
Hydrocarbons in Massive Star Forming Regions: Mapping CCH with HARP

Xue-Jian Jiang

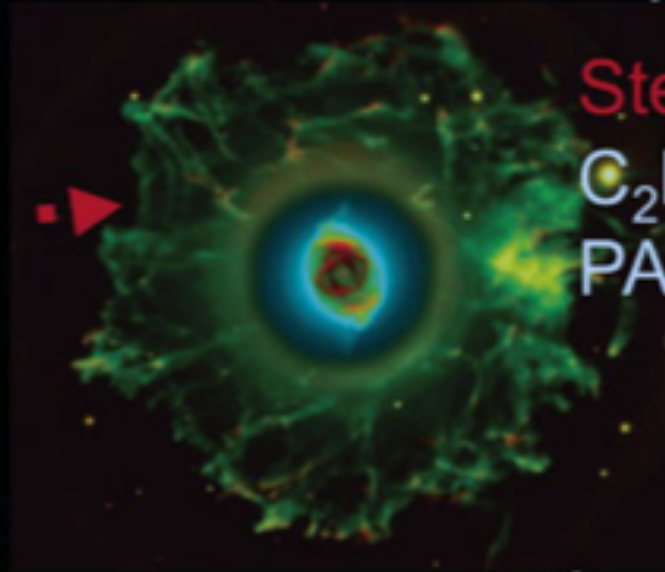
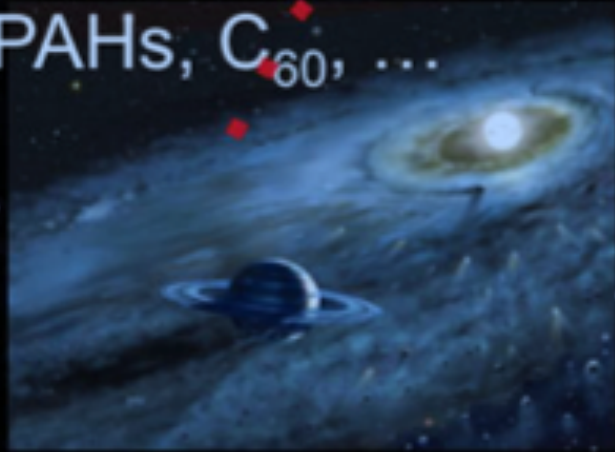
(蒋雪健)

Purple Mountain Observatory,
Nanjing

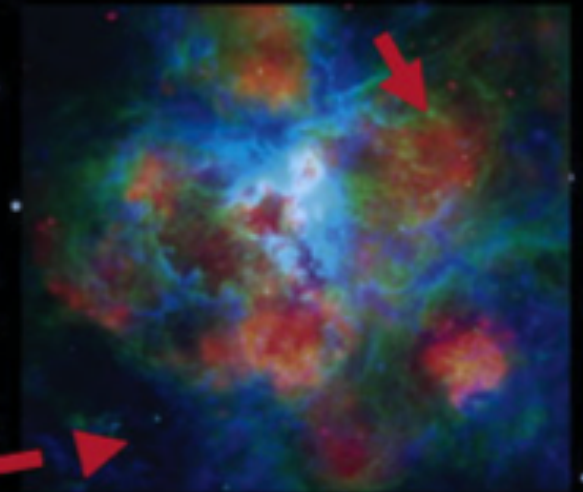
Molecules in the Lifecycle of the ISM

Star & planet formation

CO, H₂O, HCN, C₂H₂,
PAHs, C₆₀, ...



Stellar ejecta H₂, CO,
C₂H₂, HCN, HC₃N,
PAHs, C₆₀, ...

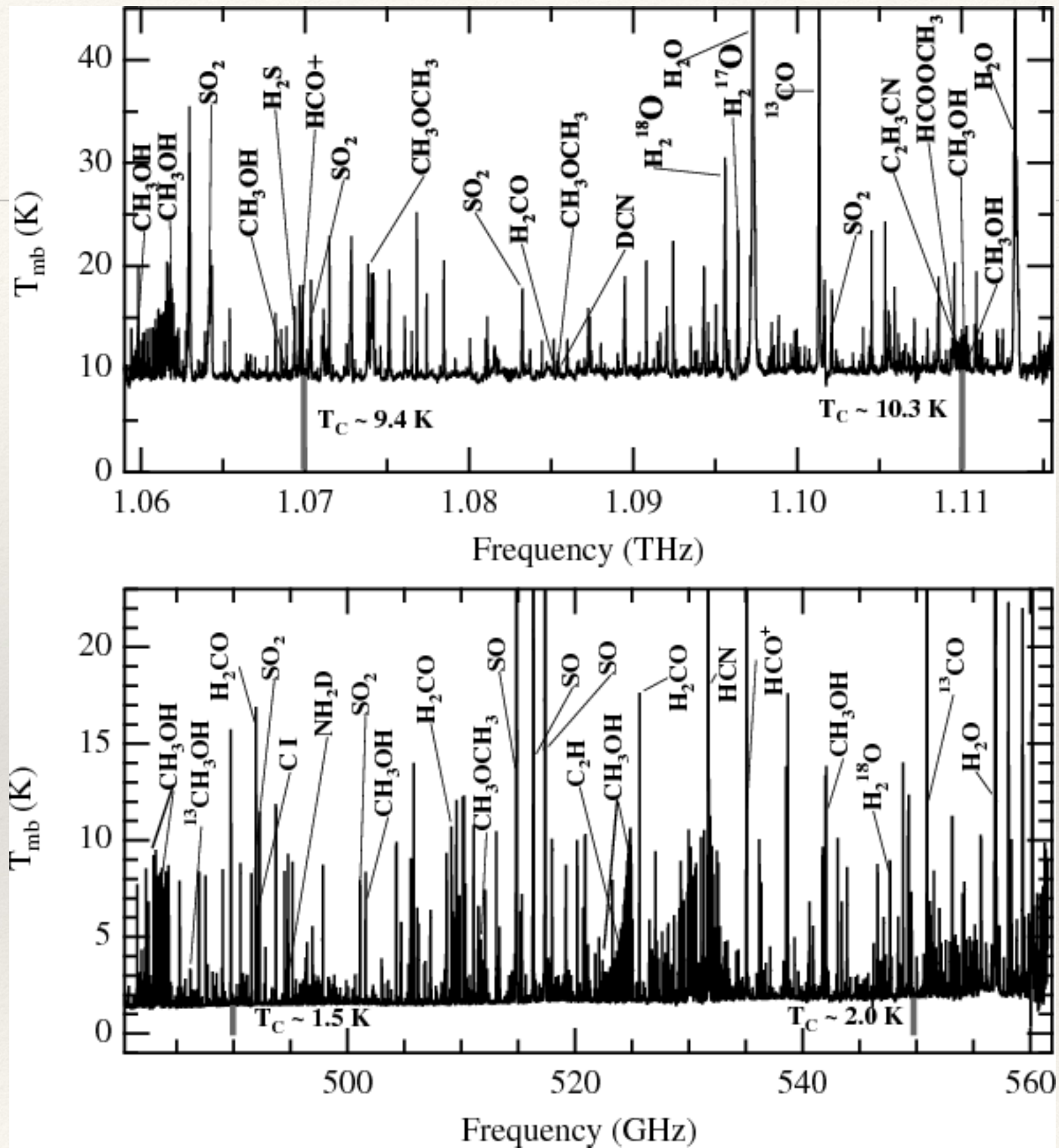


Diffuse interstellar medium

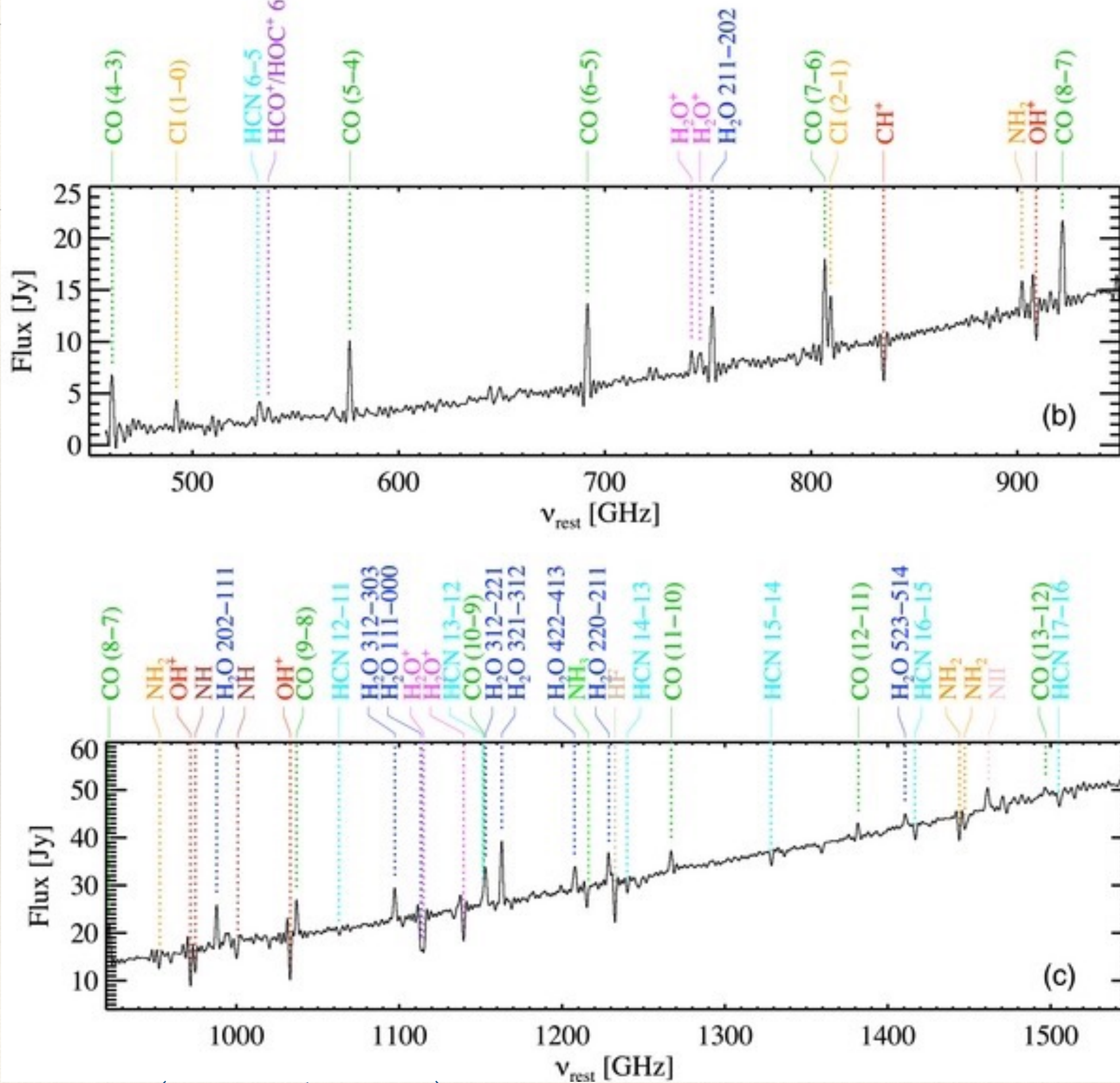
H₂, C₂, CH⁺, CN, PAHs,
C₆₀, ...

Molecular clouds H₂, CO,
HCO⁺, HCN, HC₃N, ices
(H₂O, CH₃OH), ...





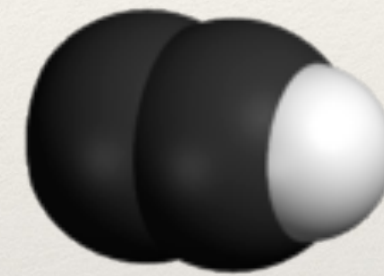
Orion KL (Bergin+ 2010)

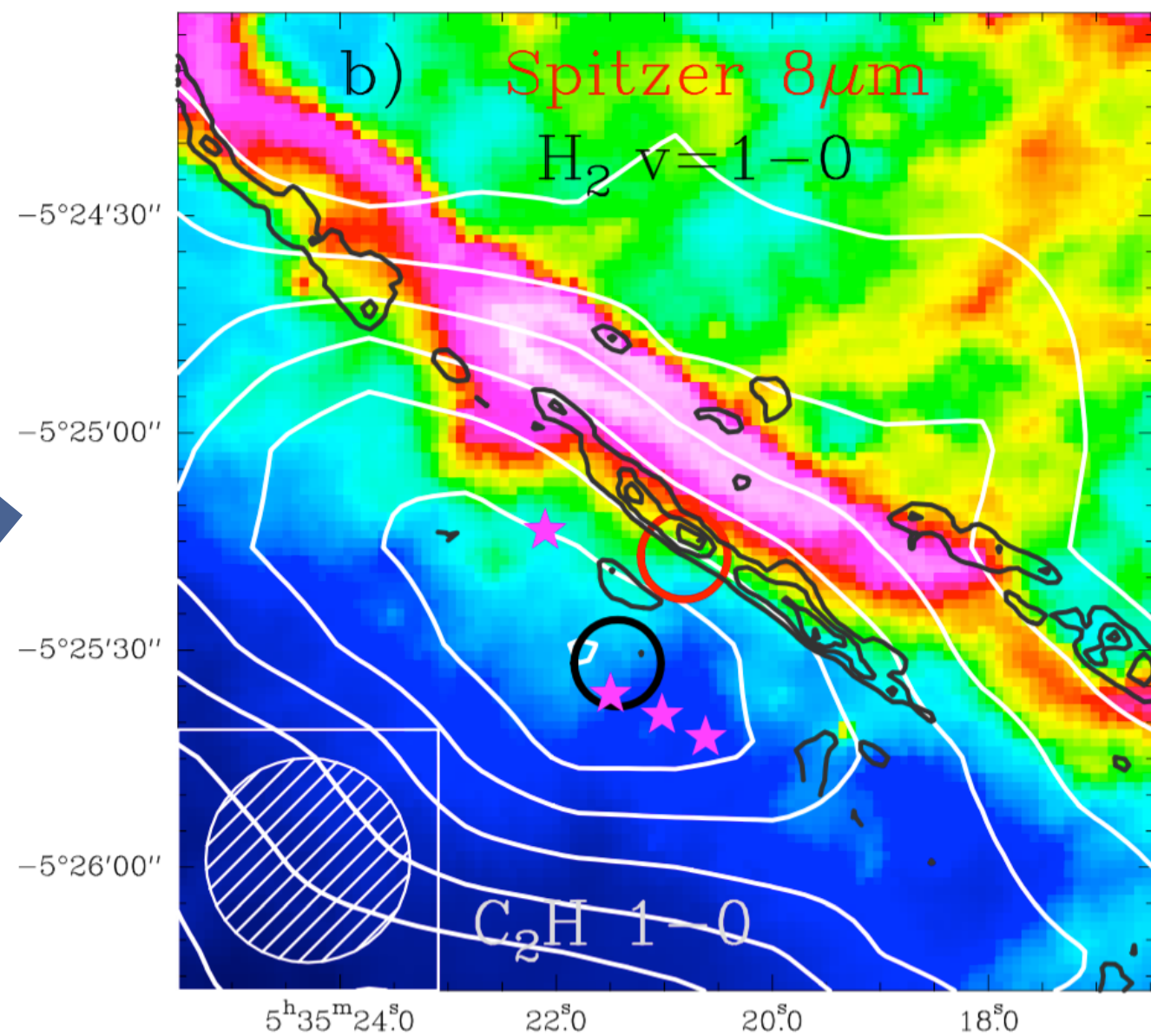
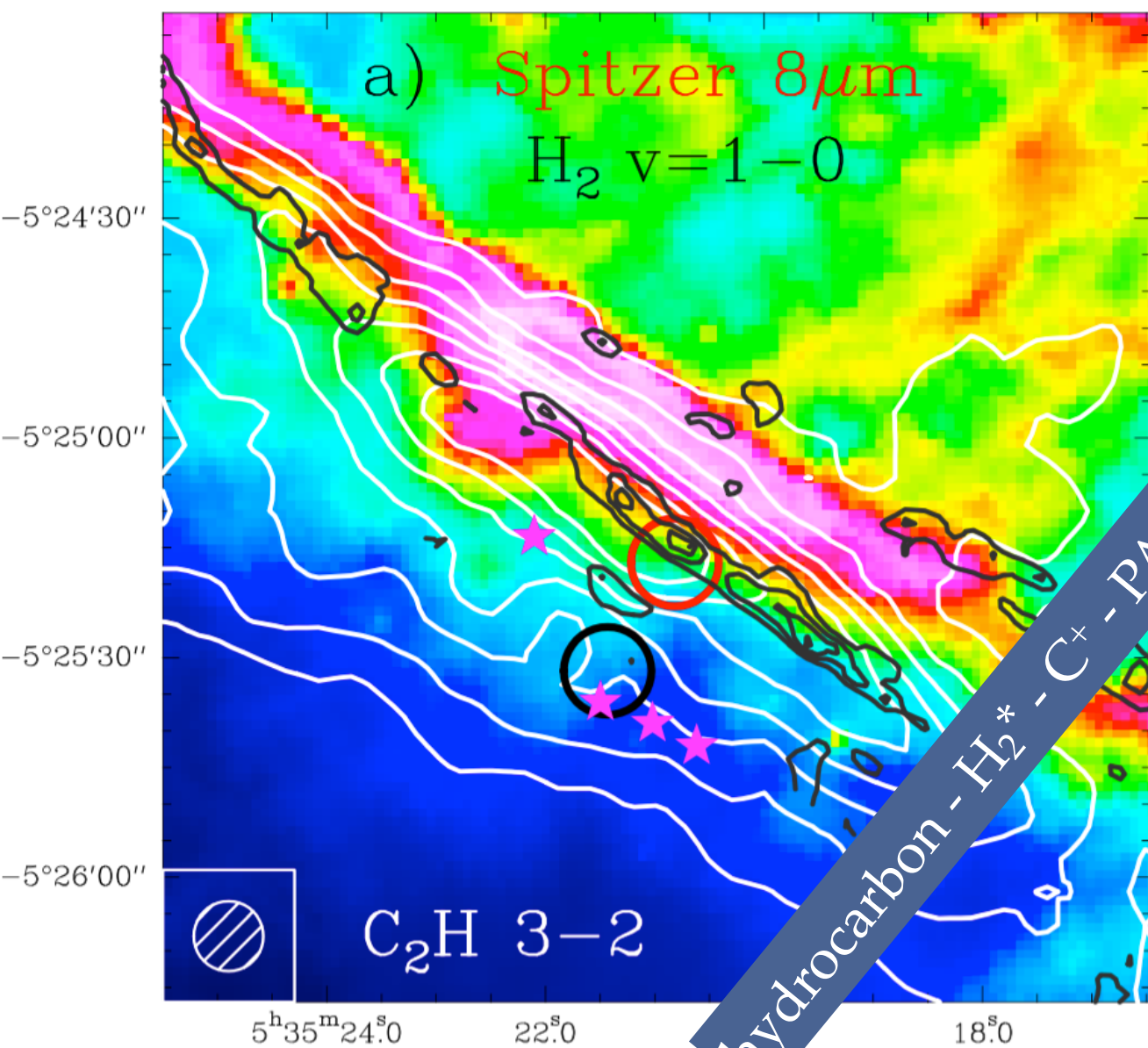
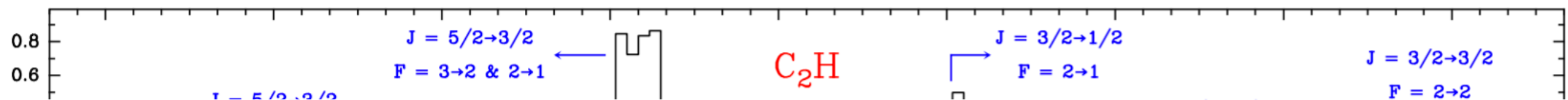
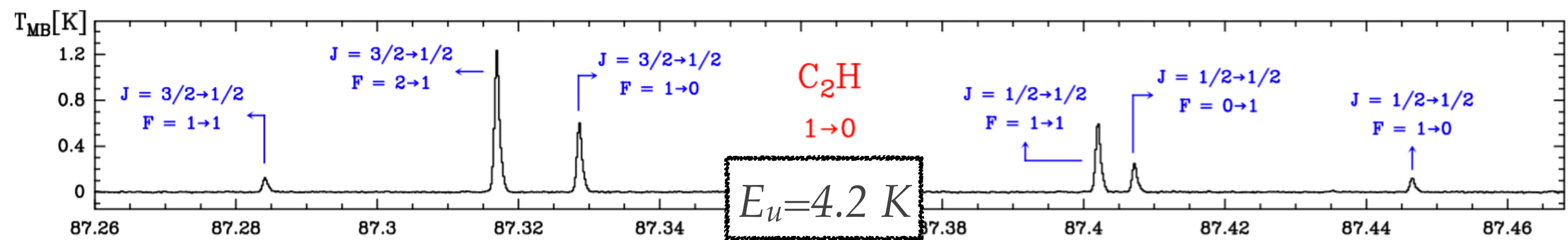


ARP220 (Rangwala+ 2011)

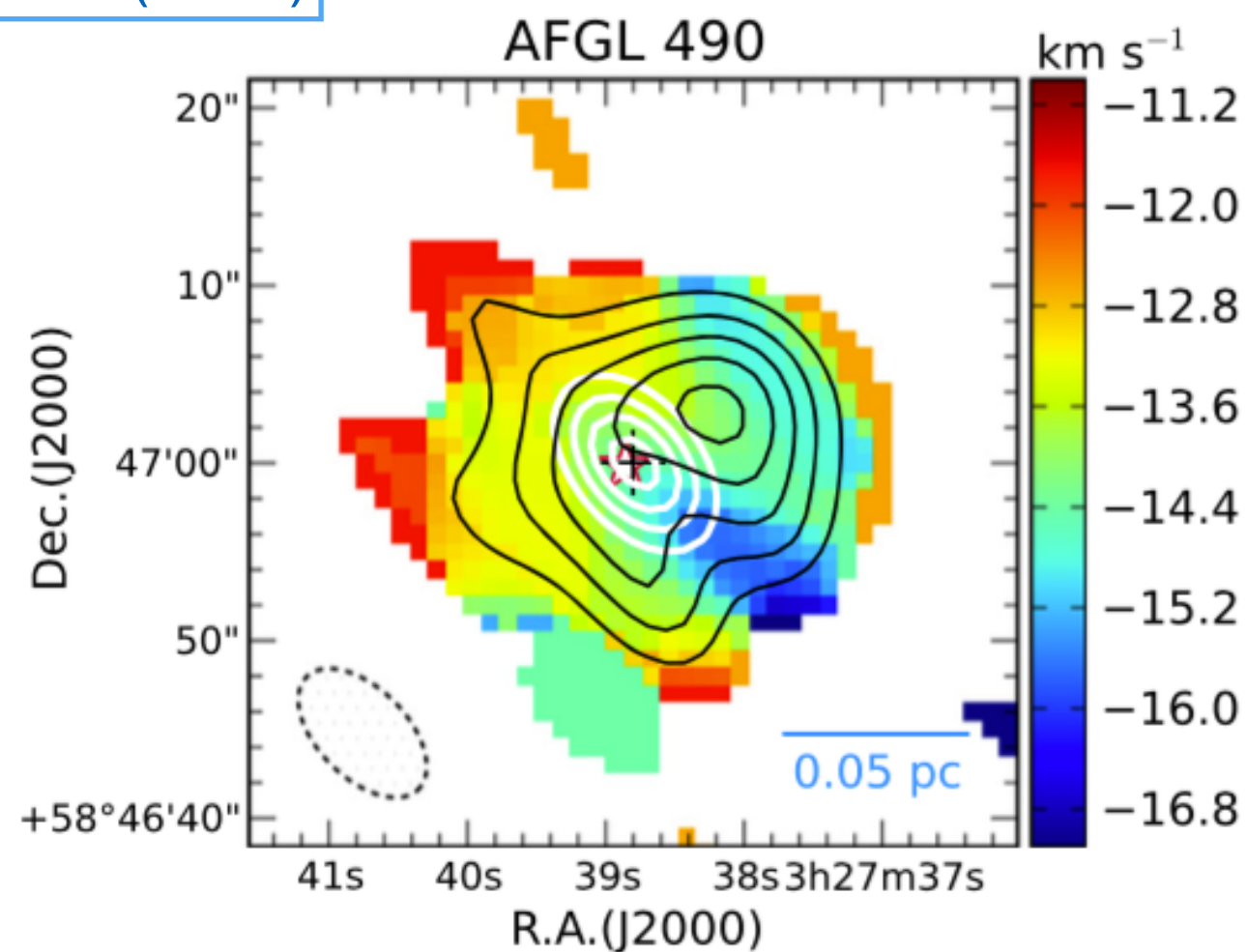
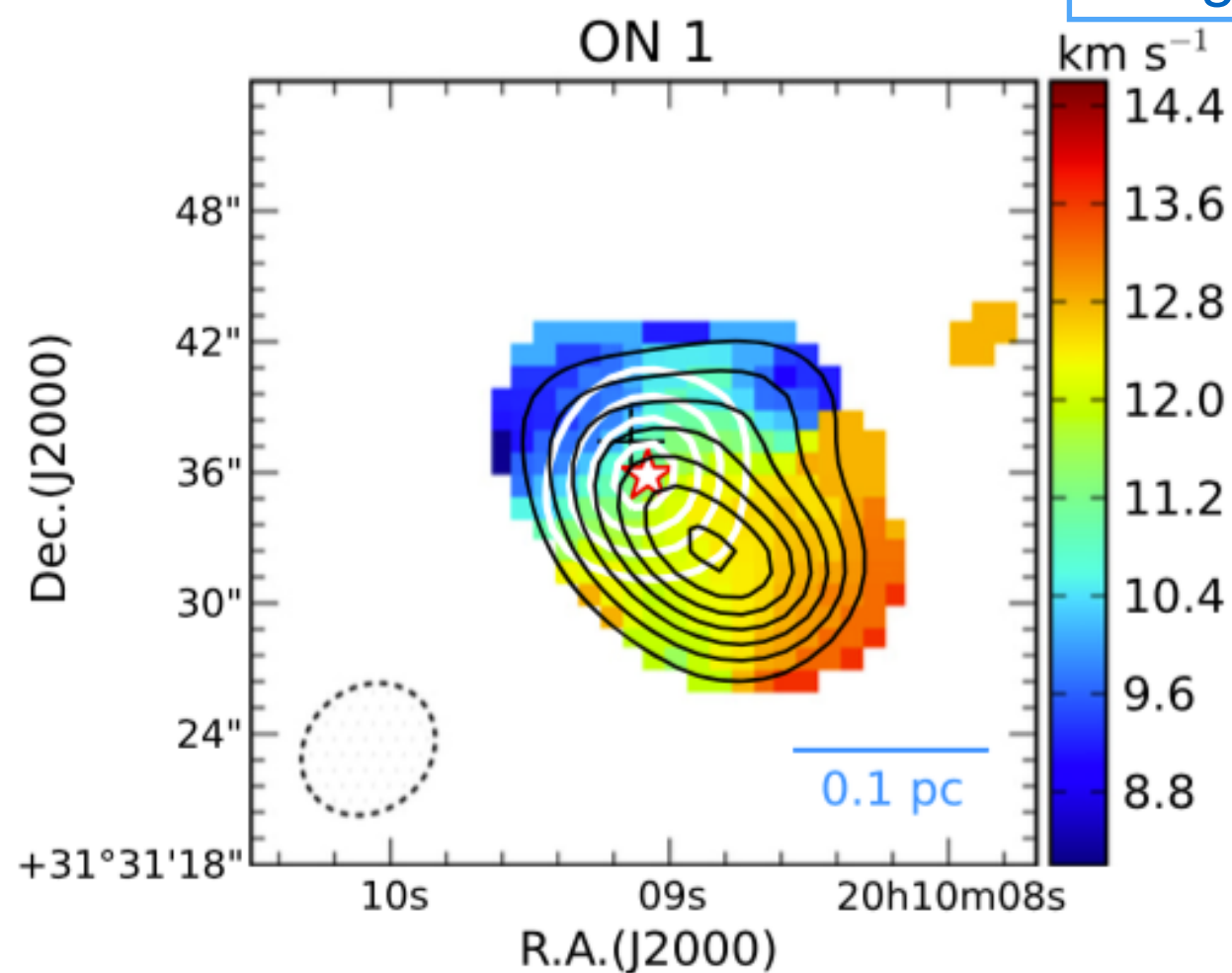
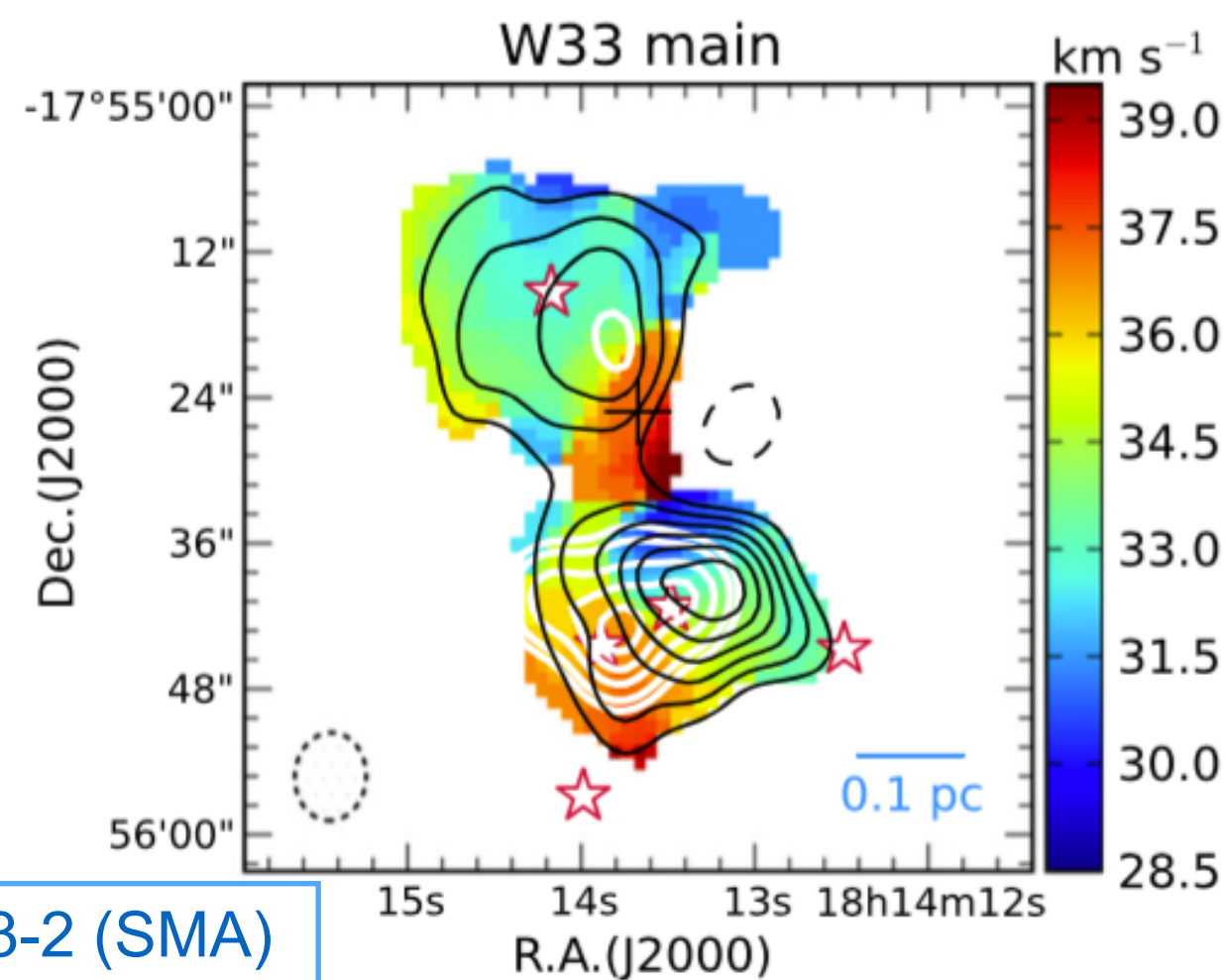
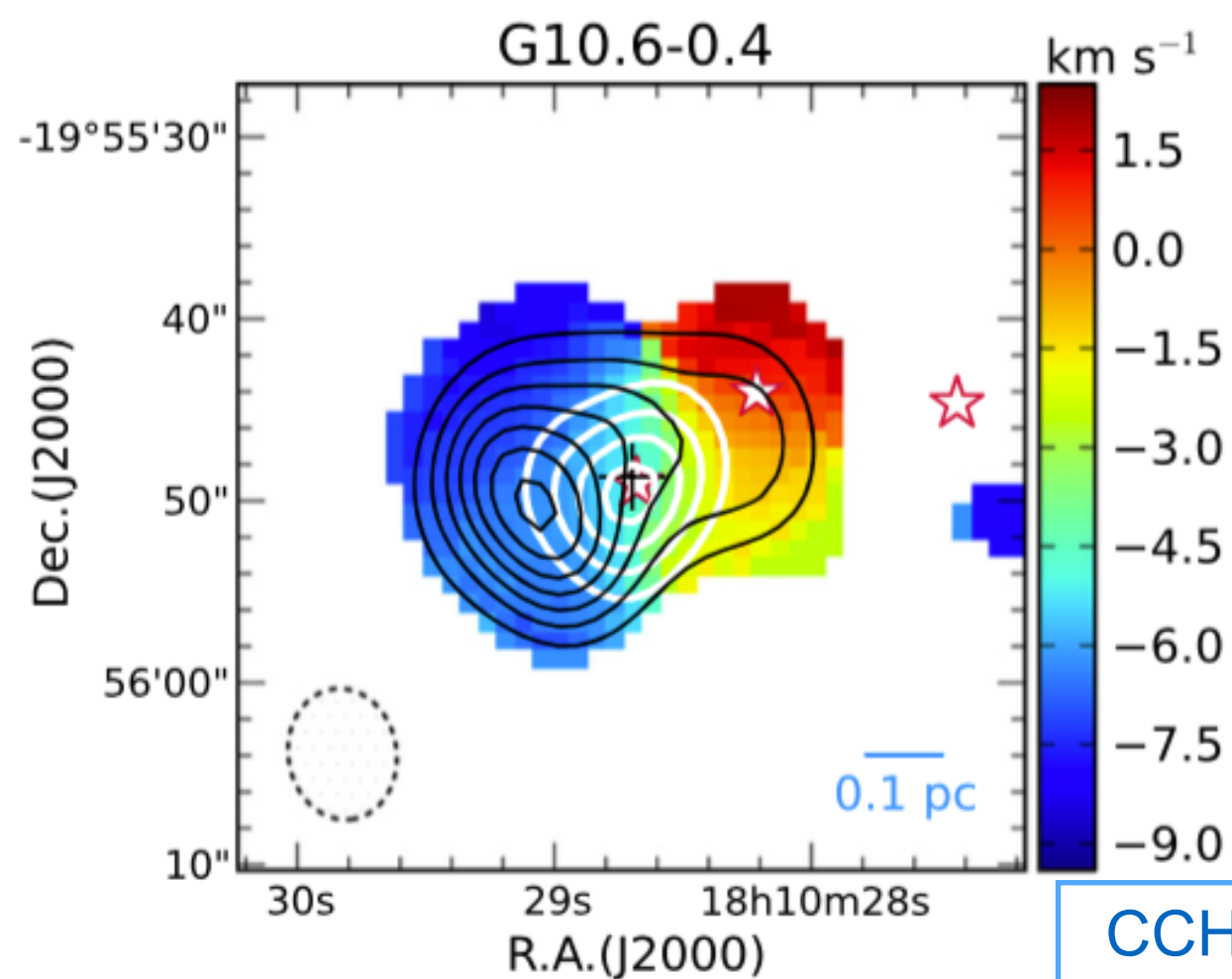
Motivation - hydrocarbons

- ❖ Star formation - Astrochemistry
- ❖ simple, abundant hydrocarbon
Ethynyl: C_2H
- ❖ carbon chain/ring
 HC_nN ($n=3,5,7\dots$)
- ❖ sensitive to photodissociation region (PDR)





Orion Bar (Cuadrado+ 2015)



CCH 3-2 (SMA)
Jiang et al. (2015)

JCMT - sample

selected from (Li+ 2012)

AFGL490

W33main

CepA

W3OH

DR21s

W44

G10.6-0.4

W51M

ON1

W75OH

S76E

NGC2264

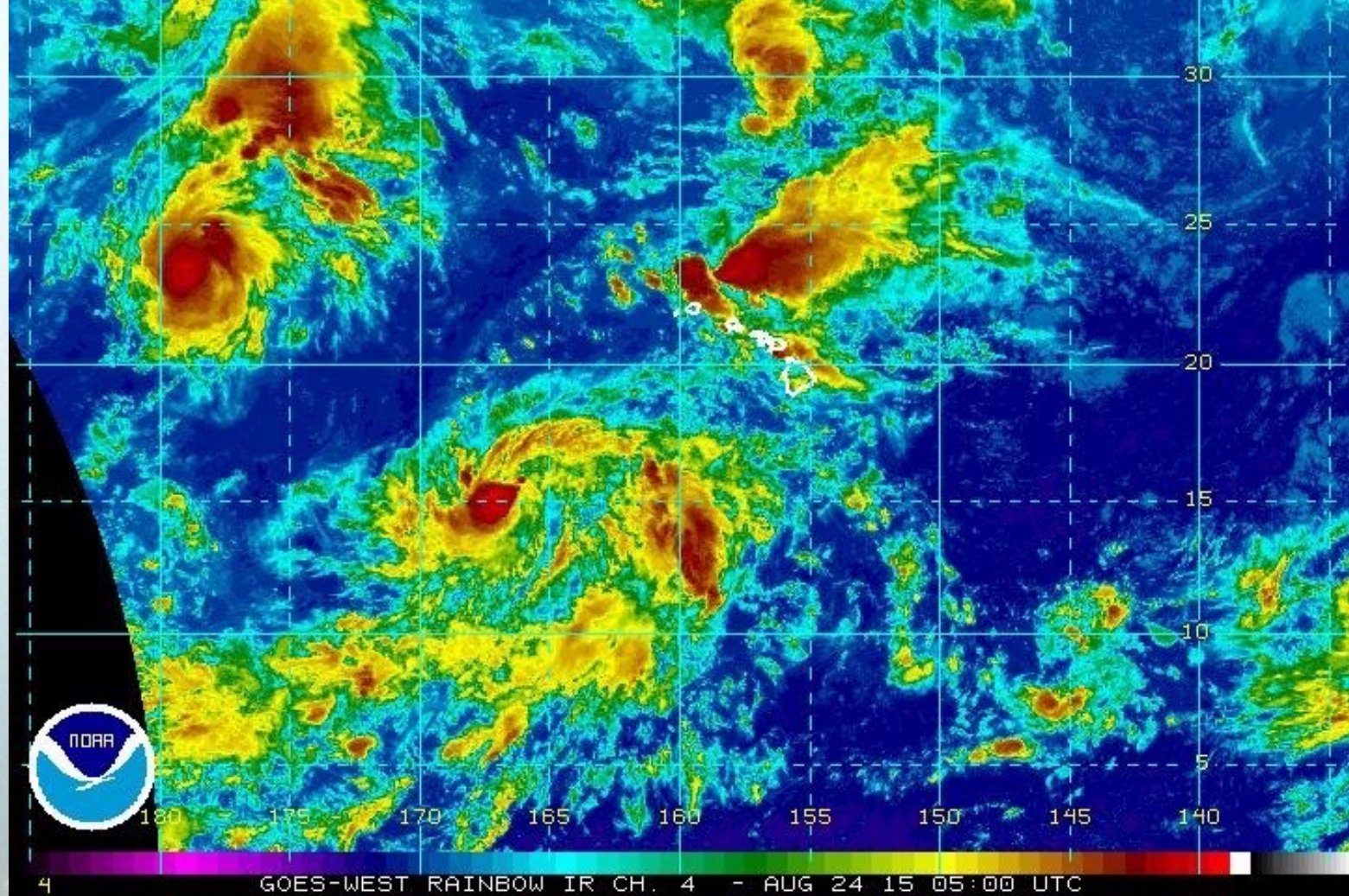
S87

S231

JCMT observation

- ❖ have CCH 1-0 (PMO + CARMA)
CCH 3-2 (CSO + SMA)
- ❖ map CCH 4-3 (349 GHz)
- ❖ HARP (raster scan, 2 to 3')
- ❖ ~32 hours (15AI046+15BI042)
- ❖ band 4 (tau: 0.12 — 0.2)

08/25/2015



Time allocated to project: 27h0m0s in tau range [0.12,0.20]

There is no time remaining on this project

Completion rate: 101%

[Click here to remote eavesdrop](#)

Observations were acquired on the following dates:

[2015-07-30](#) (2.25 hours) click on date to retrieve data

[2015-08-02](#) (7.65 hours) click on date to retrieve data

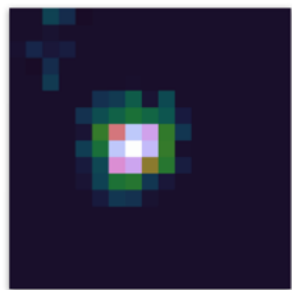
[2015-08-04](#) (8.25 hours) click on date to retrieve data

[2015-08-06](#) (5.95 hours) click on date to retrieve data

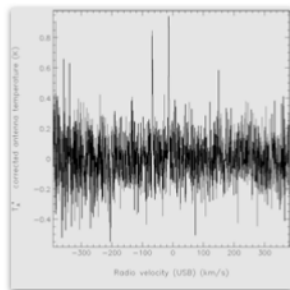
[2015-08-07](#) (1.85 hours) click on date to retrieve data

[2015-08-08](#) (1.40 hours) click on date to retrieve data

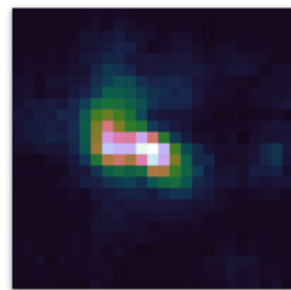
pipeline preview



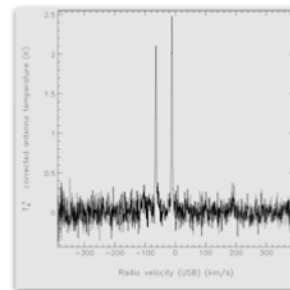
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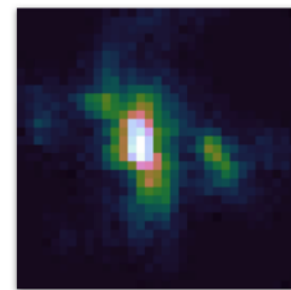
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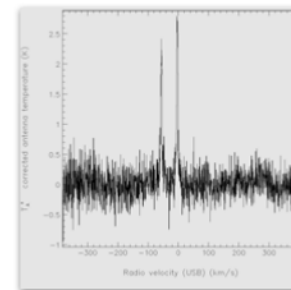
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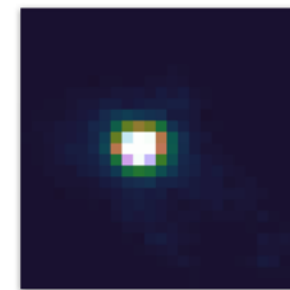
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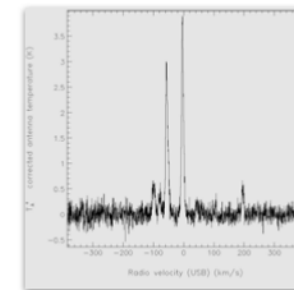
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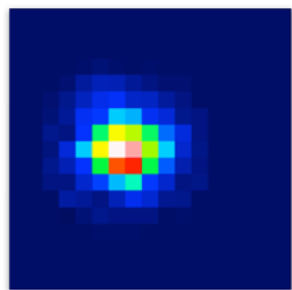
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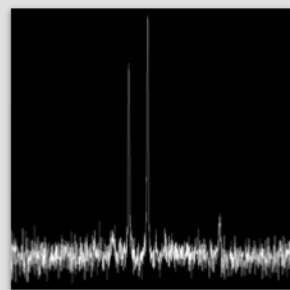
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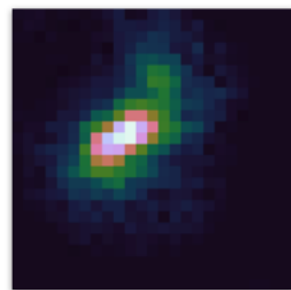
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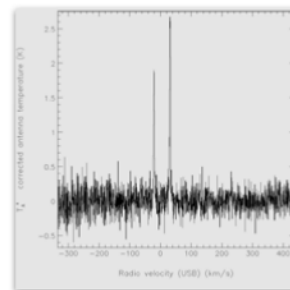
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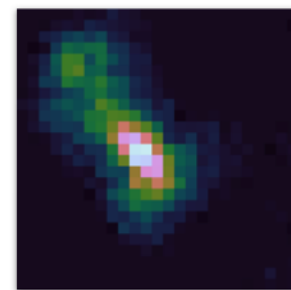
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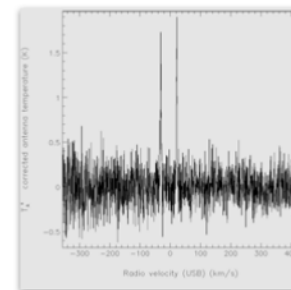
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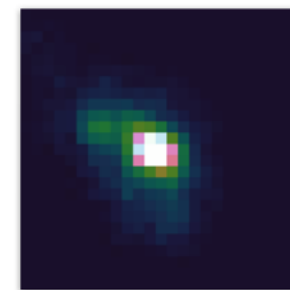
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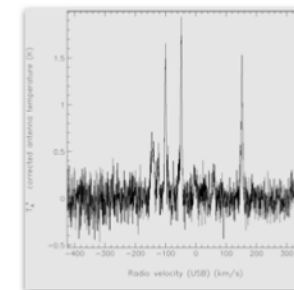
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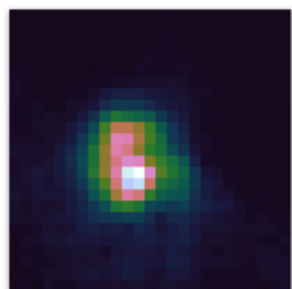
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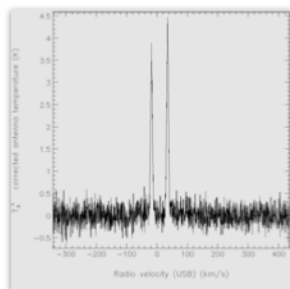
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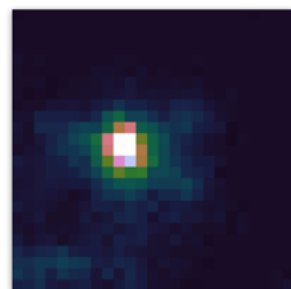
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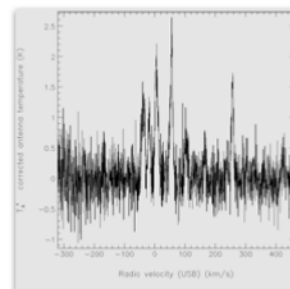
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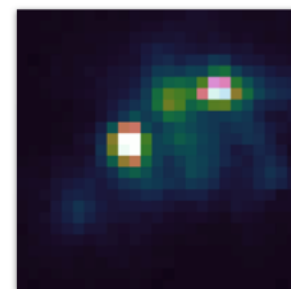
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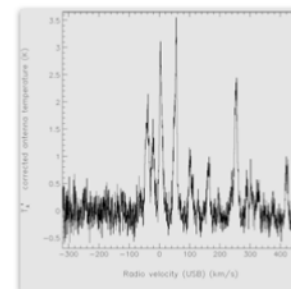
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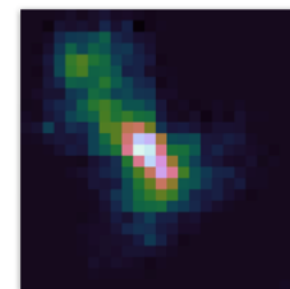
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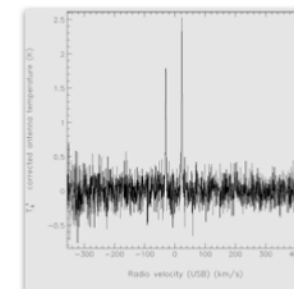
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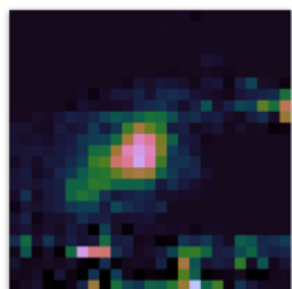
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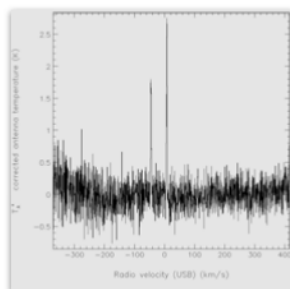
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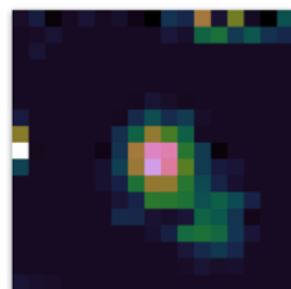
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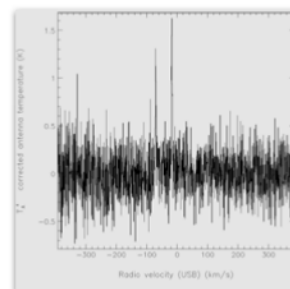
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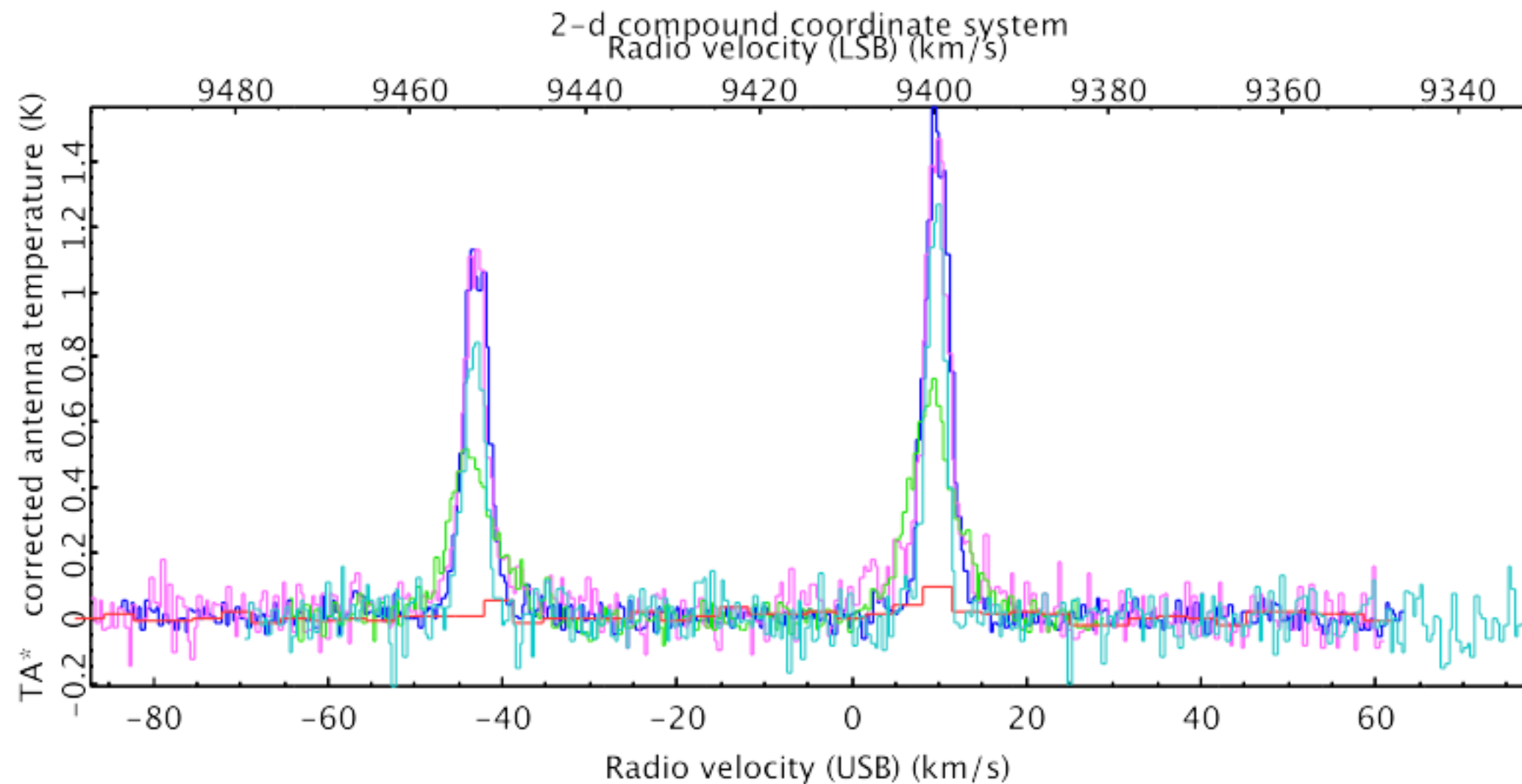
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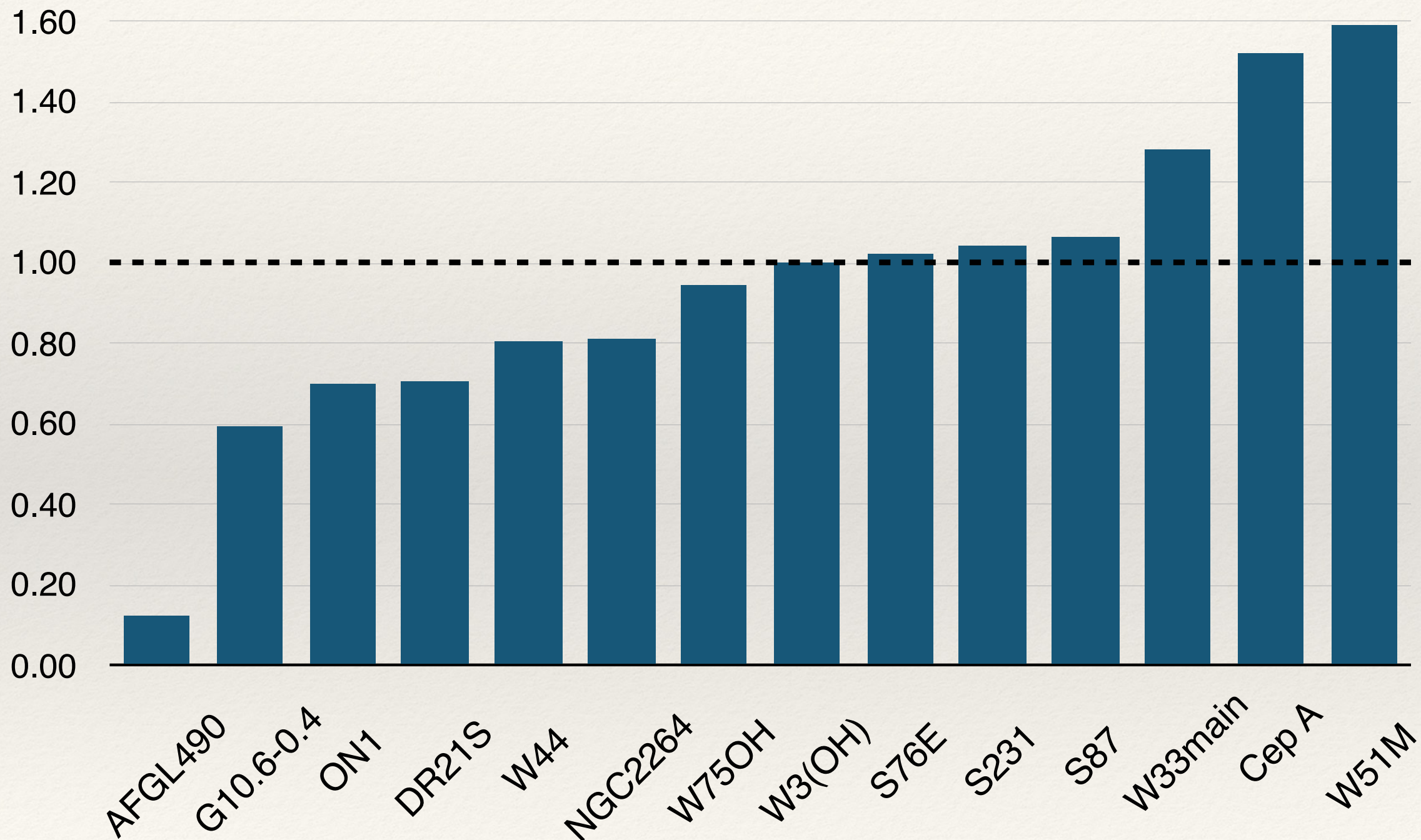
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early results

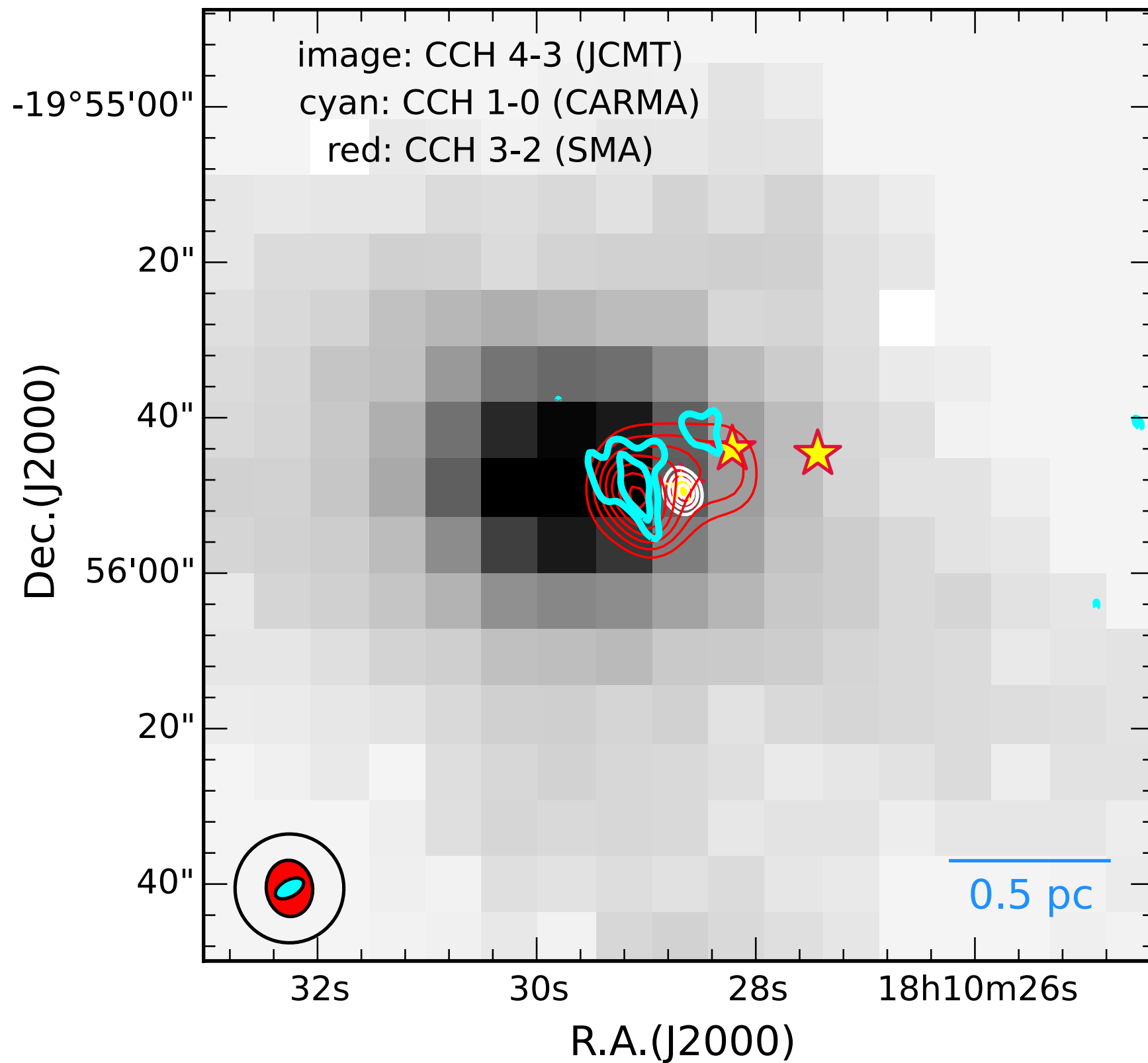
- ❖ hyperfine line ratio (4-3/1-0)
- ❖ ~ 1.3 (optical thin)



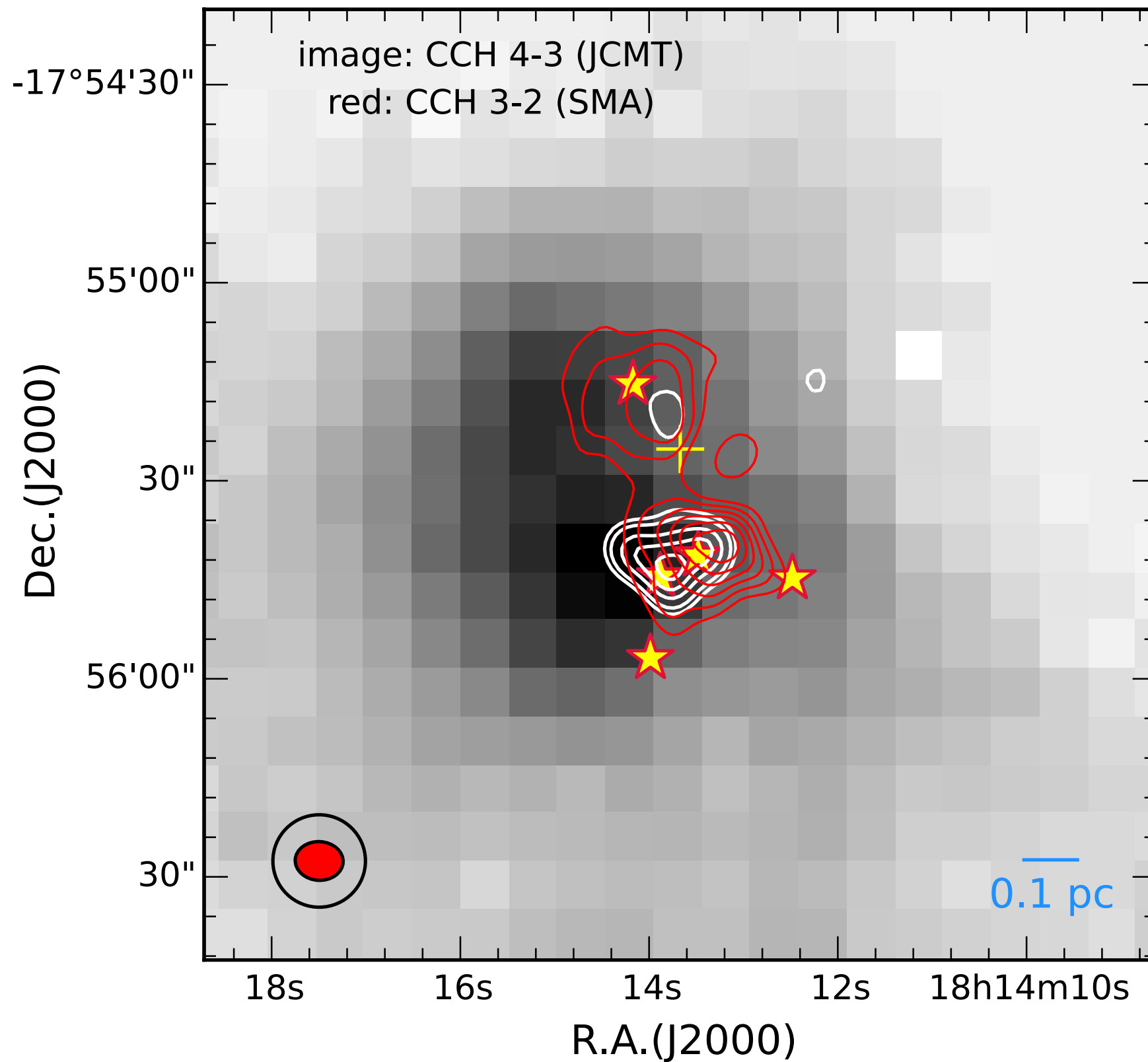
4-3/1-0 flux density ratio

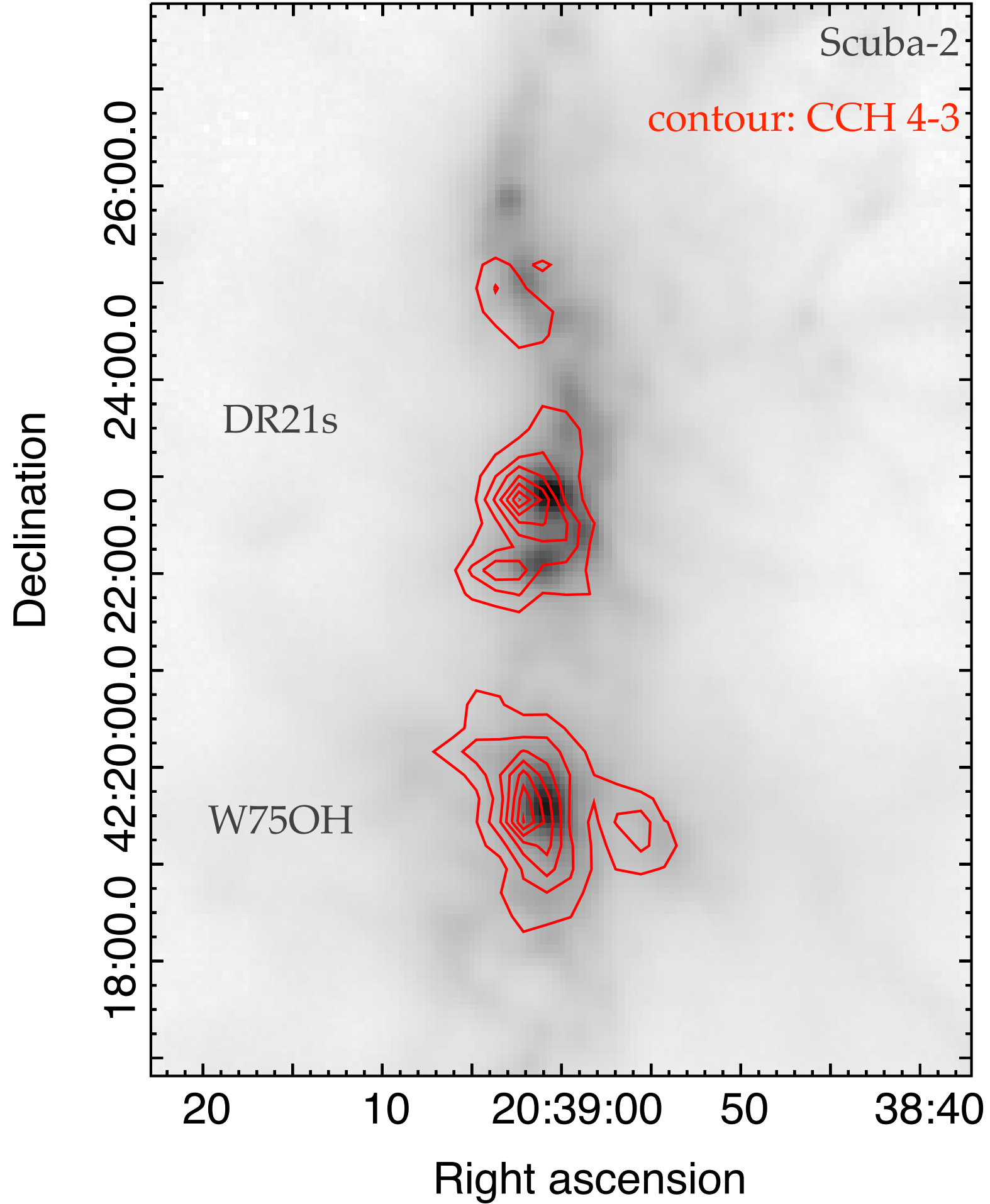


G10.6-0.4

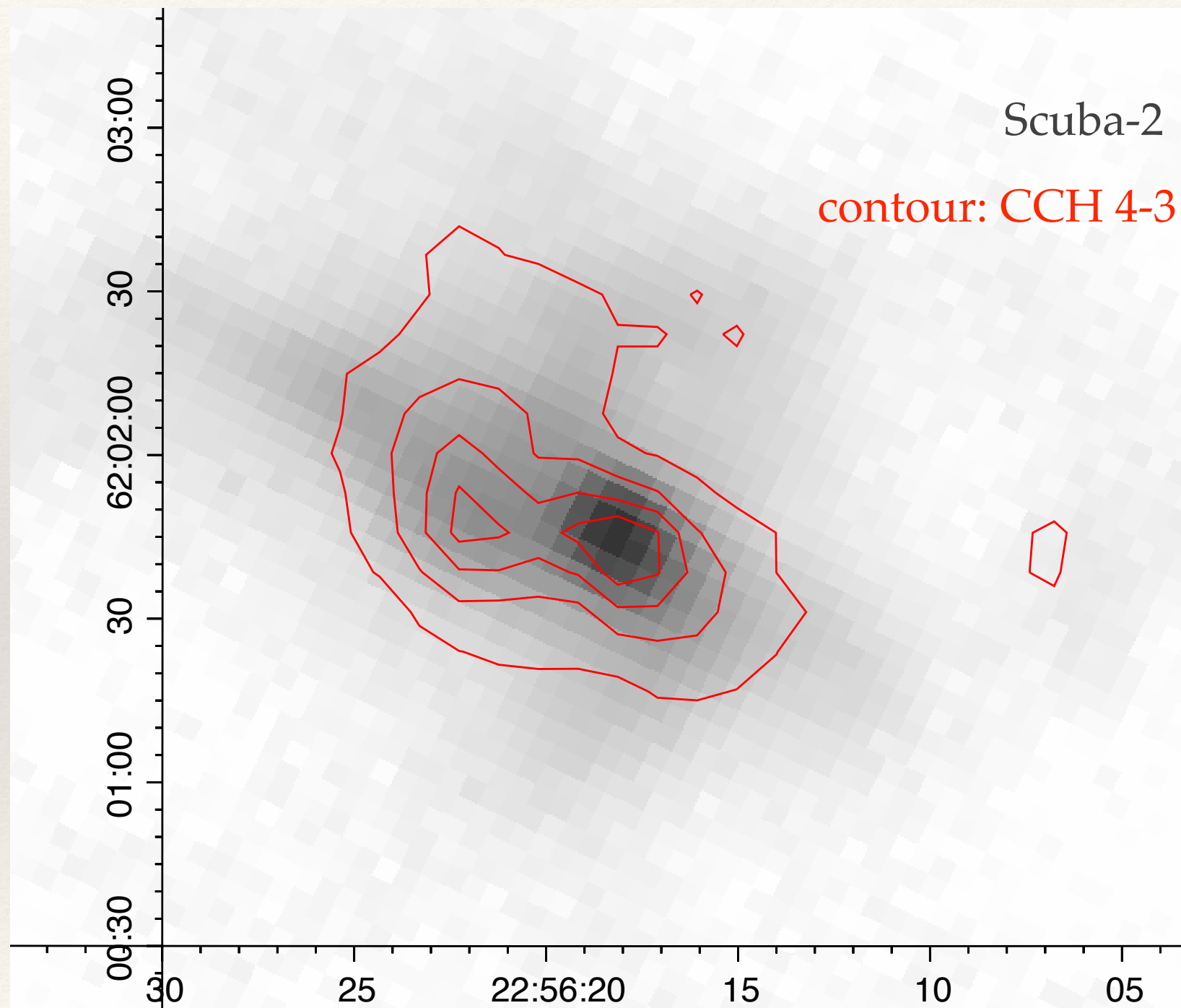


W33 main



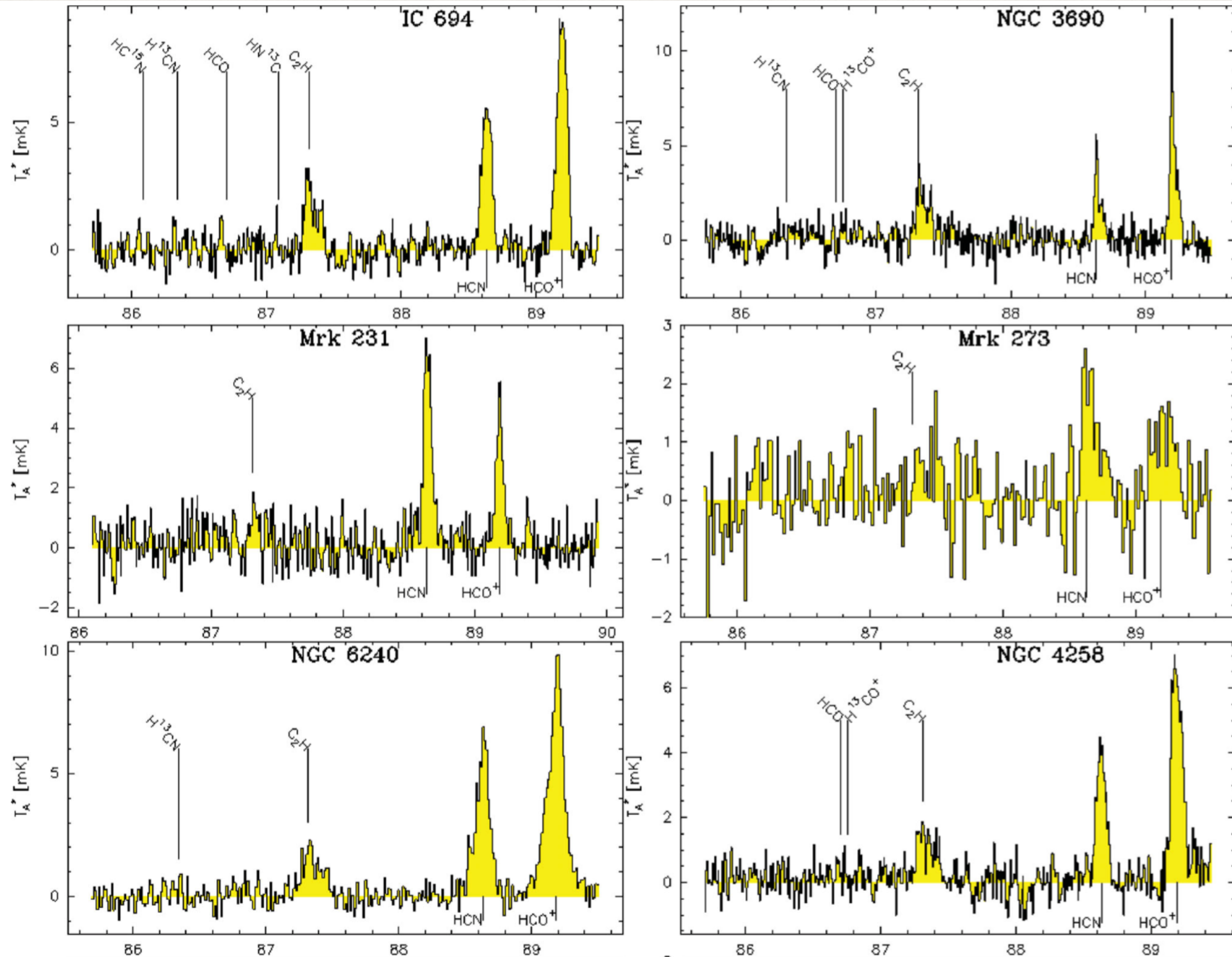


Cep A



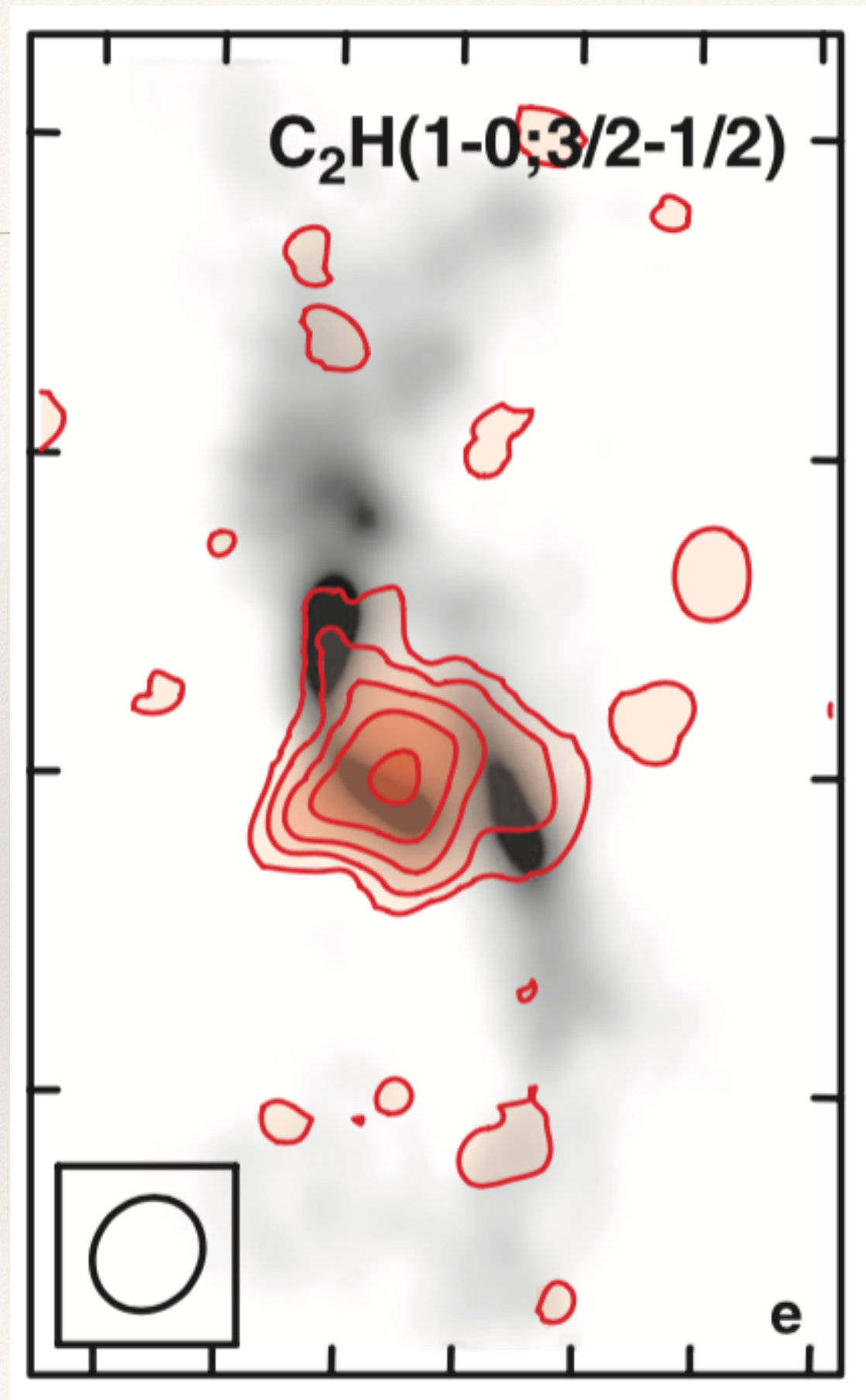
Extragalactic C₂H

- First systematic C₂H detections in active galaxies (IRAM 30m, Jiang+ 2011)



IC 342
circumnuclear region

Meier & Tuner 2005



plans

- ❖ Measurement - abundance, distribution
- ❖ PDR information
- ❖ other types of clouds (IRDC etc.)
- ❖ comparison with other lines
(CO, HCN, etc.)
spatial distribution & intensity ratio
- ❖ chemical model

