

# A New Generation of CTEQ Parton Distribution Functions with Uncertainty Analysis

Daniel Stump

Michigan State University

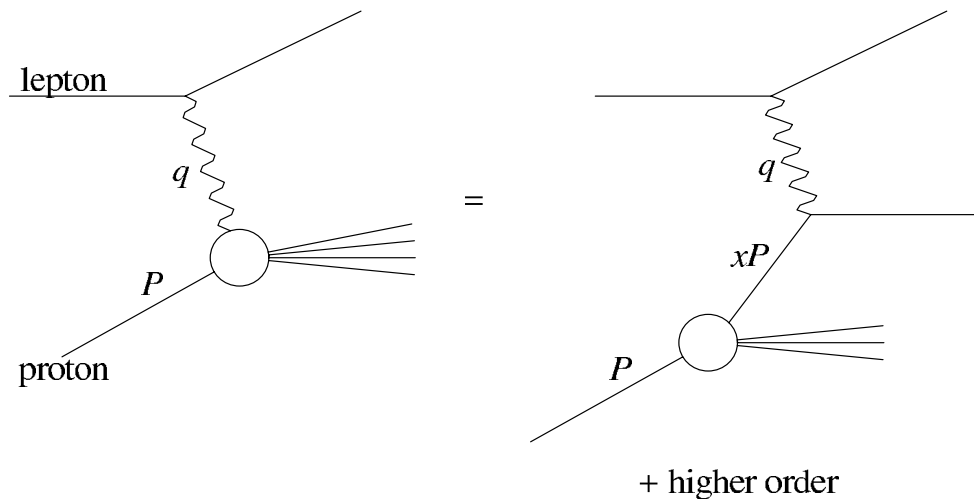
**CTEQ6**

J. Pumplin, D. Stump, J. Huston, H.L. Lai, P. Nadolsky, W.K. Tung  
hep-ph/0201195

# Parton Distribution Functions

For any short-distance process,

e.g.,  $ep$  DIS,



the factorization theorem of QCD

(schematically)

$$\sigma(Q) = \int f_i(x, Q) \hat{\sigma}_i(x, Q) dx$$

relates experimental  $\sigma(Q)$  and perturbatively calculated  $\hat{\sigma}_i(x, Q)$ .

## Global analysis

- Use data from many processes to determine the universal PDF's.
- Parametrize the  $f_i(x, Q_0)$  at  $Q_0=1.3$  GeV, with 20 fitting parameters  $\{a_1, a_2, \dots, a_n\}$ .

## What is new in the CTEQ6 analysis?

- New Data

- H1 and ZEUS : deep inelastic  $ep$  and  $\bar{e}p$  scattering
- DØ :  $p\bar{p} \rightarrow jet$  cross section, as a function of  $\eta$  and  $E_T$ .

- New methods of analysis

- For **systematic errors** ... The published systematic errors are included in the fitting procedure.
- For **uncertainties** ... Methods are available to evaluate the uncertainties of the PDF's and their predictions.

## Data used in the CTEQ6 global analysis

Data for which detailed systematic errors have been published and used in the fit:

process	data set	$\chi_e^2/N_e$
DIS $\mu p$	BCDMS p	378/339
DIS $\mu d$	BCDMS d	280/251
DIS $ep$	H1a	99/104
DIS $ep$	H1b	129/126
DIS $ep$	ZEUS	263/229
DIS $\mu p$	NMC F2p	305/201
DIS $\mu d$	NMC F2d/p	112/123
$p\bar{p} \rightarrow \text{jet}$	DØ jet	69/90
$p\bar{p} \rightarrow \text{jet}$	CDF jet	49/33

Other data used in the global analysis but without systematics:

process	data set	$\chi_e^2/N_e$
DIS $\nu \text{ Fe}$	CCFR	150/156
DY $pp$	E605	95/119
DY $pd/pp$	E866	6/15
$p\bar{p} \rightarrow W$	CDF W	10/11

Overall  $\chi^2/N = 1954/1811$

