Searching for Oscillating M-Giant Stars in Eclipsing Binary System

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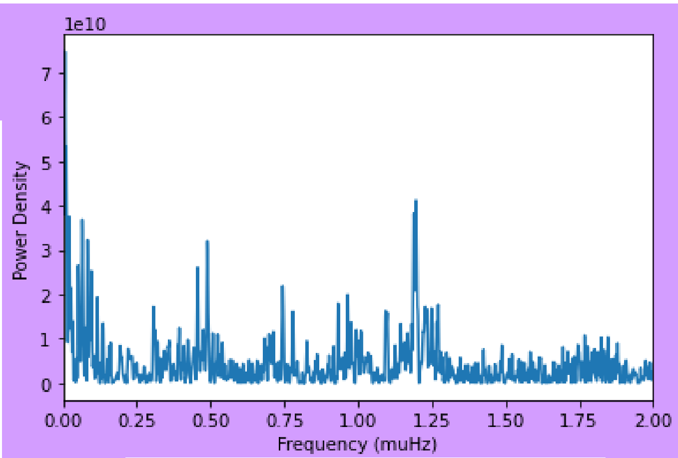
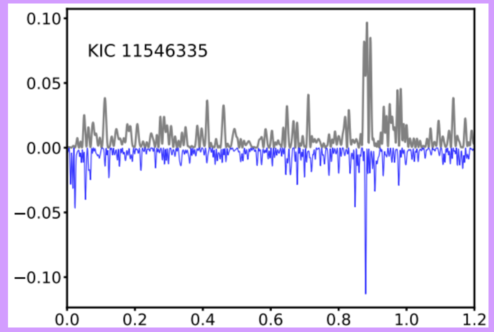
Background & Motivation

Asteroseismology, the study of stellar oscillations, allows us to calculate distances of stars that are out of reach of Gaia measurements. Finding and analyzing M-giant stars has important implications for understanding our Milky Way galaxy, including interactions with dark matter haloes and satellite galaxies. We are using asteroseismology as our main method by measuring a star's luminosity which allows us to also calculate distance by detecting the frequencies of the target system. Light curves can then be utilized to identify oscillations in detected M-giants.

Methodology

We are using asteroseismology as our main method of calculating the distance to target binaries and combining it with eclipsing binary distances to calibrate the asteroseismic distance.





Auge et al., 2020

Results

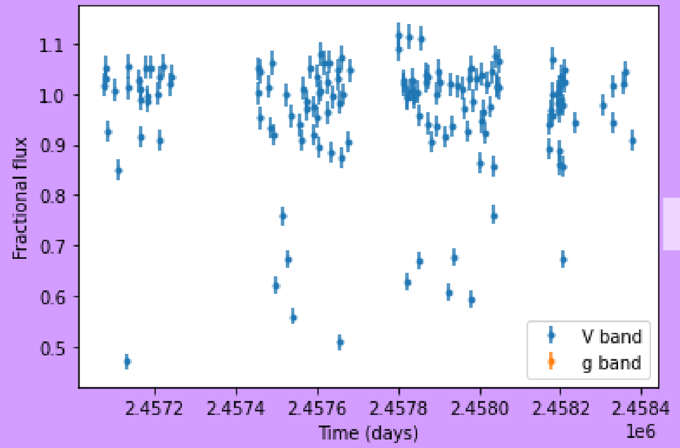
We have found one oscillating M giant in an eclipsing binary, proving that our method of finding these systems works. We have calculated the distance to this system, which is 3960 parsecs, and compared that to the Gaia distance of 2690 parsecs. The asteroseismic distance agrees with the Gaia distance within ~15%.

$$\frac{g}{g_{sun}} = \frac{\left(\frac{M}{M_{sun}}\right)}{\left(\frac{R}{R_{sun}}\right)^2}$$

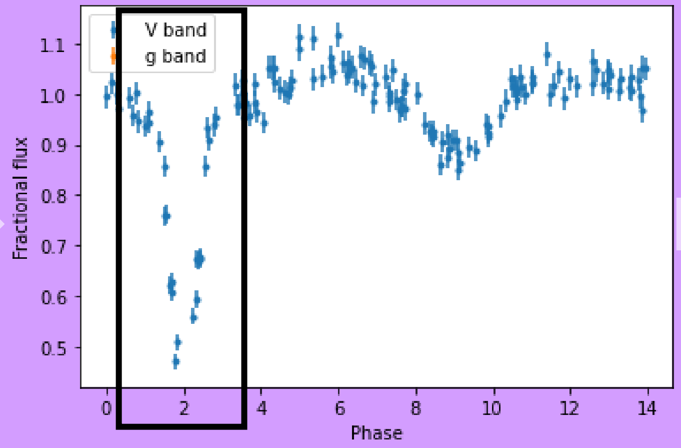
$$\frac{g}{g_{sun}} = \frac{V_{max}}{V_{maxsun}}\left(\frac{T_{eff}}{T_{effsun}}\right)$$

$$\frac{L}{L_{sun}} = \left(\frac{R}{R_{sun}}\right)^2\left(\frac{T_{eff}}{T_{effsun}}\right)^4$$

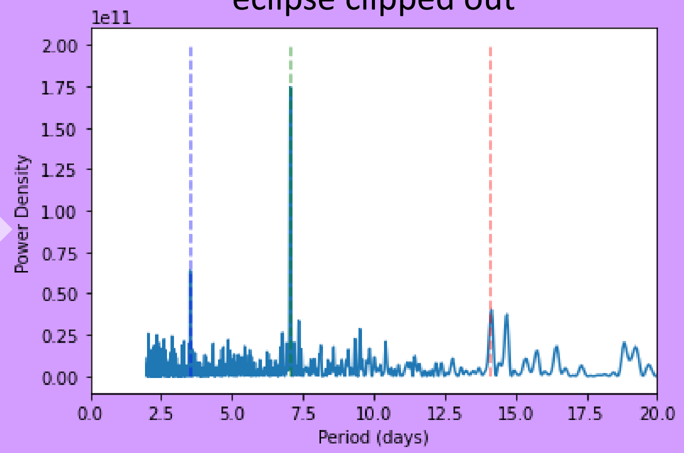
Light curve generated from ASAS-SN



Phase folded light curve using the orbital period



Power spectrum of light curve with eclipse clipped out



References