

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

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

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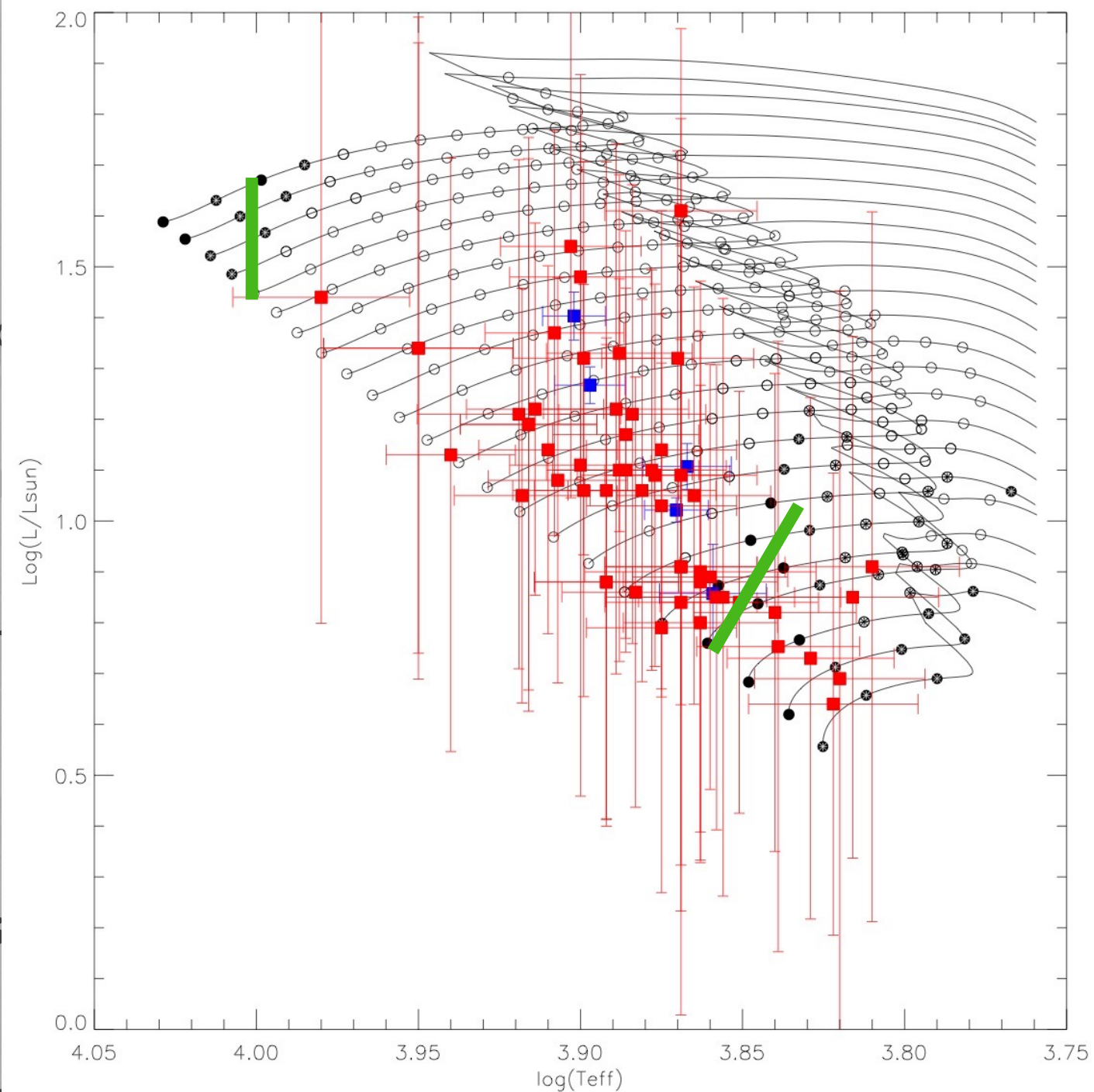
13 Jul 2016

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

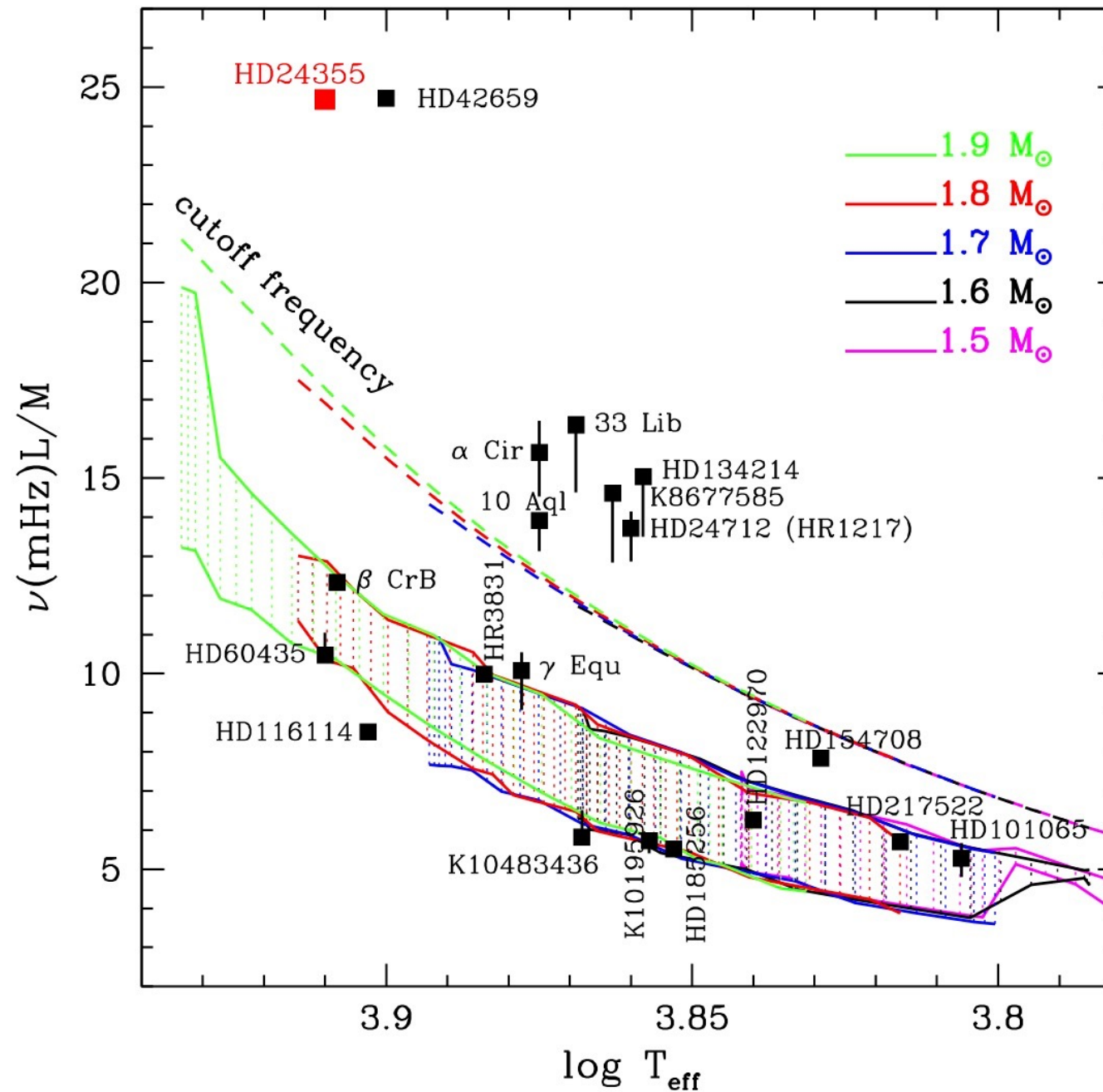
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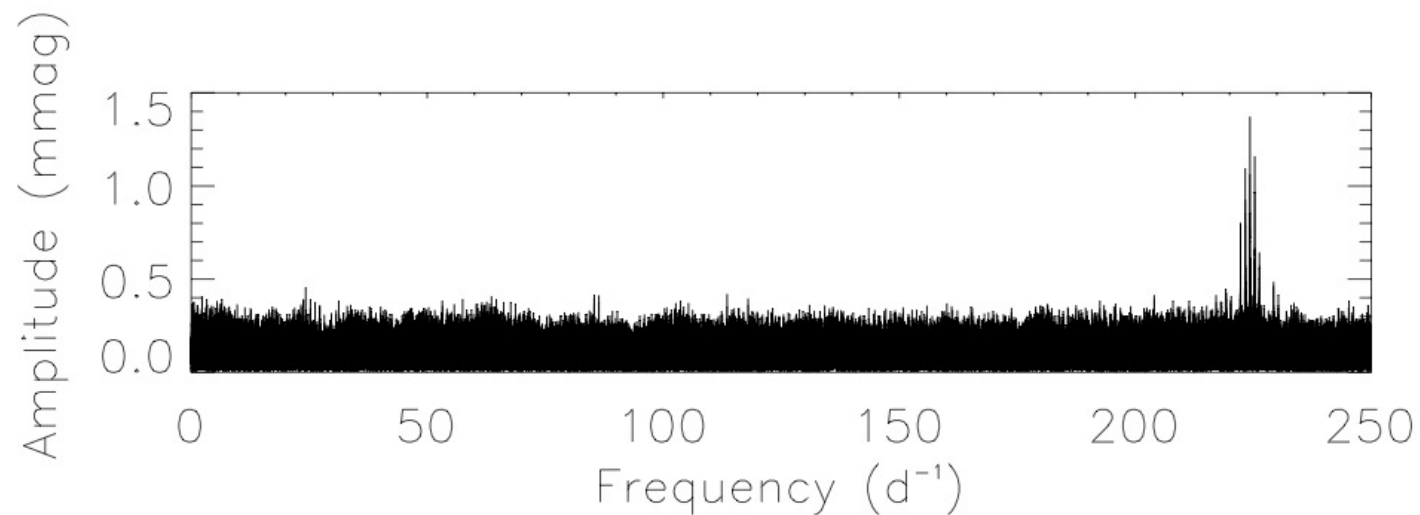
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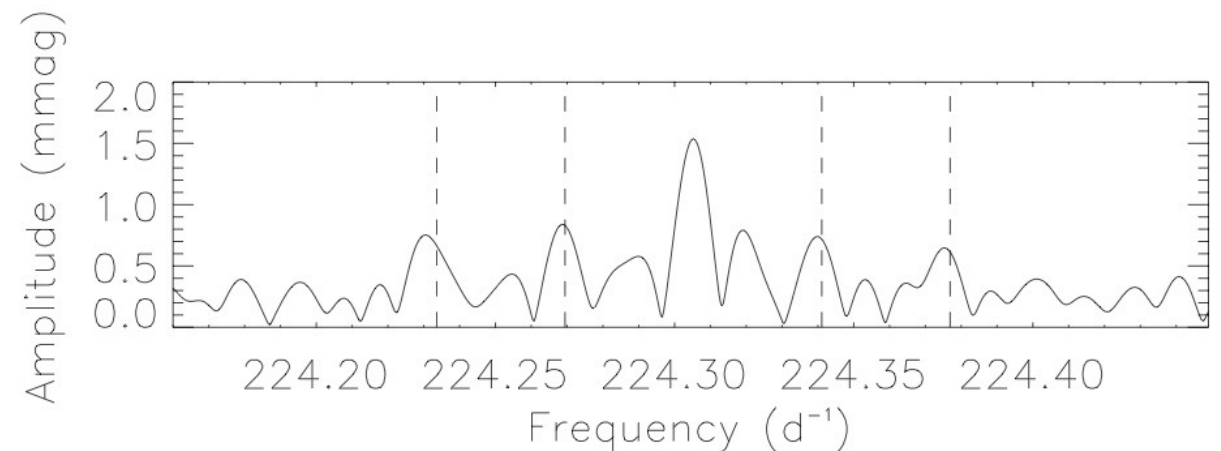
GROUND BASED OBSERVATIONS

SUPERWASP & APT

- Observed for 3 seasons between 2006 and 2010 by SuperWASP



Frequency = 224.3 d⁻¹
Period = 6.4 min

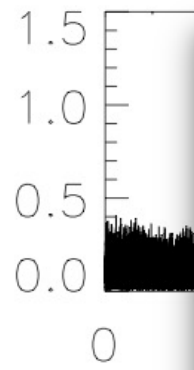


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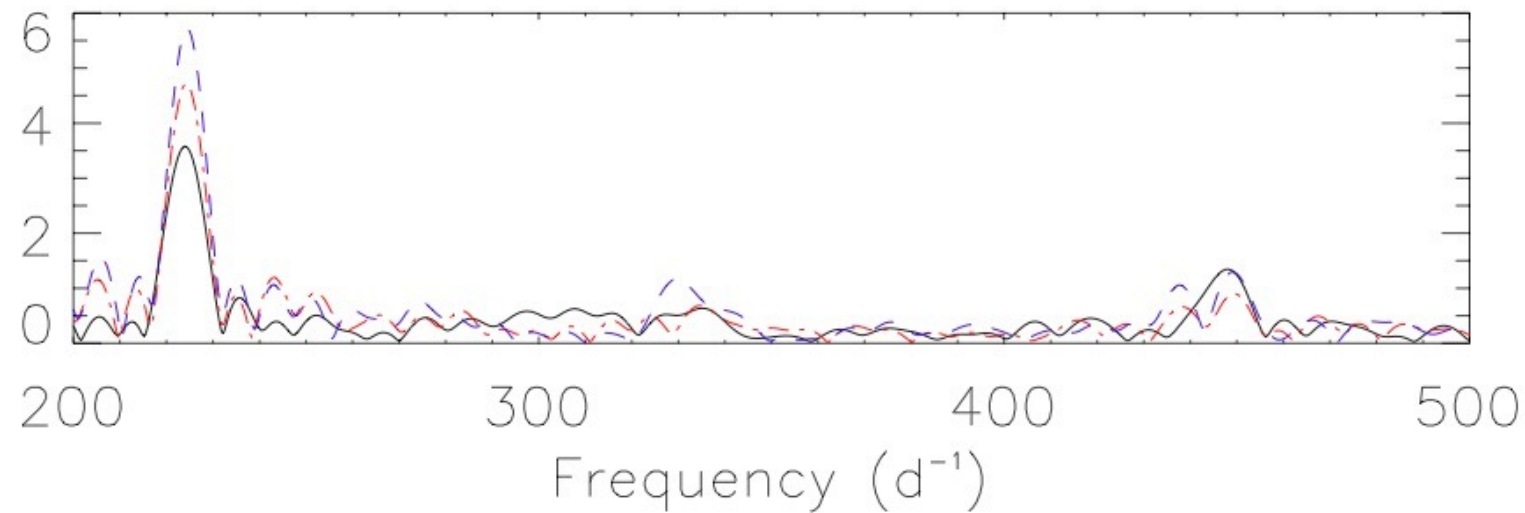
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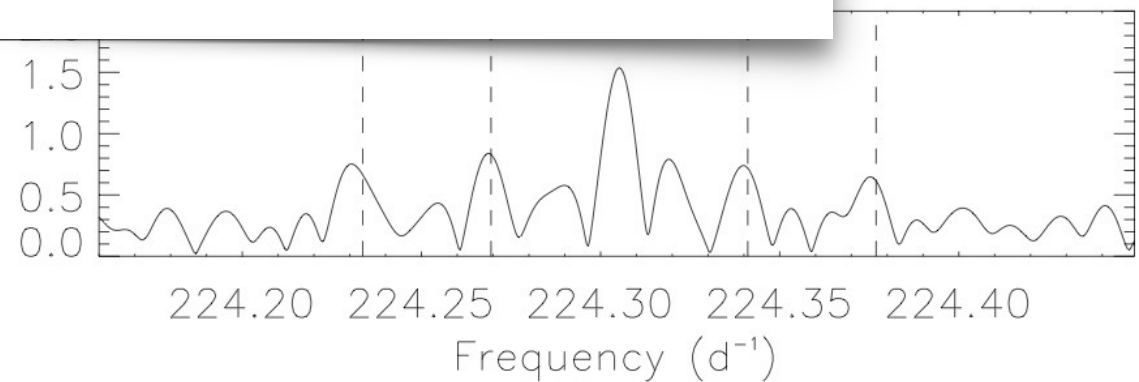
Amplitude (mmag)



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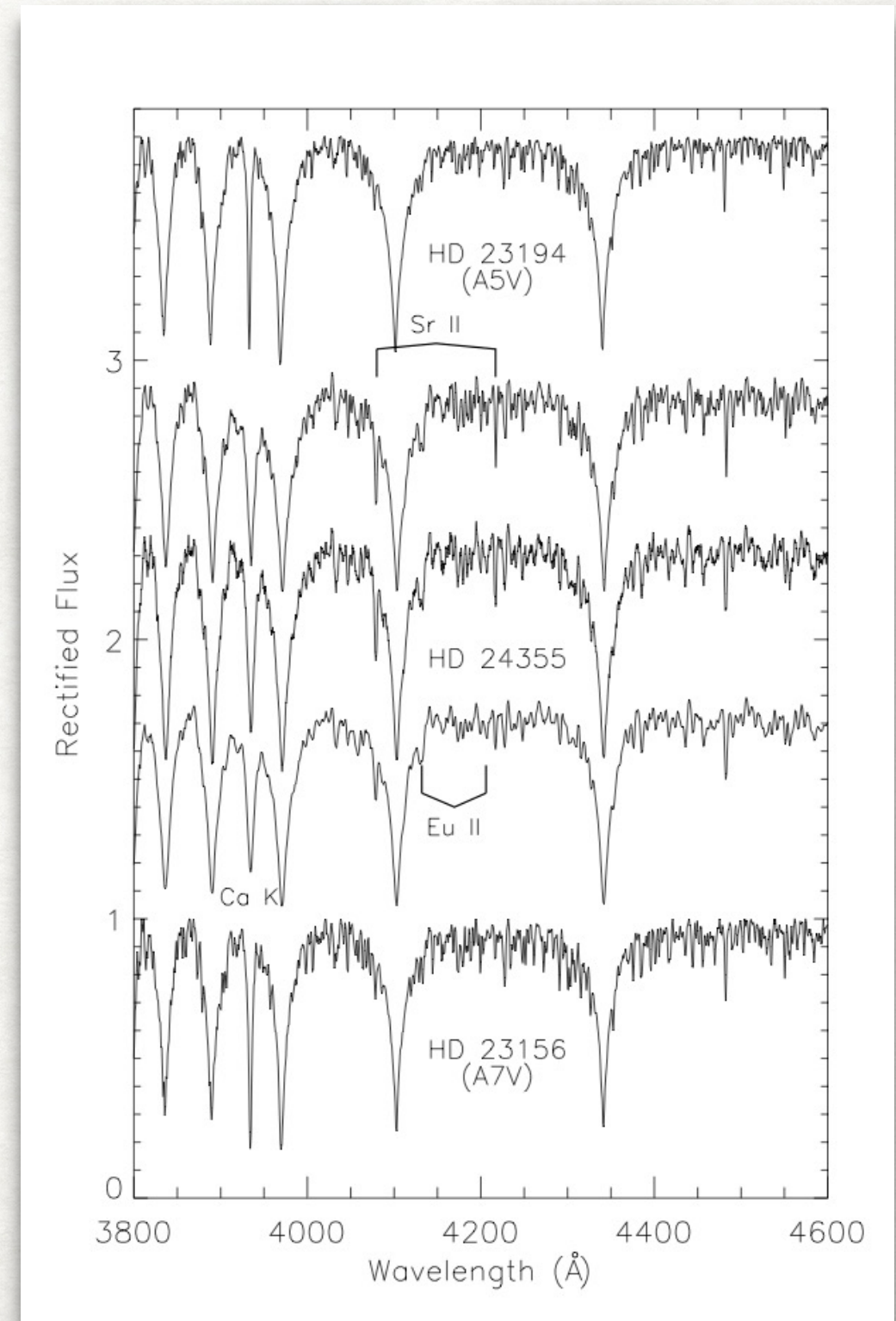


Amplitude (mmag)



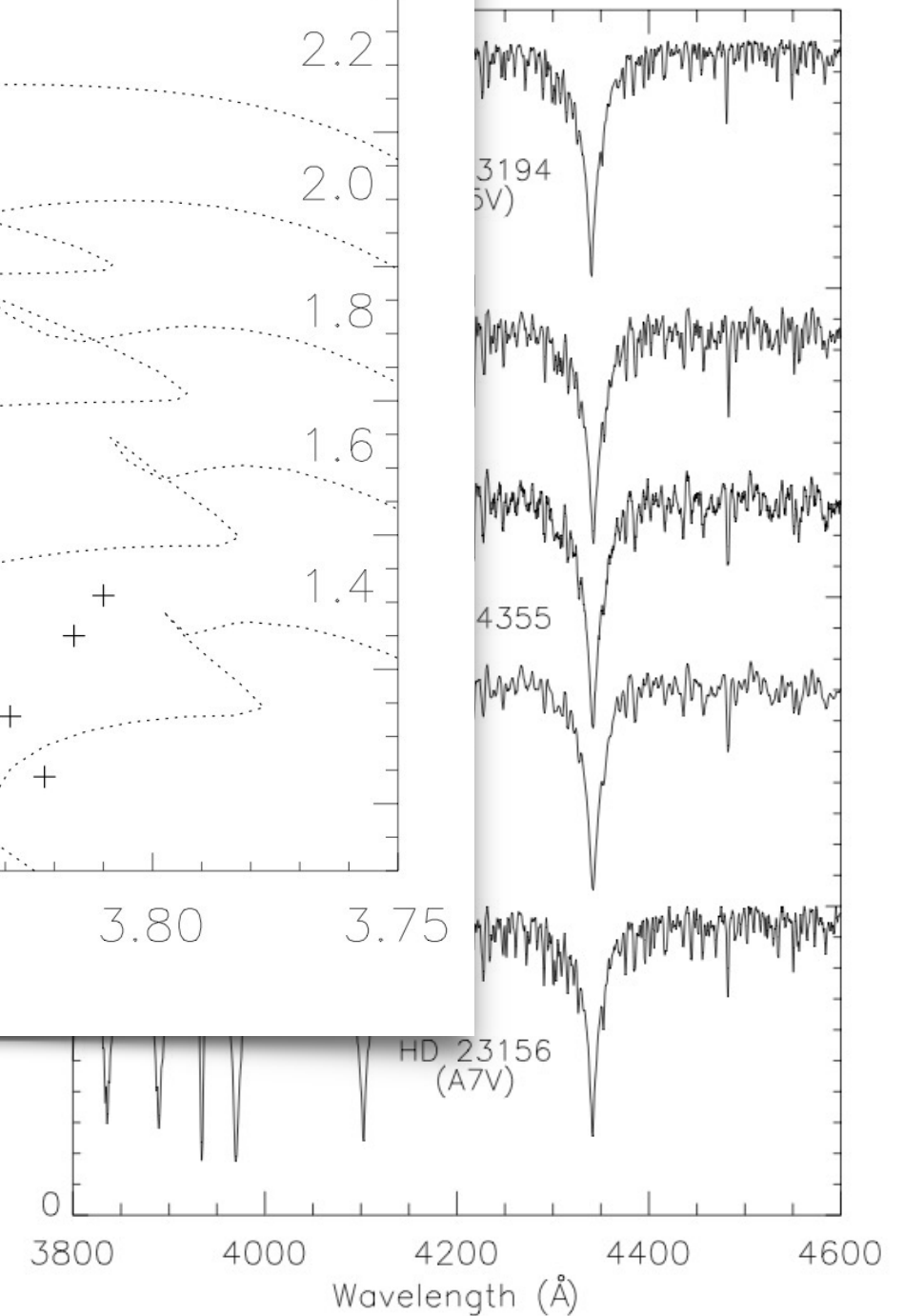
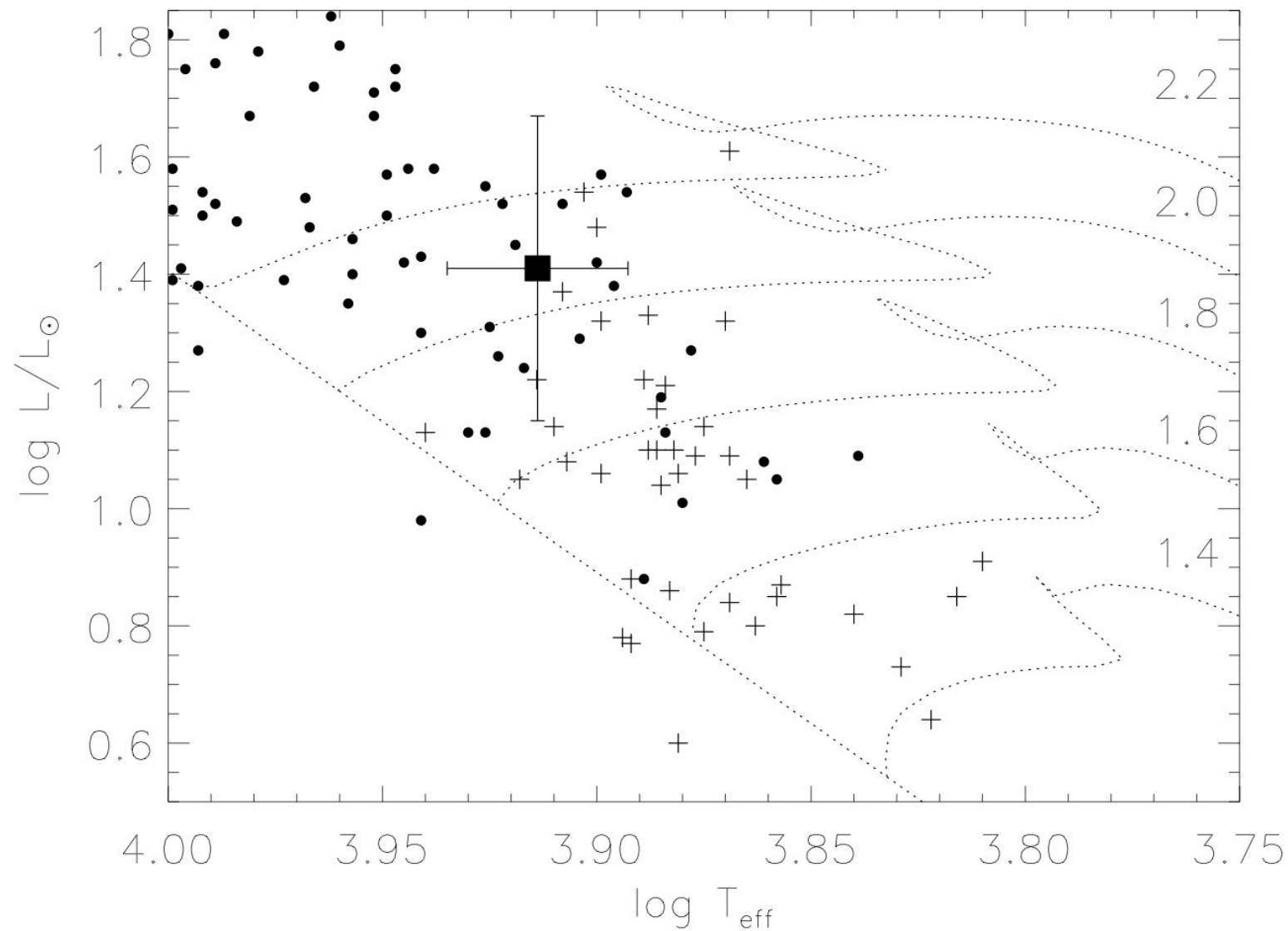
SPECTROSCOPIC PARAMETERS

- 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
- $T_{\text{eff}} = 8200 \pm 200$ K
- $M = 2.40 \pm 0.38 M_{\odot}$
- $R = 2.53 \pm 0.43 R_{\odot}$



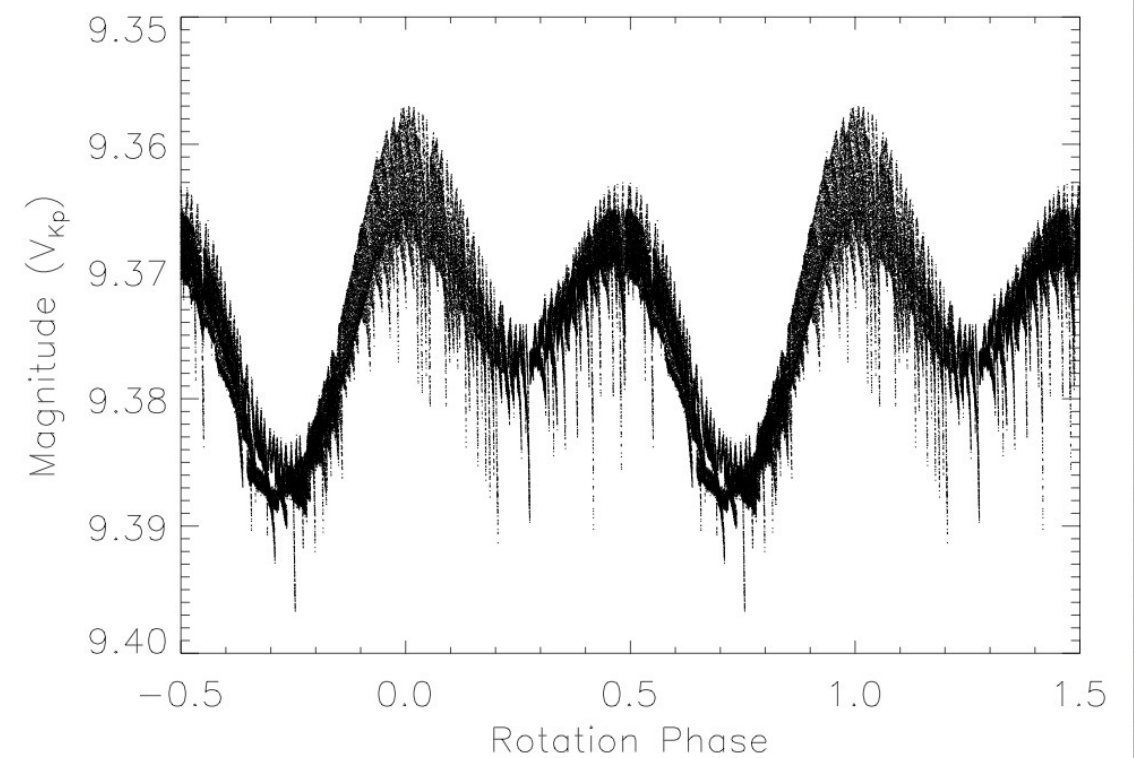
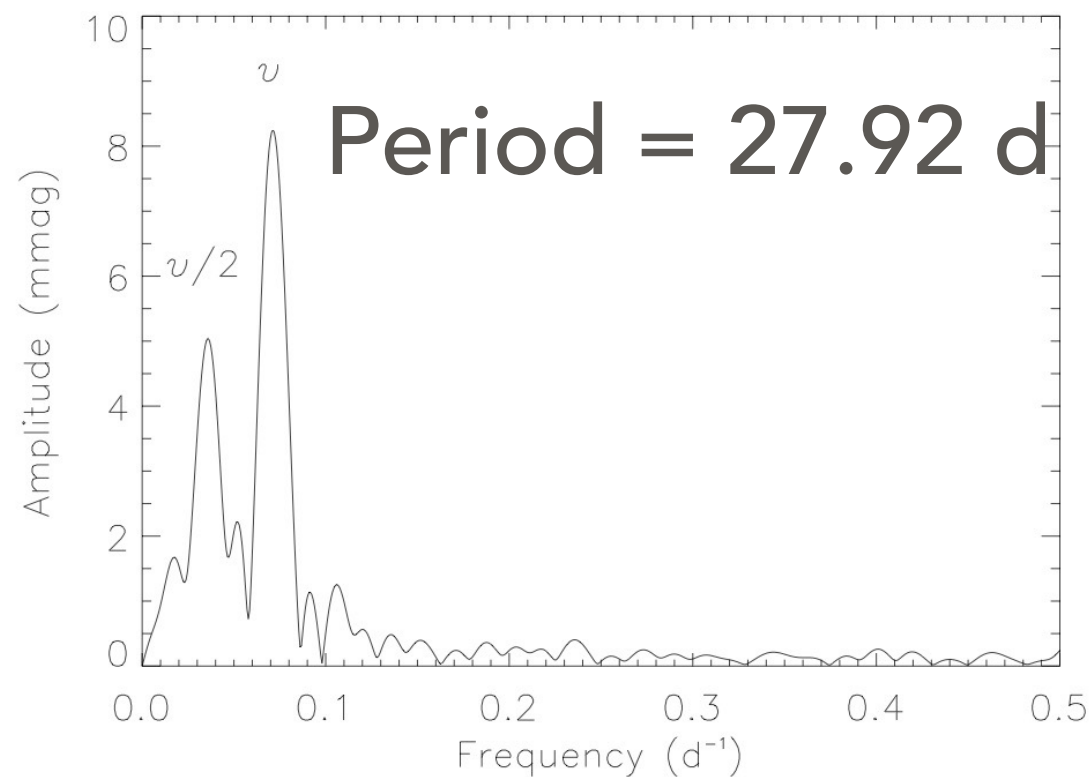
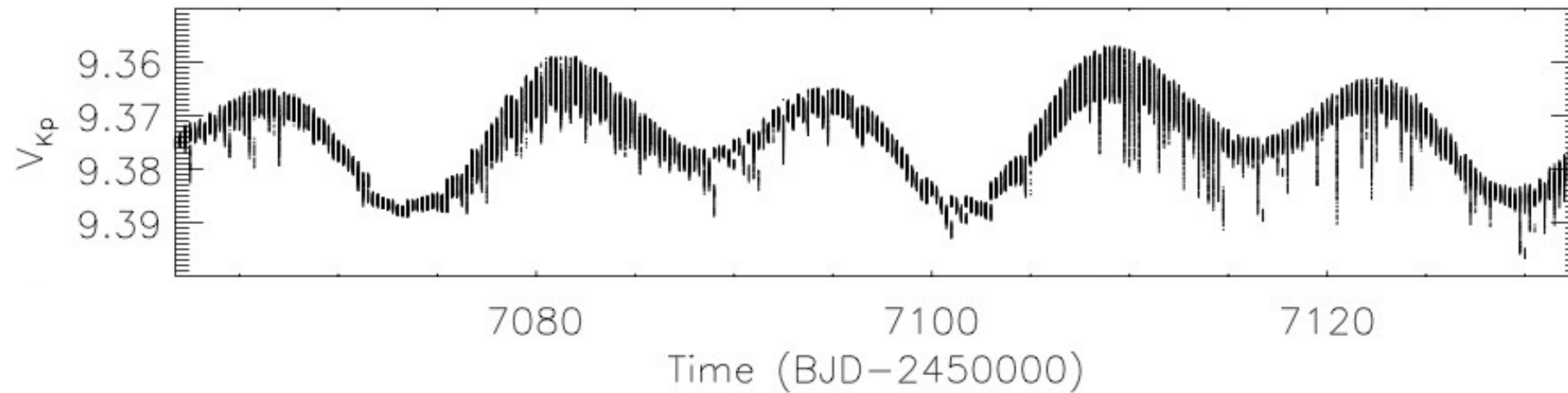
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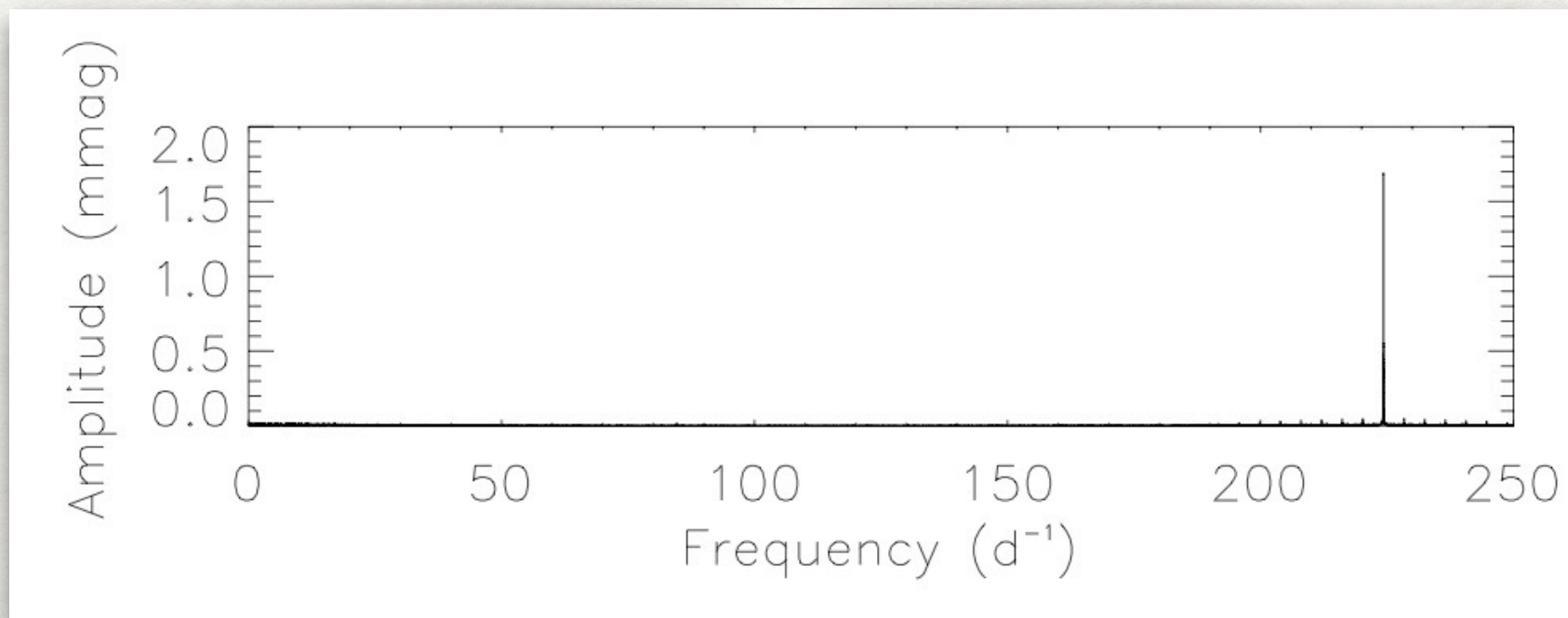
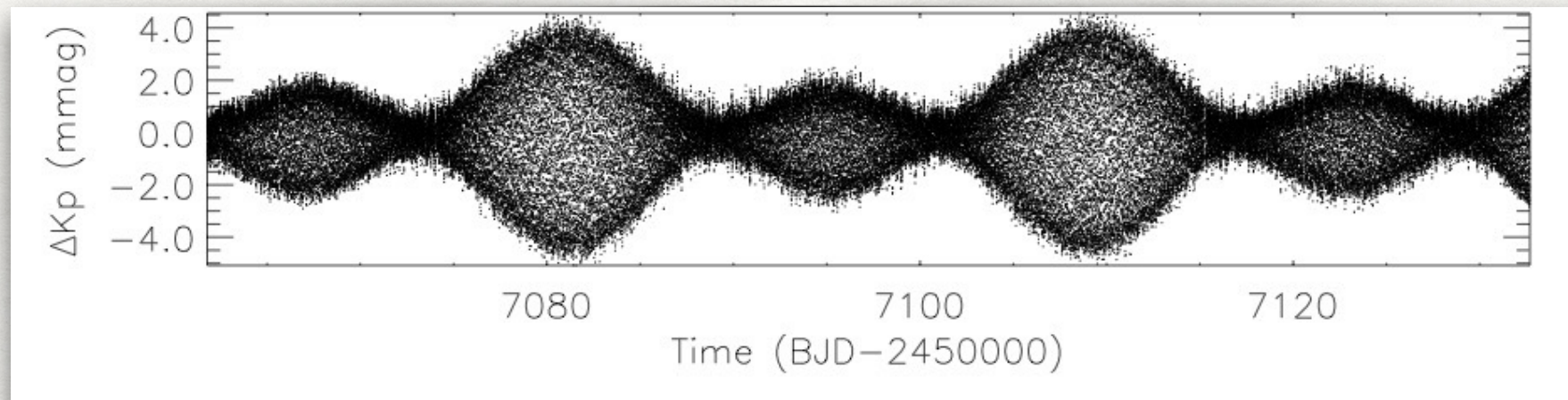
K2 OBSERVATIONS

ROTATIONAL MODULATION



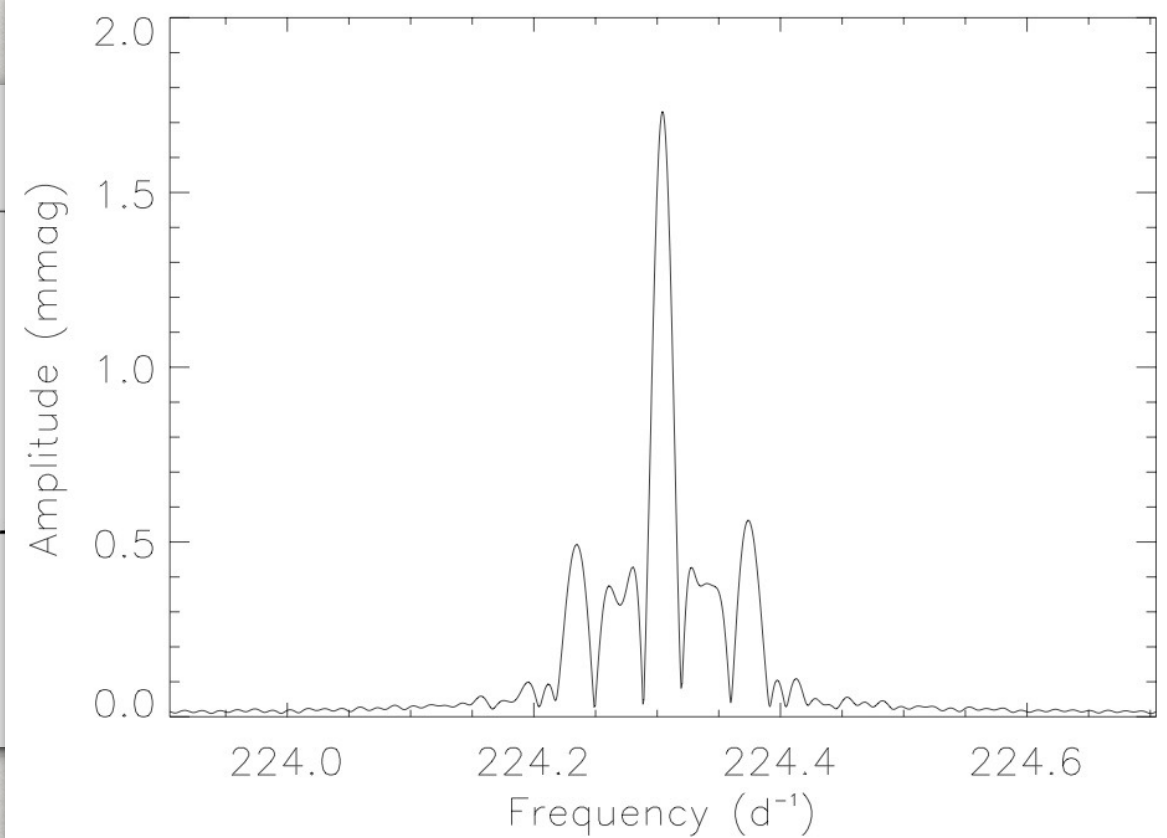
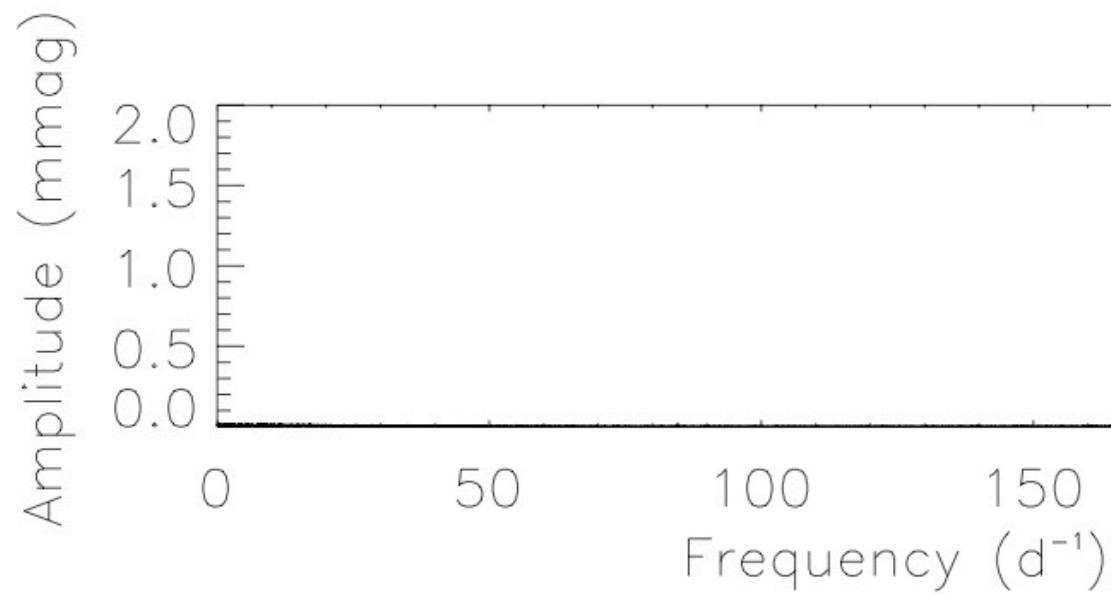
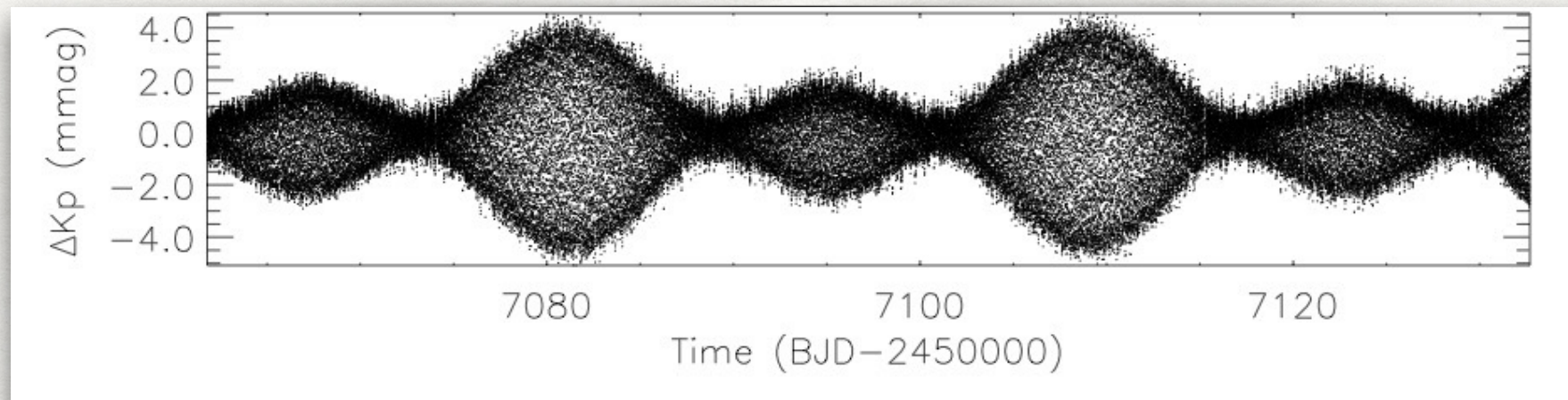
K2 OBSERVATIONS

PULSATION SIGNAL

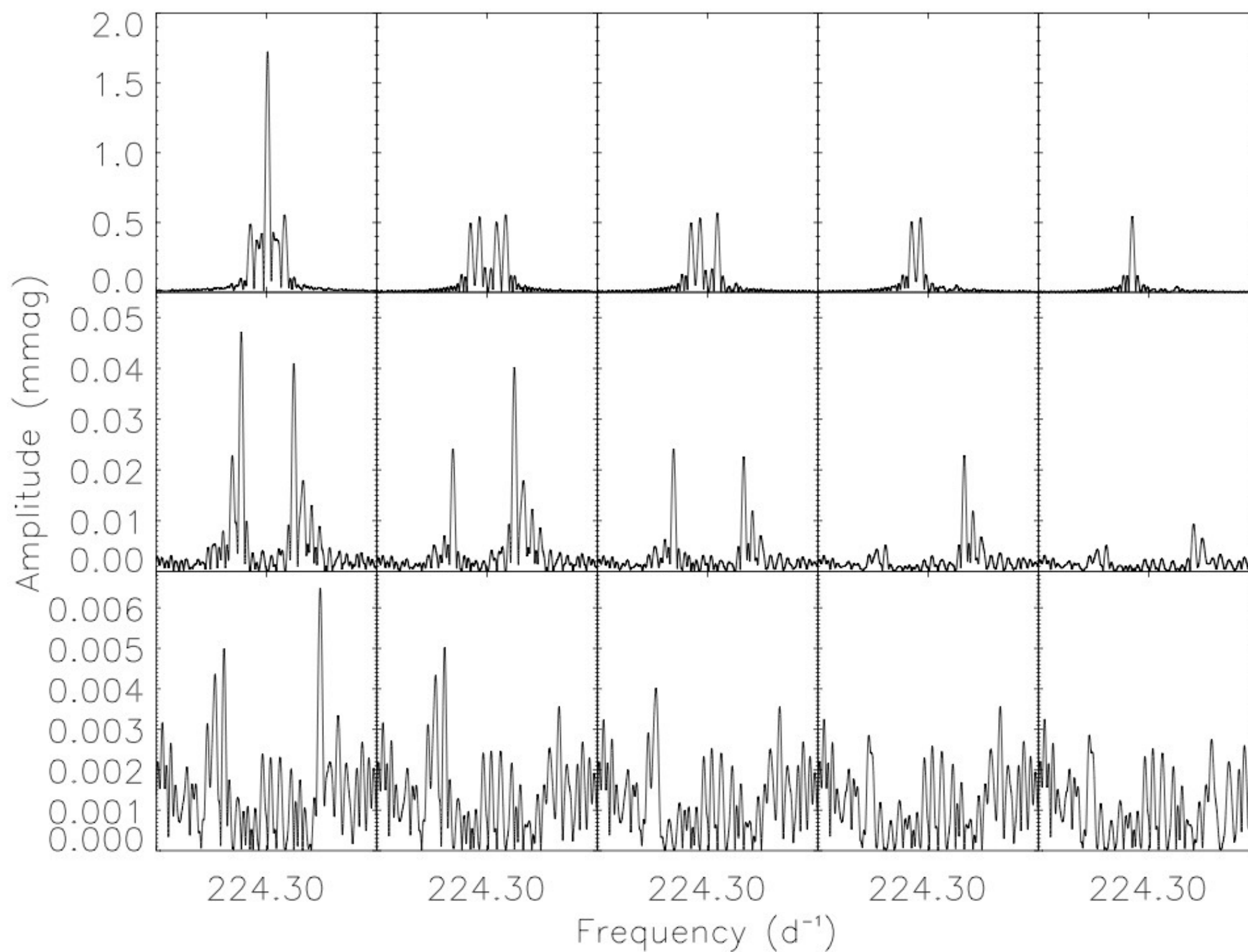


K2 OBSERVATIONS

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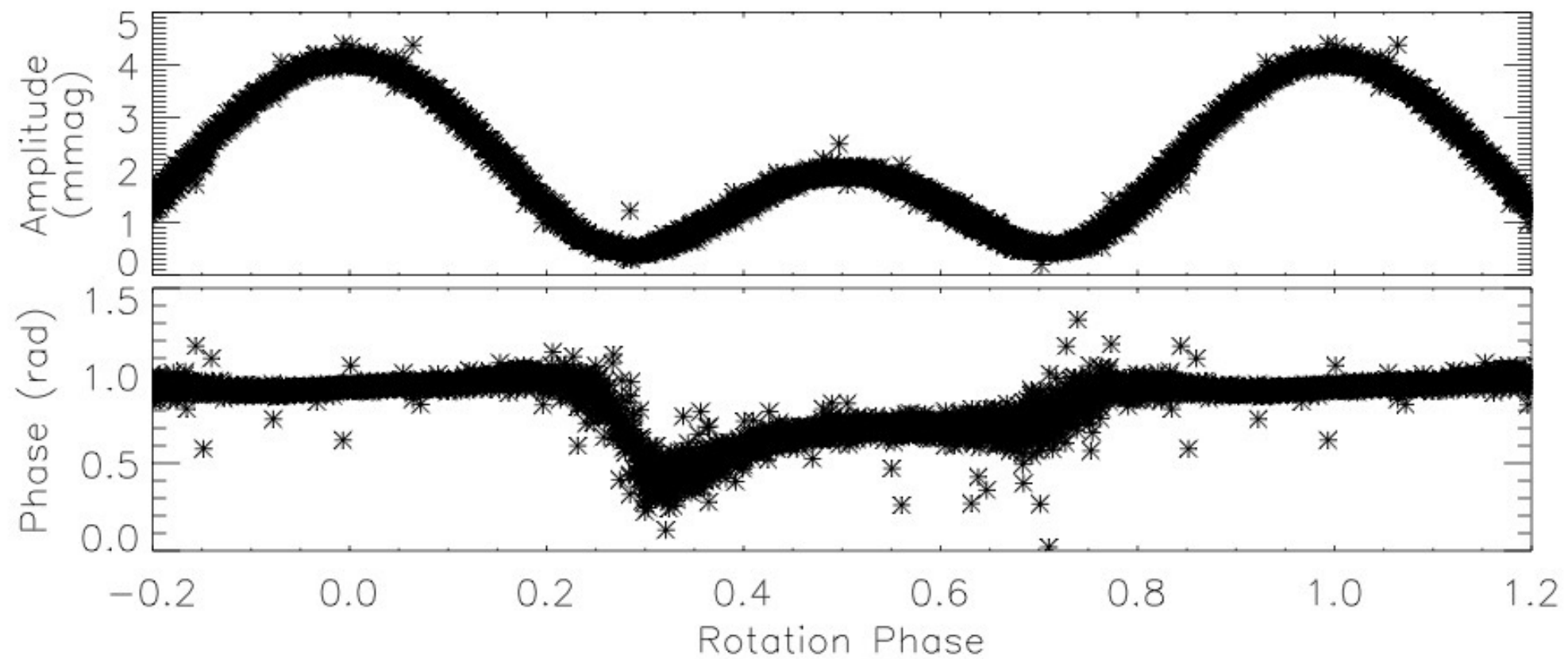


ROTATIONAL SPLITTING



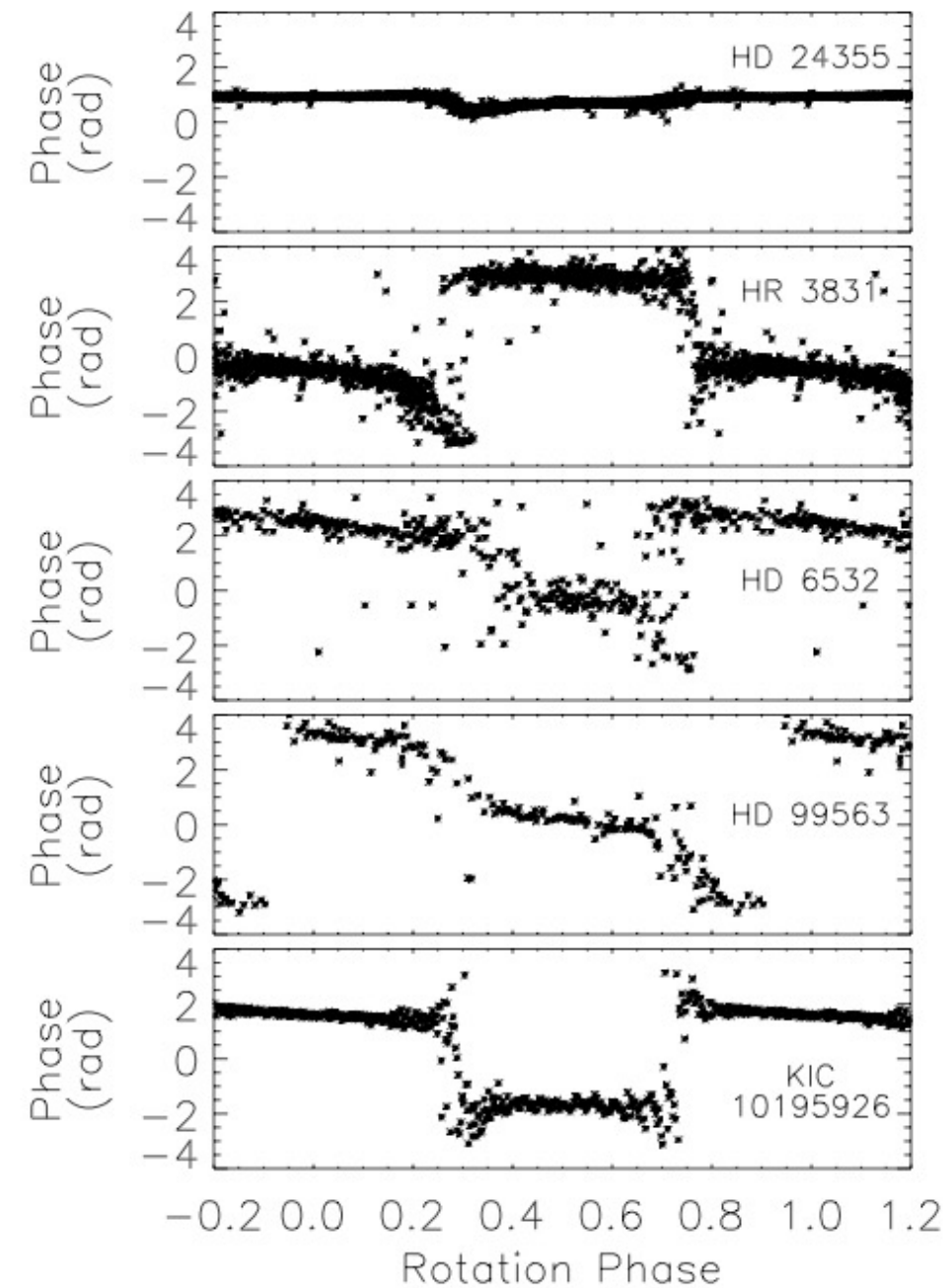
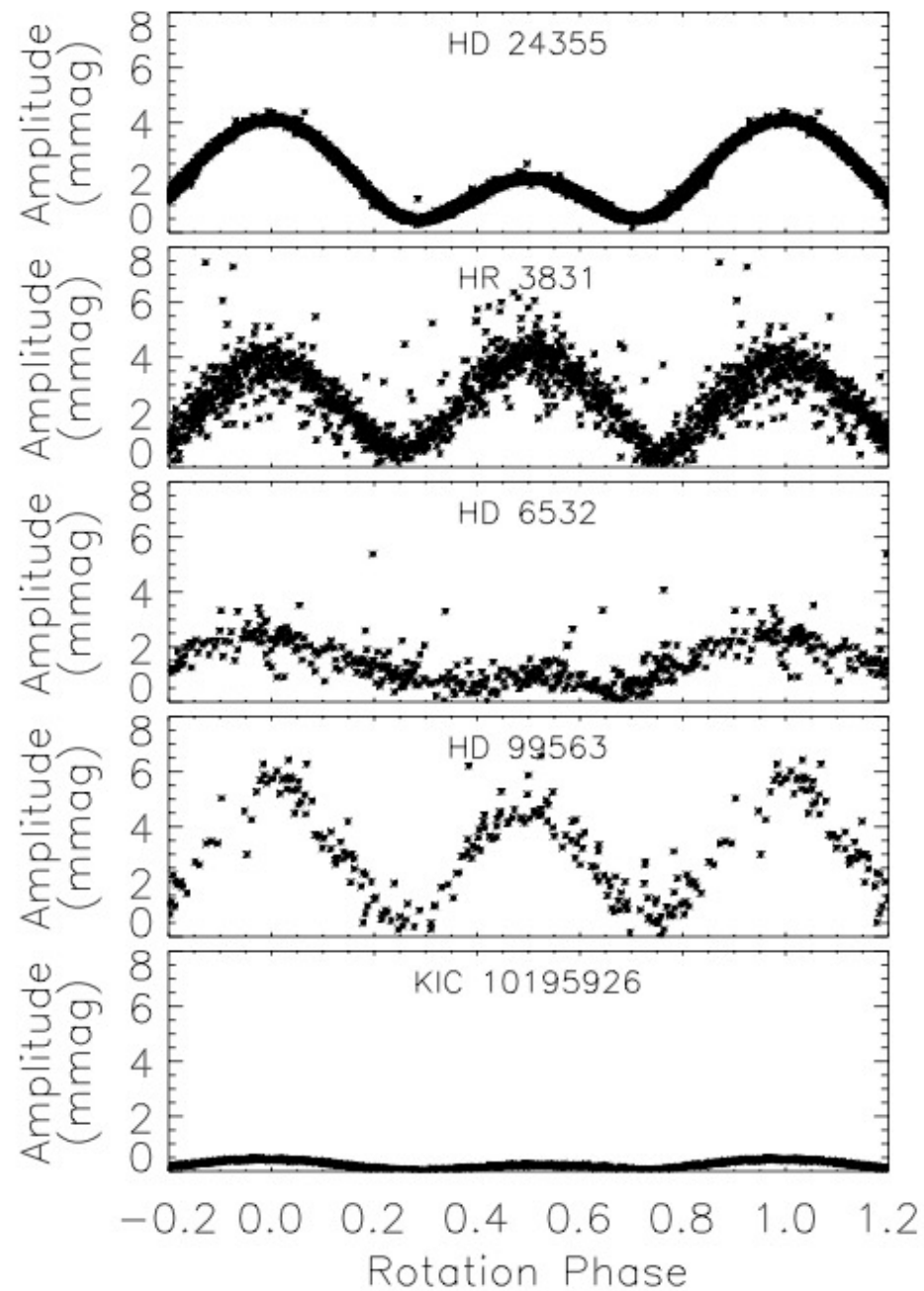
THE OBLIQUE PULSATION

AMPLITUDE AND PHASE VARIABILITY

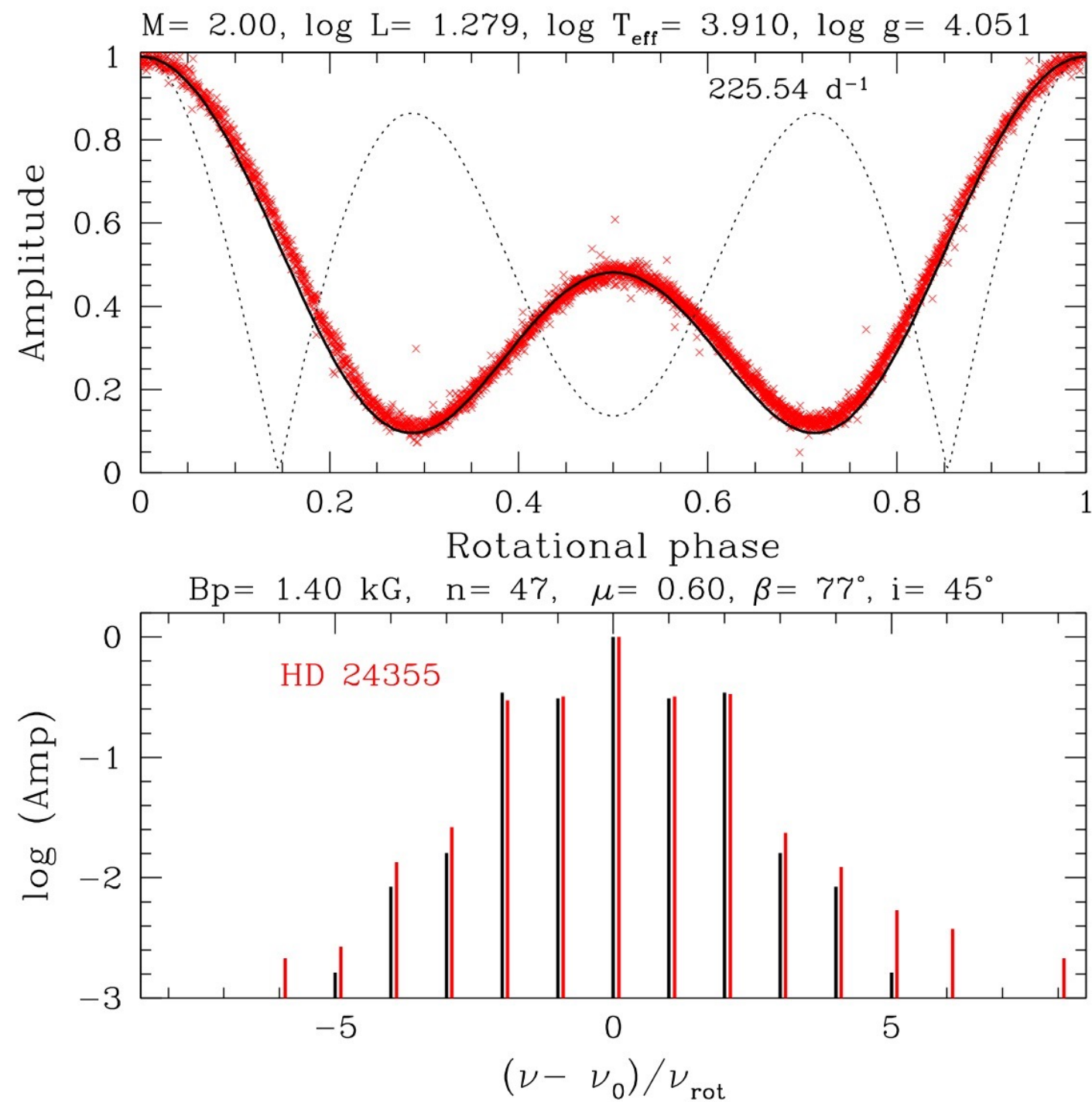


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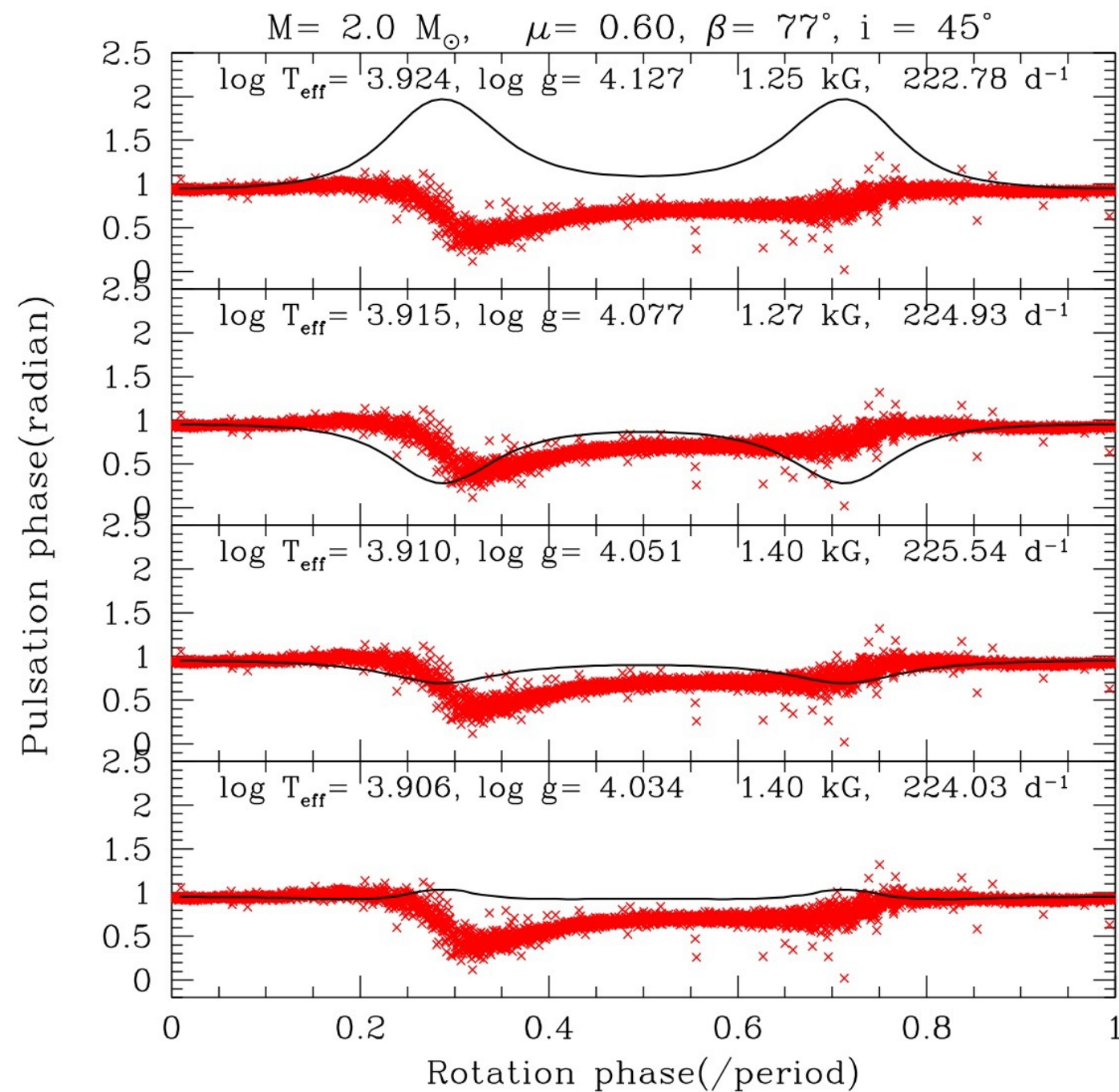
AMPLITUDE AND PHASE VARIABILITY



MODELLING THE PULSATION



MODELLING THE PULSATION



SUMMARY

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

