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Gravitationally Lensed CO and Dust at High Redshift: New LMT/GTM Images and Spectra of Sub-Millimeter Galaxies

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Abstract. We have assembled a new sample of some of the most FIR-luminous galaxies in the Universe and have imaged them in 1.1 mm dust emission and measured their redshifts $1 < z < 4$ via CO emission lines using the 32-m Large Millimeter Telescope / Gran Telescopio Milimétrico (LMT/GTM). Our sample of 31 submm galaxies (SMGs), culled from the Planck and Herschel all-sky surveys, includes 14 of the 21 most luminous galaxies known, with $L_{FIR} > 10^{14} L_{\odot}$ and $SFR > 10^4 M_{\odot}$/yr. These extreme inferred luminosities – and multiple / extended 1.1 mm images – imply that most or all are strongly gravitationally lensed, with typical magnification $\mu \sim 10\times$. The gravitational lensing provides two significant benefits: (1) it boosts the S/N, and (2) it allows investigation of star formation and gas processes on sub-kpc scales.

Keywords. galaxies: starburst; galaxies: high-redshift; submillimeter; infrared: galaxies; gravitational lensing

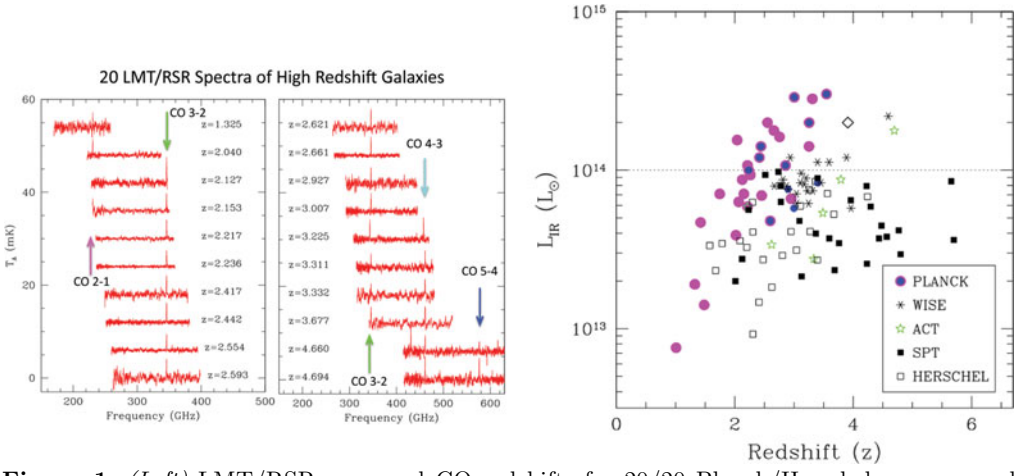

Figure 1. *(Left)* LMT/RSR-measured CO redshifts for 20/20 Planck/Herschel sources, each in 15-30 min. *(Right)* Evidence for strong gravitational lensing includes extremely high inferred IR luminosities $L_{IR} > 10^{14} L$, high $L[CII]/L_{FIR}$ ratios; SEDs that are best matched using a foreground lens; and some sources that are known from the optical and near-IR to be lensed.

References

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