



THE UNIVERSITY OF
SYDNEY

Beyond Transits

Finding non-eclipsing binaries through
pulsational phase modulation



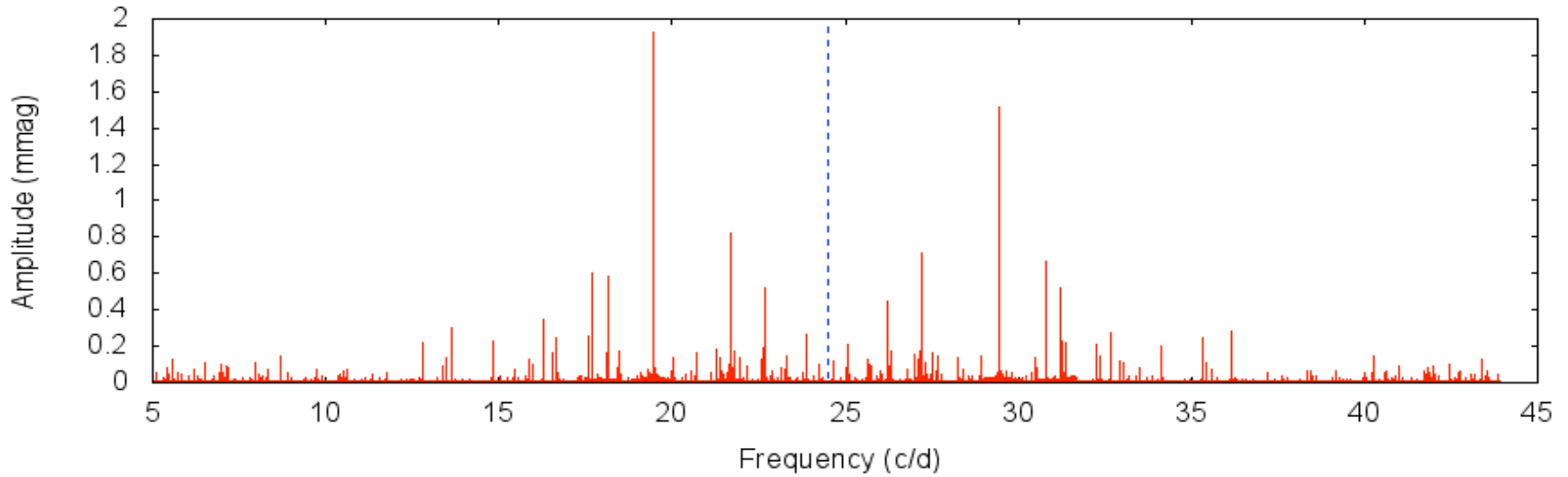
Simon J. Murphy

Tim Bedding

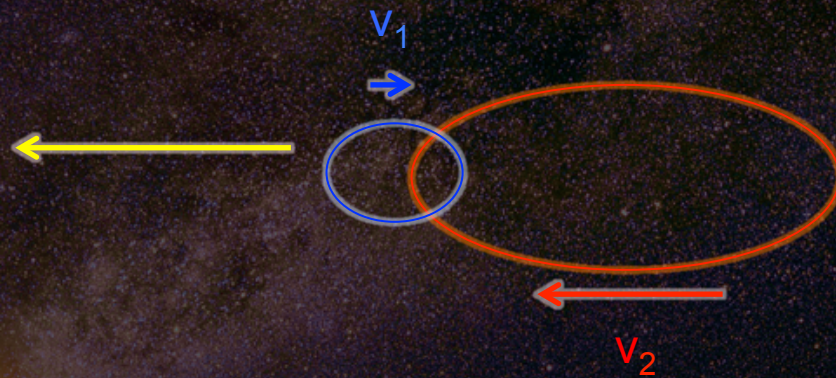
Hiromoto Shibahashi

Don Kurtz

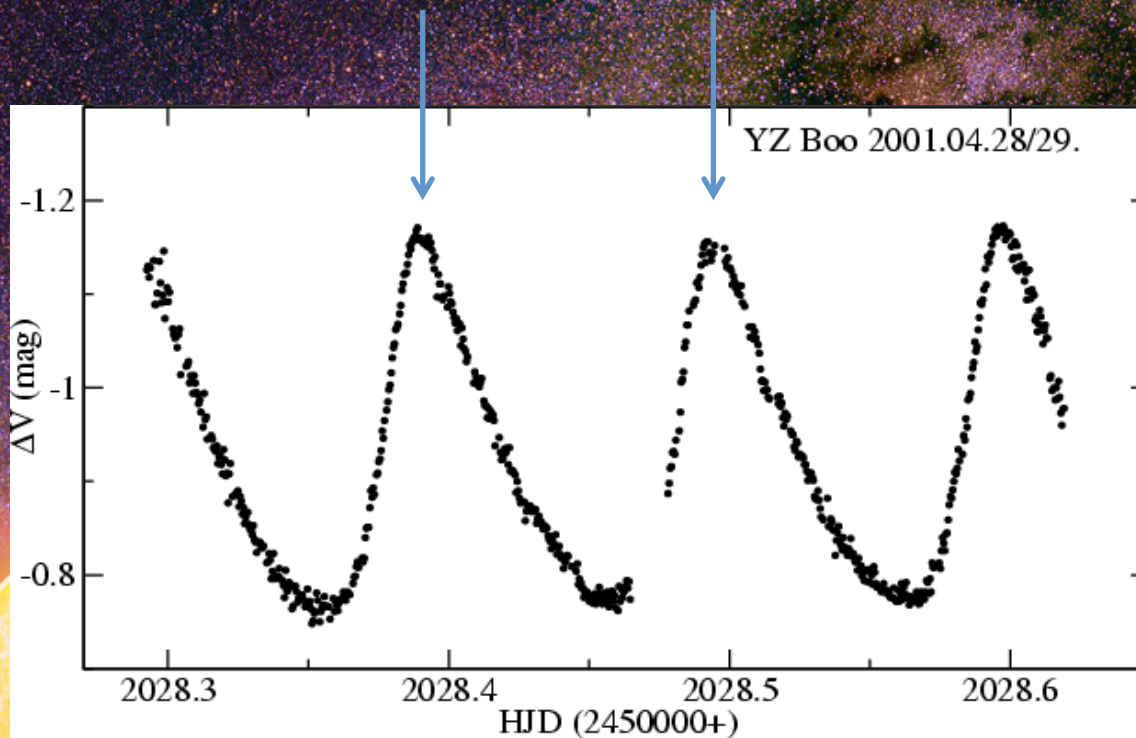
Hans Kjeldsen



see:
Poster #3 D. Bowman

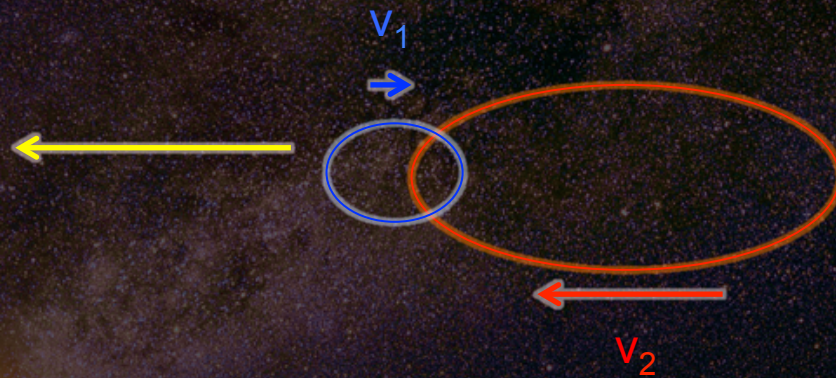


O-C diagram

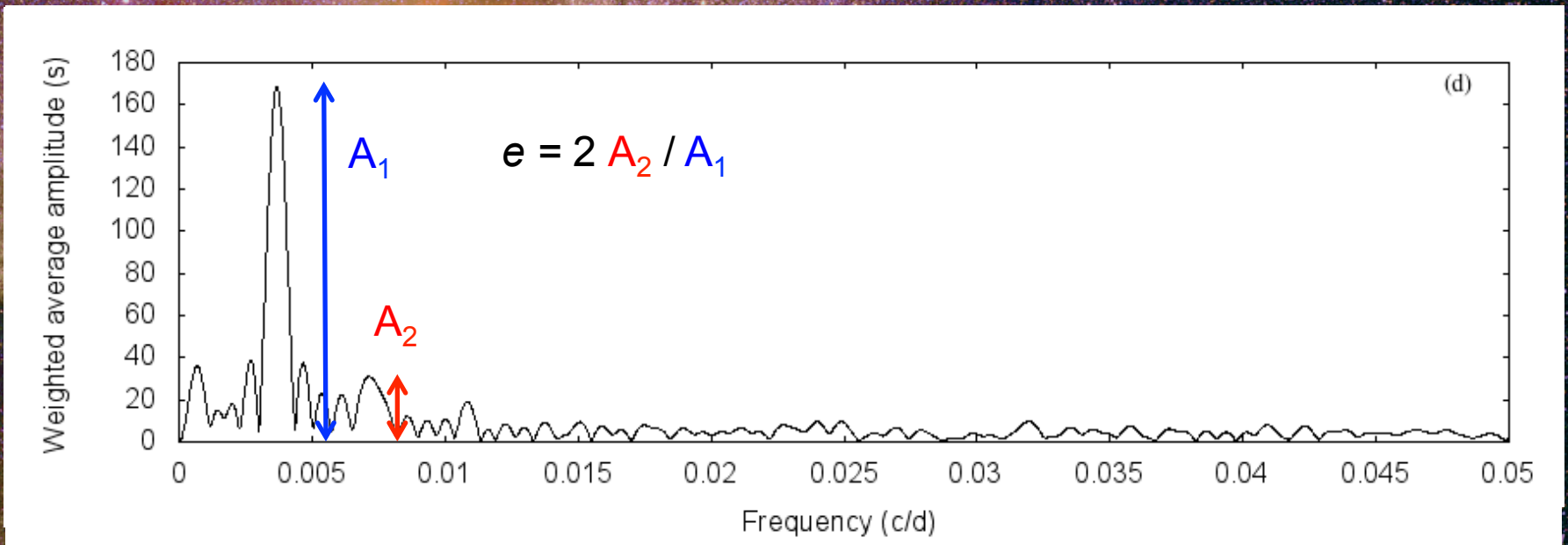
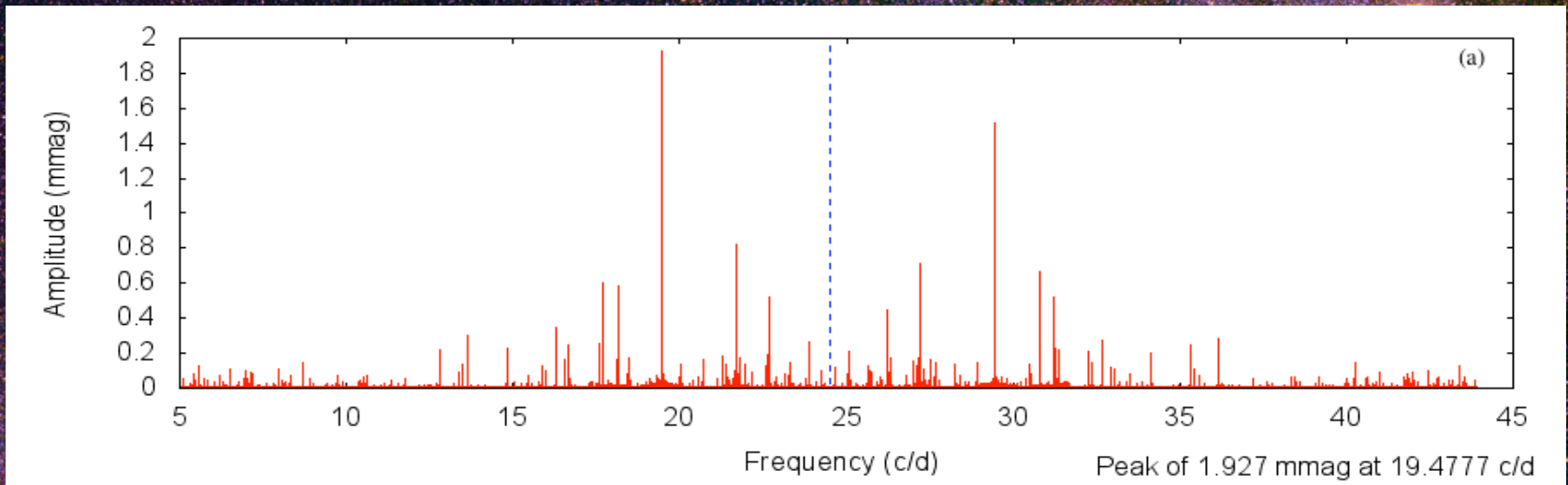


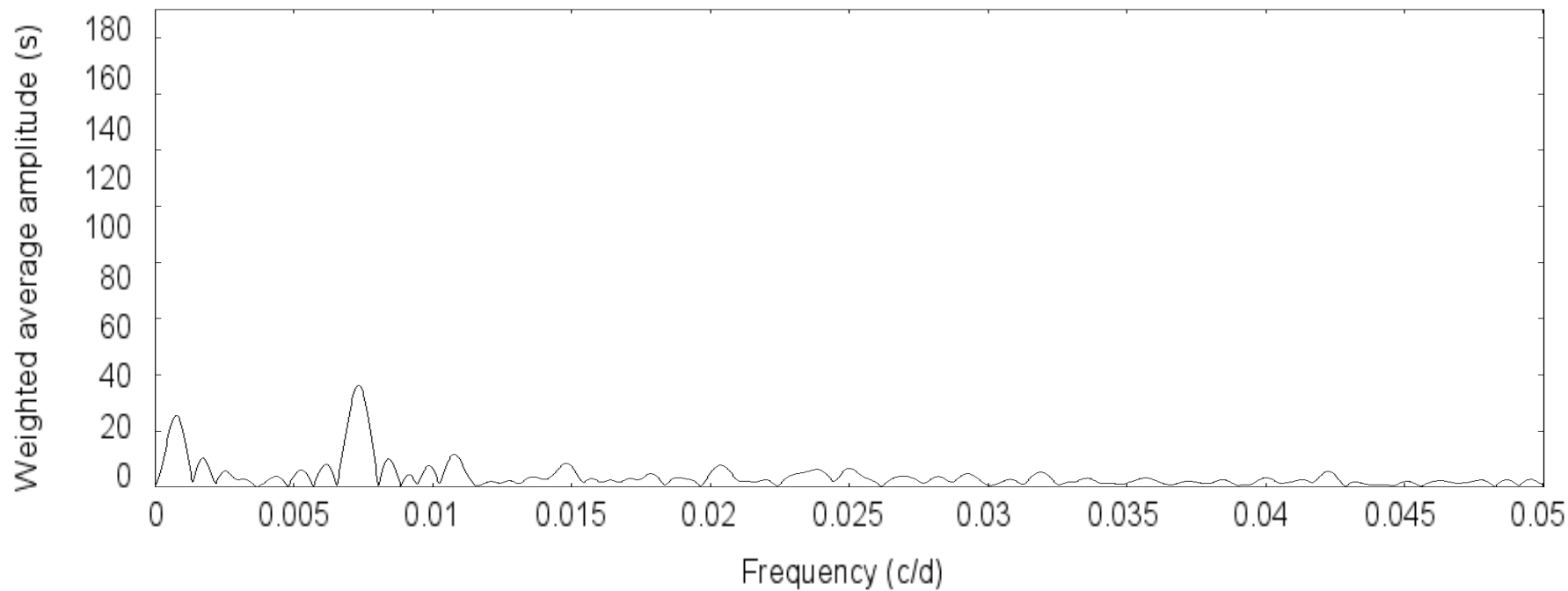
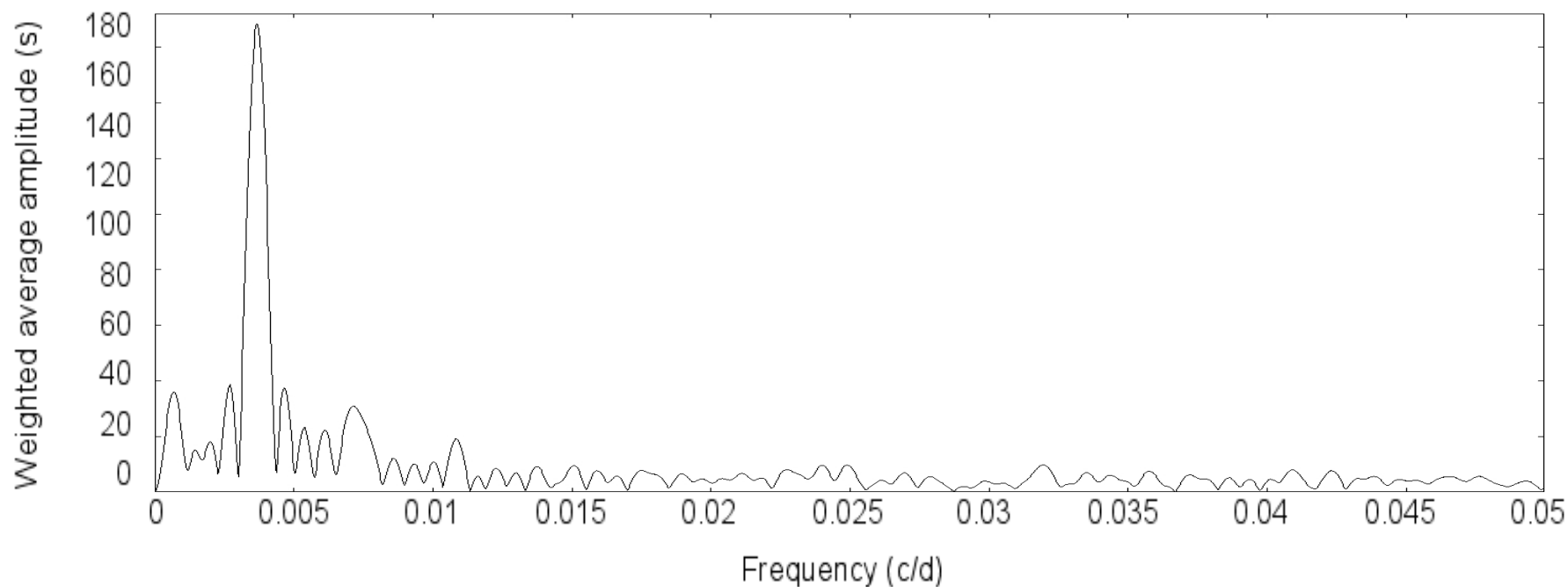
...and ETVs

Phase Modulation

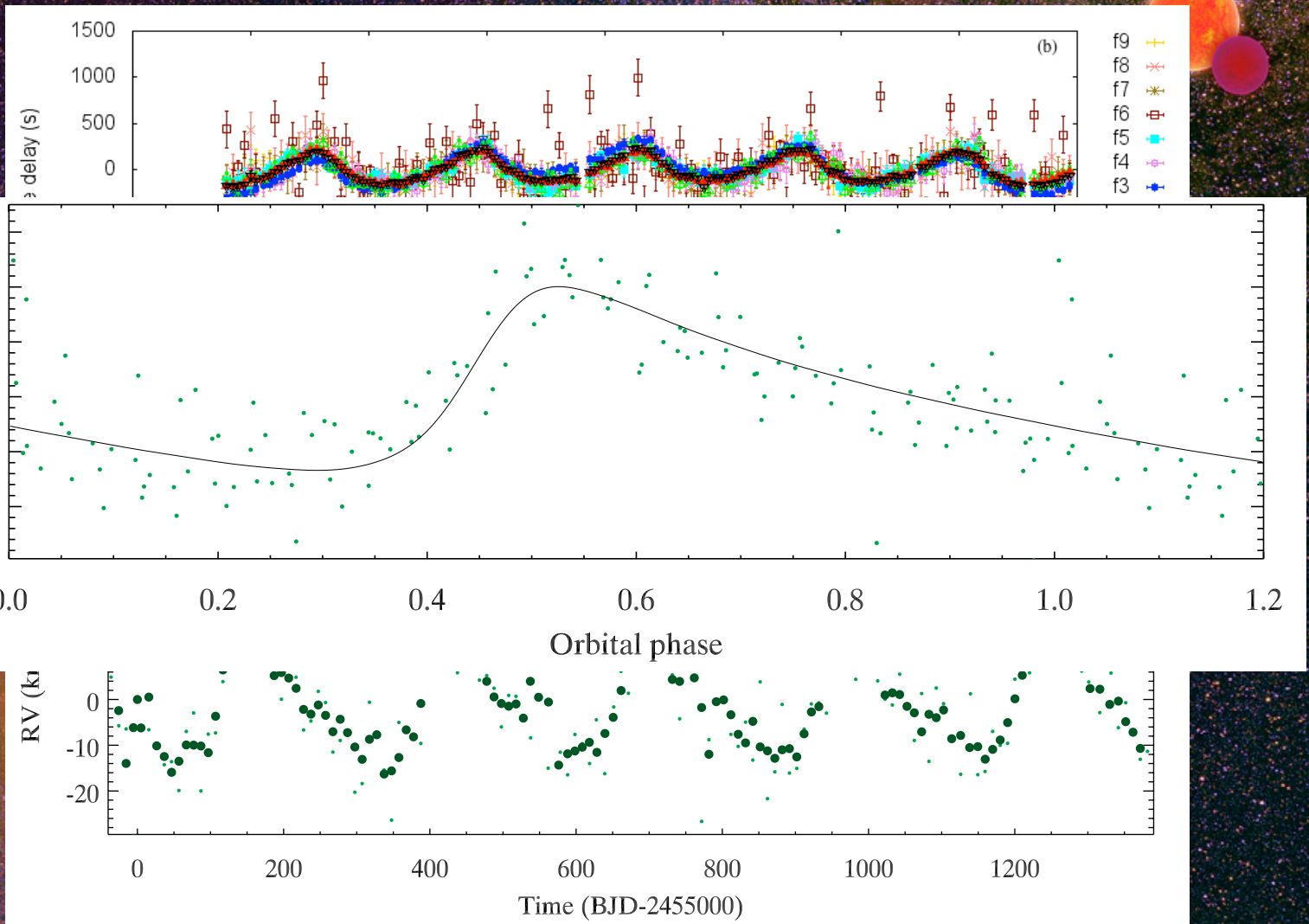


Phase Modulation continued

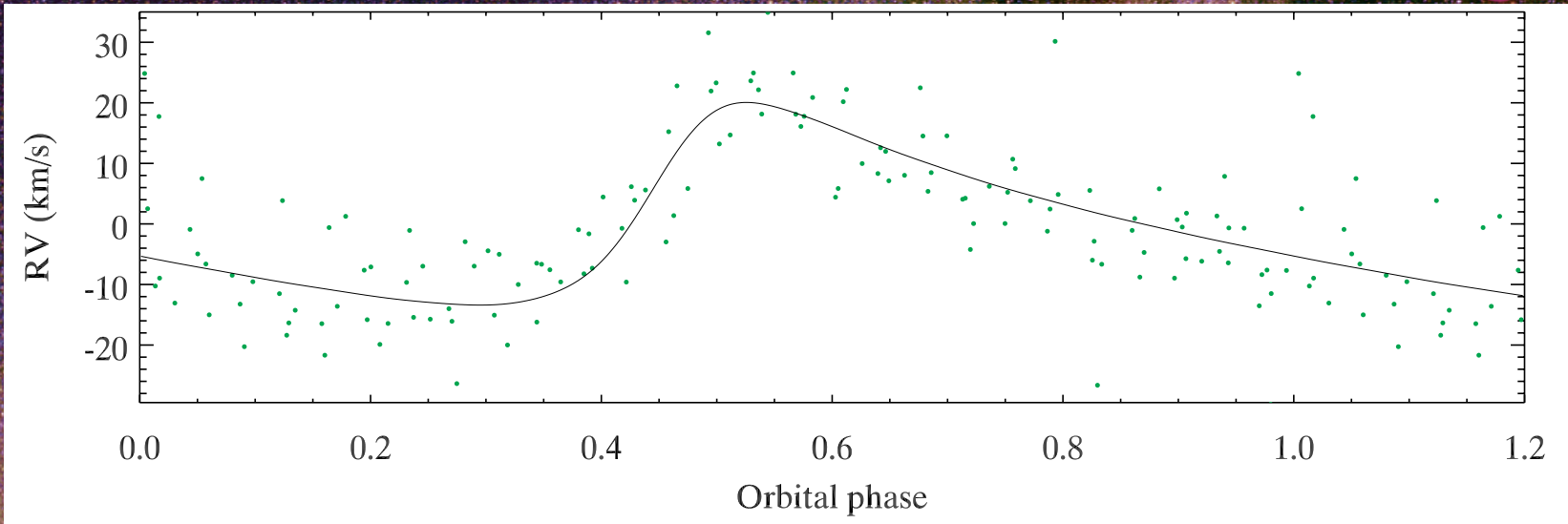




Phase Modulation continued



Phase Modulation continued

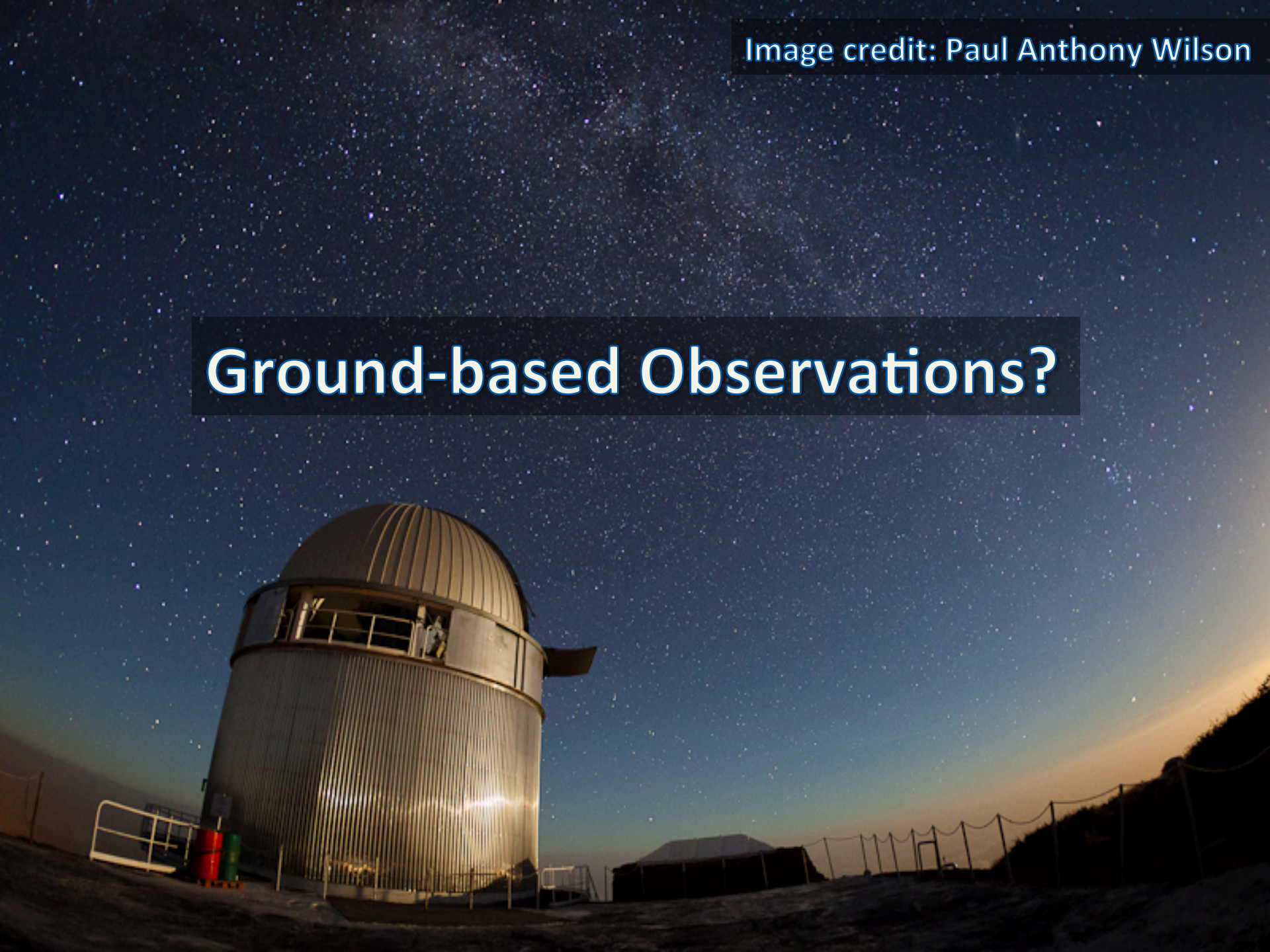


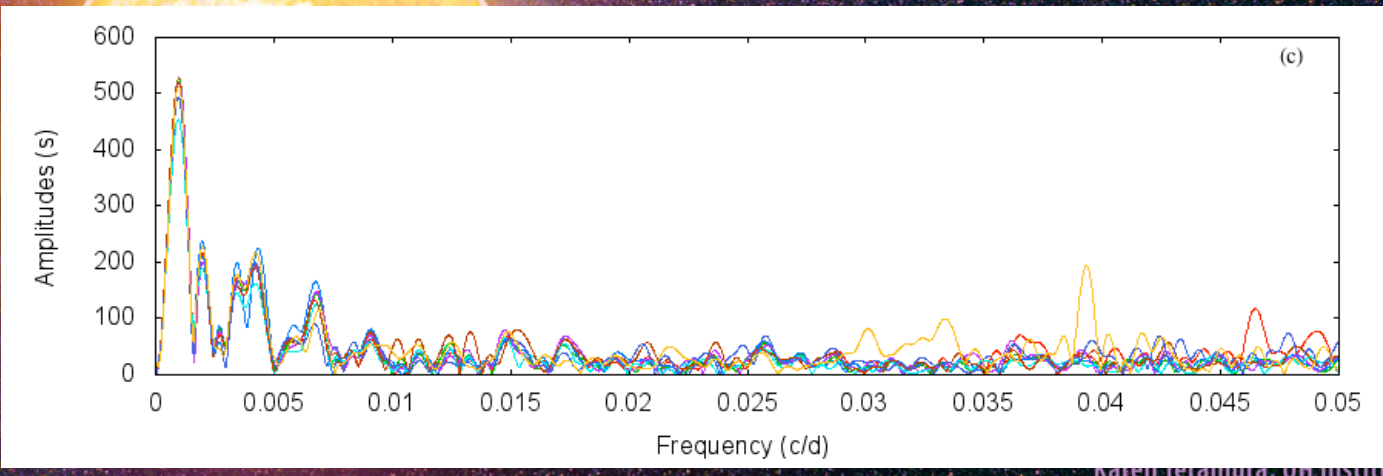
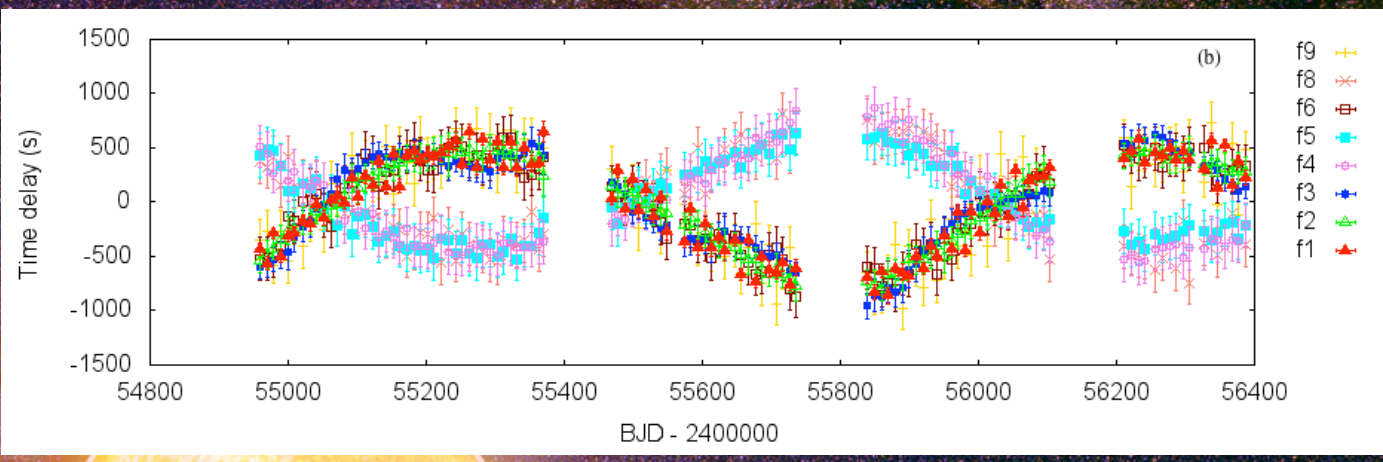
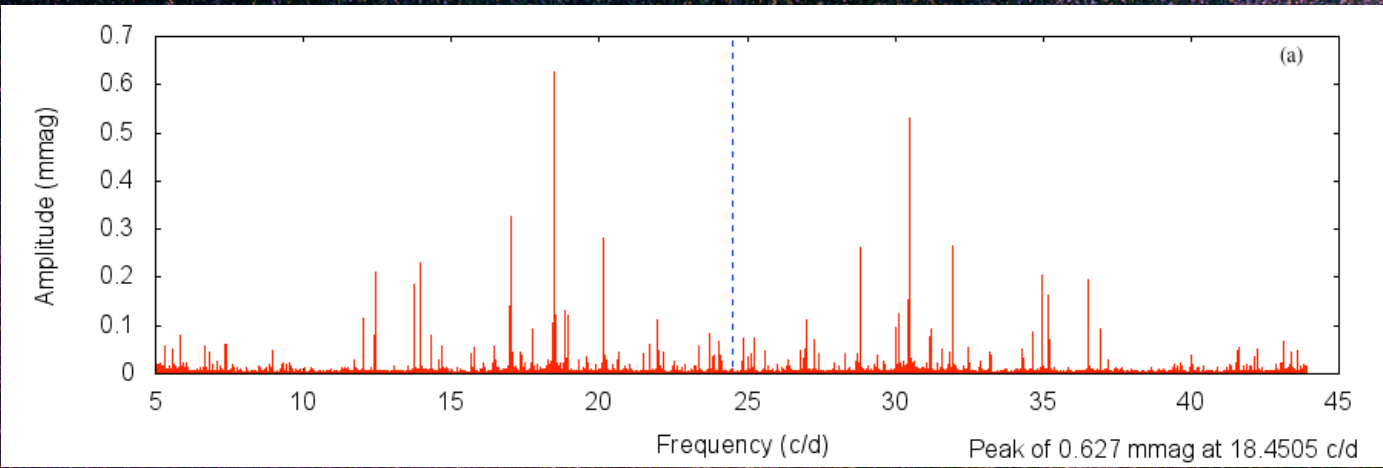
$$a_1 \sin i = \frac{1}{4\pi} \frac{1}{\nu_{\text{orb}}} \sqrt{1 - e^2} (v_{\text{rad},1,\text{max}} - v_{\text{rad},1,\text{min}})$$

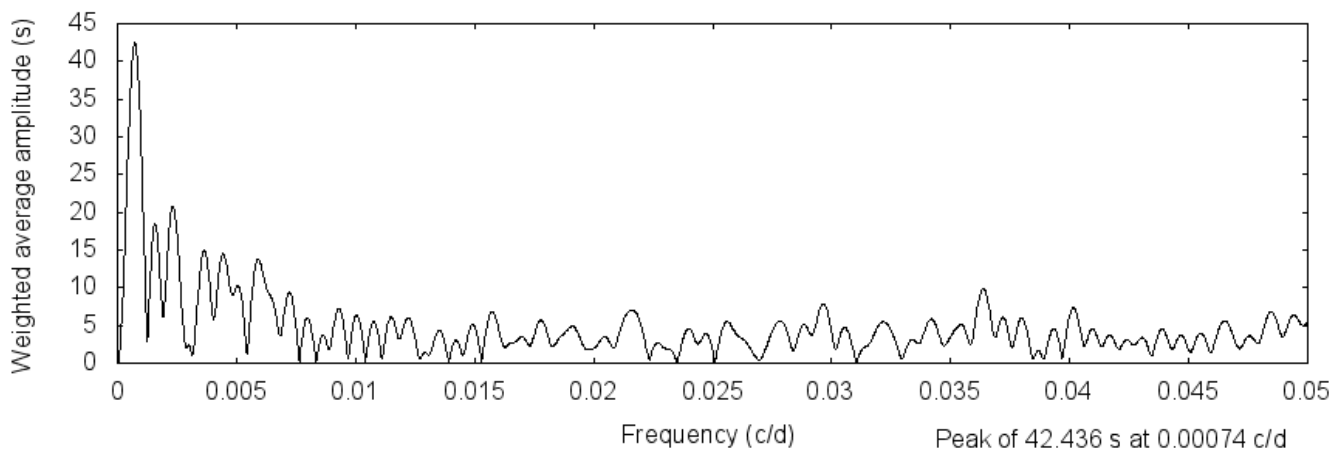
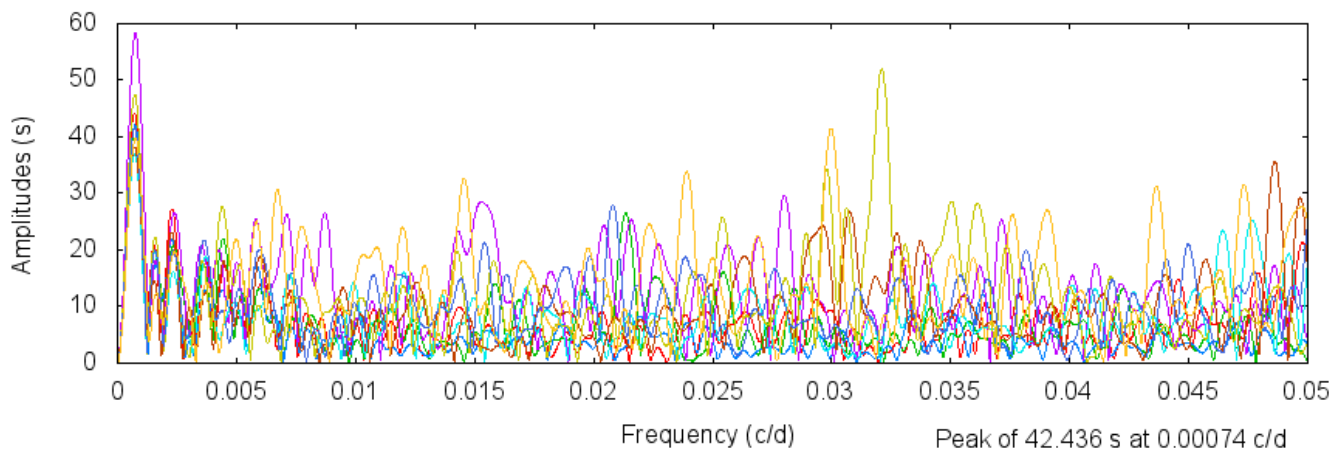
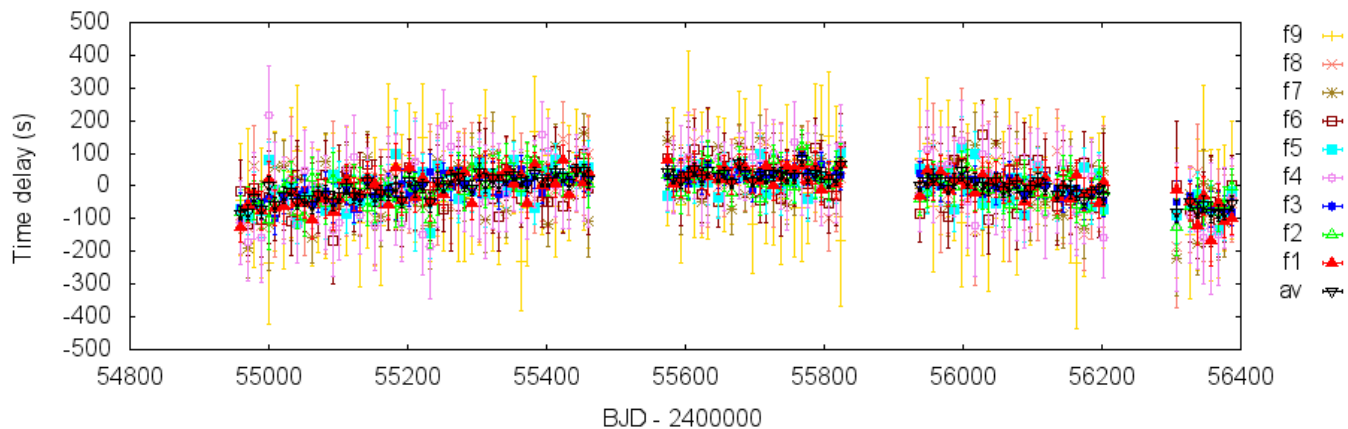
$$\begin{aligned} f(m_1, m_2, \sin i) &= \frac{(m_2 \sin i)^3}{(m_1 + m_2)^2} \\ &= \frac{(2\pi)^2}{P_{\text{orb}}^2 G} (a_1 \sin i)^3, \end{aligned}$$

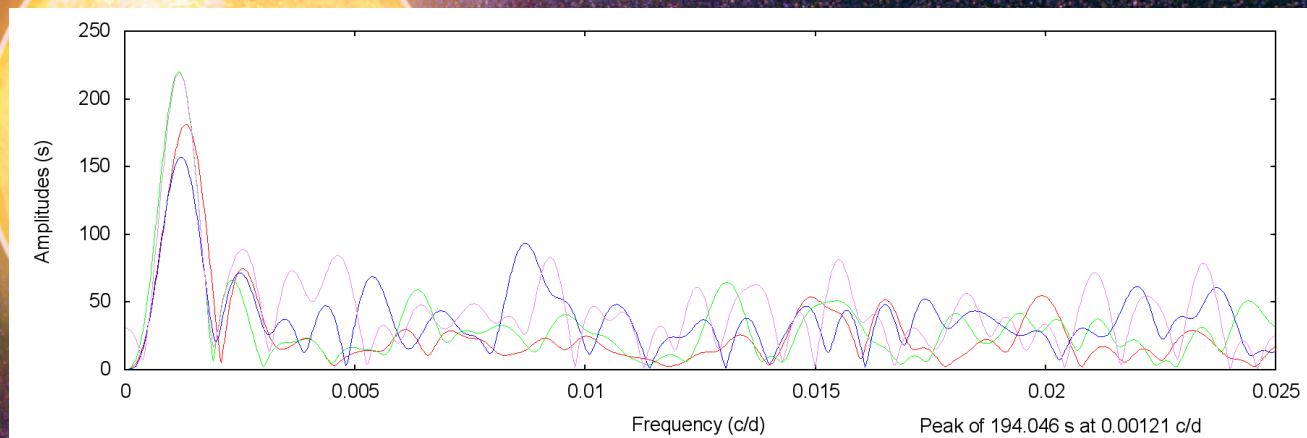
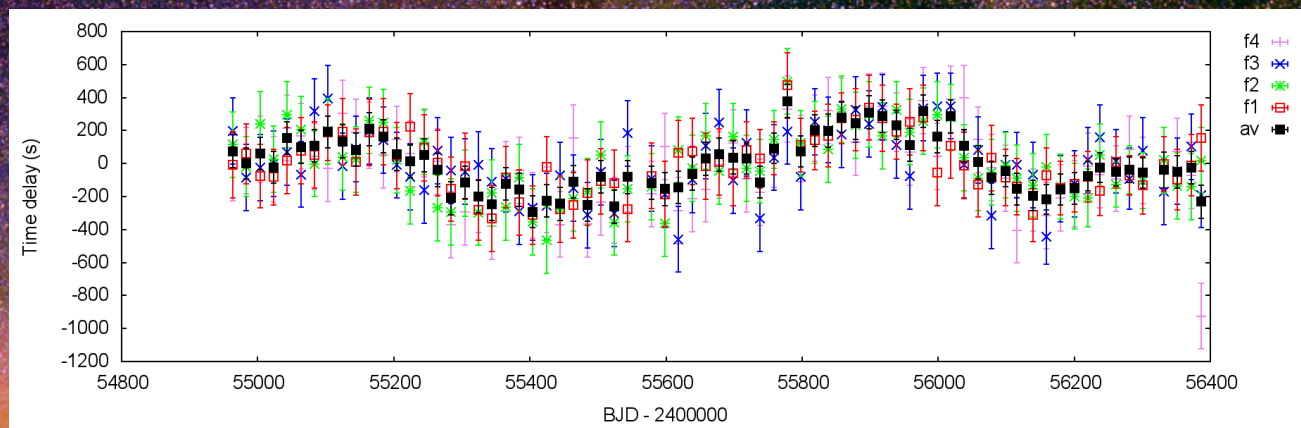
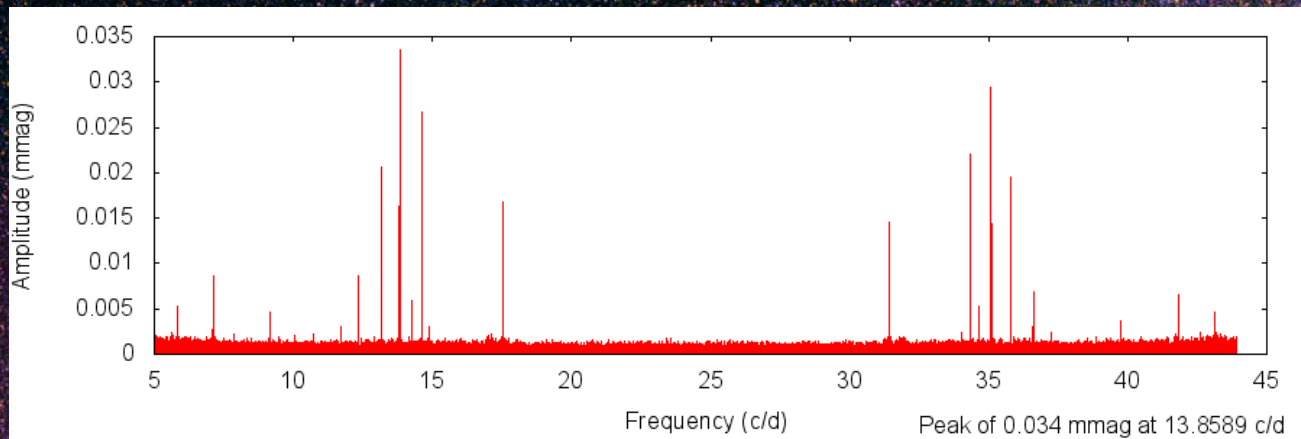
Image credit: Paul Anthony Wilson

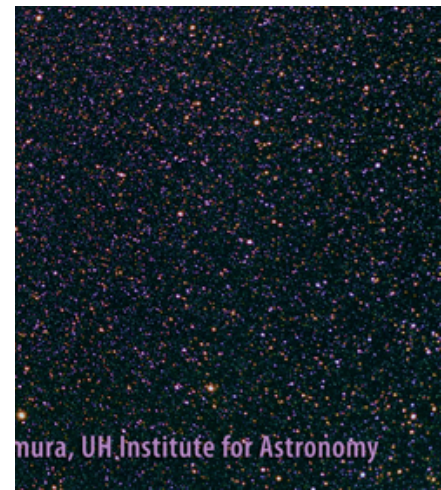
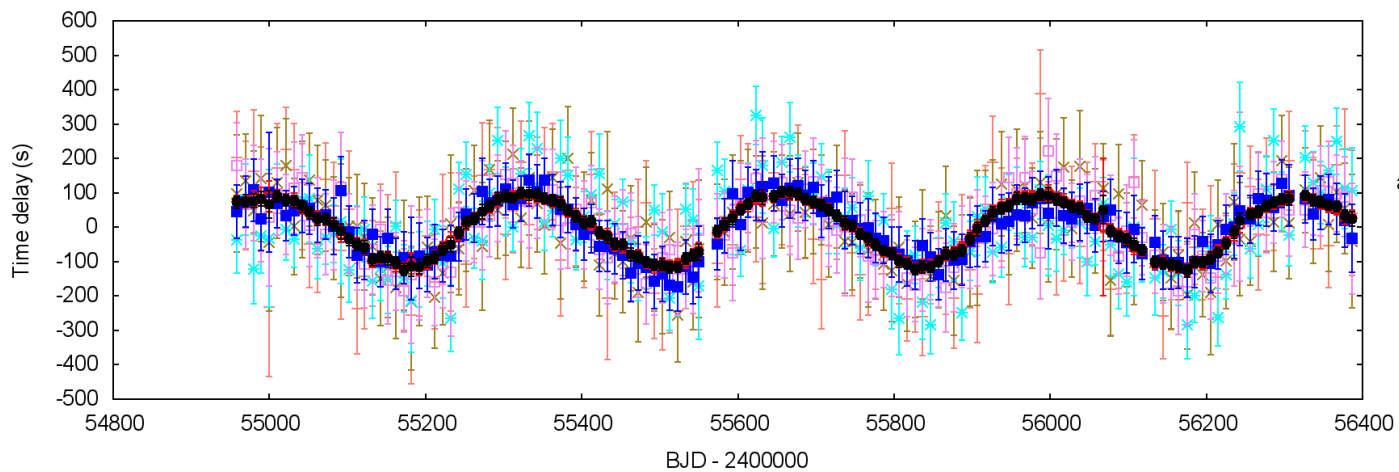
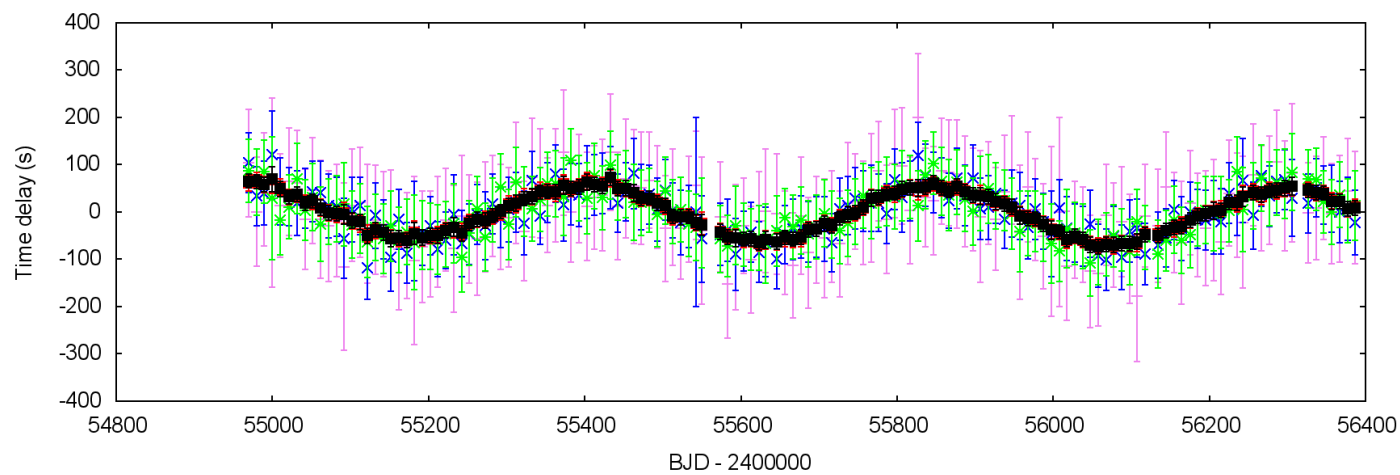
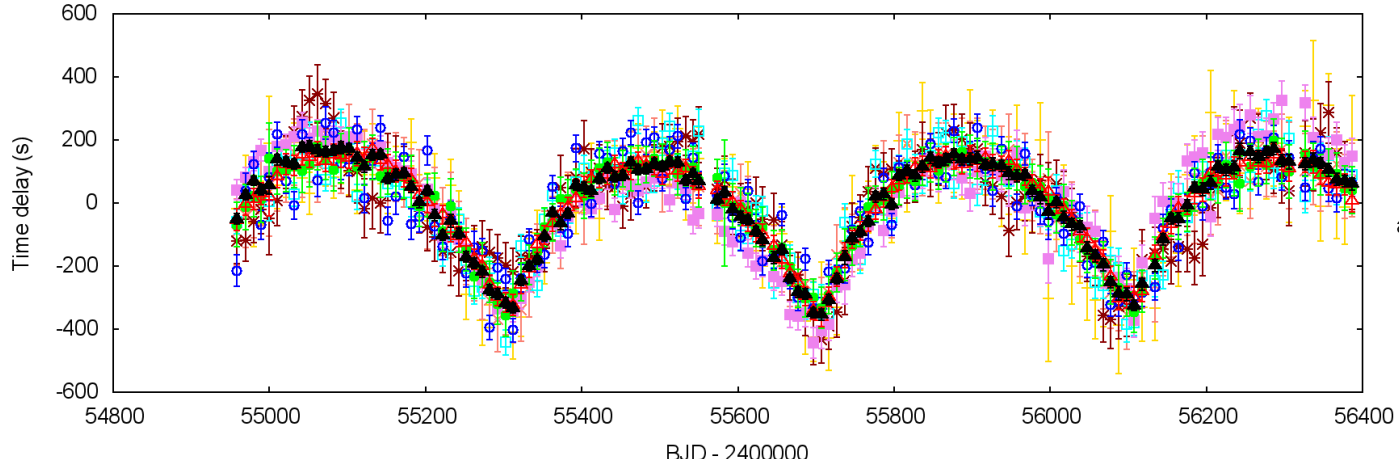
Ground-based Observations?

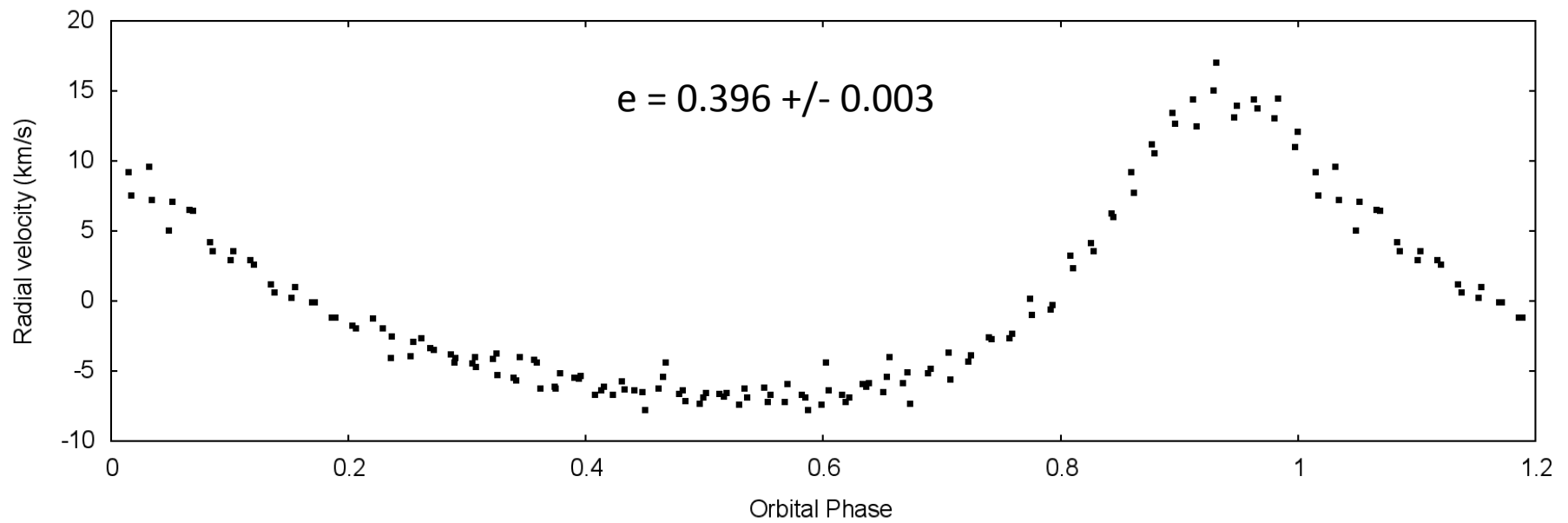
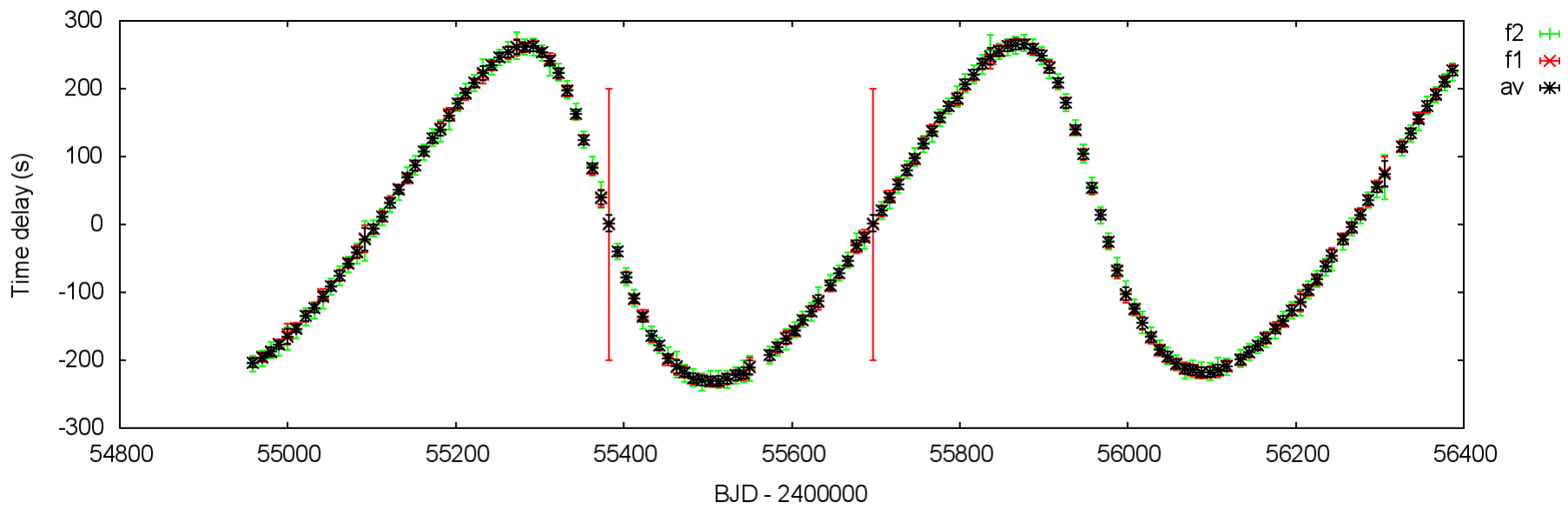








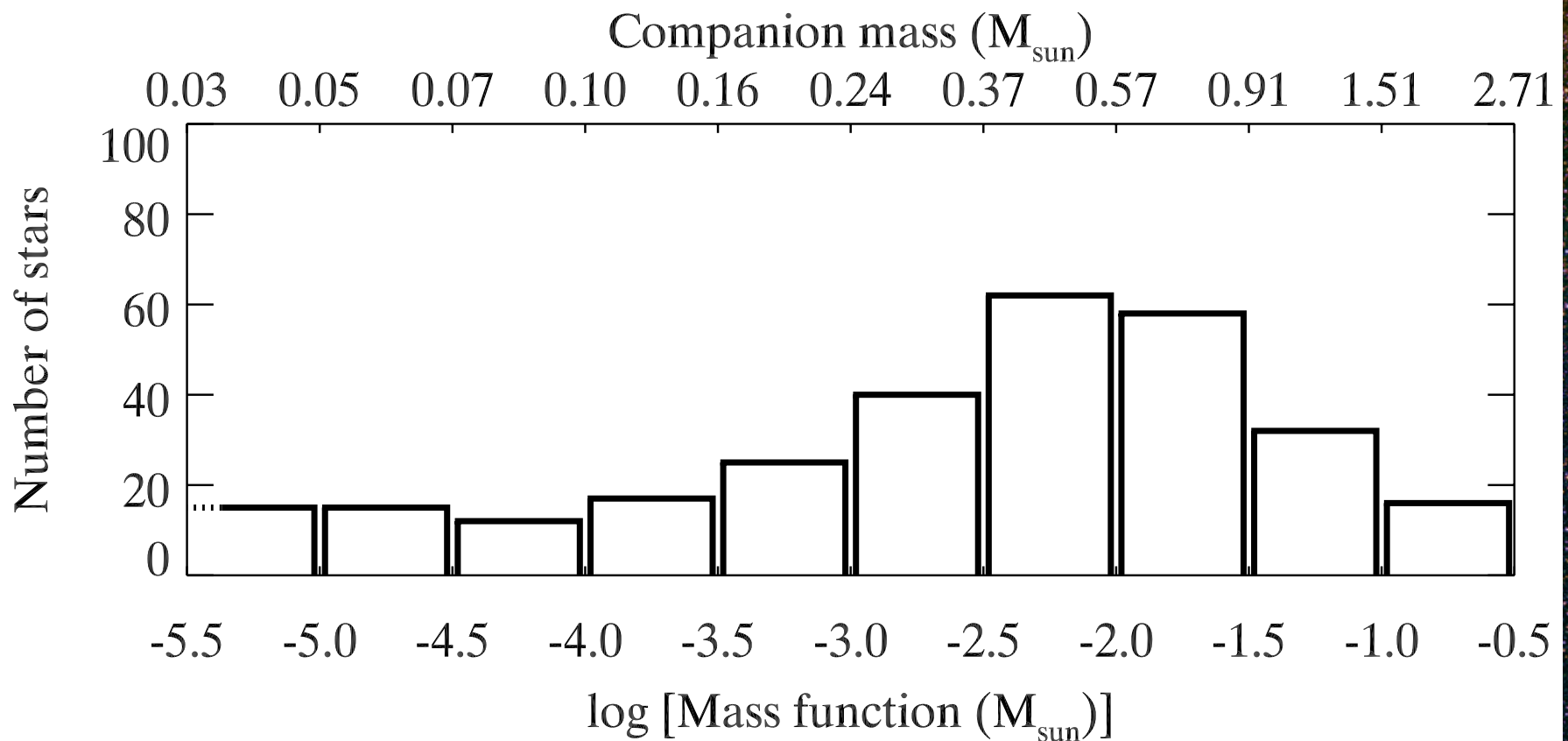




Early Results

- Smallest mass function: $(4.1 \pm 2.0) \times 10^{-7} M_{\text{sun}}$
 - Primary $\sim 2M_{\text{sun}} \Rightarrow M_{\text{planet}} \sim 10 M_{\text{jup}}$
- Eccentricity: $e = 0.71 \pm 0.08; 0.84 \pm 0.11$
 - Most precise: $e = 0.113 \pm 0.002$

Mass function distribution



~~hot~~

Cool Stuff Checklist

- Find a myriad of binaries
- Create brown-dwarf factory
- ~ Detect planetary companion
- Resolve two pulsation spectra

Nyquist Aliases

