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Precision Higgs mass predictions in minimal and non-minimal SUSY models

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Now that the Higgs mass has been well measured at the Large Hadron Collider (combined ATLAS and CMS $m_h = 125.09 \pm 0.24$) it is very important that the precision of the Higgs mass prediction in SUSY models is improved. This is particularly challenging since both limits on the sparticles and the Higgs mass indicate that the SUSY scale may be quite large. A great deal of work has recently been directed at this in the MSSM with the state-of-the-art calculations ensuring that large logs are resummed when the SUSY scale is much bigger than the EW scale. However much less has been done on non-minimal SUSY models. Currently a two-loop calculation is available with SARAH/SPheno, but the precision is still limited due to large logarithms when the SUSY scale is large. Here we present an alternative algorithm for calculating the Higgs pole mass in and SUSY theories that combines an effective field theory (EFT) approach to resum large logs with a diagrammatic calculation of the Higgs pole mass. We implement this algorithm in FlexibleSUSY and use this to study the impact of these corrections in the MSSM, NMSSM, MRSSM and E_6 SSM. In the MSSM we show that our Higgs mass prediction correctly interpolates between the known EFT results when the sparticles are heavy and fixed order calculations in the full theory when the sparticle masses are close to the electroweak scale. We compare our results to those in public codes and discuss the origin of the most significant deviations.

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