



Contribution ID: 207

Type: **not specified**

Constraints on LIV using Mrk421 flare from 2014

Thursday, 14 September 2023 17:15 (15 minutes)

Some candidates for the theory of quantum gravity allow for Lorentz invariance violation (LIV). If Lorentz's invariance is violated, it may cause an observable effect on the very high energy (VHE, $E > 100$ GeV) light curves and spectra of cosmic sources emitting gamma-ray photons. One of the possible consequences of the LIV is in-vacuo dispersion which implies that the photon group velocity is energy dependent. In this line of LIV studies, one needs a fast variable source and the highest possible photon energies. So, in order to explore the possibility of a LIV effect, we analysed an exceptional VHE flare from the blazar Mrk 421 detected by the MAGIC telescopes in April 2014. The flare reached energies up to 10 TeV with fast intra-night variability. Through an innovative time-binned likelihood analysis, we searched for arrival-time delays that increase linearly or quadratically with the photon energy. We were unable to significantly detect any energy-dependent time delay, which enabled us to establish stringent limits on the expected energy scale for LIV.

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Session Classification: IDM: Indirect DM searches

Track Classification: Indirect DM searches