SF2A - Nice - 17/05/2019

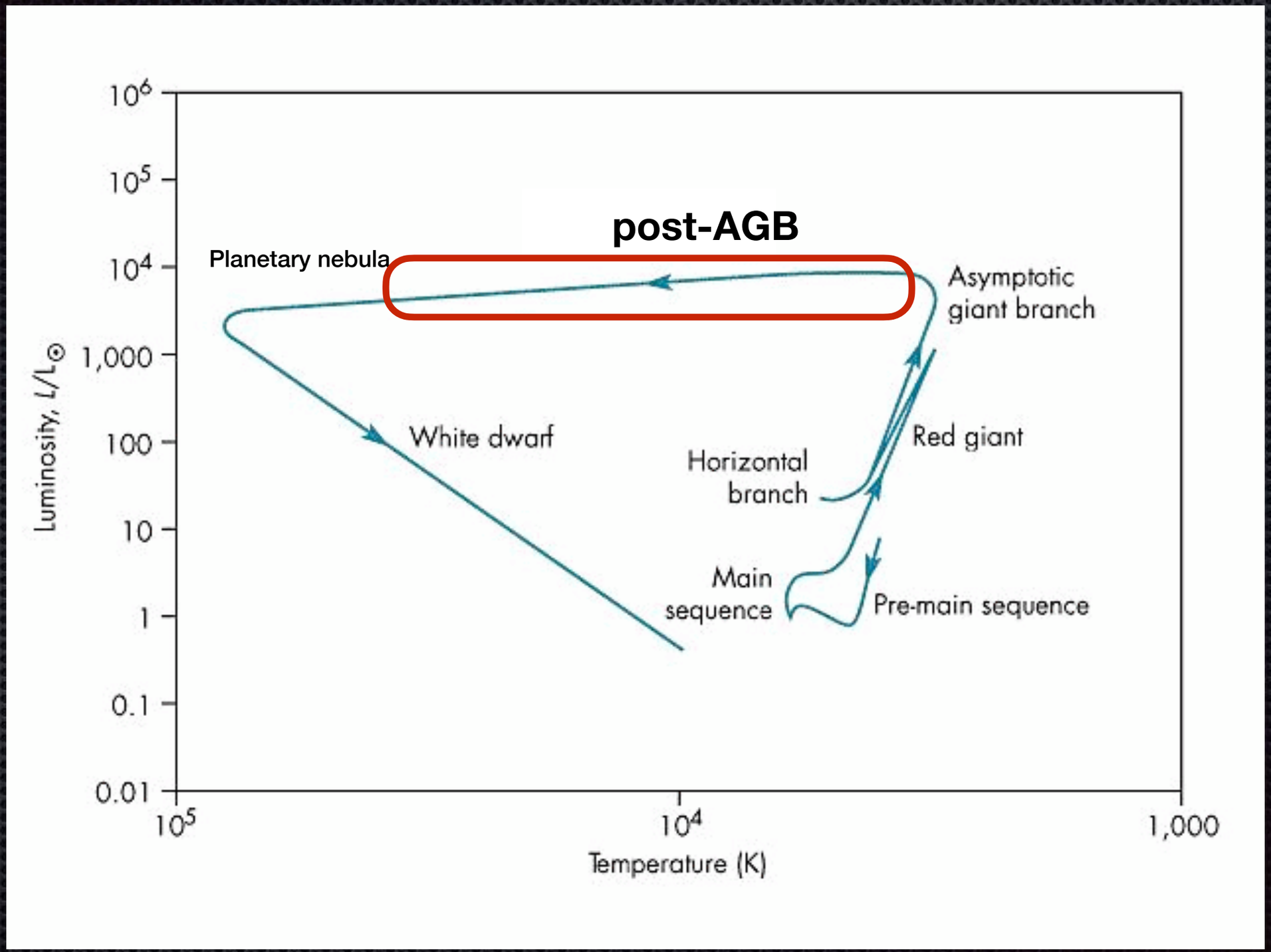
Sharp VLTI view of second-generation protoplanetary disks around evolved binaries

Jacques Kluska
H. Van Winckel, H. Olofsson, M. Hillen, D. Kamath, D. Bollen, I. Straumit, J. Alcolea, N. Anugu, J.-P. Berger, V. Bujarrabal, R. Izzard, S. Kraus, J.-B. Le Bouquin, M. Min, J. D. Monnier.

Inspiring

KU LEUVEN

Circumbinary disks around post-AGB binaries



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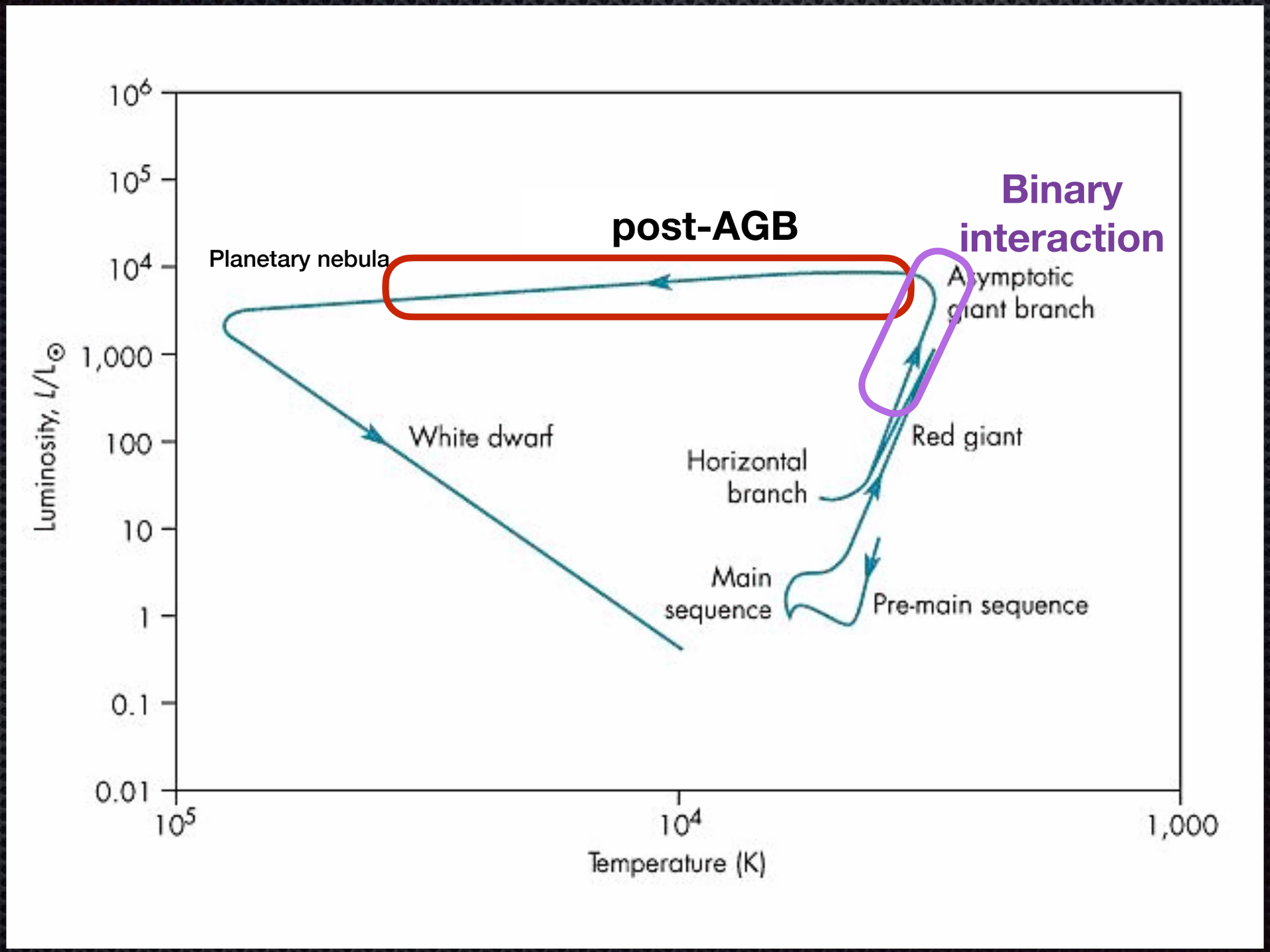

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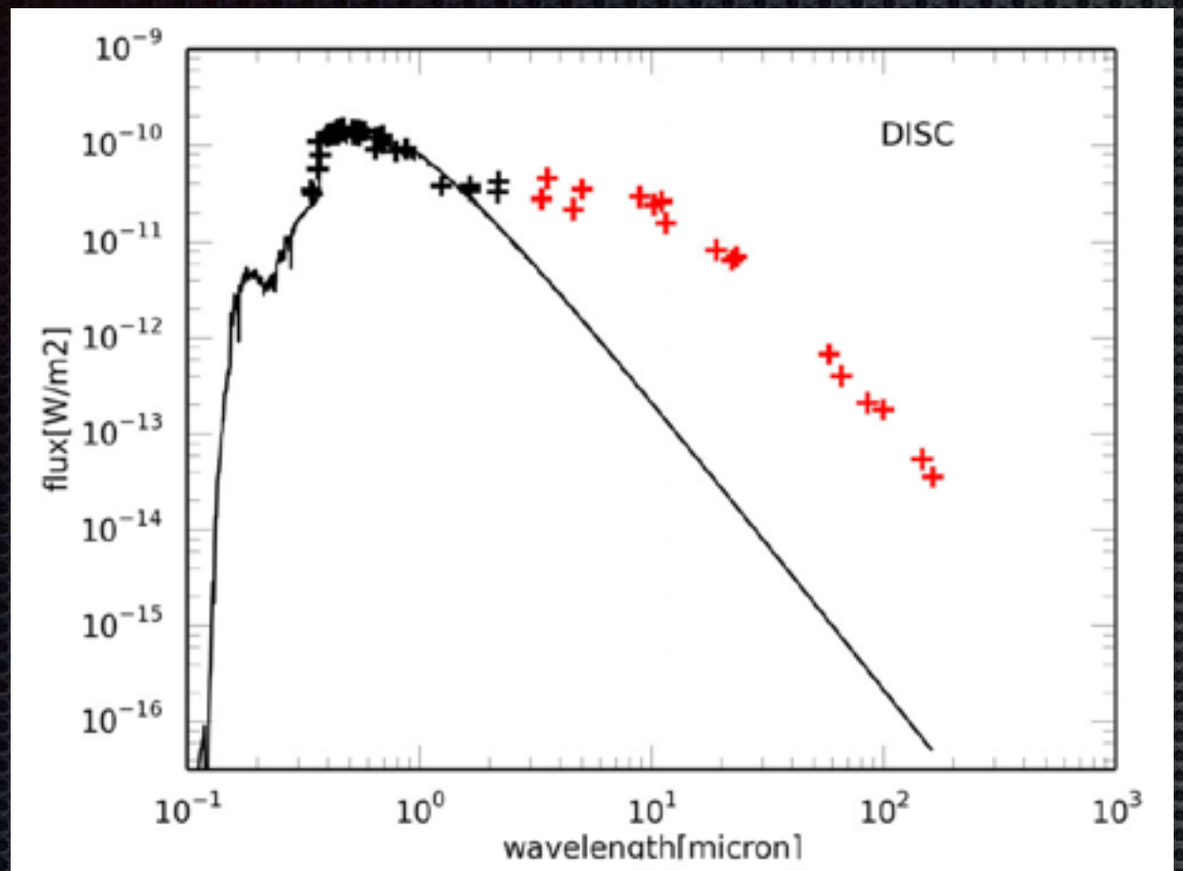

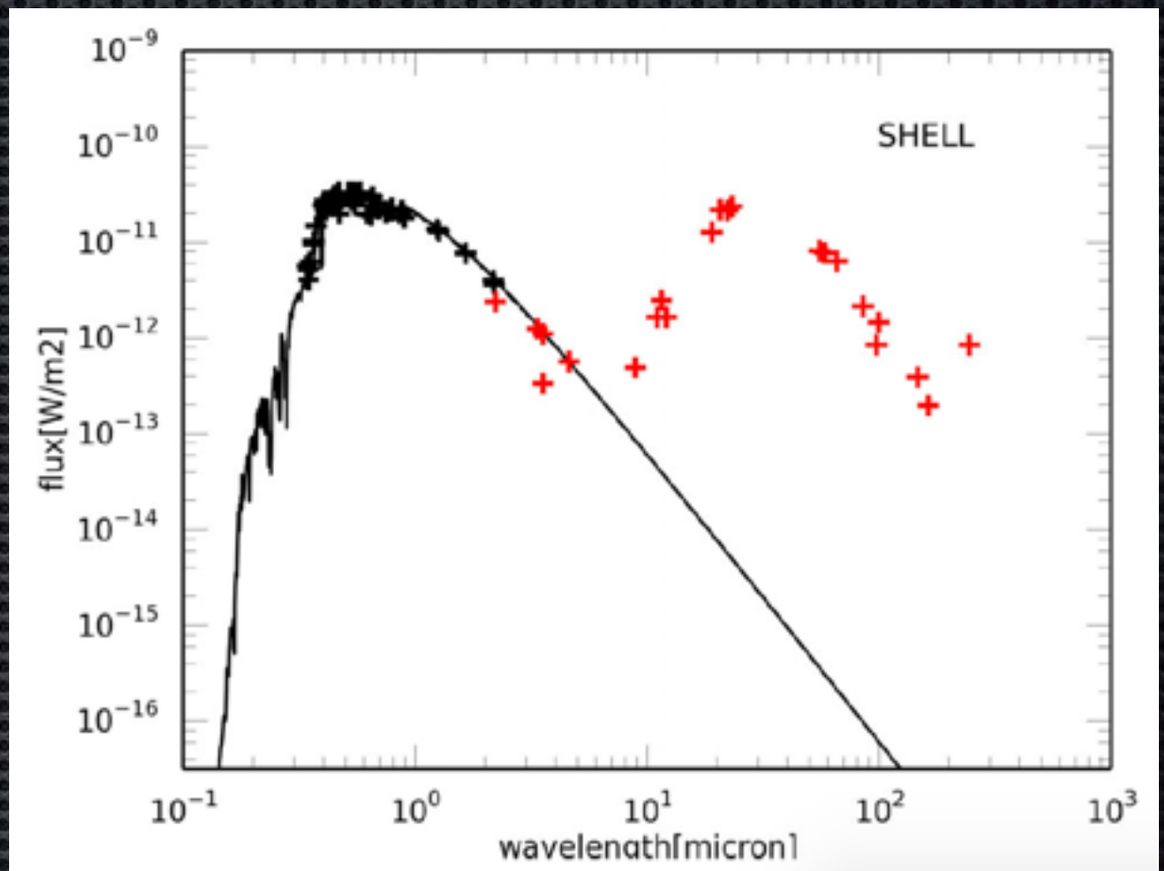

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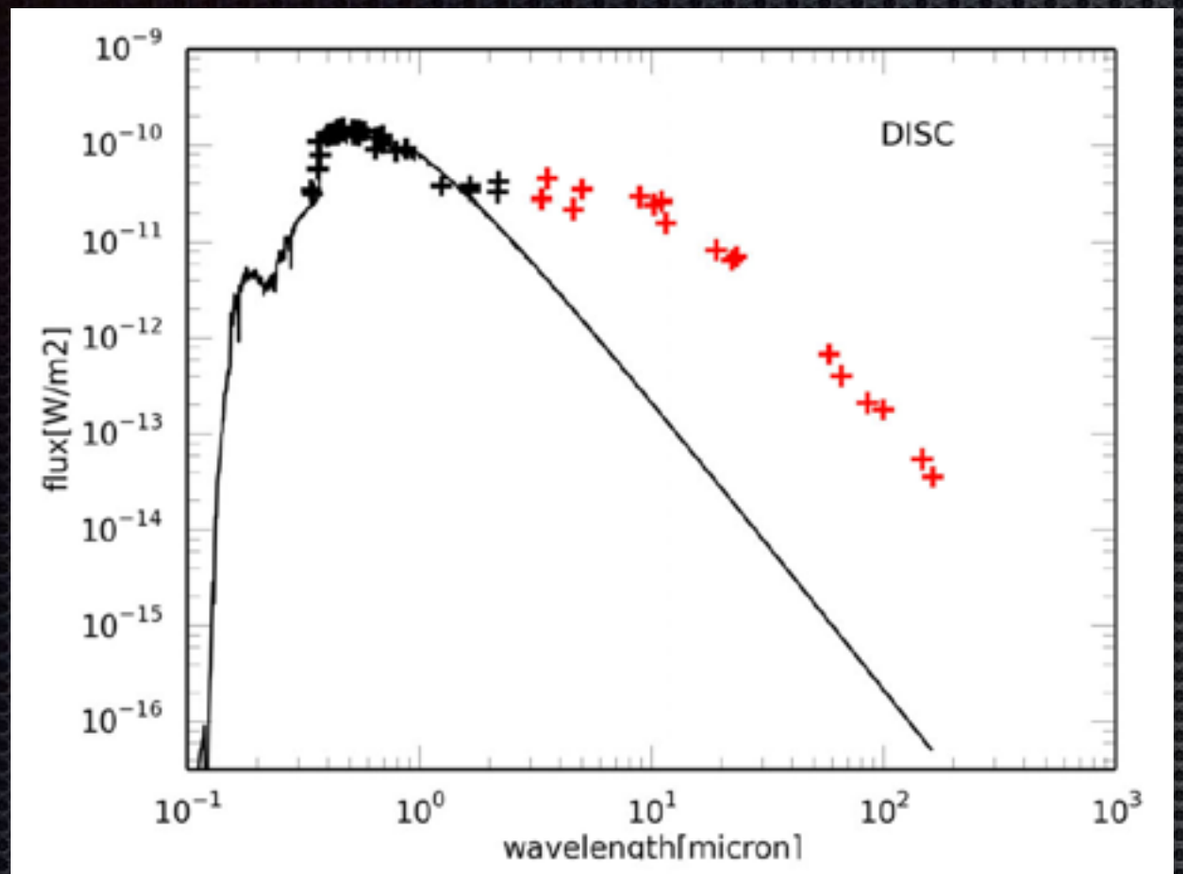
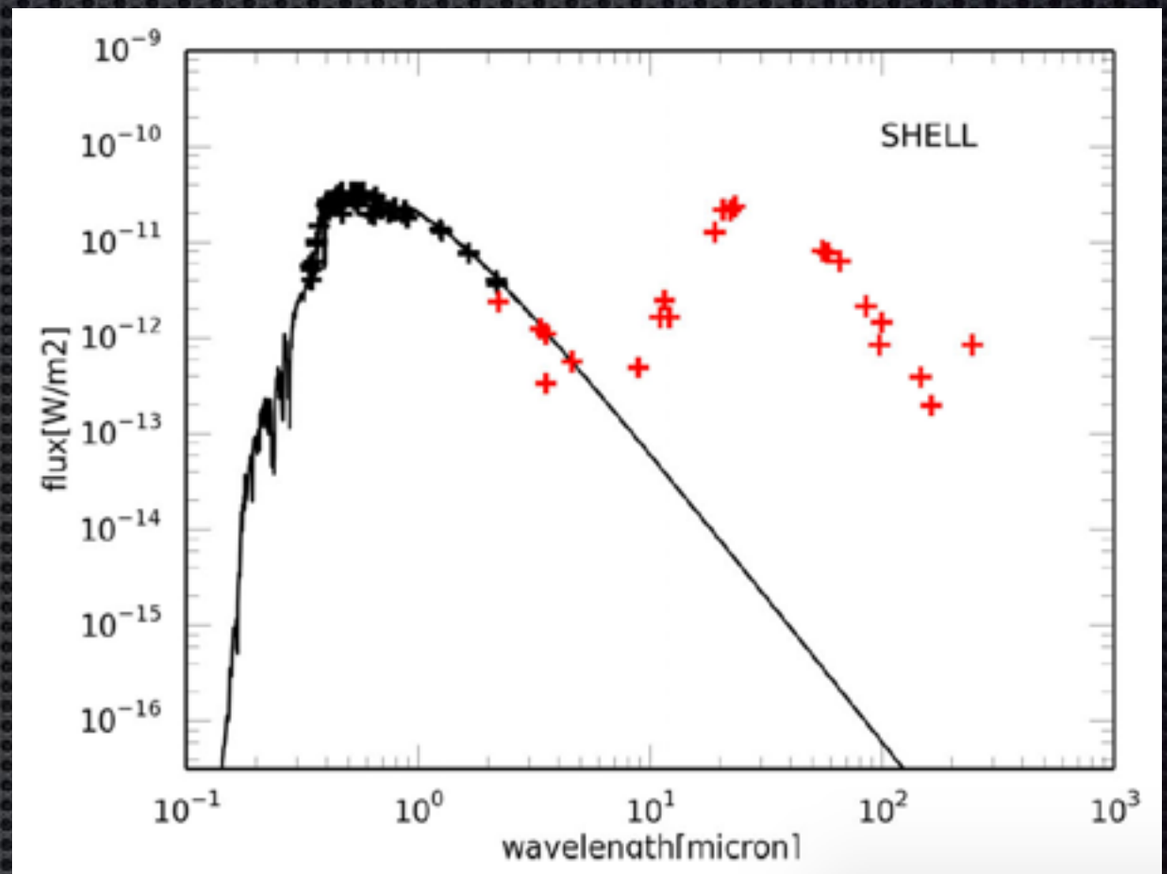
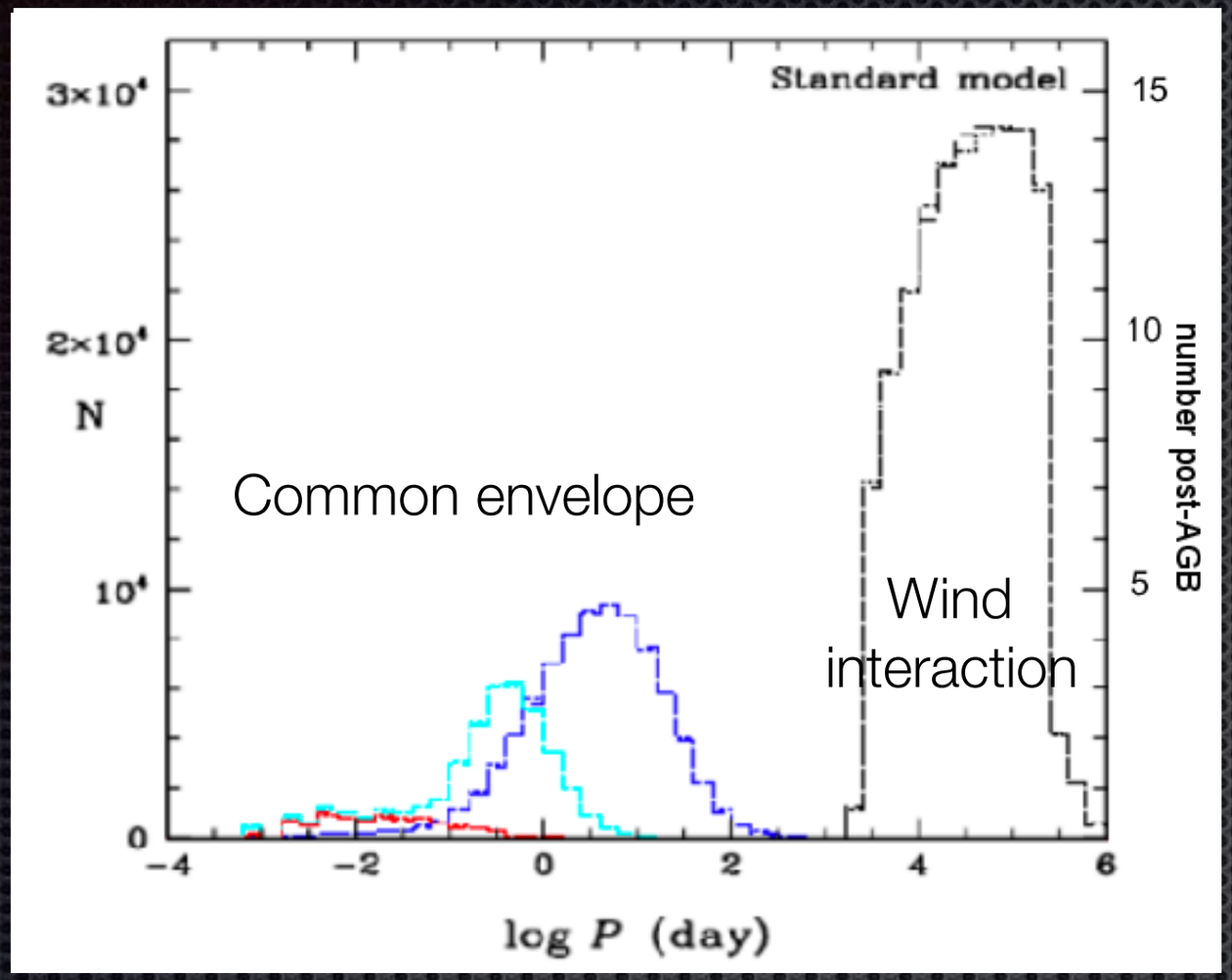




~100% of sources with a disk-like excess are binaries

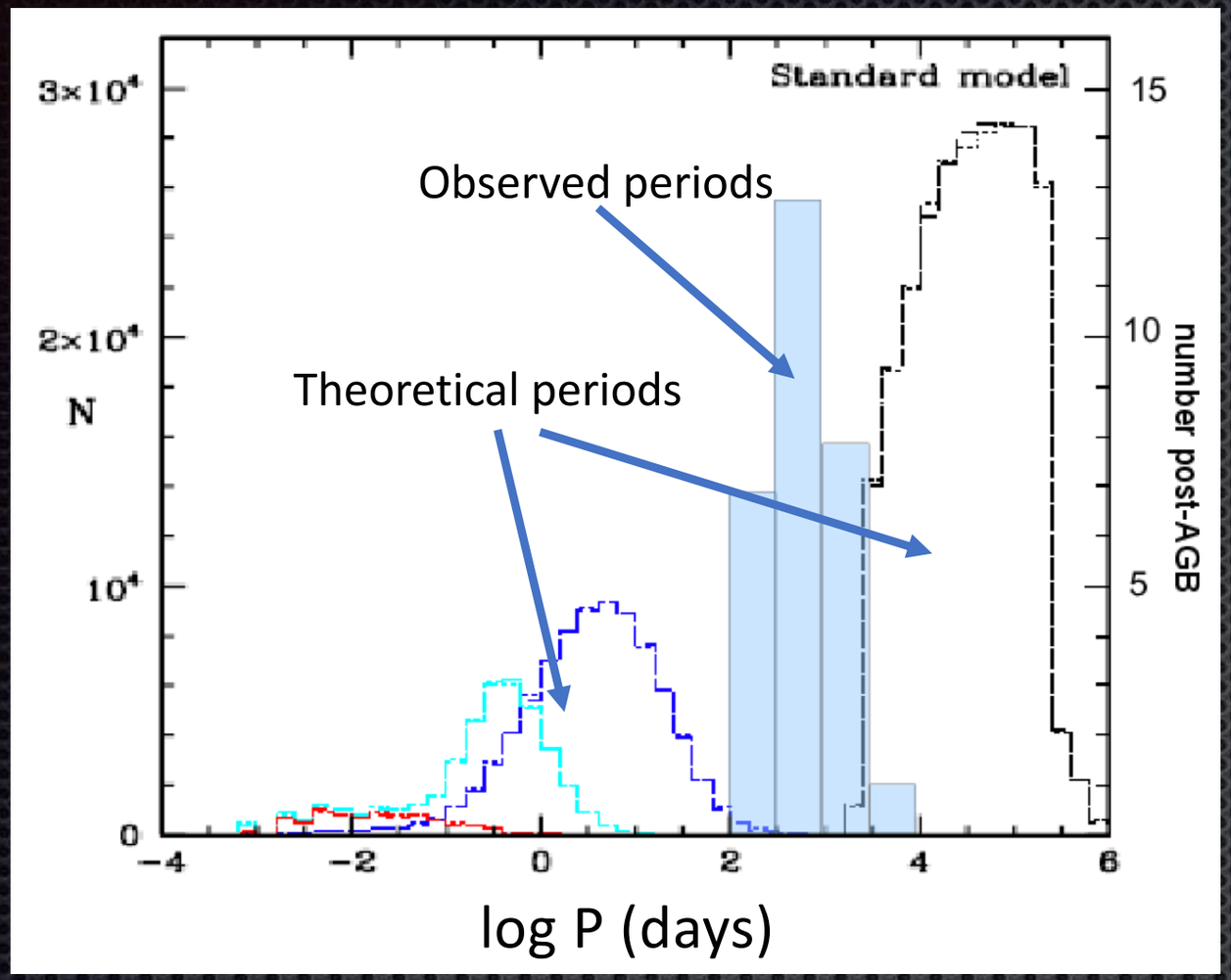
(e.g. Van Winckel 2003; Oomen et al. 2018)

Circumbinary disks around post-AGB binaries



(Nie et al. 2012)

Circumbinary disks around post-AGB binaries



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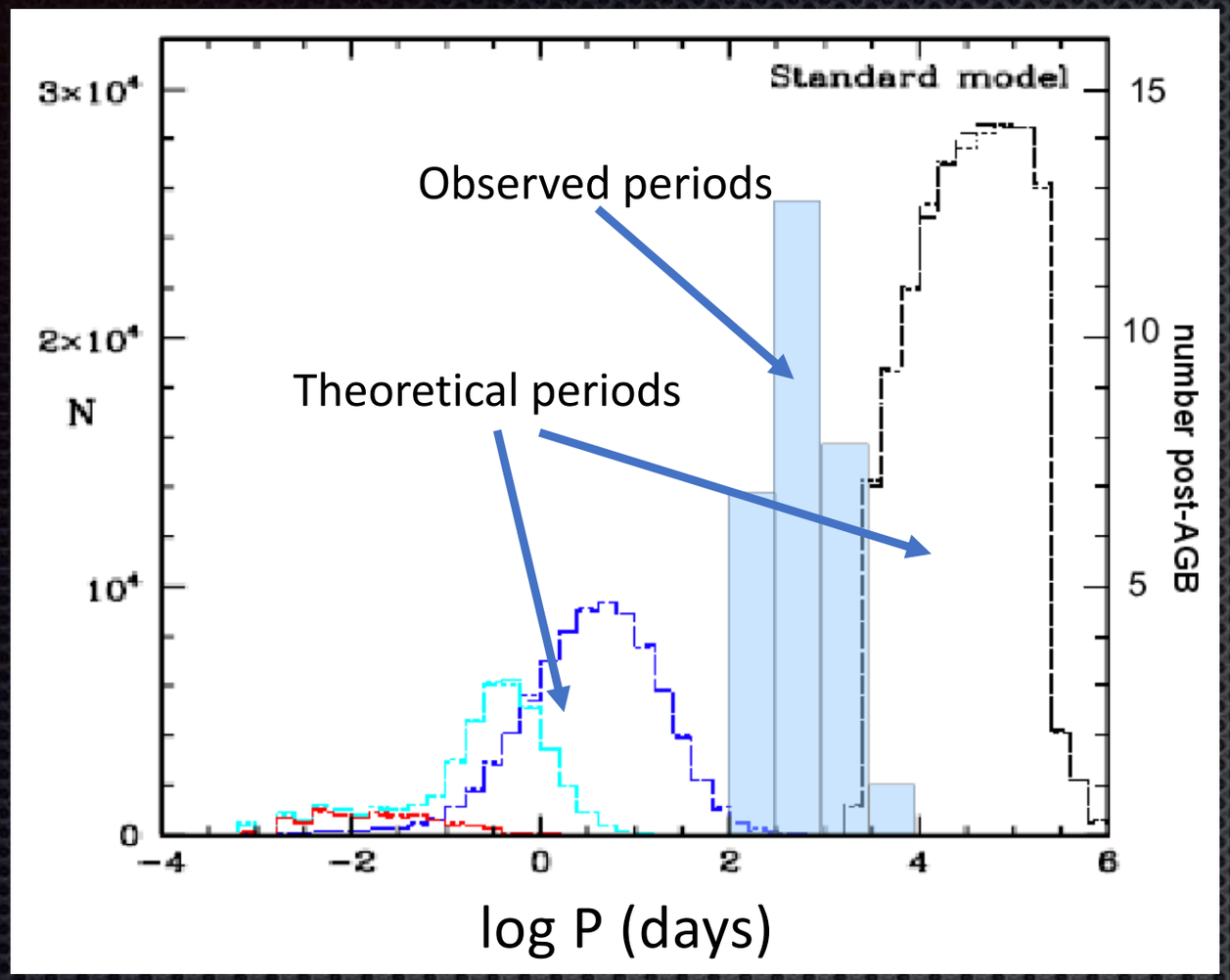

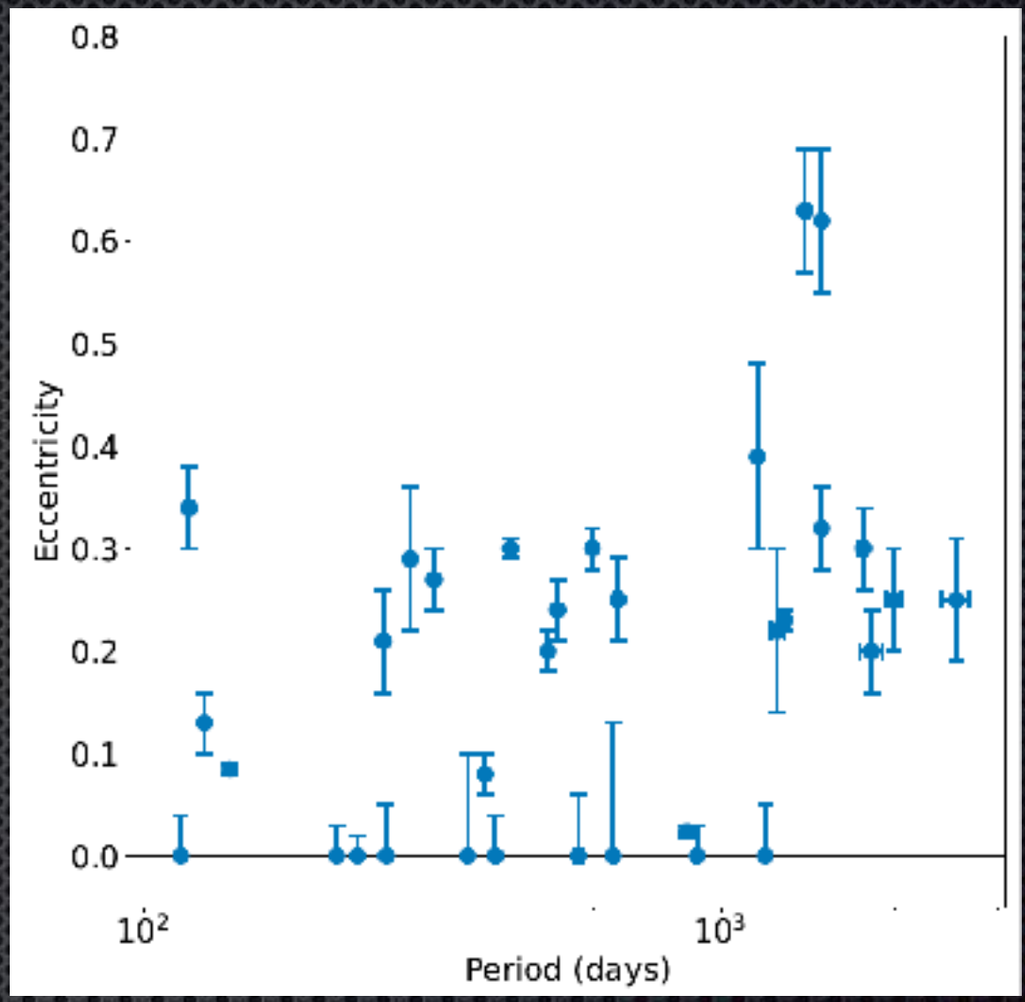

(Oomen et al. 2018)

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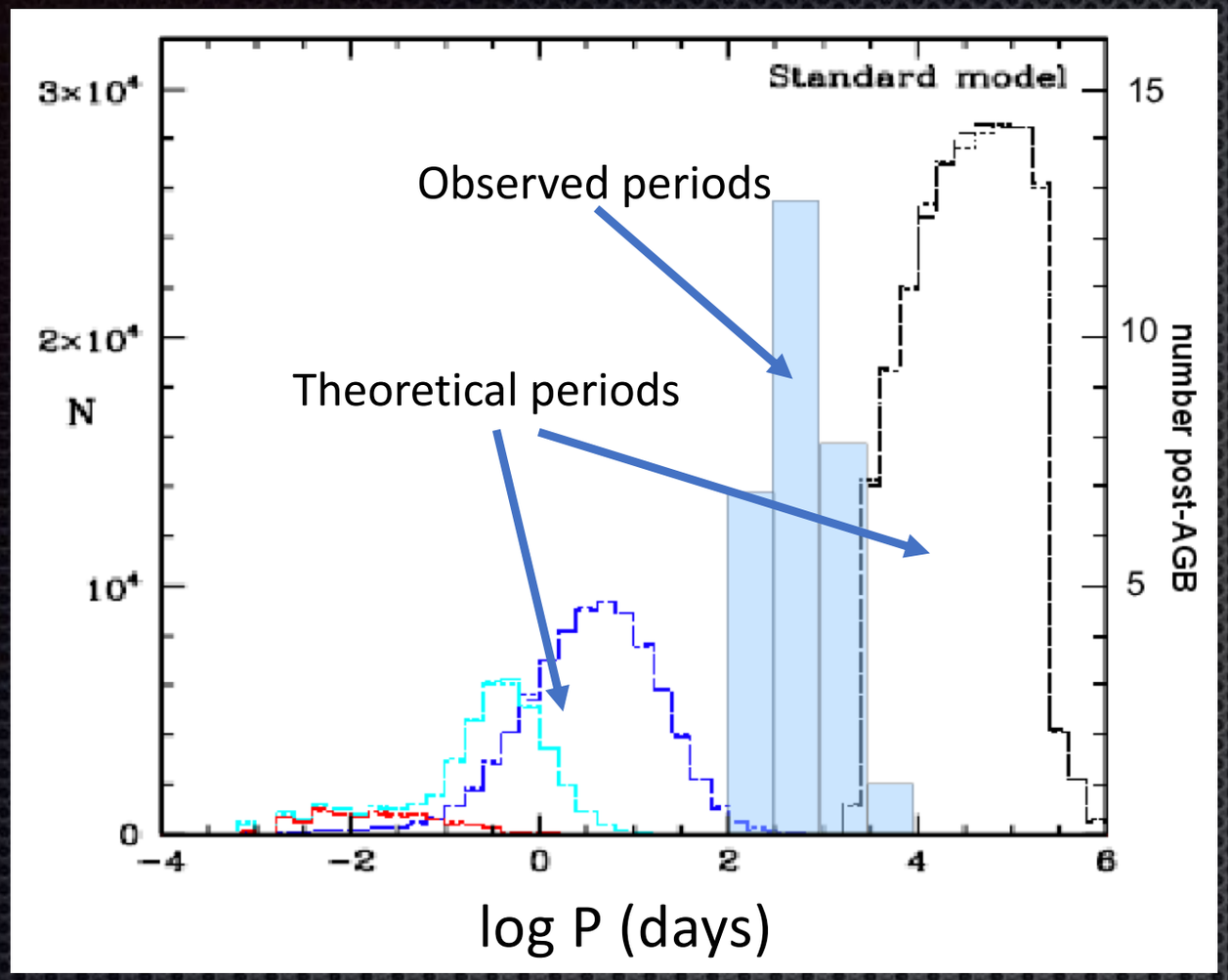
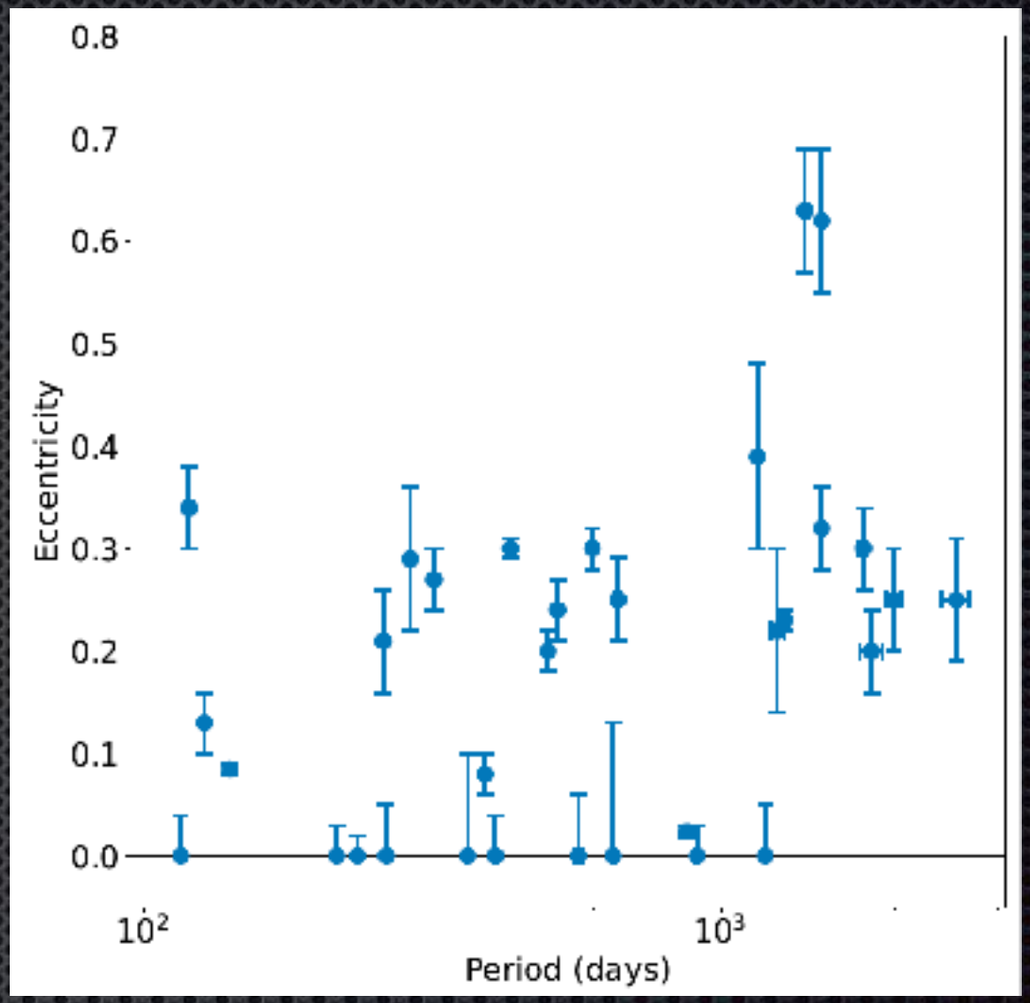




(Oomen et al. 2018)

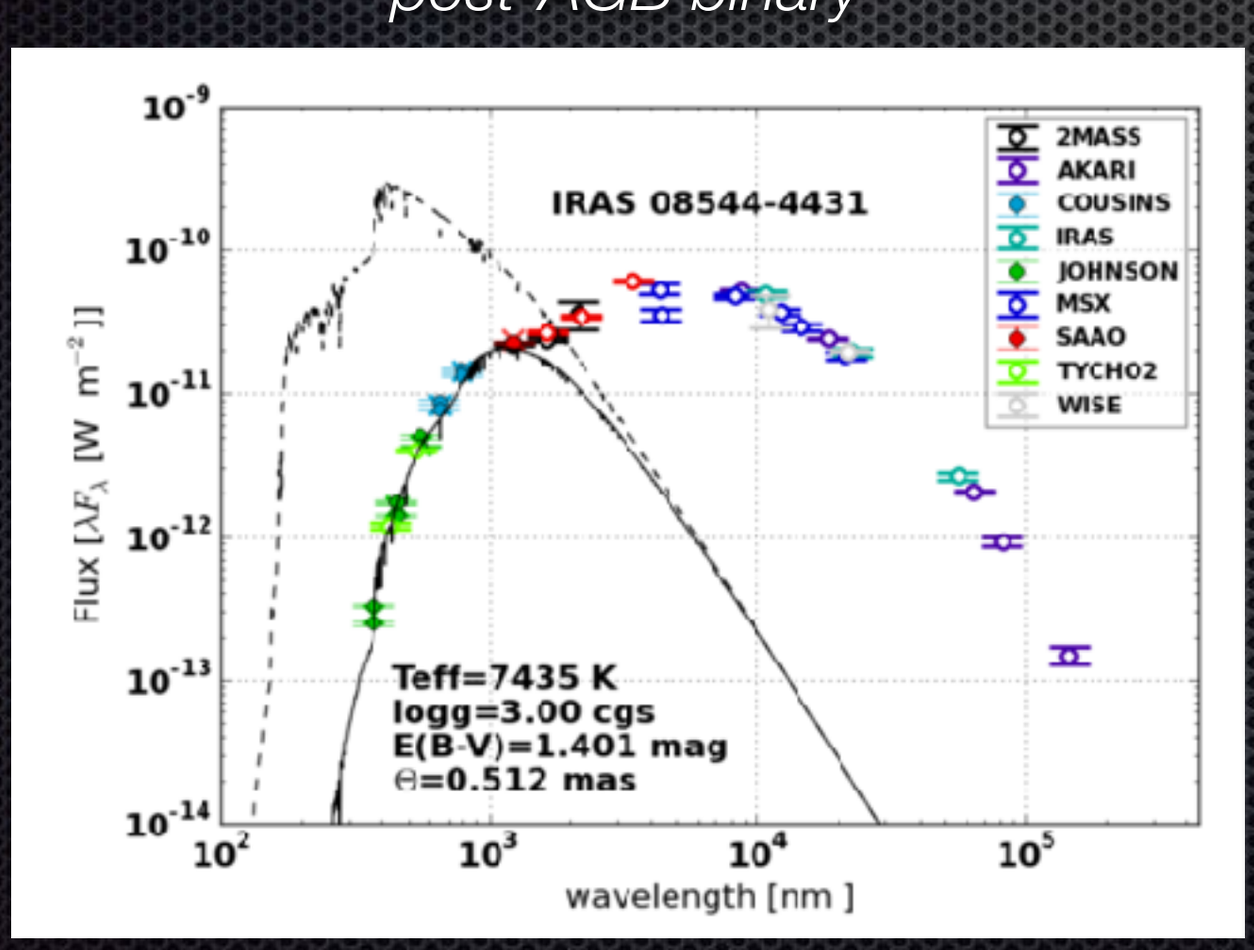
Unexpected orbits
(periods and eccentricity; Nie et al. 2012)
Eccentricity pumping mechanism?

Circumbinary disks around post-AGB binaries

Second generation protoplanetary disks?

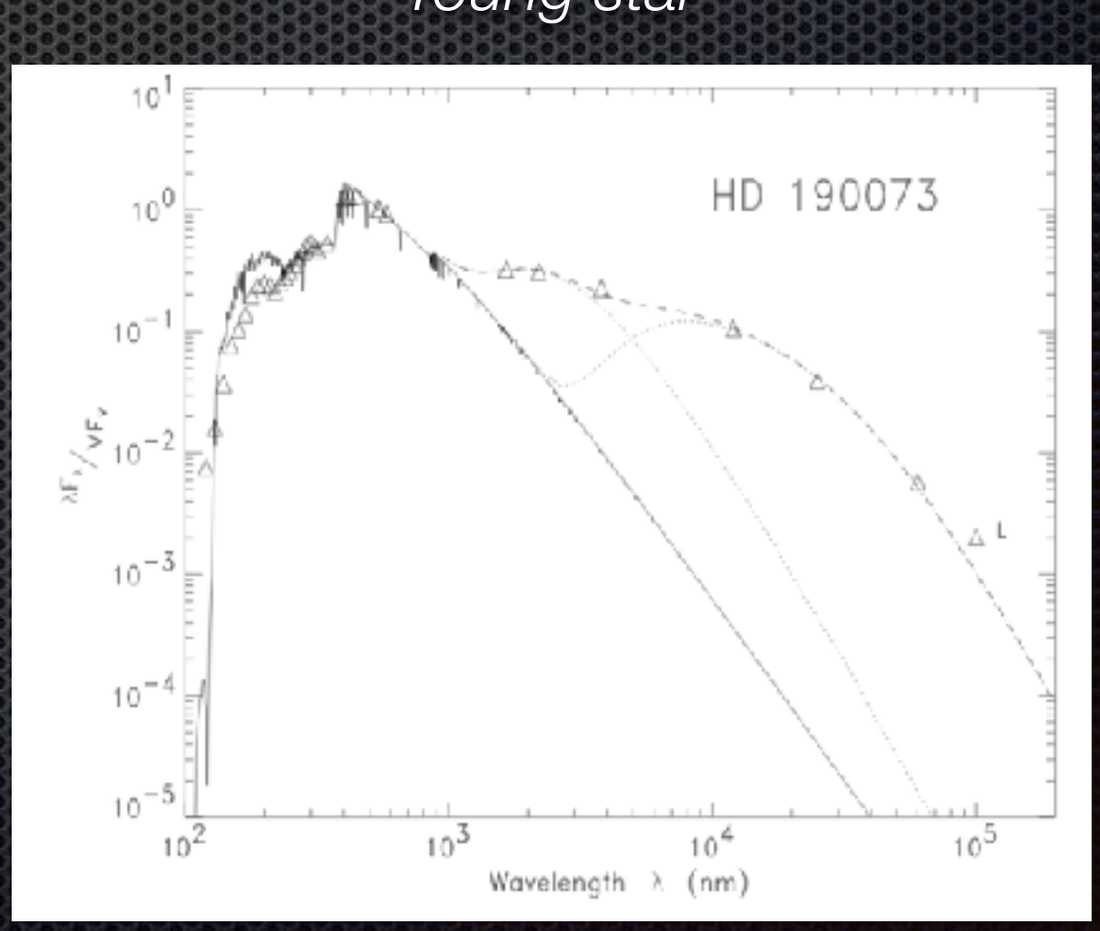
- Infrared excess *(e.g. de Ruyter et al. 2006; Hillen et al. 2017)*

post-AGB binary



Hillen et al. 2017

Young star



Malfait et al. 1998

Circumbinary disks around post-AGB binaries

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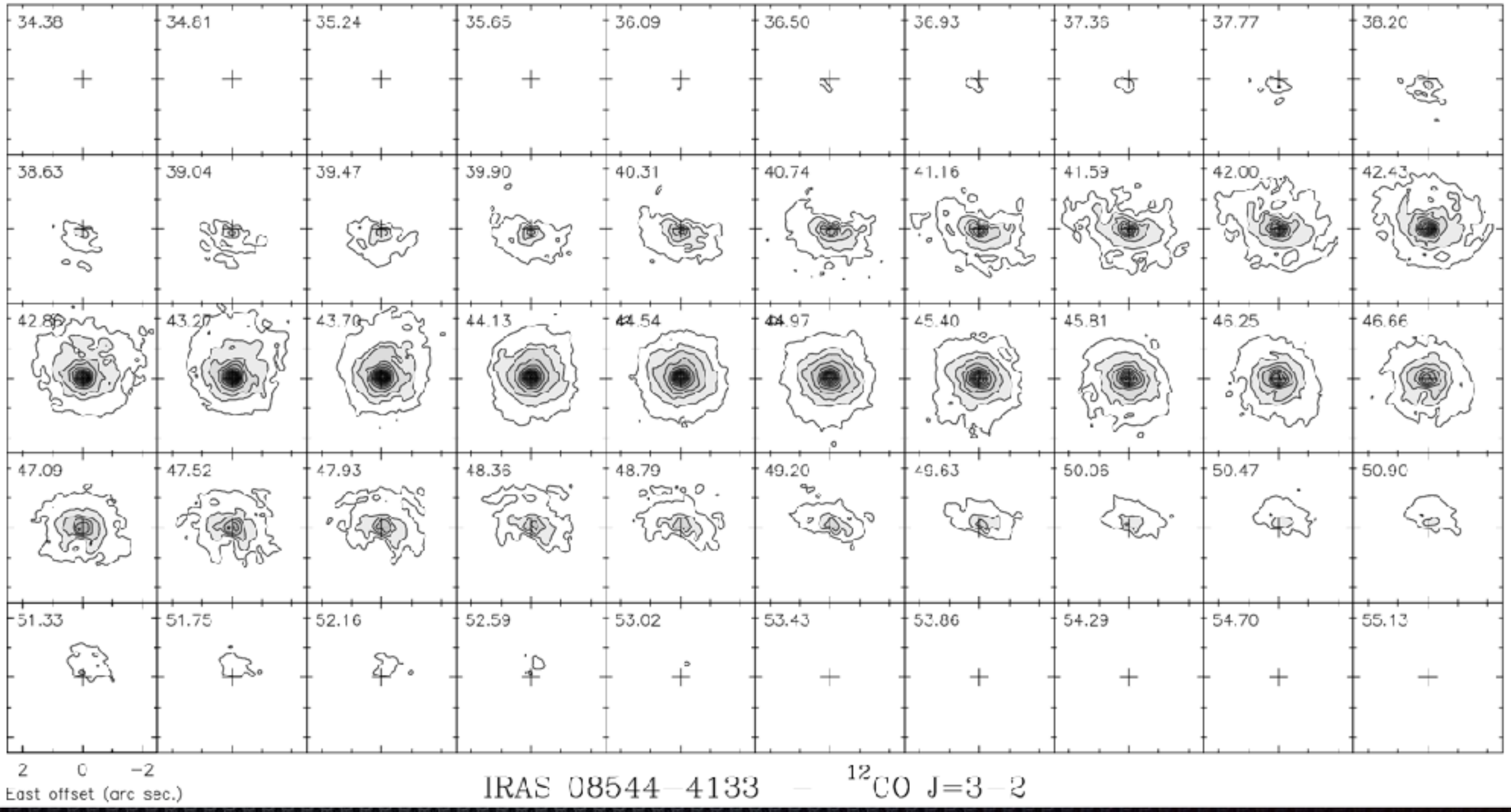

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Circumbinary disks around post-AGB binaries

Second

- Infra
- Dust

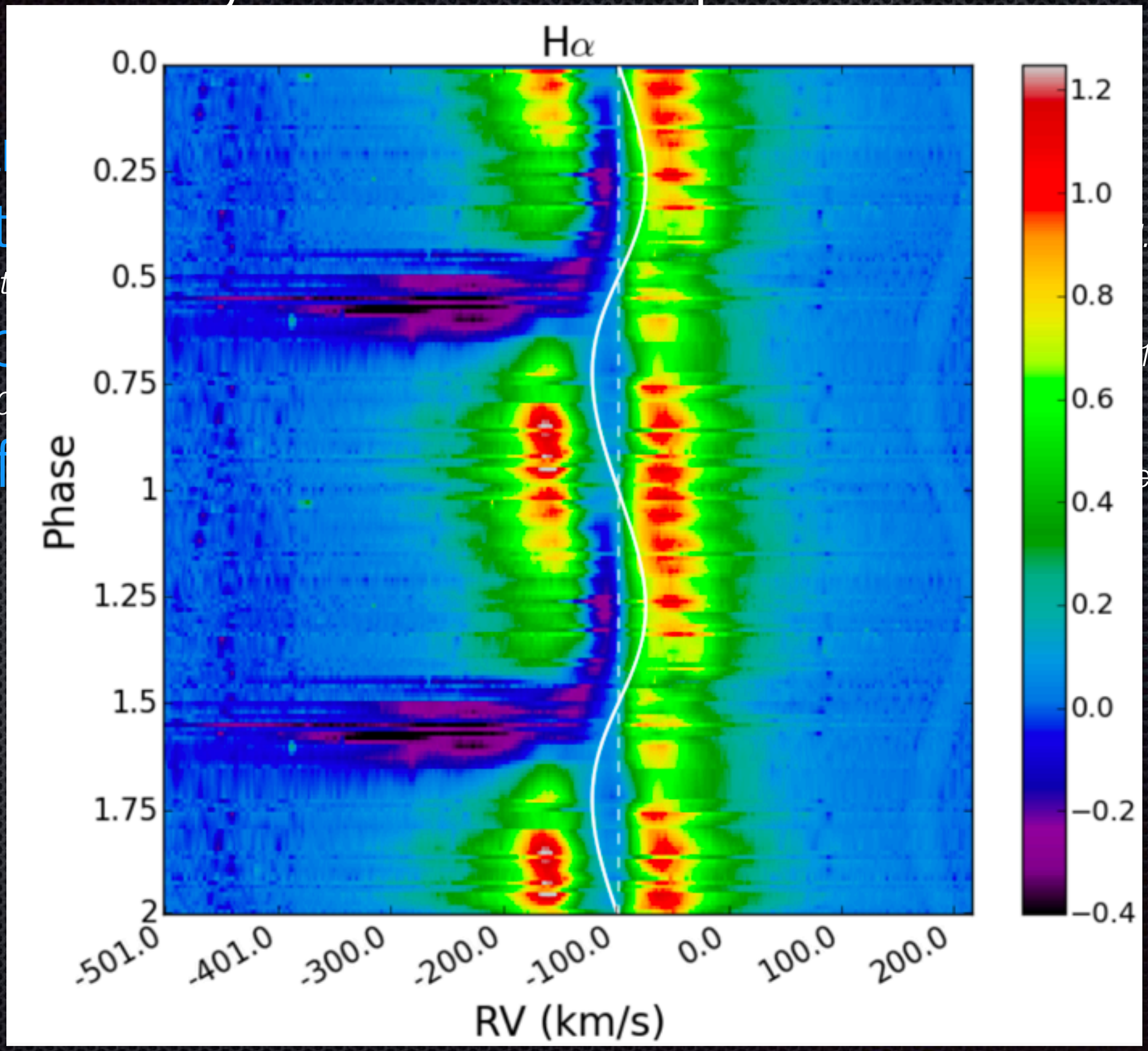
Gielen et

- Stab

2015; 20

- Outf

2017)



. 2005;

13;

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Circumbinary disks around post-AGB binaries

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Circumbinary disks around p
Second generation protoplanetar

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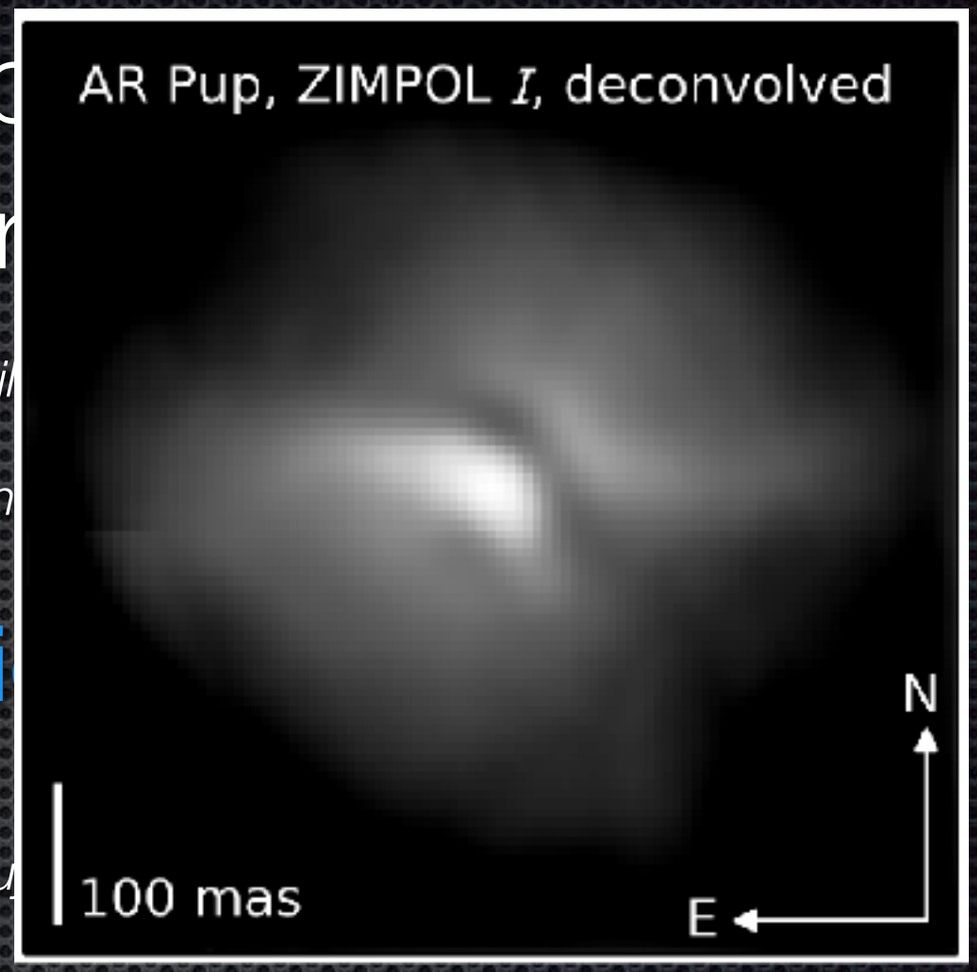

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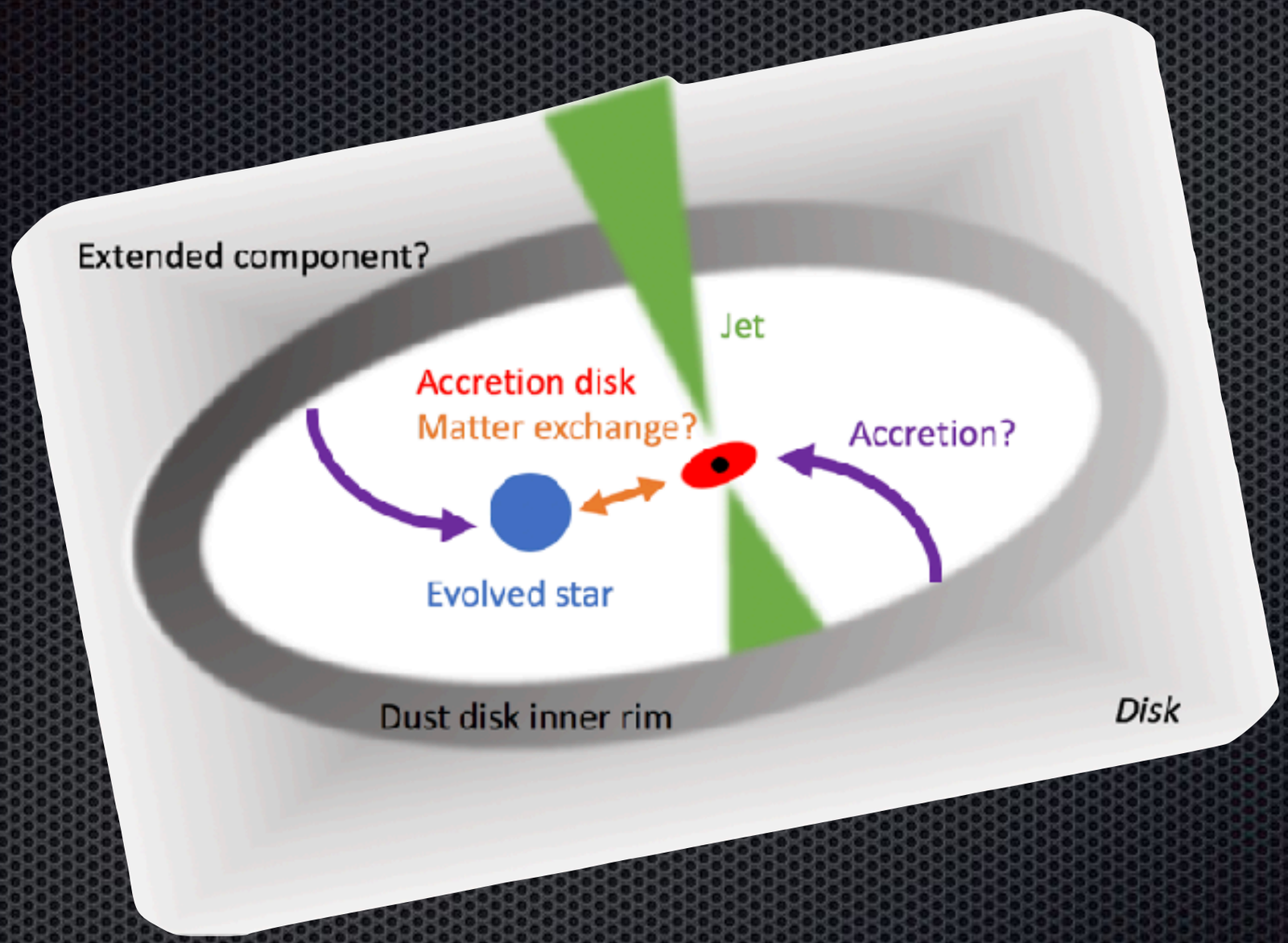
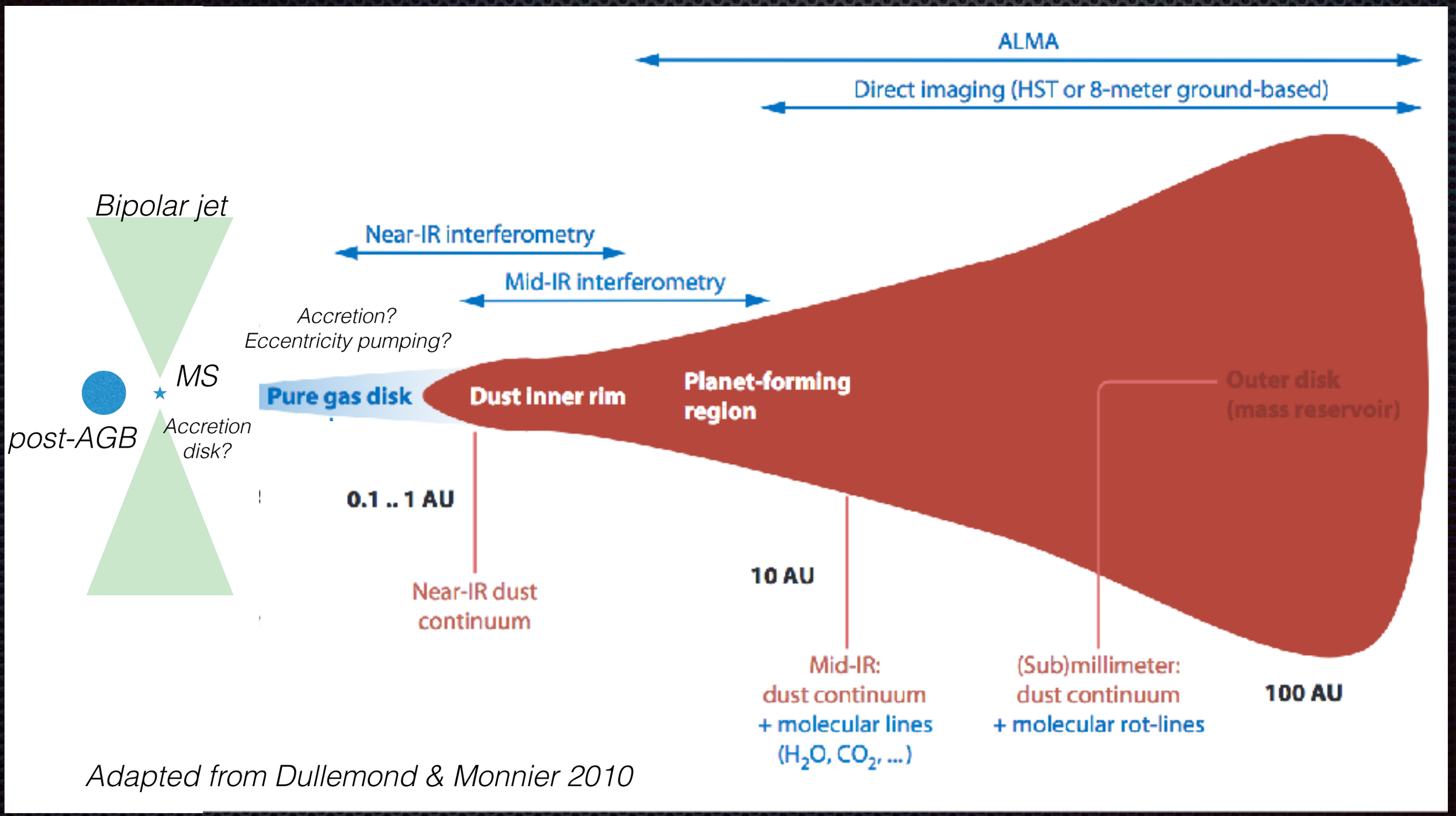


Let's investigate these disks morphology further

- ***Binary-disk interaction***
- ***Inner disk structure***

Circumbinary disks around post-AGB binaries



Adapted from Dullemond & Monnier 2010

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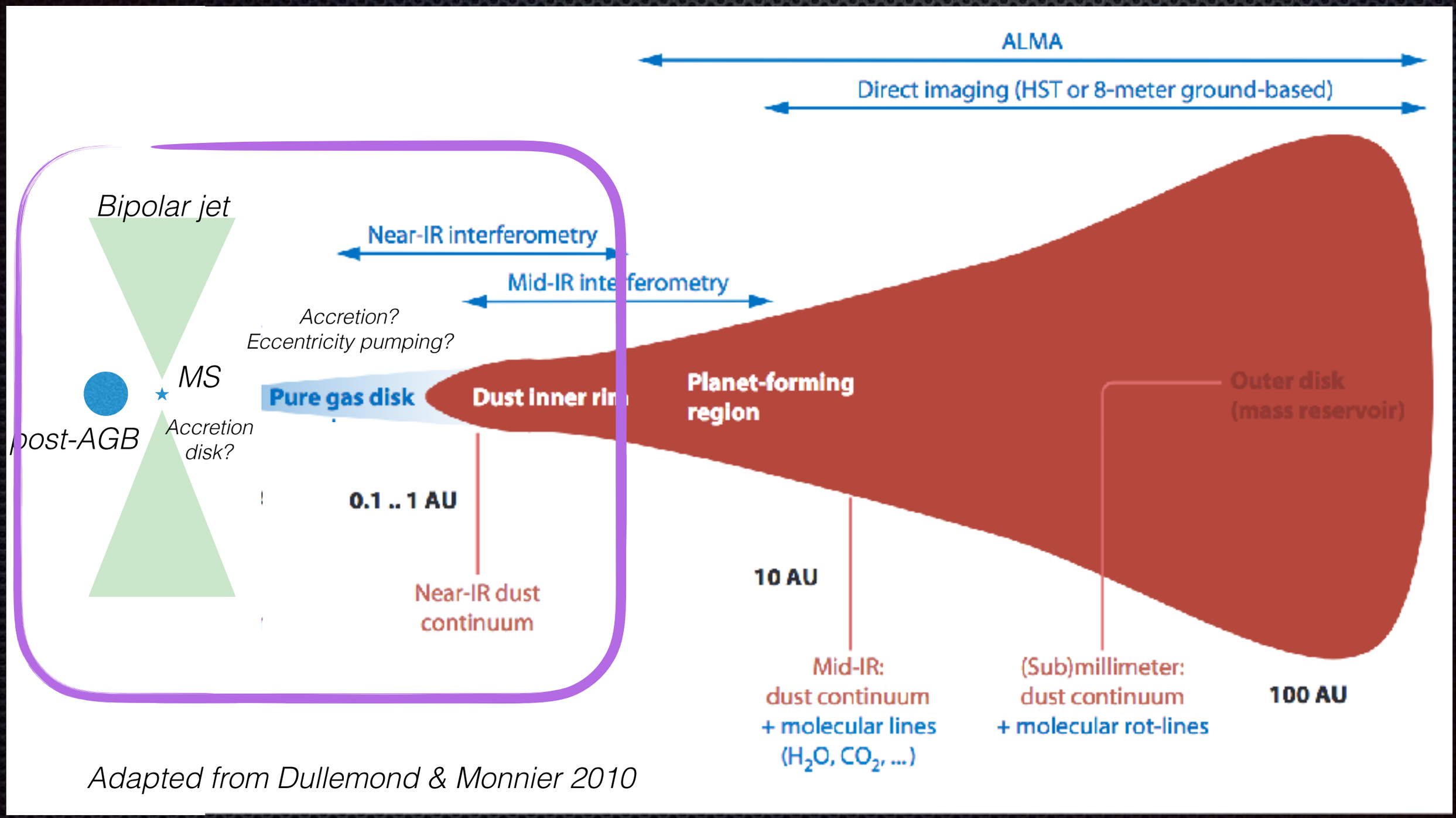

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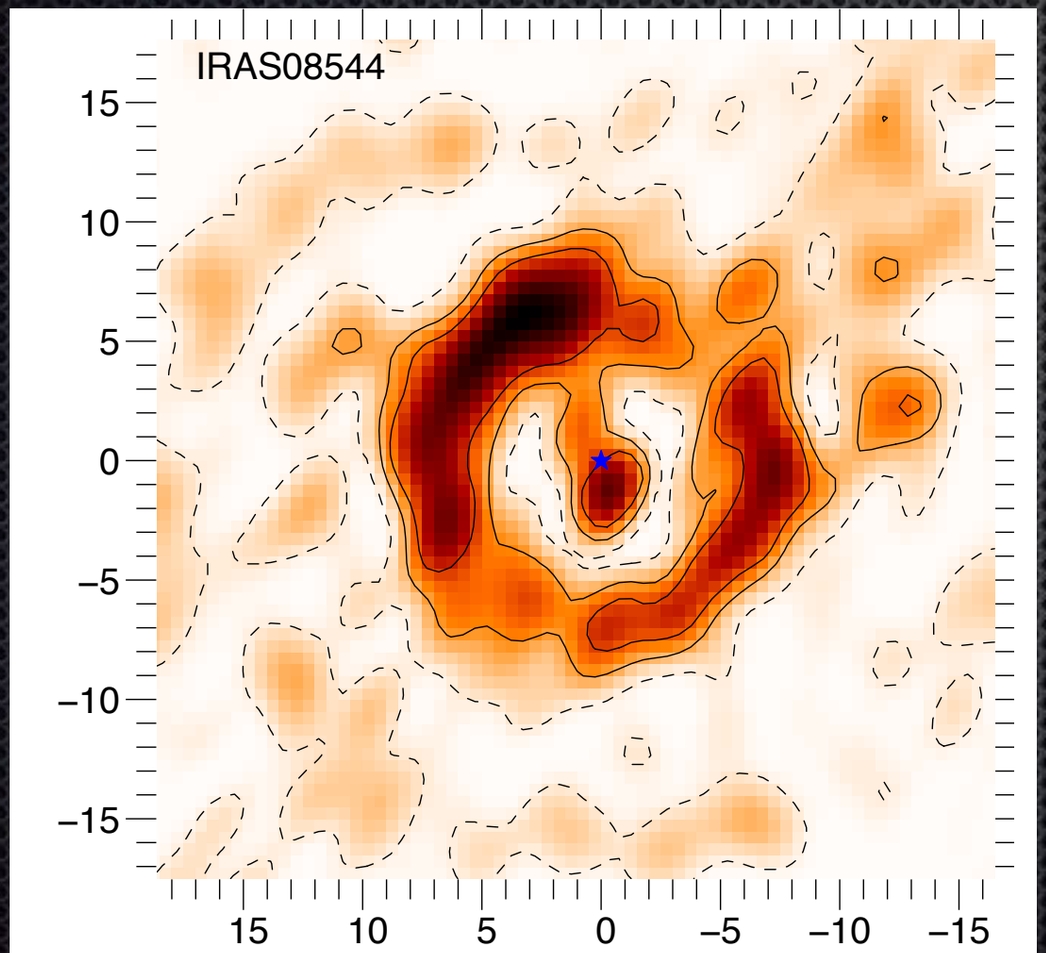
IRAS08544-4431

- First image of the inner disk rim of a disk around a post-AGB binary *(Hillen, Kluska et al. 2016)*



Parameter	Value
Flux of the primary (%)	59.7 ± 0.6
Flux of the secondary (%)	3.9 ± 0.7
Over-resolved flux (%)	15.5 ± 0.5
Binary separation (mas)	0.81 ± 0.05
Binary position angle (°)	56 ± 3
Disk inclination (°)	19 ± 2
Disk position angle (°)	6 ± 6
Disk inner radius (mas)	7.56 ± 0.05

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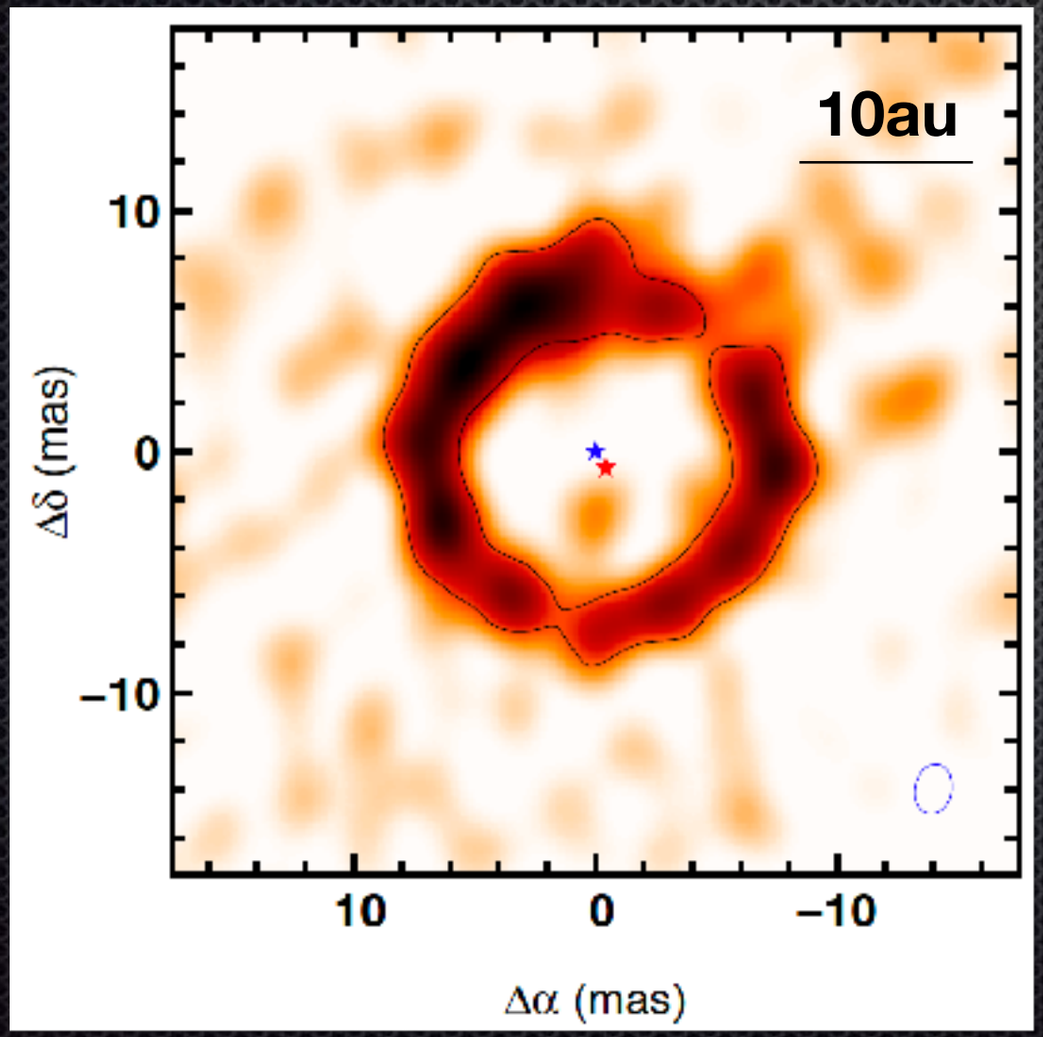

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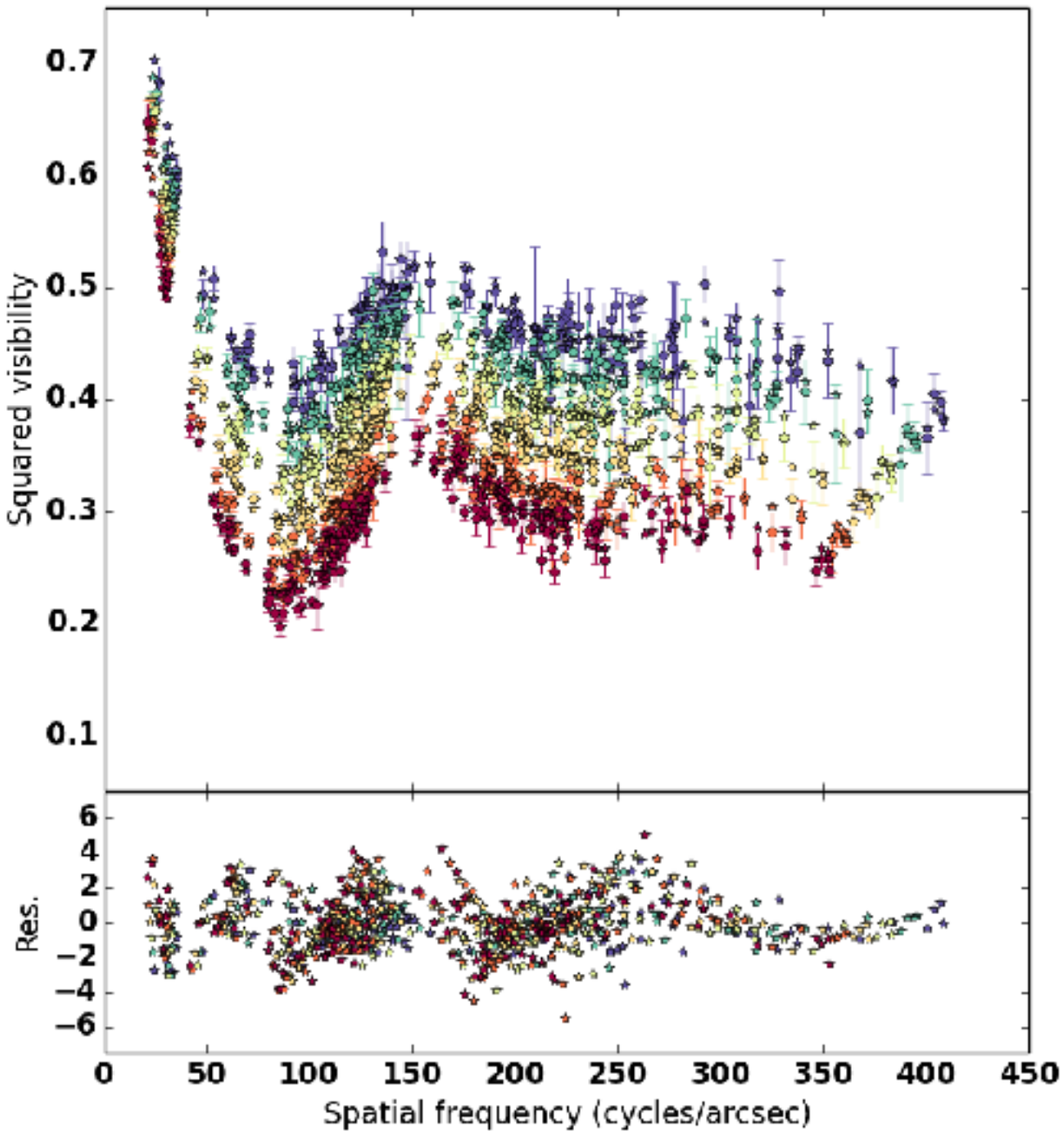
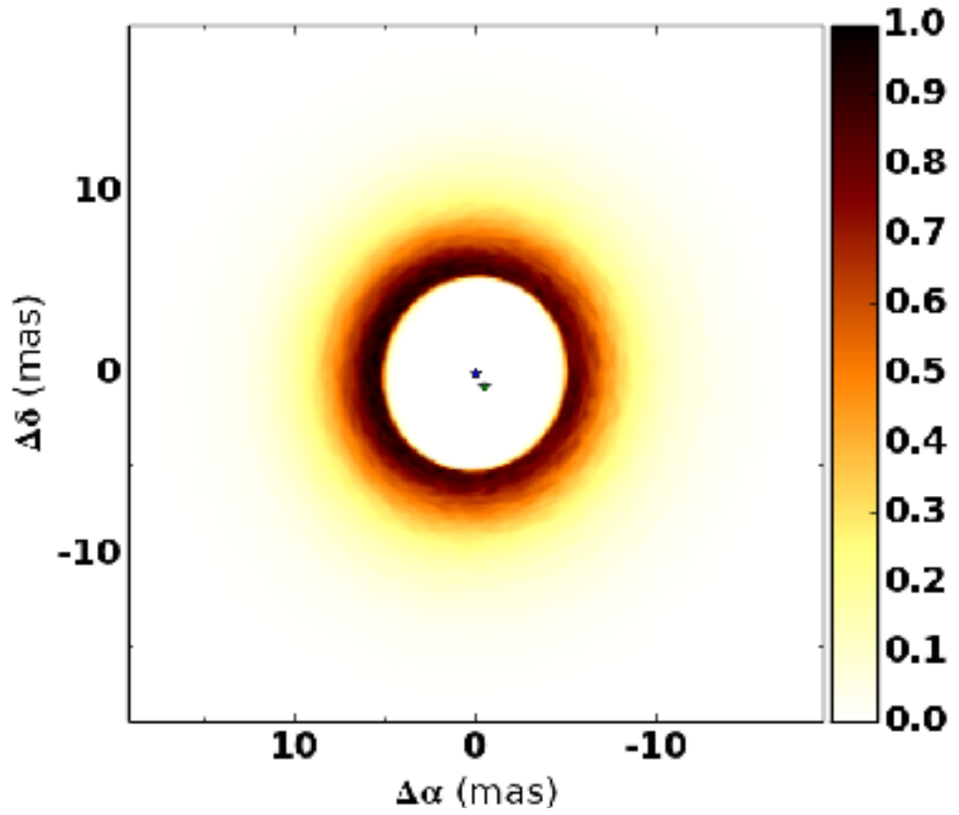
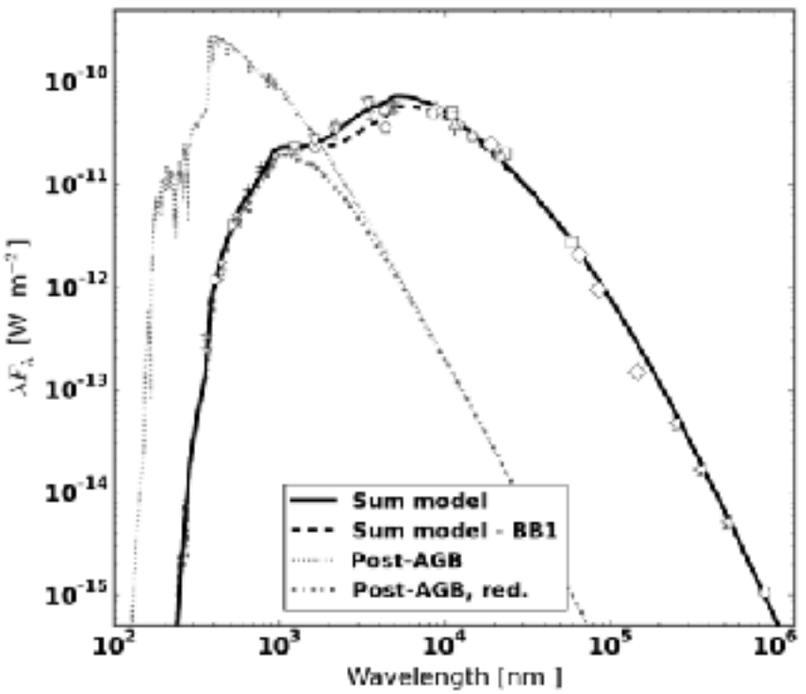
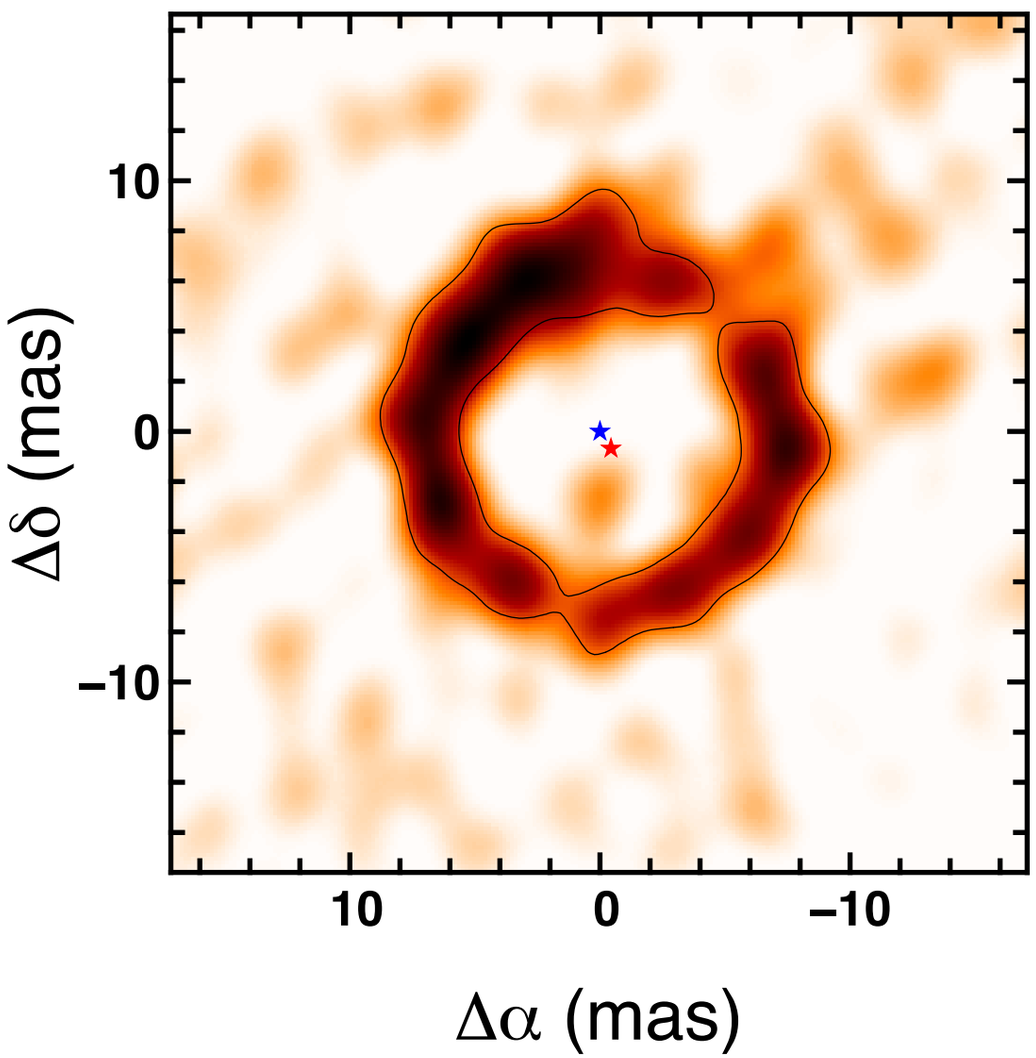




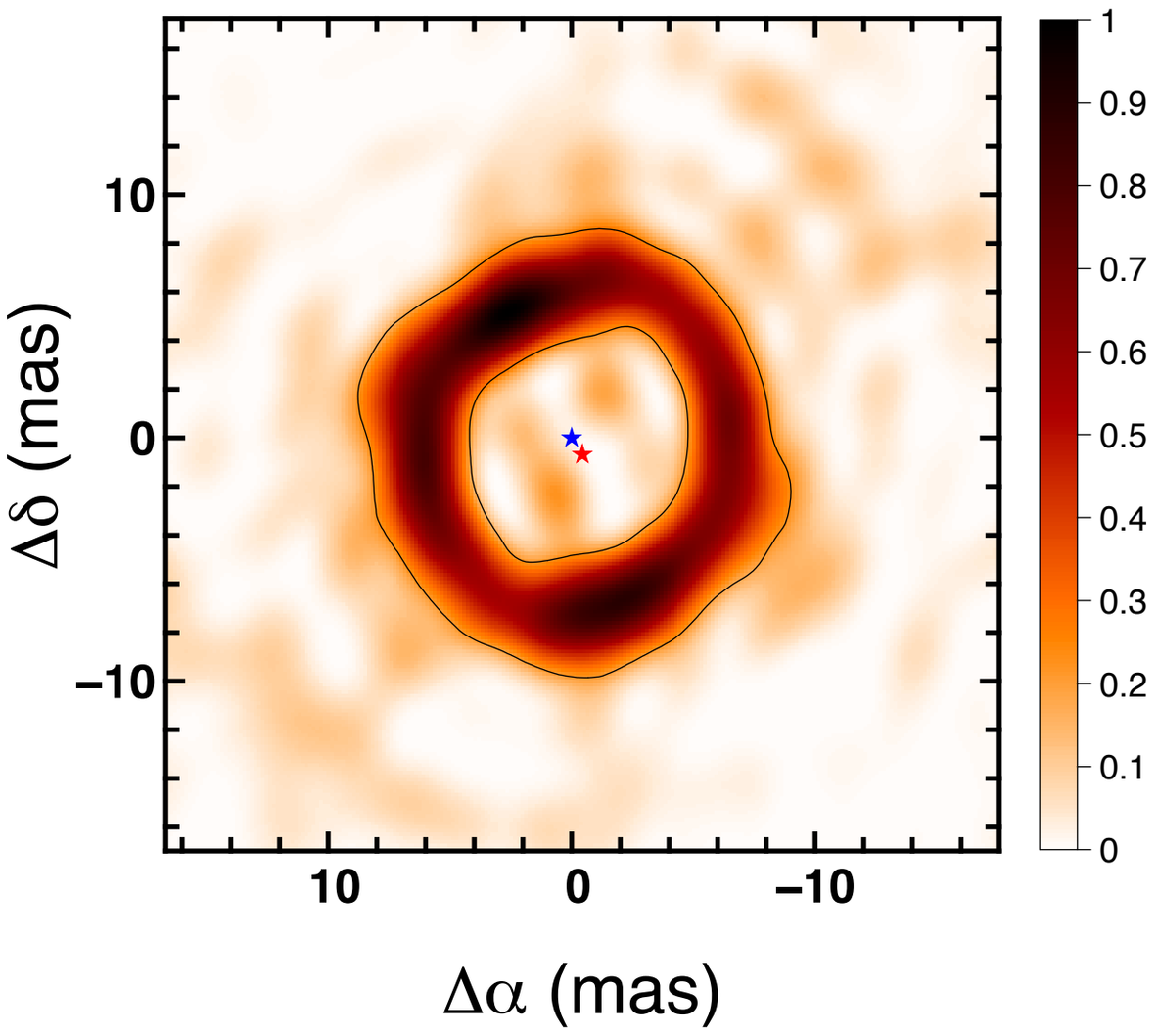


IRAS08544-4431

PIONIER dataset



MCMax model



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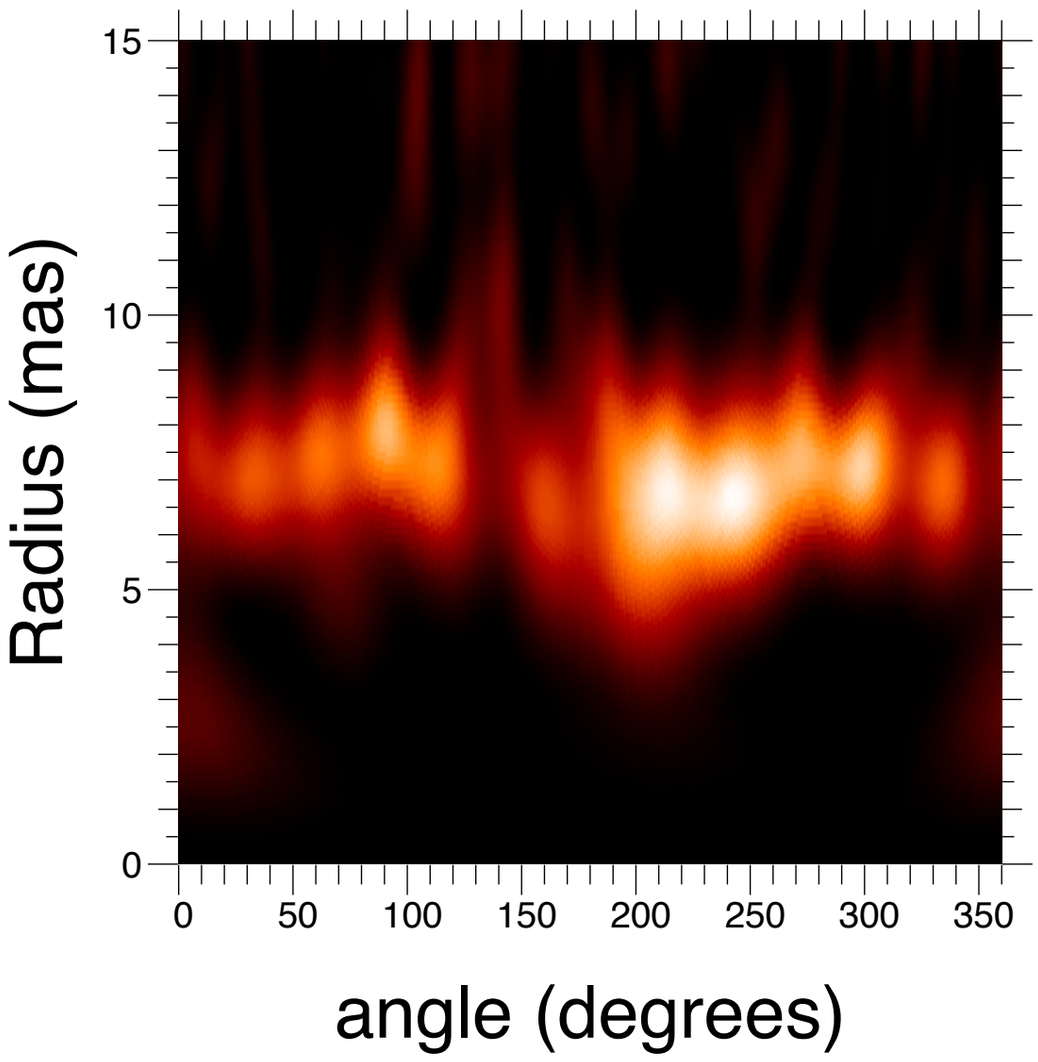

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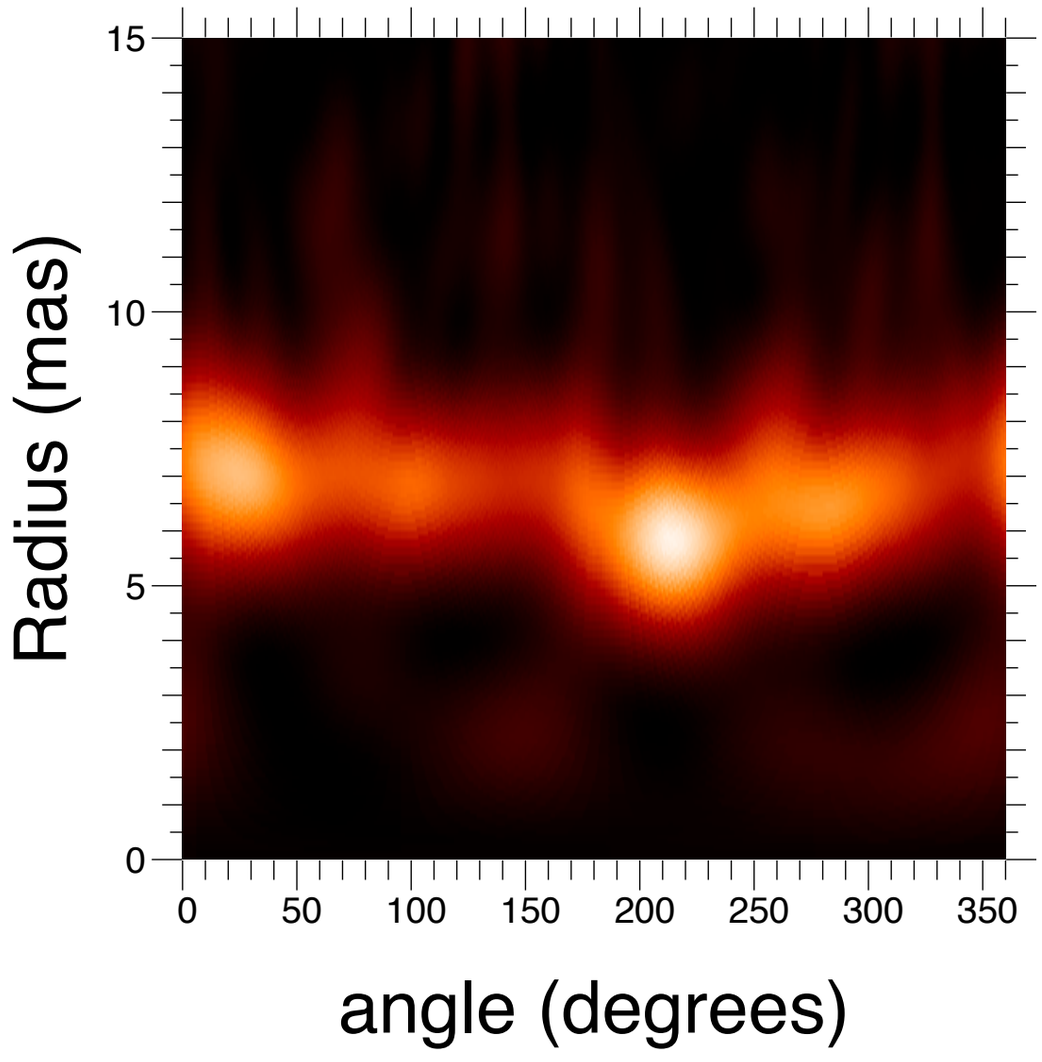

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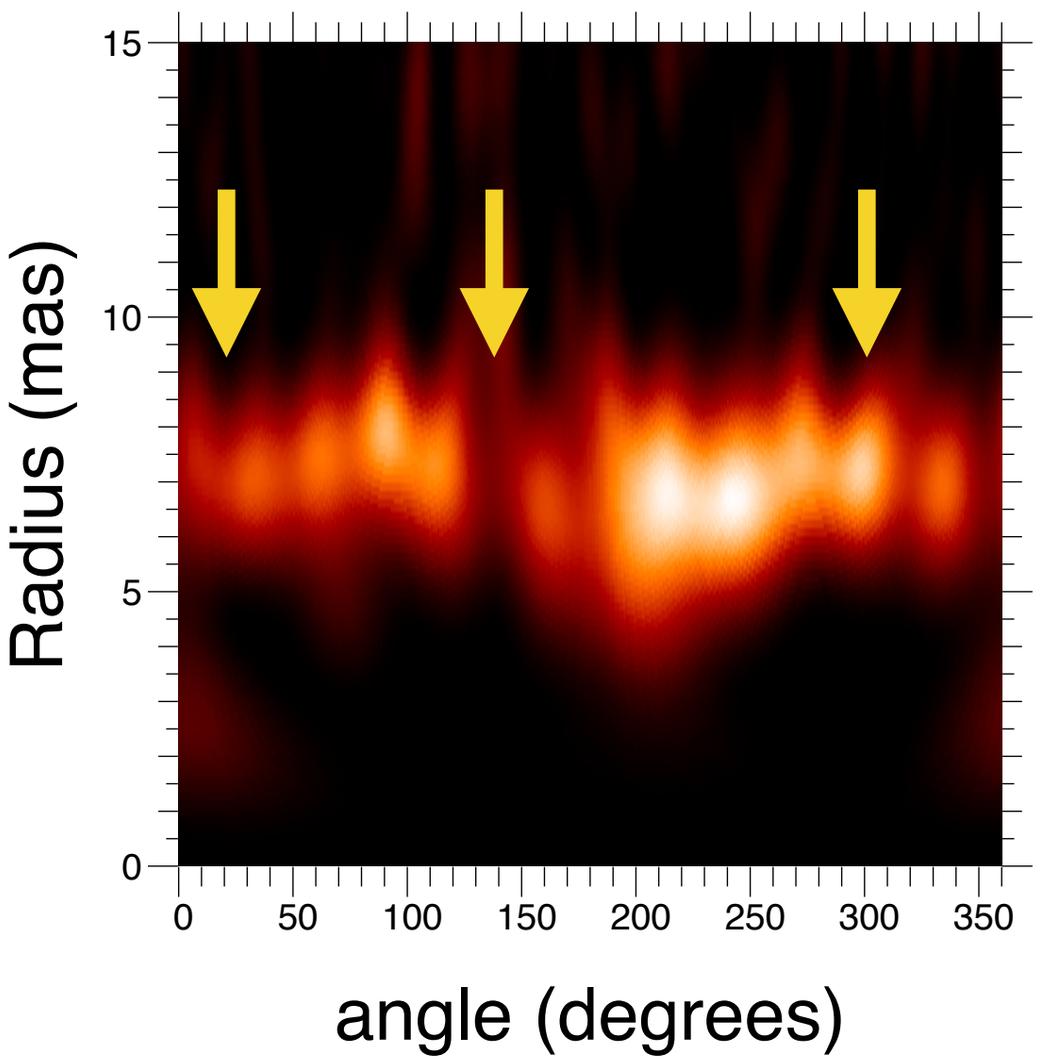

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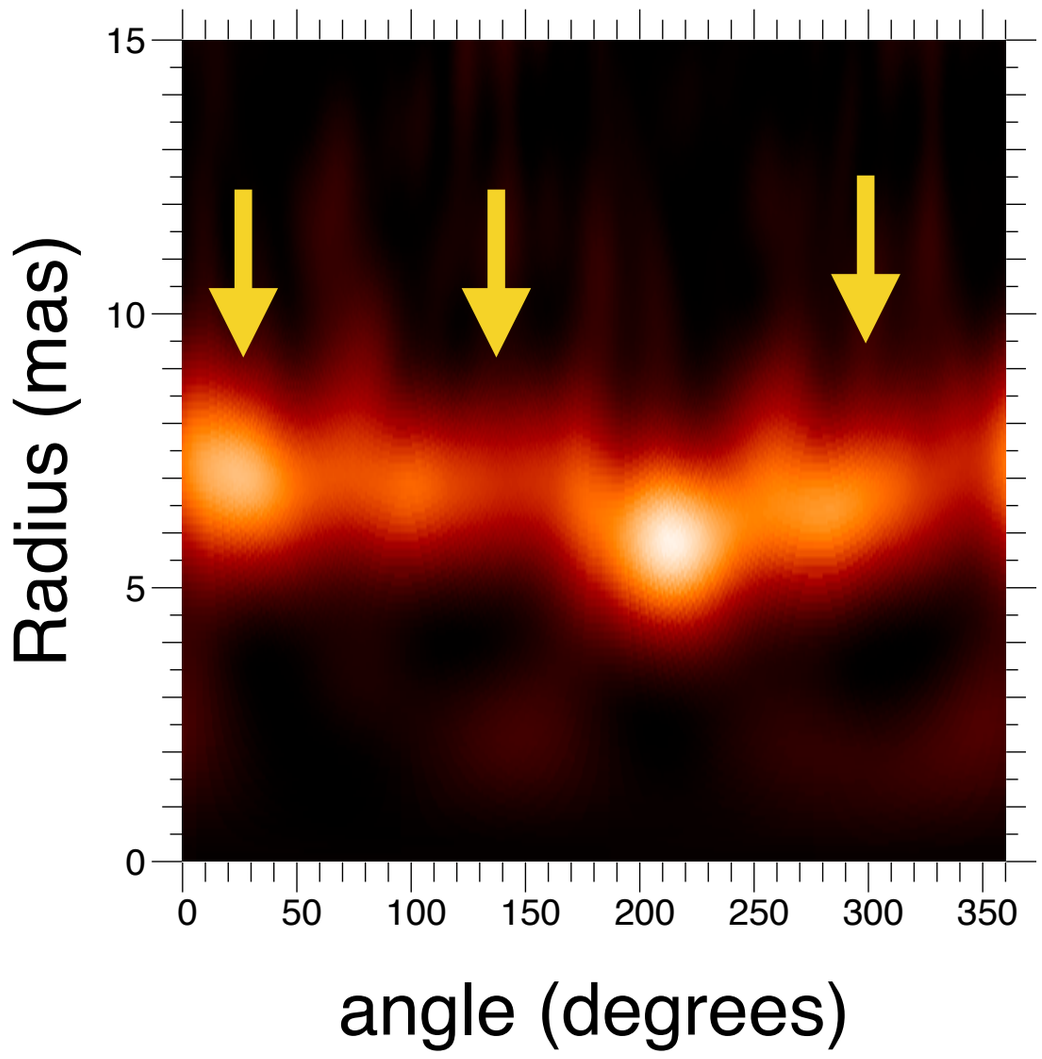
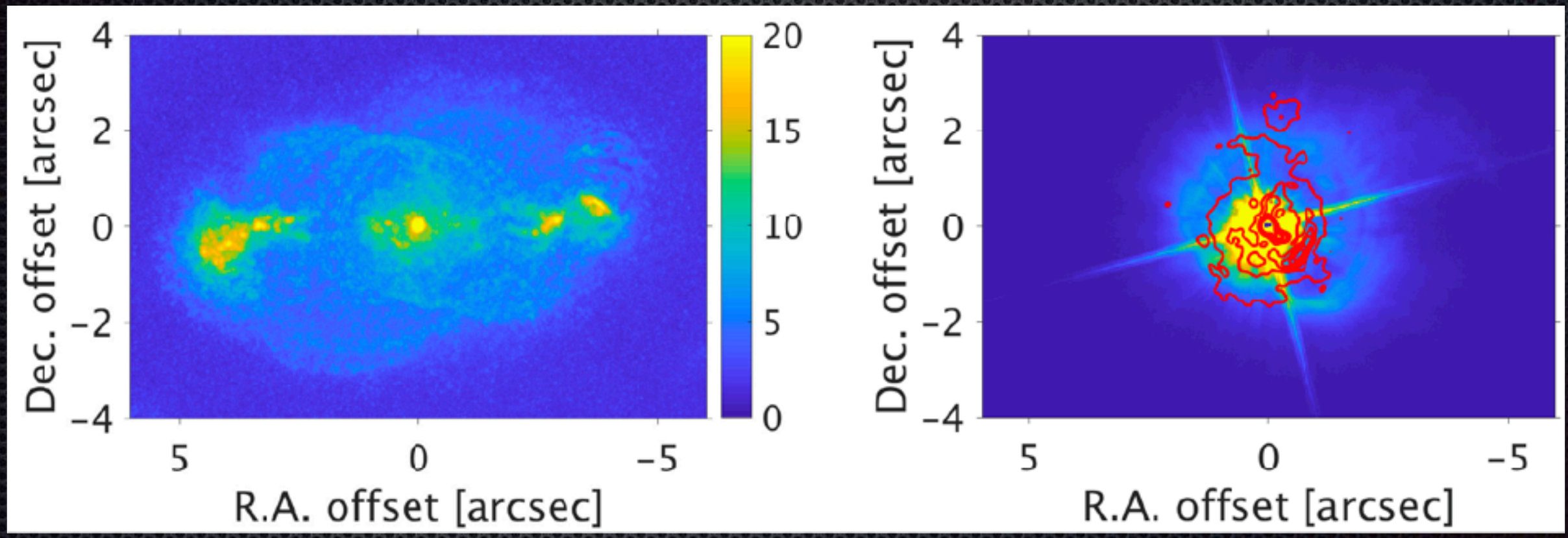


Another image of a pAGB binary: HD101584

CO(2-1)

Continuum (HST / 1.3mm)



Olofsson et al. 2019

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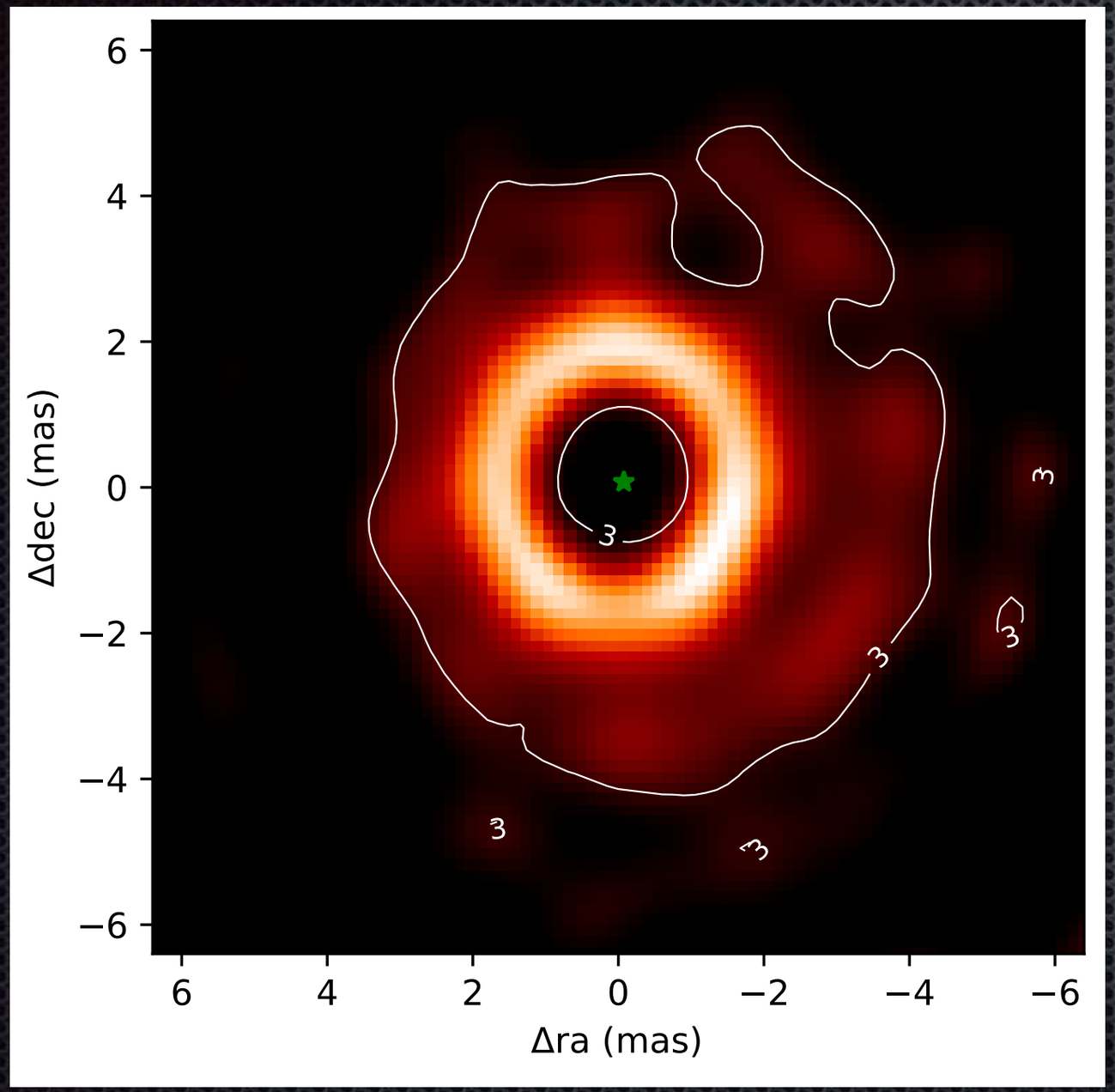

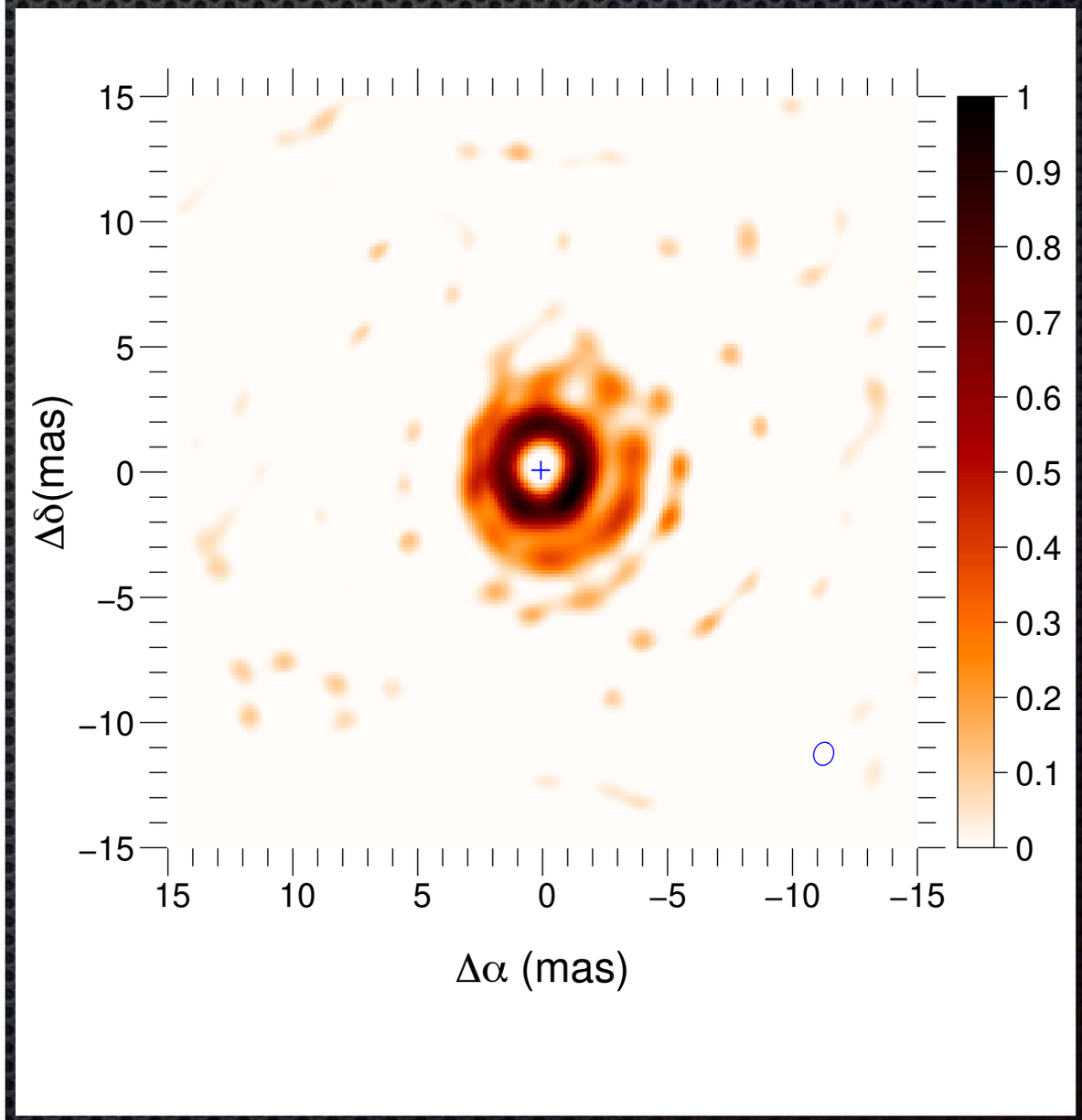

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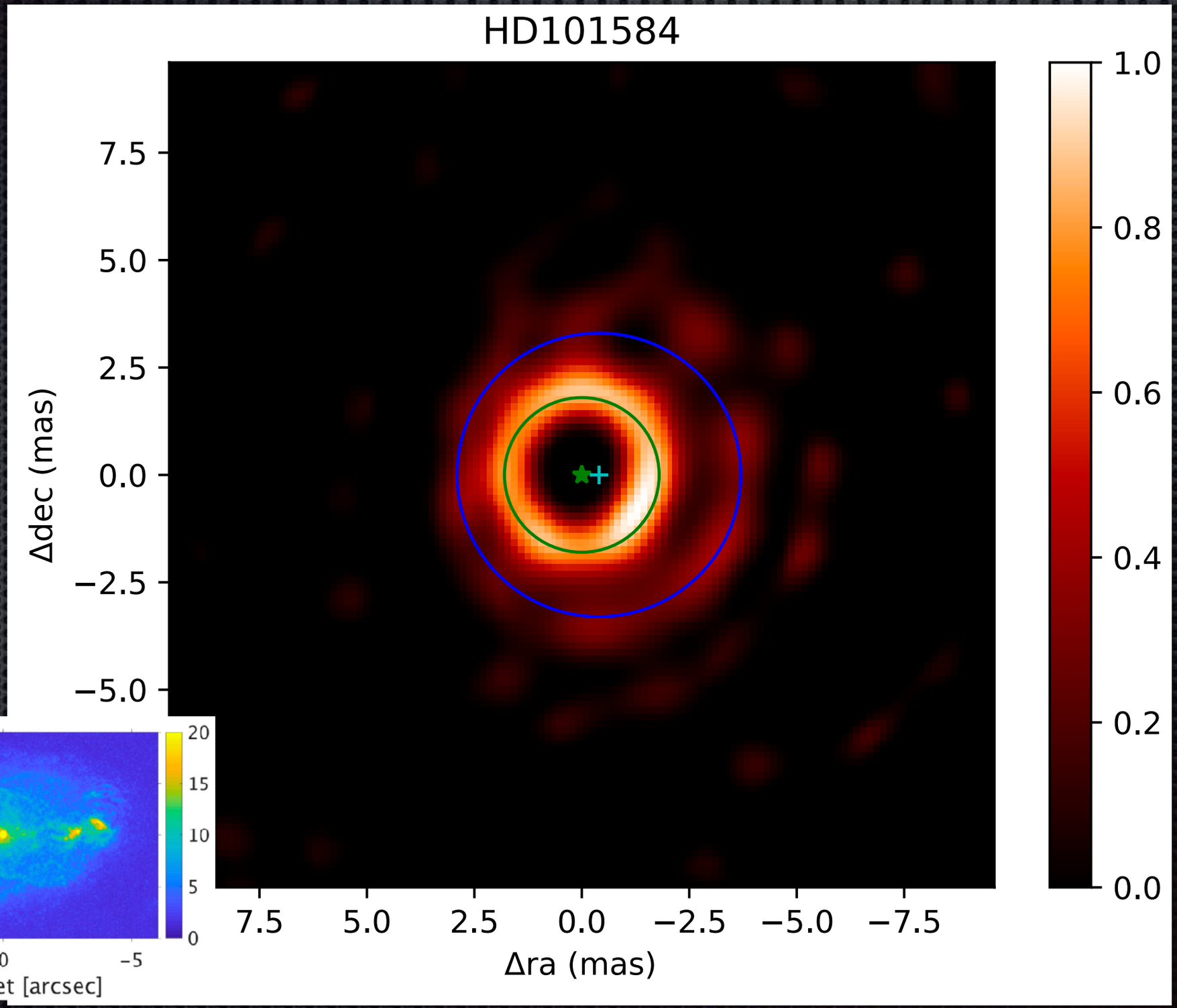

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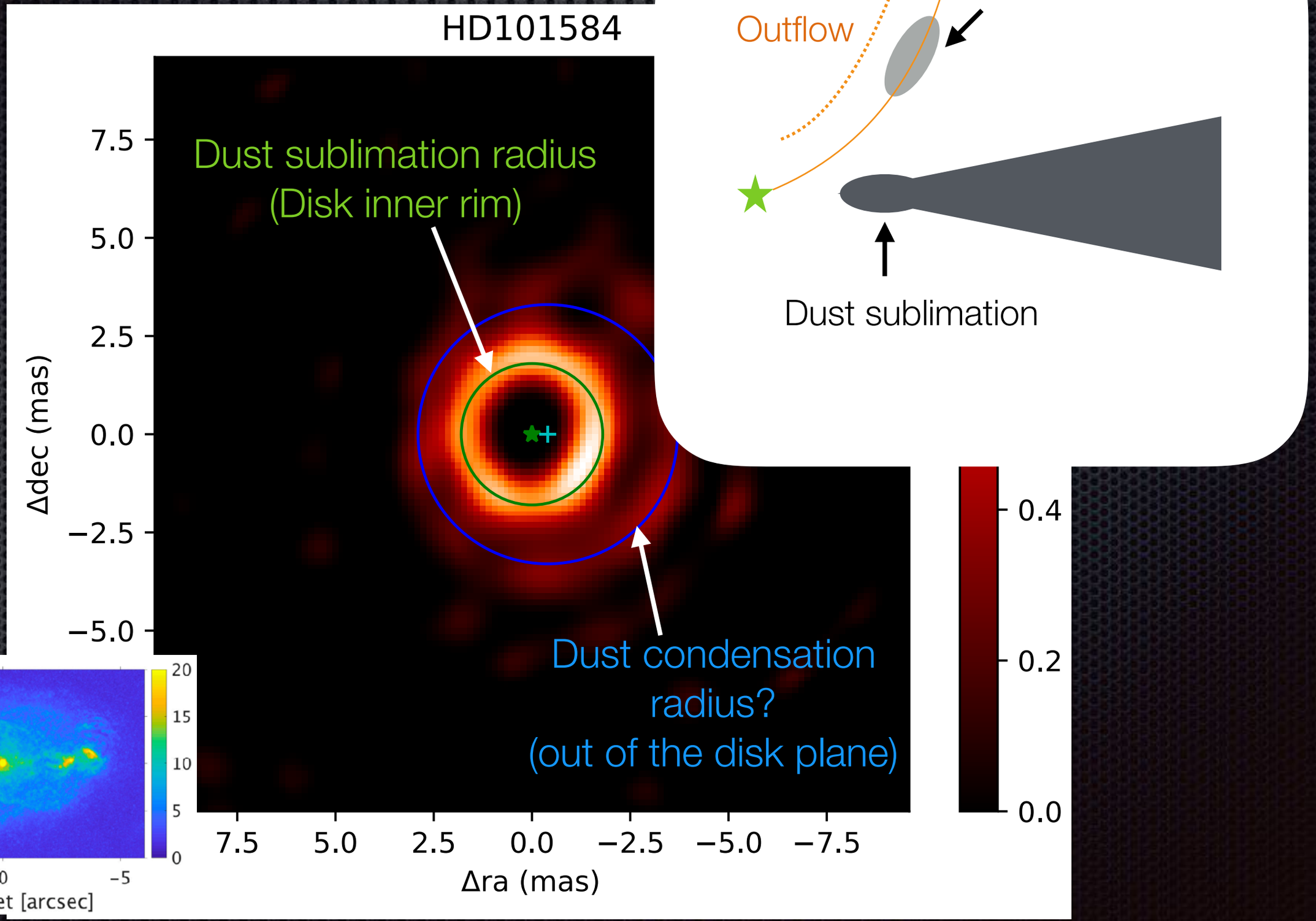


Another image of a pAGB binary: HD101584

HD101584

Dust sublimation radius
(Disk inner rim)

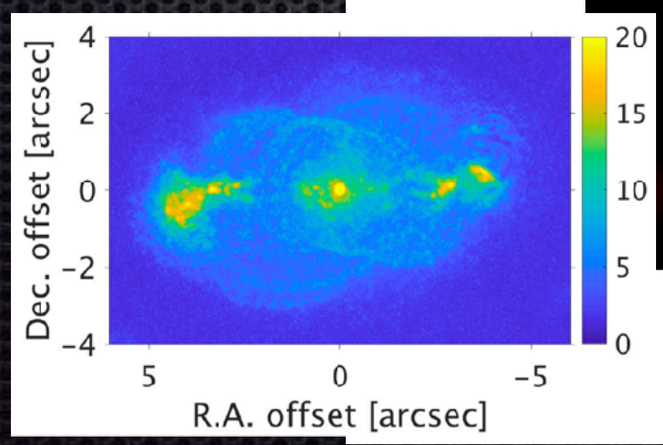
Dust condensation
radius?
(out of the disk plane)

Δdec (mas)

Δra (mas)

7.5 5.0 2.5 0.0 −2.5 −5.0 −7.5

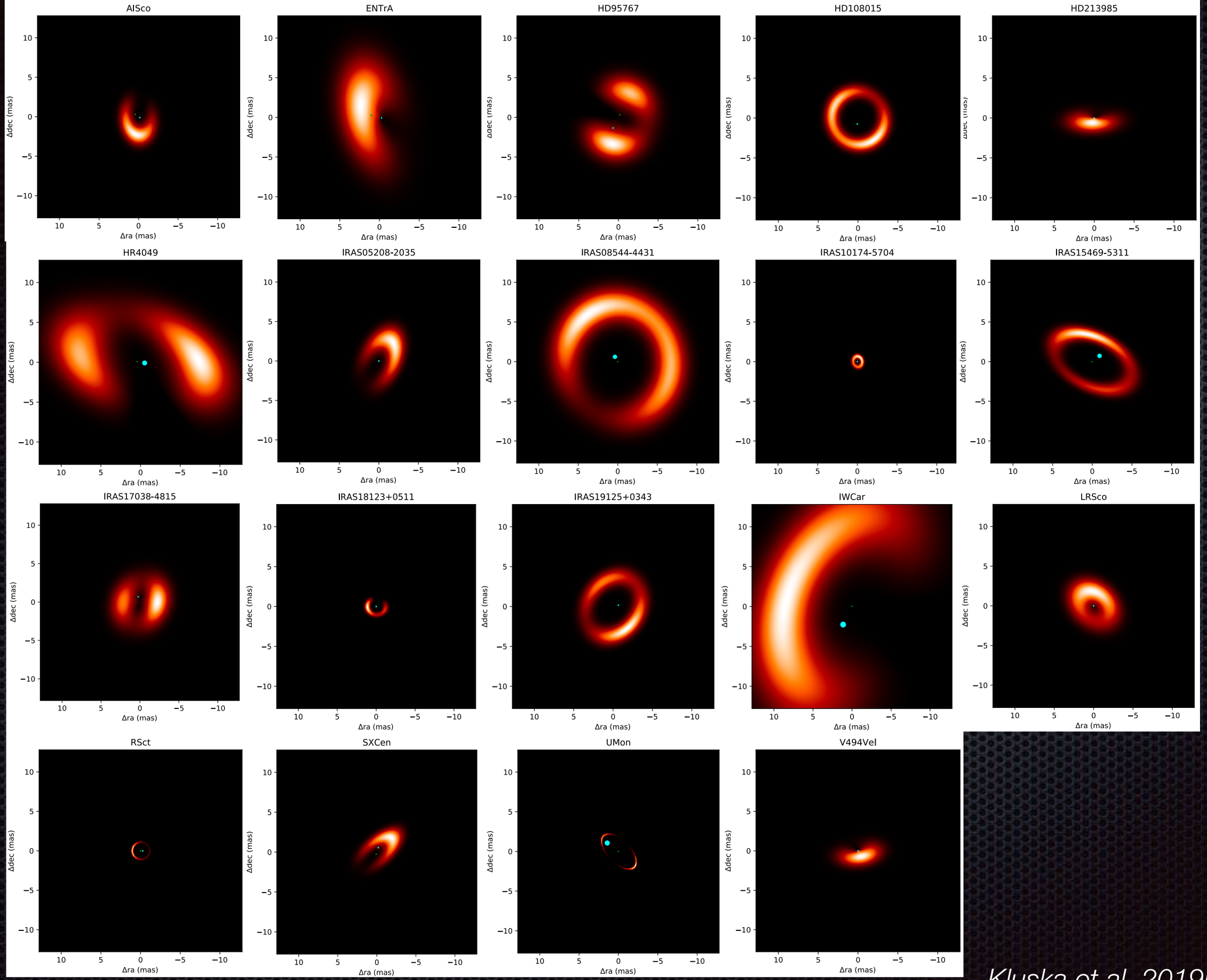
0.6 0.4 0.2 0.0



VLTI/PIONIER snapshot survey

- Goals: Focusing on the dust disk
  - Morphology (radii, azimuthal brightness distributions)
  - Temperatures
  - Deduce some interesting properties (e.g. mineralogy, density)

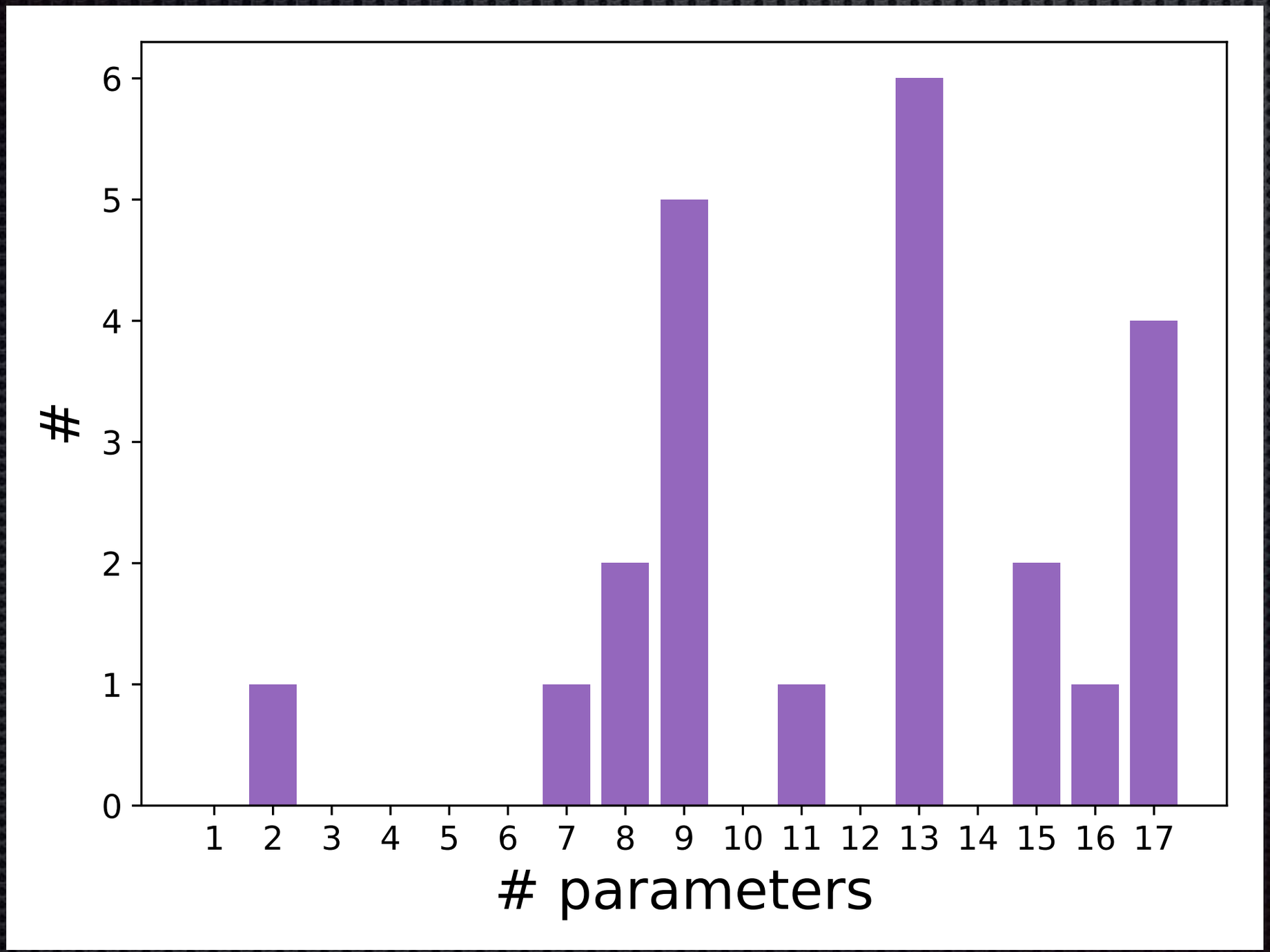
- 23 targets
- Near-infrared (H-band) with VLTI/PIONIER



Kluska et al. 2019b, soumis

VLTI/PIONIER snapshot survey

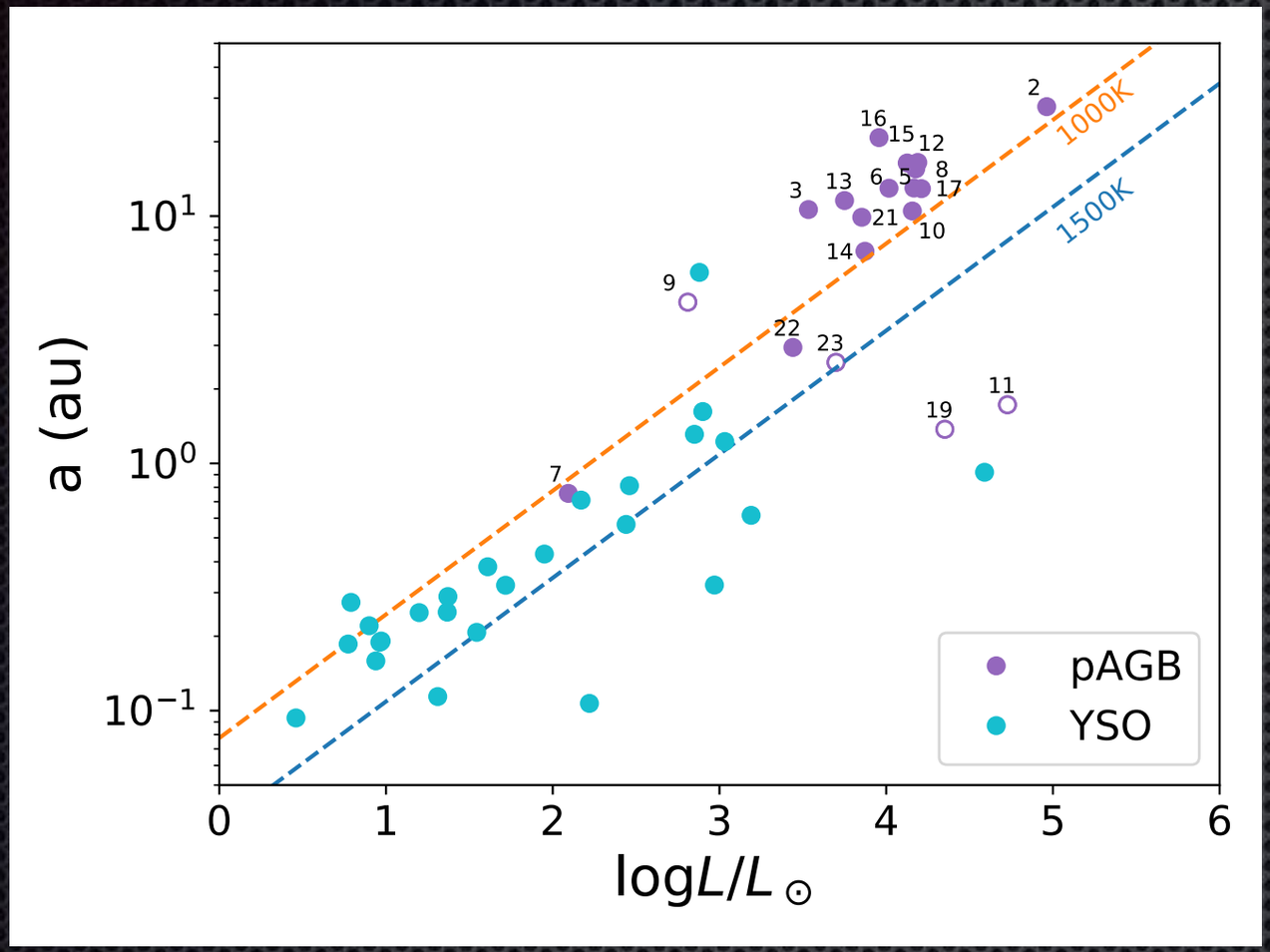
- Results: object complexity

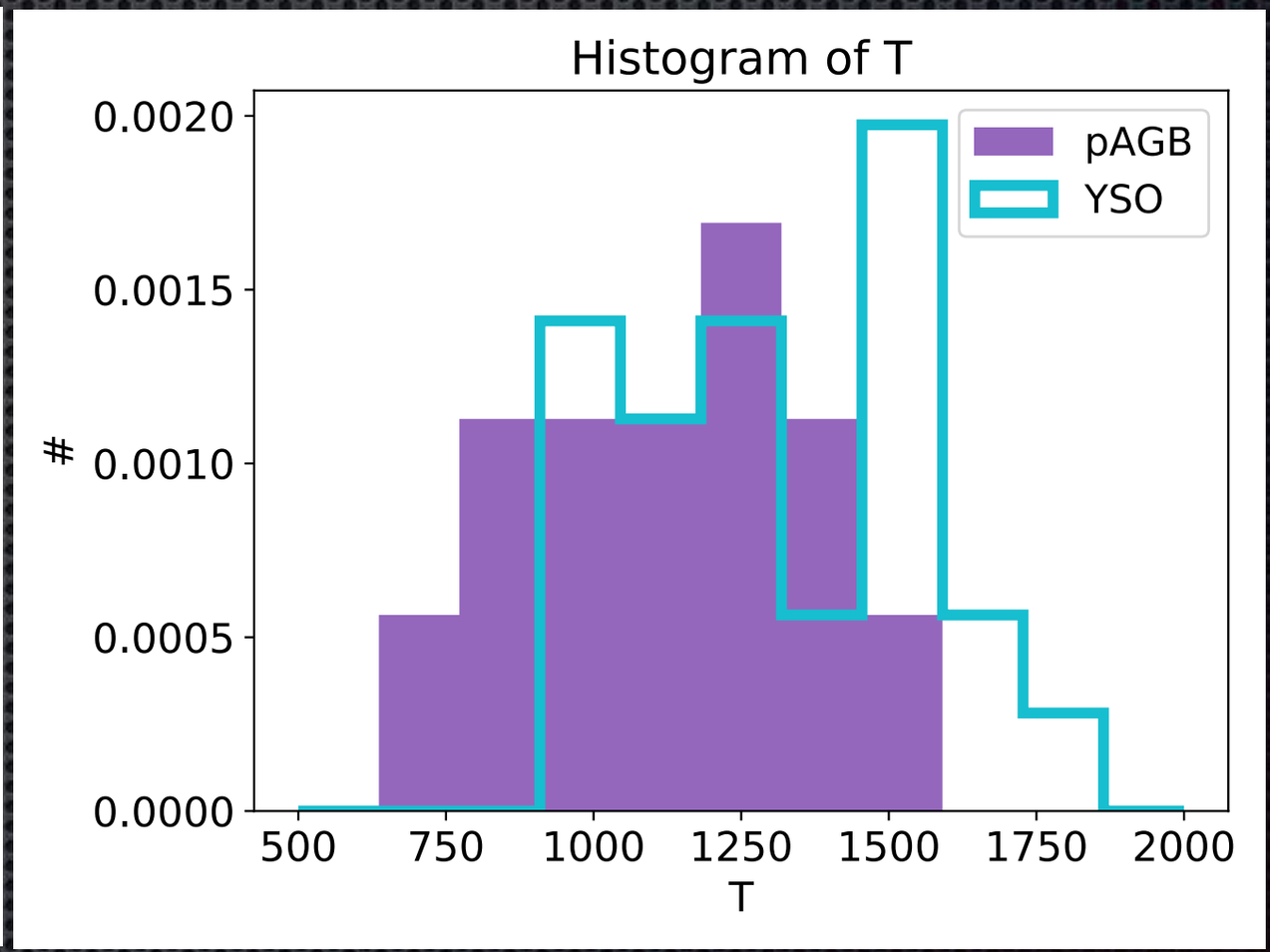


Kluska et al. 2019b, soumis

VLTI/PIONIER snapshot survey

- Results: Different mineralogy?





Kluska et al. 2019b, soumis

Conclusions

- First VLTI images —> Complexity of these systems
- Snapshot survey
  - Inner rim ruled by dust sublimation physics
  - Different dust mineralogy (w.r.t. PPDs)

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- First VLTI images —> Complexity of these systems
- Snapshot survey
  - Inner rim ruled by dust sublimation physics
  - Different dust mineralogy (w.r.t. PPDs)

- Constraining the disks structure behind the dust sublimation
  - Origin of the over-resolved flux (disk? wind?)
    - SPHERE
  - Disk structure and comparison with PPDs
    - VLTI/MATISSE
    - ALMA
- VLTI Imaging survey

INterferometric **S**urvey of **P**ost-AGB binaries **I**nteraction with their **RING**

- PIONIER + GRAVITY Large Programme
  - Continuum at 1.65μm —> Imaging
  - Lines at 2.2μm (Brγ, CO) —> Line detection/location
- 11 targets - 250h
- *Morphology*
- *Secondary detection*
- *Accretion*

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A PhD position will be opened soon,
if interested please contact me!
Application deadline: 1st of June 2019