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Physical and Chemical Conditions in the N113 Star-Forming Region in the Low-Metallicity Large Magellanic Cloud

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The Large Magellanic Cloud (LMC) is the nearest (~50 kpc) star-forming galaxy characterized by a low metallicity (Z~0.3-0.5 $Z_{\odot}$) similar to galaxies during the early phases of their assembly. As a result, star formation studies in the LMC provide a stepping stone to understanding star formation at earlier epochs of the universe where these processes cannot be directly observed. N113 is one of the most prominent star-forming regions in the LMC hosting one of the most massive giant molecular clouds. N113 is small enough to be imaged in its entirety, but large enough to showcase many important phenomena such as multiple generations of stars, stellar feedback, and different environments.

We present our findings from an investigation of the early stages of star formation in the N113 region using the Atacama Large Millimeter/submillimeter Array (ALMA) molecular line data probing a wide density range: ^{12}CO, ^{13}CO, and C^{18}O (2-1), ^{13}CO and C^{18}O (1-0), HCN (1-0), HCO$^+$ (1-0), H^{13}CN (1-0) and (3-2), H^{13}CO$^+$ (1-0) and (3-2), CS (2-1) and (5-4), as well as 1.3 mm and 3 mm continuum. We used the Python package *quickclump* to identify molecular clumps. We utilized the multiline non-LTE fitting tool based on models from RADEX developed by Finn et al. (2021, ApJ, 917, 106) to construct the CO, HCN, HCO$^+$, and CS temperature and column density, and the H_2 density maps of N113. We constructed a catalog of molecular clumps including their physical properties, chemical abundances, sizes, velocities, and velocity dispersions. To establish the evolutionary status of the clumps, their positions were compared with previously identified young stellar objects (YSOs) from the Spitzer/SAGE and Herschel/HERITAGE surveys, as well as water and OH masers. We compared the properties of the clumps in N113 to those in the Galaxy and other regions in the LMC to assess the impact of the environment (e.g., metallicity, stellar feedback) on the star formation process.