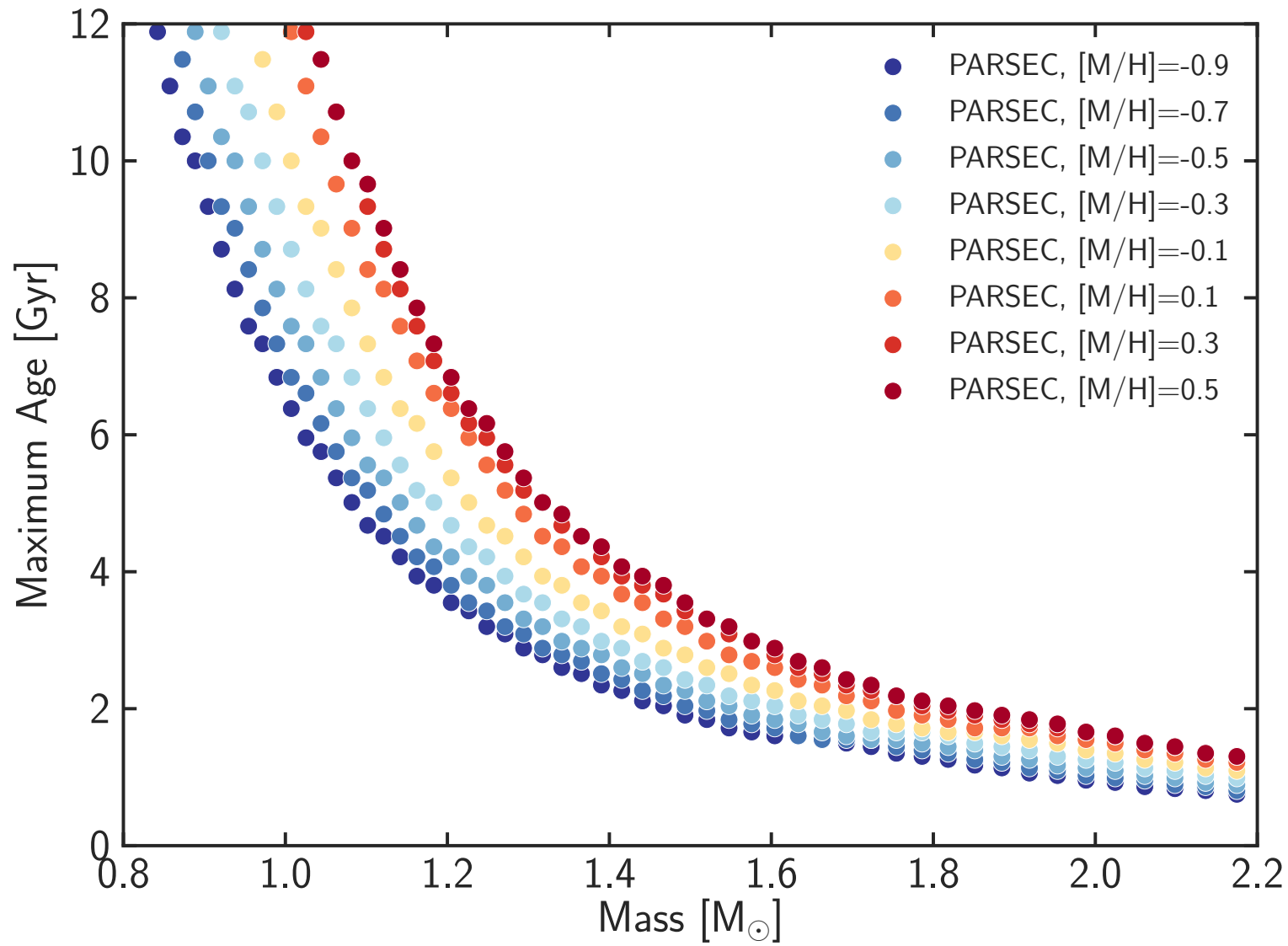
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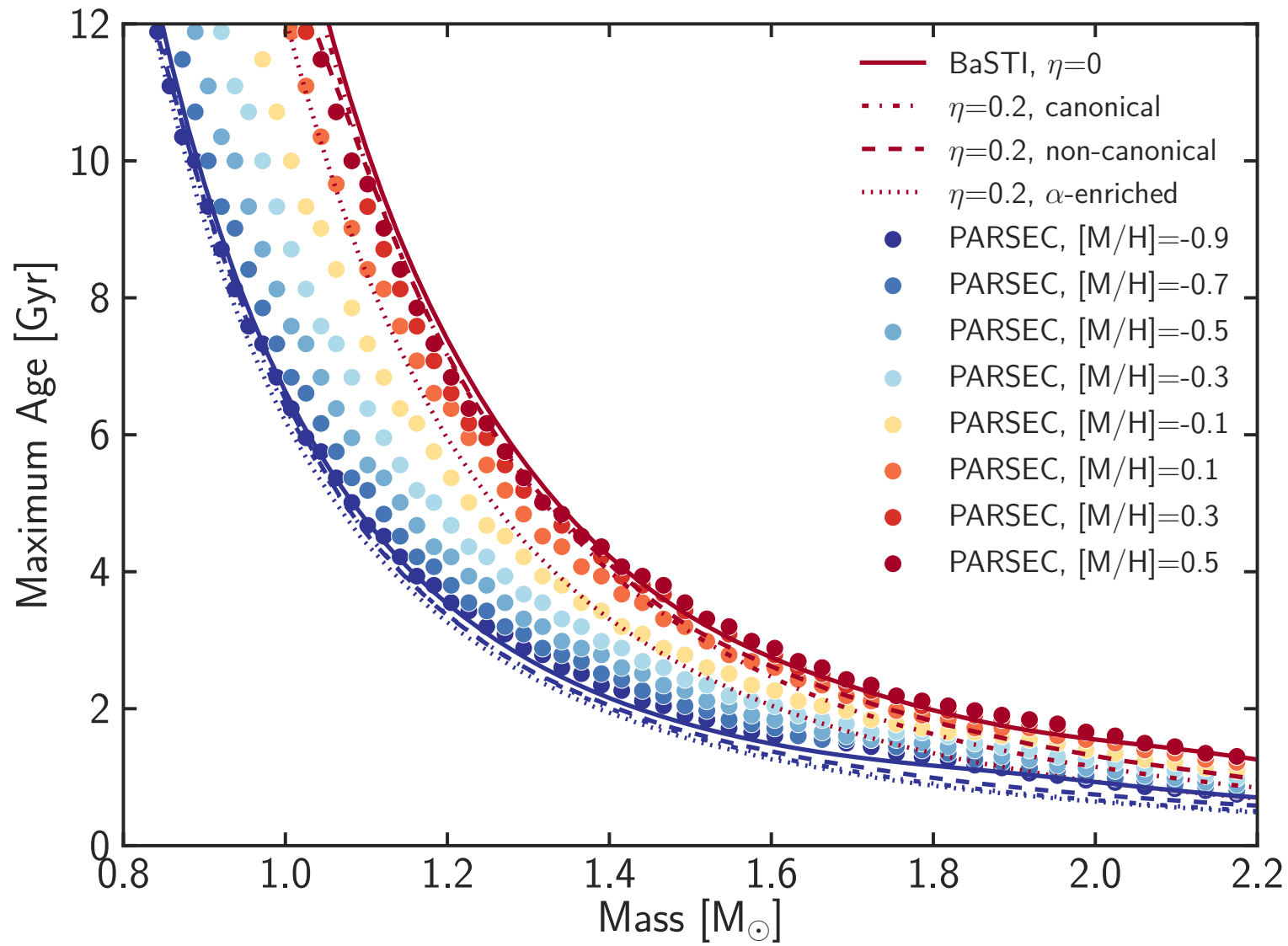
A simple way to get upper limits on ages



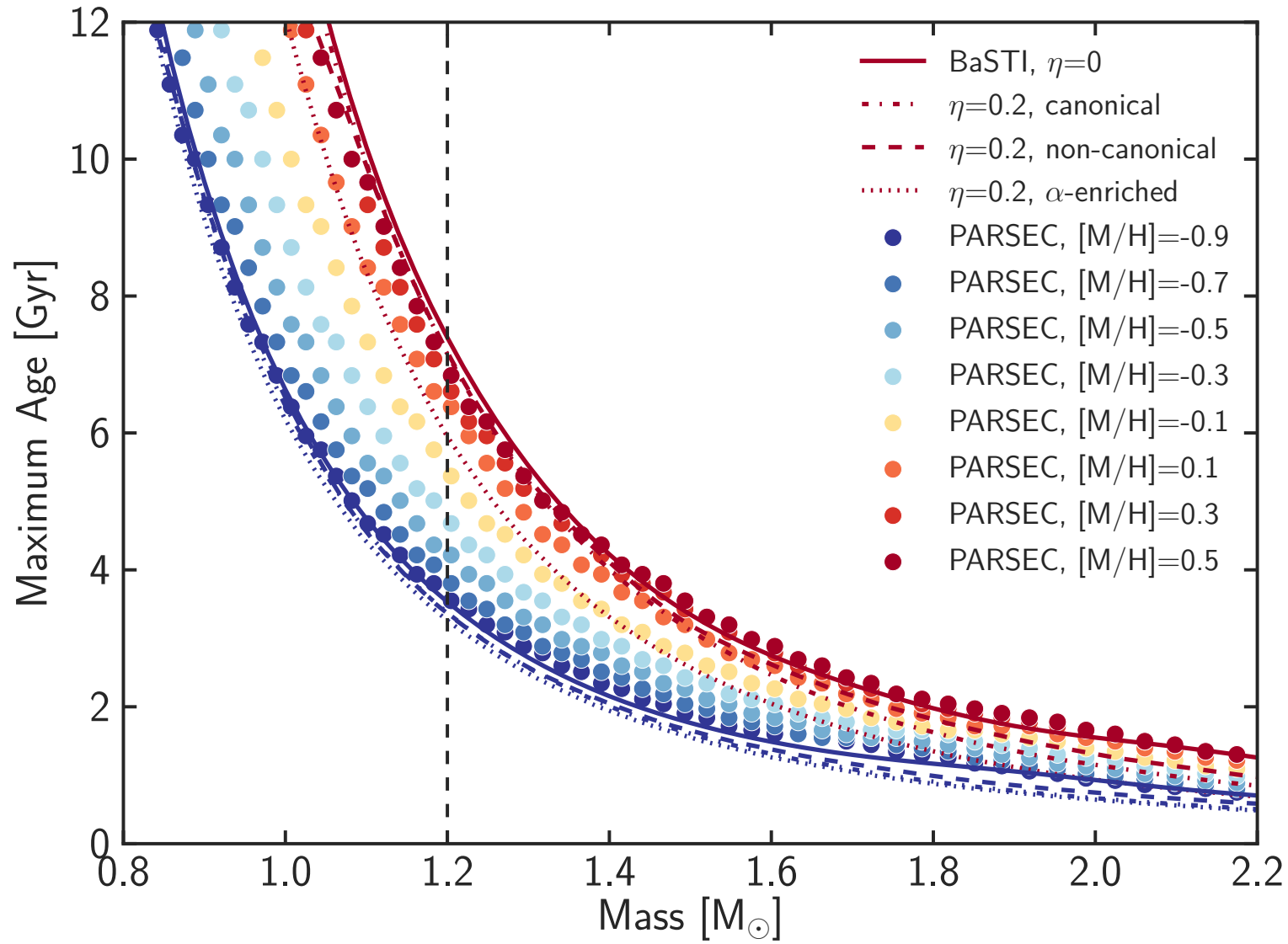
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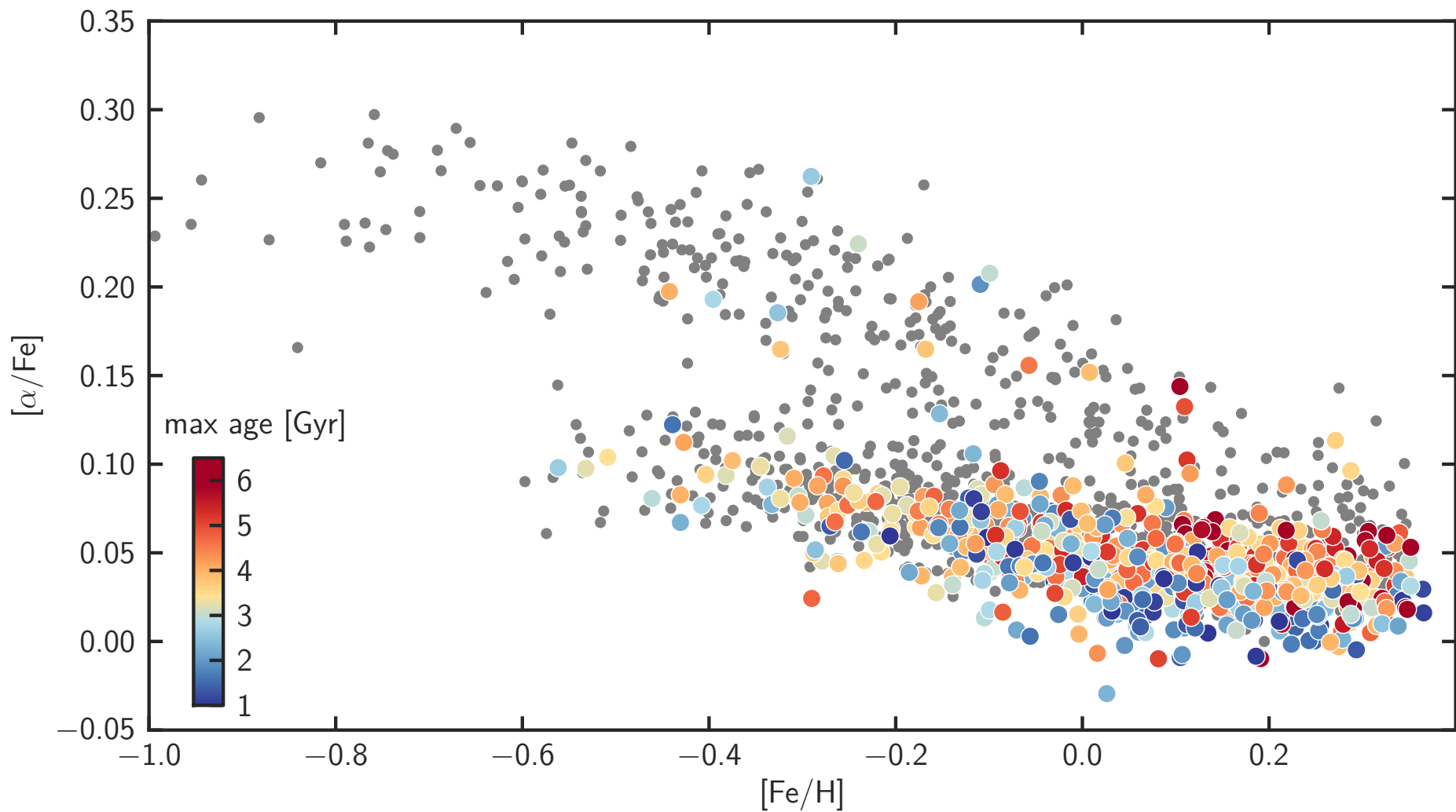
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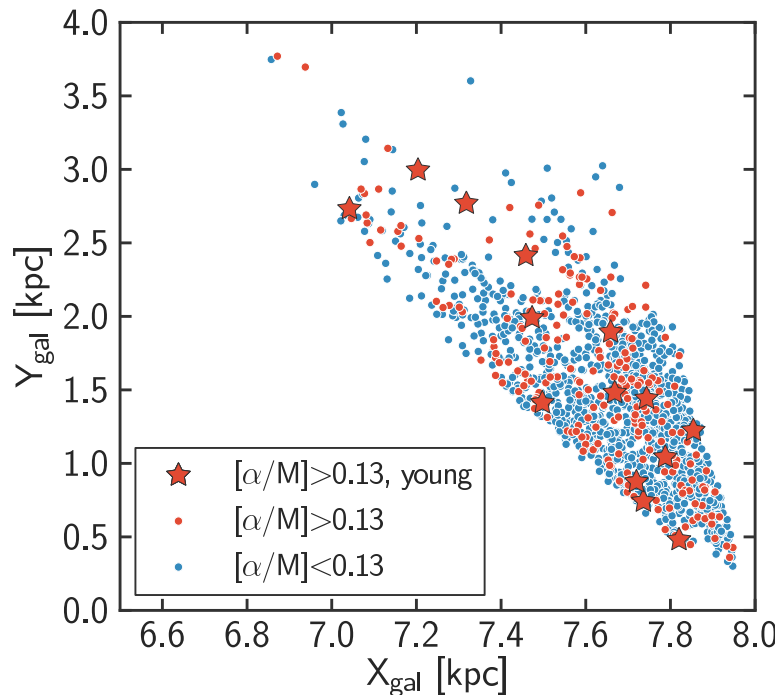


14 young alpha enriched stars



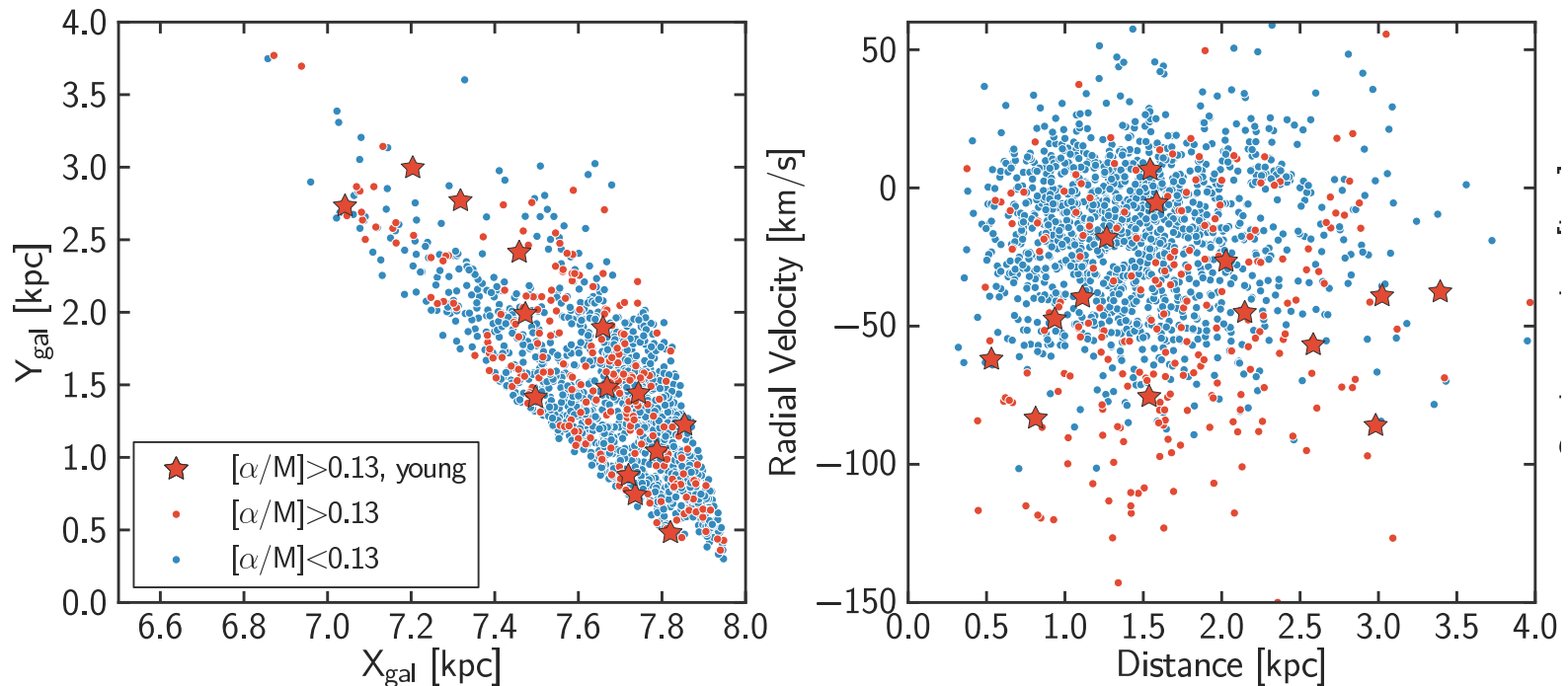
14 young alpha enriched stars

- ▶ Visual inspection of spectra and light curves: OK
- ▶ No anomalous surface rotation, low radial velocity scatter
- ▶ Spatial and velocity distribution typical of other alpha rich stars



14 young alpha enriched stars

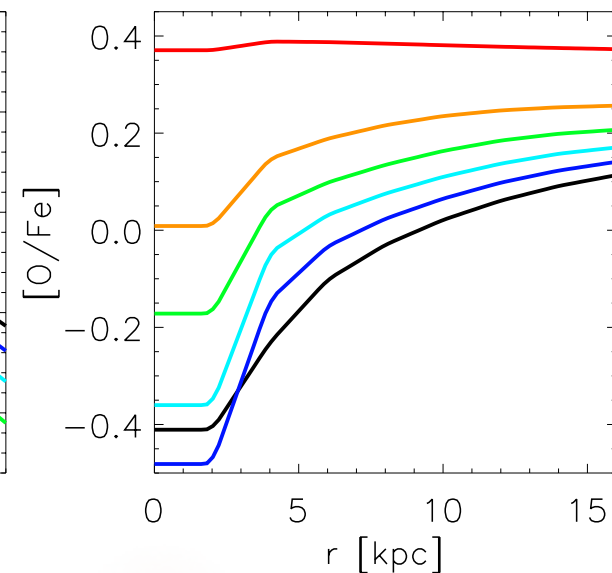
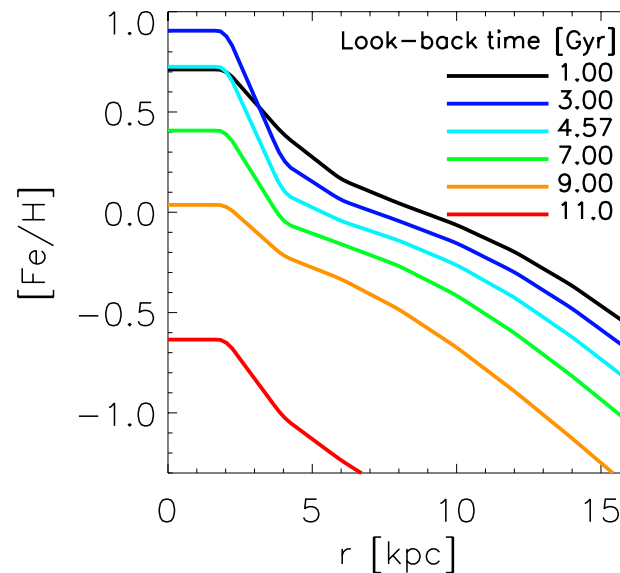
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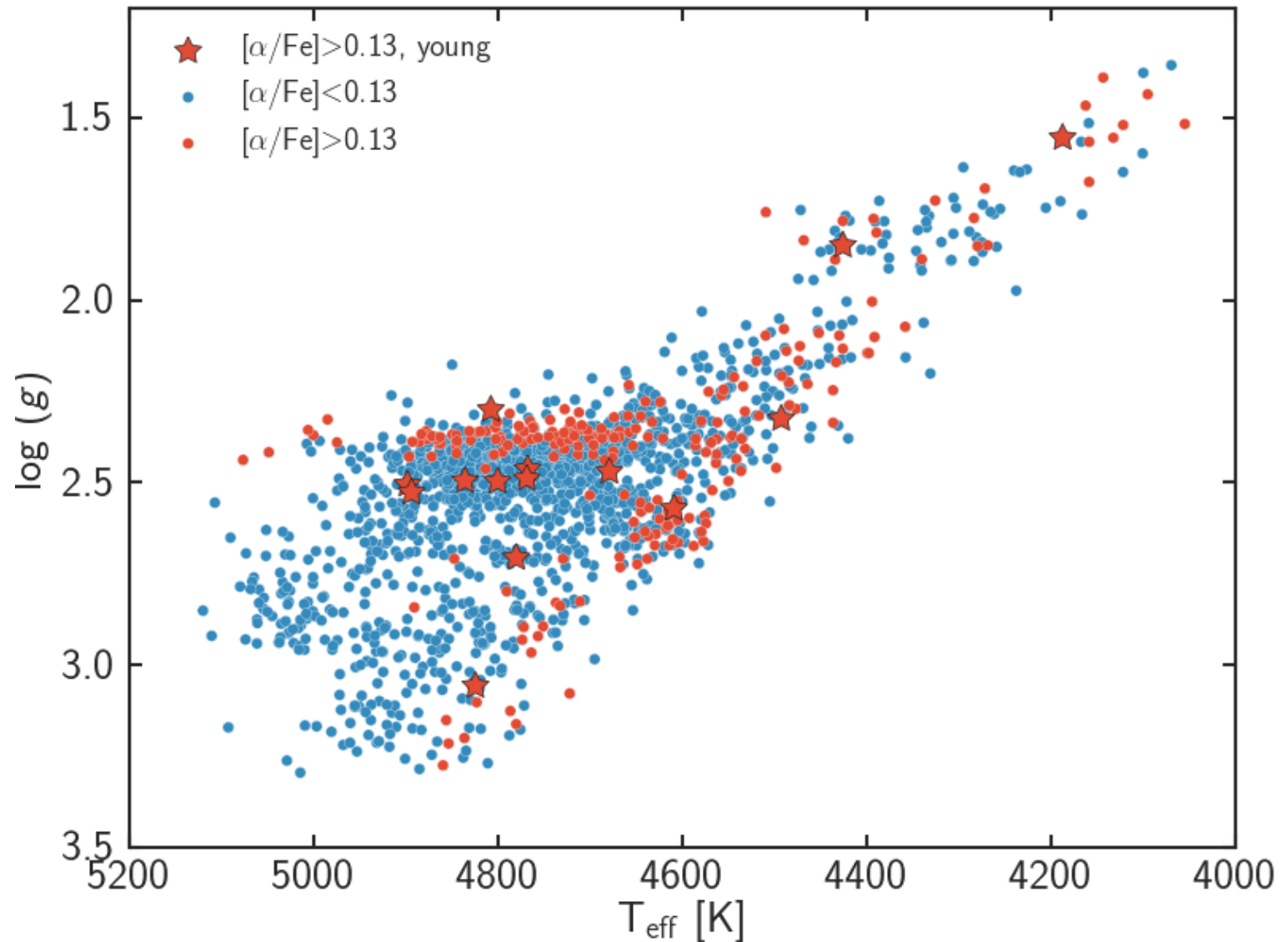
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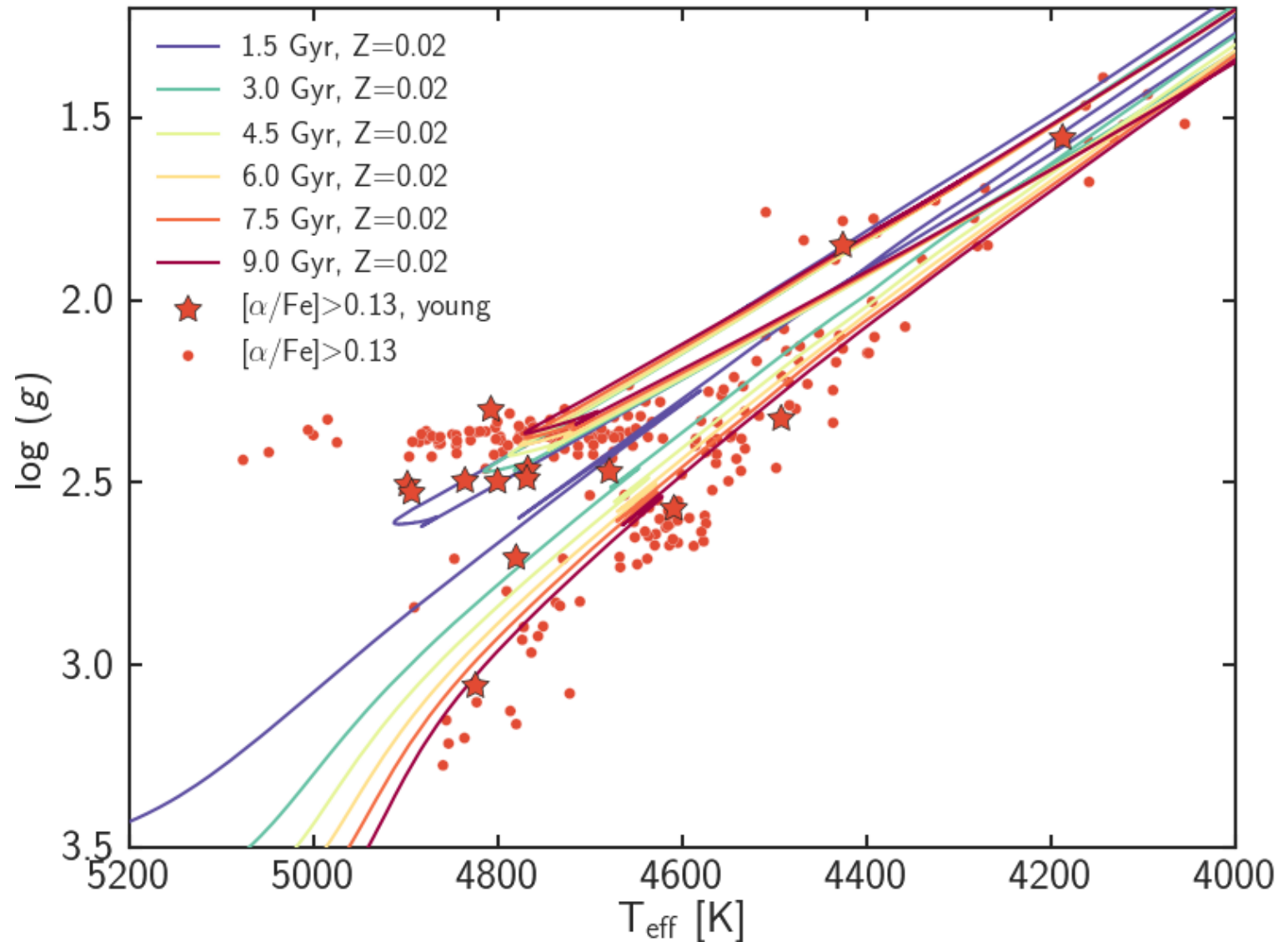
Not predicted
by standard
chemical evolution
models



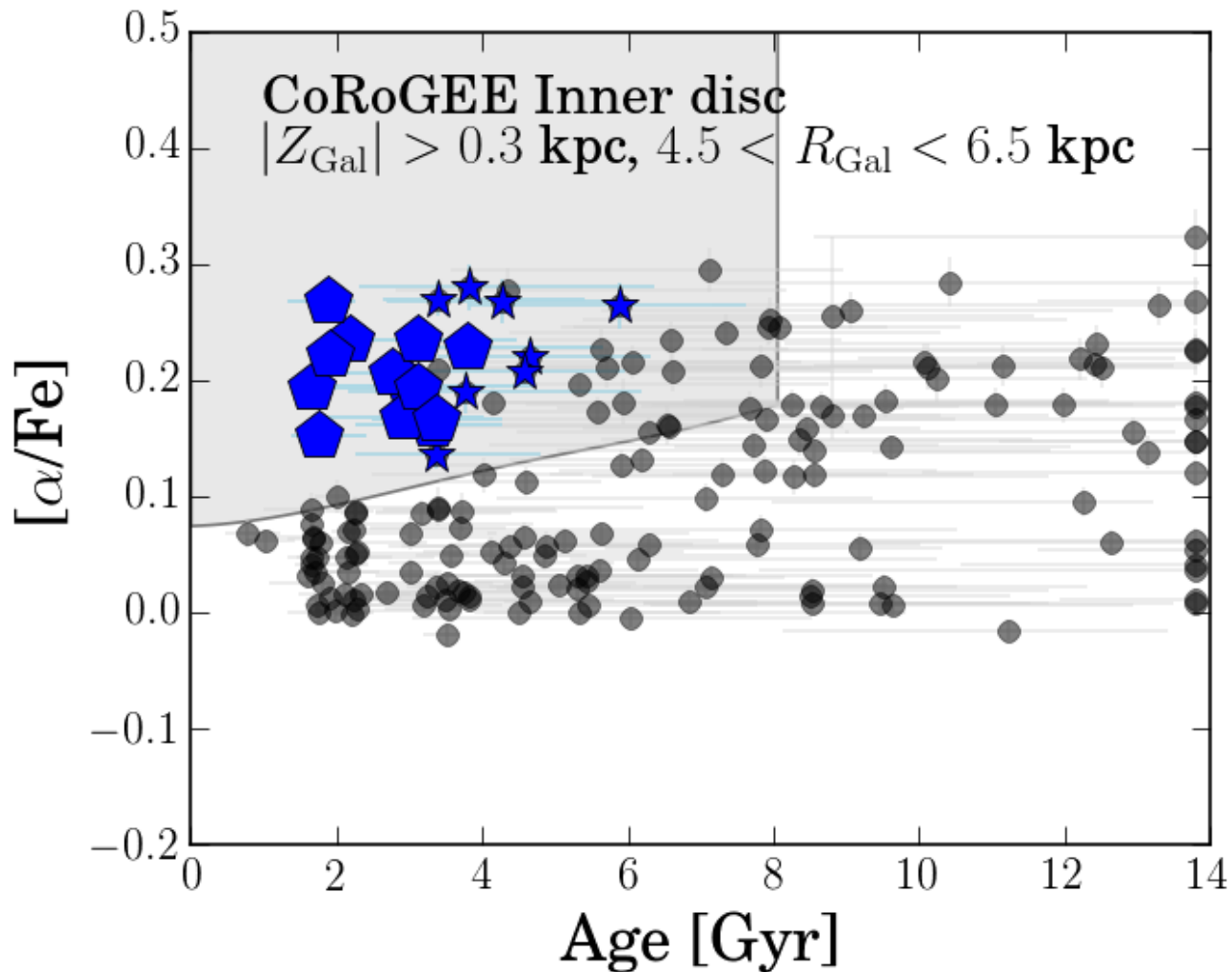
For RC stars, young ages consistent with isochrones



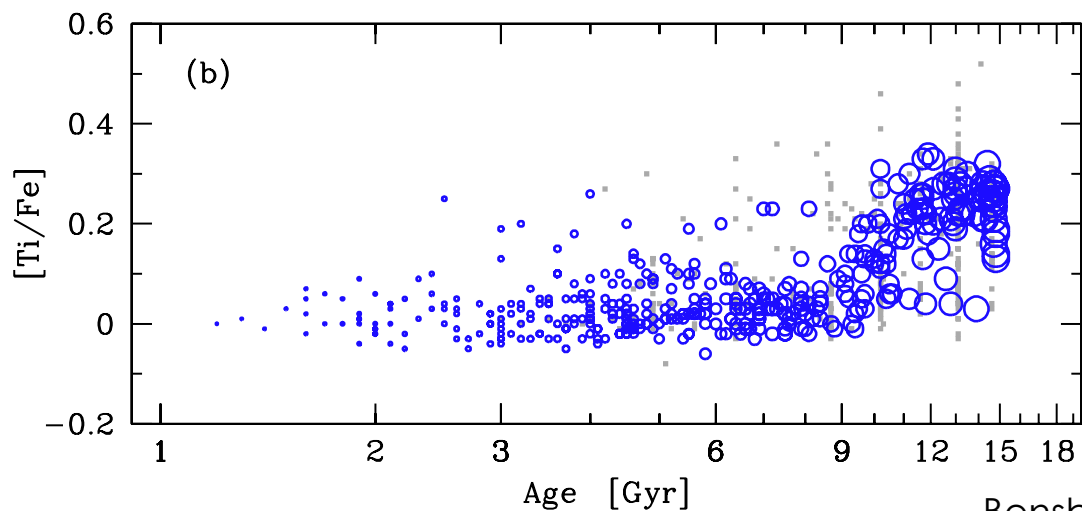
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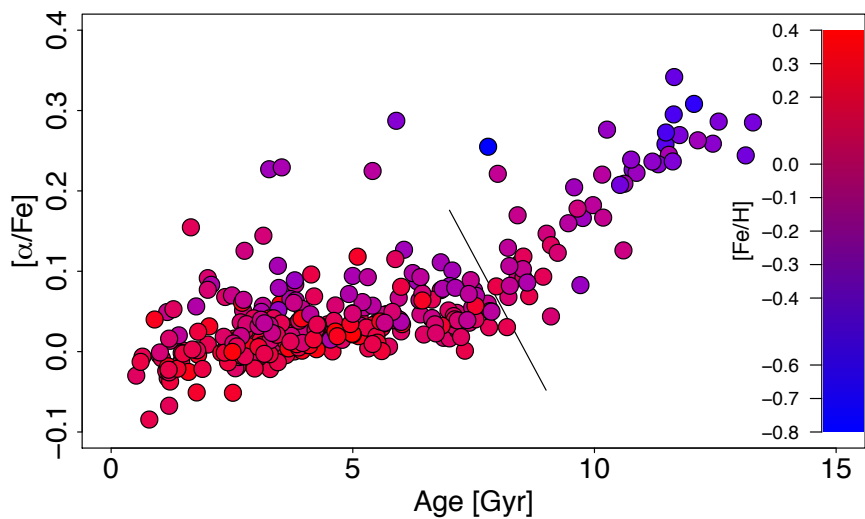
Other examples of alpha-rich young stars – (1) CoRoGEE



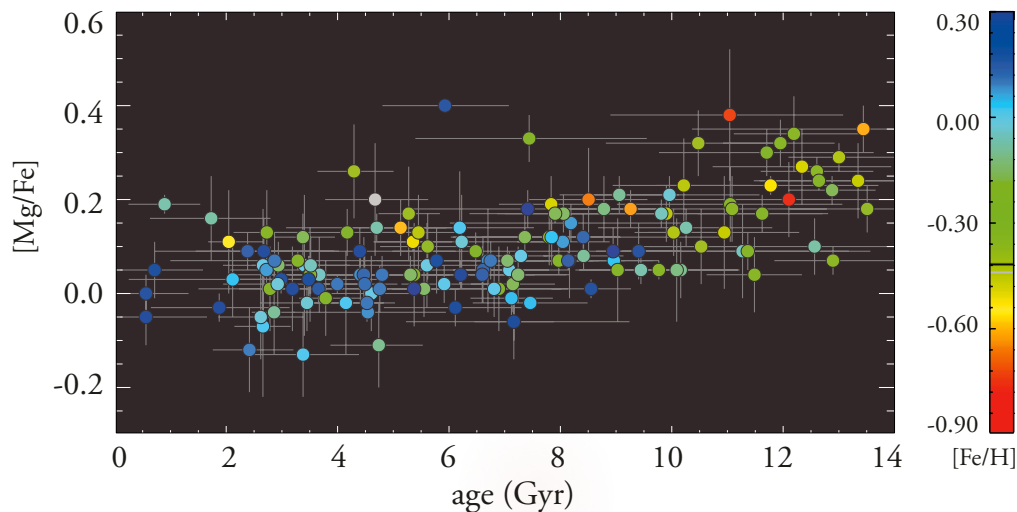
Other examples of alpha-rich young stars – (2) near the Sun



Bensby et al 2014

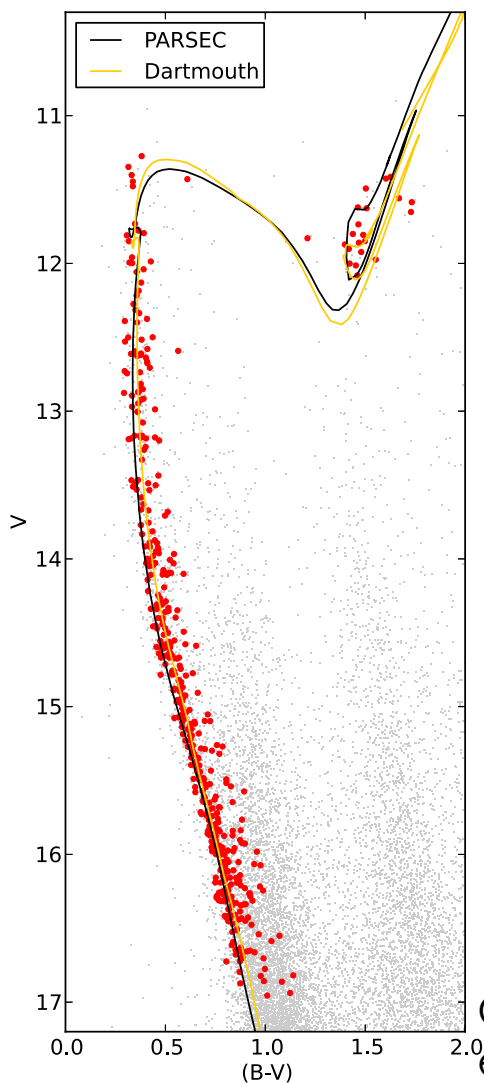
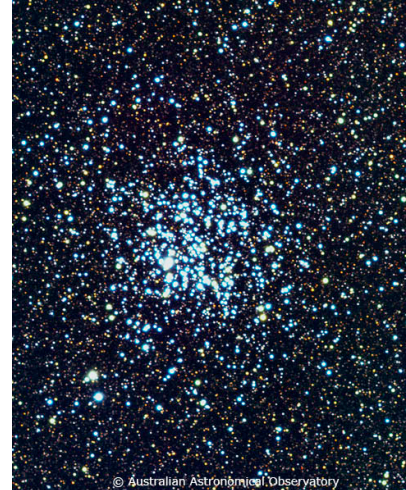


Haywood et al 2013

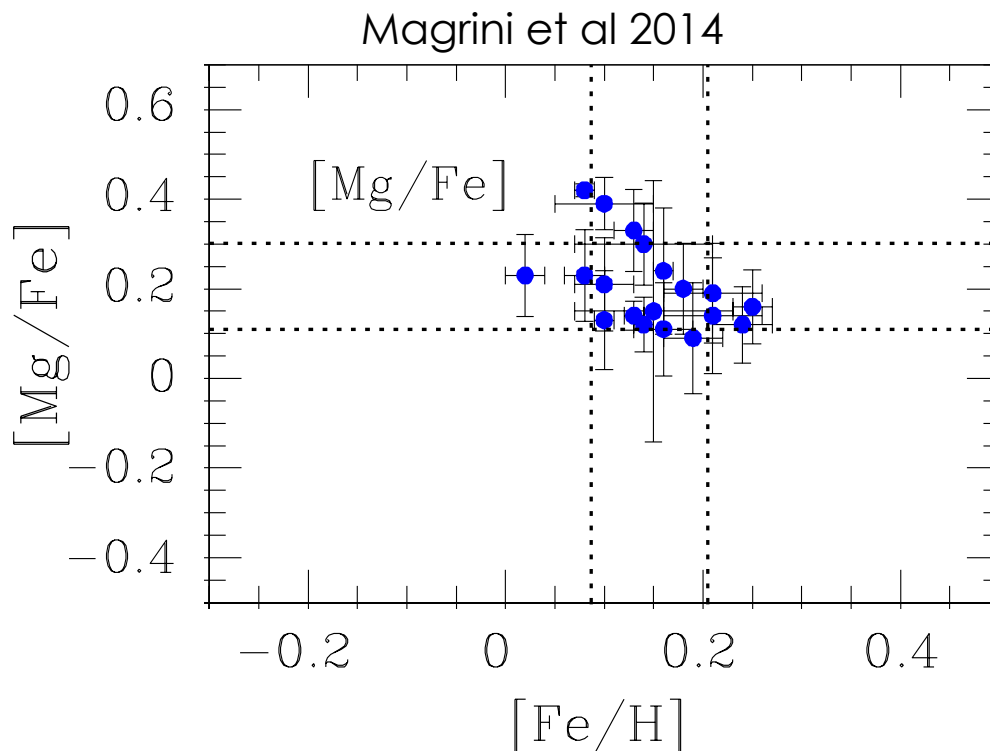


Bergemann et al 2014

Other examples of alpha-rich young stars – (3) NGC6705



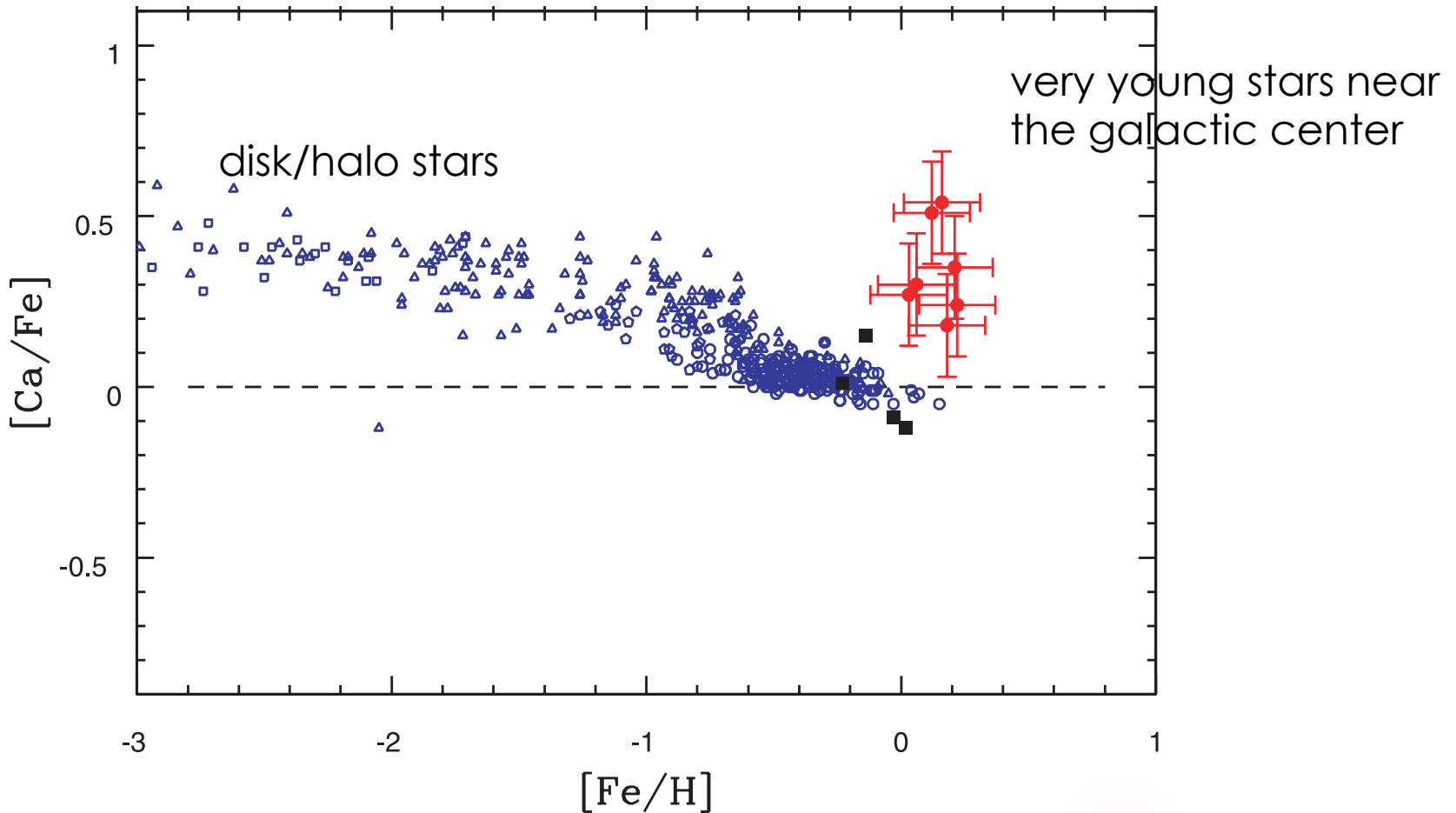
Cantat-Gaudin et al. 2014



Magrini et al 2014

→ a 300 Myr old alpha-rich cluster at $R_{gc}=6.3$ kpc

Other examples of alpha-rich young stars – (4) galactic center



Conclusion

- ▶ Several surveys find alpha-enriched young stars
- ▶ Not predicted by standard chemical evolution models
- ▶ Inhomogeneous mixing in the ISM + radial migration

