Spatially resolved chemical compositions of a prestellar core

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We present ALMA and ACA observations with Band 3 and 6 toward the prestellar core, TUKH122 located in the Orion A cloud. The Band 3 observations have been performed with 3 mm dust continuum, N_2H^+ (1 - 0) and CH_3OH ($J_K=2_K - 1_K$) molecular lines using ALMA 12-m array and ACA. The Band 6 observations have been performed with 1.2 mm dust continuum, N_2D^+ (3 - 2), and DCO^+ (3 - 2) molecular lines using only ACA. From dust continuum observations, we identify several condensations aligned along the parent filamentary structure. The separation of these condensations is ~ 0.035 pc, consistent with the thermal Jeans length at a density of 4.4×10^5 cm^{-3}. This density is similar to the central part of the core. The spatial distributions of N_2H^+, N_2D^+, and DCO^+ are similar to that of dust continuum. However, an N_2D^+ hole is recognized in the dust peak position, which may suggest that the ionization degree may become lower with increasing density. On the other hand, the CH_3OH emission shows a large shell-like distribution and surrounds these condensations, suggesting that the CH_3OH molecule formed on dust grains is released into the gas phase by nonthermal desorption such as photoevaporation caused by cosmic-ray-induced UV radiation.

References

[1] Ohashi, S., Sanhueza, P., Sakai, N., et al. 2018, ApJ, 856, 147