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Presentation Requested: oral
Category: Evolution of the Interstellar Medium and Star formation over Cosmic Time
Question: Other

Physical conditions and kinematics from [CII] observations at z 2

What drives higher rates of star-formation at z$\geq$ 2? Is it because the physical conditions in starbursts are different? Or is it due to kinematics of the gas: higher turbulence, inflows, outflows? With ALMA, we can observe multiple transitions of CO, as well as [CI] and [CII] fine structure lines. These can constrain the physical conditions quite well. We can also probe kinematics of the gas.

We address these question with a relatively unbiased survey of [CII] line emission of highly lensed galaxies at redshift z=1-3 from the Herschel Extreme Lensing Line Observations (HELLO) survey. These galaxies span a range of luminosities and star-formation rates from 7-100 solar-masses/year, but they are lensed enabling HIFI measurements of [CII] line fluxes for these galaxies. We use [CII]/FIR ratios as a diagnostic of the physical conditions in the ISM in these galaxies, and compare them to low redshift normal galaxies. Additionally, the high spectral resolution of HIFI enables us to study the kinematics of ISM in several galaxies. [CI] observations of a subset of this sample have been approved with ALMA. They will give us spatially resolved kinematics of gas.

We find, at both low and high redshifts, that FIR color (or dust temperature) and not FIR luminosity is the main determining factor for the [CII]/FIR ratio. At low redshifts, highly luminous galaxies tend to have warm dust, so effects of dust temperature and luminosity are hard to disentangle. Luminous galaxies at high redshifts show a range of dust temperatures, making it possible to establish that [CII]/FIR correlates most strongly with dust temperature. Galaxies with warmer FIR colors show lower [CII]/FIR ratios. This supports the hypothesis that at high UV intensities, photoelectric heating of neutral gas is less efficient.