

Estimating the mass and radius of HD3148 using asteroseismology

Analysis

We looked at lightcurve data from NASA's Transiting Exoplanet Survey Satellite of HD3148 for this analysis.

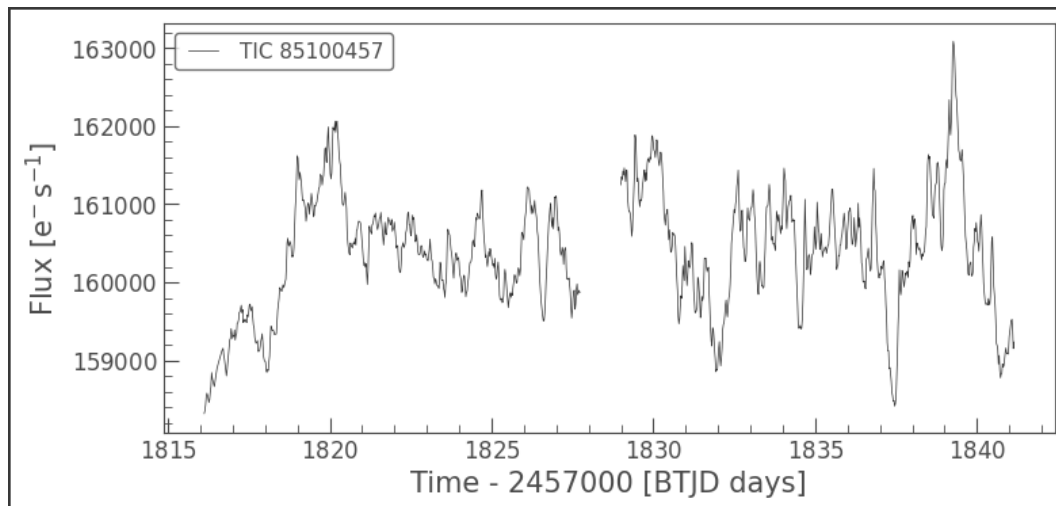


Fig1: HD31648 lightcurve

To calculate frequency spacing and frequency of maximum amplitude, we plotted the corresponding periodogram

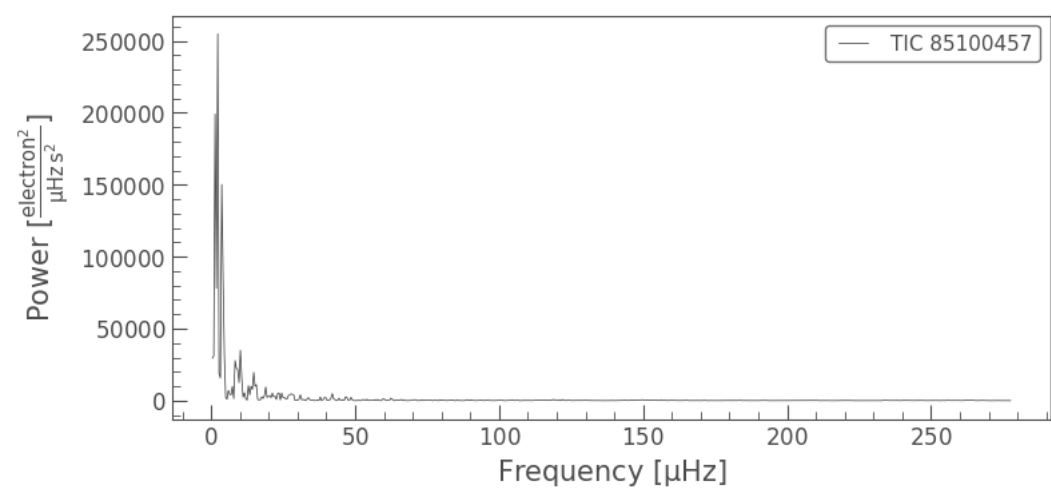


Fig2: HD31648 Periodogram

Flattening the periodogram and then using the autocorrelation function, we calculated frequency of maximum amplitude to be **2145.00 μHz**

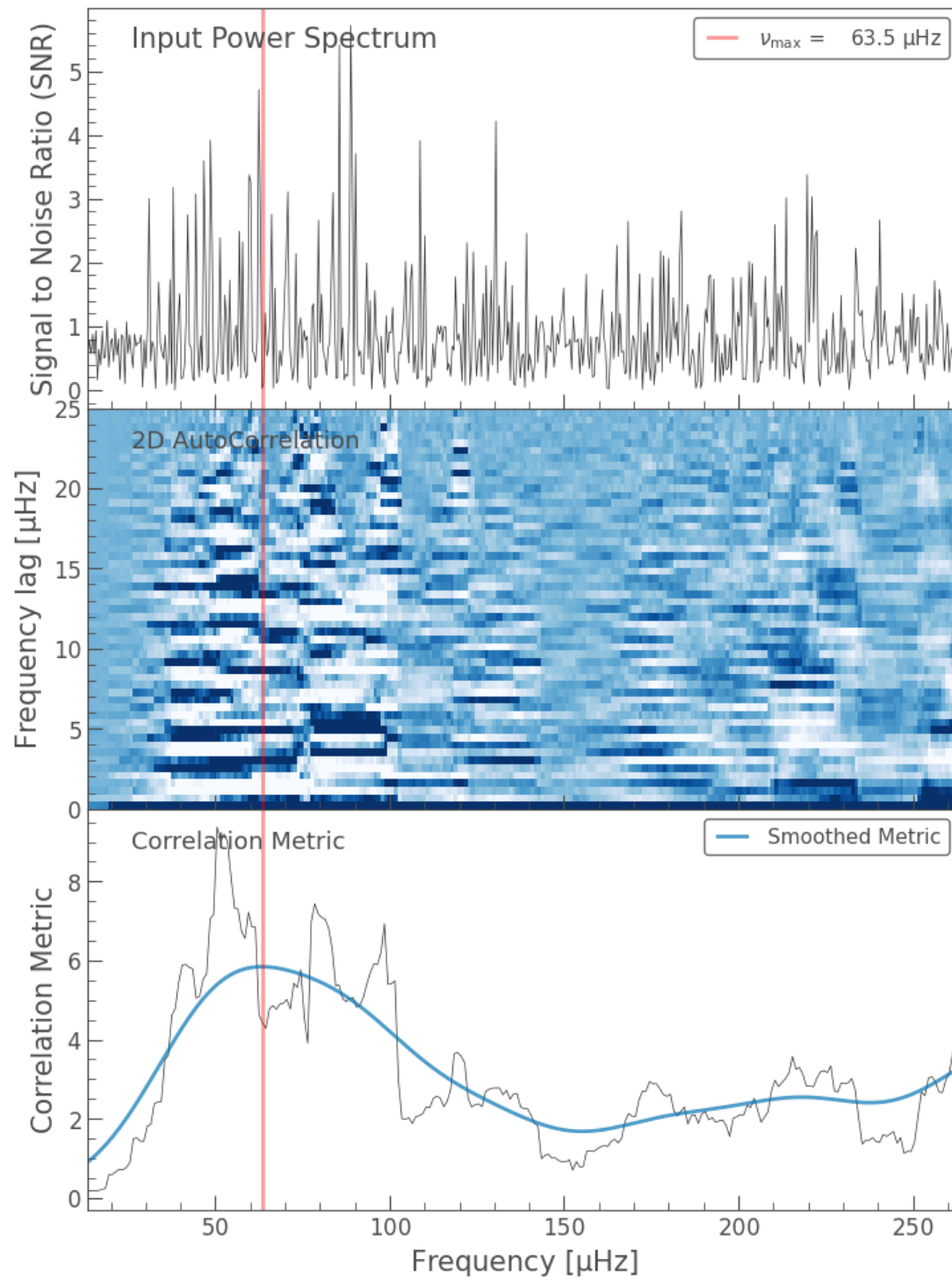


Fig3: Diagnosis of numax calculation

Based on ν_{max} , we estimated $\Delta\nu$ as **7.94 μHz** .

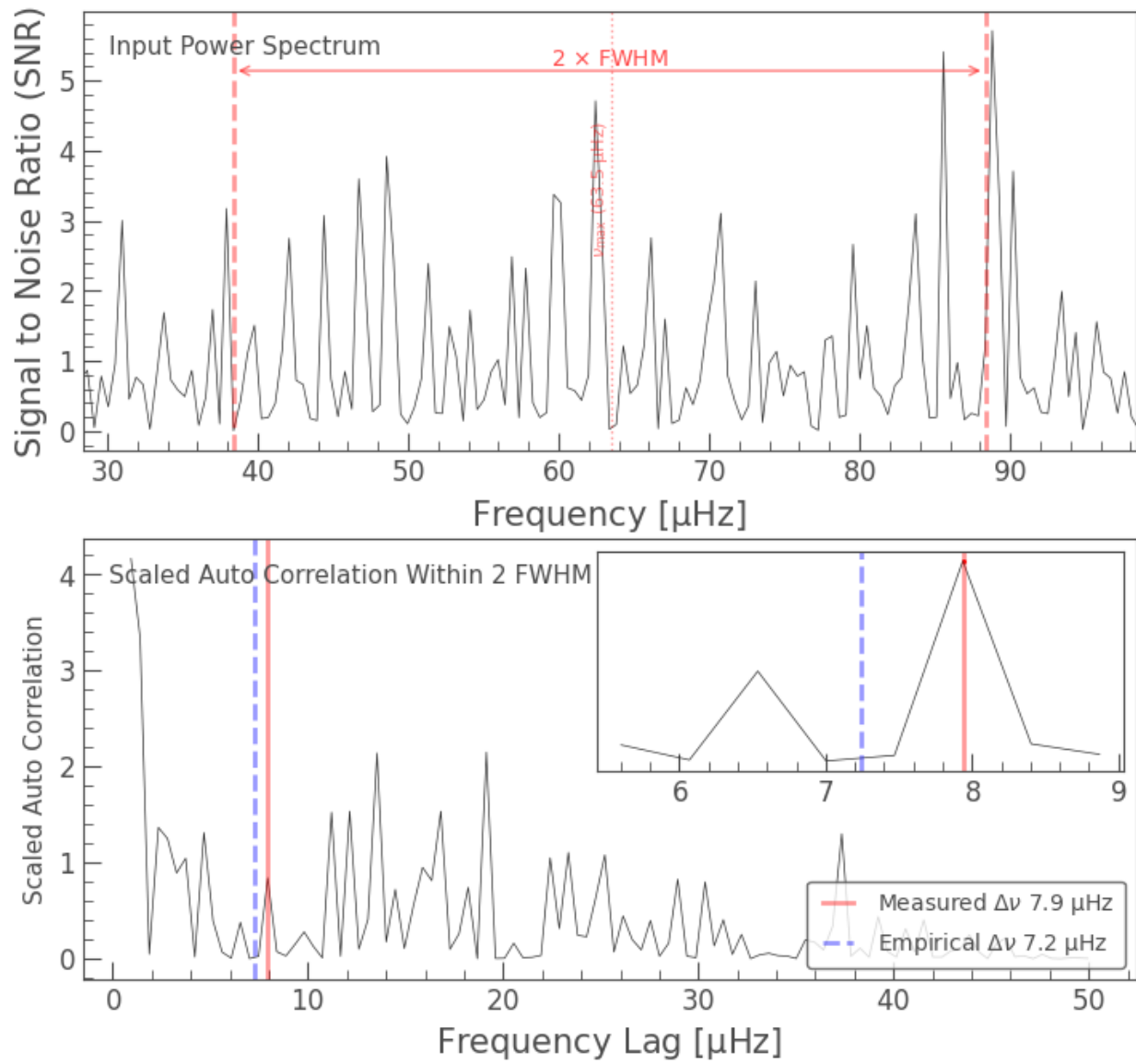


Fig4: Diagnosis of $\Delta\nu$ calculation

Finally, using scaling relations (given an estimate of the star's effective temperature as 5777.2 K)

$$\frac{M}{M_{\odot}} \simeq \left(\frac{v_{\max}}{v_{\max,\odot}} \right)^3 \left(\frac{\Delta v}{\Delta v_{\odot}} \right)^{-4} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{3/2},$$

$$\frac{R}{R_{\odot}} \simeq \left(\frac{v_{\max}}{v_{\max,\odot}} \right) \left(\frac{\Delta v}{\Delta v_{\odot}} \right)^{-2} \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{1/2} \text{ and}$$

$$\frac{g}{g_{\odot}} \simeq \left(\frac{v_{\max}}{v_{\max,\odot}} \right) \left(\frac{T_{\text{eff}}}{T_{\text{eff},\odot}} \right)^{1/2}$$

We estimated stellar mass and radius using Uncorrected Scaling Relations as:

Mass = 1.91 M_{\odot}

Radius = 2.89 R_{\odot}