

MOLECULAR LINE OBSERVATIONS IN TWO DUSTY STAR FORMING GALAXIES AT $Z=6.9$

SREEVANI JARUGULA, *Department of Astronomy, University of Illinois at Urbana-Champaign, Urbana, IL, USA.*

SPT0311-58 is a pair of dusty star-forming galaxies (West and East) at $z=6.9$, less than 800 Myr after the Big Bang. It is the most massive infrared luminous galaxy pair discovered in the Epoch of Reionization (EoR). In this talk, I will present the analysis of the molecular emission lines in this source, observed with ALMA at $0.3'' - 0.5''$ corresponding to 1.6 - 2.7 kpc. We analyzed CO(6-5), CO(7-6), CO(10-9), [CI](2-1), and H₂O(211-202) molecular lines and dust continuum emission using non-local thermodynamic equilibrium (non-LTE) radiative transfer models. We find that the CO spectral line energy distribution and brightness temperature ratios in West and East are typical of high-redshift submillimeter galaxies (SMGs). The CO-to-H₂ conversion factor and the gas depletion time scales estimated from the model are consistent with the other high-redshift SMGs within the uncertainties. Based on the energy budget calculations, we find that turbulence driven mechanical heating and energy from stellar winds and supernovae contribute significantly to the overall CO line excitation in the dense molecular region. This is the most detailed study of molecular gas content of a galaxy in the EoR to-date, with the most distant detection of H₂O in the literature.