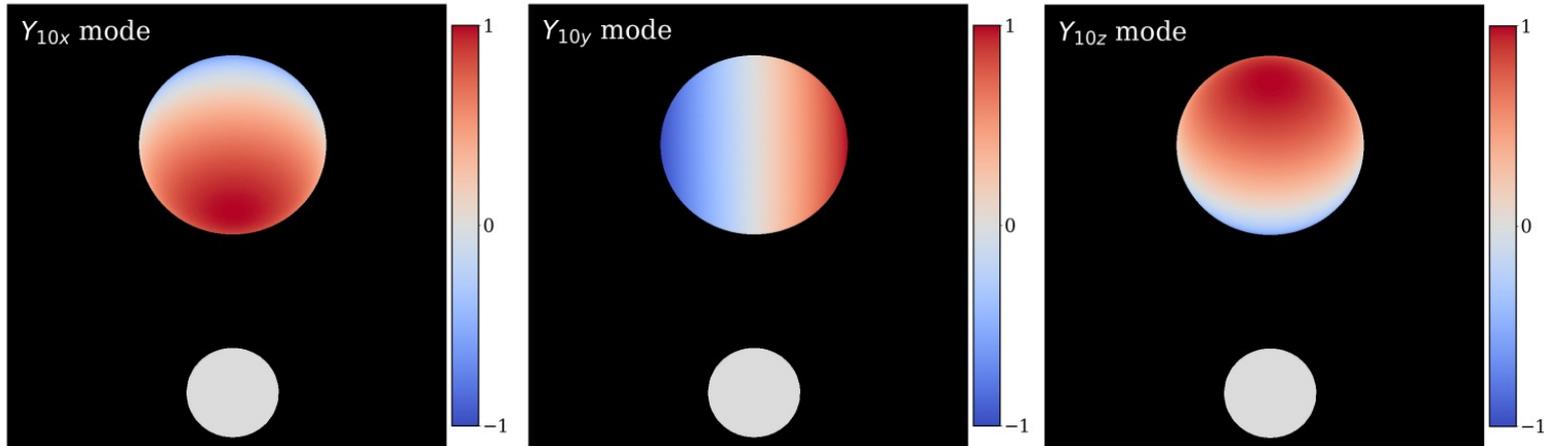
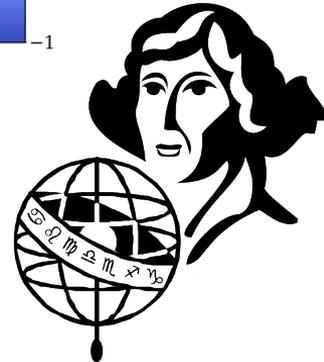


T⁷

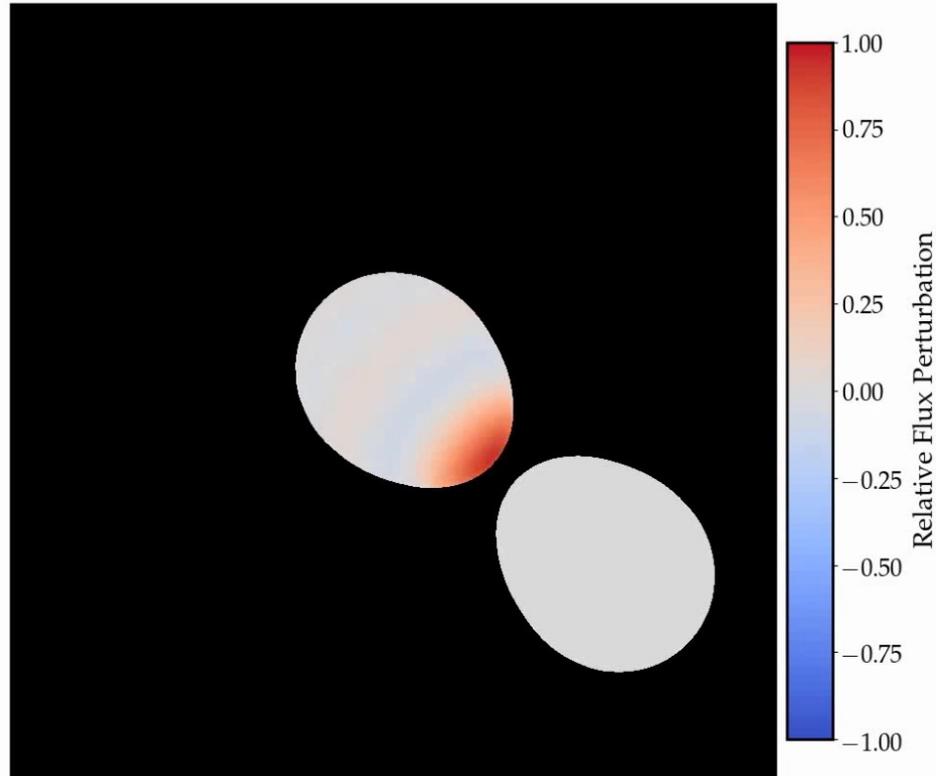
The Tricky Tidally Tilted Trapped Triaxial pulsaTions



Gerald Handler
Nicolaus Copernicus Astronomical Center Warsaw

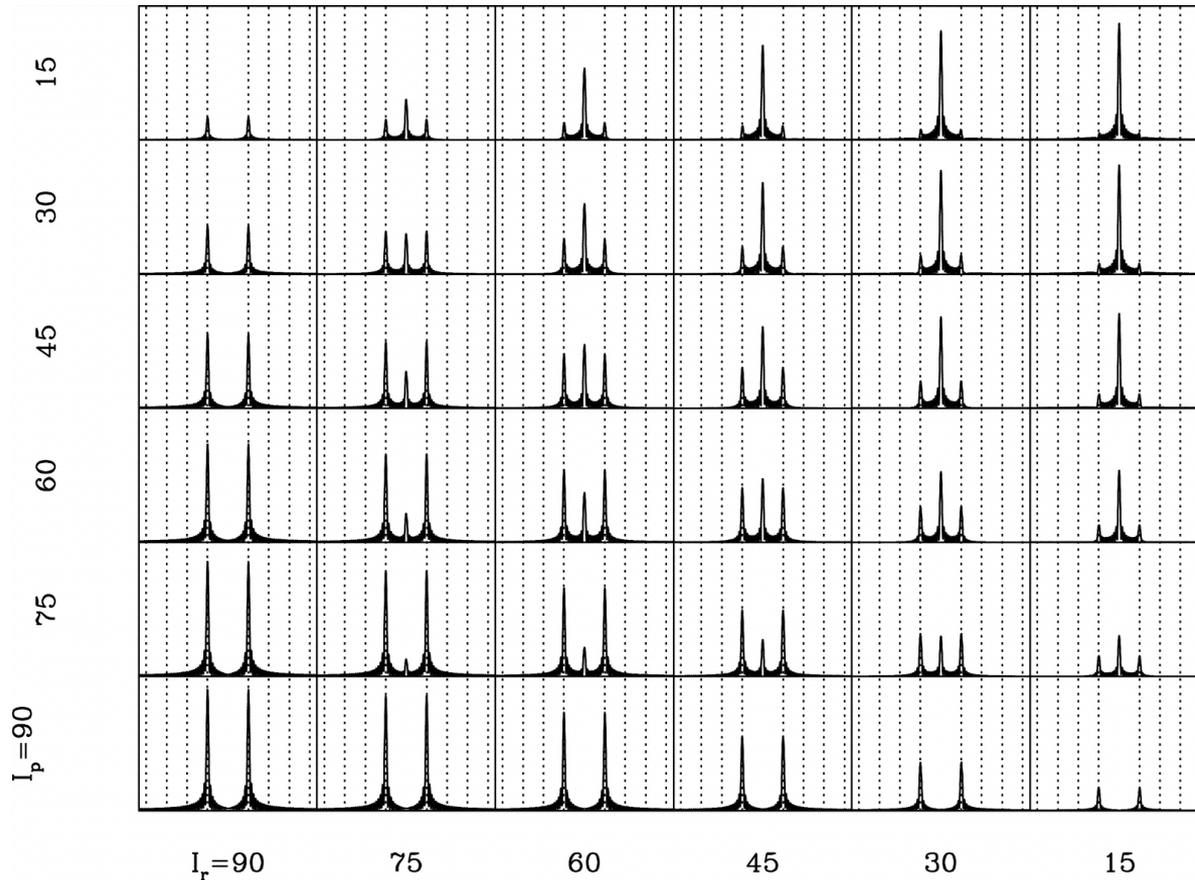


Tidally tilted pulsators...



Fuller et al. 2020, MNRAS 498, 5730

...leave predictable frequency structures in a Fourier Transform of the light curve depending on the system geometry...



...that also allow to identify the pulsation modes causing them

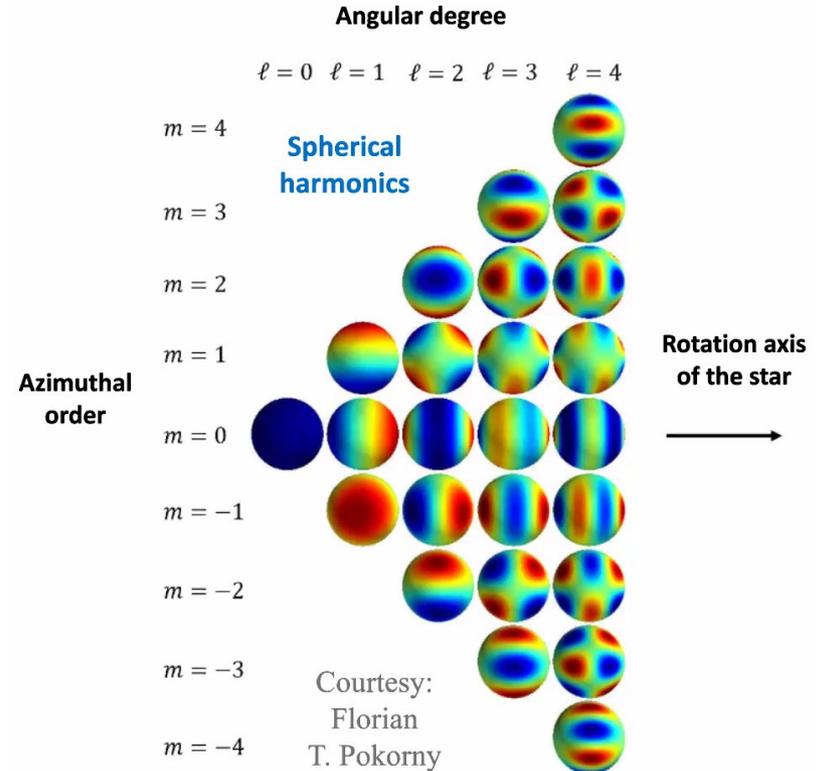
$$\mathcal{A}_{\text{osc}} \equiv \sqrt{\left(\sum_{n=-\min}^{n=\max} a_n \cos(n\Phi_{\text{orb}} + \phi_n) \right)^2 + \left(\sum_{n=-\min}^{n=\max} a_n \sin(n\Phi_{\text{orb}} + \phi_n) \right)^2}$$

$$\Phi_{\text{osc}} \equiv \text{ArcTan2}$$

$$\times \left\{ \left(\sum_{n=-\min}^{n=\max} a_n \sin(n\Phi_{\text{orb}} + \phi_n) \right), \left(\sum_{n=-\min}^{n=\max} a_n \cos(n\Phi_{\text{orb}} + \phi_n) \right) \right\}$$



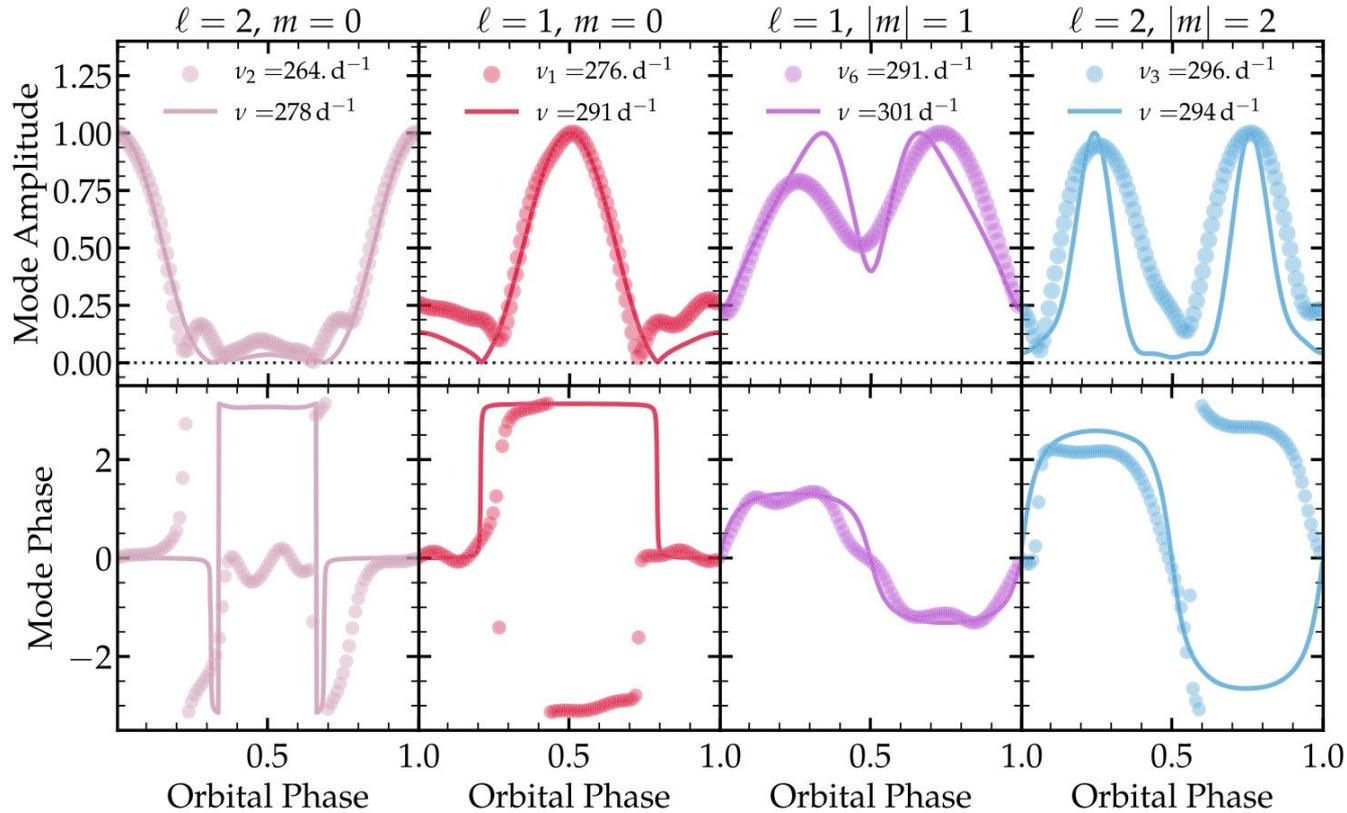
Jayaraman et al. 2022, ApJ 928, L14



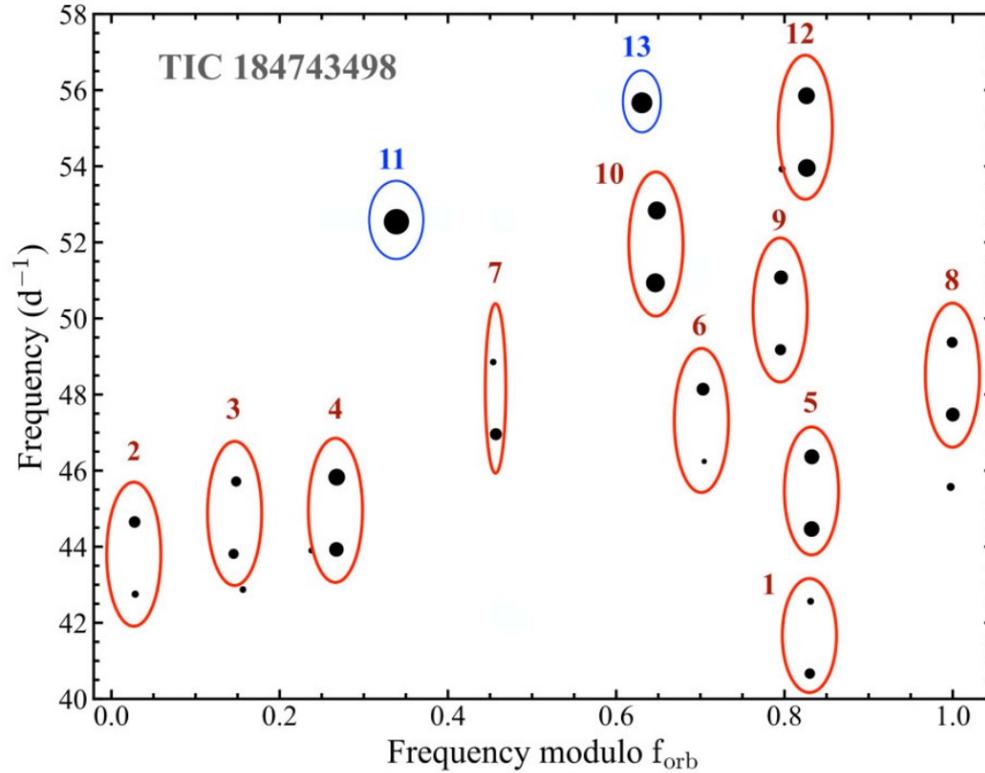
...that also allow to identify the pulsation modes causing them

THE ASTROPHYSICAL JOURNAL LETTERS, 928:L14 (12pp), 2022 April 1

Jayaraman et al.



TIC 184743498 and TIC 435850195 behave differently...



Theoretical explanation

THE ASTROPHYSICAL JOURNAL, 979:80 (17pp), 2025 January 20

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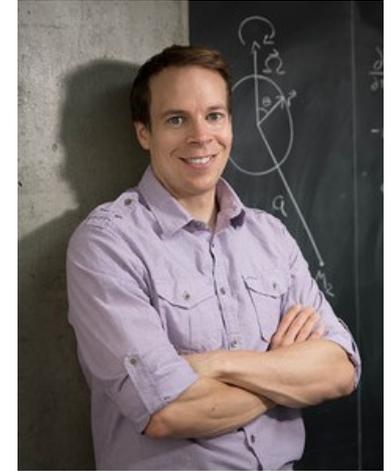
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<https://doi.org/10.3847/1538-4357/ad9eb2>

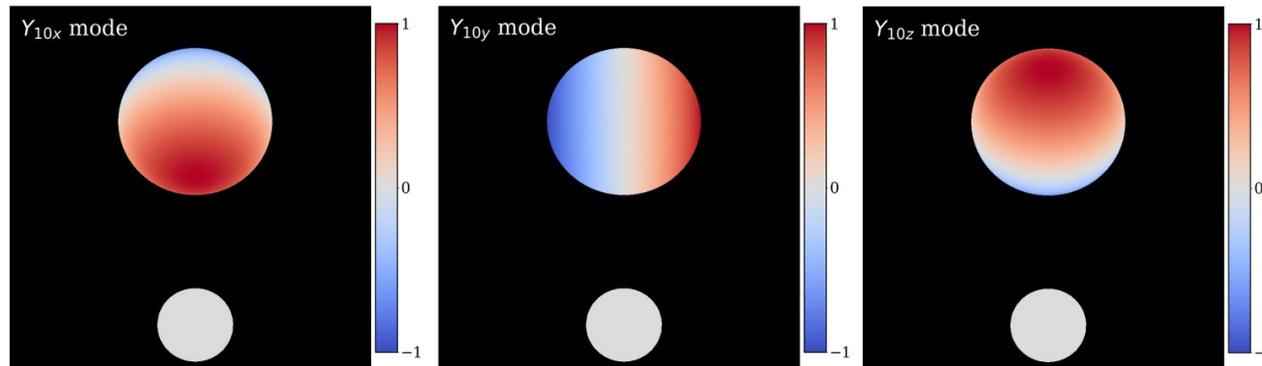


Tidally Distorted Stars Are Triaxial Pulsators

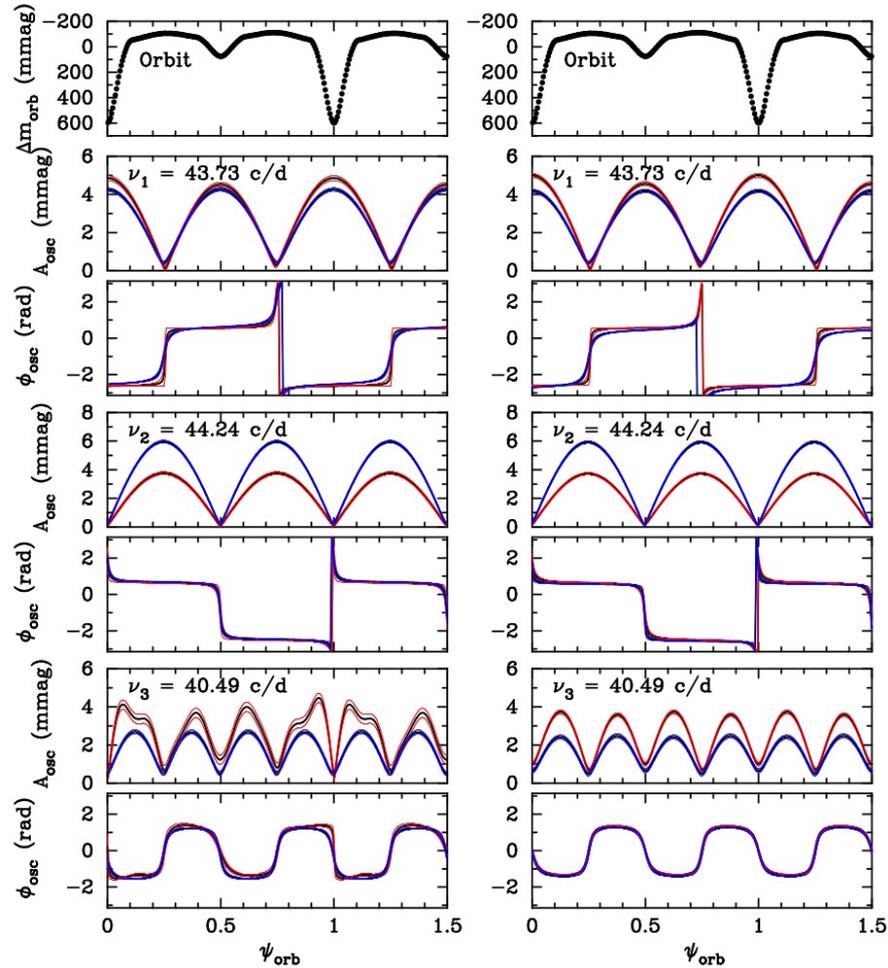
Jim Fuller¹ , Saul Rappaport² , Rahul Jayaraman² , Don Kurtz^{3,4} , and Gerald Handler⁵ 



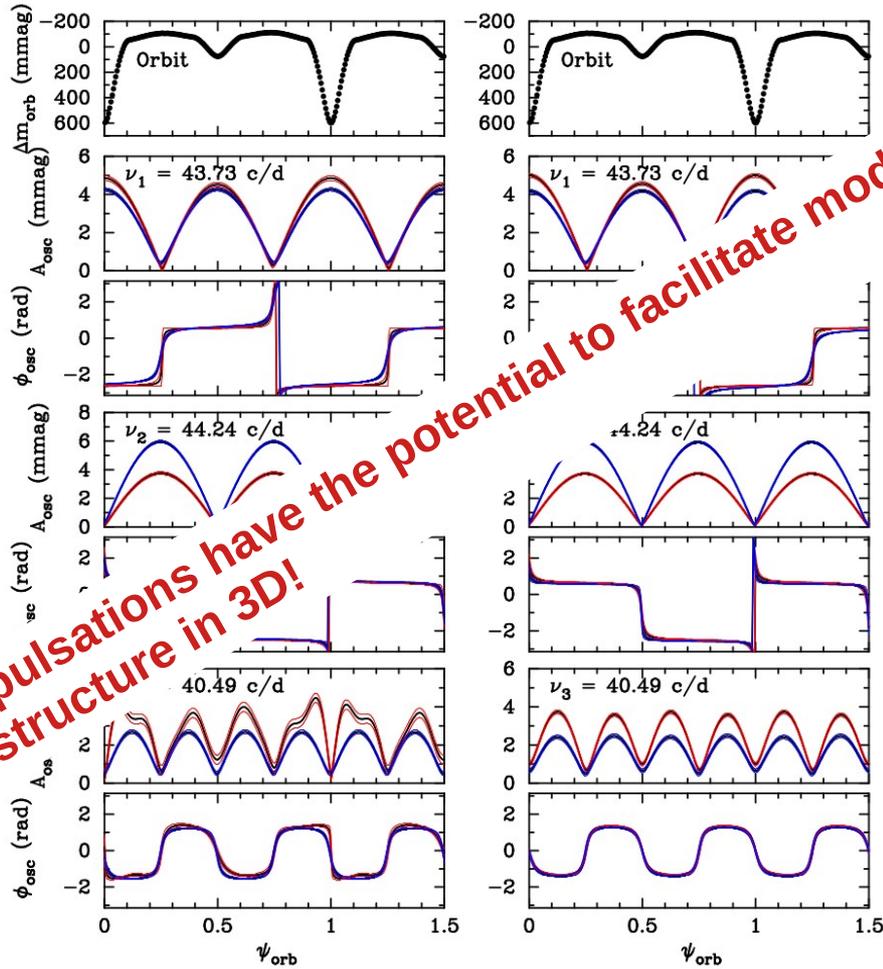
Model computations of pulsations in tidally distorted stars including tidal coupling of modes with the same spherical degrees but different azimuthal orders, including the effect of the Coriolis force



...and observational confirmation



...and observational confirmation



Triaxial pulsations have the potential to facilitate modelling interior stellar structure in 3D!



GH publications in 2025

Tidally Distorted Stars Are Triaxial Pulsators

Fuller, Jim; Rappaport, Saul; Jayaraman, Rahul; Kurtz, Don; Handler, Gerald

ApJ 979,80

HD 60435: the star that stopped pulsating

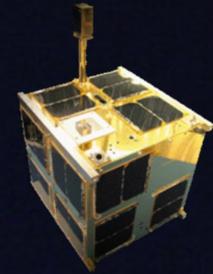
Kurtz, Donald W.; Handler, Gerald; Holdsworth, Daniel L.; Cunha, Margarida S.; Saio, Hideyuki; Medupe, Thebe; Murphy, Simon J.; Krüger, Joachim; Brunsden, E.; Antoci, Victoria; Hey, Daniel R.; Shitrit, Noi; Matthews, Jaymie M.

MNRAS 536, 2103

EL CMI: Confirmation of triaxial pulsation theory

Handler, G.; Rappaport, S. A.; Jones, D.; Miszuda, A.; Omohundro, M.; Jayaraman, R.; Gagliano, R.; Fuller, J.; Kurtz, D. W.; Munday, J.; Chen, H.-L.; Powell, B. P.; Kostov, V. B.

A&A 702, A104



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