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Lattice results on twist-3 parton distributions

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Twist-3 distributions are very important quantities for the study of hadron structure, and presently they are poorly known experimentally. In this talk, we present the first-ever results on the proton iso-vector twist-3 PDFs $g_T(x)$ and $h_L(x)$, obtained from lattice QCD. We employ the quasi-PDF approach, which is based on computation of correlation functions between two boosted proton states at finite momentum, that are eventually matched to the light-cone distributions through perturbative matching formulae, that we developed specifically for twist-3 PDFs.

Our calculations are performed on a gauge ensemble with two degenerate light quarks, a strange and a charm quark ($N_f = 2 + 1 + 1$), with lattice spacing $a = 0.093$ fm and pion mass $M_\pi = 270$ MeV.

The proton is boosted to 0.83 GeV, 1.25 GeV and 1.67 GeV to check momentum convergence. On the same ensemble we also extract the twist-2 counterparts and test the Wandzura-Wilczek approximation.

Extending the methodologies developed for PDFs, we also present preliminary results for twist-3 GPDs.

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