Near-Infrared Properties of Starbursts at z=6
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The Hubble Ultra Deep Field (HUDF), and its accompanying observations in the near-infrared using NICMOS, have provided the astronomical community with an exceptionally valuable resource. For the first time, it has been possible to obtain a large sample of z=6 candidate galaxies, probing faint magnitudes, and to explore their properties in the near infrared. We find that the starbursting i’-drop population at z=6 has blue near-IR colours, suggesting that they may be very young, may have an IMF top-heavy in massive stars or may be metal poor.

1-i’-drop Photometric Selection and Galaxies at z=6

The I drop technique is a variant of the three-filter Lyman break technique used at z=3-4 to identify rest-frame UV luminous (starbursting) galaxies. At very high redshift (z>4.5), the sharp spectral break at λ_red =1215.6 Å, due to absorption by neutral hydrogen in the intervening IGM, leads to large colours in filters bracketing this wavelength. As the figure below illustrates, at z=6, the break is bracketed by the i’ and z’ filters and the selection of z=6 galaxies using this break has been demonstrated by spectroscopic follow-up (e.g. Bunker et al 2003, Stanway et al 2004).

This method is prone to contamination both by cool stars and galaxies at intermediate redshift (z~2 elliptical galaxies). Using the NICMOS near infrared imaging we can distinguish such contaminants (which have different observed frame near-IR spectral slopes). None of the 27 i’-drops with detections, or limits, in the NICMOS UDF are likely to be lower redshift elliptical galaxies.

Near-IR colours of I-drops

We find that our z=6 galaxy sample shows a rest frame-UV spectral slope (observed in the near-IR), rather bluer than that observed in the equivalent population at z=3-4. As the figure above illustrates, many of these sources have colours best fitted by power law spectra with f_λ ∝ λ^{-2.2} (as compared to f_λ ∝ λ^{-1.5} for z=3 Lyman break galaxies). Modelling, using codes such as Starburst99 (Leitherer et al 1999), suggests that such blue spectral slopes are indicative of either very young starbursts (<10Myr), or of stars forming in a metal poor environment, or of an initial mass function rich in massive stars when compared to the Salpeter IMF. The blue slope also suggests that there is little dust reddening in these sources.

One possibility, given the number of sources observed in pairs or groups, is that we may be seeing very young merger induced starbursts at z=6.

References:

For more information on this topic see Stanway, McMahon & Bunker, astro-ph/0403585