Galaxy formation activity just before its peak epoch explored with [OIII] emitters at $z > 3$

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Abstract

It has been known that galaxy formation activities, such as star formation and AGN growth, are peaked at $2 < z < 3$. In this study, we focus on the epoch slightly beyond this peak, $z > 3$, to know how the galaxy formation is being most activated to come to the peak. At this redshift regime where Hα can no longer be reached by ground based telescopes, the [OIII] nebula emission line turns out to be the most efficient and effective tracer of star-forming galaxies, as it becomes very strong at high redshifts due to much higher excitation states.

We have performed deep narrow-band imaging survey with Subaru/MOIRCS in the SXDF-UDS-CANDELS field as a part of MAHALO-Subaru project, and have constructed coherent samples of ~ 35 [OIII] emitters at $z = 3.17, 3.62$, as well as ~ 100 Hα emitters at $z = 2.19, 2.52$, using two custom-made narrow-band filters in the K-band. Using these unique sample of $z > 3$ [OIII] emitters, we investigate their basic physical quantities, such as stellar mass, star formation rate (SFR) and size with multi wavelength data and HST high resolution images that are all available. The stellar mass and SFR show a clear, tight correlation known as the "star forming main sequence" for star forming galaxies at lower redshifts, with a hint of turning over of its evolution towards higher redshifts. On the other hand, their mass-size relation is almost identical to that of star forming galaxies at $z \sim 2 - 2.5$, indicating that there is no evolution since $z \sim 3.6$ to $z \sim 2$.

Based upon these intriguing results together with their internal structures (e.g. clumpiness and dustiness) obtained from the HST images, we discuss the formation/evolutionary stages of those star forming galaxies at $z > 3$ in comparison with those at $z \sim 2$, and also taking into account any sampling effects.