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Line Intensity Mapping with the ALMA Archive

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In anticipation of upcoming line-intensity mapping (LIM) experiments targeting CO and [CII] emission at z > 4, we have analyzed archival data from the Atacama Large Millimeter/submillimeter Array (ALMA) to place new constraints on CO(J_up = 3–6) line emission from galaxies at z = 1–5. Focusing on the well-studied COSMOS field, we take advantage of ALMA archival observations to probe the small, shot-noise-dominated scales of CO emission. By reanalyzing the archival data cubes within a LIM framework, we constrain the CO luminosity functions over cosmic time. These limits will not only refine our picture of molecular gas reservoirs in distant galaxies, but also pave the way for future high-redshift LIM studies in the COSMOS field, where CO lines from intermediate redshifts will serve as foregrounds. In this talk, I will outline our methodology, discuss the challenges of extracting faint signals from archival data, and present preliminary constraints that highlight the potential of using ALMA archives to probe molecular gas in the early universe.

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