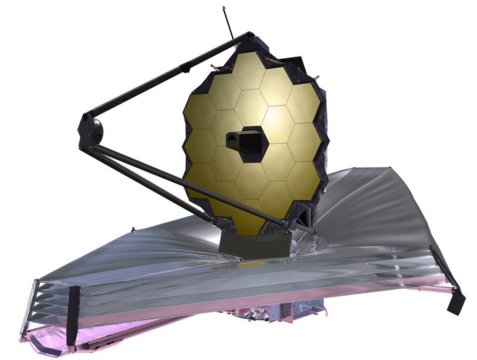
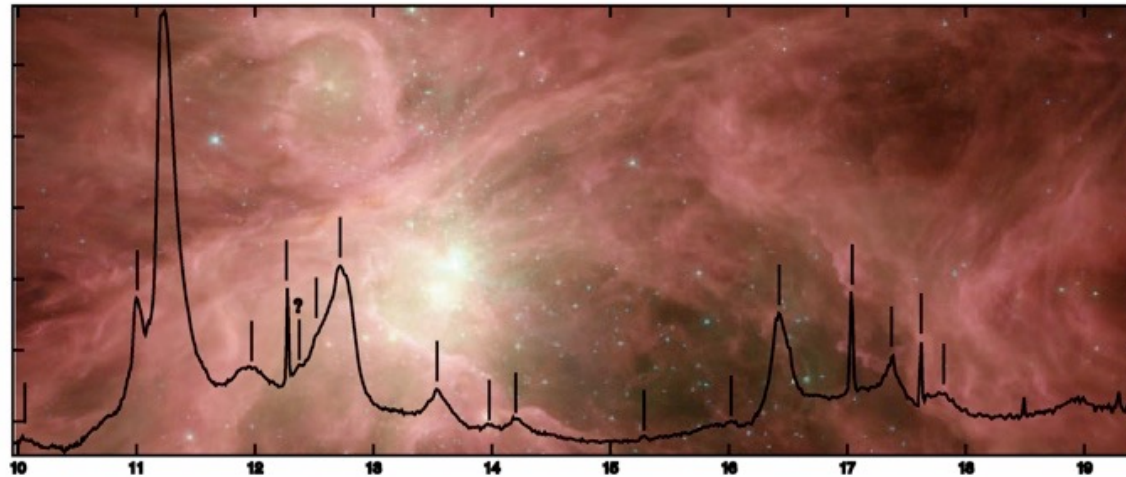


The infrared signatures of very small grains in the Universe seen by JWST



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THE ROLE OF SMALL DUST GRAINS IN THE INTERSTELLAR MEDIUM

Role of grains

- Thermal balance
- Chemical balance
- Evolution of the interstellar medium

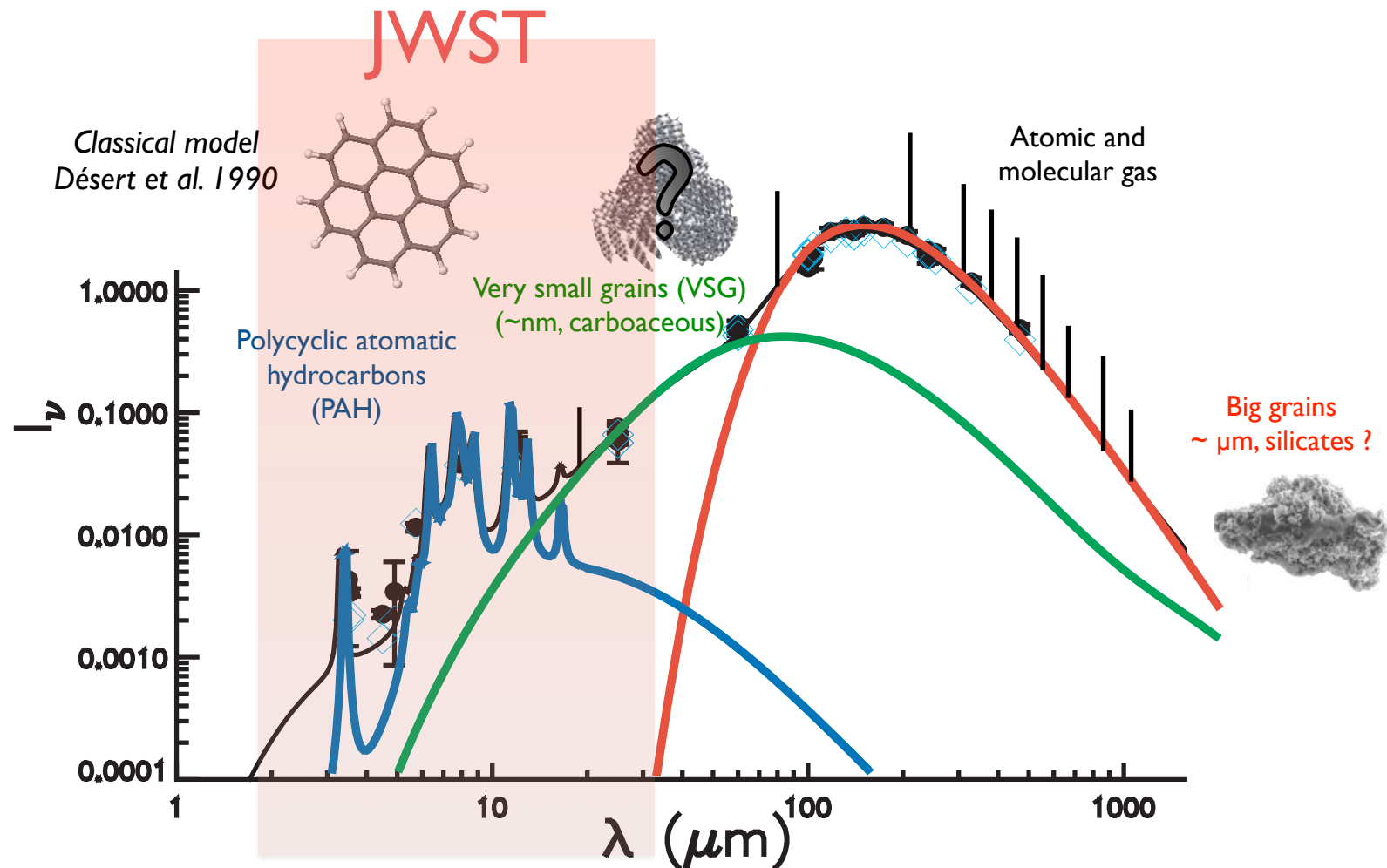
With a number of open questions

What are their physical, chemical, optical properties

Contribution to photo-electric heating

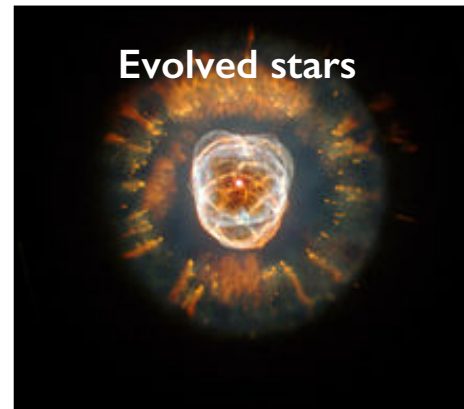
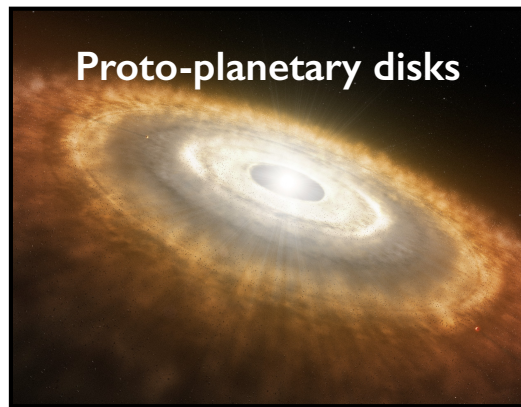
Their contribution to the formation of molecules (H_2 , ..., complex organics)

How dust grains evolve in different environments



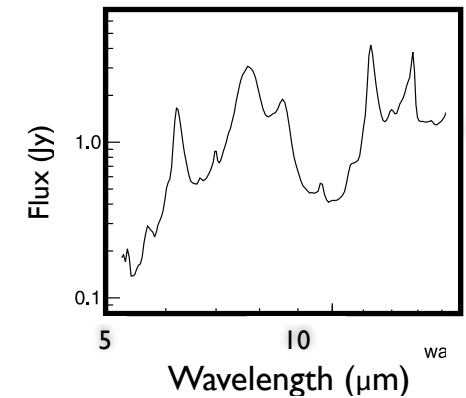
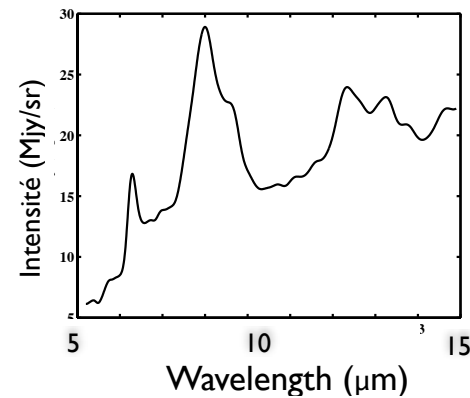
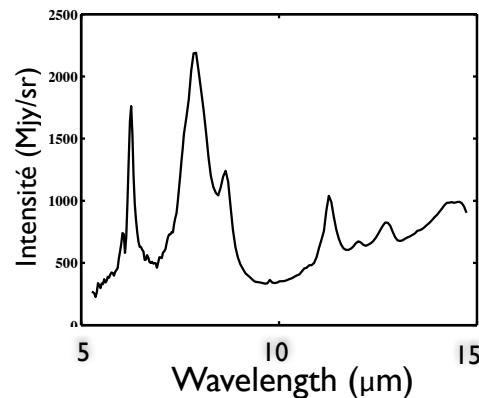
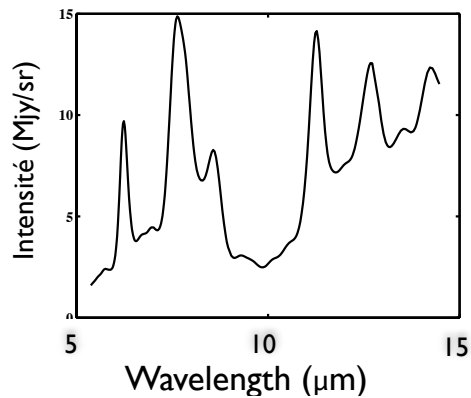
THE MID-IR BANDS IN THE UNIVERSE

Observed in UV-rich environments (photo-dominated regions or PDRs)



Spectral differences

→ Variation of the composition (and excitation conditions) of PAH / VSG



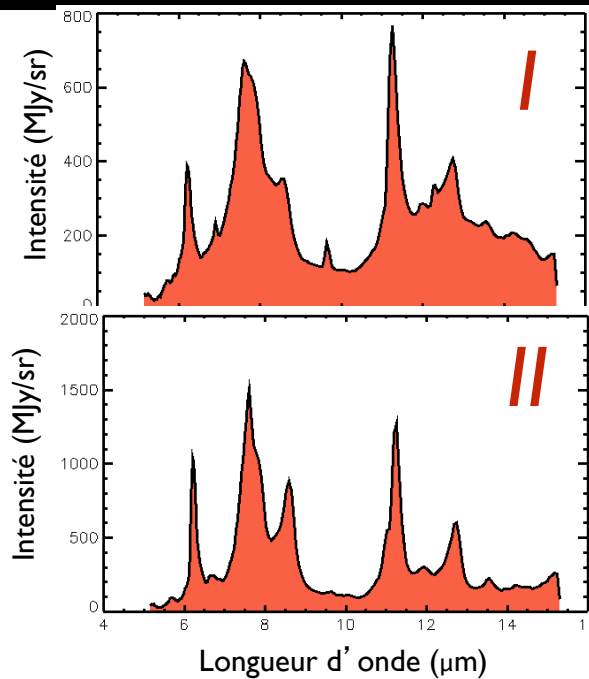
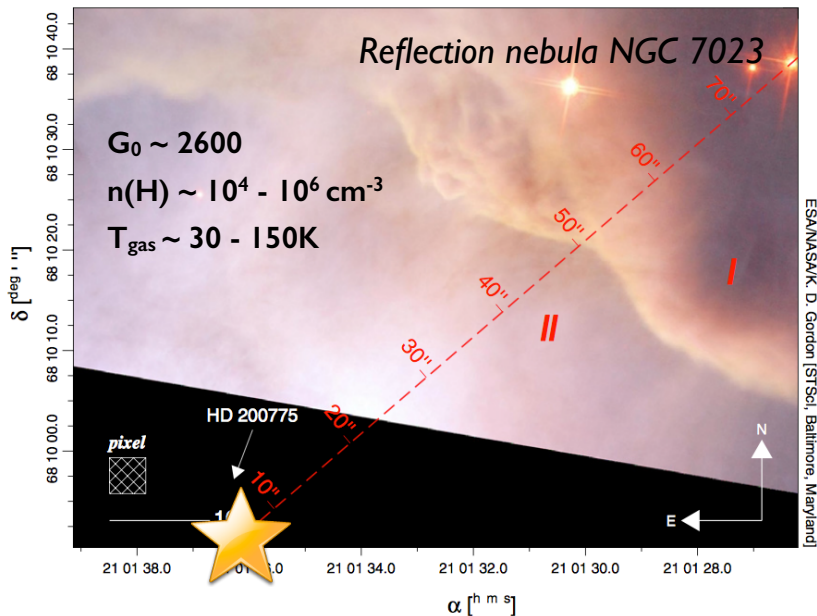
The shape and intensity of the IR bands depend on the detailed physical conditions

What physical and chemical processes drive the evolution of PAHs and VSGs?

What is their impact on the evolution of matter?

A good tracer of physical conditions and geometry?

SPITZER: MID-IR AROMATIC BANDS IN GALACTIC PDRs



Differences due to:

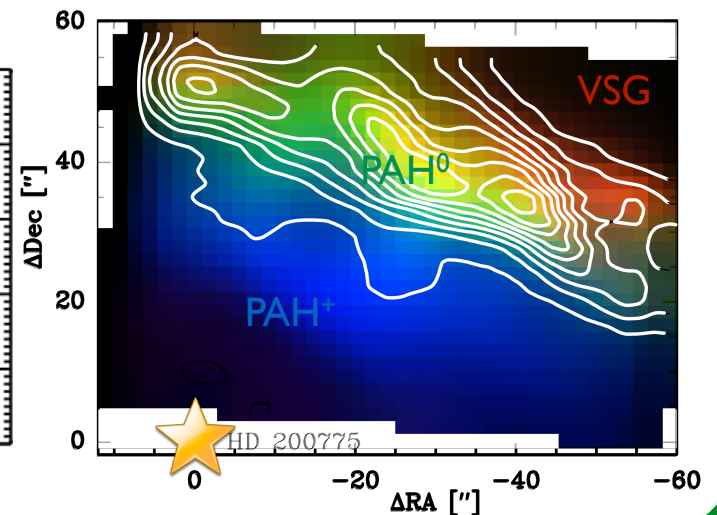
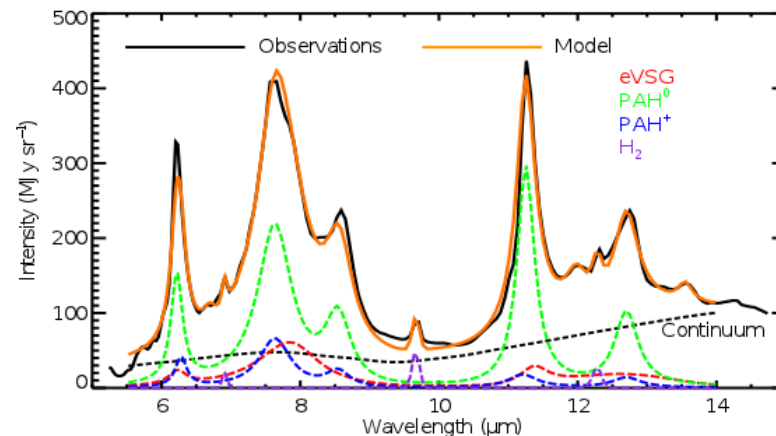
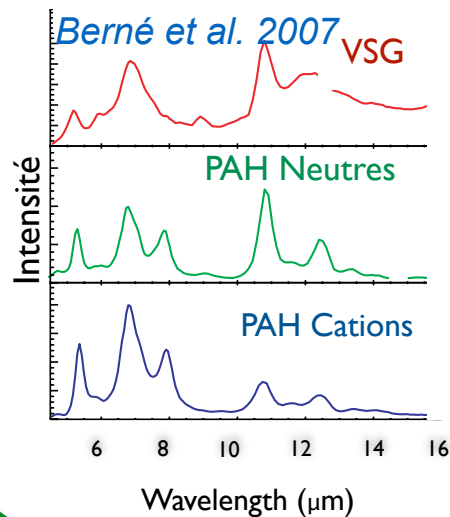
- Abundances & excitation
 - PAH, VSG (charge, size distribution, ...)
 - H_2
 - Ionized gaz
- Extinction on the LOS
- Geometry of the source

PAHTAT

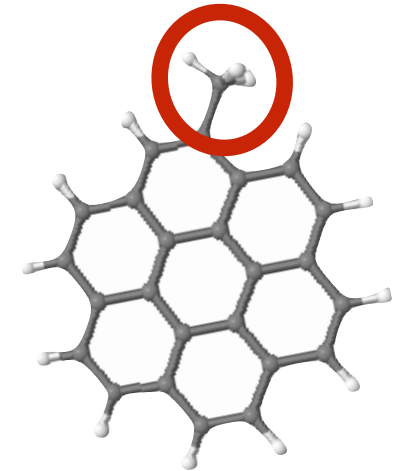
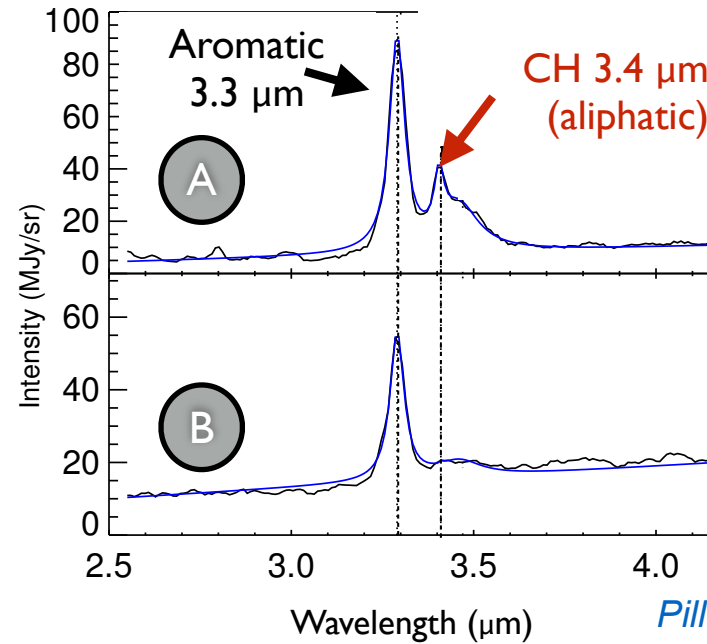
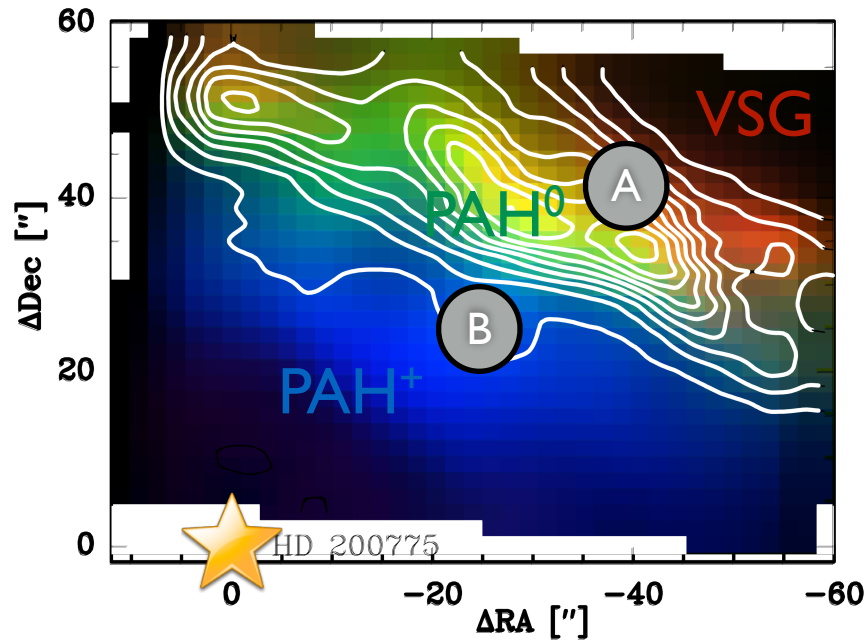
PAH Toulouse Astron. Templates

Template spectra + extinction model $\rightarrow$ relative abundances $\rightarrow$ evaporation of VSG

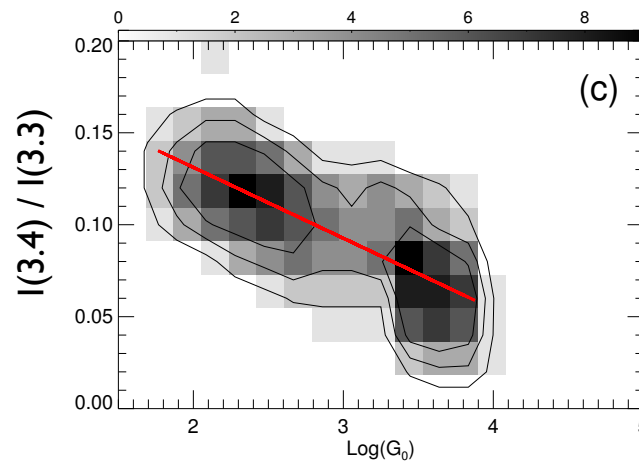
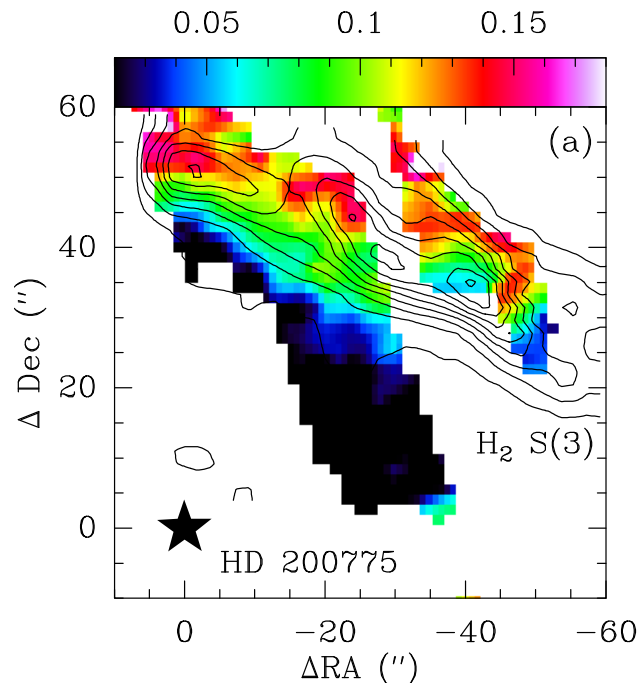
Pilleri et al., 2012



AKARI: NEAR-IR OBSERVATIONS: A CLUE OF THE NATURE OF VSG

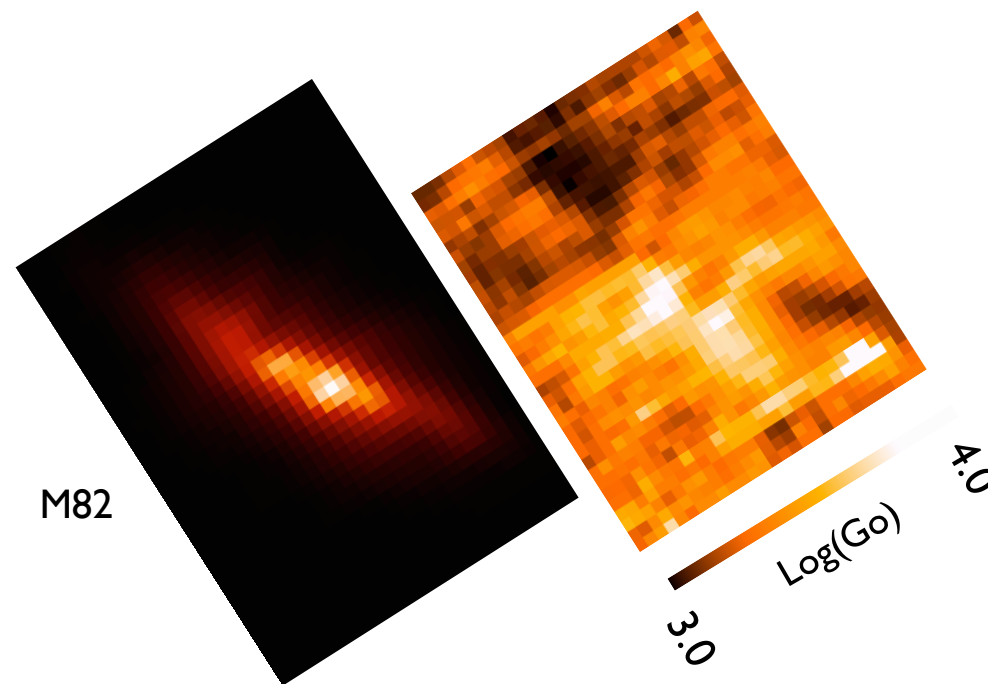
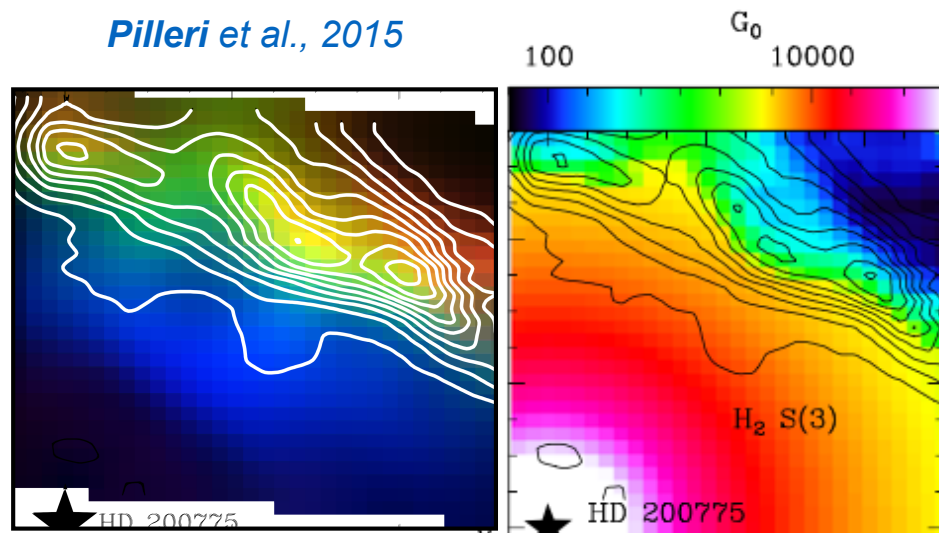
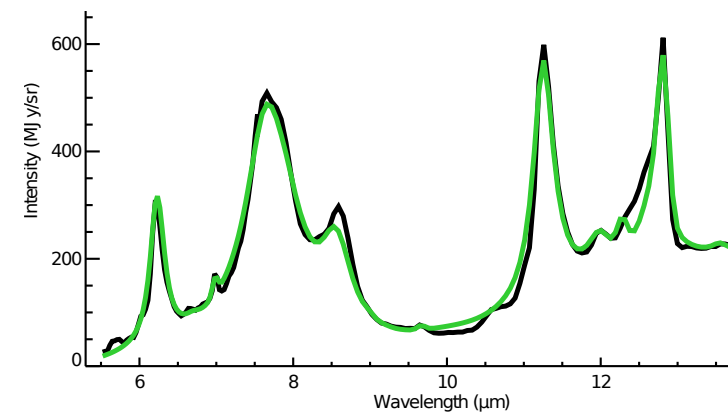
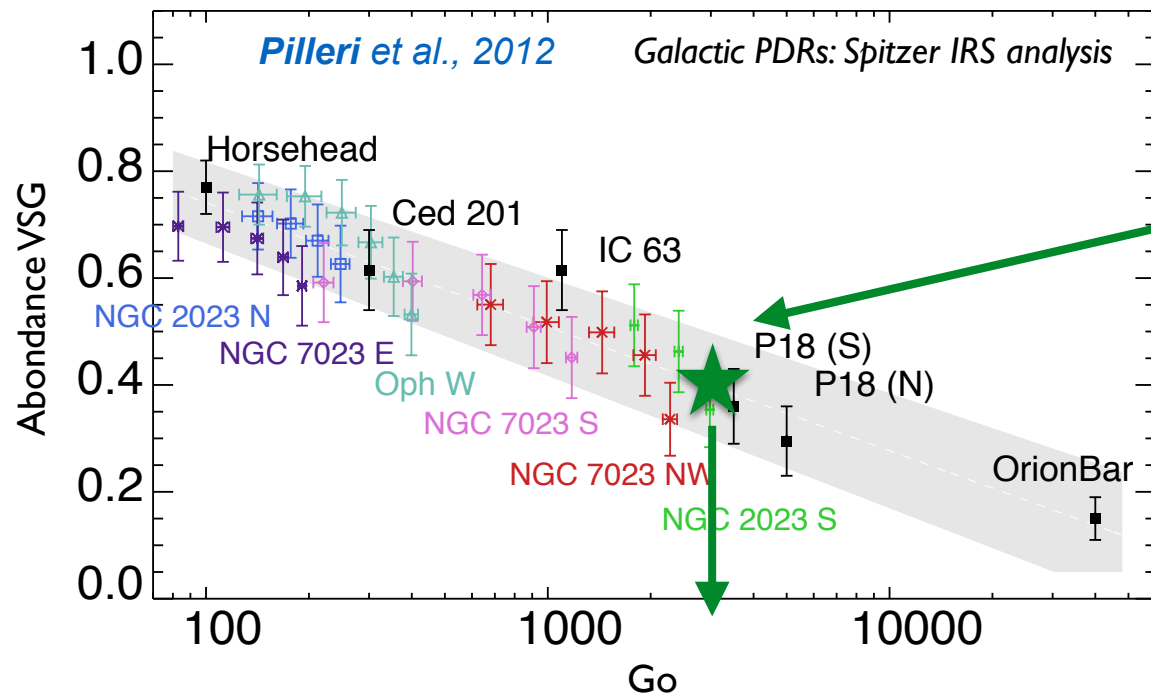


Pilleri et al. 2015

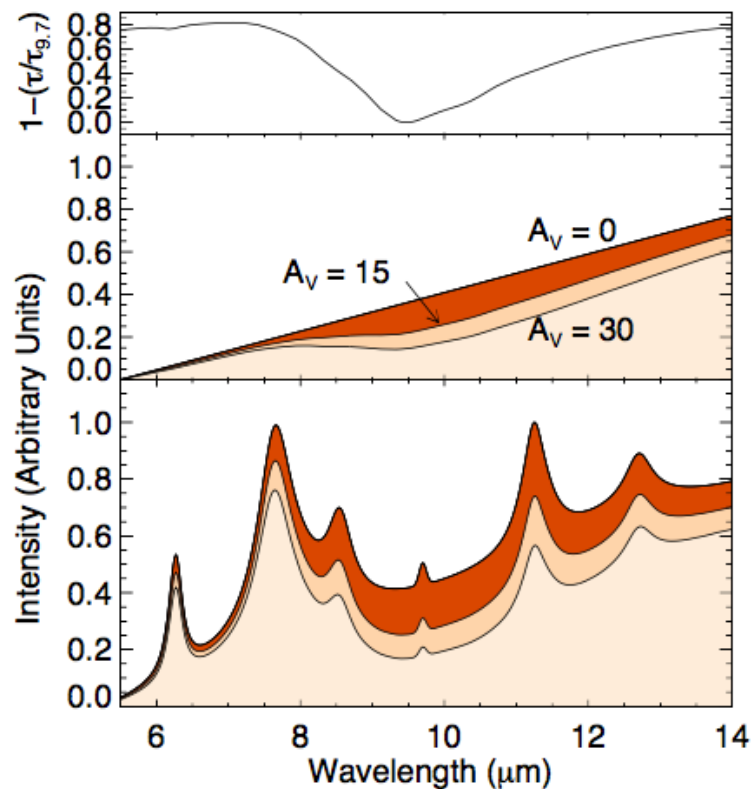


**Mixed nature
of PAHs and VSGs
aliphatic & aromatic**

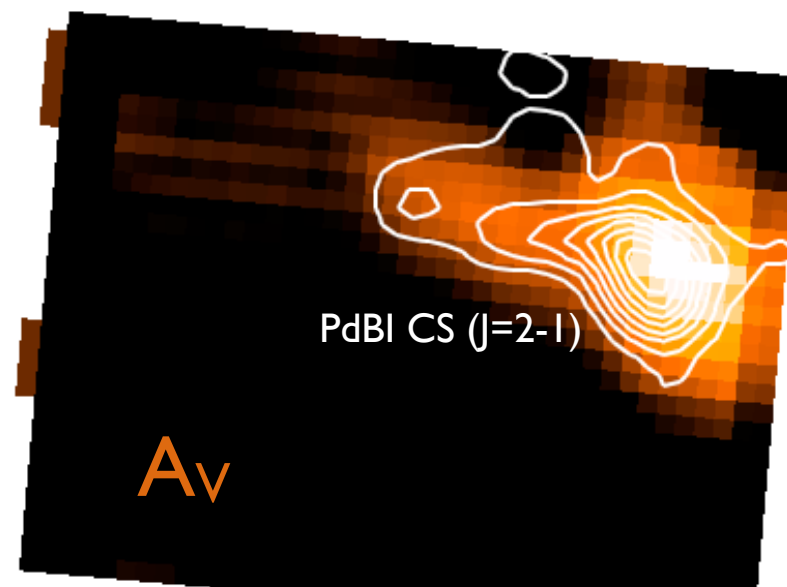
VSGs: TRACERS OF THE UV RADIATION FIELD INTENSITY



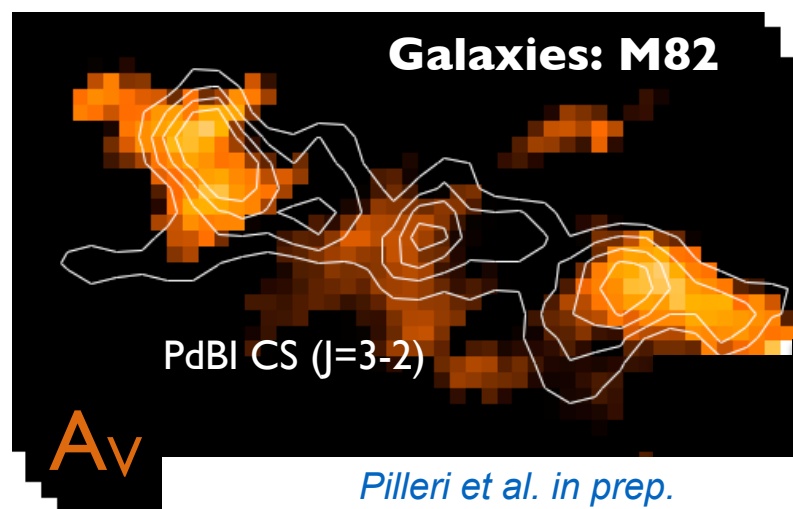
THE MID-IR SPECTRUM AS A TRACER OF EXTINCTION



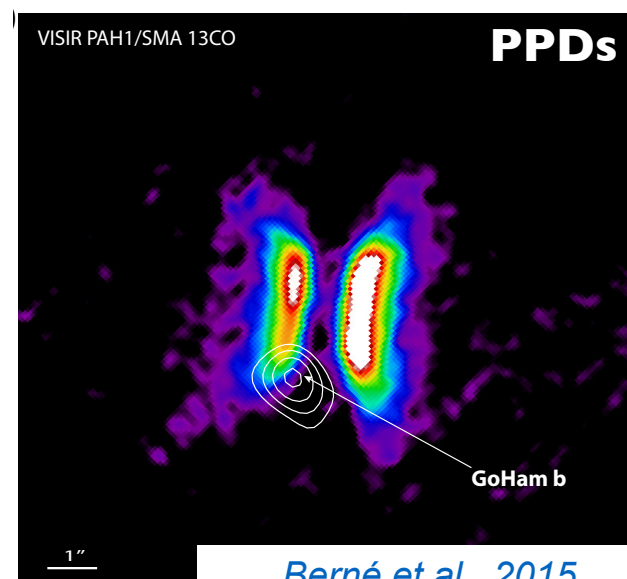
in PDRs



Pilleri et al. 2012



Pilleri et al. in prep.



Mass : $\sim 1-10 M_{\text{Jup}}$
 Density : $\sim 10^7 \text{ cm}^{-3}$
 Temperature : $< 100\text{K}$
 Radius $< 100 \text{ AU}$

Berné et al., 2015

CONCLUSIONS: WHY JWST

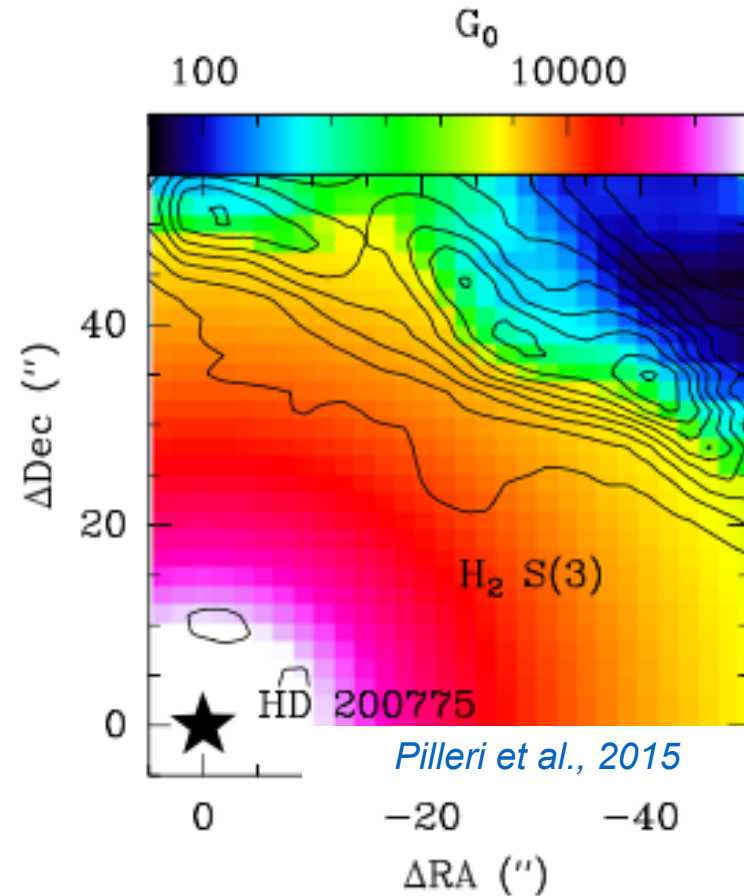
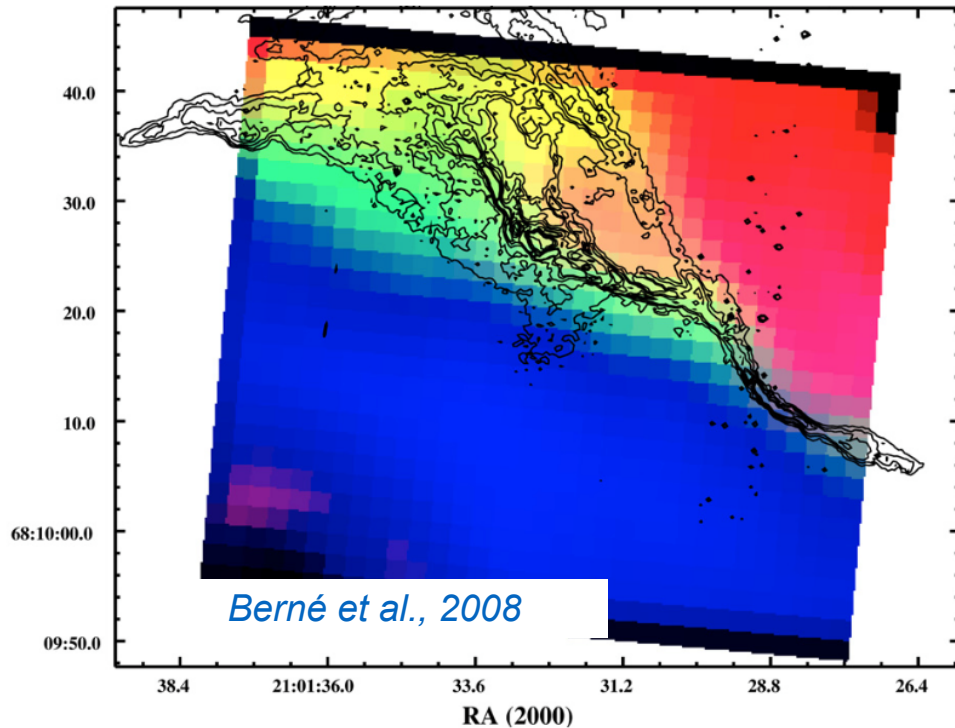
PAH bands are GREAT tracers for physical conditions in all UV-rich environments

How do the physical conditions vary at short spatial scales?

What are the properties (chemical, physical, optical) of PAHs & VSGs?

How do they evolve when they are subject to UV radiation?

PAH⁺ PAH⁰ VSG ERE



Sharp interfaces : questions to be answered by JWST!