A Large Scale Structure Traced by [OII] Emitters Hosting a Distant Cluster at $z = 1.62$

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It is widely known that the formation and evolution of galaxies strongly depend on their surrounding environments [1]. Clusters and their surrounding regions serve as ideal sites for studying the roles of galaxy environment on galaxy formation and evolution. We have conducted a narrow-band survey of [OII] emitters in and around the ClG J0218.3–0510 cluster at $z = 1.6$, which is one of the most distant cluster, using Suprime-Cam on Subaru. The observation with z_R filter was newly carried out to measure the continuum at the same wavelength as the narrow-band filter (NB 973).

On the basis of narrow-band excesses and photometric redshifts, our survey provides a sample of 352 [OII] emitters over a 830 arcmin^2 area [2]. The FMOS near-infrared spectroscopic observations have confirmed 31 [OII] emitters at $z \sim 1.6$ by the presence of Hα or [OIII] lines at the expected wavelengths. The [OII] emitters constitute a large scale structure at $z = 1.62$ in which the ClG J0218.3–0510 cluster is embedded (Figure 1). Also, we find that many star-forming [OII] emitters are located even in the cluster core ($r < 0.4$ Mpc in the physical scale) and in the surrounding clumps, and show a very high overdensity by a factor of 40 compared to the field region. This trend is consistent with our previous studies in the distant cluster at $z = 1.47$ [3,4], suggesting that the integrated star formation activity per unit volume is activated in cluster regions.

Also, we obtain a large fraction of [OII] emitters even in the cluster core, showing that the star forming activity in the cluster core is elevated substantially compared to the local clusters where there are little star-forming galaxies in their cores. There is no longer a environmental dependence in the relative fraction of [OII] emitters in the all population, and the well known SFR-density relation in the present-day Universe no longer exists within errors. Furthermore, the properties of the individual [OII] emitters, such as star formation rates, stellar masses and specific star formation rates, do not depend on the local density, either. These results suggest that the [OII] emitters in the high density regions are just in the transition phase from a star-bursting mode to a quiescent mode due to some environmental effects and the star formation rates in these systems may be rapidly declining.

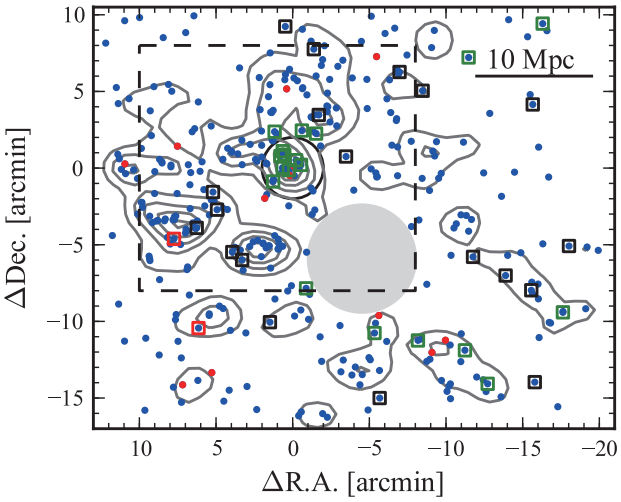

Figure 1: The 2-D distributions of 352 [OII] emitters. Blue and red filled circles show star-forming and red [OII] emitters, respectively. Squares indicate the spectroscopically confirmed objects with $1.590 \leq z_{spec} < 1.620$ (black), $1.620 \leq z_{spec} \leq 1{:}630$ (green) and $1.630 < z_{spec} \leq 1.644$ (red). Contours denote the local number density of [OII] emitters. A gray filled circle is a masked region near a bright star.

References

[1] Kauffmann, G., et al.: 2004, *MNRAS*, **353**, 713.
[2] Tadaki, K.,et al.: 2012, *MNRAS*, **423**, 2617.
[3] Hayashi, M., et al.: 2010, *MNRAS*, **402**, 1980.
[4] Hayashi, M., et al.: 2011, *MNRAS*, **415**, 2670.