THE MOST LUMINOUS STAR FORMATION REGIONS IN THE GALAXY

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We present new far-IR and submillimeter broad-band and spectroscopic results on the dense and very luminous cores of massive star formation regions. The best-studied region, W51, contains one core around the source IRS2 and another around W51 MAIN. Our earlier submillimeter continuum mapping has shown that these two cores are very massive ($2\text{-}4 \times 10^4$ $M_\odot$) and have *average* densities of $n_{H_2} \sim 10^5$ over their inner parsec. New far-IR maps show that both cores are very luminous ($L(MAIN) \sim 2 \times 10^6$ $L_\odot$; $L(IRS2) \sim 4 \times 10^6$ $L_\odot$). Observations of the (1,1) and (2,1) transitions of NH_3, indicate high kinetic temperatures (200-400 K) for the quiescent gas in the inner several arc seconds (0.1 pc) of both cores. Spectroscopy of the 370 μm J = 7→6 and 163 μm J = 16→15 transitions of CO toward the cores allows us to characterize the hot high velocity material seen previously on the H_2O maser transitions and not readily visible in the low J transitions of CO. The high velocity flow in IRS2 is ∼ 60 times more massive than the very similar outflow in the ∼ 30 times less luminous Orion/KL core. The mass loss rate is ∼ 30 times greater than in Orion. Additional observations of W49 allow us to draw a few general conclusions about the most luminous star formation regions in our galaxy: (1) The luminous cores are $10^2\text{-}10^3$ more massive than the Orion core with the same density. (2) Outflows and warm regions in these cores have physical conditions similar to those in their less luminous counterparts but far more mass is involved in the flows.

MASSIVE STAR FORMATION IN W49

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W49 is the most luminous H II region complex in the galaxy. VLA maps in the continuum reveal a complex of more than two dozen compact H II regions, including a ring-like distribution of a dozen such regions within a volume of 1 pc. In addition to the VLA maps, we have obtained