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The Prevalence of Galaxy Overdensities Around UV-Luminous Lyman alpha Emitters in the Epoch of Reionization

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Before the end of the epoch of reionization, the Hydrogen in the Universe was predominantly neutral. This leads to strong attenuation of Lyman alpha lines of z>6 galaxies in the intergalactic medium. Nevertheless, Lyman alpha has been detected up to very high redshifts (z˜9) for several especially UV luminous galaxies. Here, we test to what extent the galaxy's local environment might impact the Lyman alpha transmission of such sources. We present an analysis of dedicated Hubble Space Telescope (HST) imaging in the CANDELS/EGS field to search for fainter neighbors around three of the most UV luminous and most distant spectroscopically confirmed Lyman alpha emitters at z_spec=7.73, 7.48, and 8.68, respectively. We combine the multi-wavelength HST imaging with Spitzer data to reliably select z˜7-9 galaxies around the central, UV-luminous sources. Our analysis reveals ubiquitous overdensities around luminous Lyman alpha emitting sources in the heart of the cosmic reionization epoch. Additionally, we compare our results to the expectations from simulation and show that they are in excellent agreement. Our results support the theoretical prediction that the first ionized bubbles preferentially formed in overdense regions.

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