

A CO, HCN and CI line survey of ULIRGs

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Abstract.

Preliminary results from a sensitive survey of the CO J=1–0, 2–1, 3–2, 4–3, 6–5, HCN J=1–0, 3–2, 4–3, and CI J=1–0 lines of a sample of 30 Ultraluminous Infrared Galaxies (ULIRGs) are presented. These reveal a tantalizing picture of the physical conditions of the molecular gas in these extraordinary galaxies ($L_{\text{FIR}} > 10^{12}L_{\odot}$), with a diffuse phase dominating the low-J CO lines and a much denser and warmer phase dominating the CO 4–3 and 6–5 and all the HCN lines. Preliminary analysis finds the bulk of their dense ($n \geq 10^5 \text{ cm}^{-3}$) H_2 gas reservoir to be also warm $T_{\text{k}} \sim (60 - 70)\text{K}$, without any significant reservoir of *dense and cold* H_2 gas. This points to most of the dense gas in ULIRGs as the immediate “fuel” of their prodigious star formation (SF) rates, without any SF-idle dense gas reservoir present in these rapidly evolving merger/starbursts. The CI J=1–0 emission was found to be a robust tracer of their total molecular gas mass under a large range of physical conditions, a potent alternative to the much weaker emission from the ^{13}CO isotopologue, and especially promising as an H_2 tracer for similar objects at high redshifts.

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