WATER EMISSION FROM EARLY UNIVERSE

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The study of dusty star forming galaxies (DSFGs) is important to understand galaxy assembly in early universe. A bulk of star formation at $z \sim 2-3$ takes place in DSFGs but are obscured by dust in optical/UV. However, they are extremely bright in far infrared (FIR) and submillimeter with infrared luminosities of $10^{11} - 10^{13} L_{\odot}$. ALMA, with its high spatial and spectral resolution, has opened up a new window to study molecular lines, which are vital to our understanding of the excitation and physical processes in the galaxy. Carbon monoxide (CO) being the second most abundant and bright molecule after hydrogen (H_2), is an important tracer of star forming potential. Besides CO, water (H_2O) is also abundant and it's line strength is comparable to high-J CO lines in high redshift Ultra Luminous Infrared Galaxies (ULIRGs). Studies have shown H_2O to directly trace the FIR field and hence the star forming regions. Moreover, L_{H_2O}/L_{IR} ratio is nearly constant for five of the most important water lines and does not depend on the presence of AGN implying that H_2O is one of the best tracers of star forming regions (SFRs). This incredible correlation holds for nearly five orders of magnitude in luminosity and observed in both local and high redshift luminous infrared galaxies.

In this talk, I will discuss the importance of H_2O in tracing FIR field and show the preliminary results of resolved water emission from three high-redshift gravitationally lensed South Pole Telescope (SPT) sources obtained from ALMA cycle 3 and cycle 4. These sources are among the first H_2O observations with resolved spatial scales $\sim 1\ kpc$ and will prove to be important for ALMA and galaxy evolution studies.