

Top-quark effects in diphoton production through gluon fusion at NLO in QCD

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At hadron colliders, the leading production mechanism for a pair of photons is from quark-anti-quark annihilation at the tree level. However, due to large gluon-gluon luminosity, the loop-induced process $gg \rightarrow \gamma\gamma$ provides a substantial contribution. In particular, the amplitudes mediated by the top quark become important at the $t\bar{t}$ threshold and above. In this letter we present the first complete computation of the next-to-leading order (NLO) corrections (up to α_s^3) to this process, including contributions from the top quark. These entail two-loop diagrams with massive propagators whose analytic expressions are unknown and have been evaluated numerically. We find that the NLO corrections to the top-quark induced terms are very large at low diphoton invariant mass $m(\gamma\gamma)$ and close to the $t\bar{t}$ threshold. The full result including five massless quarks and top quark contributions at NLO displays a much more pronounced change of slope in the $m(\gamma\gamma)$ distribution at $t\bar{t}$ threshold than at LO and an enhancement at high invariant mass with respect to the massless calculation.

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