

Ensemble Asteroseismology of 16,000 Kepler red giants

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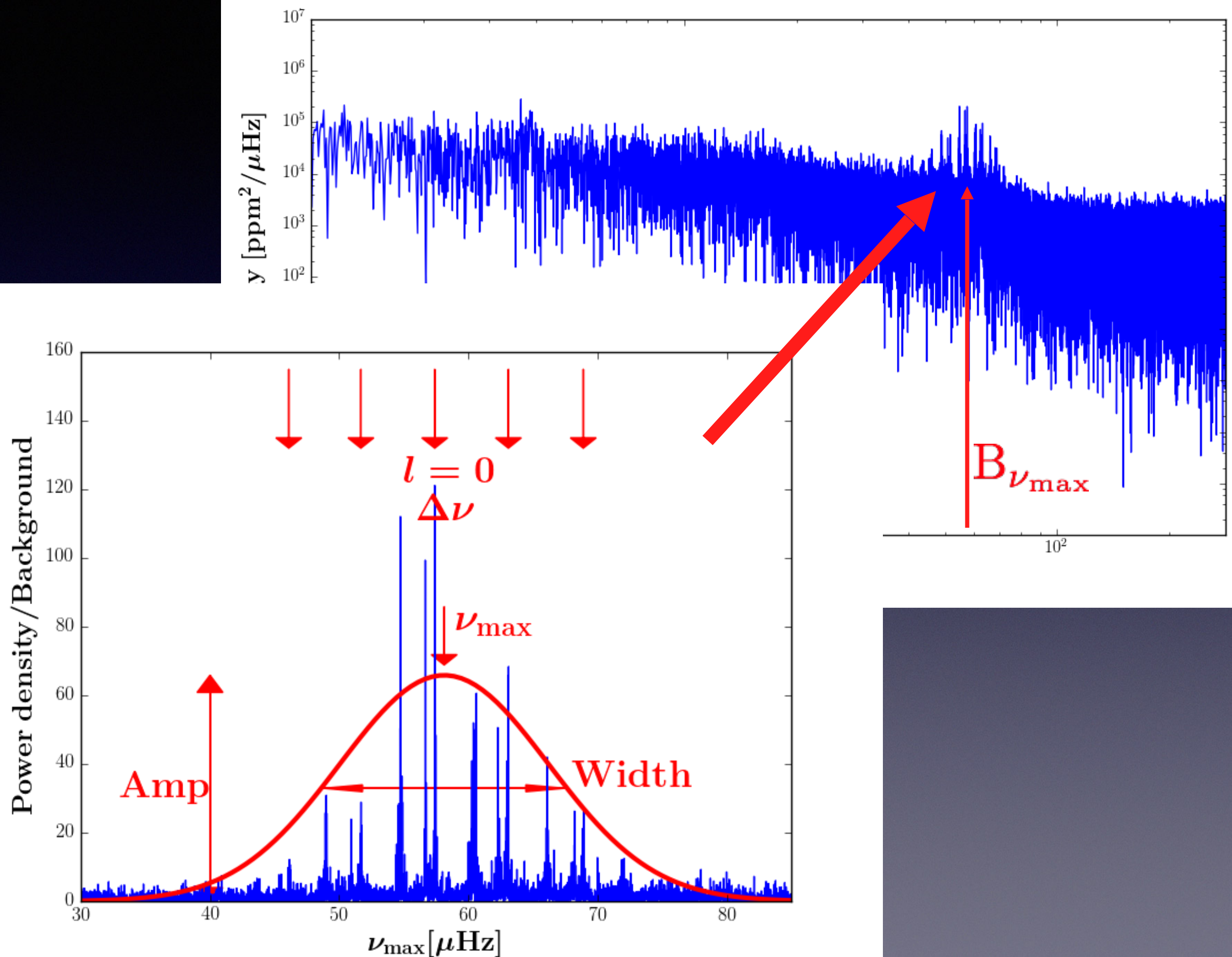
1. University of Sydney. 2. Aarhus University.

3. University of Hawaii, 4. University of New South Wales.

Motivation

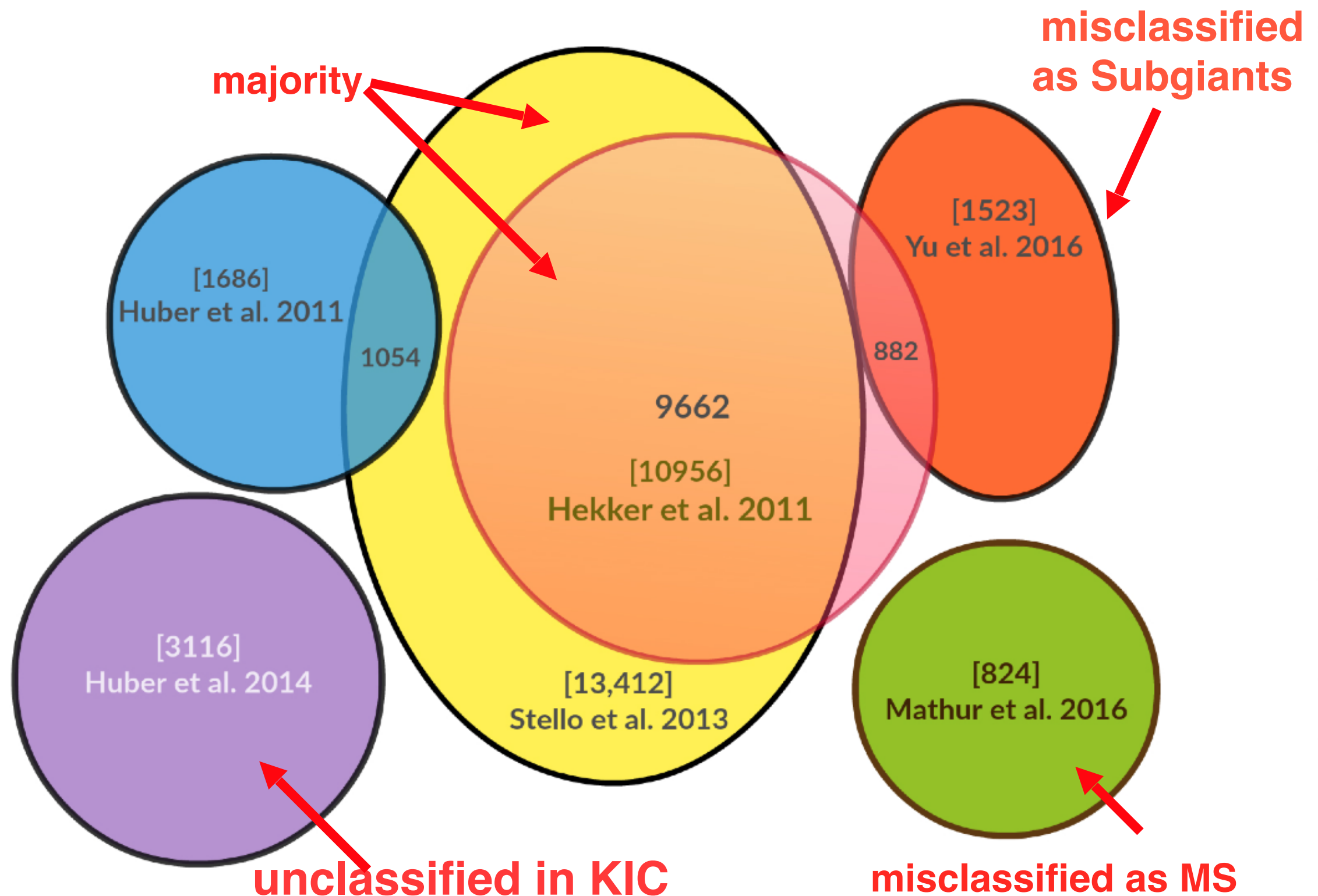
1. Homogeneity: Largest sample
2. Precision: Full-length Kepler light curves
3. Measurements: ν_{\max} , $\Delta\nu$, Amp, Width, Granulation
4. Output: Catalog of M, R, $\log g$

“SYD Pipeline”: Observables



Sample selection

19,364 seismic red giants observed by Kepler

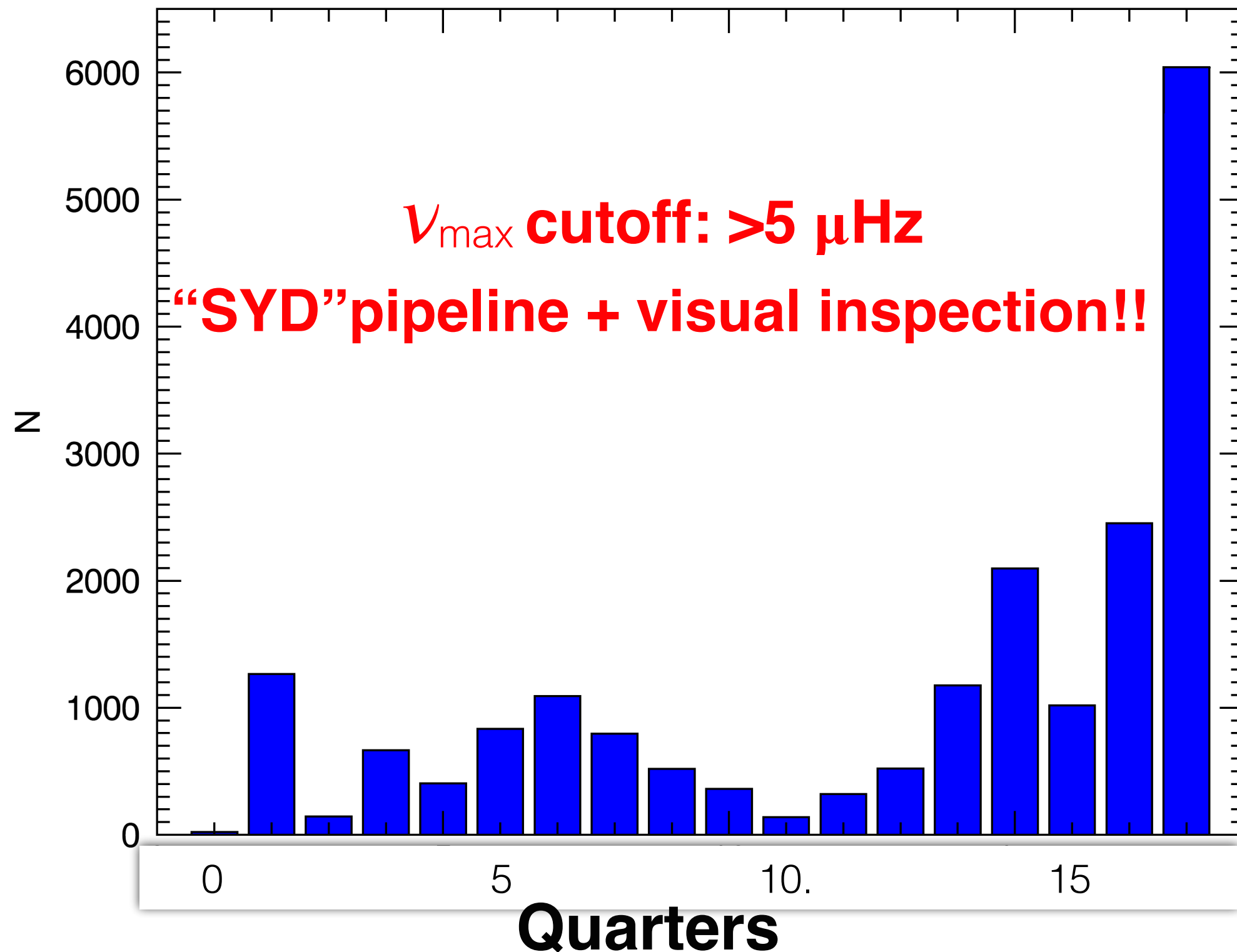


Long-cadence datasets

16,136 oscillators

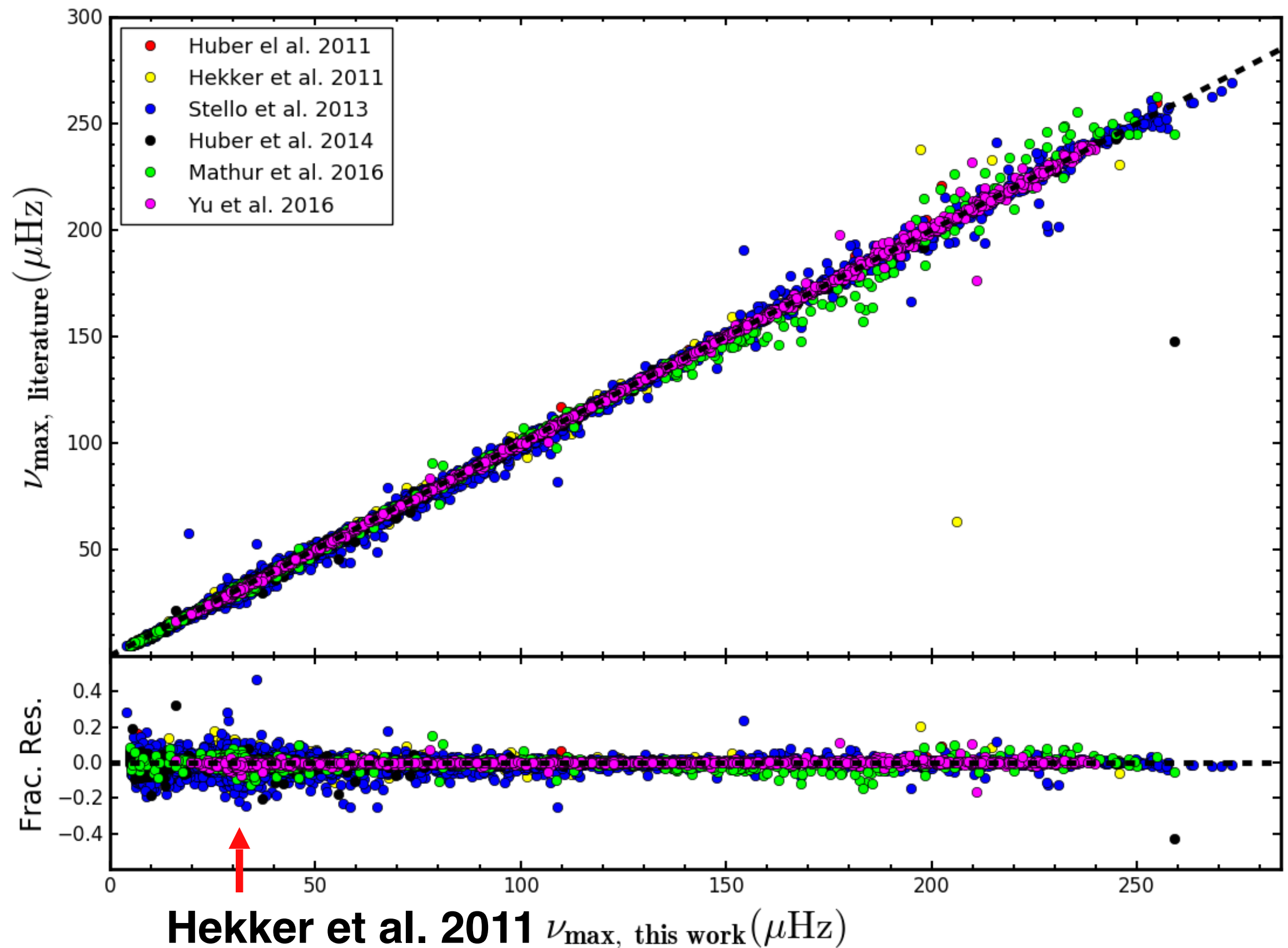
v_{\max} cutoff: $>5 \mu\text{Hz}$

“SYD” pipeline + visual inspection!!



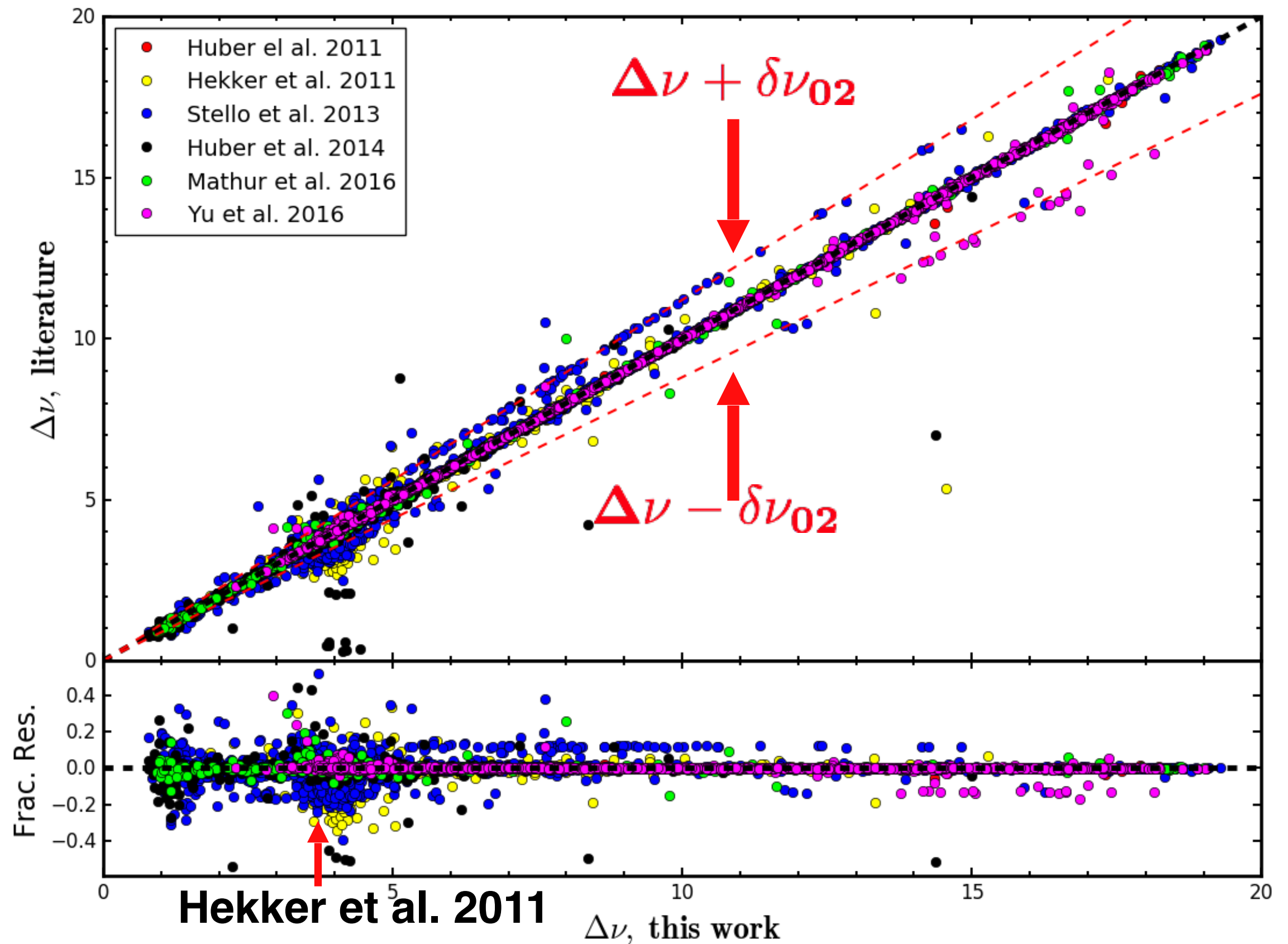
Seismic parameter comparison with literature

ν_{\max} Comparison



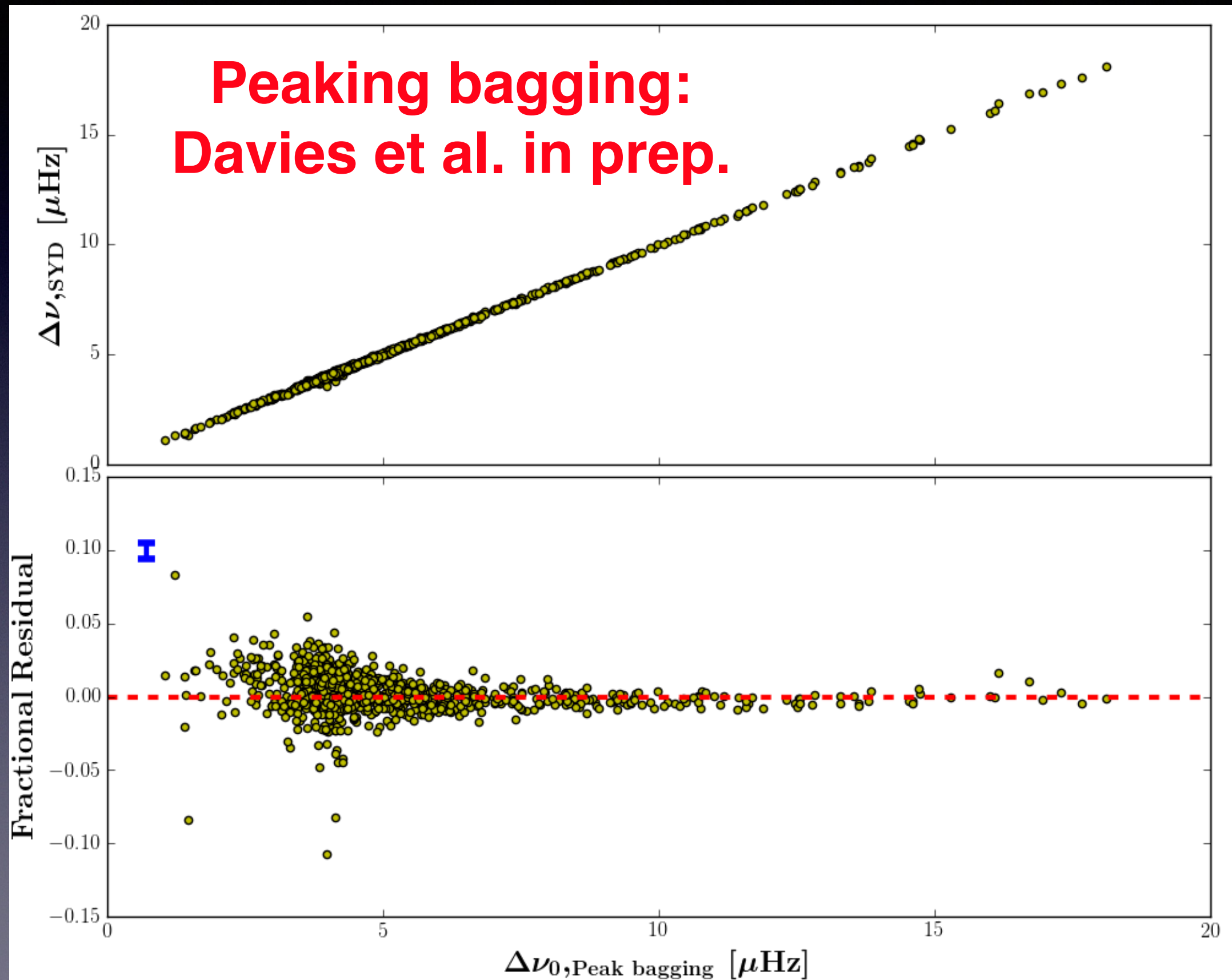
Seismic parameter comparison

$\Delta\nu$ Comparison

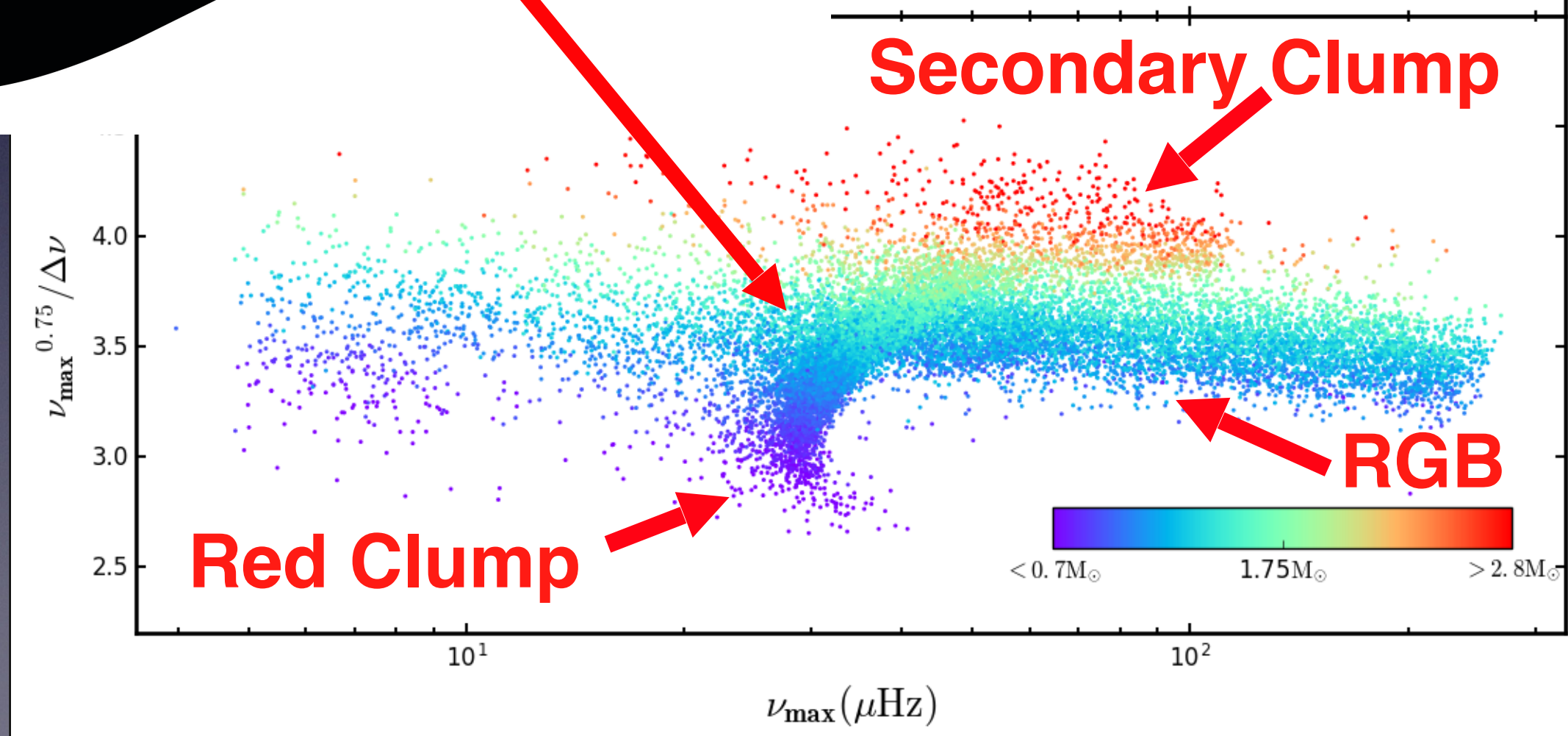
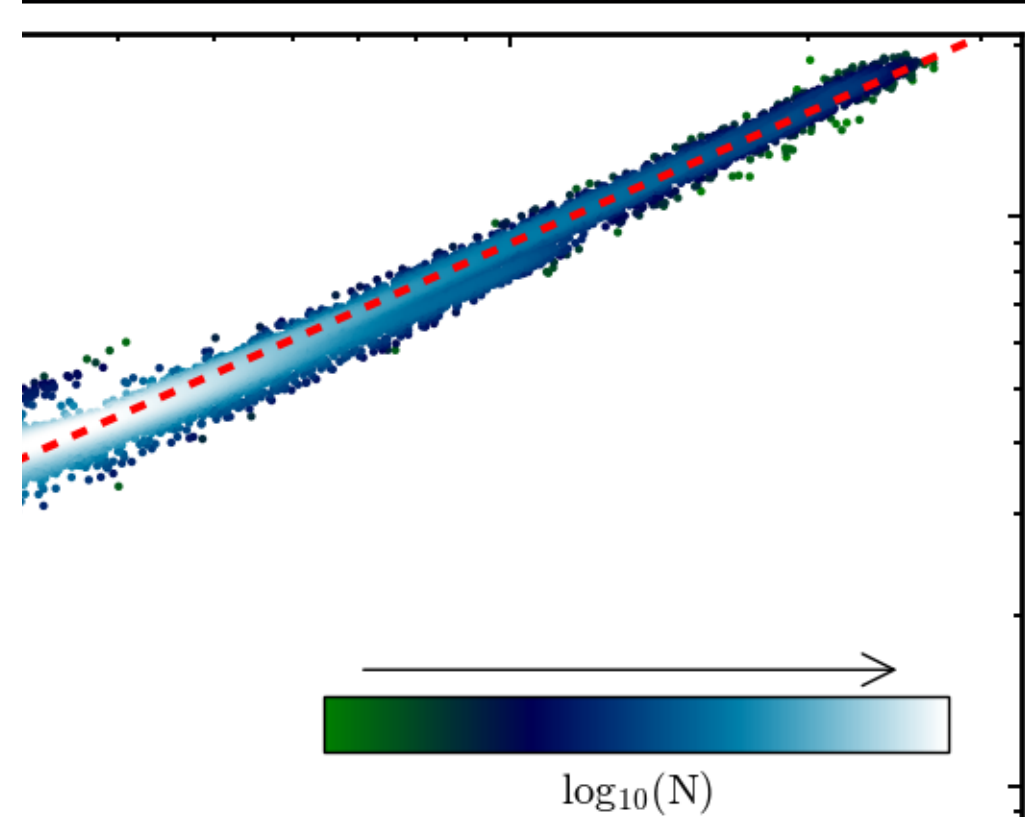


Seismic parameter comparison

$\Delta\nu$ Comparison



“Nike Diagram”



Masses and radii determination

Masses and radii are inferred with the scaling relations:

$$\frac{M}{M_{\odot}} \simeq \left(\frac{\nu_{\max}}{\nu_{\max,\odot}} \right)^3 \left(\frac{\Delta\nu}{f \cdot \Delta\nu_{\odot}} \right)^{-4} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{1.5}$$
$$\frac{R}{R_{\odot}} \simeq \left(\frac{\nu_{\max}}{\nu_{\max,\odot}} \right) \left(\frac{\Delta\nu}{f \cdot \Delta\nu_{\odot}} \right)^{-2} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{0.5}$$

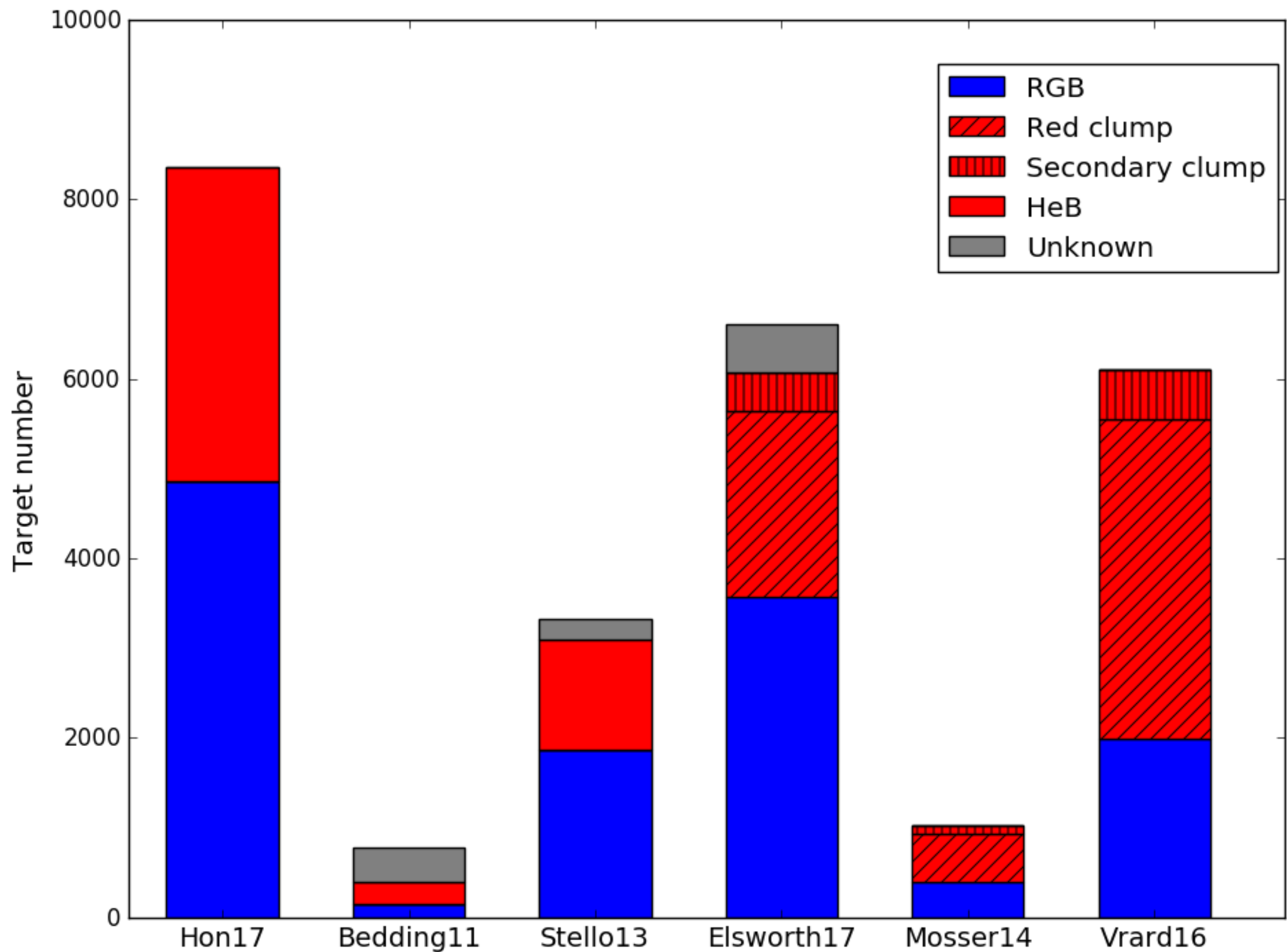
Where $\nu_{\max,\odot} = 3090 \mu\text{Hz}$, $\Delta\nu_{\odot} = 135.1 \mu\text{Hz}$, $T_{\text{eff},\odot} = 5777\text{K}$
Huber et al. (2011). The correction factor f is determined
using the method from **Sharma et al. (2016)**

$$f = f(\nu_{\max}, \Delta\nu, T_{\text{eff}}, [\text{Fe}/\text{H}], \text{Evol. Phase})$$

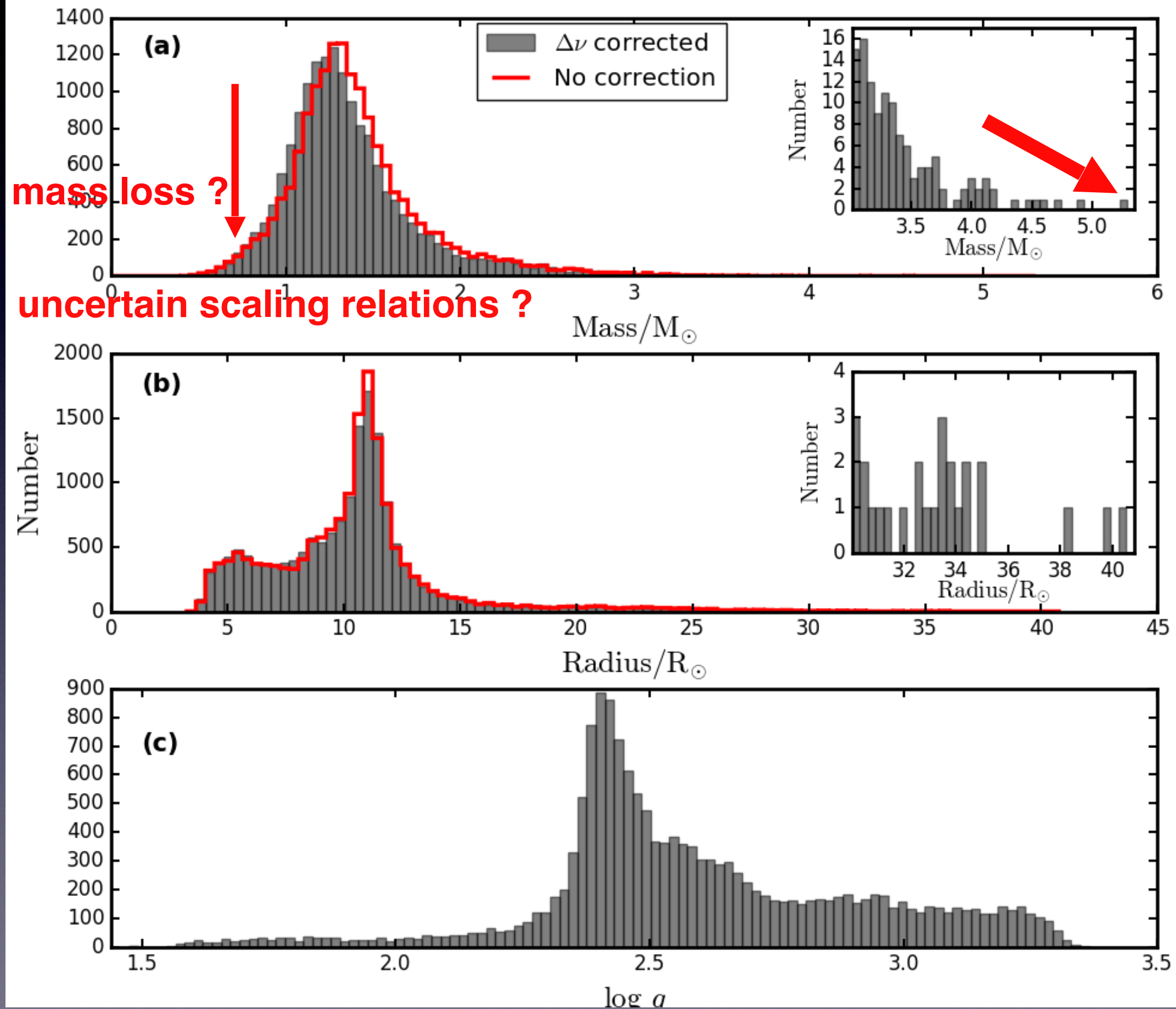
T_{eff} , $[\text{Fe}/\text{H}]$: KIC, LAMOST, APOGEE, CFOP...

Mathur et al. (2017)

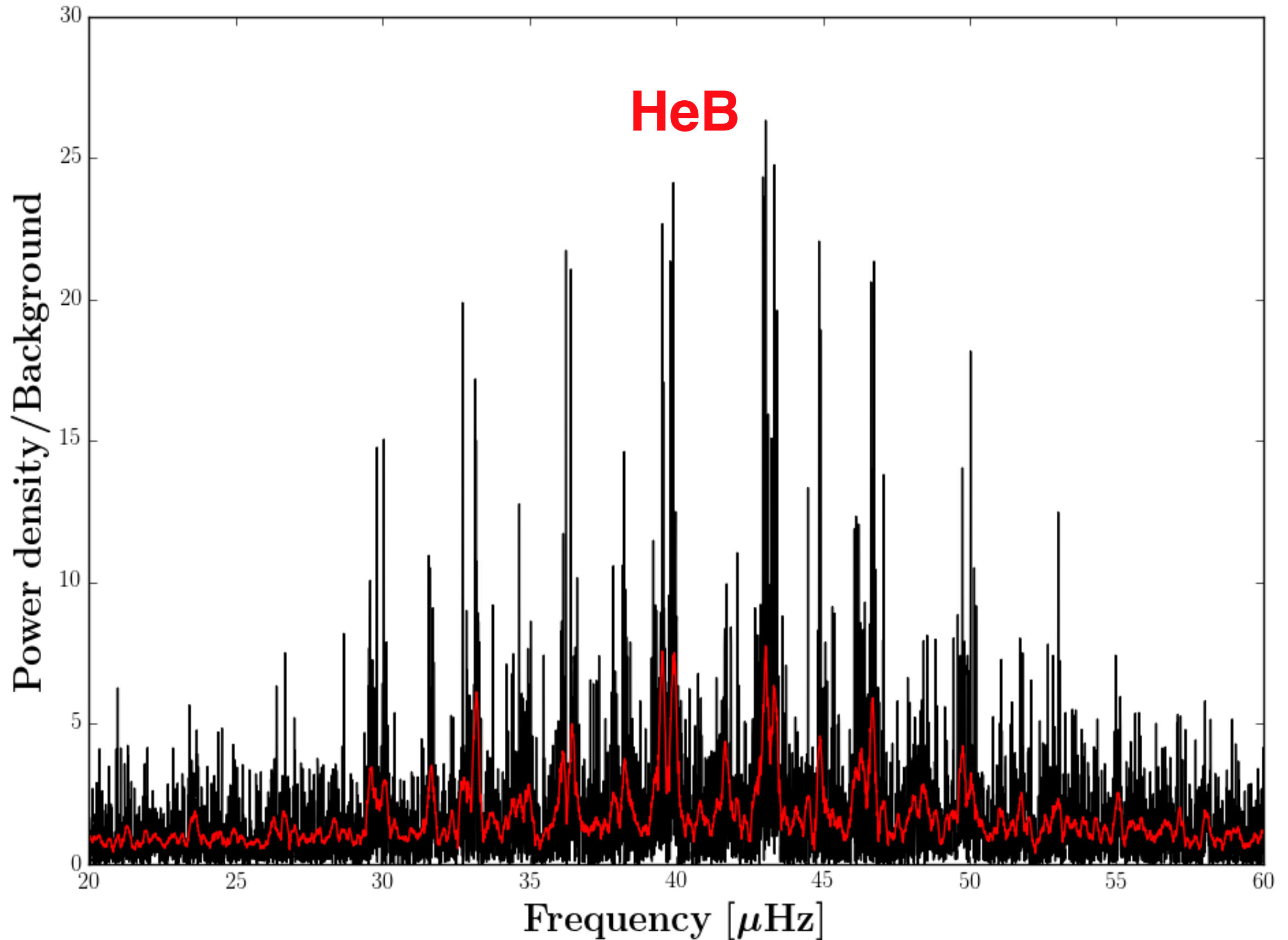
Evolutionary Phase Classification from literature



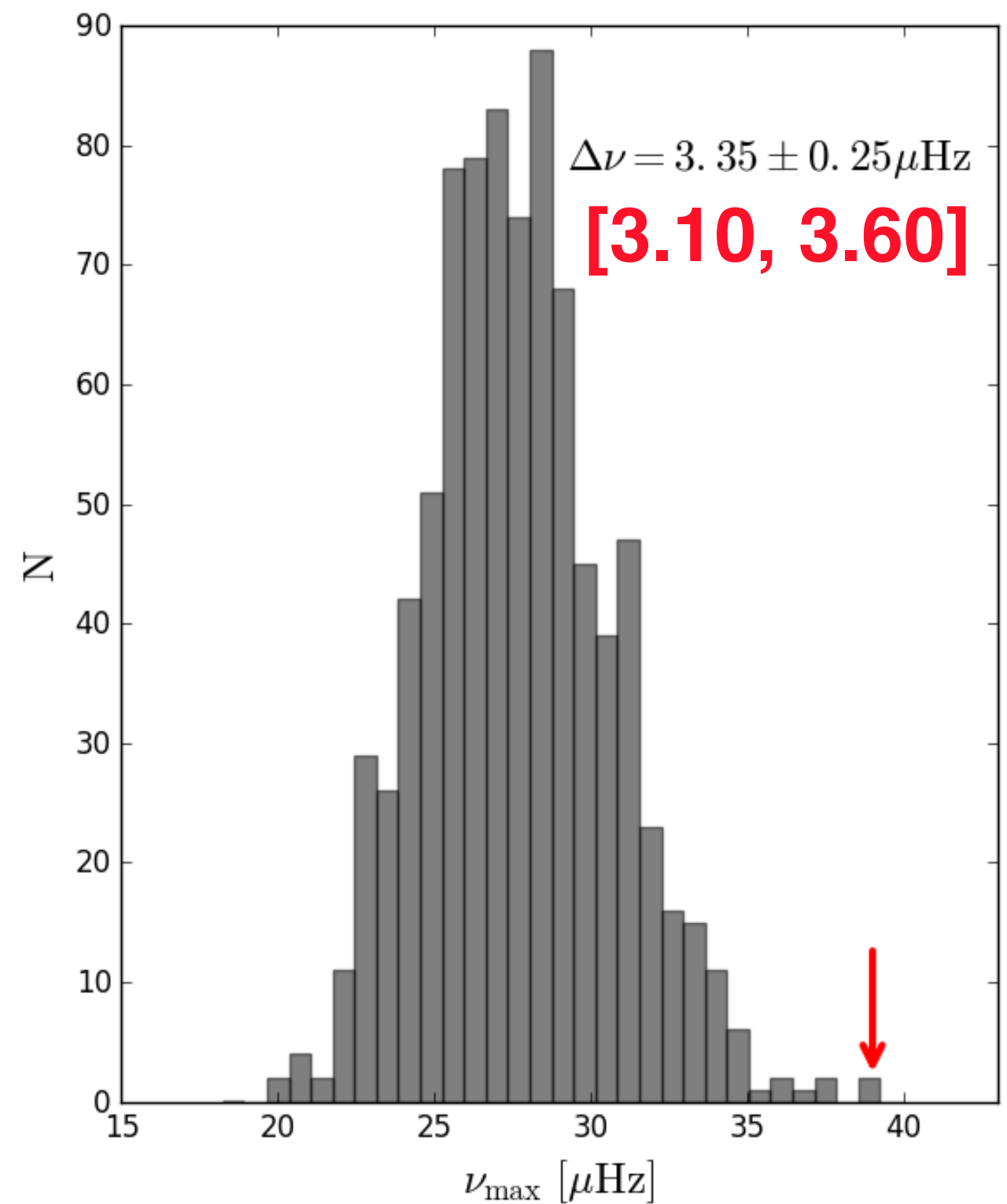
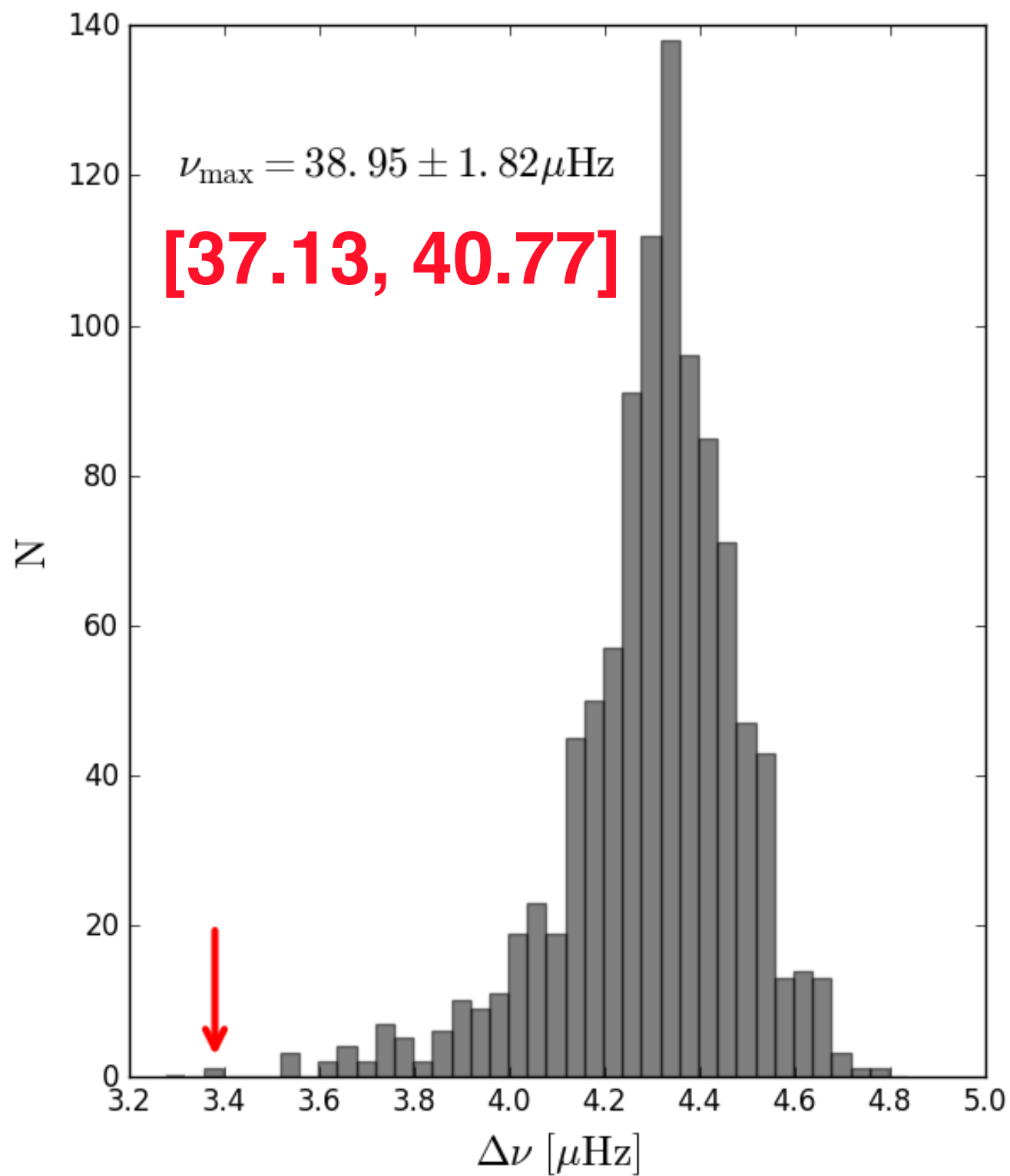
Seismically-inferred M , R , and $\log g$



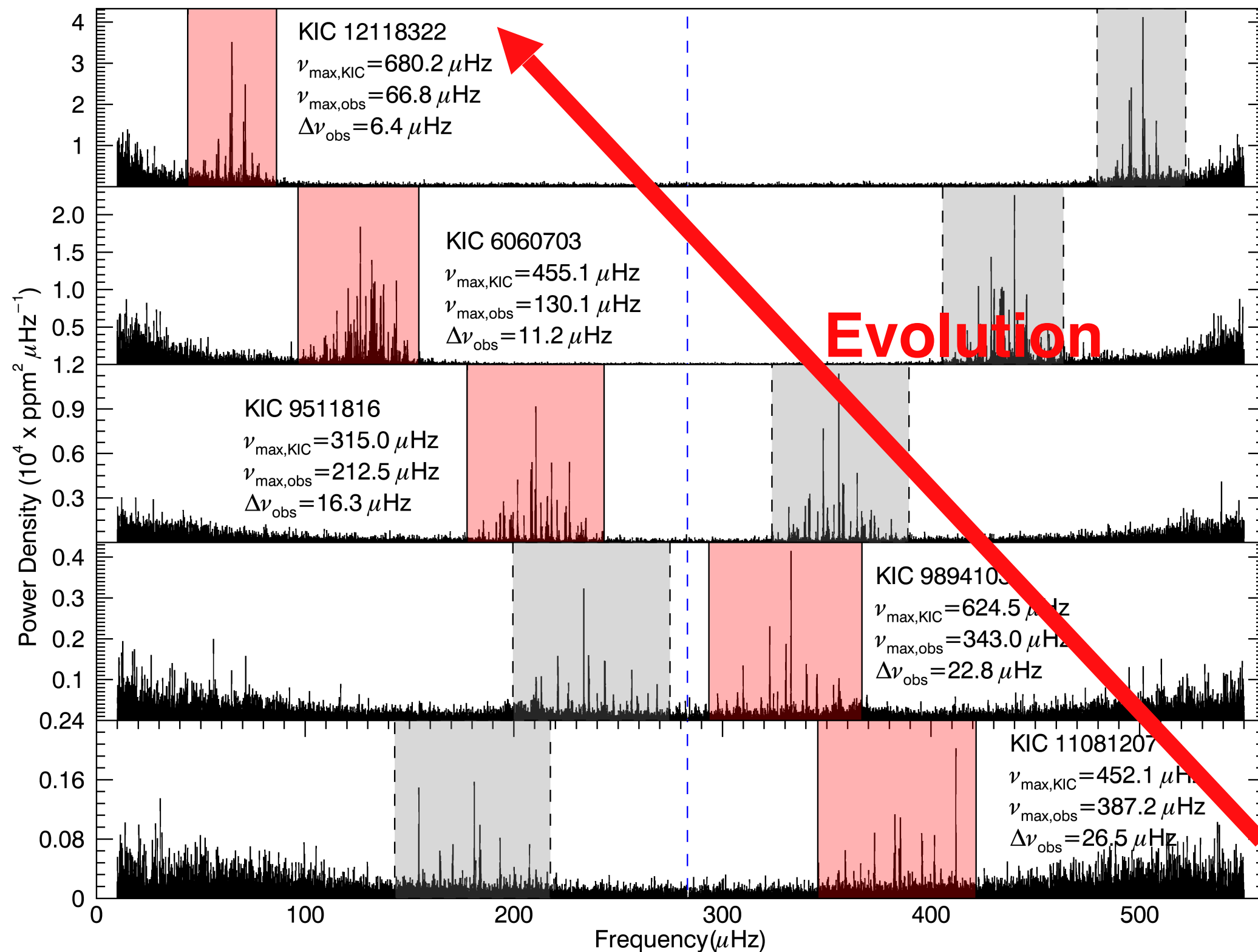
Massive oscillator



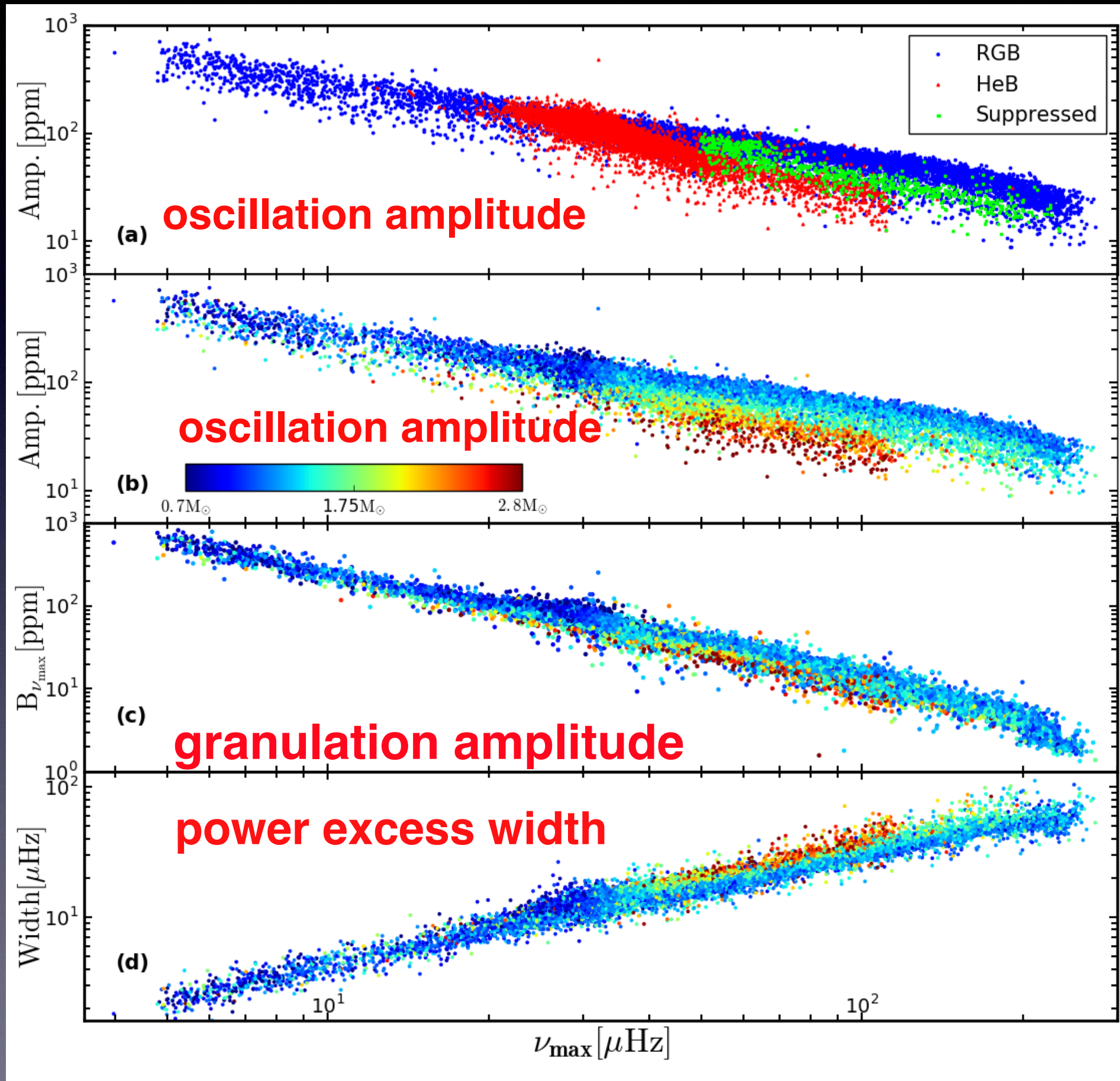
Massive oscillator



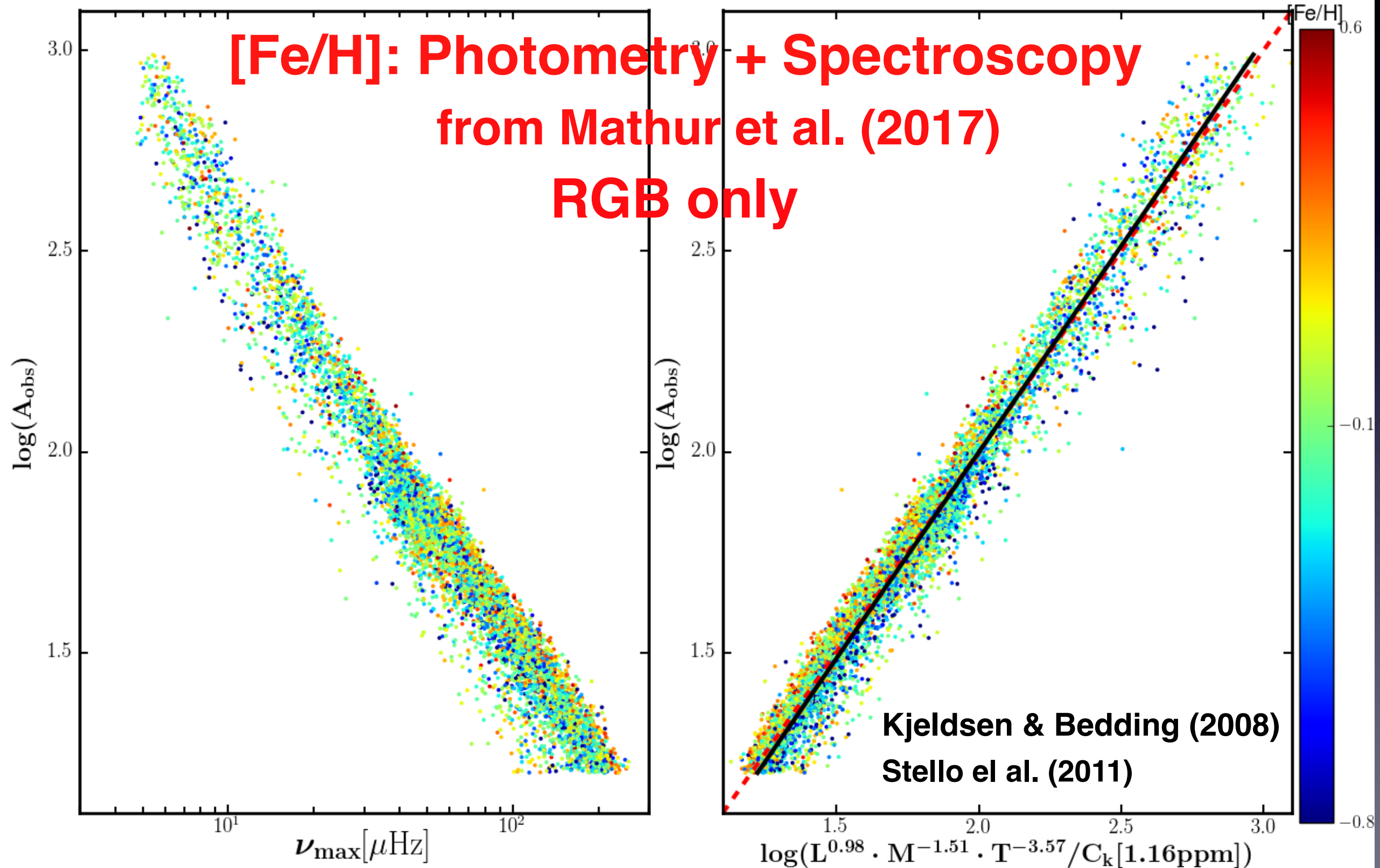
Characterisation of power excess: Amp, Width, Granulation



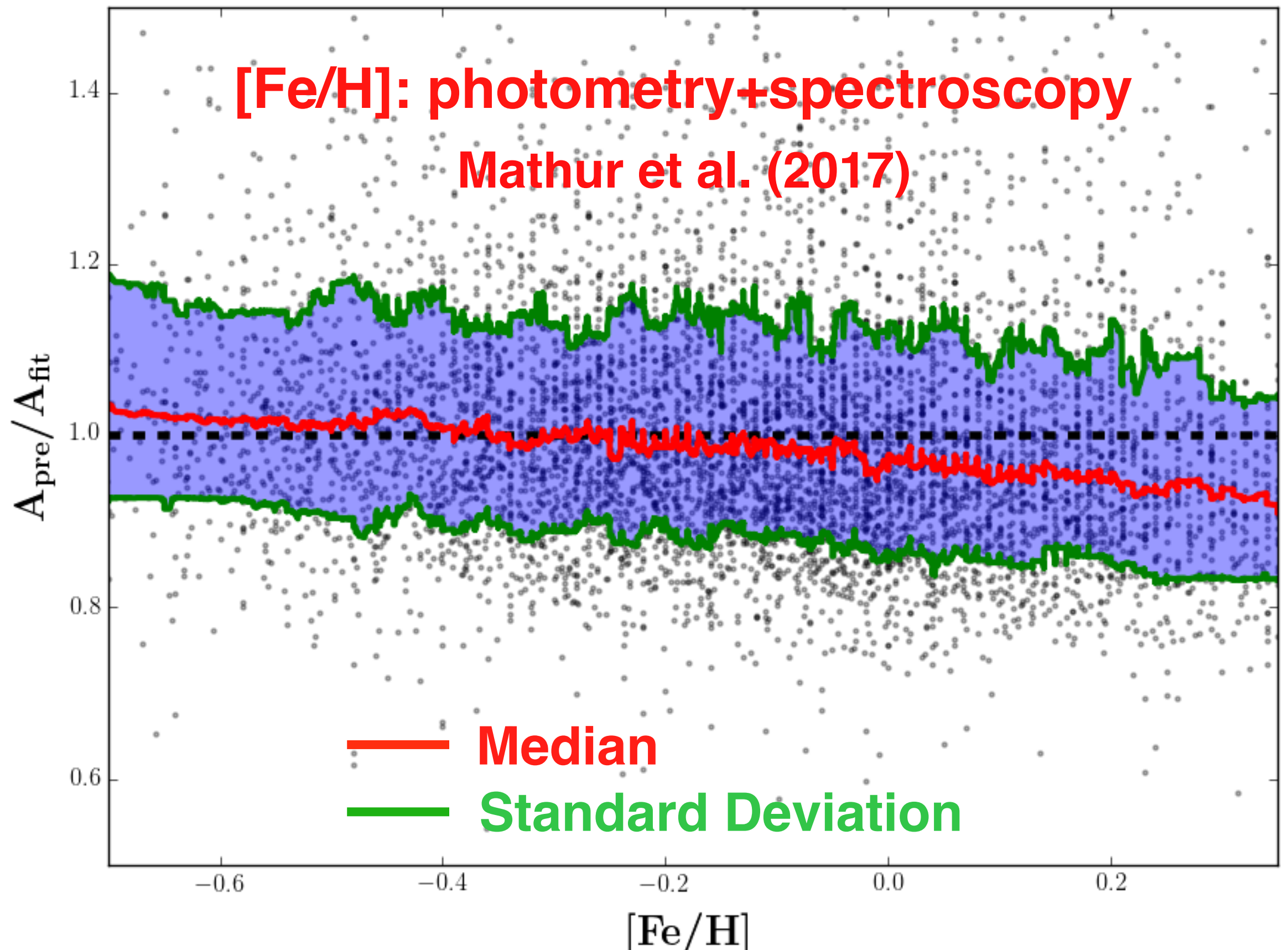
Characterisation of power excess: Amp, Width, Granulation



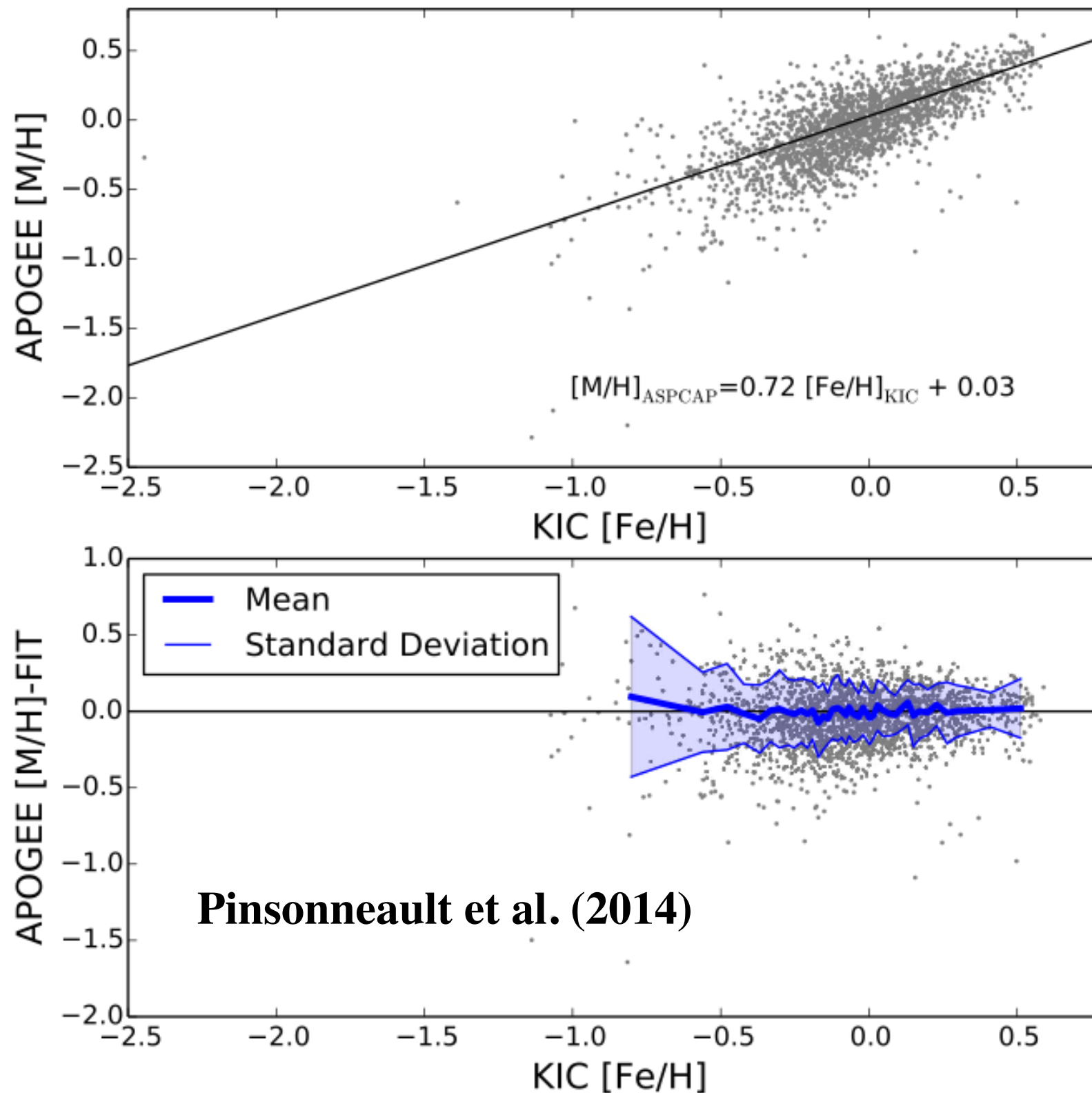
[Fe/H] influence on Amplitude



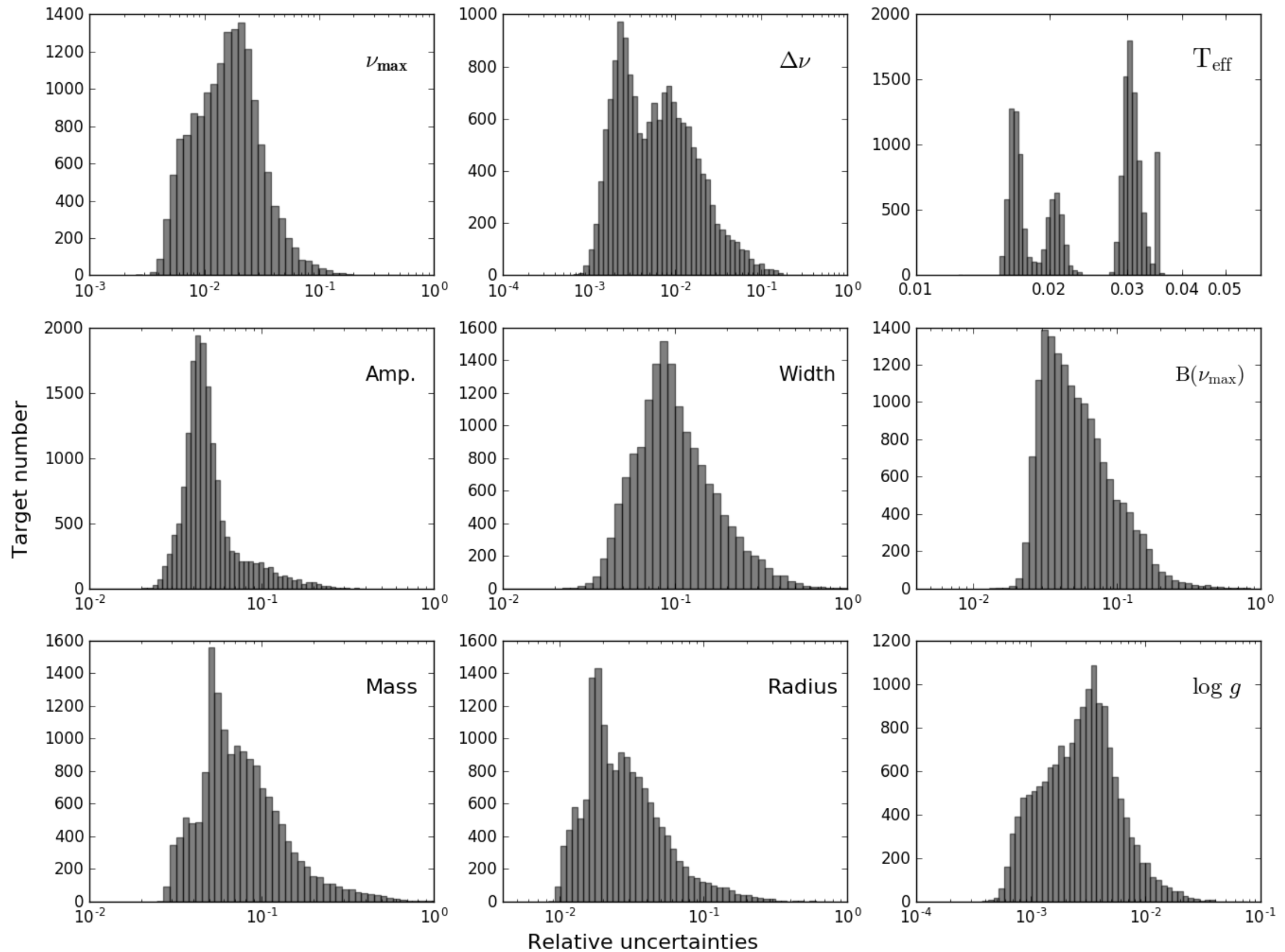
[Fe/H] influence on Amplitude



How accurate are KIC [Fe/H] values ?



Uncertainties



Summary

1. We provided a catalog of seismic **masses**, **radii** and **logg** for $\sim 16,000$ oscillating red giants.
2. Oscillation and granulation amplitudes have dependencies on mass and Metallicity.
3. Power-excess width is an increasing function of mass.

Yu et al in prep.