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Two-loop corrections to electron-muon Scattering at NNLO in QED

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In this talk, we discuss the evaluation of the two-loop virtual corrections to the electron-muon scattering at Next-to-Next-to-Leading order (NNLO) in QED. These radiative corrections are relevant for the analysis of the MUonE experiment, recently proposed at CERN. MUonE aims at the high precision determination of the QED running coupling constant in the space-like region from the measurement of the differential cross section of the elastic scattering of high-energy muons on atomic electrons. The precise theoretical knowledge of QED corrections to the process will allow to extract from the experimental data the full hadronic contribution to the running coupling constant. This will provide a new and independent determination of the leading-order hadronic correction to the muon $g-2$. As an essential step towards the full theoretical prediction, we present the decomposition of the NNLO virtual amplitude in terms of basic integrals, and the analytical evaluation of the latter by means of differential equations and the Magnus exponential method. We work in the massless electron approximation, while we retain full dependence on the muon mass. The presented results are also relevant for crossing-related processes, such as di-muon production at e^+e-colliders, as well as for the QCD corrections to top-pair production at hadron colliders.

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