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News from z$\lesssim$6-10 galaxy candidates found behind gravitational lensing clusters

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Abstract. We summarise the current status of our project to identify and classify ∼6-10 galaxies thanks to strong gravitational lensing. Building on the detailed work by Richard *et al.* (2006), we present results from new follow-up observations undertaken with the ACS/HST and the Spitzer space telescope and compare our results with findings from the Hubble Ultra-Deep Field (UDF).

Keywords. galaxies, high-redshift, gravitational lensing

1. Introduction

Combining the power of strong gravitational lensing to detect faint distant objects and the availability of near-IR instruments on large ground-based telescopes we have started few years ago a pilot-project with the aim of finding star-forming galaxies at redshifts beyond 6-6.5. This project, initially based on ISAAC and FORS2 data plus additional observations obtained at CFHT and HST, has produced 13 galaxy candidates at redshifts between 6 and 10 Richard *et al.* (2006). Here we summarise the current status of the project and present results from new follow-up observations (imaging) undertaken with ACS/HST and the Spitzer space telescope and compare our results with findings from the Hubble Ultra-Deep Field (UDF).
A recent overview of the project is given in Schaerer *et al.*(2006).

2. Observations

Focussing on two well known gravitational lensing clusters, Abell 1835 and AC114, we obtained deep near-IR images in the SZ, J, H, and Ks bands with ISAAC and an additional z-band image with FORS2 (see Richard *et al.* 2006). These deep images, reaching e.g. a 1σ depth of 26.1 in H_{AB}, were then used to search for objects which are detected at least in two near-IR bands, which show a blue near-IR colour, and which are undetected in all optical bands. These criteria are optimised to select high redshift (z >6) objects with intrinsically blue UV-restframe spectra, i.e. very distant starburst galaxies.

3. Results

Applying the above selection criteria to the observations of the two lensing clusters has yielded 13 candidates whose spectral energy distribution (SED) is compatible with that

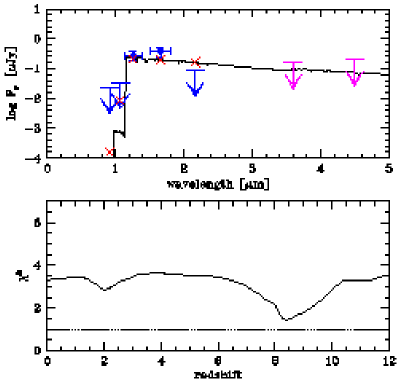

Figure 1. Best fit SED to the ACS, ISAAC and Spitzer observations (optical non-detections) of a hihg-z candidate from Richard *et al.* (2006) (top panel) and χ^2 as function as a function of redshift, showing a redshift estimate of z≈8.4.

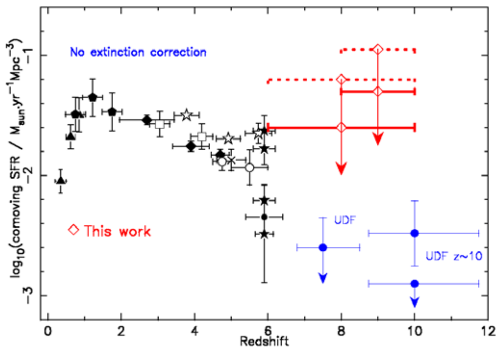

Figure 2. Evolution of the comoving SFR density as a function of z including a compilation of results at z≲6, our estimates obtained from both clusters for the redshift range[6-10] and [8-10] and the values derived from the HST UDF (2004.2005). red solid lines: SFR obtained fom integrating the LF of our first category candidates down to $L_{1500} = 0.3L^*(z{=}3)$ (Richard *et al.* (2006).

of star forming galaxies at z≳6. New additional observations, including ACS/HST and Spitzer imaging, have recently been secured on these clusters. The ACS/HST z850LP observations confirm that the vast majority (all except one of the above 13) of our high-z candidates are optical dropouts as expected, remaining undetected down to a 1σ limiting magnitude of 28. 28.3 mag_{AB} Hempel *et al.* (2007).

In collaboration with Eiichi Egami we have also access to IRAC/Spitzer GTO images at 3.6, 4.5, 5.8 and 8.0 m of large sample of lensing clusters including Abell 1835 and AC114. 11 of 18 high z candidates are in uncontam- inated regions so that IRAC photometry is feasible. These 11 objects remain undetected at 3.6 and 4.5 micron in median stacked images at a 2σ upper limit per source of 0.16 to 0.2 microJansky at 3.6-4.5 micron. Except for one ob-ject, these upper limits are compatible with the expectations from extrapolating their SED to longer wavelengths. This is easily understood, since extrapolation of their intrinsically blue SED to IRAC wavelengths shows that their expected fluxes fall below the Spitzer sensitivity of the available observations. This is illustrated in Fig. 2, showing best fit SEDs of two candidates at z≈8.4- 8.5. In other words, the IRAC non-detection can be understood if the objects are young star forming (blue) galaxies at high-z. It implies that these objects do not host old stellar populations with strong Balmer breaks, and that they are not a ected by significant extinction. In conclusion, the Spitzer non-detection is compatible with the high-z interpretation for the majority of our high-z candidates. A more detailed account of these observations will be presented elsewhere.

References

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