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Lattice QCD Calculations of Transverse-Momentum-Dependent Wave Function through Large-Momentum Effective Theory

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We'll present the first lattice QCD calculation of transverse momentum dependence wave function of pion using large momentum effective theory. We use the clover fermion action on three ensembles with $2 + 1 + 1$ flavors of highly improved staggered quarks (HISQ) action, generated by MILC collaboration, at pion mass $670 MeV$ and $0.12 fm$ lattice spacing, choose three different hadron momenta $P_z = \{1.72, 2.15, 2.58\}$ GeV. Our calculations includes light-front wave function, form factor, Collins-Soper kernel, and soft function. For wave function, we use non perturbative renormalization in MSbar scheme by using Wilson-loop renormalization. We find the curve of wave function with transverse momentum dependence has two turning points, which normal wave function doesn't.

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