VISIR: TOWARDS EXPLAINING THE FORMATION OF C-RICH MOLECULES IN O-RICH PNE

L. Guzman-Ramirez
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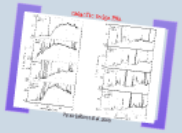
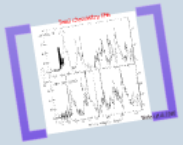
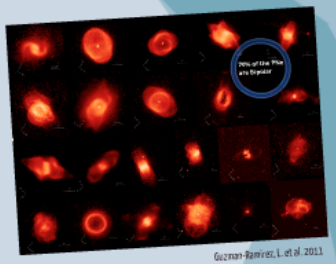
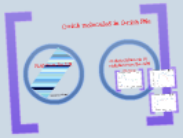
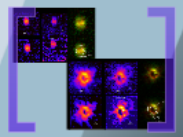
K. Gesicki (UMK)
E. Lagadec (Cornell)
T.J. Millar (Queens)
Paul M. Woods (UCL)

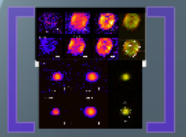


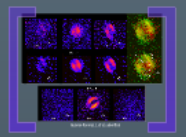


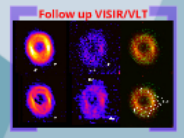


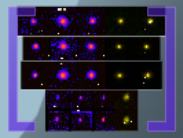












Thank you!

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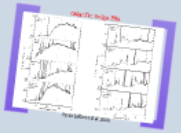
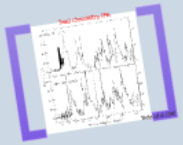
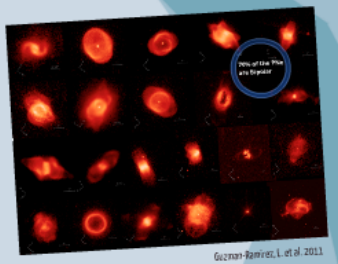
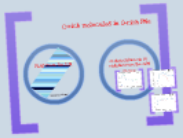
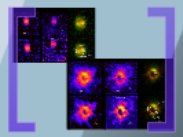
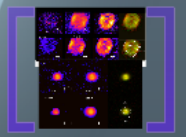


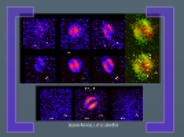


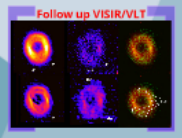


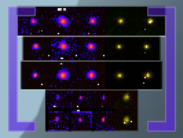






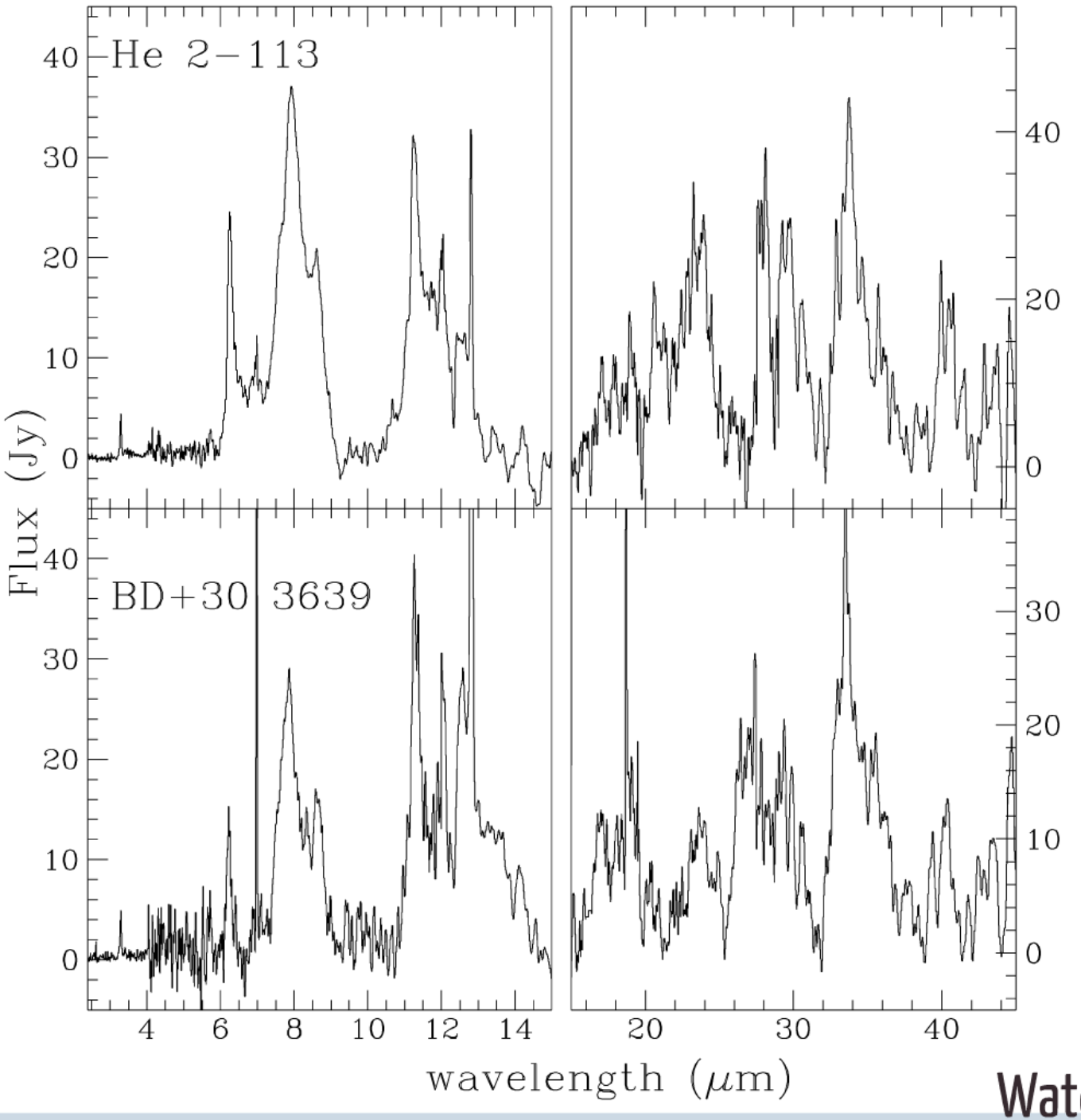






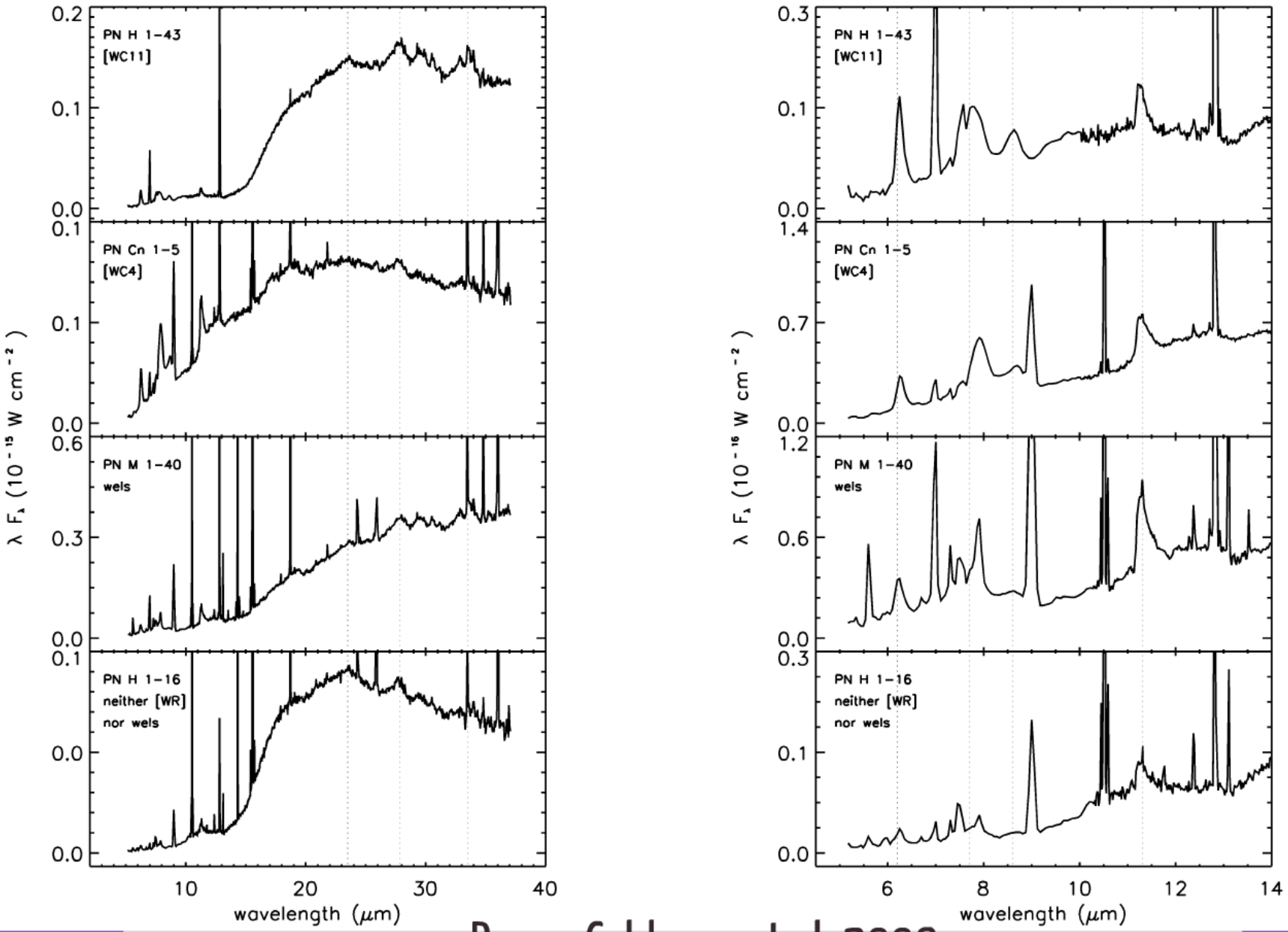
Thank you!

Dual Chemistry PNe



Waters et al. 1998

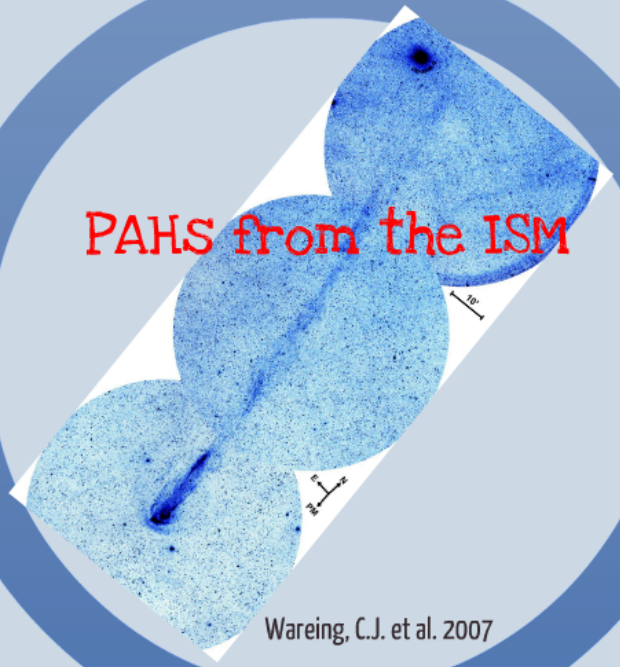
Galactic Bulge PNe



Perea-Calderon et al. 2009

C-rich molecules in O-rich PNe

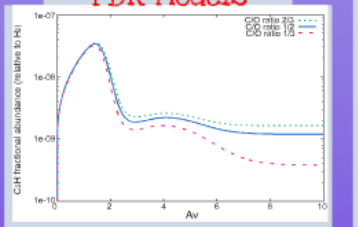
PAHs from the ISM

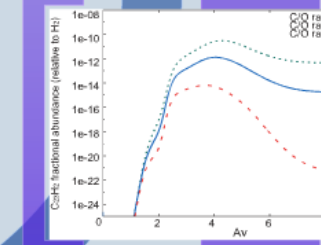


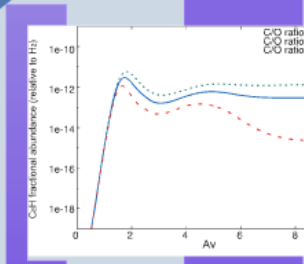
Wareing, C.J. et al. 2007

CO dissociation via UV radiation from the CSPN

PDR Models

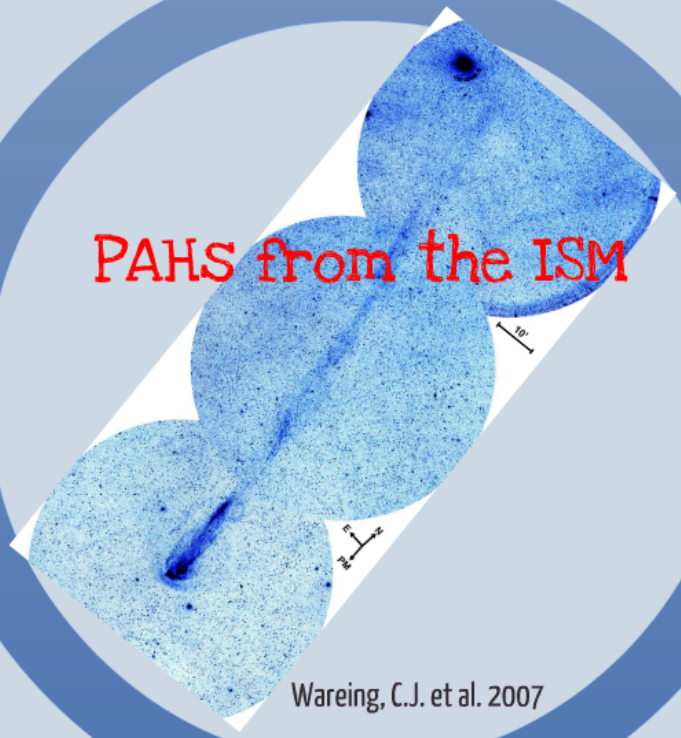






C-rich molecules in O-rich PNe

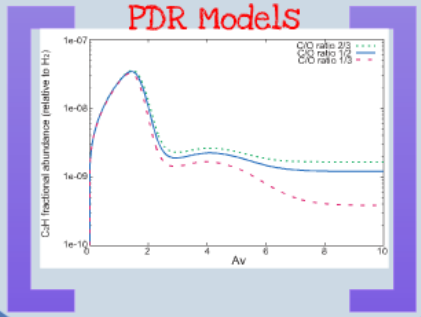
PAHs from the ISM

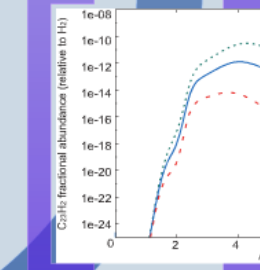


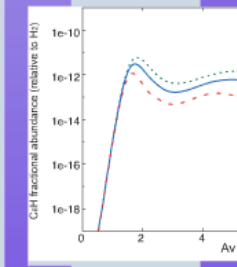
Wareing, C.J. et al. 2007

CO dissociation via UV radiation from the CSPN

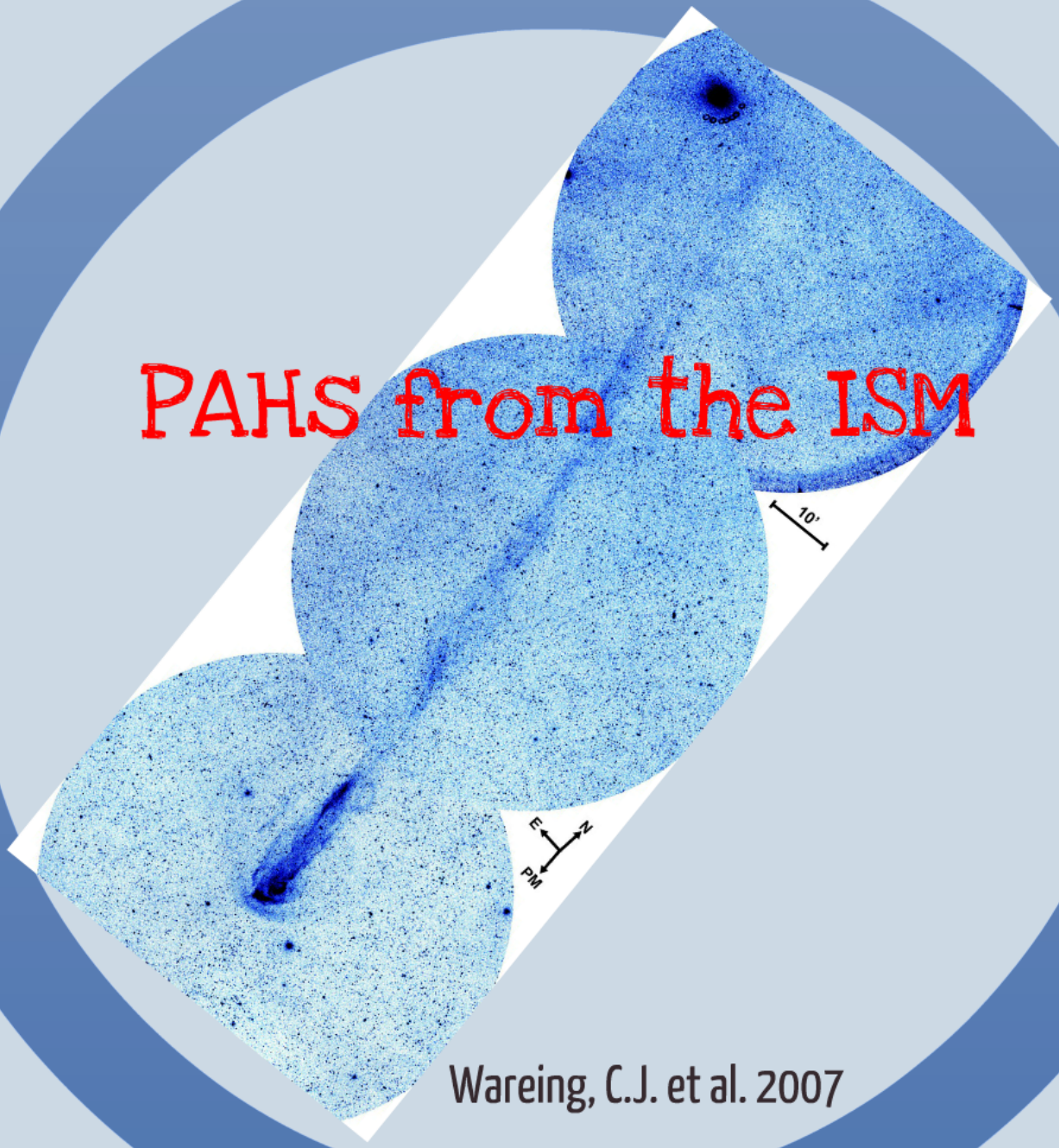
PDR Models







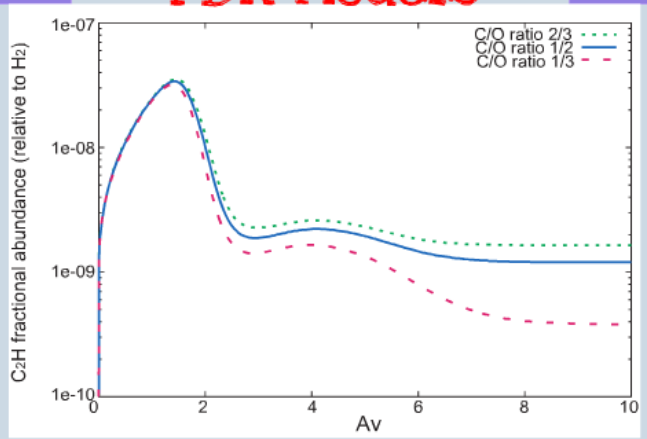
PAHs from the ISM

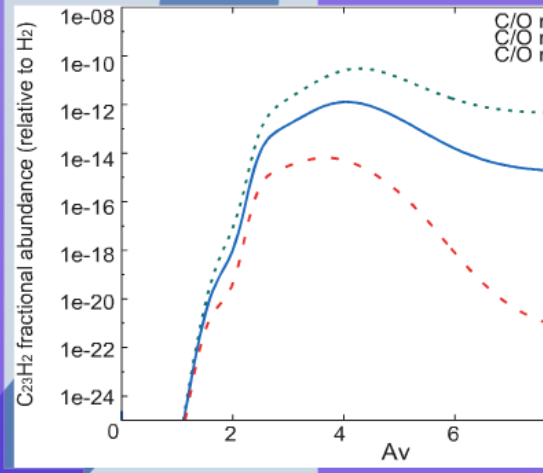


Wareing, C.J. et al. 2007

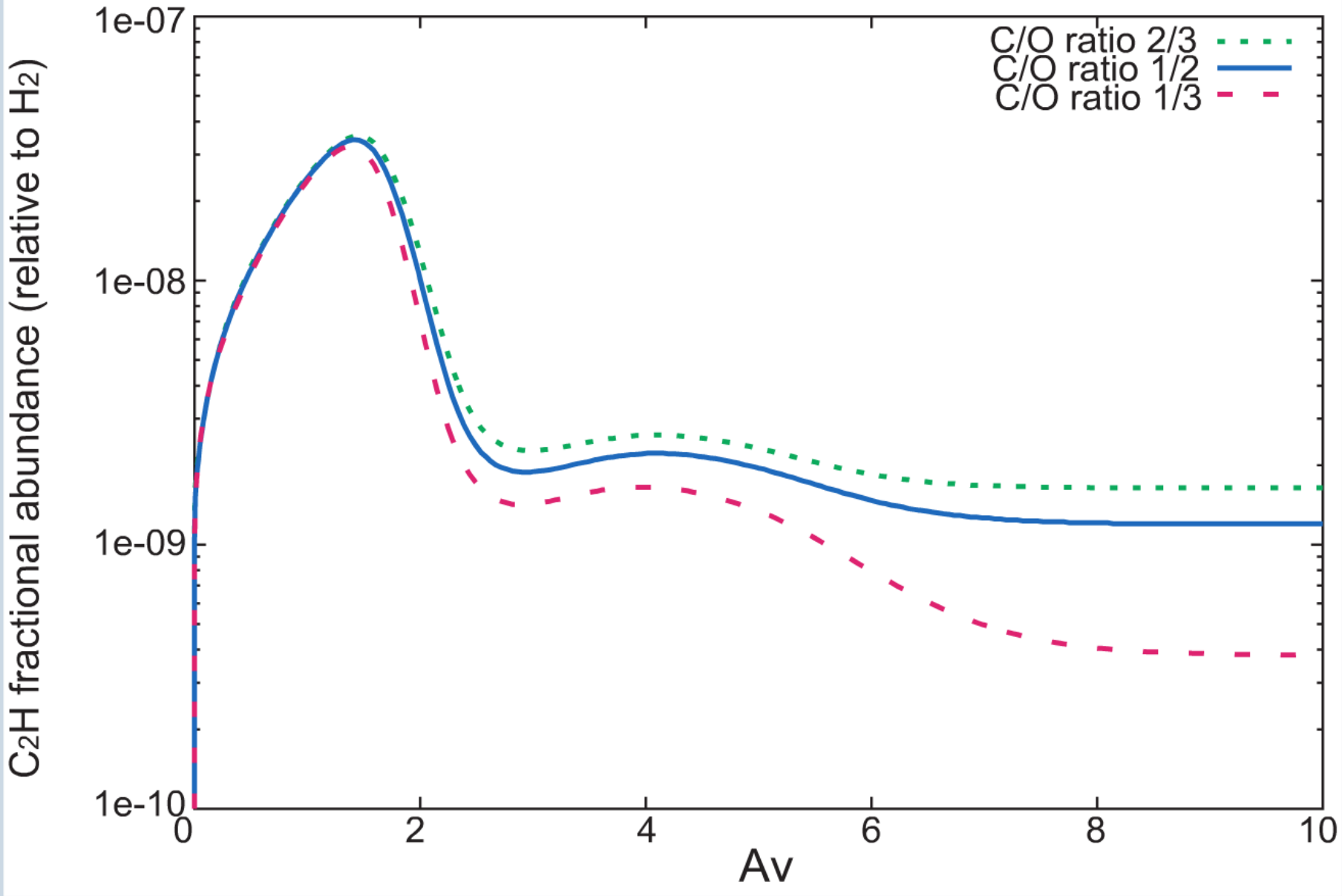
CO dissociation via UV radiation from the CSPN

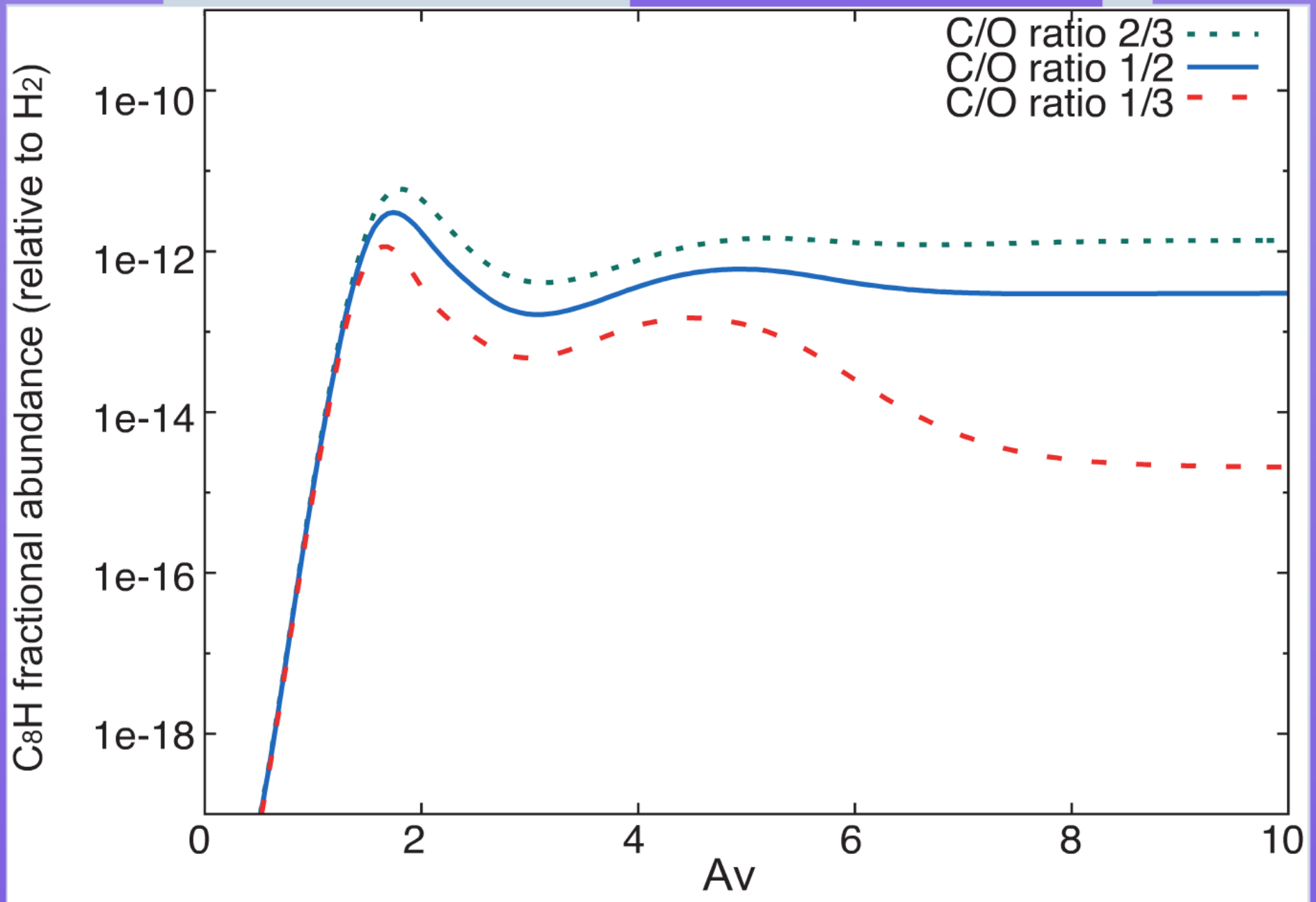
PDR Models

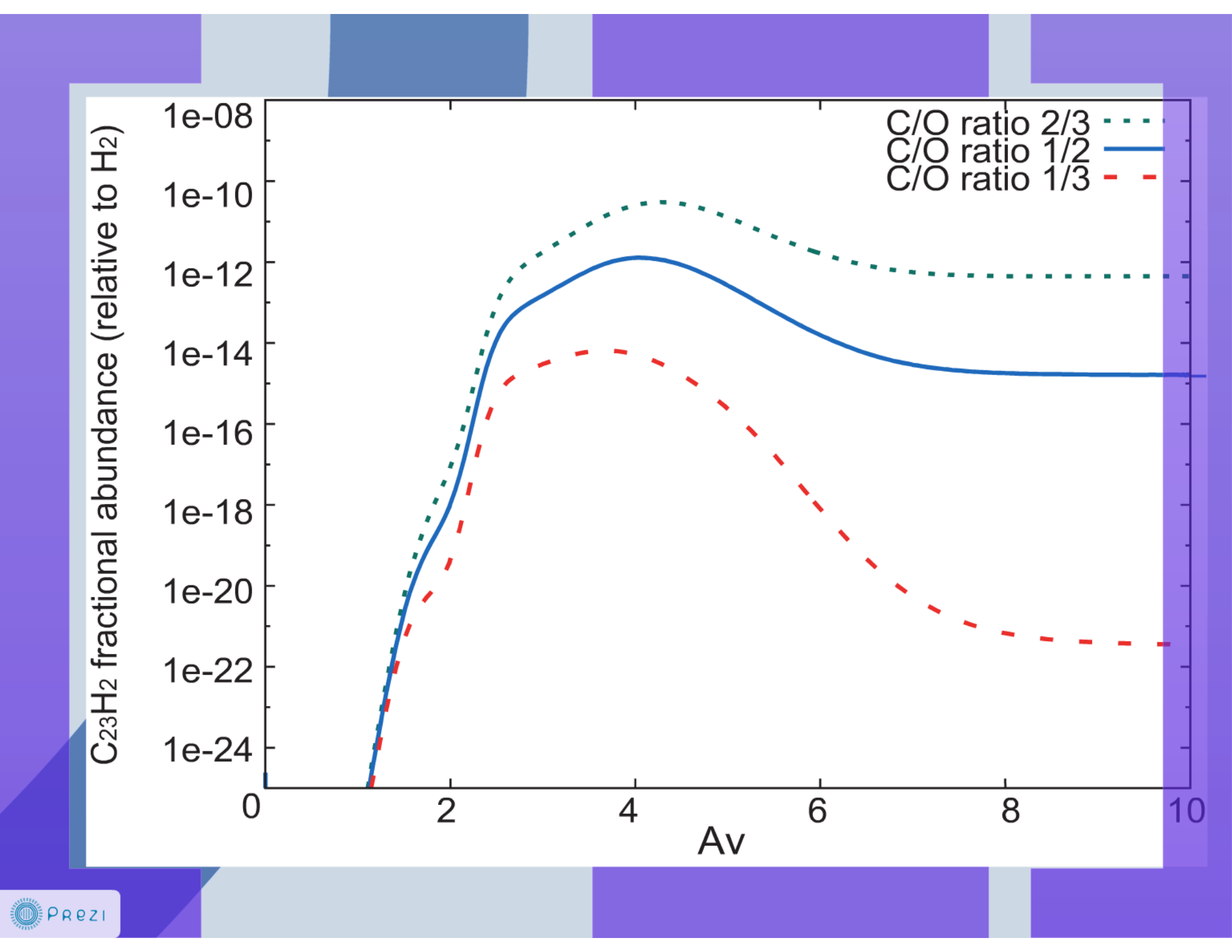


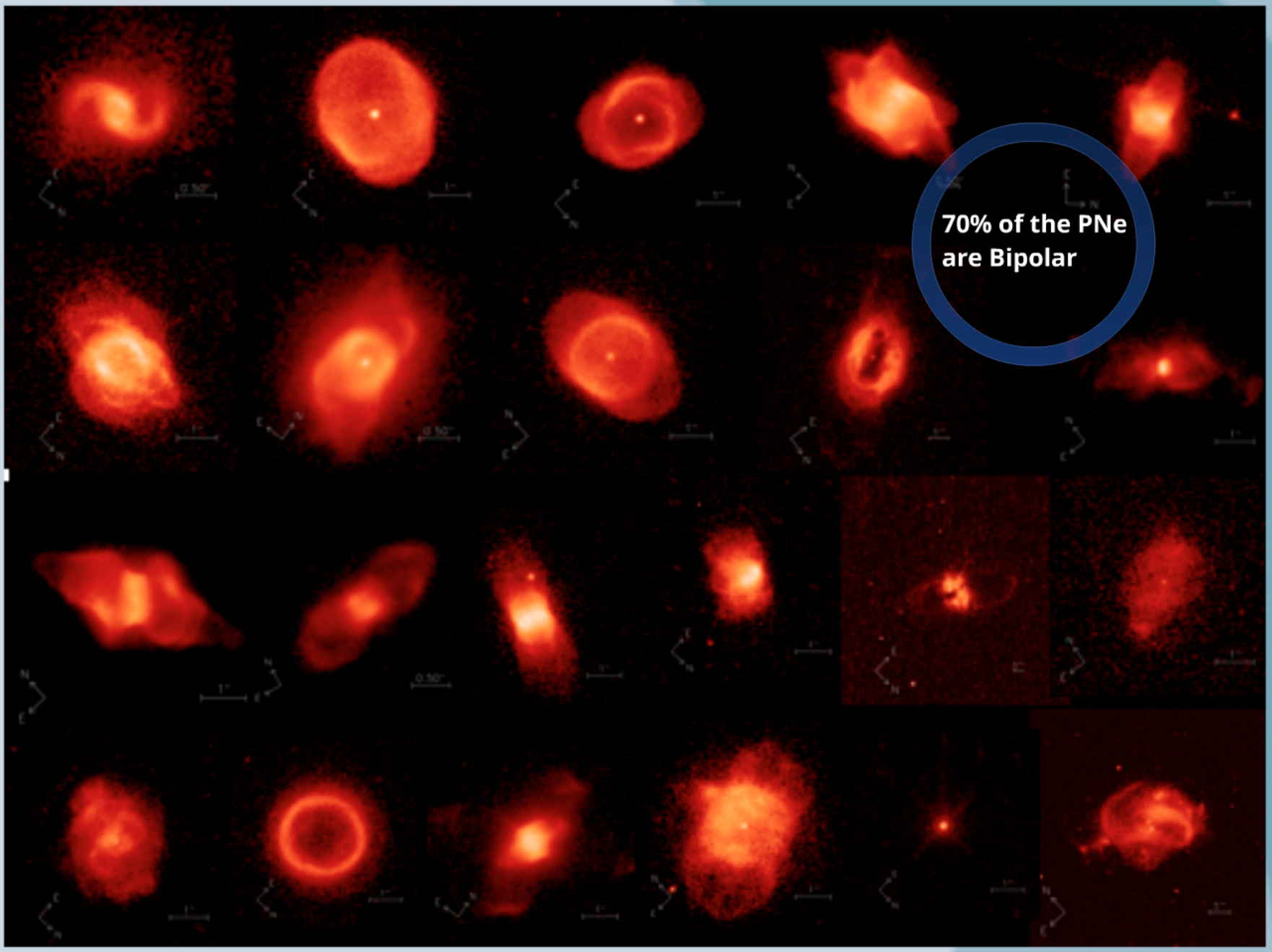


PDR Models

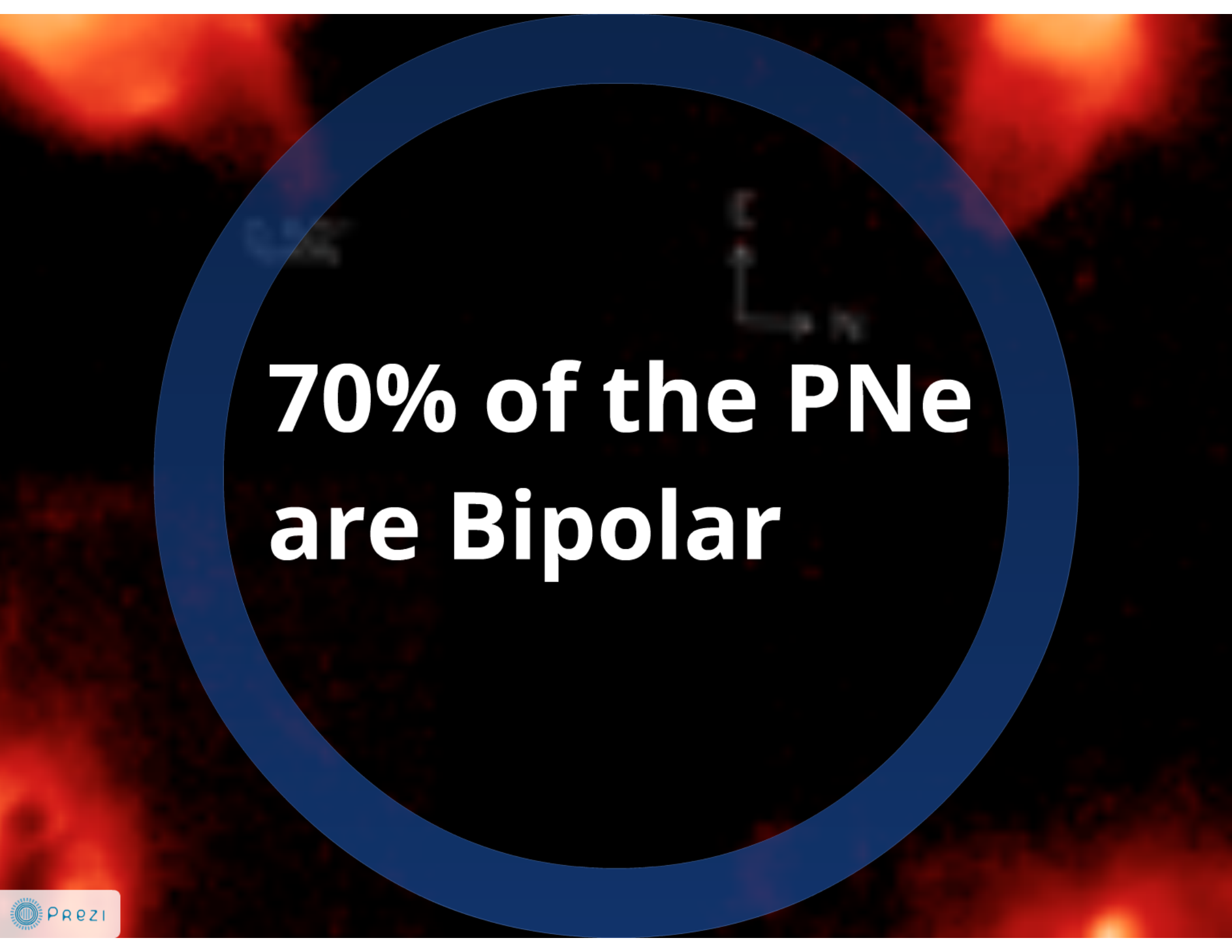



C/O ratio 2/3
C/O ratio 1/2
C/O ratio 1/3
C8H fractional abundance (relative to H2)
1e-10
1e-12
1e-14
1e-16
1e-18
0
2
4
6
8
10
Av

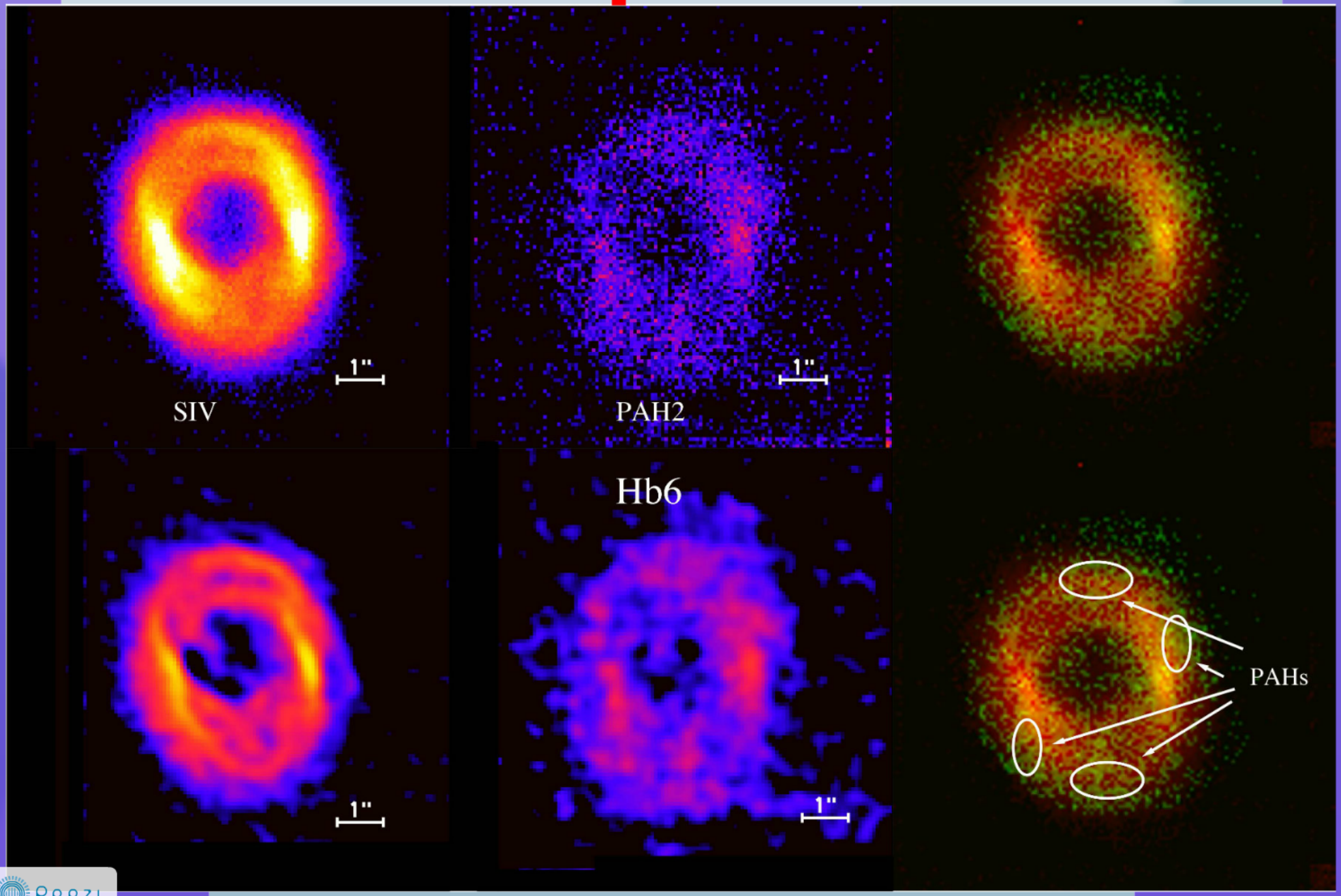

C/O ratio 2/3
C/O ratio 1/2
C/O ratio 1/3
C23H2 fractional abundance (relative to H2)
1e-08
1e-10
1e-12
1e-14
1e-16
1e-18
1e-20
1e-22
1e-24
0
2
4
6
8
10
Av

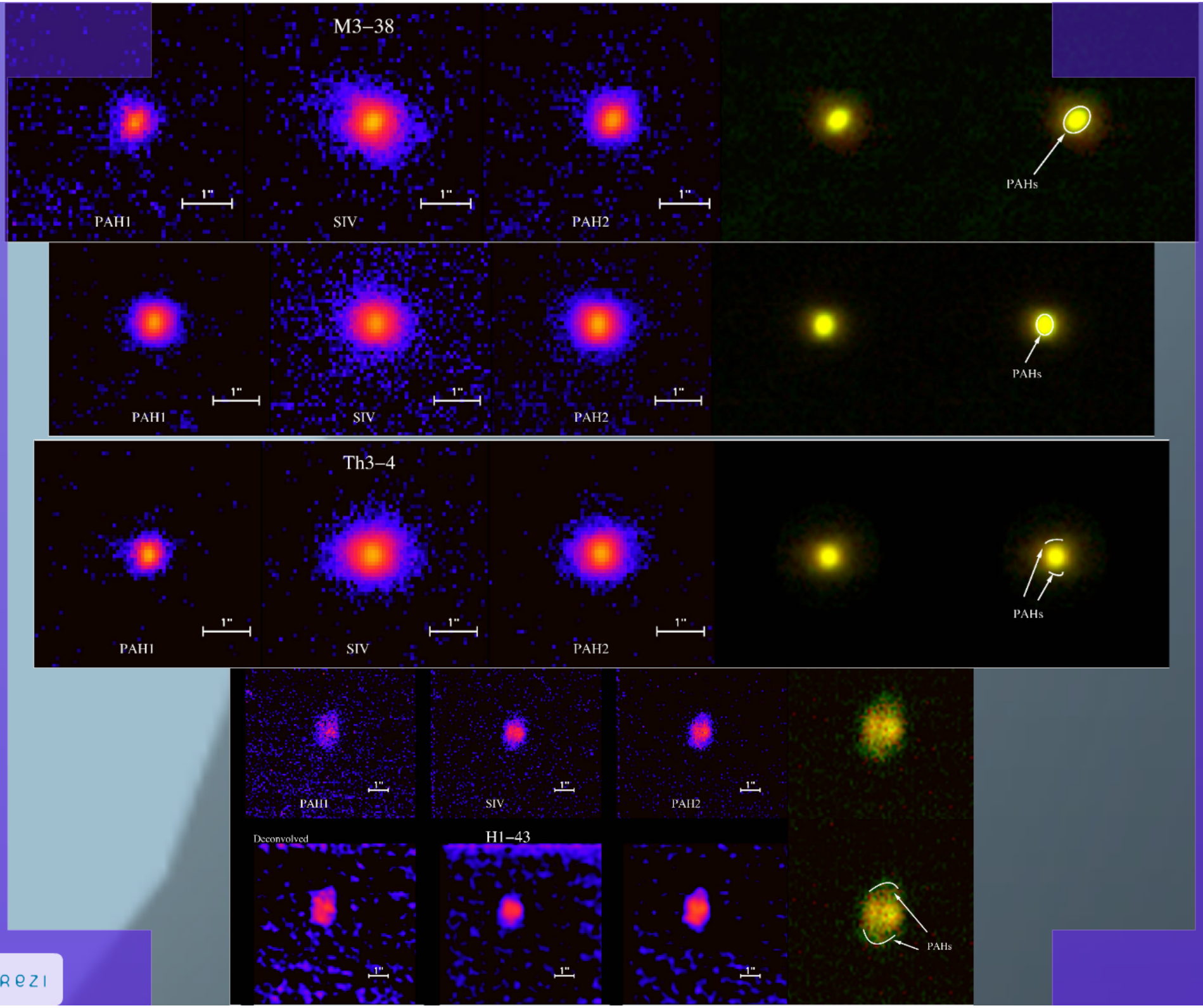


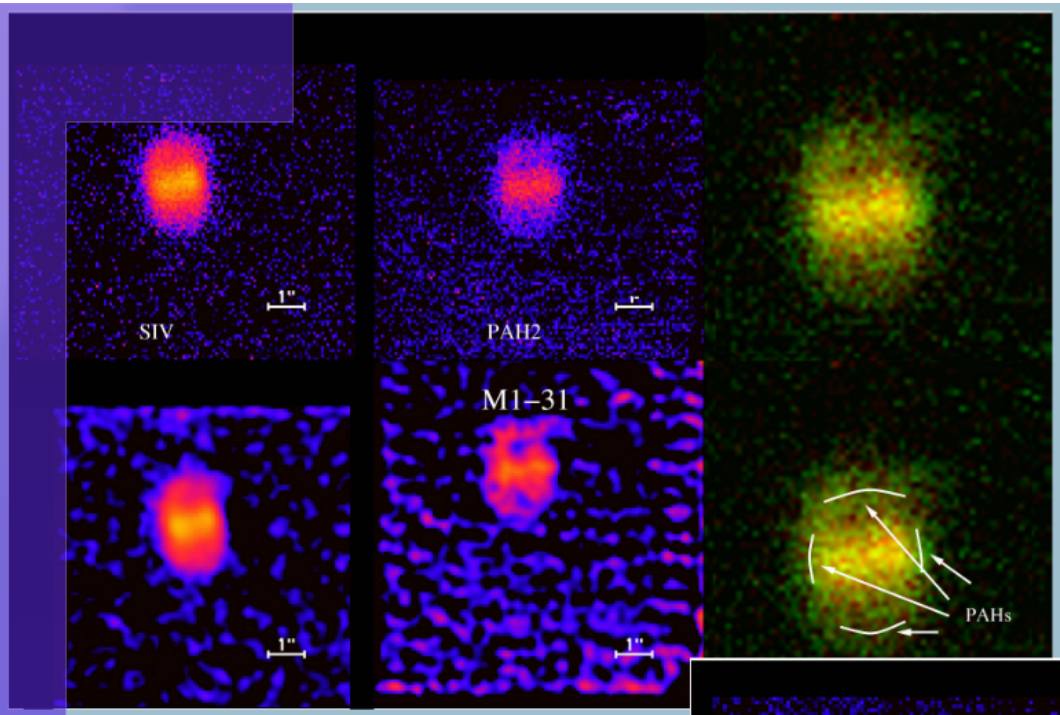
Guzman-Ramirez, L. et al. 2011

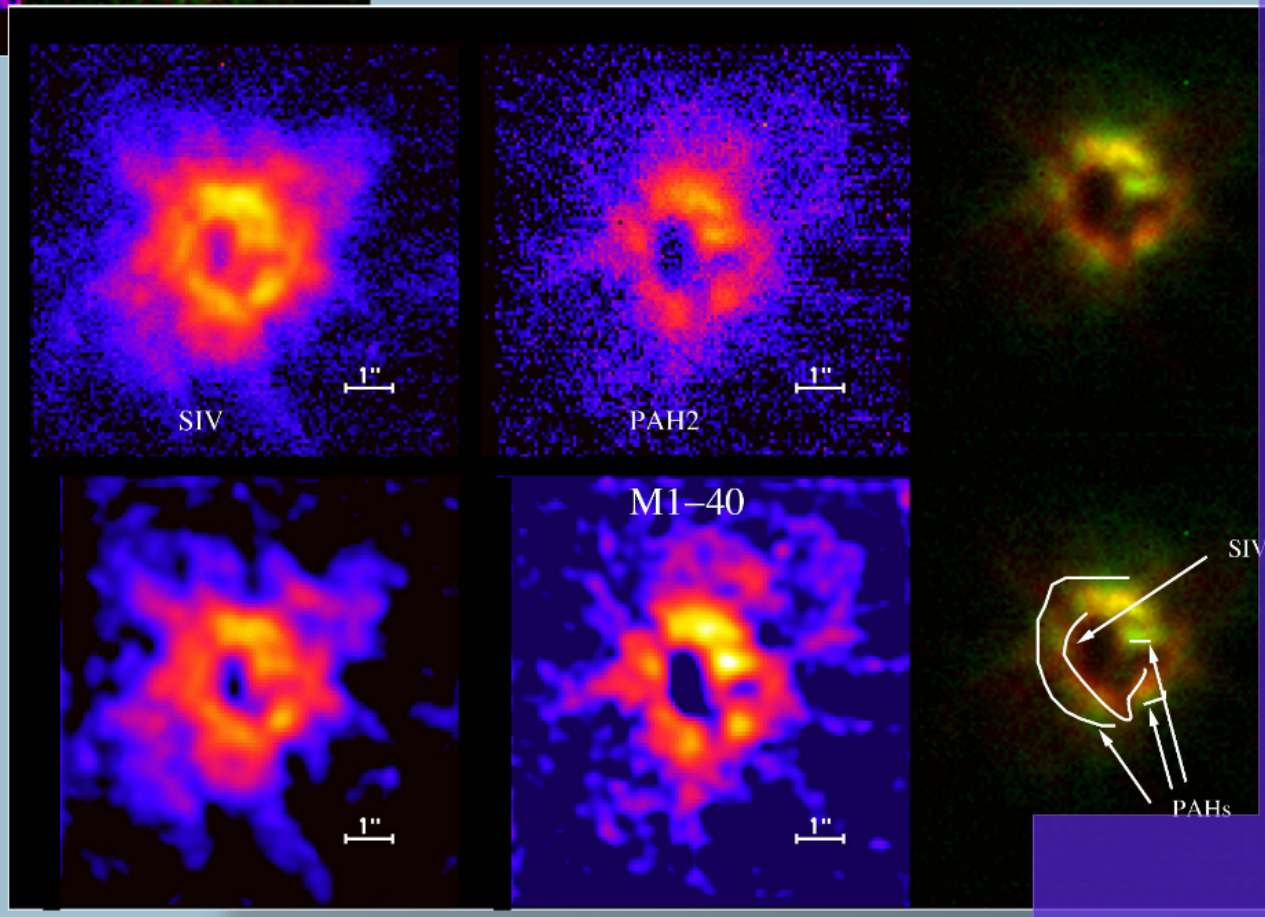

70% of the PNe
are Bipolar

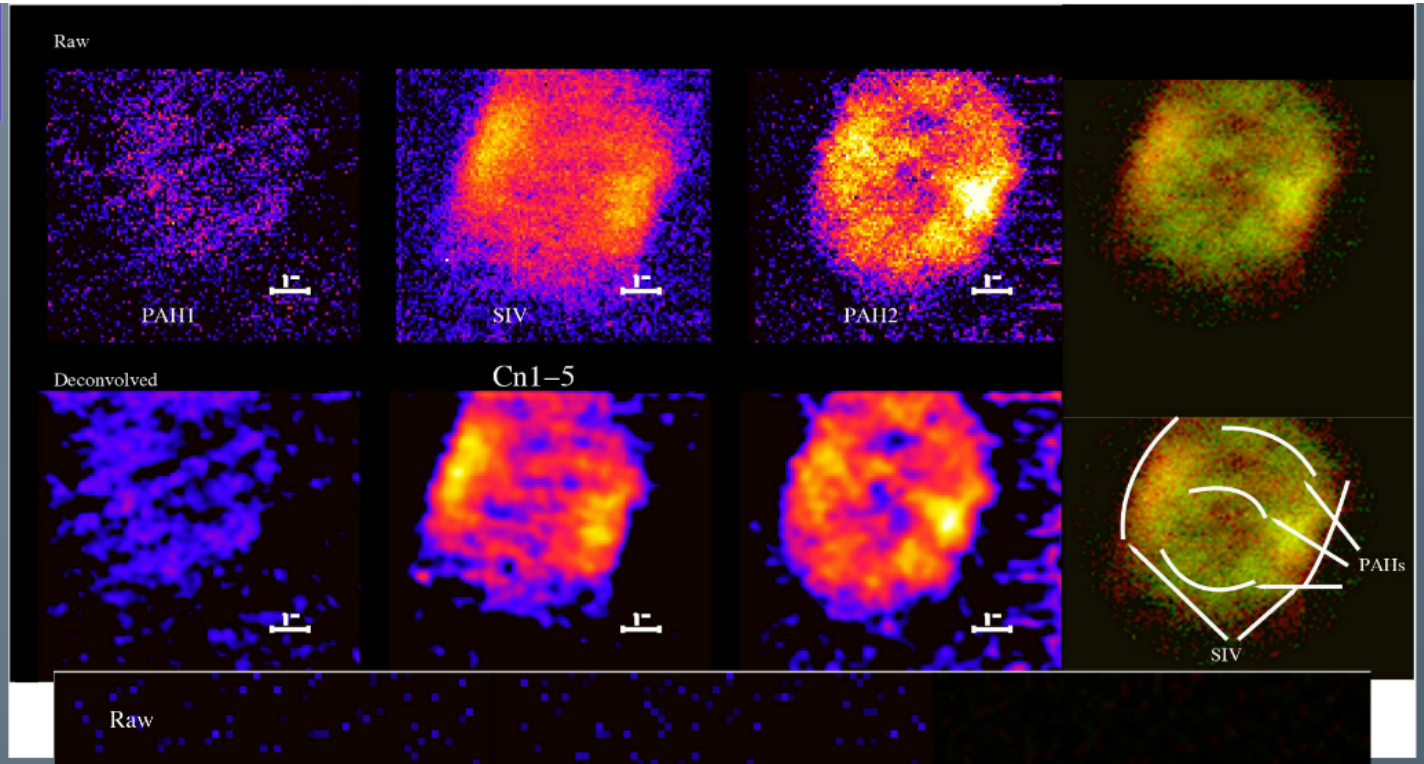
Follow up VISIR/VLT

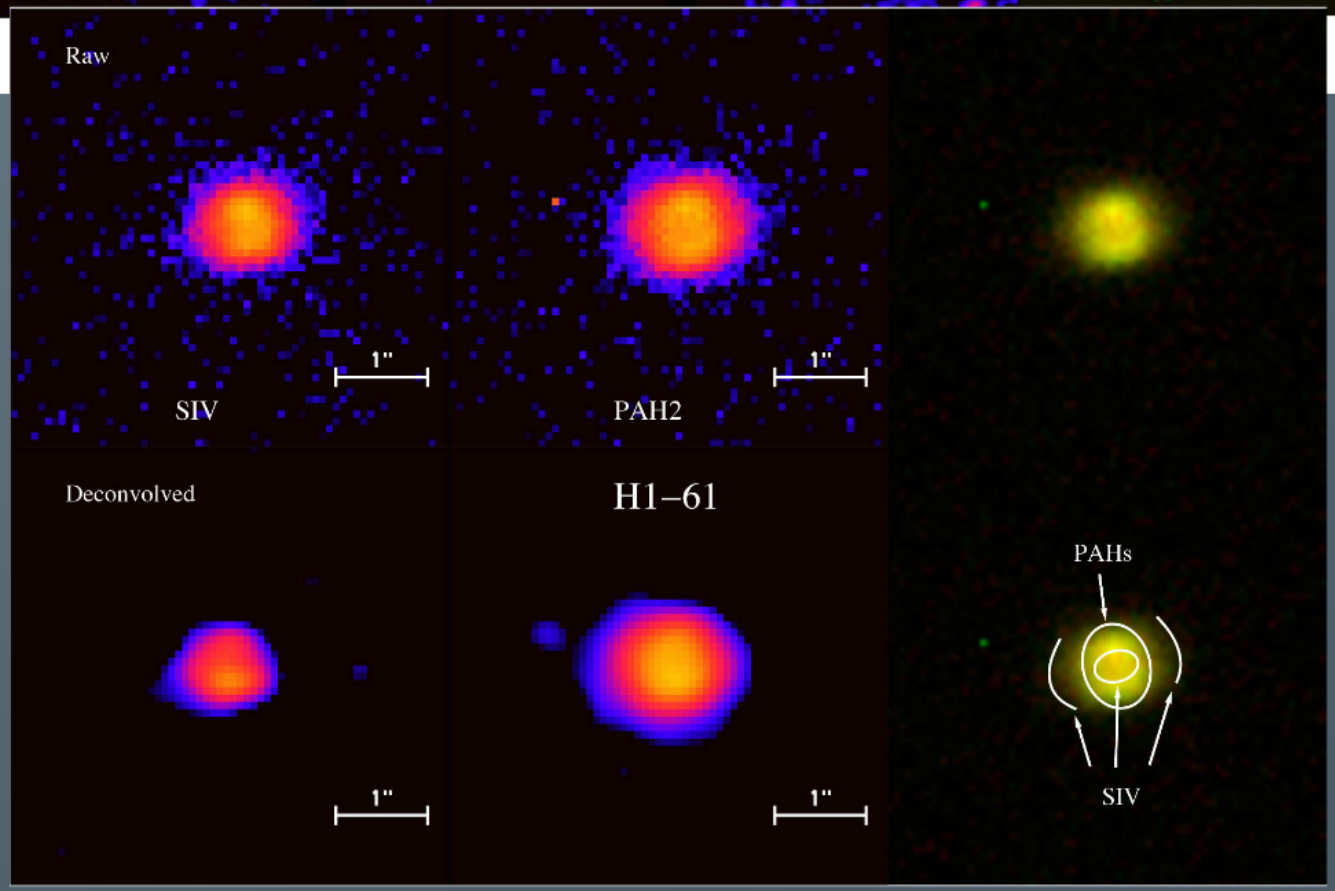


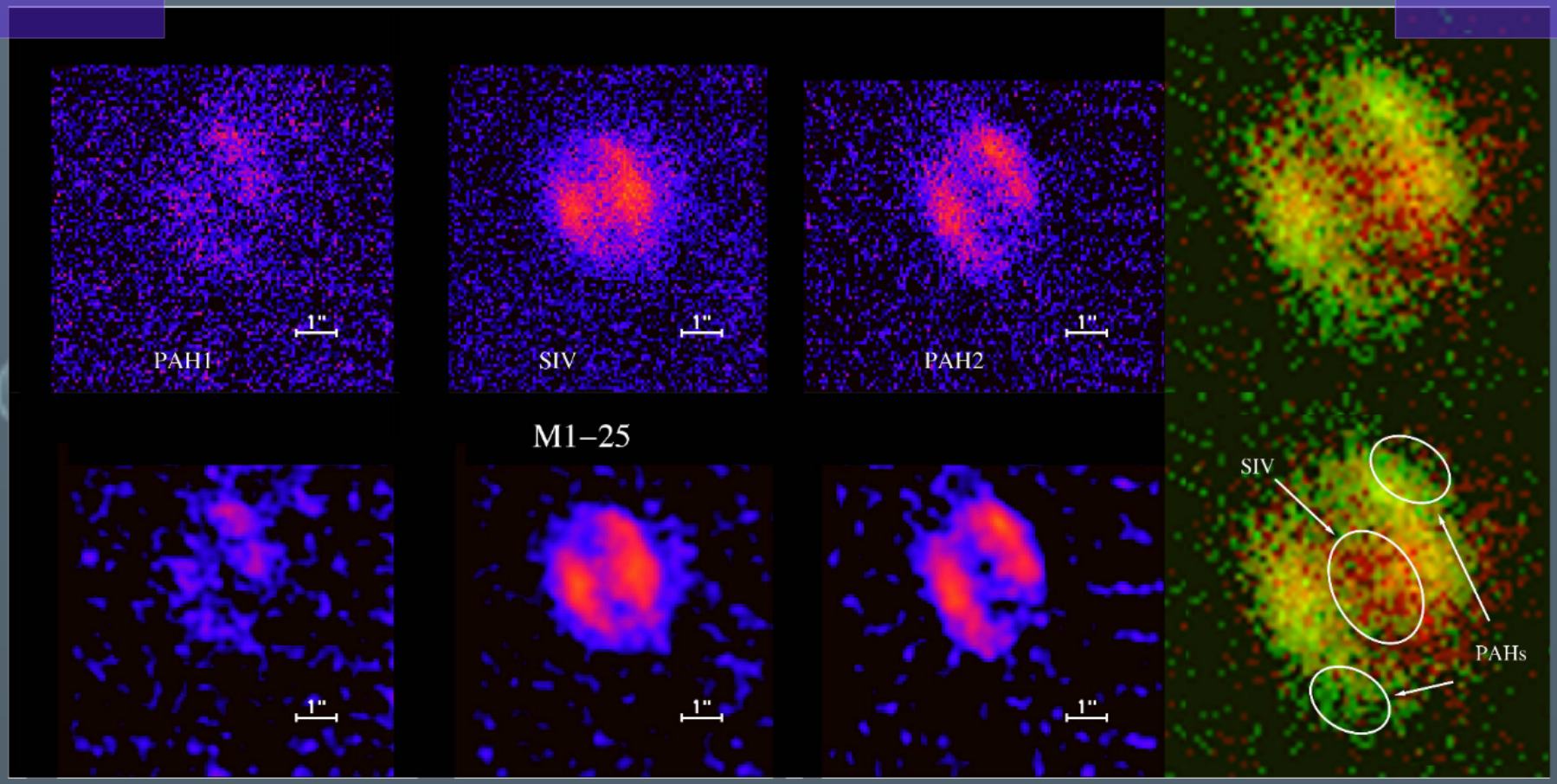

M3–38
1"
PAH1
1"
SIV
1"
PAH2
PAHs
1"
PAH1
1"
SIV
1"
PAH2
PAHs
Th3–4
1"
PAH1
1"
SIV
1"
PAH2
PAHs
1"
PAH1
1"
SIV
1"
PAH2
Deconvolved
H1–43
1"
1"
1"
PAHs

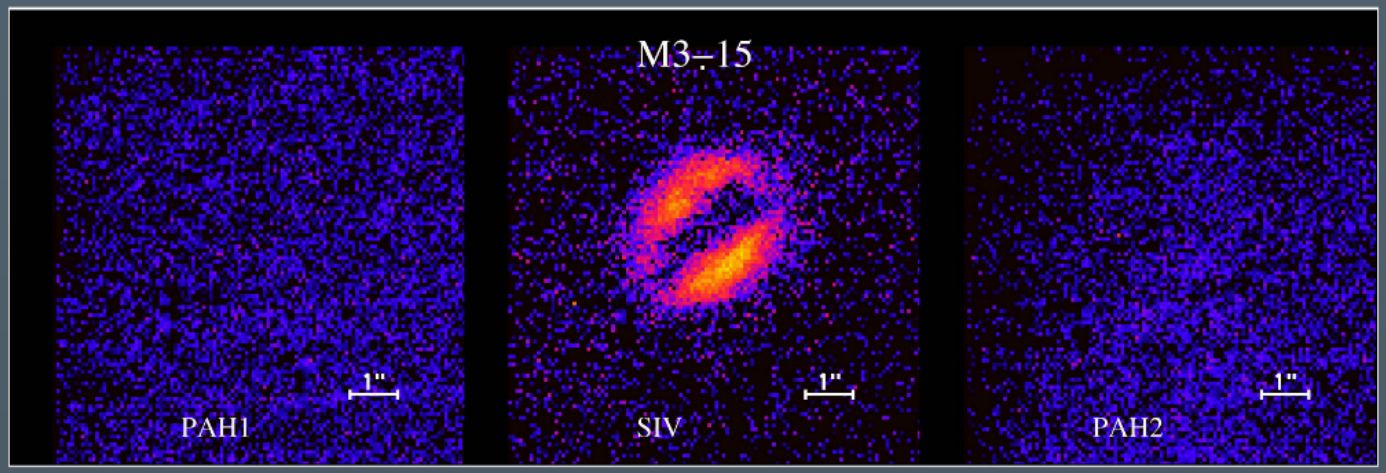

SIV
1"
PAH2
1"
M1–31
1"
1"
PAHs


SIV
1"
PAH2
1"
M1–40
1"
1"
SIV
PAHs


Raw
PAH1
SIV
PAH2
Deconvolved
Cn1–5
PAHs
SIV

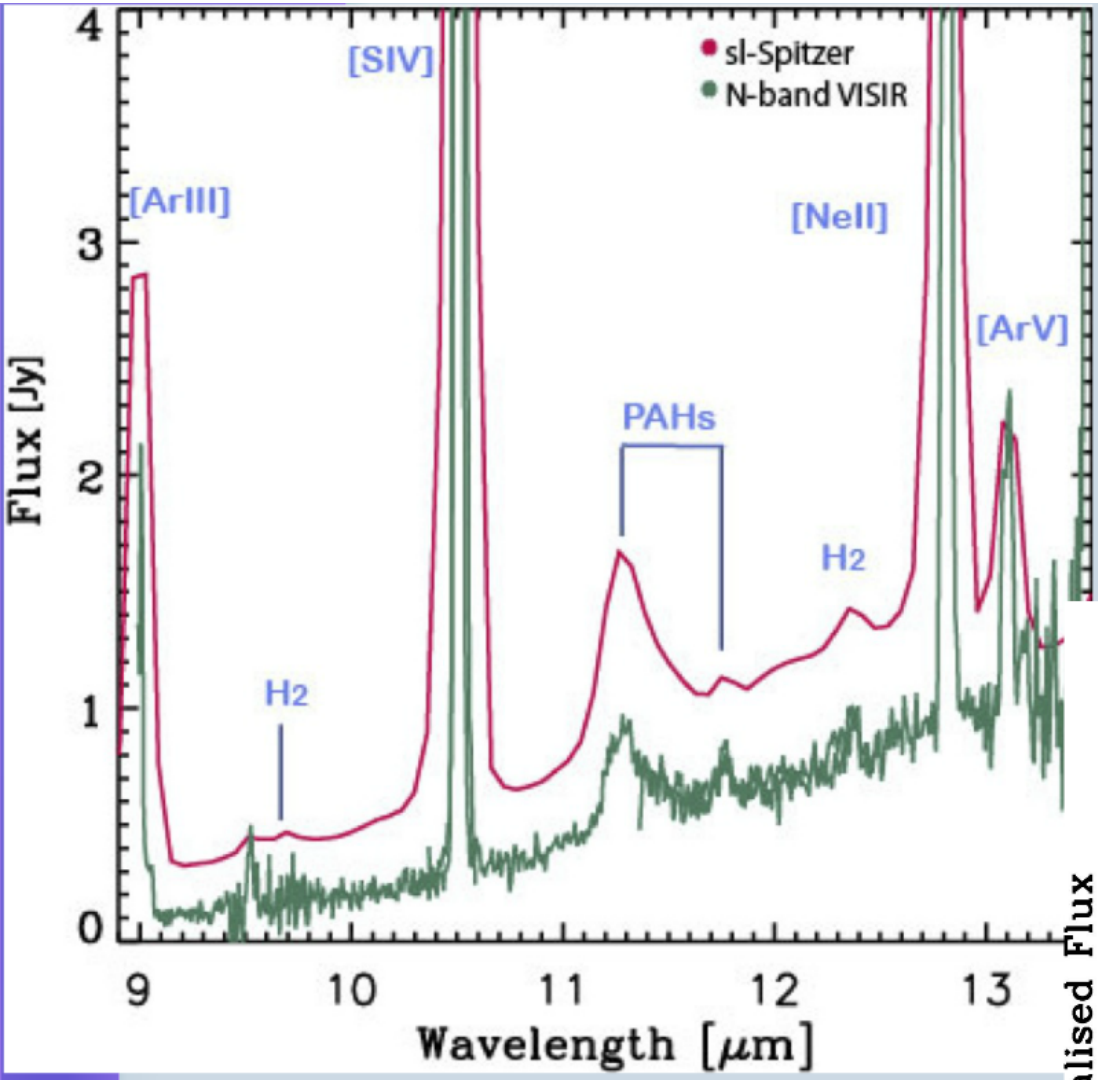

Raw
1"
SIV
1"
PAH2
Deconvolved
H1–61
1"
1"
PAHs
SIV

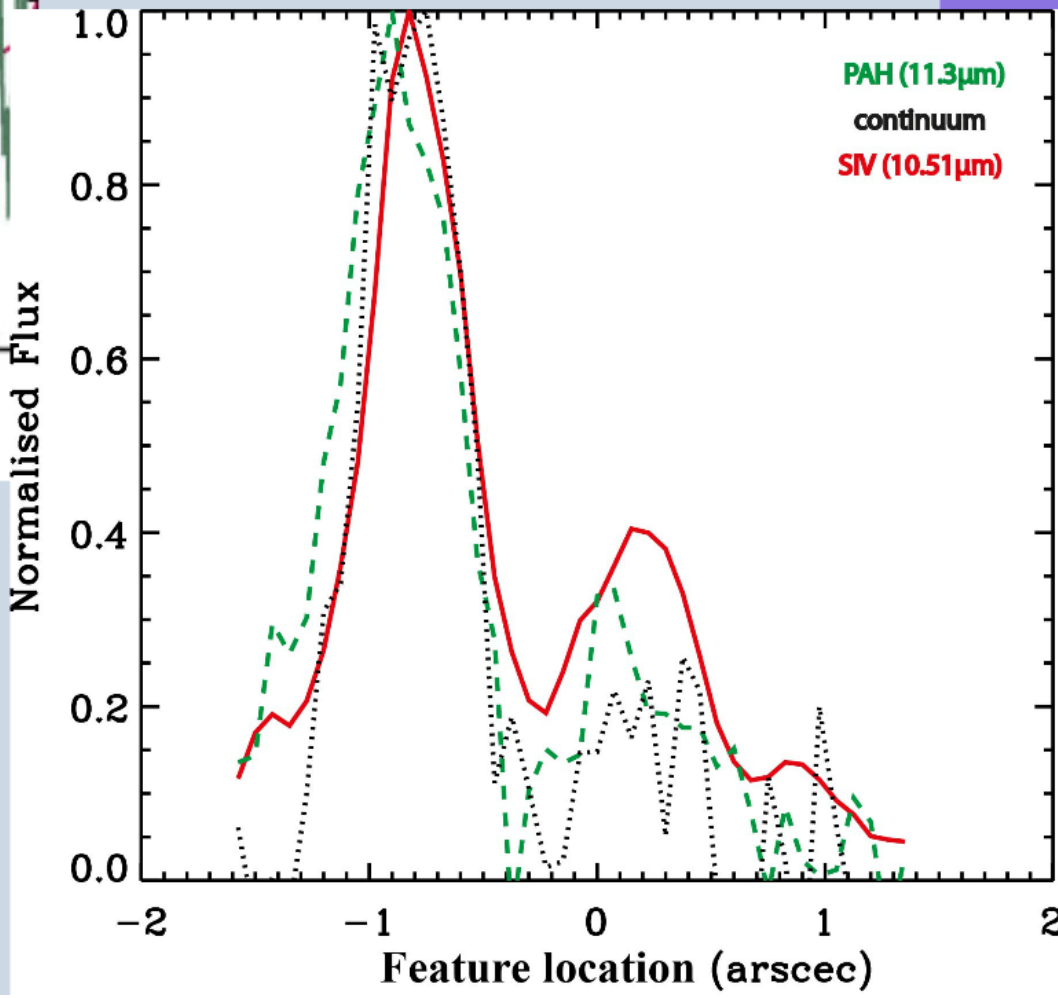




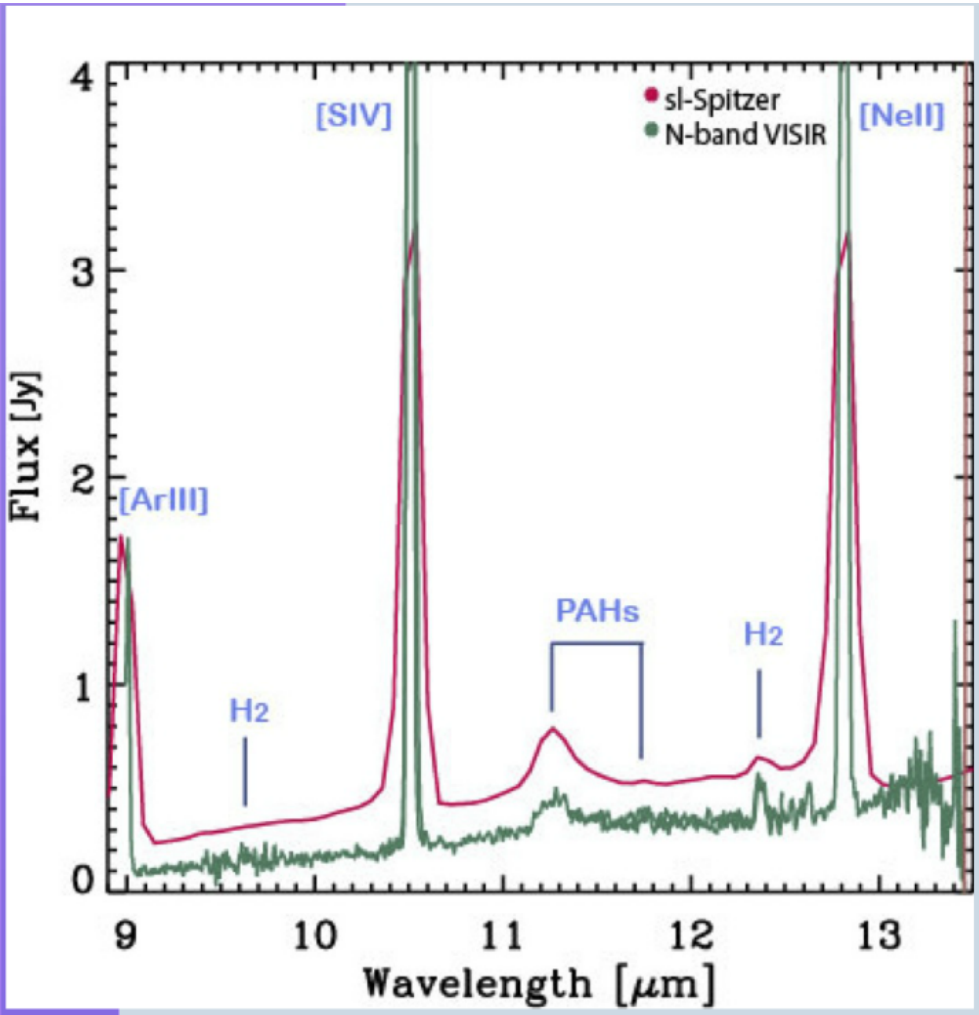
Guzman-Ramirez, L. et al. submitted

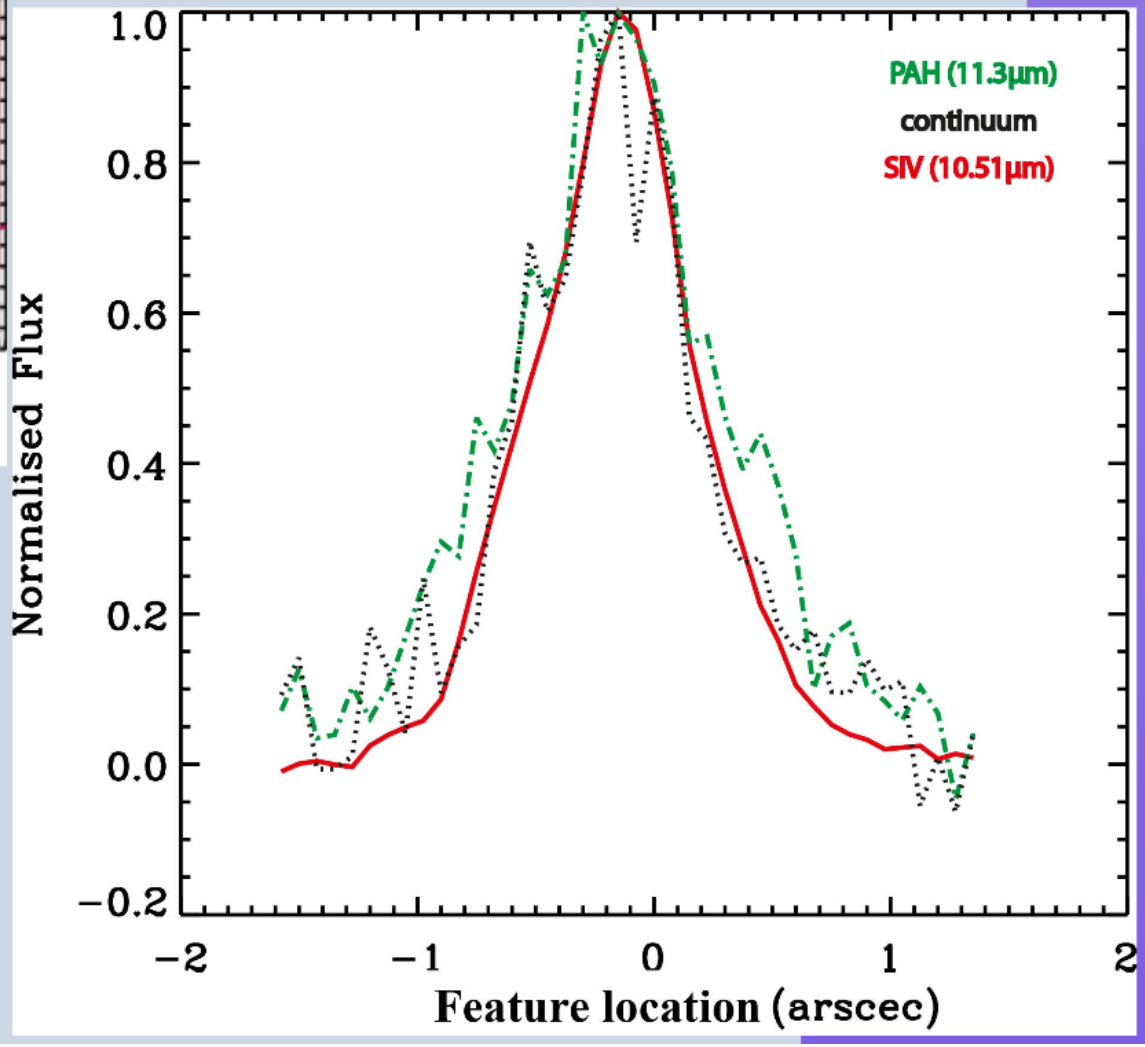
M1-40


sl-Spitzer
N-band VISIR
[SIV]
[ArIII]
[NeII]
[ArV]
PAHs
H2
H2
Flux [Jy]
Wavelength [μm]
0
1
2
3
4
9
10
11
12
13

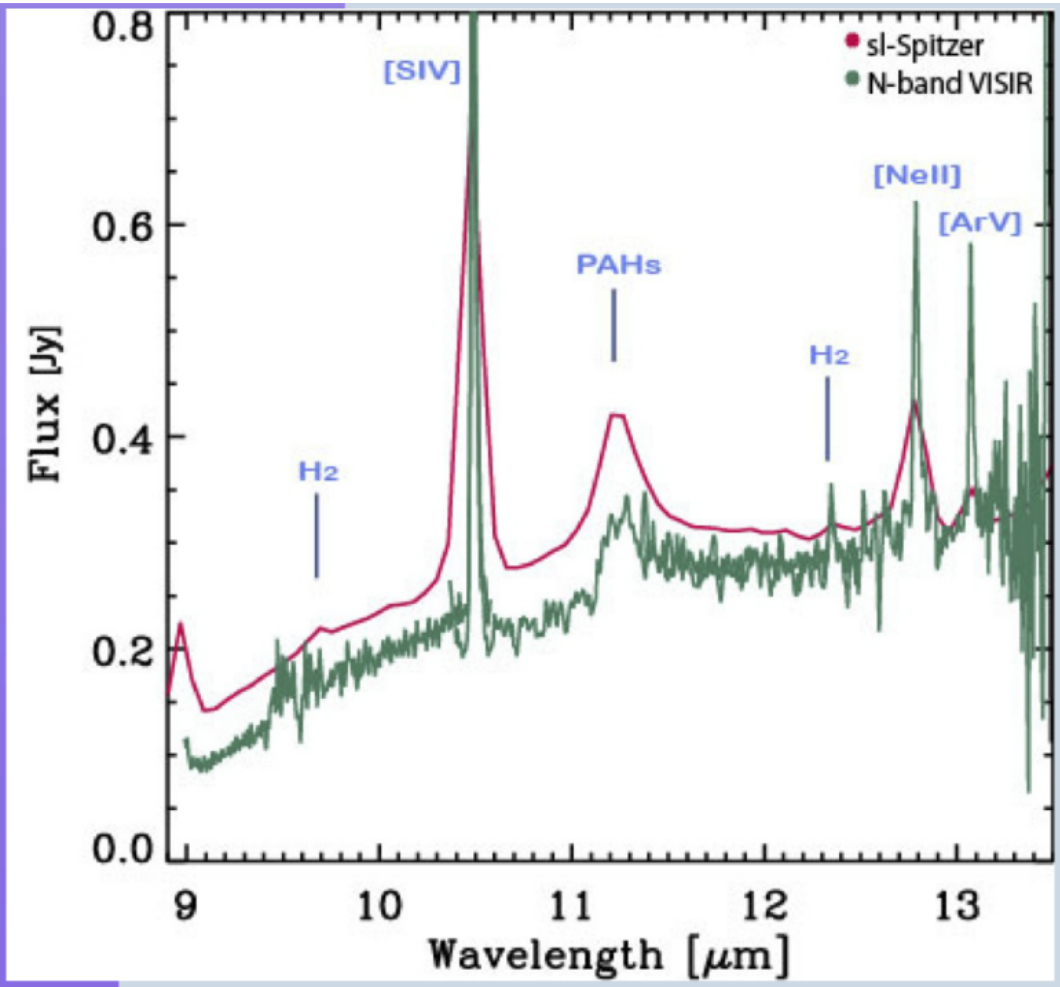

PAH (11.3μm)
continuum
SIV (10.51μm)
Normalised Flux
Feature location (arscec)
0.0
0.2
0.4
0.6
0.8
1.0
−2
−1
0
1

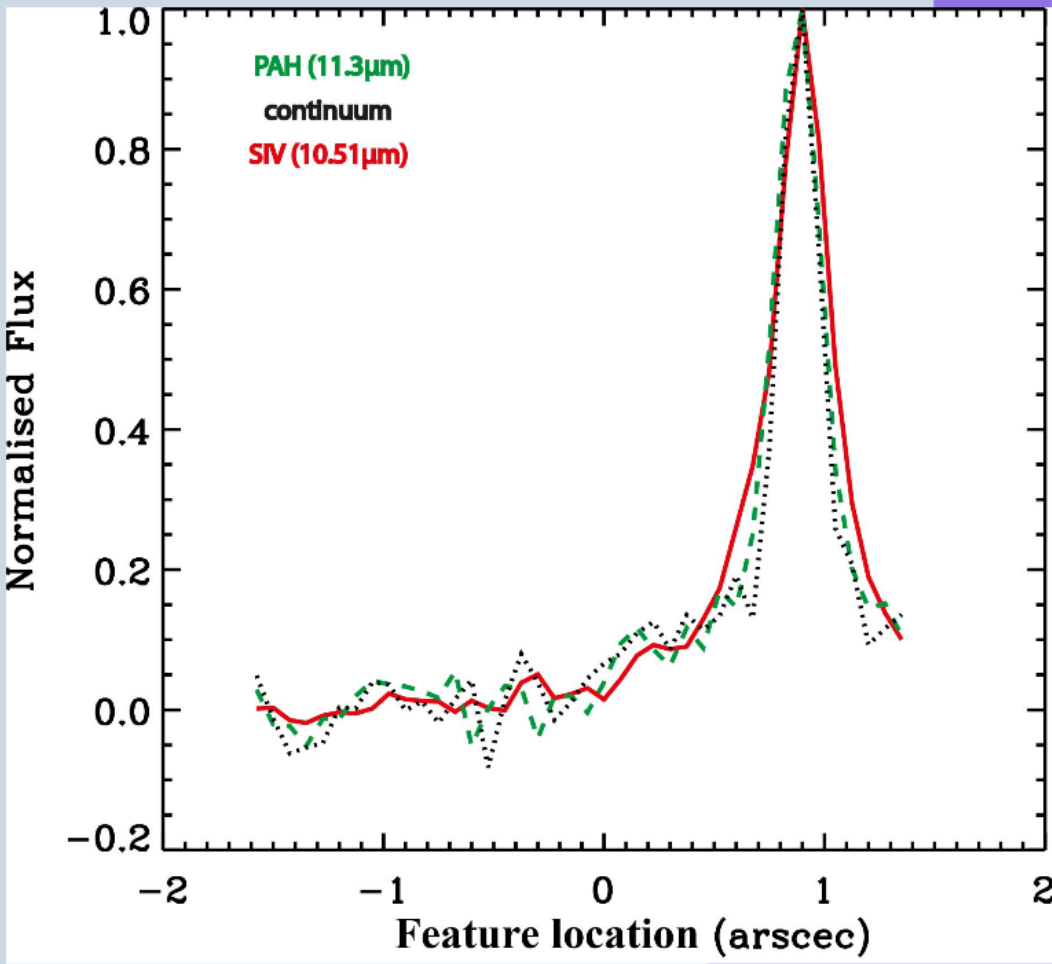
M1-31


sl-Spitzer
N-band VISIR
[SIV]
[NeII]
[ArIII]
H2
PAHs
H2
Flux [Jy]
Wavelength [μm]
0
1
2
3
4
9
10
11
12
13


PAH (11.3μm)
continuum
SIV (10.51μm)
Normalised Flux
Feature location (arscec)
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−2
−1
0
1
2

M3-38


sl-Spitzer
N-band VISIR
[SIV]
[NeII]
[ArV]
PAHs
H2
H2
Flux [Jy]
Wavelength [μm]
0.0
0.2
0.4
0.6
0.8
9
10
11
12
13


PAH (11.3μm)
continuum
SIV (10.51μm)
Normalised Flux
Feature location (arscec)
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−2
−1
0
1
2

Conclusions

- Strong correlation between strength of the PAH bands and morphology (torus).
- Modelled the formation of large hydrocarbons in an O-rich environment.
- PAH features were imaged using the VISIR/VLT.
- The ionised [SIV] material is located inside the dusty tori, while the PAHs are present at the outer edges of these tori.
- This confirms that the PAHs formation is just outside the ionised zone, therefore it must be due to the photoionisation of CO.

70% of our PNe sample are bipolar.
Bipolar PNe are associated with binarity.
Higher incidence of binarity in the Galactic Bulge?


Thank you!