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Modified TMD Factorization and Sub-leading Power Corrections

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Factorization theorems are known to be extremely powerful tools in high-energy particle physics. Processes like SIDIS, Drell-Yan vector-boson production, Higgs-boson production through gluon fusion and e^+e^- to jets and/or hadrons are just some examples of processes that have been thoroughly investigated by applying rigorous factorization formulae. Furthermore, if in these processes the transverse momentum $\mathbf{q}_T$ of the vector boson or final-state hadrons is measured, in the limit of small $\mathbf{q}_T$, leading-power transverse-momentum-dependent (TMD) factorization is an established tool to obtain further insight into the internal structure of hadrons (like spin and helicity distributions, sea quark contributions) and/or jets involved. However, in order to properly exploit increasingly precise experimental data, it is important to investigate sub-leading contributions. In this talk, we present a novel method to compute next-to-leading-power and next-to-next-leading-power contributions to TMD cross sections. In the specific example of a Drell-Yan process, we show how our analytic results allow us to achieve next-to-next-to-leading logarithmic (NNLL) resummation, recover both the leading-power TMD factorization and collinear factorization expressions up to next-to-next-to-leading order in the small $\mathbf{q}_T$ limit and provide a description of the cross section valid also at intermediate $\mathbf{q}_T$. The implications for the phenomenological extraction of TMDPDFs are also discussed.

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