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Implications of Yukawa interactions in scalar sector

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In this work, a field theory model containing a real scalar singlet and an $SU(2)$ symmetry preserving complex doublet is studied using the method of lattice simulations. The model considers all quartic vertices along with the Yukawa vertex between a real scalar singlet and an $SU(2)$ symmetry preserving complex doublet field. Machine learning is used to extract representative functions of the field propagators, lattice regulator, and the Yukawa vertex. In the considered renormalization scheme the field propagators are found enhanced compared to their respective tree level structure. It is found that mixing of operators containing scalar singlet with $SU(2)$ invariant field operators results in 0 + states with a peculiar scarcity in hundreds of GeV s. The Yukawa vertex shows weak dependence on the field momenta while the theory remain interactive as found by the renormalized field propagators. The impact of the real scalar quartic self interaction is found mitigated due to other interaction vertices. The field expectation values exhibit a certain classification despite no conclusive signal of phase transition.

Special requests

Authors: SAAD, Muhammad (LUMS); Dr MUFTI, Tajdar (LUMS)

Presenter: SAAD, Muhammad (LUMS)

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