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On the energy dependence of the dipole-proton cross section in deep inelastic scattering.
(English) [Zbl 1301.81281](#)

J. High Energy Phys. 2011, No. 3, Paper No. 062, 26 p. (2011).

Summary: We study the dipole picture of high-energy virtual-photon-proton scattering. It is shown that different choices for the energy variable in the dipole cross section used in the literature are not related to each other by simple arguments equating the typical dipole size and the inverse photon virtuality, contrary to what is often stated. We argue that the good quality of fits to structure functions that use Bjorken- x as the energy variable – which is strictly speaking not justified in the dipole picture – can instead be understood as a consequence of the sign of scaling violations that occur for increasing Q^2 at fixed small x . We show that the dipole formula for massless quarks has the structure of a convolution. From this we obtain derivative relations between the structure function F_2 at large and small Q^2 and the dipole-proton cross section at small and large dipole size r , respectively.

MSC:

81U35 Inelastic and multichannel quantum scattering

81V35 Nuclear physics

81V05 Strong interaction, including quantum chromodynamics

Keywords:

deep inelastic scattering; QCD

Full Text: [DOI](#) [arXiv](#)

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