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Neutrinos from interactions between the relativistic jet and large-scale structures of BL Lac objects investigated through their gamma-ray spectrum

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Absorption and emission lines in the optical spectrum are typically used to investigate the presence of large-scale environments in active galactic nuclei (AGNs). BL Lac objects - which are a category of AGNs with the relativistic jet pointing directly to the observer - are supposed to represent a late evolution stage of AGNs. Their large-scale structures are probably poorer of material, which is distributed with lower densities throughout the circumnuclear environment. Their accretion disk is weak and weakly reprocessed, making the non-thermal continuum of the relativistic jet dominate their optical spectrum and preventing us from identifying the thermal emission of the photon fields produced by such large-scale structures. However, these photon fields may still exist and eventually interact with the gamma rays traveling in the blazar jet via gamma-gamma pair production, producing observable effects such as absorption features in their spectral energy distribution. Interestingly, the same photon field might also lead to the production of high-energy neutrinos, acting as targets for proton-photon interactions. In this contribution, we present the results of a set of simulations over a wide parameter space describing both the blazar jet and the photon field properties. We discuss the most effective conditions that may produce fluxes of neutrinos compatible with the sensitivities of the current and the next generation of neutrino detectors. We will also discuss how the possible neutrino flux would be related to the properties of the large-scale structures investigated indirectly through the analysis of the gamma-ray spectrum of the BL Lac object.

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