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Mapping Ionized Bubbles in the First Billion Years with the JWST FRESCO Survey

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After the Dark Ages, when the universe was completely neutral, the first sources of light appeared, marking the beginning of the Epoch of Reionization (EoR). During this epoch, the first stars and galaxies formed, emitting intense radiation that ionized the surrounding neutral hydrogen gas, creating ionized regions in the intergalactic medium (IGM), which grew and overlapped, making our universe completely ionized at redshift 6. Lyman alpha emitters (LAEs), are one of the tracers used to study the EoR. However, the detection of LAEs becomes more complicated at redshifts greater than 7, as the universe is mostly neutral, and energetic Lyman alpha photons are absorbed by the IGM. Nevertheless, some LAEs have been detected at very high redshifts, possibly because Lyman alpha photons had time to stretch enough inside ionized region due to cosmic expansion and avoid being absorbed by neutral hydrogen.
It is suggested that LAEs by themselves cannot create such large enough ionized bubbles. Instead, it is likely that these emitters are embedded in overdense regions where neighboring galaxies contribute to the ionizing budget, allowing us to detect Lyman alpha.
In this work, I will present the results of studying the environment of detected Lyman alpha emitters using JWST data. We identify companions to these emitters that could explain the visibility of Lyman alpha lines even for very faint sources. We find the expected sizes of ionized bubbles around LAEs at their redshifts and check whether the detected companions could contribute enough ionizing photons to create these ionized regions.

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