

R12b Galactic Center IRS21, Falling Hyper Compact HII Regions?

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Galactic Center IRS21 is a famous IR object located in the root of the Northern Arm of the Galactic Center Mini-spiral. IRS21 had been difficult to be spatially resolved in the pre-ALMA era in millimeter and sub-millimeter wavelengths because of the shortages of the sensitivity and angular resolution. In this presentation, we will present the first spatially resolved sub-millimeter images of the IRS21 at 230 and 340 GHz using ALMA (ALMA #2015.1.01080.S and ALMA #2017.1.00503.S). In the 340 GHz map with 0.1" resolution, IRS21 is resolved clearly into three disk-like objects. On the other hand, these objects are resolved into several components along the limb of the disk in the 230 GHz with 0.03" resolution. The H30 α recombination line of IRS21 is detected with the ALMA DDT observation (ALMA #2015.A.00021.S). This line has the velocity of $V_{\text{LSR}} \sim -100 \text{ km s}^{-1}$ and the width of $V_{\text{FWHM}} \sim 36 \text{ km s}^{-1}$. The radius and mean brightness temperature of IRS21 are derived to be $r = 0.008 \text{ pc}$ and $\sim 1 \text{ K}$, respectively. The radius is much smaller than even for typical values of Galactic center hyper compact HII regions. The mean electron density is estimated to be $\bar{n}_e \sim 6 \times 10^4 \text{ cm}^{-3}$. This is much denser than even for typical values of hyper compact HII regions ($\bar{n}_e \sim 1 - 3 \times 10^3 \text{ cm}^{-3}$). In addition, the CH₃OH emission line is also detected around IRS21. This shows that IRS21 is still embedded in the molecular gas. These peculiar properties suggest that IRS21 is a single or a group of very young hyper compact HII region(s), which is probably falling into the vicinity of Sgr A*.