Physical Conditions of Molecular Clouds in the Irregular Galaxies IC 10 and NGC 6822

G. R. Petitpas, C. D. Wilson

McMaster University

ABSTRACT

We have observed the ^{12}CO J=2−1, J=3−2 lines for the dwarf irregular galaxies IC 10 and NGC 6822. In addition, we have observed ^{13}CO J=2−1 for IC 10 and the first detection of the ^{13}CO J=3−2 transition in a Local Group galaxy. We find the CO line ratios in IC 10 are uniform and consistent with the average of M33 at the 1σ level. This indicates that the physical conditions in the IC 10 molecular clouds are similar to those in M33. By using the line ratios in conjuction with models we find the ^{12}CO J=3−2/J=2−1 ratio for NGC 6822 (which is higher than those found for IC 10 and M33), suggests that the ^{12}CO emission is optically thin in this region. This high line ratio requires a hydrogen density greater than 10^4 cm^{-3} and a kinetic temperature greater that 100 K. The ^{12}CO/^{13}CO J=3−2 line ratio in IC 10 MC1−2 indicates that the gas must have a rather high kinetic temperature of about 100 K. Flux measurements yield masses for the clouds of 1 to 3 $\times 10^6$, which is higher than previously estimated.