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BSM Higgs Decoupling Scenarios in light of Unitarity Constraints

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Unitarity limits from $2 \rightarrow 2$ scattering processes constrain the hVV , $hhVV$, $h\bar{f}f$ couplings to deviate from the SM values by up to $\mathcal{O}(v^2/s)$, $\mathcal{O}(v^2/s)$ and $\mathcal{O}(v/\sqrt{s})$ respectively. These bounds are not always “saturated” in NP models, for e.g. in Type-II 2HDM the decoupling of hVV has a steeper power law behaviour of $\mathcal{O}(v^4/M_{\text{new}}^4)$. We study the power law behavior of decoupling in scalar, fermion and gauge boson extensions of the SM and note features that allow saturation. In addition, we note features that always cause enhancement or suppression of the Higgs couplings. Precision measurements of these couplings would thus help discriminate between SM extensions and point to the scale at which we could expect new particles.

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