X56a ISM Properties of $z > 6$ Galaxies Revealed with ALMA [OIII] and [CII] Observations

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Investigating inter stellar medium (ISM) properties of high redshift galaxies is important for understanding galaxy formation and cosmic reionization. To study ISM properties of high redshift galaxies, we observed three Lyman break galaxies at $z = 6.033 - 6.206$ using ALMA. We have detected [OIII]88μm and [CII]158μm emission lines at $> 4\sigma$ significance levels from all of the three targets. We have calculated the $L_{[\mathrm{OIII}]}/L_{[\mathrm{CII}]}$ emission line ratios based on our ALMA observations, and found an anti-correlation between the $L_{[\mathrm{OIII}]}/L_{[\mathrm{CII}]}$ ratio and the $L_{[\mathrm{CII}]}/SFR$ ratio. This anti-correlation indicates that the high ionization state of the ISM is the origin of the [CII] deficit (the low $L_{[\mathrm{CII}]}/SFR$ ratio) recently reported in high redshift galaxies. Based on these results and the literature, we will discuss ISM properties of high redshift galaxies and implications for galaxy formation.