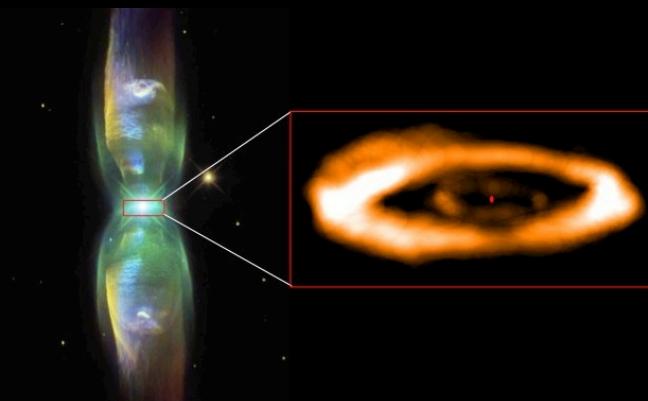
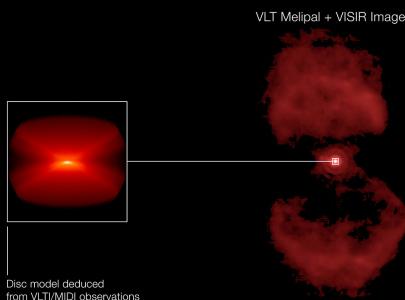


Olivier Chesneau's Work on low mass stars

Eric Lagadec

(Observatoire de la Côte d'Azur)



Olivier's path to the stars



Olivier's path to the stars

- Master's in Strasbourg with A. Acker (1996). Study of central star's of PNe with WR central stars

Olivier's path to the stars



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Olivier's path to the stars

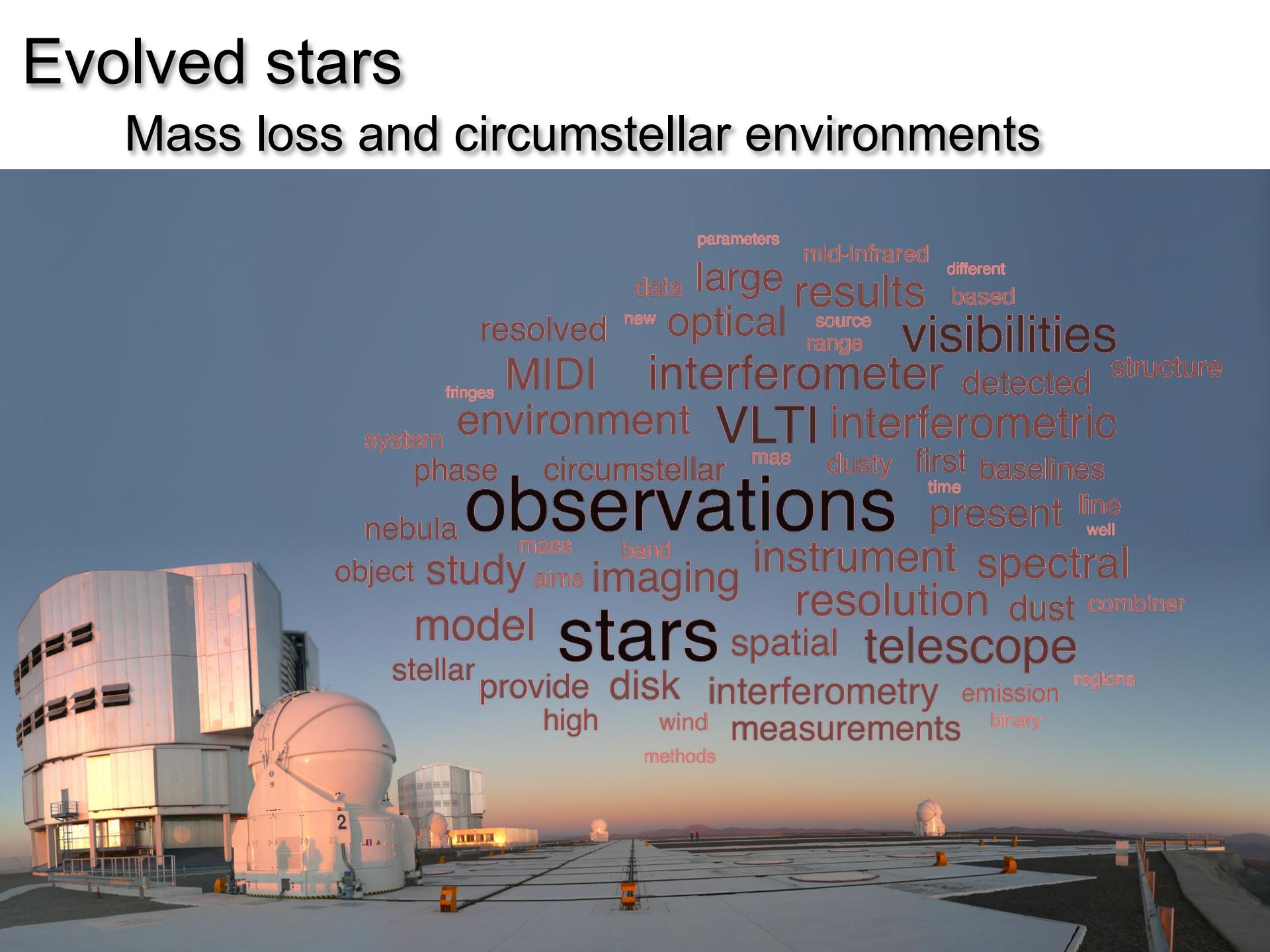
- Master's in Strasbourg with A. Acker (1996). Study of central star's of PNe with WR central stars
- PhD: Montreal (T. Moffat)/Nice (F. Vakili)/Strasbourg (A.Acker): Polarimetry and interferometry of hot stars
- Post-Doc: Heidelberg (C. Leinert): MIDI/VLTI
- Tenured job at Observatoire de la Cote d'Azur in 2003

Olivier's path to the stars



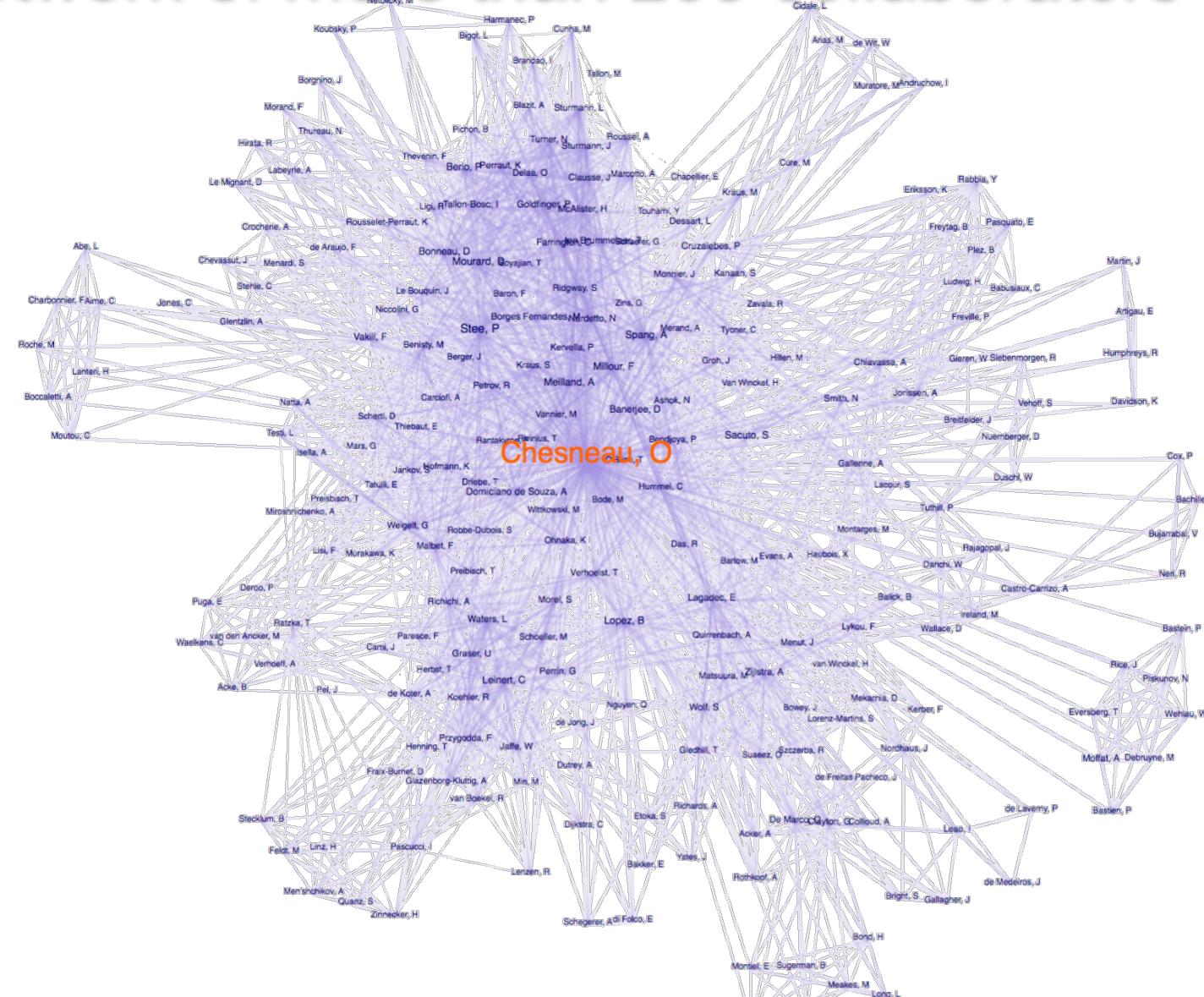
Evolved stars

Mass loss and circumstellar environments



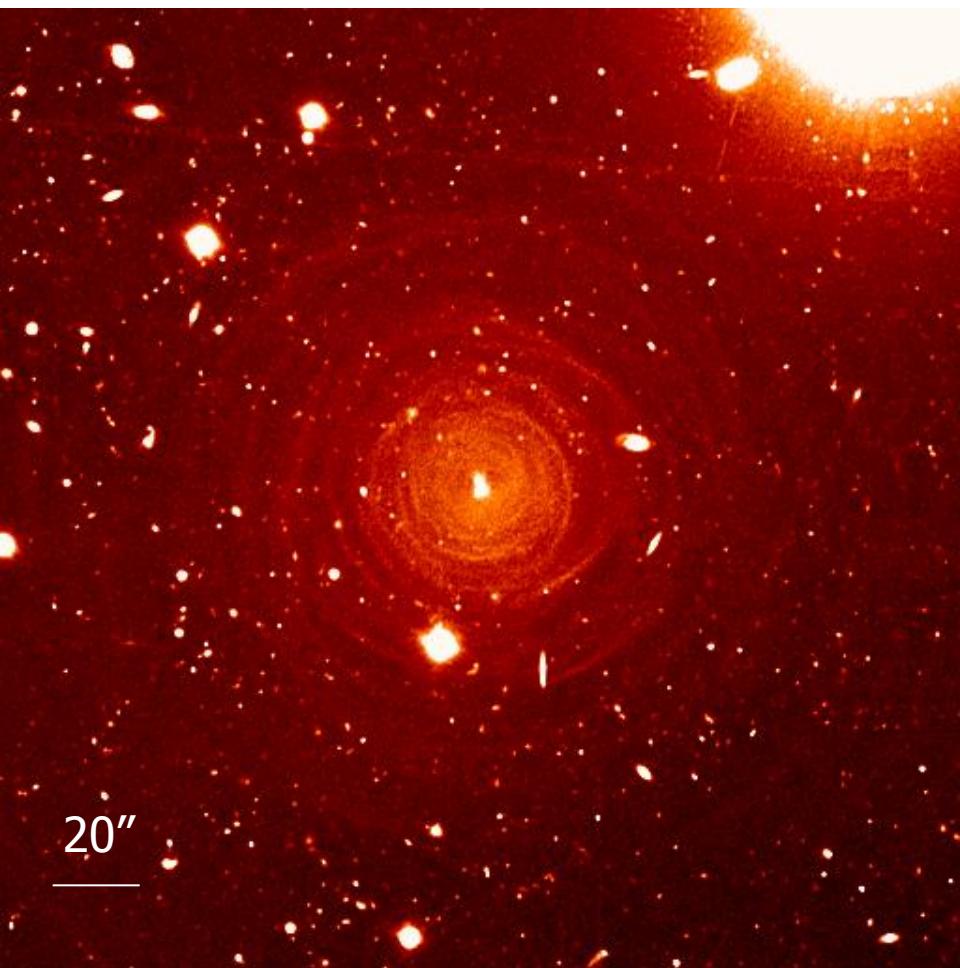
parameters
mid-infrared
data large results different
resolved new optical source based
fringes system range visibilities
MIDI interferometer detected structure
environment VLT| interferometric
phase circumstellar mas dusty first baselines
nebula object Study aims imaging instrument spectral
mass band resolution dust combiner
model stars spatial telescope
stellar provide disk interferometry emission regions
high wind measurements binary
methods

A network of more than 200 collaborators

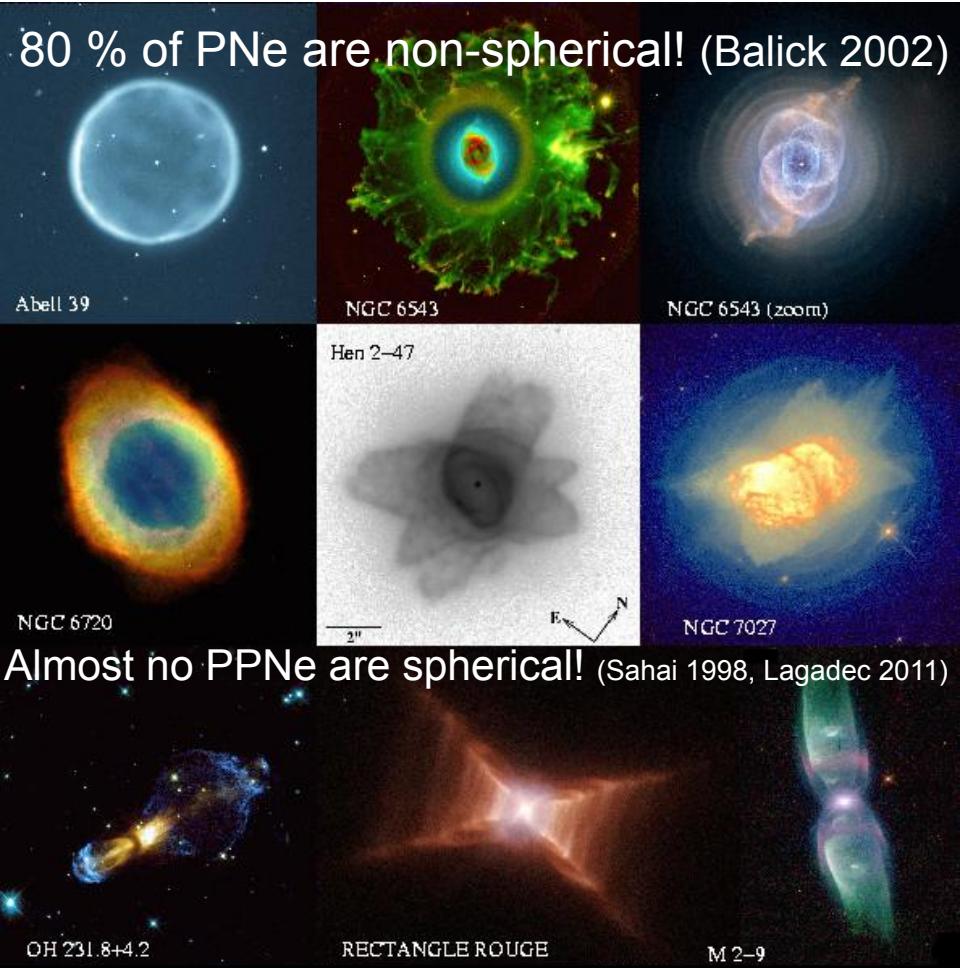


France, Germany, Nederlands, Belgium, Switzerland, Italy, Czech Republic, UK, Spain, Canada, USA, Chile, Brasil, Argentina, South Africa, India, Australia ...

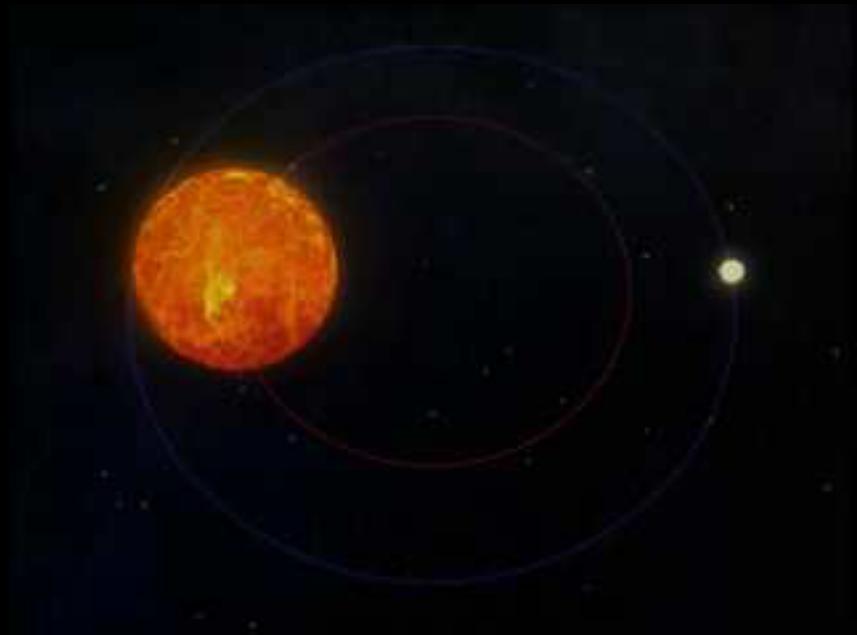
Morphologies of AGB and post-AGB envelopes



AGB star

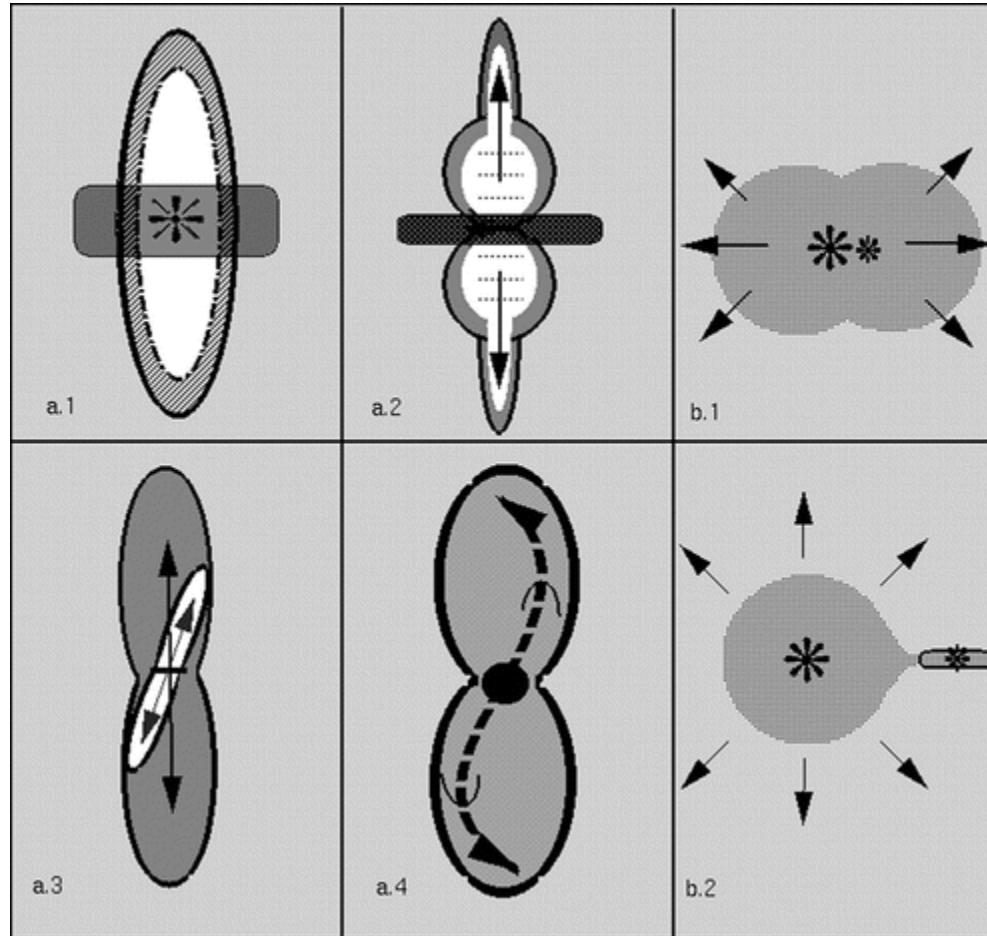


Shaping of the envelopes by a binary companion?



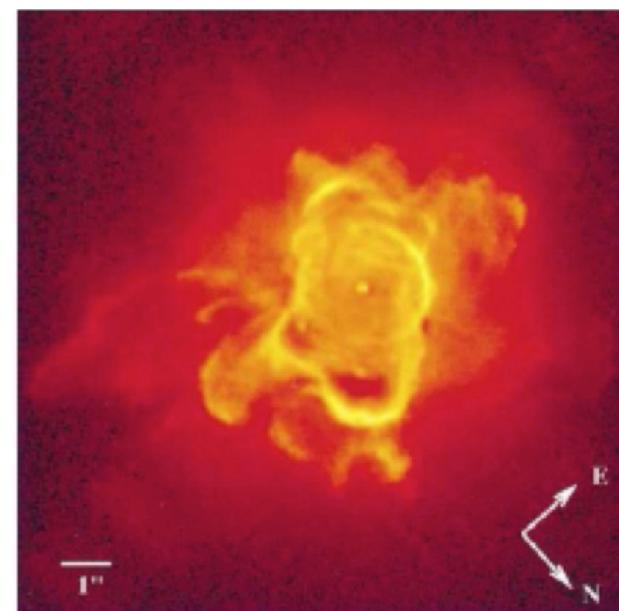
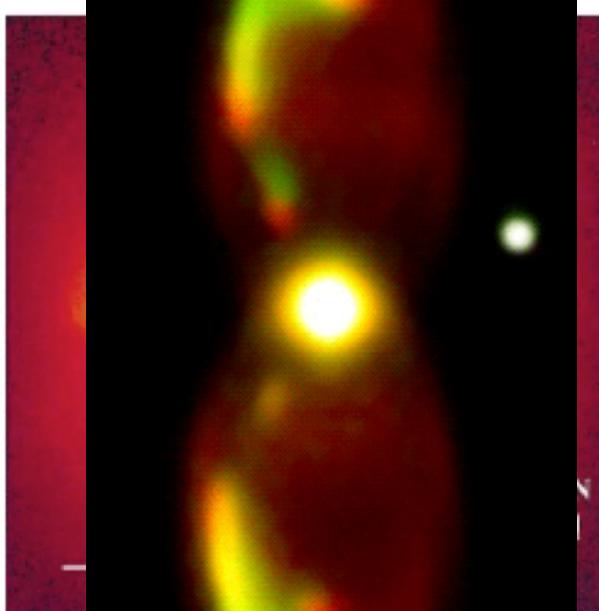
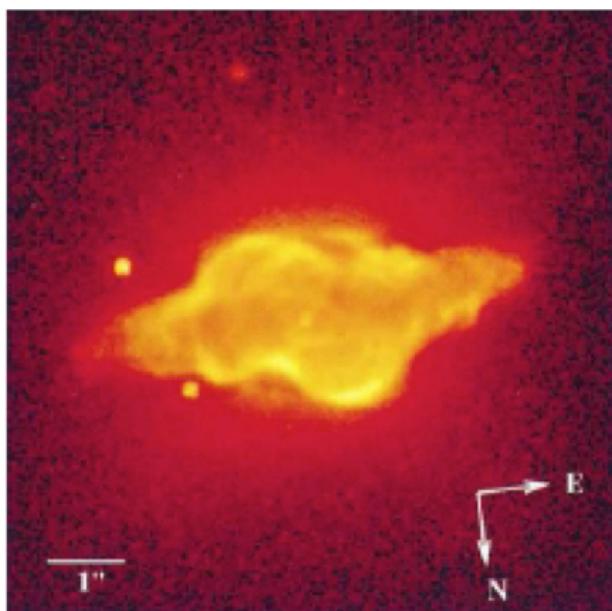
Credit: StScI

Need for equatorial overdensities



PNe shaping models (Balick & Frank 2002)

Multipolar precession?

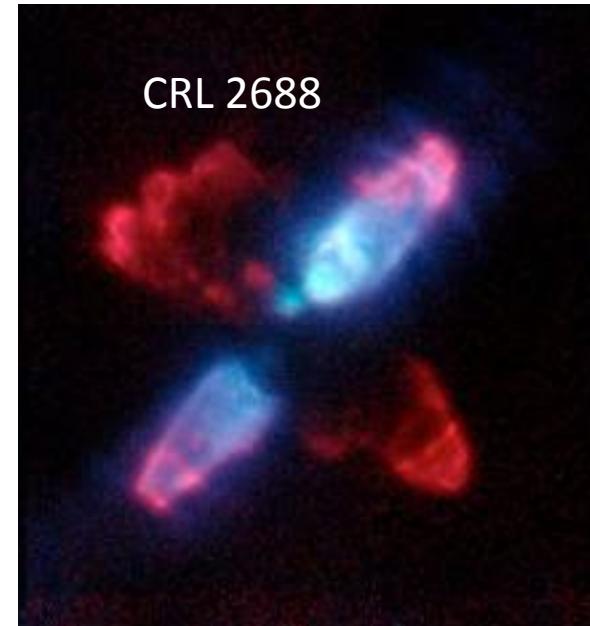
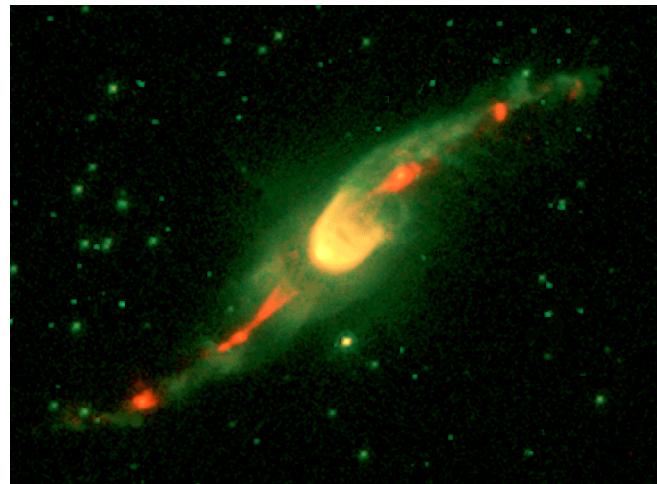
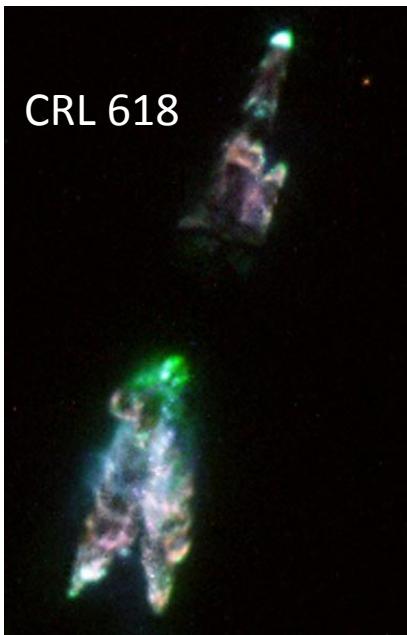


- Sahai & Trauger
enough, need
- Disc is not
symmetric

1989

Corradi 2007

Outflow/jets momentum



- Bujarrabal et al. 2001: 28/32 Post-AGB stars (PPNe) showing CO emission, have outflow momenta in excess to what radiation can provide.

Formation of a bipolar/multipolar PN

- Long debate binary vs magnetic field



Binaries



Binaries

Debate settled during a football game in La Palma (APN4, 2007)

Formation of a bipolar/multipolar PN

- Long debate binary vs magnetic field
- Soker (2005): *a single star can not supply enough energy and angular momentum to shape those nebulae*
- Nordhaus et al . (2006): *magnetic fields can play an important role but isolated stars can not sustain a magnetic field for long enough*

Direct detection of binaries

- High angular resolution techniques (AO, interferometry, lucky imaging...)
- Olivier was hoping to directly image binaries with AO or interferometry

Problems:

- AO: limited angular resolution
- Interferometry: limited sensitivity and baselines

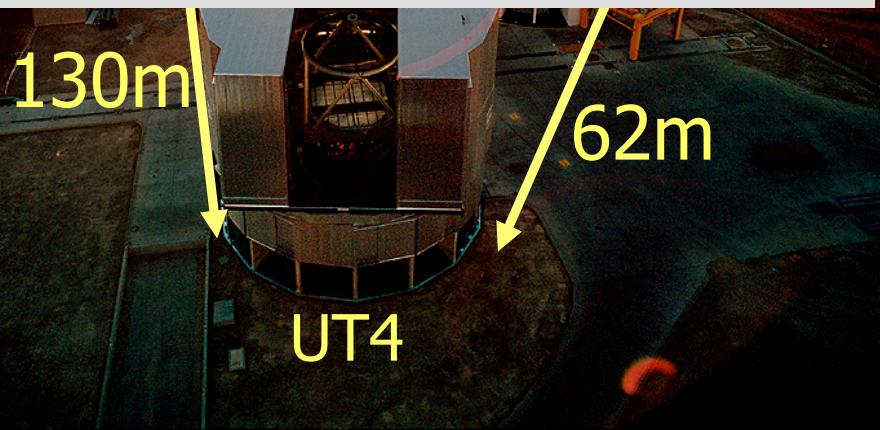
Olivier's “toys”

• NACO/VLT

- near-IR Adaptive Optics imaging, spatial resolution 60 mas
- Burst mode: images of 10-50ms

• VISIR/VLT

- mid-IR imaging, spatial resolution 250 mas
- Burst mode: images of 5-50ms



VLT at Paranal

ESO PR Photo 43a/99 (8 December 1999)



The Four Auxiliary Telescopes at Paranal

photo 51c/06 (22 December 2006)

© ESO



• MIDI/VLTI

- Direct recombination N (8-13mm), $R=30,230$, spatial resolution 10 mas (10 AU/1kpc)
- Sensitivity lim: $N < 4$ (UTs)!

• AMBER/VLTI

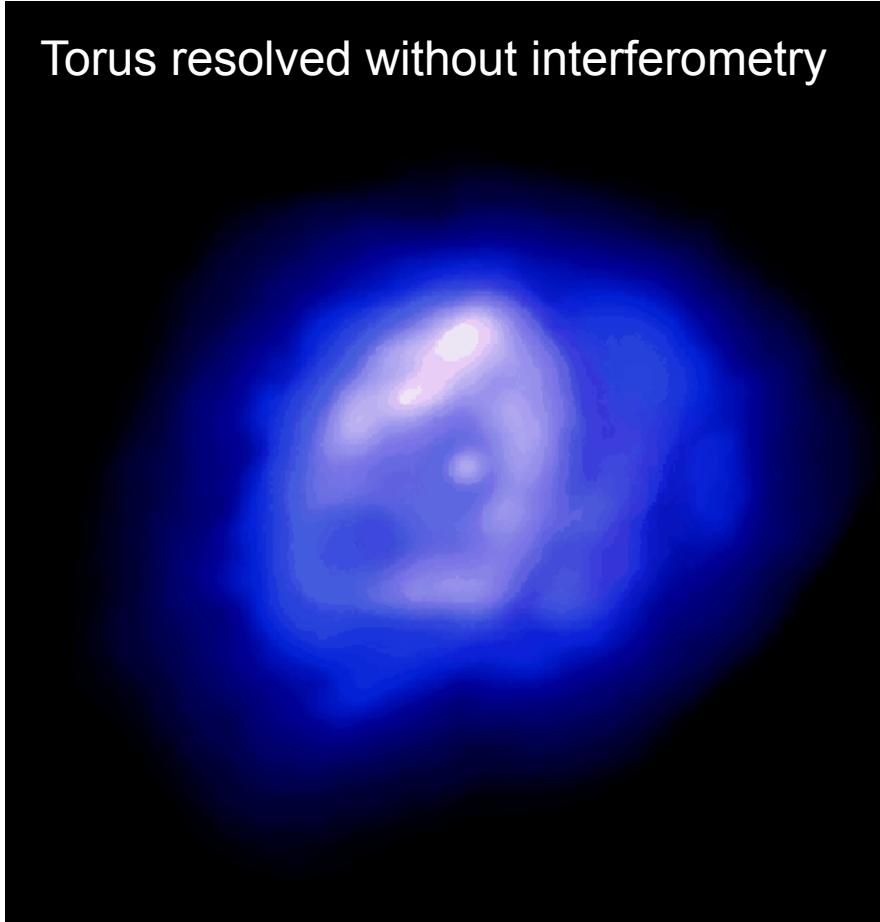
- near-IR recombiner (1-2.5mm), $R=35, 1500, 12000$, spatial resolution 2 mas (2 AU/1kpc)
- Sensitivity lim: $K < 7$ (UTs), $R=35$

© European Southern Observatory



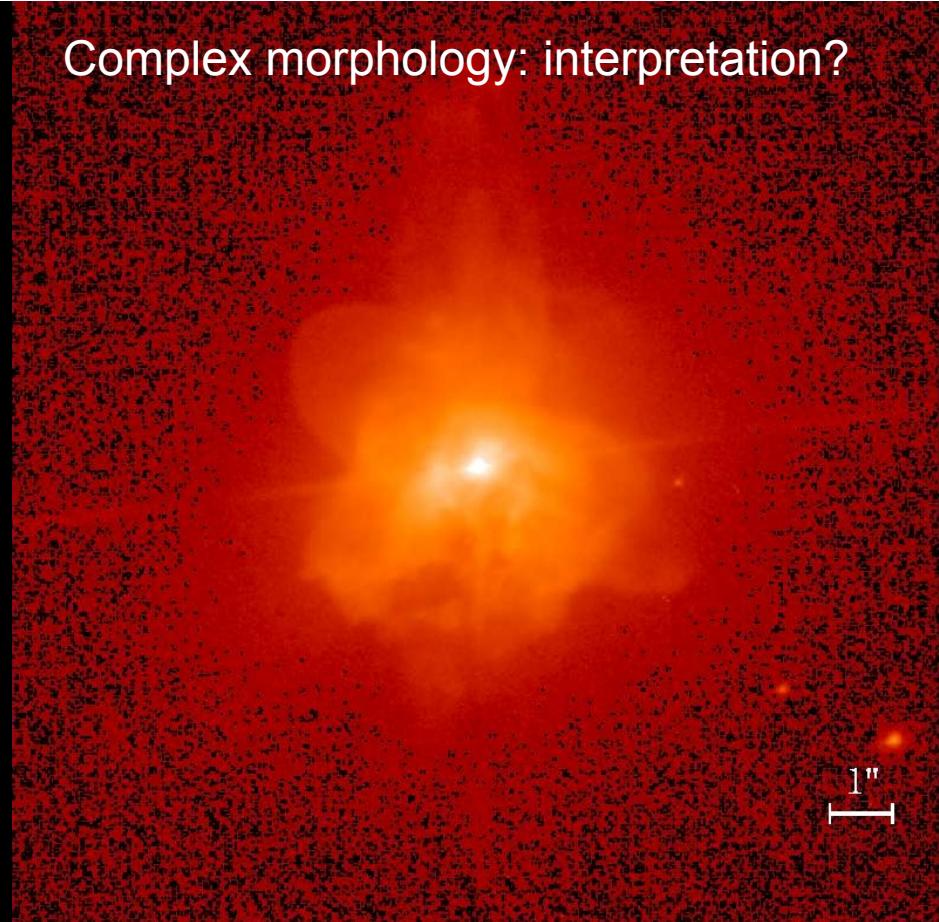
First search for disks with MIDI

Torus resolved without interferometry



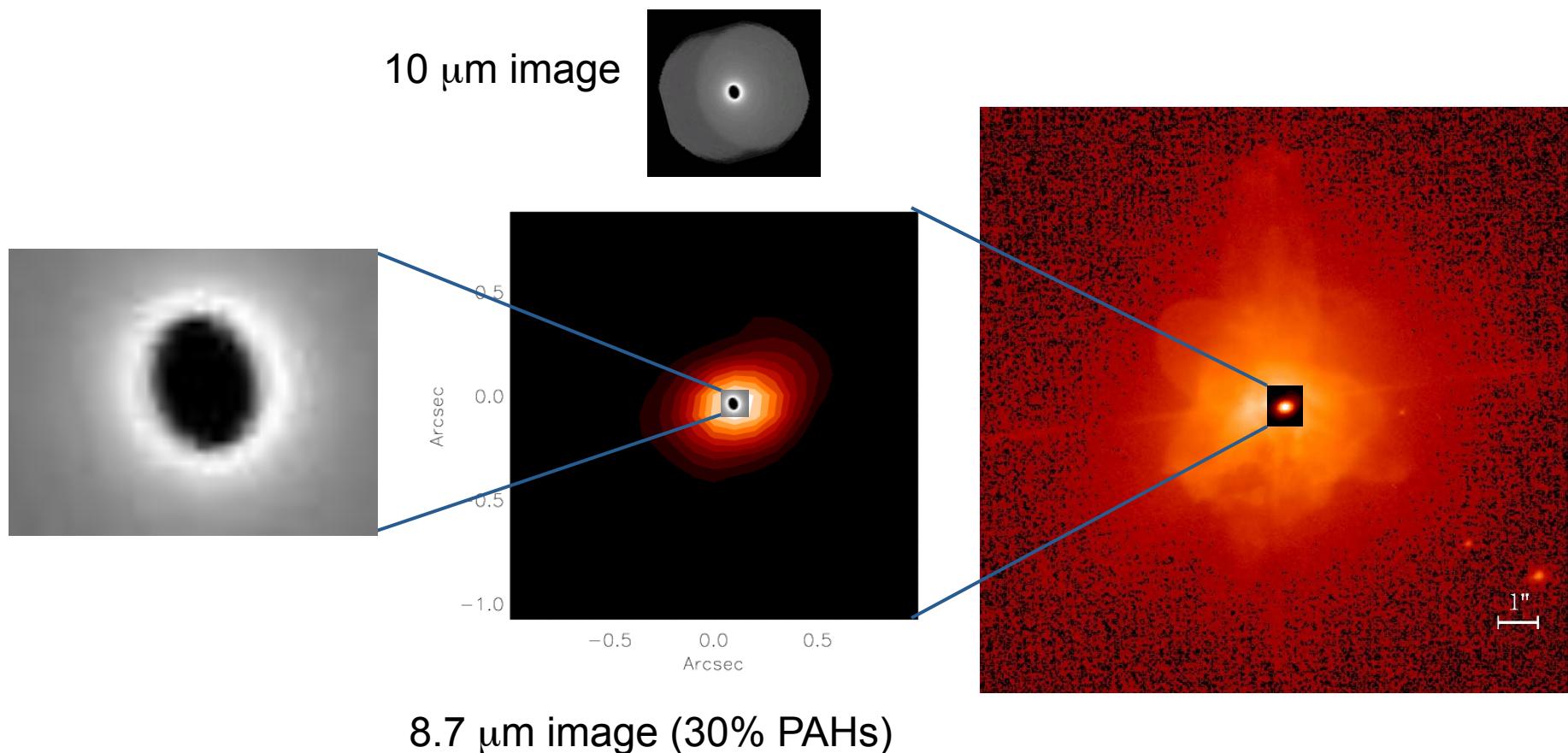
Lagadec et al., 2006 (VLT/IR)

Complex morphology: interpretation?

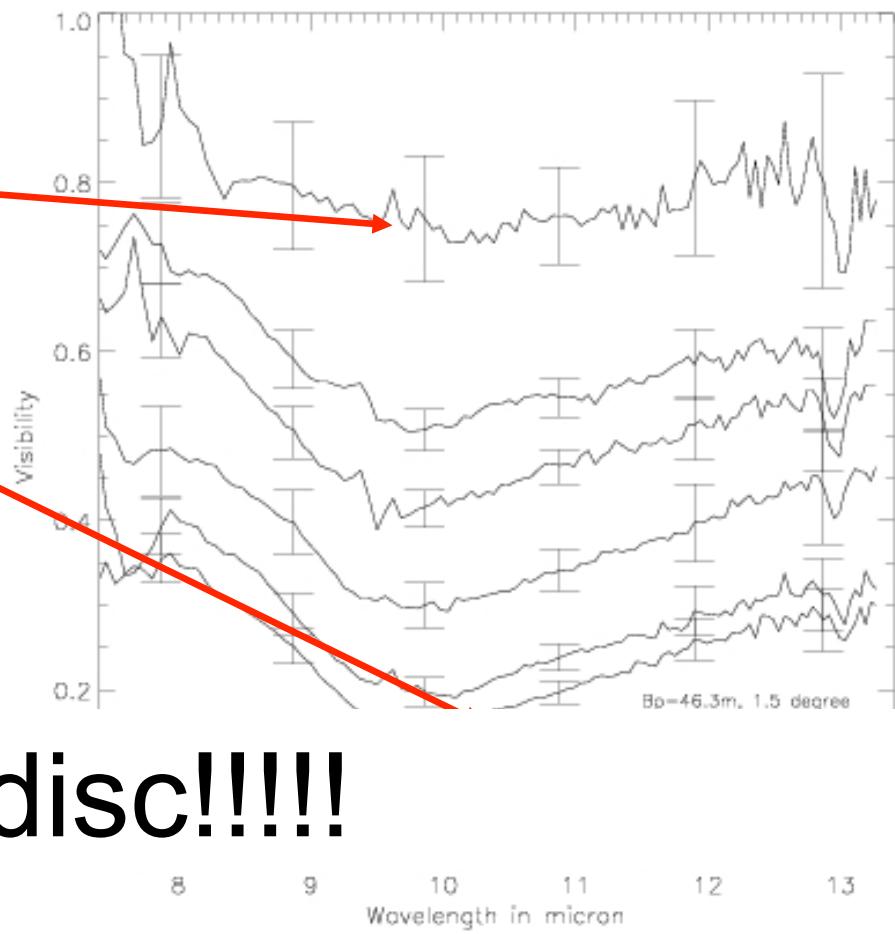
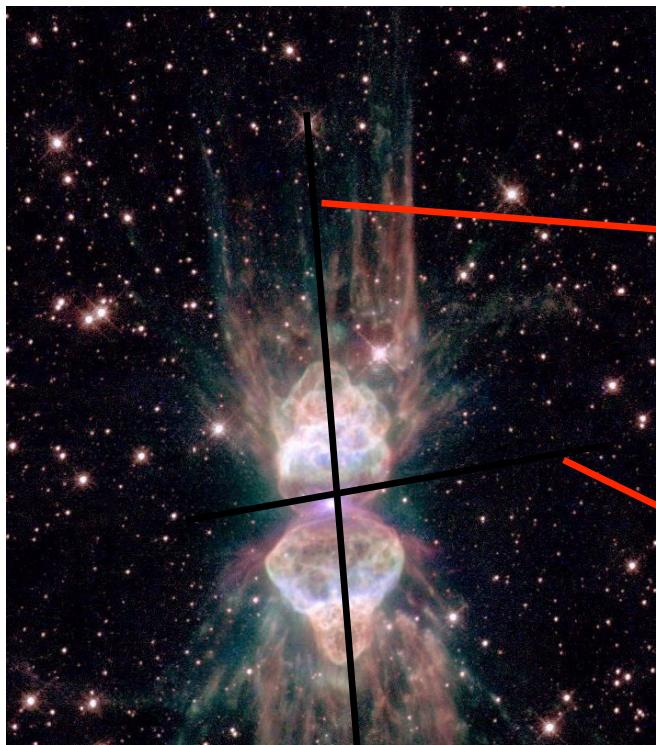


Chesneau et al., 2007 (HST/H_α)

High-Resolution view of CPD-568032



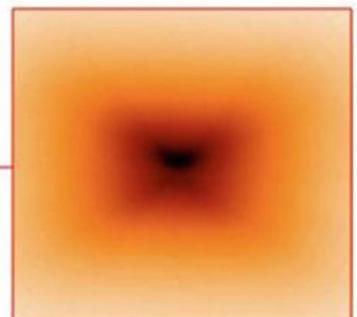
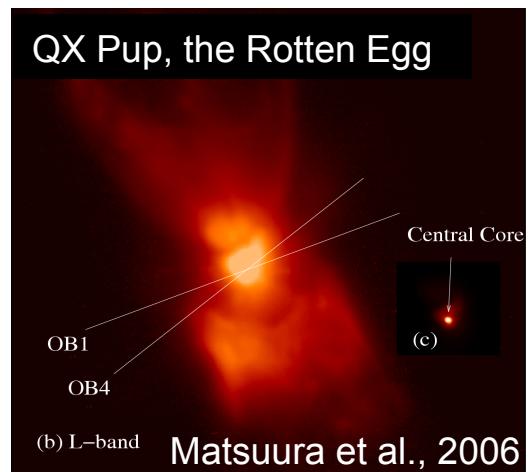
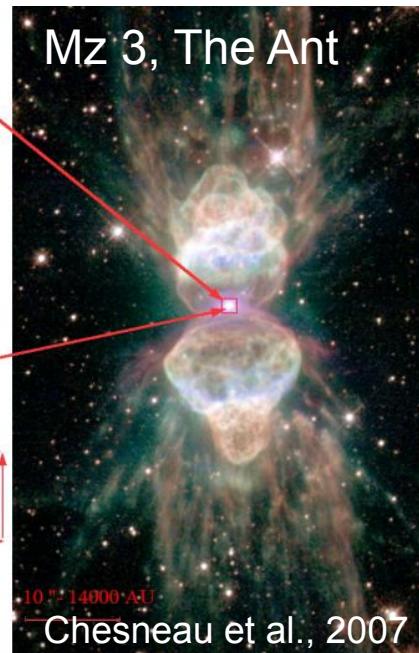
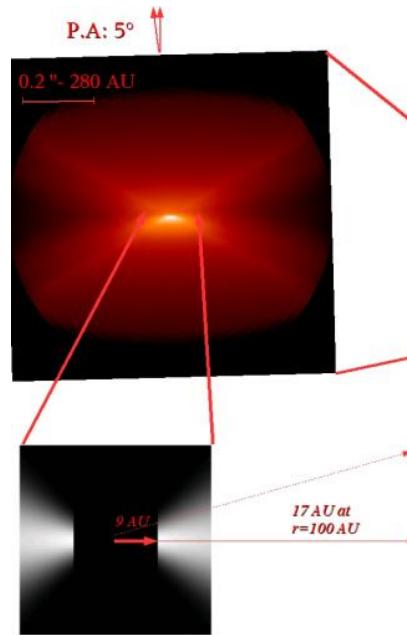
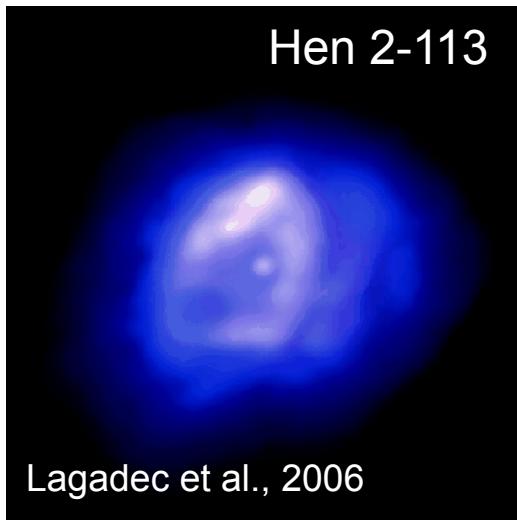
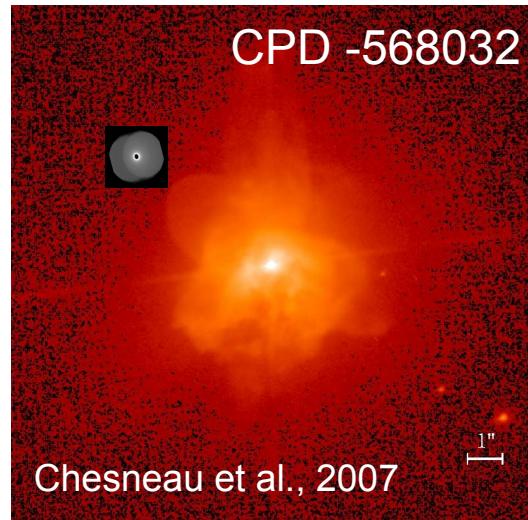
Detection of discs with MIDI



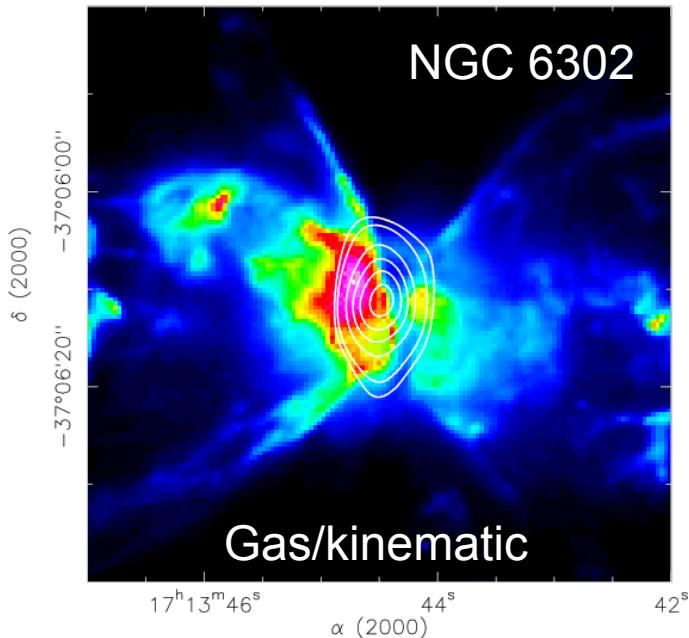
A disc!!!!

HST observations

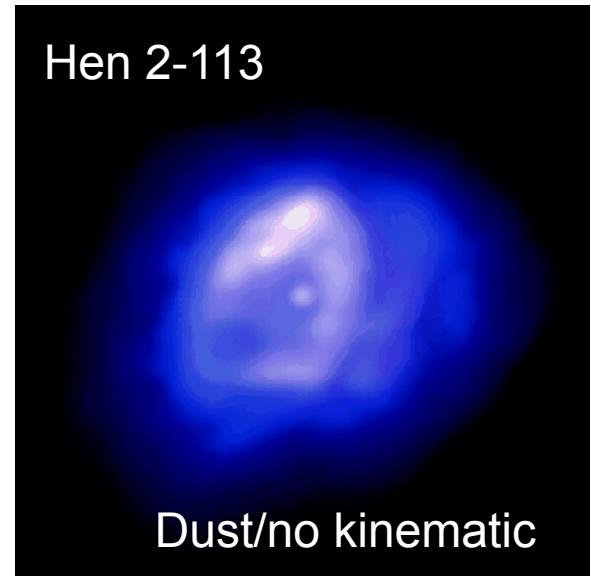
Olivier: the disc hunter with MIDI



Torii



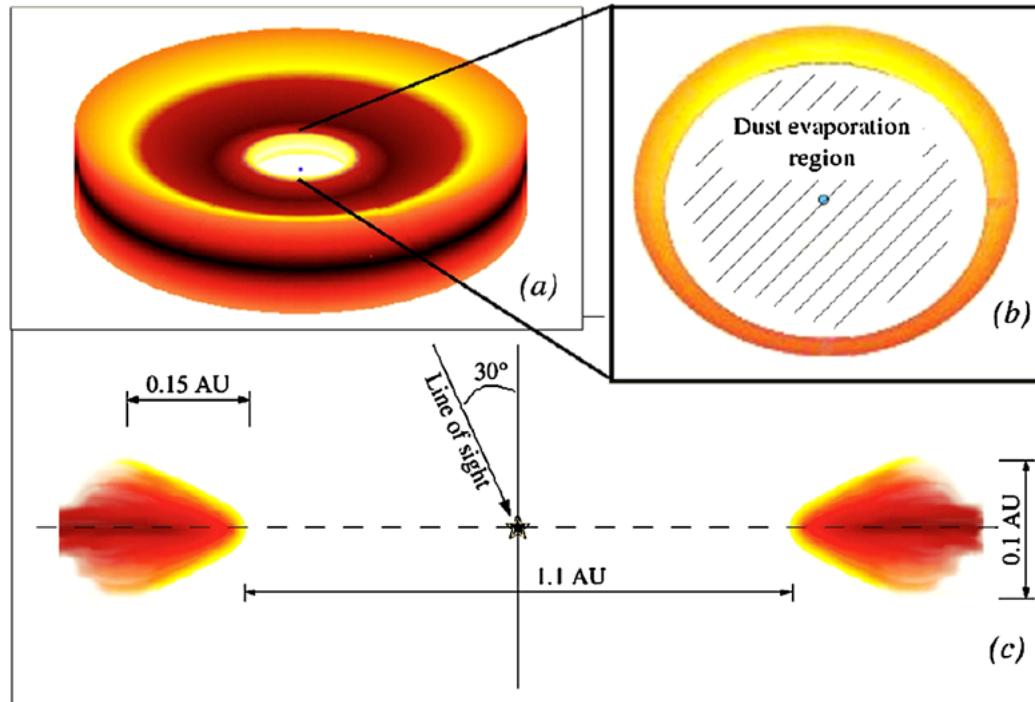
Peretto et al., 2007 (JCMT/mm)



Lagadec et al., 2006 (VLT/IR)

- Massive (1 solar mass for NGC 6302)
- Slow expansion, limited angular momentum
- If gas supply ceases: structure slowly vanishes

Stratified disks



Isella et al., 2006 (YSO)

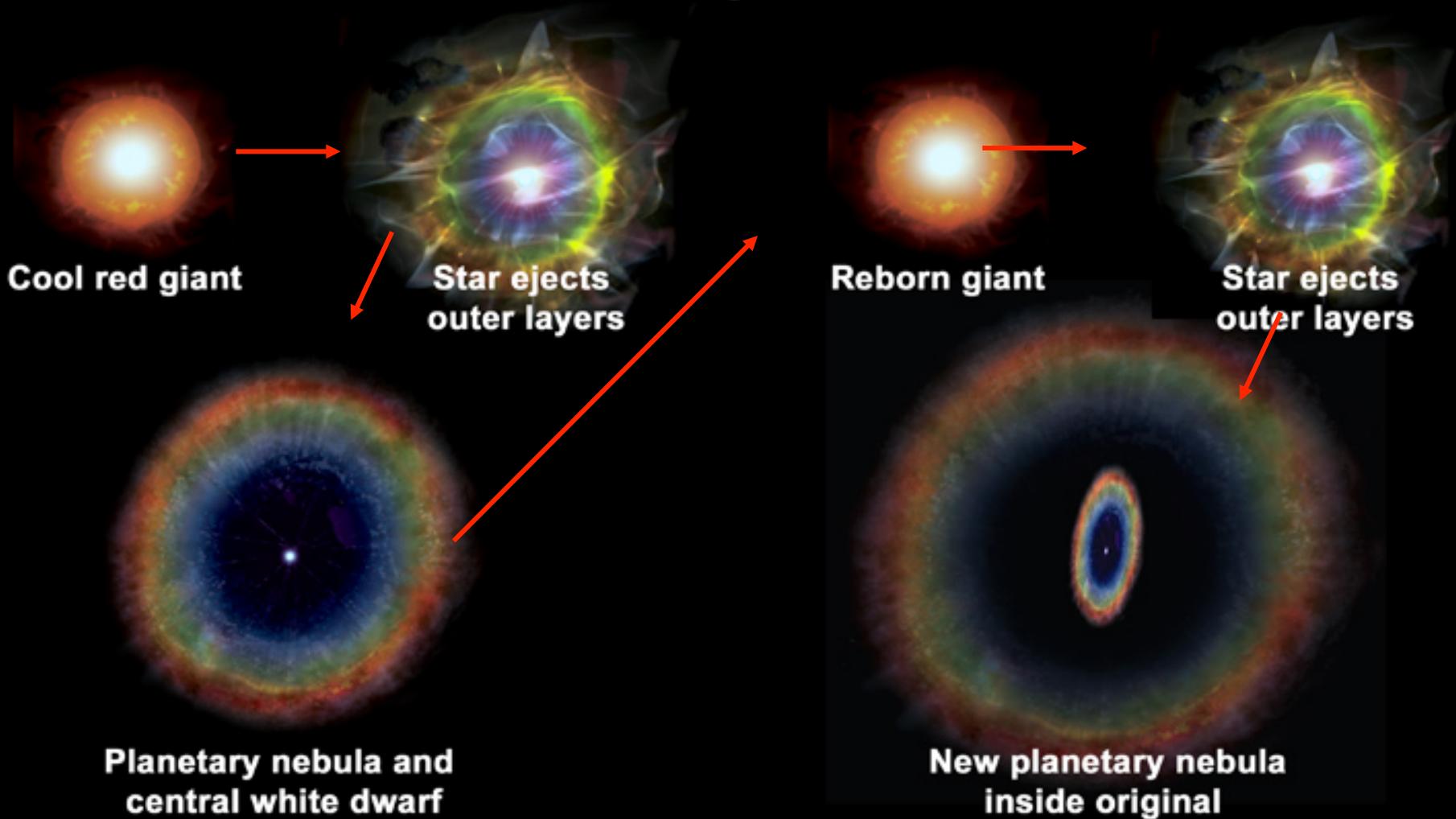
- Clear vertical stratification
- Small aperture angle (<10 degrees)
- Keplerian rotation (longer lifetime)

My personal opinion is that the discovery of a stratified disk with proved Keplerian kinematics is directly connected to the influence of a companion, albeit the few exceptions presented above, namely the Young Stellar Objects or the critical velocity rotating massive sources such as Be stars. This hypothesis must be confirmed by further observations.

Olivier Chesneau



Born-again stars



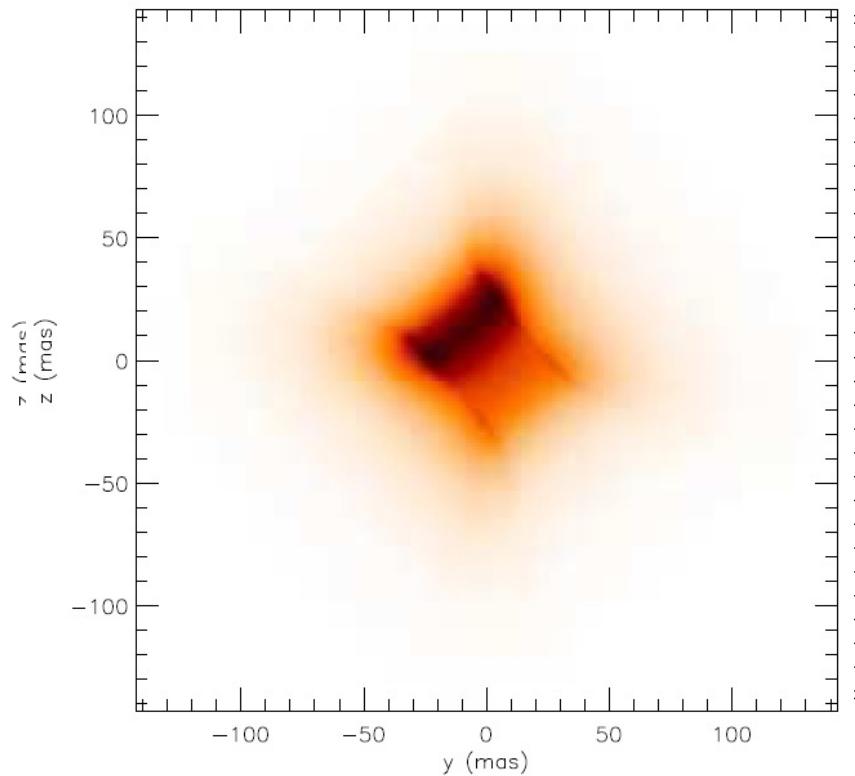
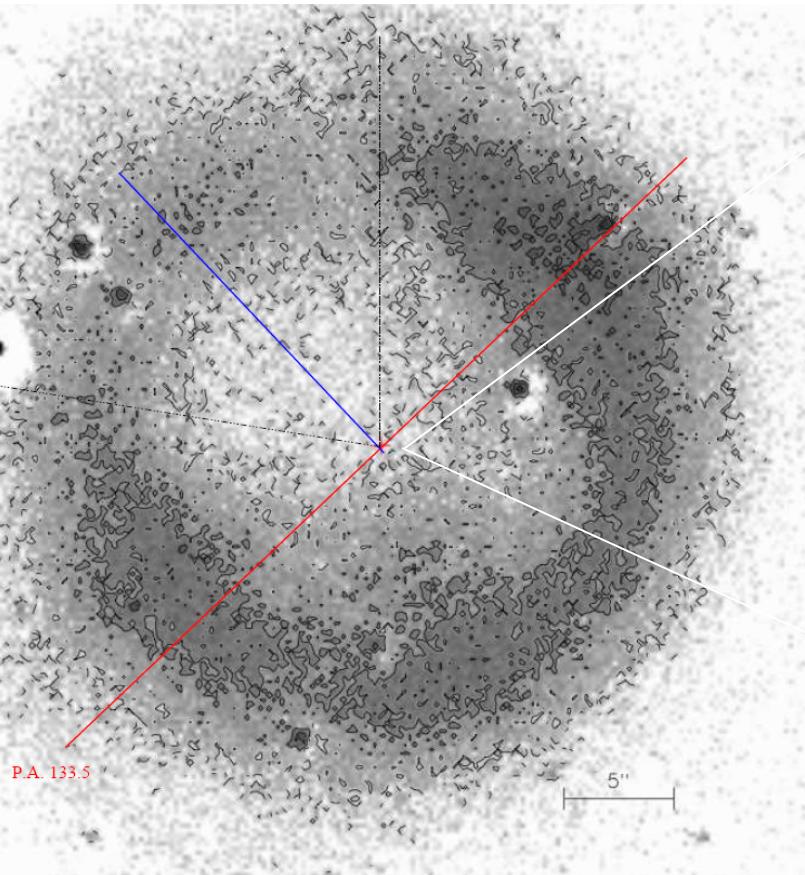
Sakurai's object : a Very Late Thermal Pulse

MIDI observations in 2007

MIDI structure coincident with PN

Fit very difficult: complex geometry.

Equatorial overdensity → *disk in formation?*



Novae with interferometry

What is the distance to the source?

Is the outburst spherical?

Is the nova wind spherical?

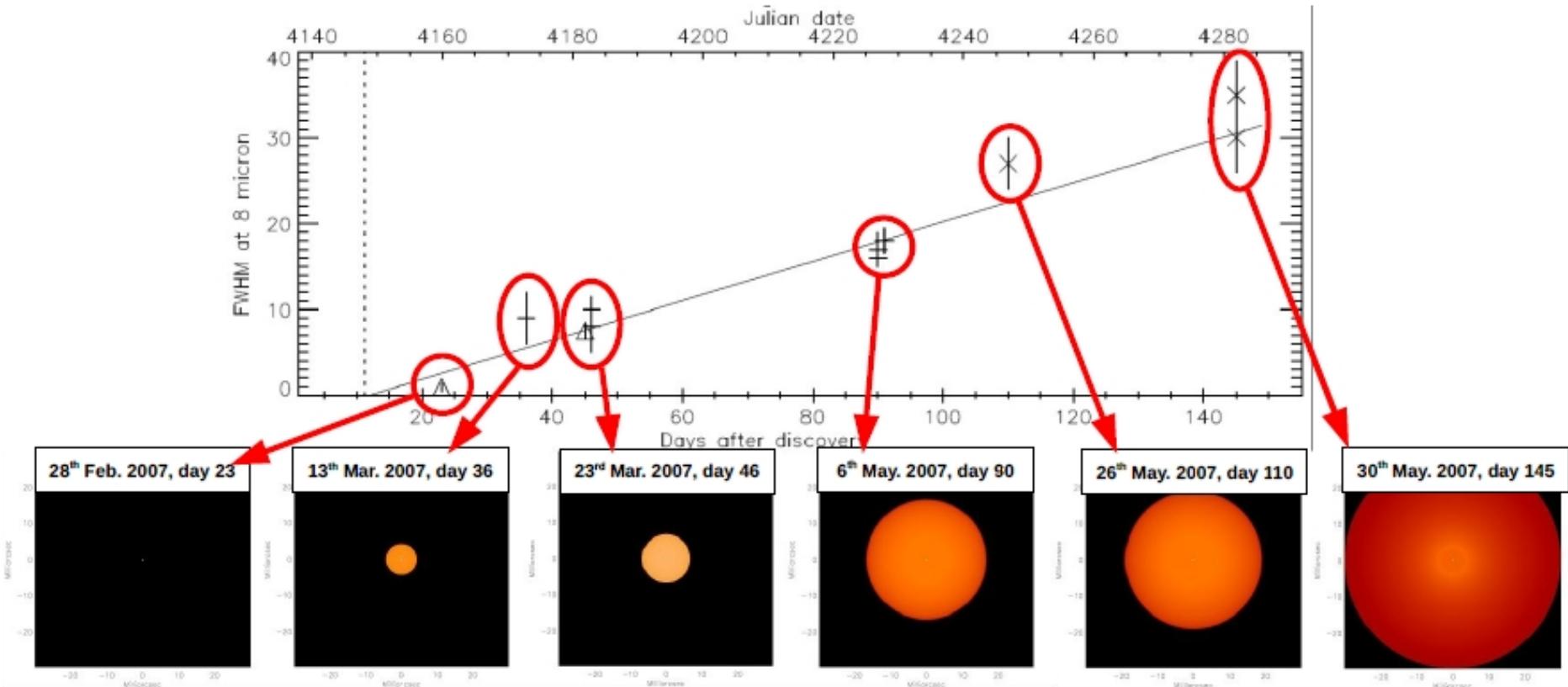
How can dust form?



HARDY

~ 1 event per year

Nova V1280 Sco: MIDI observations just after the event

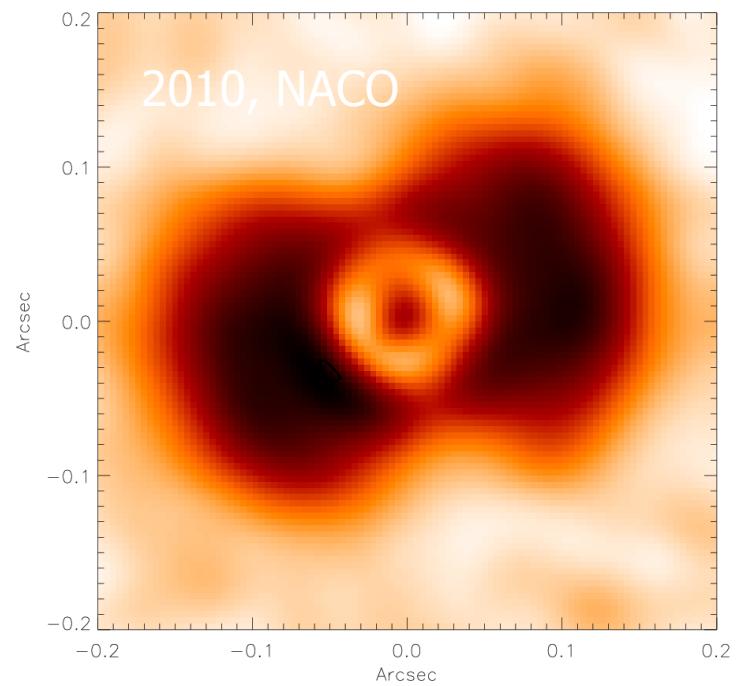
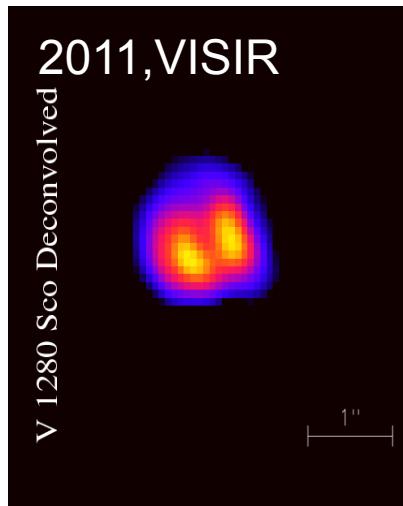
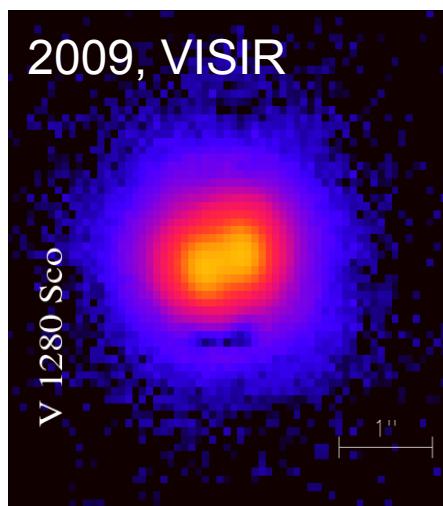
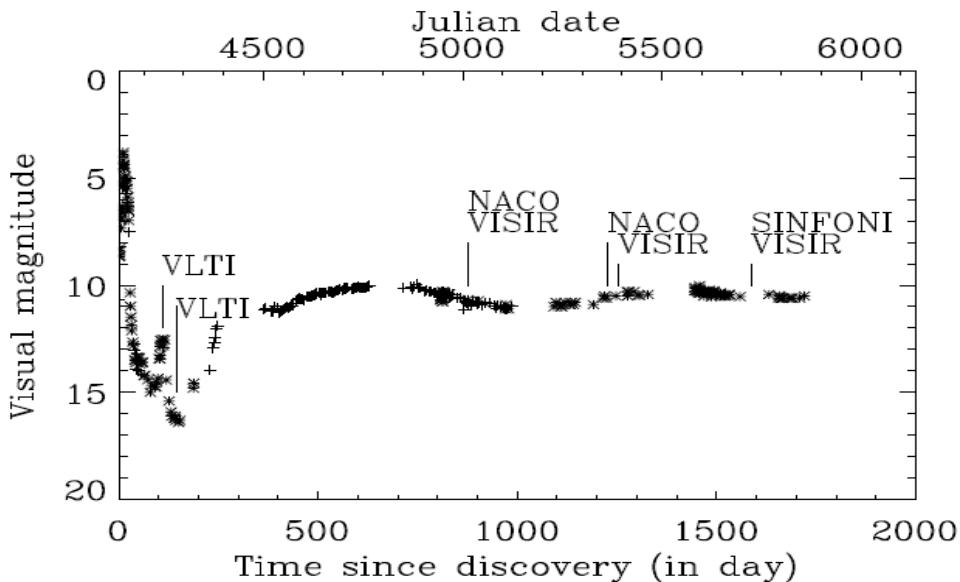


Fast dust creation! ($10^{-6} M_{\odot}$ in 140 days)

Expansion: 0.35mas per day

Chesneau et, 2008

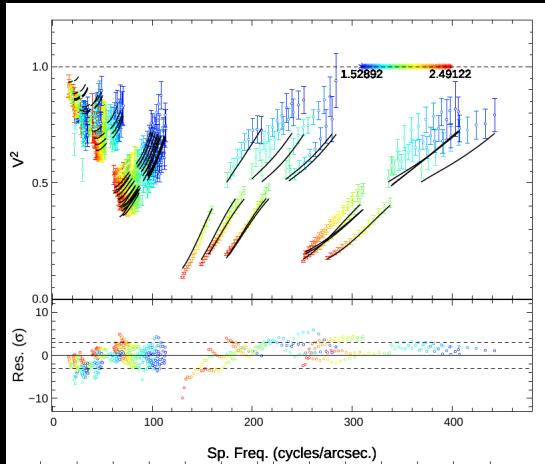
Nova V1280 Sco: Live formation of a bipolar nebula



Chesneau et al., 2012

His final works

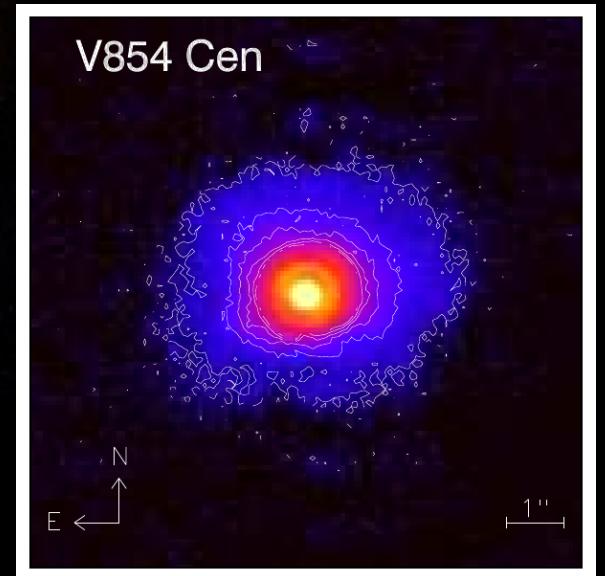
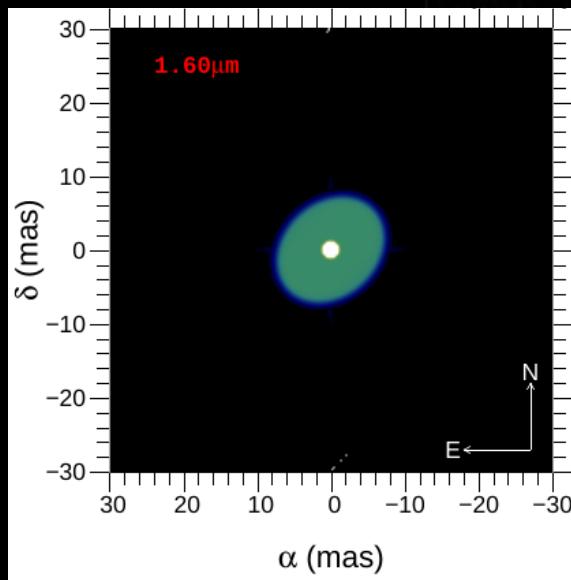
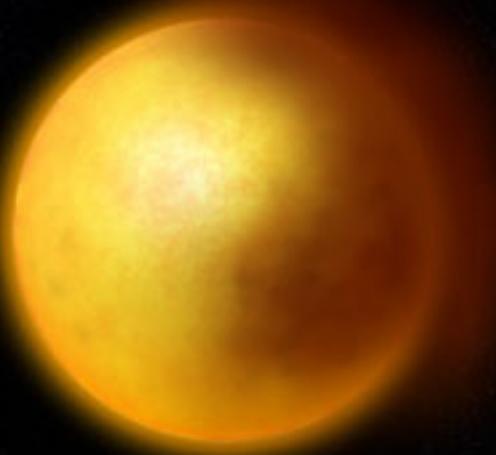
V854 Cen



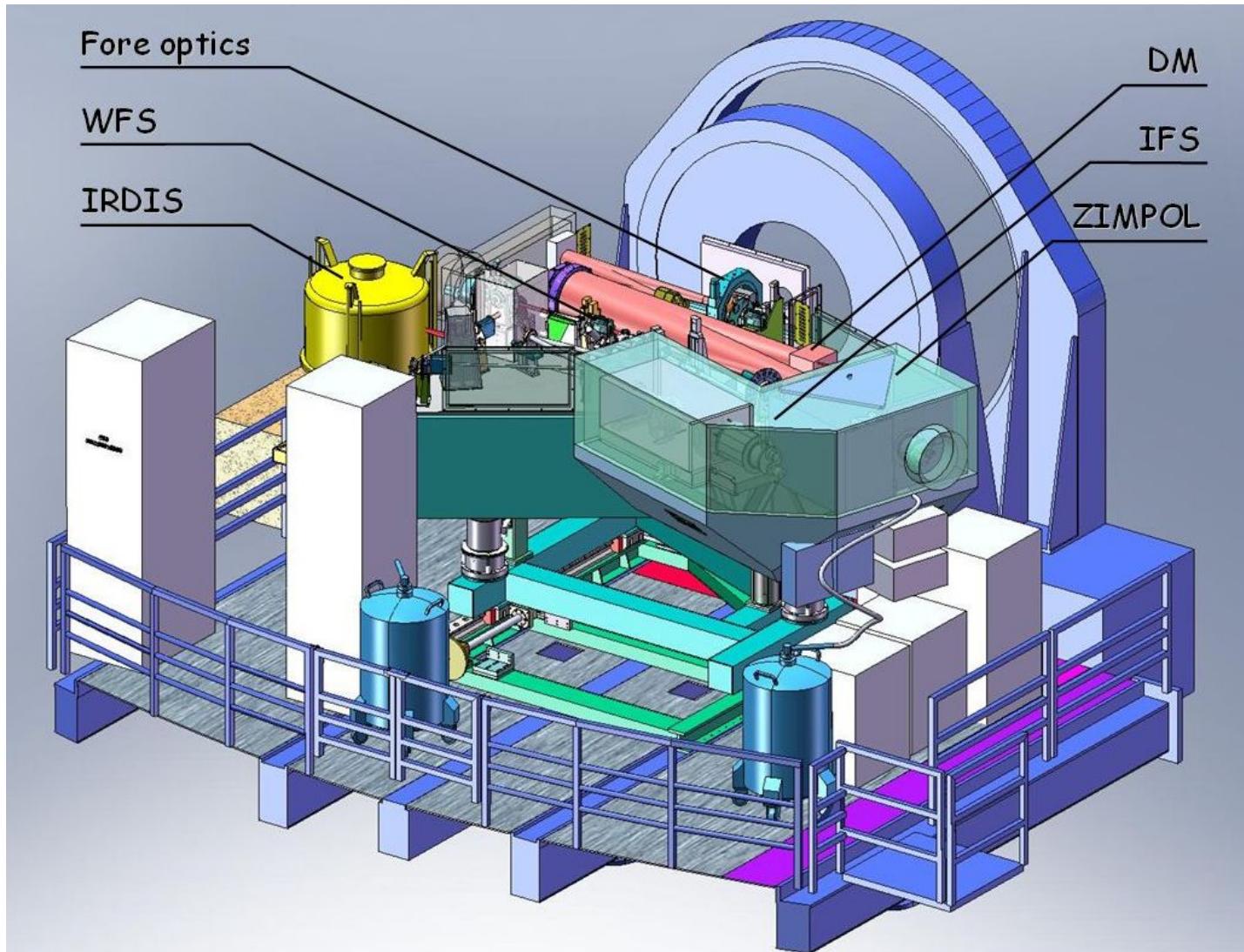
LETTER TO THE EDITOR

The R CrB star V854 Cen is surrounded by a hot dusty disk

O. Chesneau¹, F. Millour¹, O. De Marco², S. Bright^{1,2}, A. Spang¹, E. Lagadec¹, D. Mékarnia¹, and W. J. de Wit^{3,*}

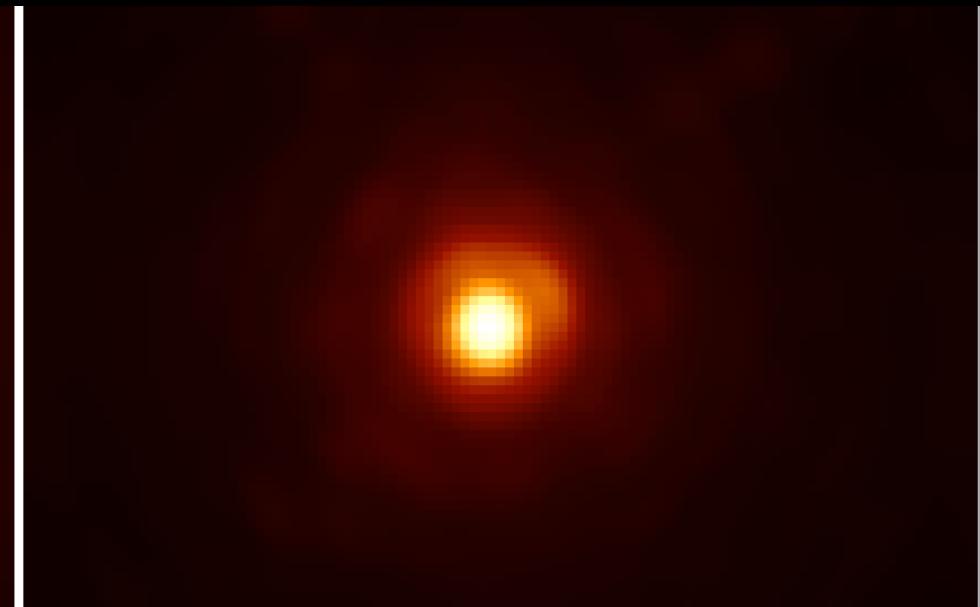
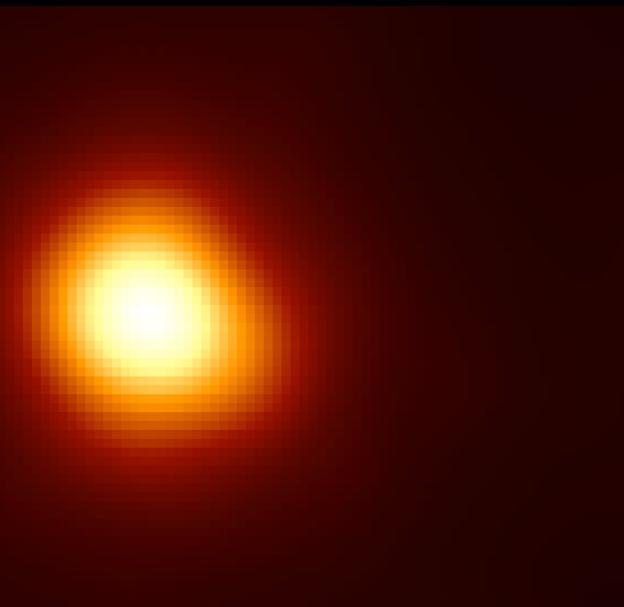


SPHERE/VLT: one of his next projects

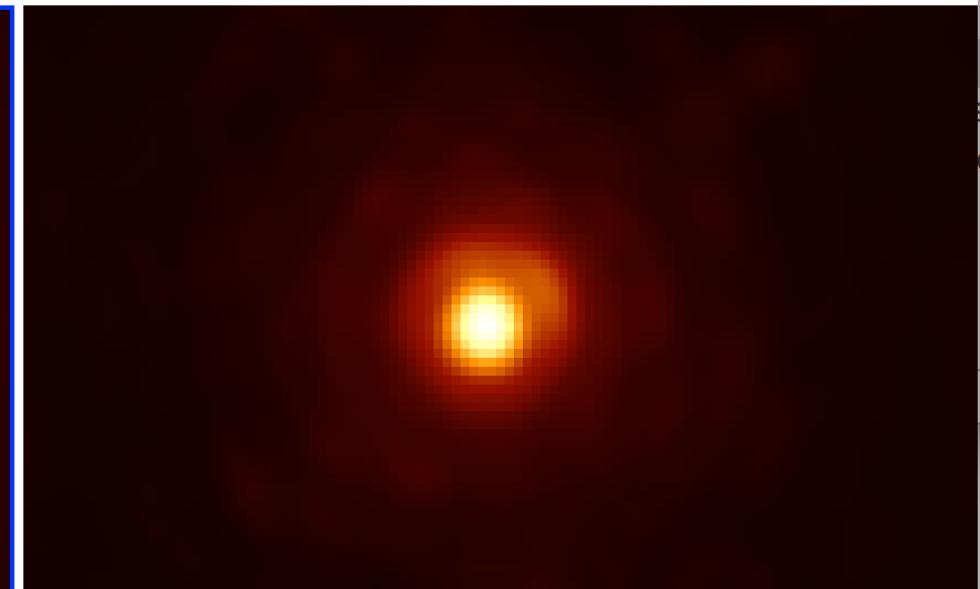
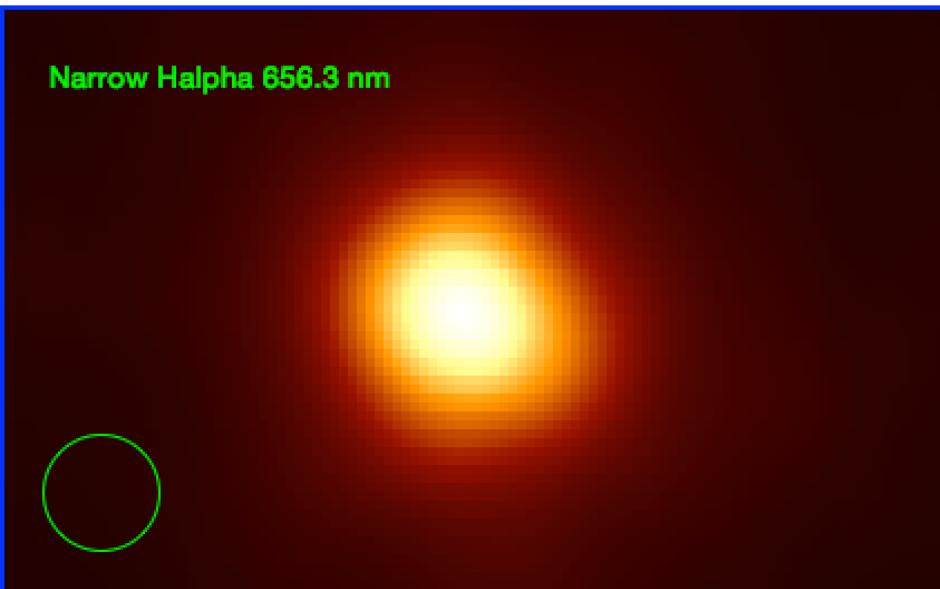


SPHERE/VLT: Betelgeuse

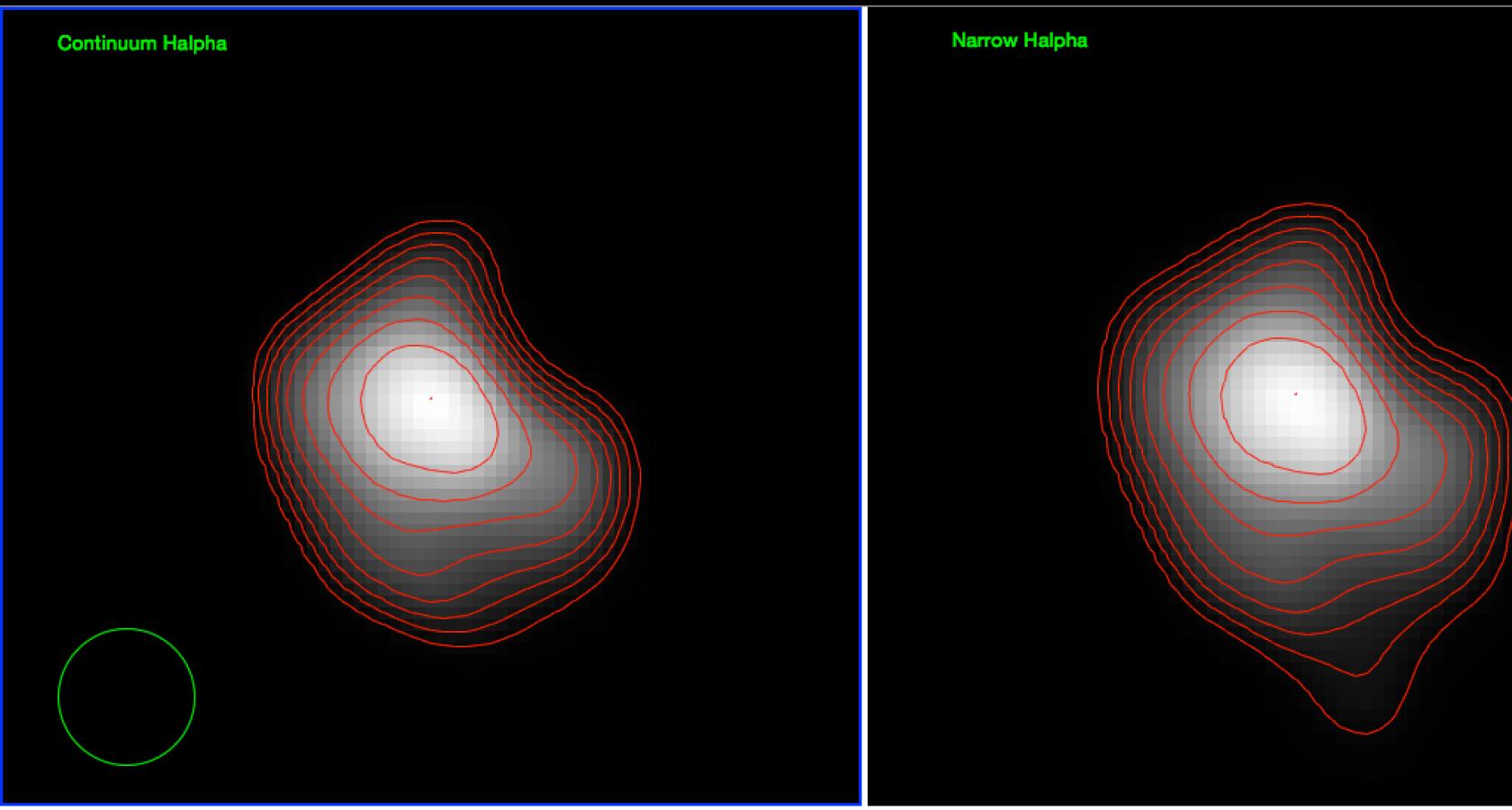
Cnt Halpha 645 nm



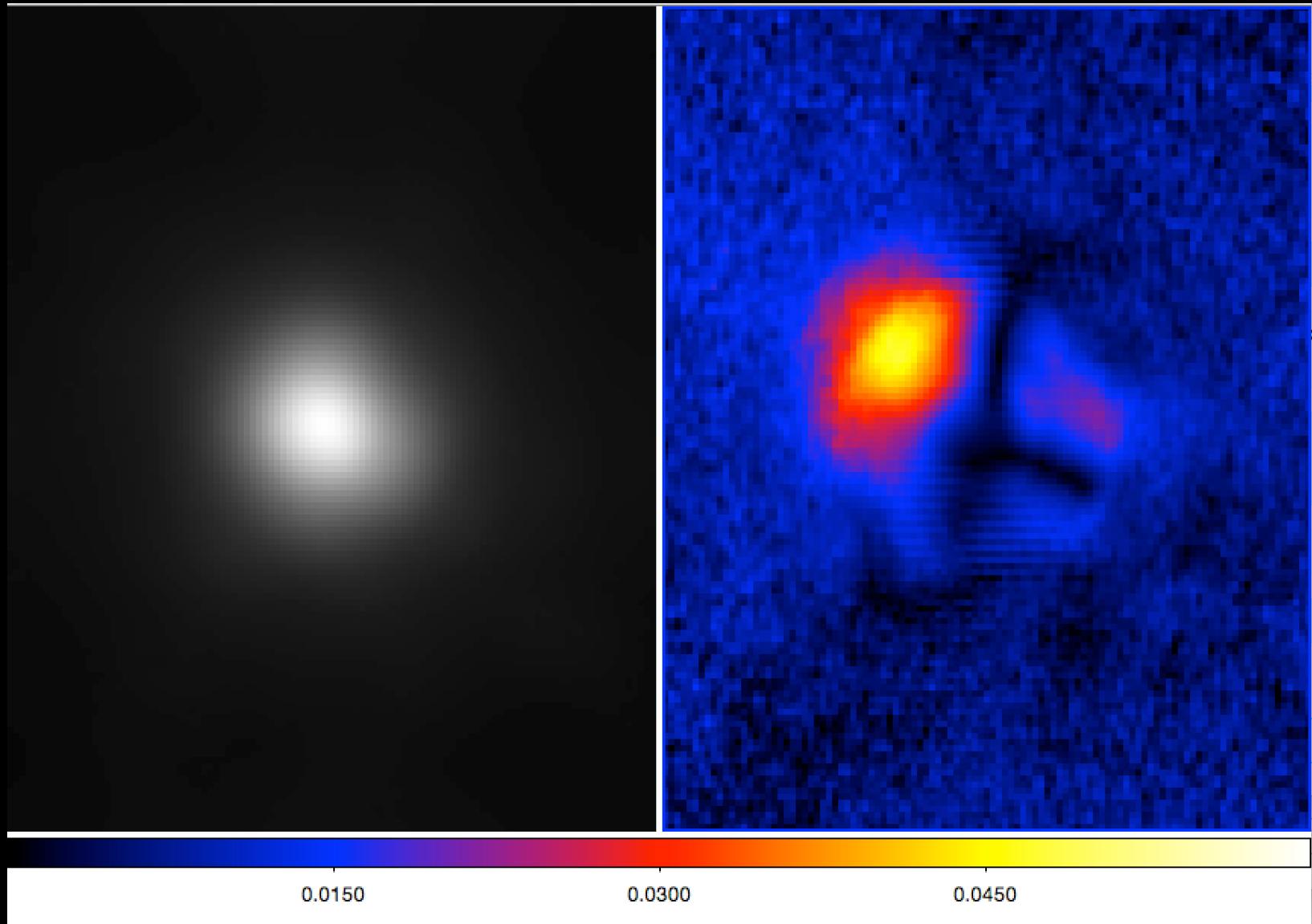
Narrow Halpha 656.3 nm



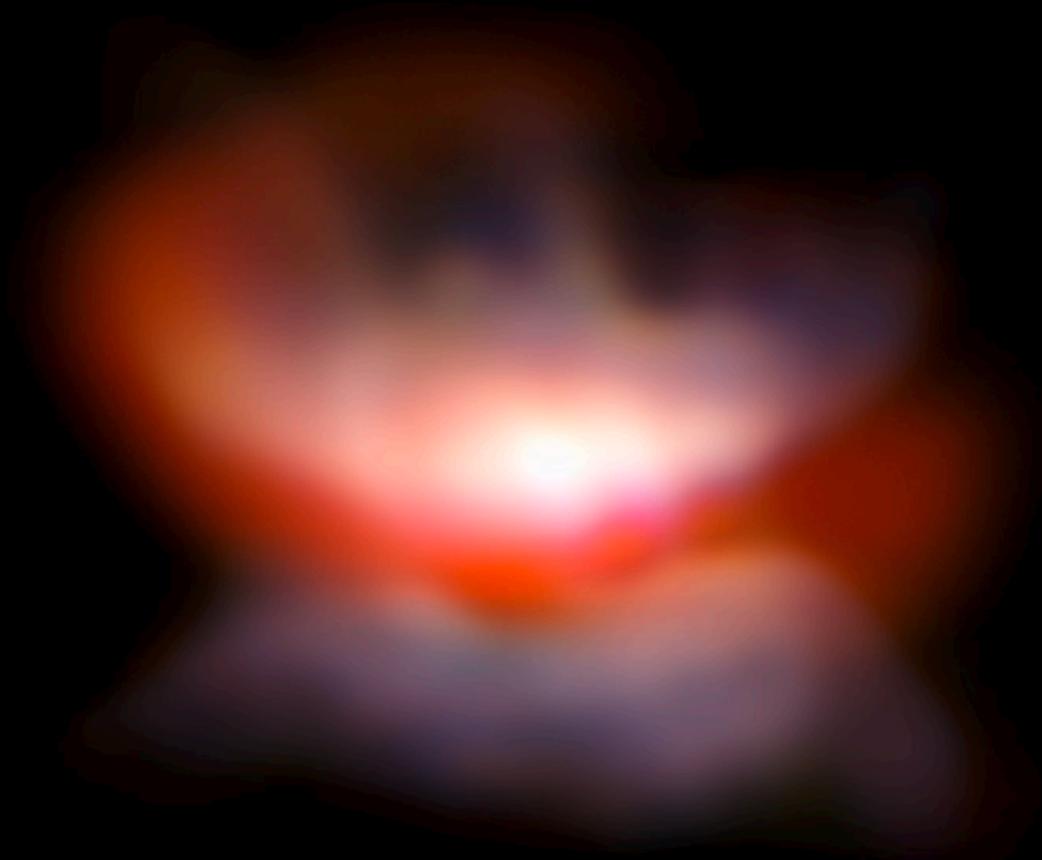
SPHERE/VLT: Betelgeuse



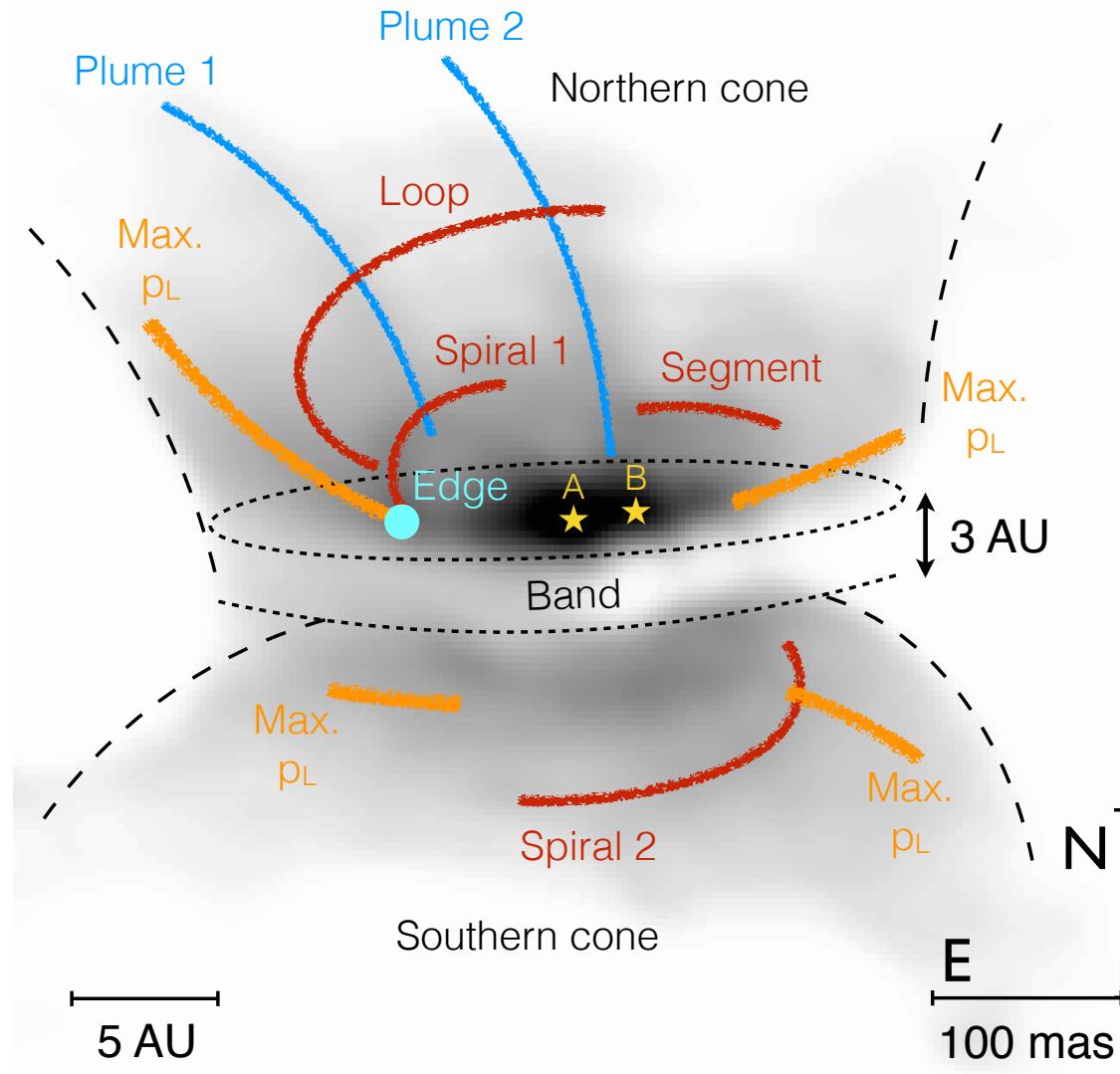
SPHERE/VLT: Betelgeuse



The AGB star L2 Pup: A bipolar PN in the making!



The AGB star L2 Pup: A bipolar PN in the making!



6065 CHESNEAU

« My dad now lives on his asteroid and is wandering to visit his favourite stars. He is happy because he now has answers to all the questions he had. »

Mathieu Chesneau



Olivier Chesneau



Olivier Chesneau

*The Little Prince of astronomy
Memories*

Olivier Chesneau



Merci Olivier!



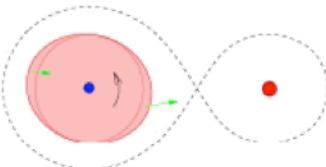


A composite image featuring two side-by-side portraits of the same man. On the left, a younger man with short brown hair and glasses, wearing a dark t-shirt, looks slightly to his right with a neutral expression. On the right, an older version of the same man, with longer, darker hair and glasses, wears a dark jacket over a light-colored shirt, looking directly at the camera with a slight smile. The background is a soft-focus outdoor scene.

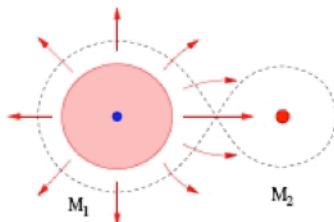
Merci Olivier!

Please send us answers to these questions!

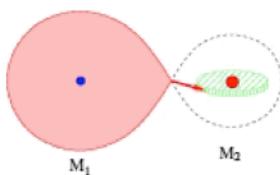
Different types of binary interactions



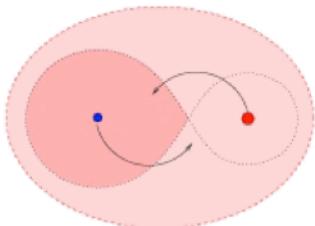
tidal interaction



wind accretion & tidally enhanced winds

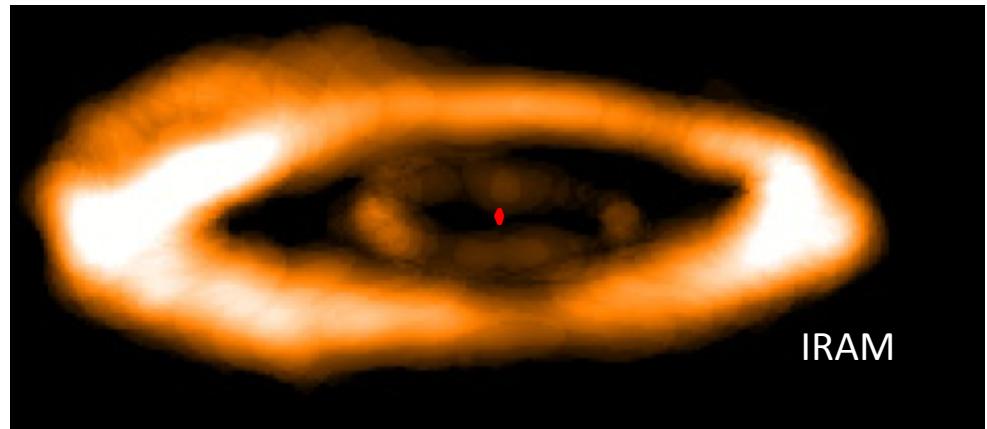
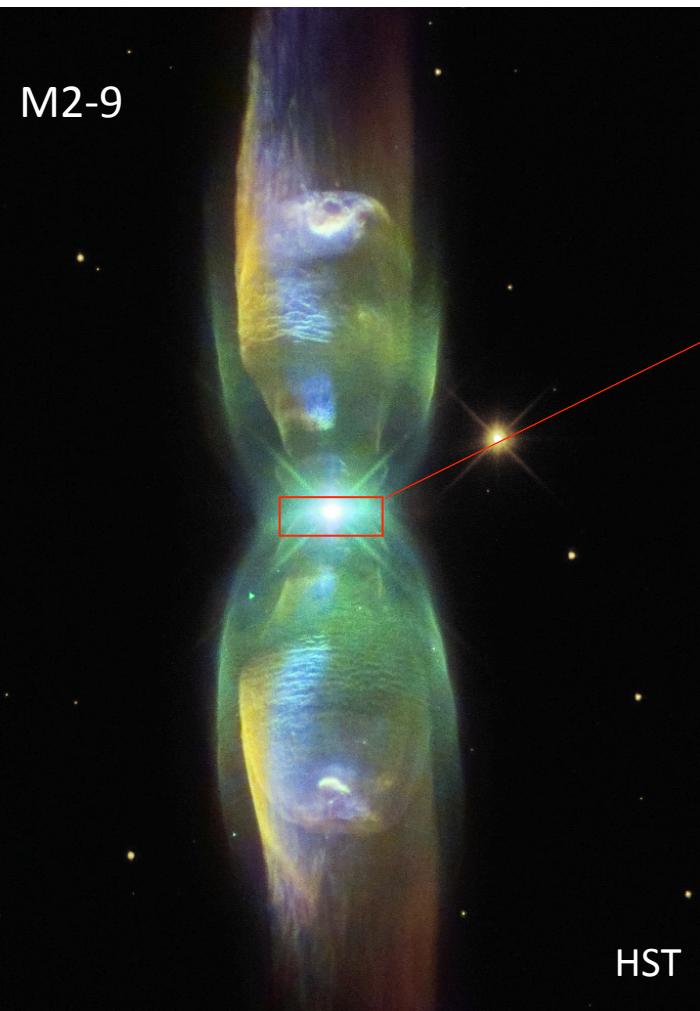


Roche-lobe overflow



common envelope evolution

A double disk in M2-9: binaries?



- Two rings (short mass loss episodes)
- Dynamical imprint: presence of a binary system ($P=90$ yr)

Lykou, **Chesneau** et al. 2011

Castro-Carrizo, Neri, Bujarrabal, **Chesneau** et al. 2012