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The First Extragalactic Detection of Higher-Order Hydrogen Recombination Lines

Marta Sewilo[1] Kazuki Tokuda[2] Stanley Kurtz[3] Jennifer Wiseman[1] Steven Charnley[1] C.-H. Rosie Chen[4] Toshikazu Onishi[5] Peter Schilke[6] Naoto Harada[2] Kei Tanaka[7] Remy Indebetouw[8]

[1]NASA Goddard Space Flight Center, [2]Kyushu University, [3]UNAM, [4]Max Planck Institute for Radio Astronomy, [5]Osaka Metropolitan University, [6]University of Cologne, [7]University of Colorado, [8]University of Virginia / NRAO

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We report the first extragalactic detection of the higher-order hydrogen recombination lines (the change in the principal quantum number, $\Delta n > 2$). The γ-, ε-, and η-transitions ($\Delta n = 3, 5, 7$) have been detected toward the source N105-1 A in the star-forming region N105 in the low-metallicity Large Magellanic Cloud (LMC) with the Atacama Large Millimeter/submillimeter Array (ALMA). We have used the H40α line, the brightest of the detected recombination lines (H40α, H36β, H50β, H41γ, H57γ, H49ε, H53η, and H54η) to determine the physical parameters of the region, and the H40α and H36β lines to study the ionized gas kinematics. The analysis of the recombination lines and the multi-wavelength photometric data indicate that the ionizing source in 1A is a massive Class I young stellar object (YSO) that has already started ionizing its surrounding, forming an H II region. The electron temperature measured for 1A is characteristic for Galactic H II regions at the Galactocentric distances where the oxygen abundance is comparable to that observed in the LMC. We have incorporated the high-resolution CO data to study the spatial distribution and the velocity structure of the diffuse molecular gas and the CS, SO, and ^{13}CO observations to study the dense gas component toward 1A. Both the ionized and molecular line data indicate the presence of bulk motions in the region. We have found evidence for the cloud-cloud collision event that likely led to the formation of the central massive star in N105-1 A.