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Searching for Signatures of Internal Gamma-ray Absorption in High-redshift Blazars

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Blazars are a special type of AGN, with jets that happen to point very close to the direction of Earth. The powerful gamma-ray beam from distant blazars represents a unique tool to explore the environment along its path and allows us to probe opacity both inside the source and in the intergalactic medium. Internally, gamma rays experience attenuation due to photon-photon absorption, a result of interactions with AGN-generated photon fields. This interaction introduces distinct features in gamma-ray spectra. Upon exiting the source, gamma rays encounter attenuation due to the Extragalactic Background Light. Understanding and characterizing these absorption processes reveals the complex structure of blazars, including the spatial distribution of the photon fields, and the poorly known location of the gamma-ray emitting zone. In this work, we perform an analysis and detailed physical modeling of Fermi-LAT data of nine high-redshift (z>3) blazars, and search for characteristic features in the gamma-ray spectra induced by the internal absorption. Our results yield important constraints on the precise location of the gamma-ray production site along the blazar jet in these sources.

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