P101a ALMA Observations of the 70 μm Dark Massive Clump G14.49-0.14

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For understanding the formation mechanism of high-mass stars, it is crucial to reveal their initial conditions. For this purpose, 70 μm dark massive clumps, which were identified by Herschel observations, are thought to be the ideal targets, because they are very cold ($\sim$10 K) and massive ($> 500\ M_\odot$). By using ALMA, we observed the 70 μm dark massive clump G14.49-0.14, whose distance is 3.9 kpc and mass is $5.2\times10^3\ M_\odot$. We observed the N_2D^+, DCO^+, DCN, SiO, H_2CO, and CO lines in ALMA Band 6 with an angular resolution of $1''.5$.

Toward G14.49-0.14, we detected strong SiO and H_2CO emission. Judging from the morphology, the SiO and H_2CO emission is likely to trace outflows. Thus, active star formation has already started in this clump, although it is dark at 70 μm. We also found that the distribution is very different among the observed deuterated molecules. In particular, the N_2D^+ emission is found to be almost anti-correlated with the DCO^+ emission, although N_2D^+ and DCO^+ are both ion deuterated molecule. The DCO^+ emission seems to trace warm regions near protostars, while the N_2D^+ emission comes from cold regions. This difference could be due to the different formation pathway between them; N_2D^+ is formed from H_2D^+, while DCO^+ can be formed from other deuterated species (e.g. $HCO^+ + D \rightarrow DCO^+ + H$). In this talk, we discuss how star formation activities affect the chemical composition, and also discuss the timescale of core/star formation in this clump.