Mathematica Interface for LHAPDF6

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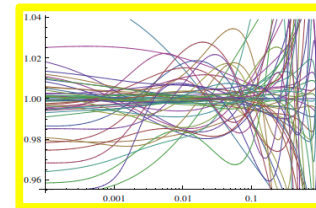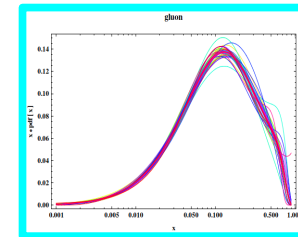Southern Methodist University

Introduction: Mathematica Interface for LHAPDF6

- Package designed to allow for user interaction

  - Check values in PDFs

  - Make plots

  - Check ratios between PDF sets

  - Integrate and check sum rules

- User accessible functions

pdfAlphaSLHA	pdfGetInfoLHA	pdfParseLHA
pdfFamilyParseLHA	pdfGetQlistLHA	pdfResetLHA
pdfFlavorLHA	pdfGetTableLHA	pdfSetListLHA
pdfFunctionLHA	pdfGetValueLHA	pdfXminLHA
pdfGetAlphaValuesLHA	pdfGetXlistLHA	

- pdfGet*LHA functions allow access to info stored in the PDF sets

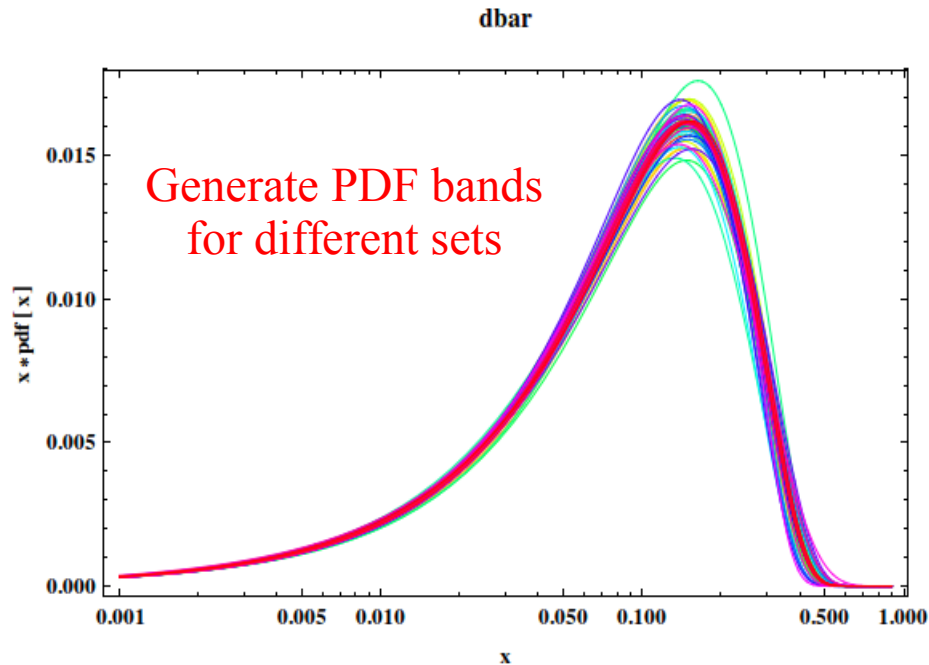- pdfFuctionLHA uses encapsulated interpolation

LHAPDF**6** Features

LHAPDF **the Les Houches Accord PDF Interface**

- All PDF sets defined with a unified grid structure

  – .. can access grids with a single interface

- New "*dat*" files available for:

  – CTEQ

  – MSTW

  – NNPDF

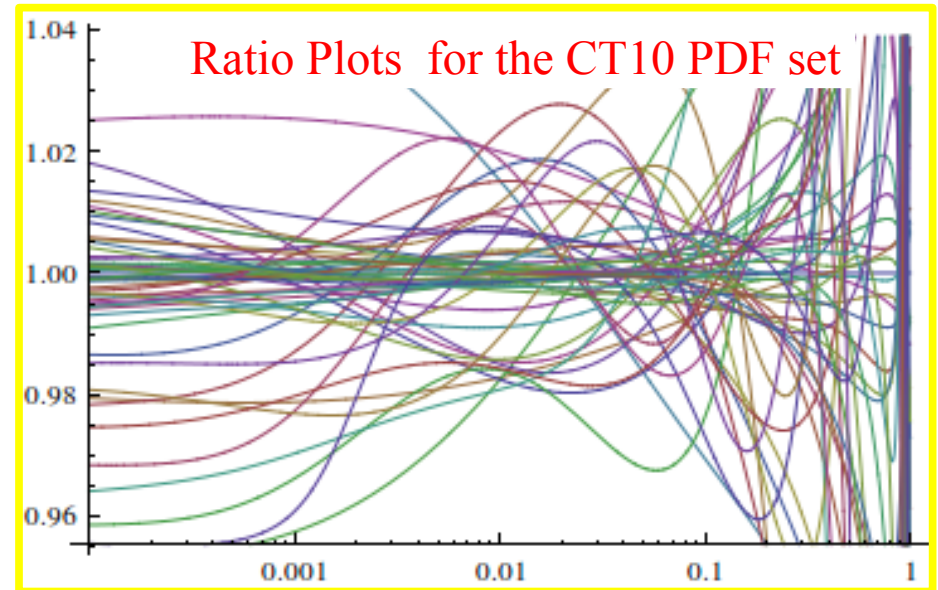- … *and under construction:*

  – ABKM, JR, CJ, nCTEQ, ATLAS, HERA

Examples: I
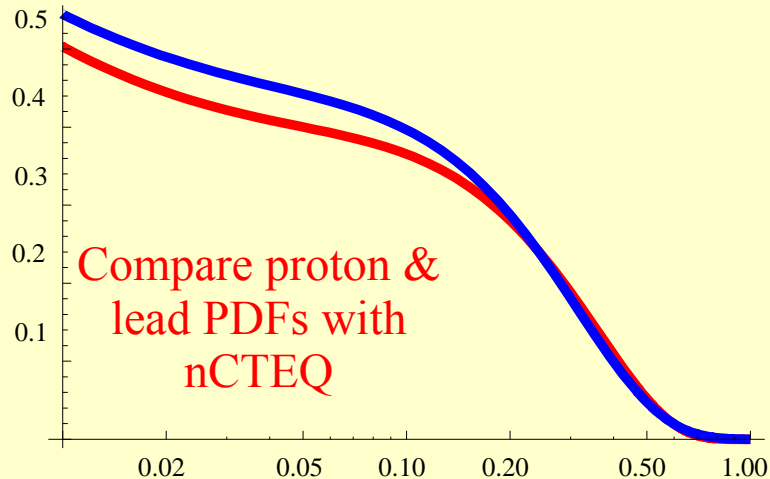
`LogLinearPlot[ pdf[iset, iparton, x, q], {x, 0.01, 0.9}]`

dbar

Generate PDF bands
for different sets

Compare proton &
lead PDFs with
nCTEQ

Full sets of PDFs inside Mathematica

Easy to manipulate

Ratio Plots for the CT10 PDF set

$$\text{LogLinearPlot}\left[\frac{pdf[iset, iparton, x, q]}{pdf[iset0, iparton, x, q]}, \{x, 0.01, 0.9\}\right]$$

Examples: II

`NIntegrate[ x pdf[iset0, ipart, x, q0], {x, 0, 1}]`

-5	bbar	0
-4	cbar	0
-3	sbar	2
-2	ubar	3
-1	dbar	4
0	gluon	42
1	down	15
2	up	32
3	strange	2
4	charm	0
5	bottom	0

`pdfAlphaSLHA[Q]`

$\alpha_S(Q)$
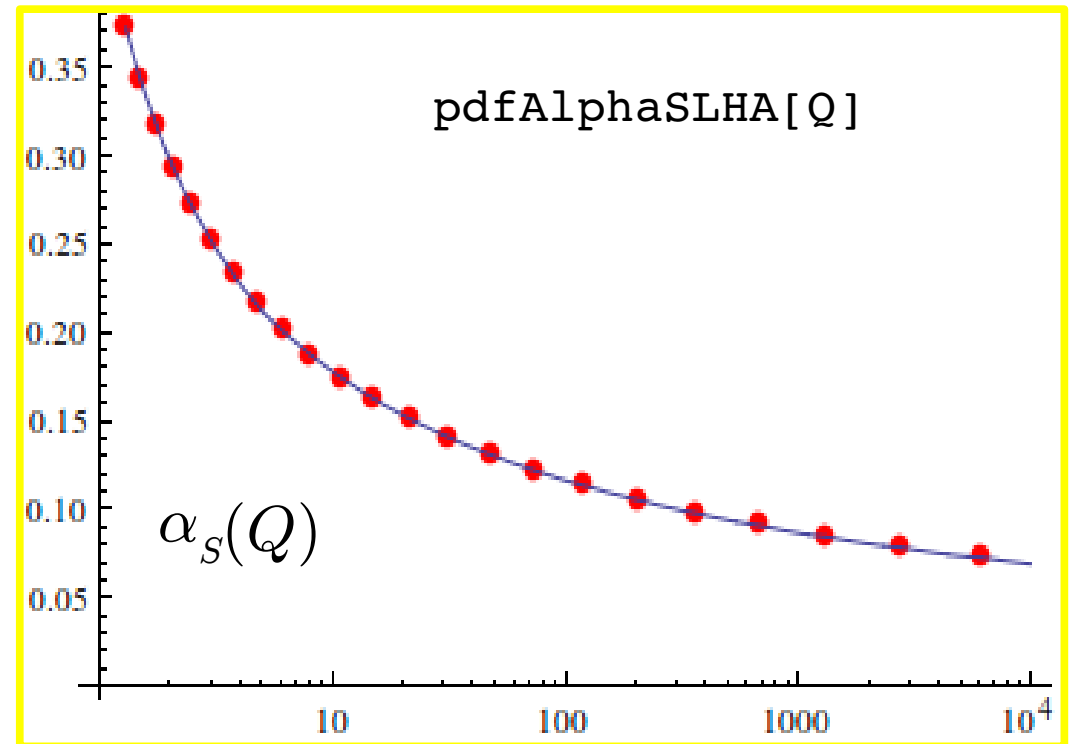
$\alpha_S(Q)$ is available

Interpolated values match grid values

Calculation of momentum fraction is trivial.

Sum rule provides important "sanity" check

Proper α_S is essential for NLO+ calculations

Conclusions & Future Work

Mathematica package is ready for beta testing

... pieces still under construction, but making progress

Will also work w/ HERA-Fitter with LHAPDF6 grids *(future?)*

Provides ability to easily and interactively examine PDF output.

This work is in collaboration with:
Ben Clark
Olek Kusina
Fred Olness

If interested in Beta-Testing
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