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Investigating Higgs Coupling Modifications in Vector Boson Fusion Higgs Pair Production.

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Understanding how the Higgs boson interacts with itself and with other particles remains one of the central goals of particle physics. In this project, I investigate Higgs boson pair production through the vector boson fusion (VBF HH) process to explore possible deviations from the Standard Model. Using Herwig and VBFNLO event generators, I simulate proton-proton collisions and study how varying these coupling modifiers, κ_V , κ_{2V} , and κ_λ , affects the event rates and kinematic distributions. Each parameter is varied independently while applying standard VBF cuts, including minimum jet transverse momentum, rapidity gap, and dijet invariant mass requirements. We anticipate that the preliminary results will inform us about the unique contributions of each of the coupling modifiers, k-parameters. These findings will demonstrate how VBF HH production can serve as a sensitive probe of the Higgs sector and help guide future efforts to search for new physics beyond the Standard Model.

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