## Dust and ice properties in dark clouds with WISH

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## **B68 seen by Spitzer/IRAC**



#### A NIR and MIR view of L183 H



One tentative model of L183. Very preliminary!!



# Coreshine is common

Fusion of Cold Spitzer surveys + Warm Spitzer Survey ~220 sources



50% positive cases , 50% negative cases (true neg + absorption + PAHs + bad data)

Lefèvre et al., Arxiv 1407.5804

## Taurus/Perseus region : 100% positive cases ?



## Excess emission in the diffuse medium



Flagey et al. 2006, A&A, 453, 969

#### Sofia

• Not sensitive enough : FLITCAM is  $\approx$  70 times slower than IRAC1

#### • Spitzer

- Cold : OK if exposures long enough (120-300 sec I1, 800-1600 sec I2), selected sources only
- Ο Warm : idem but needs WISE W3 (12 μm) or Akari S9 (9 μm) channel

#### o WISE

- Full sky but detection obvious only in some cases (L134,...)
- Juvela et al. 2012 : 7-18% of coreshine detection

#### 0 Akari

• (8 cores reported in a recent study – PPVI – 4 of which were listed in our *Science* survey, Gwanjeong Kim et al), selected targets only.

#### o JWST

Very small field of view. OK to explore external galaxies ? LMC, SMC, M31, M33, M51 ?



#### IRAC 1

#### IRAC 2 G303.39-14.26 WISE 3

- O AKall
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WISE 1

WISE 2

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WISE 3

#### o JWST

0

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### WISH!

- Ks band at CFHT : 30 min. to reach  $\approx$ 20 mag in 20' x 20' area
- WISH F3 : 30 sec. to reach  $\approx$  24 mag in 30' x 30' area  $\implies$  1200 x faster !
- Mapping Taurus+Perseus+Auriga (2000°2), in 6 filters =

   10 hours ??
   but from WISH-SPIE doc,
   it is more like 30 days with overheads
- We would map the diffuse medium + all the clouds, and find the big grains where they are, build 3D models of all clouds and of the region (+ GAIA for the stars) !

## Spectroscopy of ices





**Figure 4.** IRTF-SpeX and UKIRT-CGS2 spectra (magenta and green, respectively) of the program star H (J15542044–0254073). The spectral range includes absorption features of H<sub>2</sub>O and CO ices centered near 3.05 and 4.67  $\mu$ m, respectively (note the break and scale change on the wavelength axis between the two segments). The UKIRT-CGS2 spectrum yields the only available detection of CO ice in L183 to date.



Whittet et al. 1998, ApJ, 498, L159

# Spectroscopy of thousands of stars in regions like Taurus :

- Simultaneous mapping of CO & CO<sub>2</sub> ices -> all the depleted CO at hand, all over the clouds (Whittet et al. 2010 ApJ, 720, 259)
- Development of ice mantles identical in all clouds or not ? (Whittet et al. 2013, ApJ 774, 102)
- O Different thresholds to ice apparition ? (Murakawa et al. 2000, ApJS, 128, 603)
- With R ≥ 1000, study CO and CO<sub>2</sub> profiles, look for environment changes, ice composition changes. (*Pontoppidan et al. 2003, A&A, 408, 981*)
- Weak components ? NH<sub>3</sub>, H<sub>2</sub>CO, CH<sub>3</sub>OH, etc. CH<sub>3</sub>OH as a transition molecule between cold T chemistry and hot corinos. (*Pontoppidan et al. 2004, A&A, 426, 925*)
- Rare isotopes : HDO, <sup>13</sup>CO, <sup>13</sup>CO<sub>2</sub> (chemical & physical conditions, Boogert et al. 2000, A&A 353, 349)

# Which sensitivity with WISHSpec?

- L183- H star Ks = 7.9 mag,  $\lambda F(\lambda) \approx 10^{-10} \text{ erg/s/cm}^2$
- WISHSpec  $\approx 10^{-16} \text{ erg/s/cm}^2$  in  $\approx 30 \text{ sec.} (\text{S/N} = 10 \sigma)$
- A 10% opacity with 10 σ is detected for a 10<sup>-15</sup> erg/s/cm<sup>2</sup> star
   Ks ≈ 20.5 mag

  - $\triangleright$  a few stars in a 1'x1' field with  $A_V = 40$  mag extinction

• 6' x 9' field can be covered at the centre of each photometric field
 > ≈100 stars

>  $2000^{\circ 2} \Rightarrow 2E5$  stellar spectra in 100 days



30' x 30' field 9 ditherings 1' step Overlap for CCD gaps

1' x 1' spectro field 9 ditherings 1' step 3' x 3' total field

Shifting the arrays by 3' for each filter : edges are 'lost' but small amount out of 100 or 1000°<sup>2</sup> Spectrograph covers 9' x 6'



## Conclusion

- Possibility to study dust scattering and extinction on the scale of full regions (Taurus, Rho Oph, Cham, ...) in a few days for the small regions, a month for the «Taurus-Perseus-Aurigae » region
- Possibility to retrieve 100th of 1000th of stellar spectra
- A breakthrough in the study of dark clouds

## Thank you for your attention

## Why do we see coreshine ?

