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Looking for signs of supermassive black hole growth in ultra-compact UV-luminous galaxies using mid-infrared spectroscopy

The formation of supermassive black holes (SMBHs) and their co-evolution with the host galaxy is poorly understood in the early Universe. How is the growth of the stellar bulge related to the growth of the SMBH? Looking at the coexistence of star formation activity and SMBHs in high redshift galaxies is critical to address this question.

At high redshifts, it is hard to study galaxies as their distance renders them small and faint. This is especially true for Lyman Break Galaxies (LBGs), typical star-forming galaxies in the early ($z > 2$) Universe. There are galaxies at intermediate redshifts that share the properties of those at higher redshifts and can work as a proxy for detailed studies. Such is the case of Lyman Break Analogs (LBAs), local ultra-compact UV-luminous galaxies which have similar properties to LBGs. They may provide a great laboratory to investigate the relationship between star formation and SMBHs.

Some LBAs contain a single, dominant luminous point-like source at or near the center of the galaxy, which appears to be an ideal site for the formation of an SMBH. About 20% of the LBAs have optical emission line spectra that are intermediate between those of pure starbursts and those of active galactic nuclei (AGNs) — growing SMBHs. Unfortunately, the optical spectra alone do not unambiguously establish the presence of an AGN. The mid-infrared (mid-IR) offers a way to eradicate this ambiguity.

In this work, we analyze the mid-IR spectra of 25 LBAs ($0.1 < z < 0.3$) taken with the InfraRed Spectrograph (IRS) on the Spitzer Telescope. We use the mid-IR slope and the prominence of polycyclic aromatic hydrocarbons (PAHs) emission features to find signs of AGNs and quantify the contribution of the underlying power sources, be it AGN or star formation. Our preliminary results are consistent with the presence of obscured AGN in our sample. This work is a preparation for the spatially resolved studies that will be done with de James Webb Space Telescope (JWST).

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