THE FIRST K2 ROAP STAR: HD 24355 PULSATING IN A DISTORTED QUADRUPLOE MODE

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Mon. Not. R. Astron. Soc. **000**, 1–18 (2016) Printed 14 July 2016 (MN LATEX style file v2.2)

HD 24355 observed by the Kepler K2 mission: A rapidly oscillating Ap star pulsating in a distorted quadrupole mode⋆

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13 Jul 2016

arXiv:1607.03853v1

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THE ROAP STARS

- Discovered ~40 years ago
- Chemically peculiar A stars
- Strong magnetic fields — 1-24 kG
- Rare stars — 61 known to date (see Smalley et al 2015)
- Low degree, high overtone pulsators
    - Periods 5-20 min
    - Amplitudes up to 20 mmag in *B*-band
- Oblique pulsators — amplitude variation over rotation period

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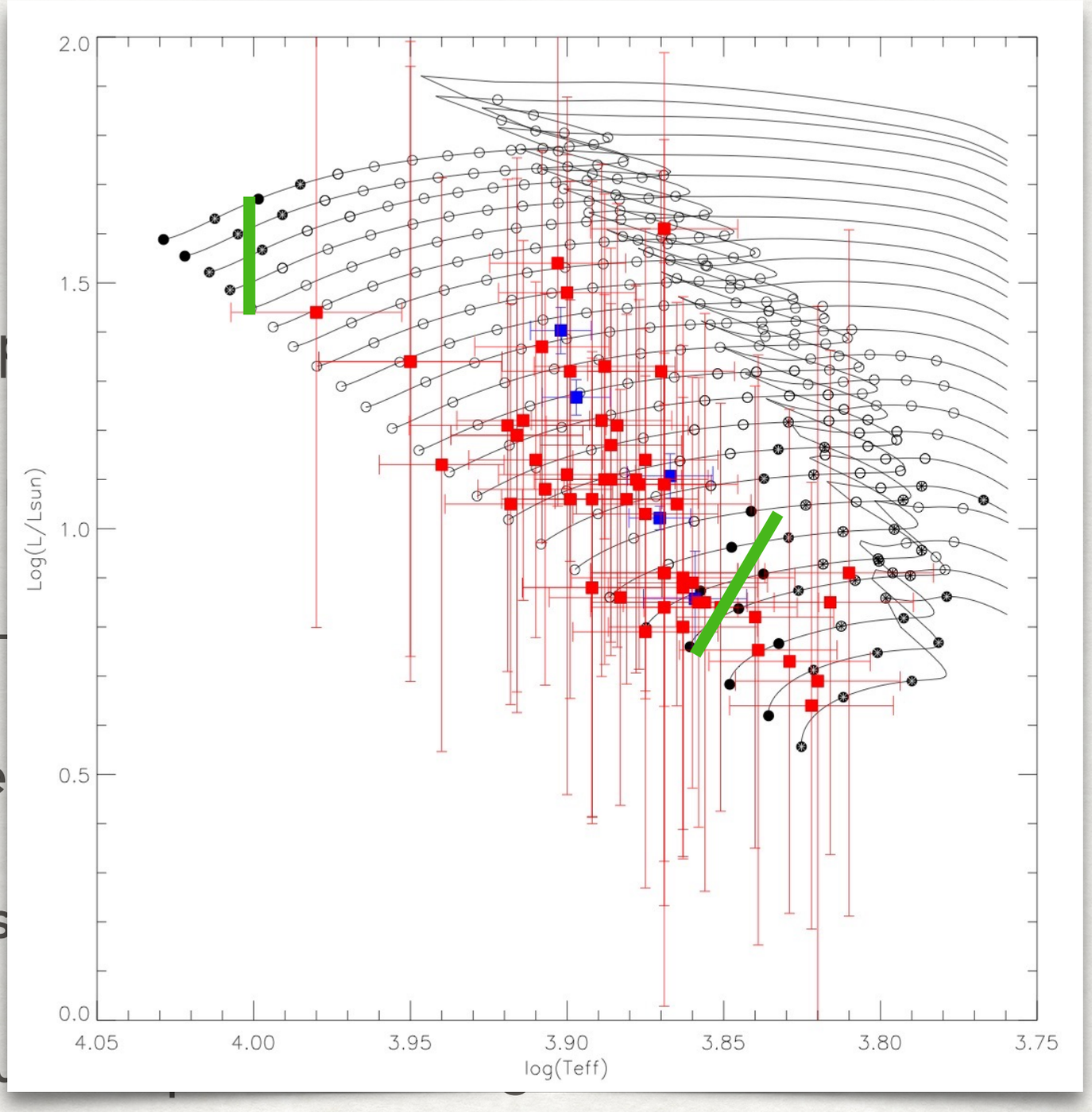
  - Periods
  - Amplitu



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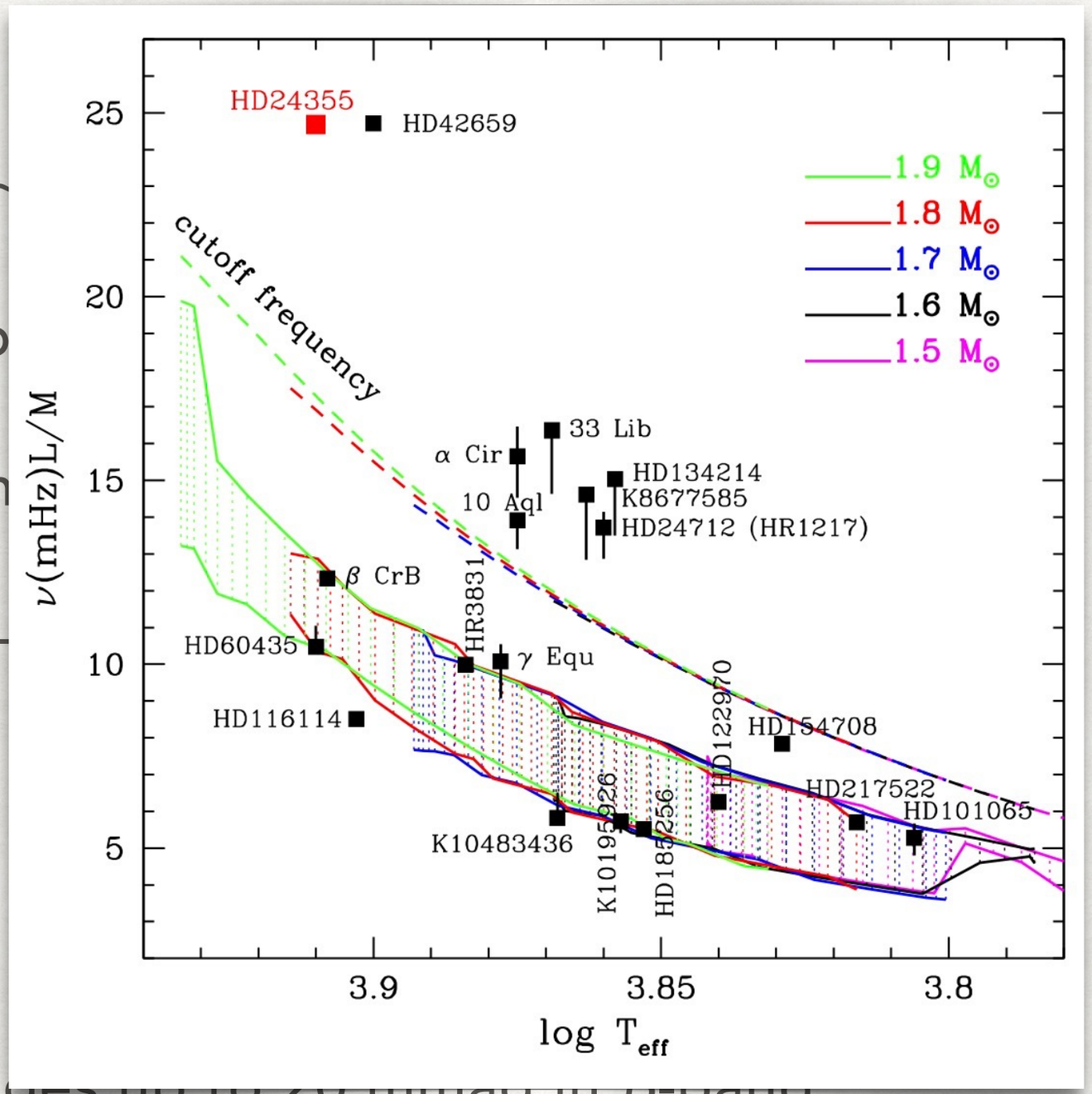
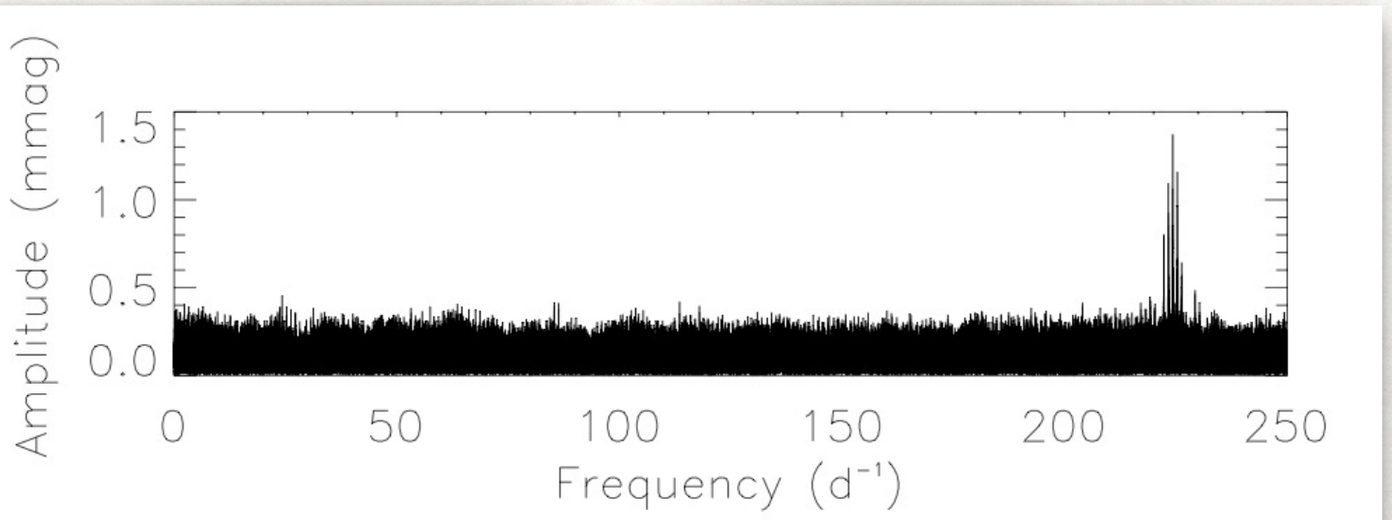


GROUND BASED OBSERVATIONS

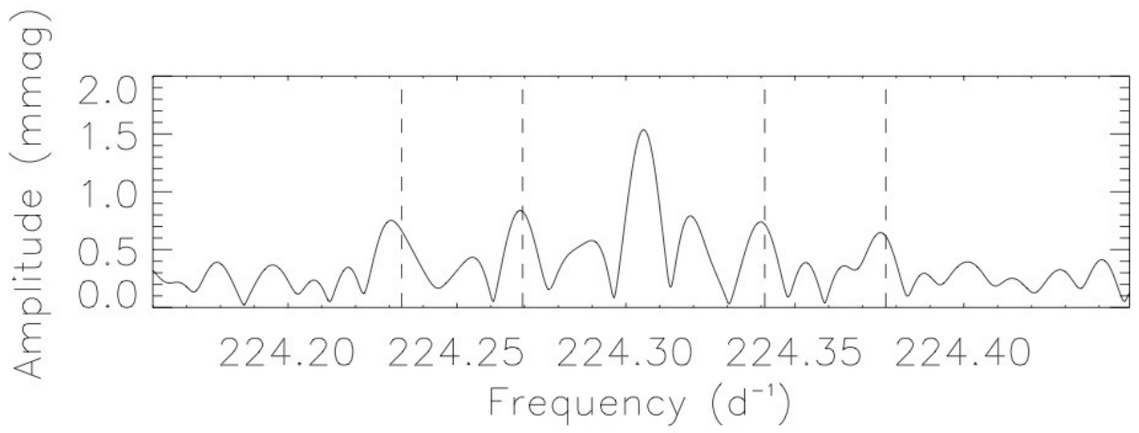
SUPERWASP & APT

- Observed for 3 seasons between 2006 and 2010 by SuperWASP



Frequency = 224.3 d^{-1}

Period = 6.4 min



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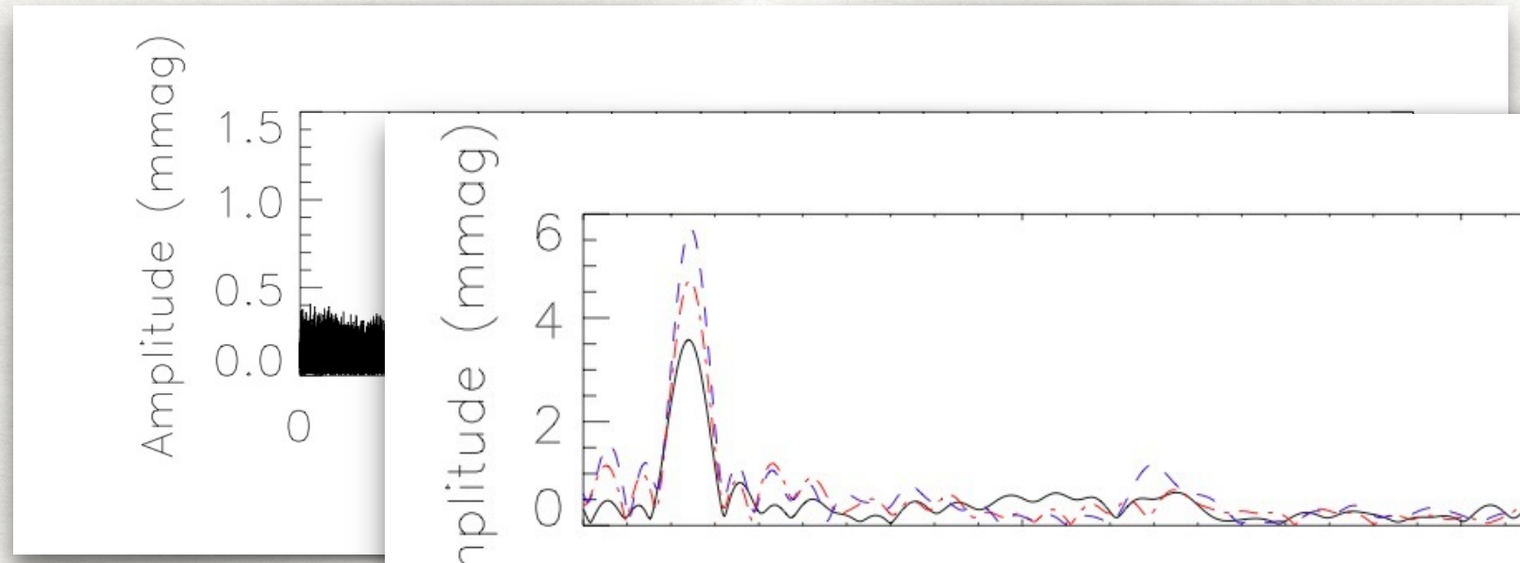
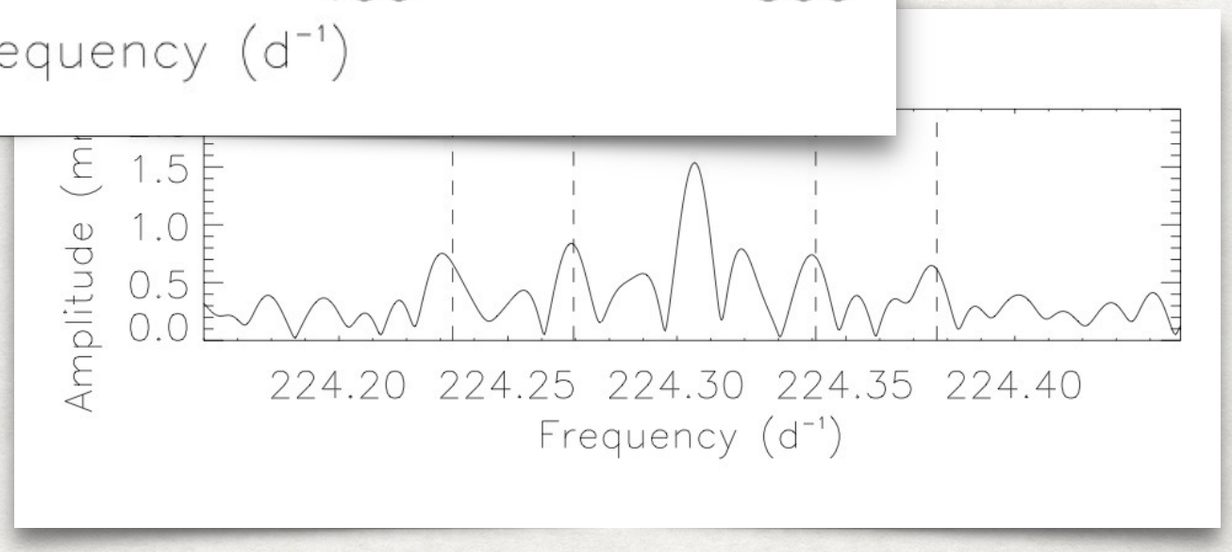
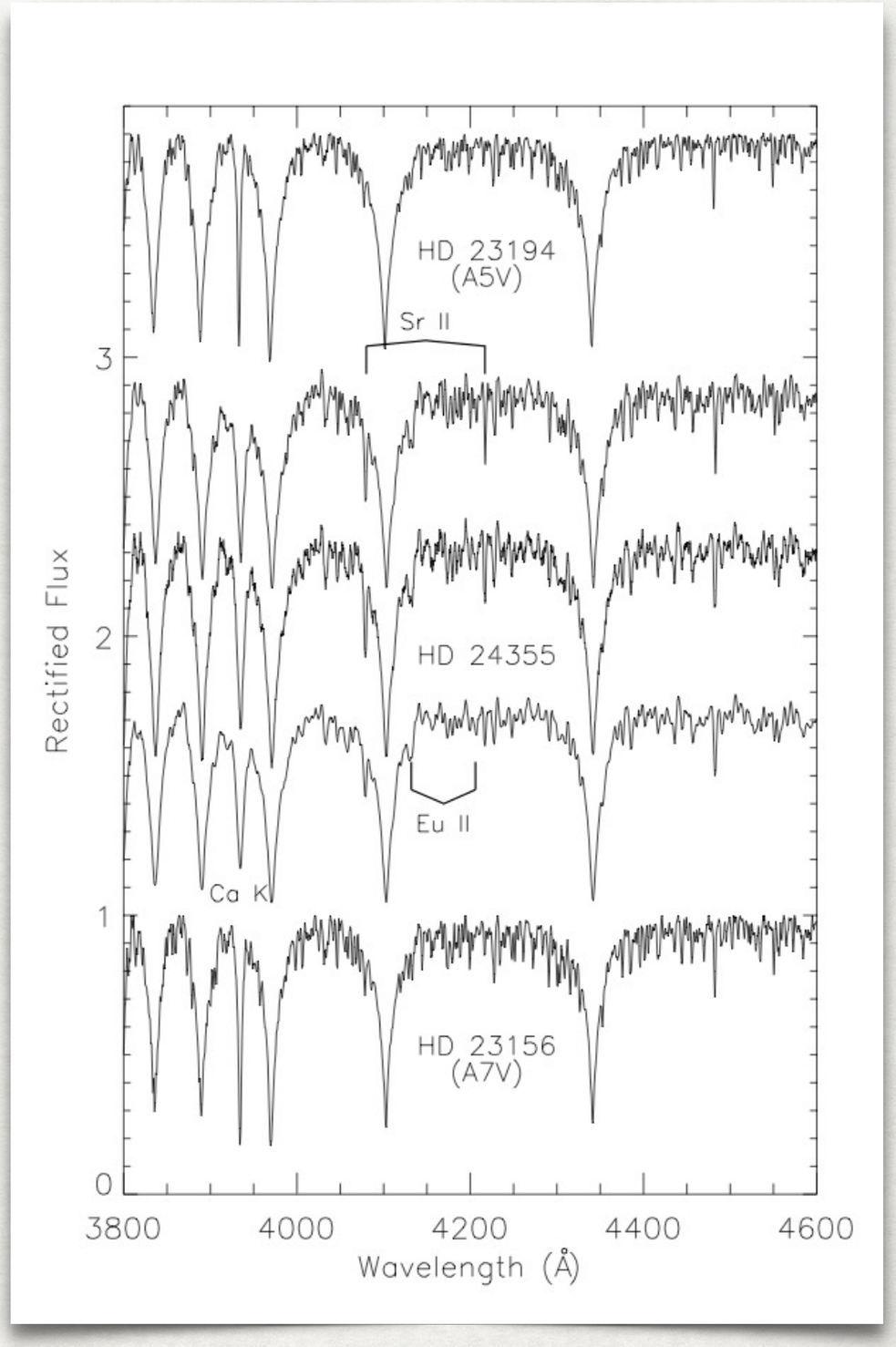




SPECTROSCOPIC PARAMETERS

- Low resolution spectra confirm Ap nature of HD 24355
- High resolution observations to measure abundances and v sin *i*
- Low magnetic field strength: 2.12±1.44 kG
- T_{eff}=8200±200 K
- M=2.40±0.38 $M_{\odot}$
- R=2.53±0.43 $R_{\odot}$



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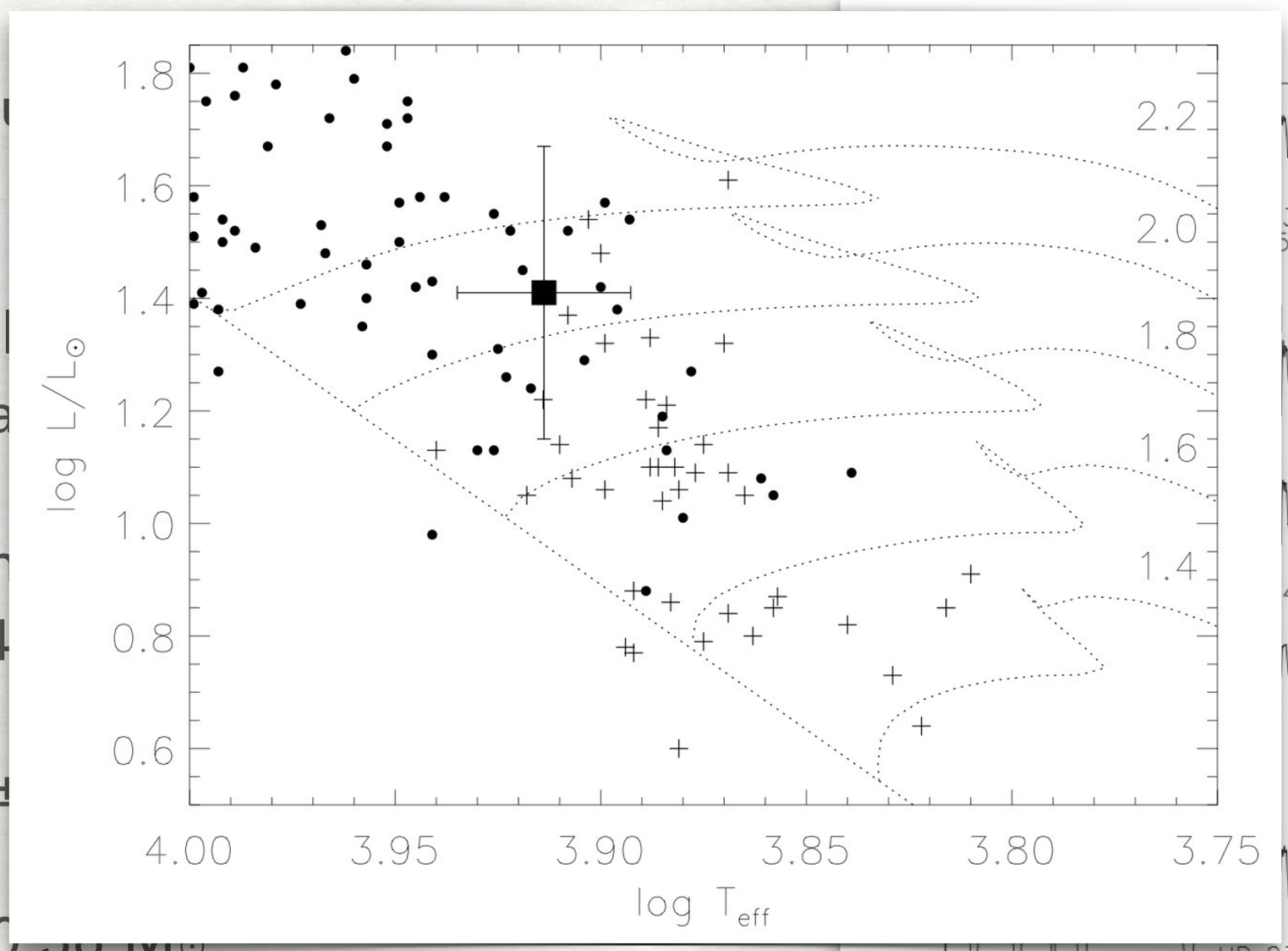
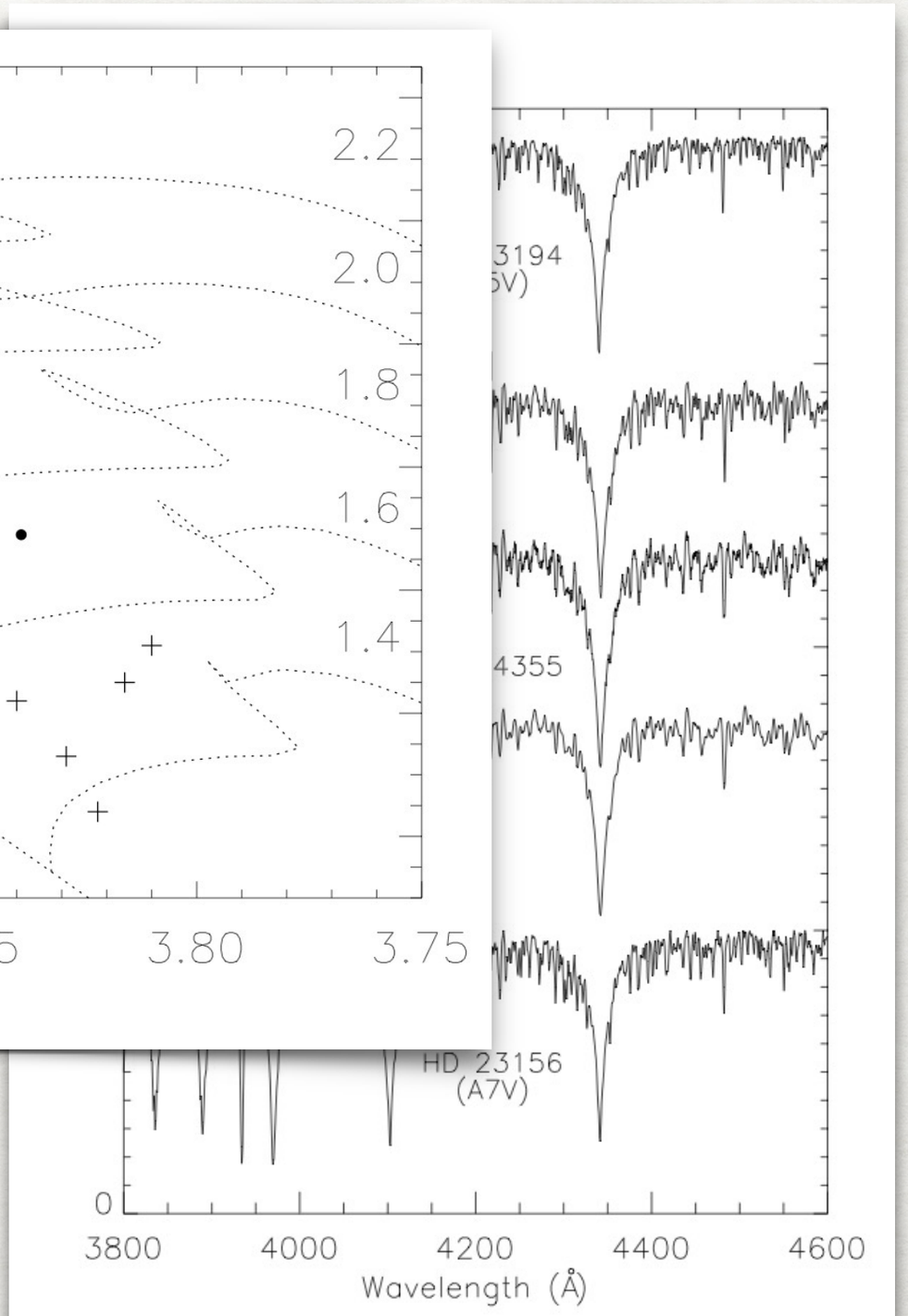
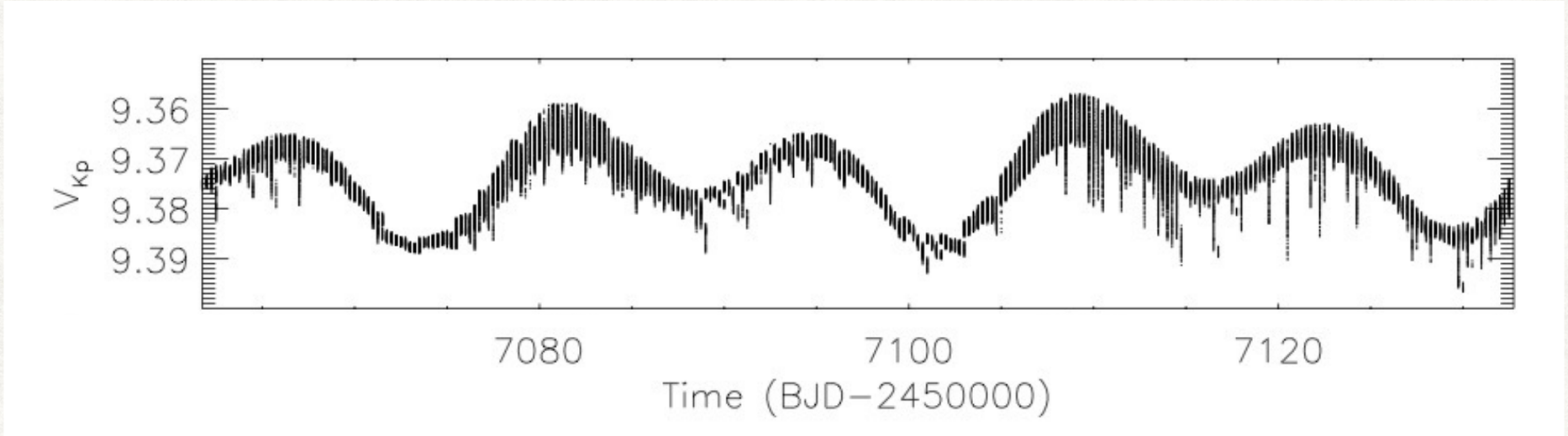
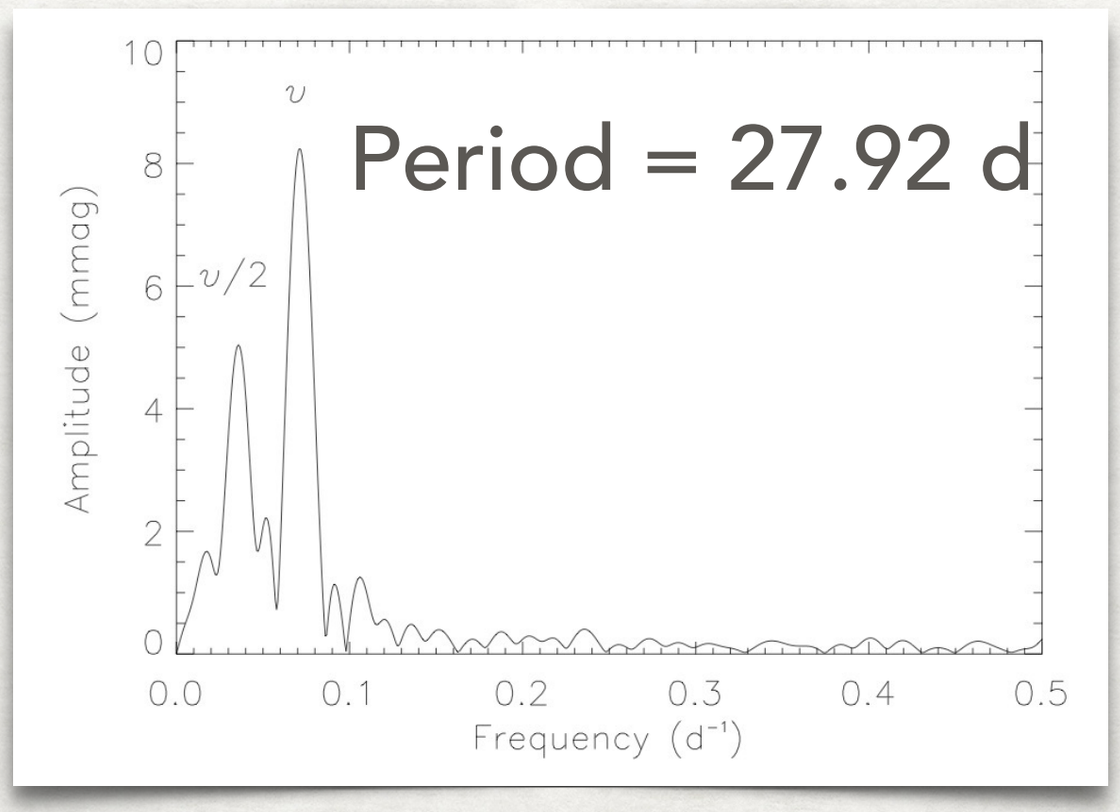


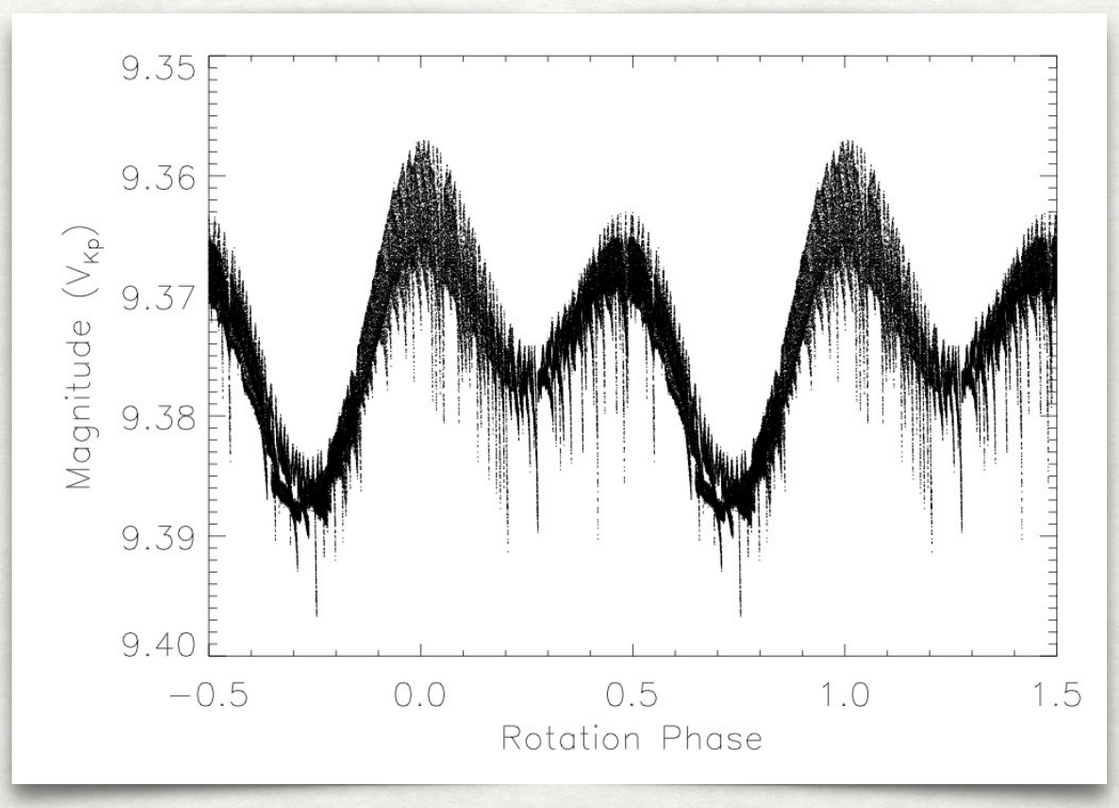


K2 OBSERVATIONS

ROTATIONAL MODULATION

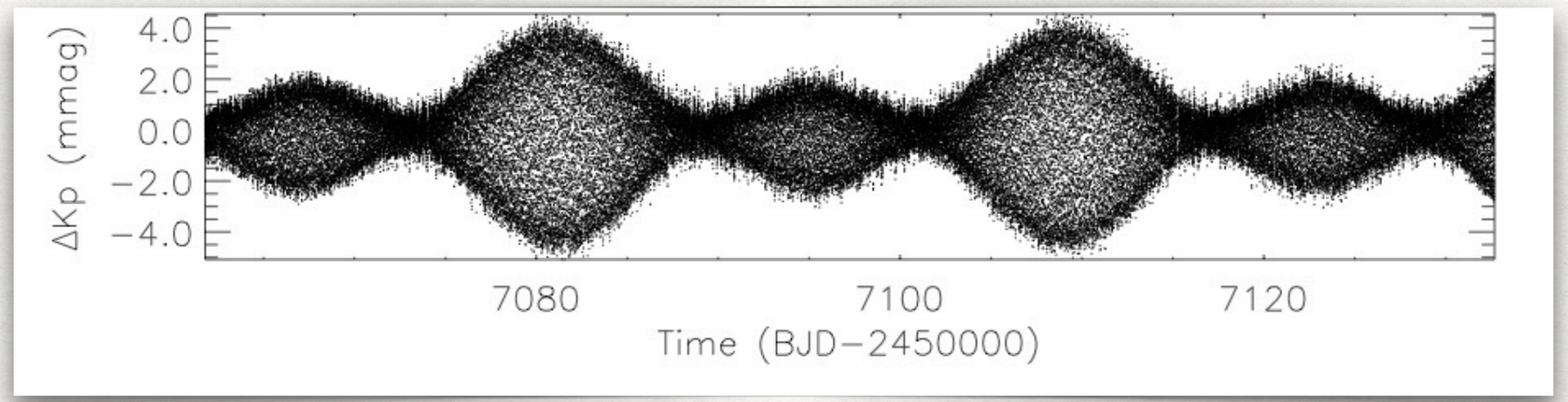


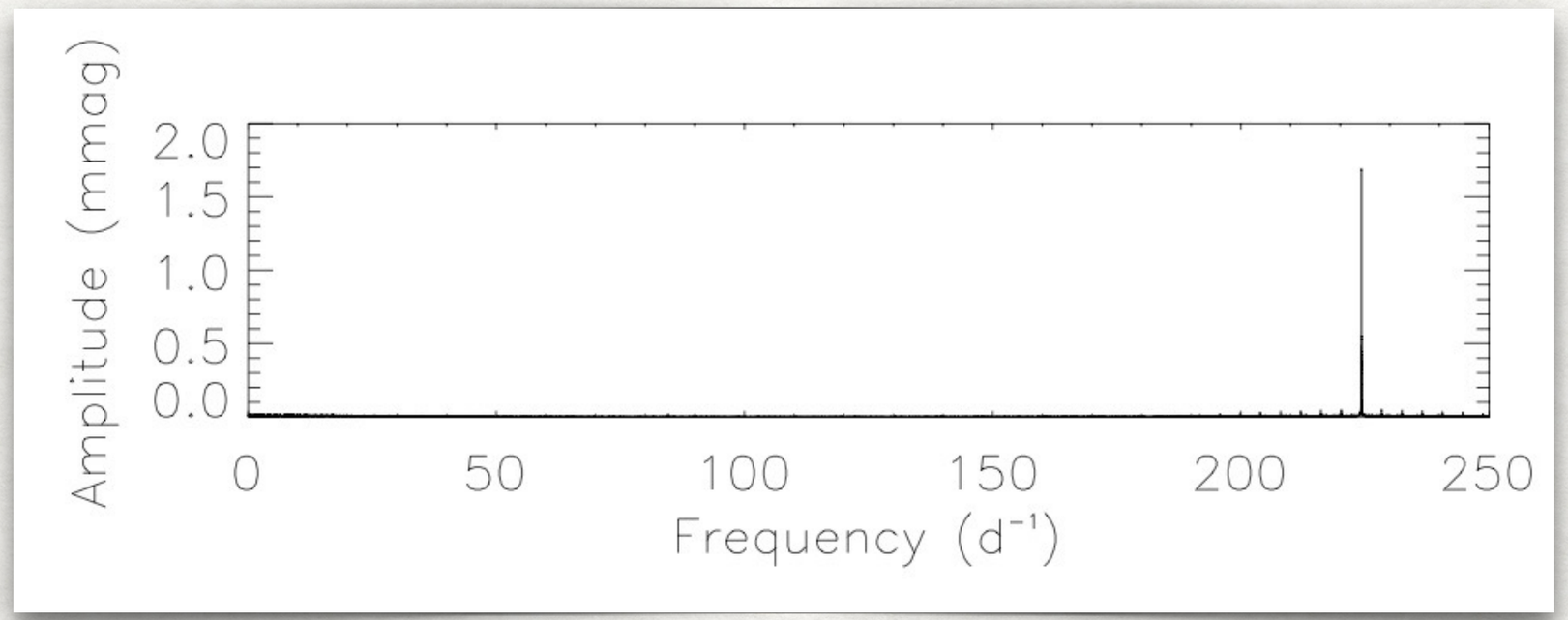




K2 OBSERVATIONS

PULSATION SIGNAL





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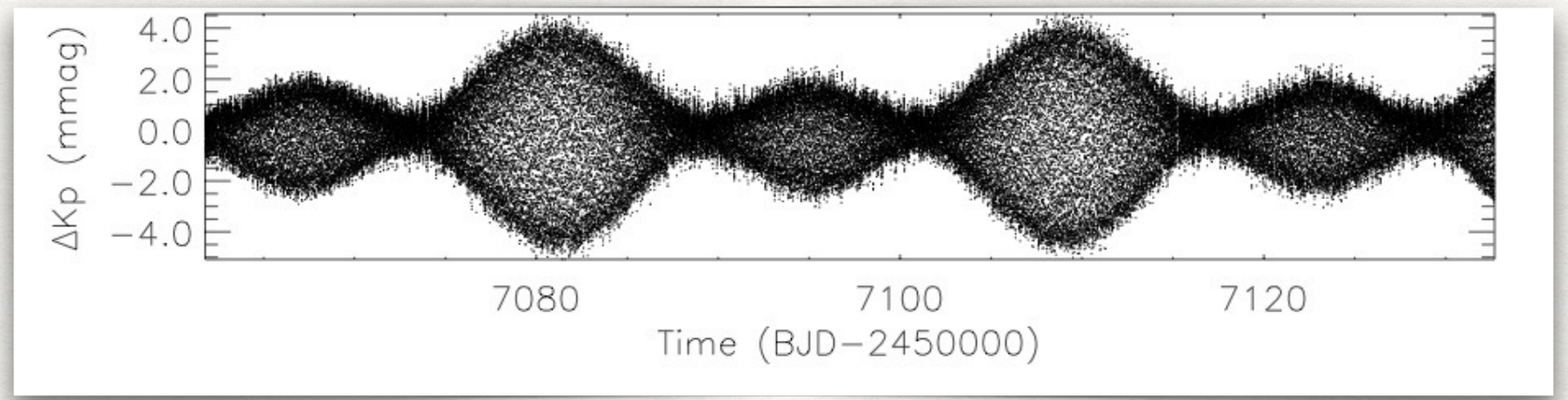
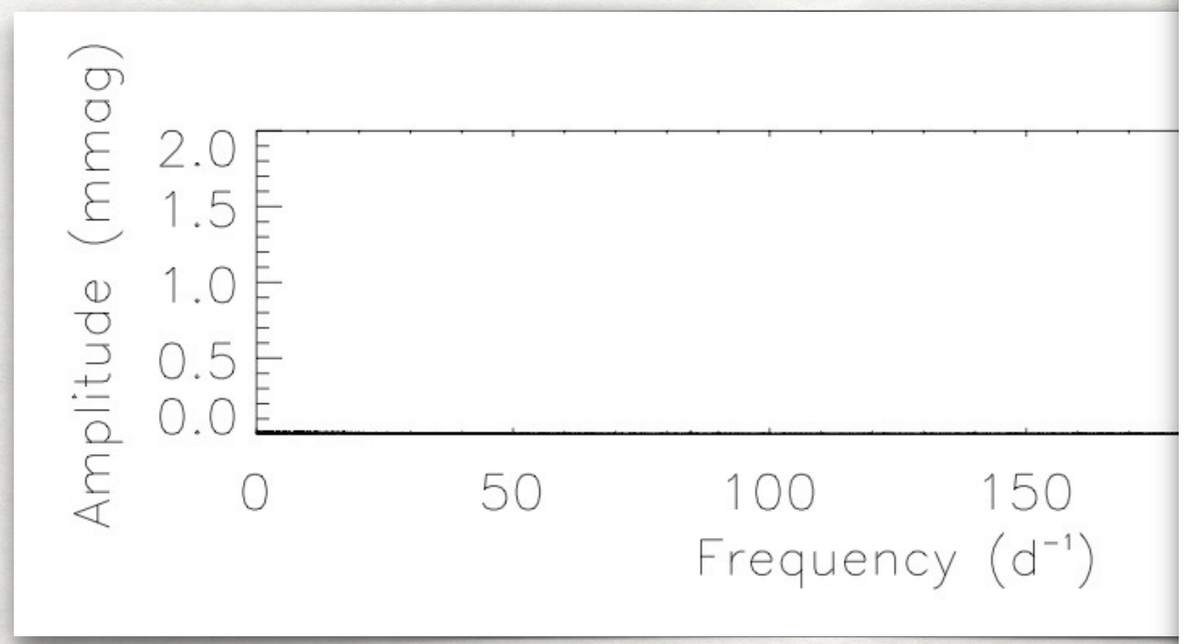
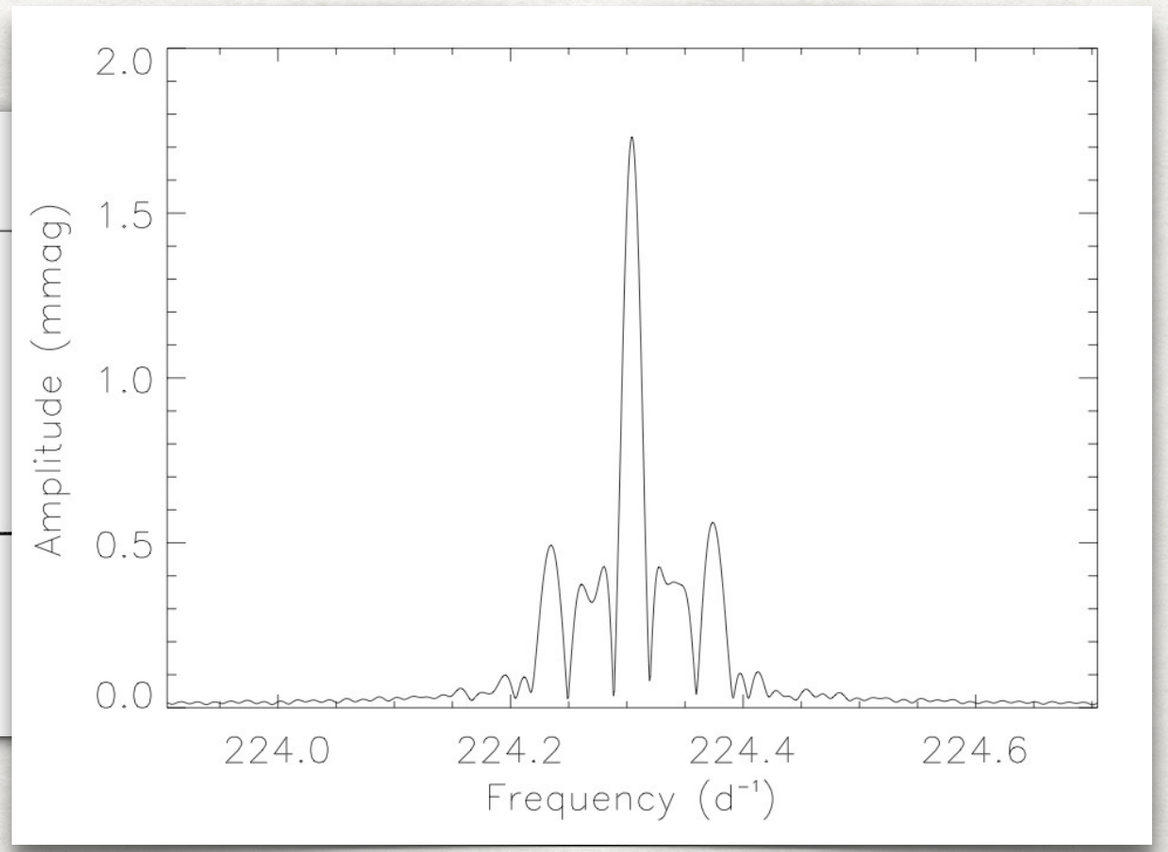
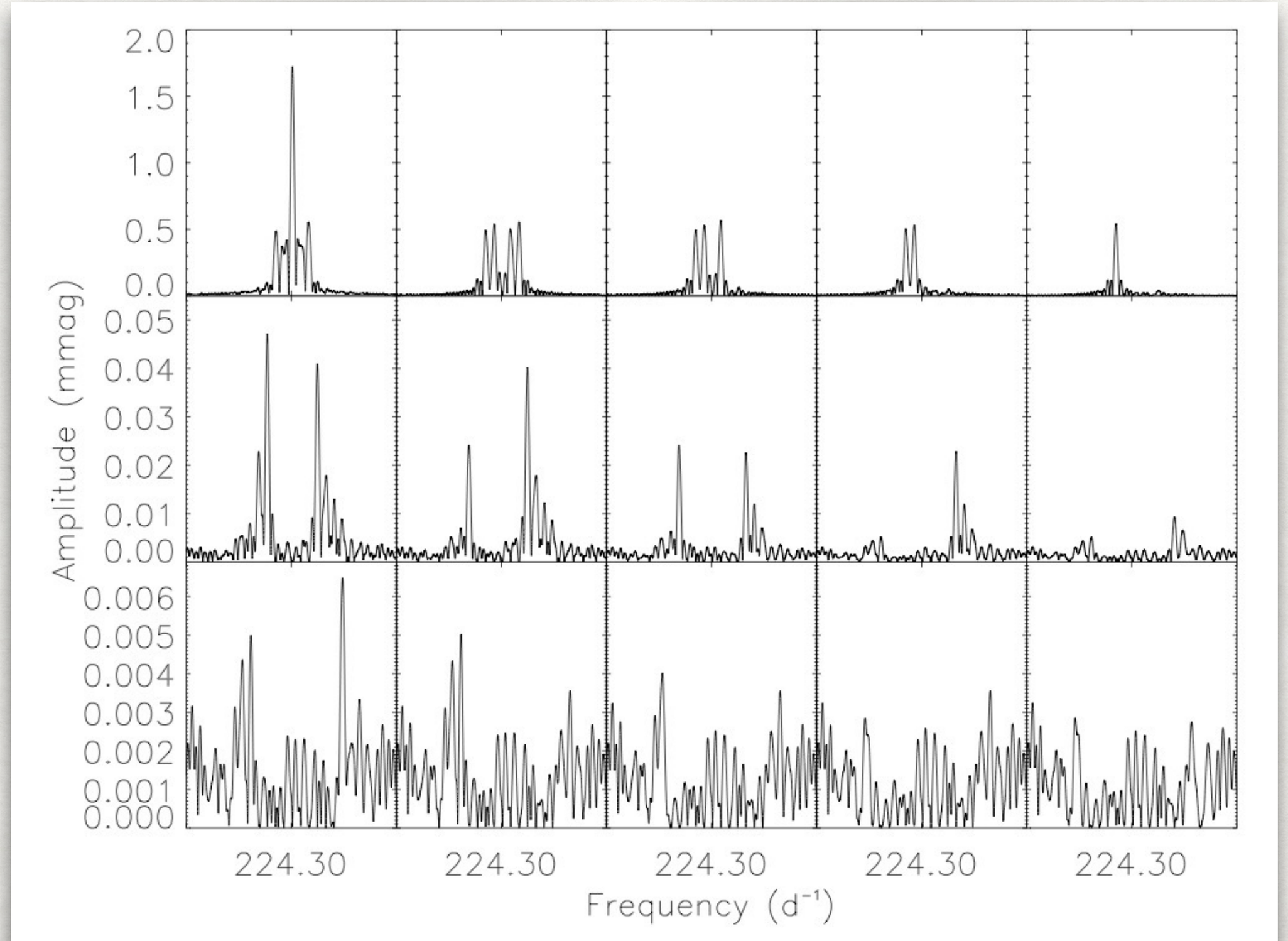




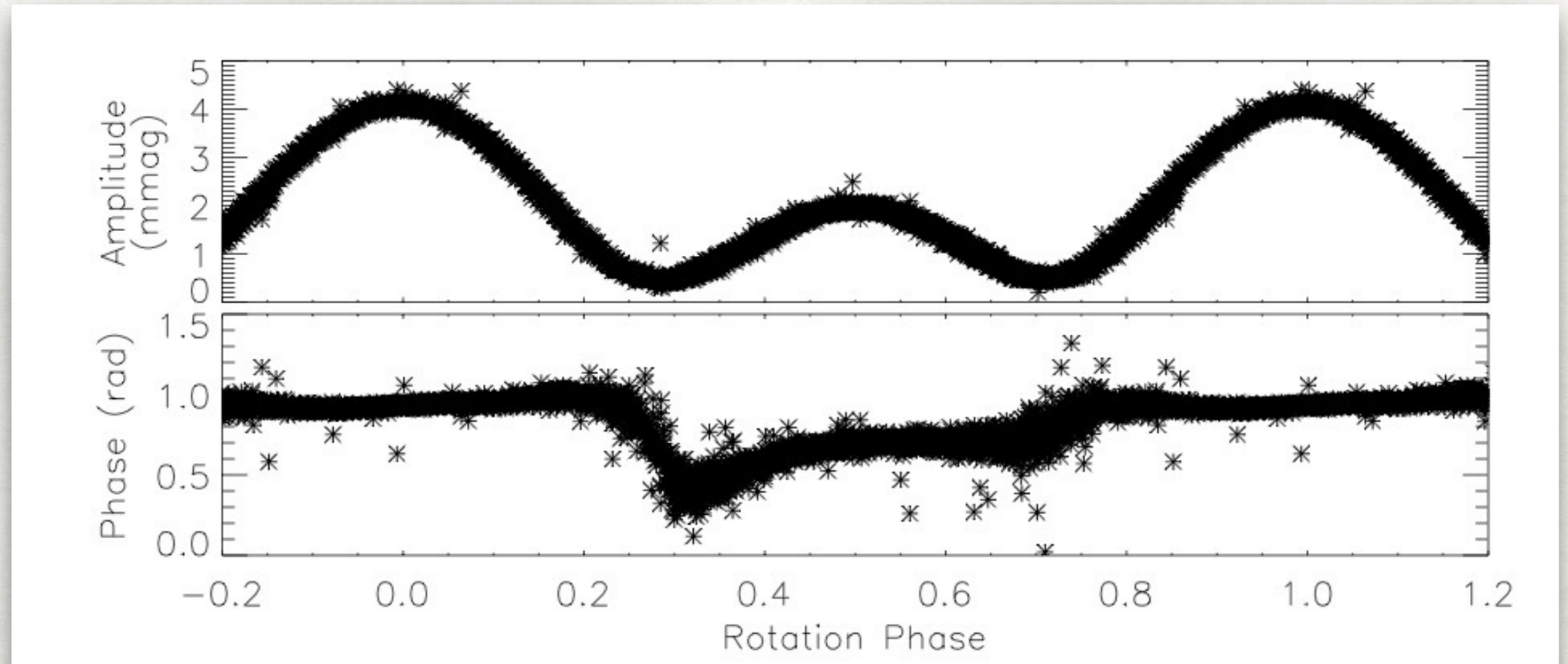


ROTATIONAL SPLITTING



THE OBLIQUE PULSATION

AMPLITUDE AND PHASE VARIABILITY



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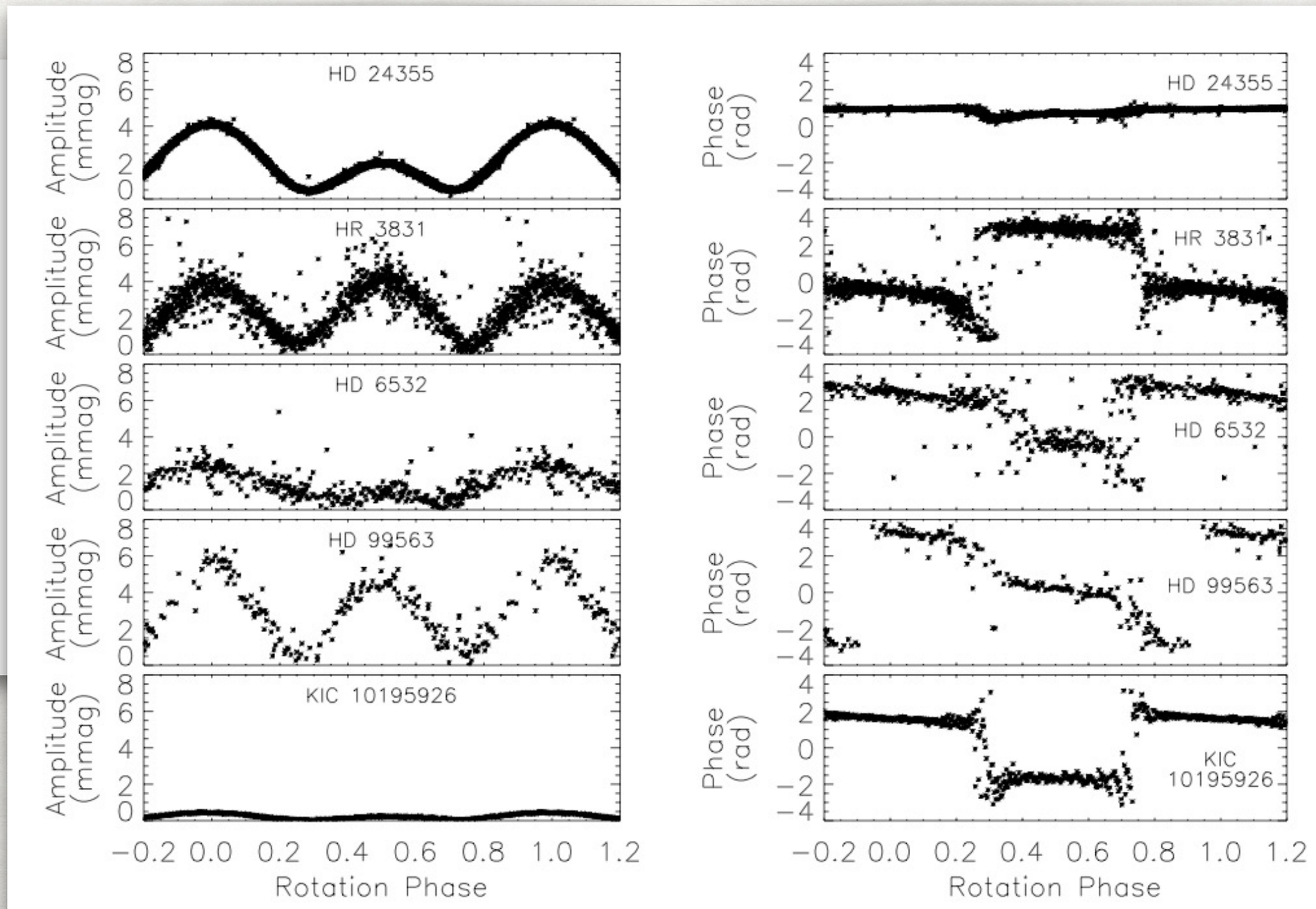
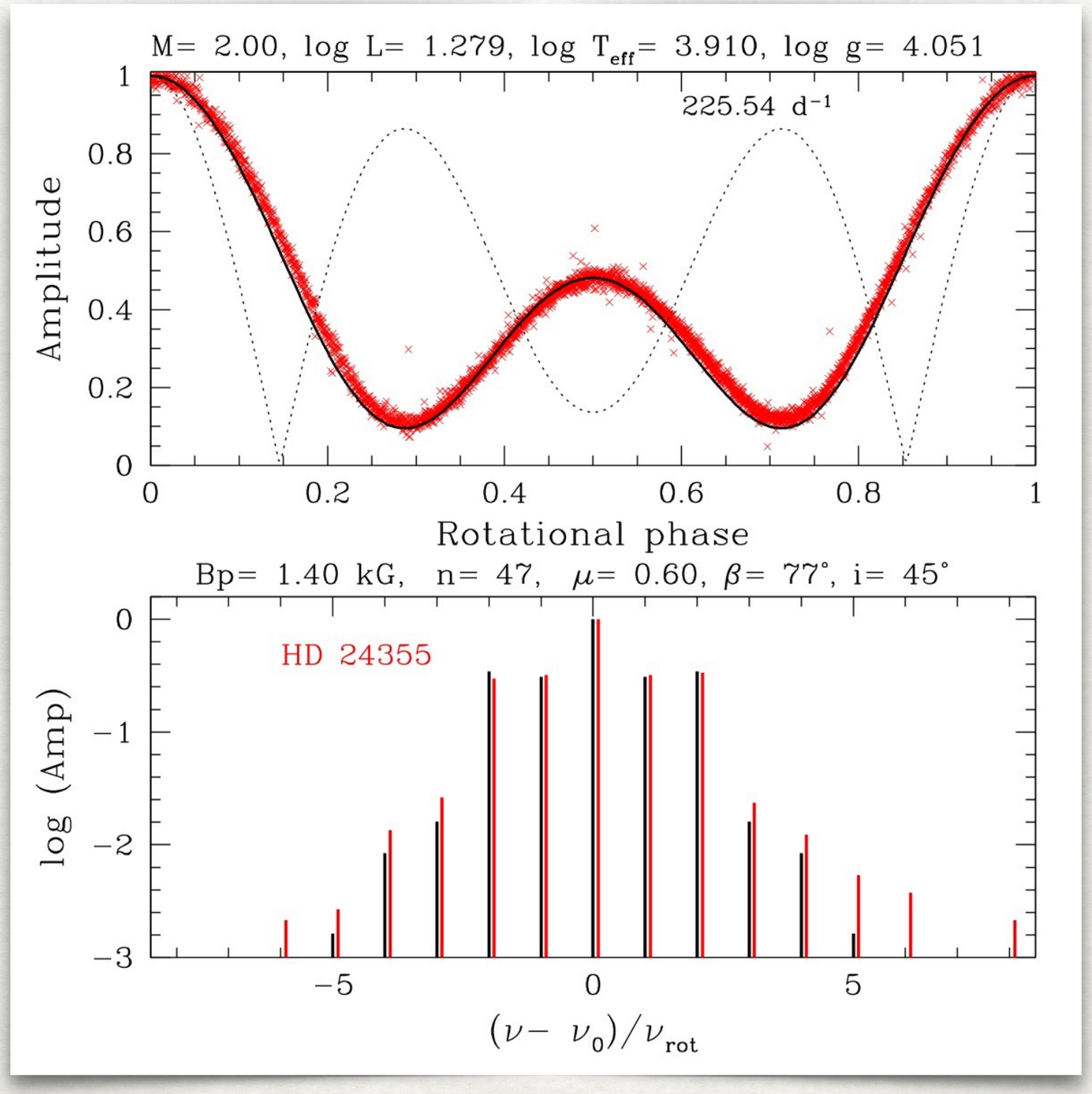


MODELLING THE PULSATION



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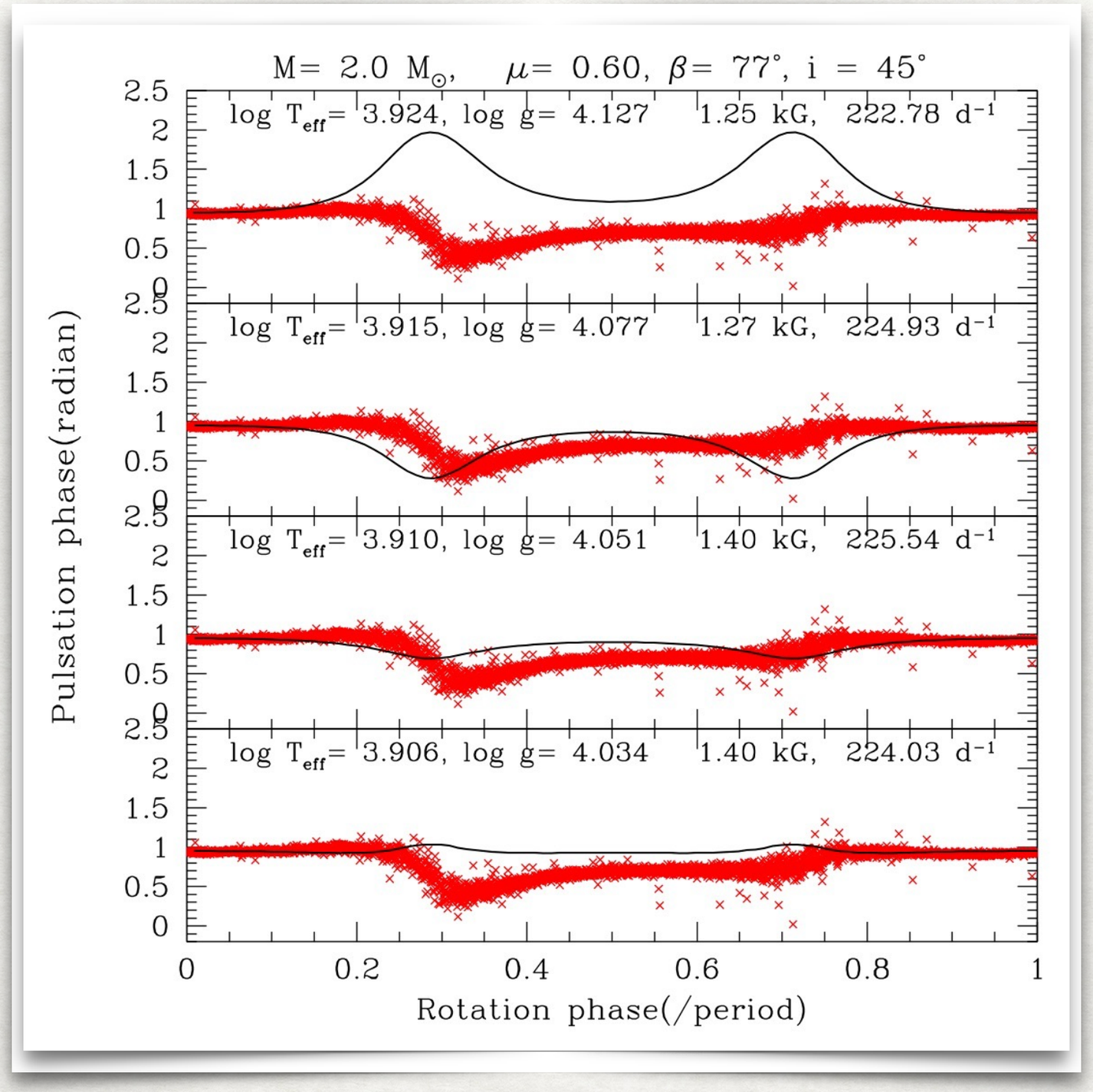

SUMMARY

- Most distorted quadrupole roAp star observed
- Such high frequency provides a challenge for theory
- Such unusual variations allow stronger constrains on models
- Homogeneous observations needed to rebuild the theoretical instability strip — TESS & GAIA