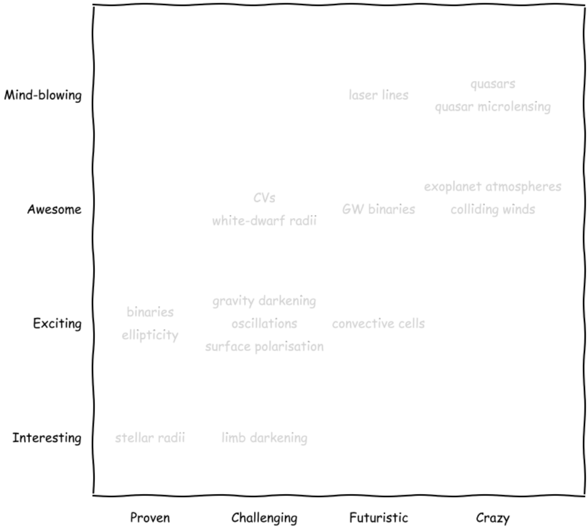
SII Science Cases: Interestingness vs Difficulty

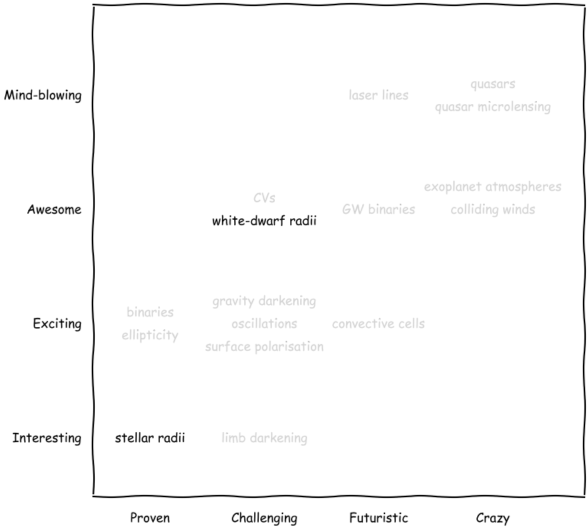
credits: S. Basak,[1] S. Baumgartner,[2] M. Bernardini,[2] J.R. Canivete Cuissa,[2] H. de Laroussilhe,[2] A.M.W Mitchell,[3] N. Rai,[1] S. Sarangi,[4] T. Schaeffer,[2] D. Soyuer,[2] L. Stanic,[2] Y. van der Burg,[2] L. Zwick[2]

[1] IISER-TVM India, [2] Uni Zurich CH, [3] FAU Erlangen-Nürnberg Germany, [4] CUTM India

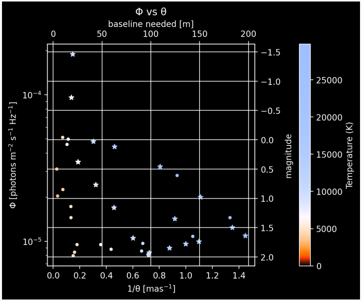
An Interestingness vs Difficulty matrix

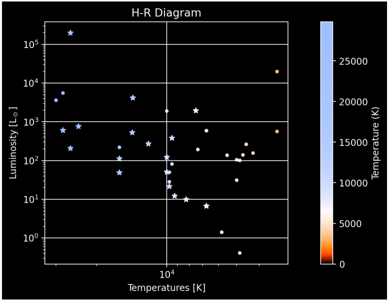


1. Pioneered by Michelson and Pease (c. 1920)



Stars with $V \leq 2$ and 200 m baseline (NSII era)

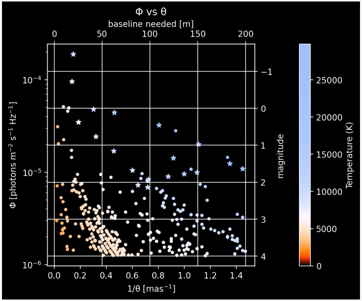


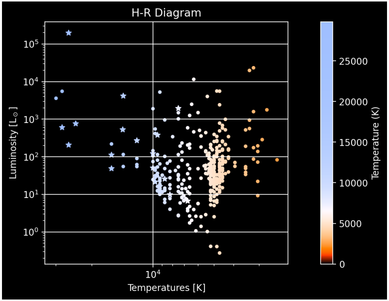


https://target-stars-sii.streamlit.app
by Lucijana Stanic

Stellar Radii

Stars with $V \leq 4$ and 200 m baseline (present day)

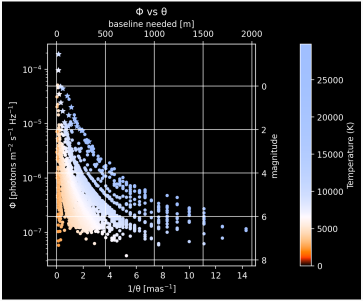


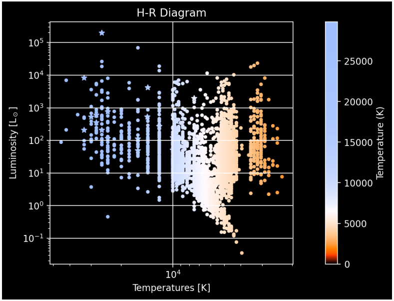


`https://target-stars-sii.streamlit.app`
by Lucijana Stanic

Stellar Radii

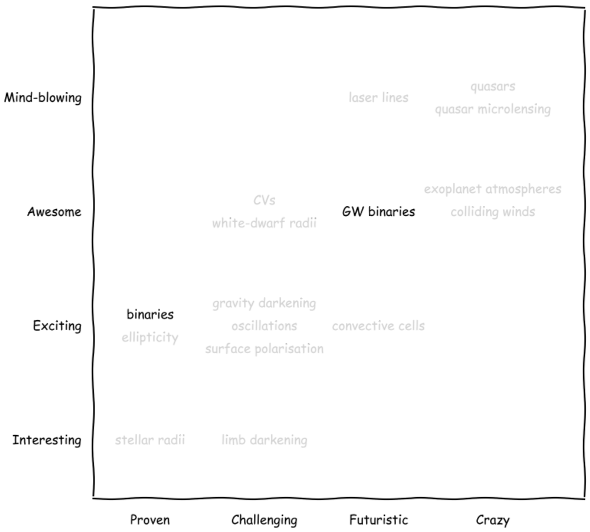
Stars with $V \leq 8$ and $2\,\mathrm{km}$ baseline (2030s?)





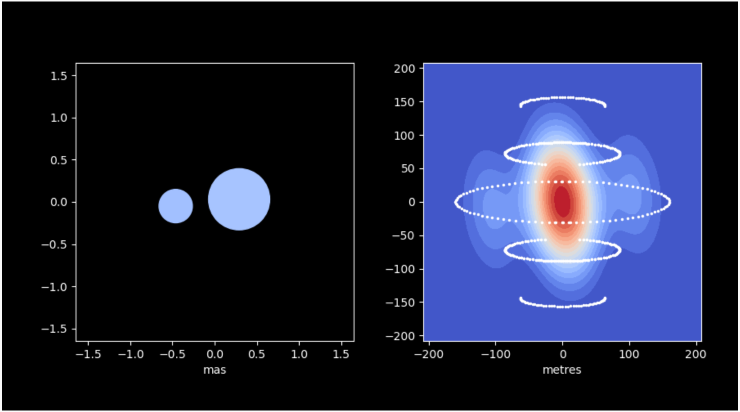
`https://target-stars-sii.streamlit.app`
by Lucijana Stanic

2. Pioneered by Hanbury Brown et al (c. 1970)



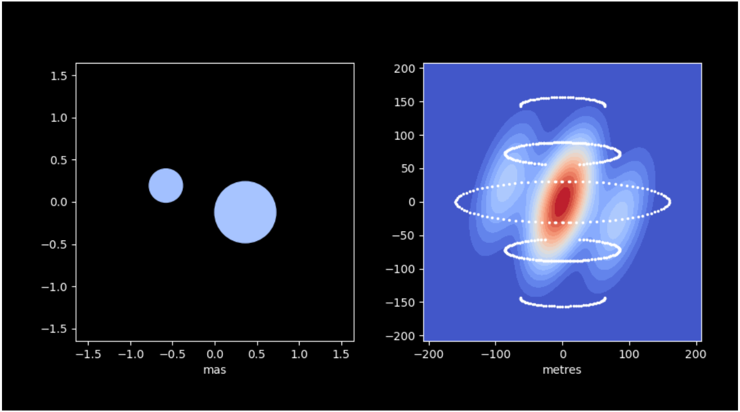
Binaries

Simulation of α Vir



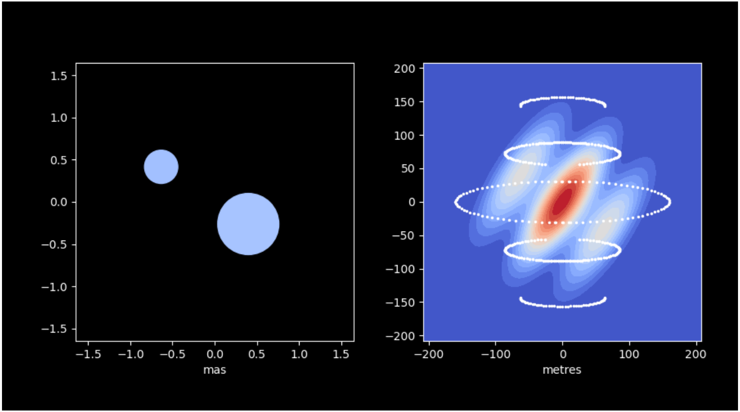
Binaries

Simulation of α Vir



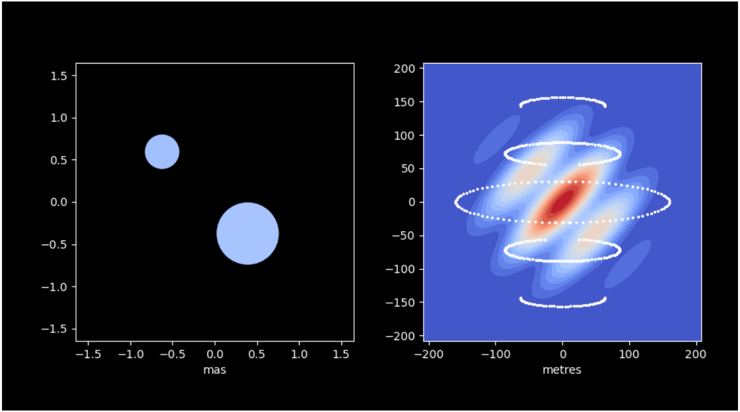
Binaries

Simulation of α Vir



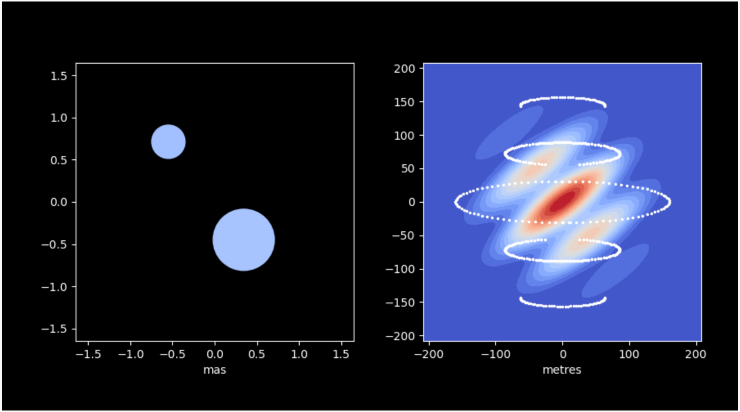
Binaries

Simulation of α Vir



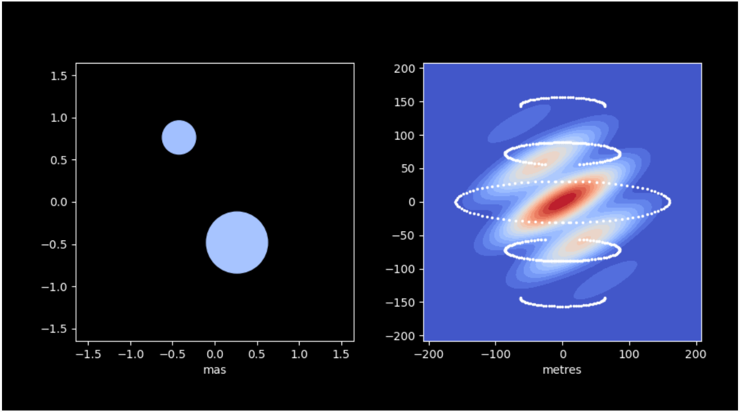
Binaries

Simulation of α Vir



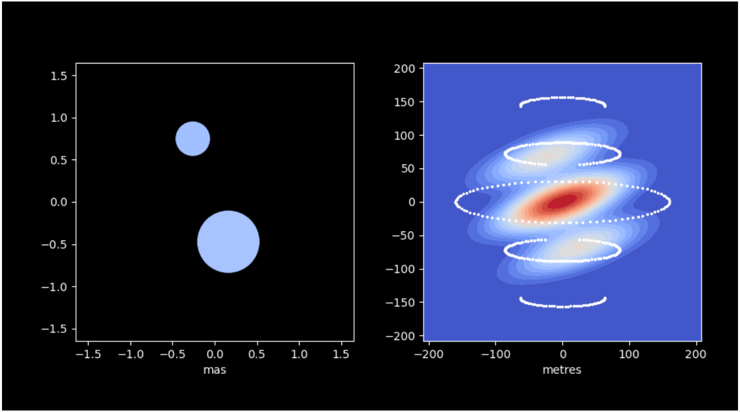
Binaries

Simulation of α Vir



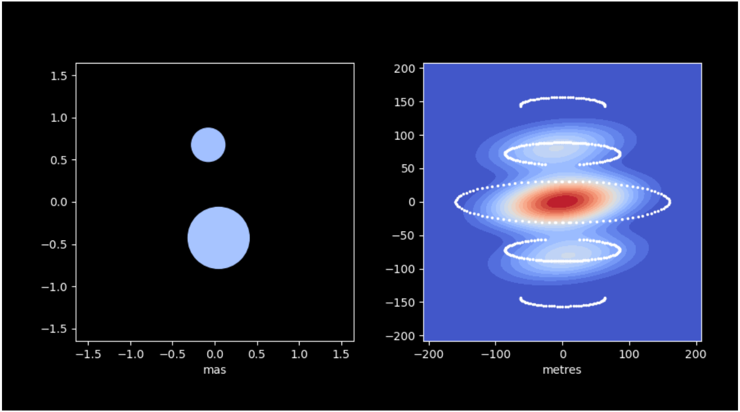
Binaries

Simulation of α Vir

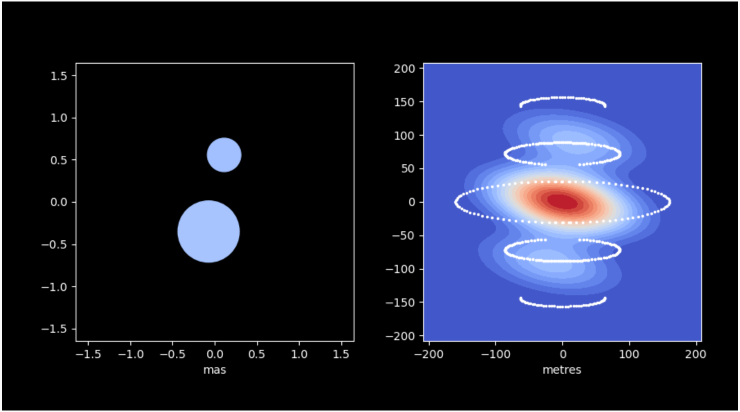


Binaries

Simulation of α Vir

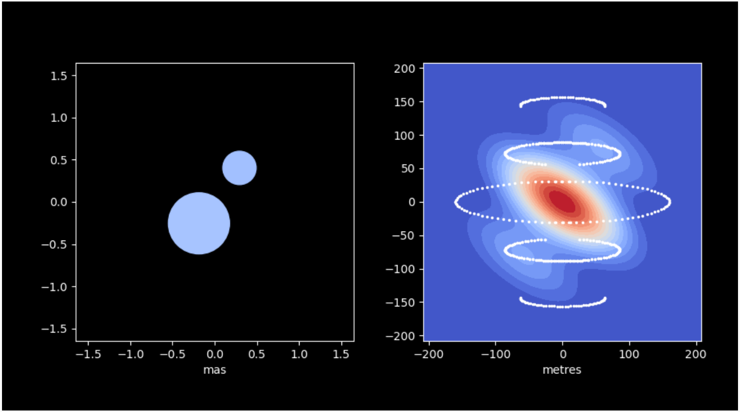


Simulation of α Vir



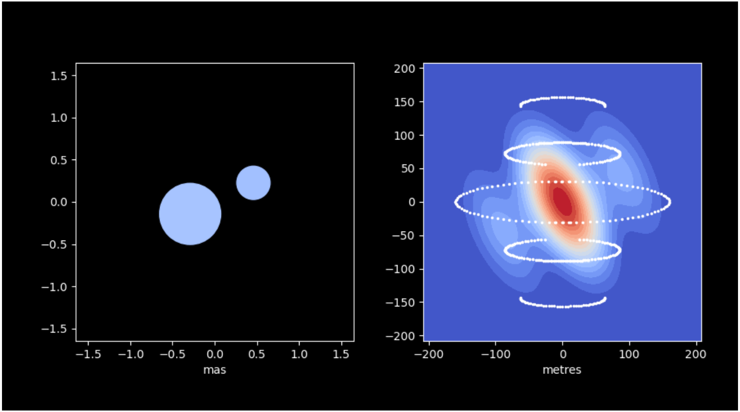
Binaries

Simulation of α Vir



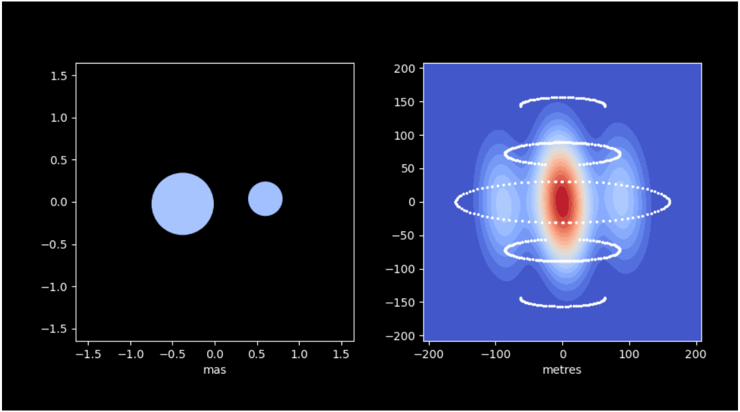
Binaries

Simulation of α Vir

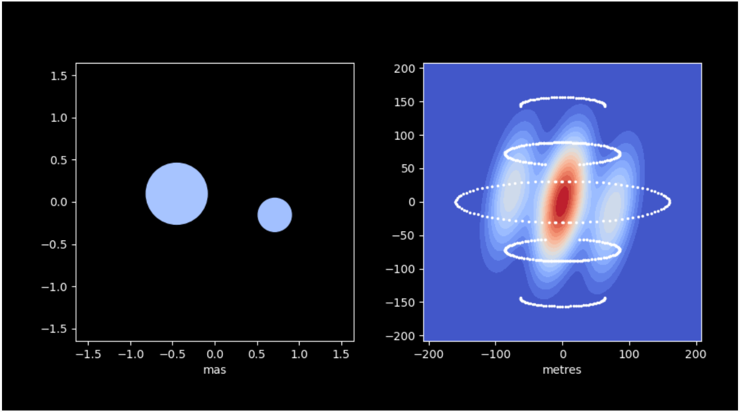


Binaries

Simulation of α Vir

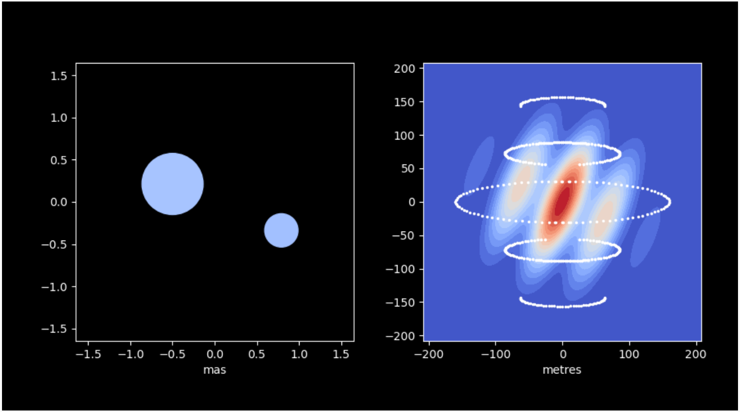


Simulation of α Vir

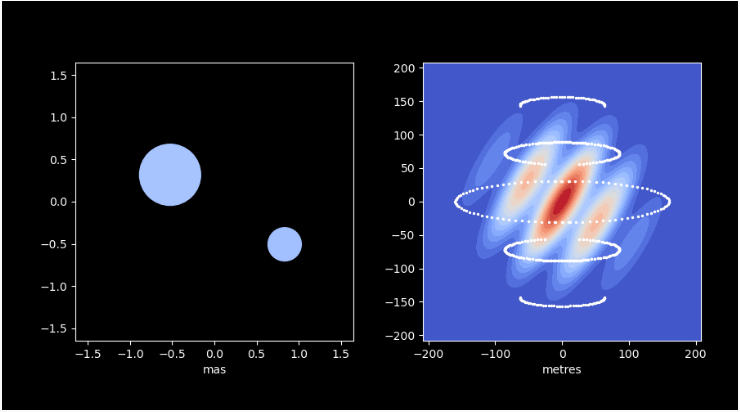


Binaries

Simulation of α Vir

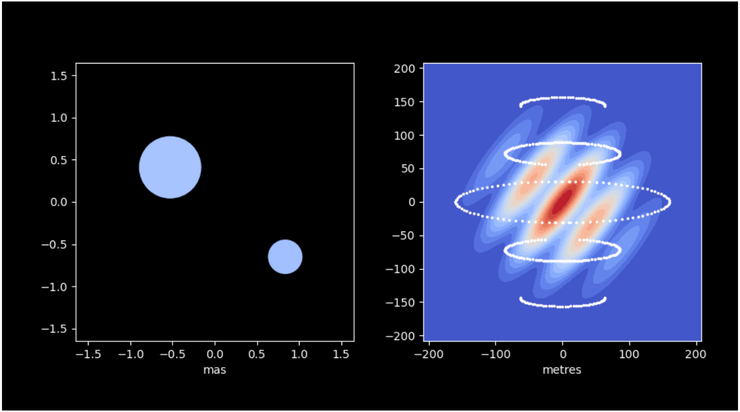


Simulation of α Vir

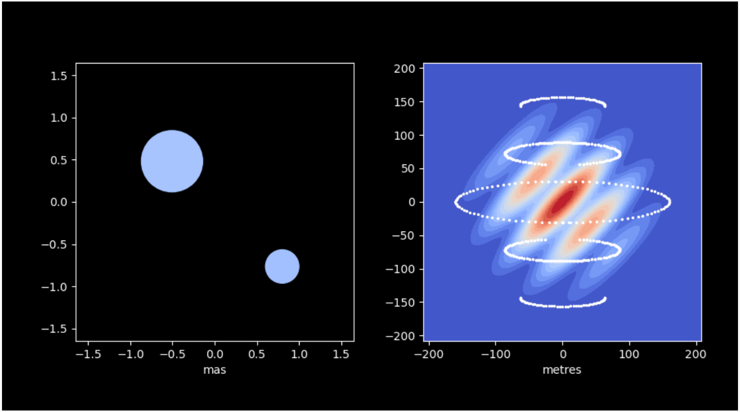


Binaries

Simulation of α Vir

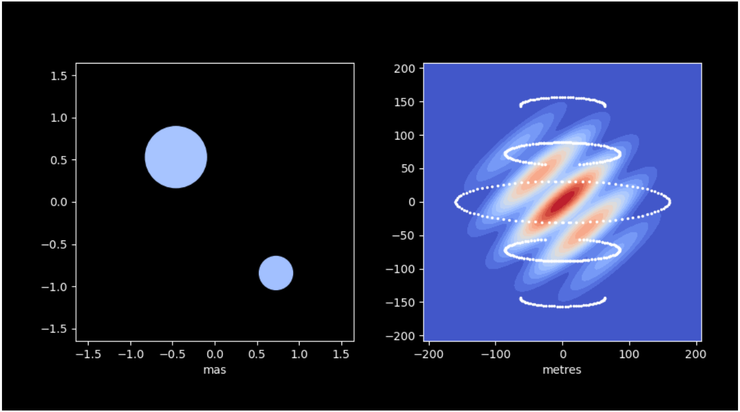


Simulation of α Vir



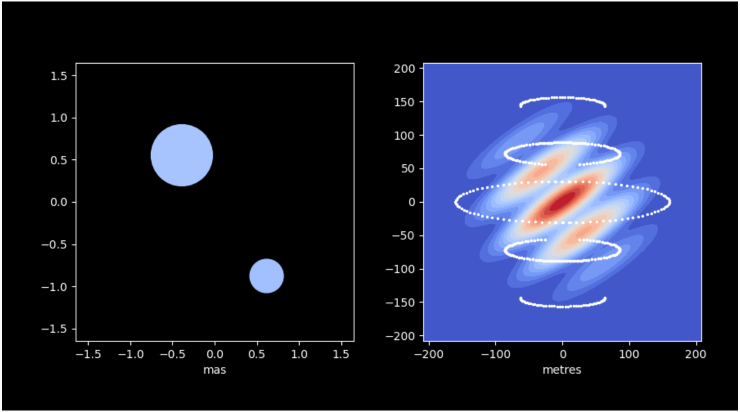
Binaries

Simulation of α Vir



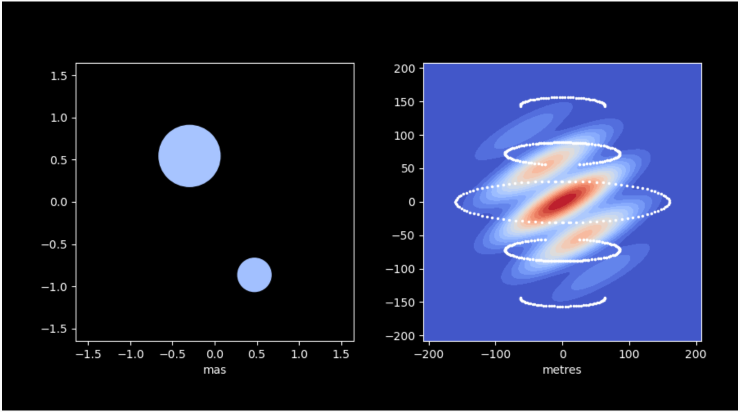
Binaries

Simulation of α Vir

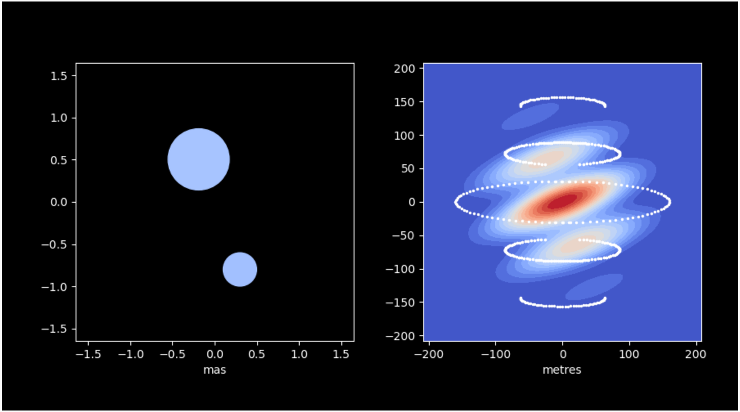


Binaries

Simulation of α Vir

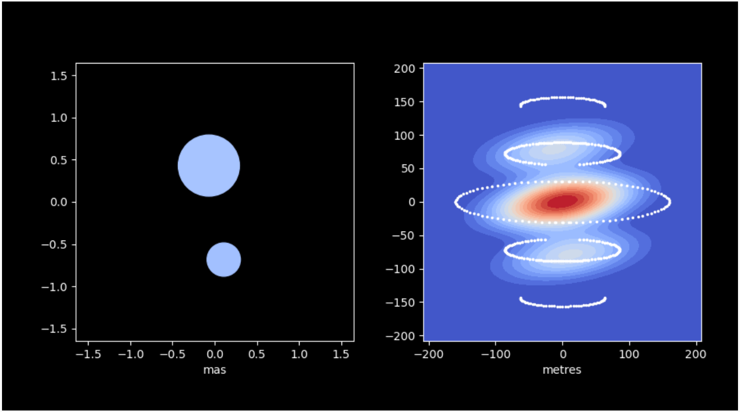


Simulation of α Vir

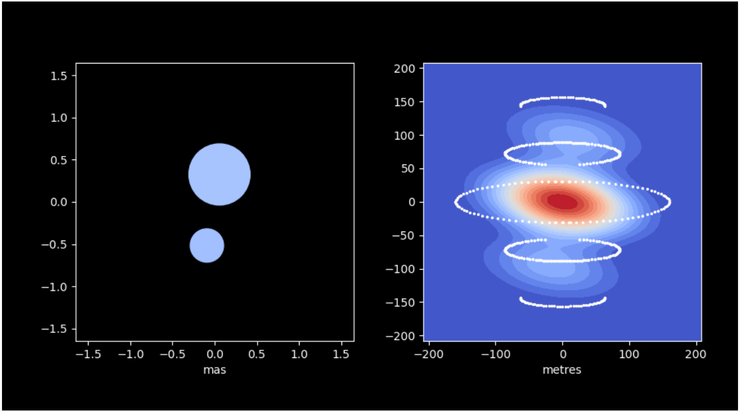


Binaries

Simulation of α Vir

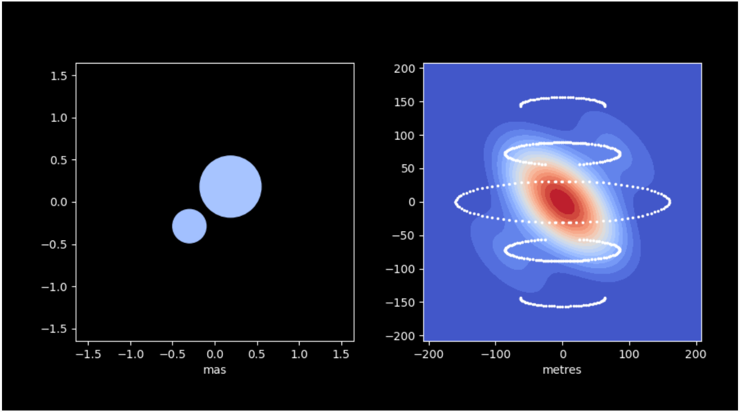


Simulation of α Vir



Binaries

Simulation of α Vir



Add spectroscopy and solve for distance and masses.

LISA verification binaries

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

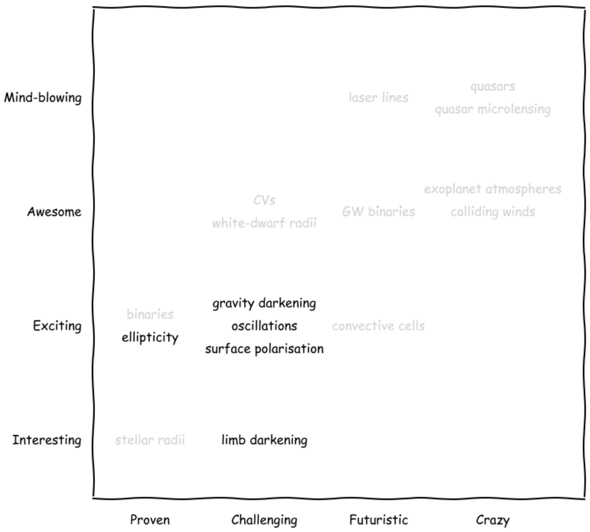
MNRAS **498,** 4577–4589 (2020) doi:10.1093/mnras/staa2638
Advance Access publication 2020 September 2

Towards a polarization prediction for LISA via intensity interferometry

Sandra Baumgartner,[1★] Mauro Bernardini,[1] José R. Canivete Cuissa,[1,2] Hugues de Laroussilhe,[1] Alison M. W. Mitchell,[3] Benno A. Neuenschwander,[1] Prasenjit Saha,[3] Timothée Schaeffer,[1] Deniz Soyuer[1] and Lorenz Zwick[1]

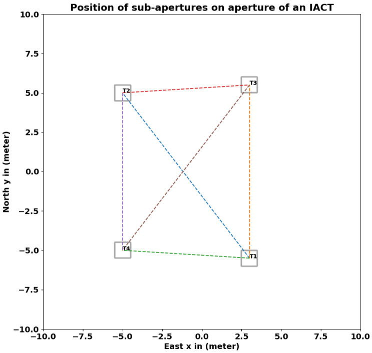
[1] *Center for Theoretical Astrophysics and Cosmology, Institute for Computational Science, University of Zurich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland*
[2] *Istituto Ricerche Solari Locarno (IRSOL), Via Patocchi 57, CH-6605 Locarno-Monti, Switzerland*
[3] *Physik-Institut, Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland*

3. Features of (theoretically) known shape



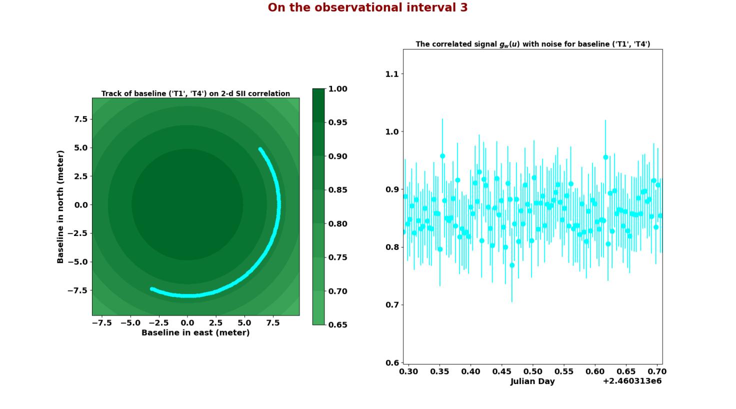
Stellar oscillations

Polaris simulations (Rai et al., in prep)



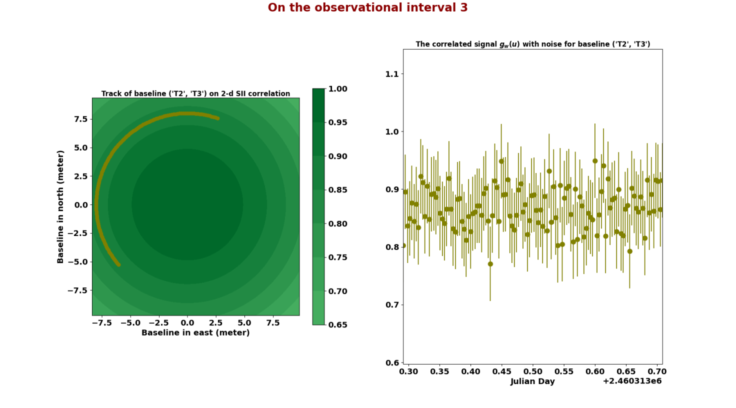
Stellar oscillations

Polaris simulations (Rai et al., in prep)



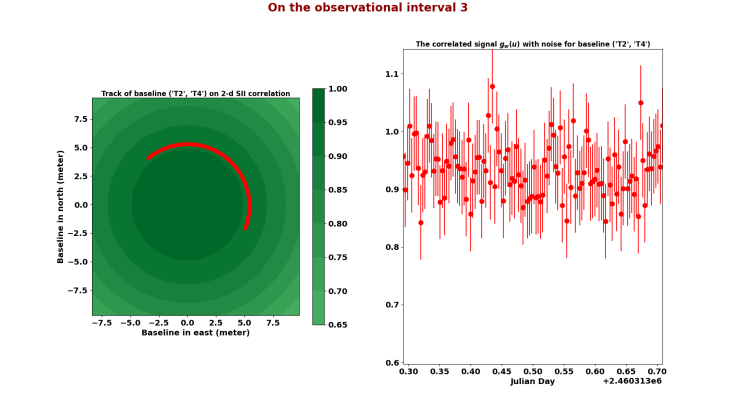
Stellar oscillations

Polaris simulations (Rai et al., in prep)



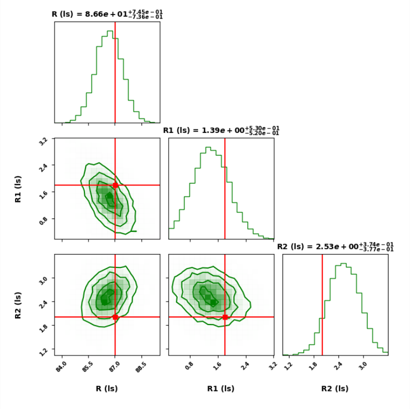
Stellar oscillations

Polaris simulations (Rai et al., in prep)



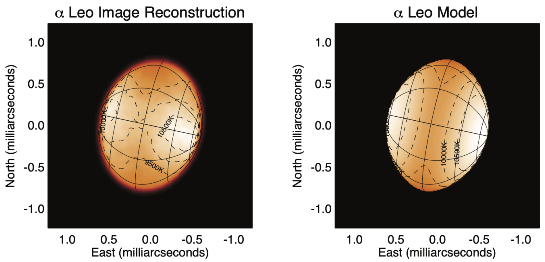
Stellar oscillations

Polaris simulations (Rai et al., in prep)



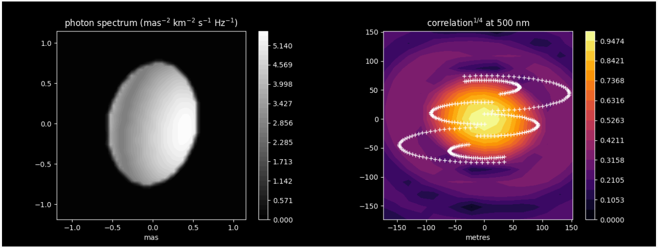
Gravity darkening

α Leo from Che et al (2011)



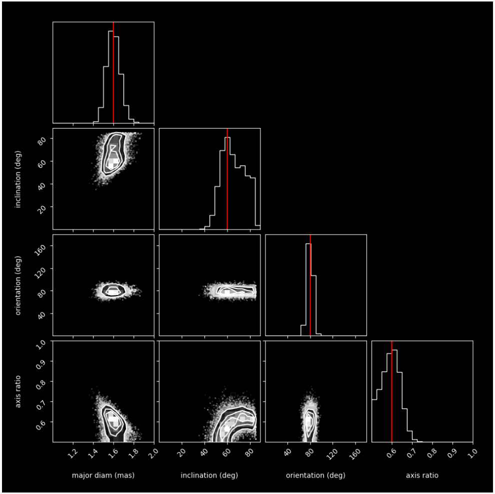
Gravity darkening

α Leo SII simulation



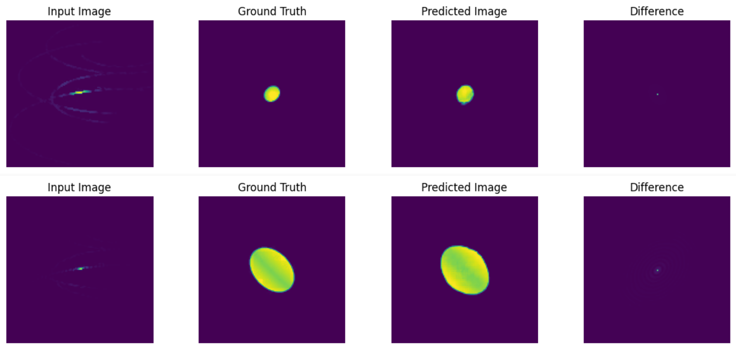
Gravity darkening

α Leo SII simulation

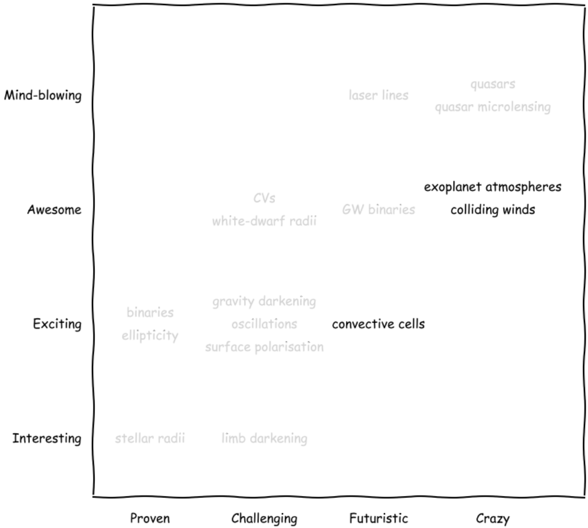


Can generative AI help?

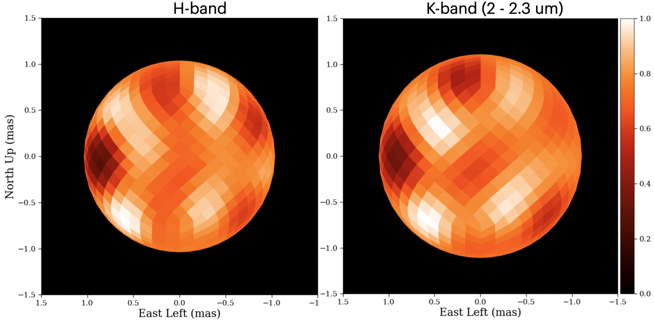
Simulated SII + GAN for image reconstruction (preliminary)



4. Features of unknown shape



Giant convective cells



from Anugu et al arXiv:2408.02756

Giant convective cells

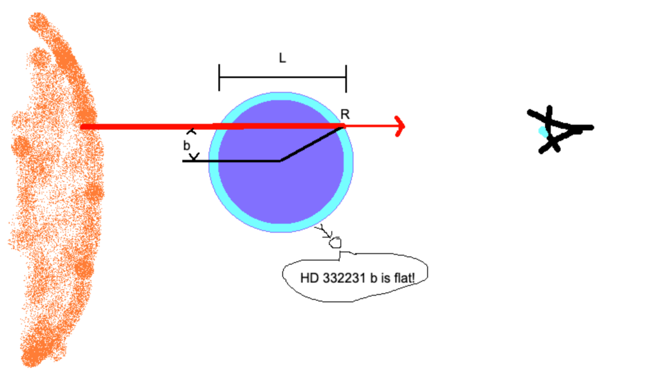
THE ASTROPHYSICAL JOURNAL, **195**:137–144, 1975 January 1

ON THE SCALE OF PHOTOSPHERIC CONVECTION IN RED GIANTS AND SUPERGIANTS

MARTIN SCHWARZSCHILD
Princeton University Observatory
Received 1974 June 21

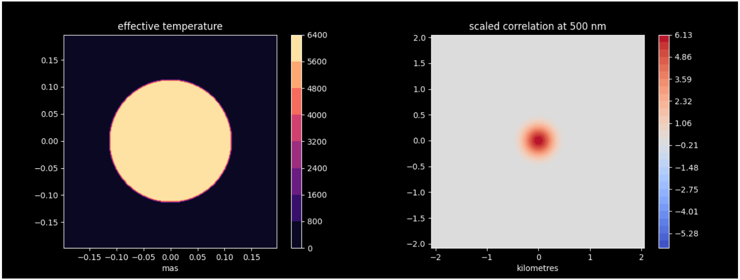
ABSTRACT

An attempt is made to estimate the sizes of the convective elements which dominate the brightness variations on the photospheres of red giants and supergiants. The data assembled permit the extreme hypothesis that these dominant convective elements are so large that only a modest number of them exists at any one time on the entire surface of such a star—in contrast with two million granules on the Sun.
Subject headings: convection — interiors, stellar — late-type stars


L
R
b
HD 332231 b is flat!

Exoplanet atmospheres

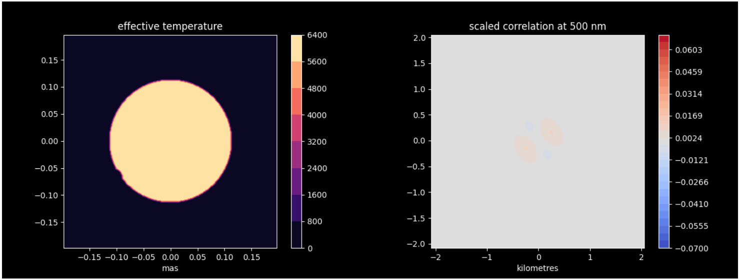
HD 332231 (scenario with a wind-dependent absorption line)



Signal outside of transit.

Exoplanet atmospheres

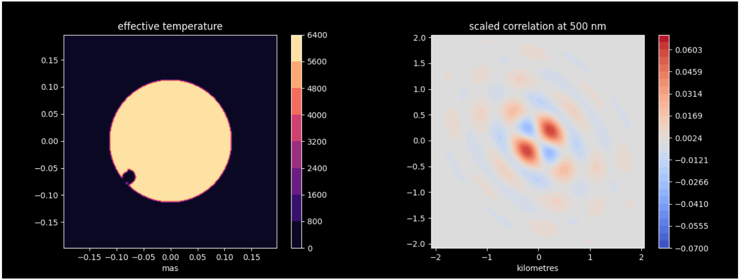
HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

Exoplanet atmospheres

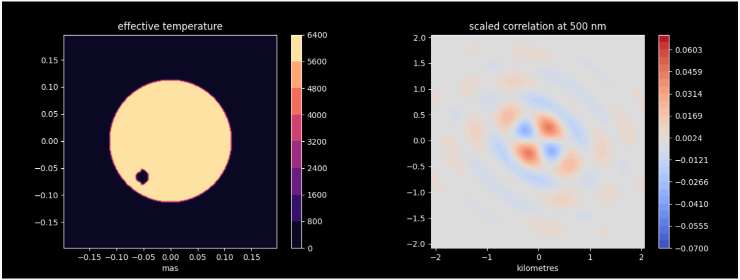
HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

Exoplanet atmospheres

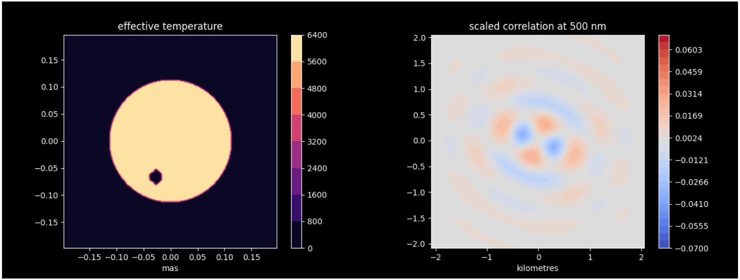
HD 332231 (scenario with a wide-dependent absorption line)



Signal difference during transit.

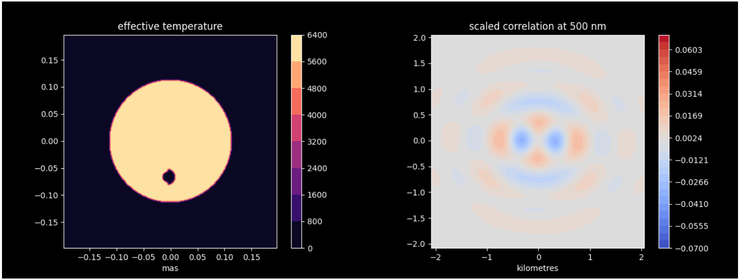
Exoplanet atmospheres

HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

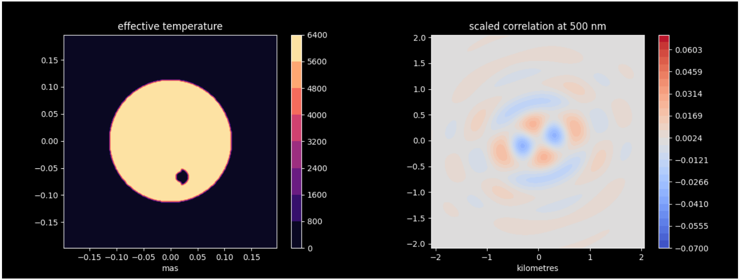
HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

Exoplanet atmospheres

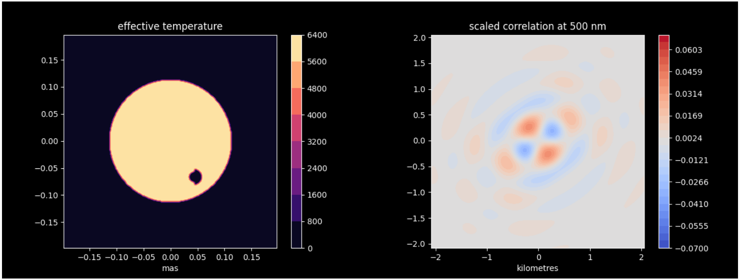
HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

Exoplanet atmospheres

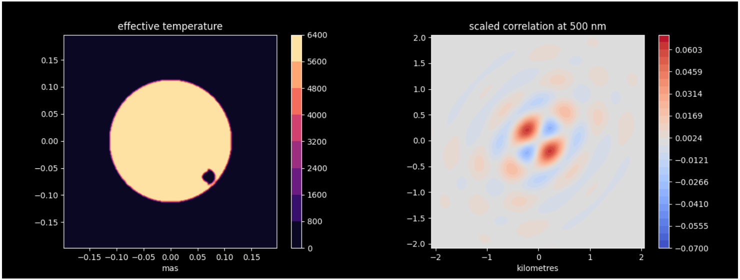
HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

Exoplanet atmospheres

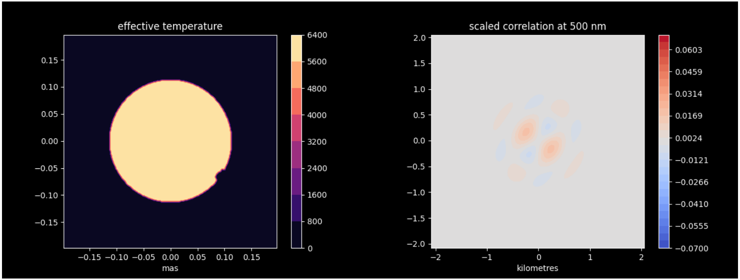
HD 332231 (scenario with a wind-dependent absorption line)



Signal difference during transit.

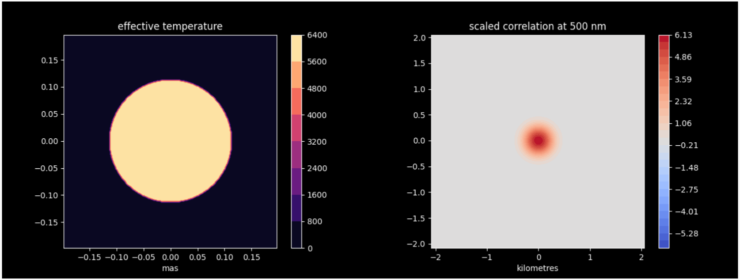
Exoplanet atmospheres

HD 332231 (scenario with a wind-dependent absorption line)



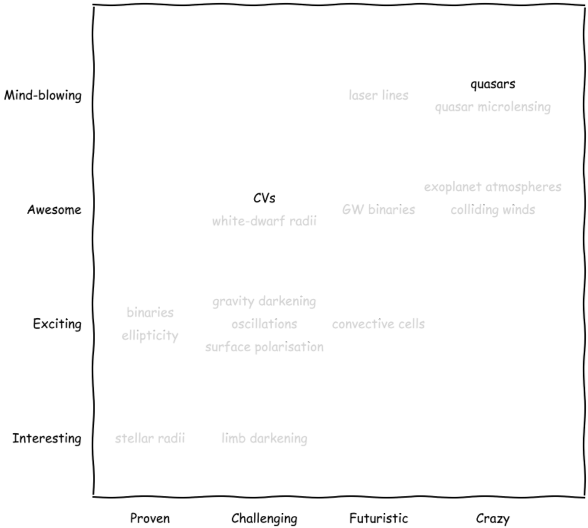
Signal difference during transit.

HD 332231 (scenario with a wind-dependent absorption line)

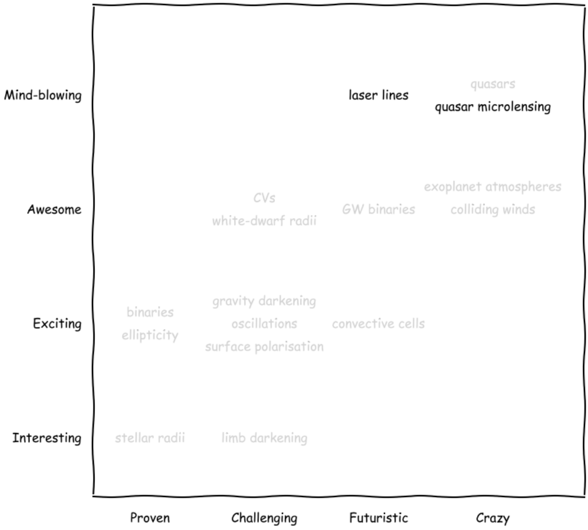


Signal outside of transit.

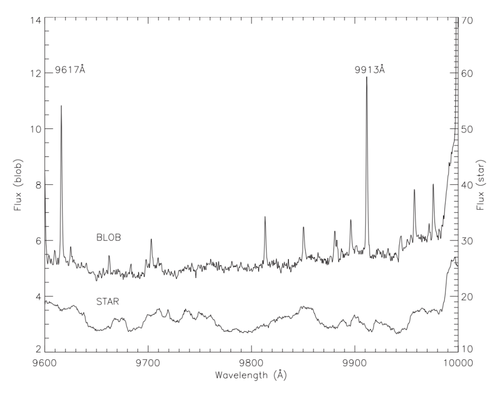
5. Accretion (Roland Walter's talk)



6. Non-image properties

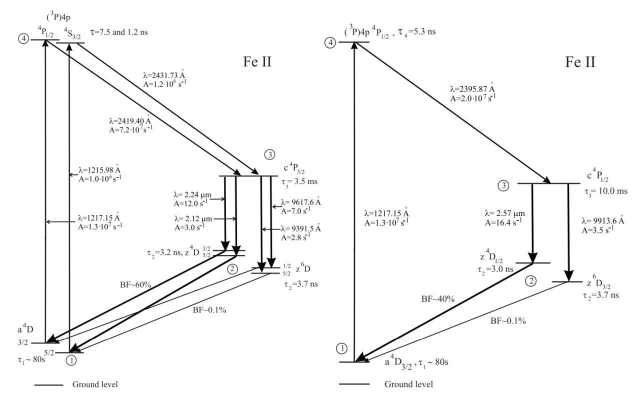


Laser blobs around η Carinae?



from Johansson & Letokhov (2004)

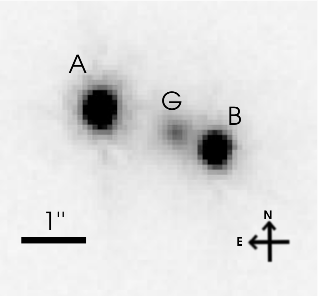
Laser blobs around η Carinae?

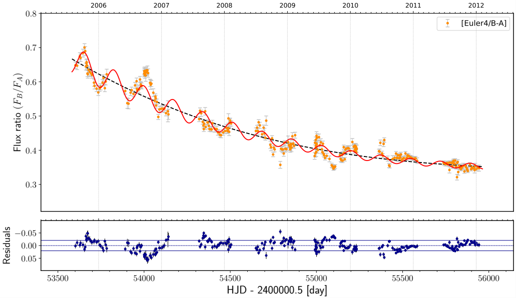


from Johansson & Letokhov (2004)

Quasar Microlensing

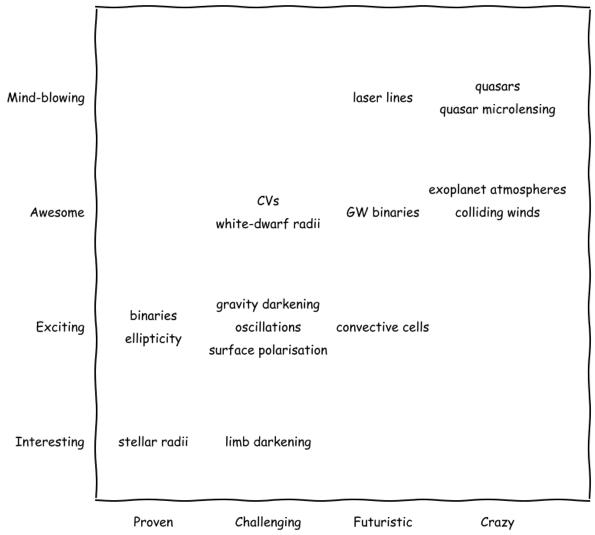
Lensed quasar J0158–4325 (Millon et al 2022)





Micro-image structure expected on μas scale.

Summary


Mind-blowing
Awesome
Exciting
Interesting
laser lines
quasars
quasar microlensing
CVs
white-dwarf radii
GW binaries
exoplanet atmospheres
colliding winds
binaries
ellipticity
gravity darkening
oscillations
surface polarisation
convective cells
stellar radii
limb darkening
Proven
Challenging
Futuristic
Crazy