NIR Spectroscopy of Star-Forming Galaxies at z~1.4 with Subaru/FMOS

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The gas-phase metallicity (hereafter metallicity) is one of the important parameters in understanding the galaxy evolution. It is known that the metallicity of galaxies correlates well with the stellar mass at the local universe. The mass-metallicity relation at higher redshifts still remains unclear because of the small sample size. We carried out the NIR spectroscopic survey of star-forming galaxies at z~1.4 by using FMOS (Fibre Multi Object Spectrograph) [1] on the Subaru Telescope.

We observed ~320 galaxies with $K < 23.9$ mag (AB), $1.2 < z_{ph} < 1.6$ ($z_{med} \sim 1.4$), $M_{*\odot} > 10^{9.5} M_{\odot}$, F(H$\alpha$)^{expected} $> 5 \times 10^{-17}$ erg s^{-1} cm^{-2} in the SXDS (Subaru XMM-Newton Deep Survey) field during the FMOS/GTO. The data reduction was done with the FMOS standard pipeline [2], and the spectral fitting including the effects of OH-masks was carried out. For 71 objects, Hα emission lines are detected significantly.

The metallicity is derived from the obtained [NII]/Hα line ratio. The stacking analysis is also done by dividing the sample into three stellar mass bins. The distribution of the metallicity and the stellar mass with the result from the stacking analysis is presented in Figure 1. It is shown that the mass-metallicity relation at z~1.4 is located between those at z~2.2 and z~0.8 with a smooth evolution from z~3 to z~0.1.

It is known that there exists an intrinsic scatter significantly larger than the observational error in the mass-metallicity relation at z~0.1. The origin of the scatter, in other words, the dependence of physical parameters on the mass-metallicity relation, is a key to understand the galaxy evolution. At higher redshift, however, it is still unclear whether there is a scatter in the mass-metallicity relation or not, again, partly due to the small sample size.

By using the large NIR spectroscopic sample at z~1.4, we examined the scatter of the mass-metallicity relation and the dependence of other physical parameters. The resultant mass-metallicity relation at z~1.4 shows an intrinsic scatter of ~0.1 dex after subtracting the observational error, which is similar to that at z~0.1. We find that the dependence of dust corrected SFR and the galaxy size (half light radius) on the mass-metallicity relation: At a fixed stellar mass, galaxies with lower SFR (smaller size) tend to show larger metallicity [3]. The sample size, however, is still limited, and further observations are desirable for more detailed discussions.

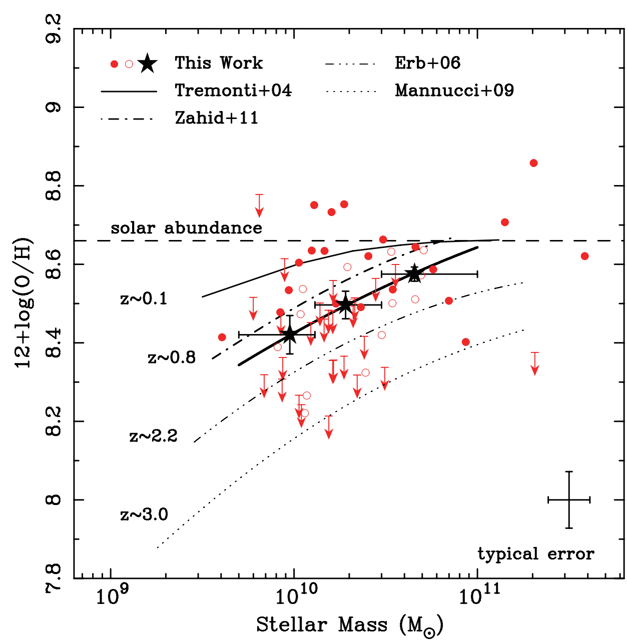

Figure 1: The mass-metallicity relation at z~1.4. Objects with the [NII] SN ratio of ≥3.0 and 1.5–3.0 are indicated by filled and open circles, respectively. Objects with the SN ratio of < 1.5 are shown by arrows as upper limits. Results from the stacking analysis are shown by filled stars with error bars. Previous results at z~0.1–3 in the literature are also presented. The typical error for an individual object is presented on the bottom-right corner.

References

[1] Kimura, M., et al.: 2010, *PASJ*, **62**, 1135.
[2] Iwamuro, F., et al.: 2012, *PASJ*, **64**, 59.
[3] Yabe, K., et al.: 2012, *PASJ*, **64**, 60.