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Probing Neutral Triple Gauge Couplings via Zγ(ℓ+ℓ−γ) Production at e+e− Colliders

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Neutral triple gauge couplings (nTGCs) are absent in the Standard Model (SM) and at the dimension-6 level in the Standard Model Effective Field Theory (SMEFT), arising first from dimension-8 operators. As such, they provide a unique window for probing new physics beyond the SM. These dimension-8 operators can be mapped to nTGC form factors whose structure is consistent with the spontaneously-broken electroweak gauge symmetry of the SM. In this work, we study the probes of nTGCs in the reaction $e^+e^-\to Z\gamma$ with $Z\to\ell^+\ell^-$(ℓ=e,μ) at an e^+e^- collider. We perform a detector-level simulation and analysis of this reaction at the Circular Electron Positron Collider (CEPC) with collision energy $\sqrt{s}$ = 240 GeV and an integrated luminosity of 20 ab^{-1}. We present the sensitivity limits on probing the new physics scales of dimension-8 nTGC operators via measurements of the corresponding nTGC form factors.

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