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QCD Factorization at Forward Rapidities

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We analyze several reactions on nuclear targets at forward rapidities and different energies (at smallest experimentally accessible Bjorken x). Nuclear effects are usually interpreted as a result of shadowing or the Color Glass Condensate. QCD factorization of soft and hard interactions requires the nucleus to be an universal filter for different Fock components of the projectile hadron. We demonstrate, however, that this is not the case in the vicinity of the kinematic limit, x⟶1, where sharing of energy between the constituents becomes an issue. The rise of suppression with x is confirmed by the E772 and E886 data on the Drell-Yan and heavy quarkonium production. We show that this effect can be treated alternatively as an effective energy loss proportional to initial energy. This leads to nuclear suppression at any energy, and predicts of Feynman x_F scaling of the suppression. We demonstrate also that the same kinematic limit can be approached in transverse momentum when the Cronin enhancement of particle production at medium-high p_T switches to a suppression at larger p_T violating thus QCD factorization. Such an unexpected effect seems to be confirmed by data for pion production in d+A collisions at RHIC, and even for direct photons. We show that this effect also brings significant corrections to all calculations for jet quenching in heavy ion collisions at RHIC.
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