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Wigner Distributions of Proton in boost-invariant longitudinal position space

The boost invariant longitudinal position space variable $\sigma = \frac{1}{2}b^- P^+$, the Fourier conjugate to skewness ξ, unravels the longitudinal impact parameter information in a proton. The Fourier transform of the GTMDs with respect to the skewness variable ξ can be employed to provide the Wigner distributions in the boost-invariant longitudinal position space σ, the coordinate conjugate to light-front time, $\tau = t + z/c$.

We investigate the skewness sensitivity of leading twist GTMDs considering a momentum transfer to longitudinal and transverse directions in a light-front quark-diquark model for the nucleon motivated by soft-wall AdS/QCD.

The Wigner distributions in T-even and T-odd sectors in the longitudinal position space exhibit diffraction patterns, which are analogous to the diffractive scattering of a wave in optics. An additional effect on the diffraction pattern is reported caused by interference between transverse momentum transfer $\mathbf{d}_\perp$ to the transverse momentum $\mathbf{p}_\perp$ of quarks.

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