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Effective Field Theories for Higgs Sector Extensions - when SMEFT is not enough

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We integrate out the heavy scalar mass eigenstate in a real Higgs singlet extension of the Standard Model (SM) at one-loop order, taking into account full mixing between the BSM singlet and the SM-like Higgs fields. We highlight subtleties in the renormalization of the effective theory. We discuss the choice of a proper decoupling limit and whether the resulting effective Lagrangian is of SMEFT or HEFT type. Finally, we validate convergence of predictions from the effective theory to the full theory result for a chosen set of electroweak precision observables.

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