Max-Planck-Institut für
extraterrestrische Physik

Dunlap Institute for Astronomy & Astrophysics
UNIVERSITY OF TORONTO

The Green Bank Ammonia Survey (GAS): First results of NH_3 mapping the Gould Belt

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H. Chen (Harvard), M. Chen (UVic), J. Di Francesco (UVic),
A. Ginsburg (ESO), A. Goodman (Harvard), F. Heitsch (UNC),
J. Keown (UVic), H. Kirk (NRC Herzberg), P. Martin (Toronto),
C. Matzner (Toronto), P. C. Myers (Harvard), S. Offner (UMass),
A. Punanova (MPE), E. Rosolowsky (Alberta),
Y. Seo (Arizona), and Y. Shirley (Arizona)

From Molecular Cloud to Dense Cores

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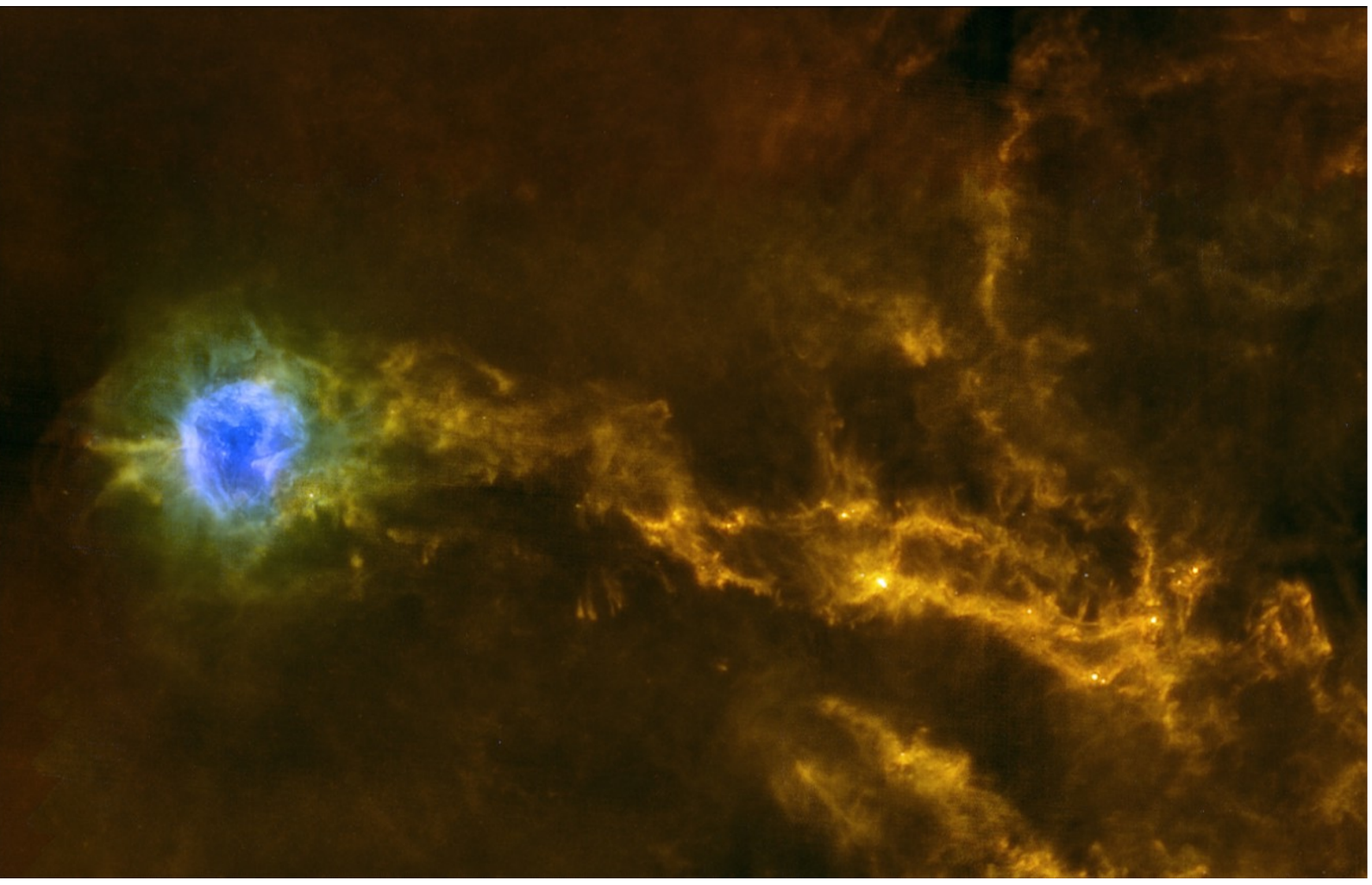
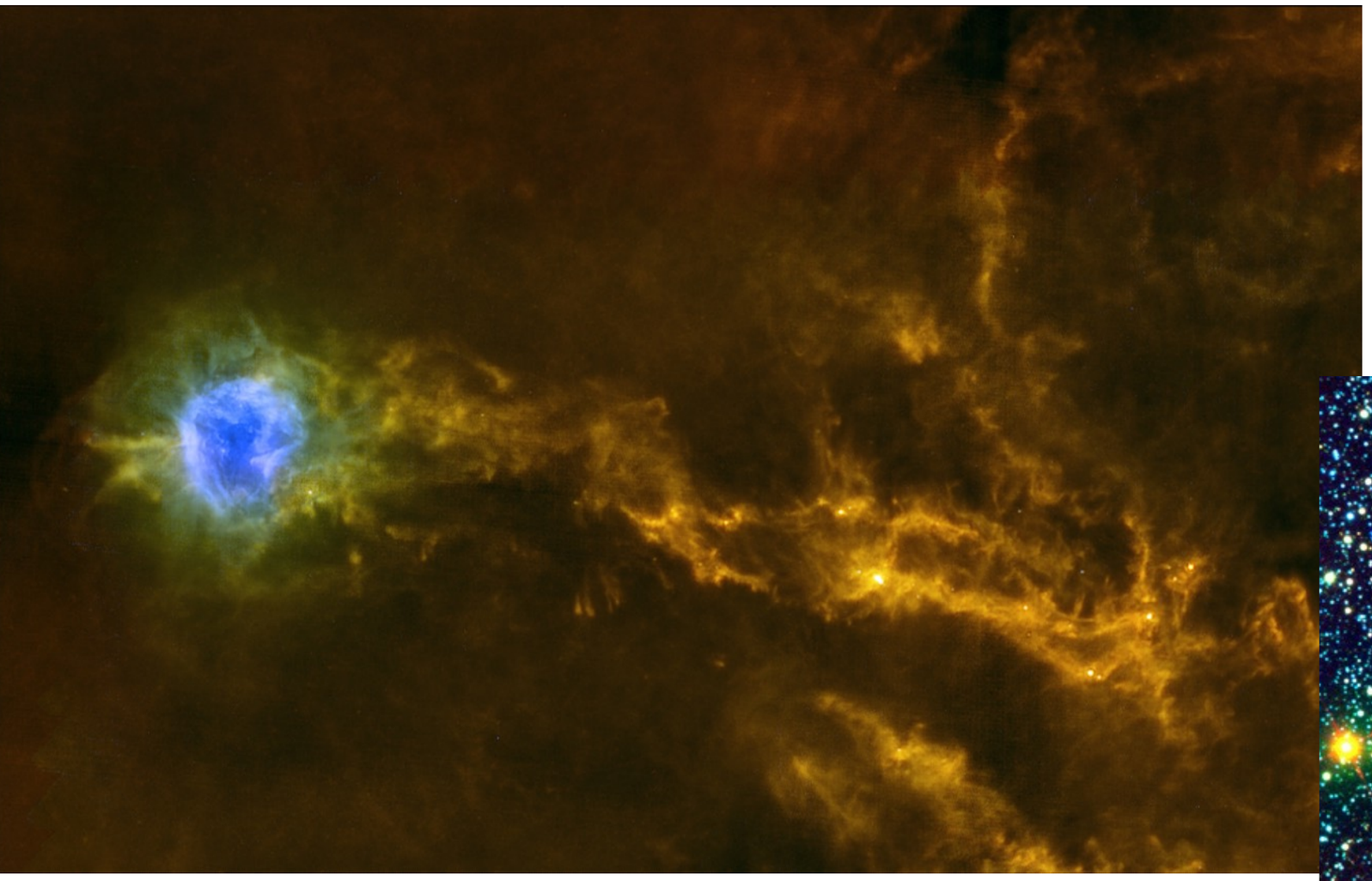


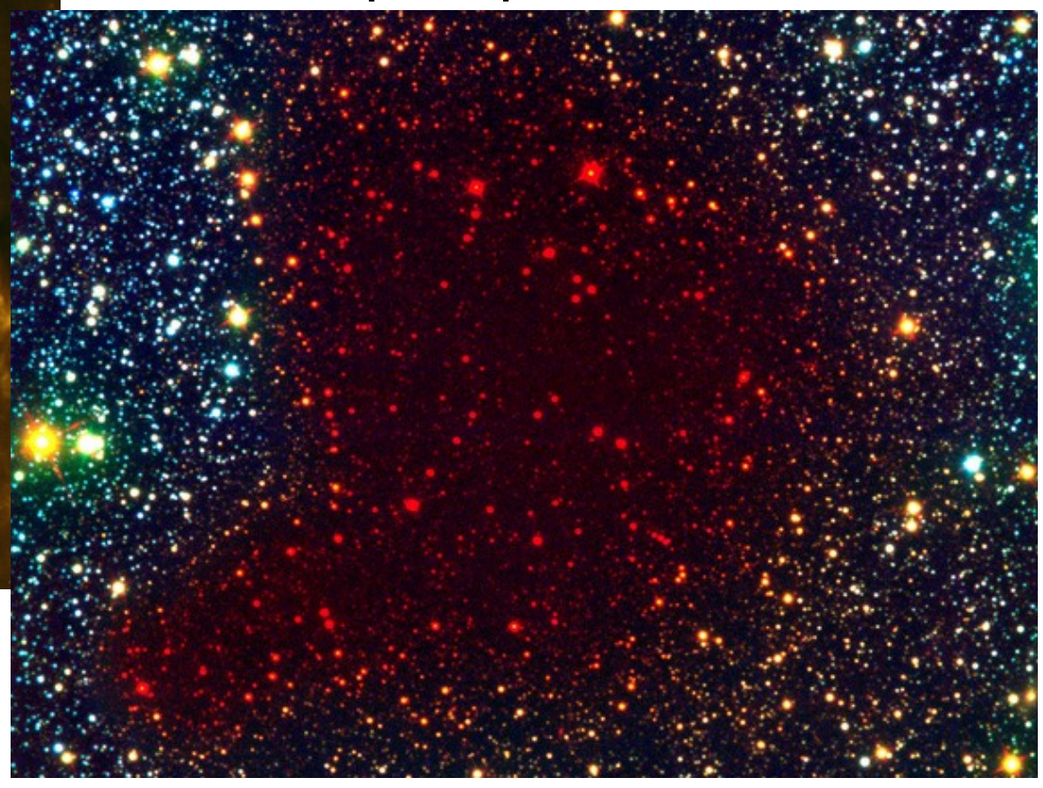
Herschel shows presence of filamentary structures in nearby clouds (Andre et al., 2014)

From Molecular Cloud to Dense Cores



Herschel shows presence of filamentary structures in nearby clouds (Andre et al., 2014)

How do we connect to Cores?
What are Cores properties



What is the effect of the molecular cloud?

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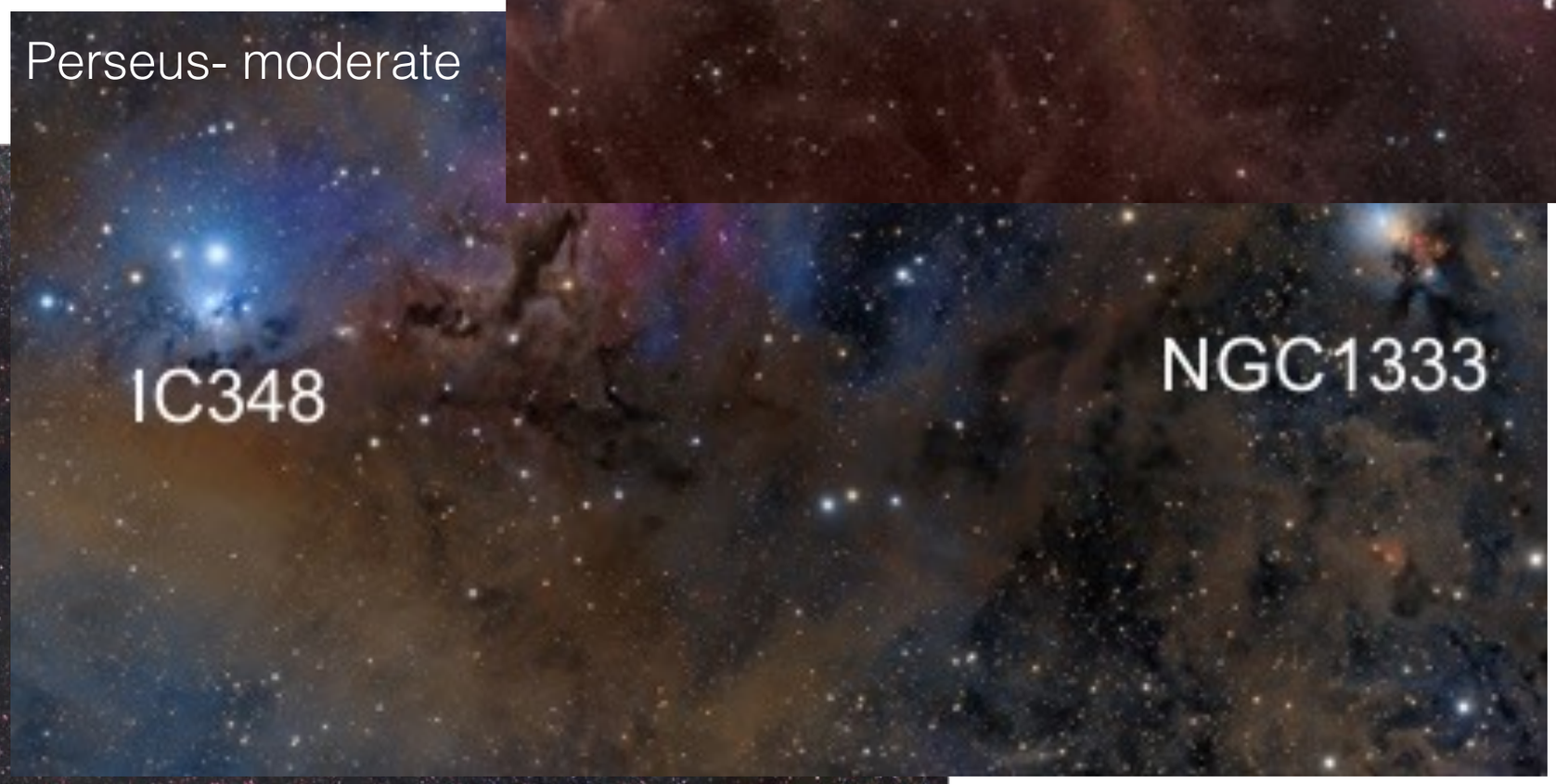
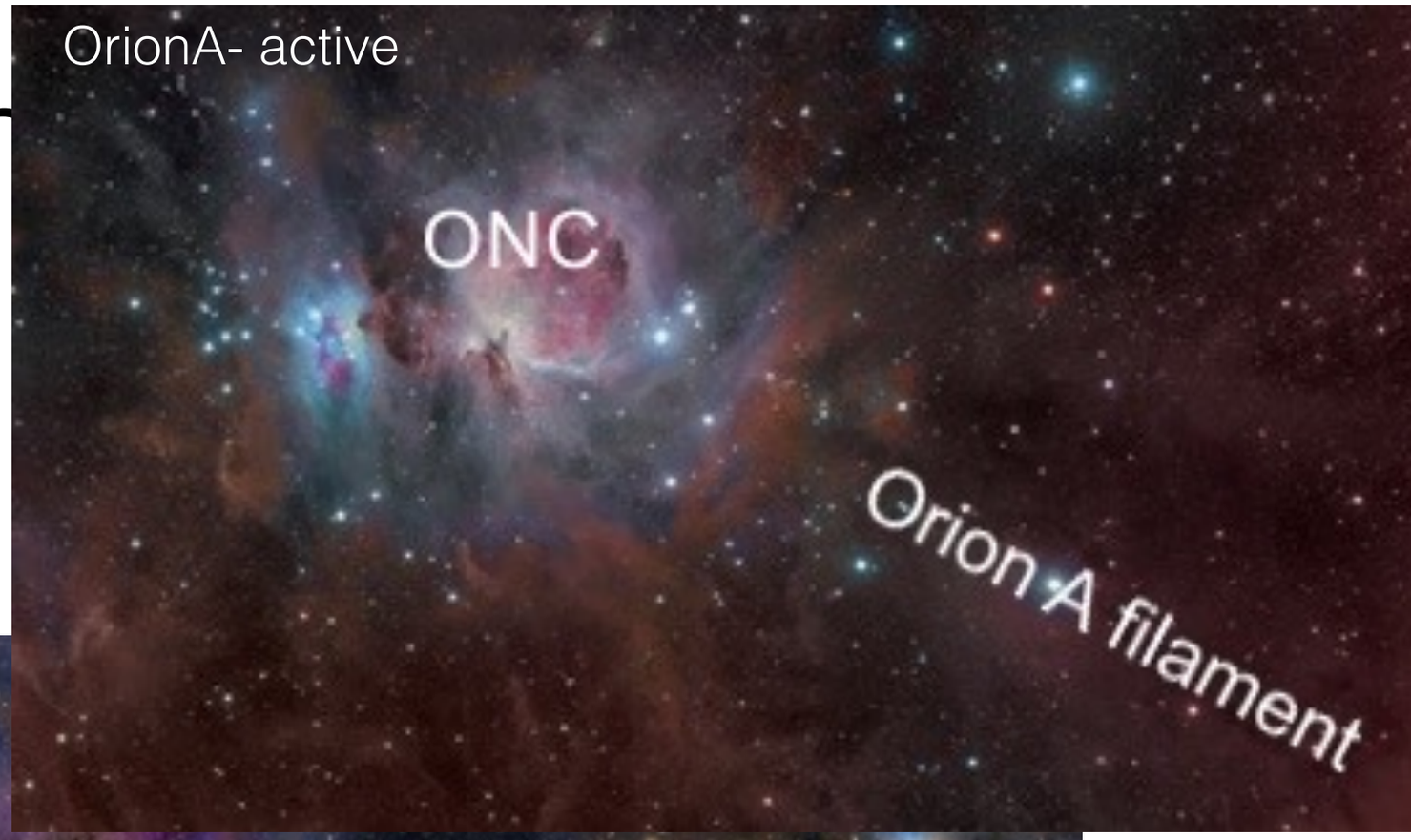
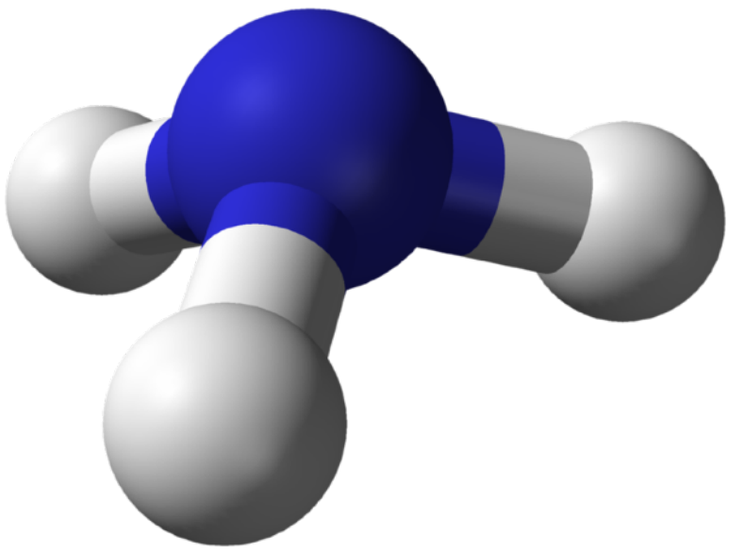
What is th
molec

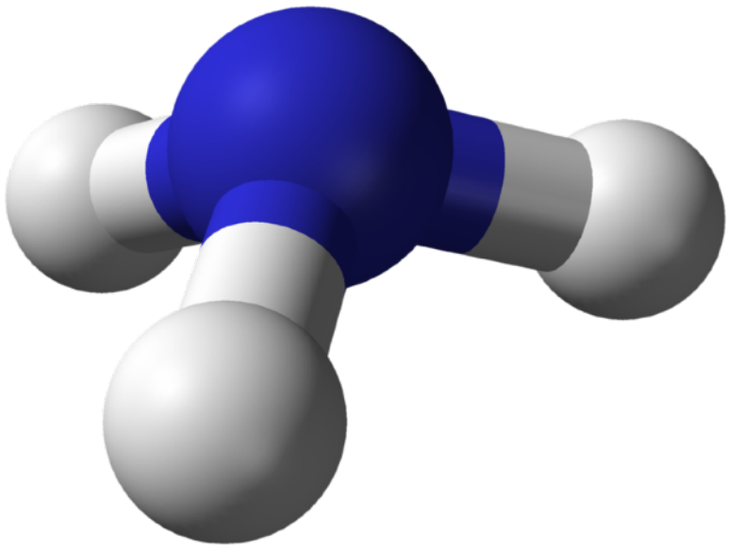




http://www.astropix.com/



NH_3 as a tool



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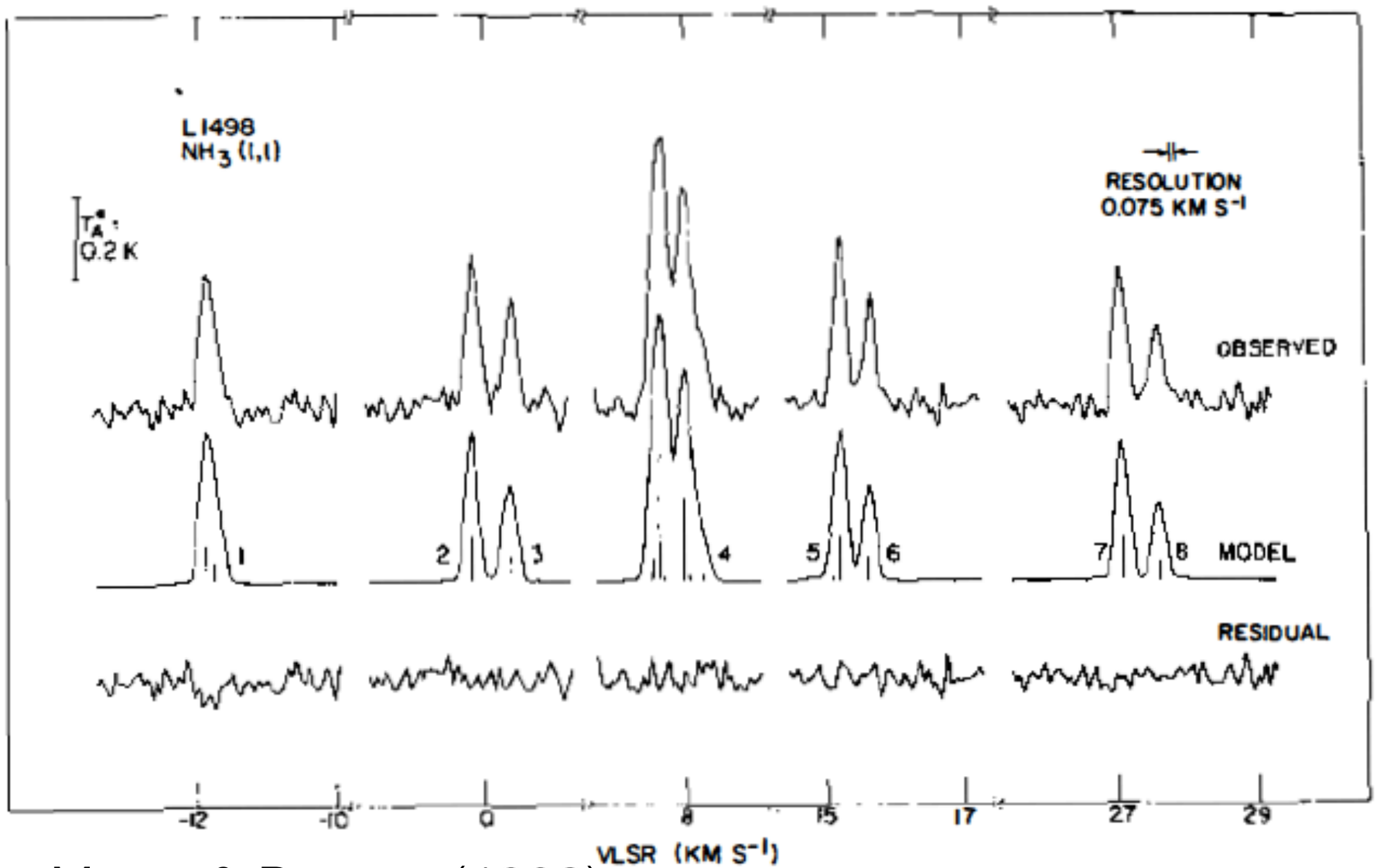
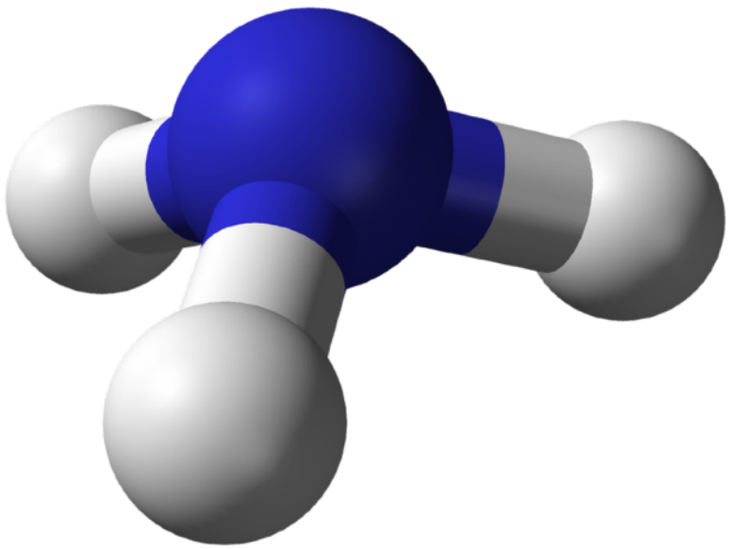
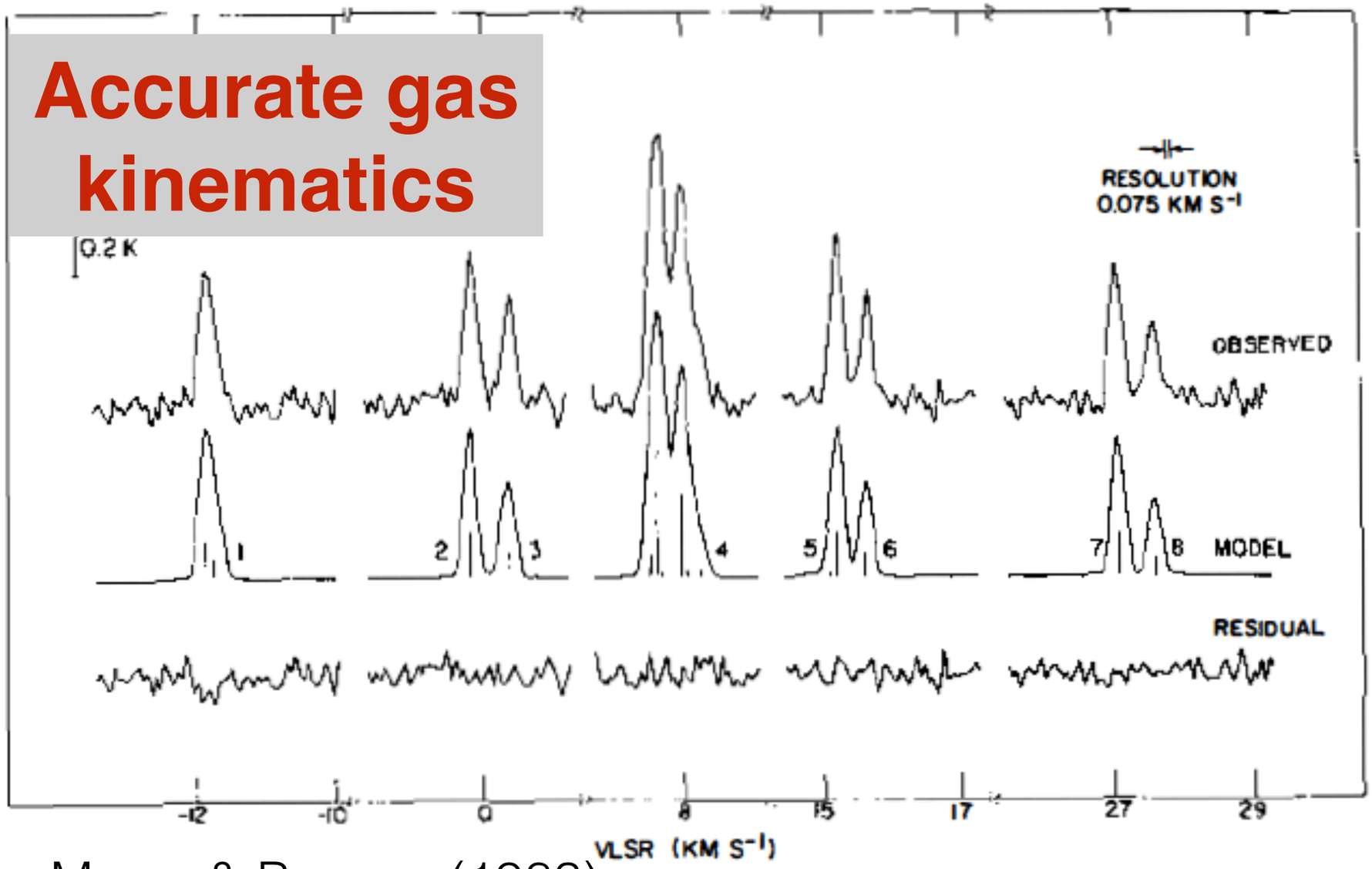


Myers & Benson (1983)



NH_3 as a tool

Accurate gas kinematics



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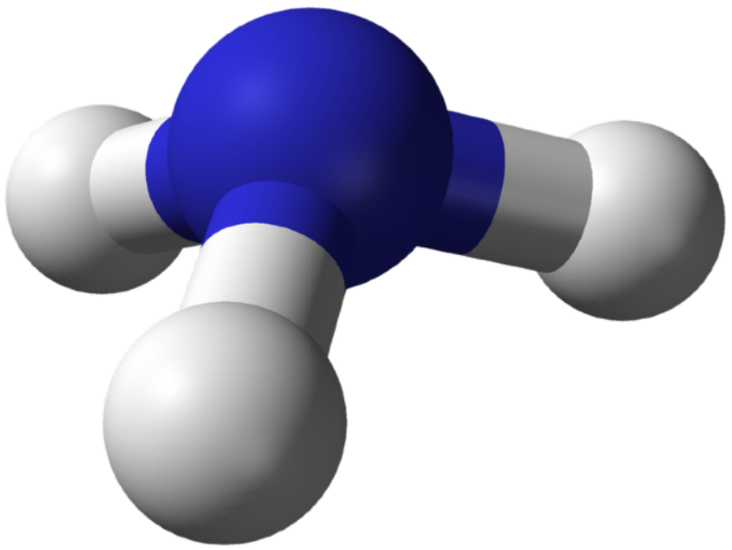

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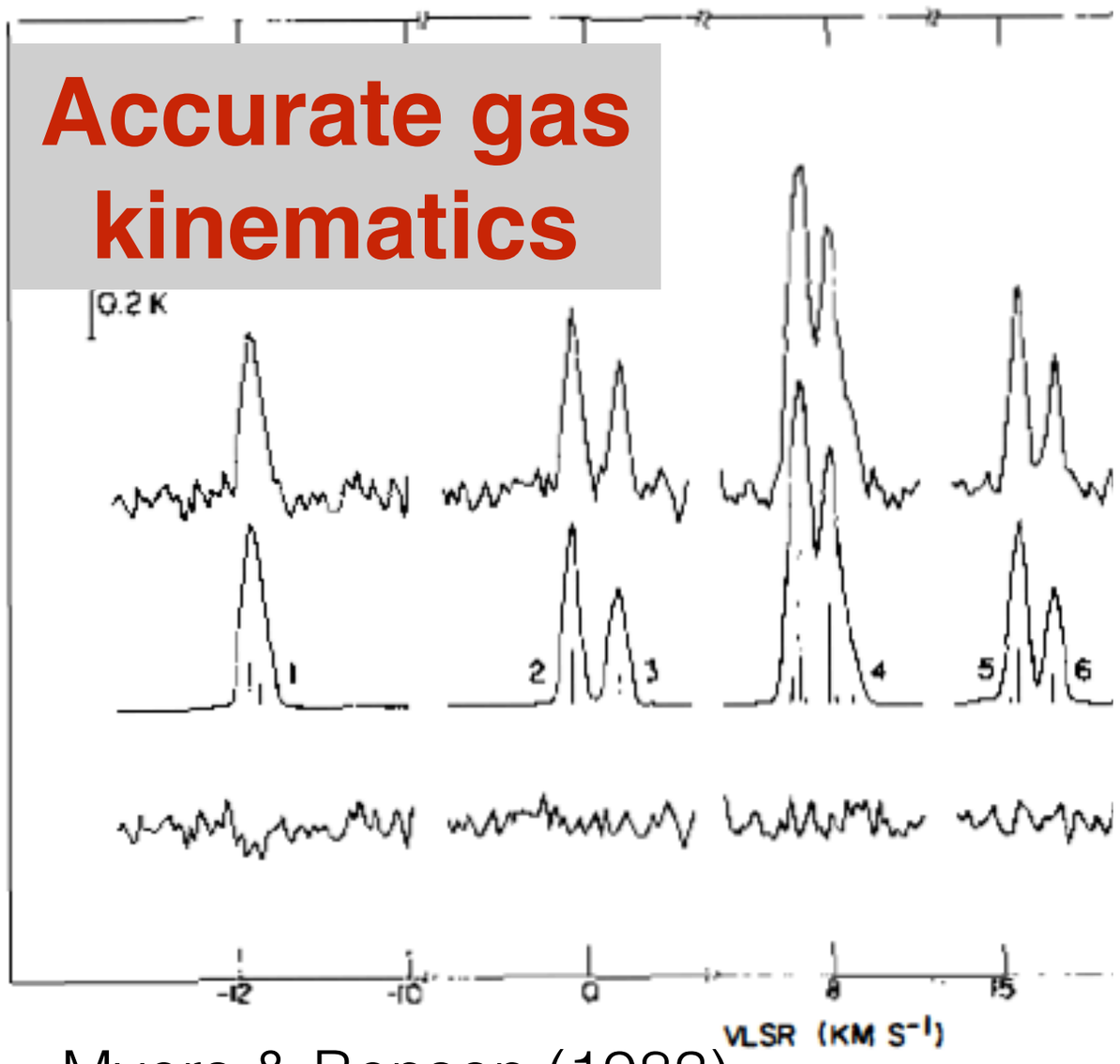

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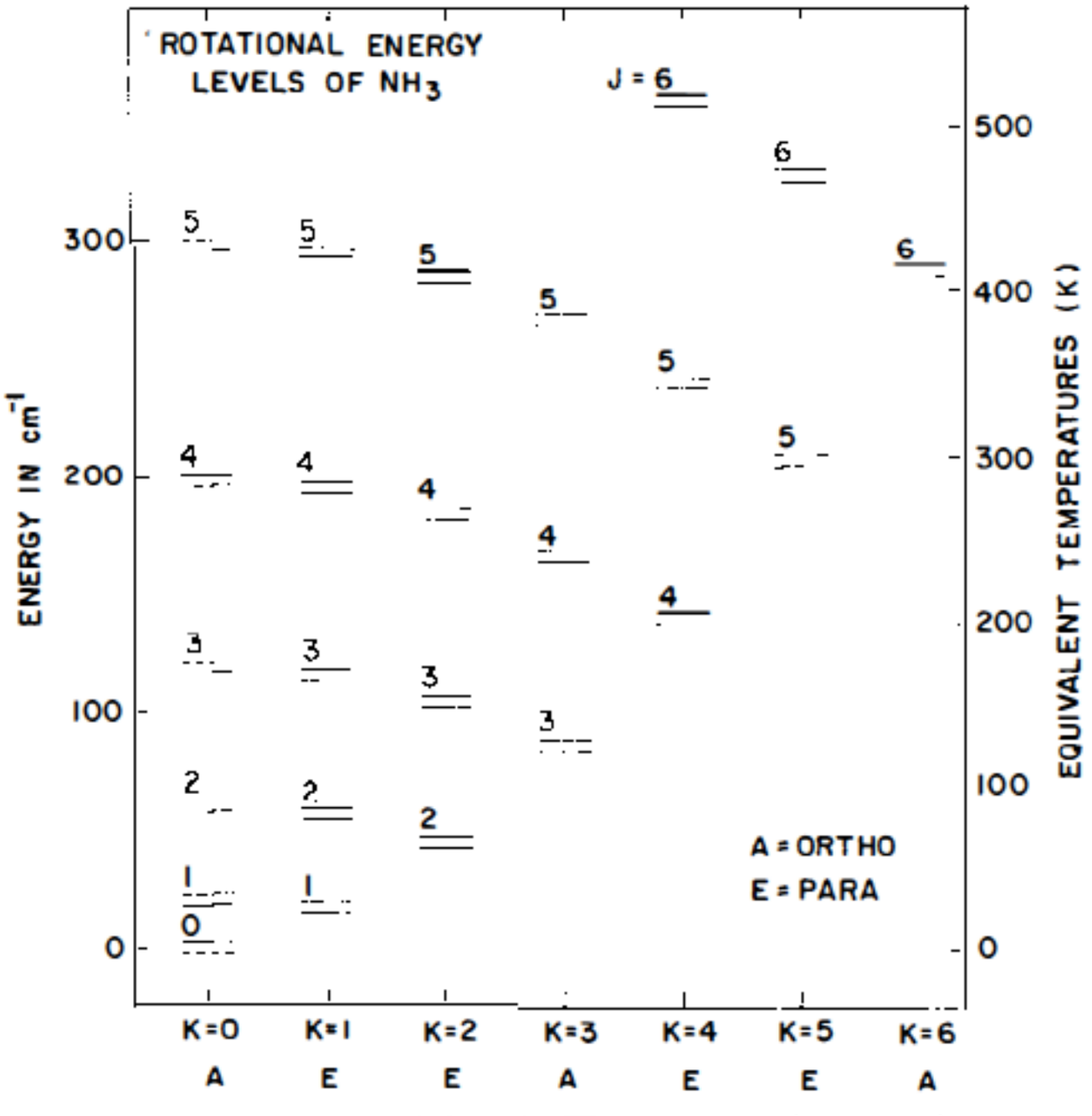
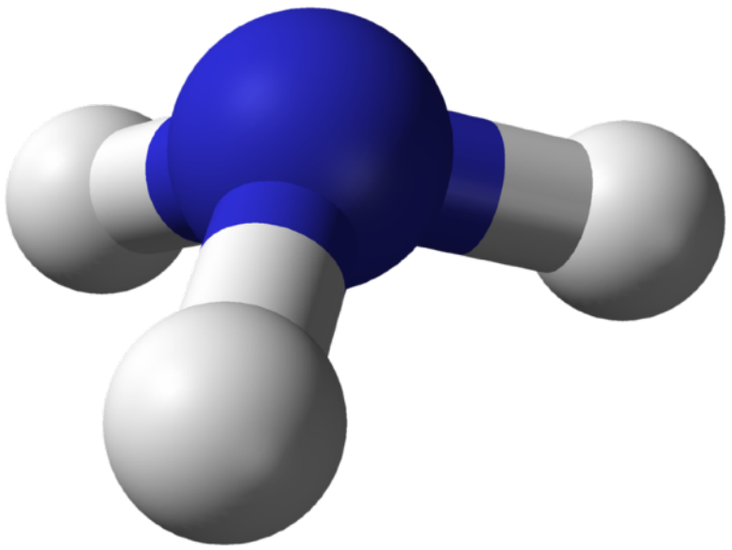


Ho & Townes (1983)



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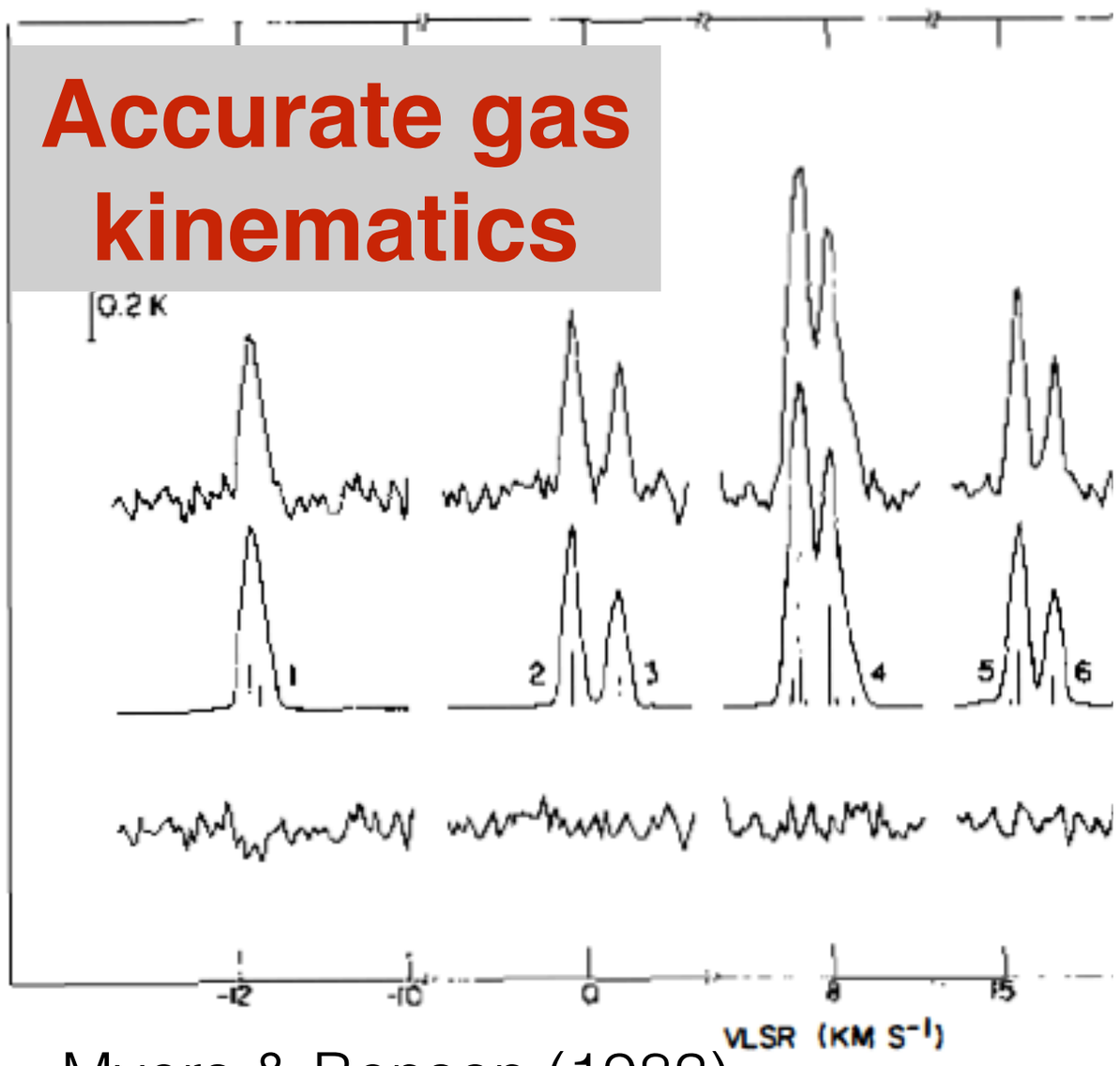

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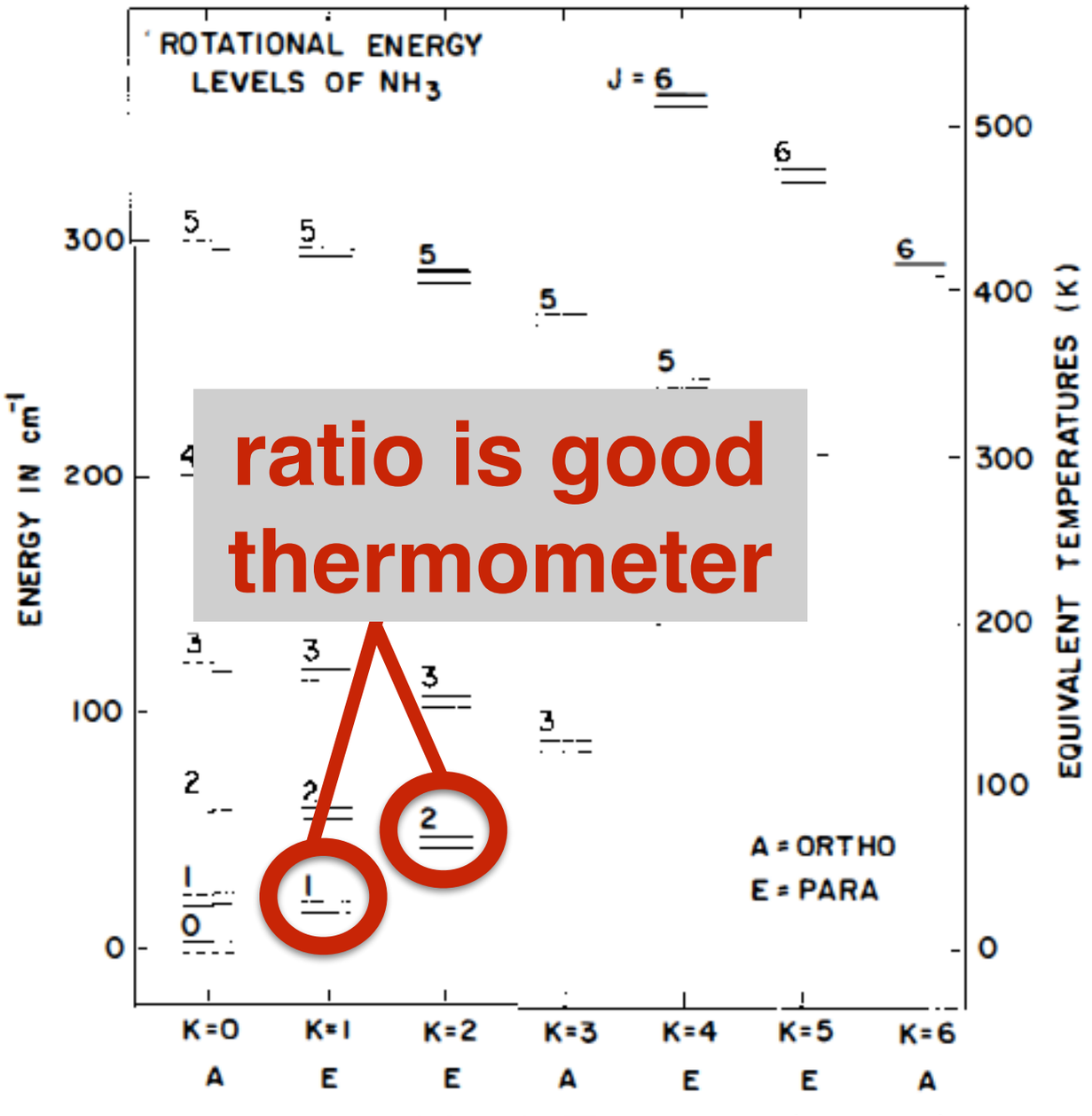


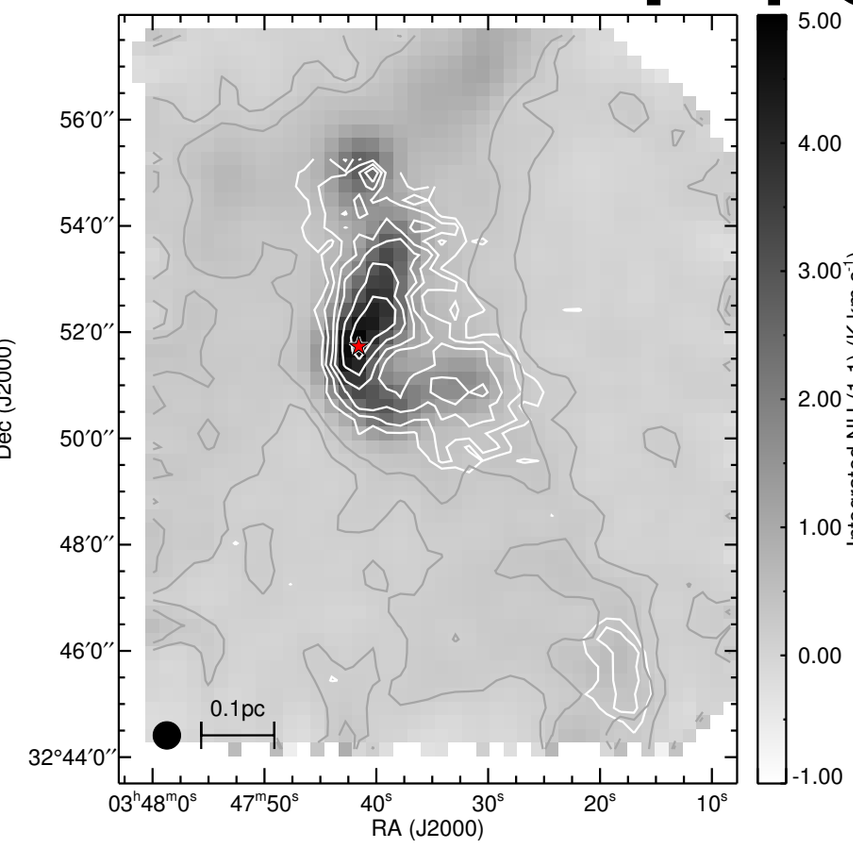
ratio is good thermometer

Ho & Townes (1983)

Previous maps

Previous maps

Pineda et al. (2010)



Perseus

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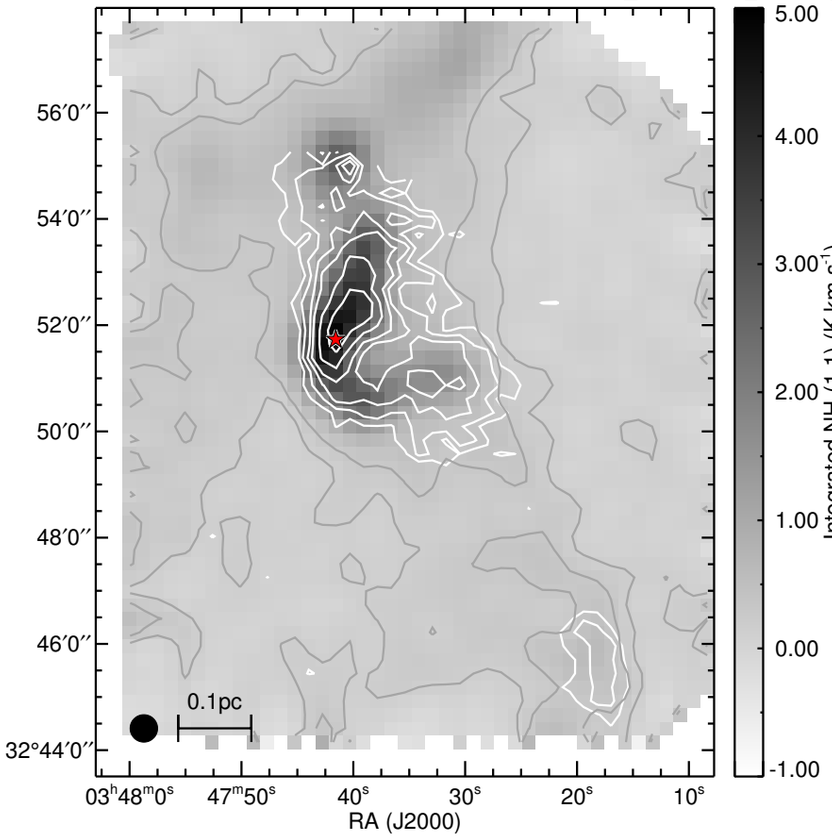
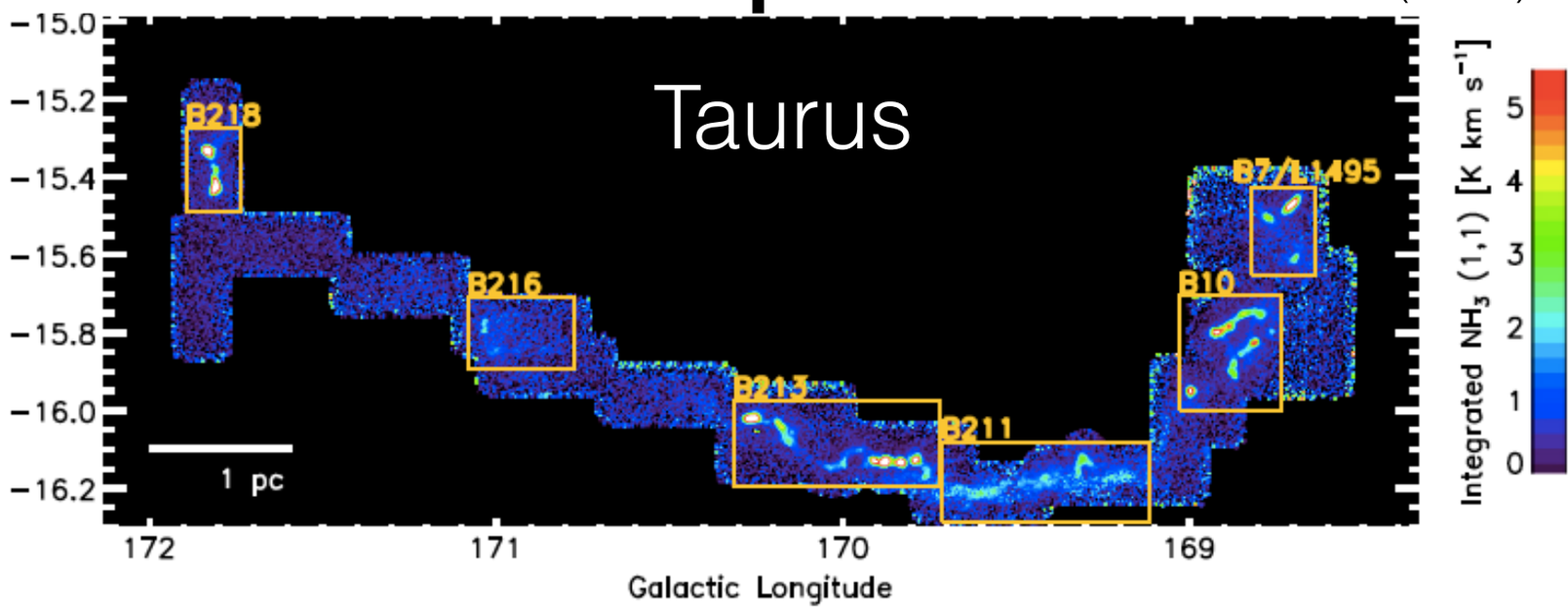


Perseus

Seo et al. (2015)



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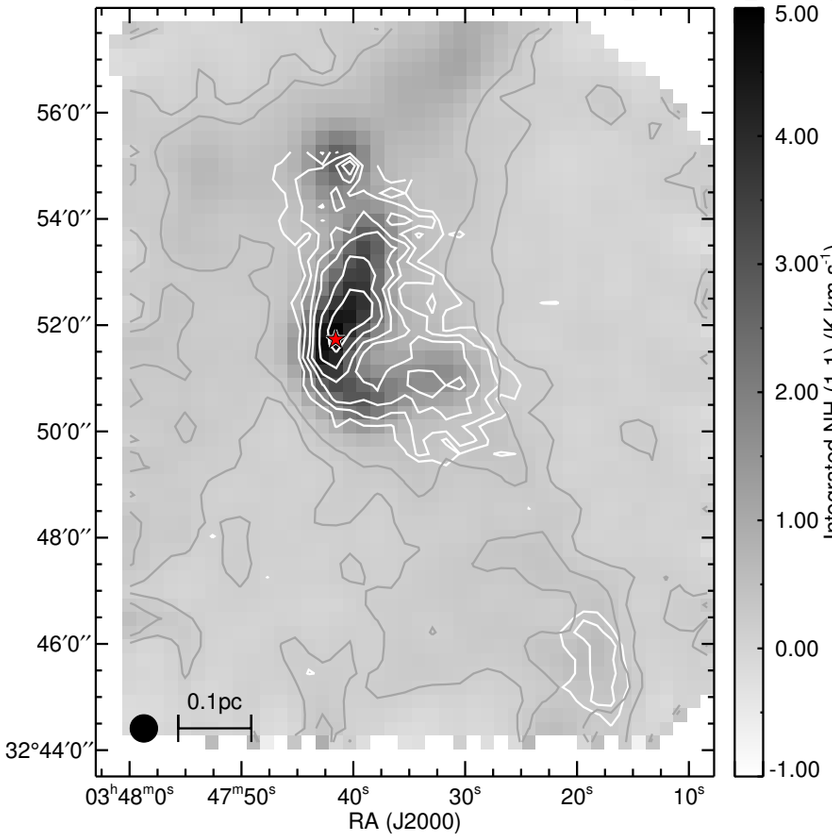

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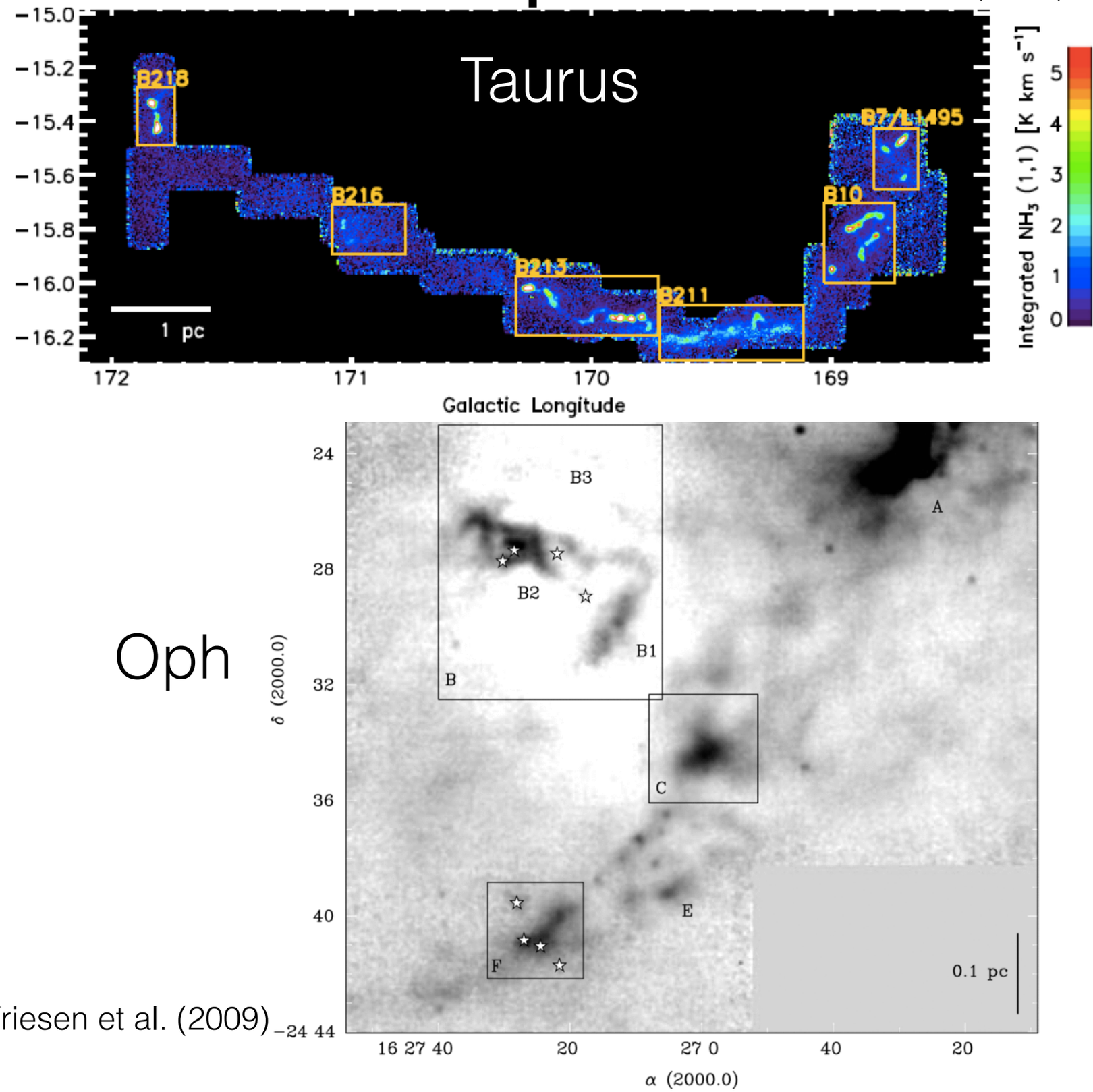

Oph

Friesen et al. (2009)

Previous maps

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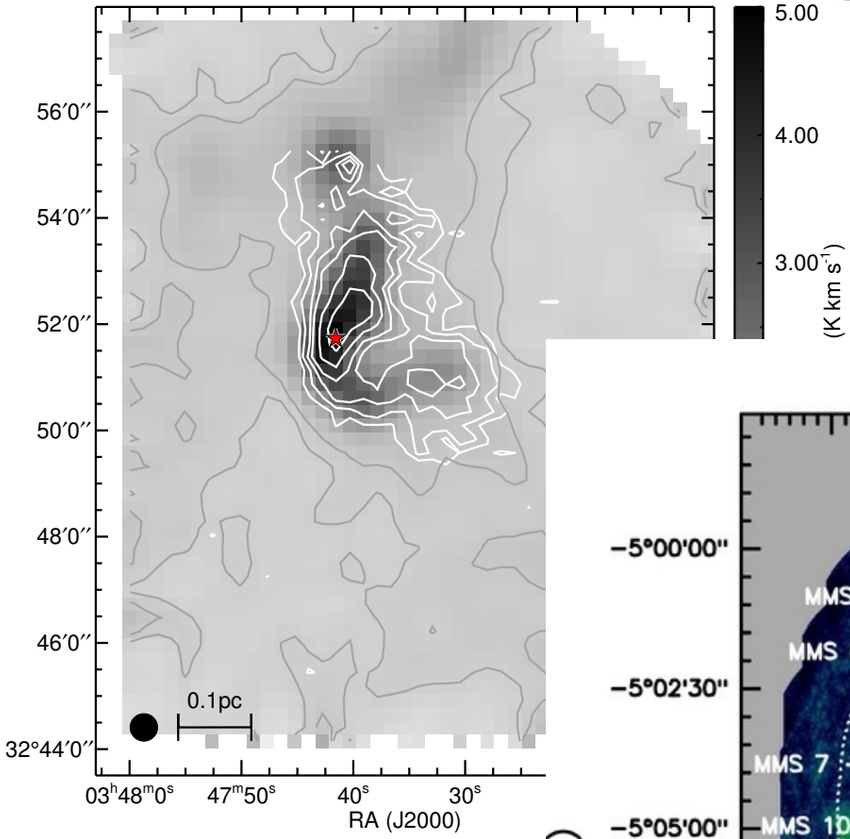
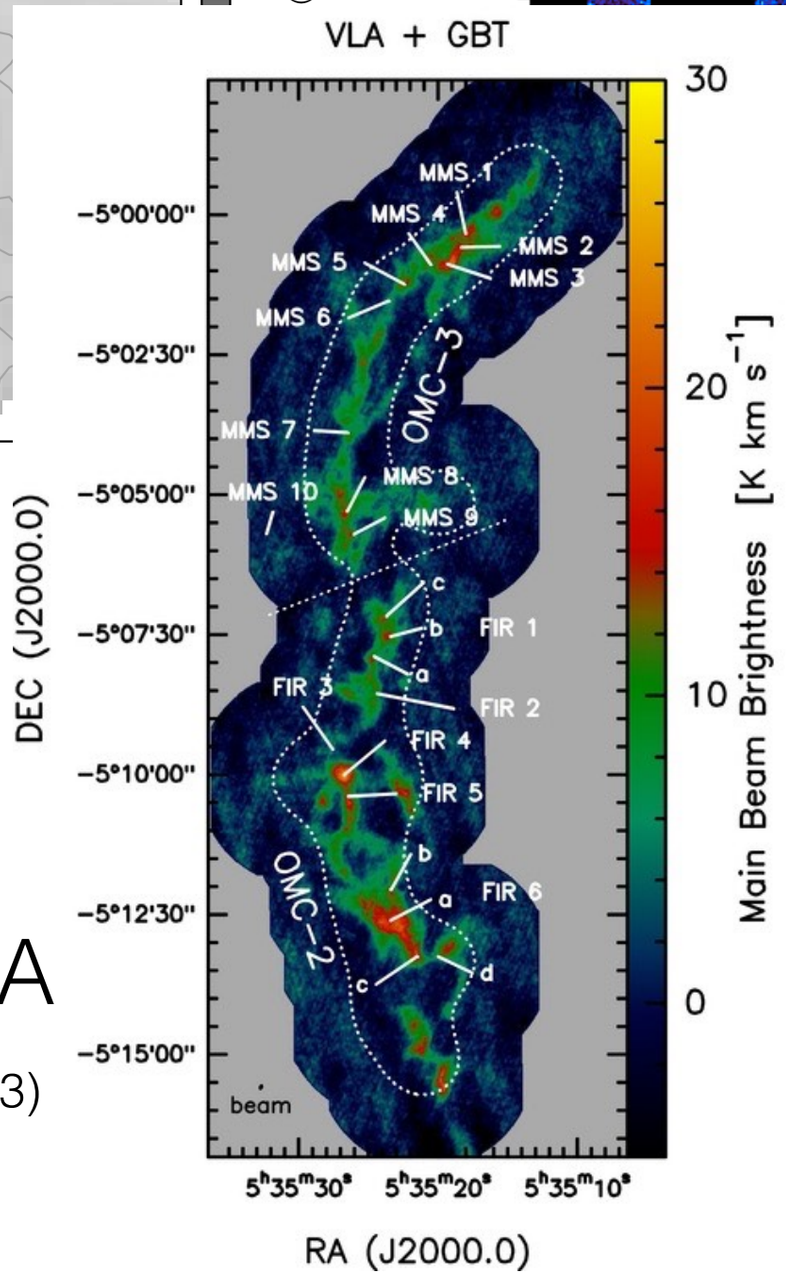


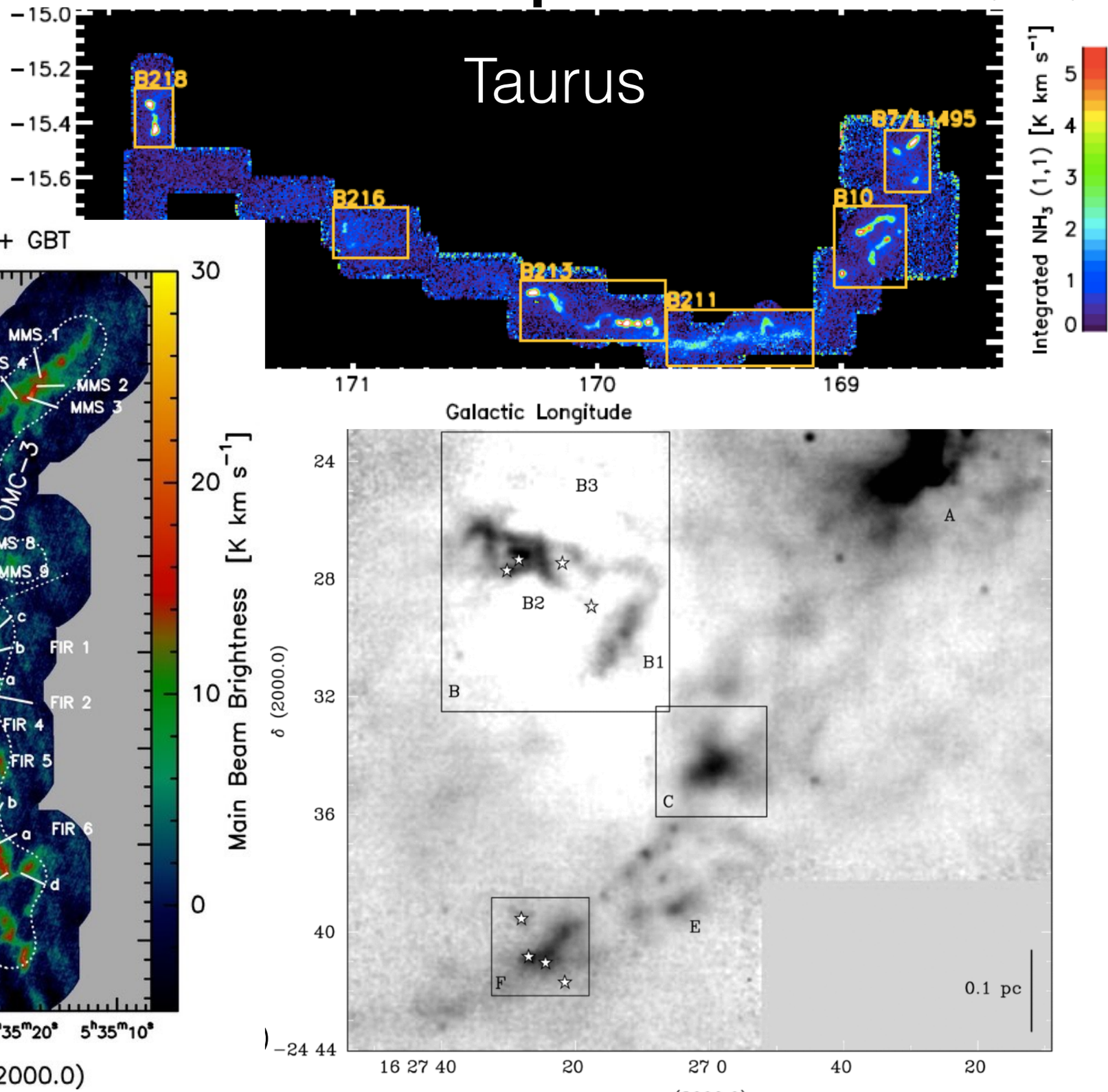
Perseus

OrionA

Li et al. (2013)



Seo et al. (2015)



NH_3 survey

- 244 hrs allocated
- lines targeted:
  - ★ NH_3 (1,1), (2,2) and (3,3)
  - ★ C_2S (2_1-1_0), HC_5N (9-8), HC_7N (21-20) and (22-21)
- maps of regions in Gould Belt clouds of A_v>7 mag: Perseus, OrionA, OrionB, Ophiuchus, IC5146, Pipe, Taurus, CrA, Cepheus, Serpens-Aquila

- Green Bank Telescope (100-m)
- K-Band Focal plane array (7-pixels)

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Data Release 1 in 2017:

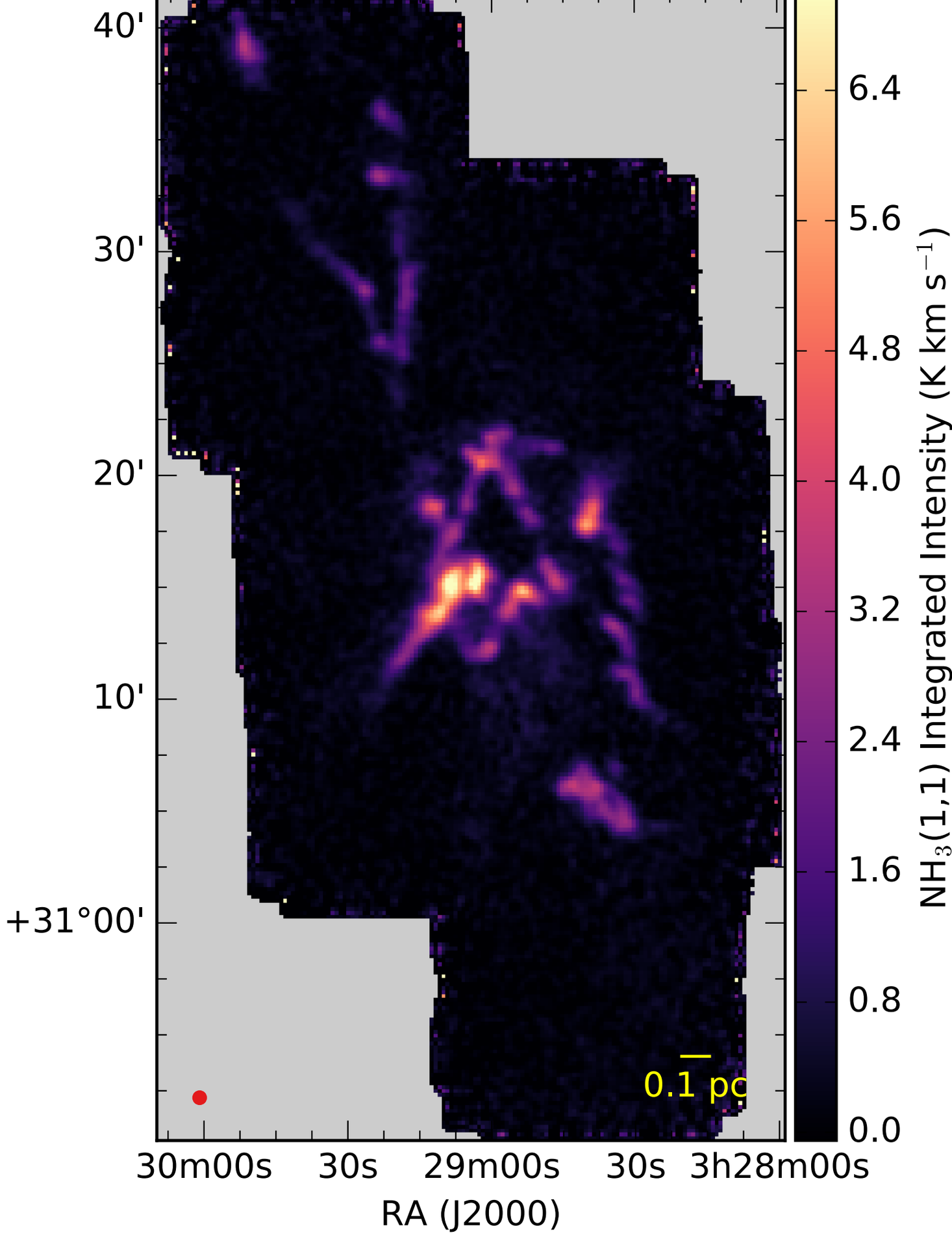
NGC1333

L1688

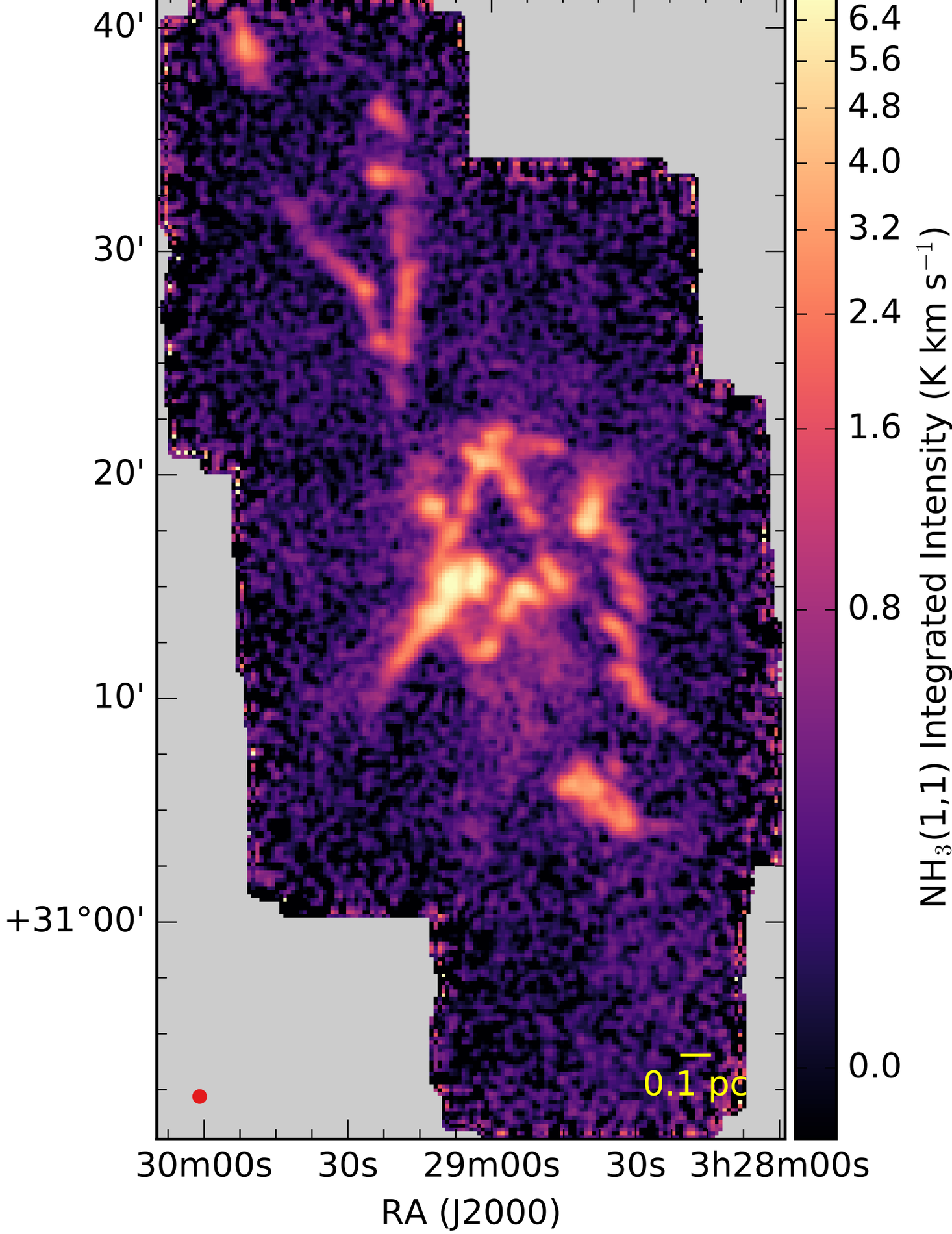
B18 (in Taurus)

OrionA-North

NGC1333


40'
30'
20'
10'
+31°00'
Dec (J2000)
30m00s
30s
29m00s
30s
3h28m00s
RA (J2000)
0.1 pc
6.4
5.6
4.8
4.0
3.2
2.4
1.6
0.8
0.0
NH3(1,1) Integrated Intensity (K km s−1)

NGC1333


40'
30'
20'
10'
+31°00'
Dec (J2000)
30m00s
30s
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30s
3h28m00s
RA (J2000)
0.1 pc
6.4
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3.2
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0.8
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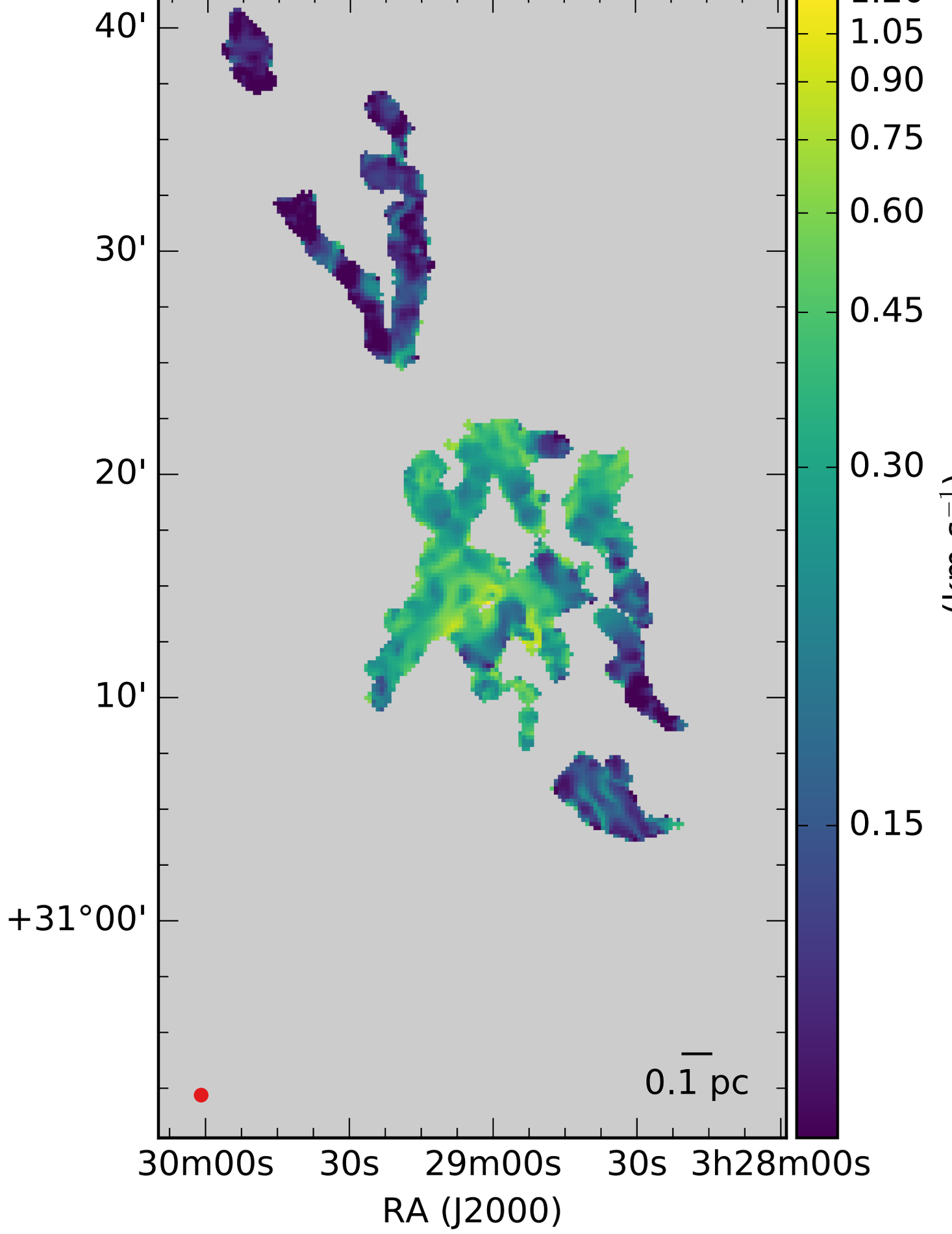
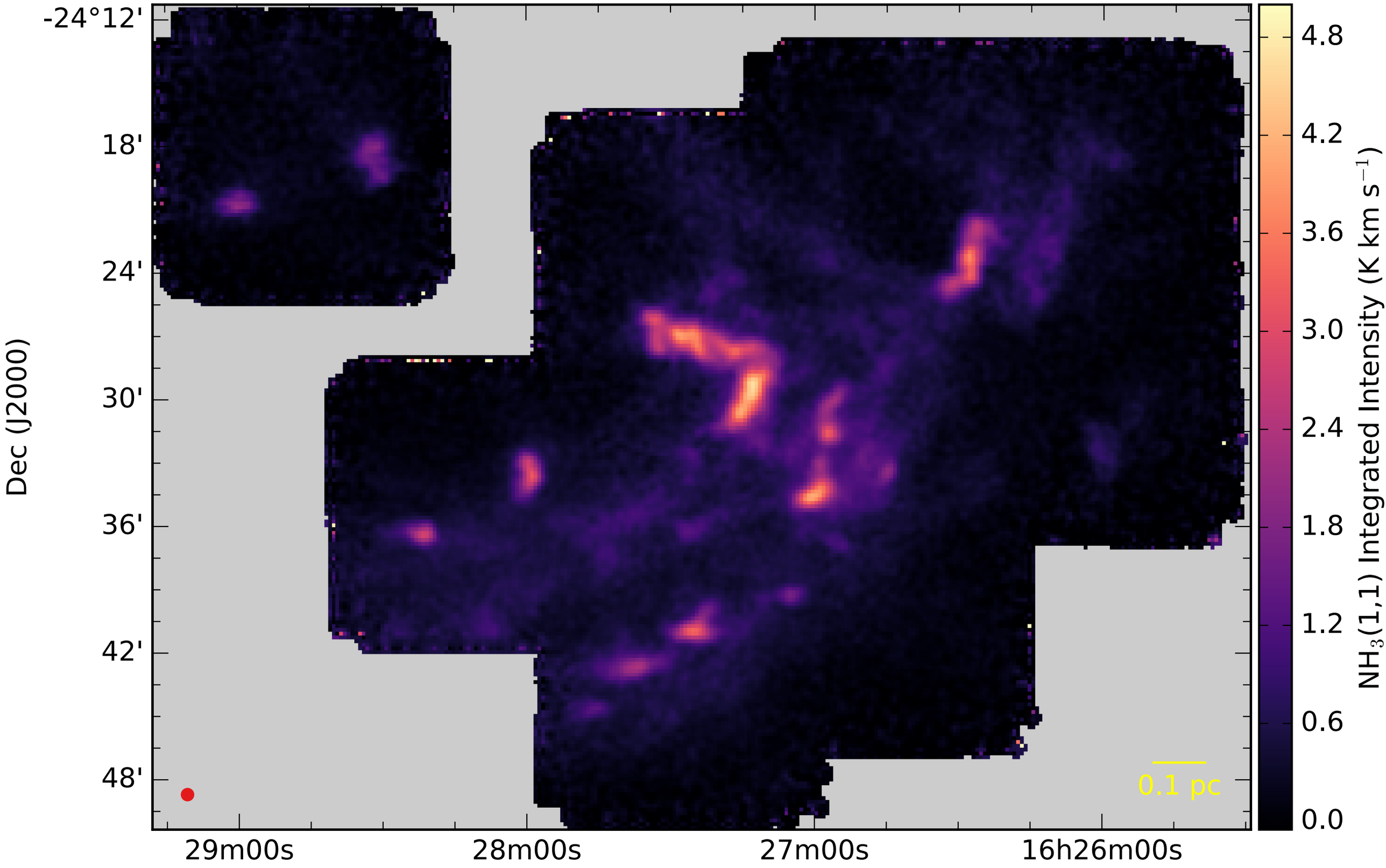
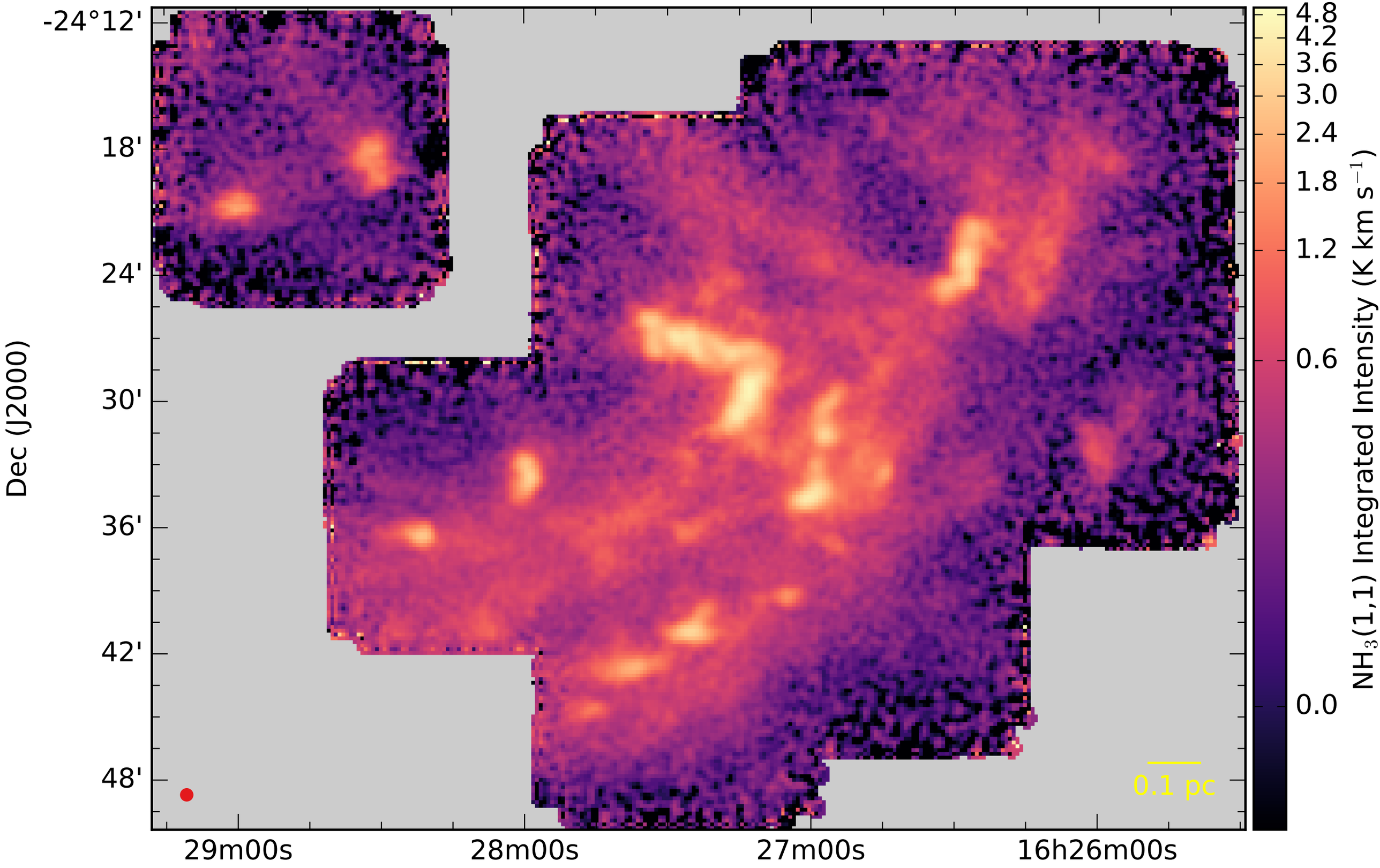
NGC1333


40'
30'
20'
10'
+31°00'
Dec (J2000)
30m00s
30s
29m00s
30s
3h28m00s
RA (J2000)
0.1 pc
1.05
0.90
0.75
0.60
0.45
0.30
0.15

L1688


-24°12'
18'
24'
30'
36'
42'
48'
Dec (J2000)
29m00s
28m00s
27m00s
16h26m00s
RA (J2000)
0.1 pc
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
NH3(1,1) Integrated Intensity (K km s−1)

L1688


-24°12'
18'
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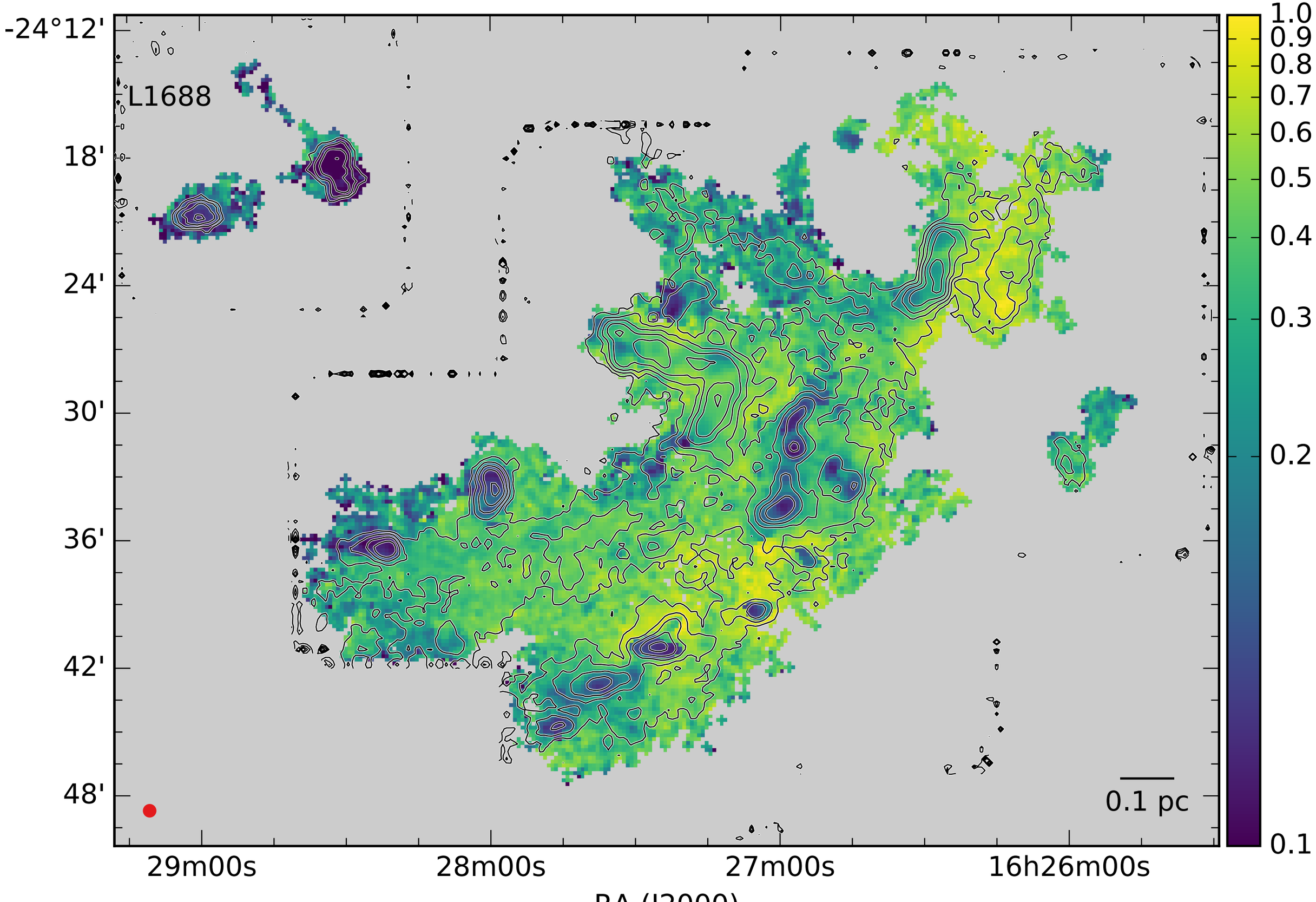
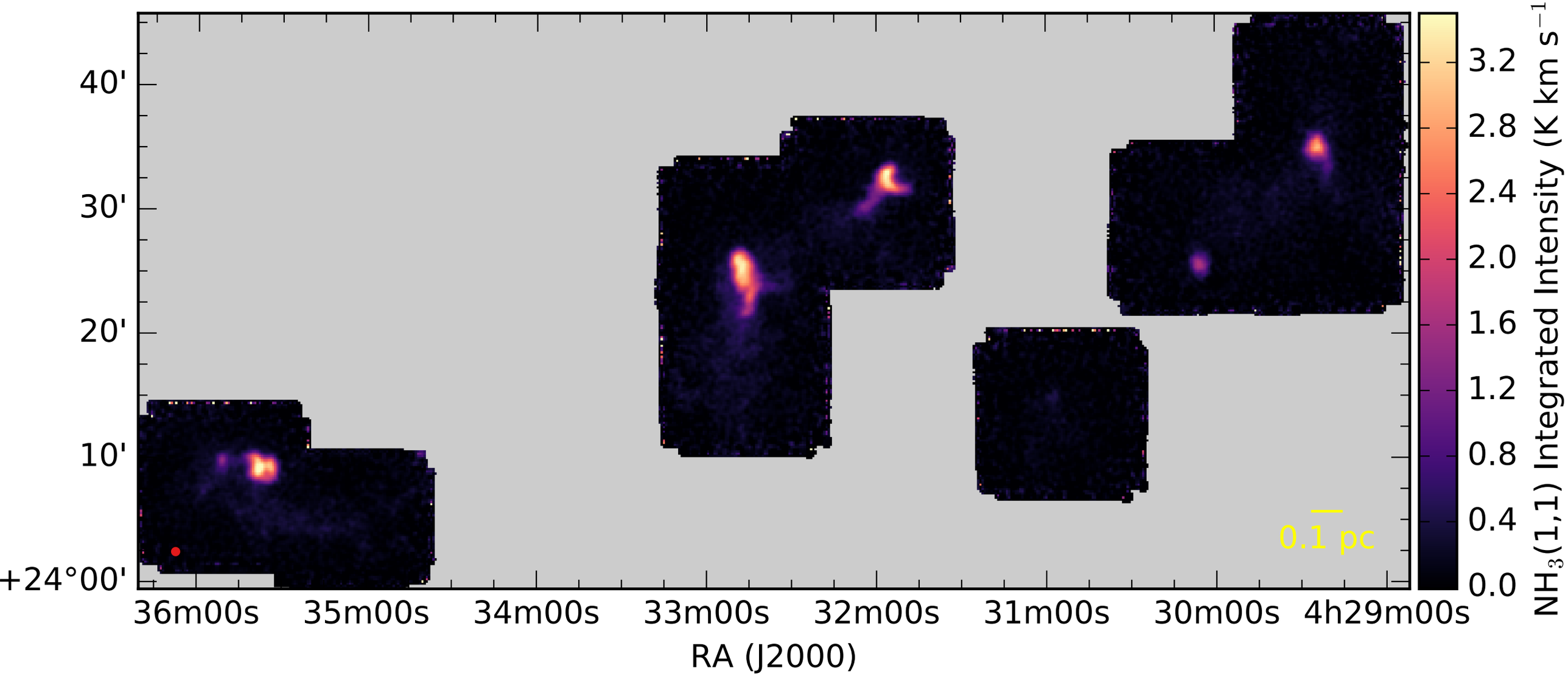
48'
Dec (J2000)
29m00s
28m00s
27m00s
16h26m00s
RA (J2000)
0.1 pc
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
NH3(1,1) Integrated Intensity (K km s−1)

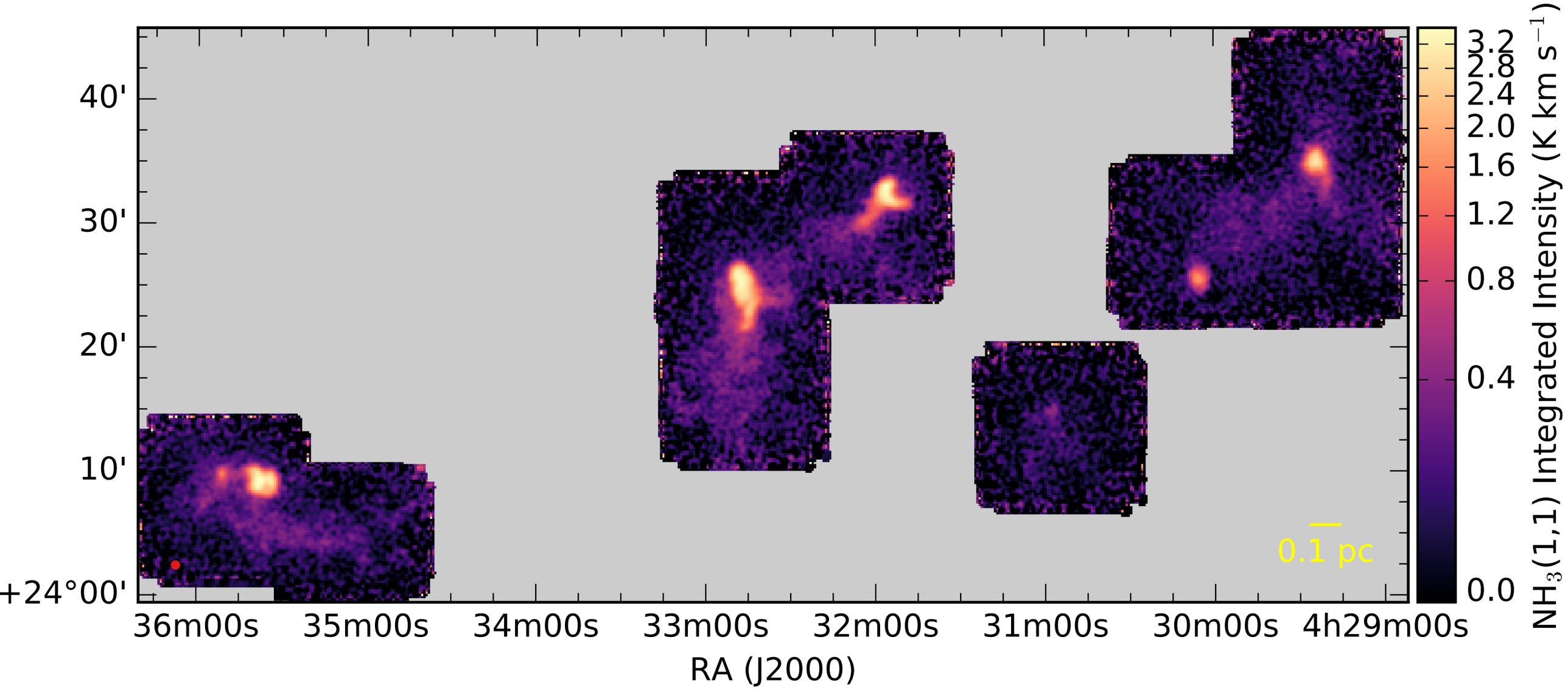
L1688


L1688
-24°12'
18'
24'
30'
36'
42'
48'
Dec (J2000)
29m00s
28m00s
27m00s
16h26m00s
RA (J2000)
0.1 pc
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
σ_v (km s^{-1})

B18


40'
30'
20'
10'
+24°00'
36m00s
35m00s
34m00s
33m00s
32m00s
31m00s
30m00s
4h29m00s
RA (J2000)
0.1 pc
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
NH3(1,1) Integrated Intensity (K km s−1)

B18


40'
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RA (J2000)
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3.2
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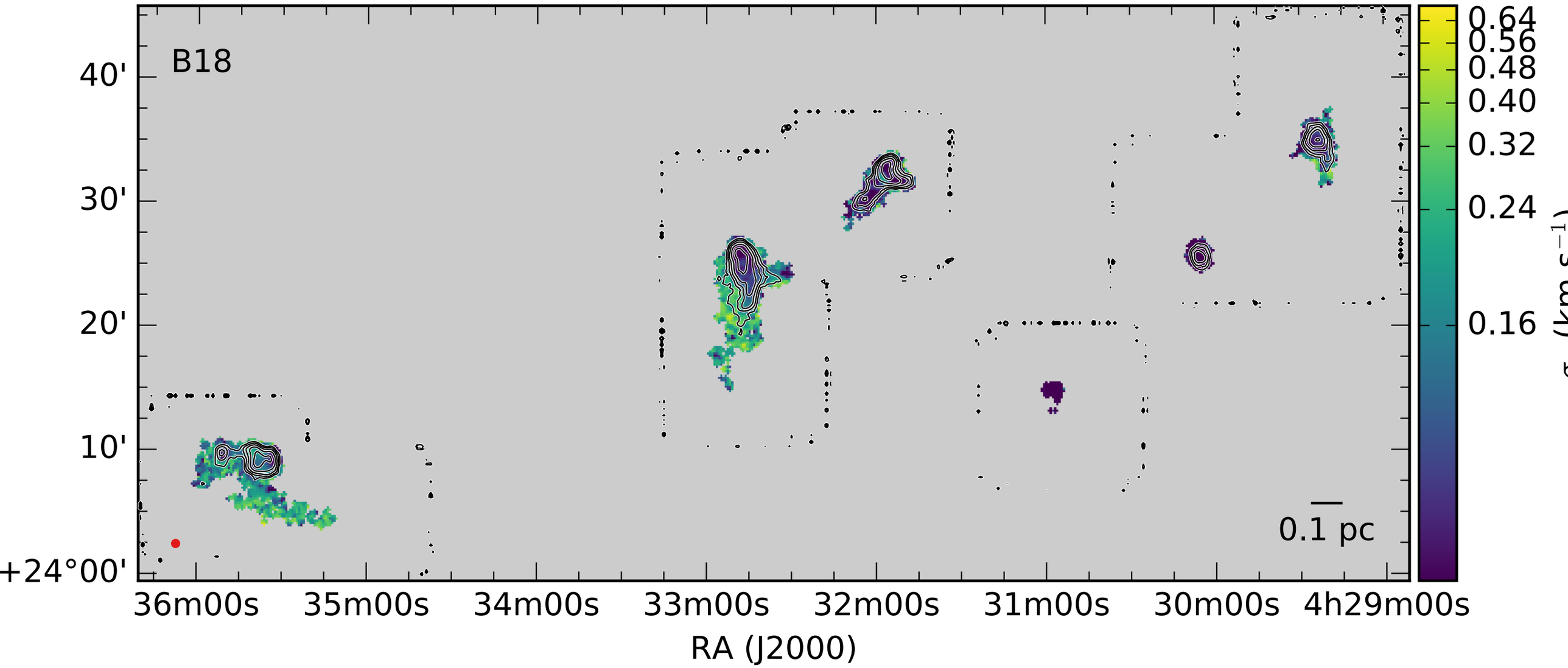
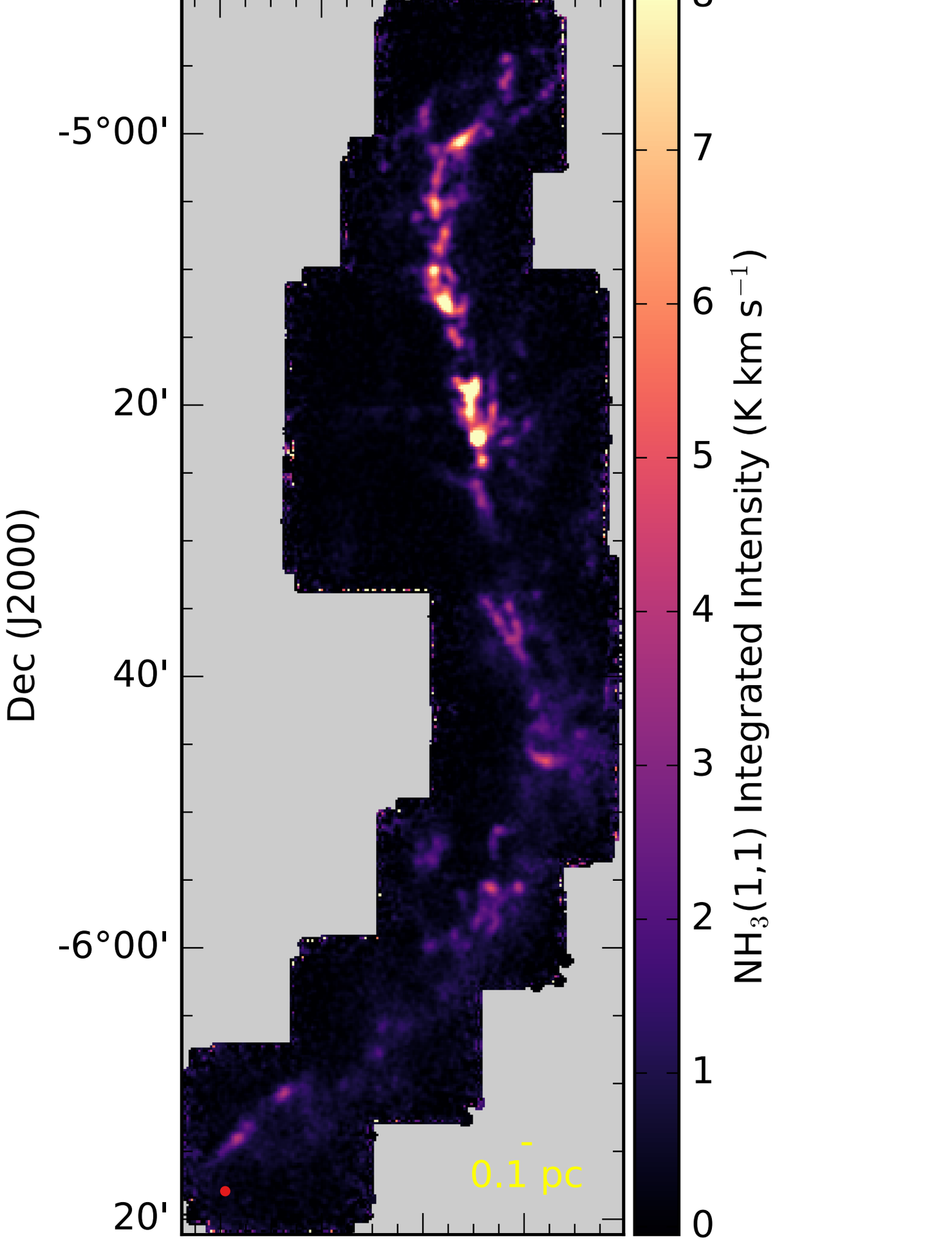
B18

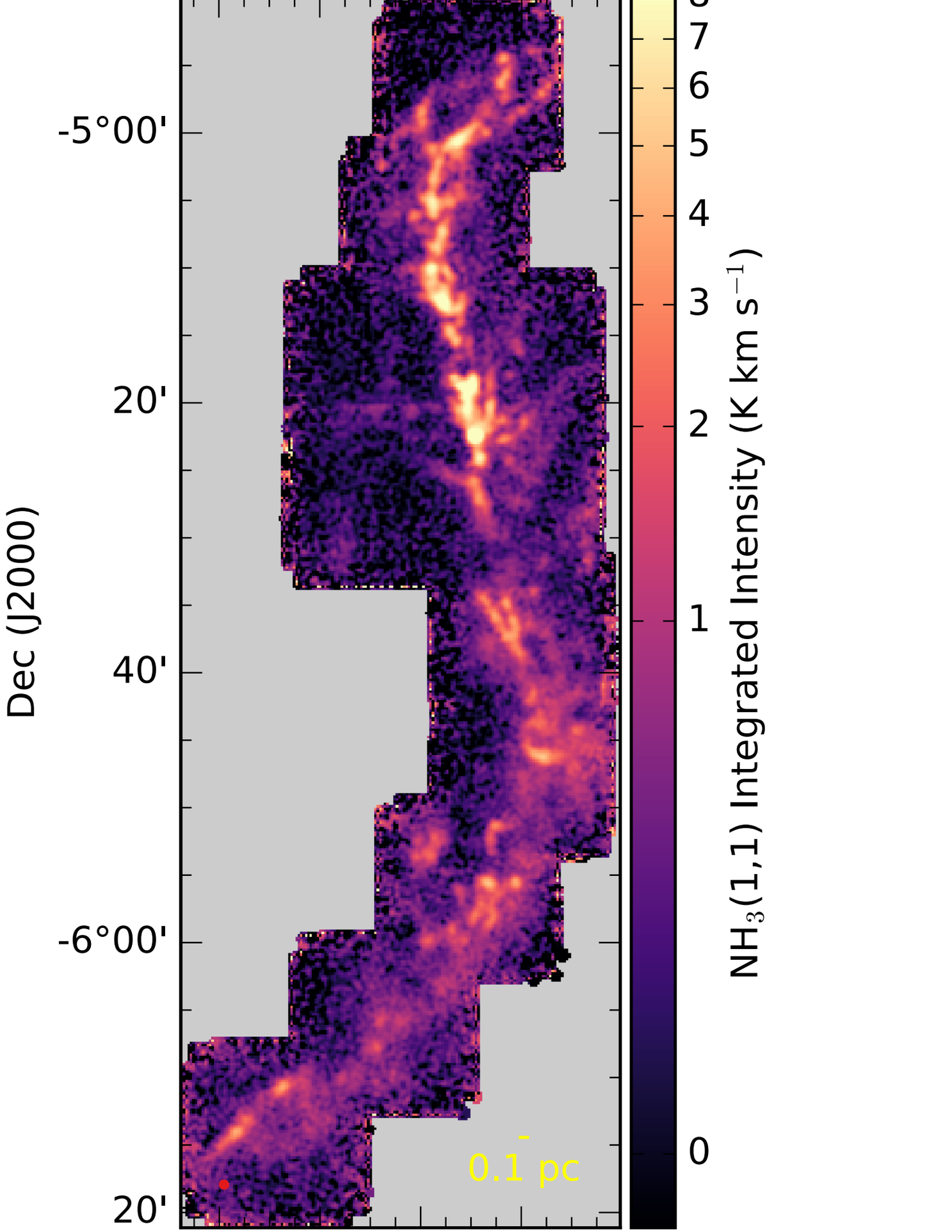


B18
40'
30'
20'
10'
+24°00'
36m00s
35m00s
34m00s
33m00s
32m00s
31m00s
30m00s
4h29m00s
RA (J2000)
0.1 pc
0.64
0.56
0.48
0.40
0.32
0.24
0.16

OrionA North



OrionA North



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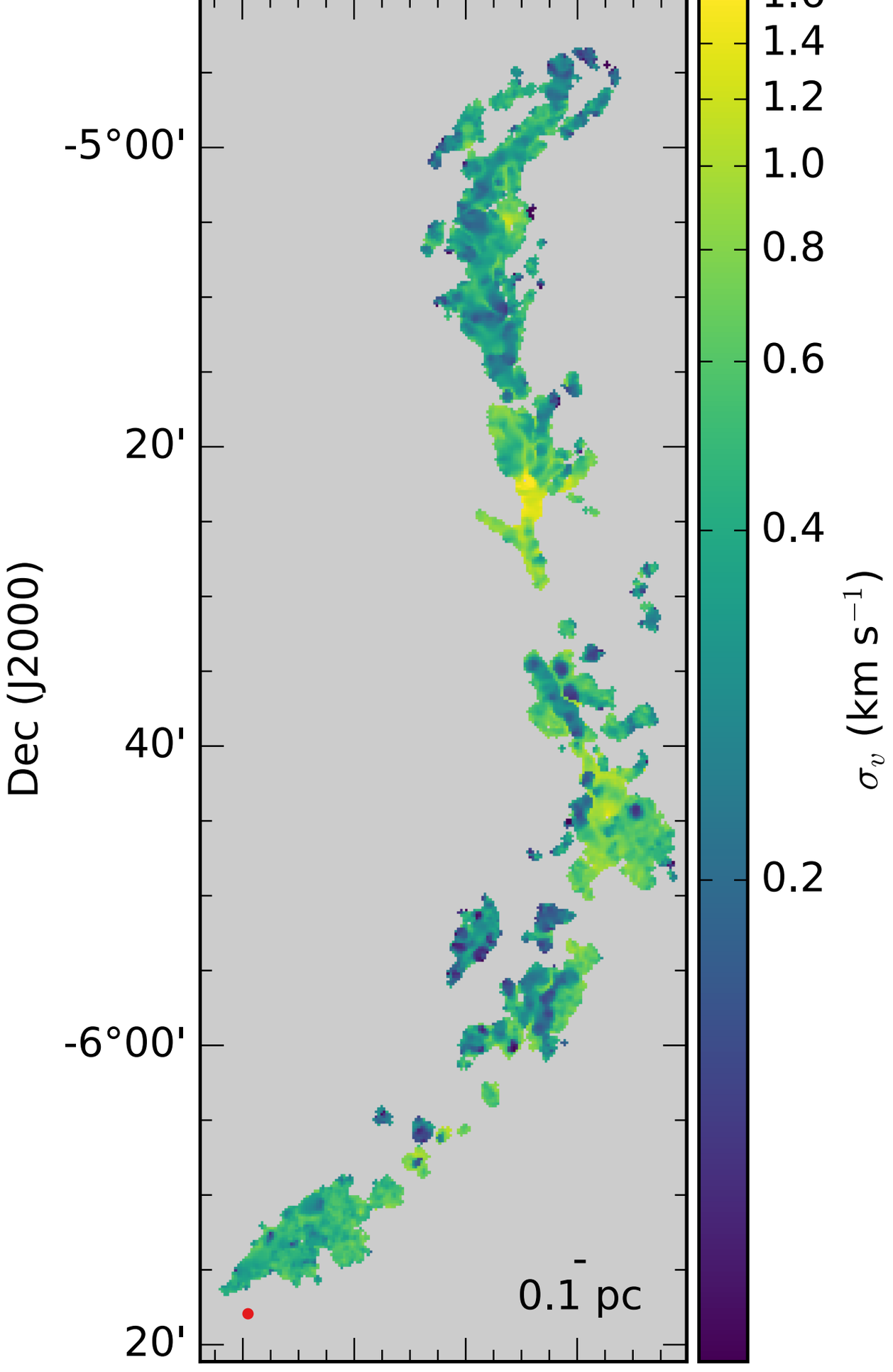
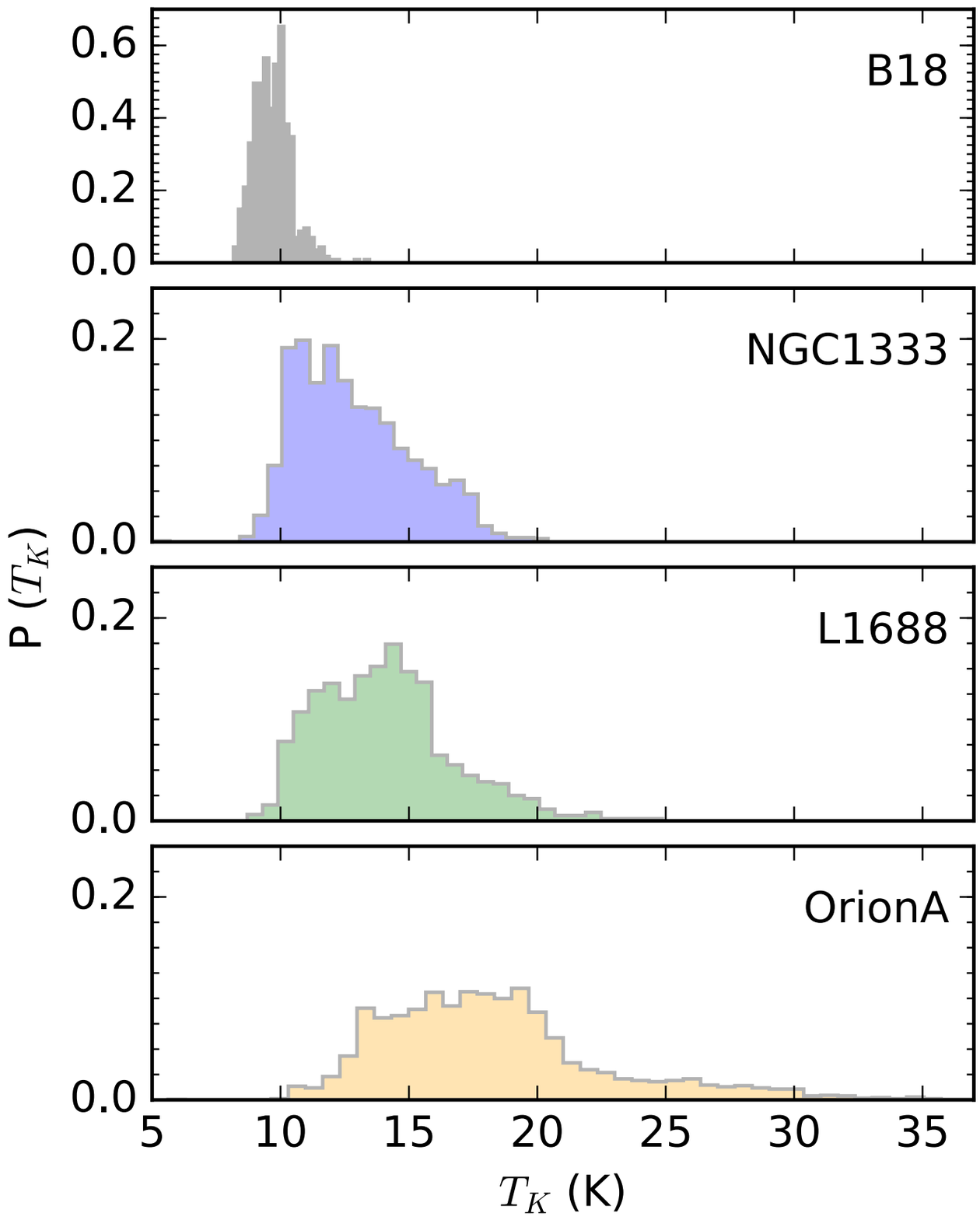
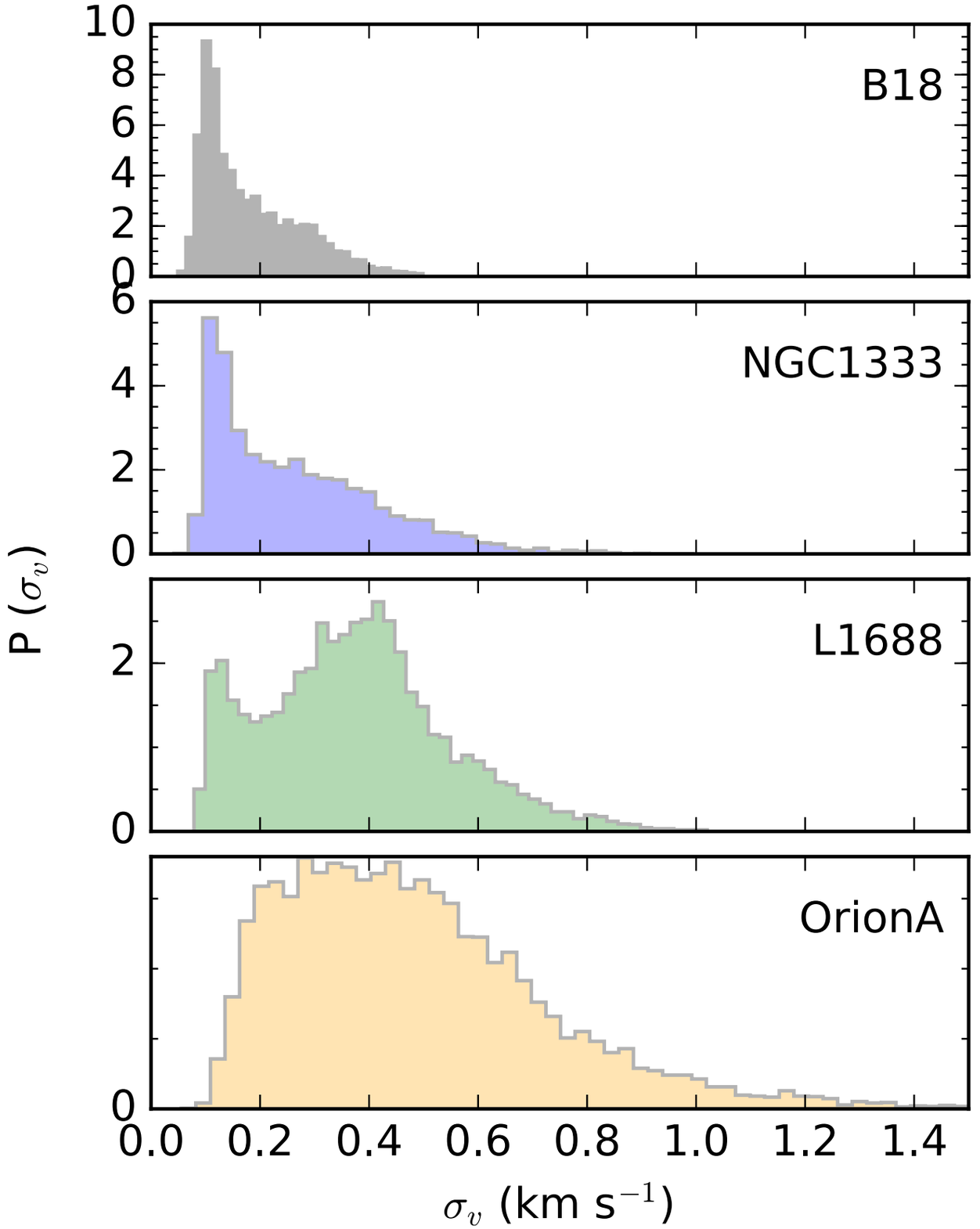


Distributions of properties





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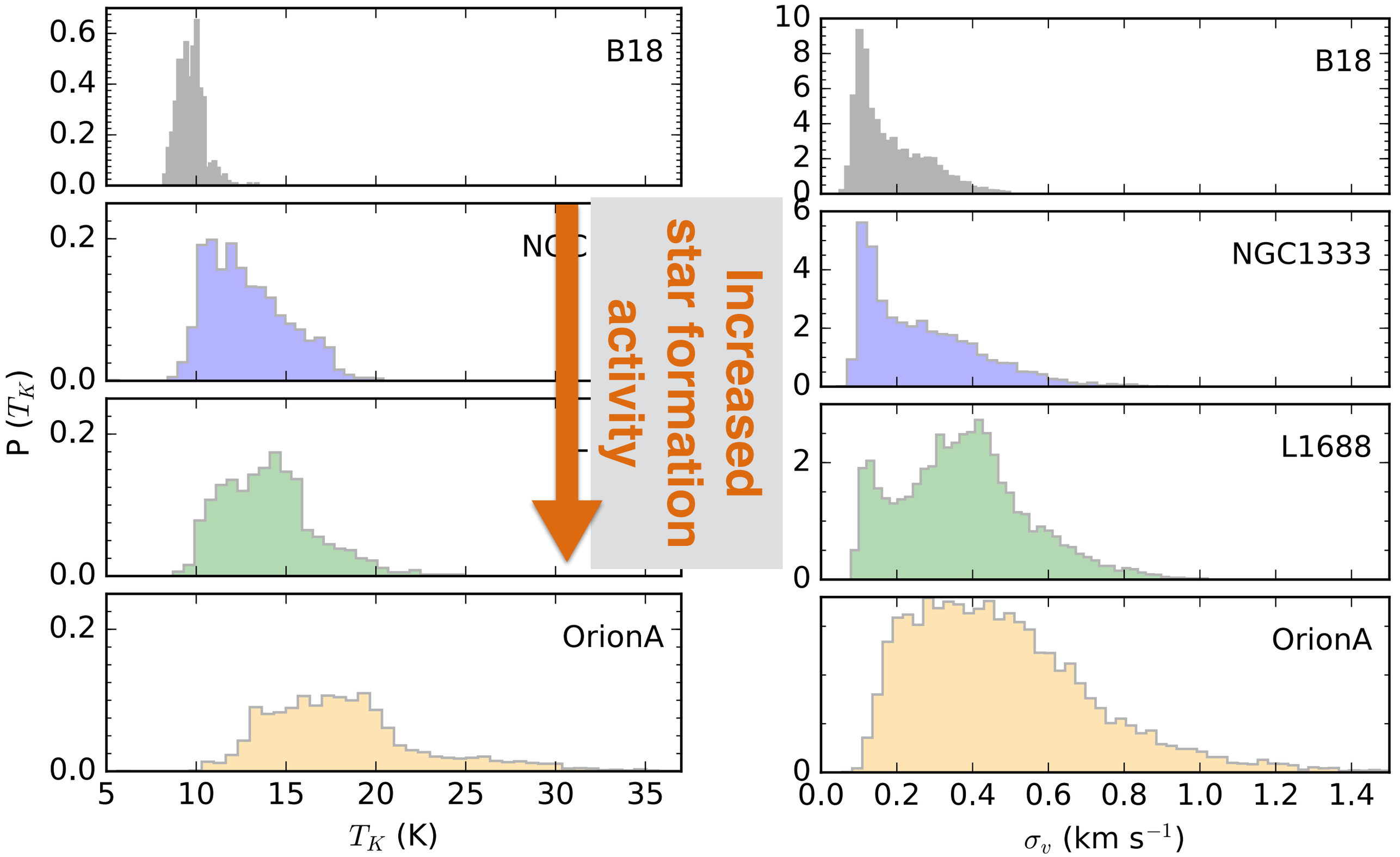

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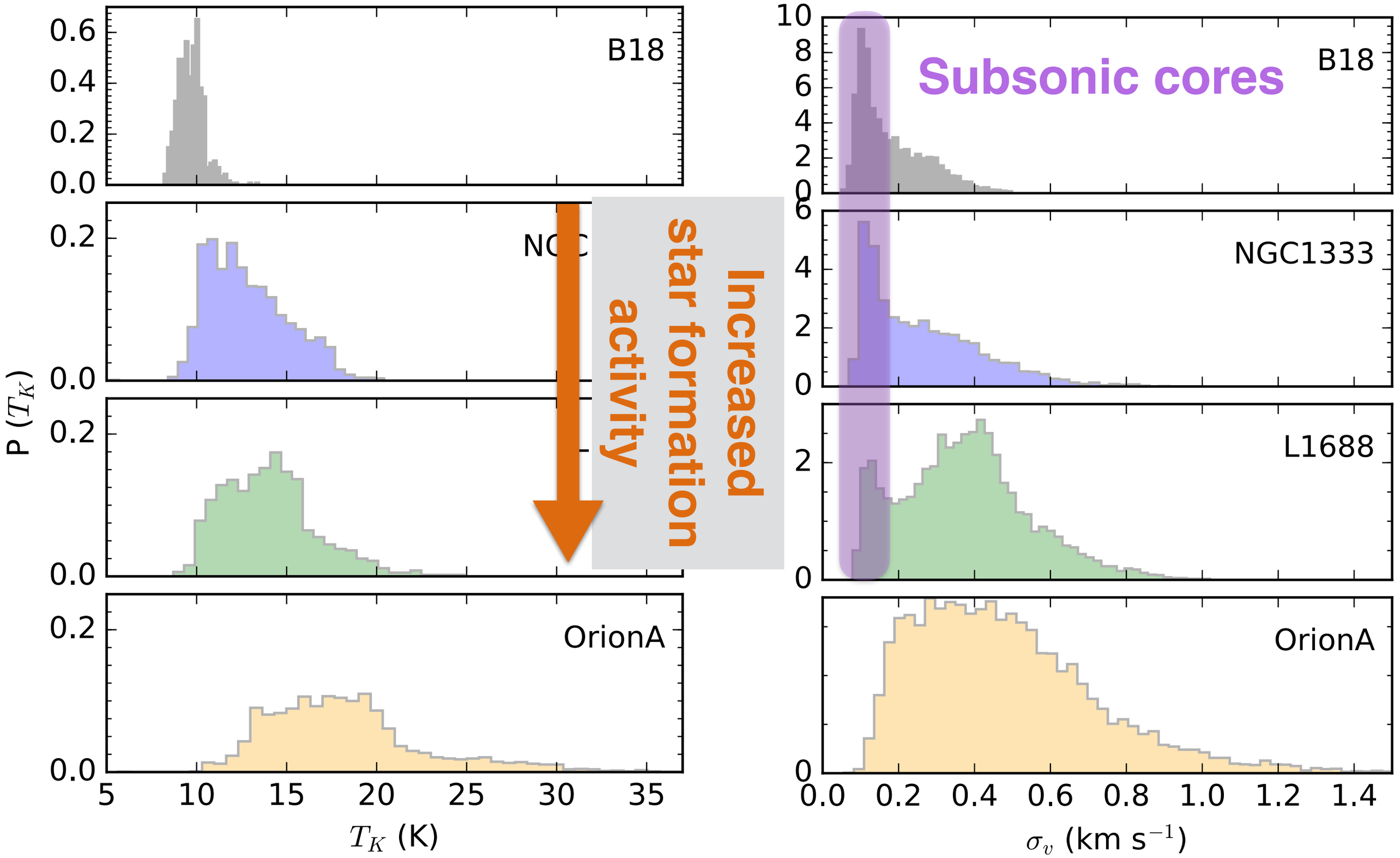
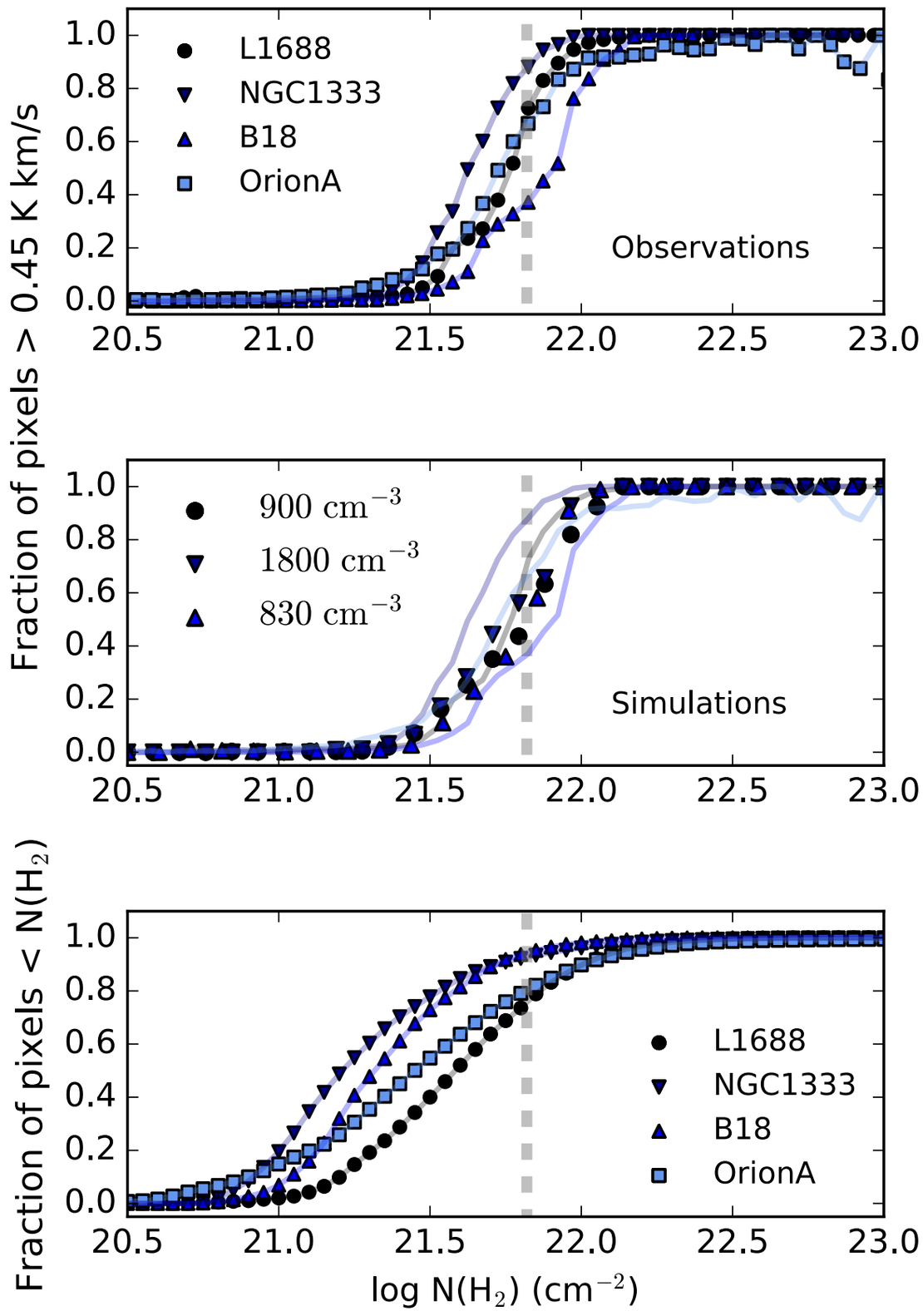
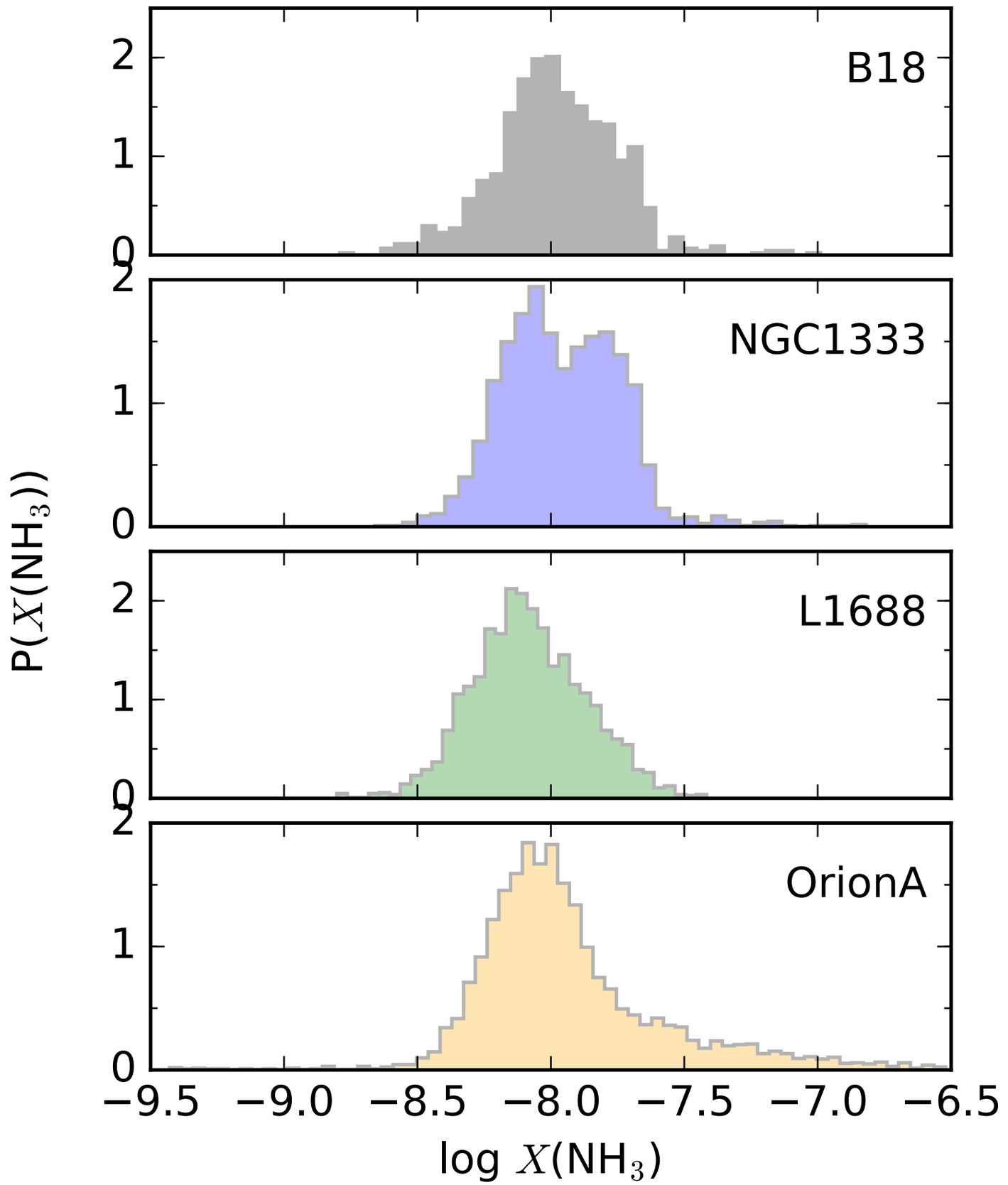
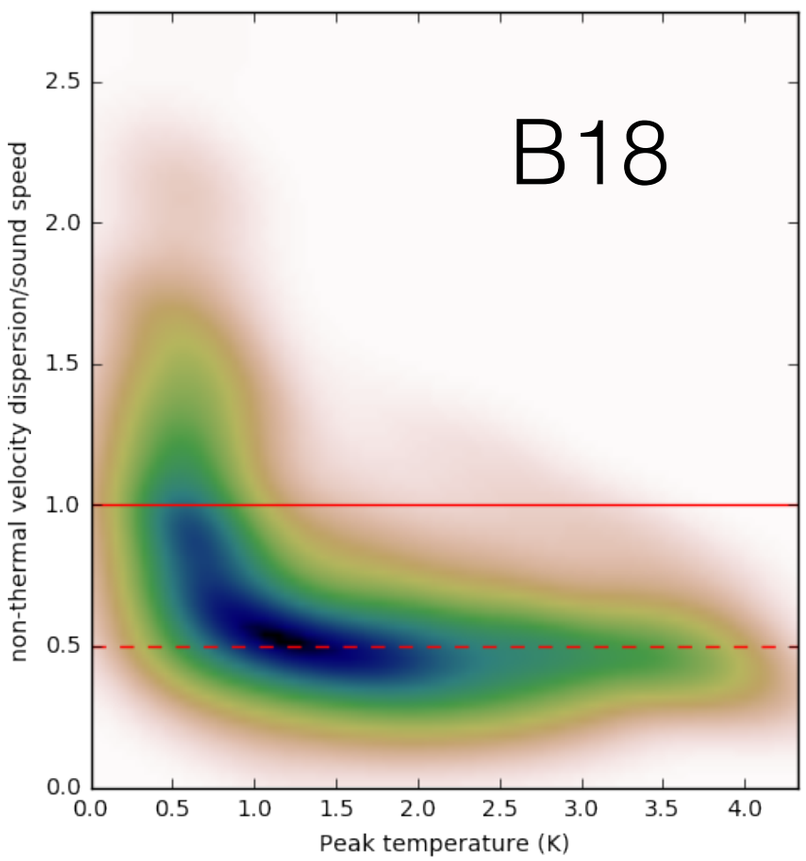
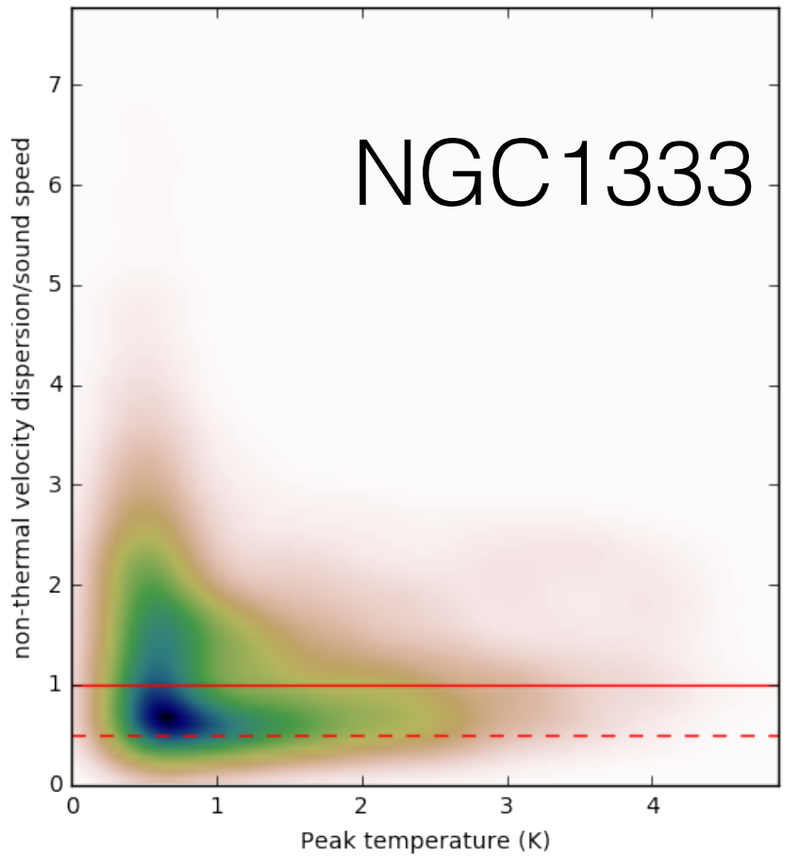


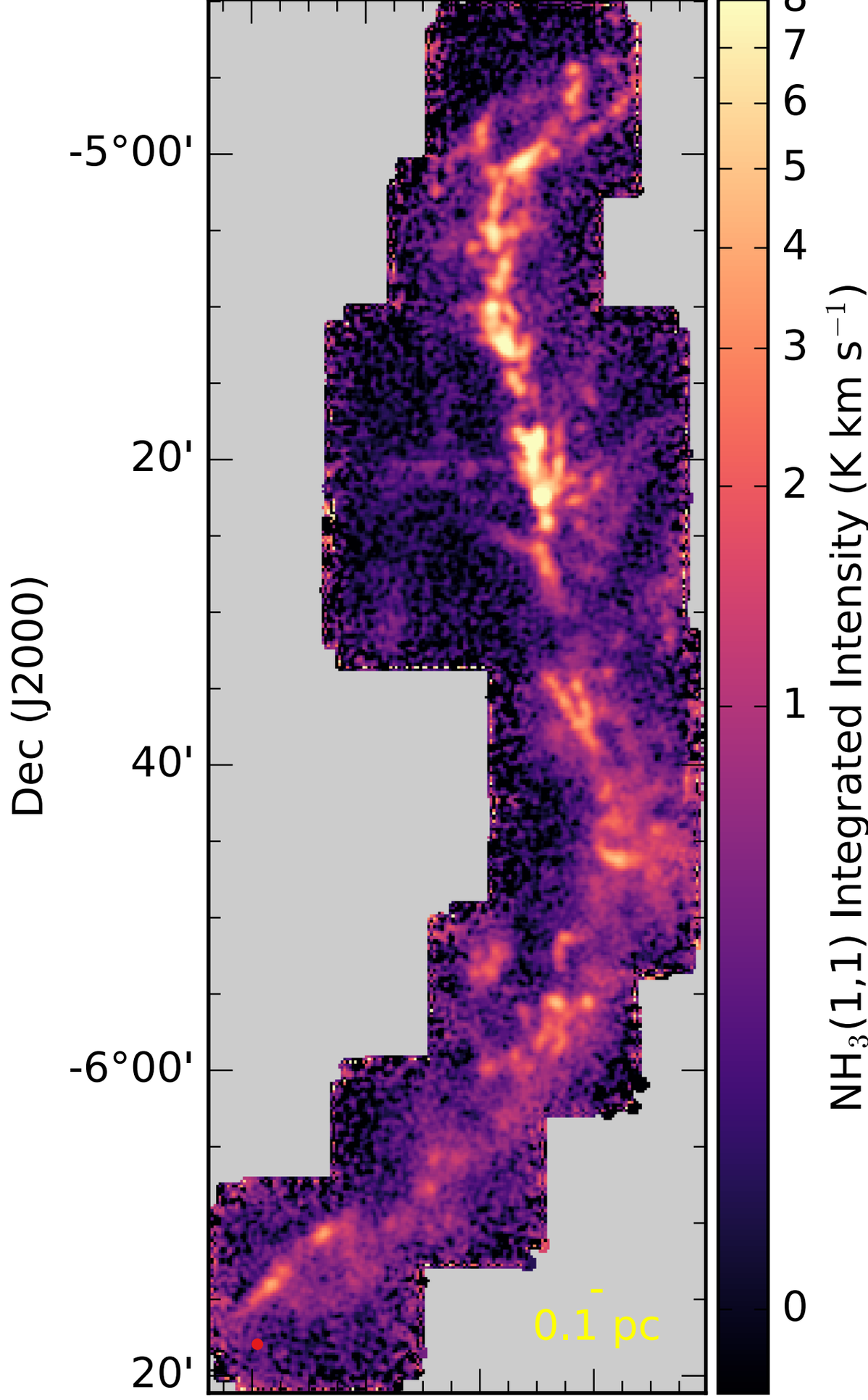

L1688
NGC1333
B18
OrionA
Observations
Simulations
900 cm^{-3}
1800 cm^{-3}
830 cm^{-3}
Fraction of pixels > 0.45 K km/s
Fraction of pixels < N(H$_2$)
log N(H$_2$) (cm^{-2})


B18
NGC1333
L1688
OrionA
P(X(NH$_3$))
log X(NH$_3$)

Subsonic Regions





Summary

- Large area maps in NH_3 for Gould Belt Clouds
- Initial release in 2017 after paper is accepted
- NH_3 (1,1) is quite extended
- Transition between subsonic and supersonic turbulence is observed in Several Regions
- Why is NH_3 detected in Taurus only at higher column densities?