Starbursts in deep images

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Abstract. Using the Lyman break technique (e.g., Steidel *et al.* 1995), large samples of star-forming galaxies at $2 < z < 5$ have been identified and studied. These Lyman break galaxies (LBGs) are UV-luminous and thought to be similar to local starburst galaxies; they are relatively small (r_h=1-3 kpc), have relatively low mass ($10^{9.5-11} M_\odot$) and low extinction. However, their role in galaxy evolution is still debatable. Do all galaxies go through a Lyman Break phase? How biased is our view of galaxy evolution due to the Lyman break technique? Are LBGs the building blocks of larger systems or just small galaxies having their first burst of star-formation? Therefore, a census of the star-forming galaxy population as a function of time is needed in order to help us better understand how galaxies acquired their present morphology. In this contribution, I discuss the physical properties of a sample of UV-selected galaxies at intermediate redshifts. I conclude by showing that galaxies of all types, sizes and shapes are forming stars at intermediate-z. However, deep image and spectroscopy with large telescopes are needed in order to properly address their nature.

Keywords. galaxies:evolution, formation, starburst

1. The shallow and deep UV data

Parallel observations were taken with HST's WFPC2 in the U-band (F300W) during the GOODS/ACS observations (Giavalisco *et al.* 2004) which covered 88% of GOODS images. Aiming also at searching for high-z supernovae (Strolger *et al.* 1998), GOODS images were taken in five repeat visits separated by approximately 45 days which makes the U-band coverage heterogeneous. A total of 741 WFPC2 images were retrieved from the archive and 30 WFPC2 drizzled images of the GOODS-South field and 25 of the GOODS-North field were produced. The drizzled images are relatively shallow with typical exposure time $\sim 2\,000$s and reaching $U < 24.5$. We detected sources on the drizzled images using SExtractor v2.2.2 (Bertin & Arnouts 1996) and matched the WFPC2 U-band catalog with the ACS B-band catalog produced by the GOODS team. We identified a total of 130 objects in GOODS-S and 138 in GOODS-N. Photometric redshifts were calculated using the template fitting method described in detail in Dahlén *et al.* (2005). The template SEDs used cover spectral types E, Sbc, Scd and Im (Coleman *et al.* 1980), with extension into UV and NIR-bands by Bolzonella *et al.* (2000), and two starburst templates (Kinney *et al.* 1996). The analysis of the ACS images of these UV-selected objects reveals that:

(*a*) Most of the objects are between $0.2 < z < 0.8$.

(*b*) The majority (45%) of the galaxies have spectral types of starbursts, however, galaxies of all spectral types are found, including early-types (5%).

(*c*) 75% of the starbursts have tidal tails or show some peculiarity typical of interaction/mergers and 50% of the starbursts have another galaxy within 5×5 arcsec.

(*d*) The bluest galaxies ($U - B < 0.2$ and $B - V < 0.1$) are at $1.1 < z < 1.9$ and have peculiar morphologies that resembles either tadpoles, chains, or double-clump galaxies.

(*e*) Starbursts at $z \sim 1$ with tadpole/clumps morphology have a half-light radius of 1.63 ± 0.37kpc.

(*f*) The UV-selected sample has an average rest-frame $M_B = 19.9 \pm 0.1$, which is at least two magnitudes fainter than typical LBGs (Pettini *et al.* 2001).

In parallel to the ACS Ultra Deep Field other instruments aboard HST also obtained deep images. We analyzed the portion of the data taken with the WFPC2 (F300W) which falls within the GOODS-S area. It is the deepest U-band image ever taken with HST (0.5 mag deeper than the HDFs). Although only slightly larger than one WFPC2 field, 415 objects were identified by SExtractor due to the large depth of the data (Wadadekar *et al.* 2006, de Mello *et al.* 2006). The main results are as follows:

(*a*) UV-selected galaxies span all the major morphological types at $0.2 < z < 1.2$. However, disks are more common at lower redshifts, $0.2 < z < 0.8$.

(*b*) Higher redshift objects ($0.7 < z < 1.2$) are on average bluer than lower-z and have spectral type typical of starbursts. Their morphologies are compact, peculiar or low surface brightness galaxies.

(*c*) Despite of the UV-selection, 13 objects have spectral types of early-type galaxies; two of them are spheroids with blue cores.

In both data sets the majority of the UV-selected galaxies have spectral types of starbursts. We performed visual inspection of these galaxies on the ACS images (at $z = 1$ the z-band is showing the morphology in the rest-frame B band) to classify their morphology and found that higher-z starbursts resembles either tadpoles, chains, or double-clump galaxies (Elmegreen *et al.* 2004, Elmegreen *et al.* 2005). These galaxies are characterized by the presence of a large clump and extended tail, or two or more large clumps in a linear arrangement. Very little is known about these galaxies due to their faintness. Deep images and spectroscopy with larger telescopes are needed in order to access the nature of these objects. Rotation curves of galaxies at $z > 1$ is still a challenge with the current instruments and will only be achieved with larger telescopes.

Acknowledgements

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