Wigner Distribution for quarks using light front wave function

Abstract

We calculate the quark Wigner distributions using overlap of light front wave functions. Instead of a proton target, we use a simplified spin 1/2 state, namely a quark dressed with a gluon. The light-front wave function of this state can be calculated analytically. We use Levin's method for the numerical integration which gives good convergence and the result does not depend on the cutoff of the $\Delta_\perp$ integration. We calculate the Wigner distributions for an unpolarized quark in unpolarized target as well as the spin and orbital angular momentum correlations between the state and the quark. We also calculate the Wigner distribution when the state is transversely polarized.