R28a ALMA observations of the dense/shocked gas in the nuclear regions of the Antennae galaxies

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Dynamical interactions and mergers of two gas-rich galaxies can result in galaxies bright in IR luminosity. Numerical simulations have predicted the ubiquitous presence of large scale central gas inflow that leads to central gas accumulation and subsequent starburst activity. In order to investigate the relation between dense molecular gas and its relation to the central starbursts and to test the theoretical predications of gas rich merger simulations, we have conducted 3 mm ALMA observations of the Antennae Galaxies (NGC 4038/9) at 100 pc scale. Five molecules (HNCO, HCN, HCO^+, CH_3OH, and CN) were detected in the central 1 kpc region of NGC 4038. In contrast to previous studies using lower resolution data, we find high HCN/HCO^+ line ratios ($\sim$2) around the nucleus. We investigate whether the HCN enhancement is related to star formation activities and X-ray luminosity, but there is no robust correlation between them. The peak of the CN/HCN line ratio is clearly consistent with the 8 μm emission peak, and thus the CN/HCN ratio is a good tracer to probe active dusty star forming regions, which is consistent with previous studies on other galaxies. In addition, the HNCO and CH_3OH emission, which has been considered to trace large-scale shocks, is detected between two molecular gas components which are identified by applying automatic clump identification algorithm to the ALMA CO (3–2) data. Since one component appears to inflow into the other component, these lines possibly trace the collision between the gas components.