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Does Nature know about perturbation theory? A phenomenological study of HERA data at low Q^2

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A phenomenological study of the final combined HERA data on inclusive deep inelastic scattering (DIS) has been performed. The data are presented and investigated for a kinematic range extending from values of the four-momentum transfer of the exchanged boson, Q^2 , above 10^4 GeV^2 down to the lowest values observable at HERA of Q^2 , and Bjorken x_{Bj} of $Q^2 = 0.045 \text{ GeV}^2$ and $x_{\text{Bj}} = 6 \times 10^{-7}$. The data are well described by fits based on perturbative quantum chromodynamics (QCD) using collinear factorisation and evolution of the parton densities encompassed in the DGLAP formalism down to Q^2 of a few GeV^2 . As Q^2 approaches zero, the Regge formalism can describe the data. It is shown to be appropriate up to $Q^2 \approx 0.5 \text{ GeV}^2$. The data covering the region between the Regge and the perturbative QCD regimes are of particular interest. Their features are presented.

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