

Filtering solar-like oscillations

Warrick Ball

Bill Chaplin, Heather Cegla, Christopher Watson & Guy Davies

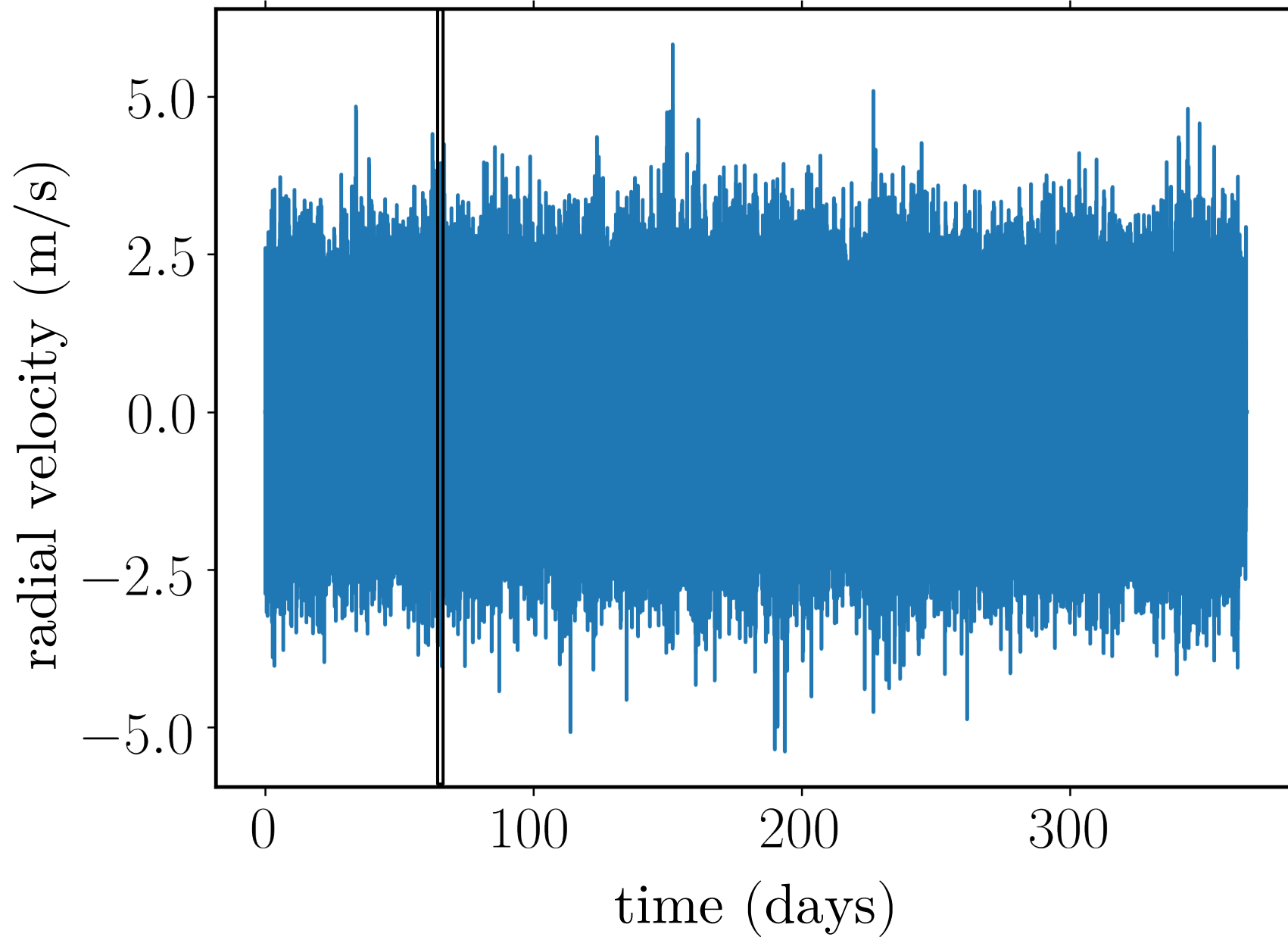
University of Birmingham

18th March 2019

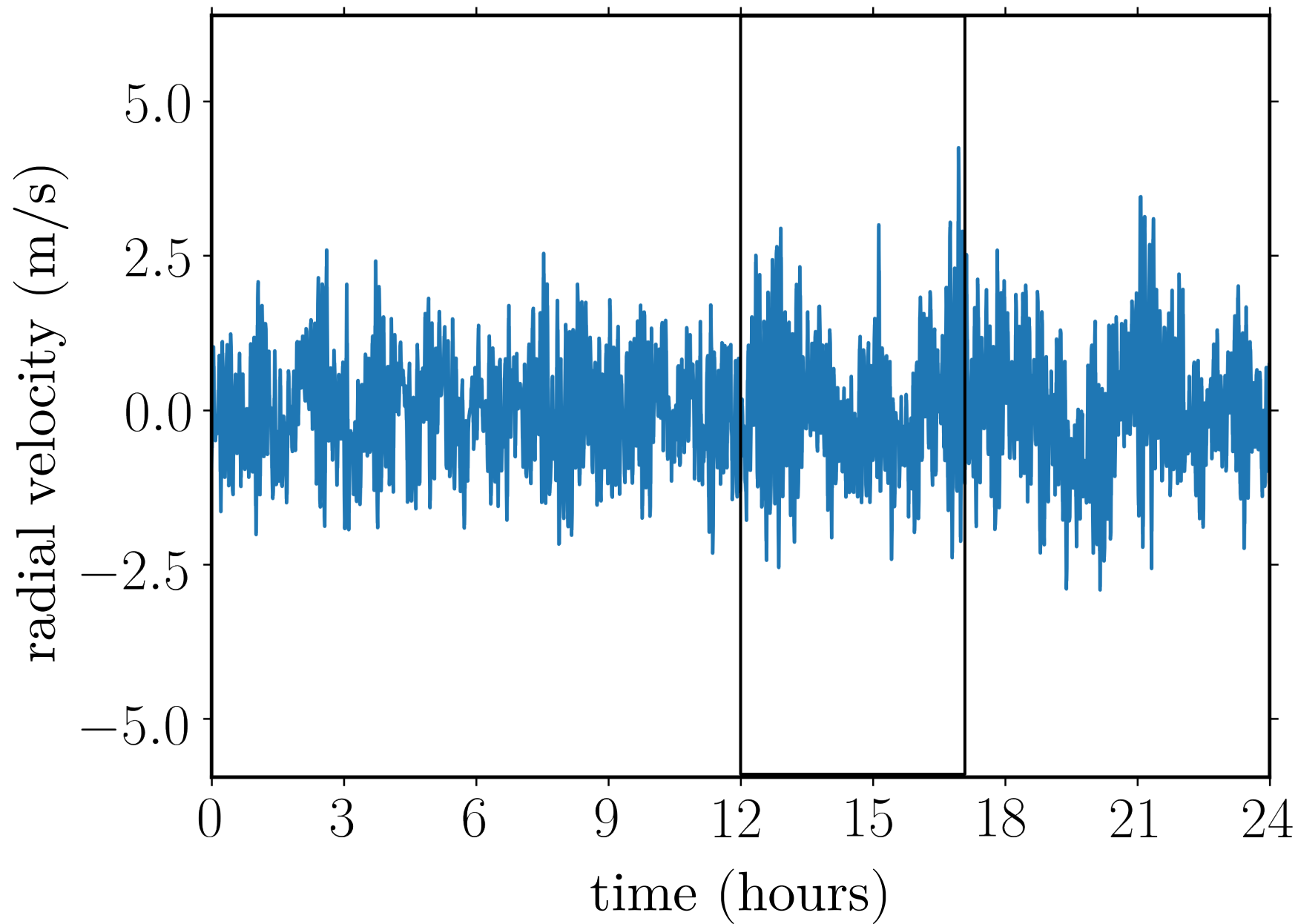


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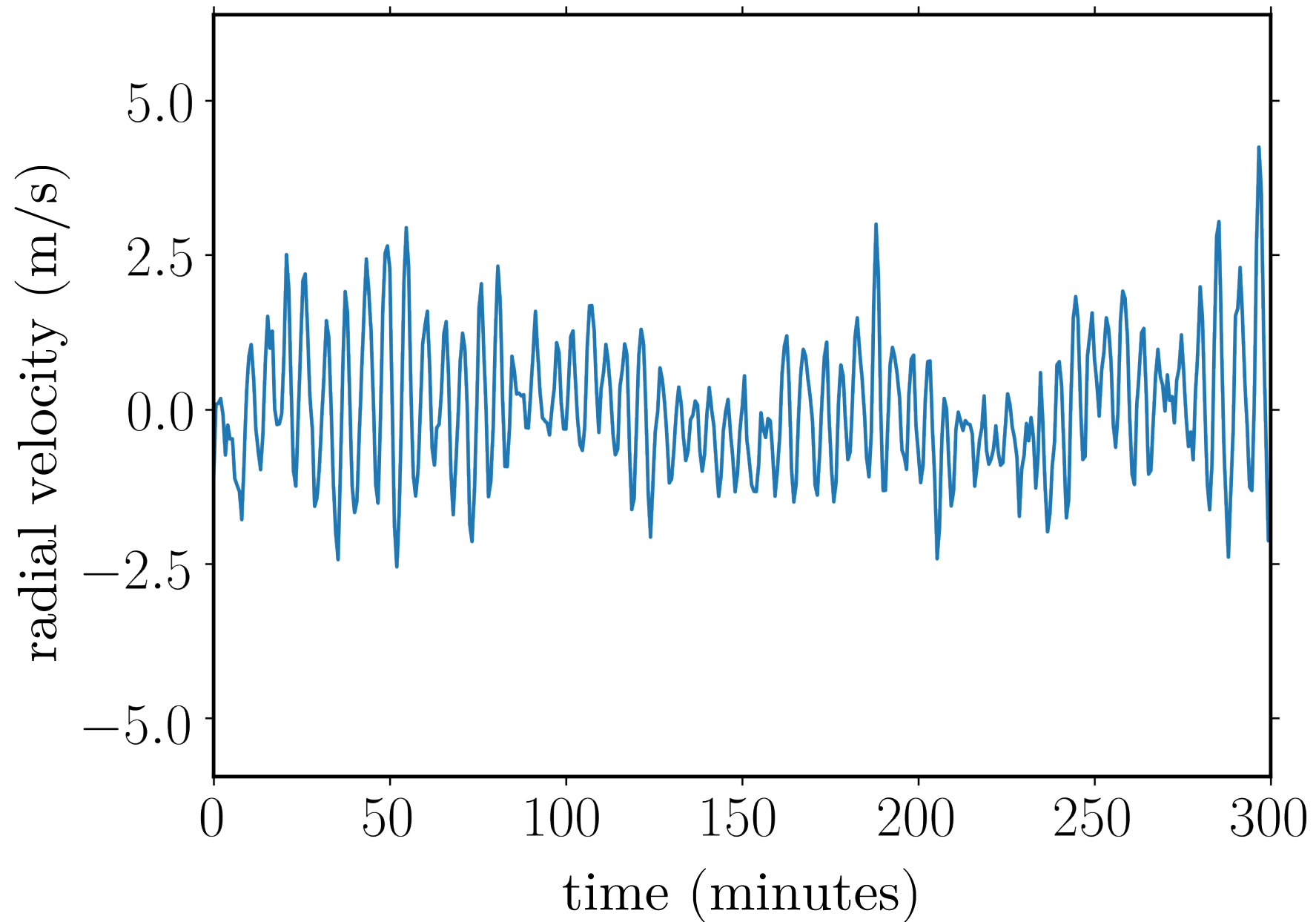
One year of BiSON RVs



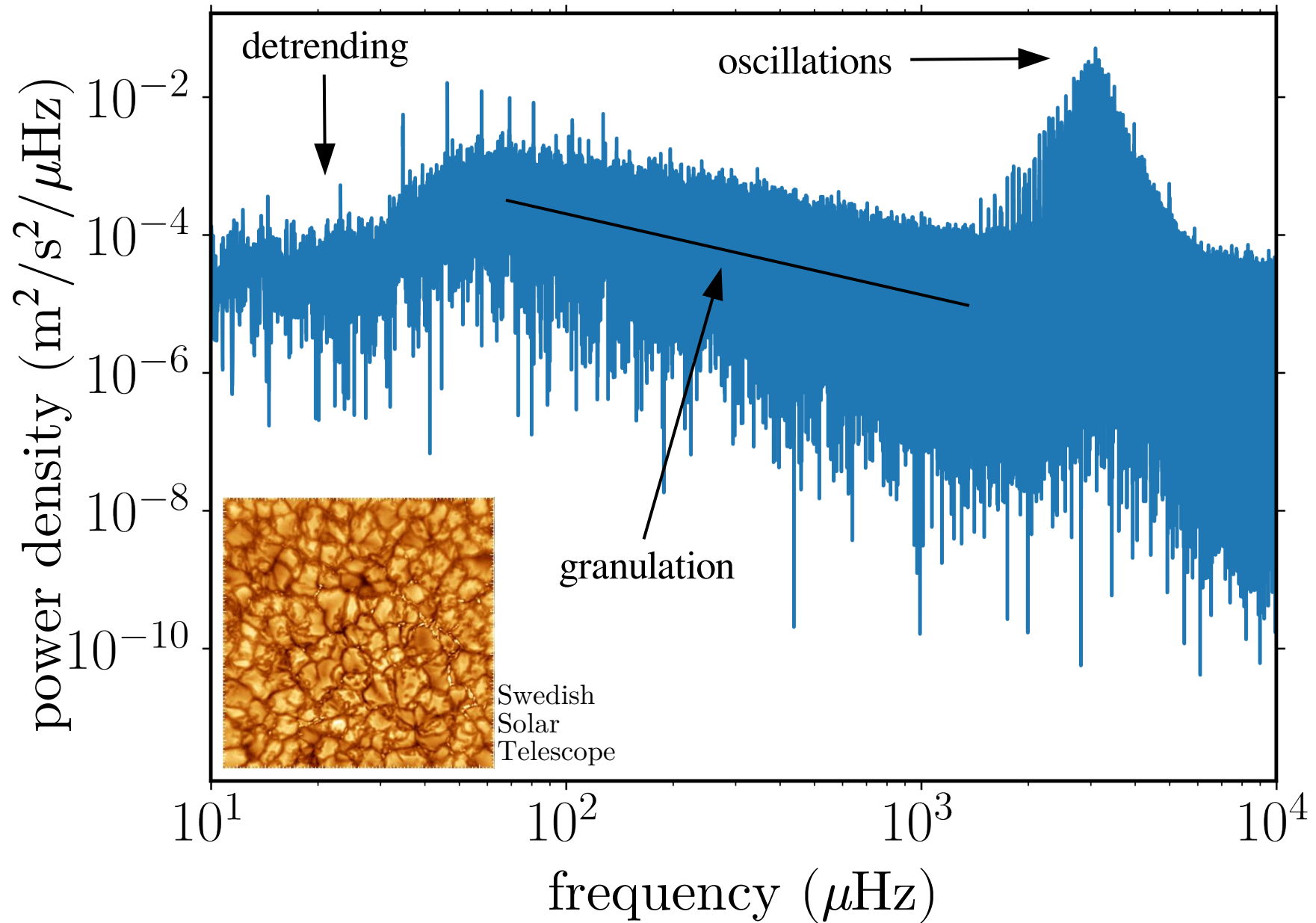
One day of BiSON RVs



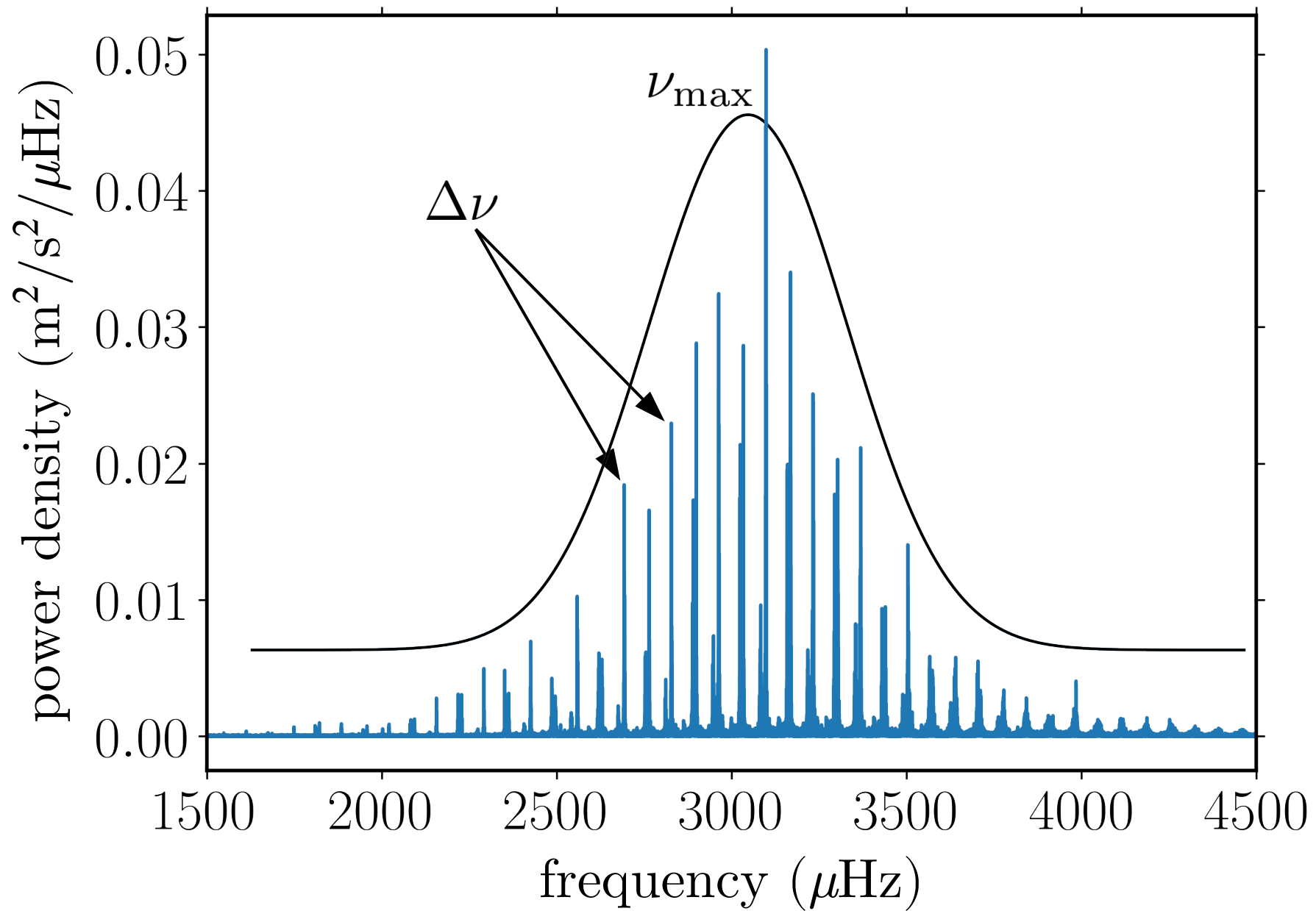
Five hours of BiSON RVs



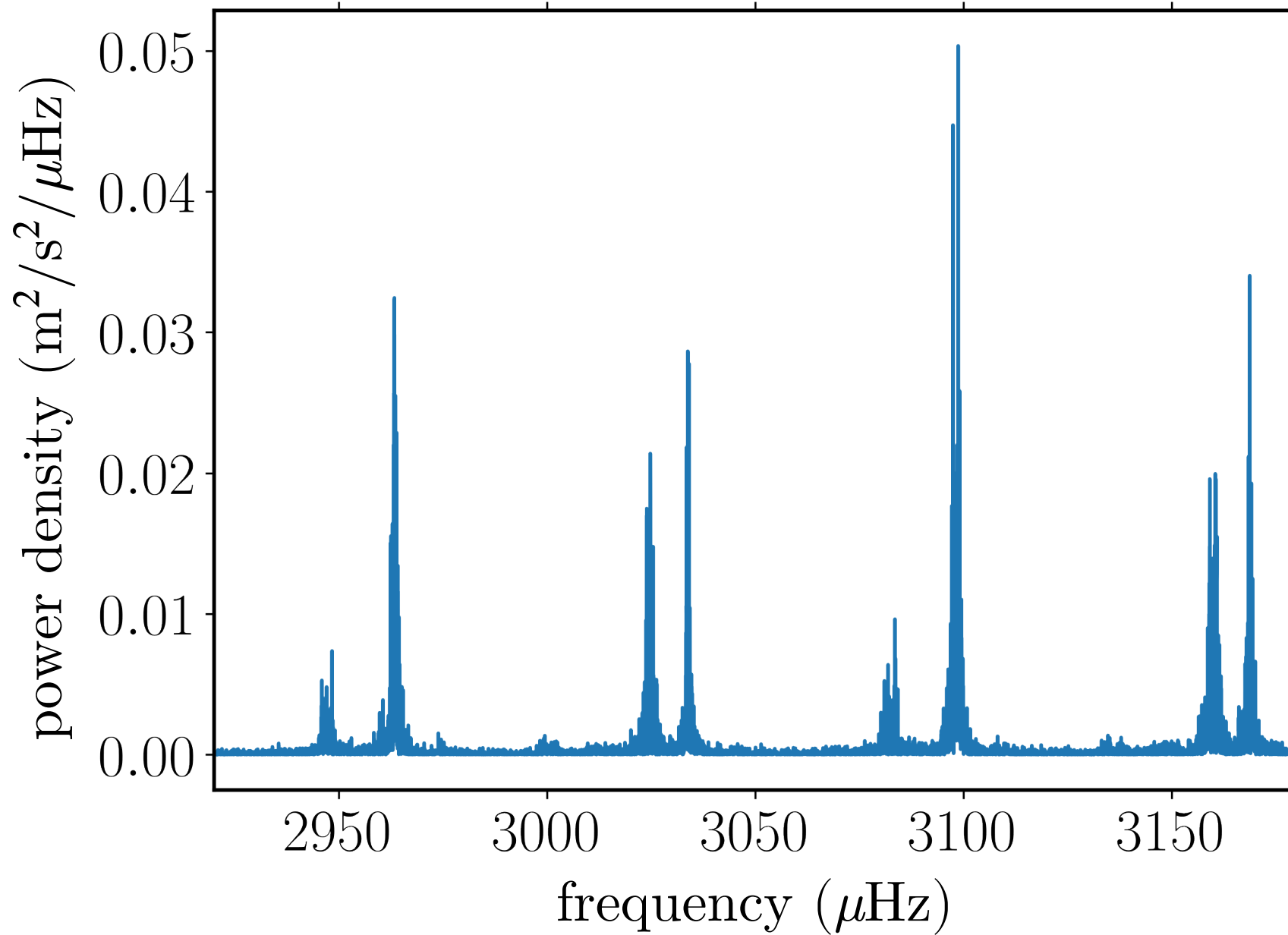
One year of BiSON RVs



“Global properties”: $\Delta\nu$, ν_{\max}

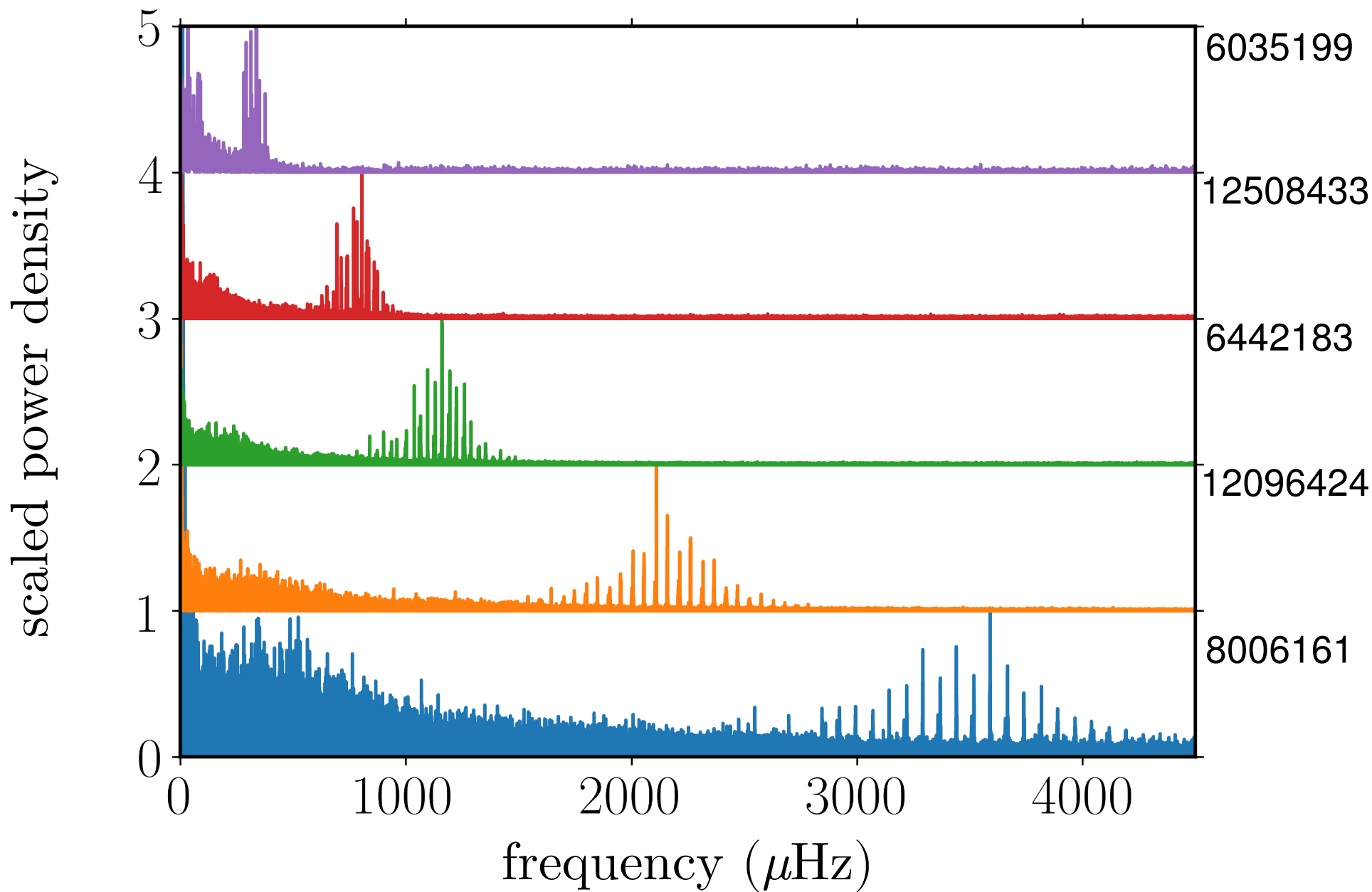


Individual modes



Solar-mass(ish) solar-like oscillations

Chaplin & Miglio (2013)

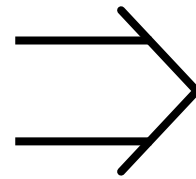


Scaling relations

Kjeldsen & Bedding (1995)

$$\Delta\nu \propto \sqrt{\bar{\rho}} \propto \sqrt{\frac{M}{R^3}}$$

$$M \propto \frac{\nu_{\max}^3}{\Delta\nu^4} T_{\text{eff}}^{3/2}$$



$$\nu_{\max} \propto \frac{g}{\sqrt{T_{\text{eff}}}} \propto \frac{M}{R^2 \sqrt{T_{\text{eff}}}}$$

$$R \propto \frac{\nu_{\max}}{\Delta\nu^2} T_{\text{eff}}^{1/2}$$

arXiv:1903.00657

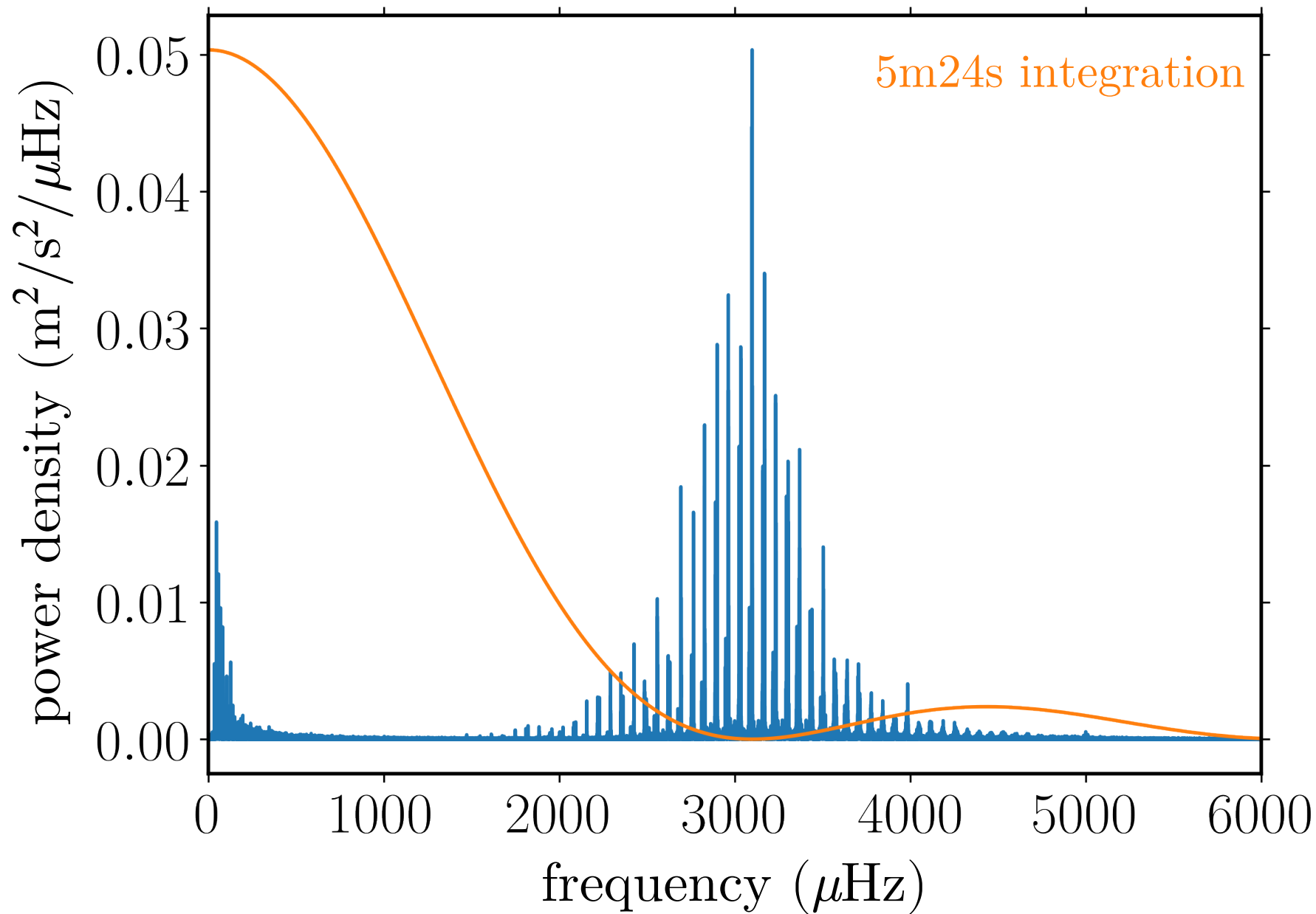
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FILTERING SOLAR-LIKE OSCILLATIONS FOR EXOPLANET DETECTION IN RADIAL
VELOCITY OBSERVATIONS

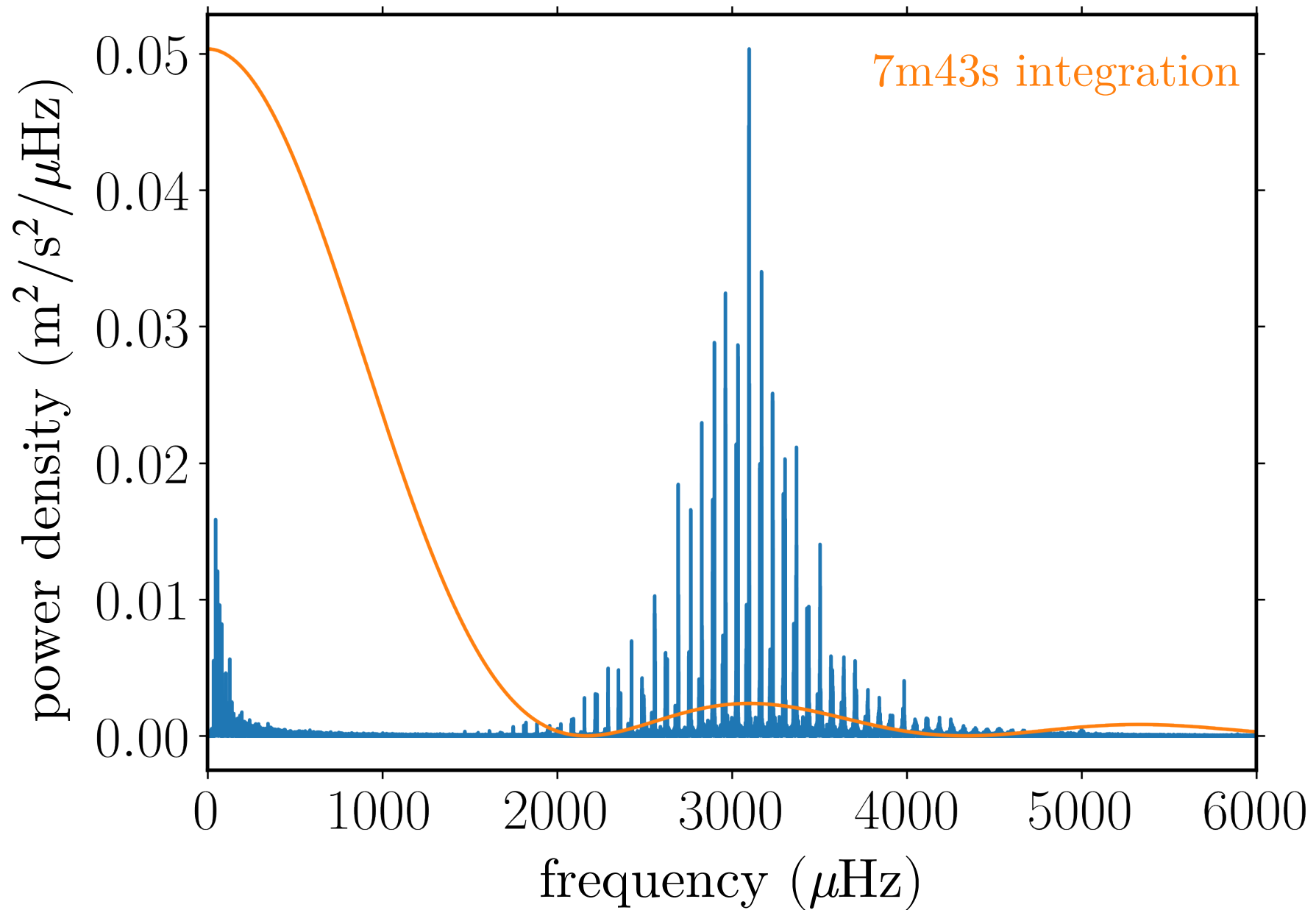
WILLIAM J. CHAPLIN,^{1,2} HEATHER M. CEGLA,^{3,4} CHRISTOPHER A. WATSON,⁵ GUY R. DAVIES,^{1,2}
AND WARRICK H. BALL^{1,2}

pip3 install chaplinfilter

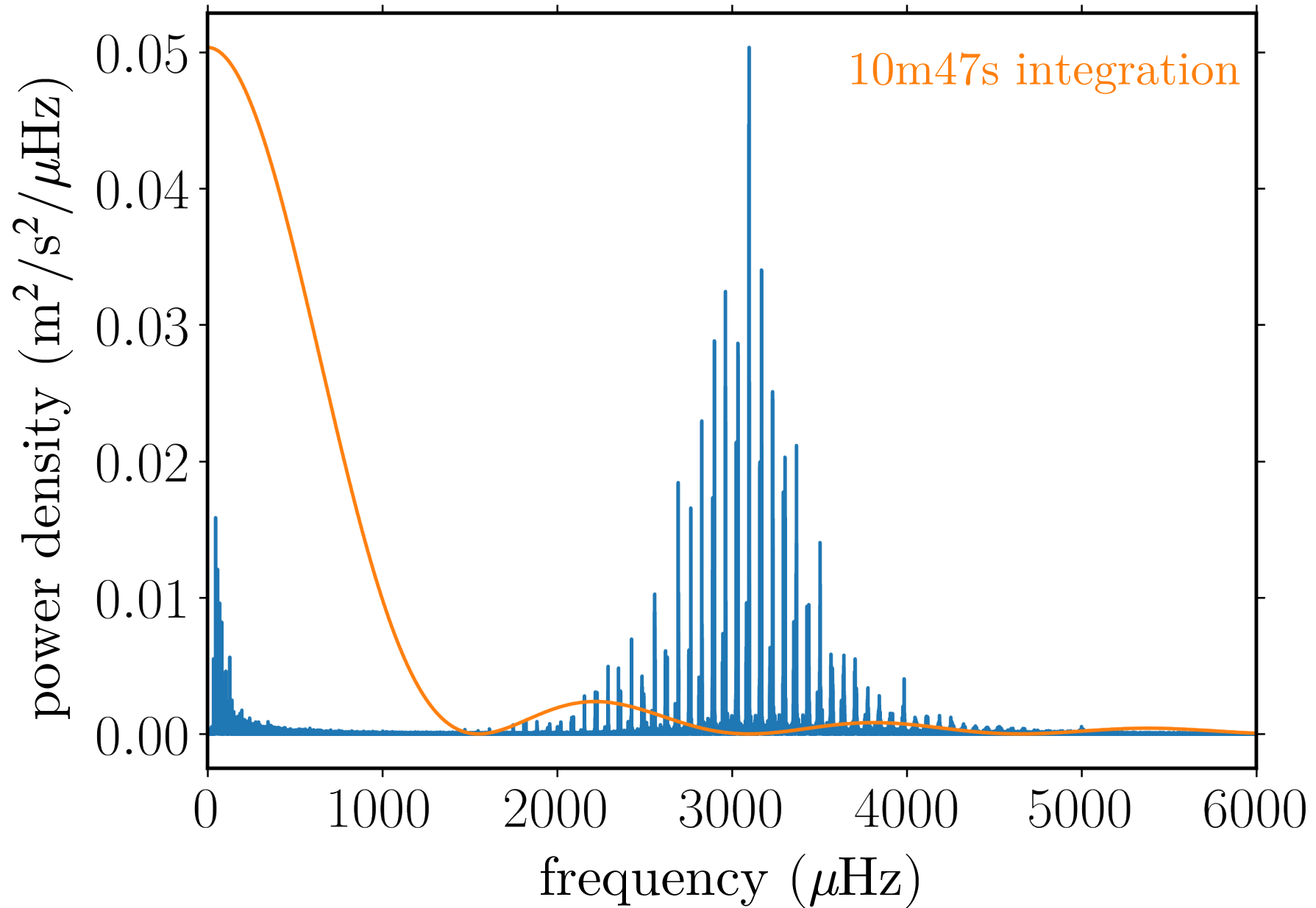
The effect of integrating on different timescales



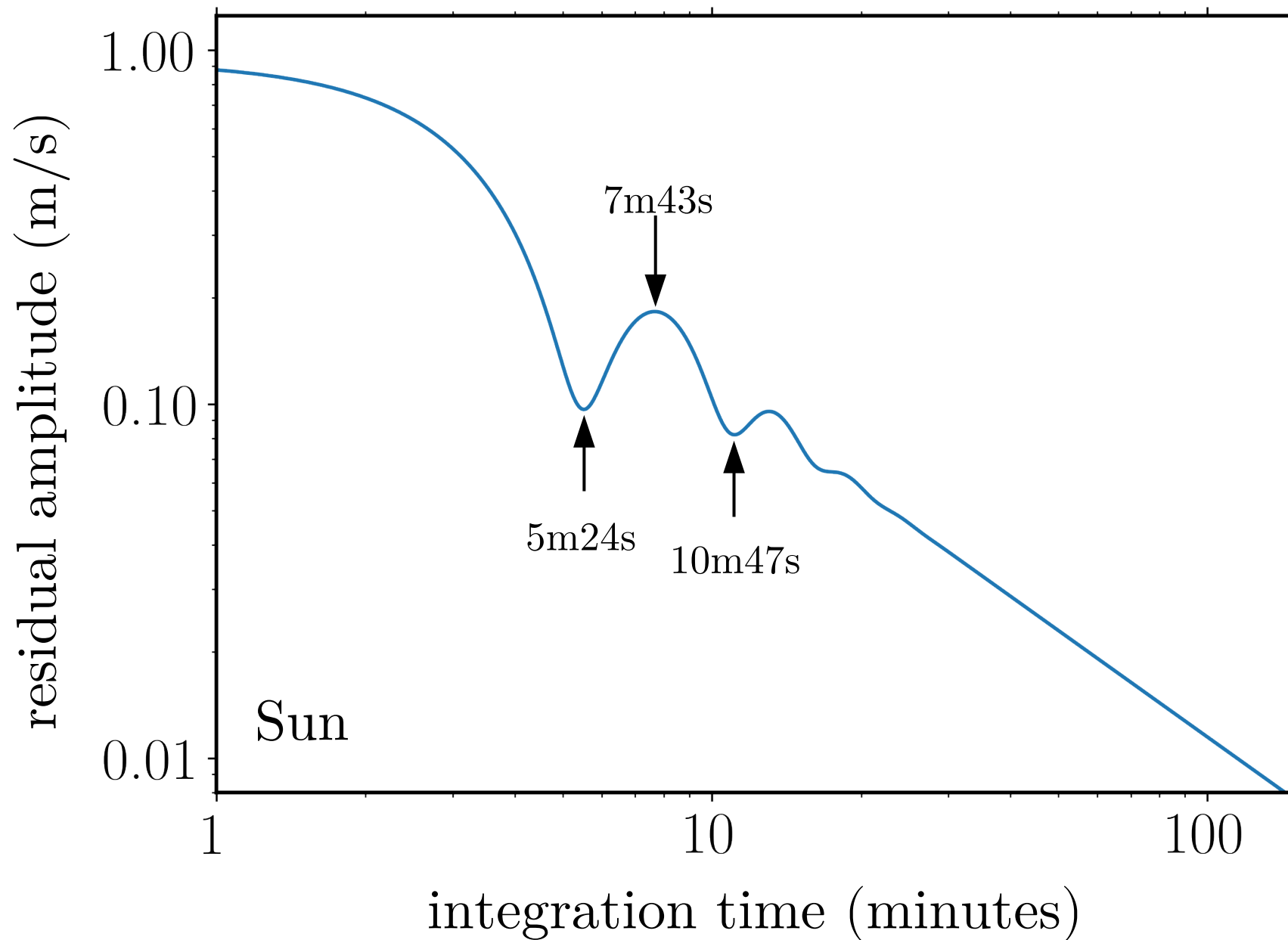
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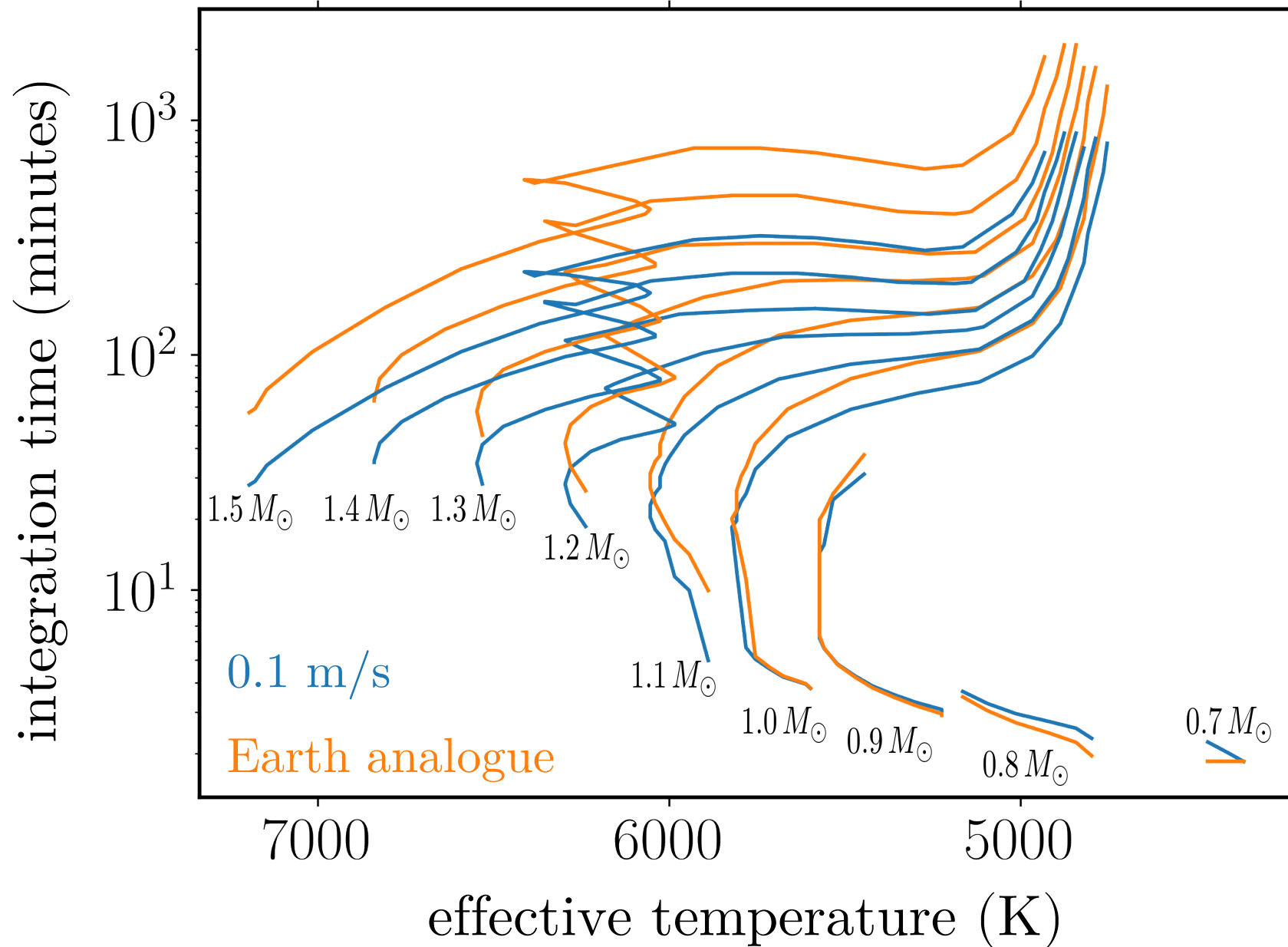
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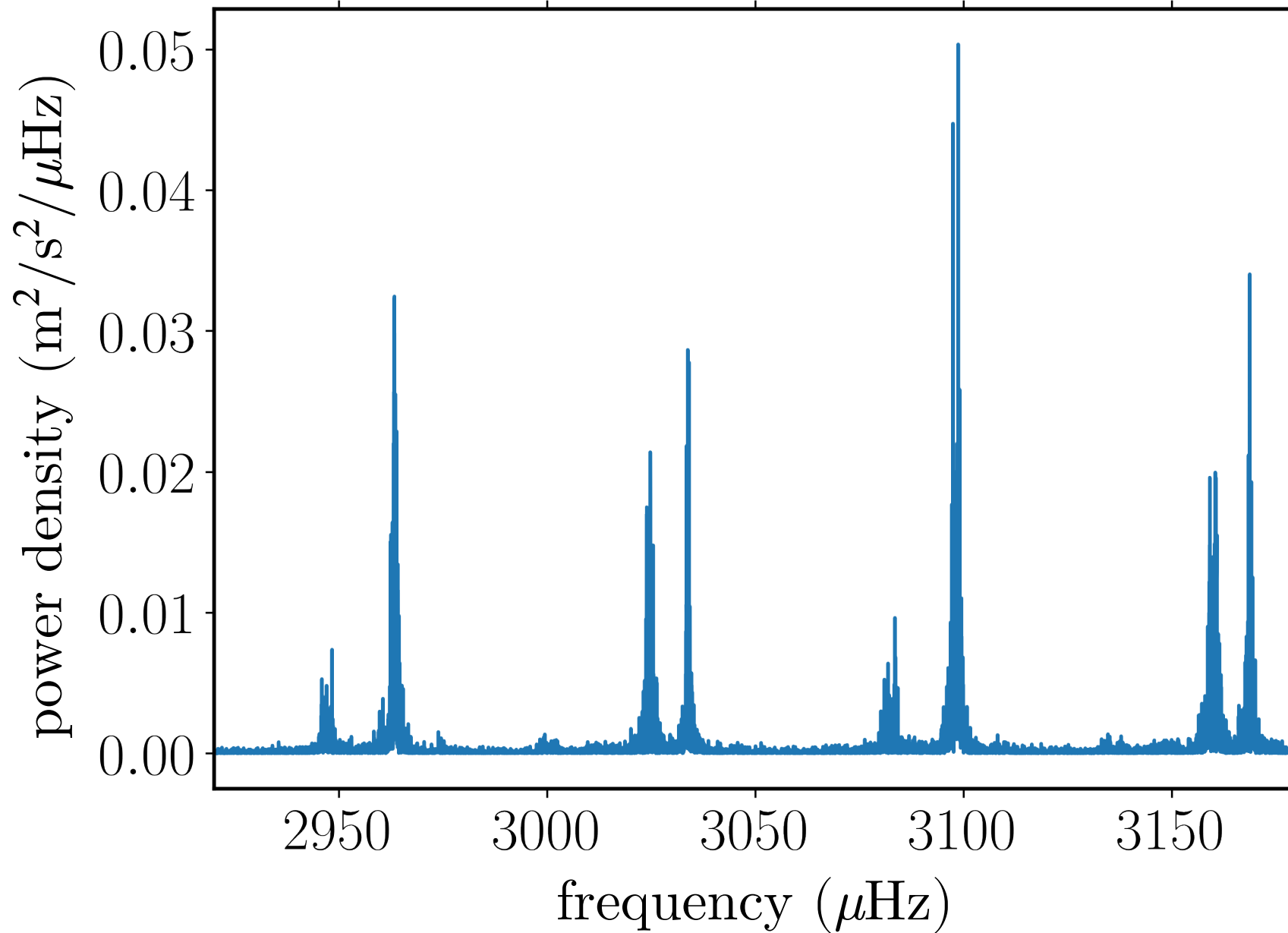
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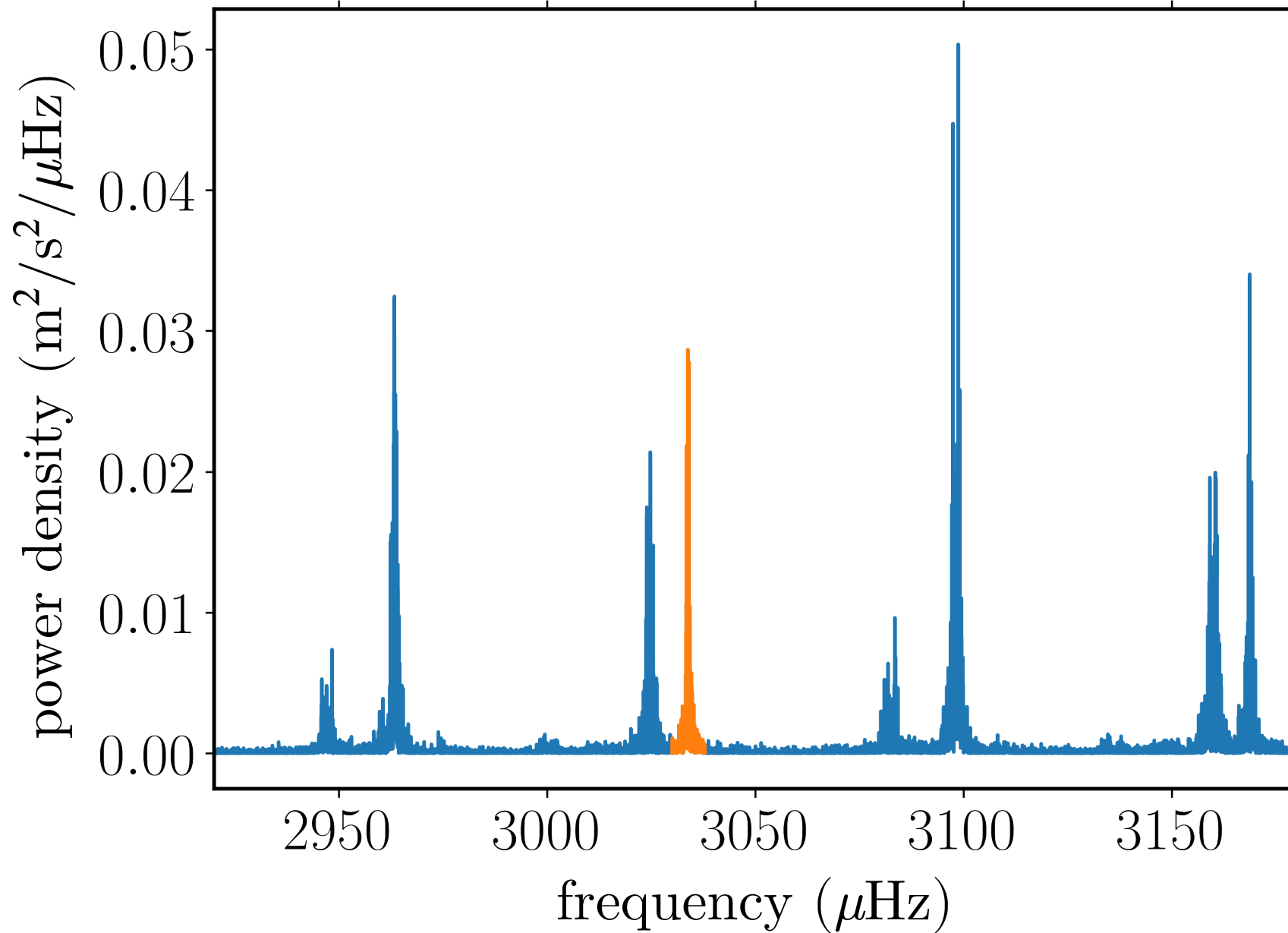
Integration time as a function of stellar properties



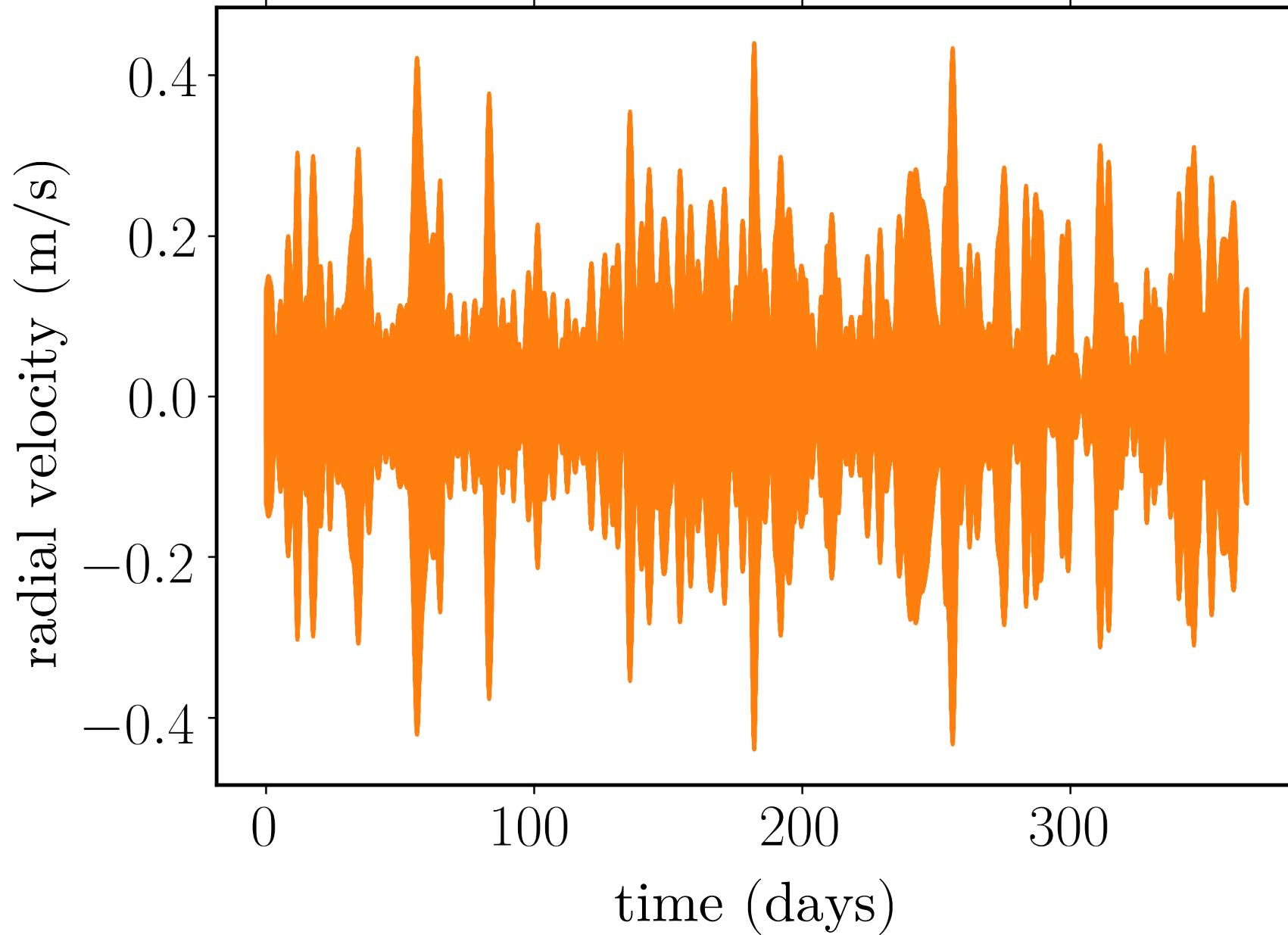
The stochastic nature of solar-like oscillations



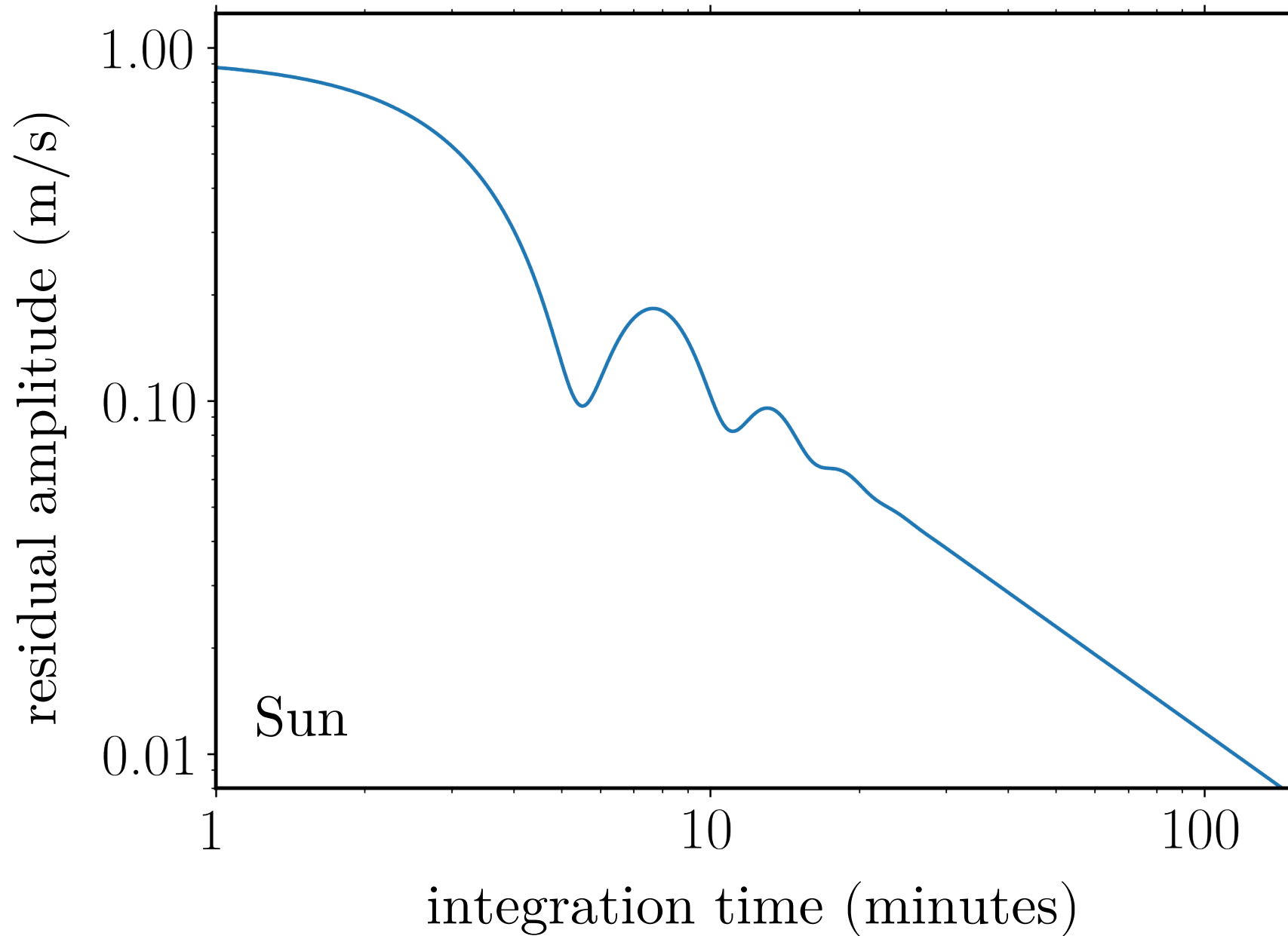
The stochastic nature of solar-like oscillations



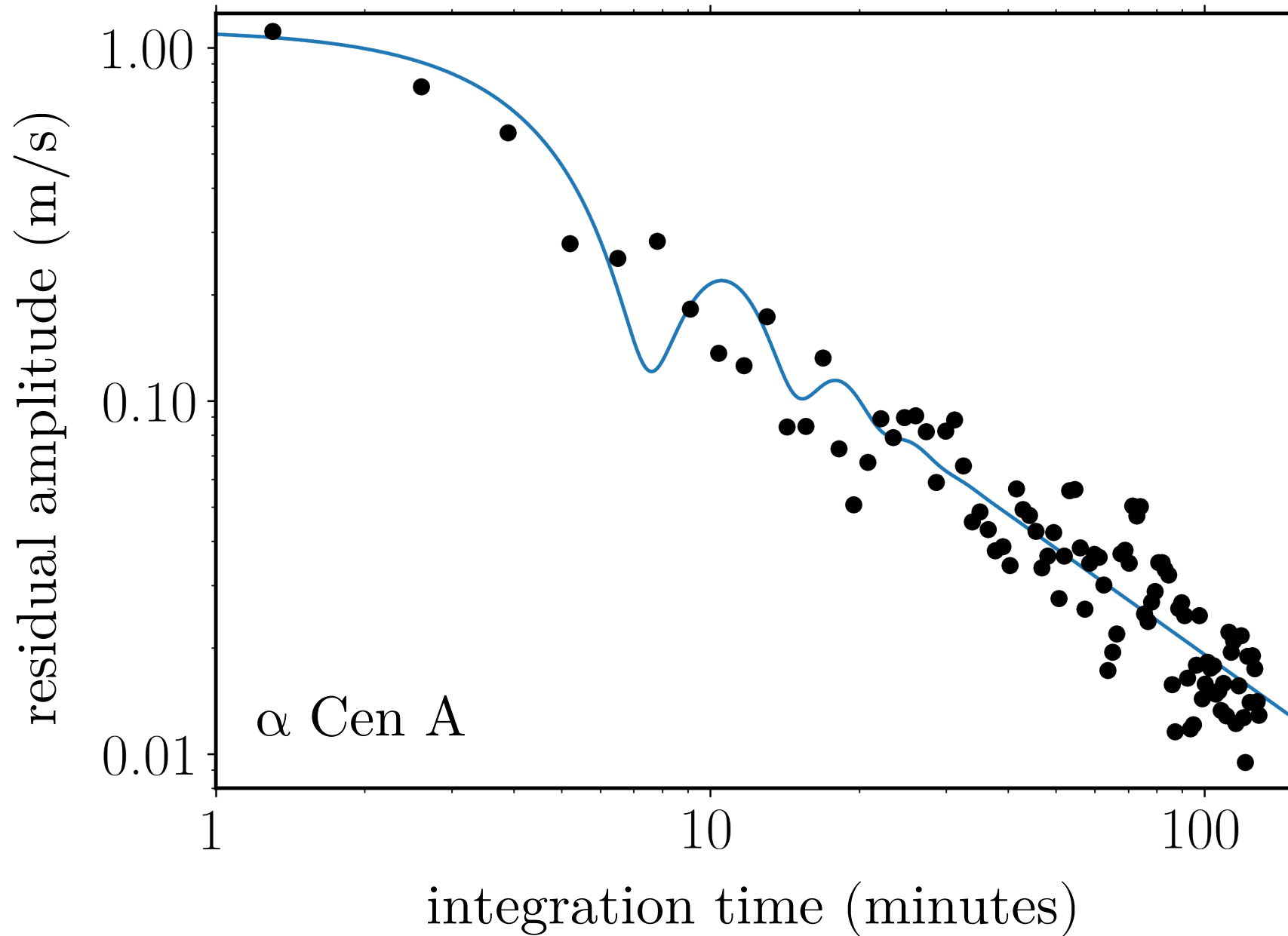
The stochastic nature of solar-like oscillations



The stochastic nature of solar-like oscillations



The stochastic nature of solar-like oscillations



Use the shortest possible integrations,
then bin up the RVs.

arXiv:1903.00657

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pip3 install chaplinfilter

Using chaplinfilter

```
In [1]: from chaplinfilter import filter
```

```
In [2]: f = filter()
```

```
In [3]: f(5745, 4.3, 1.5) # Teff, logg, L/Lsun
```

```
Out [3]: array([[28.36402475, 22.49016425]])
```