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## Analysis of the top-quark pair production via the $e^+e^-$ annihilation near the threshold region using the Principle of Maximum Conformality

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We present an improved analysis of the top-quark pair production via the process  $e^+e^- \rightarrow \gamma^* \rightarrow t\bar{t}$  near the threshold region up to next-to-next-to-leading order (N<sup>3</sup>LO) QCD corrections. Near the threshold region, the top-quark velocity v tends to zero, leading to Coulomb singularity. To achieve a reasonable prediction in the threshold region, we reconstruct the analytical expression for the Coulomb-terms up to N<sup>3</sup>LO accuracy by using the PSLQ lgorithm, whose numerical values agree well with the previous N<sup>3</sup>LO-level calculations. It is found that the N<sup>3</sup>LO series still has sizable renormalization scale dependence, and to improve the precision of the series, we apply the Principle of Maximum Conformality to eliminate such scale dependence. After that, the Coulomb part is resummed into a Sommerfeld-Gamow-Sakharov factor, which finally leads to a much more reasonable behavior near the threshold region.

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