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First unbiased determination of the parton distributions of lead nuclei

Carlota A. Casas, Stefano Carrazza[4,2], Alberto Guffanti[5], Nathan P. Hartland[1] and Juan Rojo[6]

[1] *The Higgs Centre for Theoretical Physics, University of Edinburgh, JCMB, KB, Mayfield Rd, Edinburgh EH9 3JZ, Scotland*
[2] *PH Department, TH Unit, CERN, CH-1211 Geneva 23, Switzerland*
[3] *Departament d'Estructura i Constituents de la Matèria, Universitat de Barcelona, Diagonal 647, E-08028 Barcelona, Spain*
[4] *Dipartimento di Fisica, Università di Milano and INFN, Sezione di Milano, Via Celoria 16, I-20133 Milano, Italy*
[5] *Niels Bohr International Academy and Discovery Center, Niels Bohr Institute, University of Copenhagen, Blegdamsvej 17, DK-2100 Copenhagen, Denmark*
[6] *Rudolf Peierls Centre for Theoretical Physics, 1 Keble Road, University of Oxford, OX1 3NP Oxford, UK*
[7] *The Cavendish Laboratory, University of Cambridge, J.J. Thomson Avenue, CB3 0HE, UK*

Abstract A nice abstract

We present

Contents

1 Introduction

In a series of papers [1–11], the NNPDF collaboration has introduced a methodology aimed at reducing as much as possible this procedural uncertainty.

Now we want to apply it to the case of nuclear PDFs ....

2 Dataset

In this section we summarize the data that has been used, the kinematic cuts, and the treatment of experimental uncertainties

Add table with all datasets and the corresponding references

3 Compression of nuclear data to lead structure functions

Here we explain how all the nuclear ratio data for different values of A is compressed to the lead structure function.

We write the relevant conversion formula, discuss error propagation, and show representative results for the various experiments.

$$F_2^{Pb}(x,Q^2) = \frac{F_2^{Pb}(x,Q^2)}{F_2^{A}(x,Q^2)} R^A_{F_2^{D,C,Li}} F_2^{D,C,Li}(x,Q^2), \tag{1}$$

where $R^A_{F_2}$ are the experimental data for ratios of the DIS structure function $F_2^A(x,Q^2)$ for various heavy nuclei to those for deutherium, lithium or carbon,

$$R^A_{F_2^{D,C,Li}} = \frac{F_2^A(x,Q^2)}{F_2^{D,C,Li}(x,Q^2)}, \tag{2}$$

see Tab. 1.

For $F_2^{Pb}(x,Q^2)$, $F_2^A(x,Q^2)$, $F_2^C(x,Q^2)$ and $F_2^C(x,Q^2)$ we use EPS09 NLO nPDFs [18] and, in order to obtain the DIS structure functions for deuterium, $F_2^D(x,Q^2)$, we neglect any nuclear effect, assume isospin symmetry ($u^p = d^n$ and $d^p = u^n$) and use the free proton NLO PDFs of MSTW [19].

4 Fitting methodology

Here we discuss the fitting methodology, the sum rules, the flavor decomposition, positivity, the parameterization of nuclear PDFs as ratios etc

5 Results

Here we show, well, the results of the fit

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Experiment	Nuclei	Data points	ref.
SLAC E-139	He(4)/D	9	[12]
NMC 95, re.	He/D	8	[13]
NMC 95	Li(6)/D	10	[14]
NMC 95, Q^2 dependence	Li/D	144	[14]
SLAC E-139	Be(9)/D	9	[12]
NMC 96	Be/C	12	[15]
CERN EMC	C(12)/D	9	[16]
SLAC E-139	C/D	3	[12]
NMC 95, NMC 95, re.	C/D	10	[13, 14]
NMC 95, Q^2 dependence	C/D	159	[14]
NMC 95, re.	C/Li	6	[13]
SLAC E-139	Al(27)/D	13	[12]
NMC 96	Al/C	15	[15]
SLAC E-139	Ca(40)/D	5	[12]
NMC 95, re.	Ca/D	15	[13]
NMC 95, re.	Ca/Li	7	[13]
NMC 96	Ca/C	15	[15]
SLAC E-139	Fe(56)/D	23	[12]
NMC 96	Fe/C	15	[15]
CERN EMC	Cu(64)/D	19	[16]
SLAC E-139	Ag(108)/D	7	[12]
CERN EMC	Sn(117)/C	8	[16]
NMC 96	Sn/C	10	[15]
NMC 96, Q^2 dependence	Sn/C	139	[17]
SLAC E-139	Au(197)/D	17	[12]
NMC 96	Pb/C	15	[15]
Total		702	

Table 1: Data sets included in the analysis. The mass numbers are indicated in parentheses. The number of data points refers to those falling within our cuts: $Q^2 \geq 1.69$ and S(factor) $\leq$ 1.5S(experimetal).

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