2023/49/B/ST9/01671

Pulsating Stars in Eclipsing Binaries

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CAMK Annual Meeting
23.01.2025

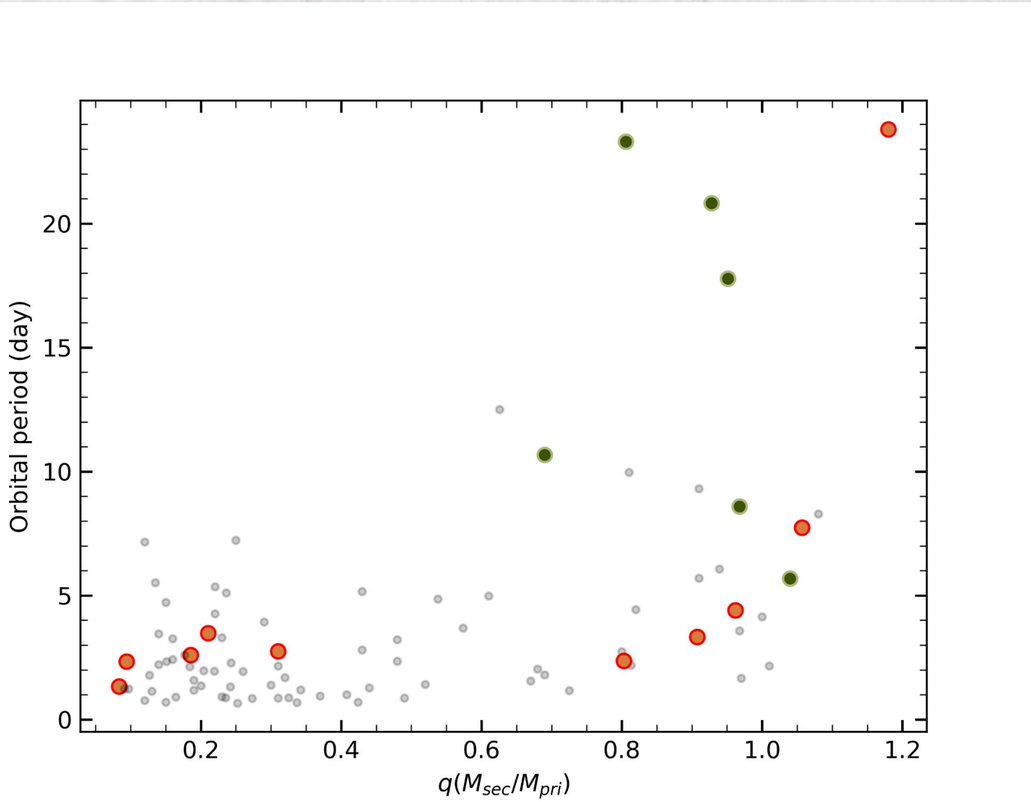
CRÉME

Comprehensive **R**esearch with **É**chelles on the **M**ost interesting **E**clipsing binaries

↓

Dynamical Masses

Selected sample of Intermediate-mass pulsators



- Liakos & Niarchos 2017

δ Scuti-type pulsators in DEBs

A&A, 691, A101 (2024)
https://doi.org/10.1051/0004-6361/202451126

Astronomy & Astrophysics

A comprehensive study of five candidate δ Scuti-type pulsators in detached eclipsing binaries

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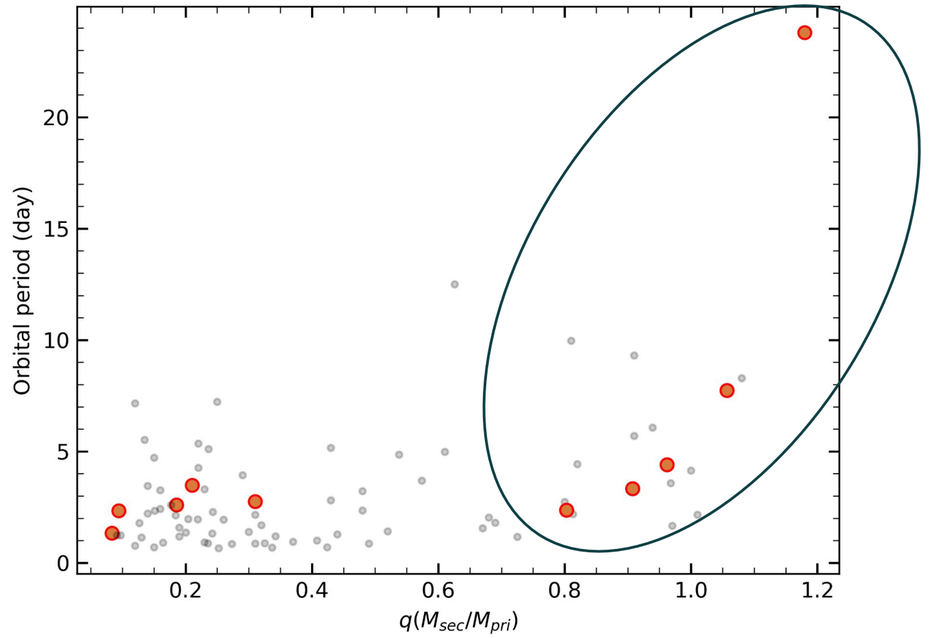
Received 15 June 2024 / Accepted 14 August 2024

ABSTRACT

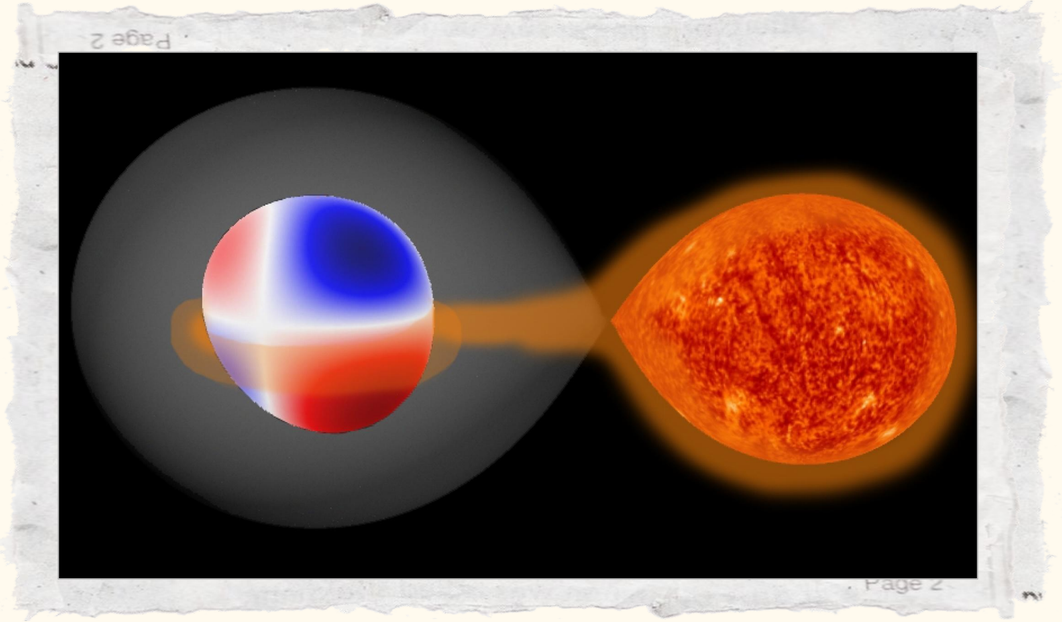
Context. Pulsating stars in eclipsing binaries (EBs) provide an excellent opportunity to obtain precise, model-independent stellar parameters for studying these oscillations in detail. One of the most common classes of pulsators found in such EBs exhibits δ Scuti-type oscillations. Characterising these pulsators using the precise stellar parameters obtained using EB modelling can help us better understand such stars, and provide strong anchors for asteroseismic studies.
Aims. We performed a comprehensive photometric and spectroscopic analysis of candidate pulsators in detached EBs, to add to the sample of such systems with accurately determined absolute parameters.
Methods. We performed radial velocity and light curve modelling to estimate the absolute stellar parameters, and detailed spectroscopic modelling to obtain the global metallicity and temperatures. Frequency power spectra were obtained using residuals from binary modelling. Finally, we used isochrones to determine the age of the stars, and compared the estimated physical parameters to the theoretically obtained values.
Results. We present a detailed analysis of four candidate δ Scuti-type pulsators in EBs, and update the light curve analysis of the previously studied system TIC 308953703. The masses and radii of components are constrained to a high accuracy, which helps us constrain the age of the systems. We perform a Fourier analysis of the observed oscillations, and try to explain their origin. For TIC 81702112, we report tidal effects causing amplitude variation in the oscillation frequencies over the orbital phase.

Key words. asteroseismology – binaries: eclipsing – stars: oscillations – stars: variables: delta Scuti



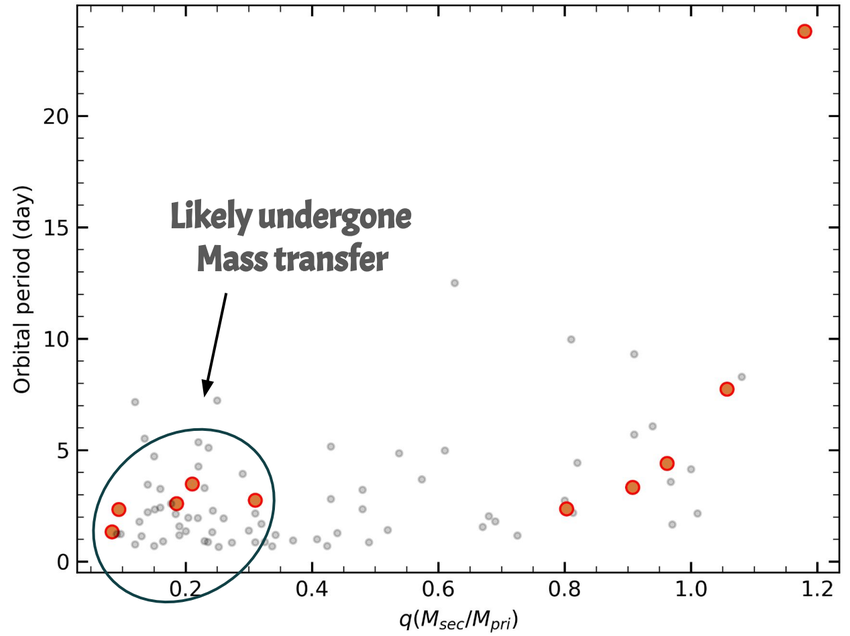
Variability type	Detached	Semidetached	Unclassified	All
SB2+E	35(31)	34(34)	5(1)	74(66)
E and el	40(15)	53(32)	399(11)	492(58)
SB1+E or SB1(2)+el	19(17)	15(12)	8(3)	42(32)
SB1 and SB2	27(7)	0	11(5)	38(12)
O–C and PM and Vis.	348(6)	0	54(1)	402(7)
Sum	469(76)	102(78)	477(21)	1048(175)

Credits: Liakos et al. 2024

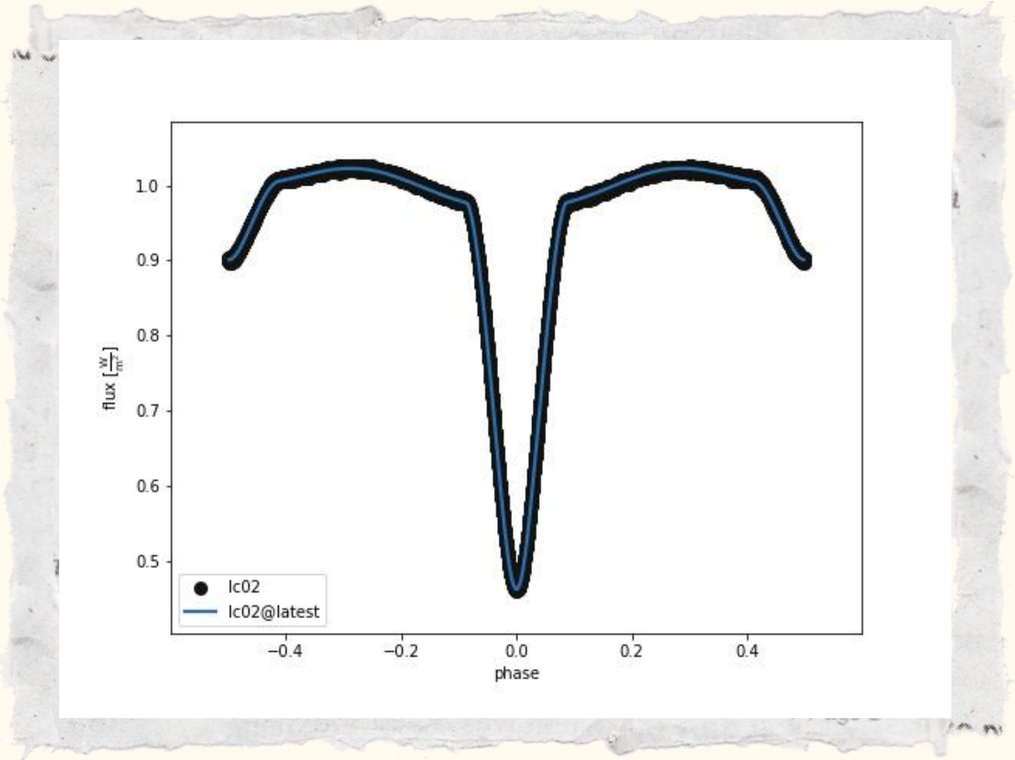


Credits: Mkrtichian et al. 2022

Post Mass-Transfer Candidates



LC, RV Modelling



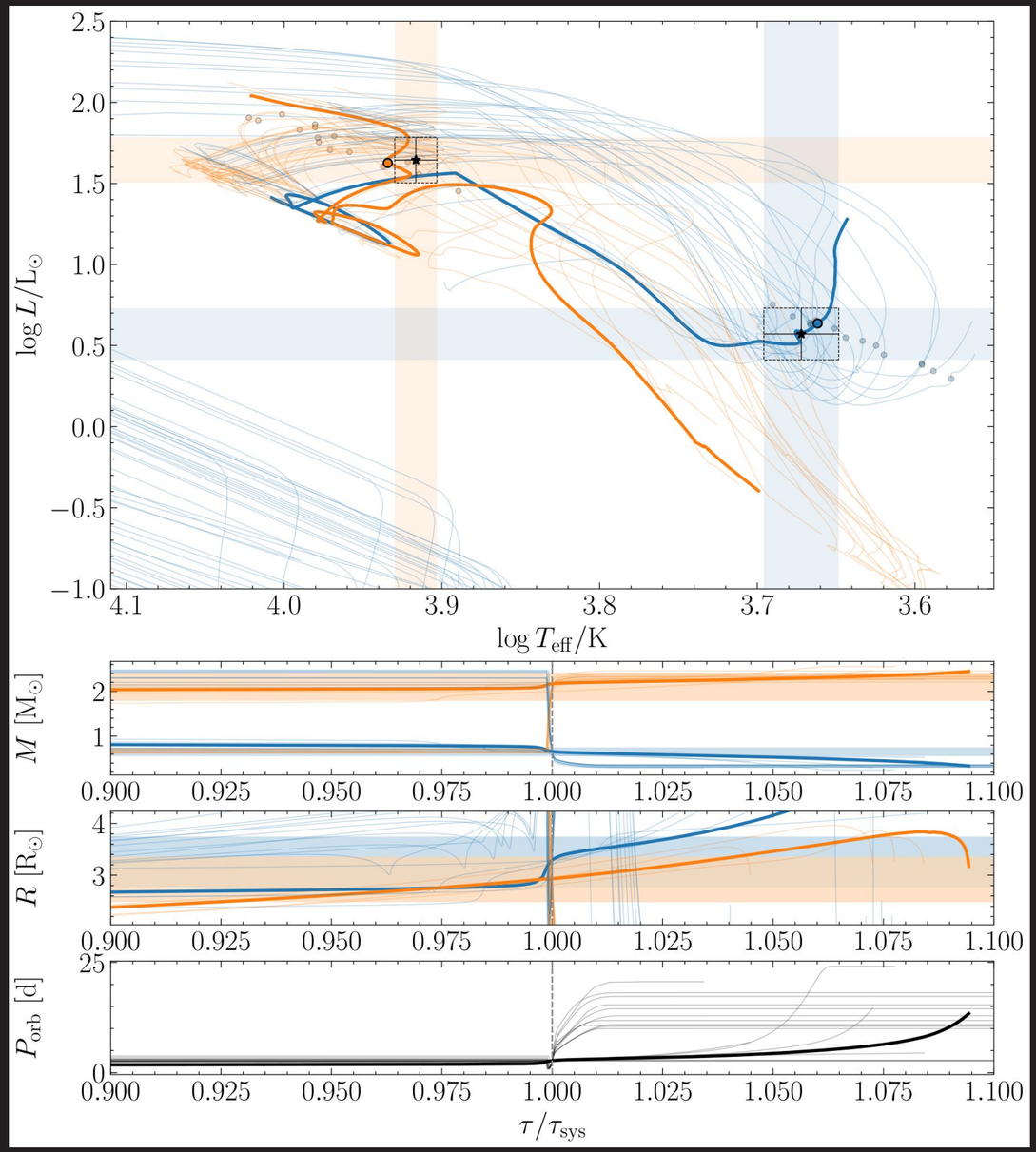
- **Masses**
- **Radii**
- **Orbital Period**

< 10 %

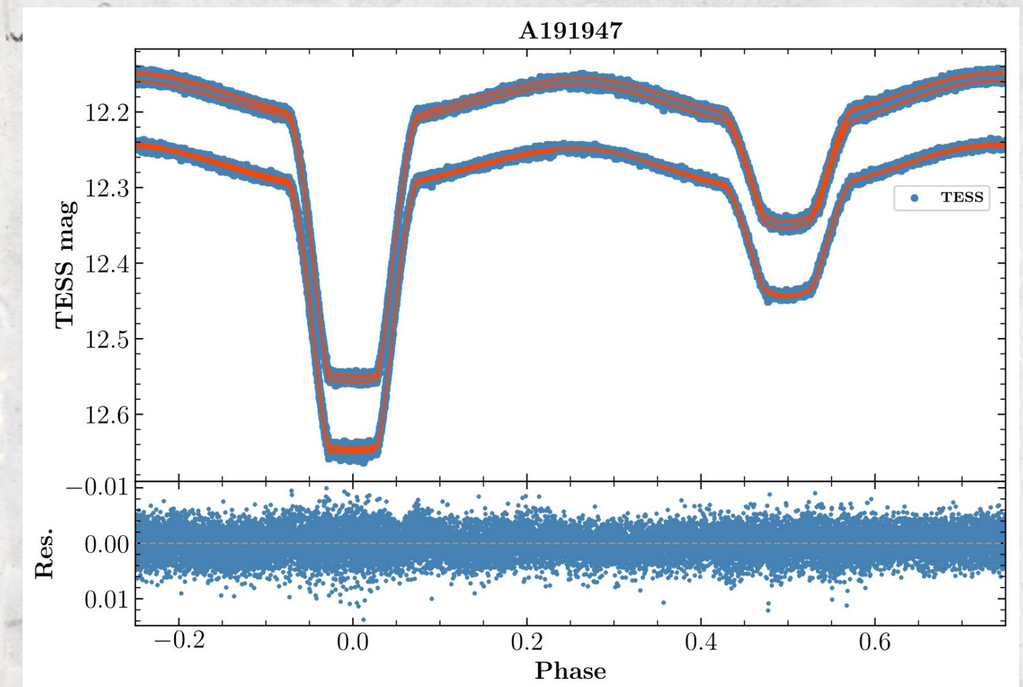
Pawar T., Miszuda A., Hełminiak K. G., Marcadon F., Moharana A., Pawar G., Konacki M.

Binary Evolution (MESA)

Modules for Experiments in Stellar Astrophysics

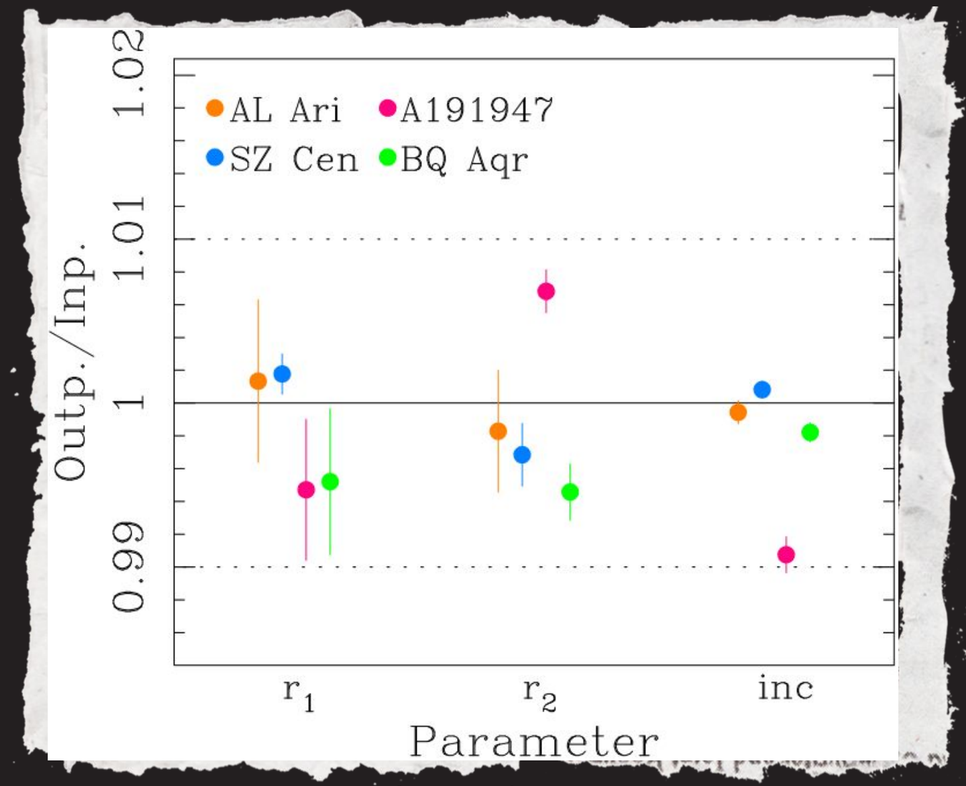


High-resolution spectroscopy of detached eclipsing binaries during total eclipses (Hełminiak et al. 2024)



PHOEBE vs. JKTEBOP

Testing effect of lightcurve fitting approach



Summary

- Analysis of 15 intermediate mass (1.2 - 2.5 M_{sun}) pulsators found in EBs
- Oscillating Eclipsing Algols -> 5 systems (*only 34 documented in total*)
- Testing the effect of mass transfer on binary evolution
- Writing PhD thesis