Star Formation at z~6 in the Ultra Deep Field

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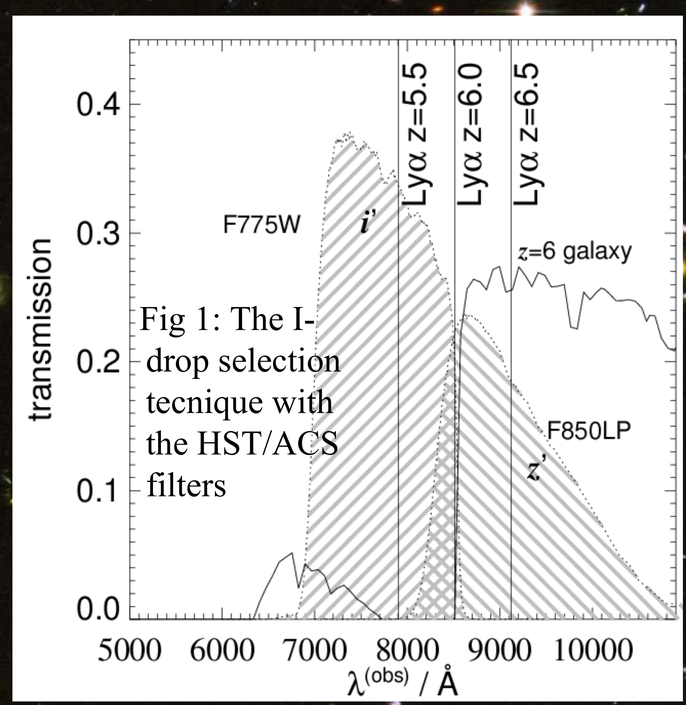


Fig 1: The I-drop selection tecnique with the HST/ACS filters

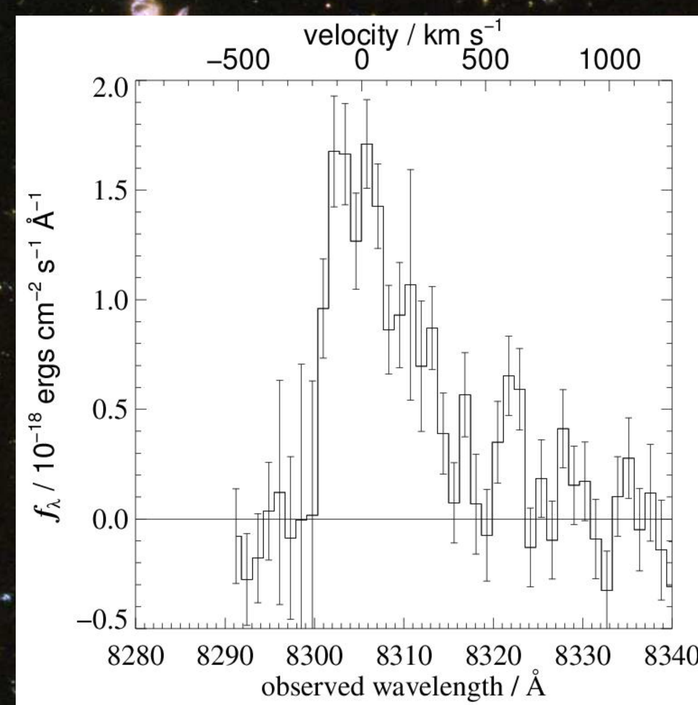
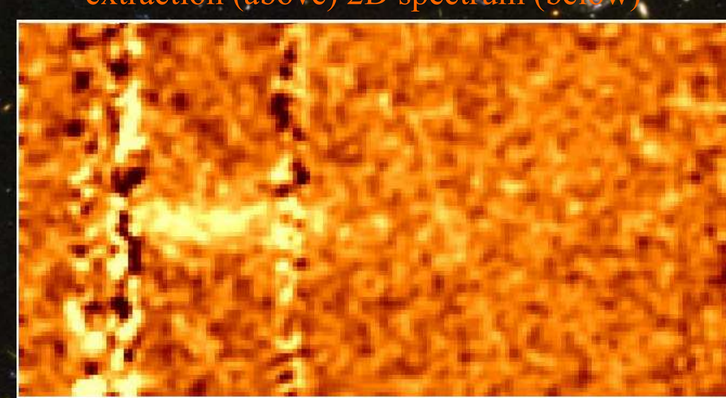


Fig 2: Spectroscopic confirmation of Lyman-alpha emission with Keck/Deimos of a z=5.78 I-drop near the UDF (Bunker et al. 2003). 1D extraction (above) 2D spectrum (below)



We determine the abundance of *i'*-band drop-outs in the recently-released *HST*/ACS Hubble Ultra Deep Field (UDF). Since the majority of these sources are likely to be *z*~6 galaxies whose flux decrement between the F775W *i'*-band and F850LP *z'*-band arises from Lyman-alpha absorption, the number of detected candidates provides a valuable upper limit to the unextincted star formation rate at this redshift. We demonstrate that the increased depth of UDF enables us to reach an 8sigma limiting magnitude of z'_{AB}=28.5 (equivalent to $1.5h_{70}^{-2}M_{sun}$/yr at *z*=6.1, or $0.1L^*_{UV}$ for the *z*~3 U-drop population), permitting us to address earlier ambiguities arising from the unobserved form of the luminosity function.

We identify 54 galaxies (and only one star) at z'_{AB}<28.5 with $(i'-z')_{AB}$>1.3 over the deepest 11arcmin^2 portion of the UDF field. The characteristic luminosity (L*) is consistent with values observed at *z*~3. The faint end slope (alpha) is less well constrained, but is consistent with only modest evolution. The main change appears to be in the number density (Phi*). Specifically, and regardless of possible contamination from cool stars and lower redshift sources, the UDF data support our previou result that the star formation rate at *z*~6 was approximately x6 *less* than at *z*~3 (Stanway, Bunker & McMahon 2003). This declining comoving star formation rate ($0.005h_{70}^{-2}$ M_{sun}/yr/Mpc^3 at *z*~6) poses an interesting challenge for models which suggest that the bulk of star forming galaxies that reionized the universe lie at just beyond *z*~6.

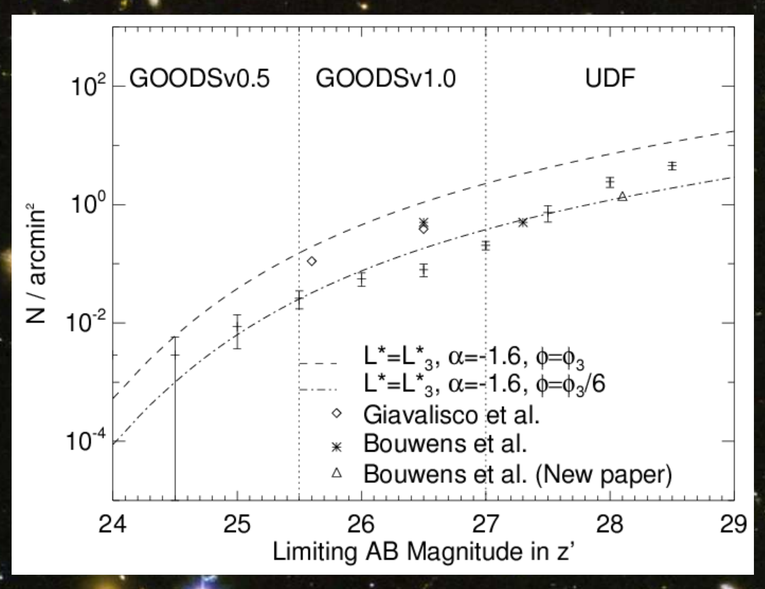


Fig 3 (right): number counts of I-drops in the UDF and GOODS fields: the dashed curve is the no-evolution prediction based on the U-drop z~3 population: our data at z~6 suggest a comoving number density 6x less than this.

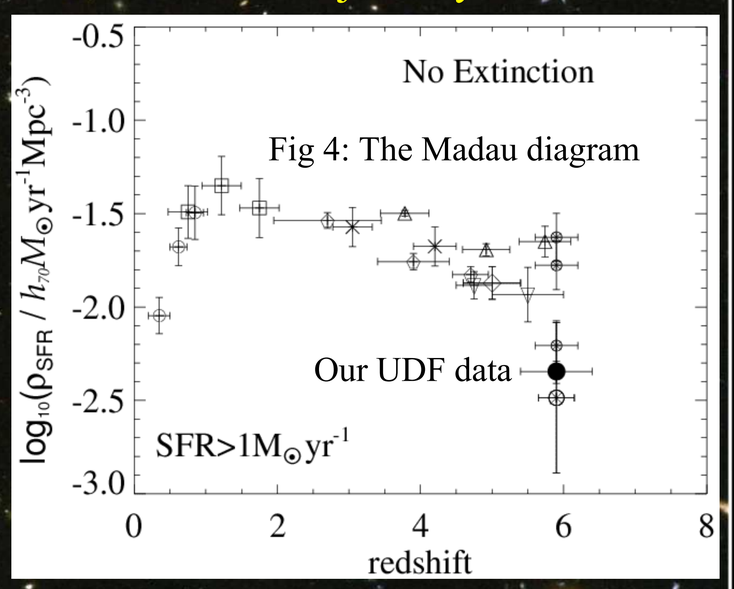


Fig 4: The Madau diagram

Hubble Ultra Deep Field

Hubble Space Telescope • Advanced Camera for Surveys

NASA, ESA, S. Beckwith (STScI) and the HUDF Team

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