Abstract

Title : High resolution spectral imaging of CO(7-6), [CI](2-1) and continuum of three high-z lensed dusty star-forming galaxies using ALMA.

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Abstract : High-redshift dusty star-forming galaxies with very high star formation rates (500 - 3000 Msun/yr) are key to understanding the formation of the most extreme galaxies in the early Universe. Characterising the gas reservoir of these systems can reveal the driving factor behind the high star formation. Using molecular gas tracers like high-J CO lines, neutral carbon lines and the dust continuum, we can estimate the gas density and radiation field intensity in their interstellar medium. We present high resolution observations of CO(7-6), [CI](2-1) and dust continuum of 3 lensed galaxies from the SPT-SMG sample at z~3 with the ALMA. Our sources have high intrinsic star-formation rates (>850 Msun/yr) and rather short depletion timescales (< 100 Myr). Based on the line and line-to-continuum ratios, our sample galaxies exhibit similar radiation field intensity and gas density compared to other SMGs. We perform visibility-based lens modelling on these objects to reconstruct the kinematics in the source plane. We find that the cold gas masses of the sources are compatible with simple dynamical mass estimates using ULIRG-like values of the CO-H2 conversion factor alphaCO but not Milky Way-like values. We find diverse source kinematics in our sample: SPT0103-45 and SPT2147-50 are likely rotating disks while SPT2357-51 is a probable major merger. The analysis presented in the paper could be extended to a larger sample to determine better statistics of morphologies and interstellar medium properties of high-z dusty star-forming galaxies.