The Effect of Star Formation on Molecular Clouds in Dwarf Irregular Galaxies: IC 10 and NGC 6822

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ABSTRACT

We have observed the ^{12}CO J=2−1 and J=3−2 lines at a few locations in the dwarf irregular galaxies IC 10 and NGC 6822 using the James Clerk Maxwell Telescope. In addition, we have observed the ^{13}CO J=2−1 line for IC 10 and the first detection of the ^{13}CO J=3−2 transition in a Local Group galaxy. The CO line ratios in IC 10 are uniform and are consistent with the average line ratios observed in M33 at the 1σ level. These low metallicity environments appear to be porous to UV radiation and allow for more efficient heating of molecular gas by nearby H II regions. The ^{12}CO J=3−2/J=2−1 ratio for the molecular cloud in NGC 6822 is higher than those found for IC 10 and M33 and suggests that the ^{12}CO emission is optically thin in this region. This high line ratio is likely the result of its location inside a large H II region with low metallicity and low gas content, and requires a hydrogen density greater than 10^4 cm^{-3} and a kinetic temperature greater than 100 K. The ^{12}CO/^{13}CO J=3−2 line ratio in one of the molecular clouds in IC 10 indicates that the gas must have a rather high kinetic temperature of about 100 K. In IC 10 we observe structures on a variety of size scales that all appear to be gravitationally bound. This effect may help explain the rather high star formation rate in IC 10.

Subject headings: galaxies: irregular — galaxies: individual (IC 10, NGC 6822) — galaxies: ISM — ISM: molecules — Local Group