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3D proton tomography at the EIC: TMD gluon distributions

The search for evidence of New Physics is in the viewfinder of current and forthcoming analyses at the Large Hadron Collider (LHC) and at new-generation hadron, lepton and lepton-hadron colliders. This is the best time to shore up our knowledge of strong interactions though and, more in particular, of the hadron structure in terms of parton distributions.
Although significant steps toward the formal definition of quark transverse-momentum dependent distribution functions (TMDs) and their extraction from experimental data through global fits has been made in the last years, the gluon-TMD field represents an almost unknown territory.
With the advent of the Electron-Ion Collider (EIC), a systematic study of observables very sensitive to gluon dynamics will become feasible, thus offering us a unique chance of deepening our knowledge of gluon TMDs, a largely unexplored territory particularly at low-x.
With the aim of fulfilling the need for a flexible model suited to phenomenology, we present a common framework for all T-even and gluon TMDs at twist-2, calculated in a spectator model for the parent nucleon and encoding effective small-x effects from the BFKL resummation. At variance with respect to previous works, our approach encodes a flexible parametrization for the spectator-mass spectral density, allowing us to improve the description in the small-x region.
An extension of our model to include twist-2 T-odd gluon TMDs is underway.
All these prospective developments are relevant in the exploration of the gluon dynamics inside nucleons and nuclei, which constitutes one of the major goals of the EIC project.
We believe that the inclusion of these topics in the SnowMass 2021 scientific program would accelerate progress of our understanding of both formal and phenomenological aspects of the hadron structure in wider kinematic ranges.

Primary frontier topic

Energy Frontier

Primary authors: Prof. BACCHETTA, Alessandro (University of Pavia and INFN); Dr CELIBERTO, Francesco Giovanni (University of Pavia and INFN); Dr RADICI, Marco (INFN Pavia); Dr TAELS, Pieter (CPT, Ecole Polytechnique, CNRS, Paris)

Presenter: Dr CELIBERTO, Francesco Giovanni (University of Pavia and INFN)

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