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Sensitivity of CTAO to axion-like particles from blazars: a machine learning approach

Axion-like particles (ALPs) are a common prediction of several extensions of the Standard Model and could be detected through their coupling to photons, which enables ALP-photon conversions in external magnetic fields. This conversion could lead to two distinct signatures in gamma-ray spectra of blazars: a superimposition of energy-dependent "wiggles" on the spectral shape, and a hardening at high (multi-TeV) energies, due to the ALP beam eluding absorption by the extragalactic background light (EBL). The enhanced energy resolution and point-source sensitivity of the Cherenkov Telescope Array Observatory (CTAO) with respect to present ground-based gamma-ray telescopes make it an ideal instrument to probe such phenomena. In this contribution, we explore an approach based on the use of machine learning (ML) classifiers and compare it to the standard method of likelihood-ratio tests, previously applied in CTAO sensitivity studies for ALP signatures. Our preliminary 2σ exclusion regions on the ALP parameter space suggest that both techniques yield consistent results, with the ML-based method offering broader coverage and potentially extending the CTAO sensitivity beyond existing constraints.

Collaboration(s)

CTAO

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