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Science with CTAO

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Intrinsic time delays and Lorentz invariance violation searches with CTAO

Lorentz Invariance Violation (LIV) effects could be spotted by Imaging Atmospheric Cherenkov Telescopes (IACTs) by searching for energy-dependent time delays in the gamma-ray photons coming from distant and highly variable astrophysical sources. As part of its scientific program, The Cherenkov Telescope Array Observatory (CTAO) will explore problems in fundamental physics, including studying and constraining the Extragalactic Background Light (EBL), searching for LIV effects and setting constraints on the characteristic LIV energy scale. This work presents the results from a feasibility study performed by simulating realistic observations with the CTA-AGN-VAR pipeline, a Python package based on Gammapy. Using the AGN Evolution Simulator (AGNES) code, the broadband spectra of a TeV blazar flare were modelled using a time-dependent one-zone Synchrotron-Self-Compton (SSC) scenario, and the presupposed LIV delays were introduced as linearly energy-dependent time lags. Observations with the CTAO Alpha and Omega configuration arrays were assumed for our simulations, taking into account observational constraints. The response and significance to intrinsic and LIV time delays are predicted for both configurations under the assumed scenario, and one method to discriminate LIV from intrinsic time delays is also presented and discussed.

Catch me if you can: Neutrino Target of Opportunity program for CTAO

Gamma-ray observations of the astrophysical neutrino sources are fundamentally important for understanding of the underlying neutrino production mechanism. We investigate the Cherenkov Telescope Array Observatory (CTAO) ability to detect the very-high-energy (VHE) gamma-ray counterparts to the neutrino-emitting extragalactic sources. The CTAO performance under different configurations and both Alpha and Omega layouts is computed based on the neutrino and gamma-ray simulations of steady sources and flaring blazars, assuming that the neutrino events are detected with the IceCube neutrino telescope. The CTAO detection probability is calculated for both CTAO sites taking into account the visibility constraints. We find that, under optimal observing conditions, in 30 minutes of observation CTAO could detect the VHE gamma-ray emission from at least 3 neutrino events per year. We investigate the blazars detectability for longer observation times.