

X41a Bright Extragalactic ALMA Redshift Survey (BEARS) : Emission line properties of the bright *Herschel*-selected galaxies in South Galactic Pole

Masato Hagimoto, Tom J. L. C. Bakx, Yoichi Tamura (Nagoya University), George J. Bendo (University of Manchester), Stephen Serjeant, and Sheona A. Urquhart (Open University)

We present Atacama Large Millimeter/submillimeter Array (ALMA) Band 3 and 4 observations of 85 high-redshift $500\ \mu\text{m}$ sources selected from the *Herschel* Astrophysical Terahertz Large Area Survey with the primary goal of identifying their spectroscopic redshifts. Through the use of CO, [C I], and/or H₂O ($2_{11} - -2_{02}$) emission lines, we have determined reliable redshifts for 71 ALMA continuum sources out of a total of 142. Alternately, we measured spectroscopic redshifts of at least one source within 62 of the 85 targeted fields in our survey. Most of our targets exhibit the typical CO line ratios for submillimeter galaxies shown by Harrington et al. (2021). Interestingly, some multiple sources exhibit unusual line ratios, which is a potential indication of a rare galaxy phase. Using [C I] ($^3P_1 - -^3P_0$) as a tracer of molecular gas, we find that the Schmidt-Kennicutt law holds over five orders of magnitude in infrared luminosity. We also investigated the H₂O line to infrared luminosities ratio over three orders of magnitude in infrared luminosity and find that it does not favor the flat ratio indicated by previous works, suggesting that the H₂O line may be not a good tracer of star formation. Finally, we created a deep composite spectrum spanning 200 to 900 GHz at rest-frame frequencies.