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Probing jet transport coefficient of cold nuclear matter in electron-ion collisions

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We present a study of the nuclear-medium induced transverse momentum broadening of particle production in future electron-ion-collision (EIC) experiments. By considering the multiple scattering between hard partons and cold nuclear medium within the higher-twist factorization framework in perturbative QCD, we calculate the transverse momentum broadening of single hadron production in semi-inclusive measurements, as well as the nuclear enhancement of the transverse momentum imbalance for di-hadron and heavy-meson pair productions. In particular, a kinematics dependent non-perturbative jet transport coefficient $\hat{q} = \hat{q}(x, Q^2)$ extracted in a global analysis of the current data, together with its uncertainty determined with a Hessian method, are input into our calculations and are available for the community. Significant kinematic and color-state dependence of the nuclear induced broadening/imbalance are predicted. Our results indicate that the future EIC measurements are able to provide powerful constraints on the kinematic dependence of the transport coefficient $\hat{q}$ and thus greatly facilitate the jet tomography of cold nuclear medium.

Theory / experiment

Theory

Group or collaboration name

Primary authors: ZHANG, Ben-Wei (Central China Normal University); Prof. WANG, Enke (South China Normal University); Dr XING, Hongxi (South China Normal University); RU, Peng (South China Normal University); KANG, Zhongbo (UCLA)

Presenter: RU, Peng (South China Normal University)

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