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Advanced searches for Lorentz invariance violation with Cherenkov telescopes

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Lorentz invariance violation (LIV) is an exciting possible consequence of Quantum Gravity (QG). Detecting and measuring LIV would pose an invaluable input for understanding the nature of QG, and suggest a direction for further development of theoretical models describing it. If Lorentz symmetry is indeed violated, the effects thereof are minuscule, but cumulative. Therefore, very high energy (VHE, E > 100 GeV) gamma rays crossing cosmological distances are excellent probes of LIV.
So far, no effects of LIV have been detected, however, it has been strongly constrained. Researchers from three major imaging Cherenkov telescopes (IACTs) experiments (H.E.S.S., MAGIC, and VERITAS) join efforts to perform the most sensitive and robust search for the energy-dependent photon group velocity up to date. It is the first attempt at merging data from different instruments to this purpose, thus creating exceptionally large statistics. Moreover, combining observations from different gamma-ray sources will decrease the influence of source intrinsic effects.
In our contribution, we will describe the likelihood-based analysis method developed for this purpose, and present results on simulated data. We will compare impacts of different observations on the overall result, and discuss characteristics of the most influential data samples. In particular, we will focus on the case of GRB 190114C, the only IACT observation of a gamma-ray burst so far whose data was scrutinized for LIV.

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