KKT11 PDFs from NLO Analysis of Deep-Inelastic World Data

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In the present article, we extract new set of parton distribution functions (PDFs) of the proton, named KKT11, by global analysis of a wide range of the most recent neutral-current deep-inelastic-scattering (NC DIS) and related hard scattering data in the 'fixed flavour number scheme' (FFNS). We find that recent DIS data sets beside a flexible PDF parameterizations for parton flavours (u, d, s, and g), can significantly improve the precision of parton distribution functions (PDFs) obtained from a fit to data. The present results in the fixed-flavour scheme are compared with those of the general-mass variable-flavour-number scheme, fixed-flavour scheme and other prescriptions used in global fits of PDFs. There are good agreement between the results.

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1. Introduction

Increasing on the precision of the DIS and related hard scattering measurements have lead to a steady progress to accurate extractions of the PDFs to higher perturbative orders in the strong coupling constants. In addition, the proper treatment of heavy flavours in global QCD analysis of PDFs is essential for precision measurements at hadron colliders, since it contributes up to 30% to the DIS inclusive cross section at small *x*. This is particularly important for the validation of PDFs in the kinematic region relevant for the foreseen experiments at the LHC since, despite the impact of collider data on the PDFs, DIS remains an unique source of information about PDFs at small *x*.

2. KKT11 QCD Analysis

The deep-inelastic scattering (DIS) of leptons on hadrons is the basic process to study the parton distribution functions (PDFs) which are instrumental for computing cross-sections of hard processes at hadron colliders. In recent years several groups have used the available experimental data to make global fits to extract PDFs which can be used in studies that involve colliding hadrons. Nowadays these data sets contain thousands of data points from over a dozen different experiments. The QCD fits can be performed up to next-to-next-to-leading order (NNLO) precision of QCD[1]. In the present article, we analyze the NLO order of perturbative QCD the most known DIS structure functions $F_2^p(x, Q^2)$ taking into account the most recent experimental data [2] in 'fixed flavour number scheme' (FFNS). According to Figure. 1, our results are in good agreement with the recent DIS data and with the reported results by CT10 [3], MSTW08 [4], ABKM10 [5] and GJR08 [6].

3. Summary and conclusions

In the present paper, all the most up-to-date data on deep inelastic scattering and related processes for the structure functions and 'reduced' cross-section data from different experiments have been analyzed in the next-to-leading order of the perturbative QCD. We have produced a new PDF set called KKT11. A FORTRAN package (grid) containing our standard NLO ($\overline{\text{MS}}$) parton densities and the structure functions, calculated in fixed-order FFN scheme can be found in Ref. [7].

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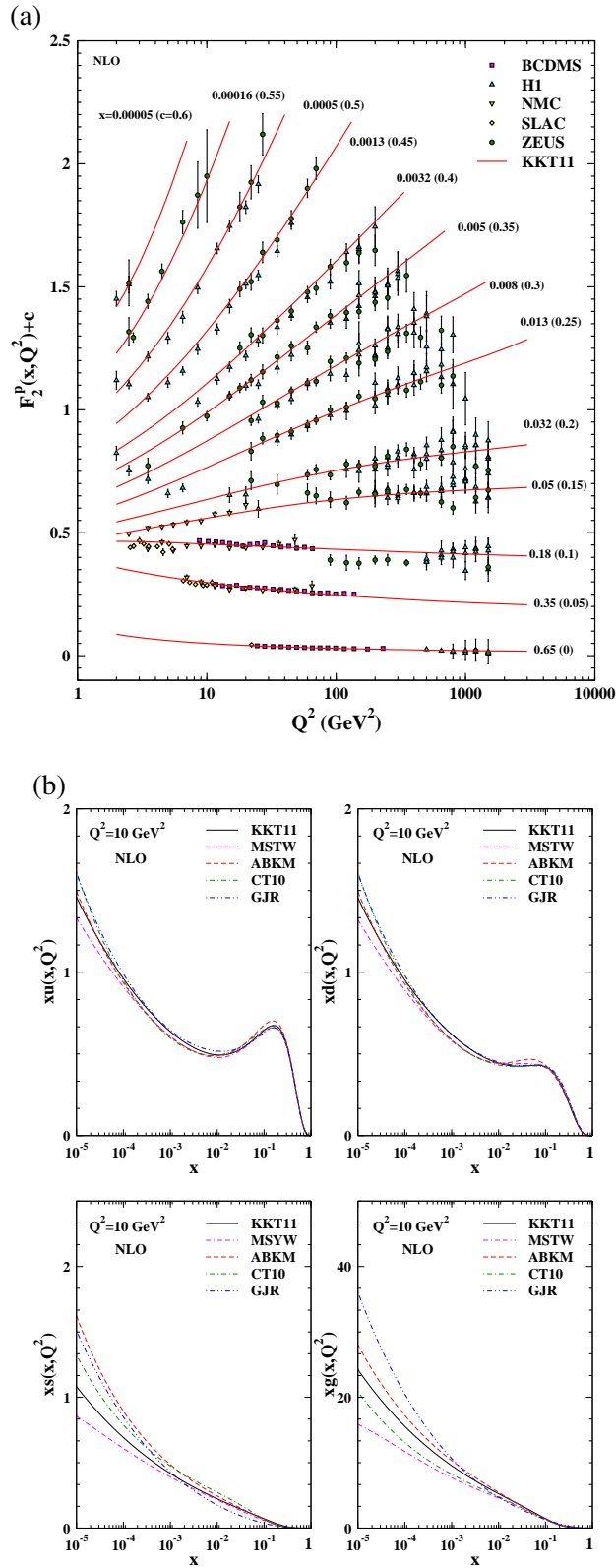[7] Program summary URL: http://particles.ipm.ir/links/QCD.htm.

Figure 1: (a): Comparison of our standard NLO ($\overline{\text{MS}}$) results for $F_2^p(x, Q^2)$ with a selection of HERA and fixed target data. (b): The u-, d-, s-quark and gluon distributions xg at $Q^2 = 10$ GeV^2 as a function of x in the NLO approximation.