G305: Looking into a stellar maternity with ALMA

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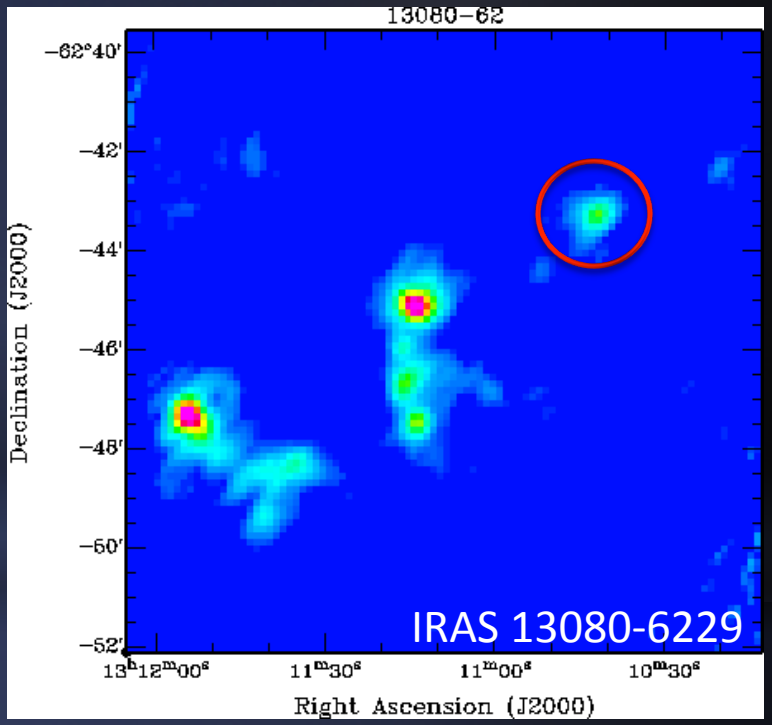
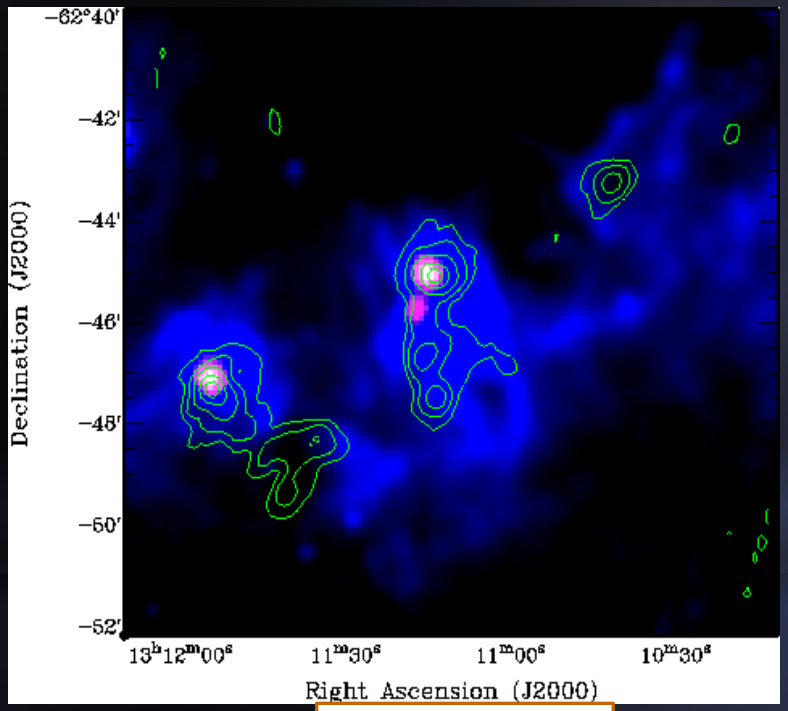
Guido Garay
Jill Rathborne

Previous Search of Cold Clumps

Garay et al. (2004) searched for mm-objects without MIR and FIR emission by cross correlating 1.2-mm/SIMBA, MSX and IRAS emission maps and found four massive cold clumps. One of them is G305.



1.2-mm (dust) → M



Mid-IR → T

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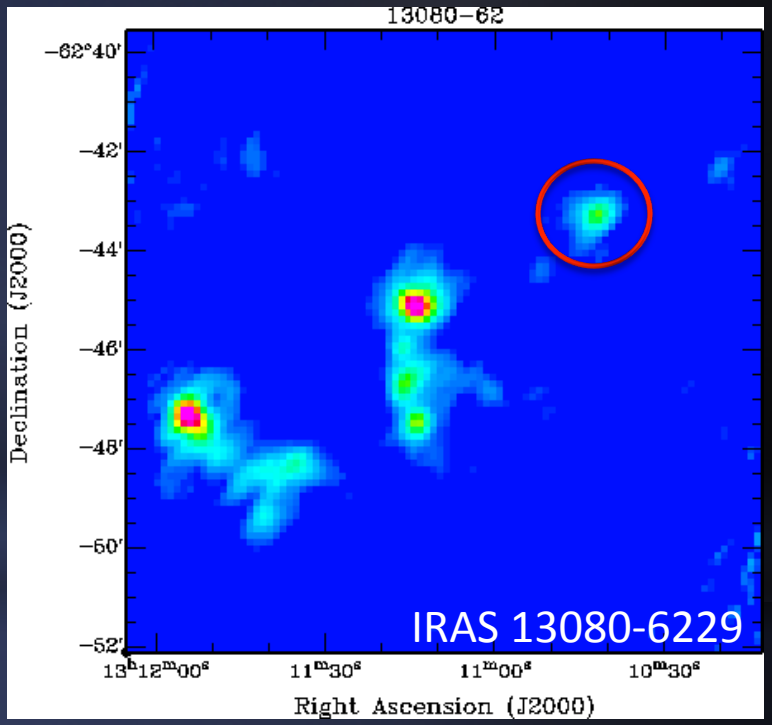
Massive, dense and cold clump



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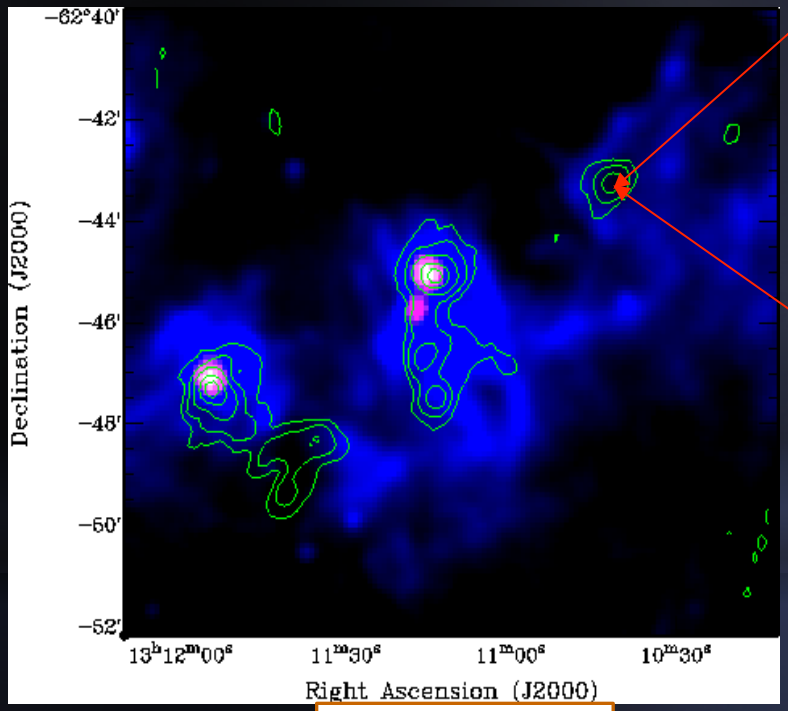
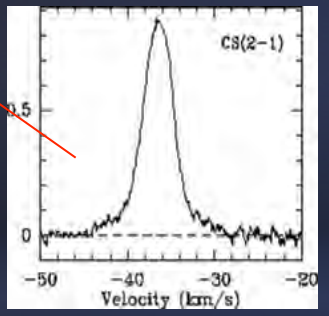


Mid-IR → T



M_d ~ 670 $M_\odot$
R ~ 0.3 pc
n~ 2×10^5 cm^{-3}
Δv~ 5 km s^{-1}
T_d < 15 K

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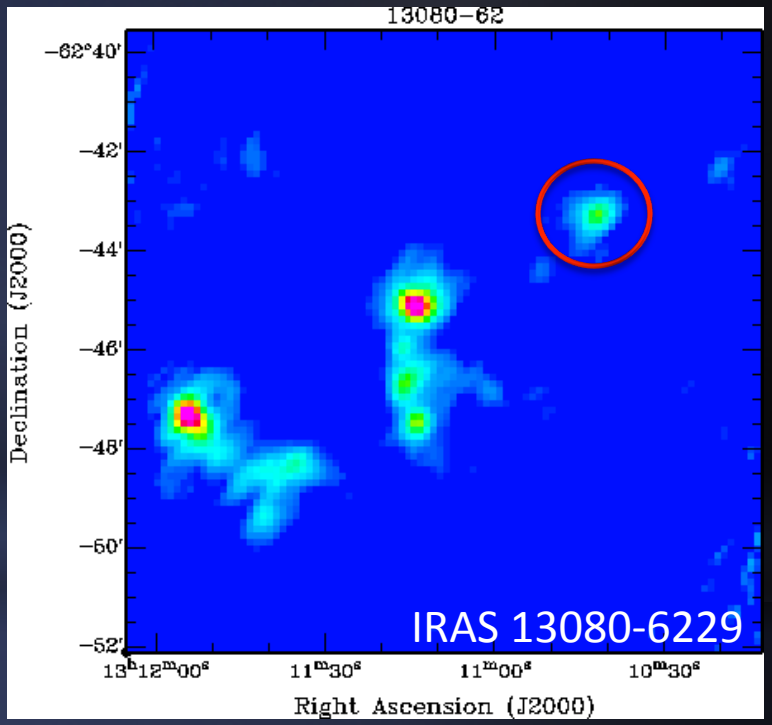

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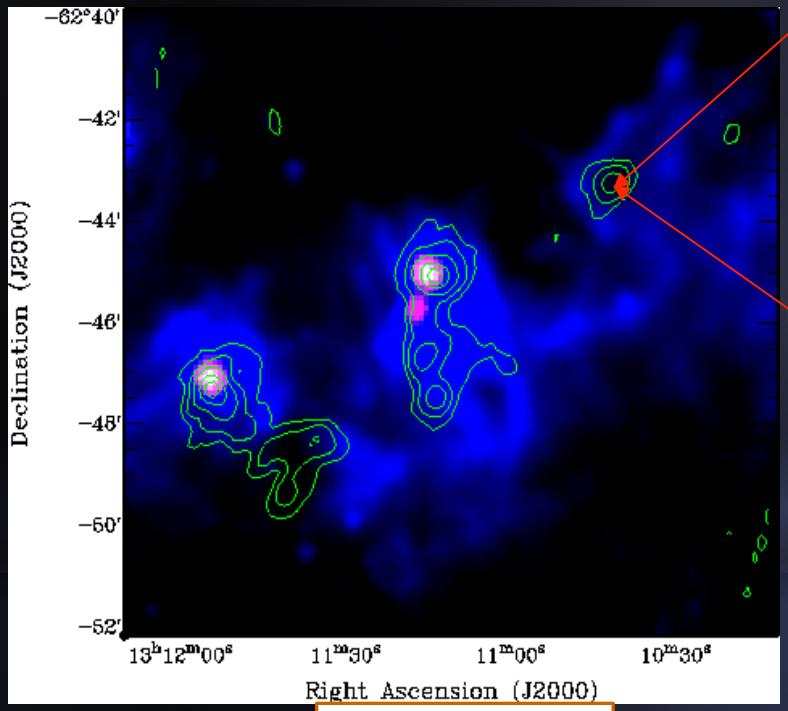

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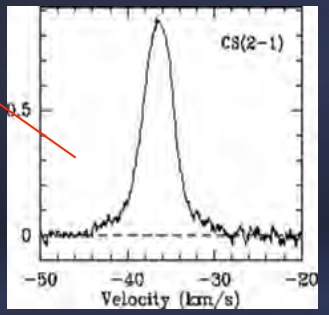

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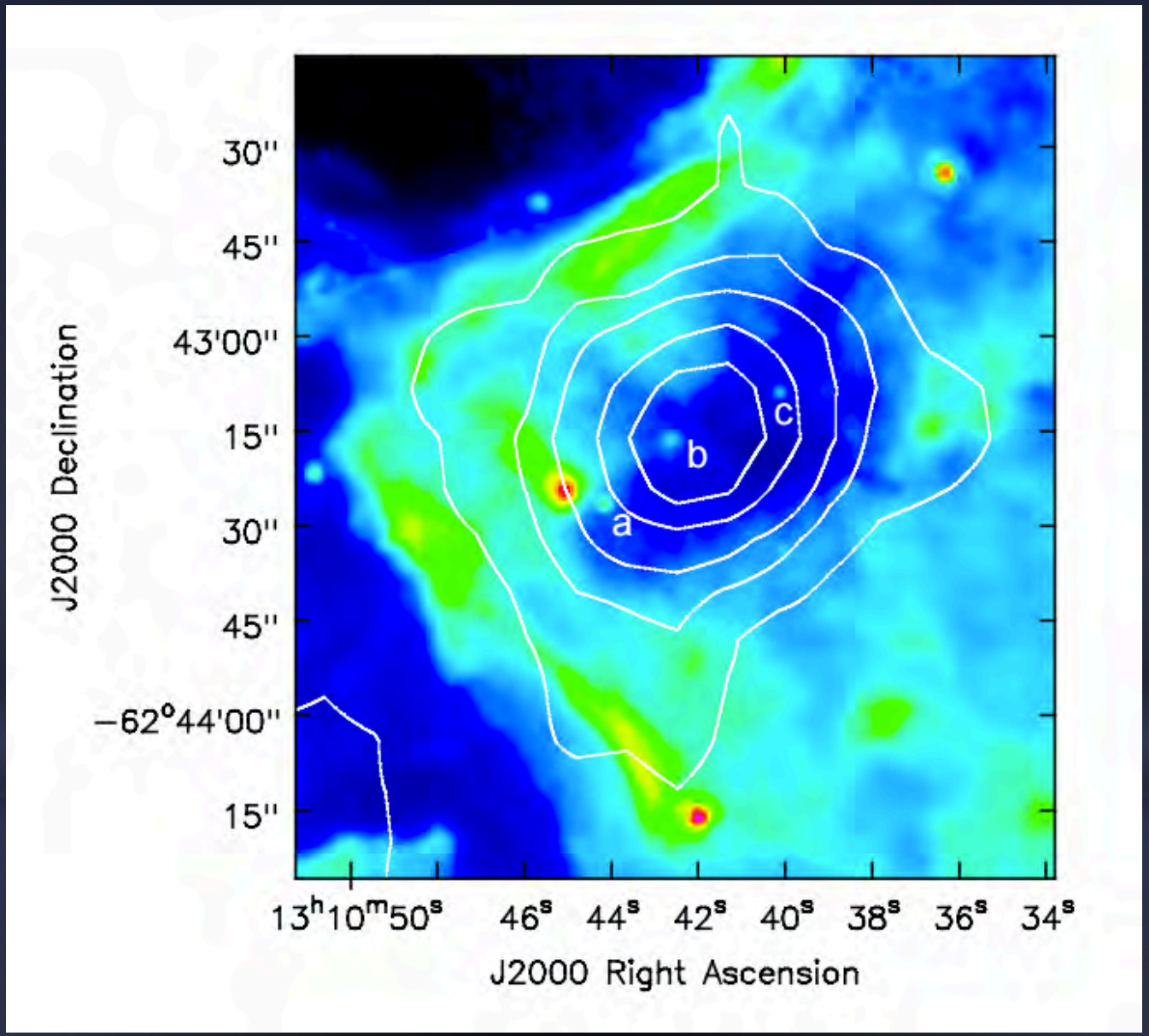
→ Initial conditions for the formation of high-mass stars

G305

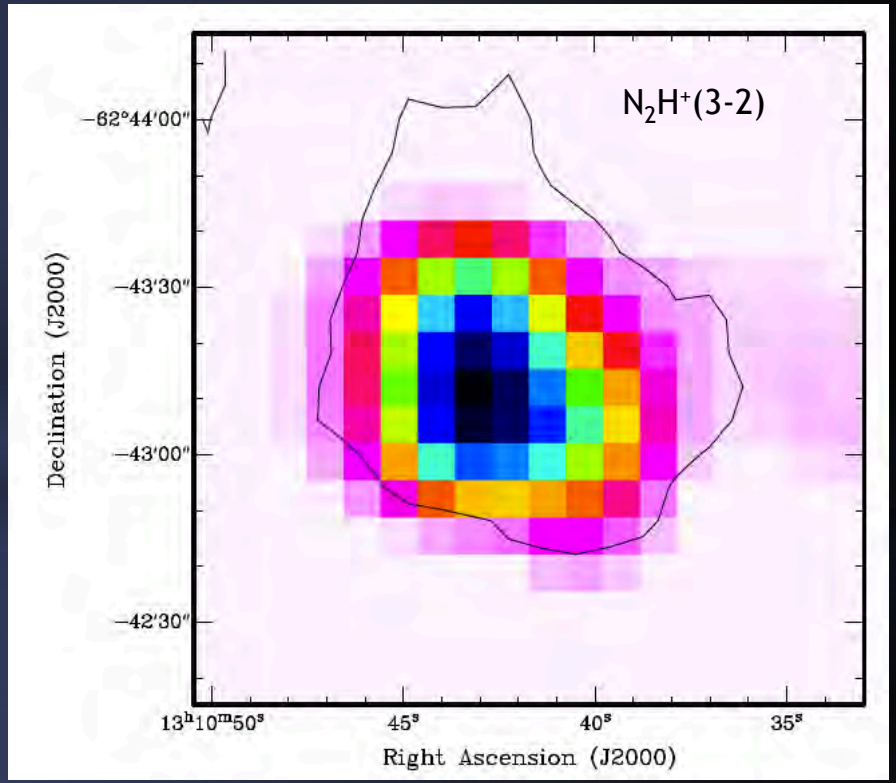
Background: 8 μm
Contours: 0.87 mm

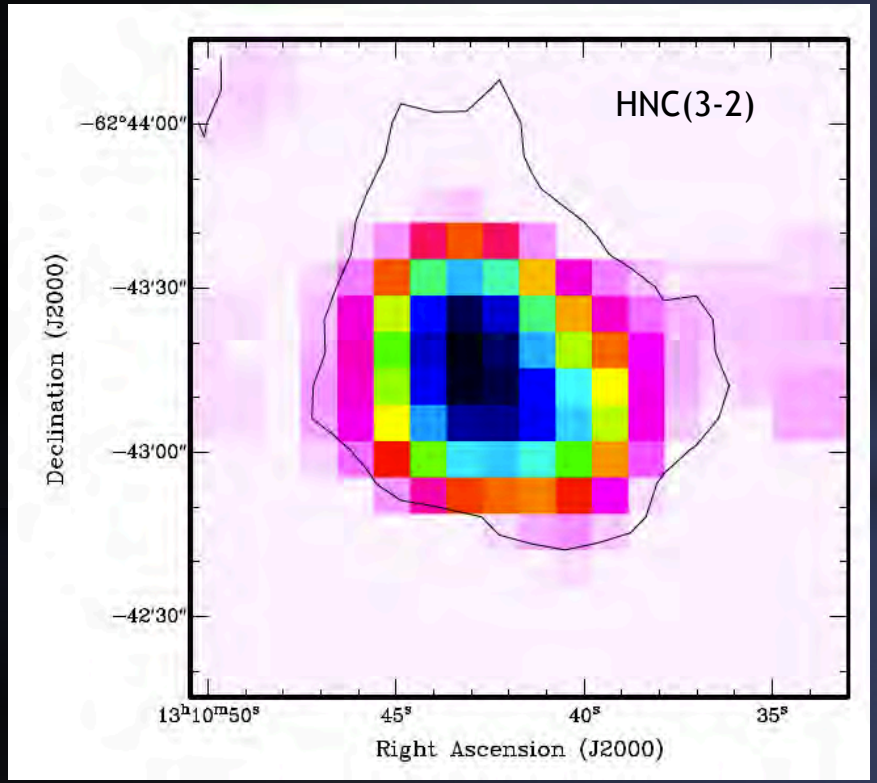


Garay et al. (2015)

Single dish molecular line observations

APEX telescope
20” angular resolution

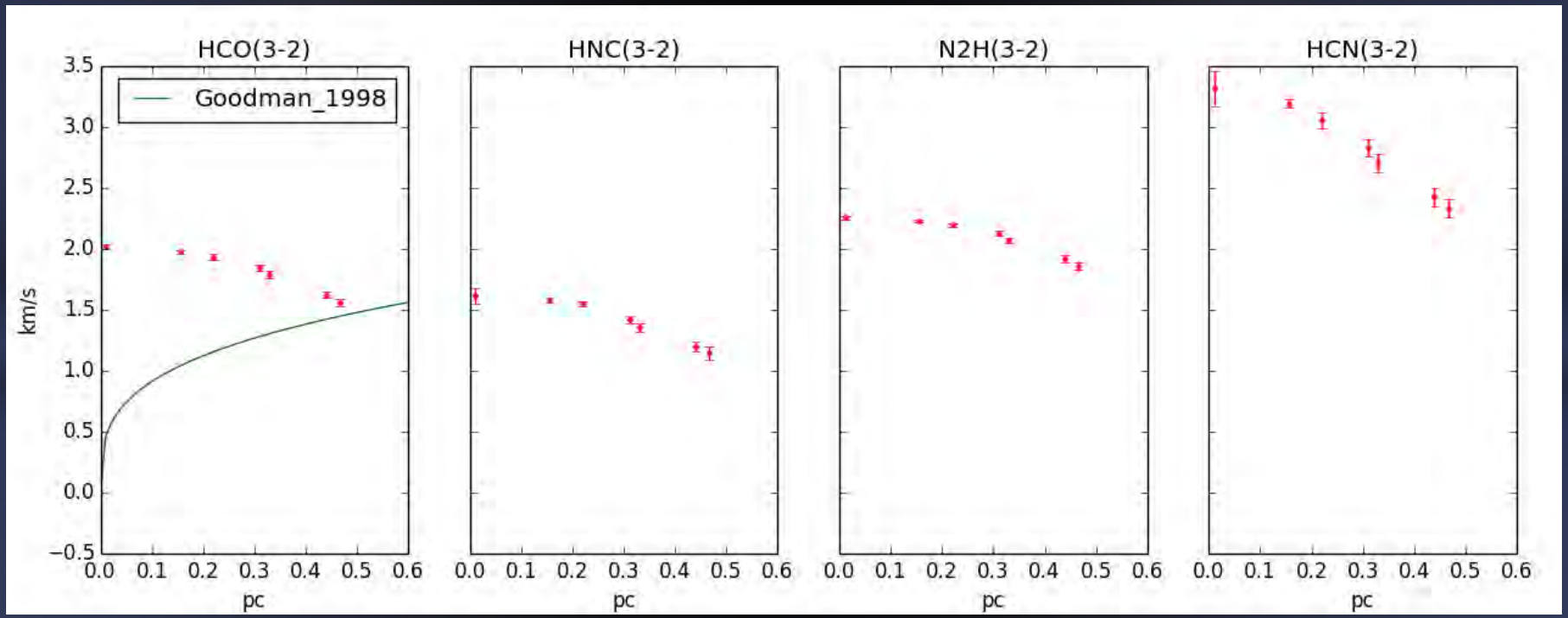




Single dish molecular line observations

APEX telescope
20” angular resolution

Some interesting results:



Looking into G305 with ALMA

Cycle 1 with 35 antennas, 12m + ACA
2”angular resolution
0.4 km/s velocity resolution
Band 3: continuum + molecular lines: HCO^+, N_2H^+, CS, ^{13}CO

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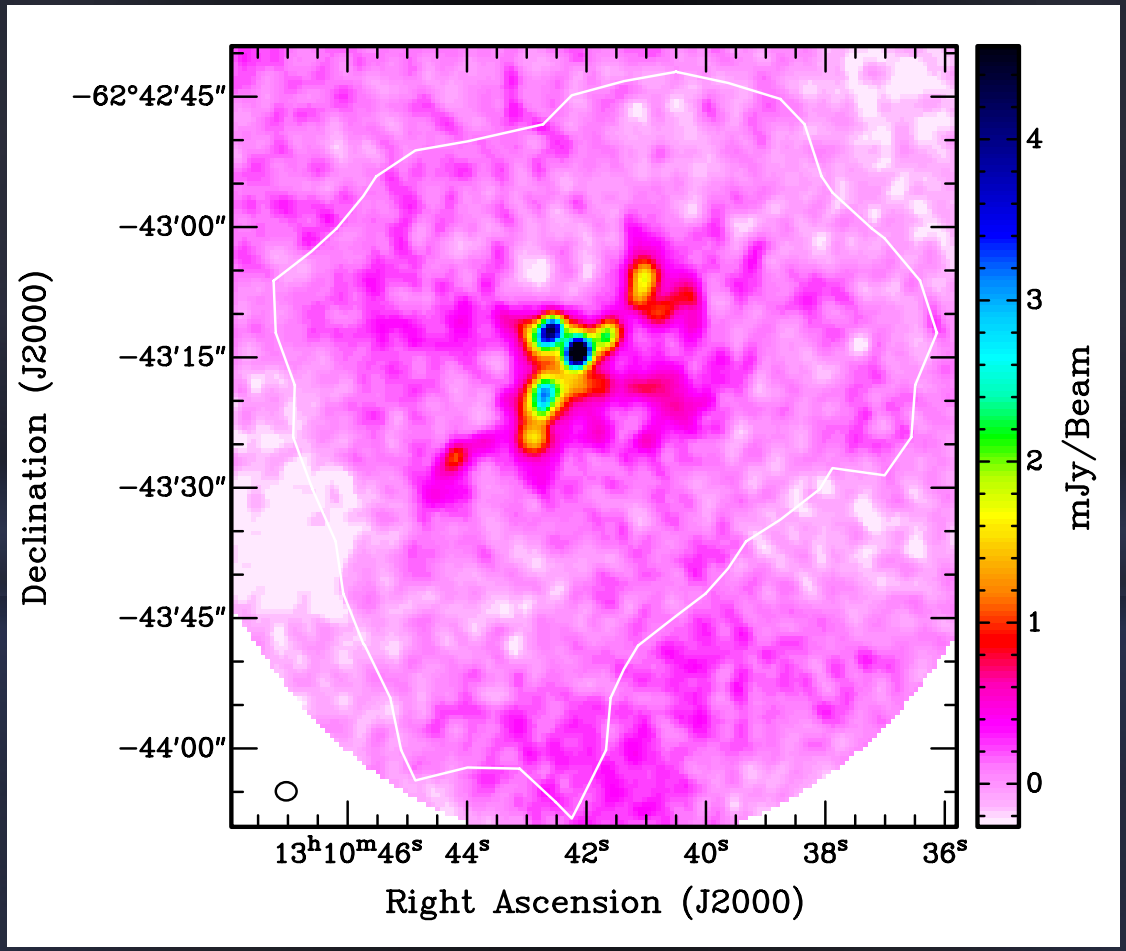
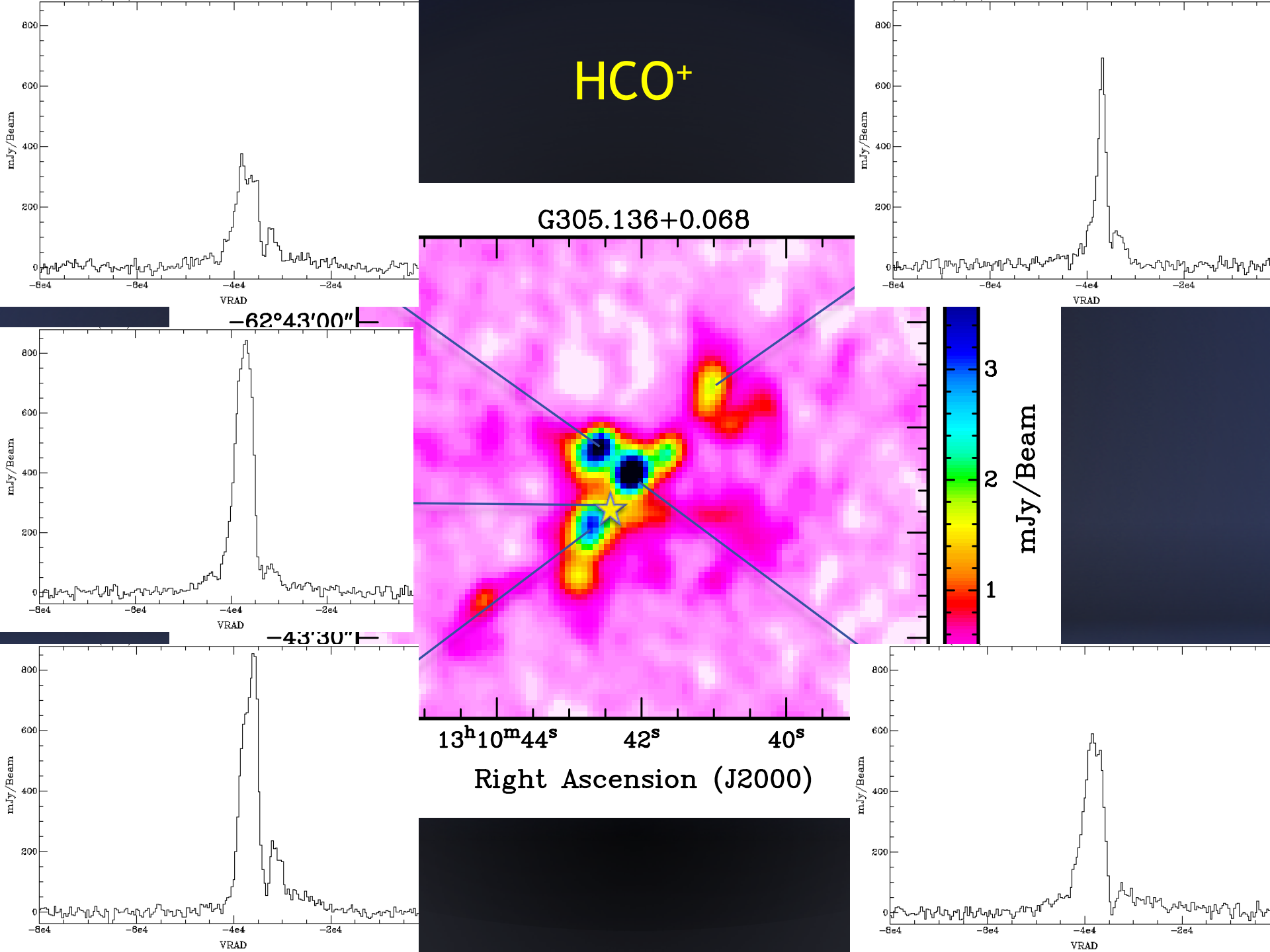
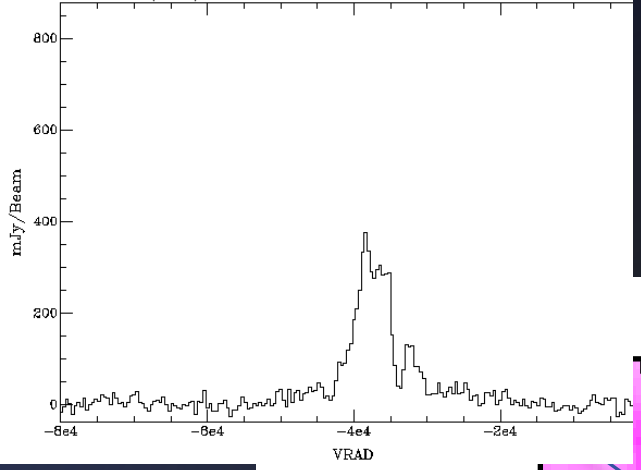
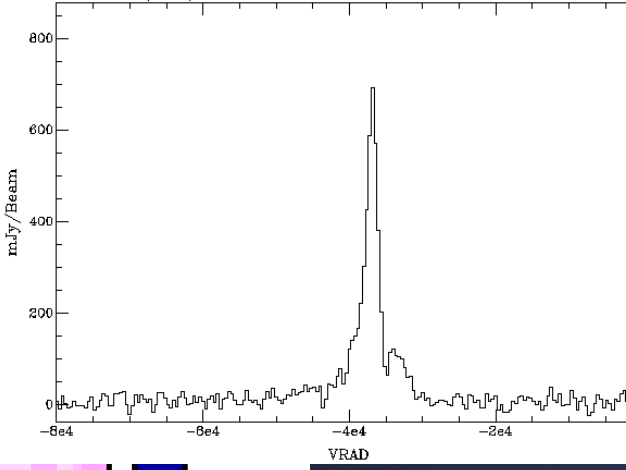
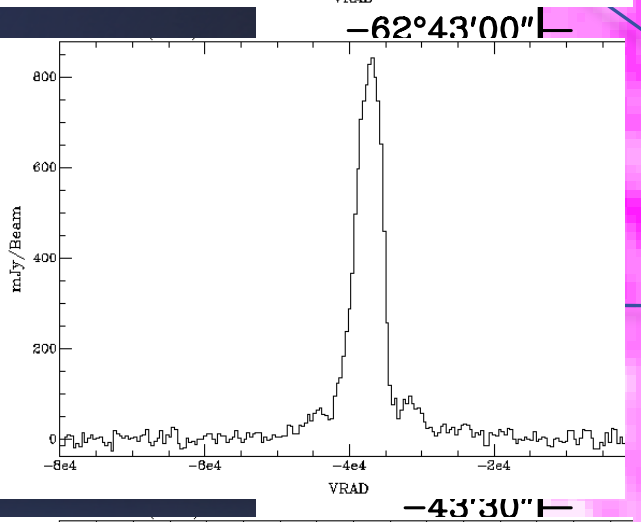


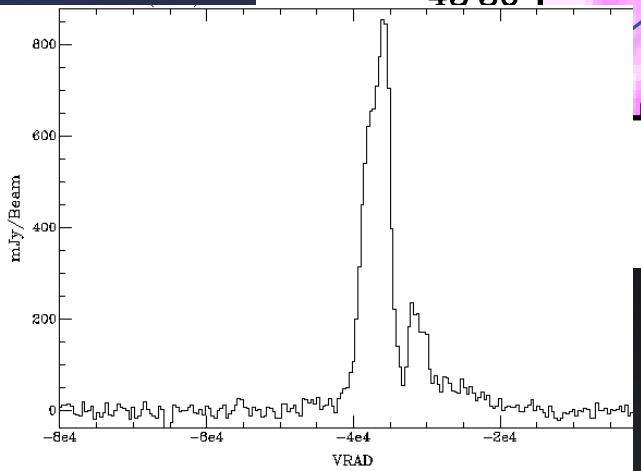

HCO+
G305.136+0.068
−62°43′00″
−43′30″
13h10m44s
42s
40s
Right Ascension (J2000)
mJy/Beam
VRAD
1
2
3

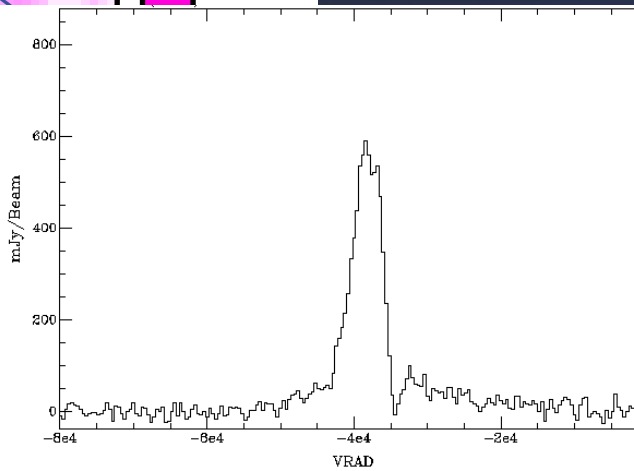
HCO^+

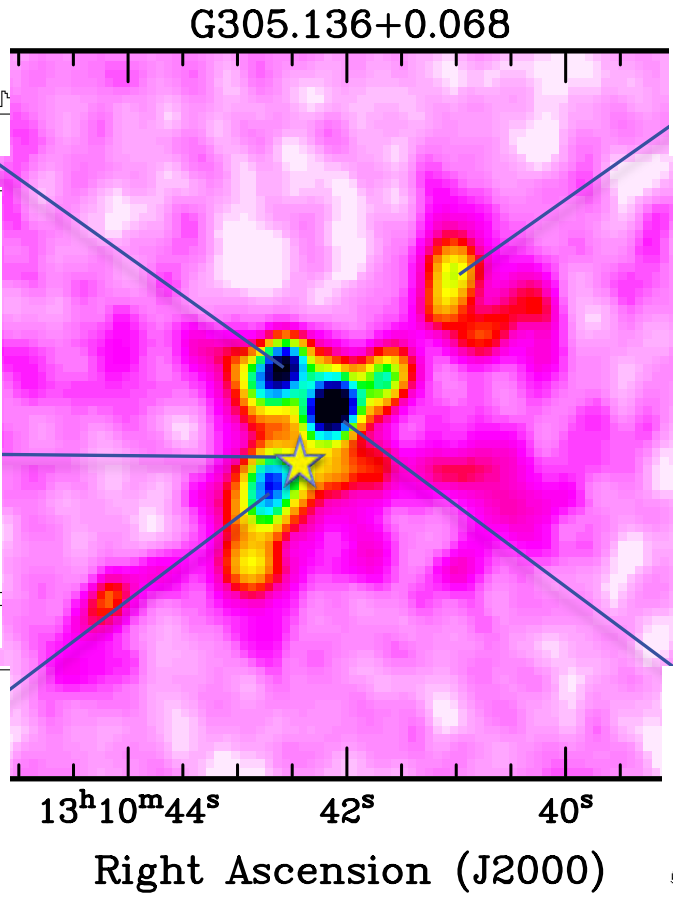


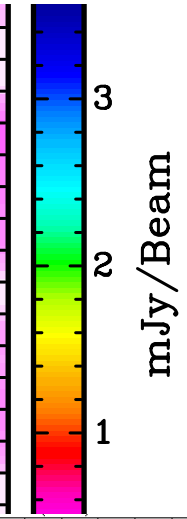




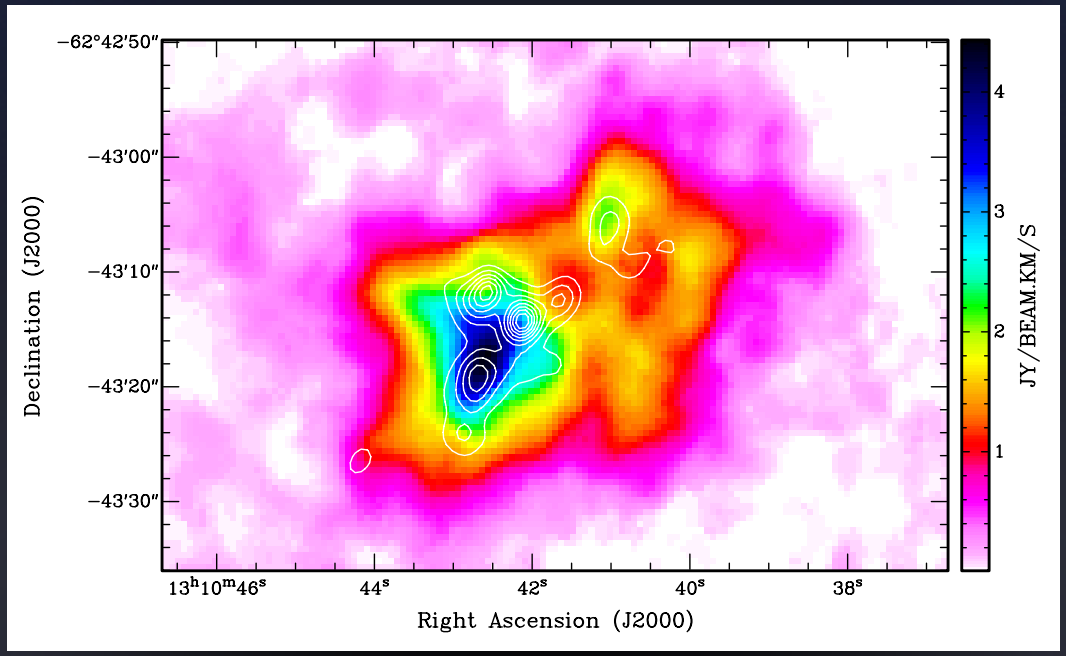


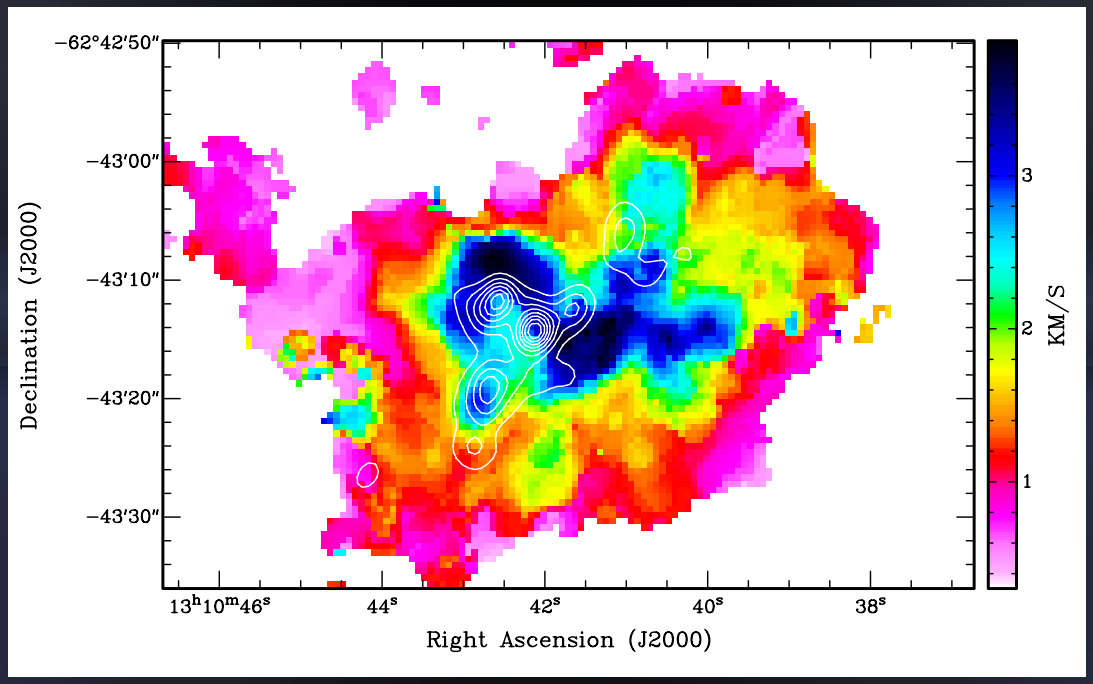






Infall line profile


−62°42′50″
−43′00″
−43′10″
−43′20″
−43′30″
Declination (J2000)
13h10m46s
44s
42s
40s
38s
Right Ascension (J2000)
4
3
2
1
JY/BEAM.KM/S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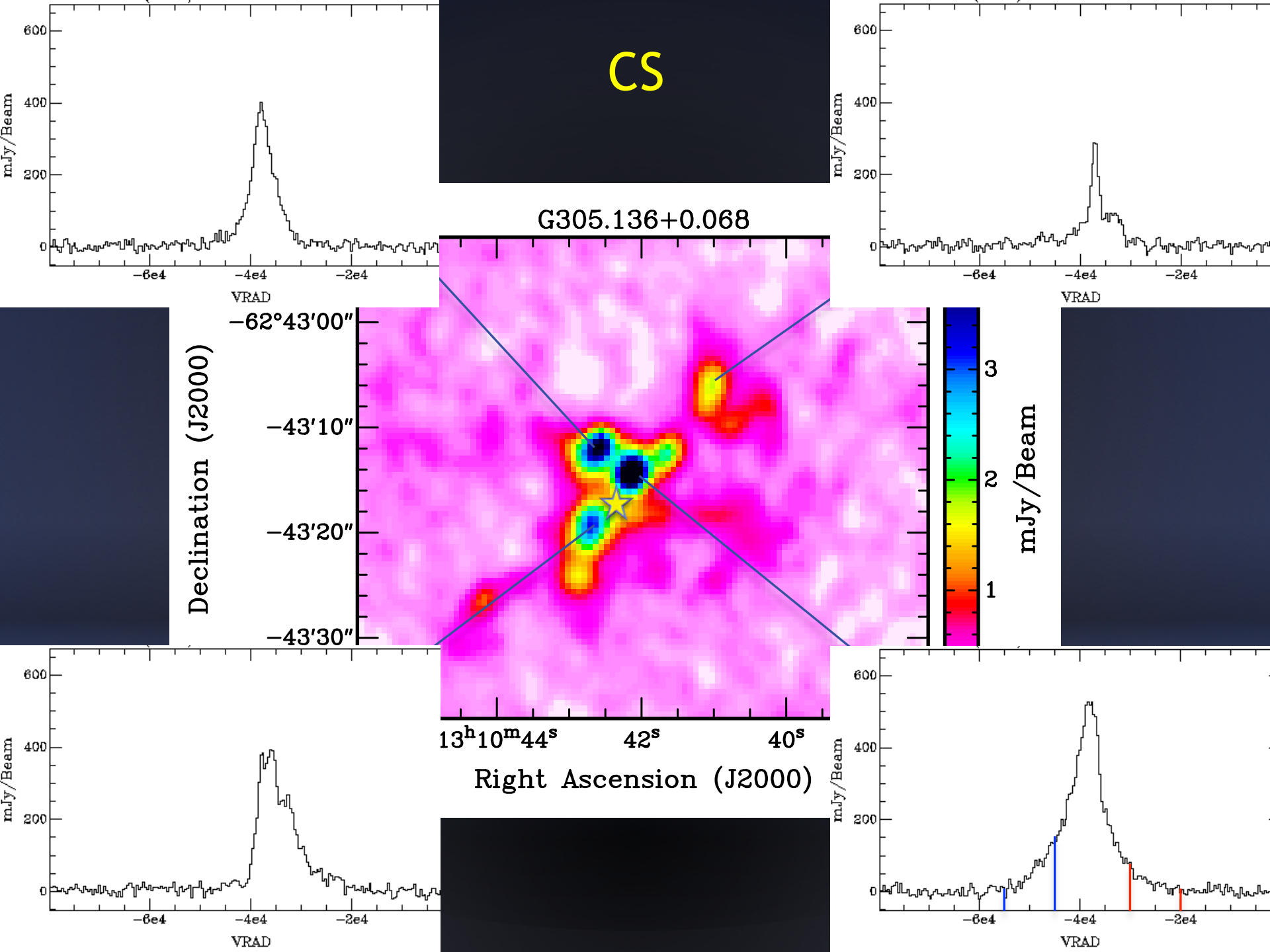
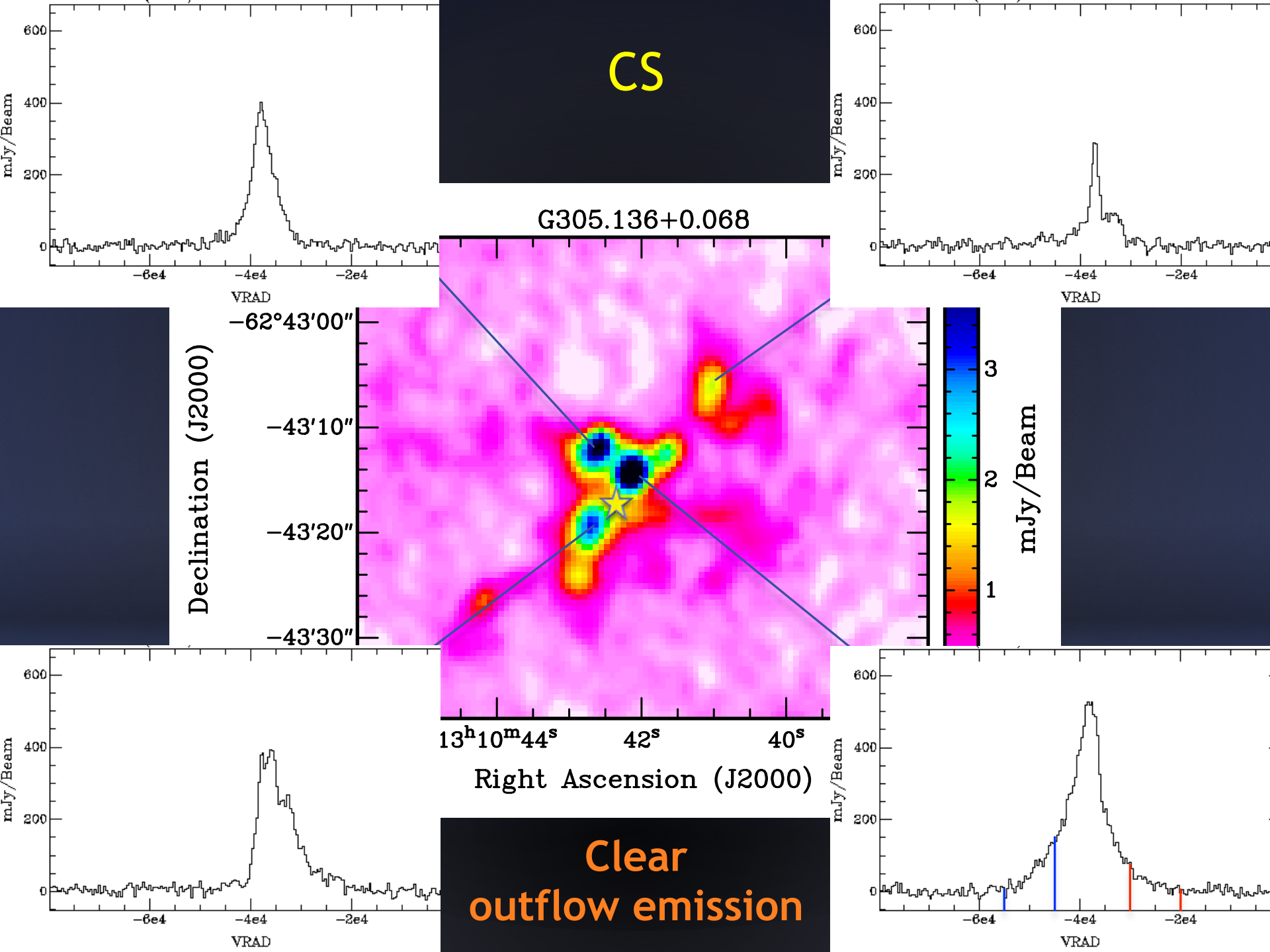

CS
G305.136+0.068
mJy/Beam
VRAD
−6e4
−4e4
−2e4
600
400
200
0
Declination (J2000)
−62°43′00″
−43′10″
−43′20″
−43′30″
13h10m44s
42s
40s
Right Ascension (J2000)
3
2
1
mJy/Beam


CS
G305.136+0.068
mJy/Beam
VRAD
−6e4
−4e4
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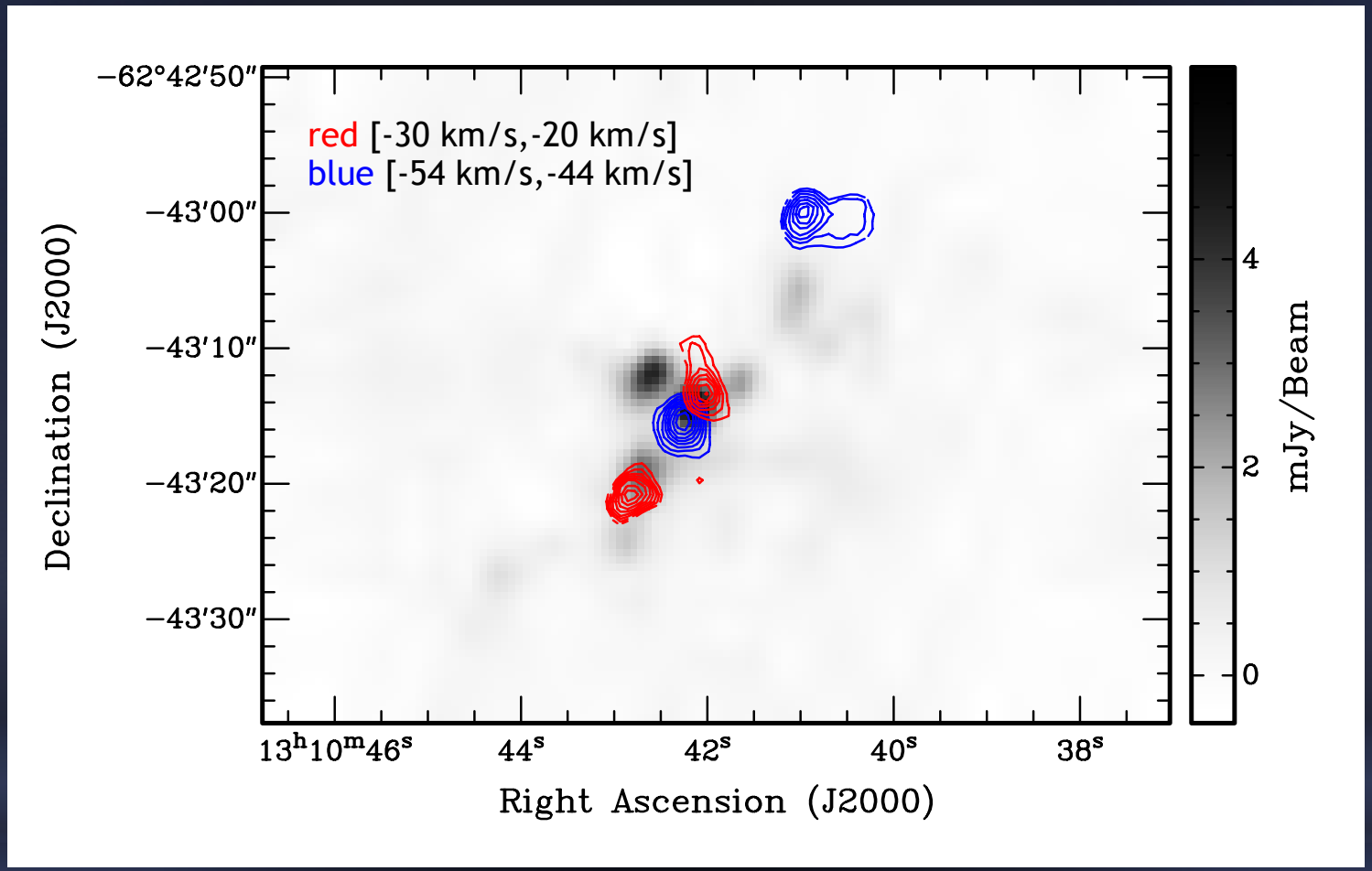
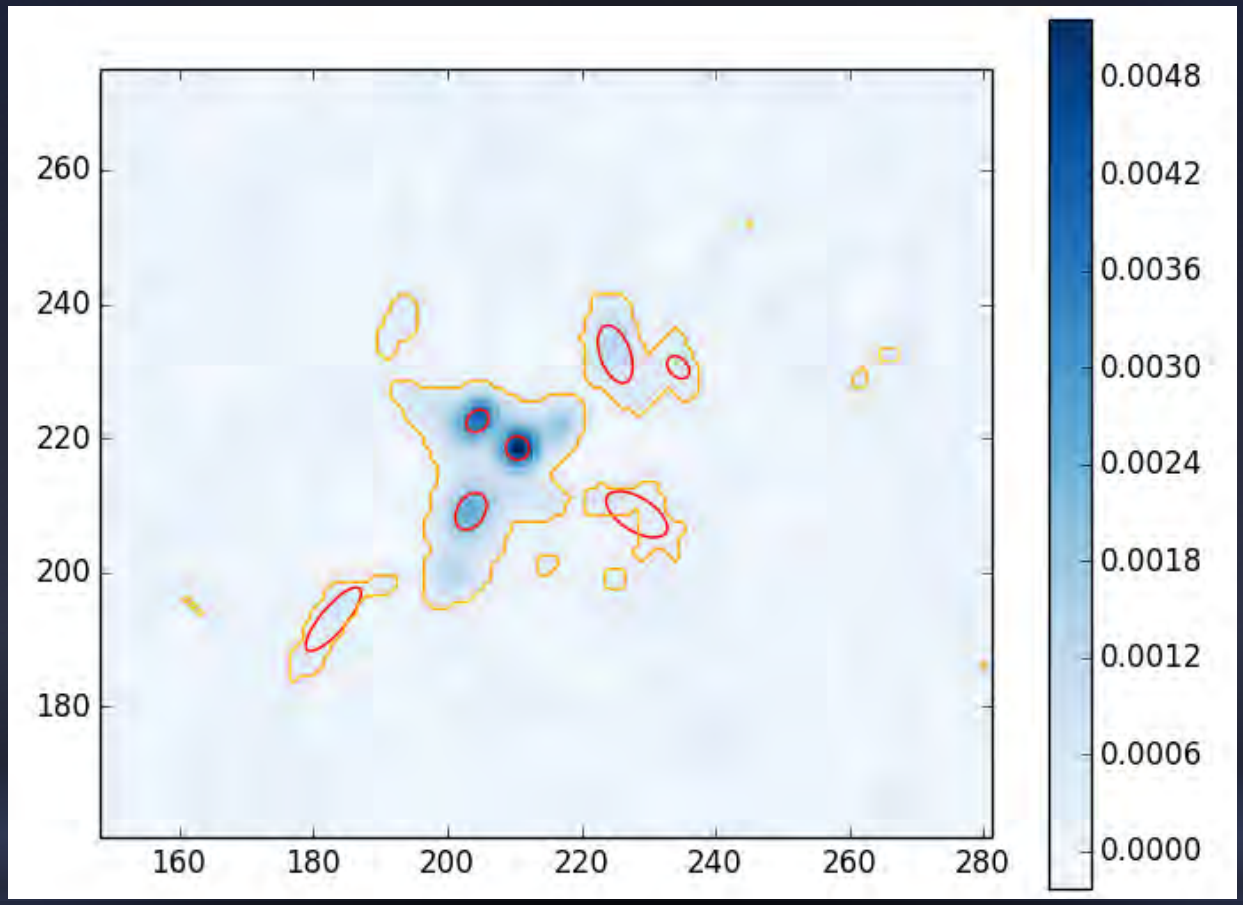
600
400
200
0
Declination (J2000)
−62°43′00″
−43′10″
−43′20″
−43′30″
13h10m44s
42s
40s
Right Ascension (J2000)
3
2
1
mJy/Beam
Clear
outflow emission



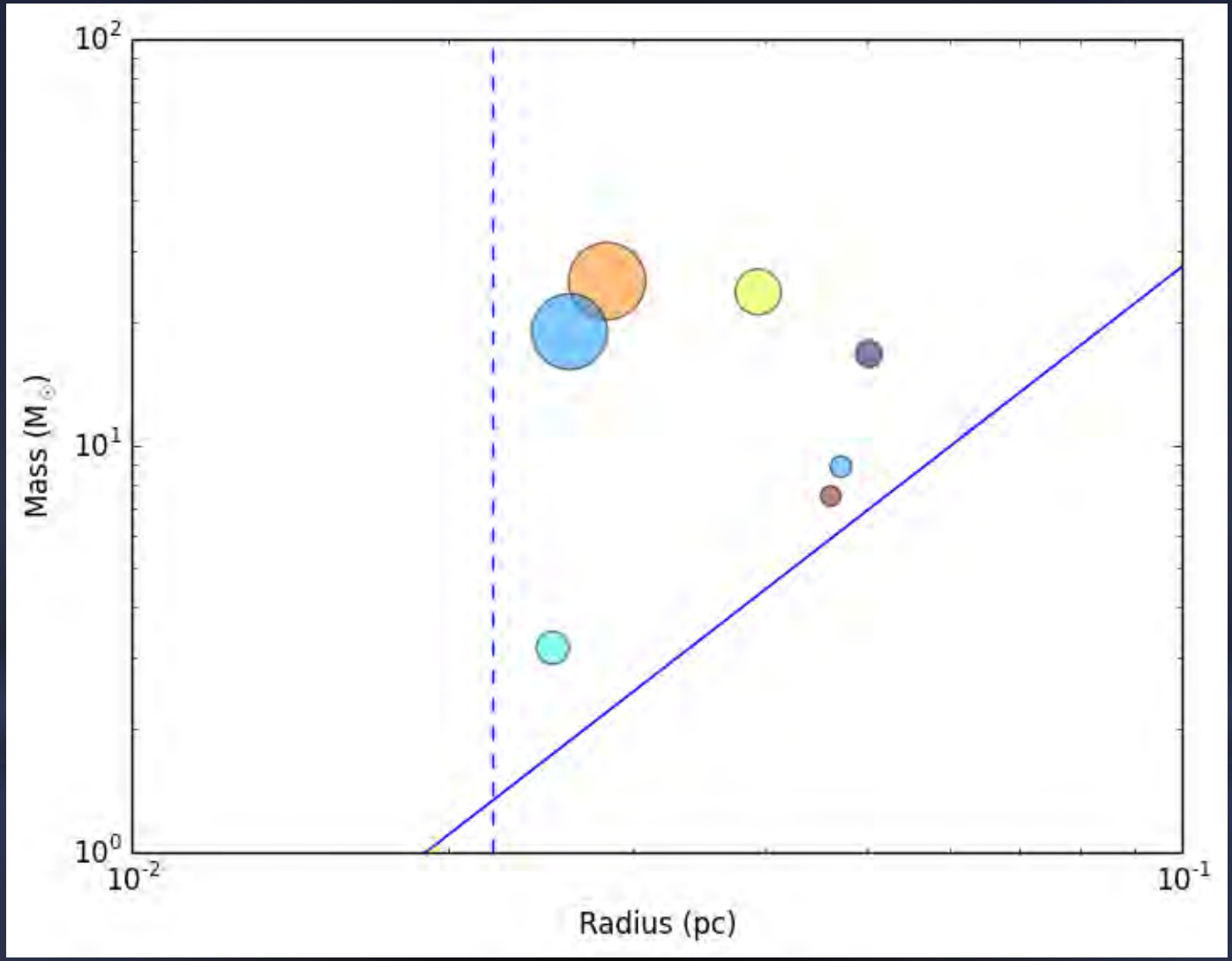
Background image: 3mm continuum

Finding the cores



7 cores
Mass range: 3-25 $M_{\odot}$
Radius range: 0.03-0.06 pc
Density range: 7×10^{5}-2×10^{7} cm^{-3}

Mass vs Radius



Density (size)

Summary

- ALMA observations show that the clump fragments into several cores.
- Infalling motions are revealed through the HCO+ line.
- The CS line profiles show the presence of an outflow.
- Based on the physical parameters some cores will form massive stars.