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Keck Spectroscopy of Faint 3<z<8 Lyman Break Galaxies:- Evidence for a Declining Fraction of Emission Line Sources In the Redshift Range 6<z<8

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Using deep Keck spectroscopy of Lyman break galaxies selected from infrared imaging data taken with WFC3/IR onboard the Hubble Space Telescope, we present new evidence for a reversal in the redshift-dependent fraction of star forming galaxies with detectable Lyman alpha emission in the redshift range 6.3 < z < 8.8. Our earlier surveys with the DEIMOS spectrograph demonstrated a significant increase with redshift in the fraction of line emitting galaxies over the interval 4 < z < 6, particularly for intrinsically faint systems which dominate the luminosity density. Using the longer wavelength sensitivities of LRIS and NIRSPEC, we have targeted 19 Lyman break galaxies selected using recent WFC3/IR data whose photometric redshifts are in the range 6.3 < z < 8.8 and which span a wide range of intrinsic luminosities. Our spectroscopic exposures typically reach a 5-sigma sensitivity of < 50 A for the rest-frame equivalent width (EW) of Lyman alpha emission. Despite the high fraction of emitters seen only a few hundred million years later, we find only 2 convincing and 1 possible line emitter in our more distant sample. Combining with published data on a further 7 sources obtained using FORS2 on the ESO VLT, and assuming continuity in the trends found at lower redshift, we discuss the significance of this apparent reversal in the redshift-dependent Lyman alpha fraction in the context of our range in continuum luminosity. Assuming all the targeted sources are at their photometric redshift and our assumptions about the Lyman alpha EW distribution are correct, we would expect to find so few emitters in less than 1% of the realizations drawn from our lower redshift samples. Our new results provide further support for the suggestion that, at the redshifts now being probed spectroscopically, we are entering the era where the intergalactic medium is partially neutral.

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