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Spectral imaging of [CI], CO and dust continuum of lensed DSFGs with ALMA

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 such as, high-J CO lines, neutral carbon lines, and the dust continuum, we can estimate the gas density and radiation field intensity in their interstellar media. We first study a sample of 30 [CI]-selected DSFGs to understand their ISM. We also compare the different tracers to understand their effectiveness and agreeability with each other. In the second part of the talk, we present high resolution (~0.4") observations of CO(7-6), [CI](2-1), and dust continuum of three lensed galaxies from the South pole telescope - sub-millimetre galaxies (SPT-SMG) sample at z~3 with the Atacama Large Millimetre/submillimetre Array. Our sources have high intrinsic star formation rates (>850 Msun/yr) and rather short depletion timescales (<100 Myr). Based on the L[CI](2-1)/LCO(7-6) and L[CI](2-1)/LIR ratios, our galaxy sample has similar radiation field intensities and gas densities compared to other submillimetre galaxies. We performed 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-H_2 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 possibly a 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.

Serdecznie zapraszam,

Agnieszka Majczyna