XX International Workshop on Deep-Inelastic Scattering and Related Subjects

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TMD Theory Overview

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Transverse momentum dependent (TMD) distribution and fragmentation functions are described as Fourier transforms of matrix elements containing non-local combinations of quark and gluon fields. While the collinear functions are light-cone correlators in which the non-locality is restricted along the light-cone, the transverse momentum dependent functions are light-front correlators including a transverse (space-like) separation away from the light-cone. In the matrix elements the time-ordering is superfluous and they are parts of the full (squared) amplitudes that account for the connections to the hadrons (soft parts).

The collinear (x-dependent) parton (quark or gluon) distribution functions (PDF's) that appear in the parameterization of collinear leading-twist correlators are interpreted as momentum densities including polarized parton densities in polarized hadrons. They involve only spin-spin densities and they do not allow for a description of single-spin asymmetries in high-energy scattering processes at leading 1/Q order in the hard scale Q.

TMD (x and pT-dependent) PDF's that appear in the parameterization of TMD correlators include spin-spin as well as momentum-spin correlations and they are able to describe single-spin and azimuthal asymmetries, such as Sivers and Collins effects in semi-inclusive deep inelastic scattering (SIDIS), but there are many open issues on pT-factorization. Upon taking moments in pT (or taking Bessel weights) the correlators involve higher-twist operators, but evaluated at zero-momentum (gluonic pole matrix elements). They can be incorporated in a 'generalized'factorization scheme with specific gluonic pole factors such as the sign in SIDIS versus Drell-Yan, which can be traced back to having TMD's with non-trivial process-dependent past- or future-pointing gauge links appearing in the light-front separated, non-local operator combinations.

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