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Anisotropy in the gamma-ray transparency of the Universe

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The propagation length of high-energy photons through the Universe is limited by e+e− pair production on the extragalactic background radiation. Previous studies reported discrepancies between predicted and observed attenuation, suggesting explanations in terms of new physics. However, these effects are dominated by a limited number of observed sources, while many do not show any discrepancy. Here, we consider the distribution in the sky of these apparently anomalous objects, selected in two very different approaches: the study of unphysical hardenings at distance-dependent energies in deabsorbed spectra of TeV blazars, and the observation of ultra-high-energy air showers from the directions of BL Lac type objects. In both cases, directions to the anomalous sources follow the projected local distribution of galaxies: all the distant sources, contributing to the anomalies, are seen through the local filament. This matches the prediction of the proposed earlier explanation of the anomalies based on mixing of photons with axion-like particles in the filament's magnetic field. For ultra-high energies, this axion interpretation may be tested by the search of primary gamma rays.

Based on https://arxiv.org/abs/2004.08321 (Eur.Phys.J.C 81 (2021) 264) +updates.

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