

X04a ALMA Lensing Cluster Survey: A Sub-kpc View of [C II] Emission from a Sub-L* Galaxy in the Epoch of Reionization

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We present bright [C II] 158 μm line detections from a strongly magnified and multiply-imaged ($\mu \sim 20\text{--}160$) sub-L* ($M_{\text{UV}} = -19.75$) Lyman-break galaxy (LBG) at $z = 6.0719 \pm 0.0004$ from the ALMA Lensing Cluster Survey (ALCS). Owing to the uniquely deep and wide survey volume being explored by ALCS, we successfully detect emission lines at 268.7 GHz at $\geq 8\sigma$ exactly at positions of two multiple images of the LBG behind a massive galaxy cluster. Our lens models indicate that a sub region of the LBG crosses the caustic and is lensed into a long ($\sim 6''$) arc with a local magnification of $\mu \sim 160$, for which the [C II] line is also significantly detected. The source-plane reconstruction resolves the interstellar medium (ISM) structure, showing that the [C II] line is co-spatial with the rest-frame UV continuum at the scale of ~ 300 pc. The [C II] line properties suggest that the LBG is a rotation-dominated system whose velocity gradient explains a slight difference of redshifts between the whole LBG and its sub region. The star formation rate (SFR)- $L_{[\text{C II}]}$ relations from the sub to the whole regions of the LBG are consistent with those of local galaxies. We evaluate the lower limit of the faint-end of the [C II] luminosity function at $z = 6$, and find that it is consistent with predictions from semi-analytical models and from a SFR function at $z=6$ converted with the local SFR- $L_{[\text{C II}]}$ relation. We will also present our JWST program for this unique lensed system, which has been approved in cycle 1.