P19a Spatially Resolving an Extremely Young Intermediate-mass Protostar

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We present results on the youngest intermediate-mass core located in the Orion Molecular Cloud-3 region, MMS 6-main ($L_{\rm bos} < 60$ $L_\odot$; $M_{\rm core} = 30$ $M_\odot$). No large scale molecular outflow, free-free jet, or infrared source has been detected toward MMS 6-main, suggesting that the core is starless. However, this source is the brightest at submillimeter wavelengths amongst the submillimeter sources detected in OMC-2/3 region. Our spatially resolved SMA 850 μm image shows a massive envelope (0.12 $M_\odot$), presence of hot gas ($\geq$200 K), and extremely high column density (N_{H_2} =8.2$\times10^{24}$ cm^{-2}) in the central 120 AU. Detailed model comparisons clearly show that a self-luminous source is necessary to explain the observed high flux density, implying that MMS 6-main is not starless. CO and HCN observations further revealed an extremely compact molecular outflow associated with MMS 6-main. The detected outflow has a large-velocity dispersion at the apexes ($\Delta v\sim$25 km s^{-1}), and clearly show bow-shock type velocity structures. The estimated outflow mass and dynamical time scale are one to three orders of magnitude smaller than those estimated in other OMC-2/3 outflows associated with IM Class 0/I sources, while the estimated outflow force ($\sim10^{-6}$ $M_\odot$ km s^{-1} yr^{-1}) is similarly energetic compared to other outflows, suggesting that MMS 6-main already has molecular outflow launched from a central 2nd core. Moreover, we have spatially resolved at least five sub-clumps within the massive envelope of MMS 6-main. The Masses of the detected sub-clumps are brown dwarf masses and their separation is consistent with the Jeans length, suggesting thermal fragmentation within the massive envelope/disk.