UNIVERSIDAD DE CHILE

CARMA observations of LDN 1780

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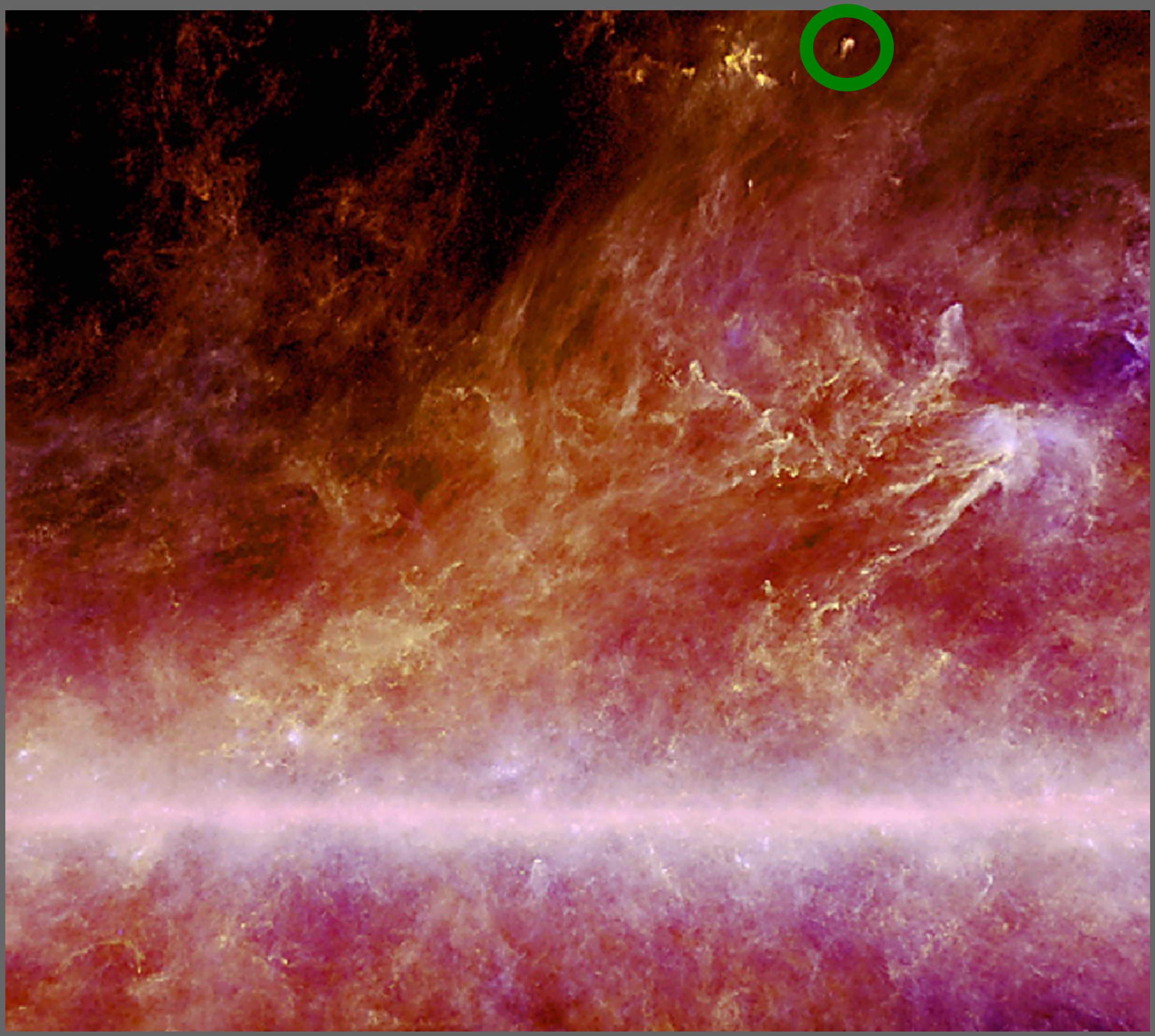
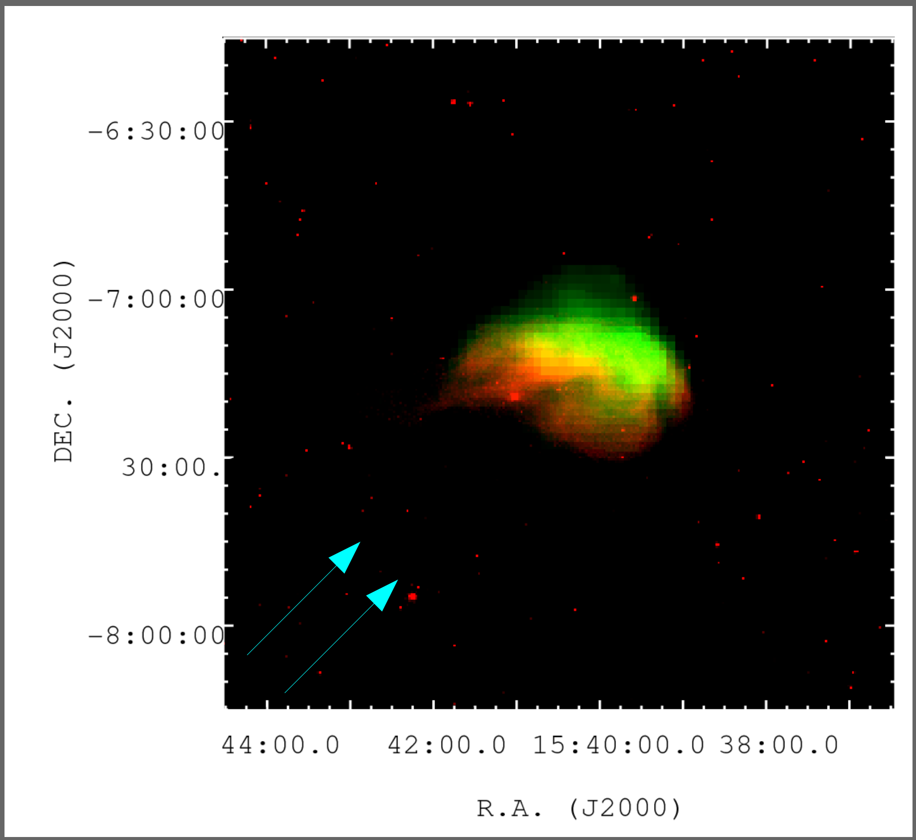
LDN 1780



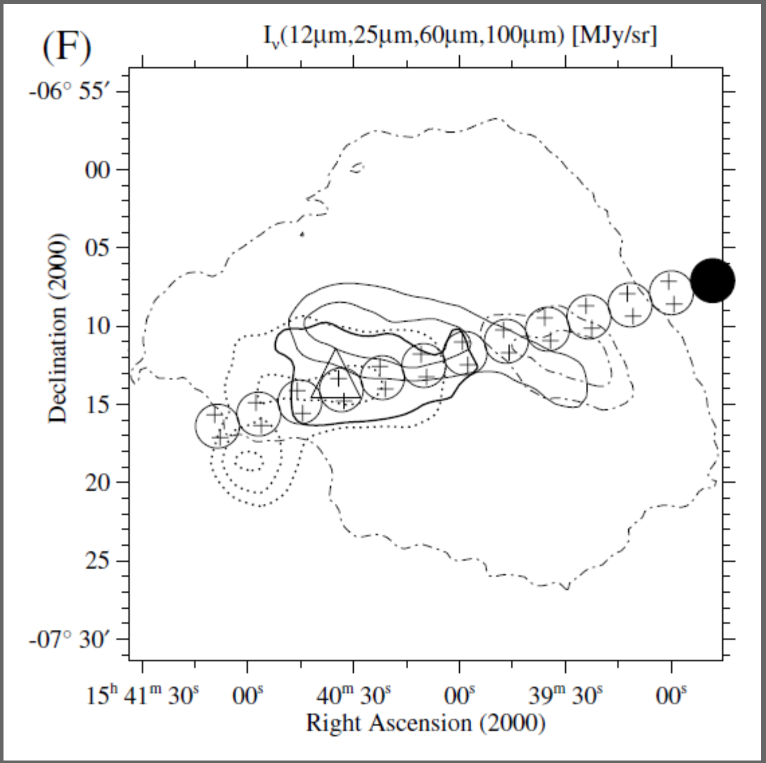
- Isolated Translucent region at 110±10 pc
- l = 359°, b = 36.7°
- Moderate optical extinction $A_V \sim$ 1-4 mag
- ~18 $M_\odot$, no star formation

Image Credit: Planck vHFI Consortium/IRAS

IR morphology



Red: WISE 12 µm
Green: IRAS 100 µm



ISO contours from Ridderstad et al (2006)

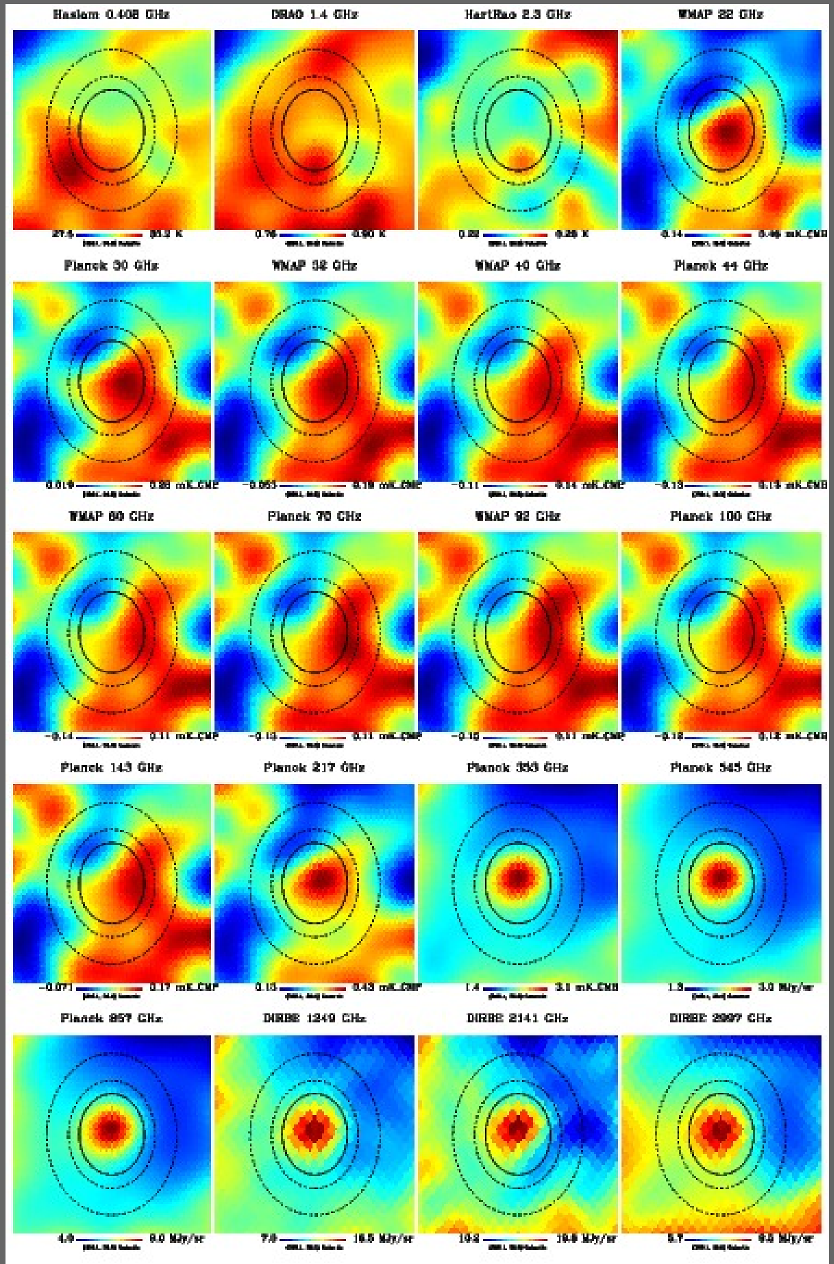
IR color ratios

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)

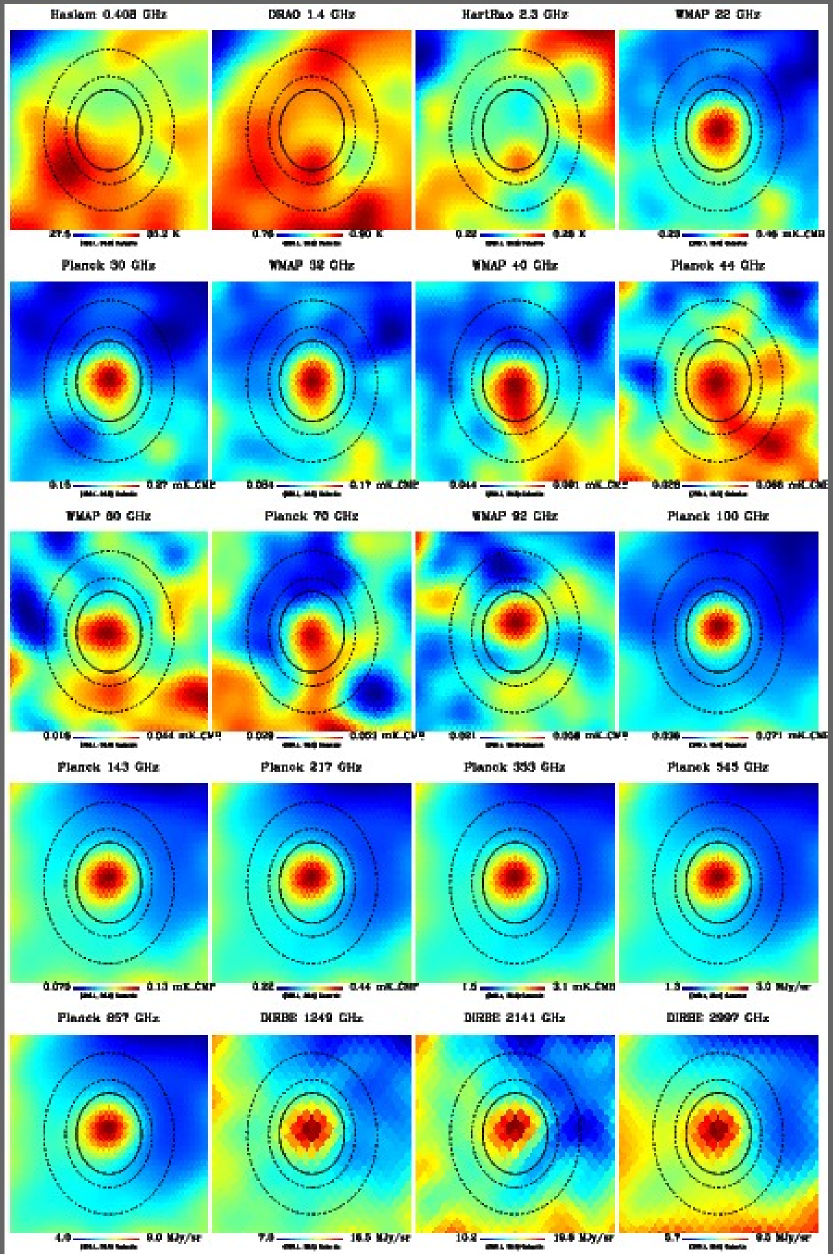
Large scale emission

- 0.408 to 3000 GHz maps, including WMAP, Planck and COBE/DIRBE data.
- 1 deg resolution
- CMB emission dominates from 30 to 150 GHz.

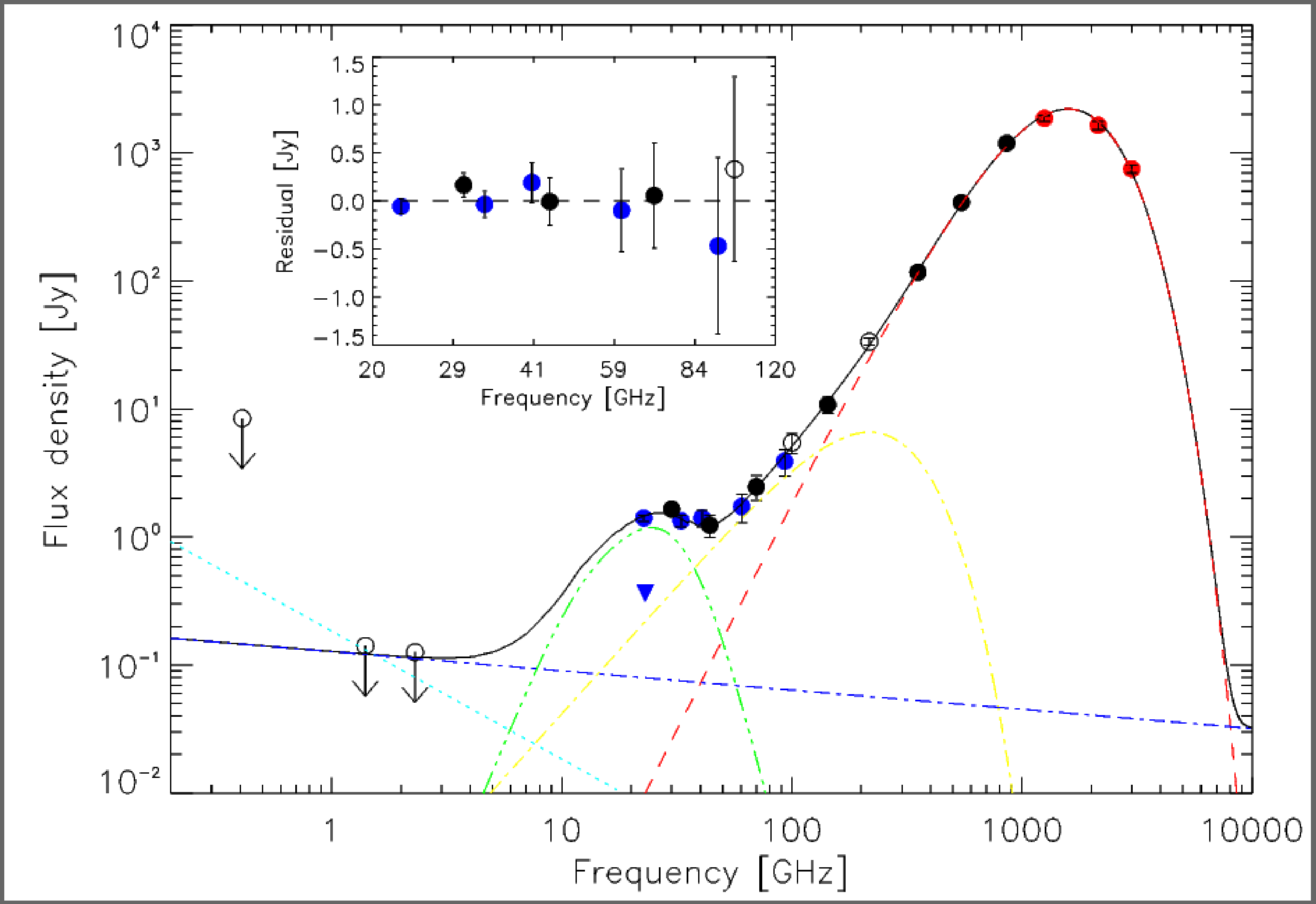


Large scale emission

- 0.408 to 3000 GHz maps, including WMAP, Planck and COBE/DIRBE data.
- 1 deg resolution
- CMB emission dominates from 30 to 150 GHz.
- After subtracction of CMB using Planck SMICA map, the cloud is visible from 23 to 3000 GHz.

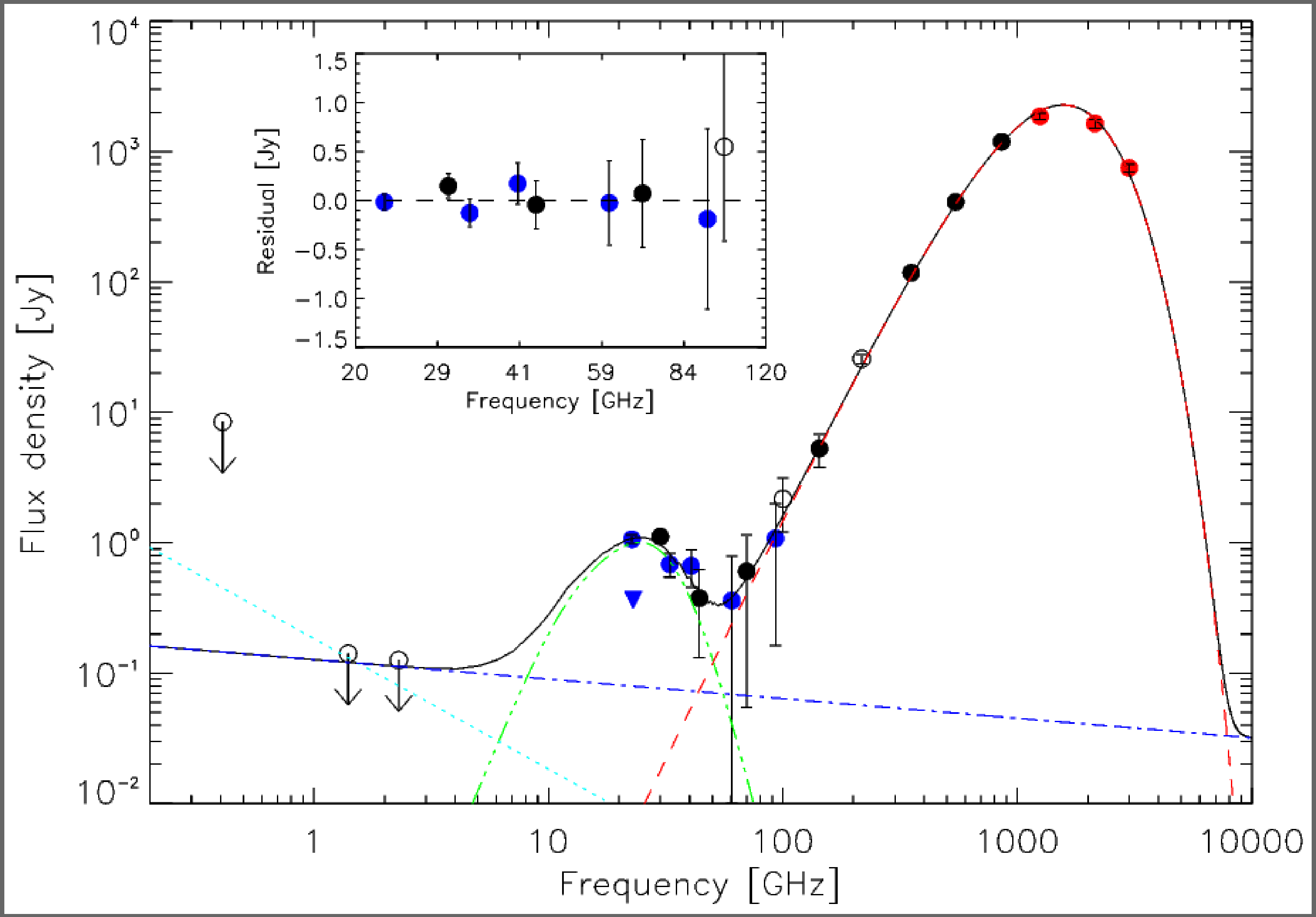


Large scale emission



Fit = ff + SD + TD + CMB

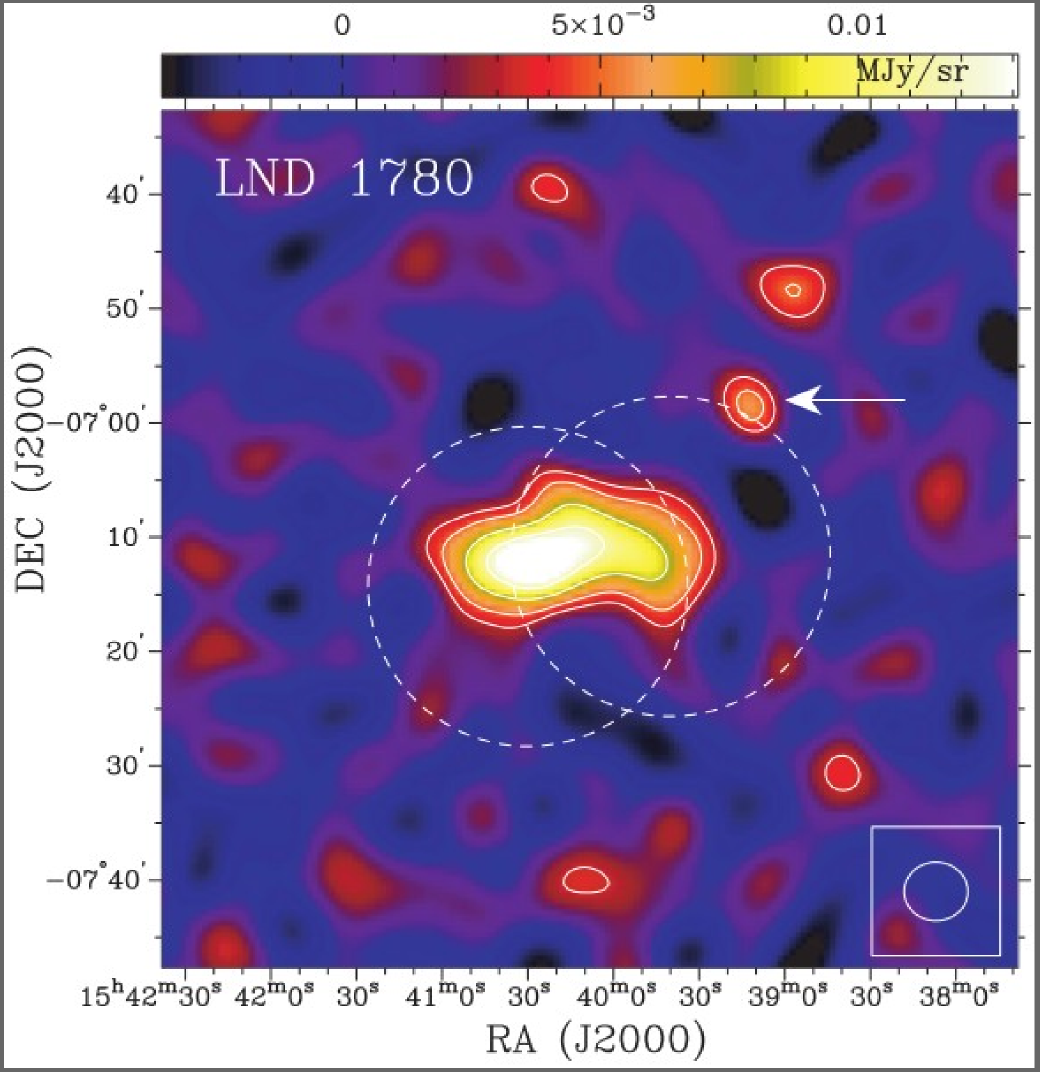
Large scale emission



Fit = ff + SD + TD + CMB

Previous high resolution observations

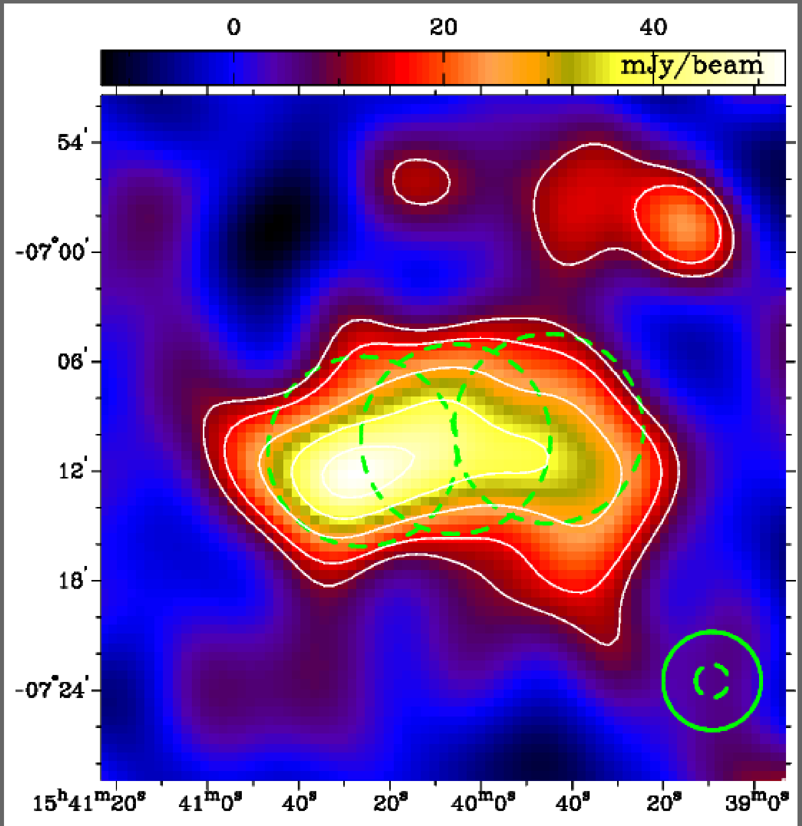
- Observed with the CBI at 31 GHz, 4' res.
- AME detected
- 31 GHz emission correlates better with IRAS 60 μm, not a PAH template.



Vidal et al. 2011

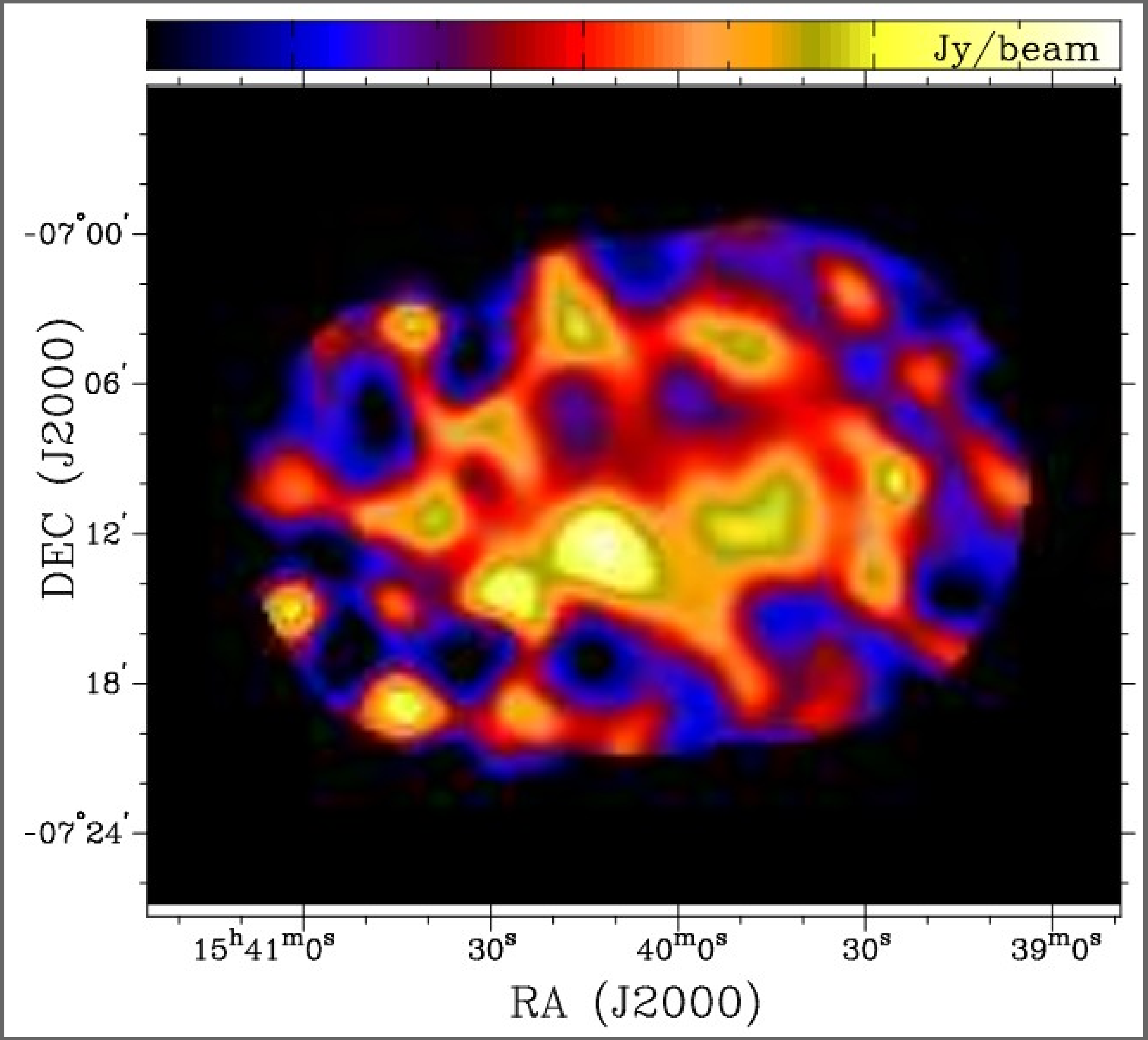
CARMA SZA observations

- 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?

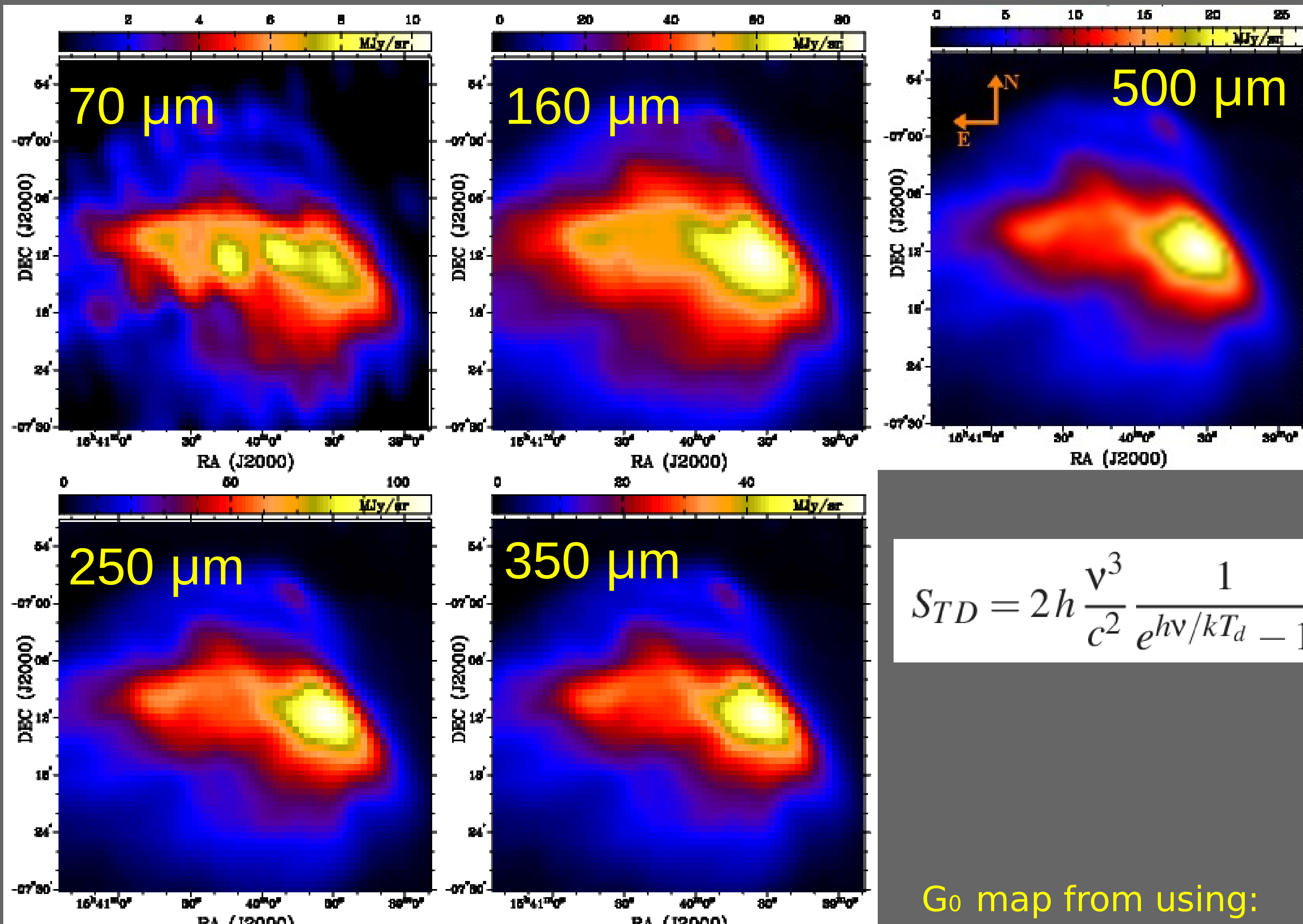
CARMA SZA observations



MEM reconstruction

2' resolution

IR maps

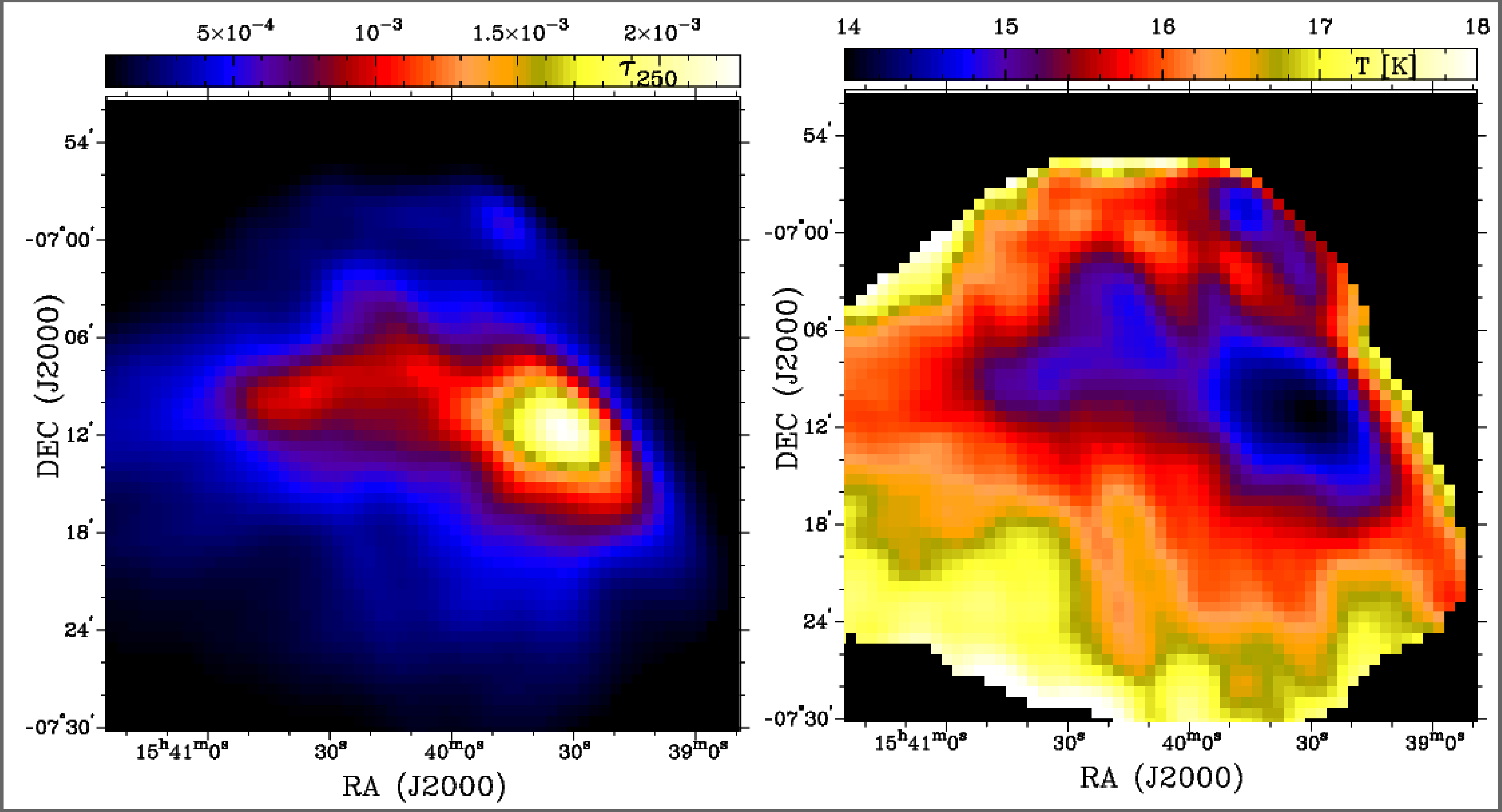


$$S_{TD} = 2h\frac{\nu^3}{c^2}\frac{1}{e^{h\nu/kT_d}-1}\tau_{250}(\nu/1.2\,\mathrm{THz})^{\beta_d}\,\Omega$$

G_0 map from using:
(as in Ysard et al. 2009)

$$G_0 = \left(\frac{T_{BG}}{17.5\,K}\right)^{\beta+4}$$

Dust temp. and opacity fit

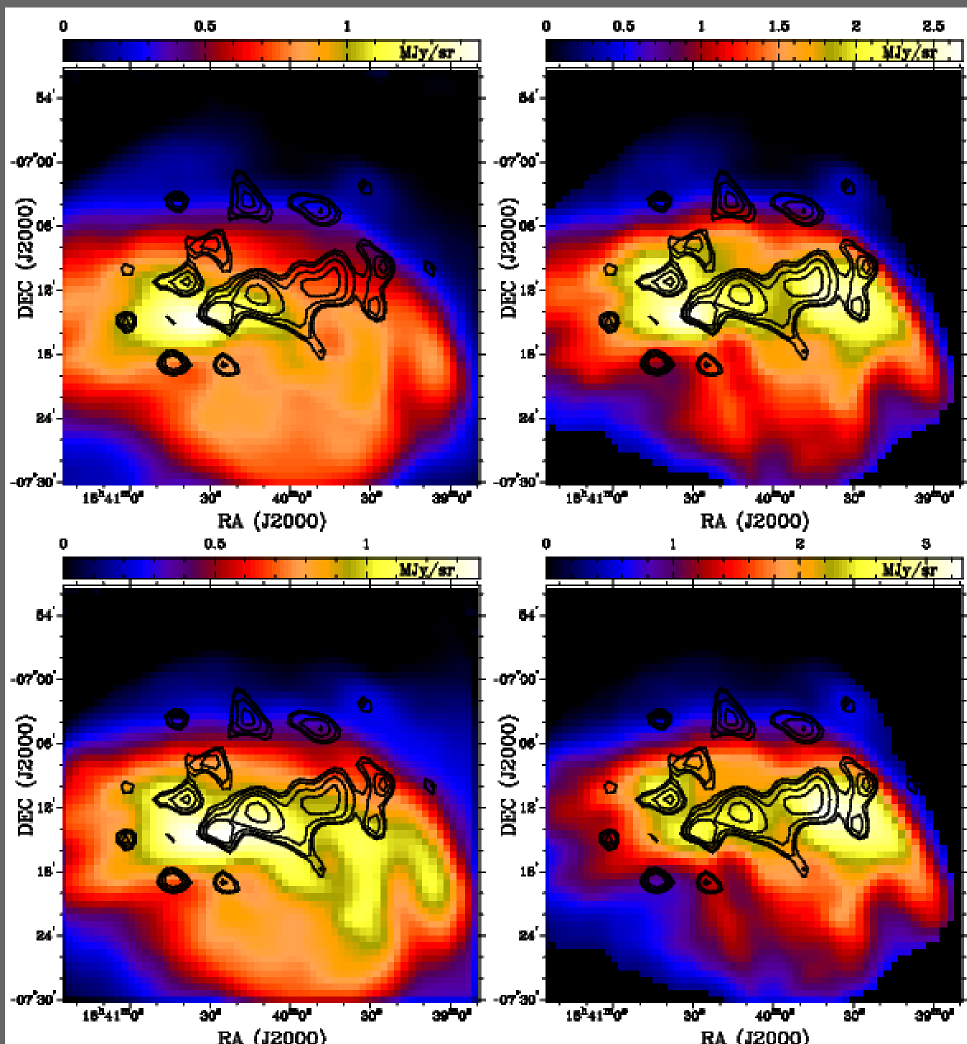


τ_{250}

DT

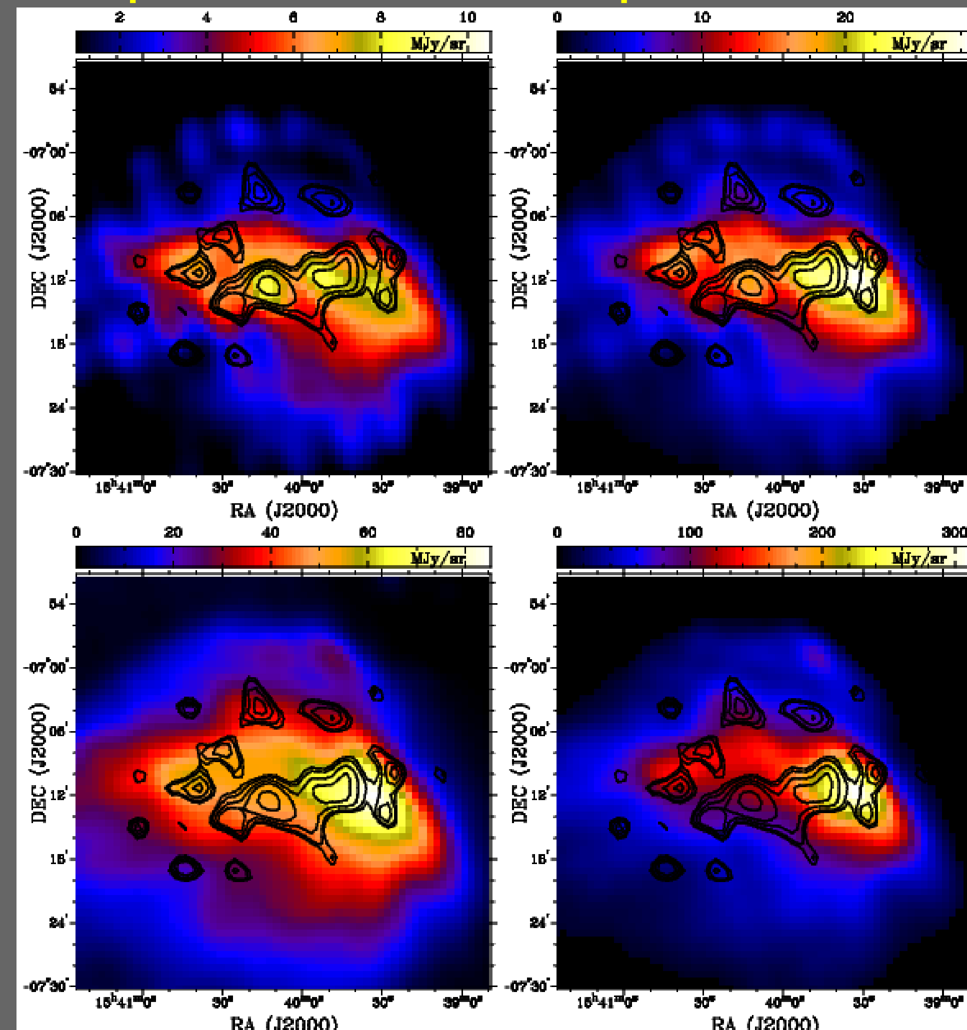
IR correlations

8 μm 8 μm/G_0



24 μm 24 μm/G_0

70 μm 70 μm/G_0

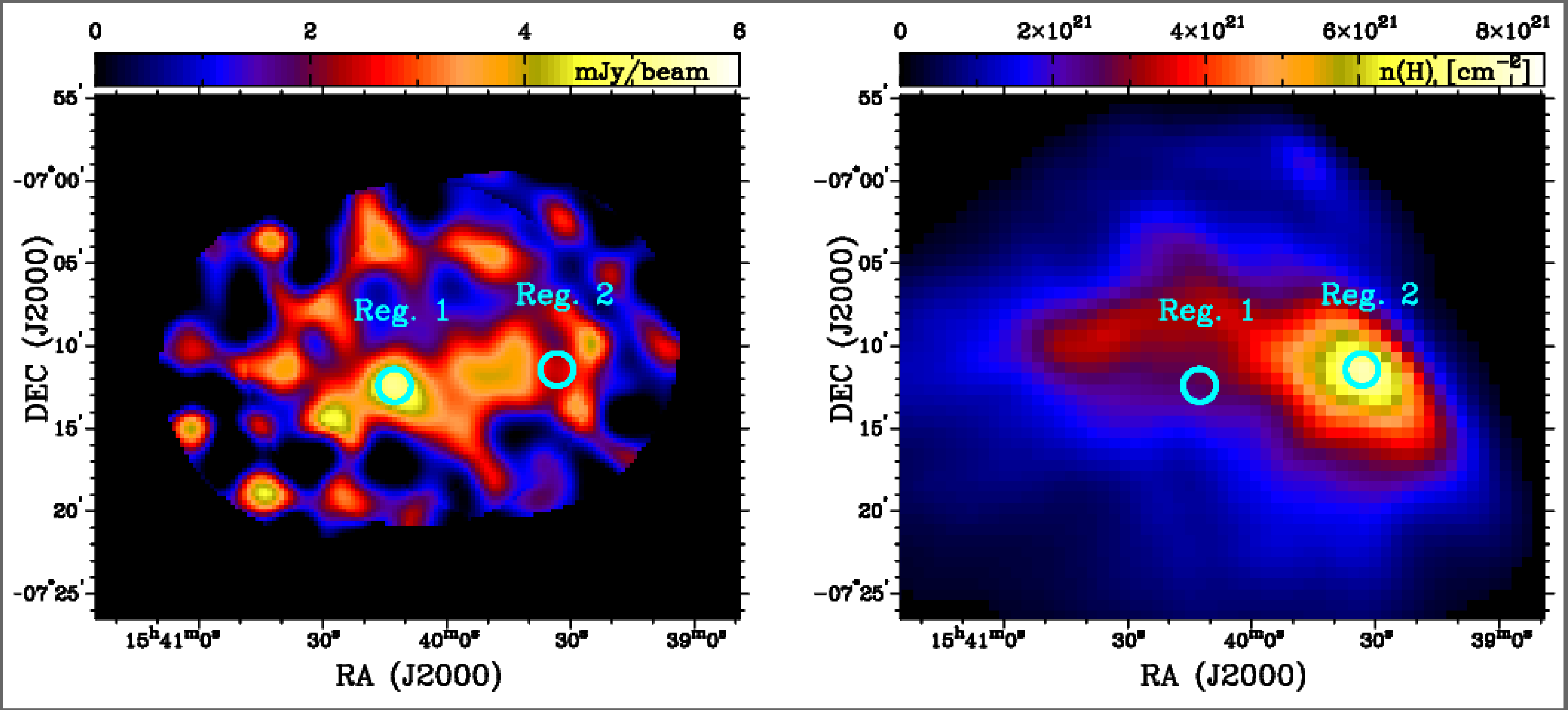


160 μm 160 μm/G_0

IR correlations

Wavelength [μm]	r_s	r_s after G_0 correction
8	0.14 ± 0.06	0.38 ± 0.07
24	0.21 ± 0.06	0.46 ± 0.06
70	0.49 ± 0.07	0.45 ± 0.07
160	0.36 ± 0.07	0.31 ± 0.07
250	0.35 ± 0.06	0.31 ± 0.07
350	0.34 ± 0.06	0.30 ± 0.07
500	0.34 ± 0.06	0.30 ± 0.06

Modelling



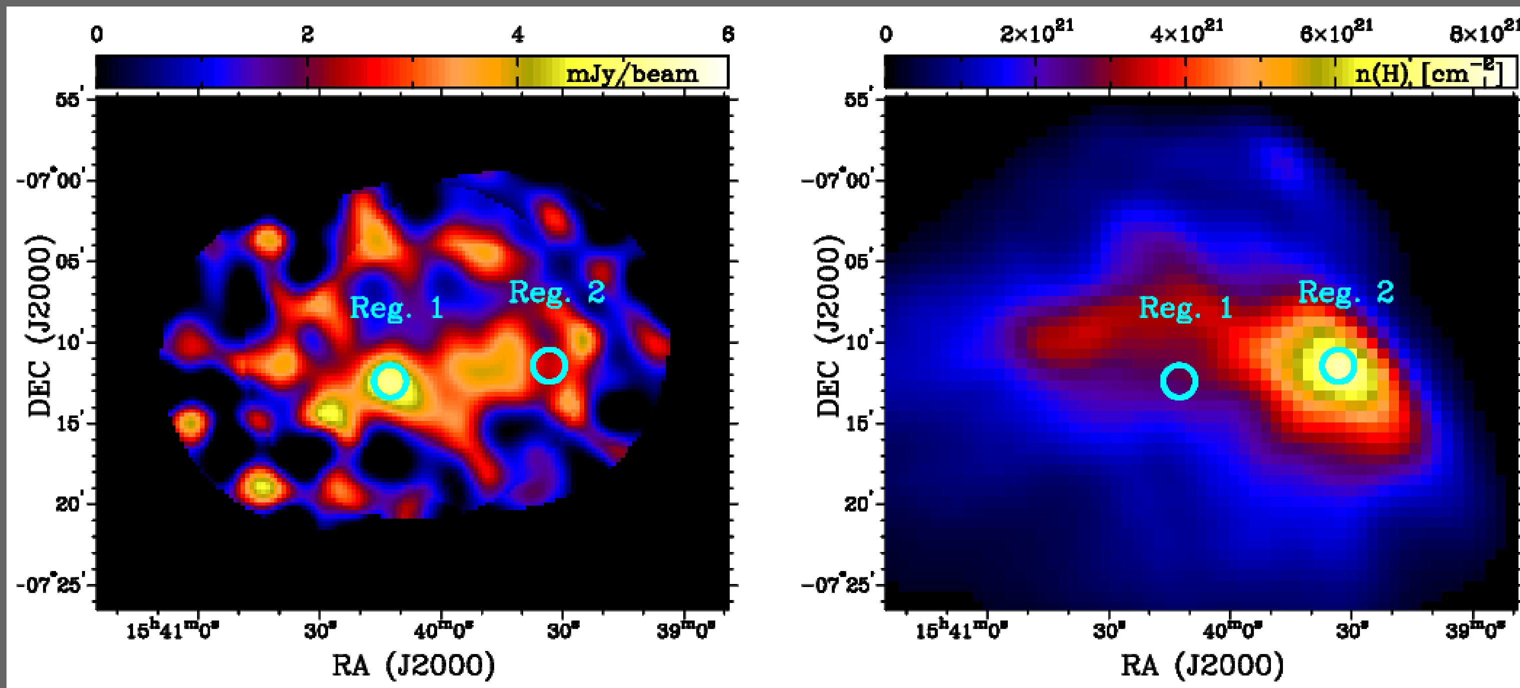
Region	$N(H)$ $[\times 10^{21}\,\mathrm{cm}^{-2}]$	T_d [K]	G_0	S_{31} mJy	$S_{31}/N(H)$ $\times 10^{-24}$ $[\mathrm{Jy\,cm}^{-2}]$
1	2.4	16.6	0.7	4.5	18.7
2	7.3	15.0	0.4	2.4	3.2

Modelling

- SPDUST package (Ali-Haïmoud et al. 2009, Silsbee et al. 2011) models SD using 7 parameters.
- 10^7 runs over a grid of parameters

Parameter	r_0	r_1	Steps	Type
n_H	0.1	10^5	10	log
T	10	10^5	10	log
χ	10^{-4}	3000	10	asinh
$x_{\rm H}$	10^{-4}	1	10	asinh
$x_{\rm C}$	10^{-4}	1	10	asinh
y	10^{-4}	1	10	asinh
b_c	0	1	10	linear

Modelling



Region	$n(H)$ cm^{-3}	T [K]	G_0	x_H	x_C	y	WD2001
MC	300	20	0.01	0	0.0001	0.99	7
CNM	30	100	1	0.0012	0.0003	0	7
Reg 1	1000	56	0.7	0.0012	0.0003	0.5	7
Reg 2	4000	40	0.4	0	0.0001	0.99	7

The difference in emissivity can be explained by SD using reasonable parameters for physical conditions.

Summary

- LDN 1780 nice isolated cloud: low free-free, no strong synchrotron, morphology in IR and expected gradient of grain type due to IRF.
- AME clearly present at 1 deg scales.
- Better correlation of 30 GHZ emission with 24 & 70 μm but correlation improves with NIR when correcting for IRF
- Differences in AME emissivity can be explained by SPDUST