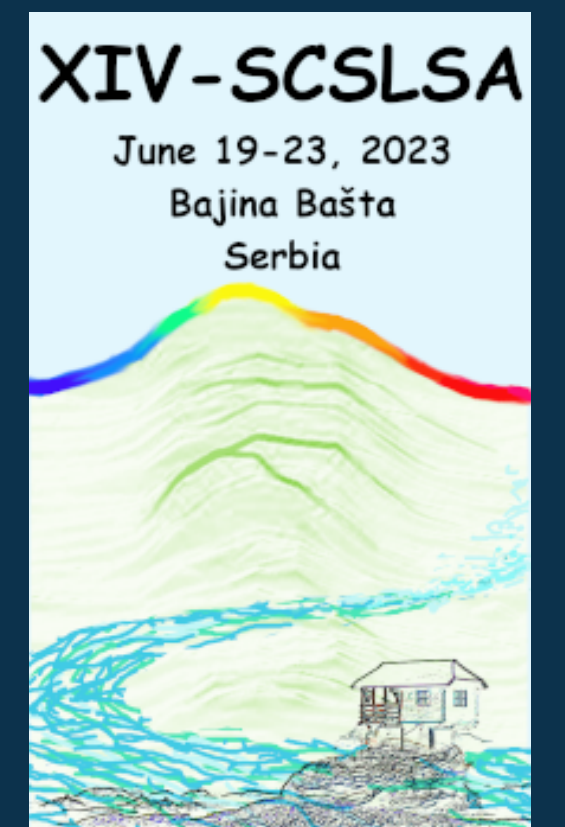
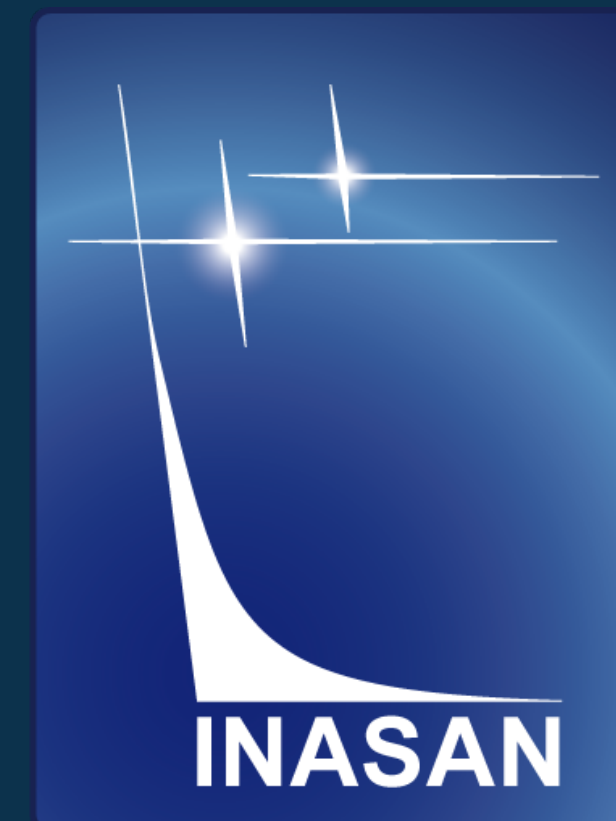


EXPLORING THE SPECTRA AND MOLECULAR COMPLEXITY OF HOT CORES IN RCW 120

PLAKITINA K.V, KIRSANOVA M.S



How do mass stars form?

Ongoing debate!

- ▶ Competitive Accretion
- ▶ Monolithic collapse
- ▶ Merging of (less) massive (proto)stars

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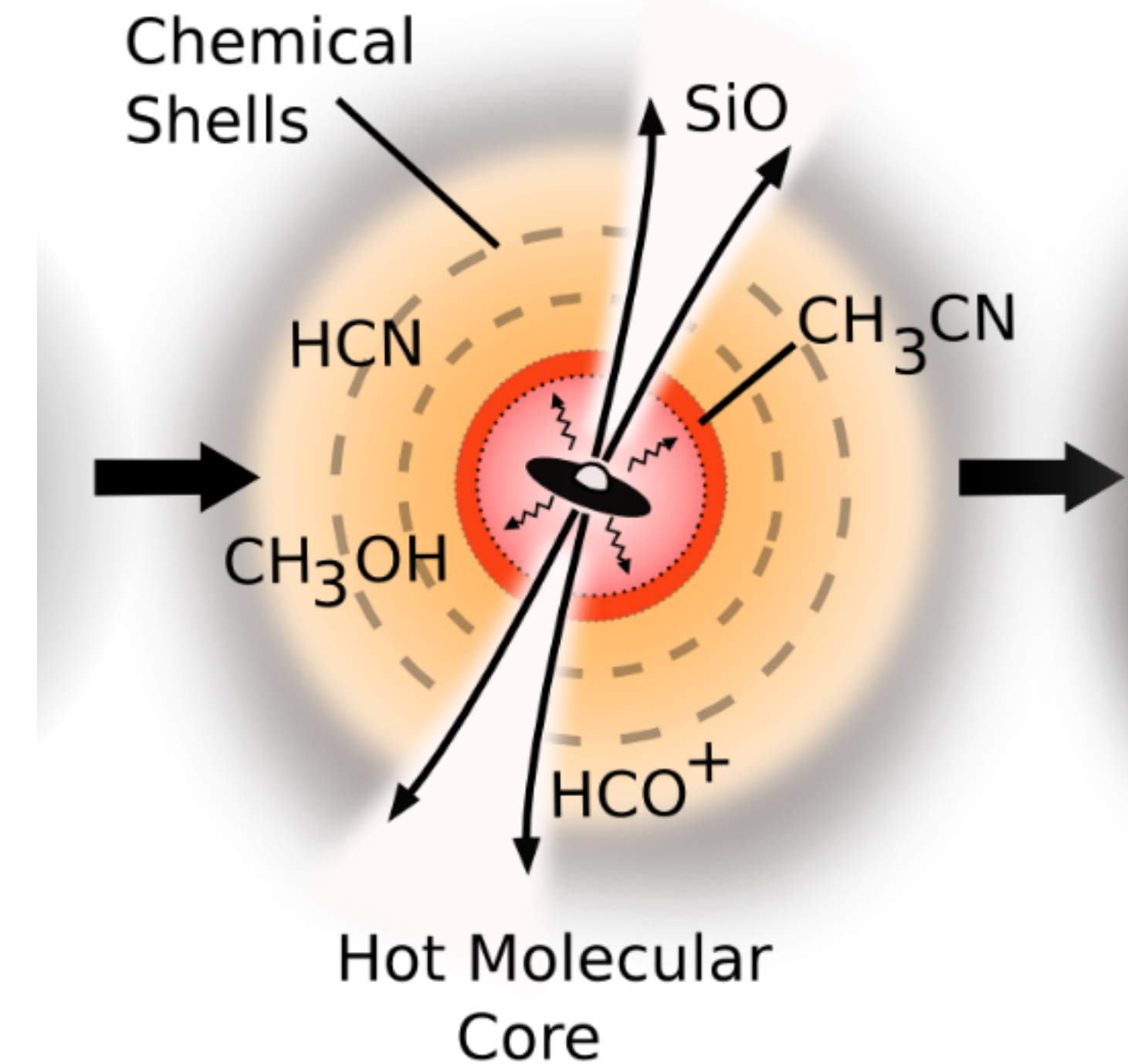


Image credit: Dr Cormac R. Purcell,
<https://crpurcell.github.io/projects.html>

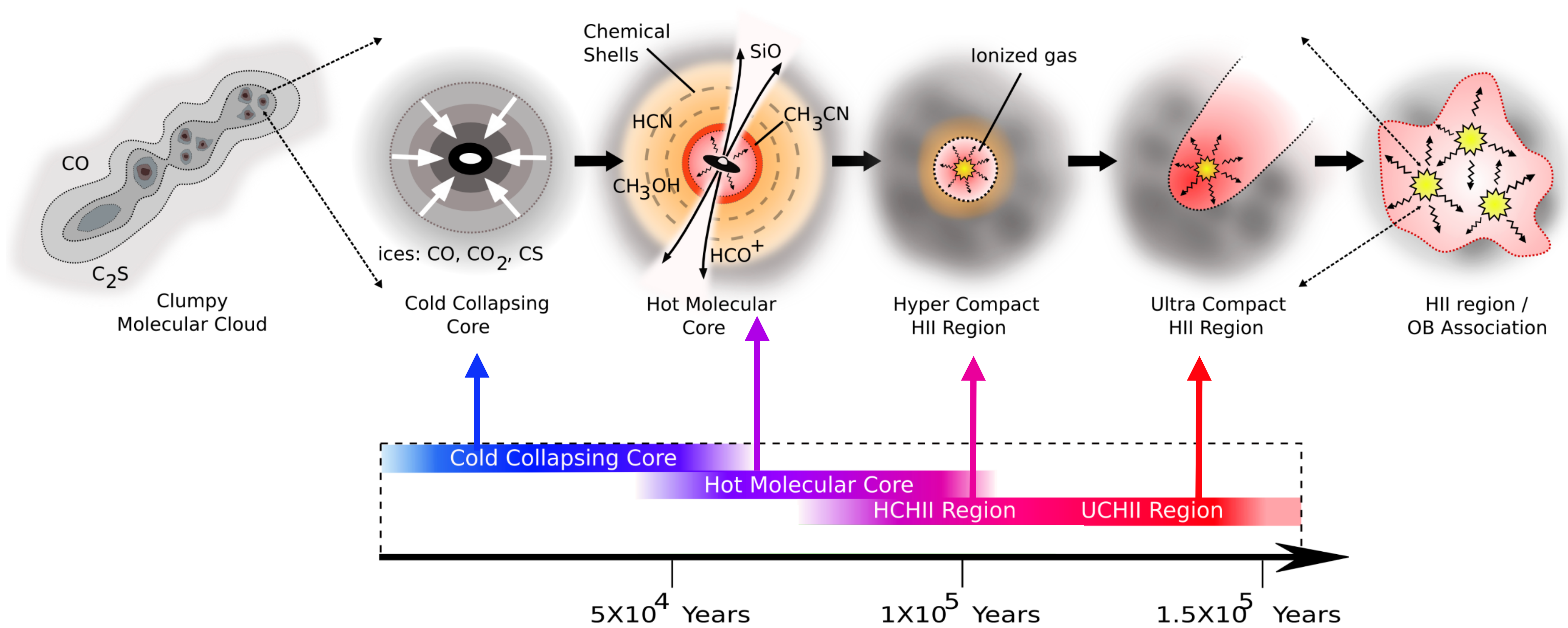


Image credit: Dr Cormac R. Purcell, <https://crpurcell.github.io/projects.html>

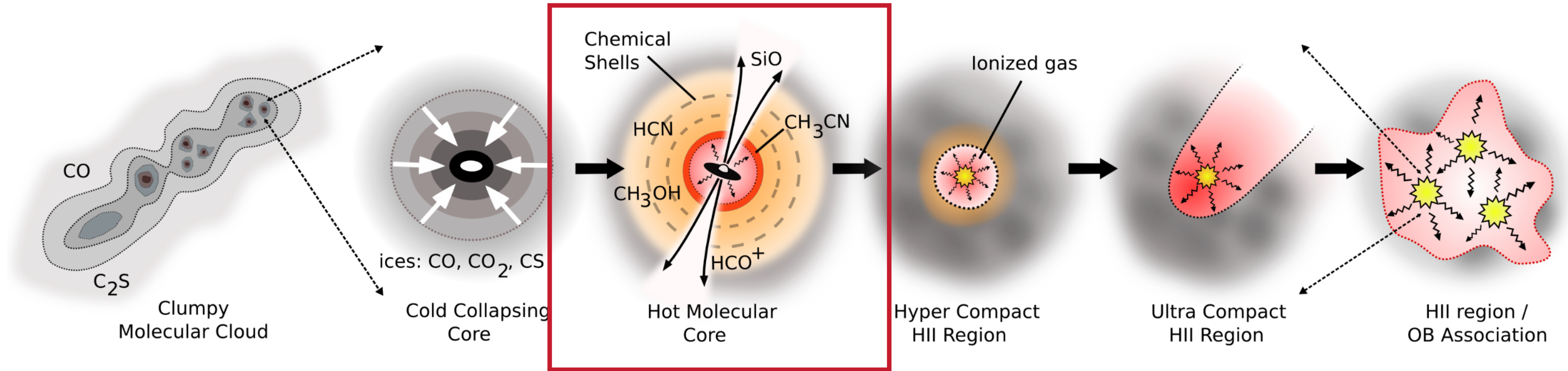


Image credit: Dr Cormac R. Purcell, <https://crpurcell.github.io/projects.html>

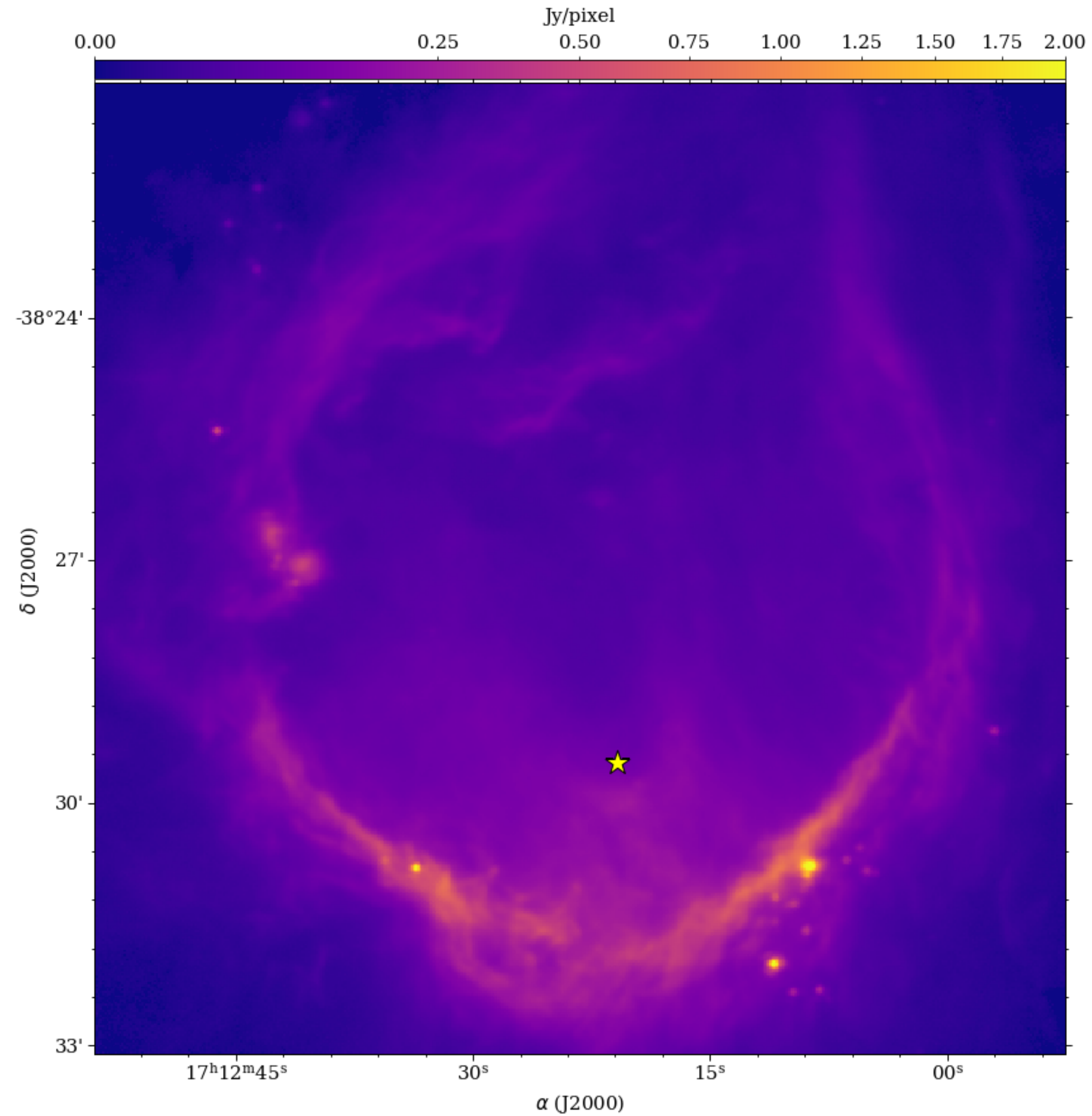
RCW120 contains hot cores at their very early stage

Hot molecular cores (HMCs) – the cradle of high-mass (>8 M_⊙) stars:

- Compact (~ 0.05 pc)
- Hot (>100 K)
- Dense (n_{H2} ~ 10⁸ cm³)

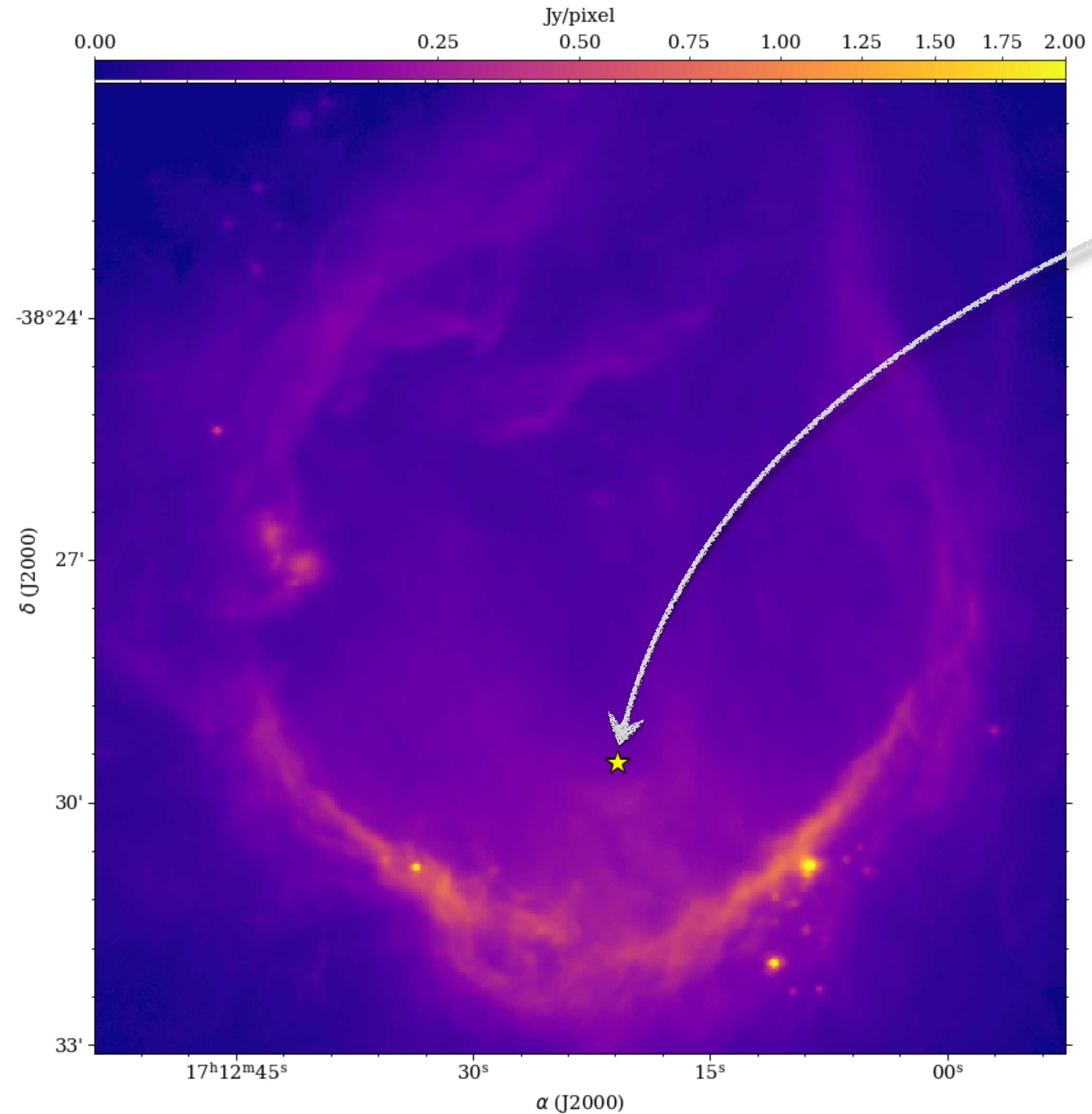
EXPLORING HIGH-MASS STAR FORMATION IN RCW120

Herschel, 70 μm



Distance 1.34 kpc
(Zavagno et al. (2007))

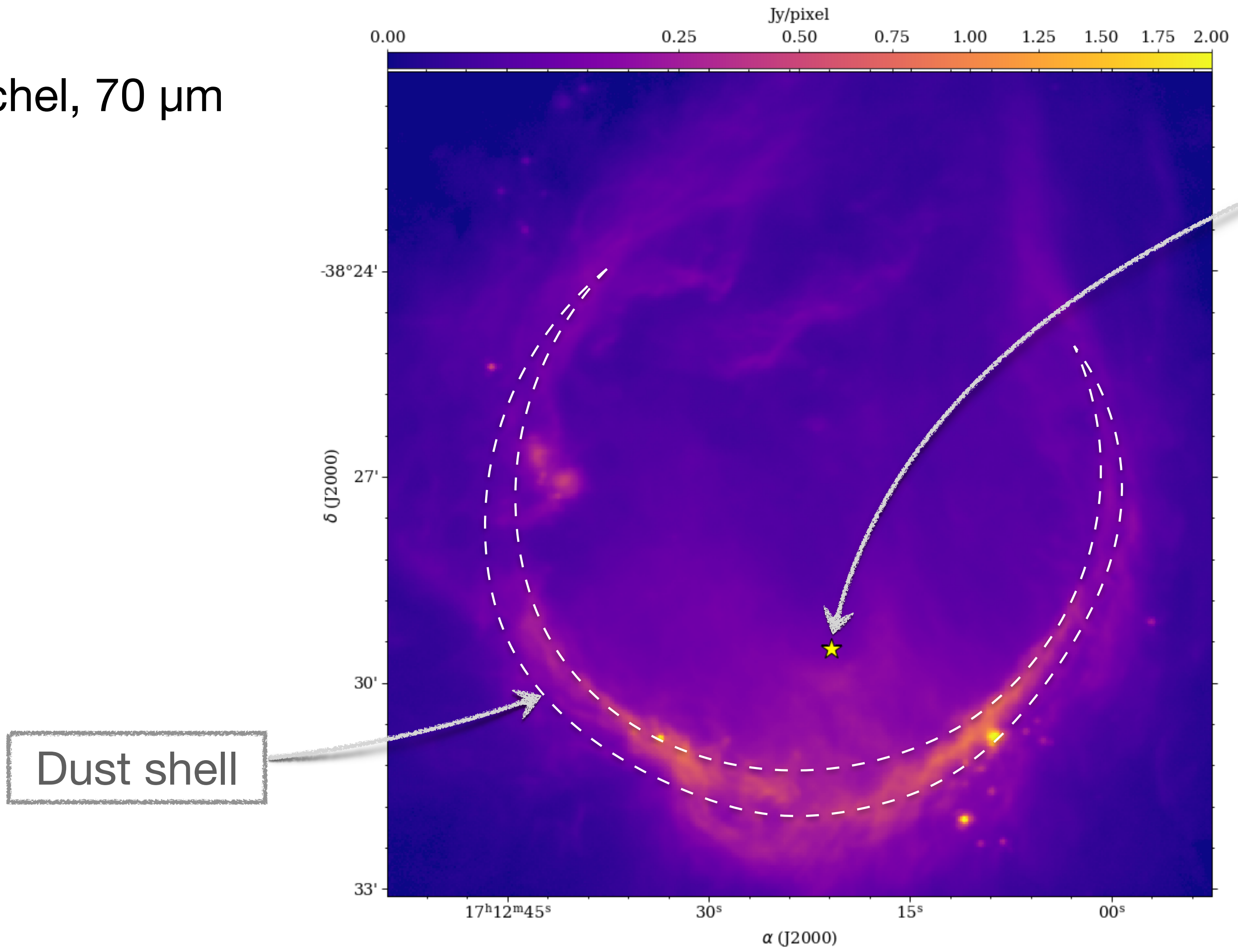
Herschel, 70 μm



Ionising O8V star

Distance 1.34 kpc
(Zavagno et al. (2007))

Herschel, 70 μm

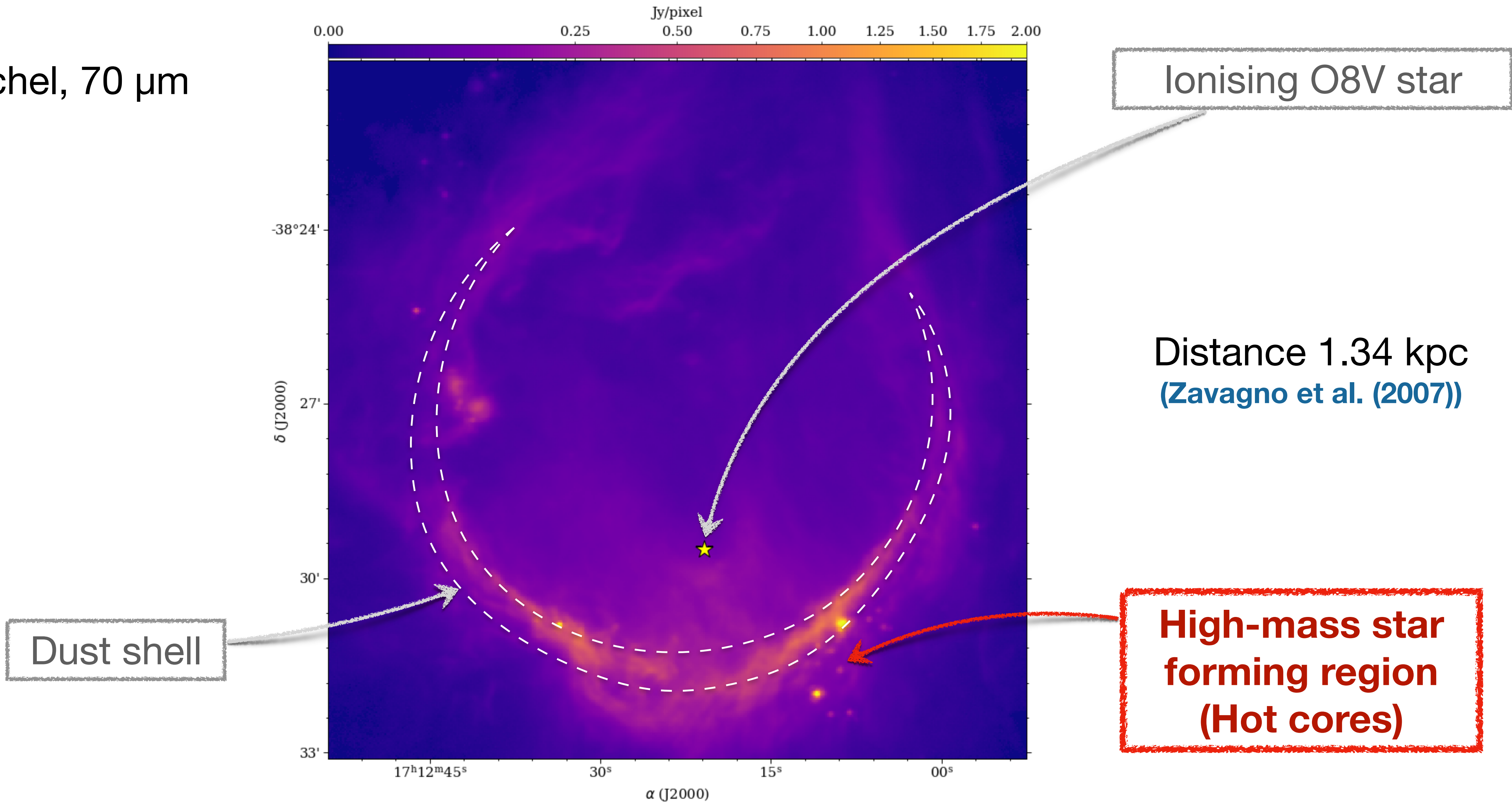


Ionising O8V star

Distance 1.34 kpc
(Zavagno et al. (2007))

Dust shell

Herschel, 70 μm

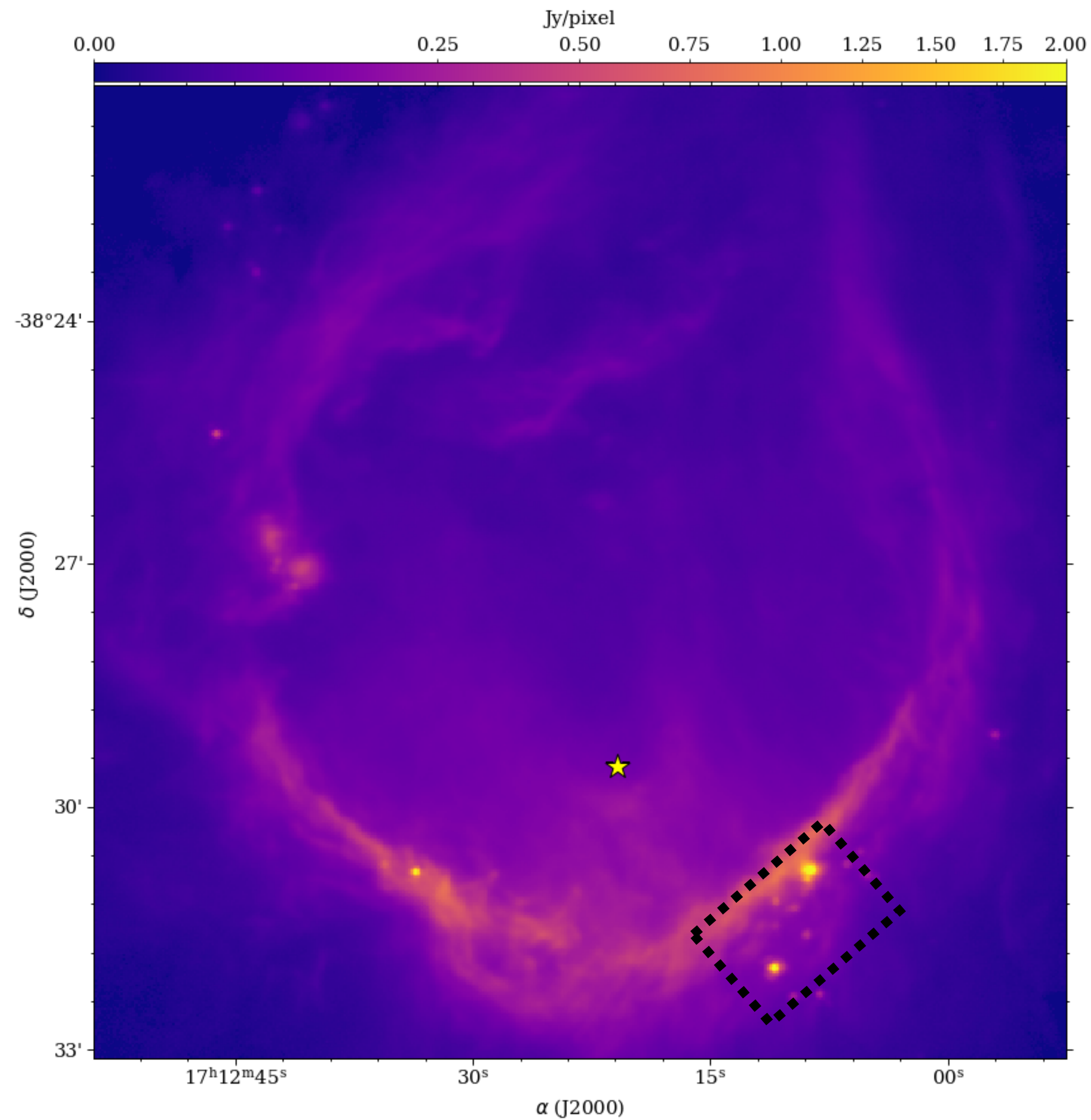


Ionising O8V star

Distance 1.34 kpc
(Zavagno et al. (2007))

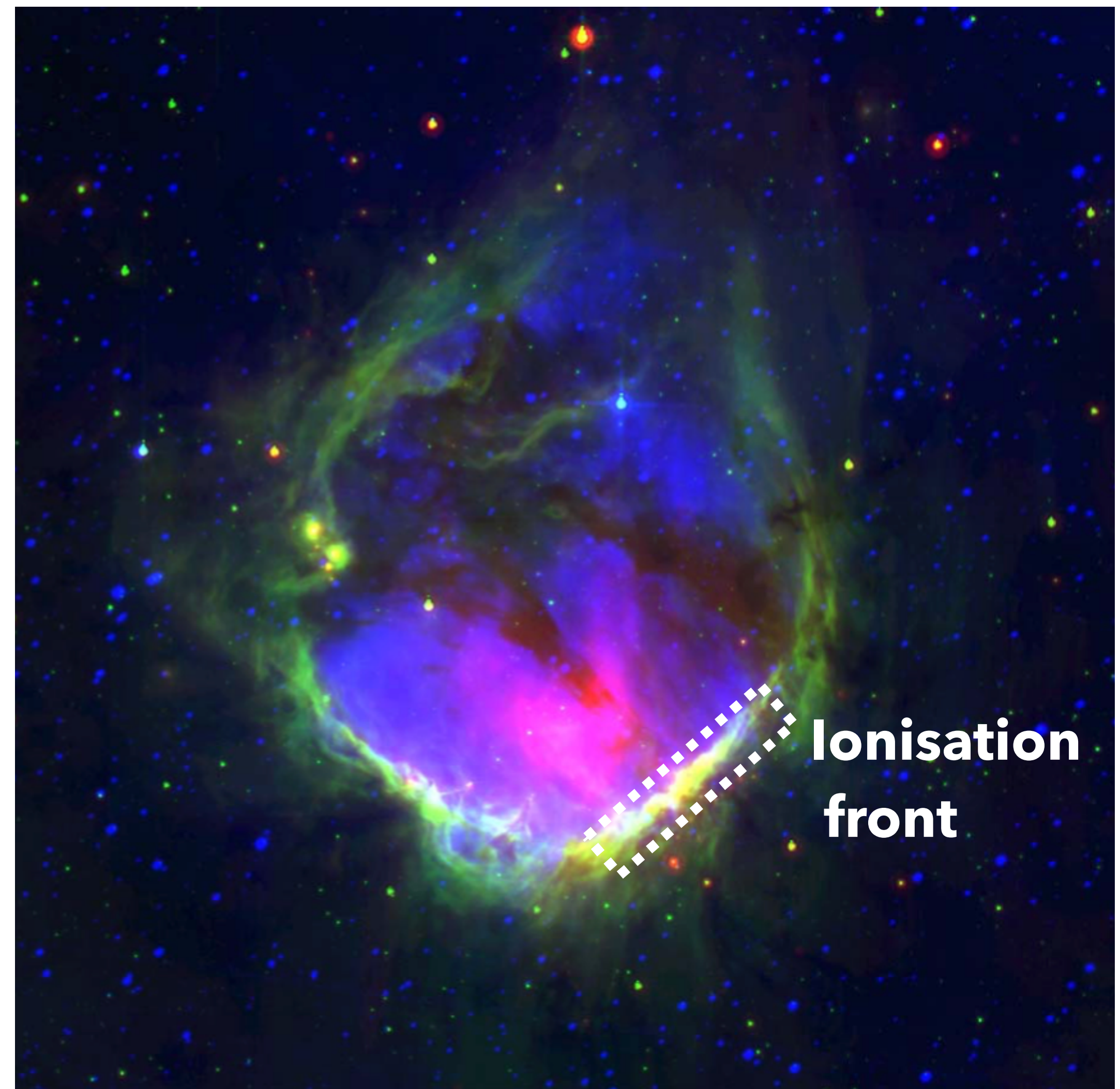
Dust shell

High-mass star forming region
(Hot cores)



Herschel, 70 μ m

L. Deharveng et al. (2009)



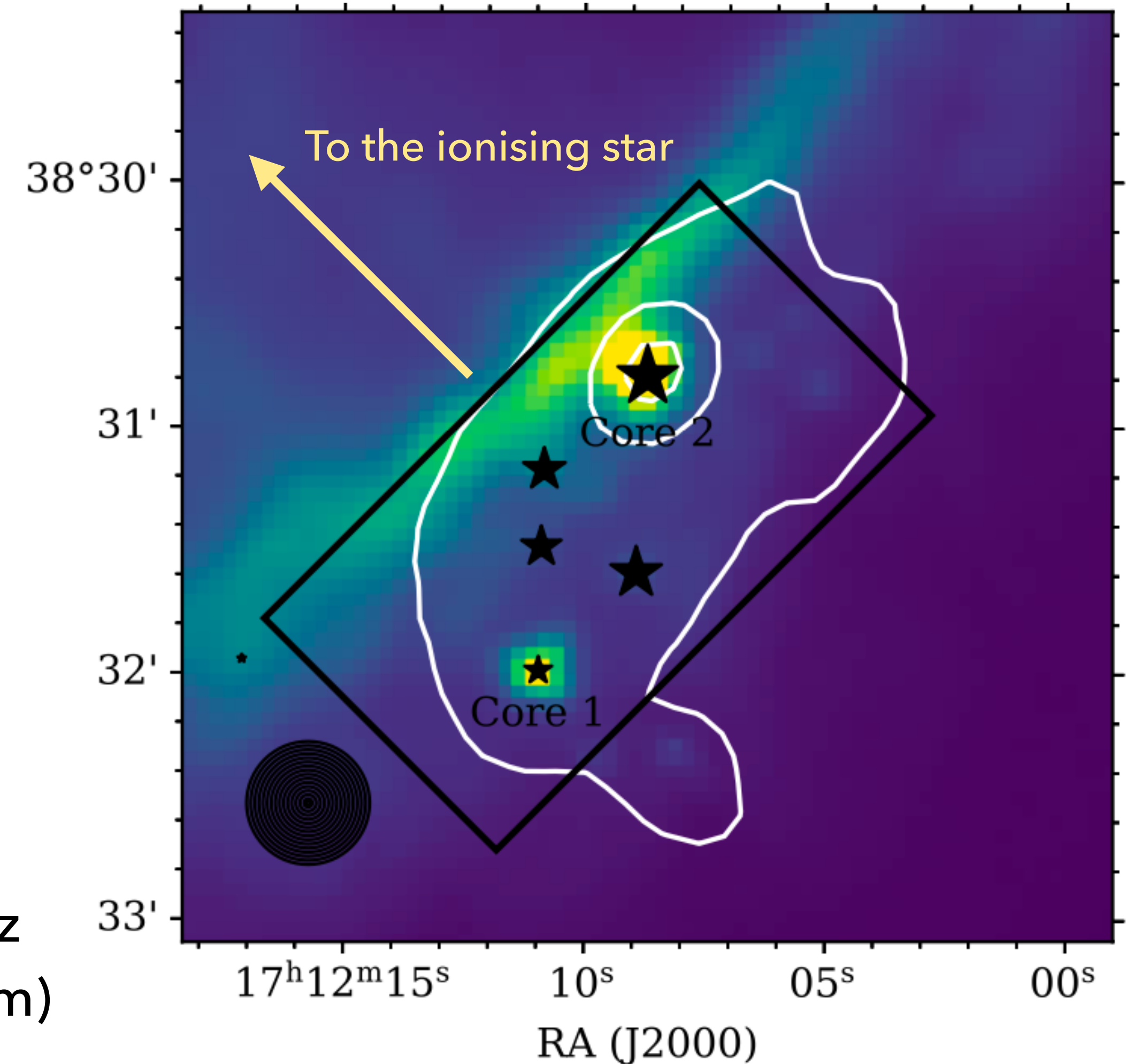
Ha emission,
PAH emission at 8.0 μ m,
24 μ m emission of dust grains

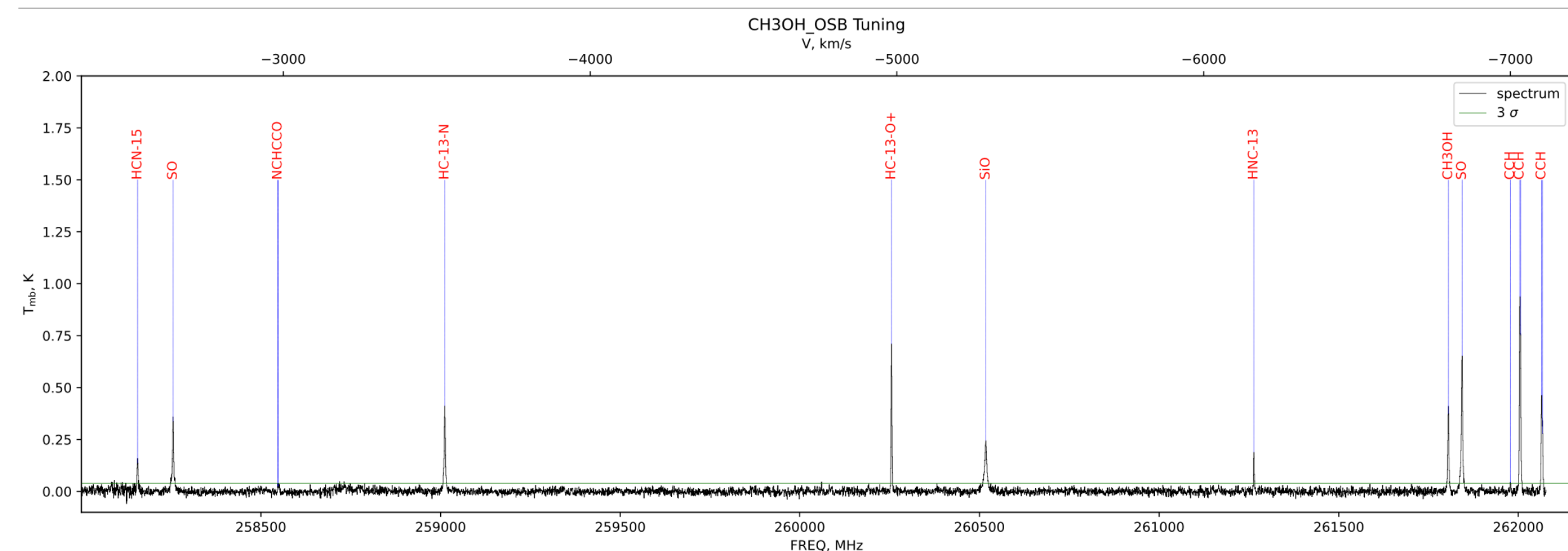
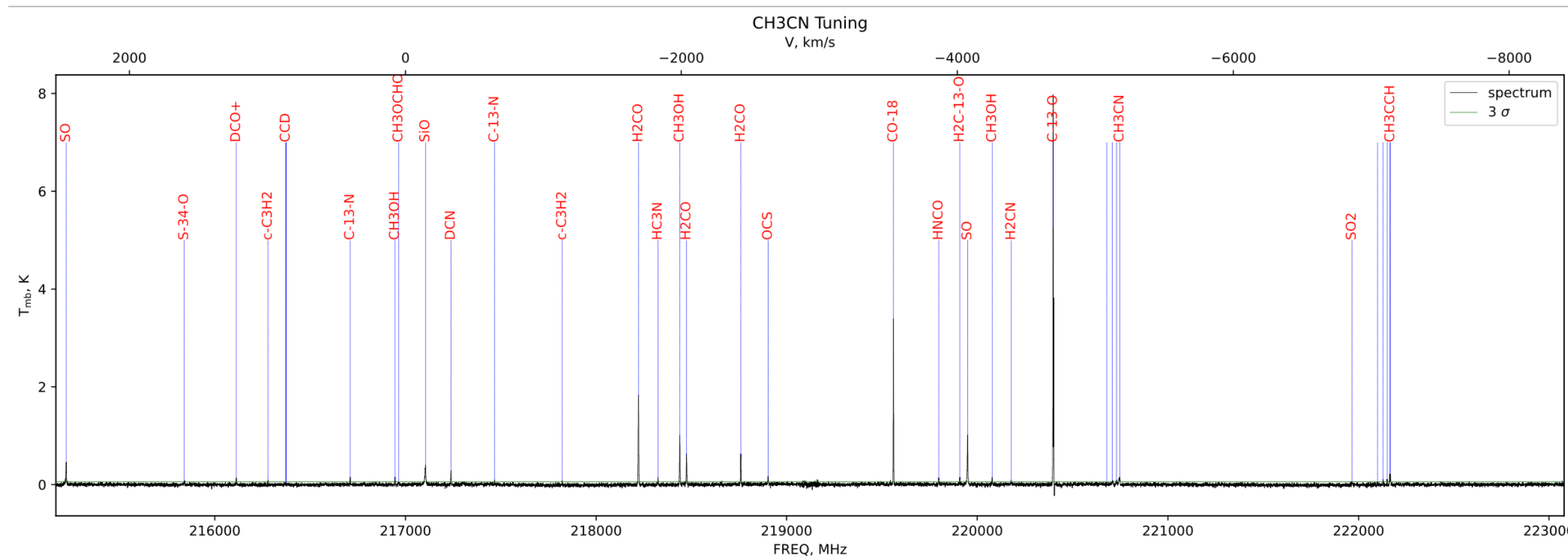
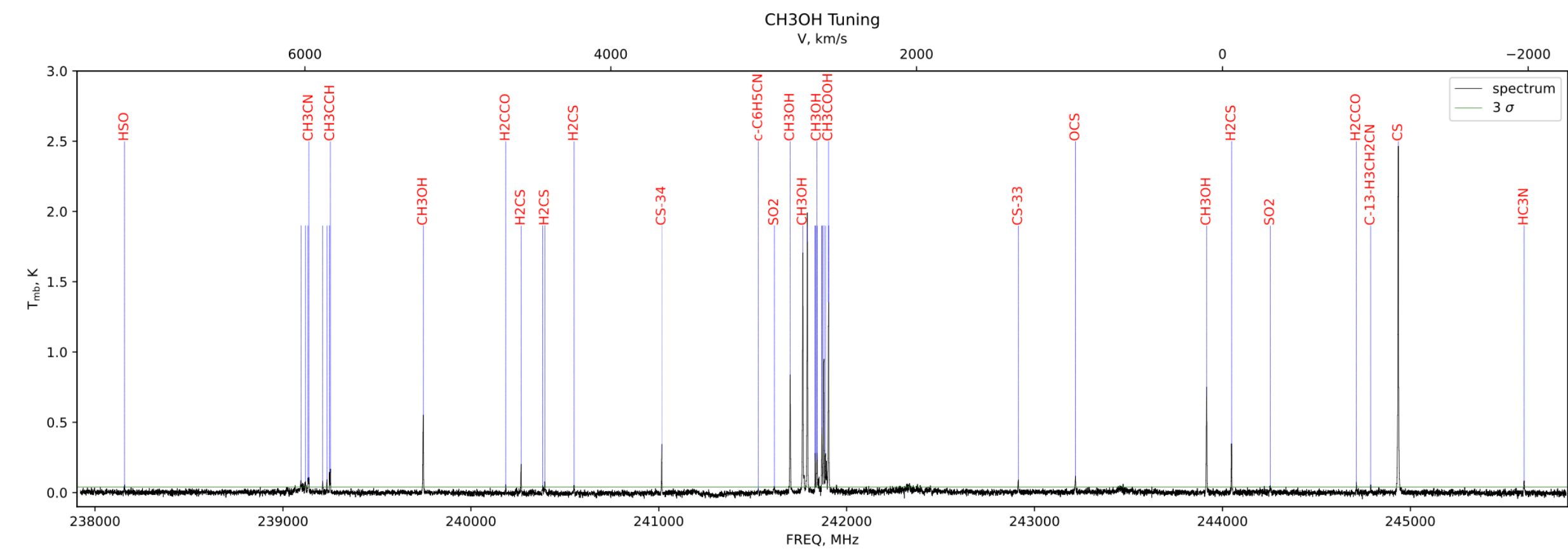
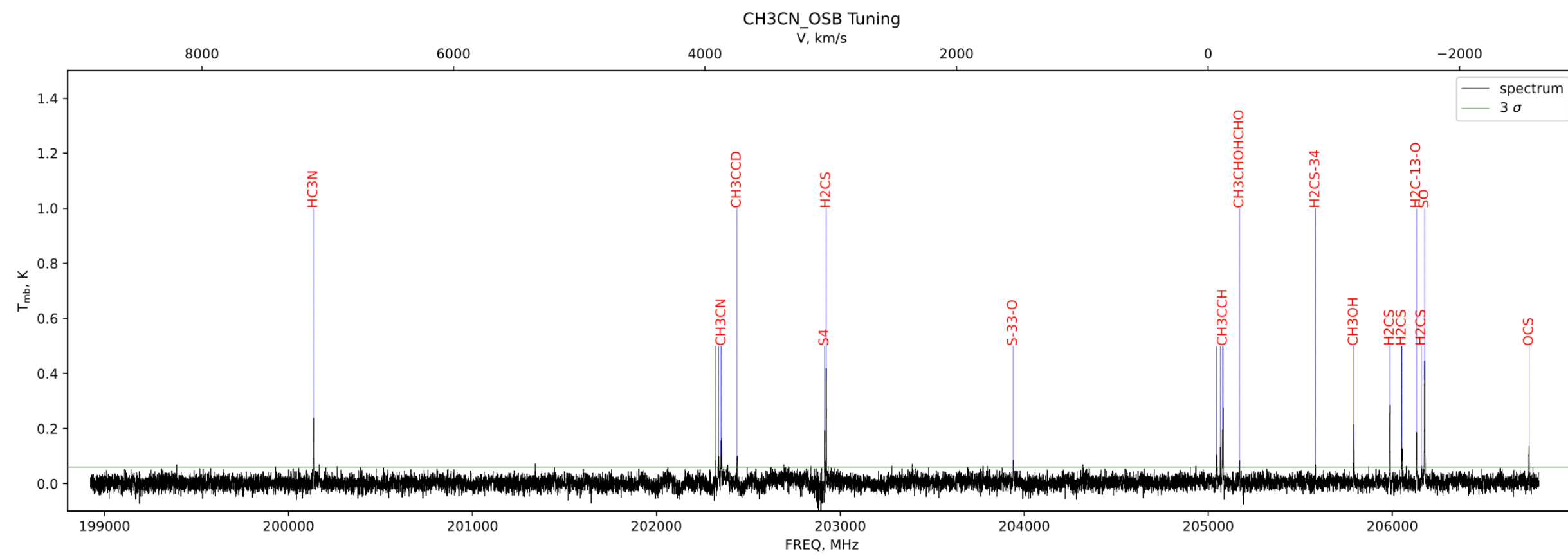
Image credit: ESO



- ▶ Aperture: 12 m
- ▶ Spectral resolution: 0.3 km/s
- ▶ Total time \approx 25 h
- ▶ Frequency range: 200–260 GHz (1.15 – 1.5mm)

South-west border of RCW 120



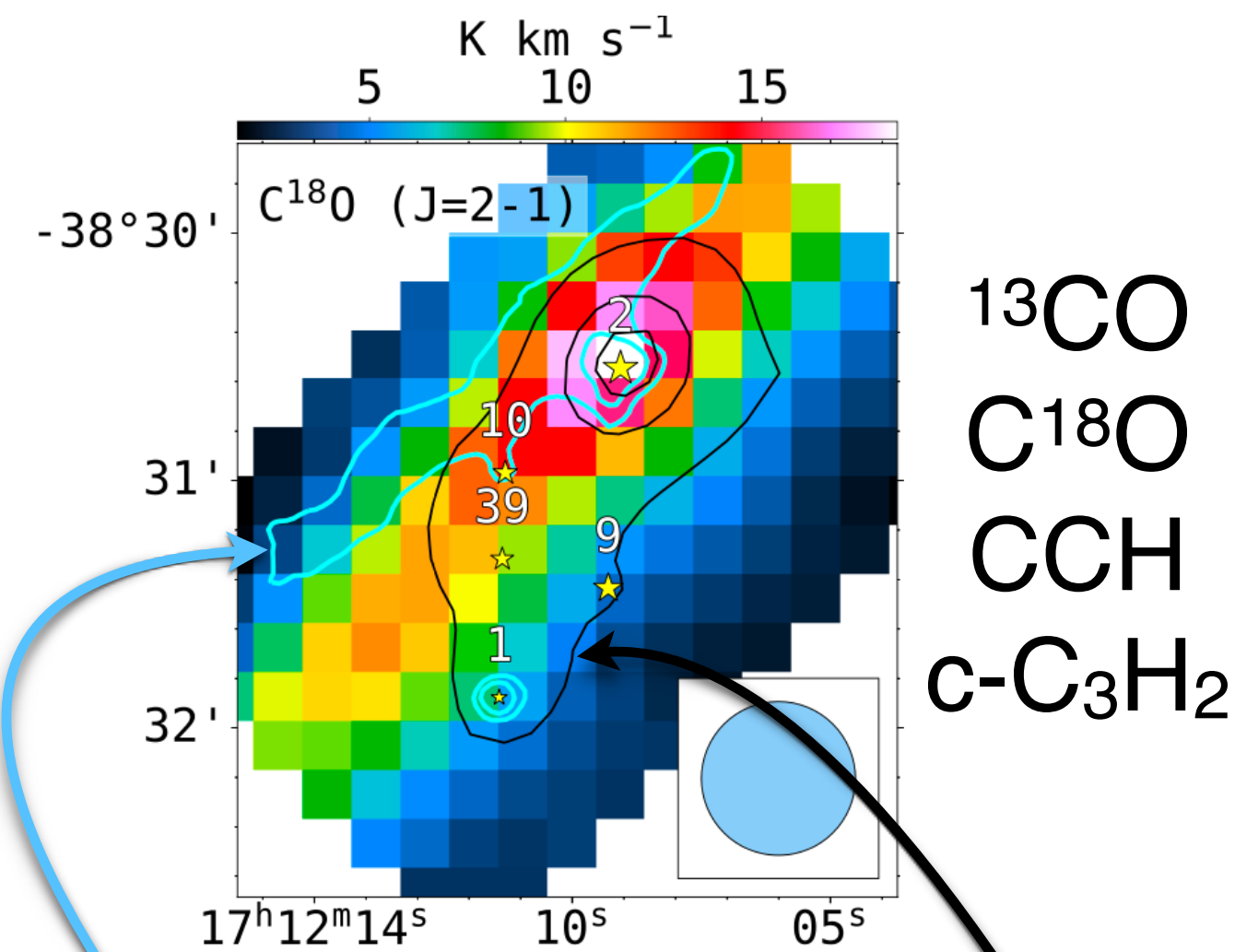


43 molecular lines were identified including isotopologues and deuterated molecules towards core 2 (the most massive core)

OBTAINED RESULTS

1 group

emission along ionisation front



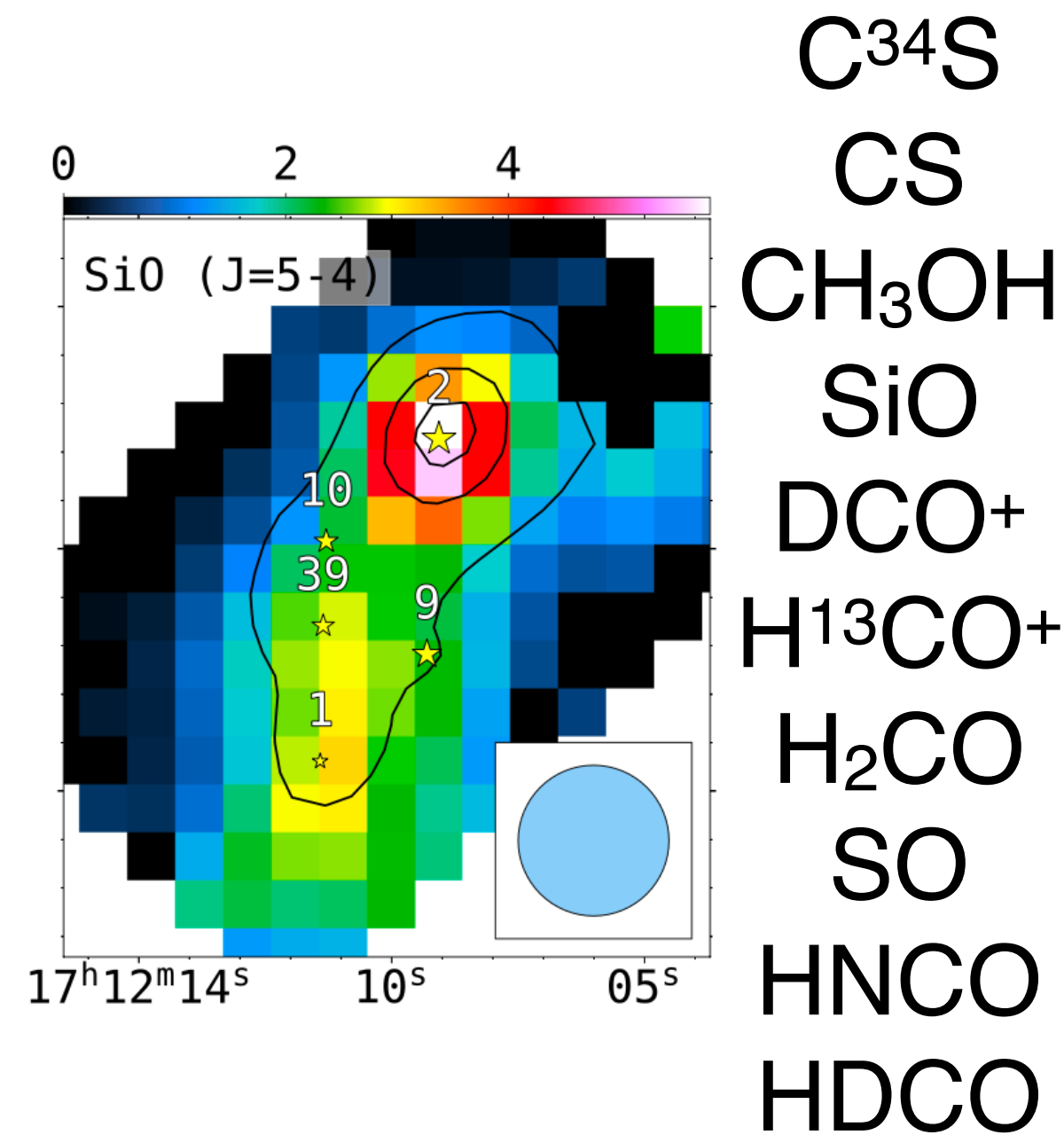
^{13}CO
 C^{18}O
 CCH
 $\text{c-C}_3\text{H}_2$

HI-GAL 70 μm
 hot dust clumps

ATLASGAL 870 μm
 cold dust clumps

2 group

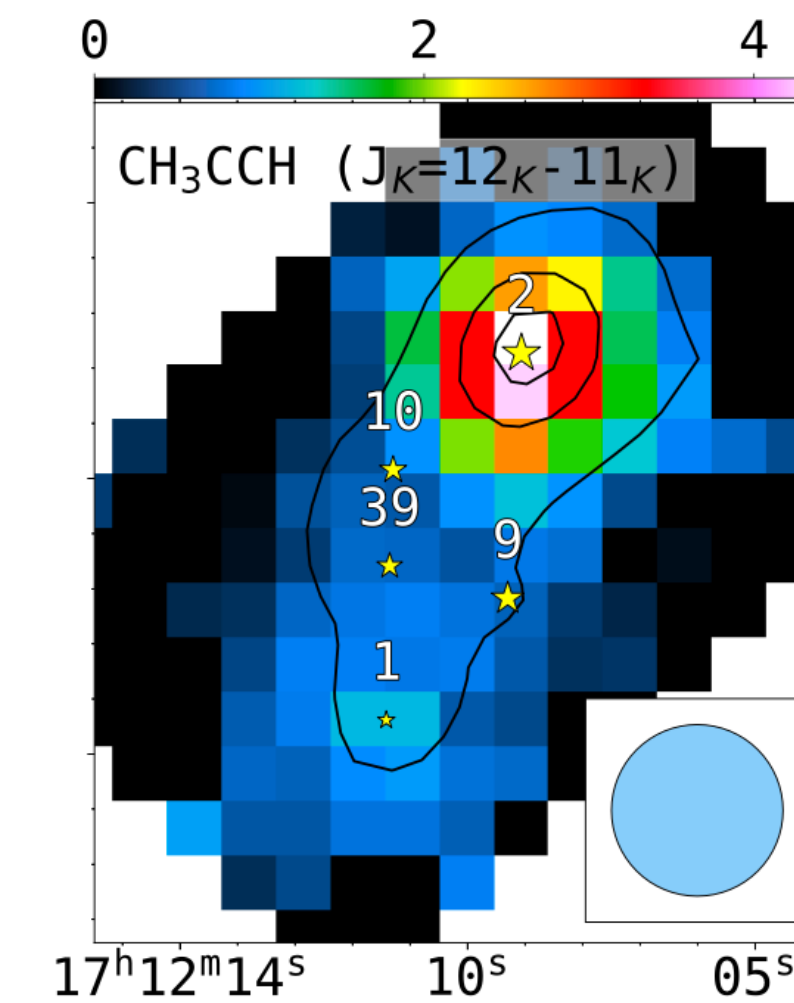
elongated emission
 within cold dust clumps



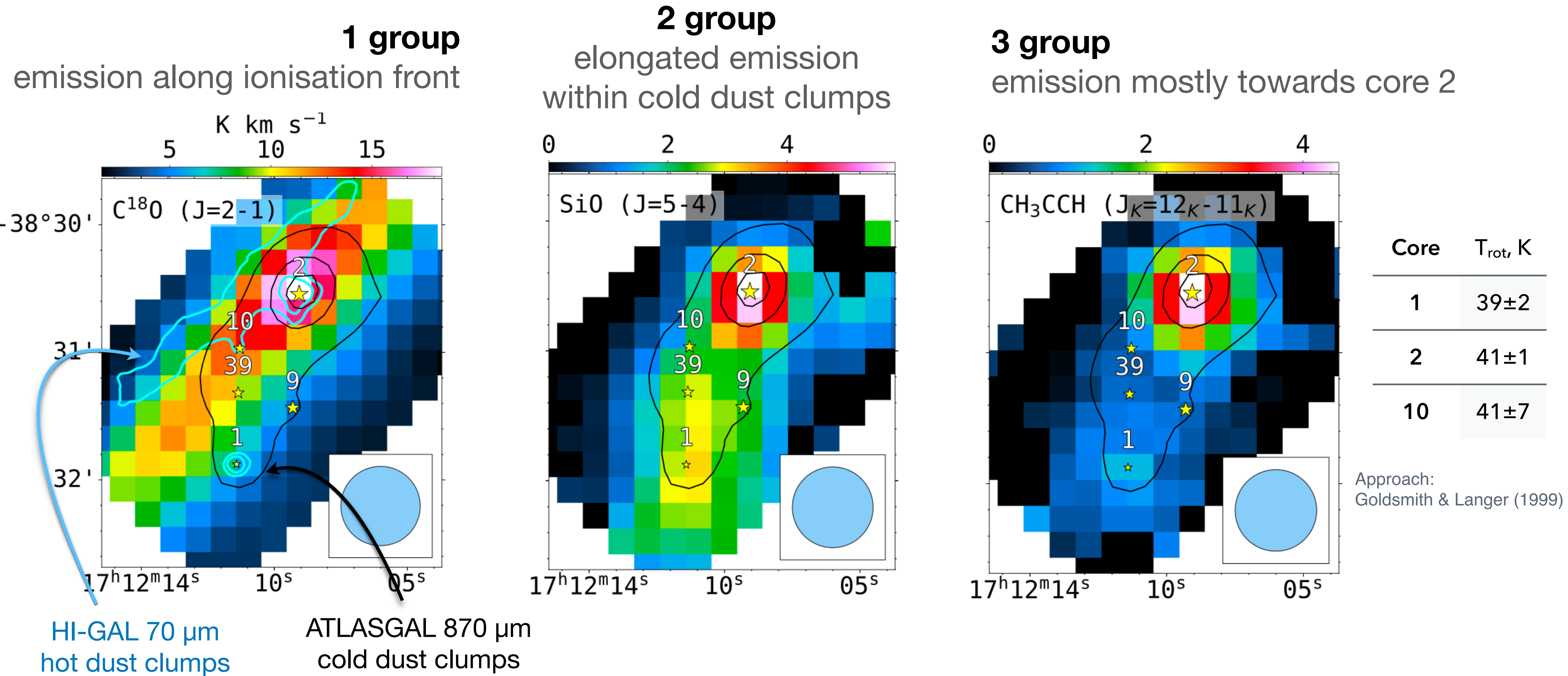
C^{34}S
 CS
 CH_3OH
 SiO
 DCO^+
 H^{13}CO^+
 H_2CO
 SO
 HNCO
 HDCO

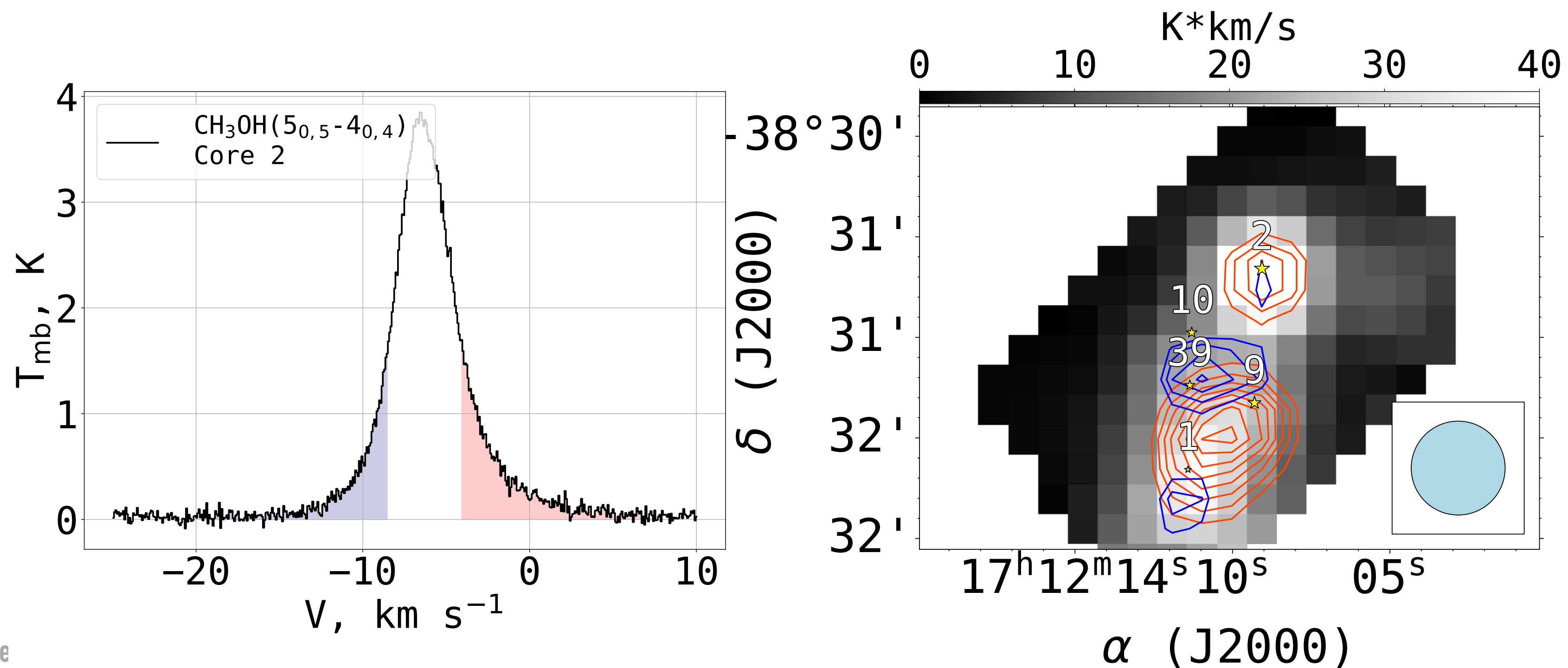
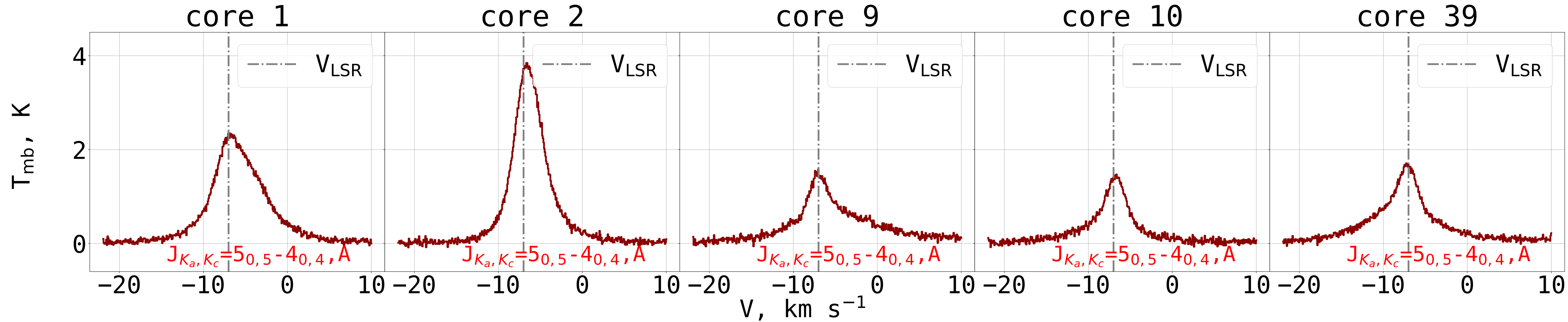
3 group

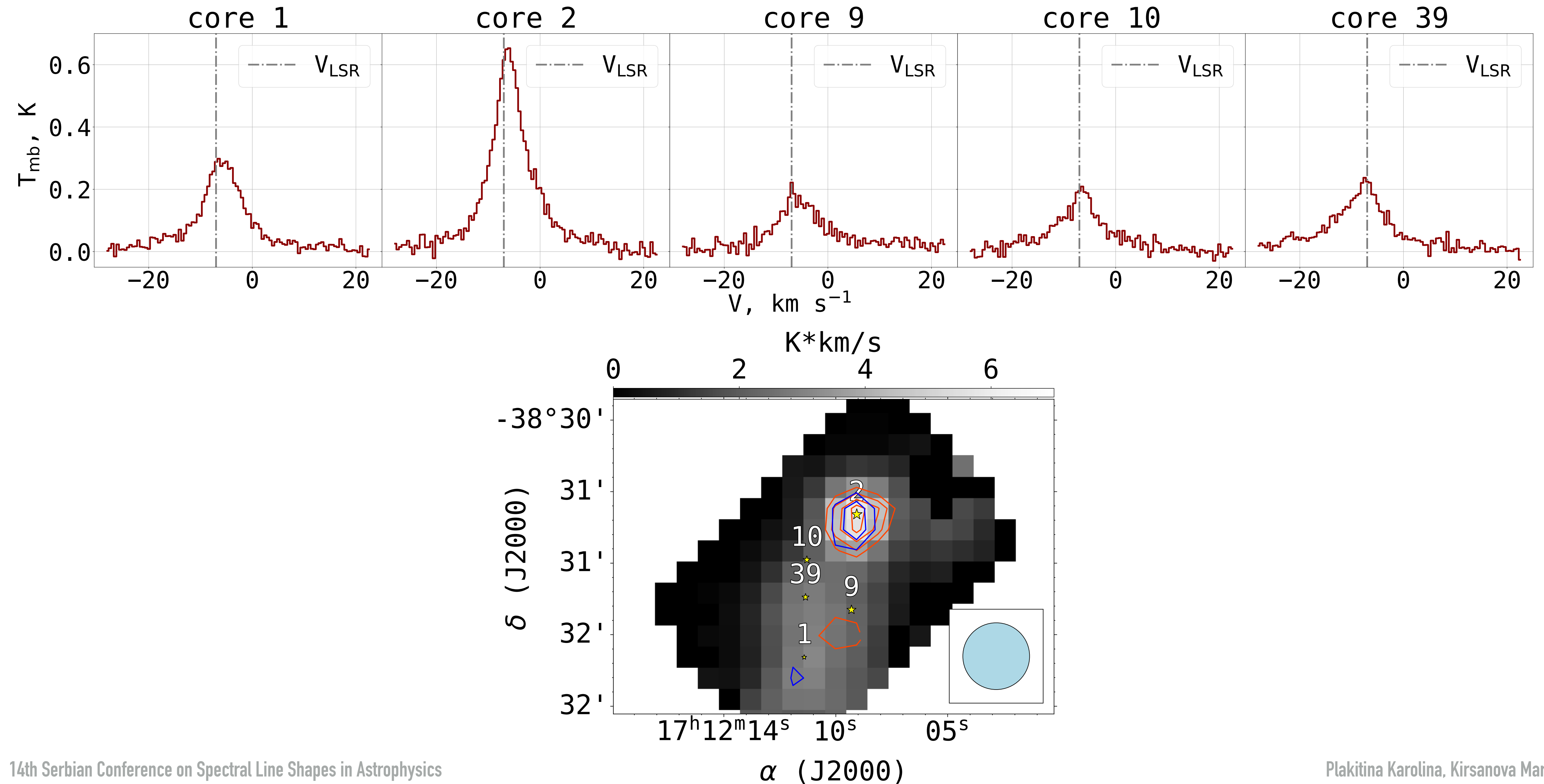
emission mostly towards core 2

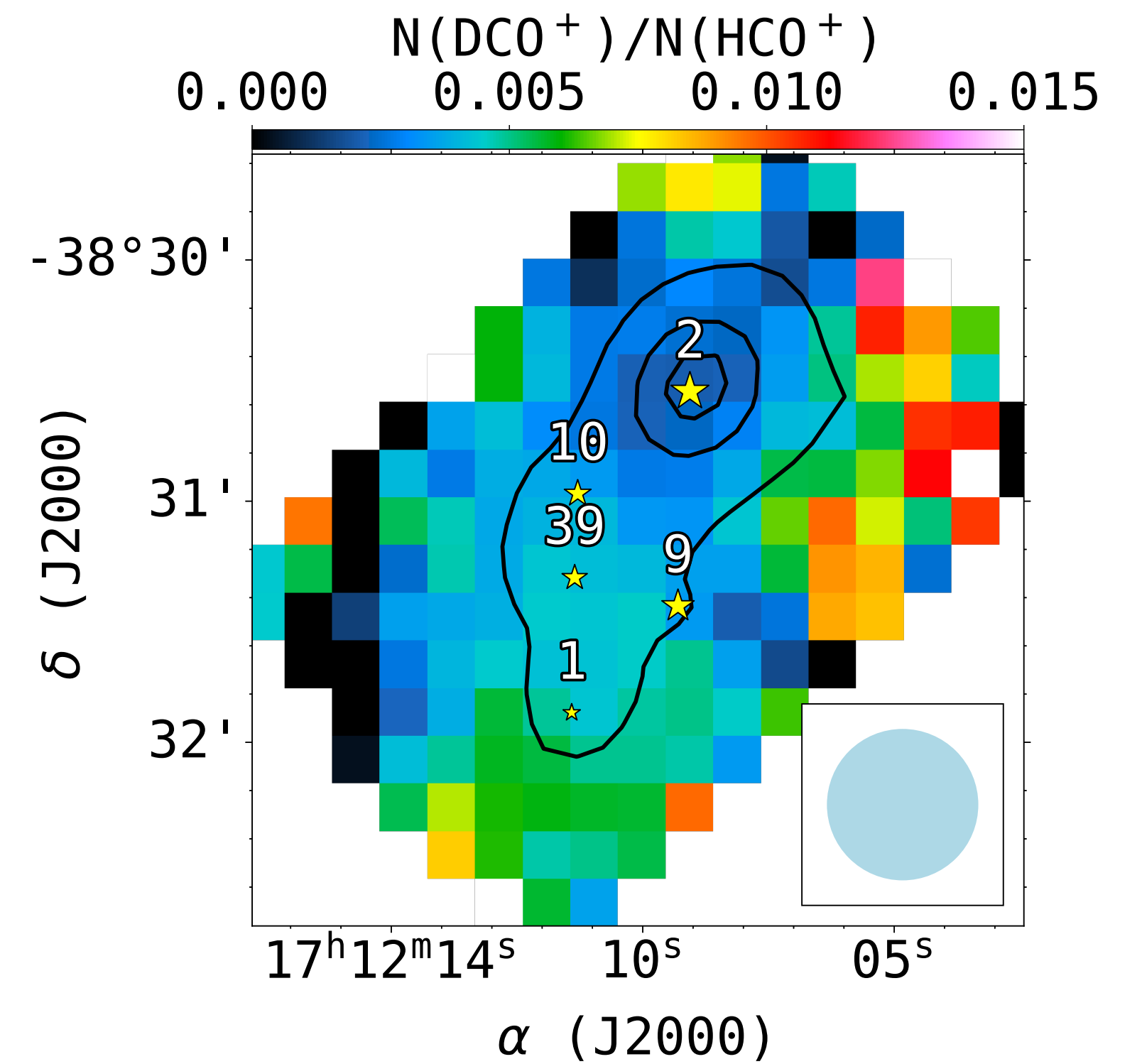
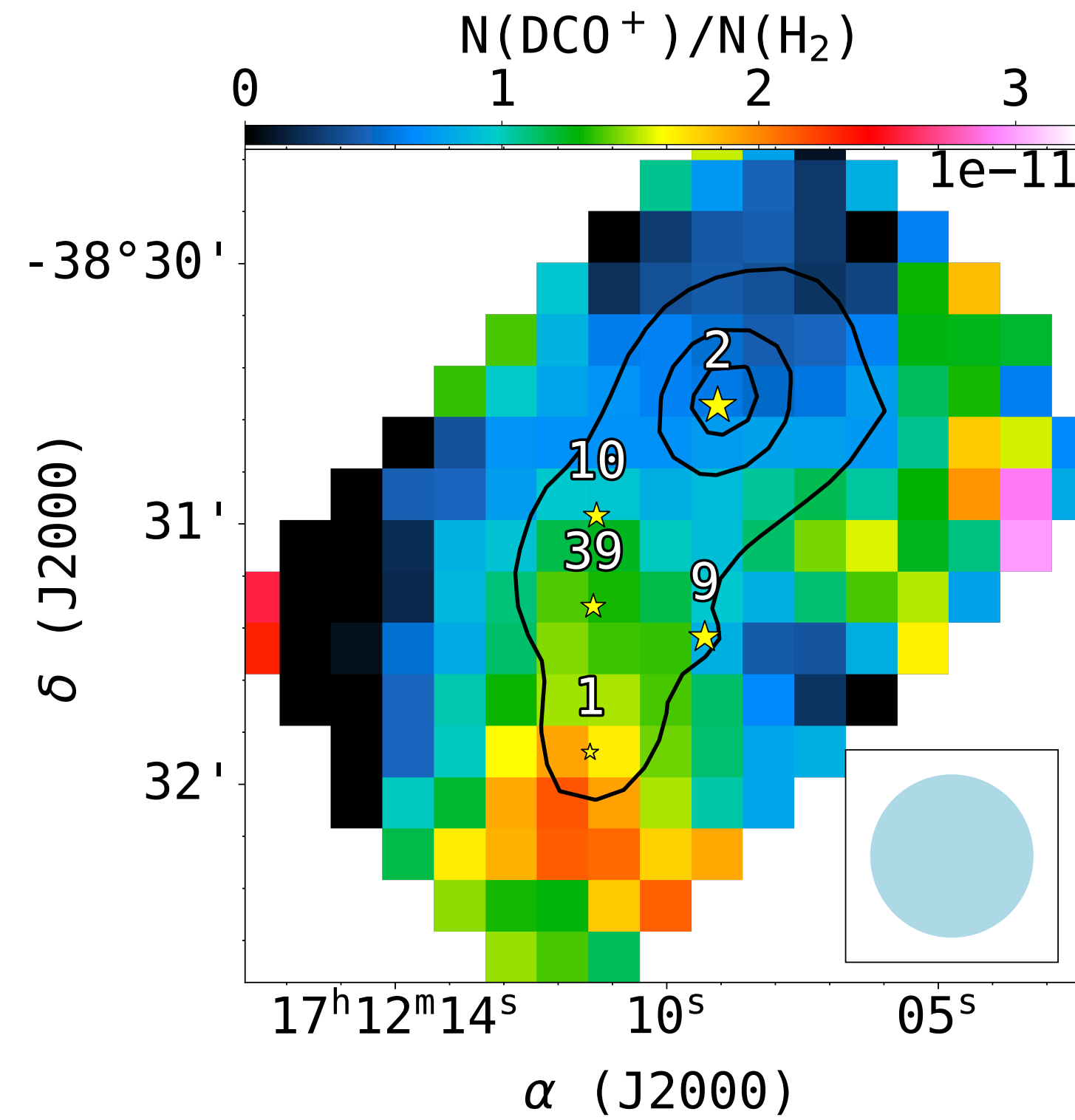
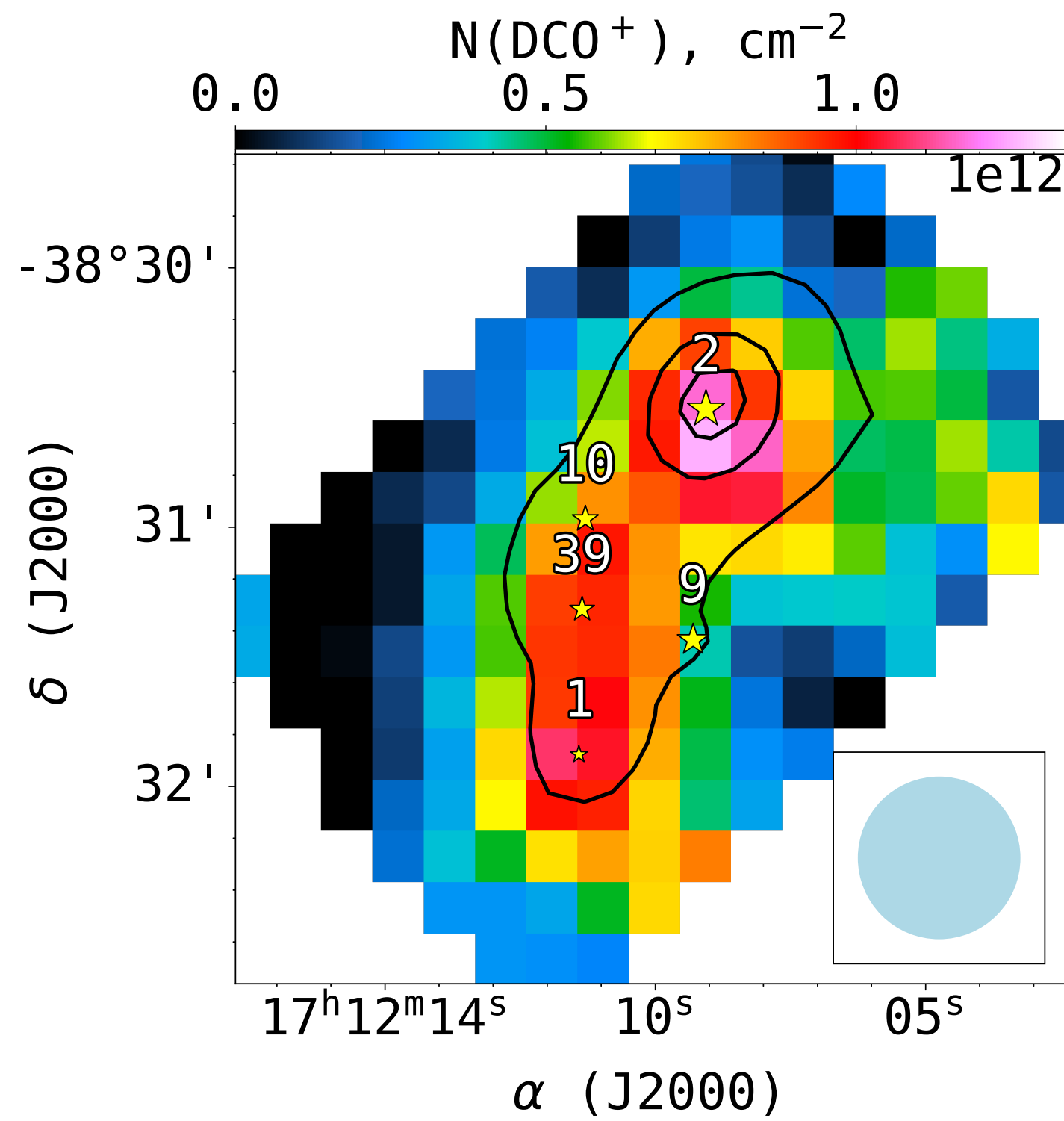


DCN
 CH_3CCH
 CH_3CN
 H_2S
 H_2CS









$$(\text{D}/\text{H})_{\text{ISM}} \geq (2.0 \pm 0.1) \times 10^{-5}$$

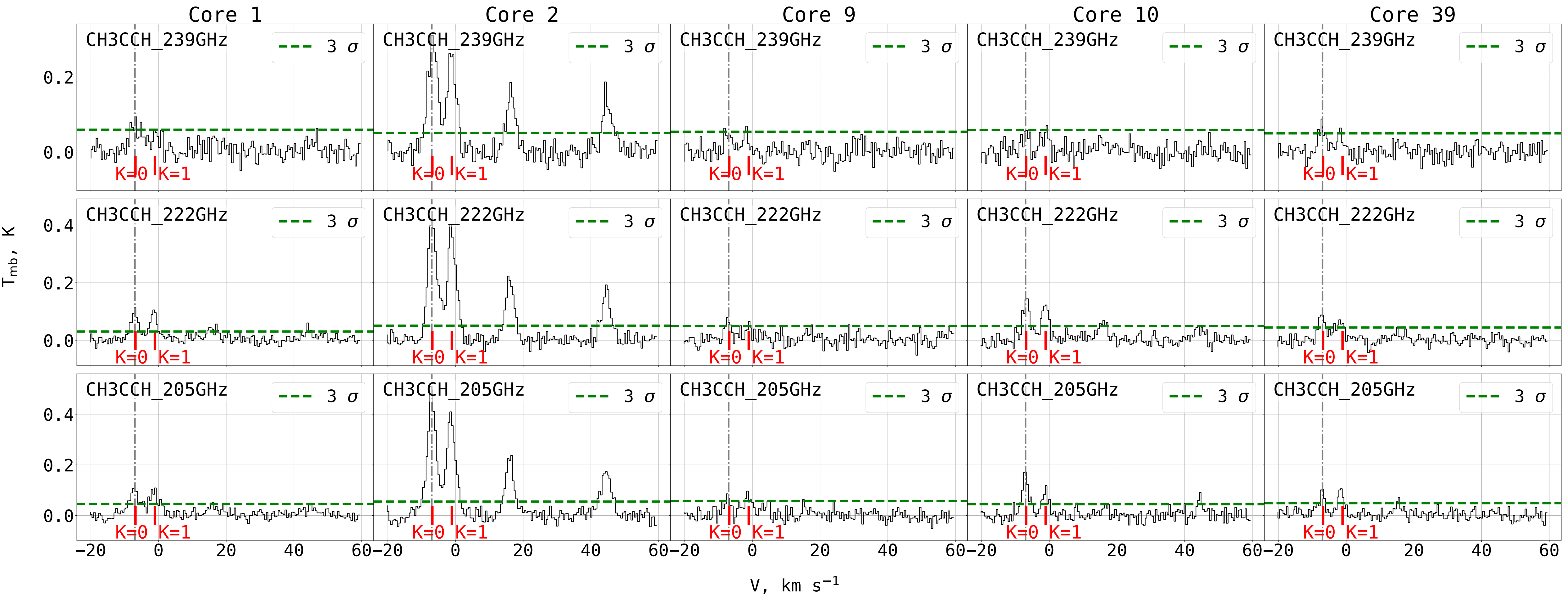
Prodanović+ (2010)

- ▶ 43 molecular lines were detected including isotopologues and deuterated molecules towards the core 2 (the most massive core)
- ▶ Using rotational diagram technique we obtained the following parameters:

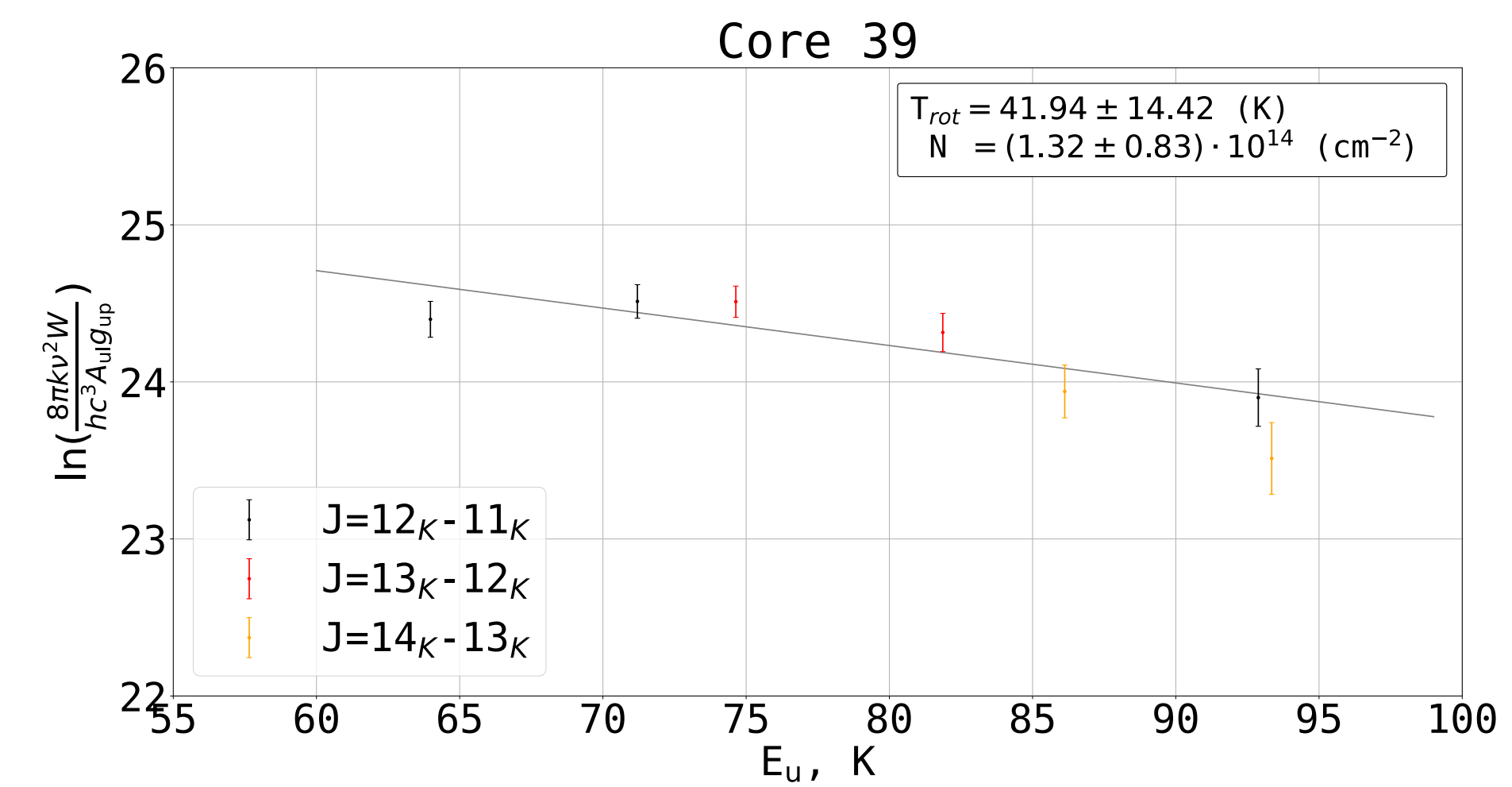
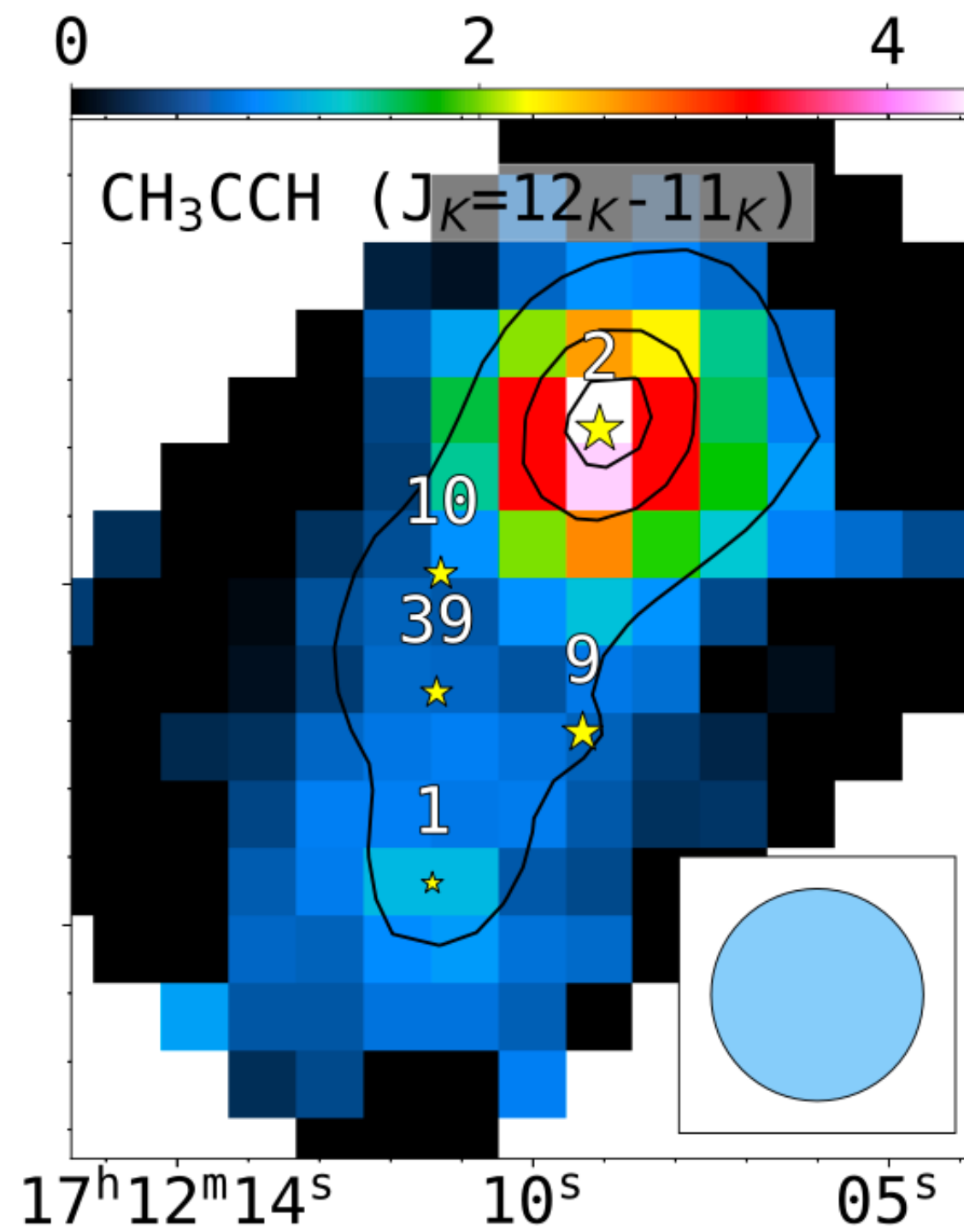
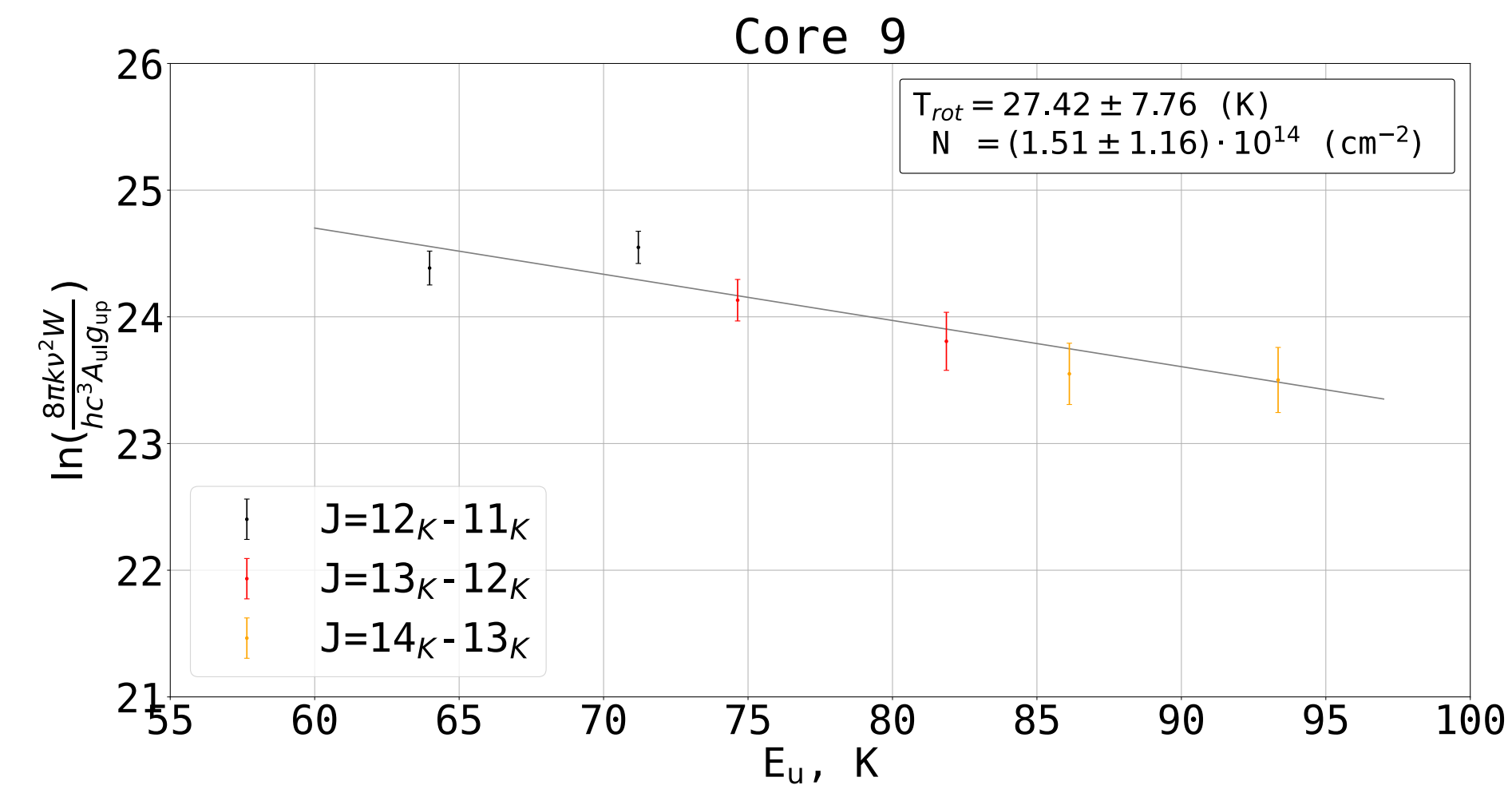
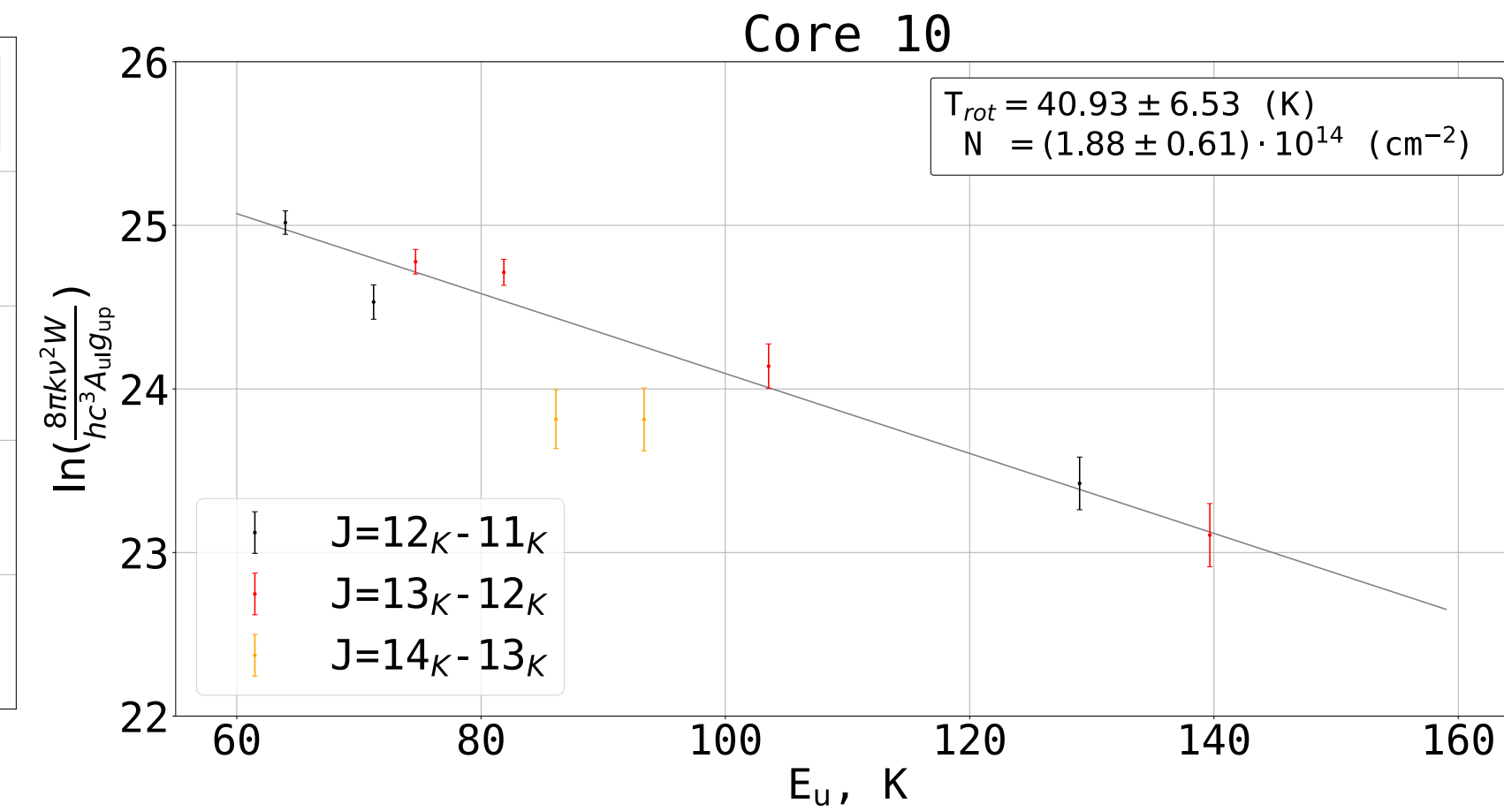
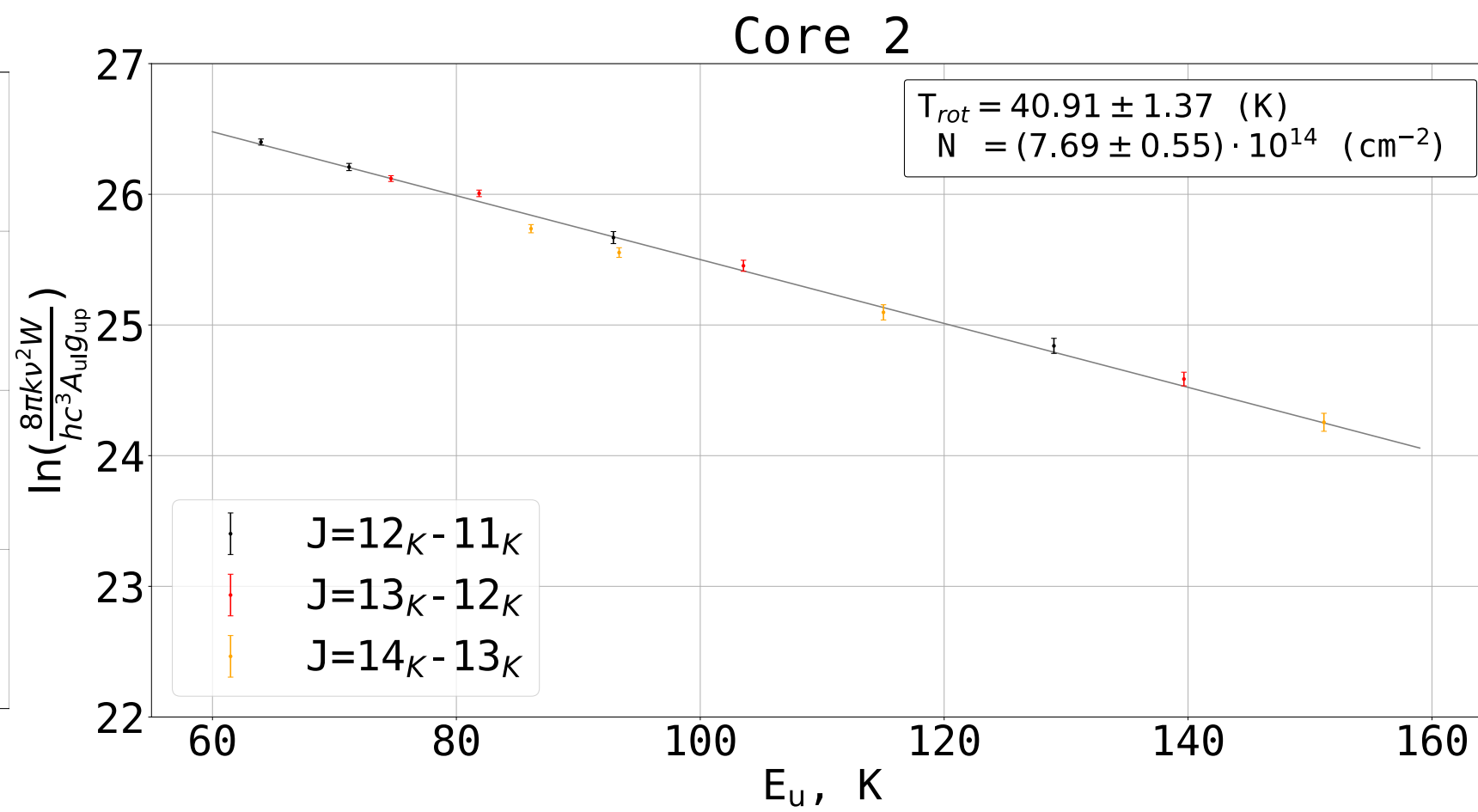
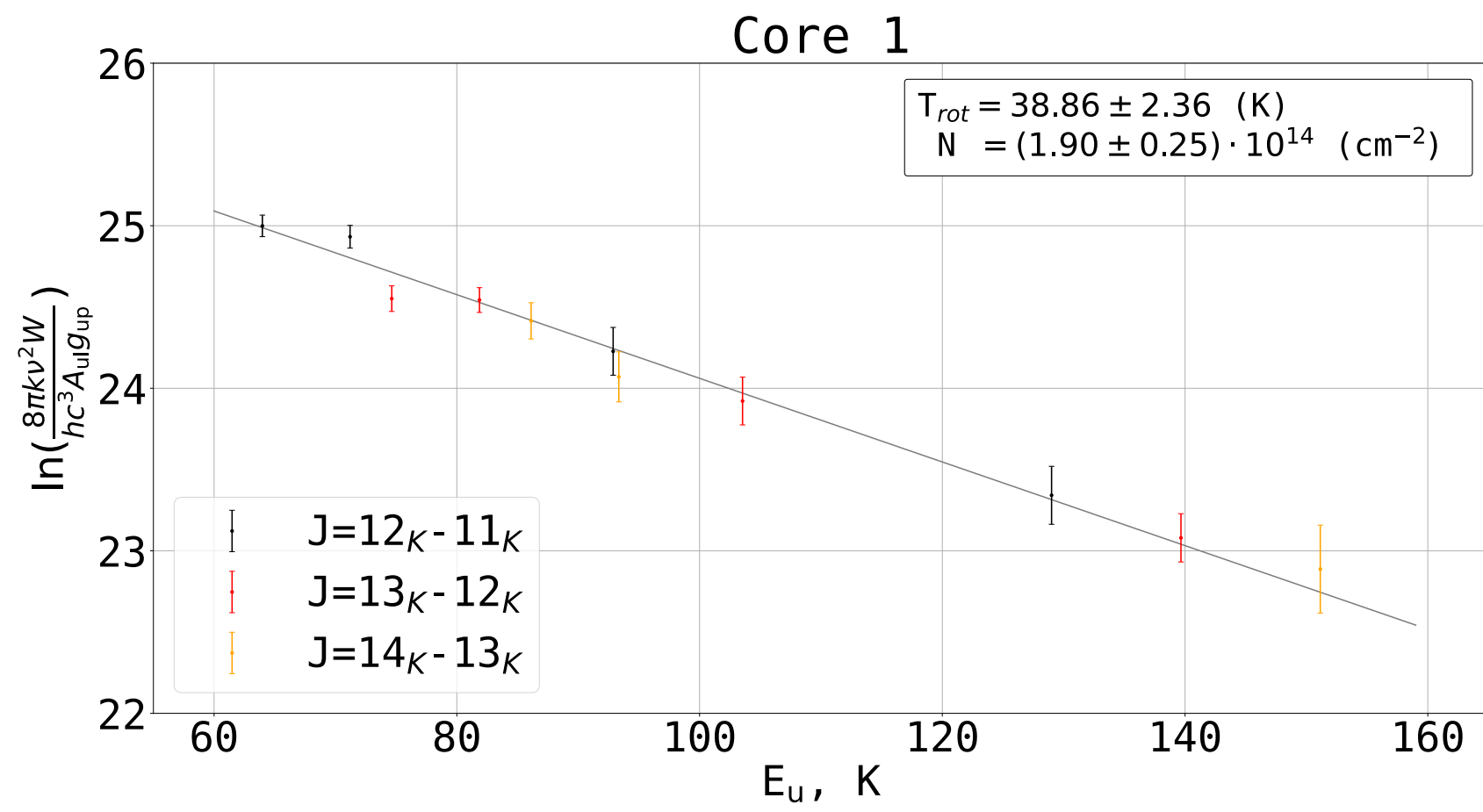
Core	T_{rot} , K	N , cm ⁻²
1	39±2	1.9±0.3
2	41±1	7.7±0.6
10	41±7	1.9±0.6

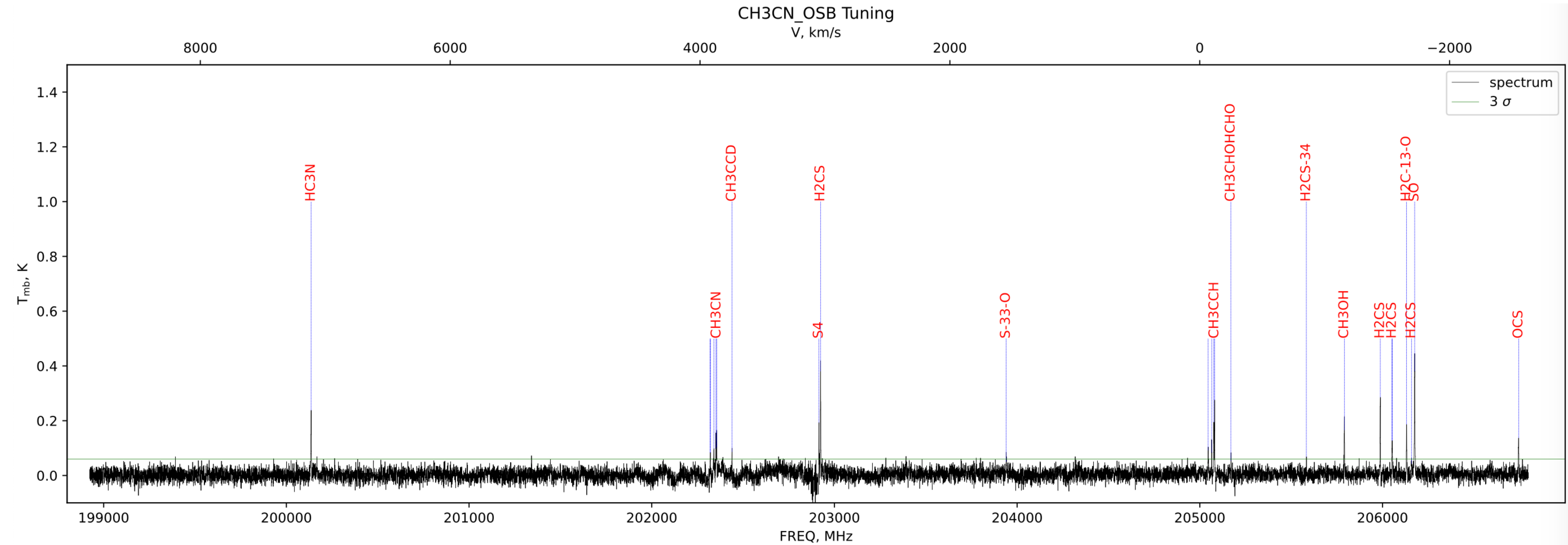
- ▶ Based on our analysis of the spectra of CH₃OH and SiO, we carefully suggest a presence of outflows in the vicinity of core 1 and core 2

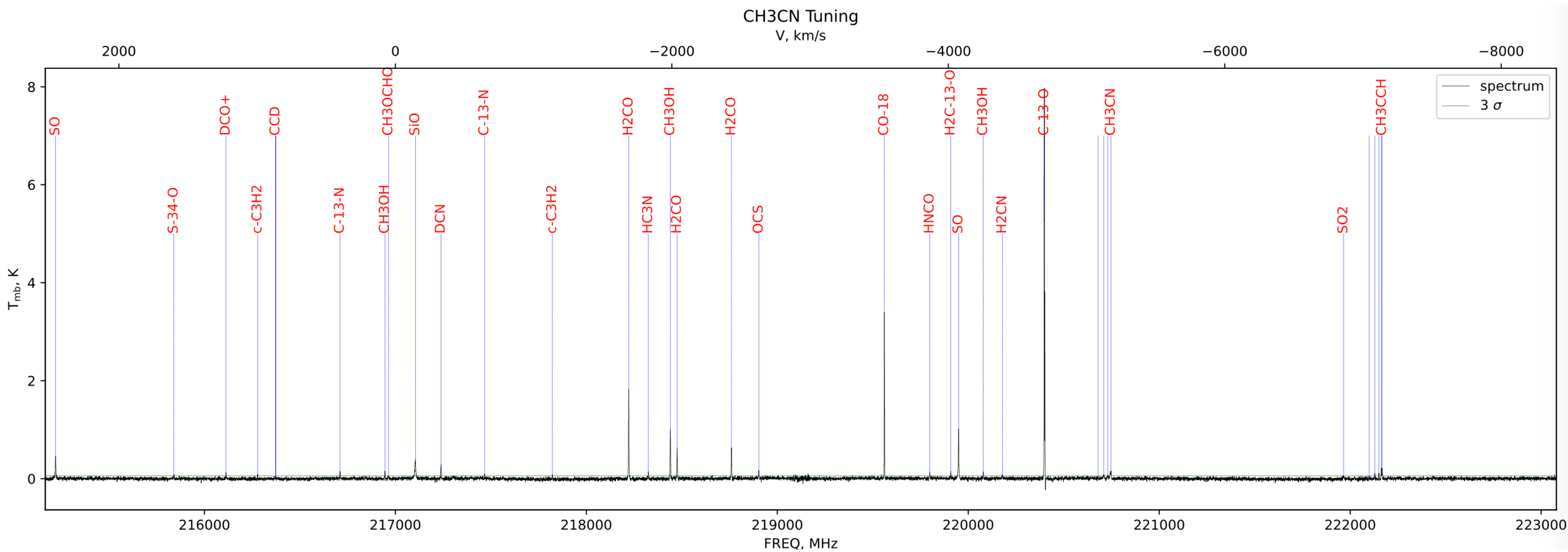
Thank you for your attention!



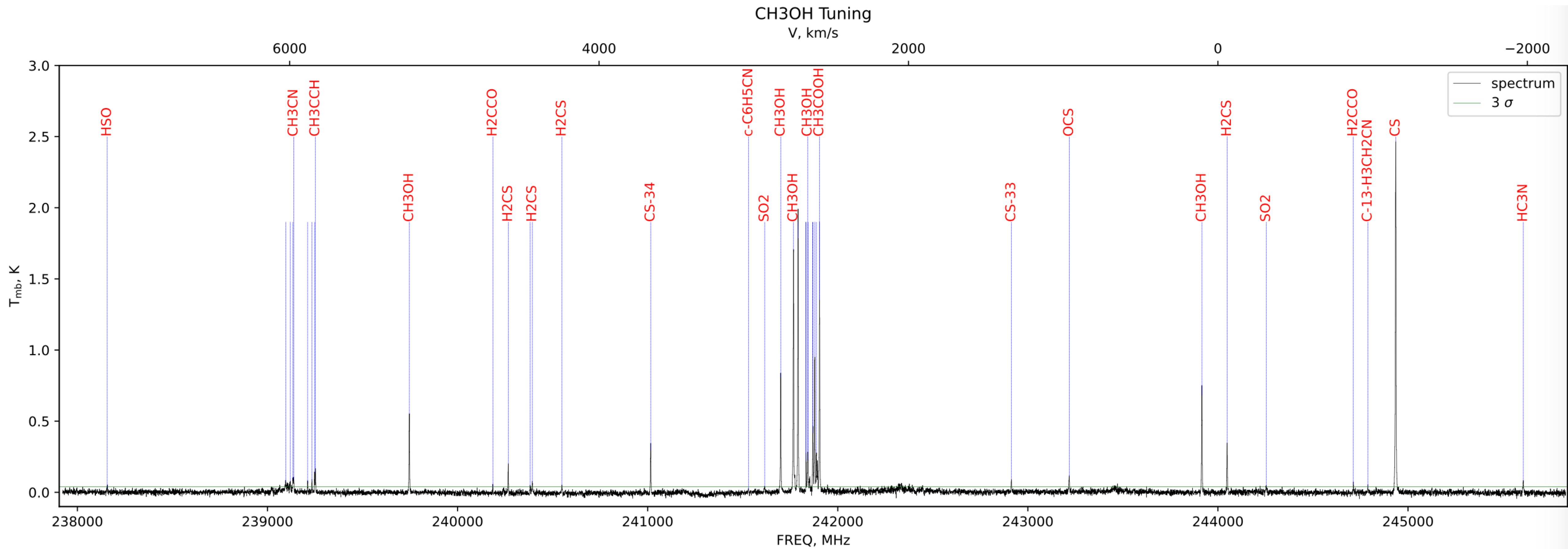
CH₃CCH ROTATIONAL DIAGRAMS



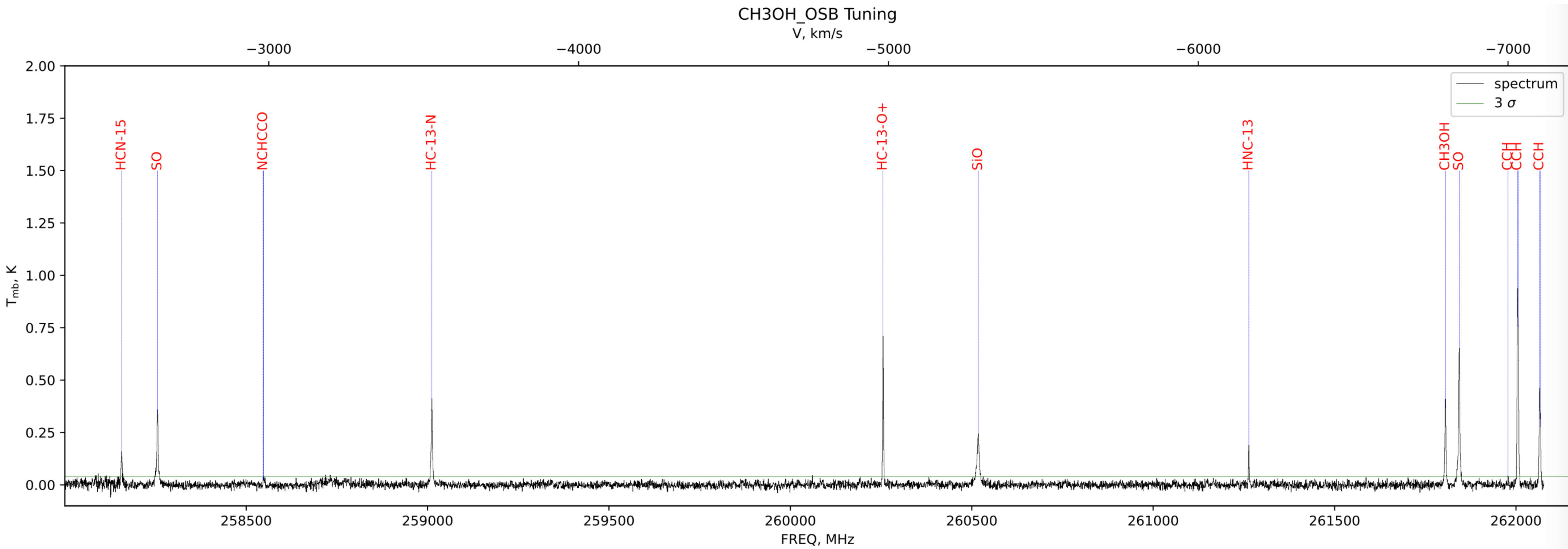


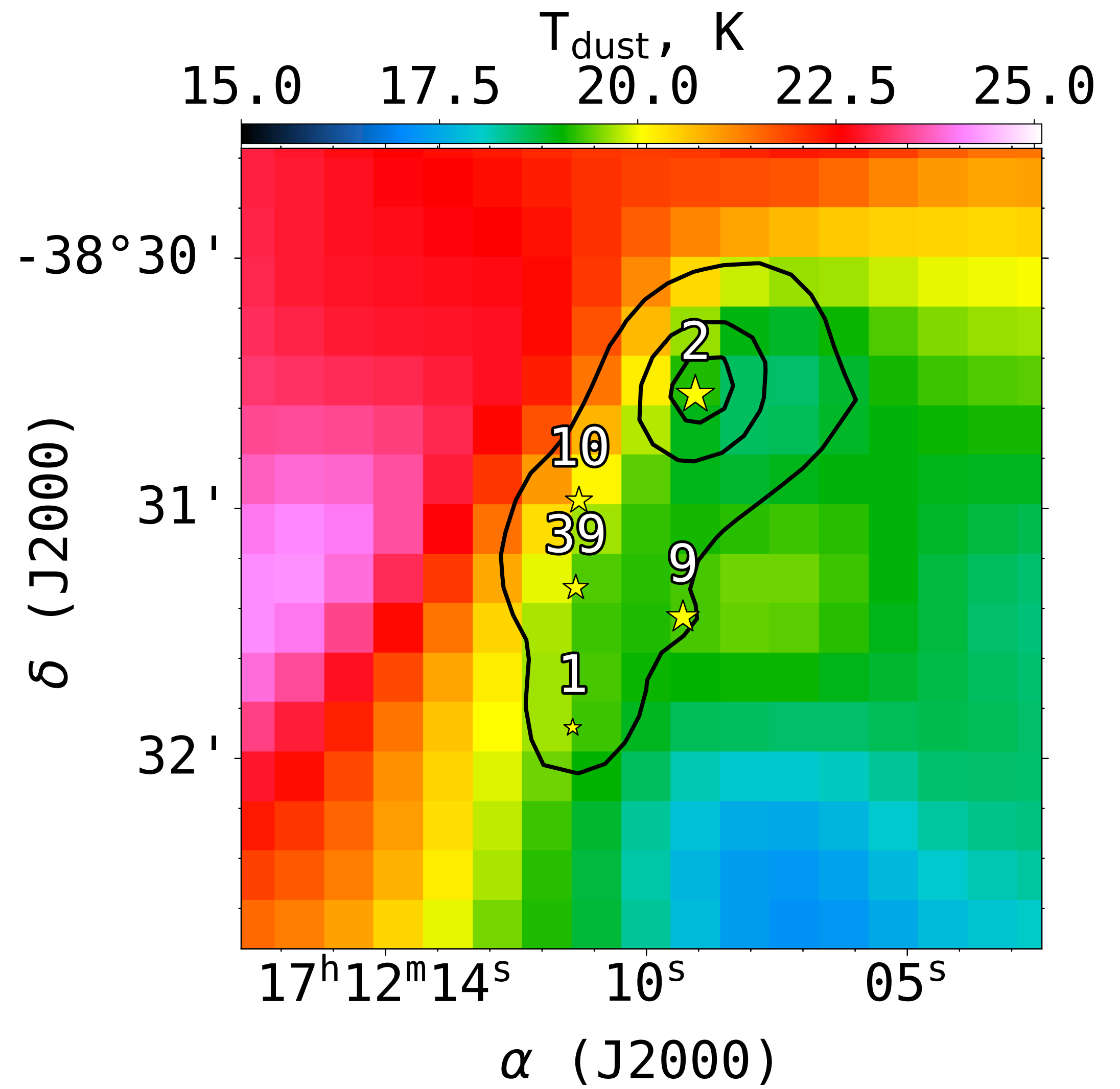
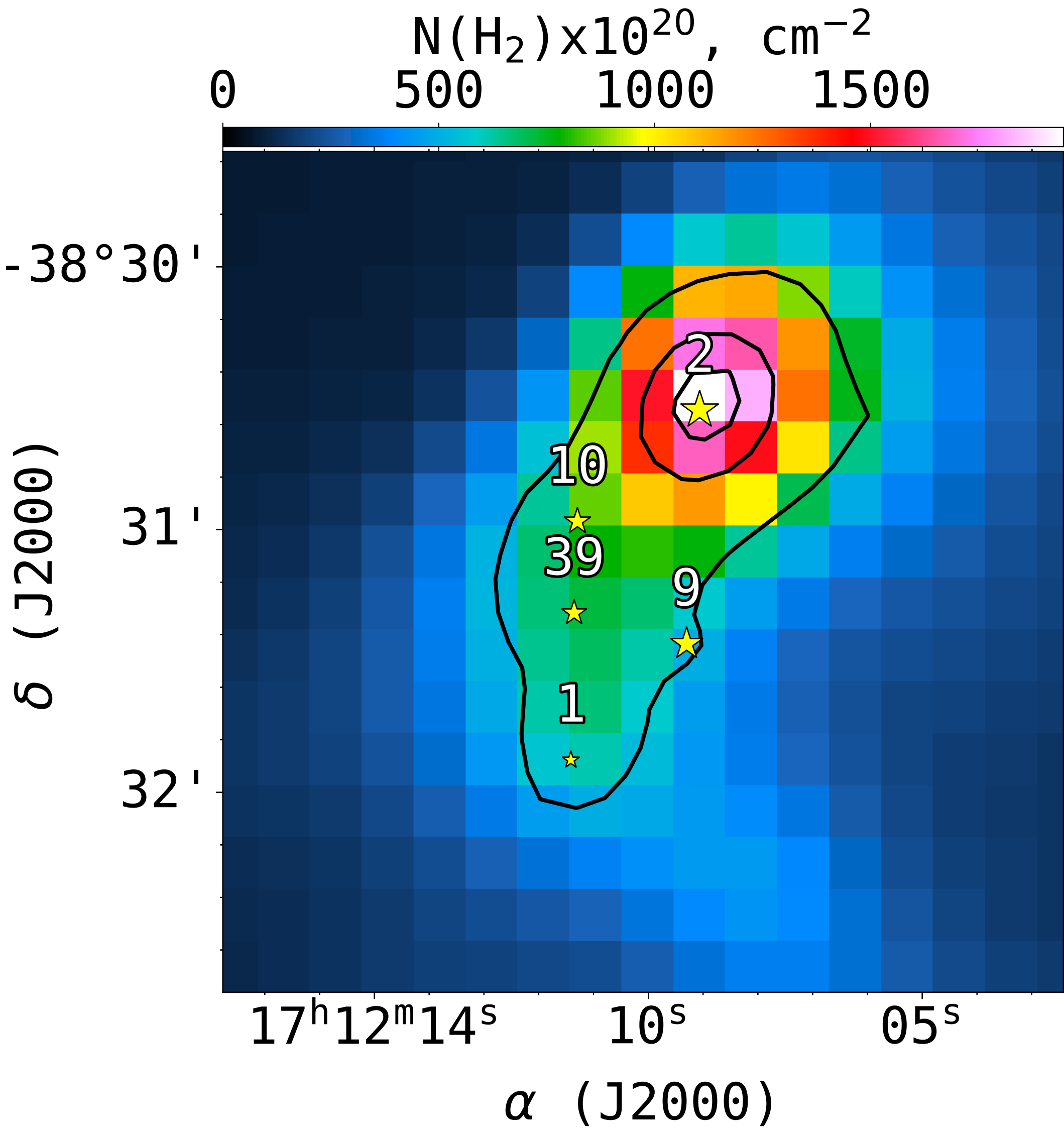


MOLECULAR LINE EMISSION (TOWARDS CORE 2)

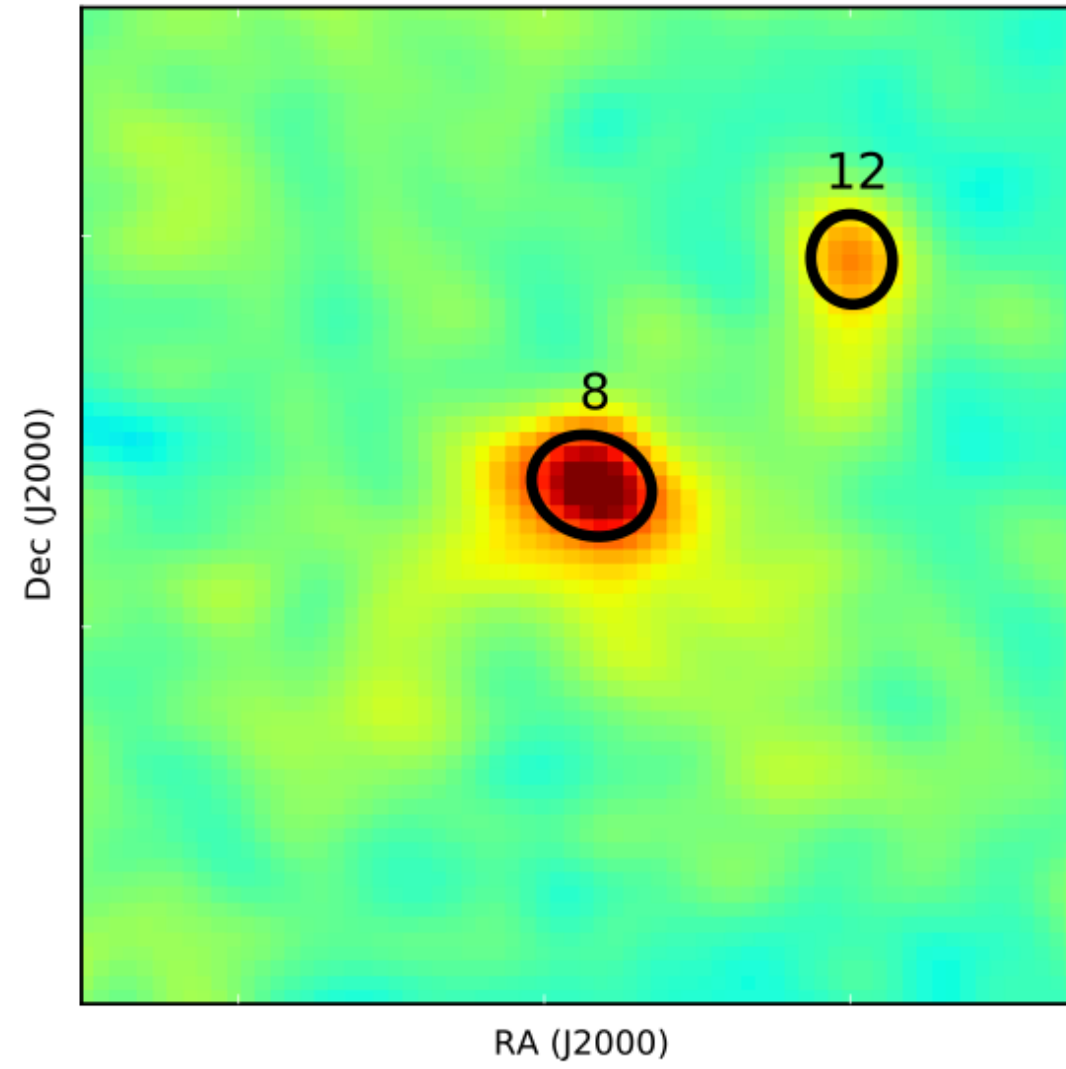


MOLECULAR LINE EMISSION (TOWARDS CORE 2)

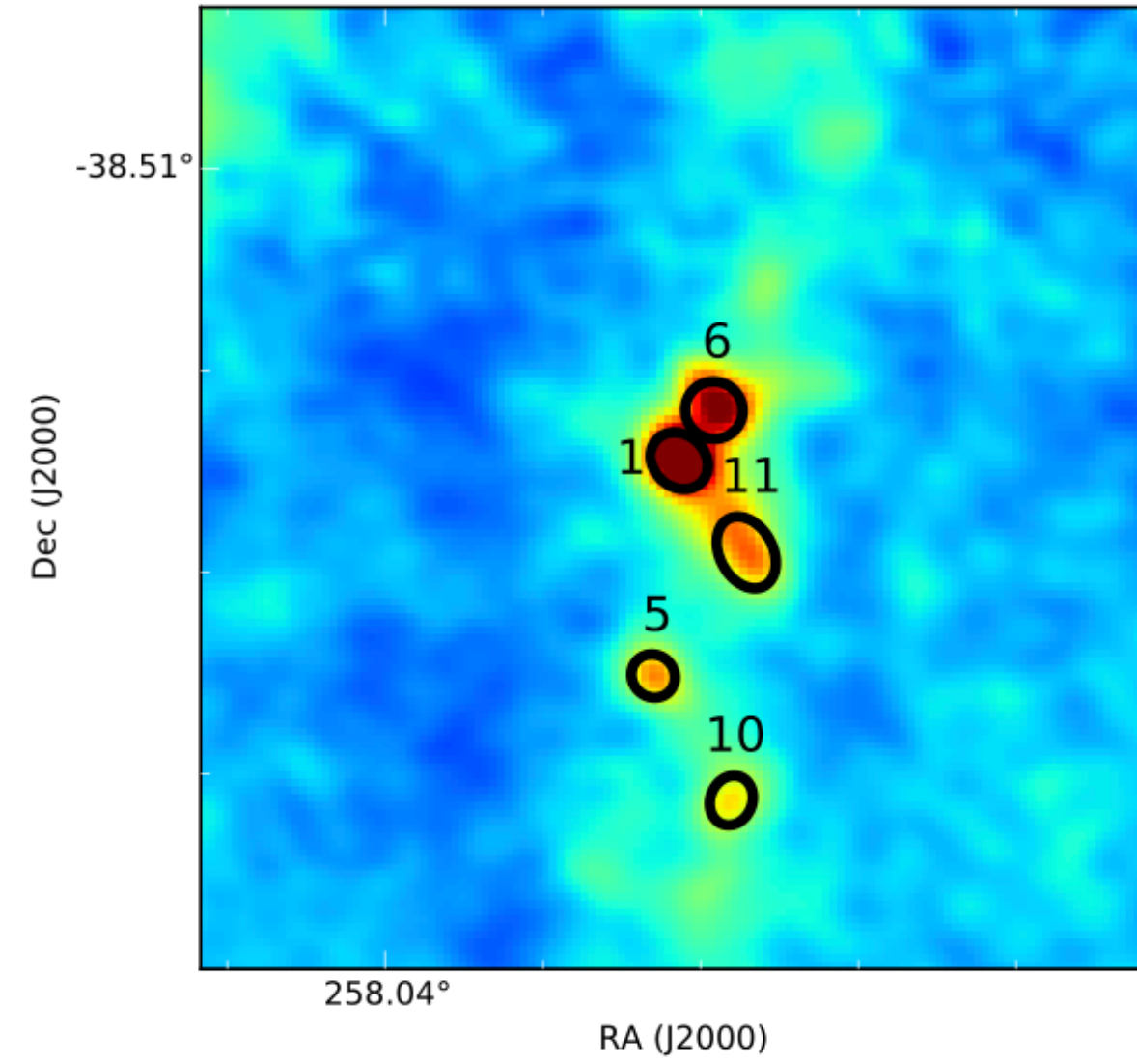




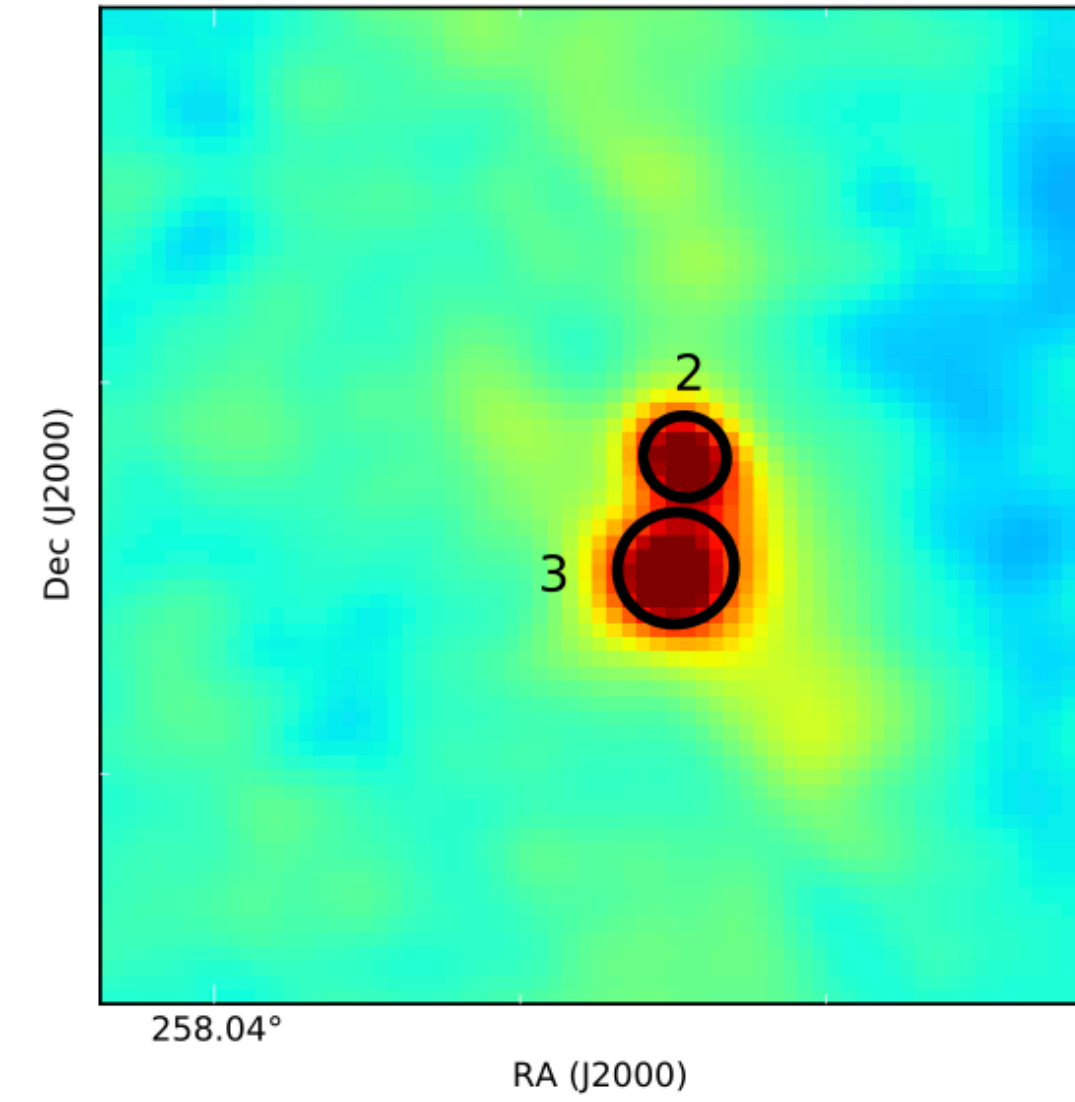
Core 1



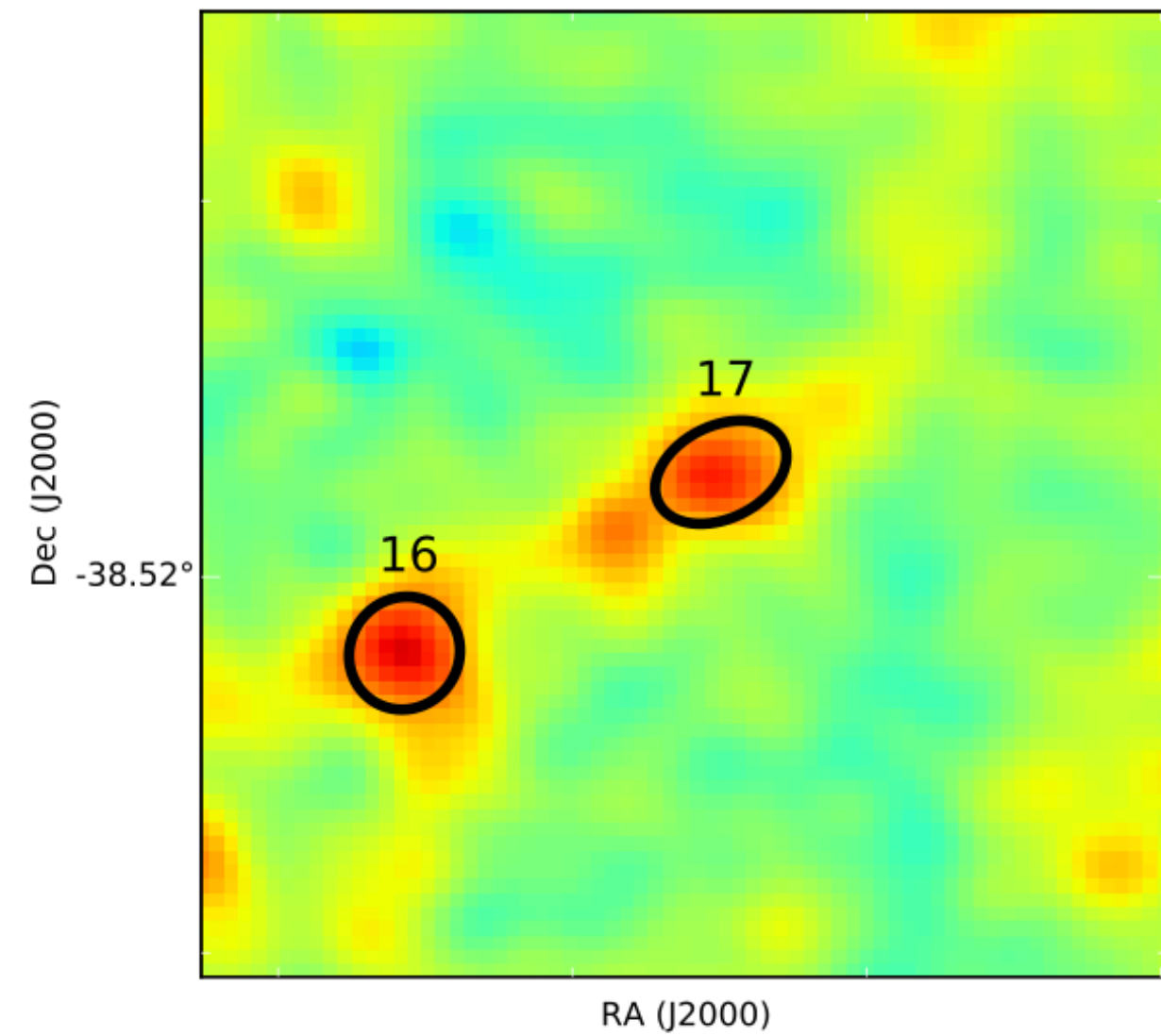
Core 2



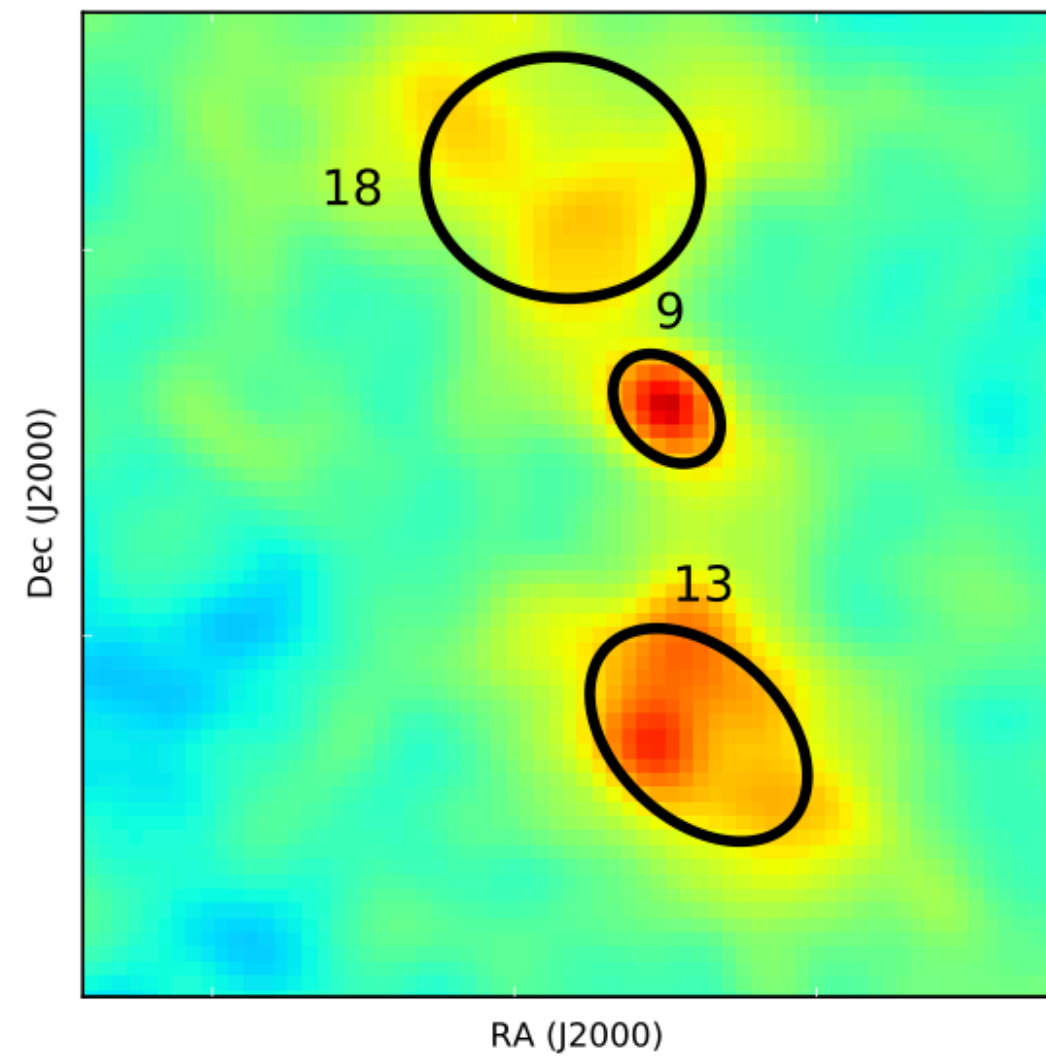
Core 9



Core 10



Core 39



ALMA sources extracted with getsources (black ellipses) for each of the Herschel cores at 3 mm