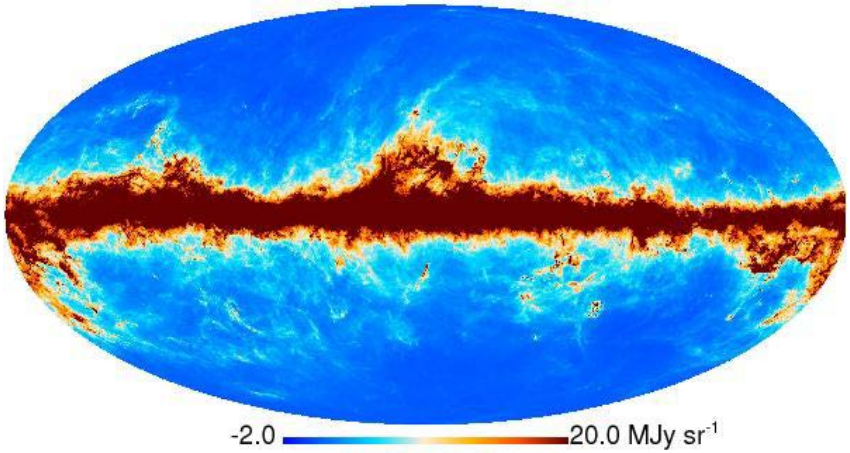
Variations in the diffuse ISM

Planck Collaboration XI (2014)



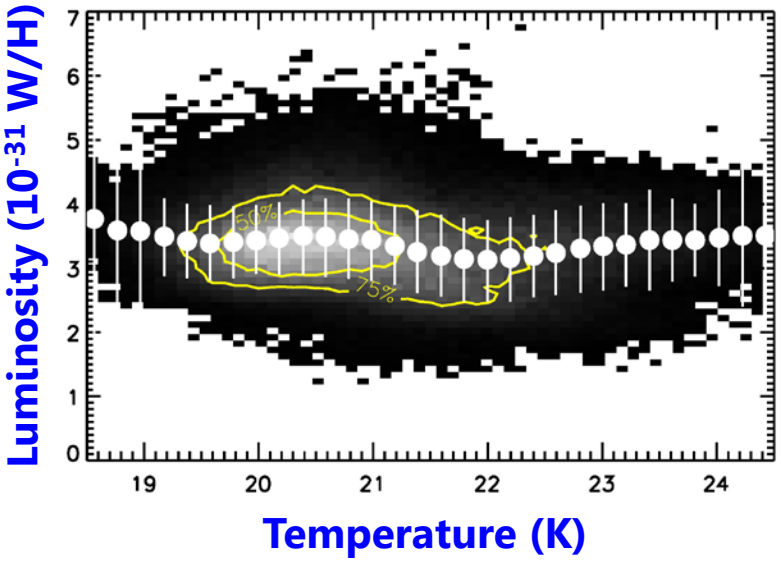
IRAS – 100 µm
Planck HFI – 350 µm
– 550 µm
– 850 µm

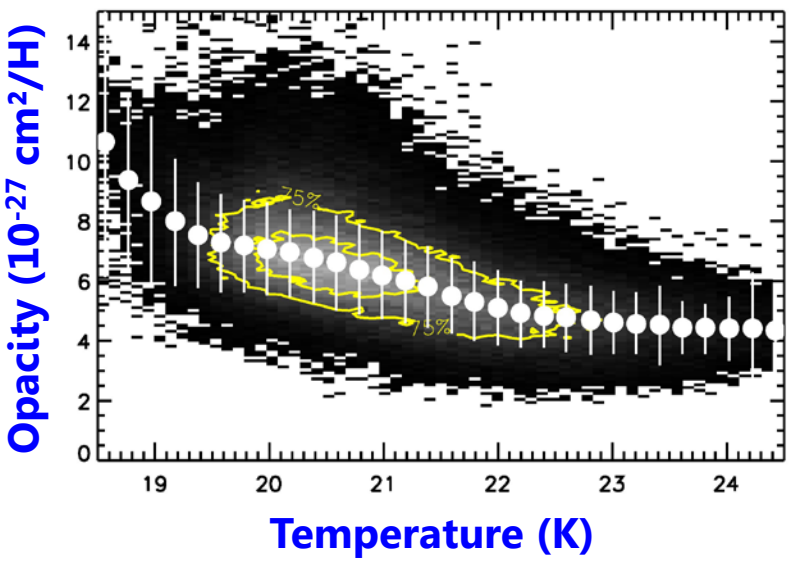
- Planck Collaboration XI (2014)
  → fit of each pixel of the sky
  $I_\nu = N_H \, \sigma_{\nu o} \, B_\nu(T) \, (\nu/\nu_0)^\beta$
  column density; opacity; Planck function; spectral index

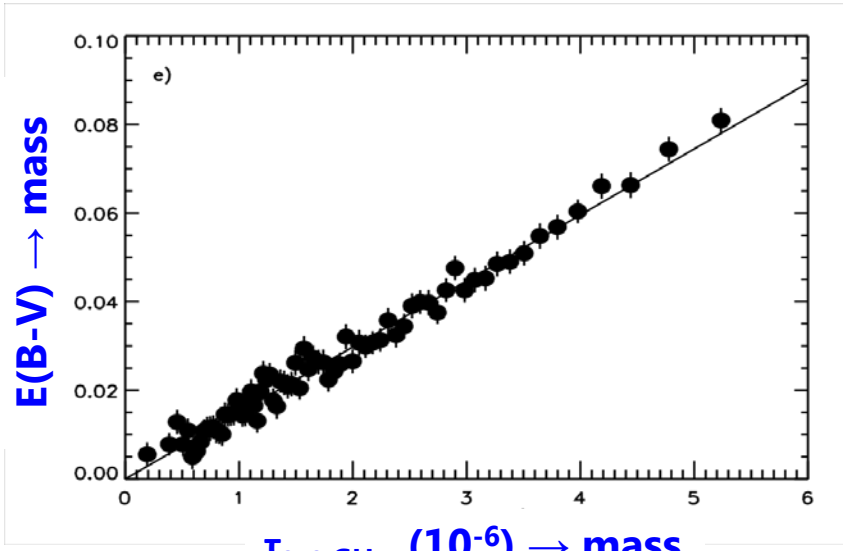
- Additional parameters
  $L_H = \int I_\nu \, d\nu \;/\; N_H$ ← luminosity
  $\tau_{\nu o} = N_H \, \sigma_{\nu o}$ ← optical depth

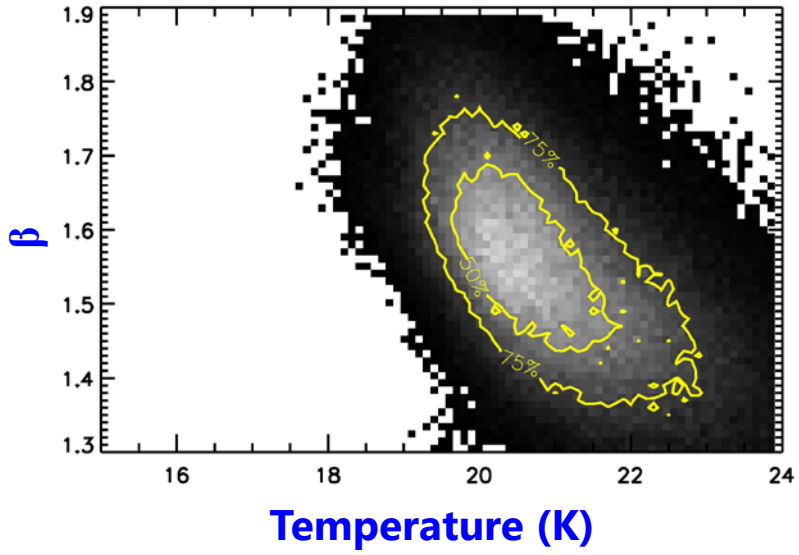
- Comparison with the extinction in the visible for the bands B = 0.44 µm et V = 0.55 µm
  $E(B\text{-}V) = A_B - A_V$

Results for the diffuse ISM ($N_H < 3\times10^{20}$ H/cm^2)









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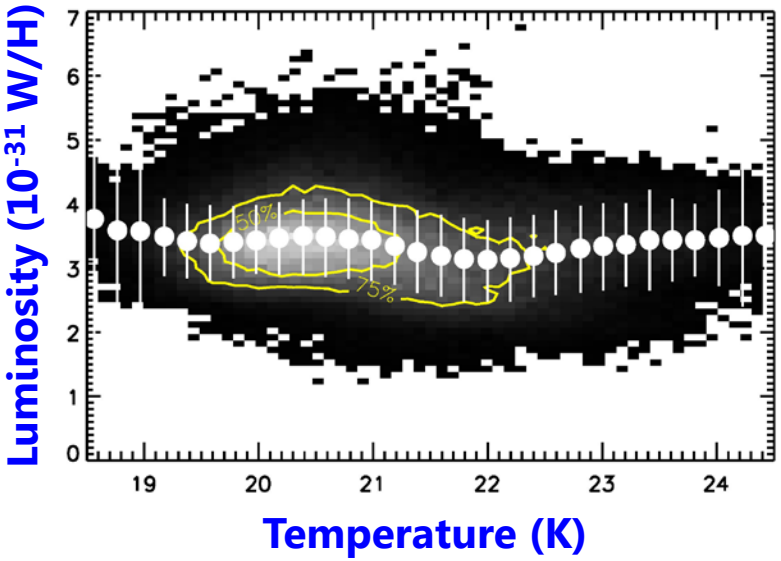
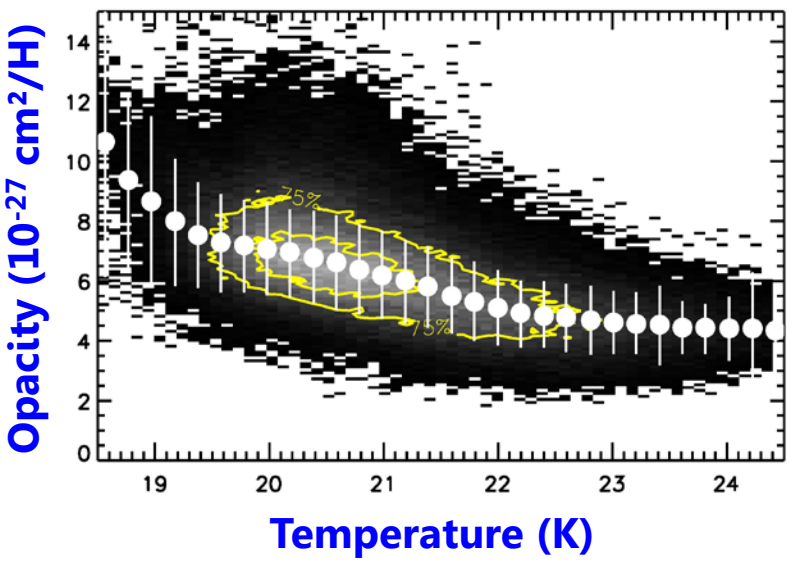
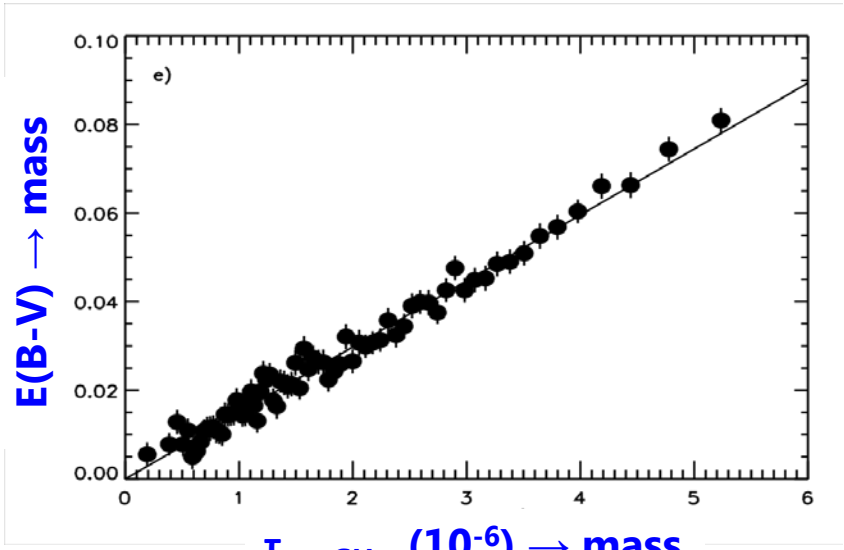


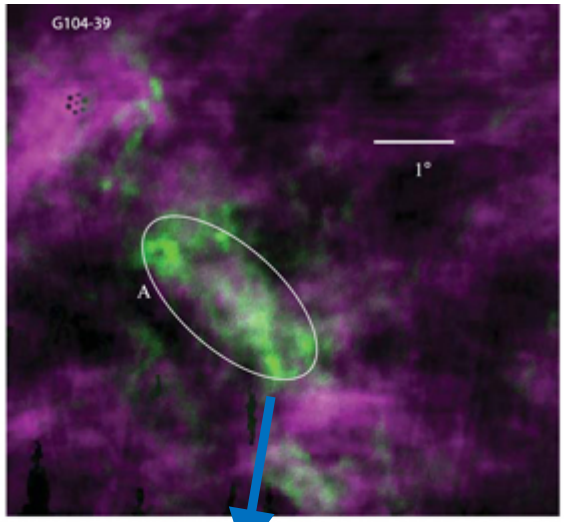




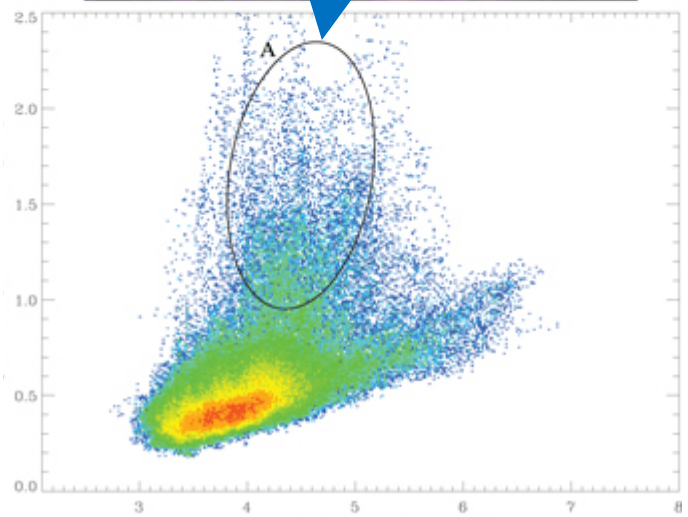
- E(B-V) from SDSS data towards quasars
- Observational results
  - → β-T variations
  - → luminosity independent of T
  - → hotter grains = less emissive grains

➡ **dust evolves in the diffuse ISM**

Gas-to-dust ratio variations (Reach et al. 2015)

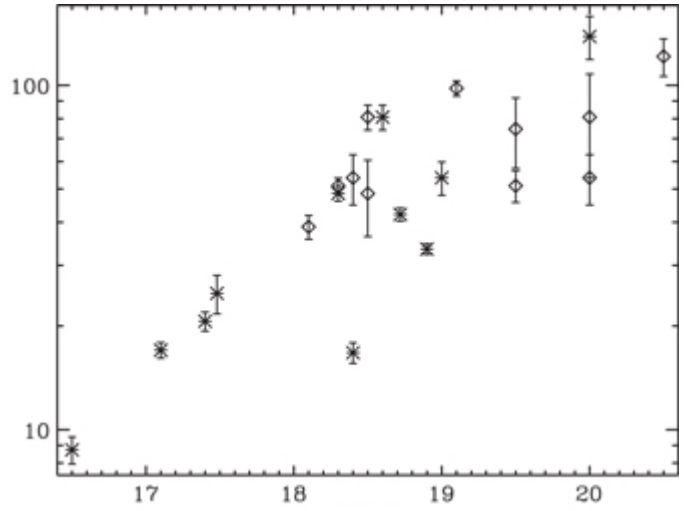


- Planck-HFI + ARECIBO GALFA-21cm survey
  11 clouds with $N_H < 8\times10^{20}$ H/cm²
- Variations in the gas-to-dust ratio
  - → from cloud to cloud
  - → within individual regions



$\tau_{353\ GHz}$ from Planck (10^{-5})

N(H) from Arecibo [10^{20}cm^{-2}]



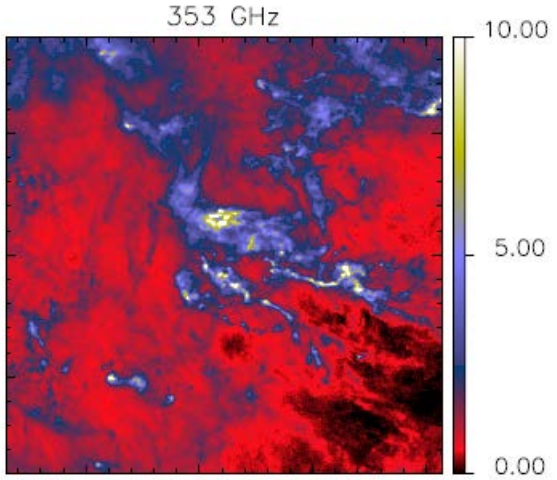
[G/D]

Temperature (K)

VARIATIONS TOWARDS/IN THE DENSE ISM

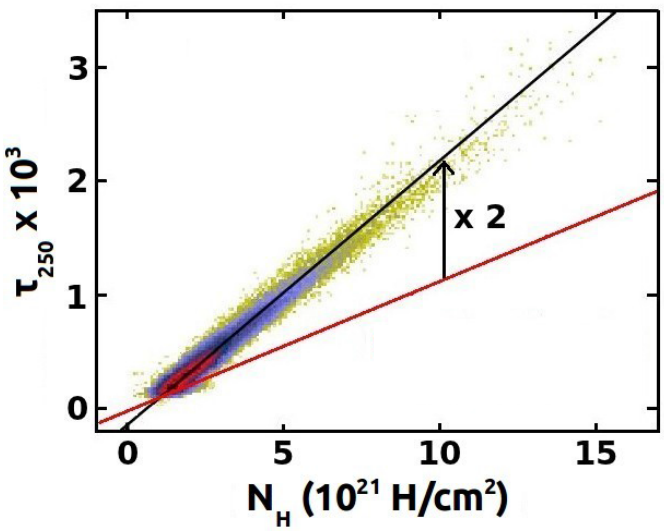
Far-IR/submm emission

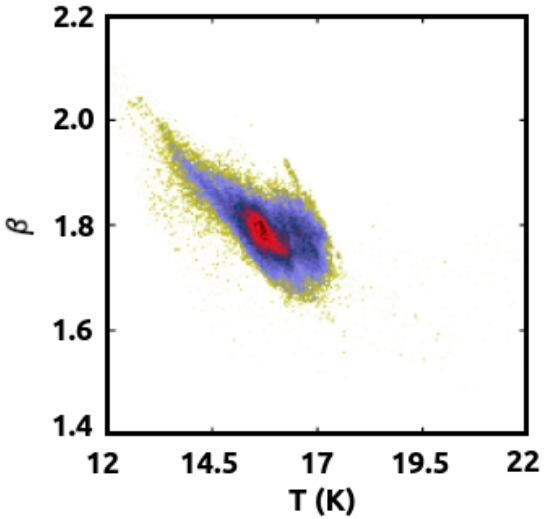
- Planck Collaboration XXV (2011) : Taurus



For regions with detected CO:

→ far-IR opacity increases
→ temperature decreases
→ β-T anti-correlation





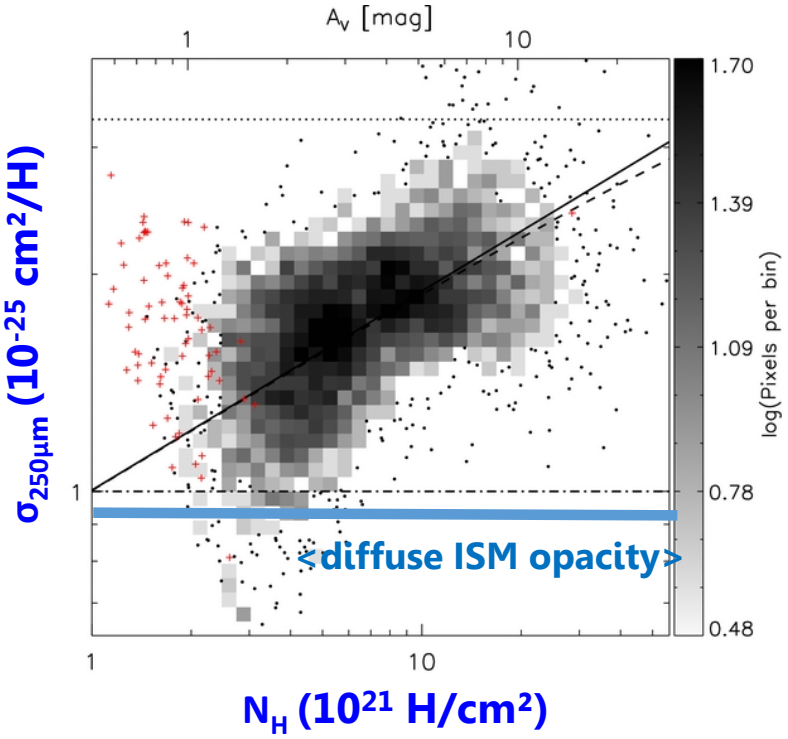
Far-IR/submm emission

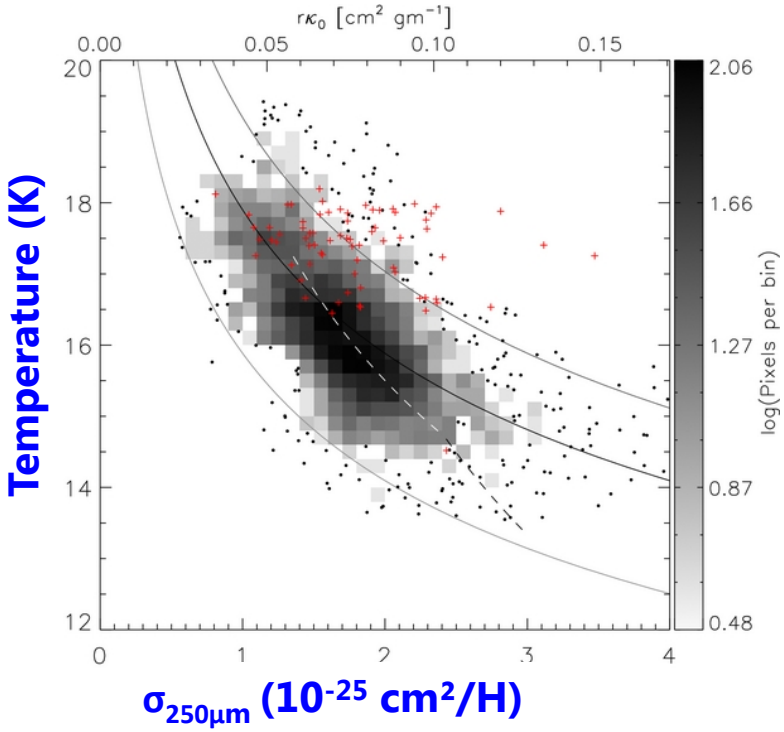
- Roy et al. (2013) : Orion A

  For regions with $1.5\times10^{22} \le N_H \le 5\times10^{22}$H/cm²:

  → far-IR opacity increases : $\sigma_{250\mu m} \propto N_H^{0.28}$

  → temperature decreases





Scattered light: visible to mid-IR

- Many dense clouds bright at short wavelength
  - → visible
  - → near-IR, labelled cloudshine
  - → mid-IR, labelled coreshine

- Andersen et al. (2013) + Andersen et al. (2014) → grains with sizes up to 1 μm
  - → common N_H threshold for 3.6 μm scattering and water ice