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Constraints on the trilinear and quartic Higgs couplings from triple Higgs production at the LHC and beyond

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Experimental information on the trilinear Higgs boson self-coupling κ_3 and the quartic self-coupling κ_4 will be crucial for gaining insight into the shape of the Higgs potential and the nature of the electroweak phase transition. While Higgs pair production processes provide access to κ_3 , triple Higgs production processes, despite their small cross sections, will provide valuable complementary information on κ_3 and first experimental constraints on κ_4 . In this work, we consider triple Higgs production at the HL-LHC, employing efficient Graph Neural Network methodologies to maximise the statistical yield. We show that it will be possible to establish bounds on the variation of both couplings from the HL-LHC analyses that significantly go beyond the constraints from perturbative unitarity. We also discuss the prospects for the analysis of triple Higgs production at future high-energy lepton colliders operating at the TeV scale.

Collaboration / Activity

T (Phenomenology)

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