Abstract

In this thesis, we explore how complex CP-violating phases in the MSSM with heavy super-partners effect the masses and mixings of the MSSM Higgs bosons. The motivation for exploring this scenario is both to improve upon the EFT result, and to use the EFT result to improve the fixed-order calculation of the `fortran` code `FeynHiggs`. The bulk of this thesis is dedicated to an EFT calculation in a mass scenario where all superpartners are heavy and there is an intermediate Higgs mass scale between the scale of SUSY breaking and electroweak symmetry breaking. We match the complex MSSM to an effective type-III 2HDM, thereby incorporating all phase dependence in matching conditions and renormalization group equations that take imaginary contributions into account. We explore different methods of extracting the masses and mixings from this EFT procedure at the low scale, and identify parameter scenarios that maximize the size of the CP-odd component of the lightest Higgs boson. We find that it is difficult to generate an observable CP-component of the lightest Higgs boson with a mass of 125 GeV given current LHC constraints. In the second part of the thesis, the EFT result is incorporated into `FeynHiggs`, thereby resumming large logarithmic contributions in the scenario of light Higgs masses and complex parameters.