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Using Very High Energy Photons from Blazars for Cosmological Insight

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Gamma-ray blazars are among the most extreme astrophysical sources, harboring energetic phenomena far beyond that attainable by terrestrial accelerators. These galaxies are understood to be active galactic nuclei that are powered by accretion onto supermassive black holes and have relativistic jets pointed along the Earth line of sight. The very high energy photons emitted by these extragalactic sources are detectable with ground based imaging atmospheric Cherenkov telescopes such as VERITAS, MAGIC and HESS. As these photons propagate extragalactic distances, the interaction with the diffuse starlight that pervades the entire Universe results in a distance and energy dependent gamma-ray opacity, offering a unique method for probing photon densities on cosmological scales. These galaxies have also been postulated to be potential sources of ultra-high-energy cosmic rays, a theory which can be examined through the deep gamma-ray observations of sources which probe moderate gamma-ray opacities. If confirmed as cosmic ray progenitors, these galaxies would provide an opportunity to probe the intergalactic magnetic field, as the charged particles would be deflected from the line of sight in a field-dependent manner.