Position Space Interpretation for GPDs

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The Fourier transform of generalized parton distribution functions at $\xi = 0$ describes the distribution of partons in the transverse plane. The physical significance of these impact parameter dependent parton distribution functions is discussed. In particular, it is shown that they satisfy positivity constraints which justify their physical interpretation as a probability density. The generalized parton distribution $H(x, 0, -\mathbf{\Delta}_\perp^2)$ is related to impact parameter distribution of unpolarized quarks for an unpolarized nucleon, $\tilde{H}(x, 0, -\mathbf{\Delta}_\perp^2)$ is related to the distribution of longitudinally polarized quarks in a longitudinally polarized nucleon. The spin-flip GPD $E(x, 0, -\mathbf{\Delta}_\perp^2)$ is related to the distortion of parton distribution functions in impact parameter space if the target is not a helicity eigenstate, but has some transverse polarization. The magnitude of the resulting transverse flavor dipole moment can be related to the anomalous magnetic moment for that flavor in a model independent way. This transverse distortion, in combination with the final state interactions, can be used to develop an intuitive explanation for various transverse single spin asymmetries in semi-inclusive DIS.

References:

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