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Resolving Star Formation and Nuclear Activities in a Protocluster with JWST/NIRCam PaB Imaging

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Understanding the interplay between galaxies and SMBHs has become a central theme in the latest research on galaxy formation and evolution. AGN feedback is thought to be the most reasonable solution to regulate star formation and match current observations in the modern hydrodynamic simulations. The hydrodynamic simulations report that studying solely luminous AGNs would not contribute to understanding AGN feedback as it only traces temporary AGN activities and its energy injection is fairly low compared with the total budget. Rather, they claim that examining low-luminosity AGNs in low accretion states is important for uncovering permanent quenching.

This talk will show the results of JWST/NIRCam PaB narrowband imaging in the Spiderweb protocluster at z=2.16 (Shimakawa et al., 2024 in press and submitted), where one of the deepest Chandra X-ray image is available (T_exp=700ks). While NIR lines are useful for studying the properties of massive, dust-obscured galaxies than UV and optical lines, until JWST, there has been no suitable instrument for resolving them for high-z galaxies. We investigate PaB radial profiles of massive protocluster galaxies with and without low-luminosity X-ray AGNs, and then spatially resolve their star formation and AGN activities for the first time. Obtained PaB line images of non-X-ray members indicate significant star formation in the outskirts. In contrast, those of low-luminosity AGNs are dominated by point source components and star formation in host galaxies is significantly suppressed. Our results also show a great agreement with their passive natures independently derived from the X-ray-to-submm SED fitting (Shimakawa et al., 2024 MNRAS 528:3679). Considering their high stellar potential parameters, we conclude that their different PaB characteristics would be driven by the impact of AGN feedback.

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