



pyPAHTAT

Python Polycyclic Aromatic Hydrocarbon Toulouse Astronomical Templates

Why?

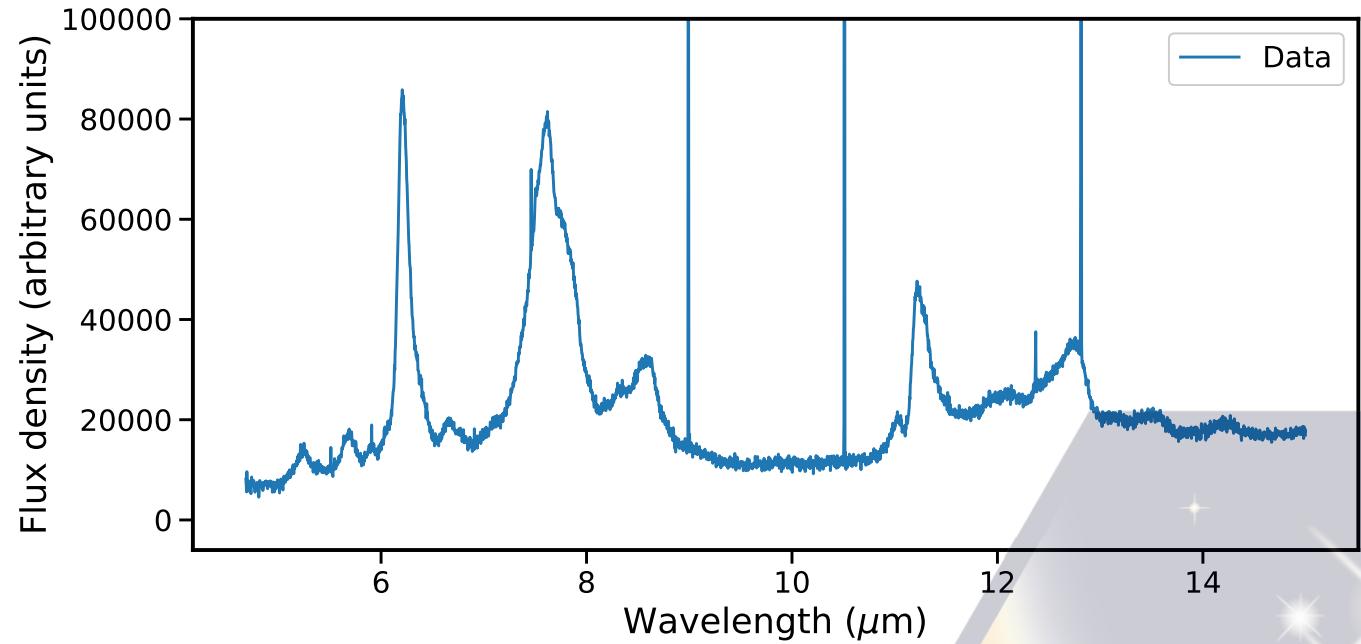
Data fitting !

- great, but what do we get?
- what are AIB contributions in an object?
- get the physical properties!



Toulouse approach

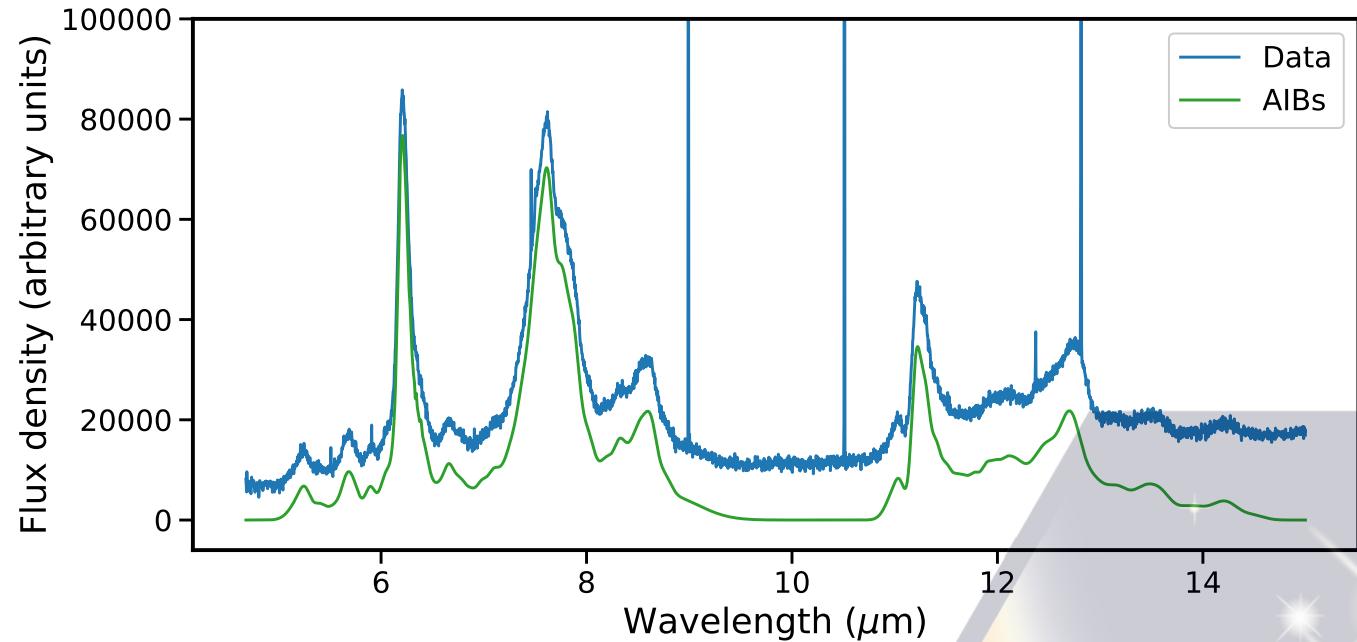
Each PDR spectrum is composed by:



Toulouse approach

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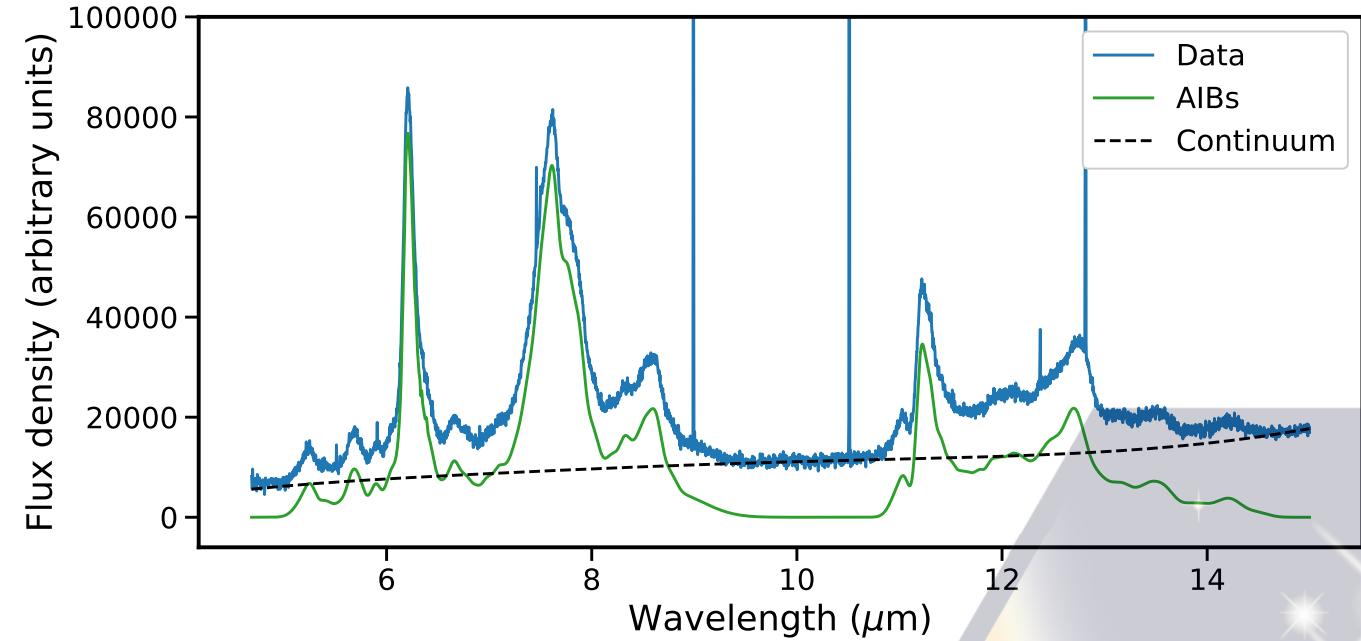
→ AIBs



Toulouse approach

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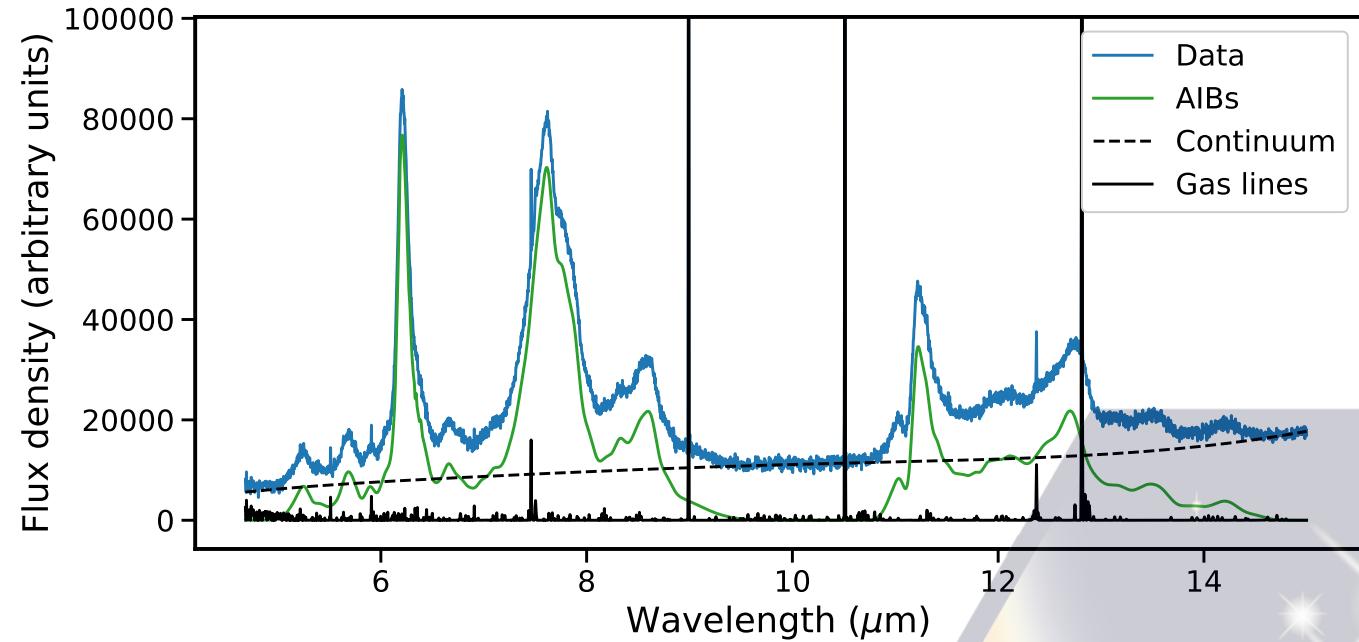
- AIBs
- Continuum



Toulouse approach

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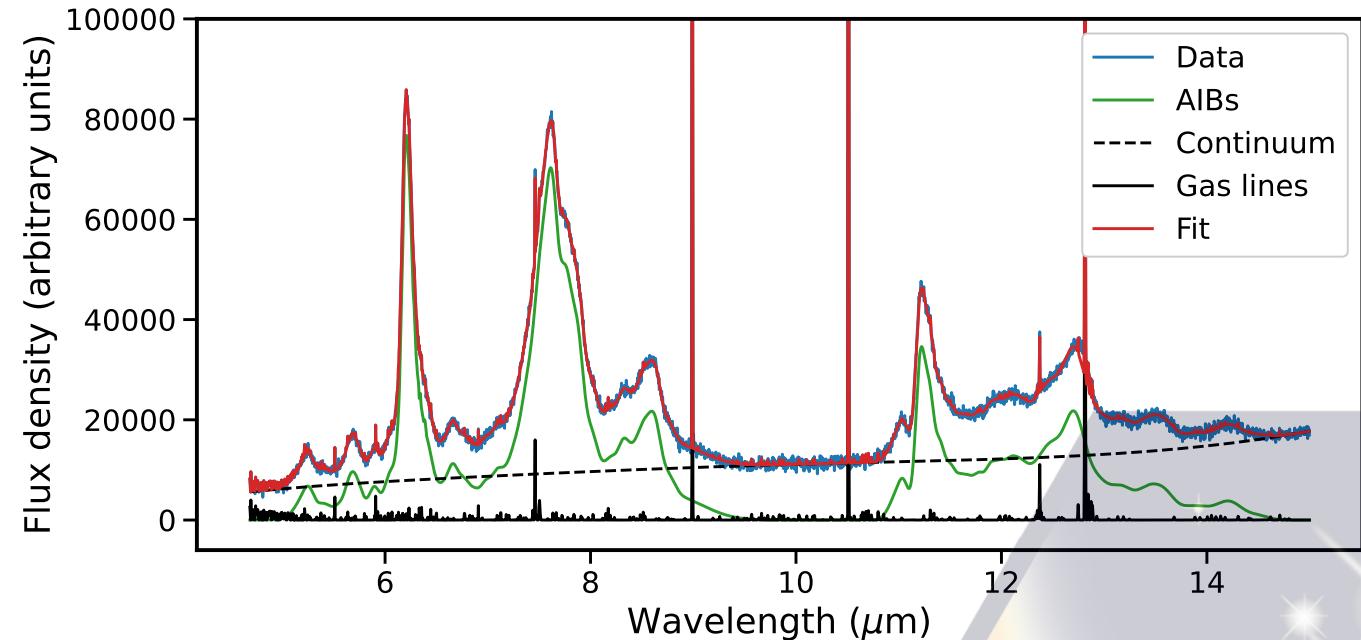
- AIBs
- Continuum
- Emission lines
- Noise



Toulouse approach

Each PDR spectrum is composed by:

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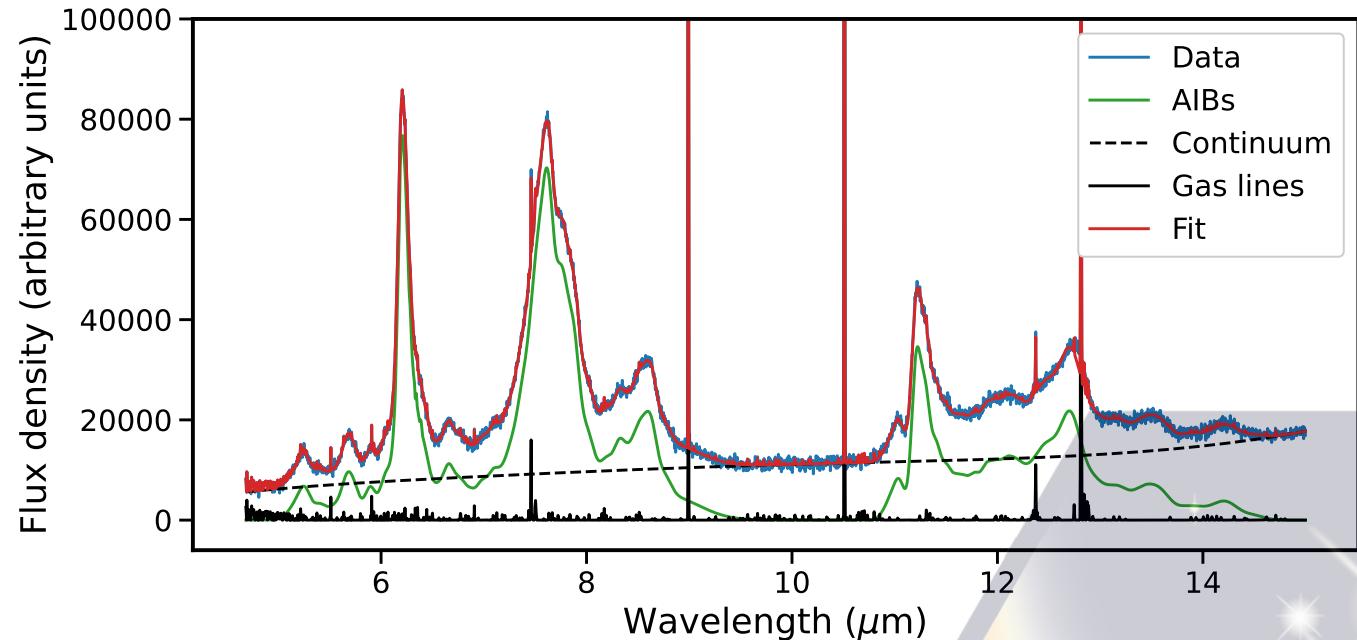


Linear combination of
those contributions!

Toulouse approach

Each PDR spectrum is composed by:

- AIBs
- Continuum
- Emission lines
- Noise



Linear combination of
those contributions!

→ fast convergence using NNLS compared to
non linear approach!! (few seconds)

PAHTAT

From observations and quantum chemistry guided using ML methods

Pilleri et al. 2012 extracted PAH populations from Spitzer spectra

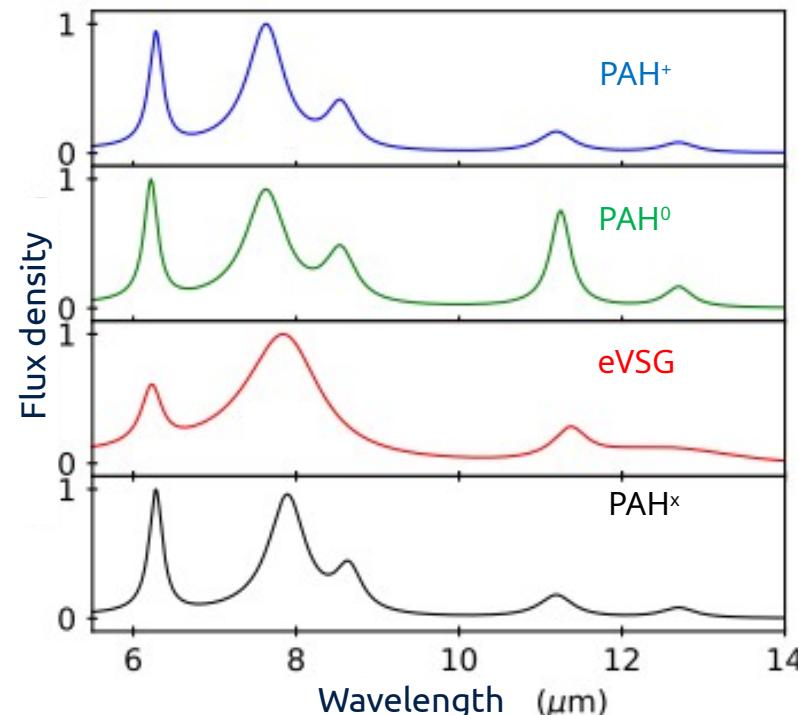


PDRs4All

PAHTAT

From observations and quantum chemistry guided using ML methods

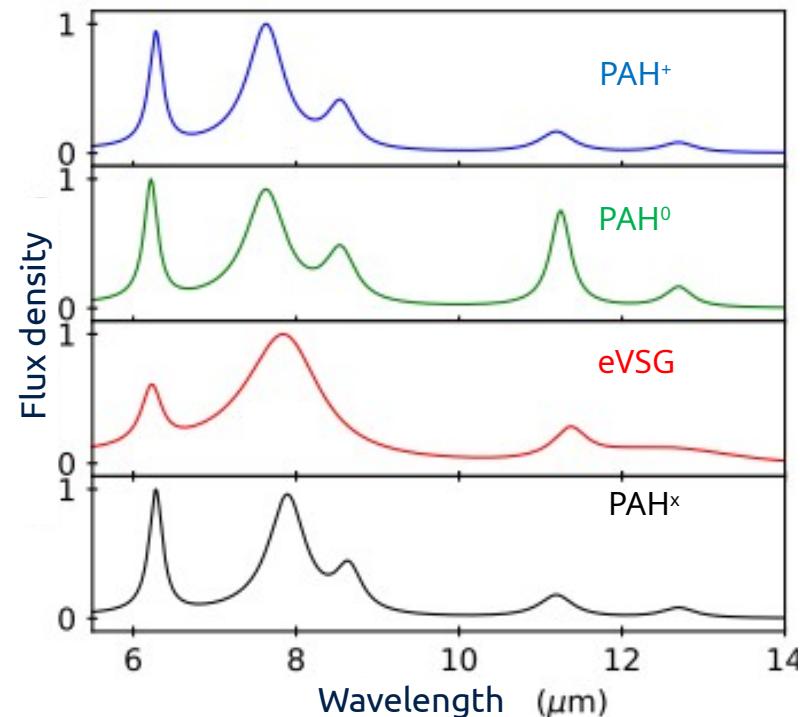
Pilleri et al. 2012 extracted PAH populations from Spitzer spectra



PAHTAT

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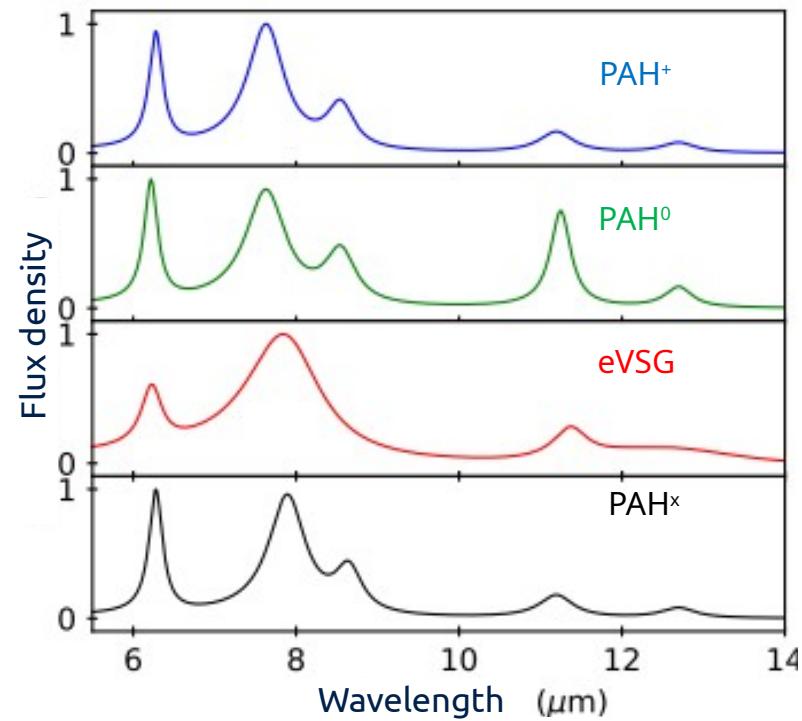


PAH ⁺	Ionized PAHs	(Berné+07, Pilleri+12)
PAH ⁰	Neutral PAHs	
eVSG	Evaporating very small grains	
PAH ^x	Large ionized PAHs	(Joblin+08)

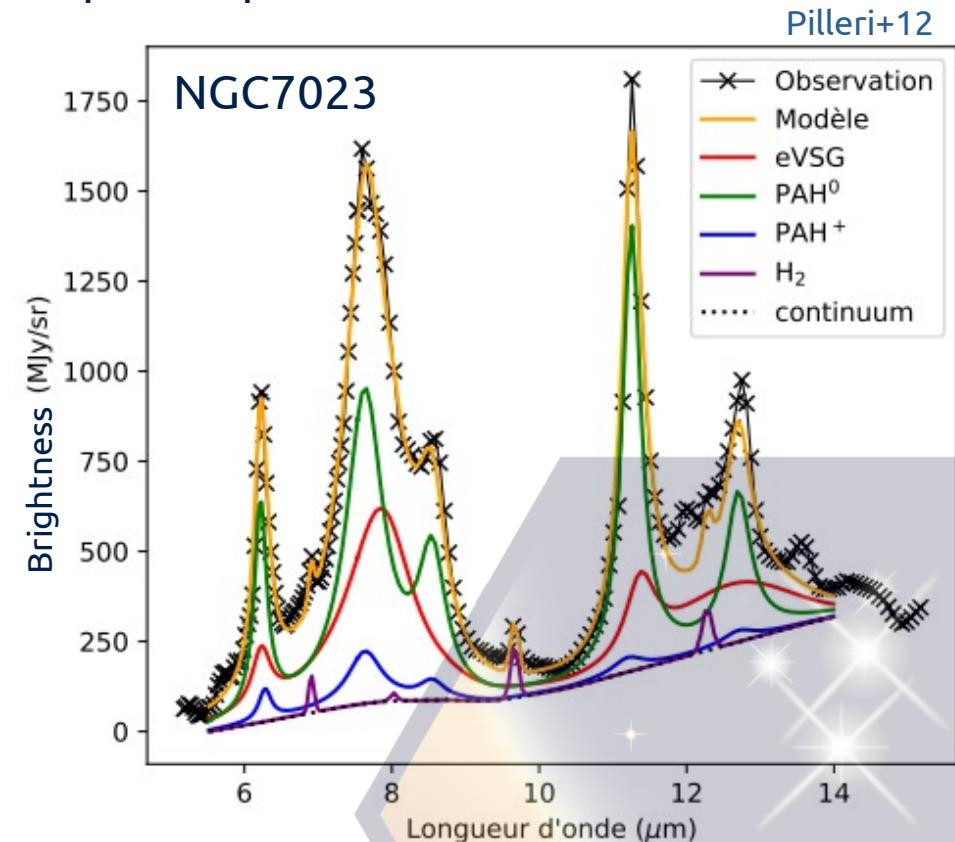


PAHTAT

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PAHTAT

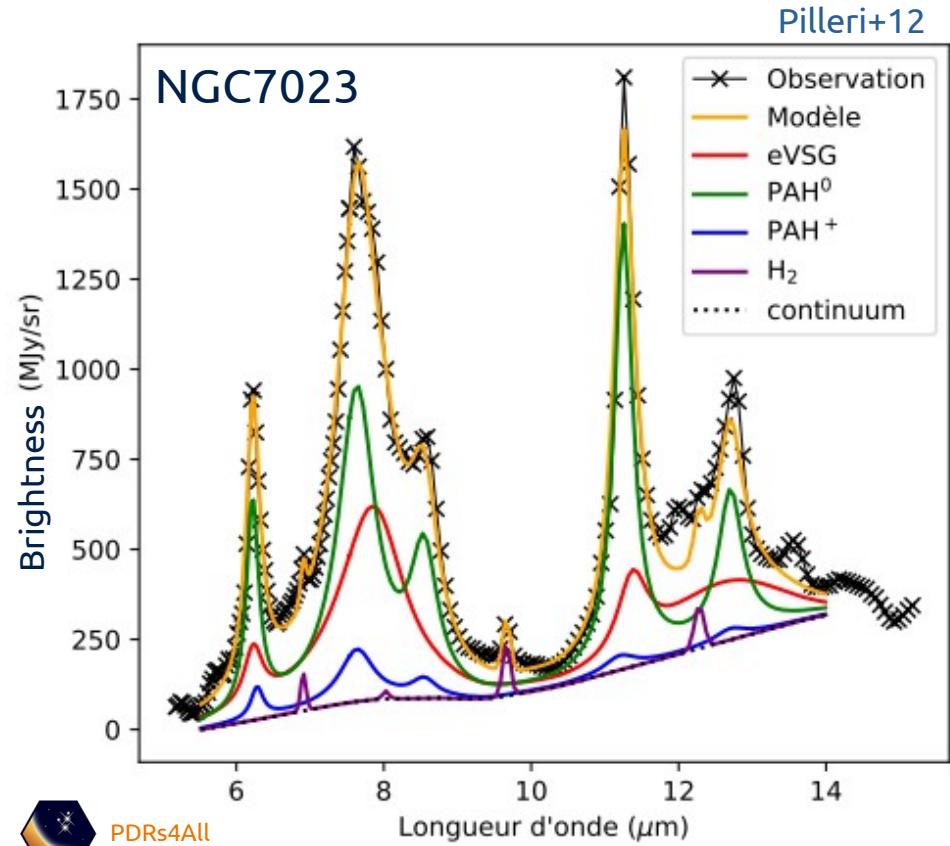


Pilleri+12



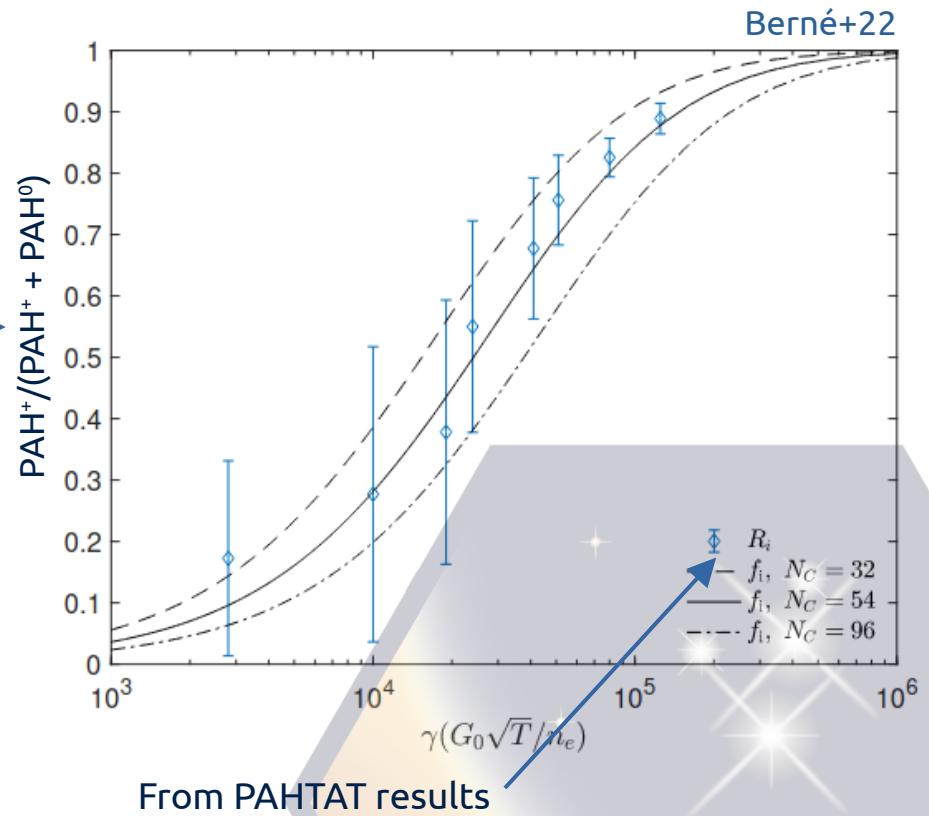
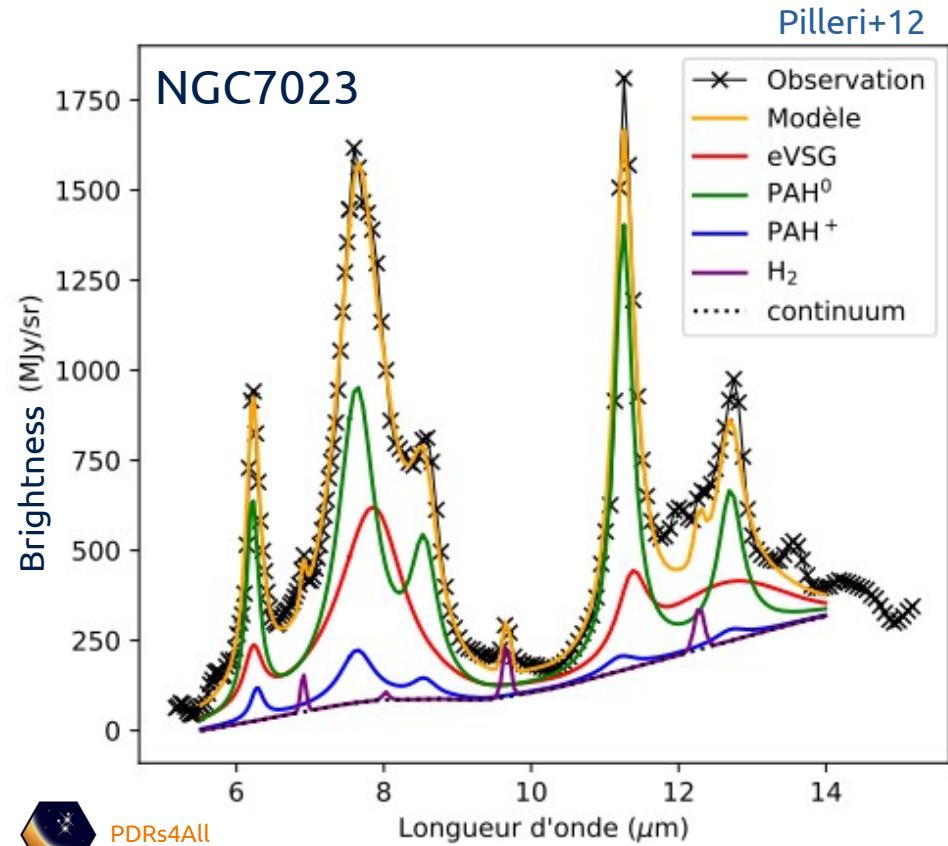
PDRs4All

PAHTAT



PDRs4All

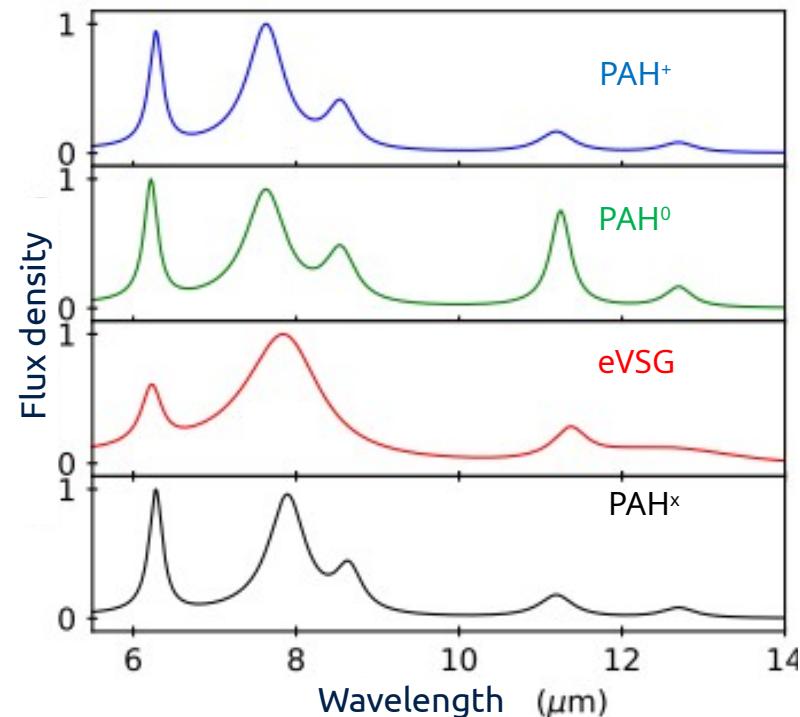
PAHTAT



PDRs4All

PAHTAT

PAHTAT evolution

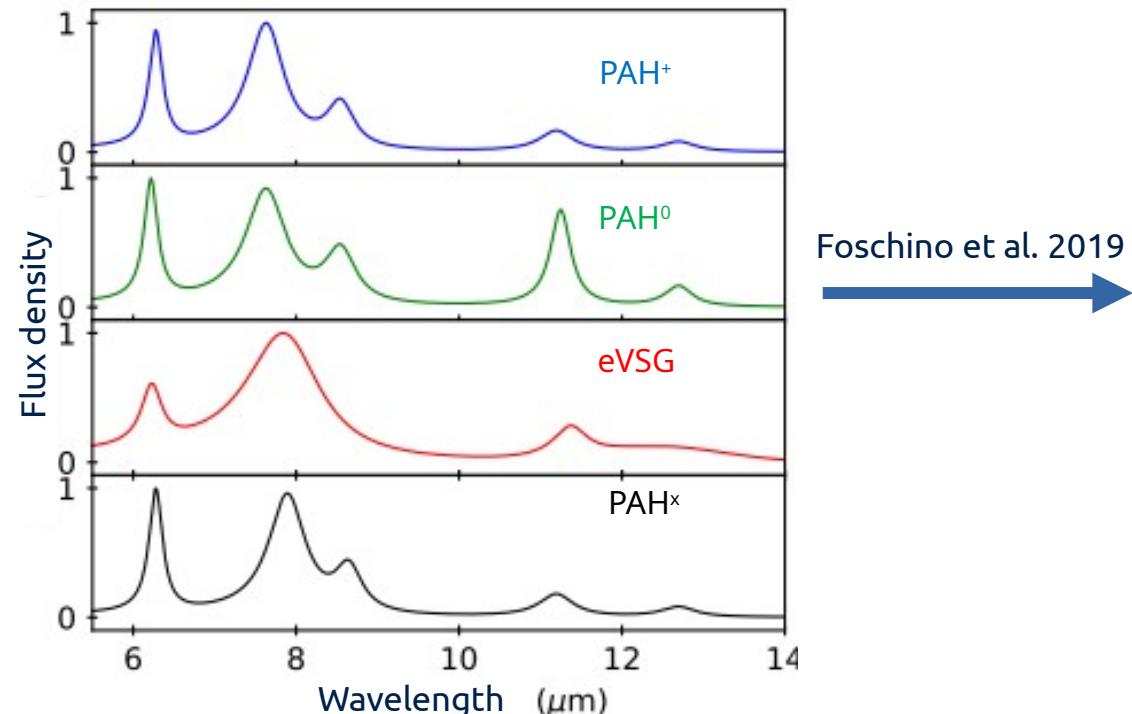


PDRs4All

PAHTAT

PAHTAT evolution

Foschino et al. 2019 re-extracted PAHs with ISO spectra → better resolution + 3.3 band



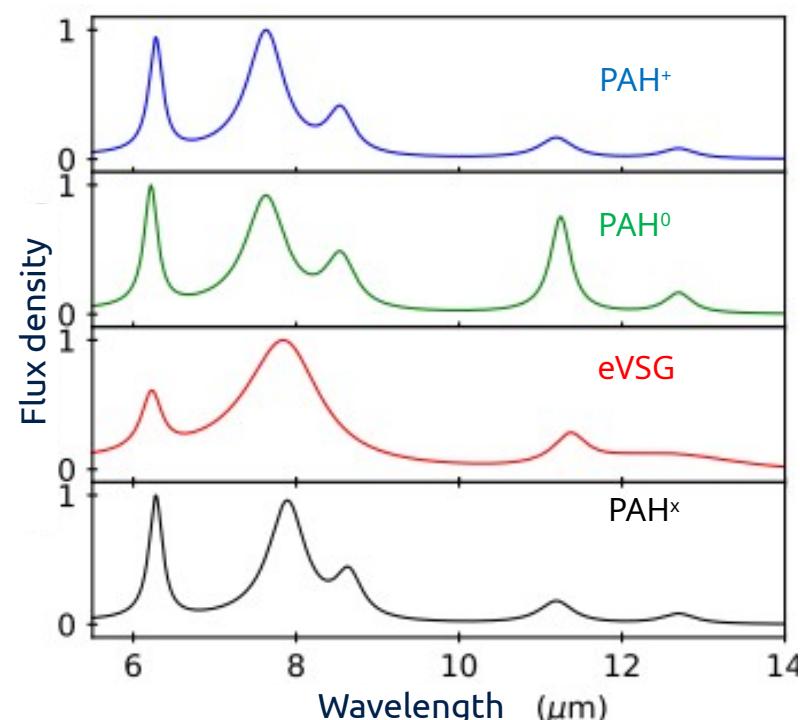
Foschino et al. 2019



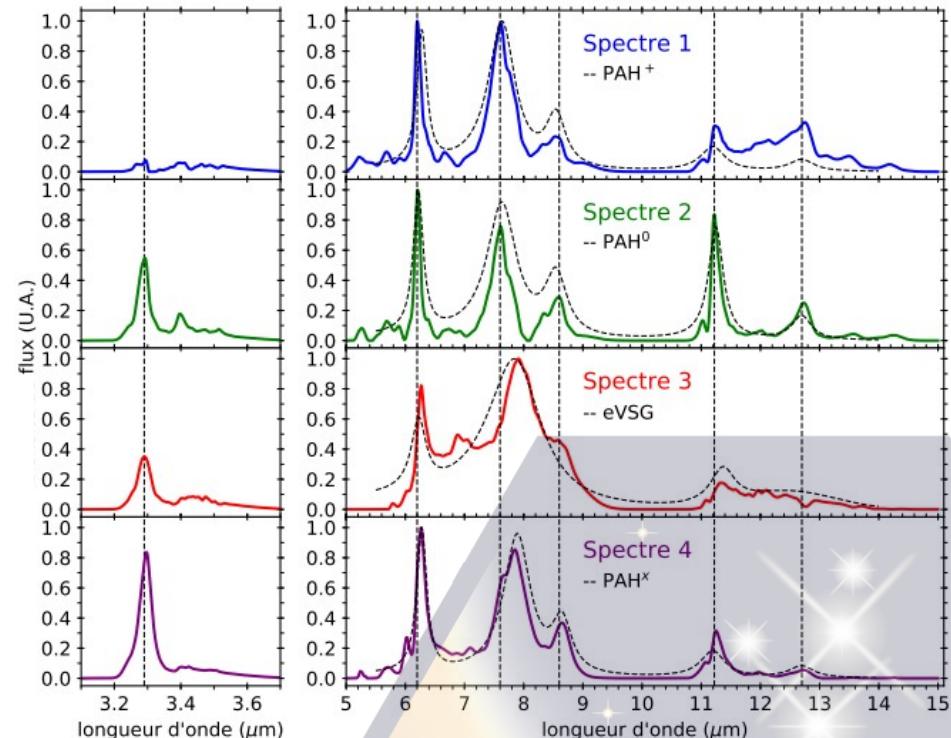
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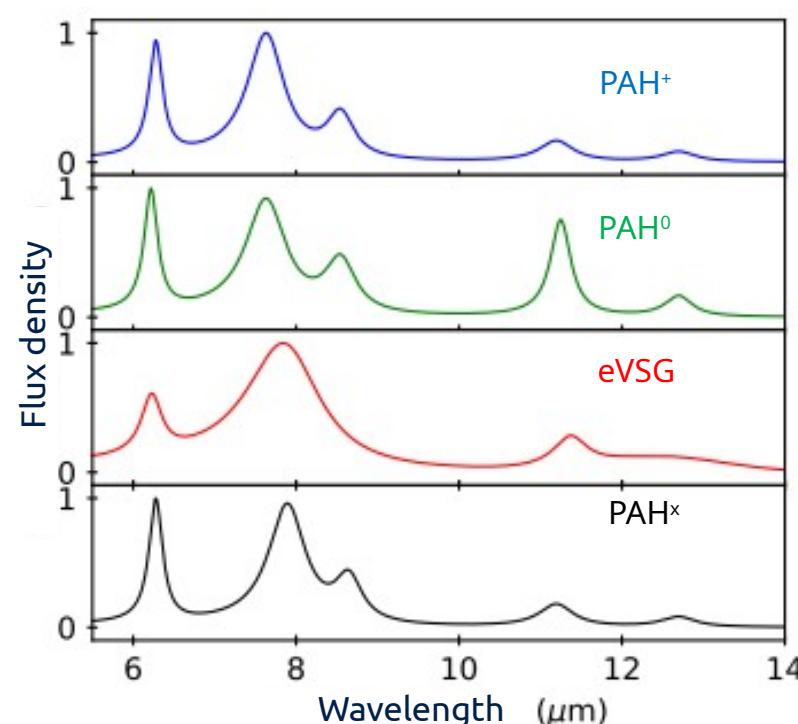
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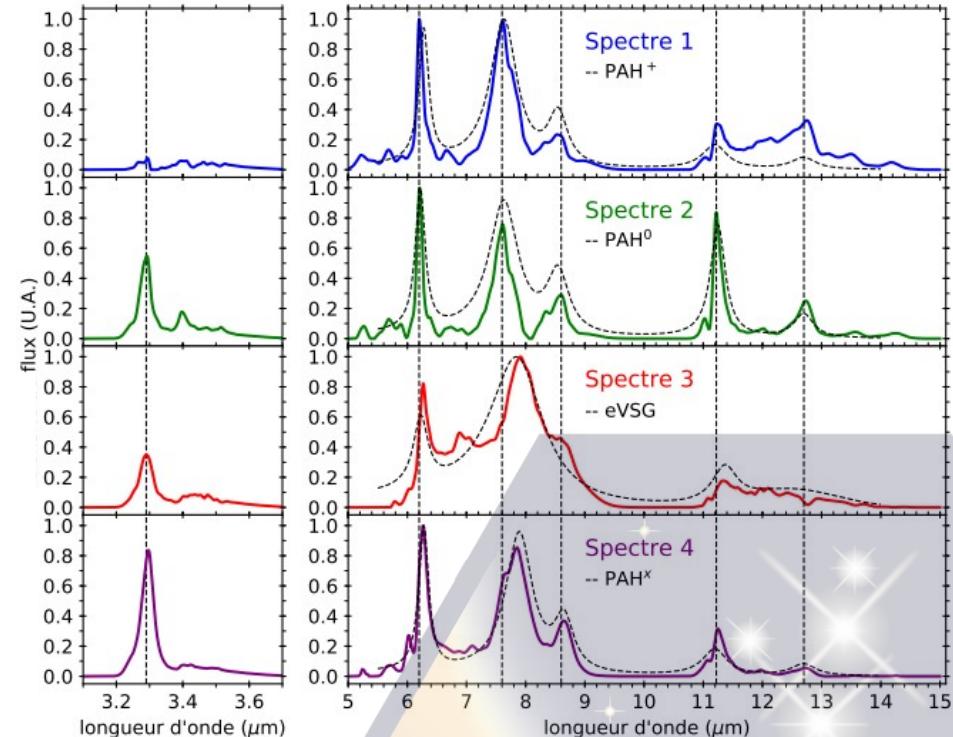
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Foschino et al. 2019



JWST data need new templates extraction!



PDRs4All

PAHTAT in ERS PDRs4All

Get new templates from MIRI MRS observations !

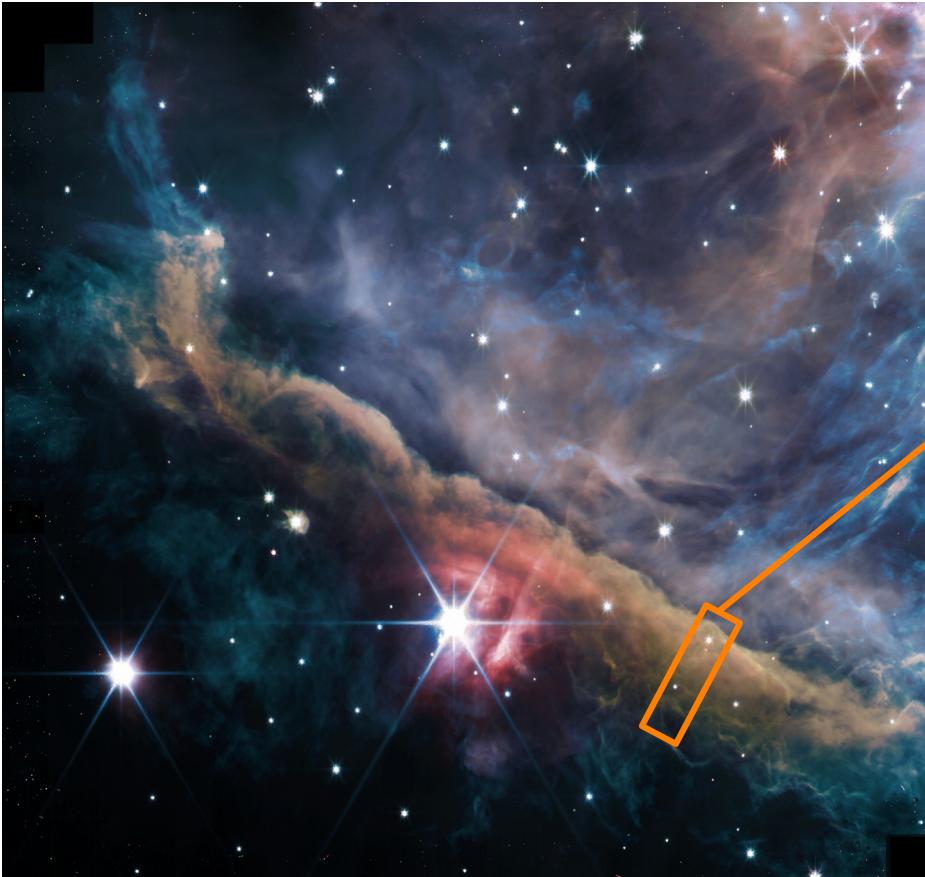


Credit NASA/ESA/CSA/PDRs4All & Salomé Fuennmayor



PAHTAT in ERS PDRs4All

Get new templates from MIRI MRS observations !



MIRI MRS obs. delayed to end of
January 2023 !
→ new templates next year !!

PyPAHTAT today

Apply on JWST data using Foschino+19 templates!

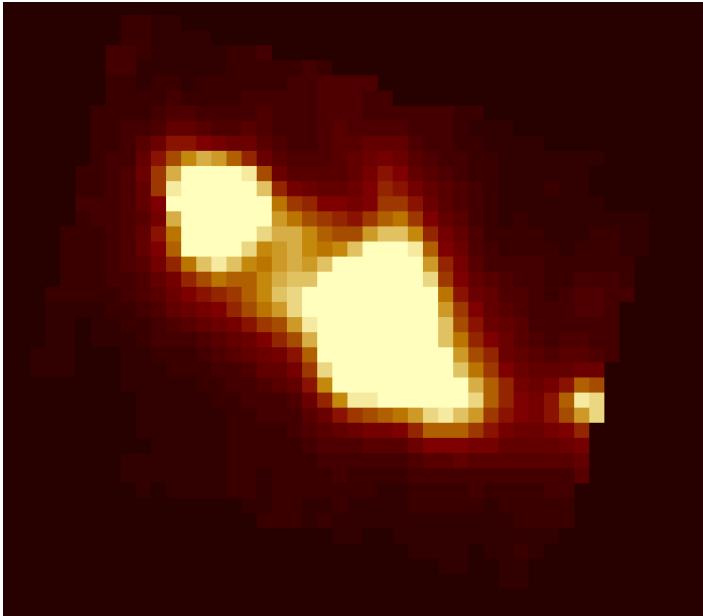


PDRs4All

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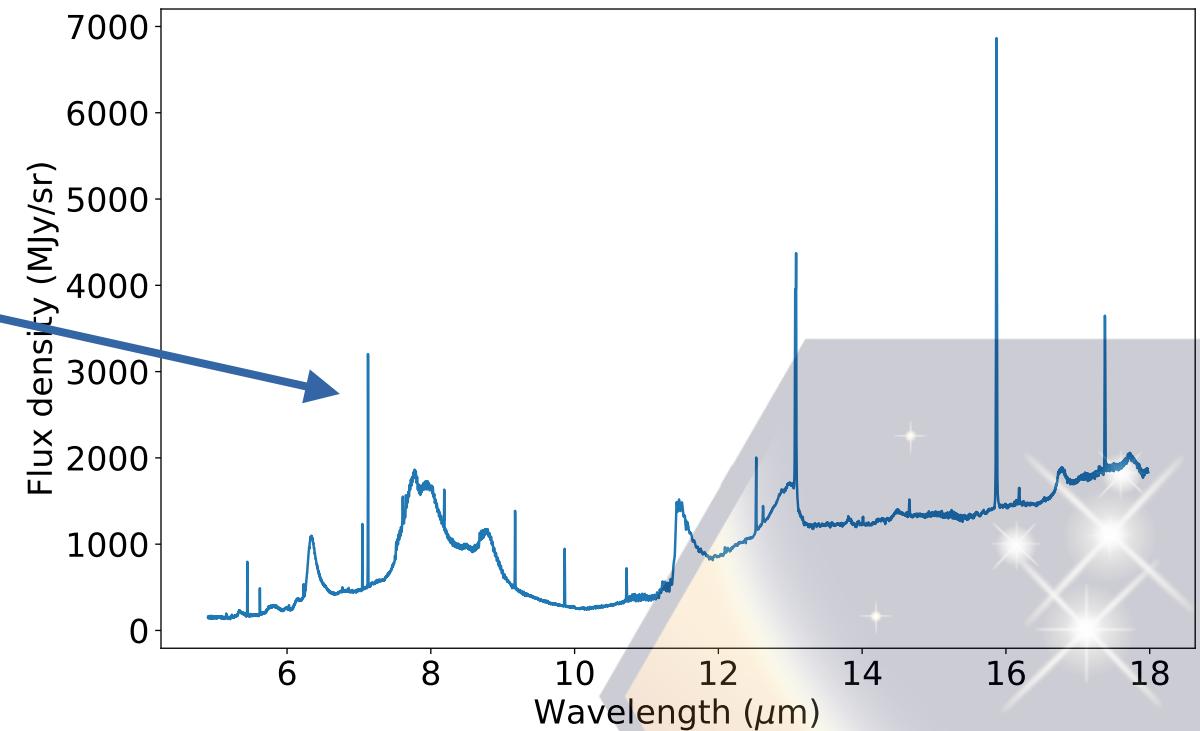
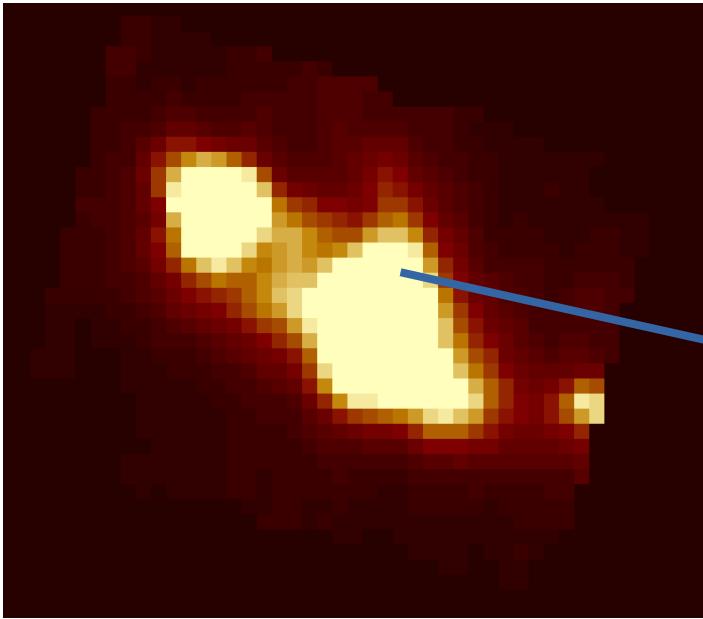
VV114 MIRI MRS nb image



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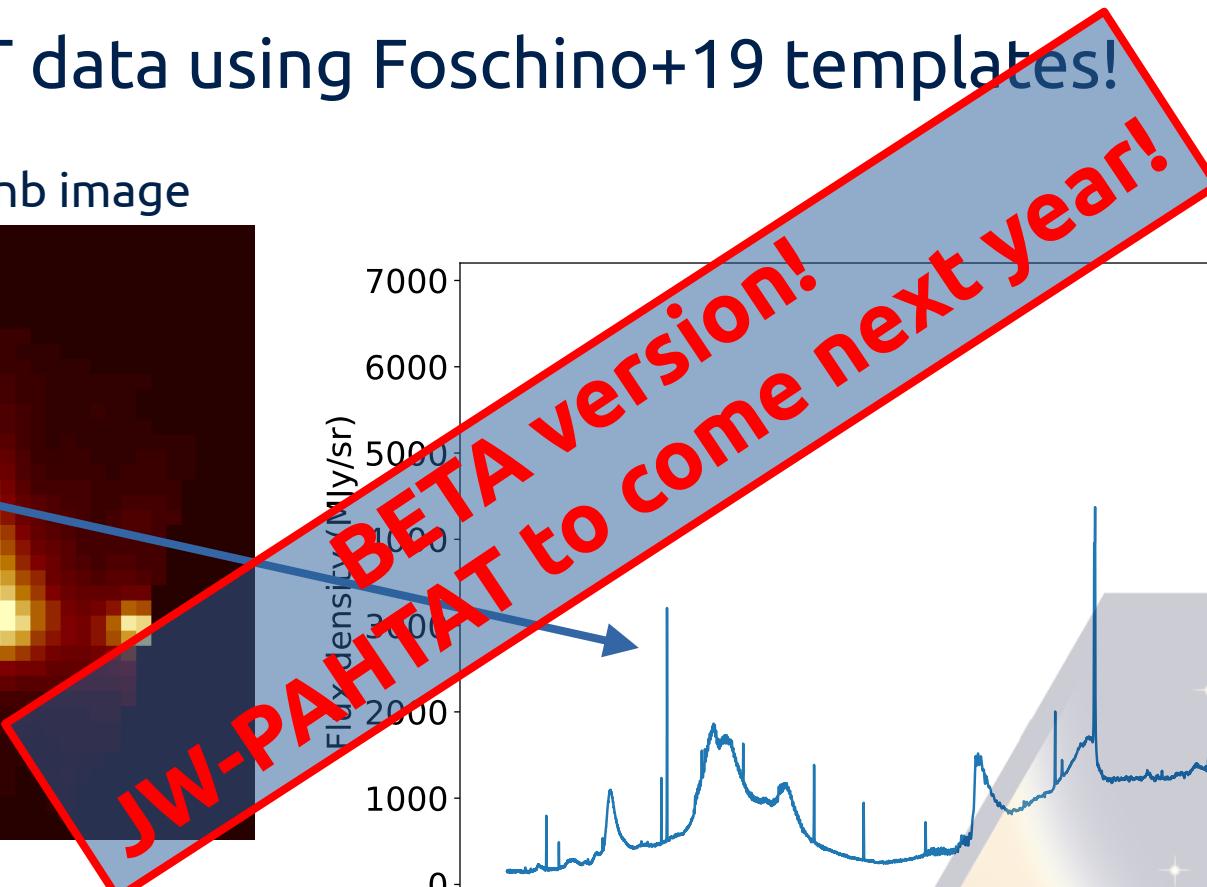
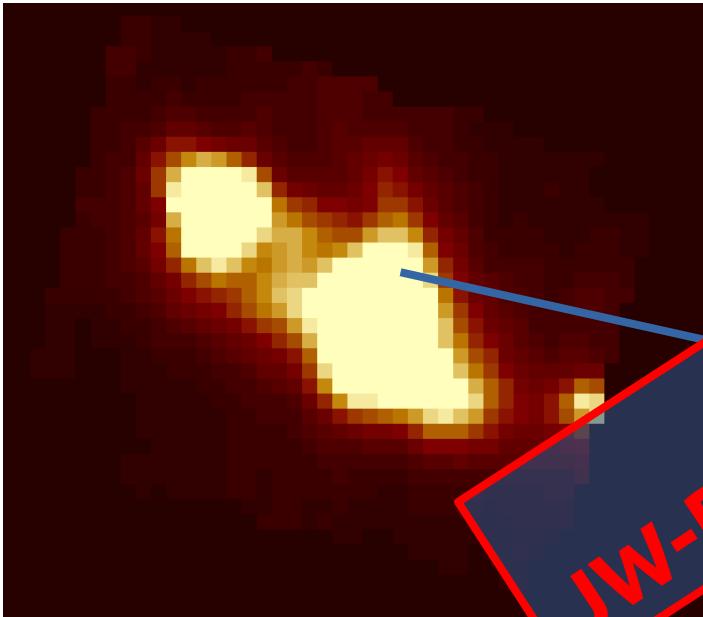
VV114 MIRI MRS nb image



PyPAHTAT today

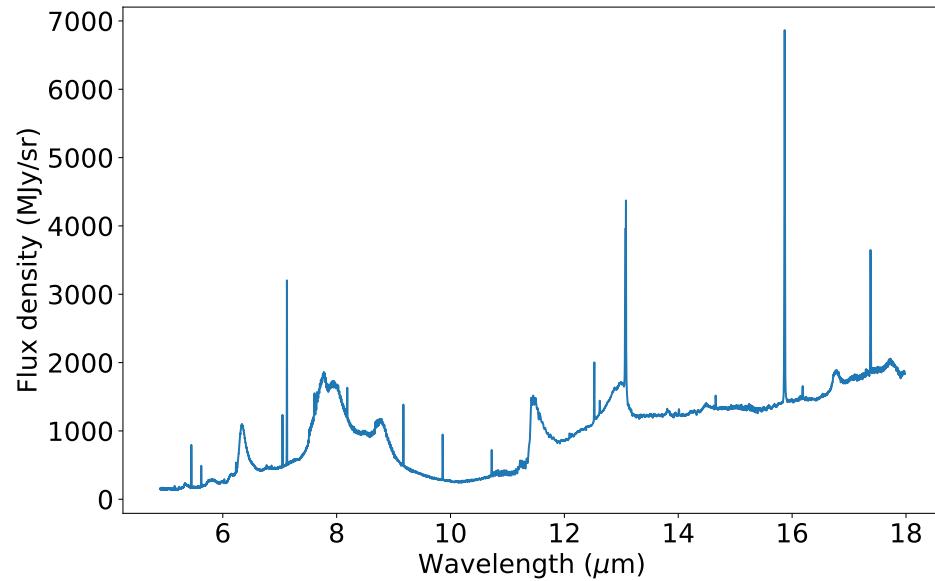
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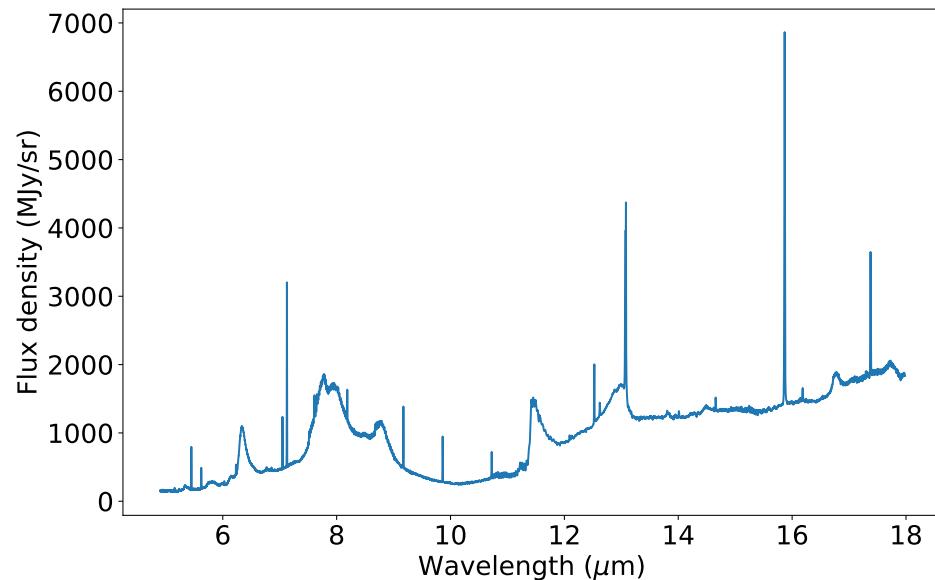
PyPAHTAT practice

How do you fit the data using PAHTAT?



PyPAHTAT practice

How do you fit the data using PAHTAT?



1. Initialize the Spectrum class

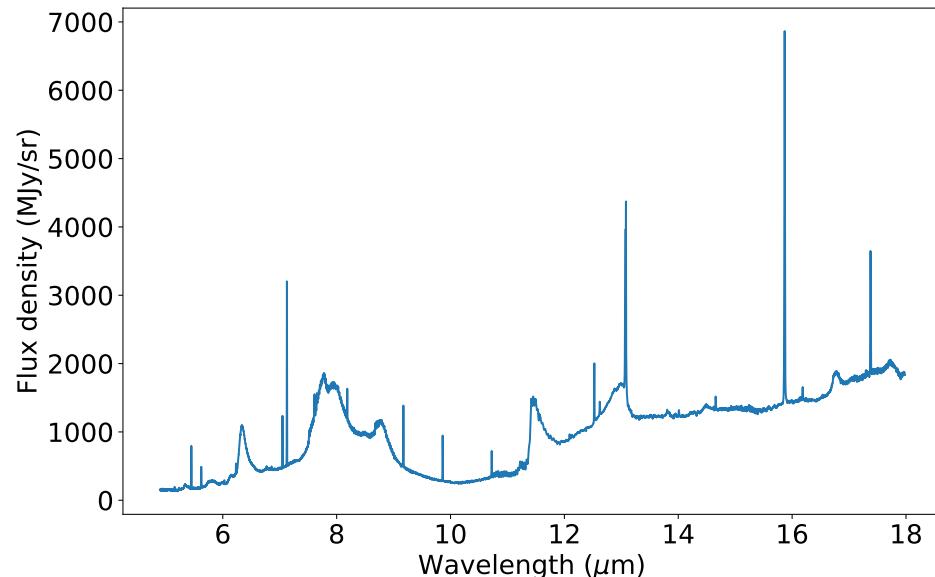
```
from astropy.table import Table  
import PAHTAT as pahtat
```

```
vv114_stitched_spectrum = Table.read('VV114_MIRI_MRS_stitched_spectrum.txt',  
format='ascii')
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PyPAHTAT practice

How do you fit the data using PAHTAT?



1. Initialize the Spectrum class

- spectrum to fit
- instrument resolution
- redshift of the object

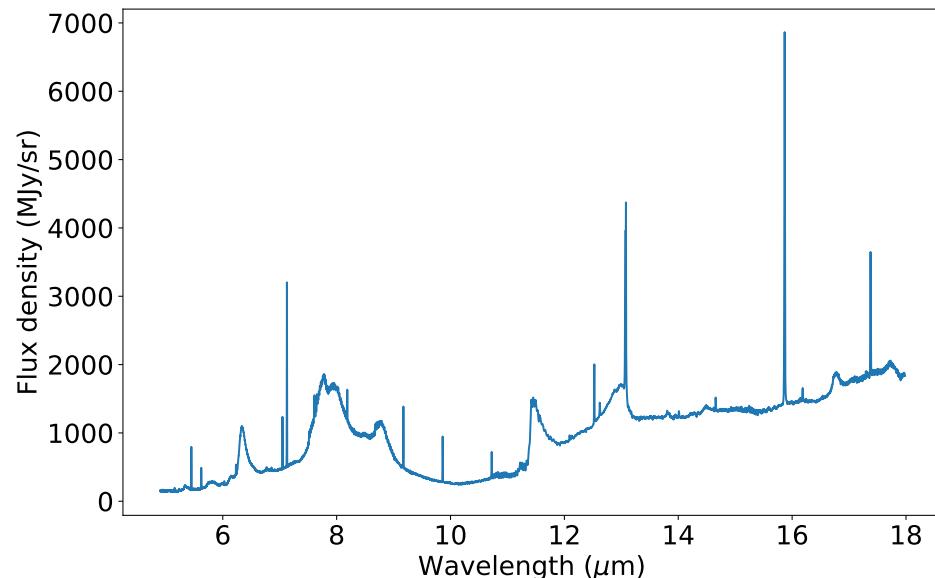
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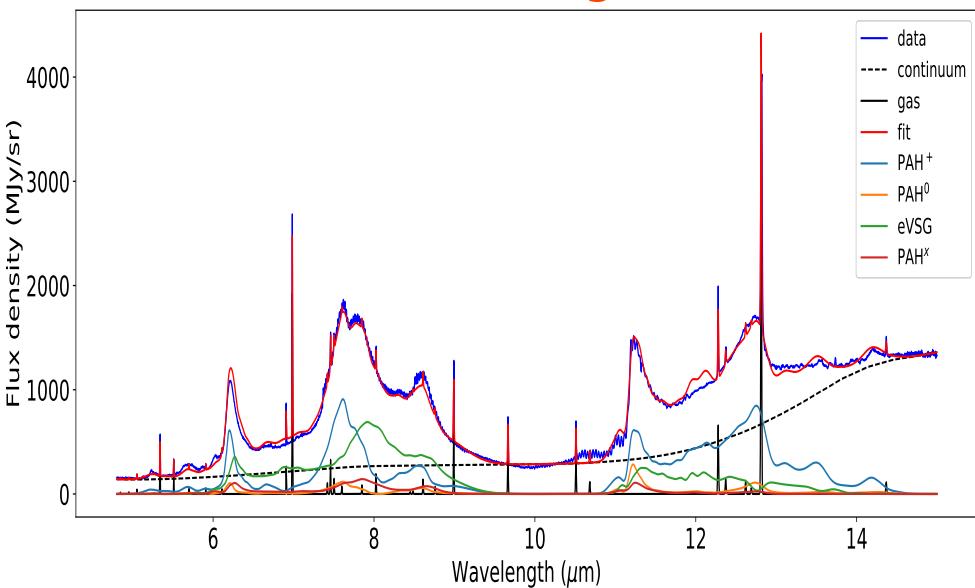
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stitched_spectrum.plot_results()
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PyPAHTAT practice

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Fit in ~1 sec using NNLS



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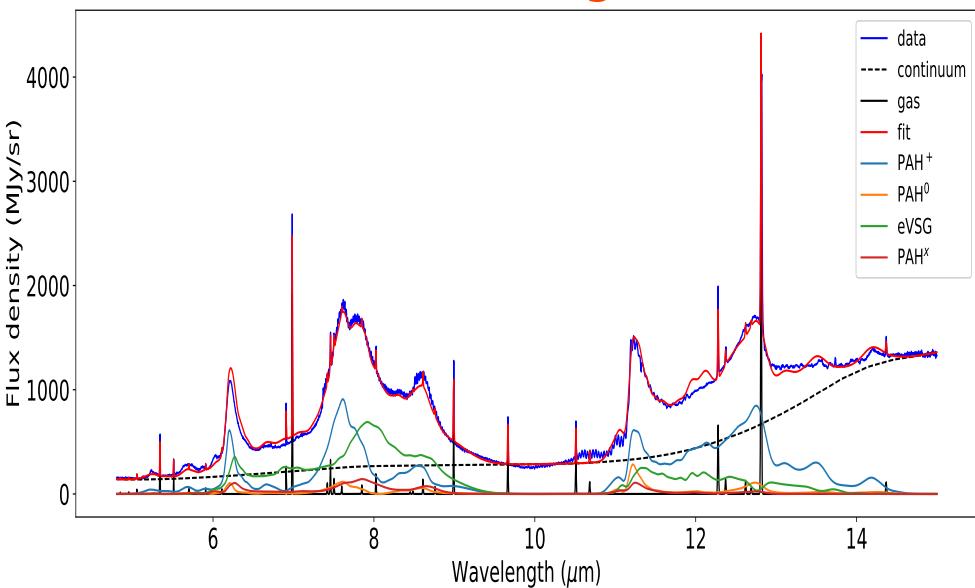
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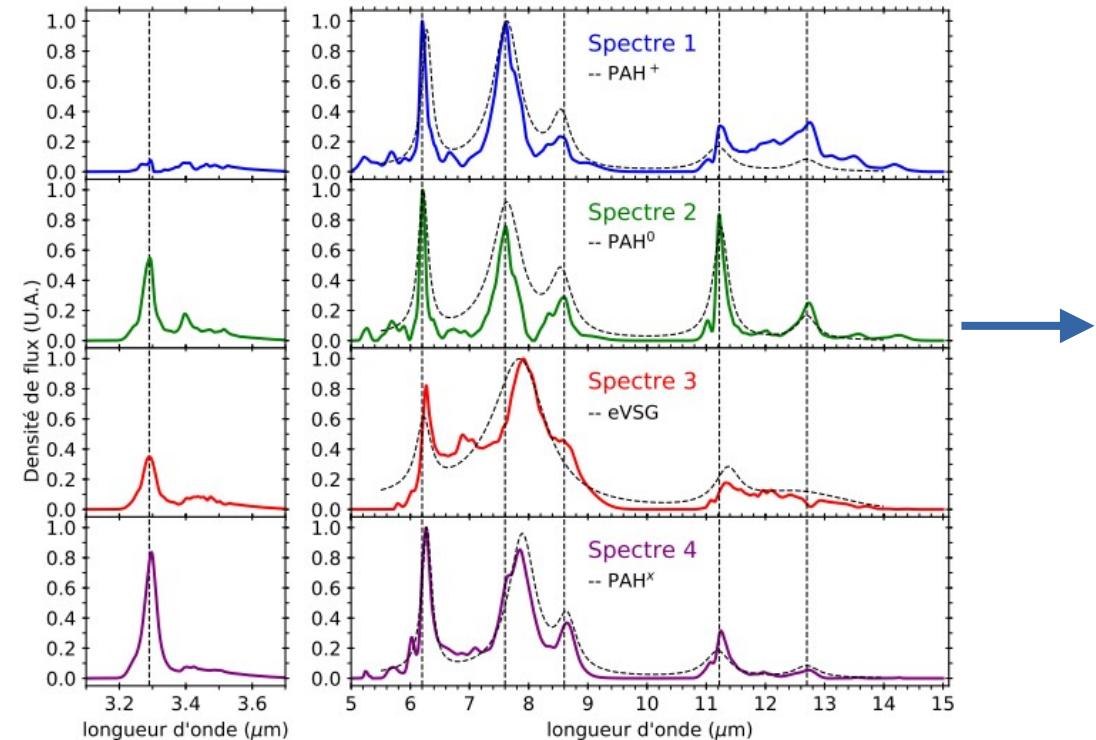
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3. Save results

```
stitched_spectrum.save_results(filename='VV114_stitched_MIRI_pahtat_results',  
gas_lines=True)
```

JW-PAHTAT

What is the next step for PAHTAT?



NIRSpec + MIRI MRS

→ New templates from 0.9 to 28 microns!
(at high spectral resolution)

→ Choose between fitting methods

→ Add extinction

