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ALMA Lensing Cluster Survey (ALCS): Overview and synergies with JWST

Kotaro Kohno*(1),
(1) Institute of Astronomy, Graduate School of Science, The University of Tokyo, Tokyo, Japan; e-mail: kkohno@ioa.s.u-tokyo.ac.jp

The ALMA lensing cluster survey (ALCS) is a 96-hr large program to search for intrinsically faint continuum sources and line emitters with the assistance of gravitational lensing. All 33 cluster fields were selected from *HST*/*Spitzer* treasury programs including CLASH, Hubble Frontier Fields, and RELICS. The total sky area surveyed reaches $\sim$133 arcmin^2 down to a depth of $\sim$60 μJy beam^{-1} (1σ) at 1.2 mm, yielding 141 secure blind detections of continuum sources and additional 39 sources aided by priors. Fig.1 shows rich ALMA 1.2 mm sources including known multiply imaged dusty galaxy at $z = 3.631$ and newly uncovered two sets of triple-image H-dropout sources [1, 2]. We find an association of an H-dropout ALMA source with a MUSE-selected galaxy group at $z = 4.32$ behind "El Gordo" [3]. Multi-wavelength mosaics across all 33 ALCS fields and photometric catalogs have been created [4], which have been exploited to conduct stacking analysis [5]. *Herschel* far-infrared and *Chandra* X-ray properties of ALCS sources have been investigated [1, 6]. An exceptionally magnified ($\mu \sim$20–160), intrinsically faint (sub-L^*-class) low-mass ($M_* \sim 10^9\ M_\odot$), bright [CII] line emitting star-forming galaxy at $z = 6.07$ [7, 8] is scheduled to be observed by *JWST*/NIRCam, NIRSpec, VLT/MUSE, and so on. *JWST* observations of lensing clusters including ALCS fields are now rapidly increasing, allowing us to characterize ALCS 1.2 mm continuum sources in e.g., Abell 2744 [9].

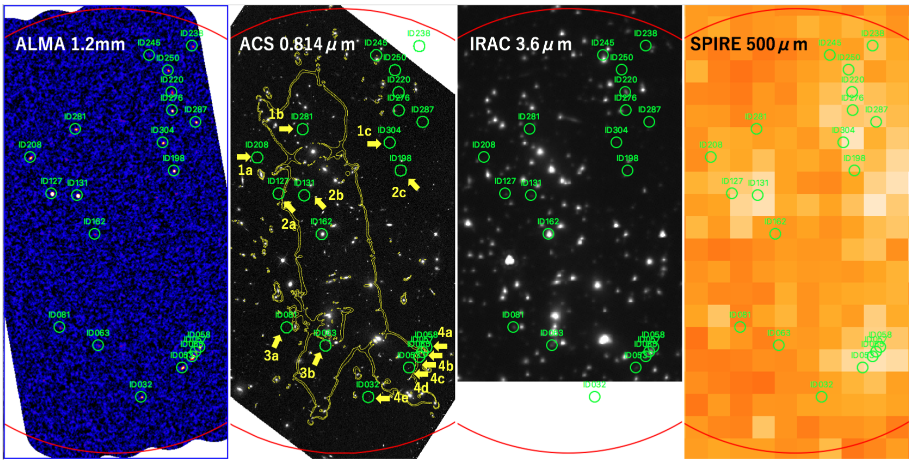

Figure 1. ALMA 1.2 mm continuum image of RXCJ0032.1+1808, along with the *HST*/ACS, *Spitzer*/IRAC, and *Herschel*/SPIRE images. Critical curves at $z = 4$ are shown in the *HST*/ACS panel, exhibiting the richness of multiple images of dusty star-forming galaxies, which are mostly invisible even in the *HST* near-infrared bands.

References

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