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One-loop Amplitudes for $t\bar{t}j$ and $t\bar{t}\gamma$ Productions at the LHC

We present analytic expressions for the one-loop QCD helicity amplitudes contributing to top-quark pair production in association with a photon or a jet at the Large Hadron Collider (LHC), evaluated through $O(\epsilon^2)$ in the dimensional regularisation parameter, ϵ . These amplitudes are required to construct the two-loop hard functions that enter the NNLO QCD computation. The helicity amplitudes are expressed as linear combinations of algebraically independent components of the ϵ -expanded master integrals, with the corresponding rational coefficients written in terms of momentum-twistor variables. We derive differential equations for the pentagon functions, which enable efficient numerical evaluation via generalised power series expansion method.

Field

Pheno

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