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CS LINES AND DUST CONTINUUM OBSERVATIONS OF THE OMC2 INFRARED CLUSTER

T. UMEMOTO, N. OHASHI, Y. MURATA, K. TATEMATSU, & M. SUZUKI
Nobeyama Radio Observatory, National Astronomical Observatory, Minamimaki, Minamisaku, Nagano 384-13, Japan

1. Introduction

It is known that stars in GMCs are often born as clusters. Recently, near infrared imaging has enabled us to study the young stars within molecular clouds (e.g., Lada & Lada 1991). Orion Molecular Cloud 2 (OMC2) is located 12′ north of the Trapezium cluster in the Orion A cloud, and contains a cluster of about 20 near-IR sources and several FIR sources distributed within a diameter of 0.2 pc (Rayner *et al.*1989; Johnson et al. 1990; Mezger, Wink, & Zylka 1990). By large scale mapping observations using the NRO 45 m telescope, this infrared cluster is found to be associated with a dense molecular core (Tatematsu *et al.*1993, Umemoto *et al.*1993). The region was observed using the Nobeyama Millimeter Array (NMA) to elucidate the structure and cluster formation process within a core.

2. Results and Discussion

Single- dish CS(1–0) data show that the infrared cluster is associated with a dense core having a mass of 230 $M_\odot$ and a radius of 0.18 pc. Assuming the total stellar mass is 20 $M_\odot$, the star formation efficiency is estimated to be 8%, which is lower than 22% in the ρOph core (Wilking, Lada, & Young 1989).

The interferometer observations of the CS(2–1) line and continuum emission at 98 GHz show several features of emission corresponding to previously known sources. In paticular, we detected strong CS line and continuum emission toward the FIR4 detected in λ1.3 mm dust continuum. Continuum emission was also detected toward the luminous NIR source IRS4 (FIR3) and FIR 5 (Fig. 1). The mass of dust clumps was estimated to be 1.9 $M_\odot$(FIR3), 3.3 $M_\odot$(FIR4), and 0.76 $M_\odot$(FIR 5), assuming the dust temperature was 40 K. These values are a factor of 10 lager than T Tauri stars (Ohashi *et al.*1991). We cannot detect T Tauri stars in this region due to the high detection limit of these observations.

From velocity-channel maps, we found 7 small clumps of CS emission (Fig. 2). The mean radius of clumps was 0.02 pc, 1/10 of the molecular cloud core radius. The mass of clumps ranged from 0.38 to 12 $M_\odot$(all 16 $M_\odot$) (assuming T_{ex} = 40 K). These suggest that a substructure exists within the molecular cloud core. We also found clumps without NIR or FIR sources, which might evolve into the next generation of cluster members.

The high-velocity CS(2–1) emission was detected around FIR4, but the center of the emission does not coincide with FIR4. The high-velocity emission shows a bipolar pattern with east-west orientation and 23″ separation from a previously known bipolar outflow source (Fisher *et al.*1985). This indicates that there is a new bipolar outflow source which does not have a strong continuum source.

If the lower SFE is due to the early evolutionary stage of the cluster formation, the lower SFE together with recent star formation may indicate that the OMC2 is now in the process of forming a cluster.

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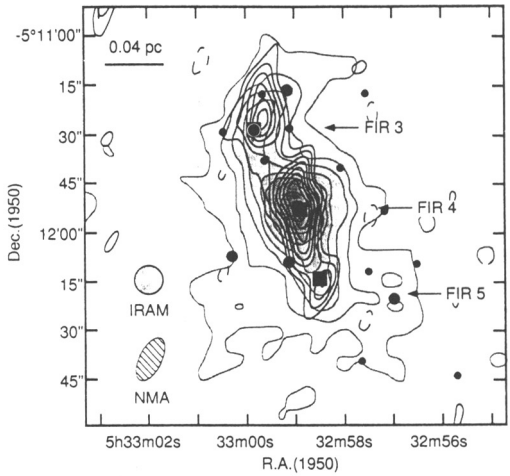

Figure 1. λ 3 mm continuum map compared with λ 1.3 mm continuum map obtained by Mezger, Wink, & Zylka (1990). The lowest contour and contour interval for λ 3 mm continuum map are 220 mJy • beam^{-1} and 7.0 mJy • beam^{-1}. The filled circles and filled squares represent NIR stars (Johnson et al. 1990 ; Rayner et al. 1989) and λ 1.3 mm continuum sources (FIR3-FIR5).

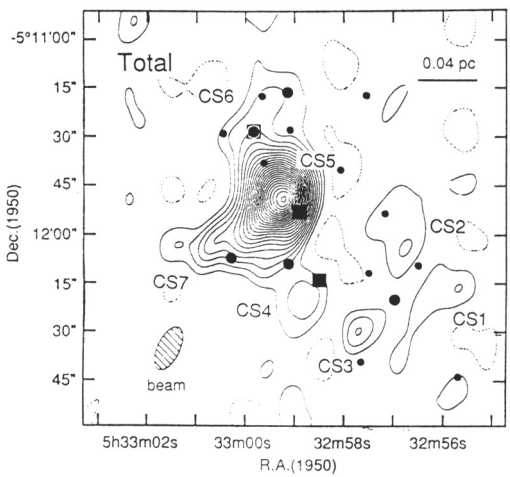

Figure 2. Total intensity map of the CS (2-1) emission integrated over a velocity range from 3.8 km • s^{-1} to 16.3 km • s^{-1}. The lowest contour and contour interval are 2σ, where the 1σ level is 830 mJy • beam^{-1}. CS1 - CS7 indicate the clumps of CS (2-1) emission.

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