The Subaru Lyα Blob Survey: Morphology-Density Relation of Lyα Blobs at z=3?

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- Lyα blobs (LABs) are ideal laboratories to study large-scale gas circulation processes between galaxies and the surrounding IGM during the peak epoch of galaxy formation.
- We obtained Lyα imaging at z=3.1 in wide range of environment from blank field to protocluster.
- We construct a sample of 14 LAB candidates with major-axis diameters larger than 100 kpc.
- The giant LAB sample shows a “morphology-density relation”
  - Filamentary LABs tend to reside in lower galaxy density regions
  - Circular LABs tend to reside in higher galaxy density regions
- One possible interpretation is:
  - Filamentary LABs may remain gas filaments made from cold streams
  - Circular LABs may relate to gas outflows from intense starburst/AGN induced by more frequent galaxy interactions in galaxy over-dense regions
- Our survey highlights the potential usefulness of giant LABs to investigate the interactions between galaxies and the surrounding IGM as a function of environment at high-redshift.

Table 1. Summary of source local observations

![Figure 1. Filamentarity of the 14 giant LABs as a function of the overdensity of Lyα emitters (LAEs). The blue squares and red circles indicate giant LABs without QSO and with QSO, respectively. The error bars show 1σ uncertainties. The filamentarity of the LABs shows a weak anti-correlation with the overdensity of the LAEs. The definition of the filamentarity is $F = 1 - \left(\frac{\text{isophotal area}}{\pi \times (a/2)^2}\right)$, where $a$ is the major-axis diameter of the LABs. For example, a circle has $F = 0$ and an extremely thin filament has $F = 1$.](image1)

Figure 2. Colour images (B for blue, N B497 for green, V for red) of the 14 giant LABs. The size of the images is 40 × 40 arcsec$^2$ (300 × 300 kpc$^2$). The yellow contours indicate isophotal apertures with a threshold of 1.4 × 10$^{-18}$ erg s$^{-1}$ cm$^{-2}$ arcsec$^{-2}$. The white horizontal bar in the lower right image represents the angular scale of 100 kpc (physical scale) at z = 3.1.

![Figure 3. Sky distribution of the 14 giant LABs and smoothed density maps of ∼2100 compact LAEs at z=3.09. In the left panel (a), the small black box indicates SSA22a field by Steidel et al. (2000, S00) and the dashed box indicates SSA22-Sb1 by Matsuda et al. (2004, M04). The thick bars show the angular scale of 20 comoving Mpc at z = 3.1. The blue squares and red circles indicate the giant LABs without QSO and with QSO, respectively. The contours represent LAE overdensity, 5σ, 1, 2, 3, 4, 5, and 6.](image3)