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Study of Lorentz invariance violation int the propagation of ultra-high energy photons and their development in atmosphere

We investigate the effects of Lorentz invariance violation (LIV) on photon interactions, considering both intergalactic propagation (Breit-Wheeler process) and atmospheric interactions (Bethe-Heitler process). By incorporating LIV into the theoretical framework, we analyze how it modifies key quantities such as the cross section, threshold energy, and mean free path of photons traveling through intergalactic space. In addition, we study its impact on extensive air showers initiated by high-energy photons, demonstrating that LIV can alter the cross section of the primary interaction in the atmosphere. Our results highlight the necessity of accounting for both propagation effects in intergalactic space and interactions in the atmosphere when evaluating LIV signatures. Even small deviations from Lorentz invariance can lead to measurable changes in astroparticle propagation and photon dynamics, offering new opportunities to test-quantum gravity theories through high-energy astrophysical observations.

Collaboration(s)

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