

Toward Accurate Astero-seismic Masses for Luminous Giants

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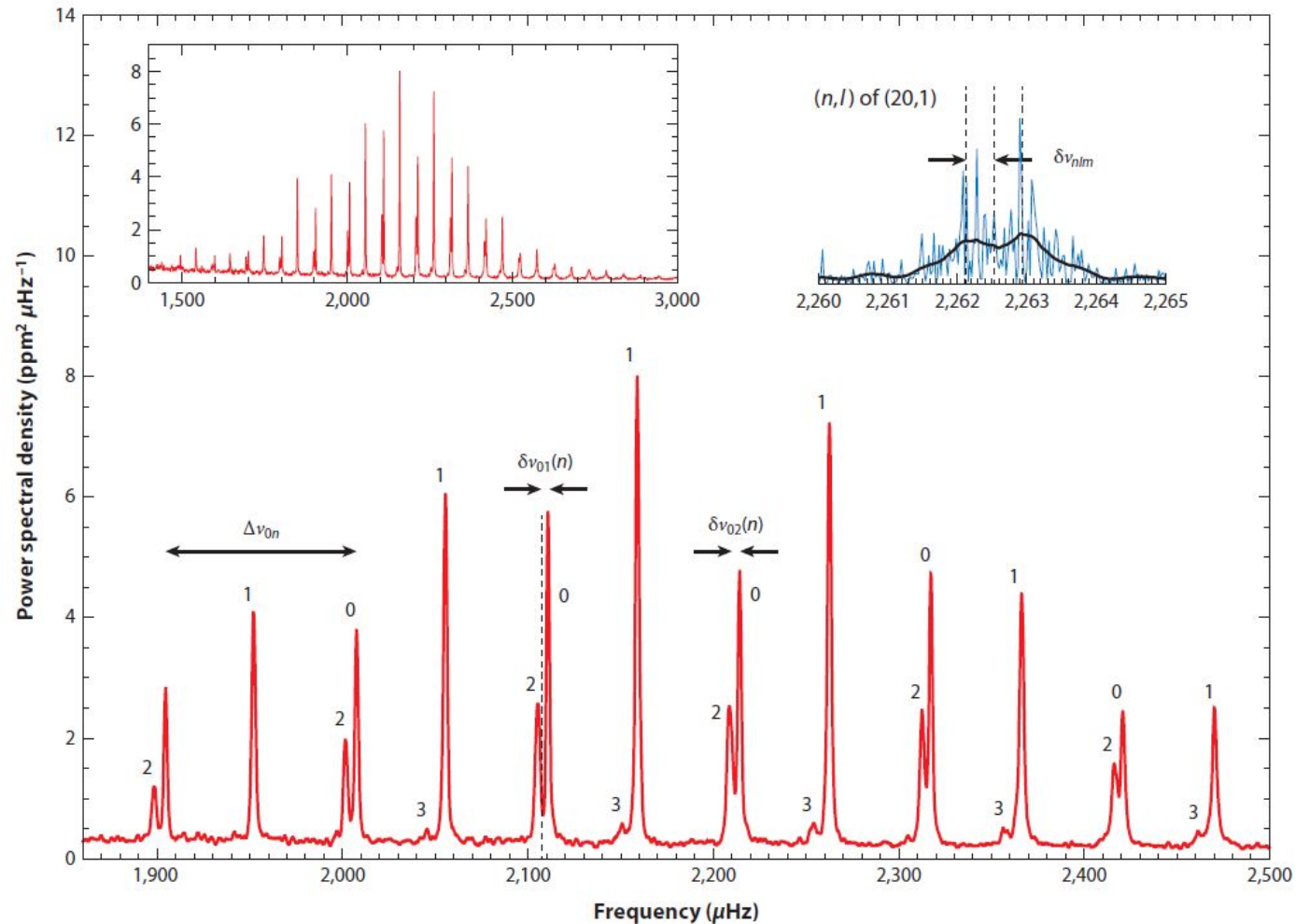
Galactic Genesis
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Astro- seismology

Two figures of merit:
Frequency of the maximum power – $\nu_{\max}$
Large-frequency spacing – $\Delta\nu$

[Chaplin & Miglio](#)
[2013](#)



Correction

Scaling Relations

$$\frac{M_{\text{seis}}}{M_{\odot}} = f_{\nu_{\text{max}}}^3 \left(\frac{\nu_{\text{max}}}{\nu_{\text{max},\odot}} \right)^3 \left(\frac{f_{\Delta\nu} \Delta\nu}{\Delta\nu_{\odot}} \right)^{-4} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{1.5}$$

$$\frac{R_{\text{seis}}}{R_{\odot}} = f_{\nu_{\text{max}}} \left(\frac{\nu_{\text{max}}}{\nu_{\text{max},\odot}} \right) \left(\frac{f_{\Delta\nu} \Delta\nu}{\Delta\nu_{\odot}} \right)^{-2} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{0.5}$$

Correction Factors

- $f_{\nu_{\text{max}}}$ comes from reference system.
- $f_{\Delta\nu}$ comes from theoretical models.

APOKASC-3

$$\left\langle f_{\nu_{\text{max}}} \left(\frac{\nu_{\text{max}}}{\nu_{\text{max},\odot}} \right) \left(\frac{f_{\Delta\nu} \Delta\nu}{\Delta\nu_{\odot}} \right)^{-2} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{0.5} \right\rangle = \frac{\langle R_{\text{Gaia}} \rangle}{R_{\odot}}$$

- Assuming theoretical $f_{\Delta\nu}$ is perfect.

This Work

$$\left\langle f_R \left(\frac{\nu_{\text{max}}}{\nu_{\text{max},\odot}} \right) \left(\frac{f_{\Delta\nu} \Delta\nu}{\Delta\nu_{\odot}} \right)^{-2} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{0.5} \right\rangle = \frac{\langle R_{\text{Gaia}} \rangle}{R_{\odot}}$$

- Assuming gravity error is small.

Figure 1

Upper: $f_{\Delta\nu}$ in APOKASC-3.
Note the mass dependence.

Middle: Feedback loop
between $f_{\Delta\nu}$ and mass.

Lower: Correction Factor for
asteroseismic mass.

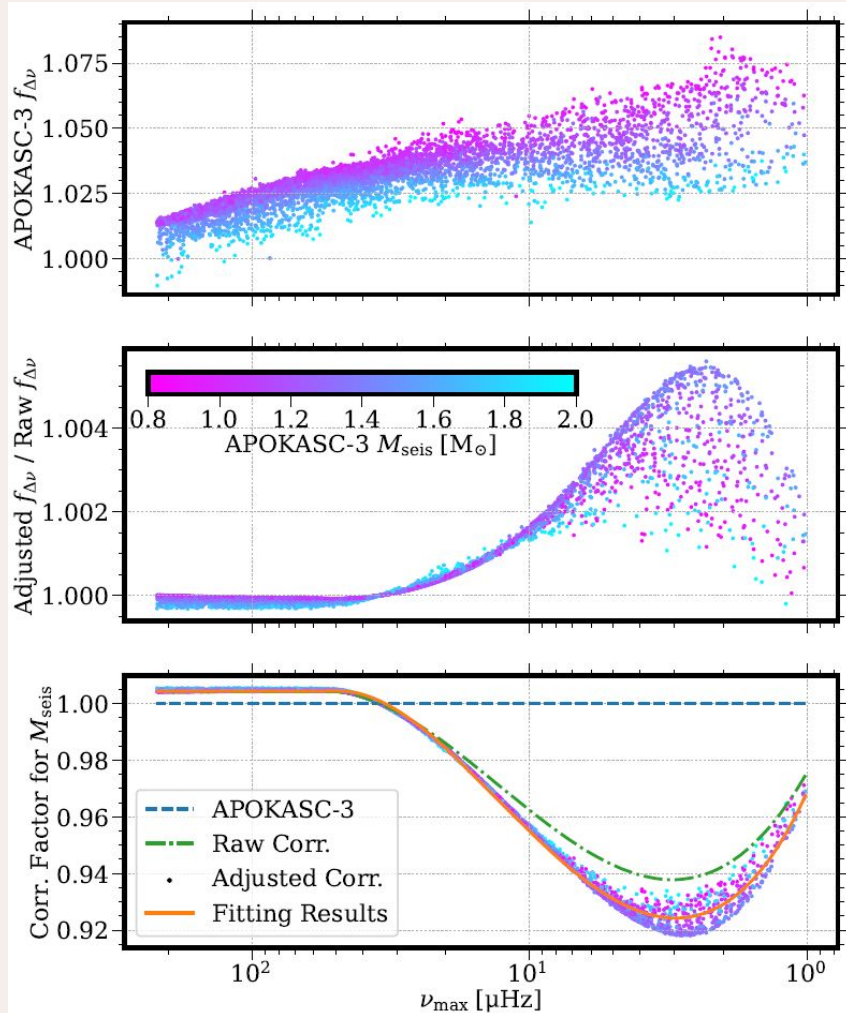


Figure 2
(Part 1)

GARSTEC and
Sharma are two
sets of models.

Mosser and
White are two
different
weighting
schemes.

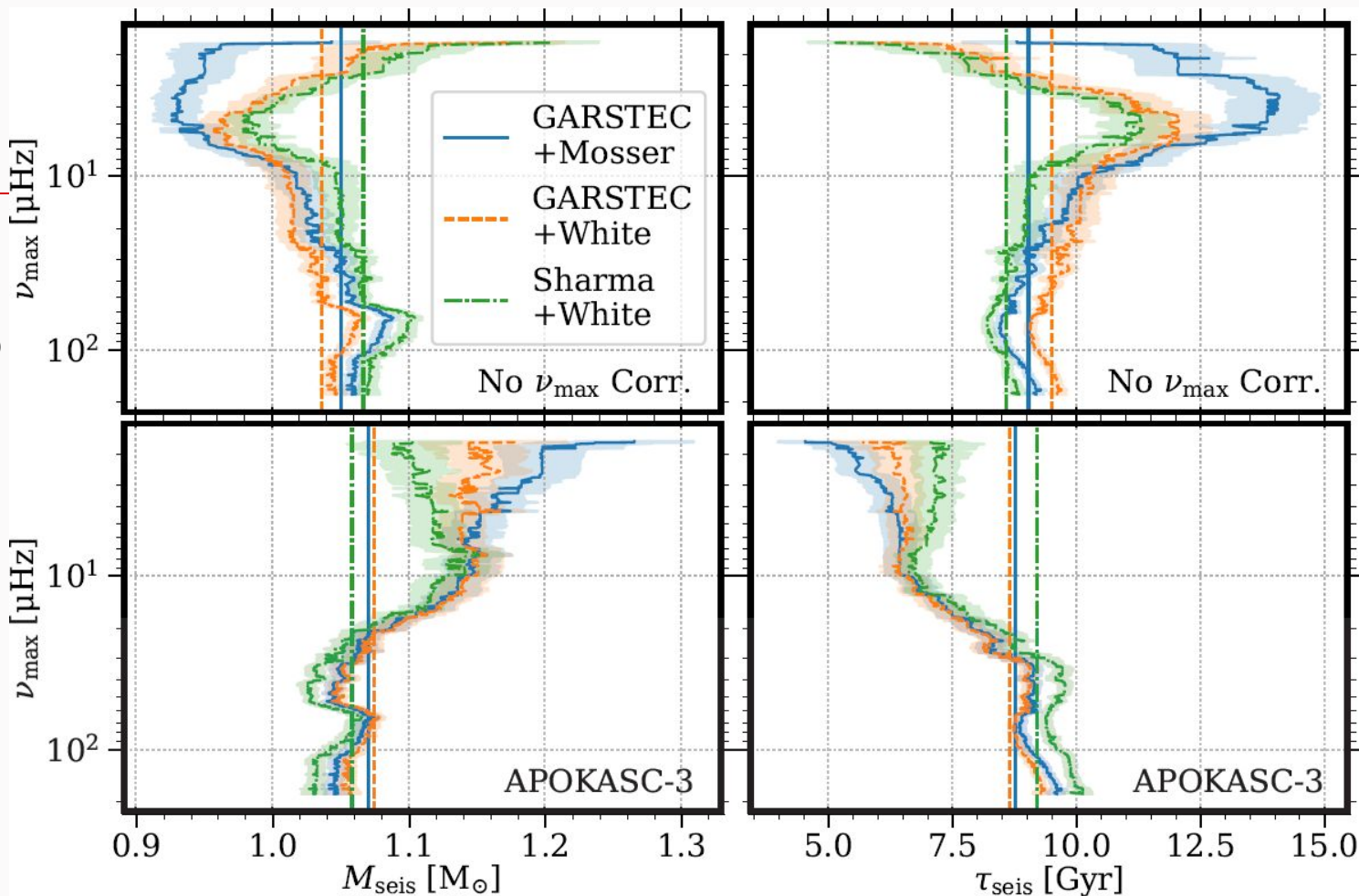


Figure 2
(Part 1.5)

Dual reduction
in systematics:

Consistency
between
methods

Agreement
with vertical
lines (medians)

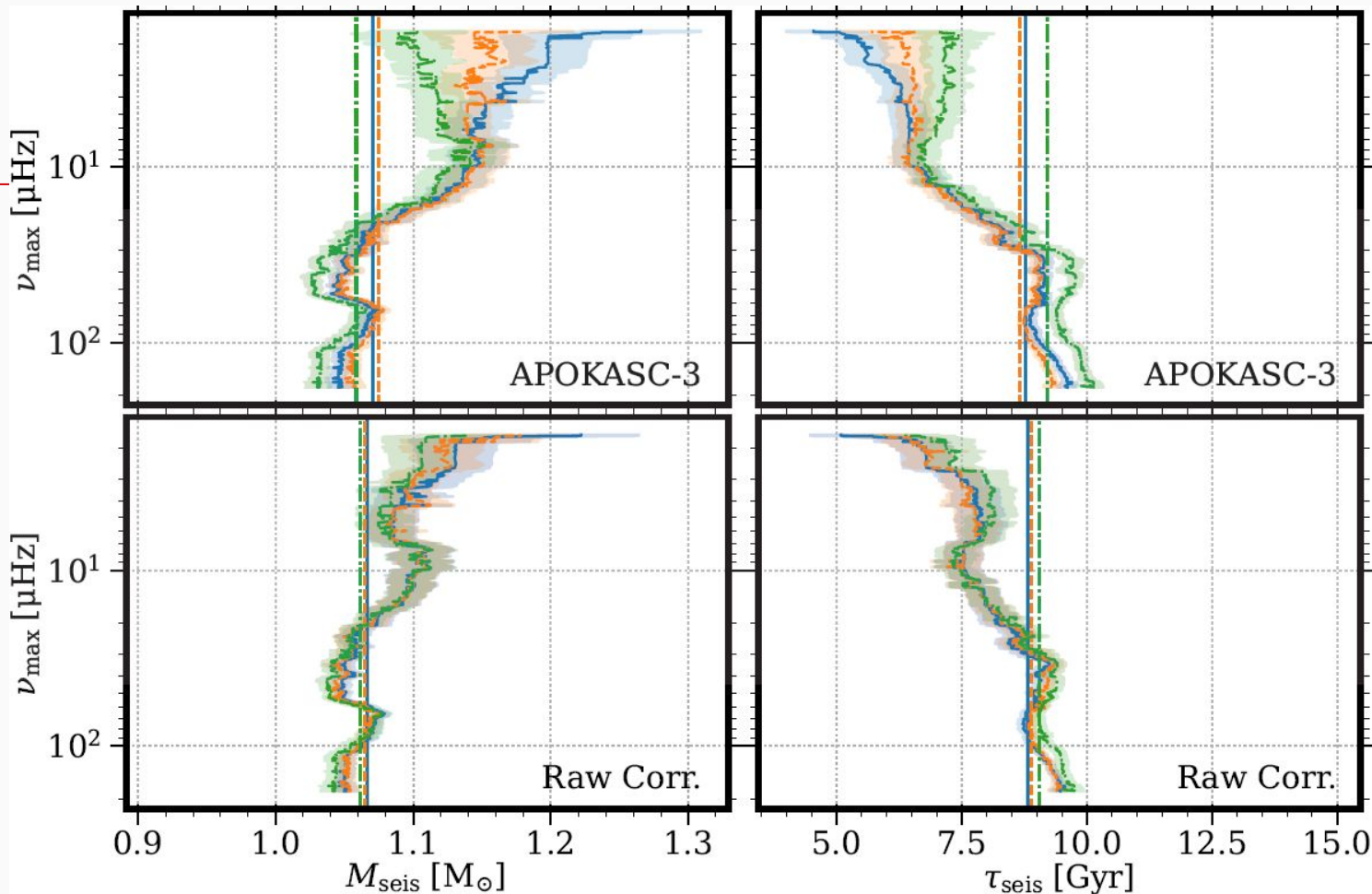


Figure 2 (Part 2)

Feedback loop
between $f\Delta\nu$
and mass

Technical detail,
less important
than Part 1.5

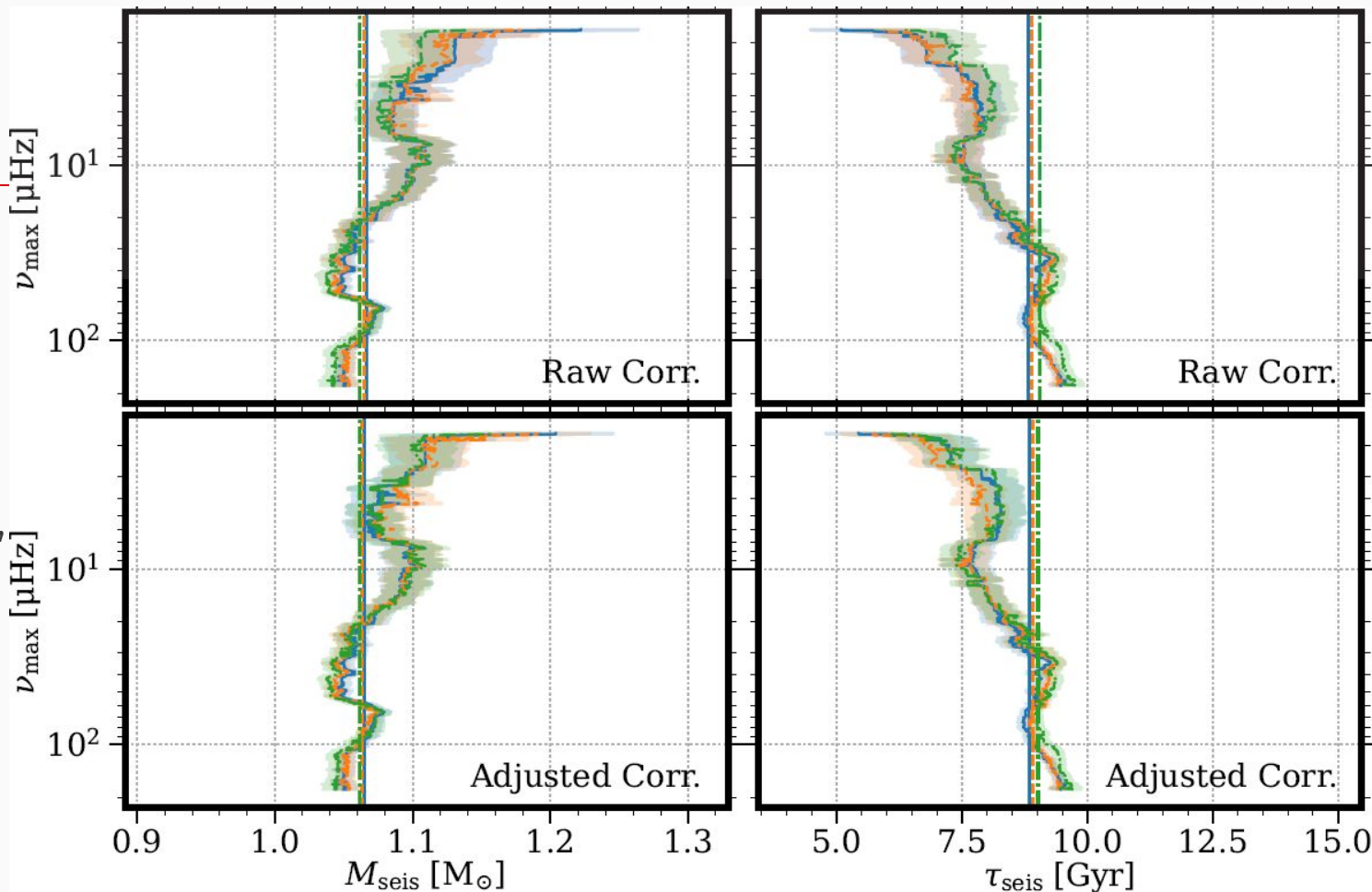


Figure 3

How does this work affect asteroseismic ages?

Trick: Pick a few data points, compared their positions in the two rows.

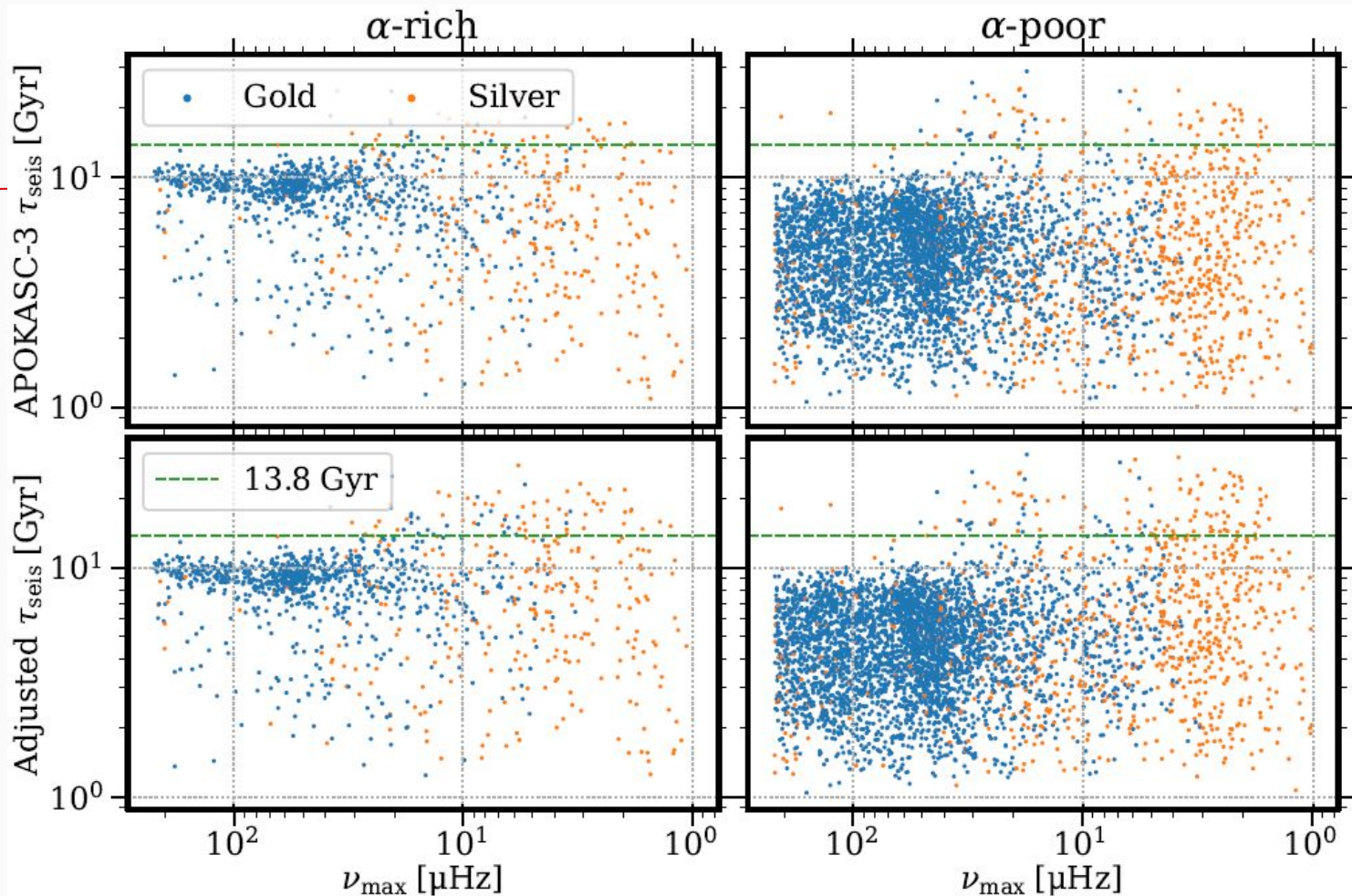


Figure 4

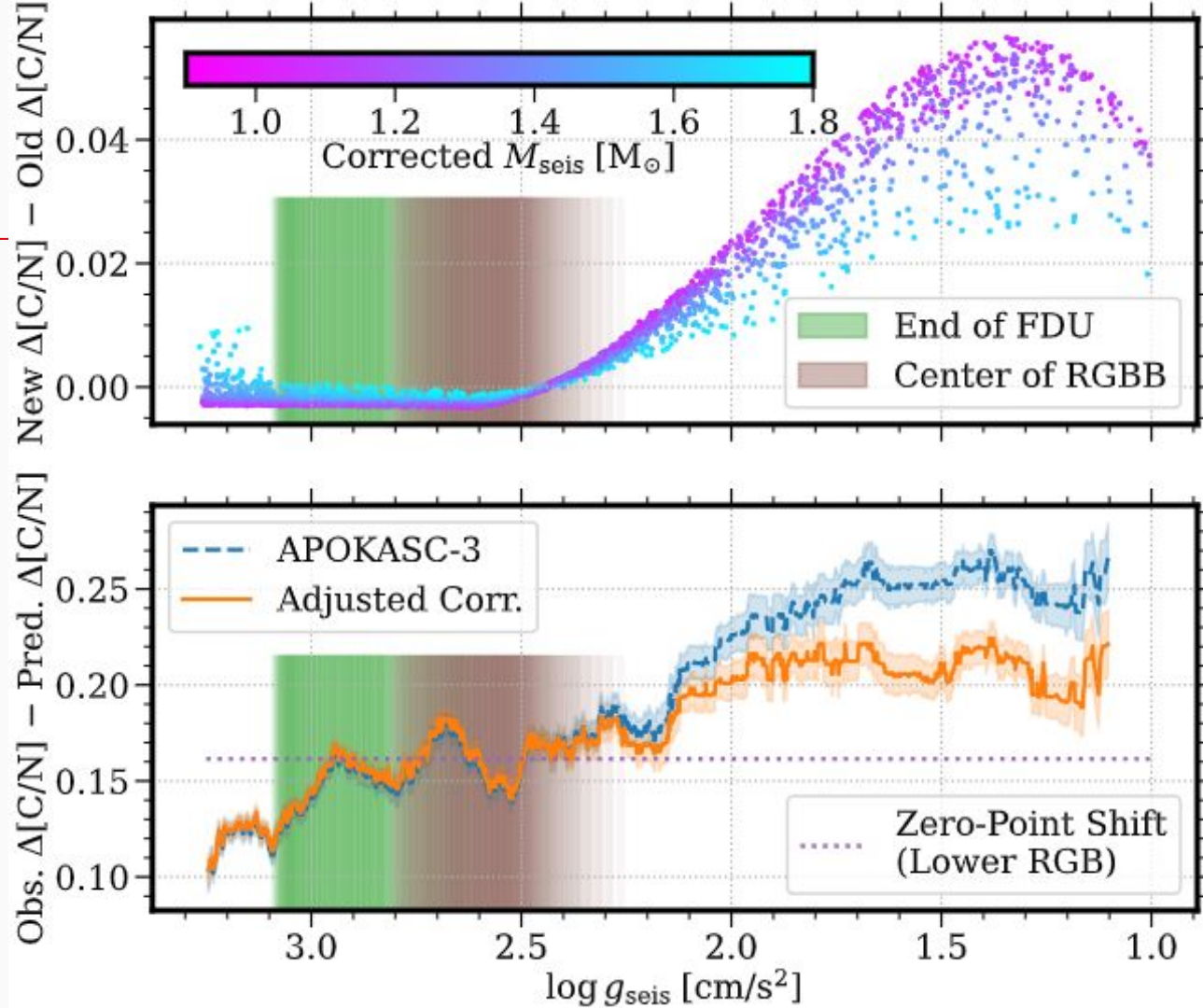
How does this work
affect first dredge-up?

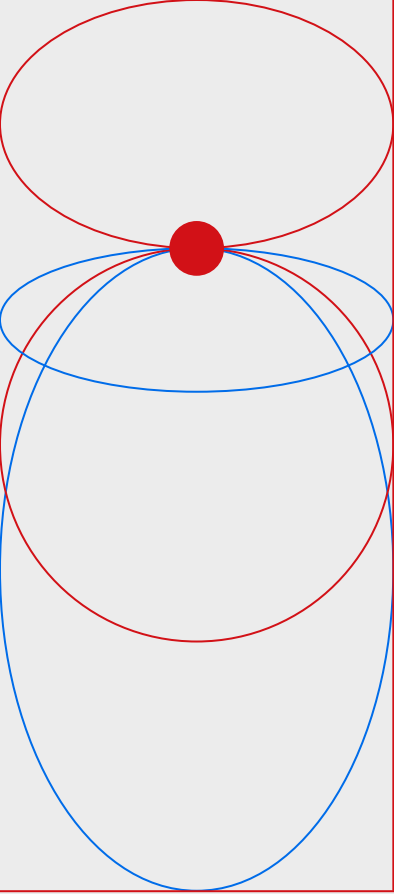
Context:

Observation – [Roberts et al. 2024](#)

Theory – [Cao & Pinsonneault 2025a](#)

Incomplete FDU –
[Liagre et al. 2025](#)





*Thank
you*