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Transverse momentum-dependent parton distributions for longitudinally polarized nucleons from domain wall fermion calculations at the physical pion mass

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Previous Lattice QCD calculations of nucleon transverse momentum-dependent parton distributions (TMDs) focused on the case of transversely polarized nucleons, and thus did not encompass two leading-twist TMDs associated with longitudinal polarization, namely, the helicity TMD and the worm-gear TMD corresponding to transversely polarized quarks in a longitudinally polarized nucleon. Based on a definition of TMDs via hadronic matrix elements of quark bilocal operators containing staple-shaped gauge connections, TMD observables characterizing the aforementioned two TMDs are evaluated, utilizing a RBC/UKQCD domain wall fermion ensemble at the physical pion mass.

Primary authors: POCHINSKY, Andrew (MIT); KALLIDONIS, Christos (Jefferson Lab); SILVI, Giorgio (University of Wuppertal); GREEN, Jeremy R (School of Mathematics and Hamilton Mathematics Institute, Trinity College); NEGELE, John (MIT); ENGELHARDT, Michael (New Mexico State University); HASAN, Nesreen (University of Wuppertal); SYRITSYN, Sergey (SBU); KRIEG, Stefan (JSC, Forschungszentrum Jülich & HISKP, Bonn University); MEINEL, Stefan (University of Arizona); IZUBUCHI, Taku (BNL)

Presenter: ENGELHARDT, Michael (New Mexico State University)

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