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Investigating AGN/starburst activities through ALMA multi-line observations in the mid-stage IR-bright merger VV114

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The importance of galaxy mergers in the context of galaxy formation and evolution have been clearly demonstrated in various numerical simulations. The violent merger event not only results in large scale morphological transformation and mass accumulation, but it also triggers gas compression, turbulence, and gas inflow to the galactic center region. We present high resolution $^{12}CO(1-0)$, $^{13}CO(1-0)$, HCN(4-3), HCO$^+$(4-3), CN($1_{3/2}$-$0_{1/2}$), CN($1_{1/2}$-$0_{1/2}$), CS(2-1), CH$_3$OH(2-1), and CS(7-6) maps of an IR-bright late stage merger VV114 obtained during cycle 0 of ALMA. An unresolved strong HCN(4-3) source (< 200 pc) is detected at the nucleus of VV114E and has a high velocity dispersion ($\simeq 290$ km s^{-1}), and these features are also shown in HCO$^+$(4-3). These evidences suggest that this source has an obscured AGN. We also find a clumpy filament with resolved dense gas across the galaxy disks. This filament has several clumpy star-forming regions, and these clumps clearly show physical and chemical differences in our molecular line data. These new ALMA data demonstrated the importance of observing both the diffuse and dense gas in order to obtain a comprehensive view of the physical processes that occur during a major merger event.