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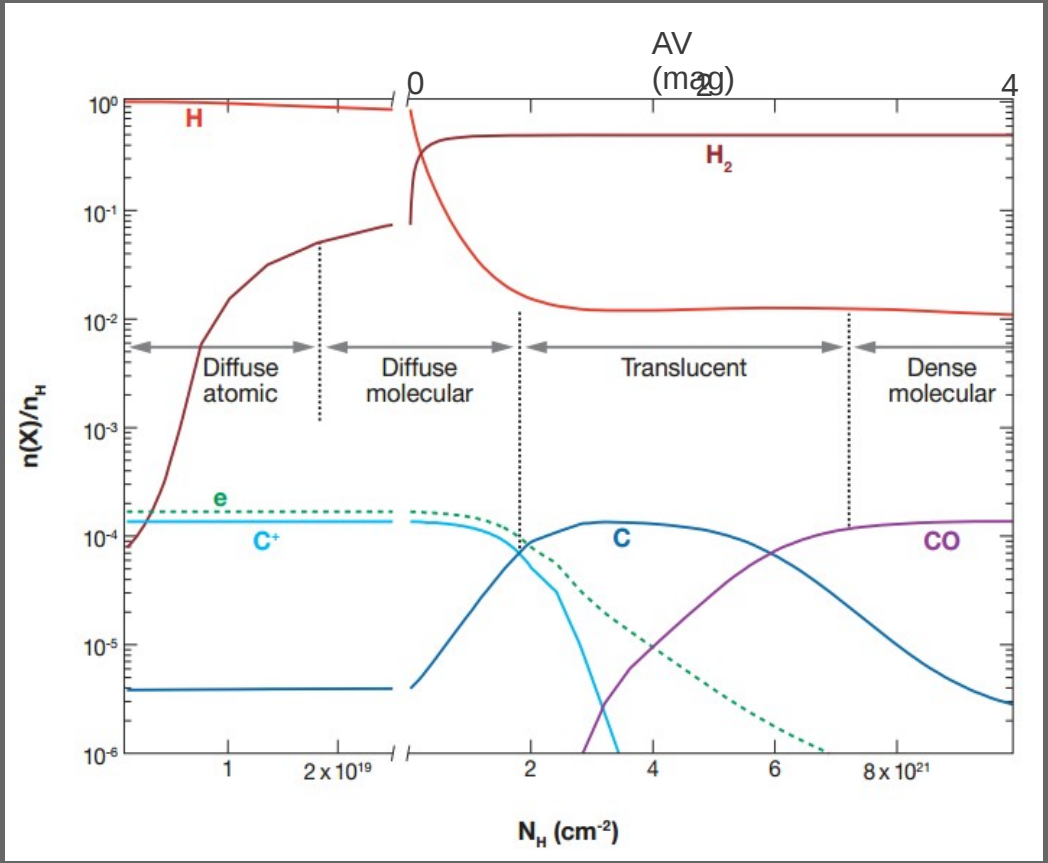
# AME in LDN 1780

Matias Vidal
Jodrell Bank Centre for Astrophysics

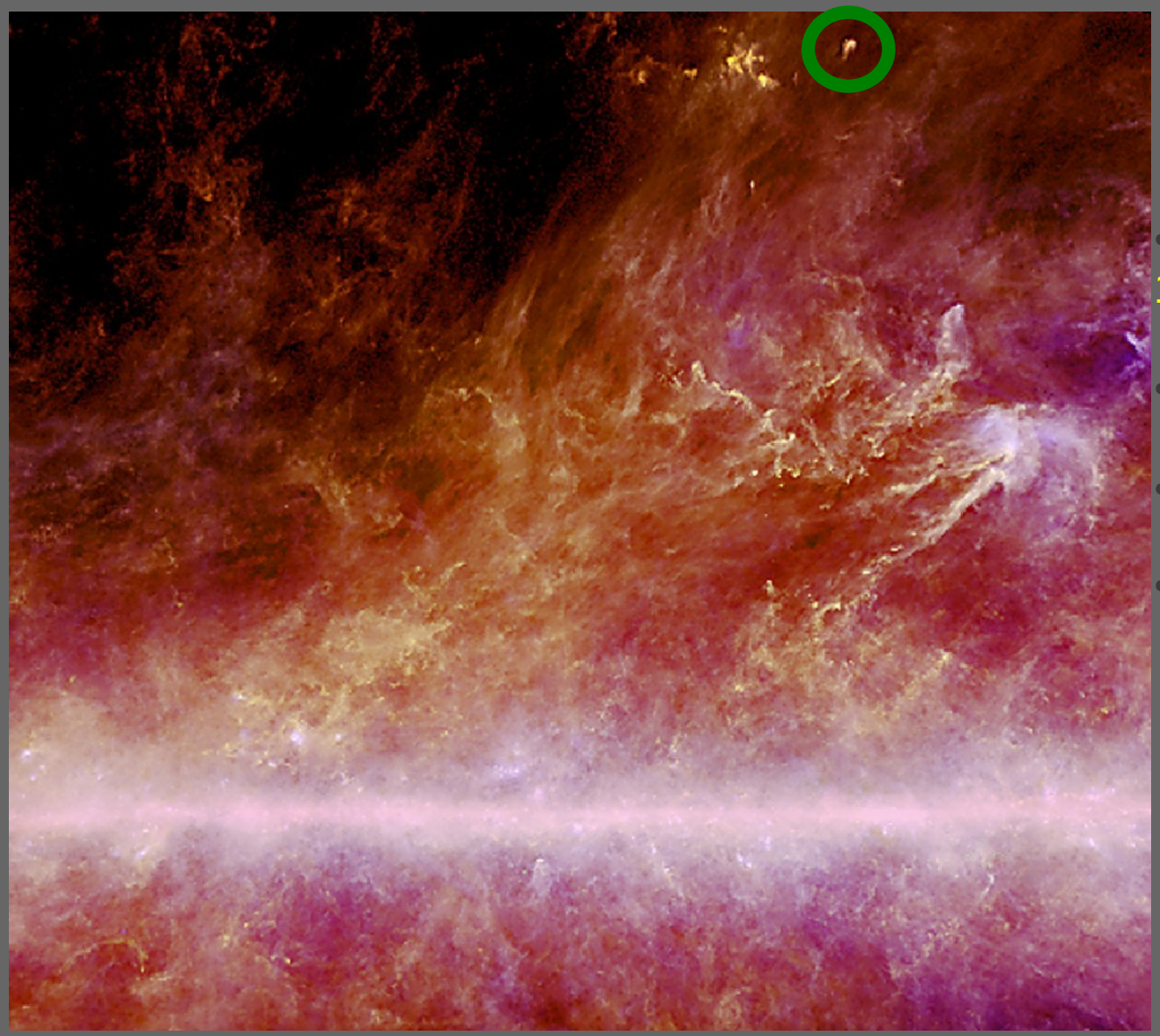
# Motivation




From Snow & McCall (2006)

- Aim to extrapolate 31 GHz emissivities from denser clouds to the ubiquitous cirrus.
- Translucent clouds have intermediate physical properties between diffuse cirrus and the denser clouds.
- 2 targets: LDN 1780 & ζOph
- Only LDN 1780 in this talk.

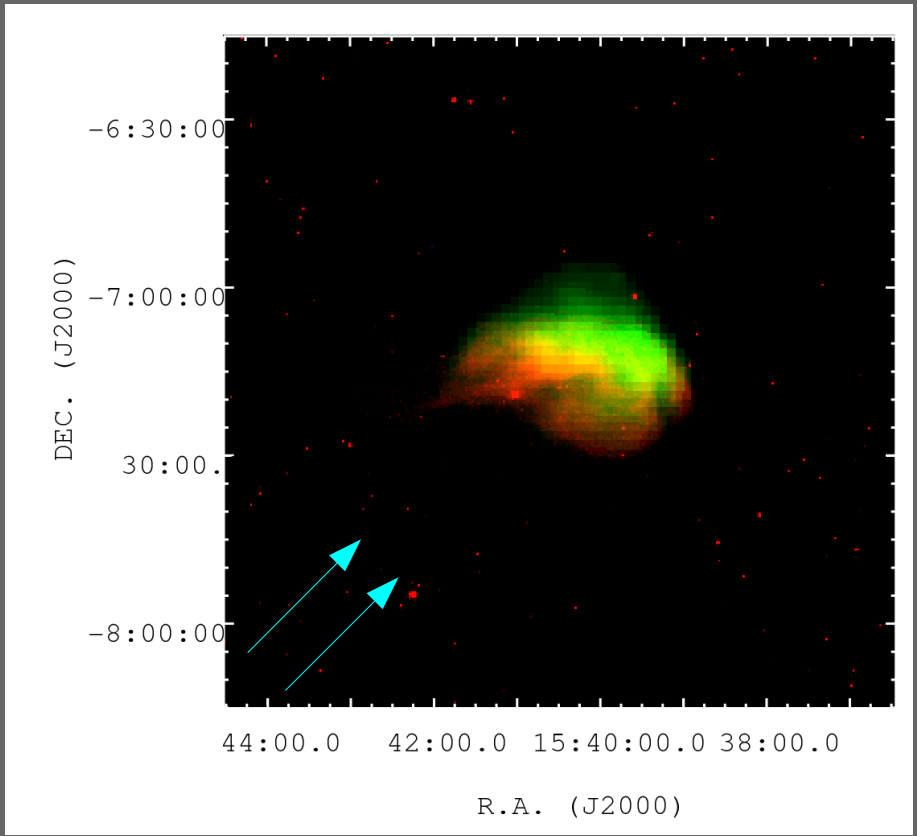
# LDN 1780



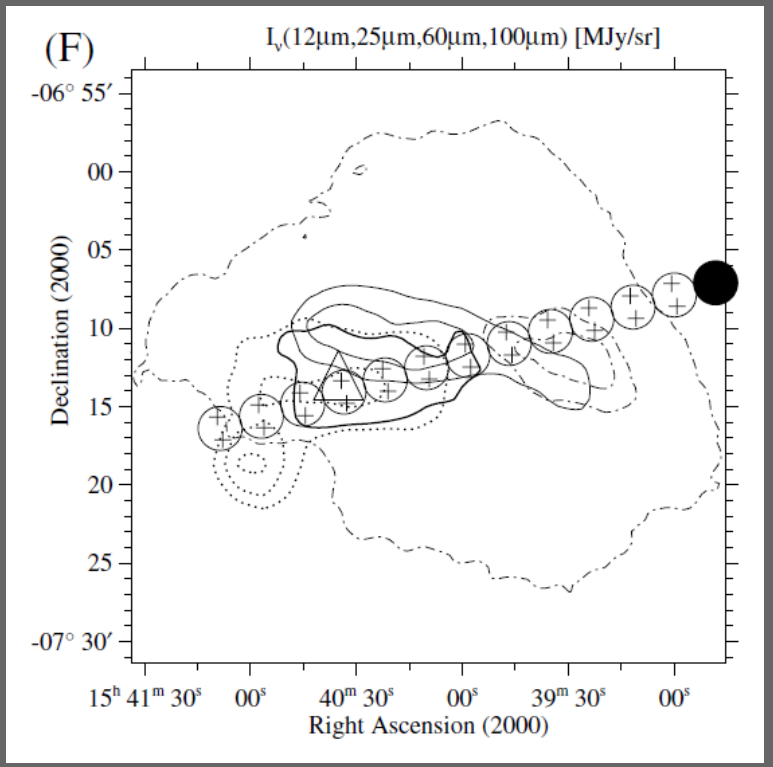
- Isolated translucent region at 110±10 pc
- $l = 359°, \quad b = 36.7°$
- ~18 M $\odot$, no star formation
- We have ancillary data (IRAC, ISO)

Image Credit: ESA/HFI Consortium/IRAS

# IR morphology




Red: WISE 12 µm
Green: IRAS 100 µm



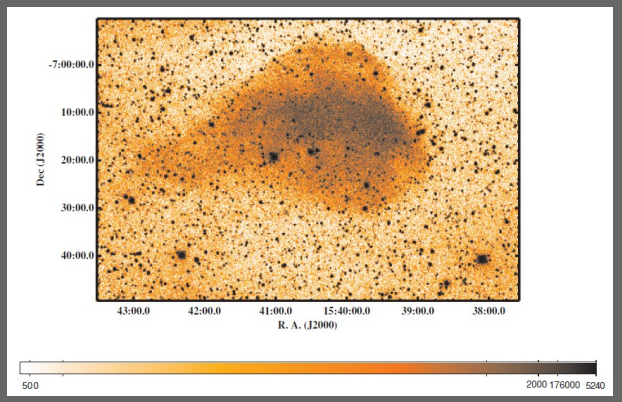

ISO contours from Ridderstad et al (2006)

IR color ratios

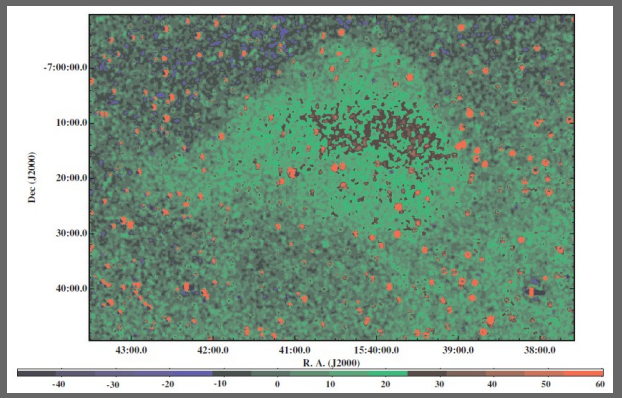
| Color | $L1780_{AVG}$ | $L1780_{MAX}$ | $L1780_{MIN}$ | *SN* |
|---|---|---|---|---|
| 12/100 | 0.10 | 0.20 | 0.05 | 0.042 |
| 25/100 | 0.16 | 0.26 | 0.07 | 0.054 |
| 60/100 | 0.31 | 0.42 | 0.21 | 0.21 |

Over-abundance of PAHs?
(increased UV IRF can explain this too)

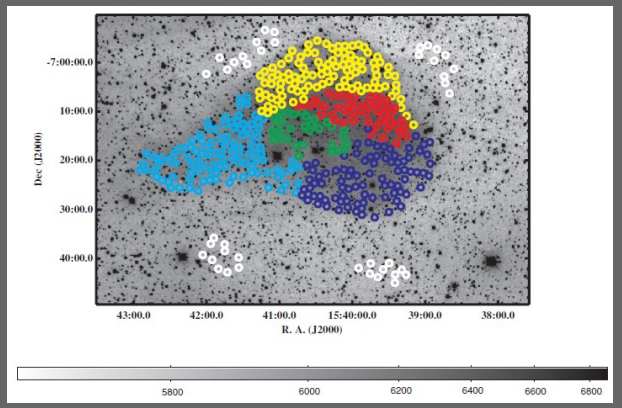
# Hα excess

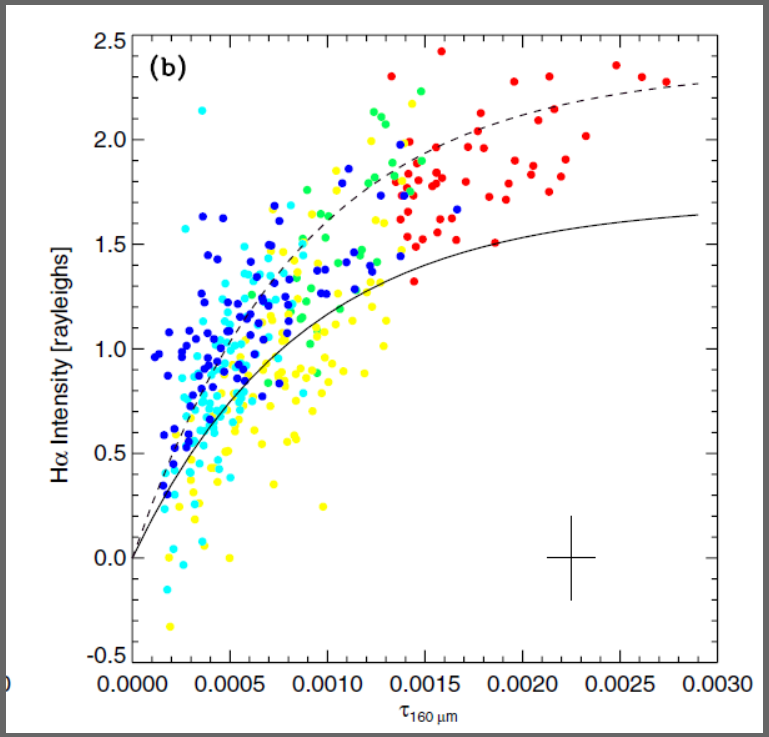



Hα




Hα CC



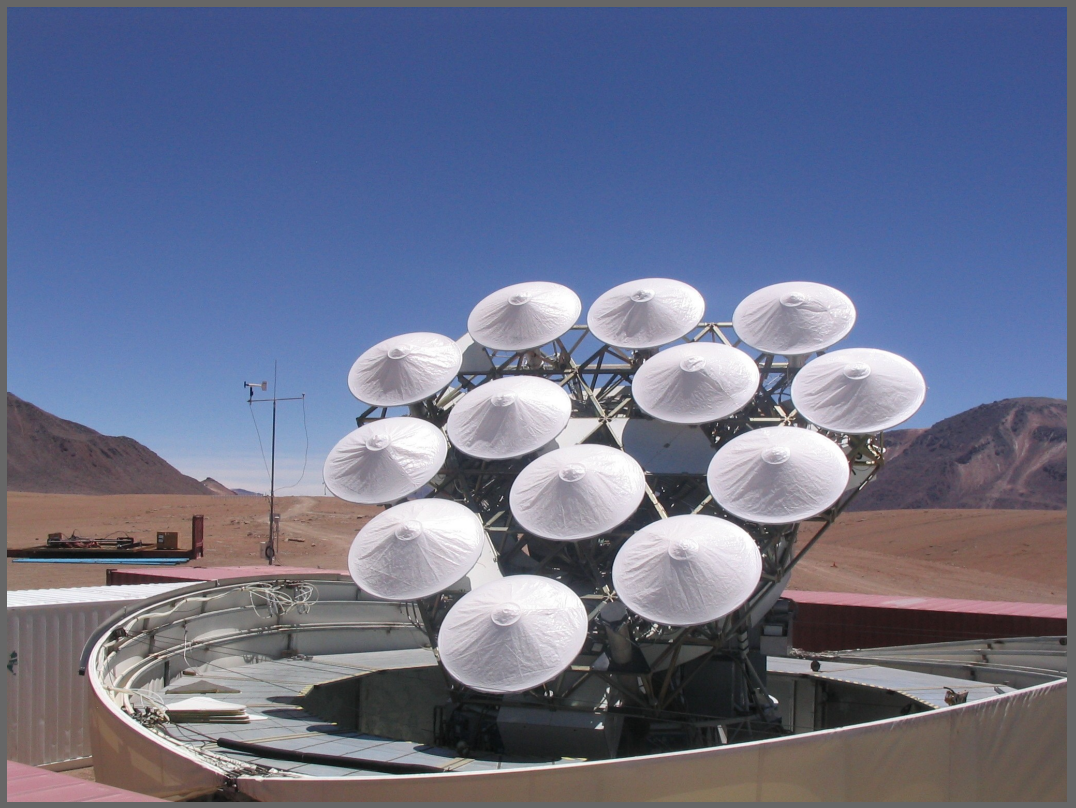




Solid: expected scattered Hα light.
Dashed: Hα increased by 38% with respect to Solar neighbourhood

Witt et all. (2010): excess due to scattered Hα photons.

=> Very little free-free from the cloud.

# Cosmic Background Imager



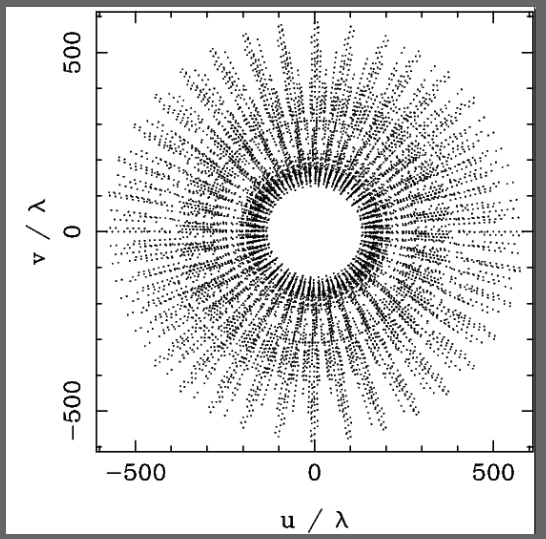
- 13 elements interferometer located in Chajnantor plateau
- 10 frequency channels from 26 to 36 GHz
- Designed to measure CMB anisotropy in the range ~5' to 5 deg
- 1.4 m dishes (CBI2) and PB: 22.8' FWHM

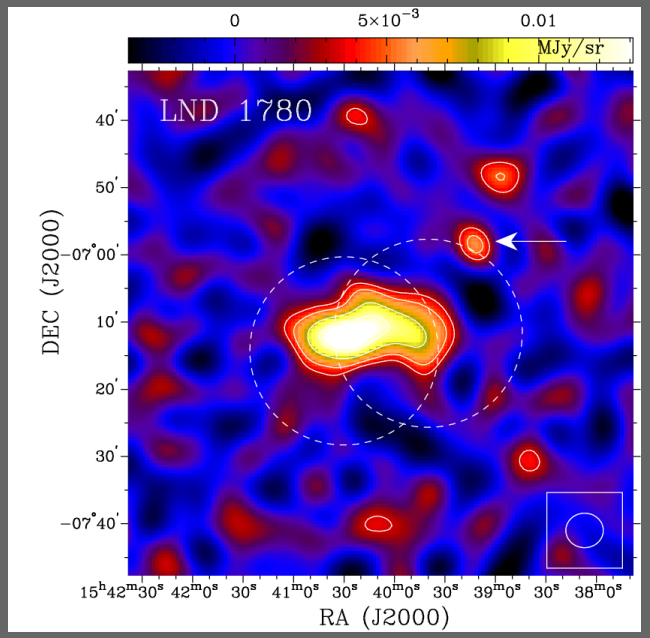
# CBI data

2 pointings. ~20,000 s on source

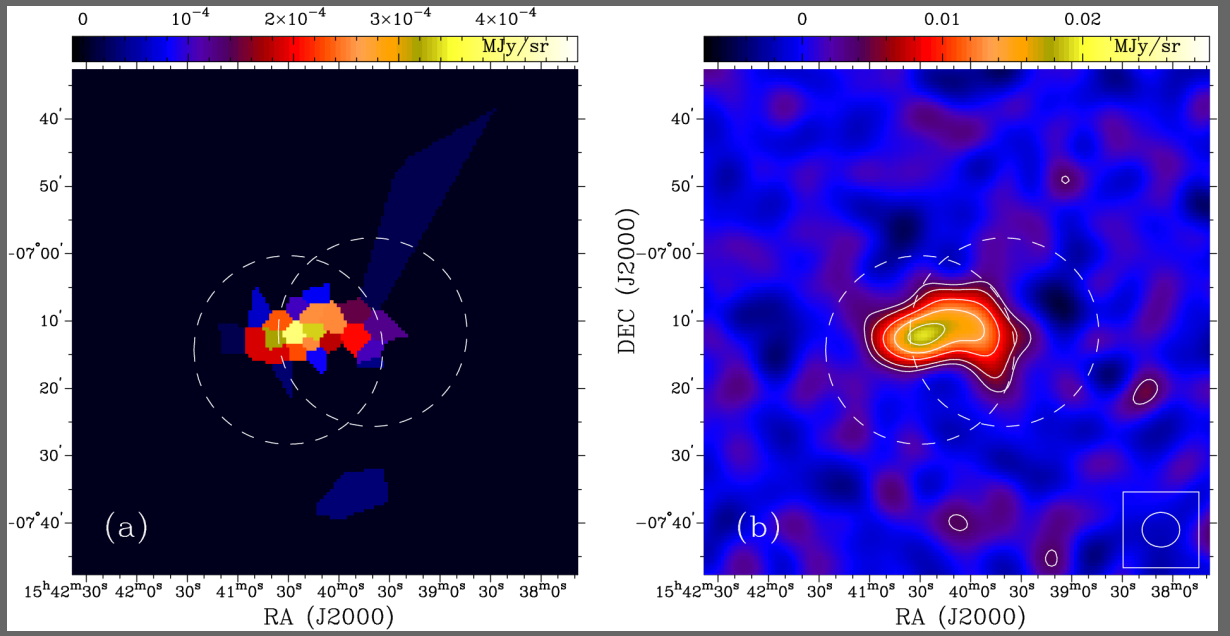
Synthetic beam: ~ 5.0 '

We tried 2 different reconstruction methods



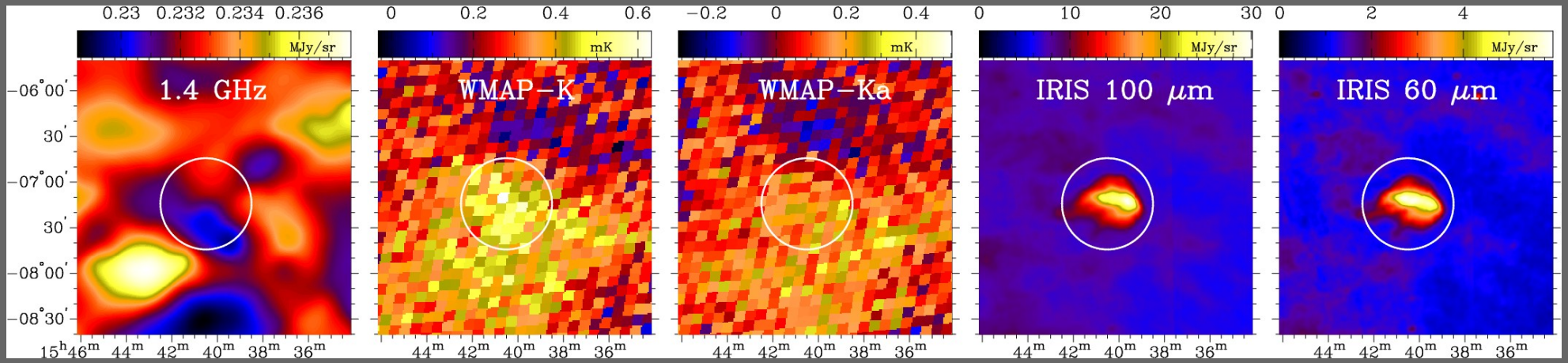



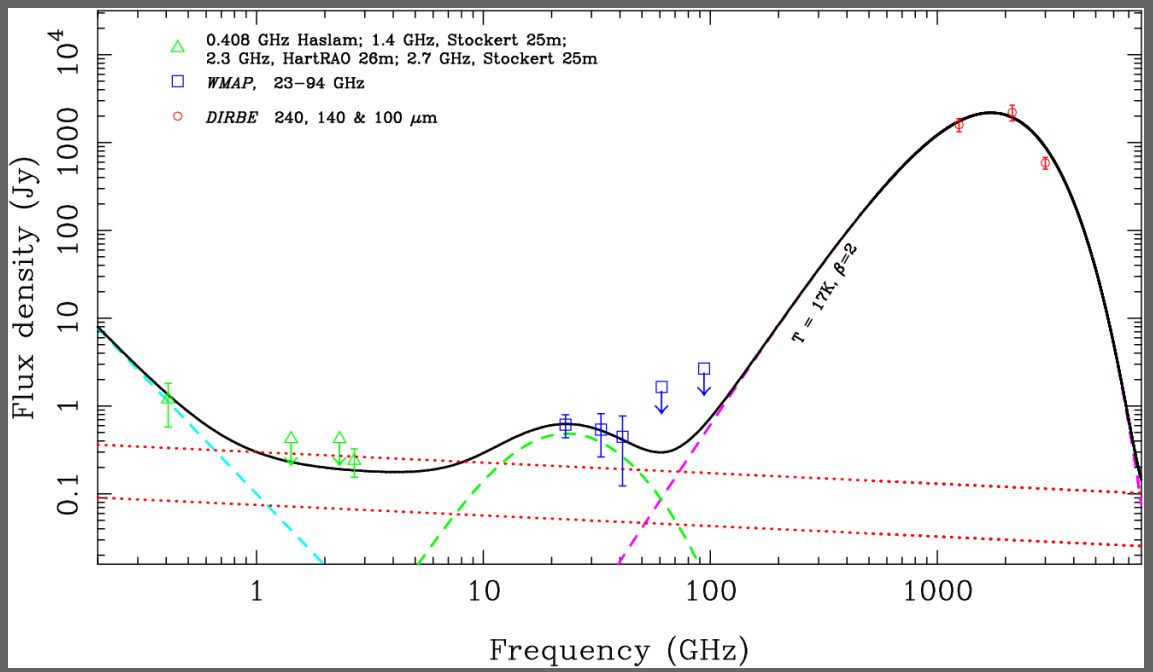

CLEAN reconstruction




Voronoi image reconstruction (Cabrera et al. 2008)

# 1° SED



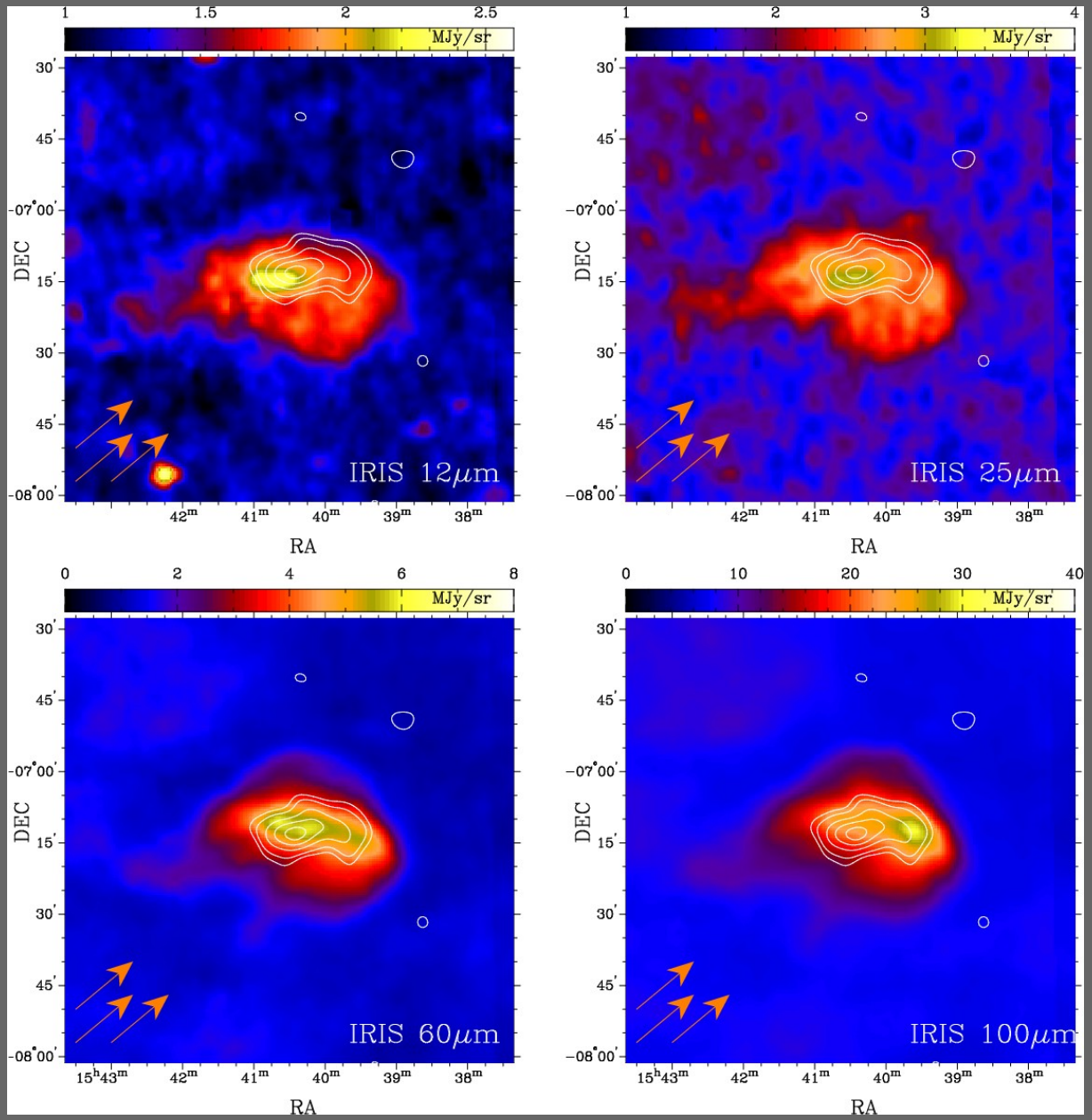




Fit = Synch + ff + SD + TD

CBI not in the SED due to large flux losses: ~ 80% from simulations

=> diffuse 31 GHz emission

# IR correlation

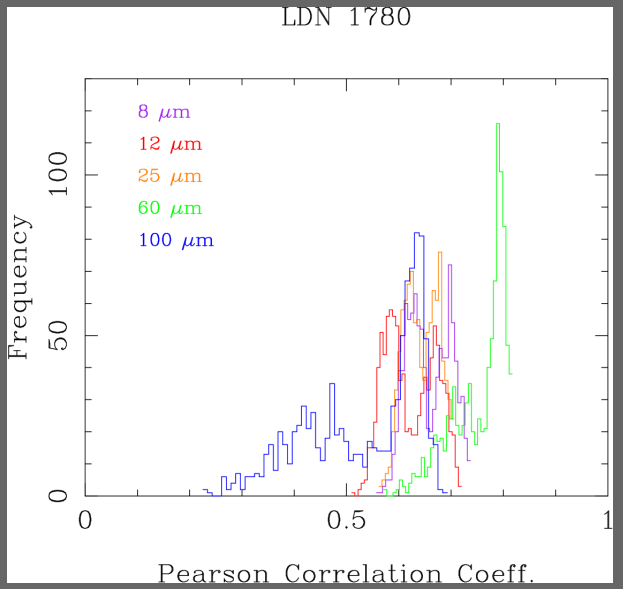


# IR correlation

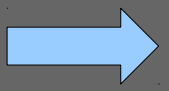
**Table 6.** Correlation parameters for LDN 1780. $r$ is the linear correlation coefficient and $a$ is the proportionality factor between the 31-GHz image and various templates in units of μK $(\mathrm{MJy/sr})^{-1}$. The errors are given by the dispersion in the Monte Carlo simulations.

| | 8 μm | 12 μm | 25 μm | 60 μm | 100 μm |
|---|---|---|---|---|---|
| $r$ | $0.6 \pm 0.1$ | $0.5 \pm 0.1$ | $0.7 \pm 0.05$ | $0.8 \pm 0.1$ | $0.6 \pm 0.1$ |
| $a$ | $5.3 \pm 1.0$ | $5.2 \pm 1.4$ | $3.7 \pm 0.9$ | $0.9 \pm 0.2$ | $0.2 \pm 0.1$ |

Best fit with IRIS 60 μm contradicts SD, but NIR emission depends on IRF.



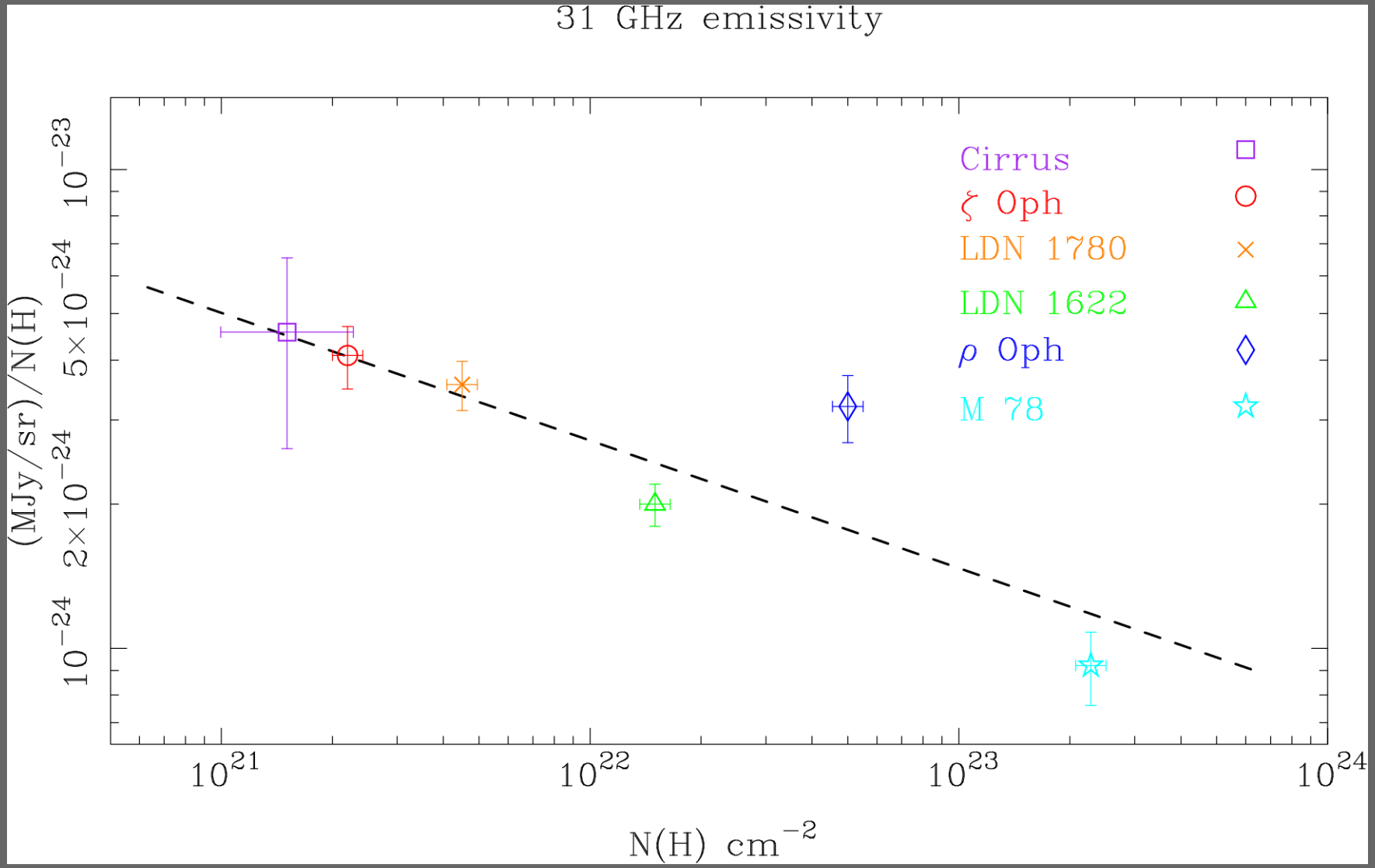

$G_0$ map from using:
(as in Ysard et al. 2009) $G_0 = \left(\frac{T_{BG}}{17.5\,K}\right)^{\beta+4}$



Increased correlation with 8 μm and 12 μm to r = 0.7

$T_{BG}$ map from ISO 100 & 200 μm

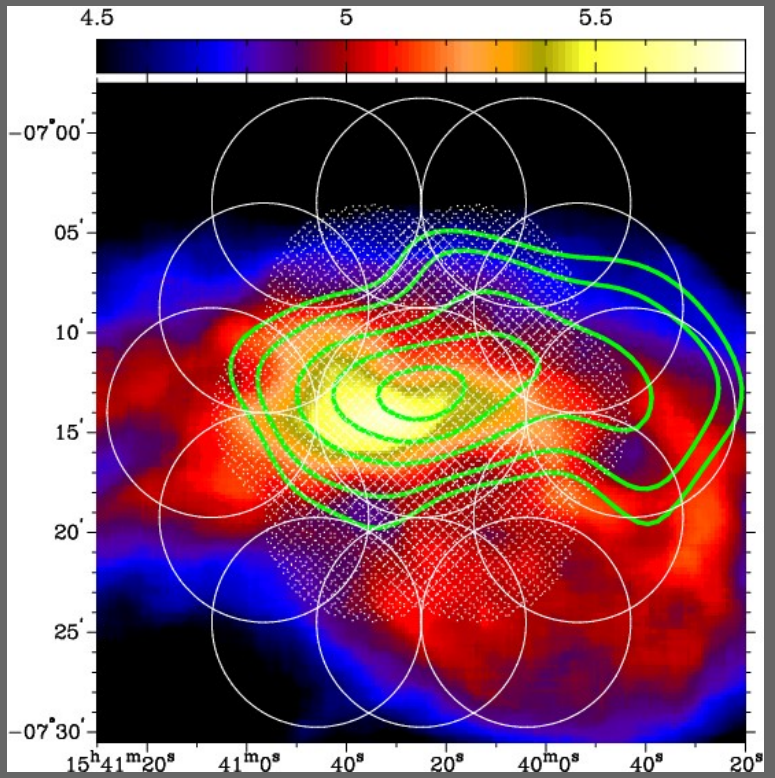
# 31 GHz emissivities



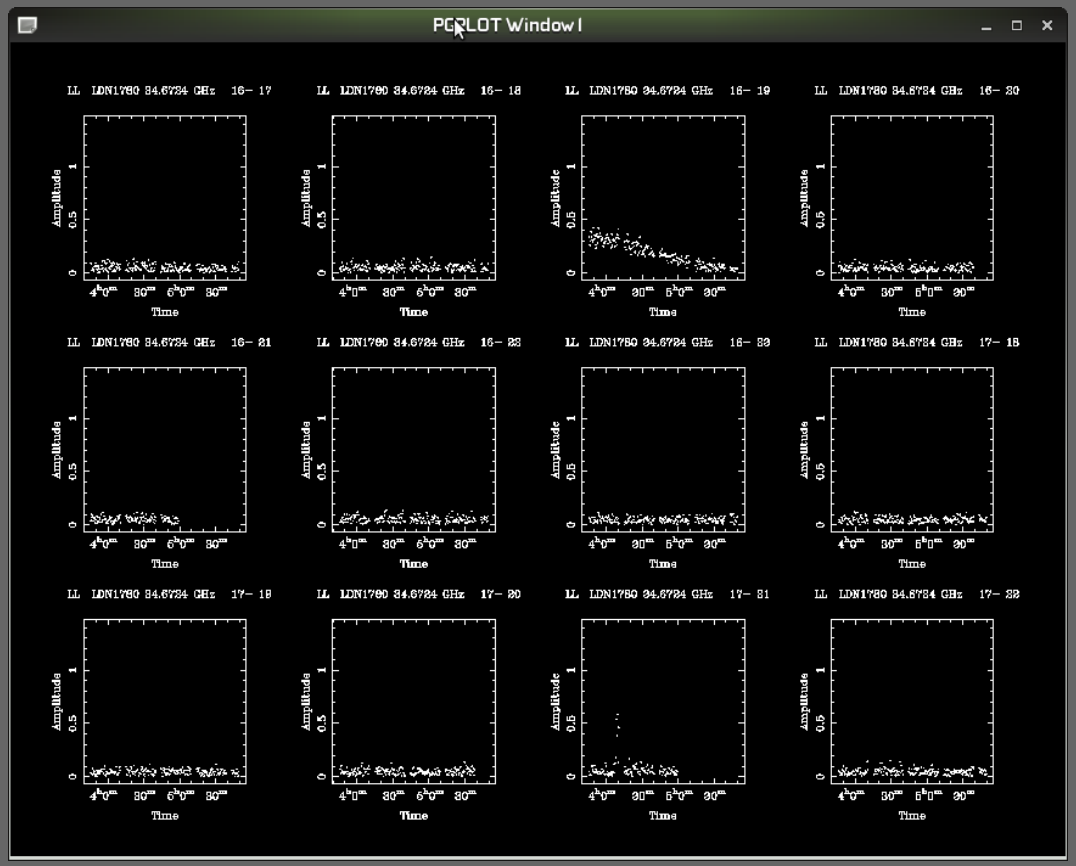
# CARMA SZA observations

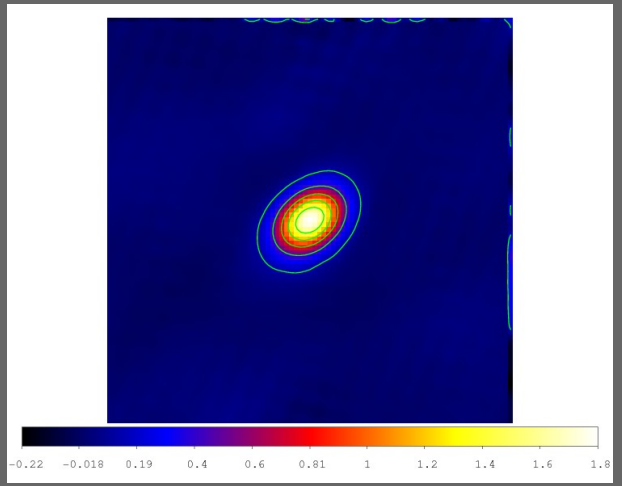
- 8 x 3.5m antennas
- 26 - 36 GHz
- ~11' PB
- ~2' resolution.

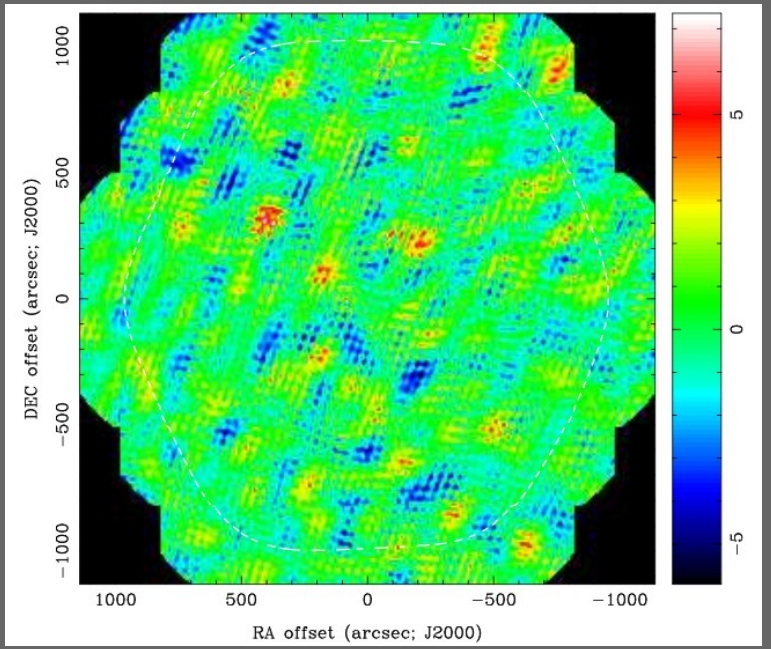
- Given the illumination of the cloud, we expect a gradient in grains size across the cloud as PAH destruction rate is very sensitive to PAH size.
- Can we see this in the radio?



# CARMA SZA observations



# Summary

- LDN 1780 nice isolated cloud: low free-free, no strong synchrotron, morphology in IR and expected gradient of grain sizes due to IRF.
- Better correlation with 60 μm but correlation improves with NIR when correcting for IRF
- Excess in 1°  SED that can be fitted with SD model.
- Ongoing SZA observations with better resolution.