

Determining the physical parameters of eclipsing binaries in the B-Type characterization programme (BBC) with PHOEBE

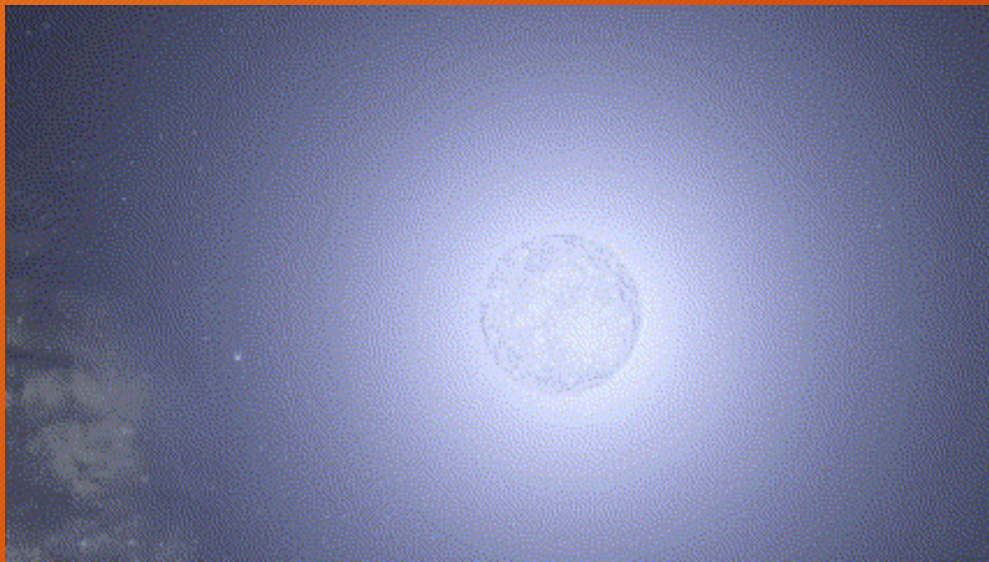
1

Binary and multiple stars in the era of big sky surveys
Litomyšl, Czech Republic

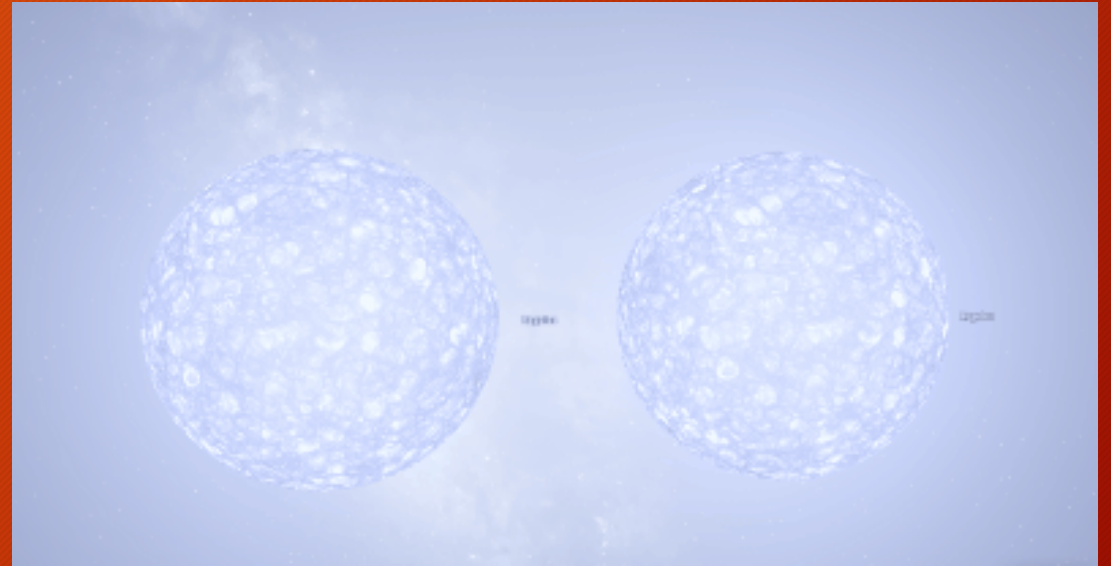
Motivation

2

- Importance of massive binaries



- Mass transfer?



Created with Universe Sandbox 2

Introduction

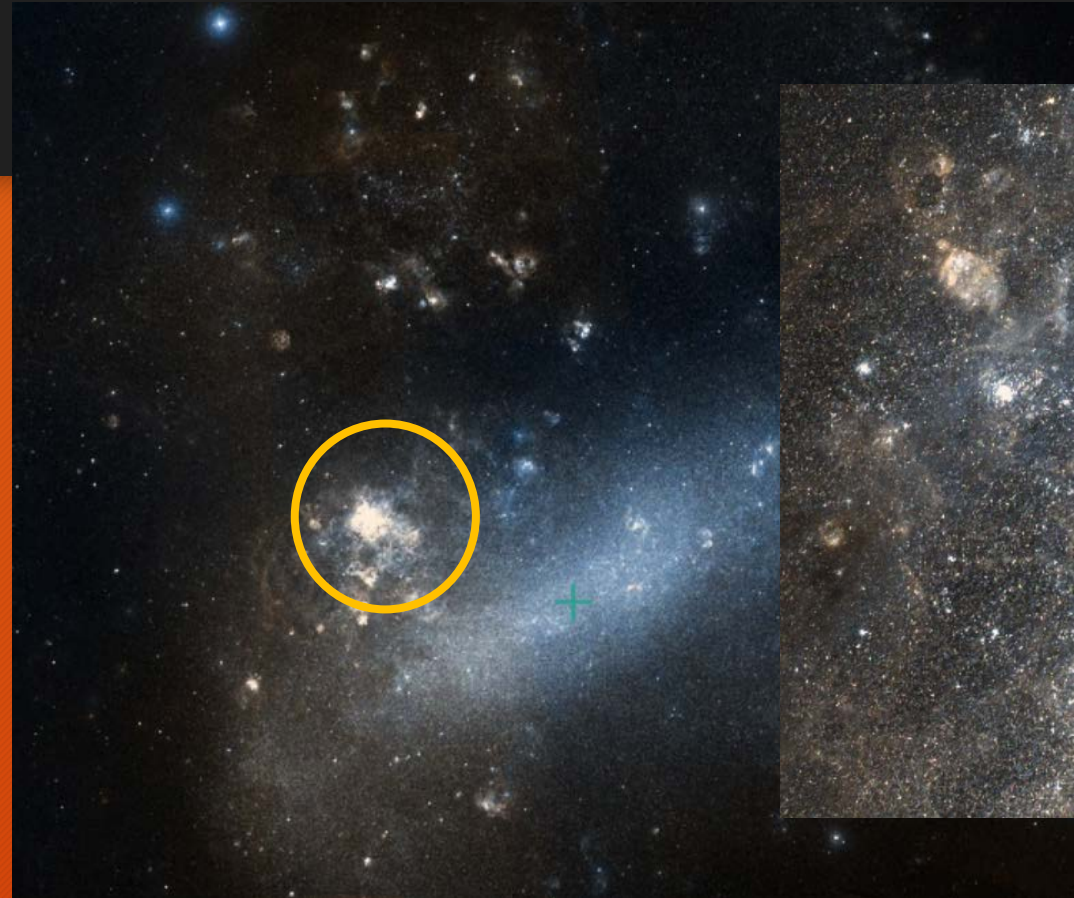
3

BBC programme
(spectroscopy)

Villaseñor+2021

OGLE
photometry

Pawlak+2016



30 Doradus

Simbad

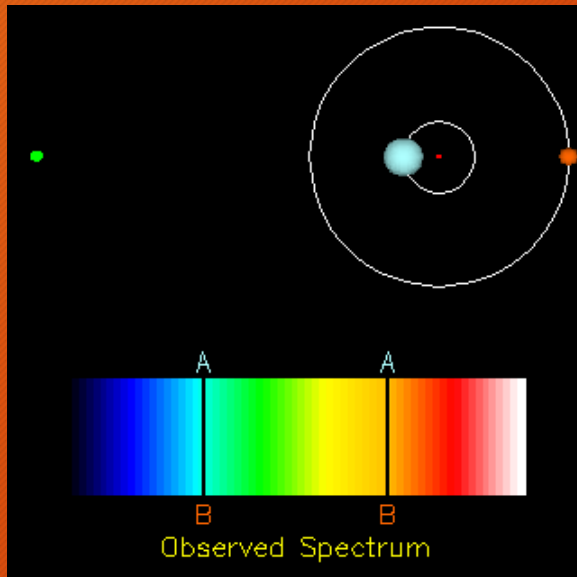
Scientific aim

4

Determination of set of physical parameters of the binary through

Spectroscopy

$$p, e, K_1, (, q)$$

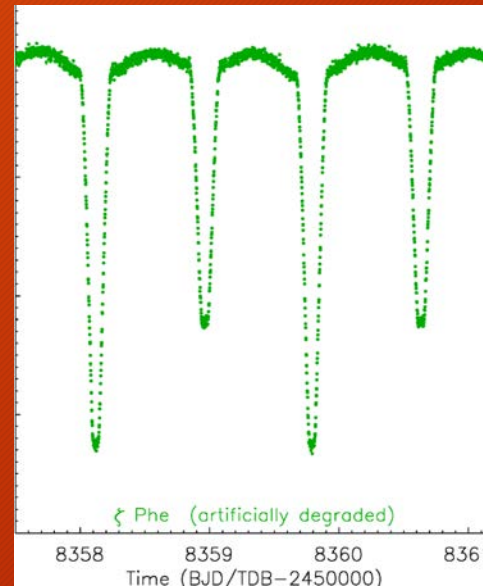


Henry Willems, MPIA

Ohio state university

Photometry

$$T_{eff}^p, T_{eff}^s, r_{eq}^p, r_{eq}^s, i$$



Southworth 2021

Python package
PHOEBE
(Physics of
eclipsing
binaries)

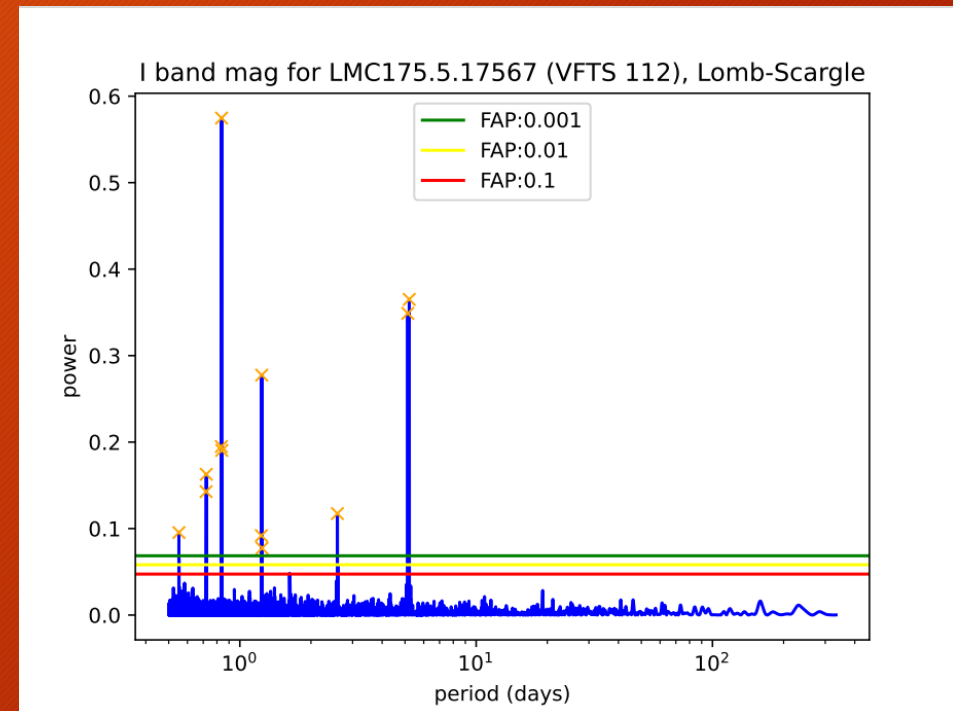
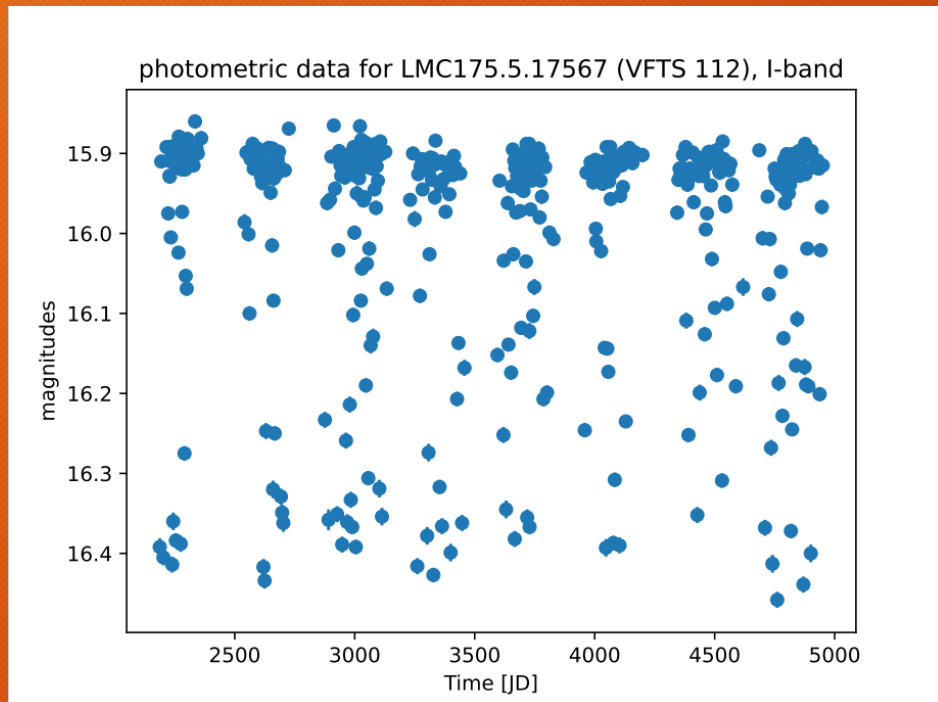
September 13, 2024

Period determination

Period determination

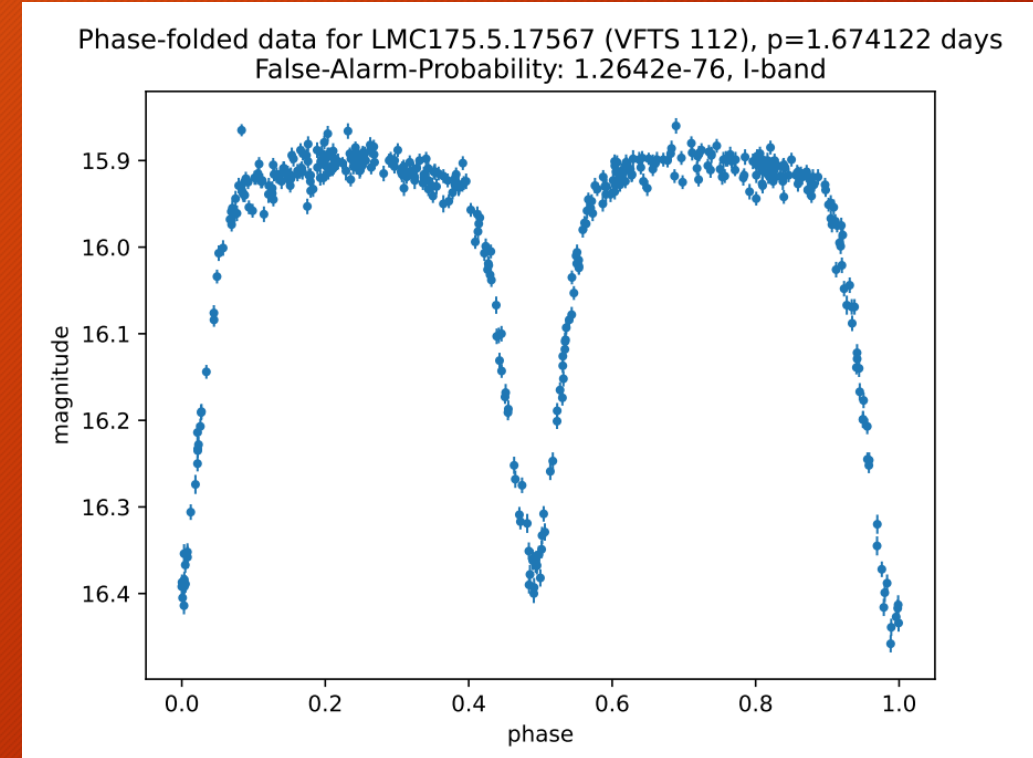
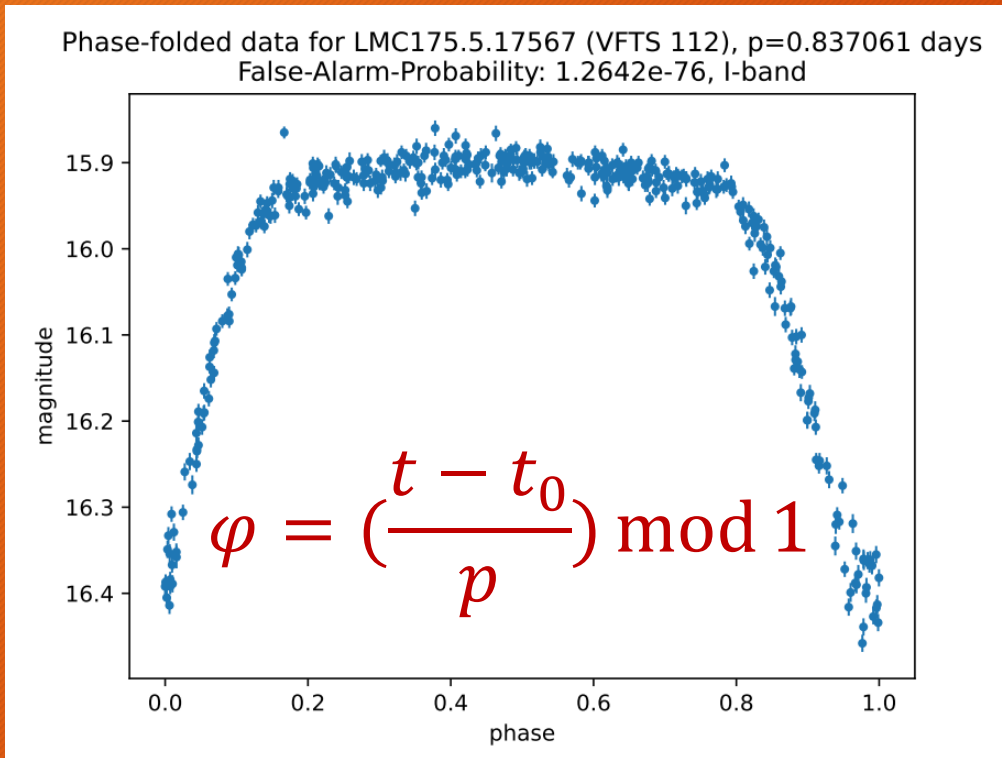
7

Lomb-Scargle periodogram



Phase-folding light curve

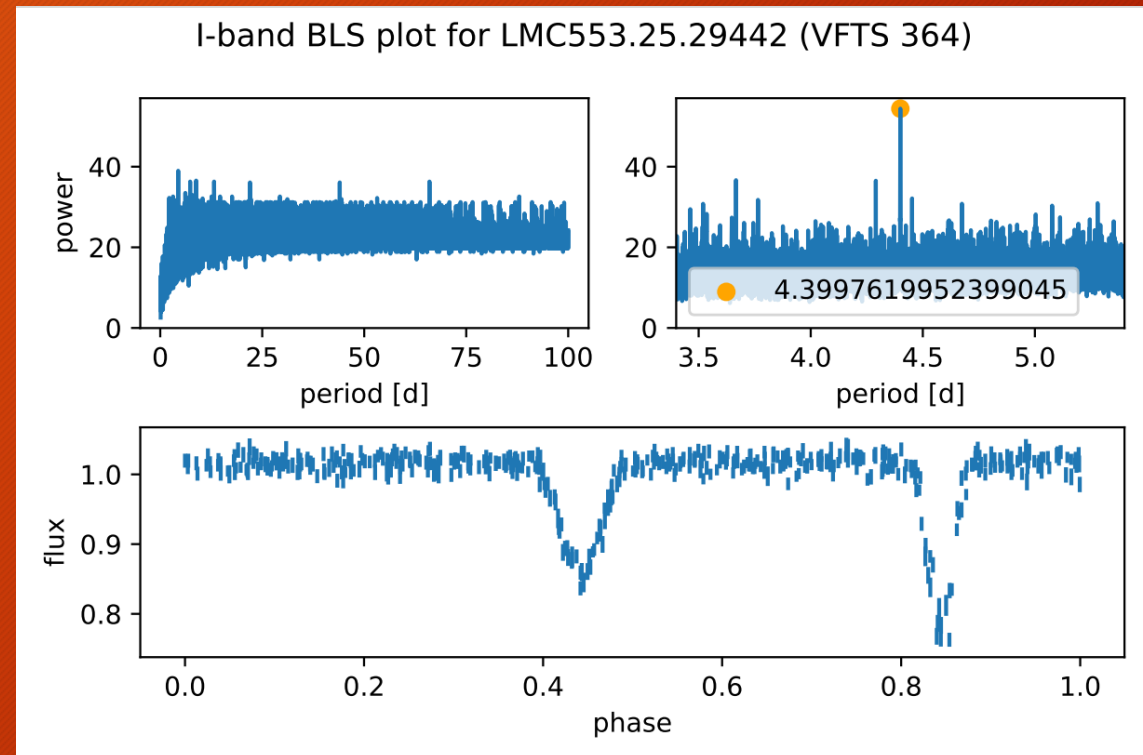
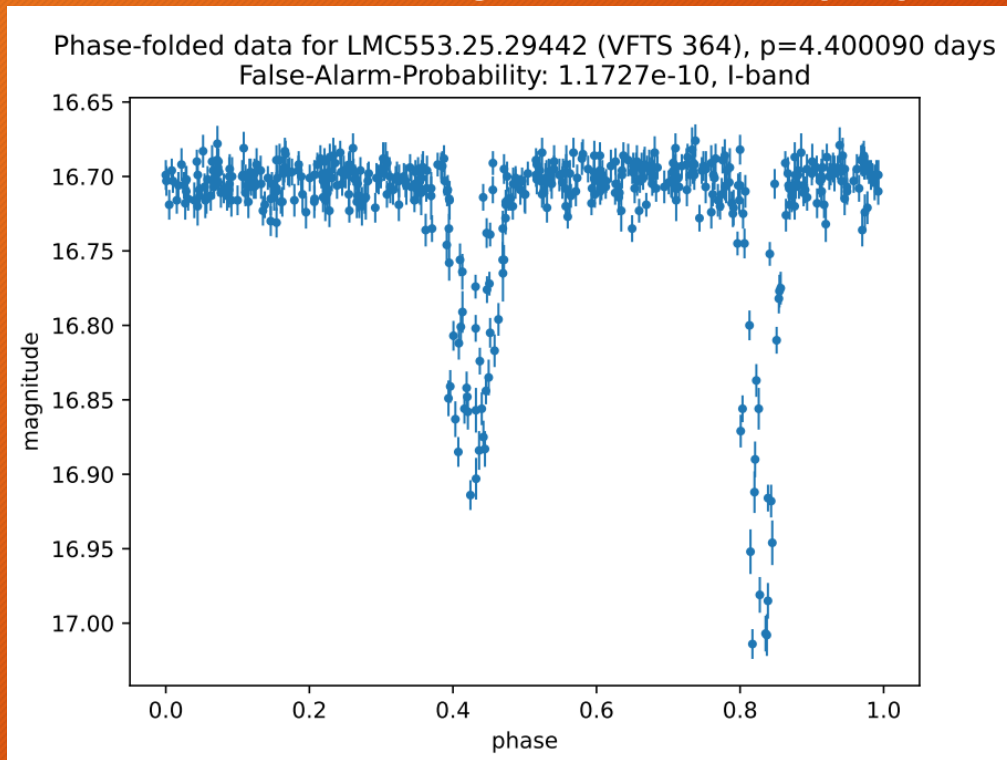
8



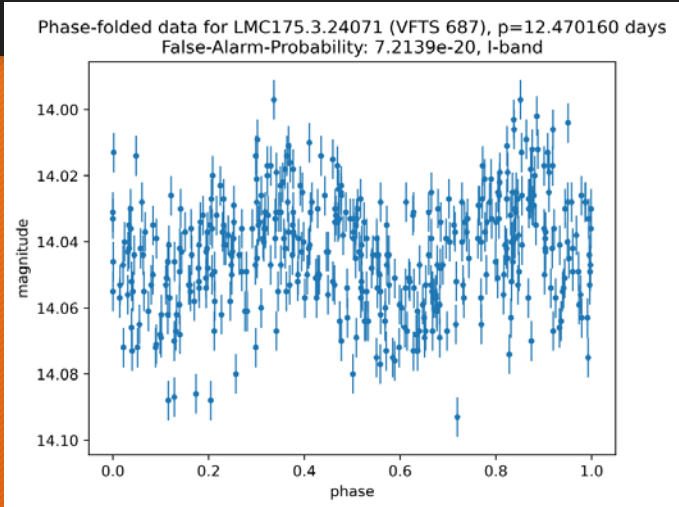
Period determination (Box-Least-Square)

9

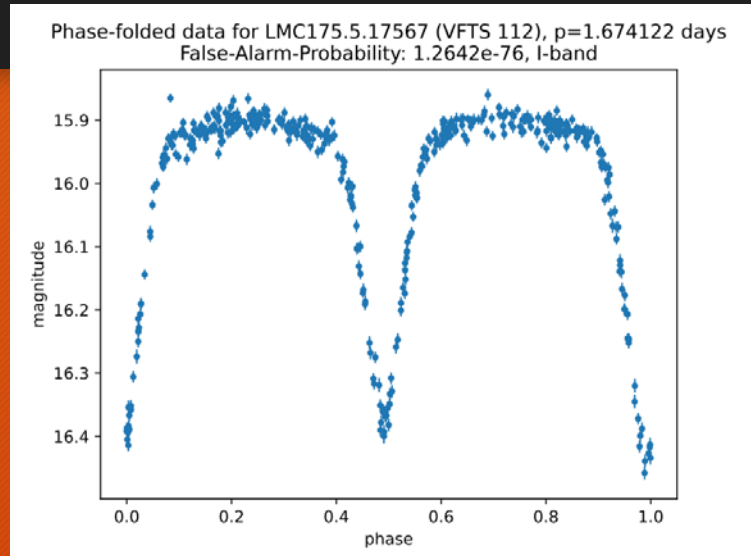
Lomb-Scargle not always yielding the best period



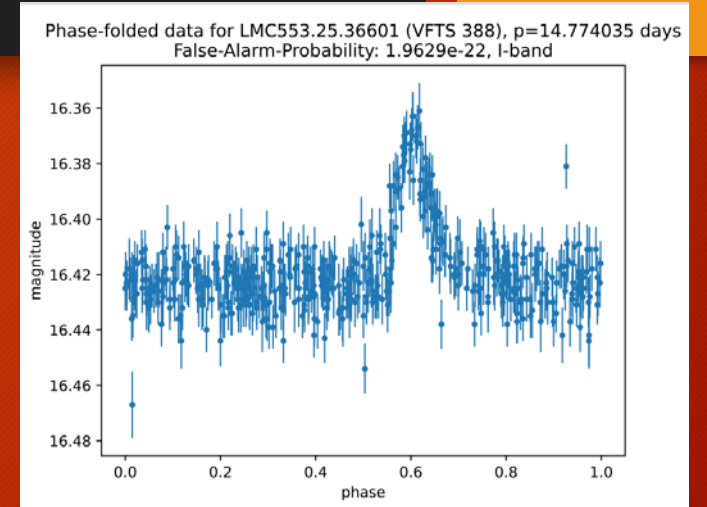
Ellipsoidal variables (4)



Results



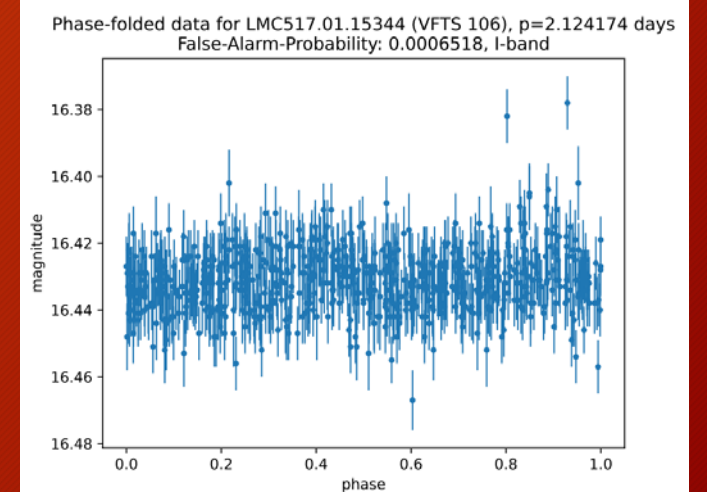
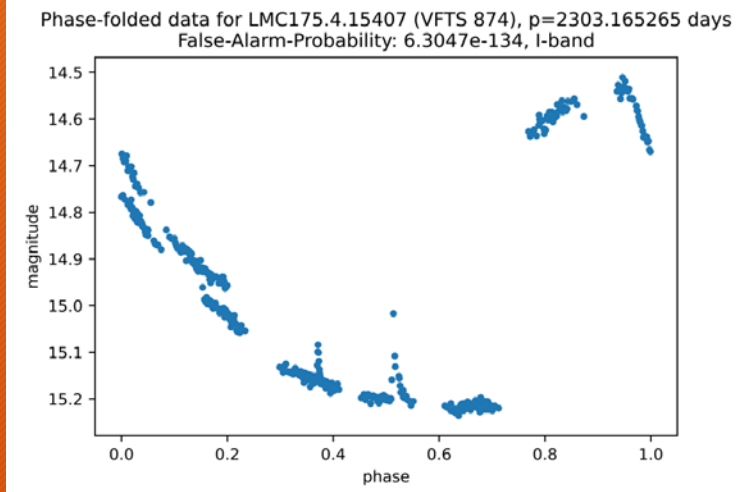
Heartbeat star (1)



Eclipsing binaries (9)

Be star
(6)

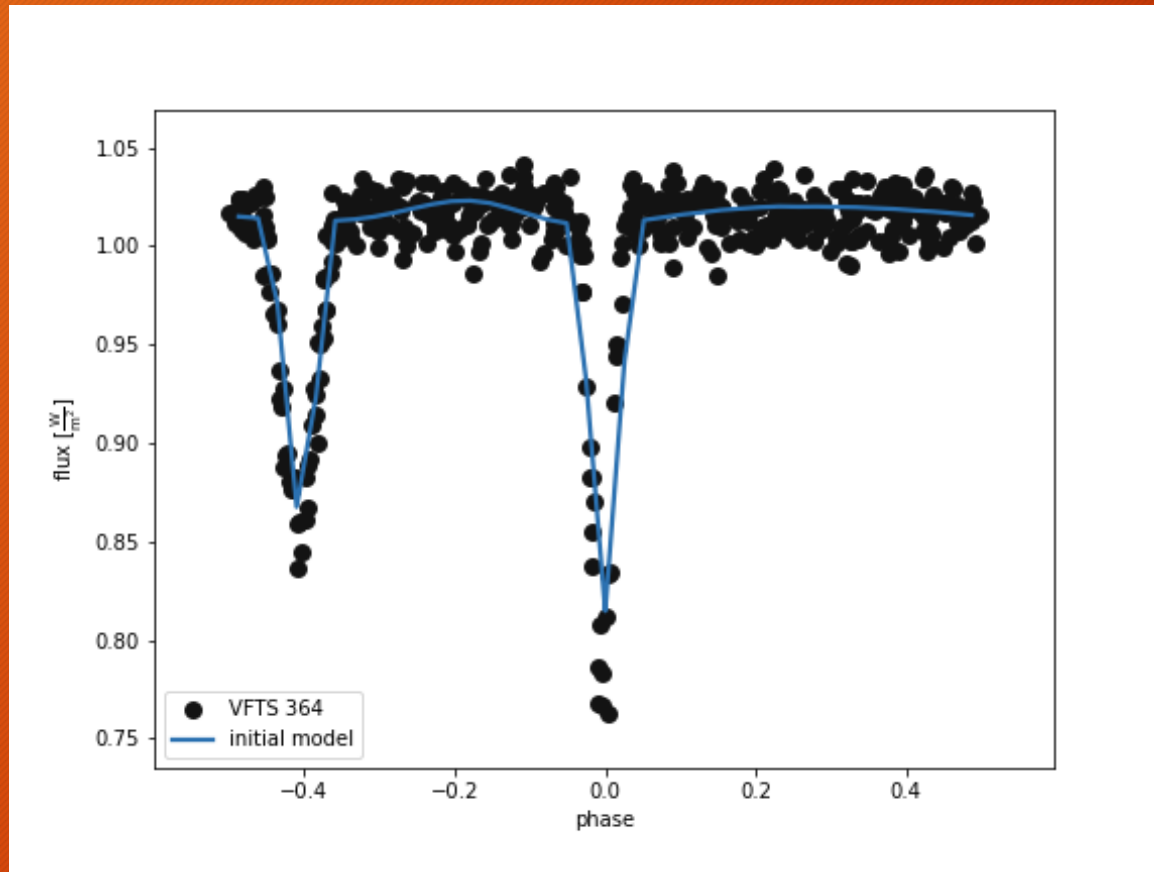
No variability
(50)



PHOEBE: Modelling

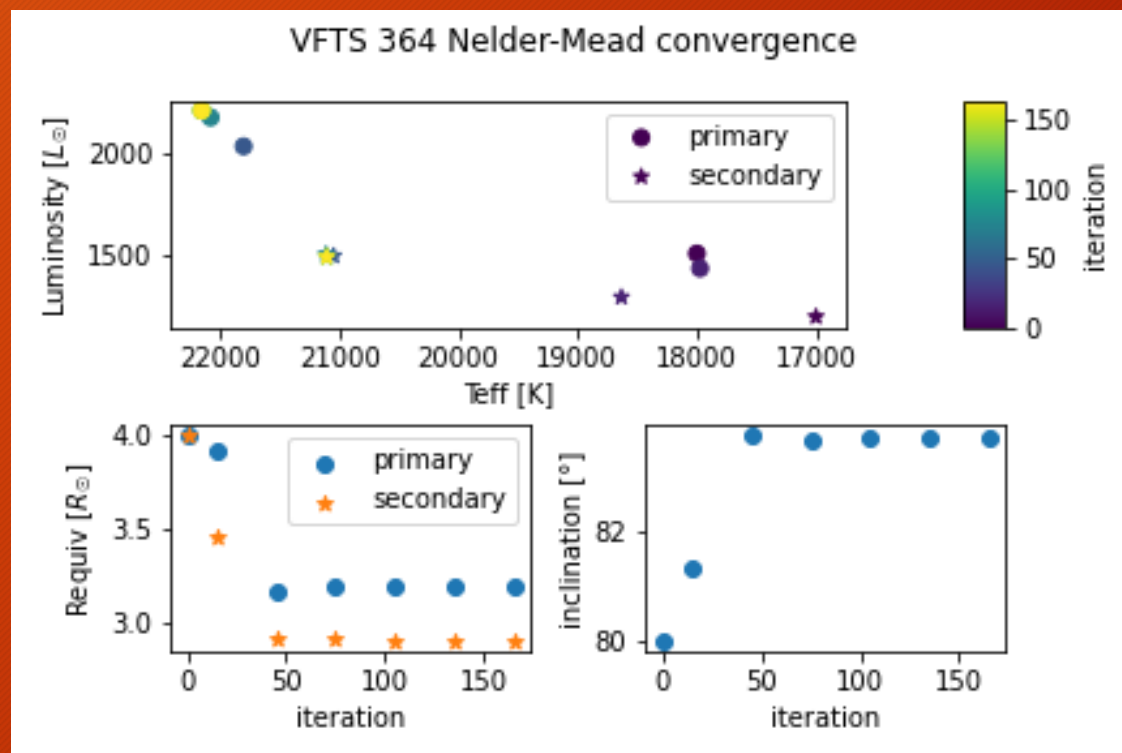
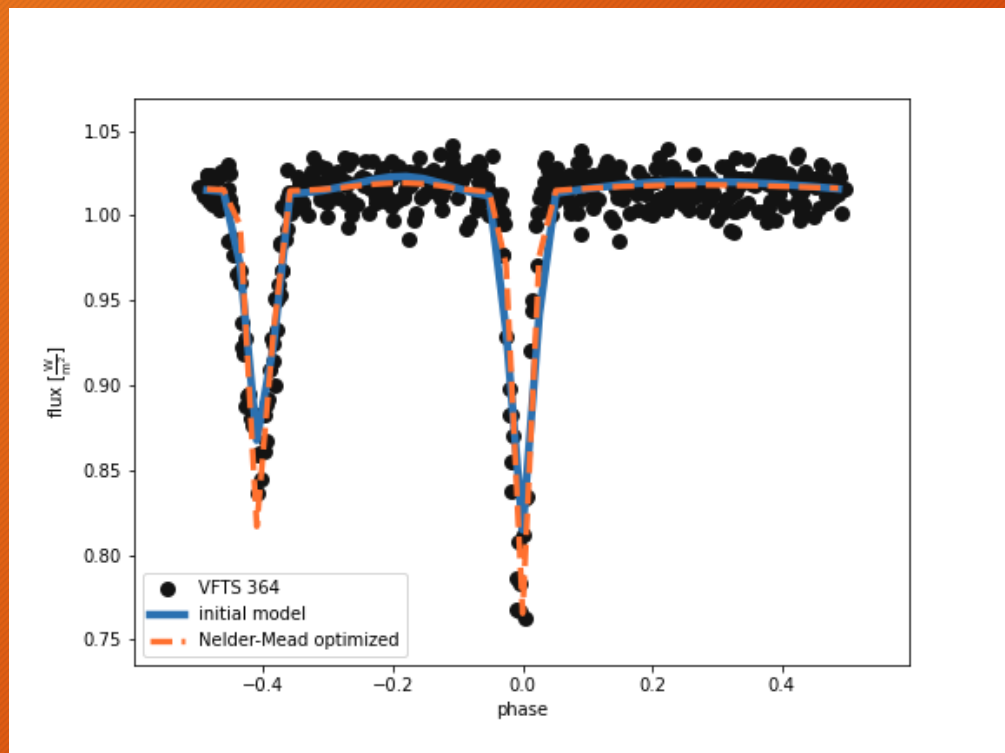
PHOEBE: First guesses

12



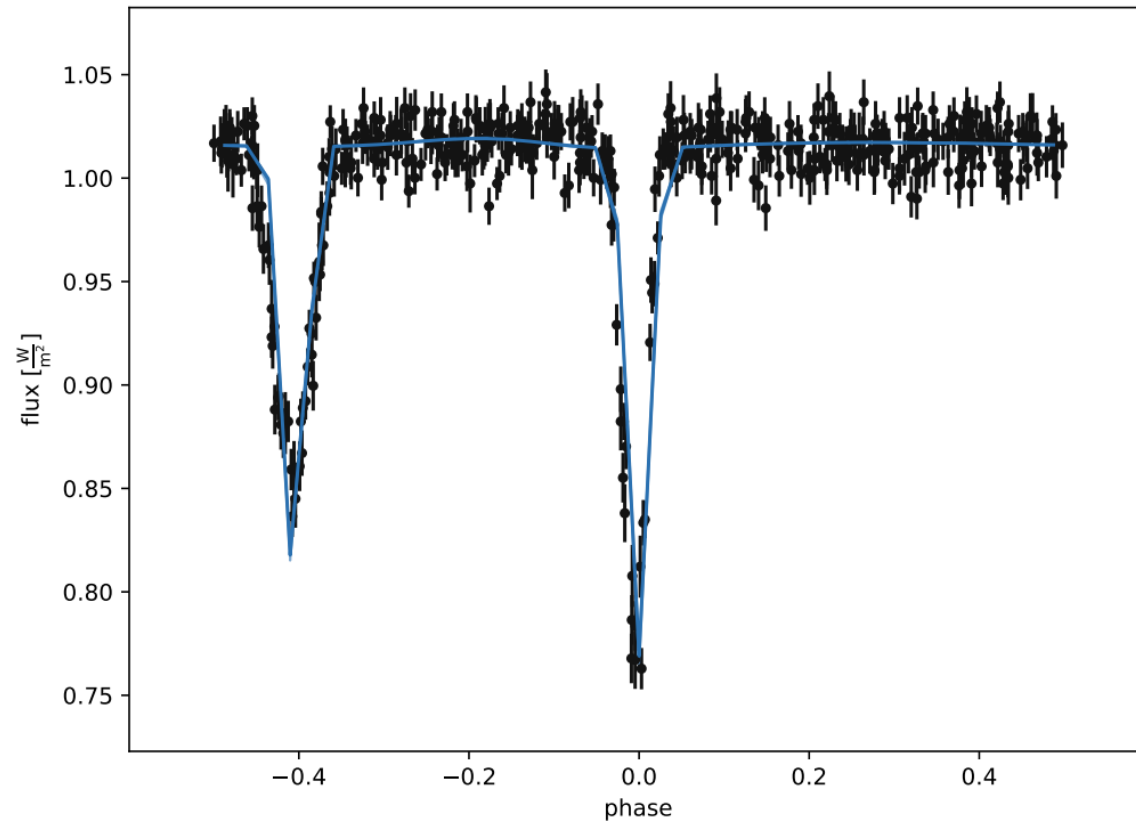
Optimizing models (Nelder-Mead)

13



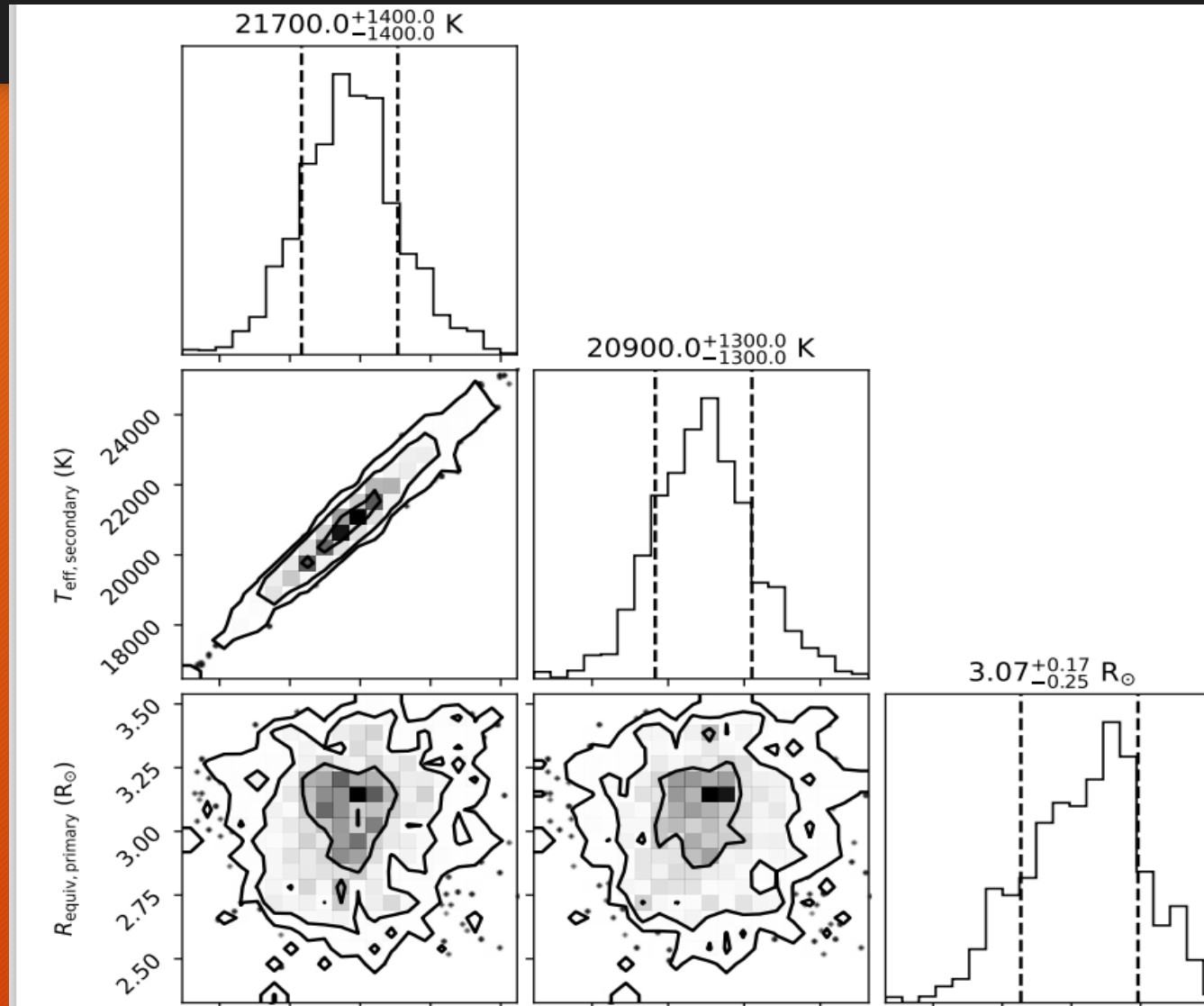
Estimation of uncertainties (emcee)

14



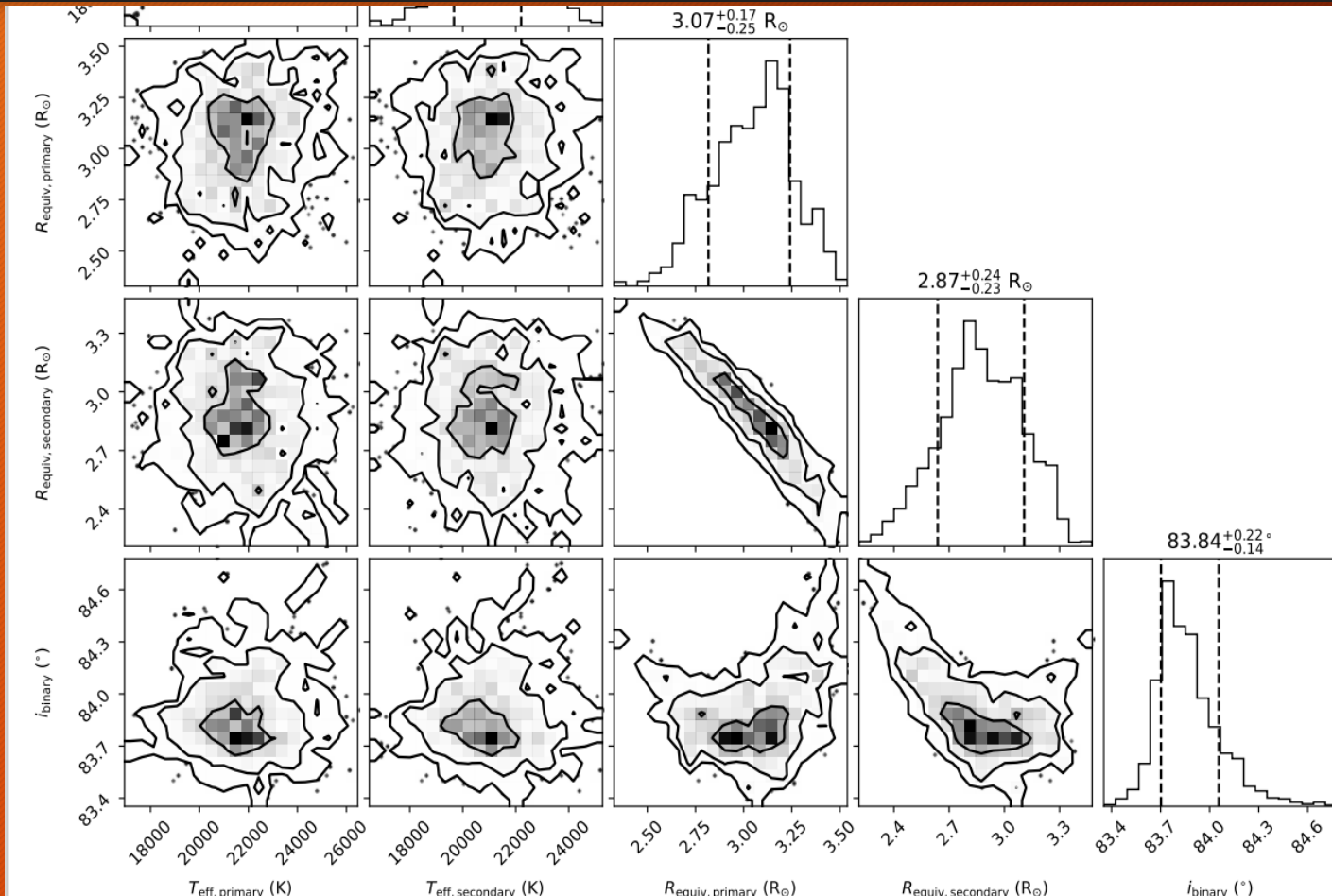
Estimation of uncertainties (emcee)

15



Estimation of uncertainties (emcee)

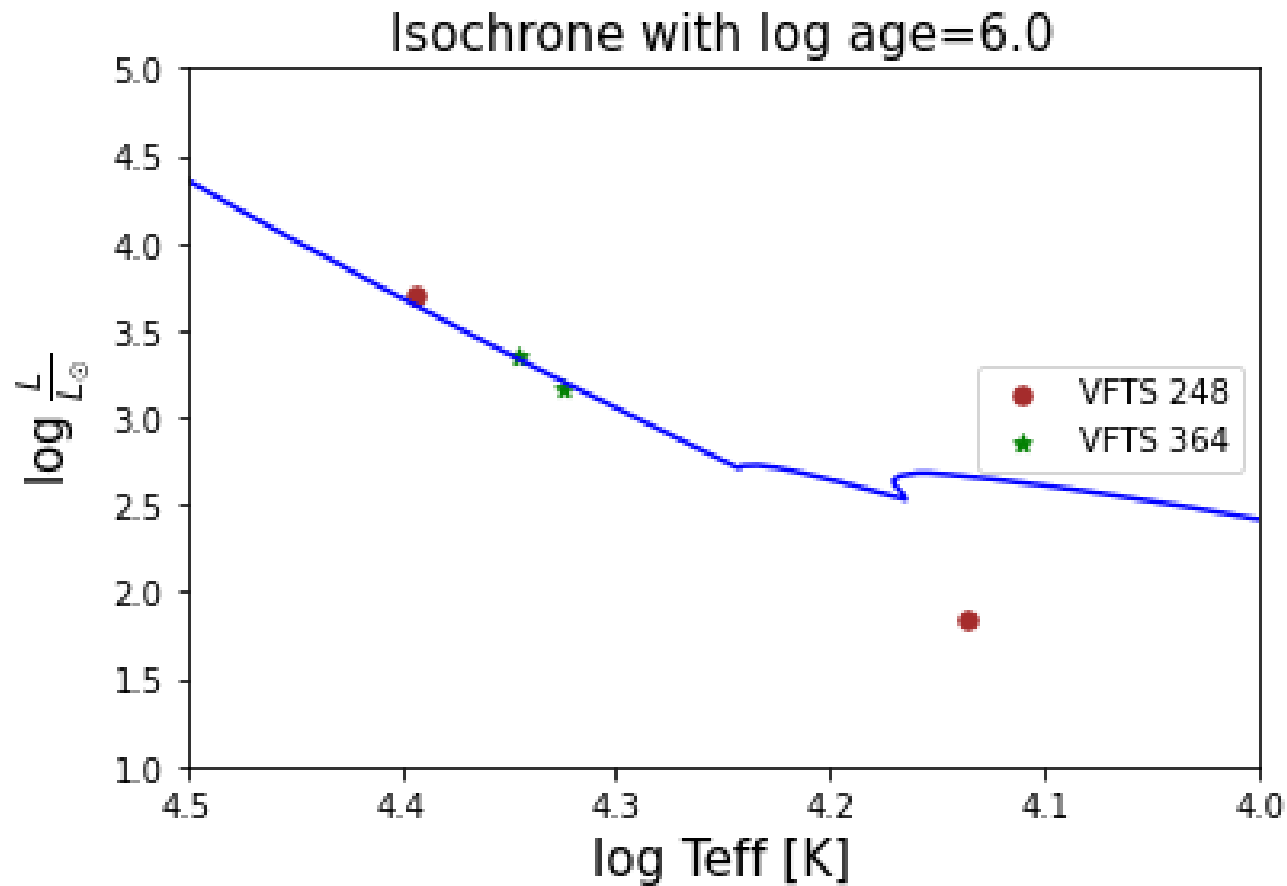
16



Looking for mass- transferring systems

Results

18



[CMD 3.7 input form \(inaf.it\)](#)

Future Outlook

Constraining parameters for more systems

How many systems have undergone mass transfer?

Thank you for your attention

20