A MULTI-TRANSITION AND MULTI-ISOTOPE STUDY OF CO IN THE GIANT MOLECULAR CLOUD ORION-A

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In order to study the excitation conditions in the Orion-A region, we applied an LVG code to ^{12}CO , ^{13}CO and $C^{18}O$ data obtained with the AT&T Bell Laboratories 7-meter telescope in USA (CO isotopes : $J = 1 - 0$, CS : $J = 2 - 1$) and the radiotelescope of the "Groupe d'Astrophysique de Grenoble" in France (CO isotopes : $J = 2 - 1$).

Figure 1 presents the CS (2-1) integrated area map superimposed to the $C^{18}O$ (2-1) integrated area. Figure 2 corresponds to the N(^{13}CO) map of the main filament (referred as the $\int$ shape filament) derived from our ^{13}CO LVG analysis (Castets et al. 1990). They show that contrarily to $C^{18}O$, ^{13}CO do not probe the dense cores. However, some high H_2 density, low column density features are revealed, not seen in CS and located in the envelope. Conversely the $C^{18}O$ map reveals that the same dense cores are seen in CS and $C^{18}O$ map suggesting in the Orion-A region a high density in the cores.

In the south (below $Dec = +2.5'$, see the location in the maps) the ^{13}CO reveals several components with different excitation temperature and line opacities. The $C^{18}O$ analysis is consistent with the existence of four components ($V = 7, 8.3, 9.1, 10.1 km/s$), especially below $Dec = -10'$. Due to the opacity of ^{13}CO lines, they are not always clearly separated in the ^{13}CO data. Below $Dec = -10'$, the ^{13}CO LVG analysis of the "main component" gives an average density of $1200 cm^{-3}$ and N(^{13}CO) of $2 \cdot 10^{16} cm^{-2}$ while preliminary $C^{18}O$ results show an average n(H_2) of $5000 cm^{-3}$ and N($C^{18}O$) of $8 \cdot 10^{14} cm^{-2}$ for the brightest components.

The n(H_2) density obtained from $C^{18}O$ represents an average value along the line-of-sight, while the density derived from ^{13}CO probes only external layers. To get the density and to determine the excitation conditions in the cores, a CS study is on progress.

Reference

Castets A., Duvert G., Dutrey A., Bally J., Langer W.D., Wilson R.W *Astron. Astrophys.* **1990, in Press.**

E. Falgarone et al. (eds.), Fragmentation of Molecular Clouds and Star Formation, 405–406.

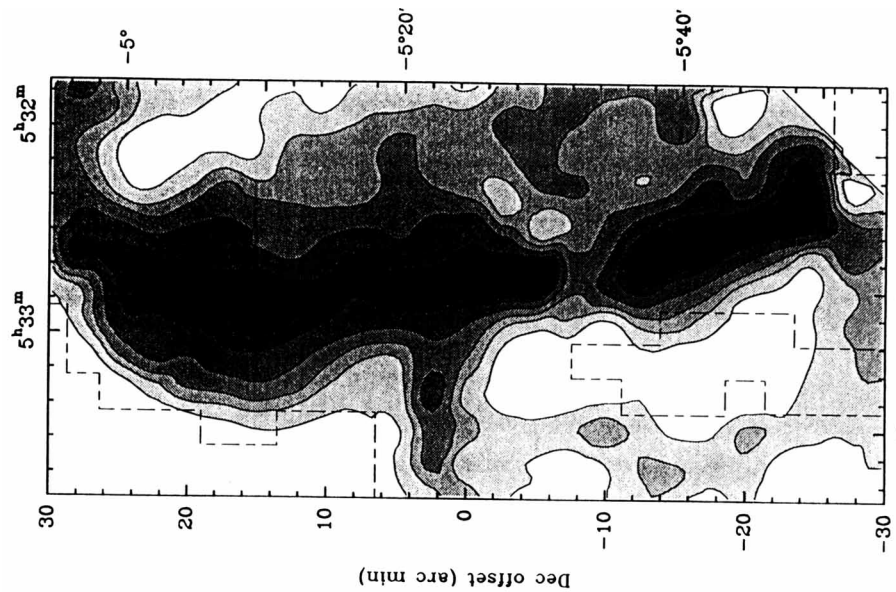

Fig 2 - ^{13}CO column density map derived from LVG analysis. Contours levels are $5 \cdot 10^{15}$, 10^{16}, $1.6 \cdot 10^{16}$, $2.5 \cdot 10^{16}$, $4 \cdot 10^{16}$, $6.5 \cdot 10^{16}$, cm^{-2}.

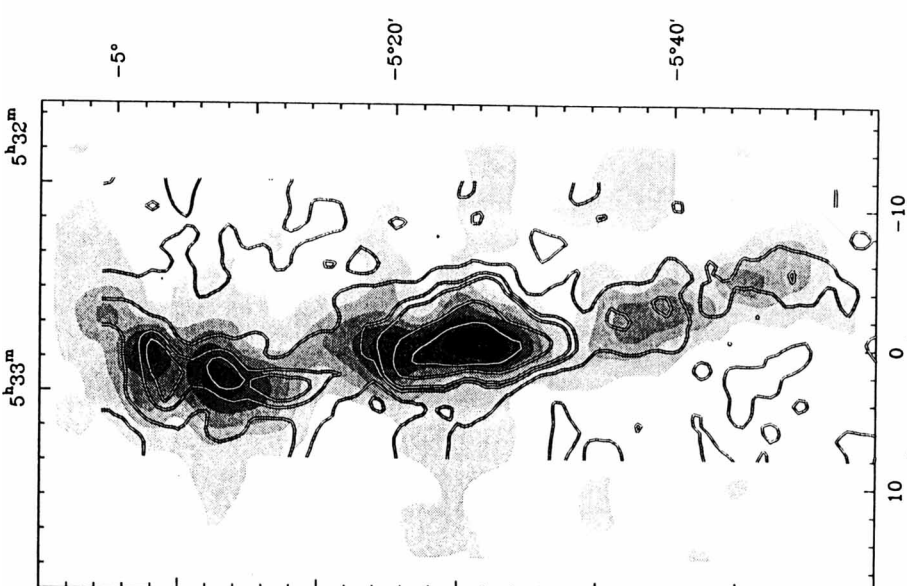

Fig 1: CS 2-1 integrated area map (lines) superimposed to $C^{18}O$ 2-1 integrated area (grey levels). Contours levels are CS: 0, 2, 4, 5, 9, 15 K.km/s; $C^{18}O$: 1, 2.5, 3.5, 4.5, 5.5, 7 K.km/s.