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Next-to-leading order weighted Siverts asymmetry in semi-inclusive deep inelastic scattering: three-gluon correlator

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We study the Siverts asymmetry in semi-inclusive hadron production in deep inelastic scattering. In particular, we concentrate on the contribution from the photon-gluon fusion channel, where the three-gluon correlation functions play the major role within a twist-3 collinear factorization formalism. We establish the matching between such a formalism and the usual transverse momentum dependent (TMD) factorization formalism at the moderate hadron transverse momentum, for the three-gluon correlation functions. We derive the so-called coefficient functions used in the usual TMD evolution formalism, where one expands the quark Siverts function in the b -space in terms of the collinear twist-3 three-gluon correlation functions. We further perform the next-to-leading order calculation for the transverse-momentum-weighted spin-dependent differential cross section, from which we identify the off-diagonal contribution from the three-gluon correlation functions to the QCD collinear evolution of the twist-3 Qiu-Sterman function.

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