Low-mass and High-sSFR Hα Emitters at z ~ 2 in the ZFOURGE-COSMOS field

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The cosmic noon epoch (z ~ 2), when the cosmic star formation rate density peaked, marks a key phase in galaxy evolution driven by rapid gas accretion. While most galaxies lie on the star-forming main sequence, some exhibit elevated specific star formation rates (sSFRs), probing accelerated growth.

We present near-infrared spectroscopy of seven Hα emitters at z = 2.06–2.49 in the ZFOURGE-COSMOS field using Subaru/SWIMS. The sample includes three low-mass galaxies (< 10^9 $M_\odot$) with high sSFRs and four high-mass galaxies (> 10^{10} $M_\odot$) close to the star-forming main sequence, selected via the Ks-band excess method.

Hα emissions were detected in all targets, verifying the effectiveness of the selection via broad-band excess. Difference in Hα fluxes from the excess method and spectroscopy show a mass-dependent trend: the low-mass galaxies exhibit consistent fluxes, whereas the high-mass galaxies show lower fluxes in spectroscopy, possibly due to slit-loss from their extended star formation distributions.

The low-mass galaxies exhibit strong [O III] emissions, high [O III]/Hβ ratios (> 4), and high ionization parameters (logU ~ -2.2). In the R_{23}-O_{32} and R_2-R_3 diagnostic diagrams, they occupy a phase space similar to z ~ 6 galaxies and local analogues. Conversely, the high-mass galaxies display higher metallicities (12+log(O/H) ~ 8.4-8.6) and lower ionization parameters (logU ~ -3.2), consistent with the mass-metallicity relation at z ~ 2.

Furthermore, JWST/NIRCam images show different radial F115W–F277W color gradients between the two groups. The low-mass galaxies show positive gradients characterized by young stellar population in the central regions ($\lesssim$ 10 Myr), whereas the high-mass galaxies exhibit negative gradients. This suggests different assembly pathways depending on stellar mass of galaxies.