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Indications for a cascade component in gamma-ray blazar spectra

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The great majority of works on extragalactic gamma-ray propagation accounted for only two elementary processes: the absorption of primary gamma-rays and adiabatic losses. However, recently a number of experimental results were obtained that indicate the presence of a cascade (secondary) component in gamma-ray blazar spectra. We describe and characterize the main signatures of the cascade emission: 1) a high-energy cutoff due to the absorption process of primary photons on Extragalactic Background Light, 2) an “ankle” formed by the primary and cascade components 3) a possible low-energy steepening induced by the Extragalactic Magnetic Field (the so-called “magnetic cutoff”). We analyze a large sample of blazar observations and show that the presence of the secondary component in a spectrum may drastically influence the data interpretation. Namely, the so-called “pair-production anomaly” at Very High Energy (VHE, $E > 100$ GeV) is somewhat relaxed, especially for blazars with hard intrinsic spectra. As well, the recent finding indicating that gamma-ray sources with hard spectra are predominantly located in the directions to the voids in the Large Scale Structure might be a manifestation of the “magnetic cutoff” signature. The work was supported by the RFBR Grant 16-32-00823.

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