

A study of dense and cold cloud cores in the TMC-1 ridge

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TMC-1

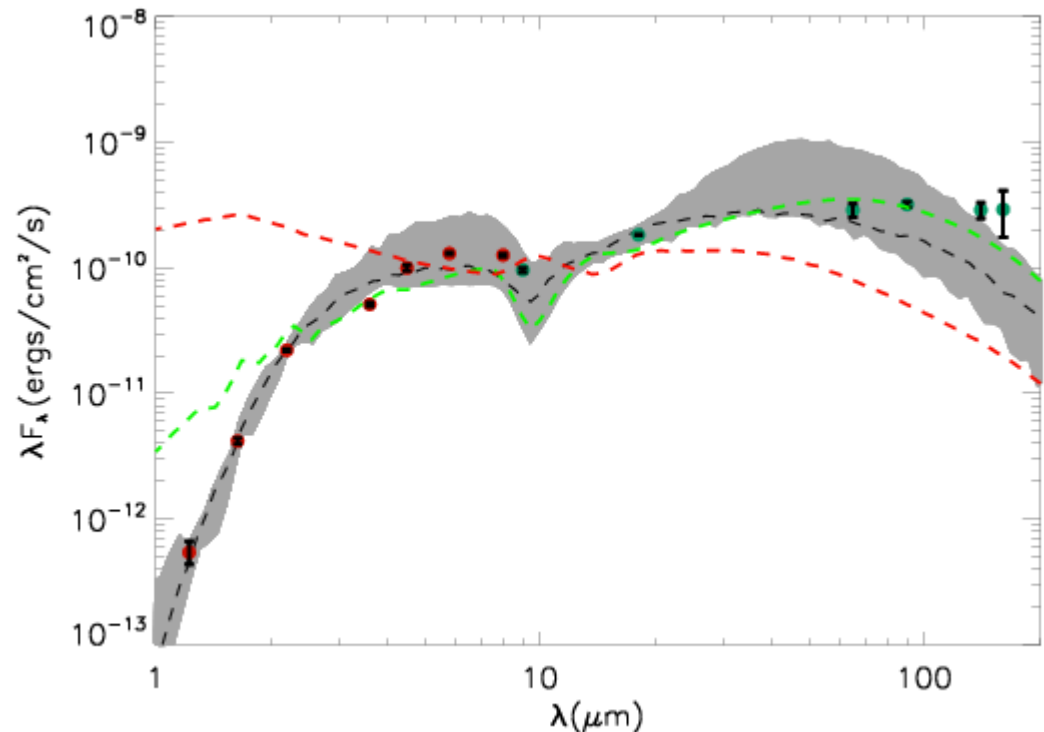
- Taurus clouds: 140 pc
- Heiles 1968: cold interstellar gas, HCL2 most massive molecular cloud in Taurus
- HCL2: 4 main clouds

- Taurus Molecular Cloud 1
- dense ridge that extends more than $5' \times 15'$ in a southeast to northwest direction
- rich source of carbon-bearing molecules

- northwest part of TMC-1 contains an infrared source (IRAS 04381+2540).

IRAS 04381+2540

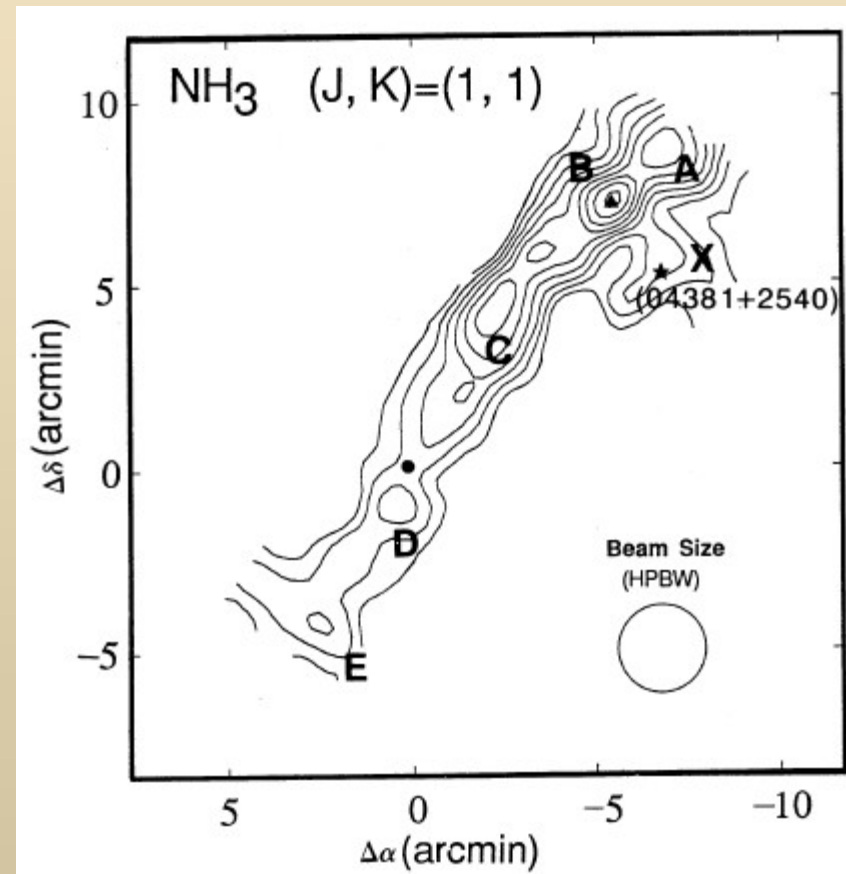
- Green points: AKARI IRC and FIS data
- Red points: archive data
- Model: Robitaille et al. (2006, 2007)
- Red dashed line:
 - average Class II
- Green dashed line:
 - average Class I



TMC-1C

- TMC-1 is fragmented, least five large clumps and several small clumps (Hirahara et al. 1992)
- TMC-1C is a starless core (Kenyon, Dobrzycka, & Hartmann 1994)

Hirahara et al., 1992



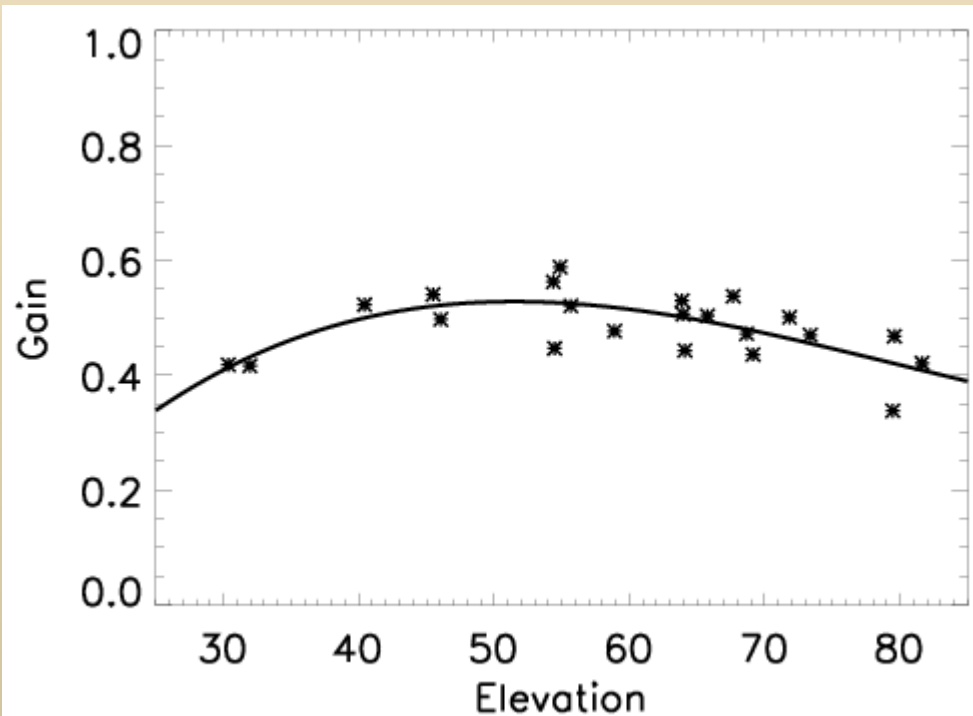
Observations

- 2008. november - december
- Effelsberg 100-m telescope
- ammonia rotation inversion line
- emission in the transitions of NH_3 at 23.694495 and 23.722633 GHz.

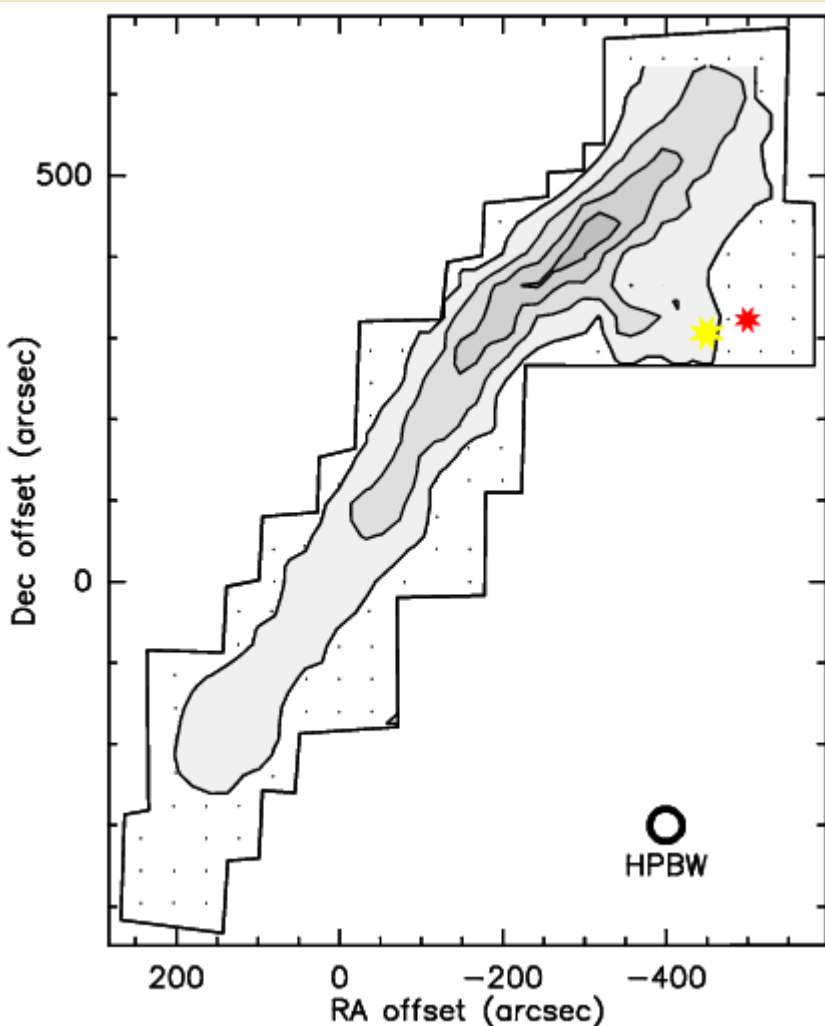


Data reduction & calibration

- Gildas CLASS
- Pointing: continuum measurements: 3C123, 3C138
- Pointing accuracy: 3''
- Gain curve for:
NGC 7027

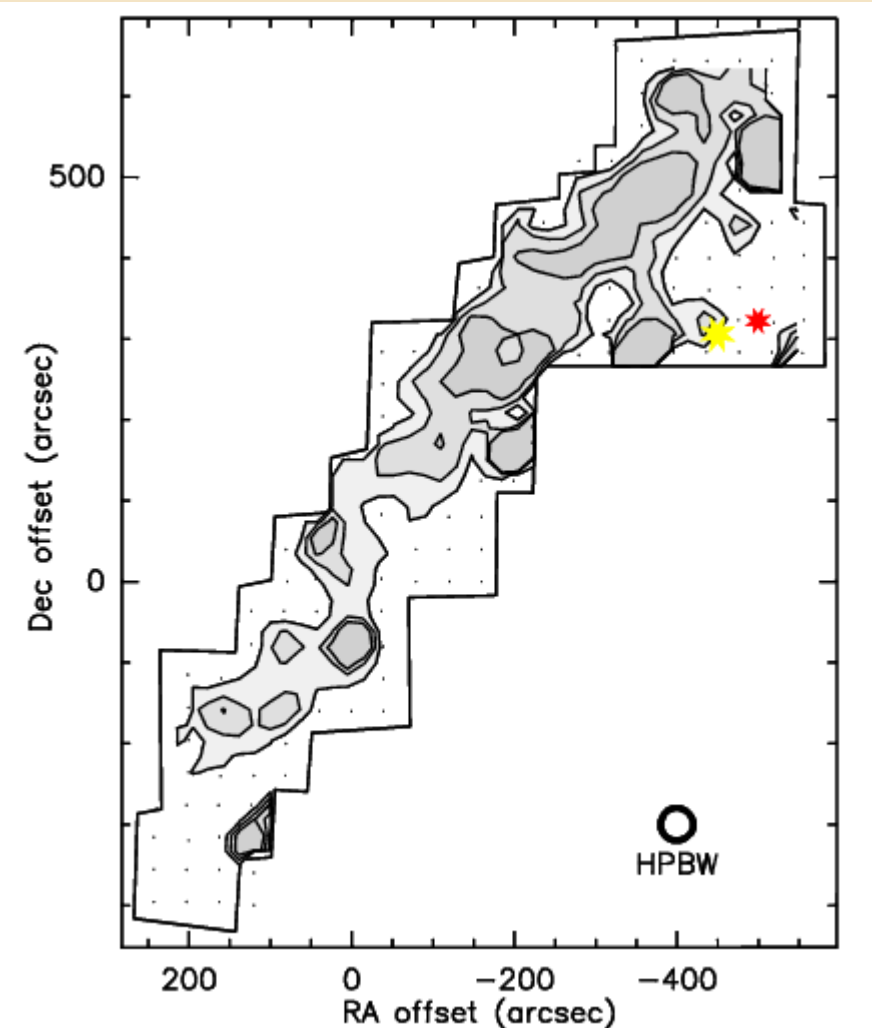


NH₃(1,1) main group line area



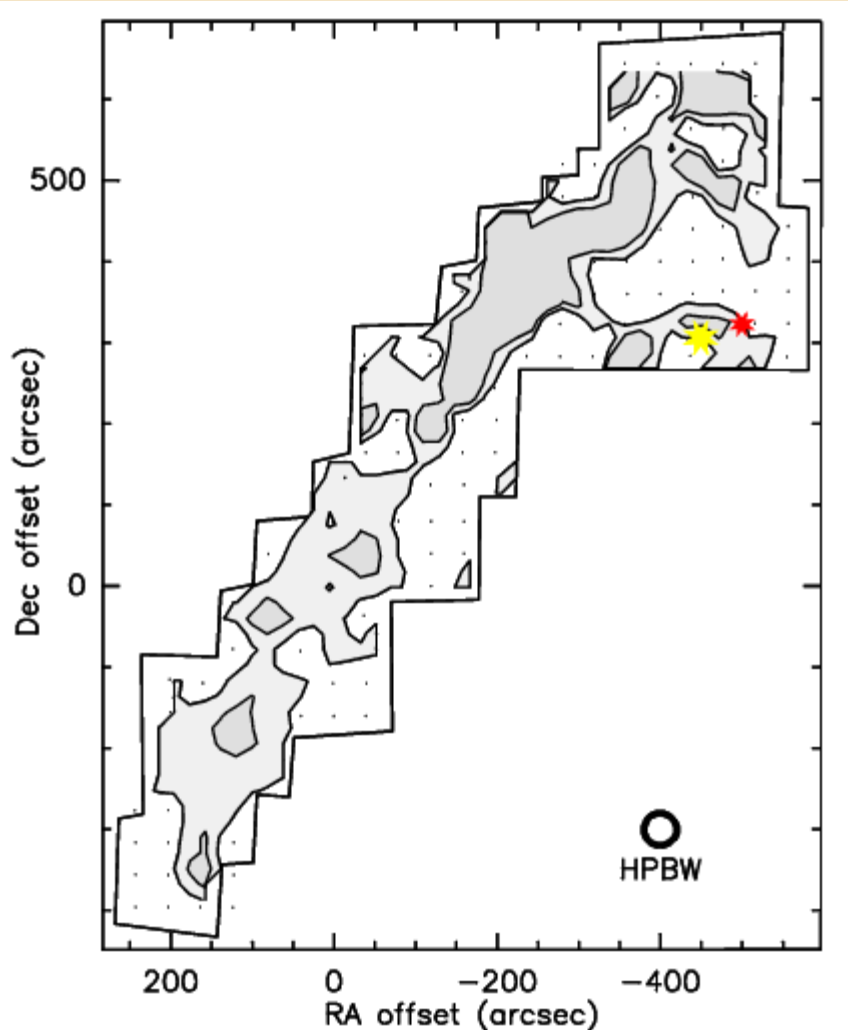
- TMC-1
- (0,0) : 4:38:18.9 25:42:30
- HPBW: 40''
- Contours: from 0.5 Kkm/s by 0.5 Kkm/s
- Yellow star: IRAS 04381+2640
- Red star: a new AKARI FIS point source?

NH₃(1,1) optical depth



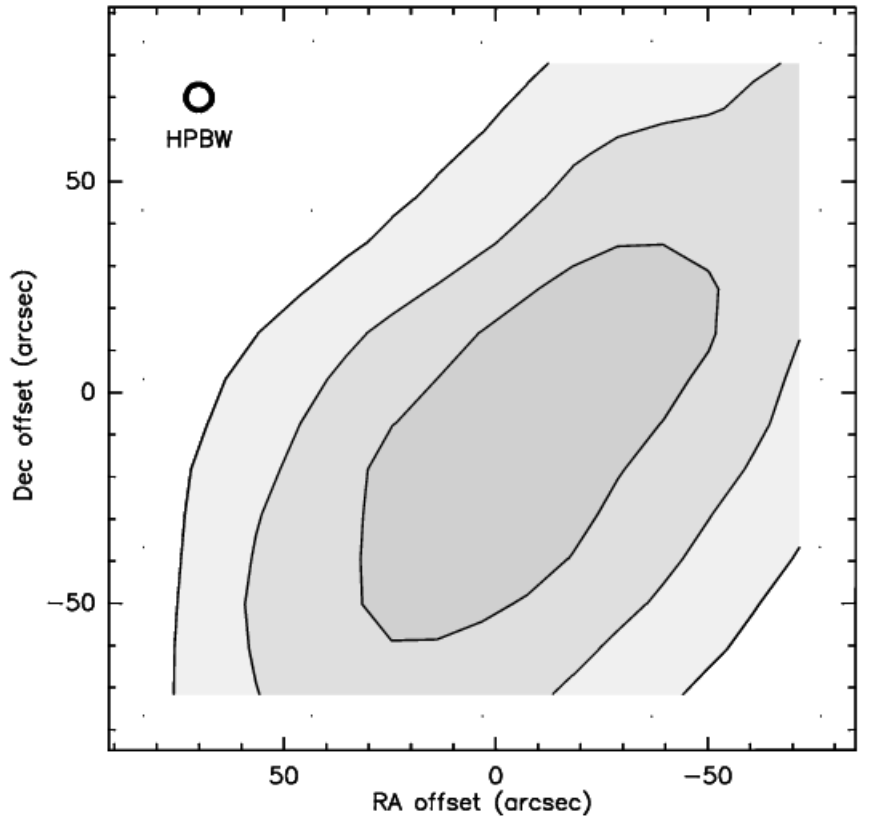
- TMC-1
- (0,0) : 4:38:18.9 25:42:30
- HPBW: 40''
- Contours: from 1 by 1
- Yellow star: IRAS 04381+2640
- Red star: a new AKARI FIS point source?

NH₃(2,2) main group line area



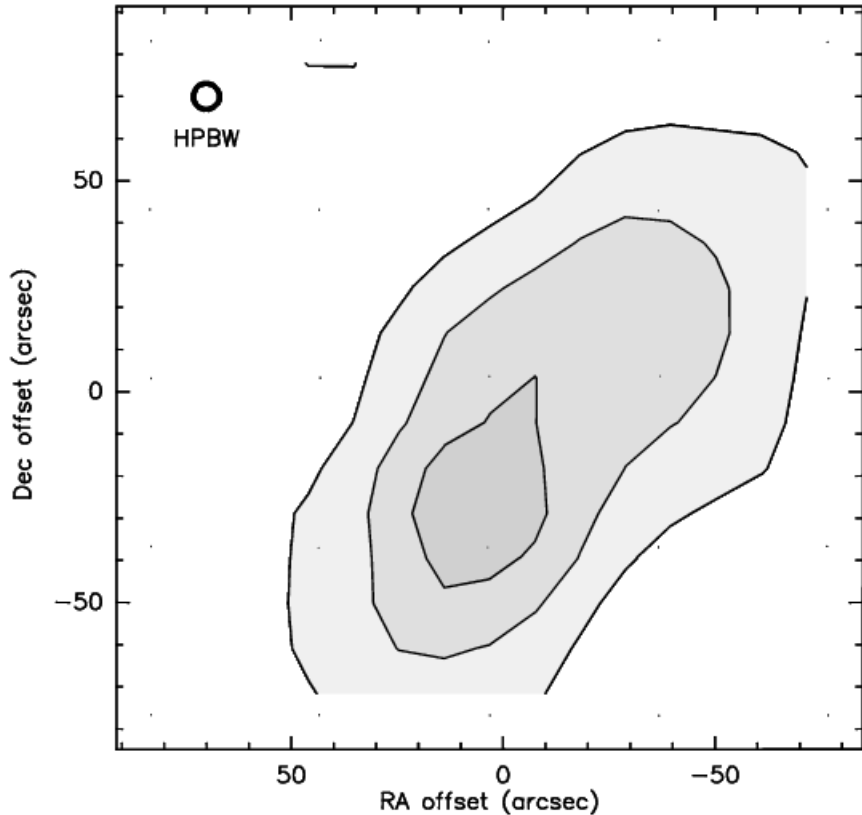
- TMC-1
- (0,0) : 4:38:18.9 25:42:30
- HPBW: 40''
- Contours: from 0.03 Kkm/s by 0.03 Kkm/s
- Yellow star: IRAS 04381+2640
- Red star: a new AKARI FIS point source?

NH₃(1,1) main group line area



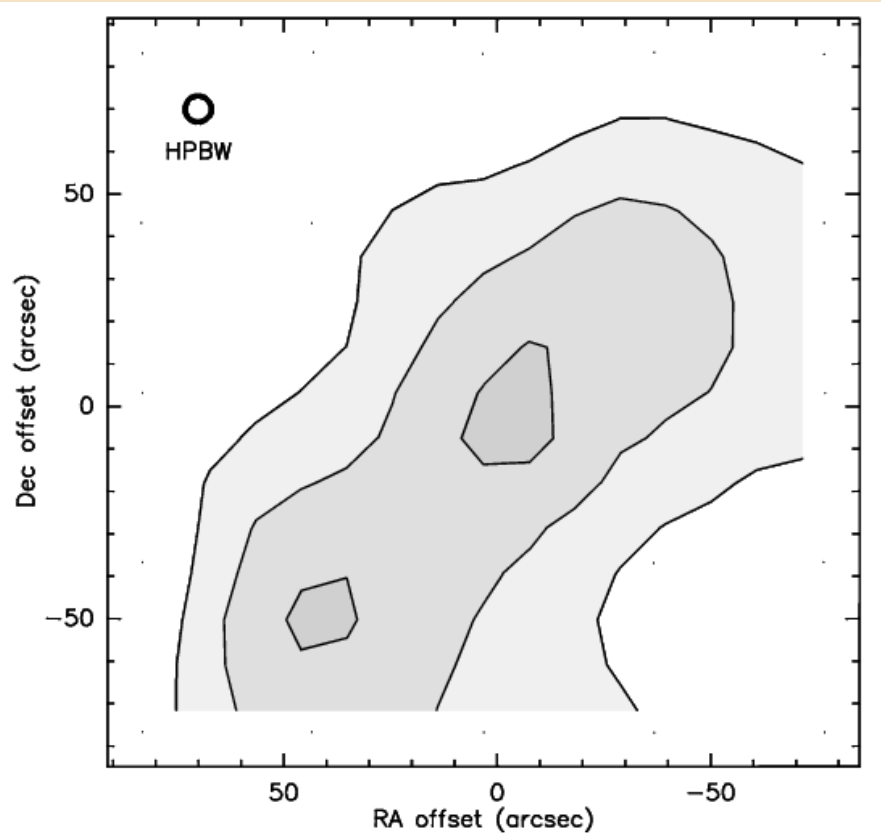
- TMC-1C
- (0,0) : 4:41:38.8 26:00:42
- HPBW: 40''
- Contours: from 0.5 Kkm/s by 0.5 Kkm/s

NH₃(1,1) optical depth



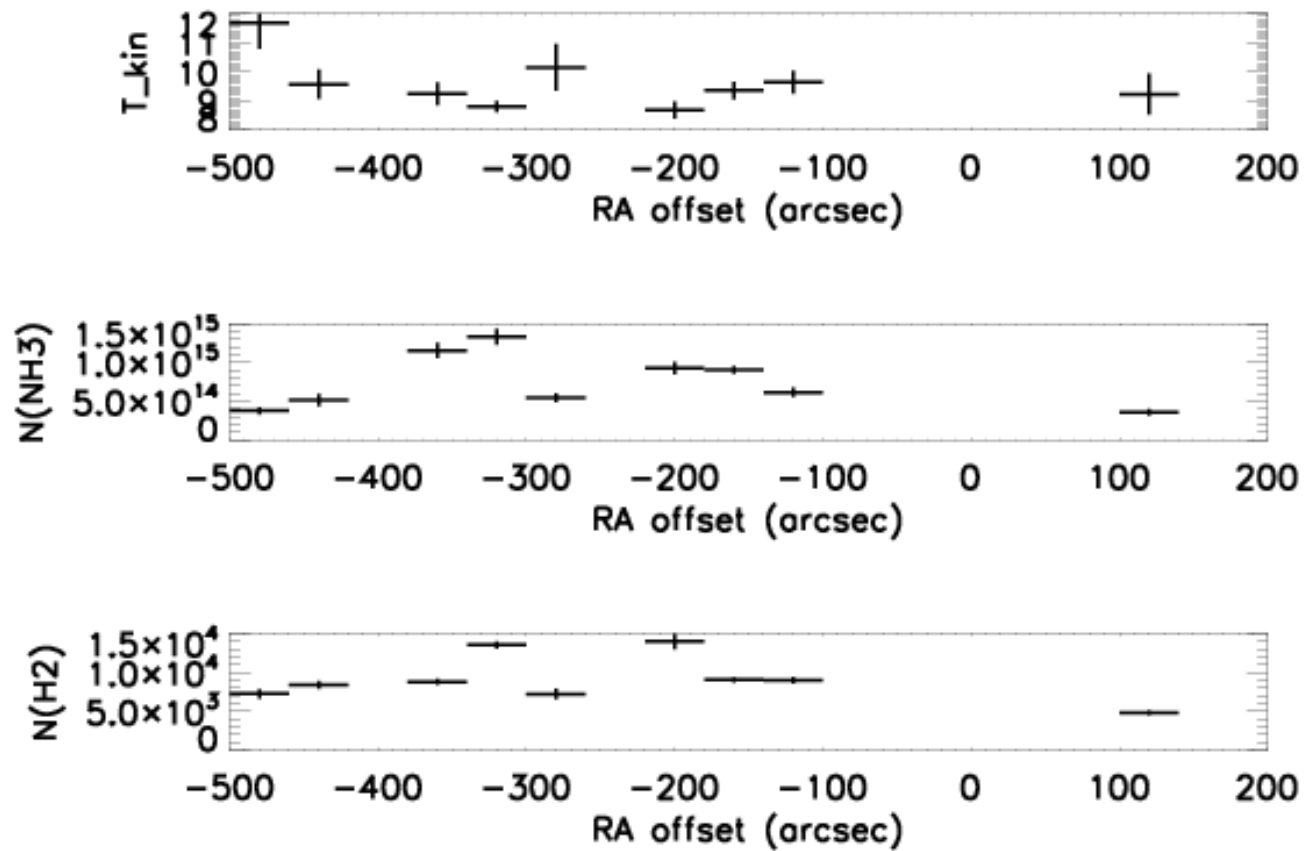
- TMC-1C
- (0,0) : 4:41:38.8 26:00:42
- HPBW: 40''
- Contours: from 1 by 1

NH₃(2,2) main group line area



- TMC-1C
- (0,0) : 4:41:38.8 26:00:42
- HPBW: 40''
- Contours: from 0.05 Kkm/s by 0.05 Kkm/s

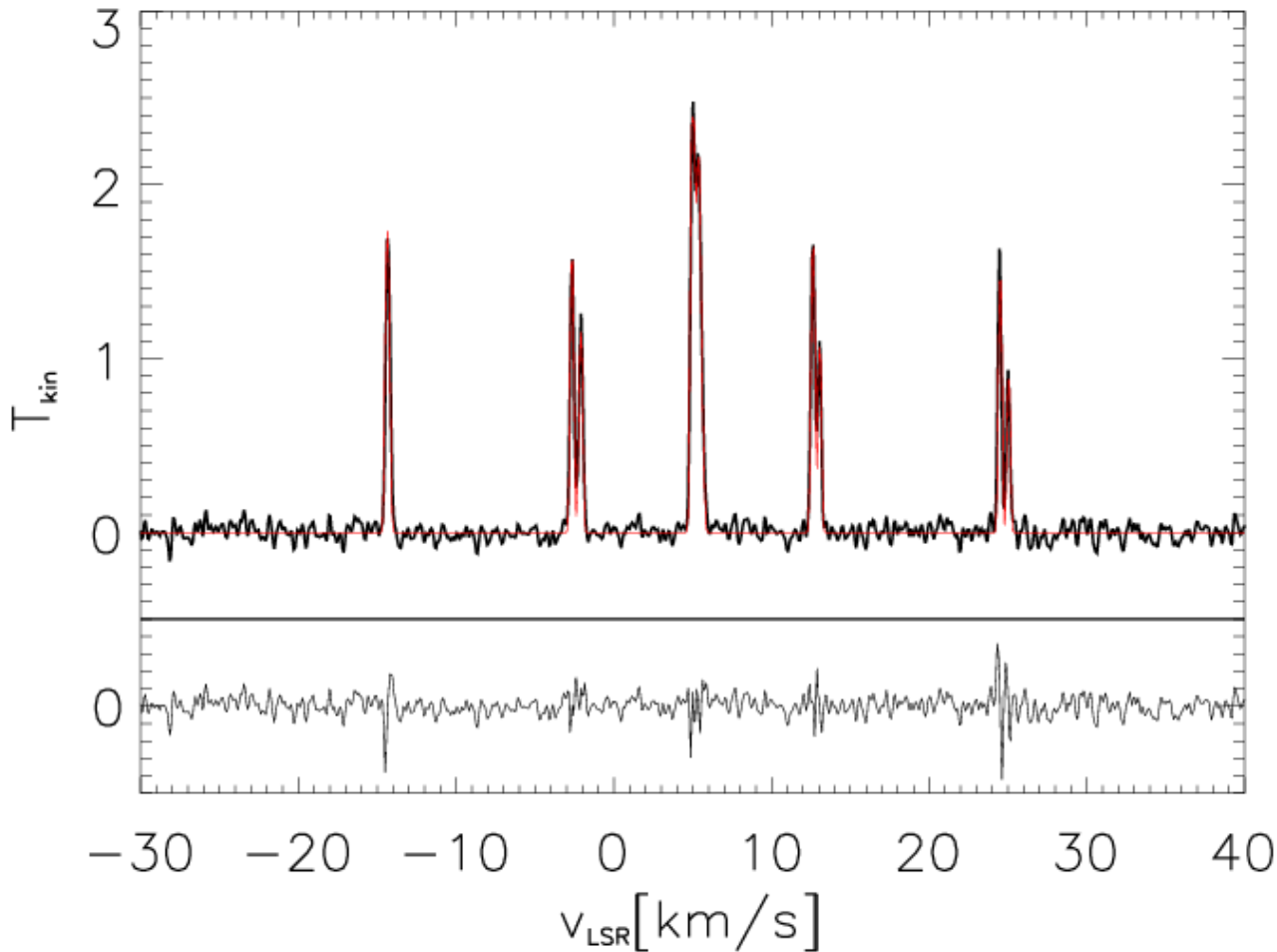
Distribution of T_{kin} , $n(\text{NH}_3)$ and $n(\text{H}_2)$



Cppsimu

- The program cppsimu is used to simulate radiative transfer of line emission in molecular clouds.
- We can investigate:
 - 1D or 3D model
 - Axissymmetric or non-axissymmetric clouds

Model spectrum of TMC-1C centre



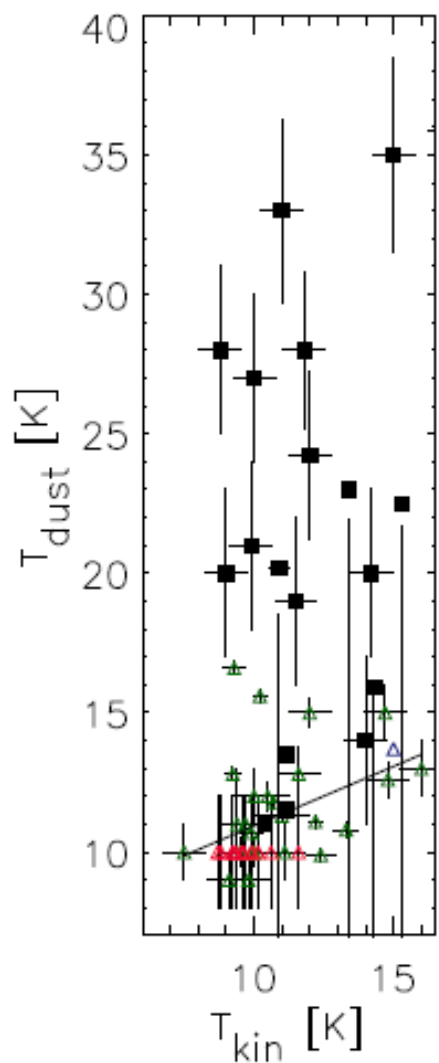
(0,0) position

4:41:38.8 26:00:53

$\text{NH}_3(1,1)$

- Observed
- Modeled
- residual

Relation between T_{kin} and T_{dust}



- Empty: starless cores
- Filled: cores with IR source
- Red triangles: TMC-1 starless cores

- Linear correlation for starless cores
- $T_{\text{dust}} = 0.4 T_{\text{kin}} + 6.7$

Future plans

- cppsimu modeling of
 - the other cores in TMC-1
 - the whole TMC-1 ridge as one object
- New accurate dust temperatures in TMC-1
- Starless and starry clumps: investigation with AKARI IRC and FIS data (from 9 to 160 μm)

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- This research has made use of the SIMBAD an VizieR data base operated bat CDS, Strasbourg, France.

Thank you for your attention!