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Scalar and fermion on-shell amplitudes in generalized Higgs effective field theory

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Beyond standard model (BSM) particles should be included in effective field theory in order to compute the scattering amplitudes involving these extra particles. We formulate an extension of Higgs effective field theory which contains arbitrary number of scalar and fermion fields with arbitrary electric and chromoelectric charges. The BSM Higgs sector is described by using the non-linear sigma model in a manner consistent with the spontaneous electroweak symmetry breaking. The chiral order counting rule is arranged consistently with the loop expansion. The leading order Lagrangian is organized in accord with the chiral order counting rule. We use a geometrical language to describe the particle interactions. The parametrization redundancy in the effective Lagrangian is resolved by describing the on-shell scattering amplitudes only with the covariant quantities in the scalar/fermion field space. We introduce a useful coordinate (normal coordinate), which simplifies the computations of the on-shell amplitudes significantly. We show the high energy behaviors of the scattering amplitudes determine the "curvature tensors" in the scalar/fermion field space. The massive spinor-wavefunction formalism is shown to be useful in the computations of on-shell helicity amplitudes.

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