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MILLIMETER OBSERVATIONS OF G5.89-0.39

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ABSTRACT We present multi-line millimeter interferometer maps and single dish observations of the G5.89-0.39 ultracompact HII region. Radiative transfer modelling suggests an overall collapse.

OBSERVATIONS

The G5.89 ultracompact HII region is particularly well suited to detailed study because it is one of the closest (d$\sim$ 3 kpc), most luminous (L$\sim$ 3×10^5 $L_\odot$) and most morphologically simple of the known ultracompact HII regions (Wood and Churchwell 1989). Nine transitions in five molecular species, continuum emission, and a recombination line were mapped toward G5.89 with the Hat Creek interferometer (HCO^+ 1–0, $H^{13}CN$ 1–0, SO 2_2–1_1, ^{12}CO 1–0) and the Nobeyama Millimeter Array (H41α, CH_3CN 5-4, K=0,1,2,3,4). The highest spatial resolution was obtained with the NMA, where uniform weighting yielded a $2\farcs7 \times 1\farcs7$ synthesized beam (Figure I).

G5.89 KINEMATICS

Our ^{12}CO J=1–0 interferometer maps and J=2–1 and J=3–2 single dish spectra constrain the ^{12}CO excitation and confirm earlier estimates that the G5.89 bipolar outflow is the most powerful yet discovered (Harvey and Forveille 1988). The HCO^+ 1–0 spectrum toward the HII region shows two redshifted absorption features (Figure II). The strength of the redder feature does not change relative to the continuum with increasing beam size, indicating that there is no emission associated with this feature; this absorption is probably due to an unrelated foreground cloud. In contrast, there is emission associated with the lower velocity absorption system. Since this requires high densities ($\gtrsim 10^5 cm^{-3}$), this absorbing material is likely dynamically related to the G5.89 core. We have modelled the molecular envelope with the radiative transfer code described by Auer and Dickel (1988) and find that the detailed distributions of HCO^+ J=1–0 and J=3–2 emission and absorption are well matched by remnant infall.

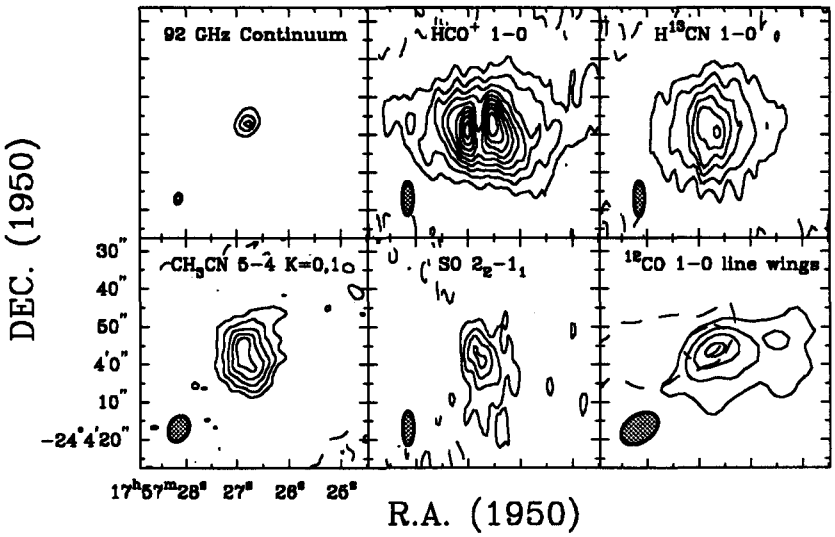

FIGURE I Integrated intensity maps toward G5.89. Continuum emission has been subtracted from the molecular maps. The contour interval and lowest contour are 1.5 K for HCO^+, $H^{13}CN$ and SO, 0.5 K for CH_3CN, 7 K and 35 K for the continuum, and 2.4 K for the ^{12}CO line wings ([30,60] km s^{-1} dashed, [-40,-10] km s^{-1} solid).

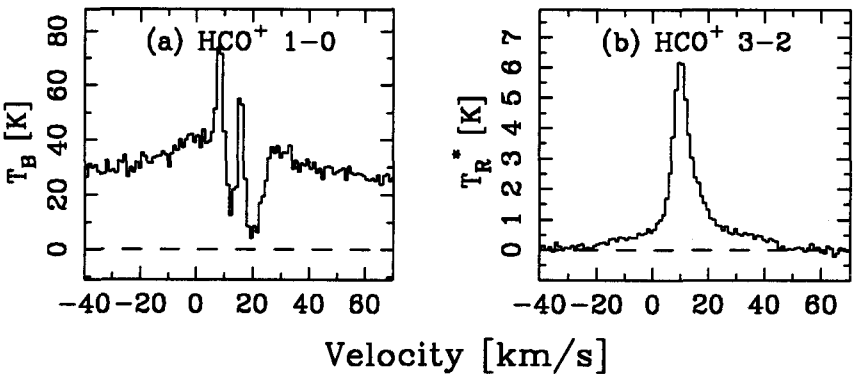

FIGURE II HCO^+ spectra toward G5.89. (a) J=1–0 profile from the Hat Creek array; beam 8.″7 × 2.″8. (b) J=3–2 profile from the NRAO 12 m telescope, continuum subtracted; beam 24.″

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