Bade Uzgil (UPenn JPL, graduate)

James Aguirre (UPenn)
Charles M Bradford (Caltech JPL)
Adam Lidz (UPenn)

Presentation Requested: poster
Category: Environment, Large Scale Structure and Galaxy Evolution
Question: Other

Measuring Galaxy Clustering and the Evolution of [CII] Mean Intensity with Far-IR Line Intensity Mapping During 0.5 ¡ z ¡ 1.5

Infrared fine-structure emission lines from trace metals are powerful diagnostics of the interstellar medium in galaxies. We explore the possibility of studying the redshifted far-IR fine-structure line emission using the three-dimensional (3-D) power spectra obtained with an imaging spectrometer. The intensity mapping approach measures the spatio-spectral fluctuations due to line emission from all galaxies, including those below the individual detection threshold. The technique provides 3-D measurements of galaxy clustering and moments of the galaxy luminosity function. Furthermore, the linear portion of the power spectrum can be used to measure the total line emission intensity including all sources through cosmic time with redshift information naturally encoded. Total line emission, when compared to the total star formation activity and/or other line intensities reveals evolution of the interstellar conditions of galaxies in aggregate. As a case study, we consider measurement of [CII] autocorrelation in the $0.5 < z < 1.5$ epoch, where interloper lines are minimized, using far-IR/submm balloon-borne and future space-borne instruments with moderate and high sensitivity, respectively. In this context, we compare the intensity mapping approach to blind galaxy surveys based on individual detections. We find that intensity mapping is nearly always the best way to obtain the total line emission because blind, wide-field galaxy surveys lack sufficient depth and deep pencil beams do not observe enough galaxies in the requisite luminosity and redshift bins. Also, intensity mapping is often the most efficient way to measure the power spectrum shape, depending on the details of the luminosity function and the telescope aperture.