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Higher Order Leptonic Corrections using Covariant Approach

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In order to search for physics beyond the Standard Model at the precision frontier, it is sometimes essential to account for higher-order radiative corrections. We perform complete and detailed calculations of electroweak radiative corrections to parity-violating lepton scattering with a distinguishable target (electron-proton, muon-proton) up to Next-to-Next-to-Leading Order (NNLO) level using a covariant approach. In the covariant approach, we apply a unitary cut to the Feynman diagrams and separate them into leptonic and hadronic currents which after contraction gives a total amplitude squared.

Our numerical results are presented at energies relevant for a variety of existing and proposed experimental programs such as QWEAK, P2, MOLLER (background studies), MUSE, and EIC working at the precision frontier. Analysis of these results shows that such corrections at the NNLO level are quite significant to consider at the theoretical level with the increasing precision of future experimental programs at low-energy scales.

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