

First Identification of 10-kpc Scale [CII] 158 μ m Halos around Star-Forming Galaxies at $z=5-7$ (Seiji Fujimoto)

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We report the discovery of 10-kpc scale [CII] 158 μ m halos surrounding star-forming galaxies in the early Universe. We choose deep ALMA data of 18 galaxies each with a star-formation rate of $\sim 10-70$ M_{\odot} with no signature of AGN whose [CII] lines are individually detected at $z=5.153-7.142$, and conduct stacking of the [CII] lines and dust-continuum in the uv-visibility plane. The radial profiles of the surface brightnesses show a 10-kpc scale [CII] halo at the 9.2 σ level significantly extended more than the HST stellar continuum data by a factor of ~ 5 on the exponential-profile scale length basis, as well as the dust continuum. We also compare the radial profiles of [CII] and Ly α halos universally found in star-forming galaxies at this epoch, and find that the scale lengths agree within the 1 σ level. The existence of the extended [CII] halo is the evidence of outflow remnants in the early galaxies and suggest that the outflows may be dominated by cold-mode outflows, which challenges current galaxy evolution models.

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