Two Nuclei, One Galaxy: Unveiling a Close Dual AGN with HST and JWST.

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Abstract

Galaxy mergers are believed to play a key role in triggering active galactic nucleus (AGN) activity and driving the co-evolution of galaxies and supermassive black holes. Dual AGN systems, hosting two actively accreting supermassive black holes within merging galaxies, therefore provide important laboratories for studying black hole growth, galaxy assembly, and merger-driven nuclear activity, particularly during the peak epoch of cosmic evolution. In this work, we present a study of the close quasar pair J0749+2255 (z = 2.17) using high-resolution observations from the Hubble Space Telescope (HST) and James Webb Space Telescope (JWST) to investigate whether the system is a gravitationally lensed quasar or a genuine dual AGN. The source, originally identified in the Sloan Digital Sky Survey (SDSS) and later selected as a dual AGN candidate through the VODKA survey, shows two nuclei separated by 0.46 (_˜3.8 kpc). Using GALFIT-based two-dimensional surface brightness decomposition of HST/WFC3 F475W, F814W, F160W, and JWST/F200W imaging, we detect extended host galaxy components around both nuclei, consistent with an ongoing merger between two galaxies. JWST/NIRSpec F170LP observations further reveal that the system is dispersion-dominated, with an Hα gas velocity offset of _˜241 km s^{1} between the two components. We additionally detect a clear metallicity gradient across the system and evidence for counter-rotation between the stellar and ionized gas kinematics. The combined imaging and spectroscopic results strongly support J0749+2255 as a close dual AGN system embedded within a merging galaxy at z $\approx$ 2.17.

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