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Time-dependent Pair Halo Emission from Very-High-Energy Gamma-Ray Sources

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Gamma-rays with energy exceeding 100 GeV emitted by extragalactic sources, such as blazars, initiate cascades in the intergalactic medium. The angular and temporal distribution of the cascade photons that arrive at the Earth depend on the strength and configuration of extragalactic magnetic fields (EGMFs) in the line of sight. For weak enough fields, extended emission around the source (halo) is expected to be detectable, and the characteristics (size, energy dependence, and shape) of this emission are a sensitive probe of EGMF strength and correlation length. In this work, we have, for the first time, performed detailed calculations of the time dependence of such blazar halos, in a large range of EGMF parameter space, unconstrained by existing data. I will discuss the quantitative constraints that can be imposed on the EGMF from the recent tentative detection of halo emission around 24 stacked blazars observed with the Fermi LAT, as well as the constraints that can be derived in the absence of such extended emission around GeV and TeV emitting blazars.

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