

Study of Formation Processes and Chemical Conditions of L1544 Pre-stellar Core

N. Tanekura,¹ H. Maezawa,¹ and Y. Aikawa²

¹*Department of Physical Science, Osaka Prefecture University, Japan*

²*Department of Earth and Planetary Sciences, Kobe University, Japan*

Dark cloud cores are star-forming sites. L1544 located in the eastern area of Taurus molecular complex is a well-known dense pre-stellar core accompanied by a 0.1pc-scale rotating and collapsing disk [1,2,3,4]. We have conducted observations of some molecular species such as SO, CS, CCS, HC₃N, N₂H⁺, NH₃ and so on, toward the L1544 core with the NRO 45-m telescope. N₂H⁺, NH₃ and SO increase at the late stages of chemical evolution of molecular clouds, whereas carbon chain molecules such as CCS and HC₃N increase in the early stages. We found that the distributions of SO and CCS show the anti-correlation, and the SO decreases at the center of the disk due to the depletion onto dust grains. These results are well consistent with the conventional time-dependent chemical models [2]. Additionally it was found that the maximum peak of SO exists in 0.1 pc northeast² of the disk where N₂H⁺ and NH₃ were not detected, and the line intensity of CCS was very faint (Fig.1). According to a time-dependent chemical model (density=2.0E+04 cm⁻³, Av=8 mag), the chemical abundances observed in the SO-clump correspond to those of the molecular cloud in the early stage of chemical evolution (a few ten thousand years).

The parent cloud of L1544 core has blue and red-shifted velocity components [4]. The rotating/collapsing disk appears to be located along the interface region of the two components. On the other hand, the SO-clump adjacent to the disk belongs only to the blue-shifted one. This suggests that the encounter of the two clouds possibly induced the formation of the L1544 pre-stellar core with rotating/collapsing disk, and that the SO-clump is still a chemically and physically young clump left behind by the evolution and formation of the L1544 pre-stellar core. These observed results will be presented in this symposium.

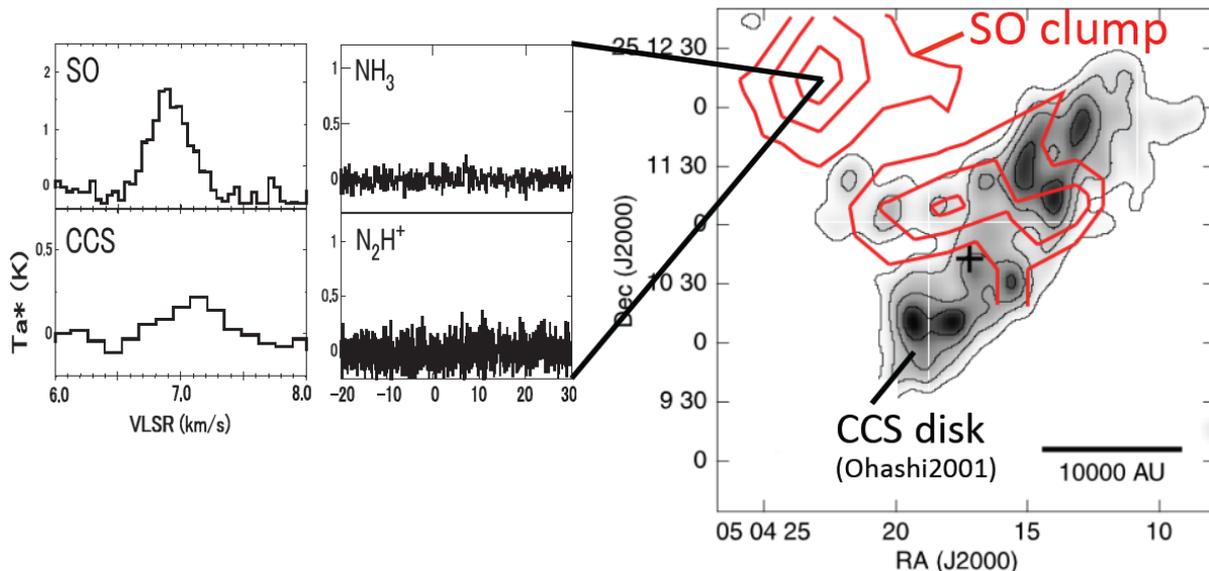


Figure 1: Integrated intensity map of SO ($J_N=3_2-2_1$) and the spectral lines observed toward the SO clump.

References

- [1] Ohashi et al, ApJ, 518, L41 (1999). [2] Aikawa et al, ApJ, 620, 330 (2005). [3] Caselli et al, ApJ, 565, 331 (2002). [4] Tafalla et al, ApJ, 504, 800 (1998).