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Investigation of Neutral Anomalous Quartic Gauge Couplings via Tri-Photon Production at FCC-hh

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A direct investigation of the self-couplings of gauge bosons, completely described by the non-Abelian gauge symmetry of the Standard Model, is extremely valuable in understanding the gauge structure of the SM. In this study, we present a detailed Monte Carlo study searching for anomalous quartic gauge dimension-8 couplings related to $\gamma\gamma\gamma\gamma$ and $\gamma\gamma\gamma$ Z vertices at the future hadron-hadron collider (FCC-hh) via tri-photon production at a 100 TeV center of mass energy with an integrated luminosity $L_{int}=30$ ab⁻¹. In order to distinguish between signal and background events and obtain the best sensitivities on anomalous quartic gauge couplings, events that have been parton showered and include detector effects are analyzed with a Toolkit for Multivariate Data Analysis (TMVA) using a boosted decision tree. Our obtained results reveal that the limits on anomalous quartic gauge couplings f_{T8}/Λ^4 and f_{T9}/Λ^4 at 95% C.L. without systematic errors are about three orders of magnitude stronger compared to the best current experimental limits reported by the ATLAS collaboration at the LHC.

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