Study of the L1551 pre-stellar core using the $C^{18}O$(1-0) and $H^{13}CO^{+}$(1-0) line emission with the Nobeyama 45 m telescope and Millimeter Array.

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We carried out $C^{18}O$(1-0) and $H^{13}CO^{+}$(1-0) line observations of the L1551 pre-stellar core (L1551 MC) with the Nobeyama 45 m telescope and Millimter Array (NMA). The purpose of this study is to reveal the initial conditions for low-mass star formation. We obtained the $C^{18}O$ and $H^{13}CO^{+}$ maps of the core with the 45 m telescope. The peak position of the $C^{18}O$ core is shifted by 60" to the center from that of the $H^{13}CO^{+}$ core. The radius , mass, and velocity width of the core are 0.1 pc, 1 $M_{\odot}$, and 0.71 km s-1, respectively, in $C^{18}O$, and 0.15 pc, 4 $M_{\odot}$, and 0.47 km s-1, respectively, in $H^{13}CO^{+}$. Our model analysis derived the density profiles of rho ~ $r^{-1.3}$ and $r^{-1.4}$ for the $C^{18}O$ and $H^{13}CO^{+}$ cores, respectively, which are flatter that the theoretical prediction of r^{-2} for a star-forming core (Shu 1977[1]; Larson 1969[2]; Penston 1969[3]). In addition, we found that the $C^{18}O$ core has a velocity gradient along the NE-SW direction, which can be interpreted as rotation, and that the velocity width of the core increases toward the center. However, the NMA could not detect any compact component within 0.05 pc from the core center in $C^{18}O$. These results lead us to the conclusion that the L1551 MC has not yet evolved into a centrally concentrated star-forming core in spite of the age of 10^{4-5} yr (Swift et al. 2005[4]). The ALMA can reveal the detailed density and velocity structures of the interesting core..

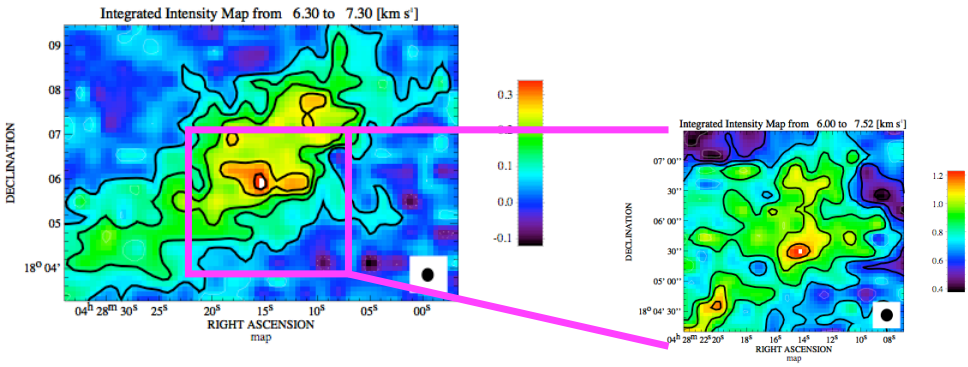

Figure 1: (left) Total integrated intensity map of the $H^{13}CO^{+}$(1-0) emission (color and contours). (right) Total integrated intensity map of the $C^{18}O$(1-0) emission (color and contours). The contours with the intervals of 3 σ level start from the 3 σ levels, where the 1 σ noise levels are 0.05K and 0.1K in T_A^{*} for $H^{13}CO^{+}$ core and $C^{18}O$ core, respectively.

References

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