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On perturbative unitarity in an extended MSSM Higgs sector

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The MSSM Higgs sector extended by dimension-six operators $U^{(6)}$ [1], which are loop contributions in a Coleman-Weinberg-type potential, is considered. The presence of such additional contributions allows reopening phenomenological MSSM scenarios [2] closed in previous analyses. In order to restrict corresponding parameter space, perturbative unitarity constraints must be satisfied. The common approach for checking this is to consider a two-particle scattering matrix of scalars in the large center-of-mass energy $\sqrt{s}$ limit where only point interactions contribute [3]. However, due to SUSY-particles interactions in MSSM, trilinear couplings can be significant and large contributions are present at smaller $\sqrt{s}$ [4]. We find the analytical formula for quartic and cubic couplings for the Higgs potential extended by dimension-six operators, compare results with loop corrected constraints, which use the large $\sqrt{s}$ approximation with and without additional $U^{(6)}$-contributions, and show how the allowed regions in the parameter space are affected in these cases.

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