

Probing Massive Protocluster-forming Cores Around IRAS 05345+3157

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1. ABSTRACT

To identify protocluster-forming cores and better understand massive star formation at the earliest stages, we observed the intermediate to massive star-forming region I05345+3157 using CS(2 – 1) with CARMA to reveal the properties of the dense gas clumps. Seven gas clumps are identified in the integrated intensity map of CS(2 – 1). Among these clumps, clump 1 and clump 3 both have counterparts in the $\lambda = 2.7$ mm continuum, as well as Spitzer data. The spectrum of clump 3 shows blue-skewed self-absorption, which suggests gas infall – a collapsing core. The LTE masses and dust masses of clump 1 and clump 3 are $4 \pm 1 M_{\odot}$ and $18 \pm 6 M_{\odot}$, and $17 \pm 7 M_{\odot}$ and $11 \pm 3 M_{\odot}$, respectively. We suggest that clump 1 and clump 3 are star-forming cores that may already or will very soon harbor massive young massive stars. These two clumps are probably at the early stage of High-Mass Protostellar Objects (HMPOs) as classified by Beuther et al. 2007. The other clumps have also the potential to form massive stars as their surface density is of the order of 1 g/cm^{-2} needed to form massive stars (McKee & Tan 2003). In addition, the observed broad line widths of the gas clumps indicate non-thermal motions. These non-thermal motions can be interactions with nearby outflows or due to the clump initial turbulence, both mechanisms are observed in the seven clumps. Finally, the virial masses are larger than the LTE masses (except clump 6), which implies a requirement on the external pressure of $\sim 10^8 \text{ K cm}^{-3}$ in order to keep the clumps bound.