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*Investigating the Spectral Properties of Dual Nuclei in Galaxy Mergers
from the GOTHIC survey: Supermassive Black Hole Growth, metal
enrichment and Dual AGN*

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Abstract

Dual nuclei systems are galaxy merger remnants or closely merging galaxies that have two distinct stellar cores separated by $\sim 10\text{pc}$ to 10kpc . They are important laboratories for probing the co-evolution of stellar populations, galaxy dynamics, and central black holes during the hierarchical assembly of galaxies. In this study, we present a spectroscopic analysis of a sample of ~ 650 dual nuclei from the GOTHIC survey, using the penalized pixel-fitting (pPXF) code. The sample consists of star forming nuclei pairs, dual active galactic nuclei (DAGN) and mixed pairs. Using the SDSS spectra, we extracted stellar kinematics, emission line fluxes, the star formation history, metallicity of the nuclei, and derived important properties such as the supermassive black hole (SMBH) masses, accretion rates and SMBH ratios. We compared different properties of the nuclei in the dual systems, such as stellar velocity dispersion, stellar masses, black hole masses, age and metallicity. Our results show that the SMBH masses are higher for BHs in galaxy mergers compared to single nuclei for a given stellar mass, thus revealing that SMBHs grow during the galaxy merging process and not only due to the merger of SMBHs. Our study provides new observational constraints on the dynamical and evolutionary states of dual-nuclei systems, offering a deeper understanding of the role these systems play in galaxy evolution and central black hole growth.