The ALMA Frontier Fields Survey: III. 1.1 mm emission line identifications in Abell 2744, MACSJ 0416.1-2403, MACSJ 1149.5+2223, Abell 370, and Abell S1063

González-López J.

Bauer F.E.

Aravena M.

Laporte N.

Bradley L.

Carrasco M.

Carvajal R.

Demarco R.

Infante L.

Kneissl R.

Koekemoer A.M.

Muñoz Arancibia A.M.

Troncoso P.

Villard E.

Zitrin A.

Context. Most sub-mm emission line studies of galaxies to date have targeted sources with known redshifts where the frequencies of the lines are well constrained. Recent blind line scans circumvent the spectroscopic redshift requirement, which could represent a selection bias. Aims. Our aim is to detect emission lines present in continuum oriented observations. The detection of these lines provides spectroscopic redshift information and yields important properties of the galaxies. Methods. We perform a search for emission lines in the Atacama Large Millimeter/submillimeter Array observations of five clusters which are part of the Frontier Fields and assess the reliability of our detection. We additionally investigate plausibility by associating line candidates with detected

galaxies in deep near-infrared imaging. Results. We find 26 significant emission lines candidates, with observed line fluxes between 0.2-4.6 Jy kms-1and velocity dispersions (FWHM) of 25-600kms-1. Nine of these candidates lie in close proximity to near-infrared sources, boosting their reliability; in six cases the observed line frequency and strength are consistent with expectations given the photometric redshift and properties of the galaxy counterparts. We present redshift identifications, magnifications, and molecular gas estimates for the galaxies with identified lines. We show that two of these candidates likely originate from starburst galaxies, one of which is a so-called jellyfish galaxy that is strongly affected by ram pressure stripping, while another two are consistent with being main sequence galaxies based in their depletion times. Conclusions. This work highlights the degree to which serendipitous emission lines can be discovered in large mosaic continuum observations when deep ancillary data are available. The low number of high-significance line detections, however, confirms that such surveys are not as optimal as blind line scans. We stress that Monte Carlo simulations should be used to assess the line detection significances since using the negative noise suffers from stochasticity and incurs significantly larger uncertainties.

Galaxies: high-redshift

Gravitational lensing: strong

ISM: lines and bands

Submillimeter: ISM

Electromagnetic wave emission

Infrared devices

Infrared imaging

Intelligent systems

Light sources

Monte Carlo methods

Surveys

Thermography (imaging)

Uncertainty analysis

Atacama large millimeter/sub-millimeter arrays

Galaxies:high-redshift

Gravitational lensing: strong

ISM: lines and bands

Near-infrared imaging

Ram-pressure stripping

Submillimeter: isms

Velocity dispersion

Galaxies