Mass-Dependent Clustering History of K-selected Galaxies at $z < 4$ in SXDS/UDS Field

FURUSAWA, Junko, SEKIGUCHI, Kazuhiro, TAKATA Tadafumi, FURUSAWA, Hisanori
(NAOJ)

SHIMASAKU, Kazuhiro
(University of Tokyo)

SIMPSON, Chris
(Liverpool John Moores University)

AKIYAMA, Masayuki
(Tohoku University)

It has been a big challenge to study galaxy formation and evolution in an observational manner at the epochs above the redshift 2, by means of star formation rate, stellar masses, and spatial clustering of galaxies. However, those studies suffered from observational limits and have been performed only for paritcular galaxy populations which are selected based on galaxy colors. The discussions for each population were done separately and relation among them have been uncertain. Our study aimed at discussing the galaxy formation and evolution across the populations by using the whole galaxy populations which is selected by photometric redshift (photo-z).

The stellar mass of galaxies is a key parameter to describe galaxy formation and evolution, since it is relevant to the star formation history of galaxies. In various surveys on different patches of the sky have been undertaken for this scientific driver, reaching an interesting common view in which star formation rates of high-mass galaxies seem to get mild and stable earlier than those of lowmass galaxies. However, there still remain significant differences in the amplitudes and the epoch of the active star formation among the surveys in various mass ranges of galaxies, needing a more wide and deep observation to give a stringent clue to those questions.

We investigated mass-dependent galaxy evolution based on a large sample of (~50,000) *K*-band selected galaxies in a multi-wavelength catalog of the Subaru/XMM-Newton Deep Survey (SXDS) and the UKIRT Infrared Deep Sky Survey/Ultra Deep Survey (UDS). This unique dataset in a contiguous deep ($K_{AB} \leq 23.5$) and wide field covering a 10 times larger area than those in other surveys with equivelent depths, allows us to discuss reliable stellar mass functions and clustering of galaxies up to $z = 4$ based on a photo-z technique. In addition, we obtained spectroscopic redshifts, especially for galaxies at $z > 2$ with Subaru/MOIRCS, confirming that the accuracy of our photo-z is sufficiently good to discuss the galaxy evolution.

Detailed discussions of the relation between stellar masses and evolution of clustering of galaxies is a unique and primary result of this study. The findings include the followings: (1) An increase of the stellar mass density in the universe is more rapid at $z > 2$ and gets relatively smaller at the below $z \sim 2$. (2) Evolution of the galaxy clustering depends on the stellar masses of galaxies, in which higher-mass galaxies tend to show stronger clustering. This trend seem to apply up to $z = 4$ (Figure 1). (3) Comparison between star-forming galaxy population (s*BzK*) and quiescent pupulation (p*BzK*) shows no clear correlation in redshift and clustering strength of the two pupulations. Post star-formation pupulations tend to have stronger clustering.

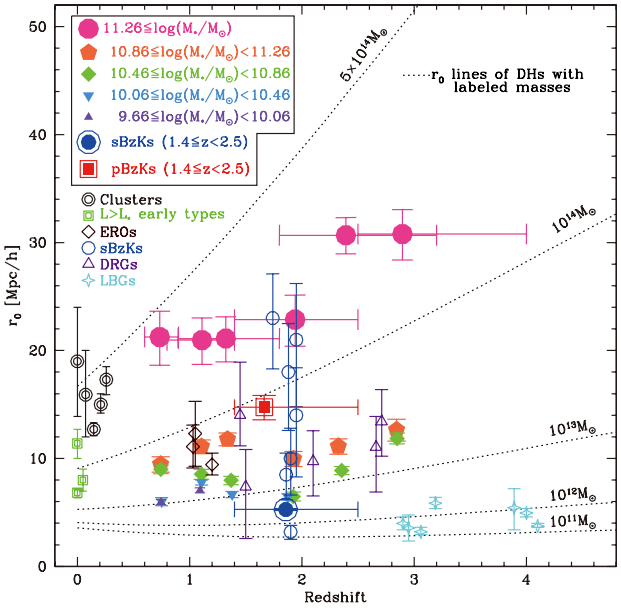

Figure 1: The redshift evolution of correlation lengths of various types of objects. Filled symbols show our result. Dotted lines show the correlation lengths of dark haloes with four different typical masses. Hollow symbols show correlation lengths of the different populations of objects (Double black circles: present-day clusters of galaxies [1]. Double light green squares: present-day luminous early-type galaxies and Brown diamonds: EROs[2]. Purple triangles: DRGs, Blue circles: s*BzK*s with various K magnitude range and Cyan crosses: LBGs[3]).

References

[1] Bahcall, N. A., et al.: 2003, *ApJ*, **599**, 814.
[2] Overzier, R.A., et al.: 2003, *A&A*, **405**, 53.
[3] Hayashi, M., et al.: 2007, *ApJ*, **660**, 72.