

Detection of CH₃NCO in Galactic Center star-forming region Sagittarius B2(M) by radio astronomical observations

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Large difference of chemical compositions between molecular clouds and comets is a big question for astrochemistry. The case of pre-biotic molecule CH₃NCO is one of them. The abundance ratio of [CH₃NCO]/[HNCO] is high in a comet (> 4, [1]), although it is low (< 0.3, [2]) in molecular clouds. An abundance of CH₃NCO is expected to be held and/or increased during evolutionary process of a cloud. A couple of an old core and a young core having the similar chemical compositions needs to be investigated for this evolutionary process. In this work, we aimed to detect CH₃NCO in the middle (M) core, which is relatively older than the north (N) core, in the Galactic Center star-forming region Sagittarius B2 with the 45 m telescope of Nobeyama Radio Observatory. The rotational transitions of $J = 10 \rightarrow 9$ to $13 \rightarrow 12$ for CH₃NCO were detected in the 85–114 GHz region. The column density and the rotational temperature are derived to be $N = (4.3 \pm 2.1) \times 10^{13} \text{ cm}^{-2}$ and $T_{\text{rot}} = (32 \pm 9) \text{ K}$, respectively, assuming local thermal equilibrium. Similarly, an abundance of HNCO is estimated to be $N = (1.3 \pm 0.5) \times 10^{15} \text{ cm}^{-2}$ ($T_{\text{rot}} = 21 \pm 2 \text{ K}$), giving the ratio of [CH₃NCO]/[HNCO] = 0.032. Thus, as the simplest model, it is suggested that an abundance of CH₃NCO is held during evolutionary process of the Sagittarius B2 region.

[1] Goesmann et al., Science, 349, 689 (2015). [2] Halfen et al., ApJ, 812, L5 (2015).

Keywords: CH₃NCO, radio, molecule, Sagittarius, pre-biotic molecule