N87-15087

THE MOLECULAR CONTENT OF THE NEARBY GALAXY FROM IRAS AND HI OBSERVATIONS

David Bazell
Applied Research Corporation
8201 Corporate Drive
Landover, MD 20785

and

F. X. Desert
Goddard Space Flight Center
Greenbelt, MD 20771

Abstract: Because infrared emission is a very good tracer of mass at high latitudes, by combining it with HI observations it provides a convenient though indirect way of observing the spatial distribution of molecular material (Desert, Bazell, and Boulanger). Moreover, these observations will allow us to place limits on the fraction of total infrared luminosity emitted by dust associated with molecular and atomic hydrogen clouds.

We report a preliminary result from the study of the correlation between HI column density and 100 um infrared flux density as measured by the IRAS satellite. The ratio F100/W(HI) = R has an average value of roughly 17 KJy/sr/(K km/s) over the whole sky. Bright regions in the FIR such as the Galactic plane and HII regions have been excluded from our data.

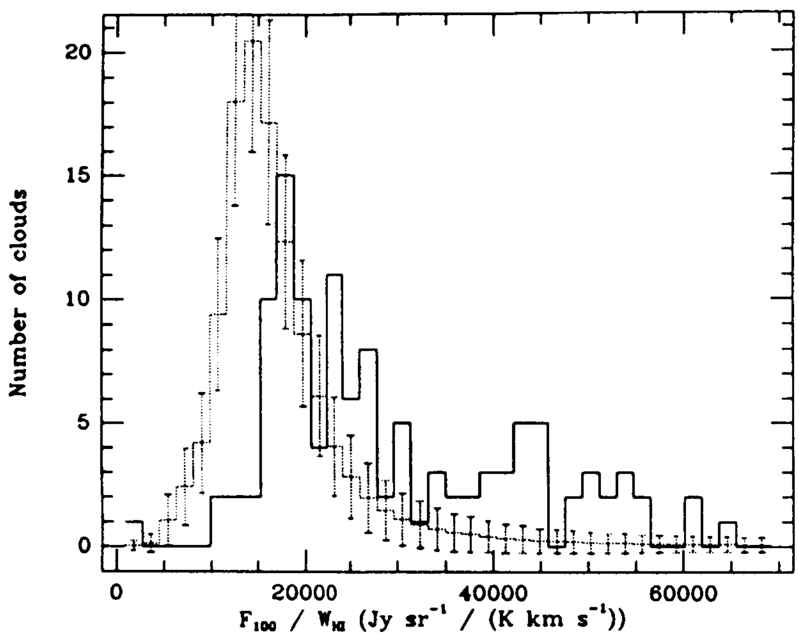
The histogram of the number of pixels vs R (cf. fig.) has a strong peak near 17 (same units as before) and is asymmetric about this mean value, having a tail at higher values of R. We find that this basic shape is fairly independent of the region of the sky we observe. The peak confirms the general correlation between infrared emission and HI column density reported previously by Boulanger et al. (1985).

One way to explain the shape of the distribution is to assume a constant dust to gas mass ratio and a constant interstellar radiation field and associate points in the tail with molecular clouds. In this case the ratio R is higher for points in the tail because it does not account for the column density of molecular hydrogen.

As an initial test of our hypothesis we have created a histogram of F100/W(HI) for points corresponding to peak intensity of CO emission in the approximately 120 High Latitude Clouds (HLCs) discovered by Magnani, Blitz and Mundy (1985) (MBM). These points are clearly not a random selection of points from our all sky distribution, because they lie mainly in the tail of the distribution. By accounting for the total hydrogen column density we can move the points in the tail into the body of the distribution.

On the other hand, we want to estimate the proportion of points in the tail of the distribution which correspond to molecular clouds. For example, the four clouds A, B, C and D of Low et al. (1984) were examined by MBM and found to have no detectable CO emission. While three of these clouds lie within the main distribution, cloud A has a ratio R of approximately 30 (same units), which is somewhat out in the tail of the distribution.

Finally, by studying the distribution of R in regions containing only HI we can separate the contributions to the luminosity into atomic and molecular components.



HISTOGRAM OF F100/W(HI)
Solid line: Number of clouds (MBM) with a given ratio of F100/W(HI). Dotted line: Number of pixels in the whole sky with a given ratio of F100/W(HI) normalized to total number of MBM clouds. Error bars indicate expected Poisson errors (square root of number of points). The high latitude molecular clouds lie mainly in the tail of the distribution of the whole sky.

Boulanger, F., Baud, B., van Albada, G. D., 1985, Astr. Ap., 144, L9.
Desert, F. X., Bazell, D., Boulanger, F., in preparation.
Low, F. J., et al., 1984, Ap. J. (Letters), 278, L19.
Magnani, L., Blitz, L., Mundy, L., 1985, Ap. J., 295, 402.