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When astroparticles arrive at Earth - new ways for investigating LIV

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Lorentz invariance can be tested by making use of ultra-high energy cosmic rays (UHECRs), namely the highest energy particles in the Universe. Their interactions in the extragalactic space can be altered if some level of Lorentz invariance violation (LIV) is present, which may lead to detectable fingerprints in the expected fluxes.
The scenario is actually more complicated than expected, due to the fact that the best astrophysical description of the UHECR energy spectrum and mass composition is found corresponding to values of maximum energy of UHECRs at the sources smaller than or comparable to the typical threshold energy for photo-meson or photo-disintegration reactions. For this reason, the sensitivity to deviations from Lorentz invariance (LI) in the UHECR propagation is milder than expected, and alternative approaches need to be investigated.
We therefore explore new ways to investigating LIV with astroparticles, by studying the development of the cascade of particles in the atmosphere, and the expected modifications in terms of muonic and electromagnetic components in showers initiated by hadronic particles. Showers initiated by photons, and the LIV modifications in the Earth atmosphere and Earth crust, will be also scrutinised, to the aim of opening new ways to better constrain this fundamental symmetry.

Working Group

WG2 - High Energy QG Experiment

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