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MOLECULAR CLOUD CORE AND CS OUTFLOW ASSOCIATED WITH HARO 4–255 FIR

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ABSTRACT

The region containing Haro 4–255 FIR is studied in CS (1–0) with the 45 m telescope and the Nobeyama Millimeter Array. We have detected intense CS outflow. The CS abundance is found to be enhanced in the outflow lobe. The aperture synthesis data show two groups of emission, one of which is likely to impede the blueshifted CS lobe.

INTRODUCTION

We carried out the systematic survey of molecular cloud cores in the Orion A GMC, and catalogued 125 cores (Tatematsu et al. 1993). In this paper, we select one core toward Haro 4–255 FIR for a further study. Haro 4–255 FIR is a far-infrared object Evans et al. (1986) discovered, and is located 45″ NE of the classical T Tauri star Haro 4–255. Recently, Anglada et al. (1992) detected two radio continuum sources at 3.6 cm with VLA in this region.

OBSERVATION

Single-dish CS (1–0) data were obtained with the Nobeyama 45 m telescope (HPBW = 36″ at 49 GHz). Details of the observation are given in Tatematsu et al. (1993). Aperture-synthesis CS (1–0) data were obtained with the Nobeyama Millimeter Array (NMA). Two fields were observed. The synthesized beamwidth was 15″ × 12″ (P. A. = –17°).

RESULTS

Figure 1 shows a CS position-velocity diagram passing through one of the VLA sources. Broad emission is observed around this VLA source, and most likely represents a CS outflow. Assuming that the momentum of the CS outflow is comparable with that of the previously known CO outflow (Levreault 1988; Morgan et al. 1991), we estimate the CS abundance to be about 10^{-8}, which is one order of magnitude larger than the value in the molecular cloud cores. From the same assumption, the total mass of the molecular outflow might be three times as large as the previous estimate solely based on the CO data. The aperture-synthesis observation detected two features of emission, which roughly coincide with local peaks within the core on the single-dish map (Fig. 2). One of them is located between Haro 4–255 FIR and the T Tauri star, and its

distribution is very similar to that in HCO^+ by Chen et al. (1992). No emission from the CS outflow was detected in the aperture-synthesis observation. The blueshifted wing of the CS outflow is weak (Fig. 1) probably because the densest part of the core, which is seen as the above aperture-synthesis feature, impedes the CS outflow. The total mass detected in the aperture-synthesis observation is 17 $M_\odot$, which is 5% of the mass observed in the single-dish observation.

REFERENCES

Anglada, G., Rodríguez, L., Cantó, J., Estalella, R., & Torrelles, J. M. 1992, ApJ, 395, 494
Chen, H., Fukui, Y., & Yang, J. 1992, ApJ, 398, 544
Evans, N. J., II., Levreault, R. M., & Harvey, P. M. 1986, ApJ, 301, 894
Levreault, R. M. 1988, ApJS, 67, 283
Morgan, J. A., Schloerb, F. P., Snell, R. L., & Bally, J. 1991, ApJ, 376, 618
Tatematsu, K., et al. 1993, ApJ, in press

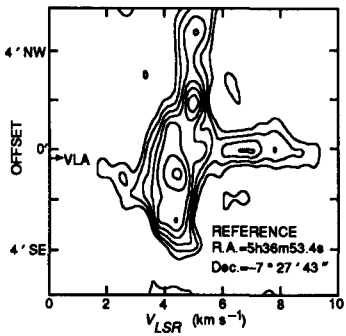
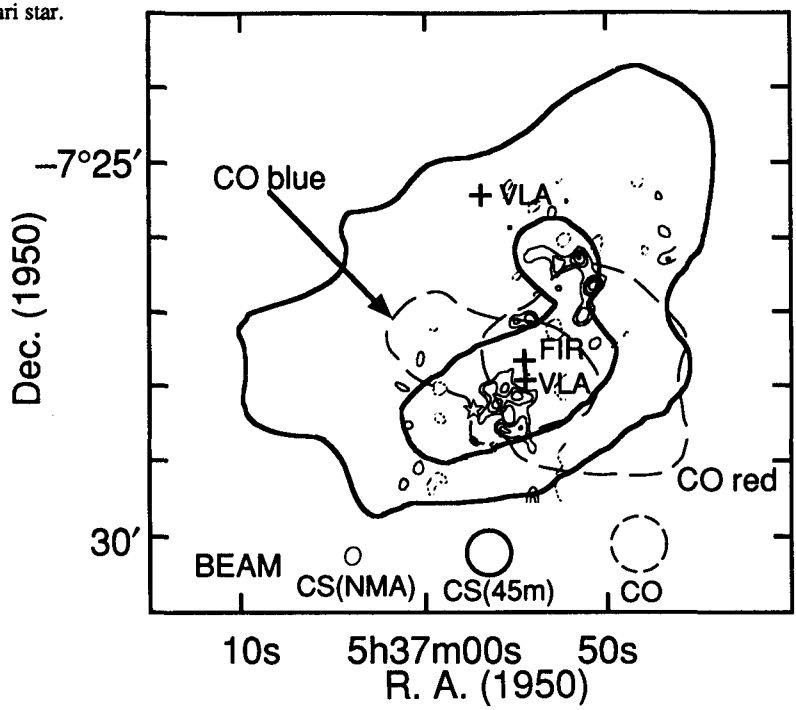


FIG. 1 *(Right)* — Single-dish CS (1–0) position-velocity diagram passing through one VLA source with a position angle of –45°. The lowest contour level is 0.68 K T_A^* and the level interval is 0.34 K T_A^*.

FIG. 2 *(Bottom)* — Comparison of the single-dish CS map [2.16 and 4.32 K km s^{-1} in T_A^*], aperture-synthesis CS map [(–2, 2, 3, 4, 5)×1.77 K km s^{-1} in T_b], and the lobes of the CO outflow [4.35 K km s^{-1}, Morgan et al. 1991]. ☆ marks the T Tauri star.



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