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Discovery of a Population of Strong Galaxy-Galaxy Lensed Faint Dusty Star-Forming Galaxies

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The measurement of galaxy-galaxy strong lens number density provides statistical constraints on foreground mass distributions. Dusty star-forming galaxies (DSFGs) uncovered in submillimeter surveys are particularly valuable for this purpose, given the large cosmological volumes they probe. Strongly lensed DSFGs have predominantly been identified as one of the brightest sources in previous submillimeter and millimeter surveys. However, theoretical models predict the existence of a population of faint strongly lensed DSFGs, which have been challenging to confirm due to technical limitations. Recently, a faint strongly lensed DSFG was discovered using high-resolution JWST data, providing the first confirmation of the model predictions. To further test the models with a larger sample, we aim to constrain the number density of faint strongly lensed DSFGs. Utilizing the deepest SCUBA-2 submillimeter survey and newly obtained JWST imaging from the COSMOS-Web and PRIMER surveys, we identify a population of 13 strongly lensed faint dusty galaxies in the COSMOS field. Photometric redshift estimation and foreground lens modeling confirmed their lensed nature, with all sources exhibiting higher photometric redshifts than their foreground lenses. Magnification factors were also derived from foreground lens modeling. Our systematic search allows us to place observational constraints on the number density of strongly lensed DSFGs at the faint submillimeter flux end. These findings support theoretical predictions for the existence of a strongly lensed faint DSFG population.

Section

Galaxy/Extragalactic

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