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Unveiling Nucleon 3D Chiral-Odd Structure with Jet Axes

We reinterpret jet clustering as an axis-finding procedure which, along with the proton beam, defines the virtual-photon transverse momentum q_T in deep inelastic scattering (DIS). In this way, we are able to probe the nucleon intrinsic structure using jet axes in a fully inclusive manner, similar to the Drell-Yan process. We present the complete list of azimuthal asymmetries and the associated factorization formulae at leading power for deep-inelastic scattering of a nucleon. The factorization formulae involve both the conventional time-reversal-even (T-even) jet function and the T-odd one, which have access to all transverse-momentum-dependent parton distribution functions (TMD PDFs) at leading twist. Since the factorization holds as long as $q_T \ll Q$, where Q is the photon virtuality, the jet-axis probe into the nucleon structure should be feasible for machines with relatively low energies such as the Electron-Ion Collider in China (EicC). We show that, within the winner-take-all (WTA) axis-finding scheme, the coupling between the T-odd jet function and the quark transversity or the Boer-Mulders function could induce sizable azimuthal asymmetries at the EicC, the EIC and HERA. We also give predictions for the azimuthal asymmetry of back-to-back dijet production in e^+e^- annihilation at Belle and other energies.

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