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INFRARED CO EMISSION FROM WL 16

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The Rho Ophiuchi source WL 16 is the second Young Stellar Object (YSO) found to have infrared CO emission bands. IRAS observations show that WL 16 is far less luminous ($\sim$ 14 $L_\odot$) than the first source of infrared CO emission, BN (> 5000 $L_\odot$). Also in contrast to BN, the CO emission from WL 16 represents a significant fraction of the total luminosity. The 2.3 μm first overtone CO emission bands were observed with the Steward Observatory Fourier Transform Spectrometer at the 2.3 m telescope.

The infrared spectrum of WL 16 shows both first overtone CO band emission and emission from the Br γ line of atomic hydrogen. No evidence of emission from molecular hydrogen is present. Analysis of the spectral features indicates that the size of the emission region is $\sim$ 1 AU or greater, the excitation temperature of CO is greater than 4000 K, and the density of the emission region is greater than 10^{11} cm^{-3}. If the additional constraints of LTE and chemical equilibrium are imposed the density, excitation, and size of the emission region become a function of the temperature. Solutions matching the size of emission region with the blackbody radius and matching the average density of a 1 $M_\odot$ protostellar model of Stahler, Shu, and Taam (1981) have been calculated. In both models the emitting gas is predominantly atomic, rather than molecular. The protostellar solution has a temperature of 4150 K, a density of 5×10^{11}, a mass of 9.1×10^{-5} $M_\odot$, and a radius of 3.7×10^{13} cm.

Although the observed CO emission matches the predicted flux from an accreting spherical protostellar model, other interpretations are

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also consistent with the observations. These include outflow from a more evolved YSO in a T Tauri phase and possible binary models. The low luminosity of WL 16 rules out supergiants and novae which are the only other sources of observed CO emission.

CO, ^{13}CO, AND HCN(J = 1-0) OBSERVATIONS OF L1204(S140)

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We present results of CO, ^{13}CO, and HCN(J = 1-0) observations of L1204 by the 4 m telescope of Nagoya University.

S140 is a small H II region ionized by a B0 V star (HD 211880) and is located at the southwest edge of L1204. S140 is associated with one of the most energetic molecular outflow sources.

We have mapped an area of about one square degree and the distribution of the L1204 cloud has been obtained. We find that L1204 consists of at least three separate elongated clouds (Figure 1). LSR velocities of each cloud are $\sim$-7, $\sim$-9, and $\sim$-11 km s^{-1}. The size of each cloud is typically $\sim$ 10 pc in length and $\sim$ 2 - 3 pc in width, if we assume the distance to be 910 pc (Crampton and Fisher 1974). The mass of each cloud is a few $\times$ 10^3 $M_\odot$ and the total mass of L1204 amounts to $\sim$ 10^4 $M_\odot$.

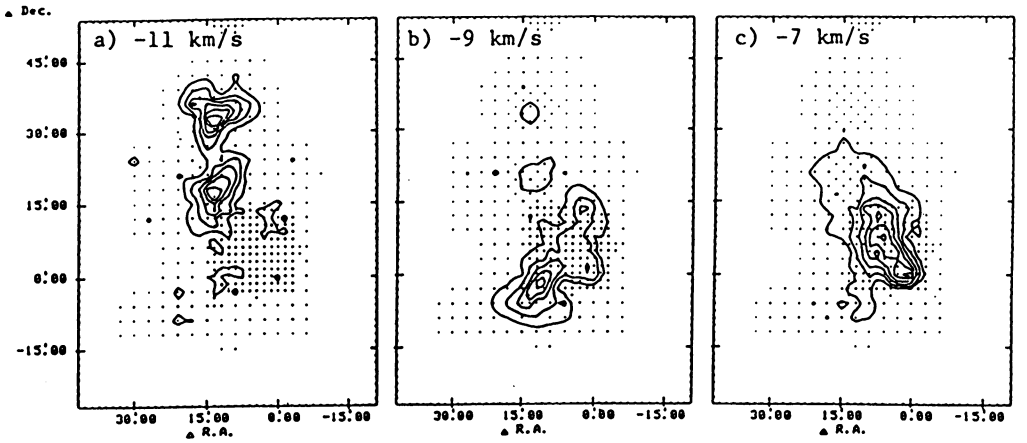

Fig. 1. (a),(b), and (c). Integrated intensity maps of ^{13}CO(J = 1-0). The coordinates are indicated by the offset from R.A. = $22^h17^m41^s$ Dec.= 63°3'49". (a) The integrated range is from -13 to -10 km s^{-1}, and the lowest contour and the contour interval are 1.5 K km s^{-1}. (b) and (c) The integrated ranges are from -10 km s^{-1} to -8 km s^{-1} and from -8 km s^{-1} to -6 km s^{-1} respectively. The lowest contour and the contour interval are 3 K km s^{-1}.

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