

Beyond Einstein: Exploring the Universe's Transparency through Lorentz Invariance Violation and Doubly Special Relativity in Astrophysical Phenomena

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Abstract: This research investigates phenomenological models of quantum gravity that modify Special Relativity, focusing on two main approaches: Lorentz Invariance Violation, in which Lorentz symmetry is broken, and Doubly Special Relativity, in which it is deformed. The study examines how these scenarios affect the propagation of very- and ultra-high-energy gamma rays, particularly through their impact on photon survival probabilities and the transparency of the Universe. The theoretical predictions are further connected with observational data through their implementation in simulation frameworks, enabling the assessment of the sensitivity of the future Southern Wide-field Gamma-ray Observatory, to potential quantum gravitational effects.