S01a  ALMA View of the Circum-nuclear Disk of the Galactic Center

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The Galactic Center is the nuclear region of the nearest spiral galaxy, Milky Way Galaxy. We present the high angular resolution and high sensitivity spectral line images of the “Circum-Nuclear Disk (CND)” and its surrounding region of the Galactic Center in the CS $J = 2-1$, SiO $v = 0 J = 2-1$, H$^{13}$CO$^+ J = 1-0$, C$^{34}$S $J = 2-1$, and CH$_3$OH $J_{K_a,K_c} = 2_{1,1} - 1_{0,1}A_{-,-}$ emission lines using the Atacama Large Millimeter/Submillimeter Array (ALMA).

The CND is recognized as a torus-like molecular gas with gaps around the Galactic Center Black Hole (Sgr A*) in these emission lines except for the CH$_3$OH emission line. The inner and outer radii of the CND are estimated to be $R_{\text{in}} \sim 1.5$ and $R_{\text{out}} \sim 2$ pc, respectively. The velocities of the rotation and radial motion are estimated to be $V_{\text{rot}} \sim 115$ km s$^{-1}$ and $V_{\text{rad}} \sim 23$ km s$^{-1}$, respectively. These are consistent with those derived in the previous observations.

We analyzed the physical parameters of the CND using also the CS $J = 7-6$ emission line images retrieved from the JVO portal by the RADEX LVG program. The CS $J = 2-1$ emission line is thermalized, $T_{\text{ex}} \sim 200$ K, although the CS $J = 7-6$ emission line is sub-thermally excited, $T_{\text{ex}} \sim 18 - 25$ K. The LTE molecular gas mass of the CND is estimated to be $M_{\text{LTE}} \sim 3 \times 10^4 M_{\odot}$ assuming the fractional abundance of CS molecule is $X_{\text{CS}} \sim 1 \times 10^{-8}$. The LTE mass is consistent with those derived in the previous observations.