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Higgs boson production in the SM and MSSM to NNLO and beyond

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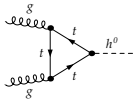
Abstract. In this contribution a brief review about the status of higher order corrections to Higgs boson production within the Minimal Supersymmetric Standard Model (MSSM) is given. Furthermore the first activities towards third-order corrections in the Standard Model (SM) are discussed.

1 Introduction



The discovery of a new Higgs boson-like particle at LHC [1, 2] has triggered plenty activities with the aim to pin down its properties like couplings and decay rates. In this contribution we consider the production cross section of a Higgs boson in the gluon-fusion channel and discuss the status both for the SM and the MSSM.

The theoretical framework of our calculations is the effective theory where all particles which are heavier than the Higgs boson are integrated out. This leads to an effective Higgs-gluon interaction which is described by

$$\mathcal{L}_{\rm eff} \;=\; -\frac{H}{v} C_1 \frac{1}{4} G_{\mu\nu} G^{\mu\nu}\,, \tag{1}$$

where $G_{\mu\nu}$ is the gluon field strength tensor and C_1 is the coupling (or matching coefficient) containing the remnant dependence on the heavy degrees of freedom. Within the SM C_1 only depends on the top quark mass via $\ln(\mu^2/m_t^2)$ where μ is the renormalization scale. In the MSSM, C_1 becomes a complicated function of all heavy mass scales and μ.

In Refs. [3–6] it has been demonstrated that at next-to-next-to-leading order (NNLO) the effective-theory approach of Eq. (1) approximates the exact SM result with an accuracy below 1%, in particular for Higgs boson masses around 126 GeV. Numerical NLO calculations [7] suggest a similar behaviour in the MSSM.

In Section 2 NNLO SUSY QCD corrections are considered within the MSSM. Afterwards, we summarize in Section 3 the first steps towards N^{3}LO in the SM.

2 NNLO corrections to $gg \to H + X$ in the MSSM

The computation of higher order supersymmetric corrections within the effective-theory framework requires the evaluation of loop corrections to the matching coefficient C_1. Several groups have computed two-loop corrections

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