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Taming scale uncertainties in exclusive quarkonium photoproduction and gluon PDFs at small x

We present a complete one-loop study of exclusive vector quarkonium photoproduction off protons in Collinear Factorisation (CF), including GPD evolution. The notoriously large scale instability of the cross section at high energies at next-to-leading order (NLO) is confirmed and resolved by resumming leading-logarithmic QCD corrections via High-Energy Factorisation (HEF) in the Doubly-Logarithmic Approximation (DLA), matched to CF. Our NLO CF + DLA HEF results agree with HERA data and show reduced scale dependence compared to Born-level predictions. Quark contributions are shown to be subleading to those from gluons. Implications for HERA, EIC, LHC, and future experiments are explored. Time permitting, we will also discuss an alternative approach that mitigates the previously noted large scale dependence of the NLO CF result. We will then perform a parton fit analysis using this approach within the PDF fitting tool xFitter to determine the gluon PDF at moderate-to-low values of based on ultraperipheral collision (UPC) measurements from the LHC. We emphasise that a combined fit to exclusive heavy-quarkonium production data from multiple collision systems will not only enhance our understanding of the underlying theoretical mechanisms at play in UPCs, but also significantly improve our knowledge of the gluon distribution in protons and heavy nuclei at small .

Secondary track

T05 - QCD and Hadronic Physics

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