

# TMD factorization at next to leading power

*Tuesday, 31 October 2023 15:50 (25 minutes)*

We present our results on transverse momentum dependent factorization and resummation at sub-leading power in Drell-Yan and semi-inclusive deep inelastic scattering. In these processes the sub-leading power contributions to the cross section enter as a kinematic power correction to the leptonic tensor, and the kinematic, intrinsic, and dynamic sub-leading contributions to the hadronic tensor. By consistently treating the power counting of the interactions, we demonstrate renormalization group consistency. We calculate the anomalous dimensions of the kinematic, intrinsic, and dynamical sub-leading correlation functions at one loop and find the evolution equations. Additionally we calculate the hard and soft functions associated with each of these contributions and compare them to the leading power results. We also calculate the one loop soft function associated with the intrinsic and kinematic sub-leading transverse momentum dependent distributions and compare them to the leading power results. Using this information, we establish the factorization formalism at sub-leading power for these processes at the one-loop level. We also focus on the matching of the large and small transverse momentum contributions in semi-inclusive deep inelastic scattering processes and Drell Yan. We pay special attention to azimuthal modulations of unpolarized cross sections such as the Cahn effect. Finally we present our findings on the QCD equation of motion relations beyond tree level.

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**Session Classification:** Parallel Workshop 2