CO OBSERVATIONS IN THE SMALL MAGELLANIC CLOUD

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The dwarf Magellanic irregular galaxies apparently have a very low molecular content compared to the Milky Way. In the LMC, molecular clouds are fairly common, but the ratio of molecular to atomic gas is at least 5 times lower than in the Galaxy (Cohen et al. 1984). Elmegreen et al. (1980) searched for CO in 6 dwarf galaxies and failed to detect any emission even though their sensitivity was adequate to detect galactic giant molecular clouds placed at the distance of these galaxies. Israel (1984) observed the $J=2\rightarrow1$ transition of CO at 15 points in the Small Magellanic Cloud and detected CO emission from five of them, but at a level two to six times lower than typical galactic values.

Since January 1983, Columbia University and the University of Chile have been making a more extensive survey of CO in the SMC, using the $J=1\rightarrow0$ line at 2.6 mm. The observations are being made with the Columbia Southern Millimeter-Wave Telescope at Cerro Tololo, Chile, a 1.2 m Cassegrain with an 8 arcminute beam (137 pc at the SMC).

Observations are now under way. We have observed 51 positions to date: 32 dark clouds, 11 optical HII regions, 5 WR star positions, 1 continuum source, 1 infrared source, and 1 H_2O maser. These positions cover a total of 0.5 square degree in the bar and 0.2 square degree in the wing. We have detected CO in only one position, Hodge's (1974) dark cloud 4 ($\alpha=0^h44^m32^s$, $\delta=-73°39'$, 1950.0). The spectrum is shown in figure 1. We have also found possible CO emission at five other positions, four of them in the southwest part of the bar and one in the central part of the bar. We are now re-observing these positions to obtain a lower noise level.

The low molecular content is confirmed by our observations. Typical galactic giant molecular clouds at the distance of the SMC would produce a CO antenna temperature of about 0.5 K. This is 15 times our noise level and 6 times the intensity of the detected CO line. If the ratio of H_2 mass to CO luminosity is the same as in our galaxy (Lebrun et al. 1983), then the H_2 mass at the position of our CO detection is 7×10^4 $M_{\odot}$, only 7% of the HI mass within the telescope beam (McGee and

S. van den Bergh and K. S. de Boer (eds.), Structure and Evolution of the Magellanic Clouds, 399–400.

https://doi.org/10.1017/S0074180900040584 Published online by Cambridge University Press

Newton 1981). In contrast, our galaxy contains roughly equal quantities of atomic and molecular hydrogen. It is quite likely, however, that because the abundance of metals, and especially of carbon, is so low in the SMC, that the CO luminosity is also low, and that we have therefore underestimated the H_2 mass.

Observations of young objects in the SMC will continue during 1984. During the next few years we plan to make a fully sampled map of the entire cloud.

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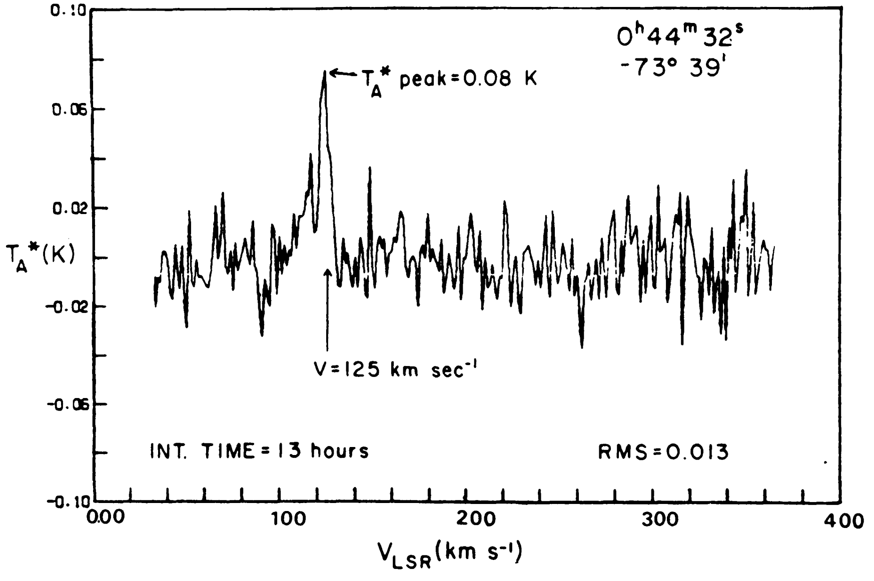

Figure 1 Spectrum of CO at Hodge dark cloud 4. As with all our spectra, only a linear baseline has been subtracted. At most positions, we integrated for 3 hours to achieve a noise level of 0.3K (RMS). Here, because the line is so weak, the time was increased to 13 hours.