LARGE SCALE INTERACTION OF THE OUTFLOW AND QUIESCENT GAS IN ORION

J. MARTIN-PINTADO, A. RODRIGUEZ-FRANCO AND R. BACHILLER
1) Centro Astronómico de Yebes, Apartado 148, 19080 Guadalajara (Spain)

The IRAM 30-m radiotelescope have been used to obtain, with high angular resolution, the spatial distribution and the physical conditions of the quiescent gas in Orion A, and to search for high velocity molecular gas far away from the well known molecular outflow around IRc2. To study the quiescent gas we mapped a region of 200"x300" around IRc2 in the J=12-11 and J=16-15 lines of HC_3N with angular resolutions of 22" and 17" respectively. The left panel of Fig.1 shows the spatial distribution of the high density quiescent gas around IRc2 for different radial velocities. Beside the already known molecular ridge north of IRc2 (see e. g. Bartla et al. 1983), we find four very thin (nearly unresolved) and long filaments, like "fingers", stretching from IRc2 to the north and west. The deconvolved size of the longest fingers is ≈180"x15". From a multi-transition analysis of the HC_3N emission we derive H_2 densities of 1-8 10^5 cm^{-3}, kinetic temperatures larger than 40 K and masses of ≈10 Mo. Our high sensitivity observations of the J=2-1 line of CO at selected positions (see right panel ib Fig. 1) show widespread molecular gas with high velocities wings over the region where the molecular fingers and the HH objects are observed (see Fig.1). The high velocity emission occurs over a range of ±40 km s^{-1}. This high velocity gas is more extended (up to 150" from IRc2) than the very compact (40") and well studied molecular outflow around IRc2 (see e.g. Wilson et al. 1986). The terminal velocities of the CO wings decrease from 100 km s^{-1} (corresponding to the very fast molecular flow) to the typical terminal velocities of the extended high velocity gas when the distance to IRc2 changes from 40" to 60". The origin of the large scale high velocity gas is unknown, but it is very likely the link between the very compact (40") and fast (±100 km s^{-1}) molecular outflow around IRc2 and the ionized high velocity gas and the HH objects (Martín-Pintado et al. 1990). The mass, momentum and energy of the extended high velocity gas are crudely estimated to be ≈1 Mo, ≈20 Mo km s^{-1} and ≈2 10^{45} erg respectively (i.e. a factor of ≈10 smaller than those of the fast molecular outflow). The location, at the edges of the molecular fingers, and the proper motions of the HH objects (see Fig. 1) suggest the stellar wind is interacting with the molecular fingers. If this interpretation is correct, the influence of the molecular outflow in Orion on the surrounding molecular clouds must be revised.

Acknowledgments: This work has been partially supported by the Spanish CICYT under grant number PB88-0453.

E. Falgarone et al. (eds.), Fragmentation of Molecular Clouds and Star Formation, 456–457.

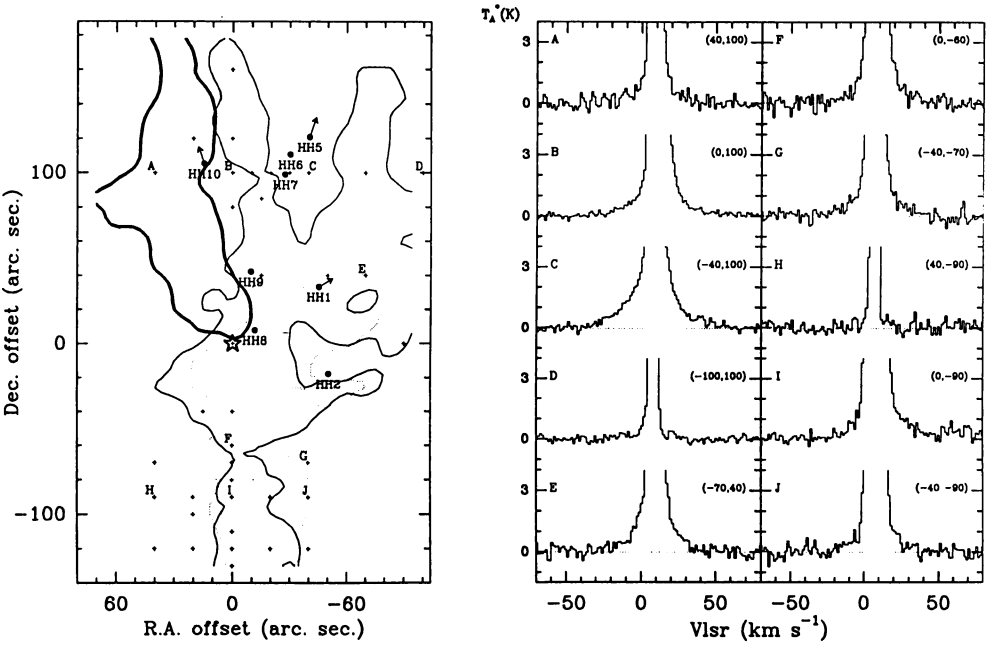

Figure 1 .- The left panel shows a sketch of the most outstanding features (the molecular fingers and the molecular ridge) as observed in the J=12-11 line of HC3N. The molecular ridge is represented by a solid thick contour corresponding at a level of 2 K km s^{-1} of the HC3N integrated intensity between 9.5 and 10 km s^{-1}. The molecular fingers are delineated by thin and dotted contours taken at levels of 0.7 (HC3N integrated intensity between 8 and 8.5 km s^{-1}) and 1 K km s^{-1} (HC3N integrated intensity between 7 and 7.5 km s^{-1}) respectively. The position of IRc2 is shown by a star. The HH objects are shown as filled circles and the direction of their proper motions is indicated by arrows (Axon and Taylor 1984; and Jones and Walker 1985). The HH objects are located close to the edges of the molecular structures and they seem to move in the direction of the fingers. The crosses show the positions where the J=2-1 CO spectra have been measured. The capital letters close to some crosses indicate the position of the CO spectra displayed on the right panel.

The right panel shows a sample of spectra in the J=2-1 line of CO taken in the Orion A molecular cloud toward positions far away from IRc2. The positions are indicated by their offsets, in arcseconds, with respect to IRc 2 (upper right corner on every spectra) and by a capital letter (upper left corner) which refer to the left panel.

References

Axon, D. J., Taylor, K. 1984, M.N.R.A.S., **207**, 241.
Bartla, W., Wilson, T. L., Bastien, P, Ruf, K. 1983, Astr. Ap., **128**, 223.
Martín-Pintado, J., Rodriguez-Franco, A., Bachiller, R. 1990, Ap. J. (Letters), **357**, L47.
Jones, B.F., Walker, M.F. 1985, A.J., **90**, 1320.
Wilson T. L., Serabyn, E., Henkel, C. 1986, Astr. Ap. (Letters), **167**, L17.

https://doi.org/10.1017/S0074180900199395 Published online by Cambridge University Press