

## 論文内容の要旨

### 論文題目

The Galaxy Evolution and Reionization  
Probed by Observations of the High Redshift Universe  
(高赤方偏移銀河の観測で探る銀河の形成・進化と宇宙再電離の歴史)

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The most distant and the oldest galaxies spectroscopically confirmed to date have been Ly $\alpha$  emitters (LAEs) at redshift  $z = 6.6$ . Recently, several candidate galaxies at  $z > 6.6$  have also been found photometrically. However, these objects are too faint and spectroscopic confirmation of their redshifts is not likely feasible with current 8-10m class telescopes.

We made a narrowband NB973 (bandwidth of 200 Å centered at 9755 Å) imaging of the Subaru Deep Field (SDF) using Subaru/Suprime-Cam and found two  $z = 7$  LAE candidates photometrically among 41,533 objects detected down to NB973 = 24.9 ( $5\sigma$ , 2' aperture). Carrying out deep follow-up spectroscopy with Subaru/FOCAS, we identified the brighter of the two candidates as a real  $z = 6.96$  LAE. This demonstrates that galaxy formation was under way when the Universe was only  $\sim 6\%$  of its present age, establishing a new redshift record.

On the other hand, it was recently found that the Ly $\alpha$  line luminosity functions of LAEs reduces to 40-60% from  $z = 5.7$  to 6.6 in the SDF. We also found the number density of  $z = 7$  LAEs was even only 17-34% of the density at  $z = 6.6$ . This series of significant decreases in LAE density can be the result of galaxy build-up process during these epochs. However, considering the small evolution seen in the UV continuum luminosity function of LAEs, we suggest that this could be due to the completion of the reionization at around  $z \sim 6$ , beyond which the fraction of the neutral IGM hydrogen rapidly increased and attenuated the Ly $\alpha$  photons from LAEs.