Heating and Cooling of the ISM in low metallicity environments

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Dwarf galaxies are thought to be important constituents in the hierarchical construction of massive galaxies. Being low in metallicity, they are thought to be at relatively early epochs of chemical evolution, thus, making local dwarfs potential laboratories to study starformation environments in young galaxies. FIRST has the capability to explore the spectral signatures characterizing the nature of dust and gas as a function of galaxy metallicity.

We are studying the effects of metallicity on the heating and cooling processes in the ISM via observations of the MIR to submm dust spectra in conjunction with the important gas cooling line, [CII], at 158 micron. From our survey of dwarf galaxies, we find a profound effect on the observed properties of the gas and dust due to the low metallicity nature of the ISM. For example, we find enhanced I[CII]/I(CO 1-0) ratios in low metallicity environments compared to those in normal (solar) metallicity environments. From these results, we have attempted to deduce the mass of H2 present in low metallicity environments, which may be substantially greater than that deduced from CO observations alone. The [CII] line is useful to probe the molecular content of low-metallicity dwarf galaxies, where the CO(1-0) line is not detected.

To understand the heating of the gas in such low metallicity environments, we have modeled the various dust components of several low-metallicity starbursting galaxies. Compared to Galactic cirrus, for example, these low-metallicity galaxies requires 2 orders of magnitude less PAHs to explain the observed dust spectra as well as a larger size range of small hot grains responsible for most of the MIR continua. This result is consistent with the destruction of PAHs in the harsh radiation fields of these objects.