In[1]:= `Clear["Global`*"];`

In[2]:= `$Version`

Out[2]= `12.1.0 for Linux x86 (64-bit) (March 14, 2020)`

Demo file for ManeParse Package Version 5.0

Fred's attempt to read one file from each group

In[3]:=
```
(* This just drops the leading path
   info to make the list of files easier to read *)
dropPath = Take[(FileNameSplit /@ #) // Transpose, -1][[1]] &;
```

In[4]:=
```
(* Remove files that start with "/.*"
   These are the pre-modified CTEQ PDS files and should not be used.  *)
Clear[noDot]
noDot[list_] := Select[list, !StringMatchQ[#, "*/.*"] &]
```

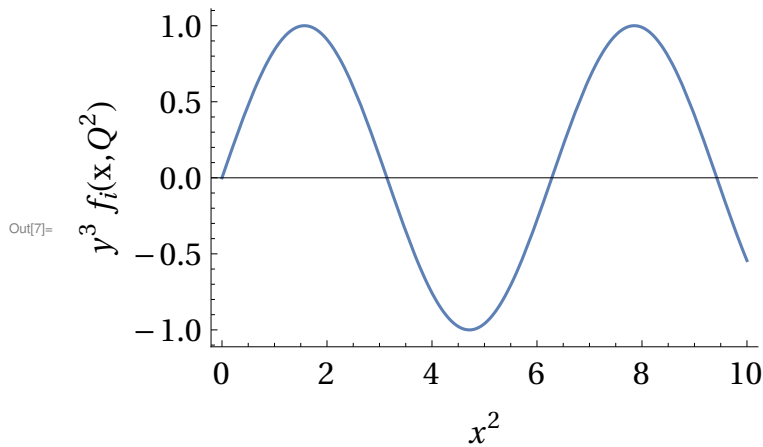## Sample Plot Styling

In[6]:= `baseSty`

Out[6]= `baseSty`

In[7]:= `Plot[Sin[x], {x, 0, 10},`
`    FrameLabel → {"x²", "y³ fᵢ(x,Q²)"},`
`    Frame → {True, True, False, False},`
`    FrameTicks → {True, True, None, None},`
`    BaseStyle → {FontSize → 18, FontFamily → "Times"}`
`]`

Out[7]=

Play with colors:

In[8]:= `colors = {Red, Green, Blue, Cyan, Magenta, Yellow, Orange, Purple, Brown, Black, Gray};`
`colors // Length`

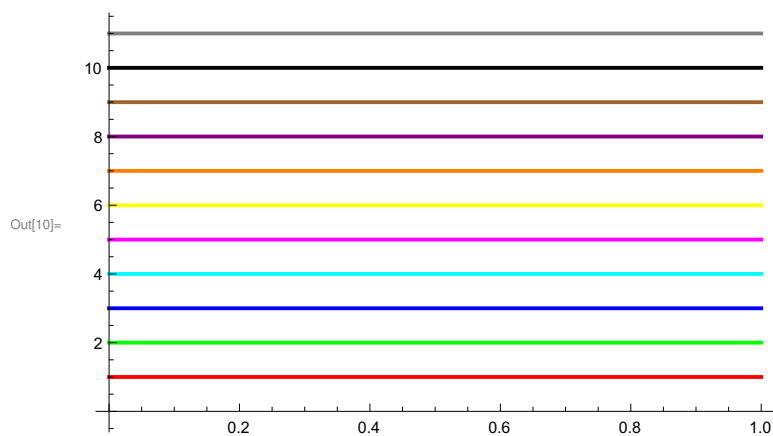Out[9]= `11`

In[10]:= `Plot[Table[i, {i, 1, Length[colors]}] // Evaluate,`
`    {x, 0, 1}, PlotStyle → ({#, Thick} & /@ colors)]`

Out[10]=

Set Directories

we need to do this better

```
In[11]:=  workDir = NotebookDirectory[]
          SetDirectory[workDir];
          FileNames[] // dropPath
```

Out[11]= /home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo/

Out[13]= {Demo5.nb, Demo5.pdf, figs4paper_v5.nb, MakeDemo.py, ManeParse_v2.pdf,
           manual_v5.nb, MP_packages, noe2.perl, PDFDIR, README, README~, User.pdf}

Set Directories

```
In[14]:=  (*maneDir="/home/olness/clark/trunk/ManeParse/Demo";*)
          maneDir = workDir <> "/MP_packages";
          SetDirectory[maneDir];
          FileNames[] // dropPath
```

Out[16]= {pdfCalc.m, pdfErrors.m, pdfParseCTEQ.m, pdfParseLHA.m, README_V05.TXT}

In[17]:=
```
lhaDir = "/usr/local/share/LHAPDF";
lhaList = FileNames["*", lhaDir] // noDot;
(* Remove files that are not directories: i.e., of the form *.*  *)
lhaList = lhaList // Select[#, !StringMatchQ[#, "*.*"] &] & ;
lhaList // dropPath
```

Out[20]=
{abm12lhc_5_nnlo, ABMP16_3_nlo, CJ15nlo, CT10, CT10nlo, CT14nlo, CT18ANLO, CT18ANNLO,
  CT18NLO, CT18NNLO, CT18ptxg, CT18ZNLO, CT18ZNNLO, cteq6, EPPS16nlo_CT14nlo_Ag108,
  EPPS16nlo_CT14nlo_Al27, EPPS16nlo_CT14nlo_Au197, EPPS16nlo_CT14nlo_Be9,
  EPPS16nlo_CT14nlo_C12, EPPS16nlo_CT14nlo_Ca40, EPPS16nlo_CT14nlo_Cu64,
  EPPS16nlo_CT14nlo_Fe56, EPPS16nlo_CT14nlo_He4, EPPS16nlo_CT14nlo_Li6,
  EPPS16nlo_CT14nlo_Pb208, EPPS16nlo_CT14nlo_Pt195, EPPS16nlo_CT14nlo_Sn119,
  EPPS16nlo_CT14nlo_W184, HERAPDF20_NLO_VAR, lha_20Rs2, lha_21Rs2, lha_22Rs2,
  lha_22Rs2ver2, lha_22Rs2ver3, MSTW2008lo68cl, MSTW2008nlo68cl, MSTW2008nnlo68cl,
  nCTEQ15_108_54, nCTEQ15_1_1, nCTEQ15_119_59, nCTEQ15_12_6, nCTEQ15_131_54,
  nCTEQ15_14_7, nCTEQ15_184_74, nCTEQ15_197_79, nCTEQ15_197_98, nCTEQ15_20_10,
  nCTEQ15_207_103, nCTEQ15_208_82, nCTEQ15_2_1, nCTEQ15_27_13, nCTEQ15_3_1,
  nCTEQ15_3_2, nCTEQ15_40_18, nCTEQ15_40_20, nCTEQ15_4_2, nCTEQ15_56_26,
  nCTEQ15_56_28, nCTEQ15_6_3, nCTEQ15_64_32, nCTEQ15_7_3, nCTEQ15_84_42,
  nCTEQ15_9_4, nCTEQ15FullNuc, nCTEQ15FullNuc_108_54, nCTEQ15FullNuc_1_1,
  nCTEQ15FullNuc_119_59, nCTEQ15FullNuc_12_6, nCTEQ15FullNuc_131_54,
  nCTEQ15FullNuc_14_7, nCTEQ15FullNuc_184_74, nCTEQ15FullNuc_197_79,
  nCTEQ15FullNuc_197_98, nCTEQ15FullNuc_20_10, nCTEQ15FullNuc_207_103,
  nCTEQ15FullNuc_208_82, nCTEQ15FullNuc_2_1, nCTEQ15FullNuc_27_13,
  nCTEQ15FullNuc_3_2, nCTEQ15FullNuc_40_18, nCTEQ15FullNuc_40_20, nCTEQ15FullNuc_4_2,
  nCTEQ15FullNuc_56_26, nCTEQ15FullNuc_6_3, nCTEQ15FullNuc_64_32, nCTEQ15FullNuc_7_3,
  nCTEQ15FullNuc_84_42, nCTEQ15FullNuc_9_4, nCTEQ15np_1_1, nCTEQ15np_208_82,
  NNPDF30_nlo_as_0118, NNPDF30_nnlo_as_0118, NNPDF30_nnlo_as_0118_nf_6,
  NNPDF31_nlo_as_0118, NNPDF31_nlo_as_0118_hessian, NNPDF31_nnlo_as_0118,
  nuanua1_12_6, nuanua1_13_7, nuanua1_16_8, nuanua1_208_82, nuanua1_40_18,
  nuanua1_56_26, nuanua1FullNuc_12_6, nuanua1FullNuc_13_7, nuanua1FullNuc_16_8,
  nuanua1FullNuc_208_82, nuanua1FullNuc_40_18, nuanua1FullNuc_56_26}

In[21]:=
```
(* This is where the PDS format files are located *)
pdsDir = workDir <> "/PDFDIR/PDS";
pdsList = FileNames["*", pdsDir];
pdsList // dropPath
```

Out[23]=
{ct10.pds, ctq66m.pds}

Load MaTex [Not used]

<< MaTeX.m

ConfigureMaTeX []

{CacheSize → 100 , pdfLaTeX → /usr/bin/pdflatex , Ghostscript → /usr/local/bin/gs}

ConfigureMaTeX ["pdfLaTeX " → "/usr/bin/pdflatex ", "Ghostscript " → "/usr/local/bin/gs"]

{CacheSize → 100 , pdfLaTeX → /usr/bin/pdflatex , Ghostscript → /usr/local/bin/gs}

MaTeX["\\frac{x^2}{x}"]

$\dfrac{x^2}{x}$

MaTeX Package : Temporary bypass

In[24]:= **MaTeX[a_ , b_] := a**

Load the package

In[25]:= **(*dirPackages =maneDir<>"/packs";**
FileNames["*",dirPackages]//dropPath*)

In[26]:= **<< pdfParseLHA.m**

```
  Version : pdfCalc  5.0

  Version : ManeParse  5.0: April  2021

  - Required  Package : pdfCalc  --Loaded  -


  === === === === === === === === === === === === === === === === === === === === ===


  - pdfParseLHA  -

Version :  5.0: April  2021

Authors : E.J. Godat , D.B. Clark  & F.I. Olness


Please  cite : *************
http ://ncteq .hepforge .org/code/pdf.html


For  a list  of available  commands , enter: ?pdf*
```

```
=== === === === === === === === === === === === === === === === === === === === === ===
```

In[27]:= **<< pdfParseCTEQ.m**

```
=== === === === === === === === === === === === === === === === === === === === === === ===
```

```
 - pdfParseCTEQ  -

Version :  5.0:  April 2021

Authors : D.B. Clark , E.J. Godat & F.I. Olness


Please  cite : *************
http ://ncteq .hepforge .org/code /pdf .html


For  a list of available  commands , enter : ?pdf*
```

```
=== === === === === === === === === === === === === === === === === === === === === === ===
```

In[28]:= **<< pdfErrors.m**

```
=== === === === === === === === === === === === === === === === === === === === === === ===
```

```
 - pdfErrors  -

Version :  5.0; April 2021

Authors : D.B. Clark , E.J. Godat & F.I. Olness


Please  cite : *************
http ://ncteq .hepforge .org/code /pdf .html


For  a list of available  commands , enter : ?pdf*
```

```
=== === === === === === === === === === === === === === === === === === === === === === ===
```

Loading the main package provides many useful functions

In[29]:= **(*Get[dirPackages <>"/pdfParseLHA .m"]*)**

In[30]:= **(*Get[dirPackages <>"/pdfParseCTEQ .m"]*)**

In[31]:= **(*Get[dirPackages <>"/pdfErrors .m"]*)**

Set Interpolator

In[32]:= **? pdfSetInterpolator**

Symbol

Out[32]=

pdfSetInterpolator [[key]]: This function selects the interpolation routine to use for pdfFunction.

Available functions include : "MMA", the default interpolation routine from Mathematica or "ManeParse", a custom cubic Lagrange interpolation routine.

The x-power for the ManeParse interpolation can be set with pdfSetXpower.

Note : The input is optional for this function. No input will reset the default Mathematica interpolator.

In[33]:= **pdfSetInterpolator ["ManeParse"]**

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1

pdfReset

In[34]:= **pdfReset[]**

Default Mathematica interpolator will be used.

All internal variables have been reset.

Read LHAPDF files

read lhapdf file

In[35]:=
```
list = {"abm12lhc_5_nnlo", "CJ15nlo", "CT10nlo",
    "CT14nnlo", "HERAPDF20_NLO_VAR", "lhapdf.conf", "MSTW2008nnlo68cl ",
    "nCTEQ15_1_1", "nCTEQ15_208_82", "NNPDF30_nnlo_as_0118_nf_6"};

list // TableForm
```

Out[36]//TableForm=
```
abm12lhc_5_nnlo
CJ15nlo
CT10nlo
CT14nnlo
HERAPDF20_NLO_VAR
lhapdf.conf
MSTW2008nnlo68cl
nCTEQ15_1_1
nCTEQ15_208_82
NNPDF30_nnlo_as_0118_nf_6
```

In[37]:=
```
lhaList // dropPath // Short
```

Out[37]//Short=
```
{abm12lhc_5_nnlo, ABMP16_3_nlo, CJ15nlo , CT10,
    CT10nlo , ≪98≫, nuanua1FullNuc_ 13_7, nuanua1FullNuc_ 16_8,
    nuanua1FullNuc_ 208_82, nuanua1FullNuc_ 40_18, nuanua1FullNuc_ 56_26}
```

In[38]:=
```
files =
    Table[Select[lhaList , !StringFreeQ[#, list[[i]]] &], {i, 1, Length[list]}] // Flatten ;

files // dropPath // TableForm
```

Out[39]//TableForm=
```
abm12lhc_5_nnlo
CJ15nlo
CT10nlo
HERAPDF20_NLO_VAR
MSTW2008nnlo68cl
nCTEQ15_1_1
nCTEQ15_208_82
NNPDF30_nnlo_as_0118_nf_6
```

In[40]:=

```
len = Length[files];

Do[
 filesDat = FileNames["*.dat", files[[i]]];
 filesInfo = FileNames["*.info", files[[i]]];
 (*xpdfParseLHA[filesInfo[[-1]],filesDat[[+1]]] //Print;*)
 pdfParseLHA[filesInfo[[-1]], filesDat[[+1]]] // Print;
 , {i, 1, len}]
```

Successfully read /usr/local/share/LHAPDF/abm12lhc_ 5_nnlo/abm12lhc_ 5_nnlo .info.

Successfully read /usr/local/share/LHAPDF/abm12lhc_ 5_nnlo/abm12lhc_ 5_nnlo_0000. dat.

1

Successfully read /usr/local/share/LHAPDF/CJ15nlo /CJ15nlo .info.

Successfully read /usr/local/share/LHAPDF/CJ15nlo /CJ15nlo_ 0000. dat.

2

Successfully read /usr/local/share/LHAPDF/CT10nlo /CT10nlo .info.

Successfully read /usr/local/share/LHAPDF/CT10nlo /CT10nlo_ 0000. dat.

3

Successfully read /usr/local/share/LHAPDF/HERAPDF20_NLO _VAR/HERAPDF20_NLO _VAR.info.

Successfully read /usr/local/share/LHAPDF/HERAPDF20_NLO _VAR/HERAPDF20_NLO _VAR_0000. dat.

4

Successfully read /usr/local/share/LHAPDF/MSTW2008nnlo68cl /MSTW2008nnlo68cl .info.

Successfully read /usr/local/share/LHAPDF/MSTW2008nnlo68cl /MSTW2008nnlo68cl_ 0000. dat.

5

Successfully read /usr/local/share/LHAPDF/nCTEQ15_ 1_1/nCTEQ15_ 1_1.info.

Successfully read /usr/local/share/LHAPDF/nCTEQ15_ 1_1/nCTEQ15_ 1_1_0000. dat.

6

Successfully read /usr/local/share/LHAPDF/nCTEQ15_ 208_82/nCTEQ15_ 208_82.info.

Successfully read /usr/local/share/LHAPDF/nCTEQ15_ 208_82/nCTEQ15_ 208_82_0000. dat.

7

Successfully read
 /usr/local/share/LHAPDF/NNPDF30_nnlo _as_0118_nf_6/NNPDF30_nnlo _as_0118_nf_6.info.

Successfully read
 /usr/local/share/LHAPDF/NNPDF30_nnlo _as_0118_nf_6/NNPDF30_nnlo _as_0118_nf_6_0000. dat.

8

Read PDS files

read PDS files

In[42]:= **pdsList // dropPath**

Out[42]= {ct10.pds, ctq66m.pds}

In[43]:= **dir1 = Select[pdsList , StringMatchQ [#, "*ct10.pds"] &];**
dir2 = Select[pdsList , StringMatchQ [#, "*ctq66m.pds"] &];
tmpList = Join[dir1 , dir2]
tmpList // dropPath

Out[45]= {/home/olness/Dropbox /mp/ManeParse5_DEMO /FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds,
/home/olness/Dropbox /mp/ManeParse5_DEMO /FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m.pds}

Out[46]= {ct10.pds, ctq66m.pds}

In[47]:= **pdfParseCTEQ [FileNames["*.pds", dir1] // First]**

PDF Table for Fit #: cx22a

Out[47]= 9

In[48]:= **pdfParseCTEQ [FileNames["*.pds", dir2] // First]**

PDF Table for Fit #: p82a3

Out[48]= 10

Current PDFs

In[49]:= **pdfSetListDisplay []**

Out[49]=

Set Number	File Name	Max Flavors	Valance Flavors
1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/ abm12lhc_5_nnlo_0000.dat	5	n/a
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat	5	n/a
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat	5	n/a
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/ HERAPDF20_NLO_VAR_0000.dat	6	n/a
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl / MSTW2008nnlo68cl_ 0000.dat	5	n/a
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_ 1_1_0000.dat	5	n/a
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/ nCTEQ15_208_82_0000.dat	5	n/a
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118 _nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat	6	n/a
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ct10.pds/ ct10.00.pds	5	2
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ctq66m. pds/ctq66.00.pds	5	2

In[50]:= **isetMax = Length[pdfSetList]**

Out[50]= 10

In[51]:= **? Part**

> Symbol ⓘ
>
> $expr[[i]]$ or Part$[expr, i]$ gives the ith part of $expr$.
>
> $expr[[-i]]$ counts from the end.
>
> $expr[[i, j, ...]]$ or Part$[expr, i, j, ...]$ is equivalent to $expr[[i]][[j]]....$
>
> $expr[[\{i_1, i_2, ...\}]]$ gives a list of the parts $i_1, i_2, ...$ of $expr$.
>
> $expr[[m ;; n]]$ gives parts m through n.
>
> $expr[[m ;; n ;; s]]$ gives parts m through n in steps of s.
>
> $expr[["key"]]$ gives the value associated with the key "key" in an association $expr$.
>
> $expr[[Key[k]]]$ gives the value associated with an arbitrary key k in the association $expr$.
>
> ⌄

In[52]:= **? Position**

> Symbol ⓘ
>
> Position$[expr, pattern]$ gives a list of the
>
>   positions at which objects matching $pattern$ appear in $expr$.
>
> Position$[expr, pattern, levelspec]$ finds only objects that appear on levels specified by $levelspec$.
>
> Position$[expr, pattern, levelspec, n]$ gives the positions of the first n objects found.
>
> Position$[pattern]$ represents an operator form of Position that can be applied to an expression.
>
> ⌄

In[53]:= **tmp = pdfSetList[[All, 2]]**

Out[53]= {/usr/local/share/LHAPDF/abm12lhc_5_nnlo/abm12lhc_5_nnlo_0000.dat,
   /usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_0000.dat,
   /usr/local/share/LHAPDF/CT10nlo/CT10nlo_0000.dat,
   /usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/HERAPDF20_NLO_VAR_0000.dat,
   /usr/local/share/LHAPDF/MSTW2008nnlo68cl /MSTW2008nnlo68cl_0000.dat,
   /usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_1_1_0000.dat,
   /usr/local/share/LHAPDF/nCTEQ15_208_82/nCTEQ15_208_82_0000.dat,
   /usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118_nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat,
   /home/olness/Dropbox /mp/ManeParse5_DEMO /FOR
      WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/ct10.00.pds,
   /home/olness/Dropbox /mp/ManeParse5_DEMO /FOR
      WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m.pds/ctq66.00.pds}

In[54]:= **tmp = StringMatchQ[pdfSetList[[All, 2]], "*MSTW2008nnlo68cl *"]**

Out[54]= {False, False, False, False, True, False, False, False, False, False}

In[55]:=
```
isetNNPDF =
  Position[StringMatchQ[pdfSetList[[All, 2]], "*NNPDF30_nnlo_as_0118_nf_6*"], True] //
    First // First
```

Out[55]= 8

In[56]:=
```
(* top quark *)
{pdfFunction[isetNNPDF, 6, 0.1, 1000.],
  pdfFunction[isetNNPDF, 66, 0.1, 1000.], pdfFunction[1, 6, 0.1, 1000.]}
```

Out[56]= {0.0495134, 0., 0.}

In[57]:=
```
baseSty = {FontSize → 18, FontFamily → "Times"};
```

PDF short-hand:

In[58]:=
```
SetAttributes[pdf, Listable];
```

In[59]:=
```
pdf[x___] := pdfFunction[x]
```

details after here :

Sum Rules

Check sum rule:

In[60]:=
```
Off[NIntegrate::slwcon]
Off[NIntegrate::izero]
Off[NIntegrate::ncvb]
q0 = 10.0;
q0 = 3.0;
```

In[65]:= **pdfFunction[1, 0, .1, 10.]**

Out[65]= 11.3071

In[66]:= **pdfSetXpower[1]**

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1

In[67]:= **(* This can take a while *)**
Do[
 mom[iset] =
  Table[NIntegrate[x pdfFunction[iset, ipart, x, q0], {x, 0, 1}], {ipart, -5, 5, 1}];
 sum[iset] = Plus @@ mom[iset];
 {iset, "mom=", sum[iset], mom[iset]} // Print;
 , {iset, 1, isetMax}]

{1, mom=, 1.00074 , {-0.00180075 , 0.00744165 , 0.0197709 , 0.0294074 ,
   0.0350435 , 0.432957 , 0.147997 , 0.304562 , 0.019768 , 0.0073844 , -0.00179197 }}

{2, mom=, 0.999618 , {0., 0.00718546 , 0.0177307 , 0.0301115 ,
   0.0369724 , 0.433275 , 0.15107 , 0.298356 , 0.0177307 , 0.00718546 , 0.}}

{3, mom=, 0.999775 , {0., 0.00706273 , 0.0216755 , 0.0300738 ,
   0.0366837 , 0.4344 , 0.145744 , 0.295397 , 0.0216755 , 0.00706273 , 0.}}

{4, mom=, 0.999793 , {0., 0.00565472 , 0.0220172 , 0.0391967 ,
   0.0299138 , 0.41708 , 0.146182 , 0.312077 , 0.0220172 , 0.00565472 , 0.}}

{5, mom=, 0.998717 , {0., 0.00737065 , 0.0183091 , 0.0328786 ,
   0.0380733 , 0.435187 , 0.146333 , 0.293345 , 0.0199055 , 0.00731524 , 0.}}

{6, mom=, 1.00098 , {0., 0.00725763 , 0.0180259 , 0.0307018 ,
   0.0376447 , 0.430206 , 0.150124 , 0.301741 , 0.0180259 , 0.00725763 , 0.}}

{7, mom=, 0.999888 , {0., 0.00753375 , 0.0182838 , 0.0271967 ,
   0.0335516 , 0.445659 , 0.170042 , 0.271804 , 0.0182838 , 0.00753375 , 0.}}

{8, mom=, 0.999797 , {-1.00624 $\times 10^{-11}$, 0.0084499 , 0.0164763 , 0.0321429 ,
   0.0365782 , 0.43639 , 0.145904 , 0.293859 , 0.0216328 , 0.00836452 , -1.12619 $\times 10^{-11}$}}

{9, mom=, 0.999744 , {0., 0.0070291 , 0.0216539 , 0.0300594 ,
   0.0366749 , 0.434205 , 0.145829 , 0.295611 , 0.0216539 , 0.0070291 , 0.}}

{10, mom=, 0.999756 , {-1.24956 $\times 10^{-20}$, 0.00734341 , 0.0226996 , 0.029121 ,
   0.0361296 , 0.435526 , 0.144766 , 0.294128 , 0.0226996 , 0.00734341 , -1.24956 $\times 10^{-20}$}}

In[68]:= **pdfSetList // TableForm**

Out[68]//TableForm=

1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/abm12lhc_5_nnlo_0000.dat
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_0000.dat
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_0000.dat
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/HERAPDF20_NLO_VAR_0000.dat
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl/MSTW2008nnlo68cl_0000.dat
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_1_1_0000.dat
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/nCTEQ15_208_82_0000.dat
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118_nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ct10.pds/
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ctq66m.p

In[69]:= **tab1 = Table[mom[iset], {iset, 1, isetMax}] // Chop;**

tab1 // TableForm

Out[70]//TableForm=

−0.00180075	0.00744165	0.0197709	0.0294074	0.0350435	0.432957	0.1479
0	0.00718546	0.0177307	0.0301115	0.0369724	0.433275	0.1510
0	0.00706273	0.0216755	0.0300738	0.0366837	0.4344	0.1457
0	0.00565472	0.0220172	0.0391967	0.0299138	0.41708	0.1461
0	0.00737065	0.0183091	0.0328786	0.0380733	0.435187	0.1463
0	0.00725763	0.0180259	0.0307018	0.0376447	0.430206	0.1501
0	0.00753375	0.0182838	0.0271967	0.0335516	0.445659	0.1700
0	0.0084499	0.0164763	0.0321429	0.0365782	0.43639	0.1459
0	0.0070291	0.0216539	0.0300594	0.0366749	0.434205	0.1458
0	0.00734341	0.0226996	0.029121	0.0361296	0.435526	0.1447

In[71]:= **tab2 = Table[{iset, sum[iset]}, {iset, 1, isetMax}];**

tab2a = tab2 // Transpose // Last;

(Round[#, 0.001] & /@ tab2) // TableForm

Out[73]//TableForm=

1.	1.001
2.	1.
3.	1.
4.	1.
5.	0.999
6.	1.001
7.	1.
8.	1.
9.	1.
10.	1.

In[74]:=
```
tab3 = Join[{tab2a} , tab1 // Transpose] // Transpose ;
tab3 // TableForm
```

Out[75]//TableForm=

1.00074	−0.00180075	0.00744165	0.0197709	0.0294074	0.0350435	0.4329
0.999618	0	0.00718546	0.0177307	0.0301115	0.0369724	0.4332
0.999775	0	0.00706273	0.0216755	0.0300738	0.0366837	0.4344
0.999793	0	0.00565472	0.0220172	0.0391967	0.0299138	0.4170
0.998717	0	0.00737065	0.0183091	0.0328786	0.0380733	0.4351
1.00098	0	0.00725763	0.0180259	0.0307018	0.0376447	0.4302
0.999888	0	0.00753375	0.0182838	0.0271967	0.0335516	0.4456
0.999797	0	0.0084499	0.0164763	0.0321429	0.0365782	0.4363
0.999744	0	0.0070291	0.0216539	0.0300594	0.0366749	0.4342
0.999756	0	0.00734341	0.0226996	0.029121	0.0361296	0.4355

In[76]:=
```
tab4 = Round[100 * tab3 , 0.1]
```

Out[76]=
```
{{100.1 , −0.2, 0.7, 2., 2.9, 3.5, 43.3, 14.8, 30.5, 2., 0.7, −0.2},
 {100., 0., 0.7, 1.8, 3., 3.7, 43.3, 15.1, 29.8, 1.8, 0.7, 0.},
 {100., 0., 0.7, 2.2, 3., 3.7, 43.4, 14.6, 29.5, 2.2, 0.7, 0.},
 {100., 0., 0.6, 2.2, 3.9, 3., 41.7, 14.6, 31.2, 2.2, 0.6, 0.},
 {99.9, 0., 0.7, 1.8, 3.3, 3.8, 43.5, 14.6, 29.3, 2., 0.7, 0.},
 {100.1, 0., 0.7, 1.8, 3.1, 3.8, 43., 15., 30.2, 1.8, 0.7, 0.},
 {100., 0., 0.8, 1.8, 2.7, 3.4, 44.6, 17., 27.2, 1.8, 0.8, 0.},
 {100., 0., 0.8, 1.6, 3.2, 3.7, 43.6, 14.6, 29.4, 2.2, 0.8, 0.},
 {100., 0., 0.7, 2.2, 3., 3.7, 43.4, 14.6, 29.6, 2.2, 0.7, 0.},
 {100., 0., 0.7, 2.3, 2.9, 3.6, 43.6, 14.5, 29.4, 2.3, 0.7, 0.}}
```

In[77]:=
```
tmp1 = tab4 // TableForm[#,
     TableHeadings → {Range[isetMax], Join[{"Total"}, pdfFlavor /@ Range[−5, 5]]}] &
```

Out[77]//TableForm=

	Total	bbar	cbar	sbar	ubar	dbar	gluon	down	up	strange
1	100.1	−0.2	0.7	2.	2.9	3.5	43.3	14.8	30.5	2.
2	100.	0.	0.7	1.8	3.	3.7	43.3	15.1	29.8	1.8
3	100.	0.	0.7	2.2	3.	3.7	43.4	14.6	29.5	2.2
4	100.	0.	0.6	2.2	3.9	3.	41.7	14.6	31.2	2.2
5	99.9	0.	0.7	1.8	3.3	3.8	43.5	14.6	29.3	2.
6	100.1	0.	0.7	1.8	3.1	3.8	43.	15.	30.2	1.8
7	100.	0.	0.8	1.8	2.7	3.4	44.6	17.	27.2	1.8
8	100.	0.	0.8	1.6	3.2	3.7	43.6	14.6	29.4	2.2
9	100.	0.	0.7	2.2	3.	3.7	43.4	14.6	29.6	2.2
10	100.	0.	0.7	2.3	2.9	3.6	43.6	14.5	29.4	2.3

In[78]:= **tmp1 // TeXForm**

Out[78]//TeXForm=

```
\begin{array}{ccccccccccccc}
 & \text{Total} & \text{bbar} & \text{cbar} & \text{sbar} & \text{ubar} & \text{dbar} & `
1 & 100.1 & -0.2 & 0.7 & 2. & 2.9 & 3.5 & 43.3 & 14.8 & 30.5 & 2. & 0.7 & -0.2 \\
2 & 100. & 0. & 0.7 & 1.8 & 3. & 3.7 & 43.3 & 15.1 & 29.8 & 1.8 & 0.7 & 0. \\
3 & 100. & 0. & 0.7 & 2.2 & 3. & 3.7 & 43.4 & 14.6 & 29.5 & 2.2 & 0.7 & 0. \\
4 & 100. & 0. & 0.6 & 2.2 & 3.9 & 3. & 41.7 & 14.6 & 31.2 & 2.2 & 0.6 & 0. \\
5 & 99.9 & 0. & 0.7 & 1.8 & 3.3 & 3.8 & 43.5 & 14.6 & 29.3 & 2. & 0.7 & 0. \\
6 & 100.1 & 0. & 0.7 & 1.8 & 3.1 & 3.8 & 43. & 15. & 30.2 & 1.8 & 0.7 & 0. \\
7 & 100. & 0. & 0.8 & 1.8 & 2.7 & 3.4 & 44.6 & 17. & 27.2 & 1.8 & 0.8 & 0. \\
8 & 100. & 0. & 0.8 & 1.6 & 3.2 & 3.7 & 43.6 & 14.6 & 29.4 & 2.2 & 0.8 & 0. \\
9 & 100. & 0. & 0.7 & 2.2 & 3. & 3.7 & 43.4 & 14.6 & 29.6 & 2.2 & 0.7 & 0. \\
10 & 100. & 0. & 0.7 & 2.3 & 2.9 & 3.6 & 43.6 & 14.5 & 29.4 & 2.3 & 0.7 & 0. \\
\end{array}
```

In[79]:= **Table[{iset, Round[100 * sum[iset], .01]}, {iset, 1, isetMax}] //**
  TableForm[#, TableHeadings → {None, {"iset", "Mom Sum"}}, Table] &

Out[79]//TableForm=

iset	Mom Sum
1	100.07
2	99.96
3	99.98
4	99.98
5	99.87
6	100.1
7	99.99
8	99.98
9	99.97
10	99.98

In[80]:= **pdfSetListDisplay []**

Out[80]=

Set Number	File Name	Max Flavors	Valance Flavors
1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/ abm12lhc_5_nnlo_0000.dat	5	n/a
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat	5	n/a
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat	5	n/a
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/ HERAPDF20_NLO_VAR_0000.dat	6	n/a
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl / MSTW2008nnlo68cl_0000.dat	5	n/a
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_ 1_1_0000.dat	5	n/a
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/ nCTEQ15_208_82_0000.dat	5	n/a
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118 _nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat	6	n/a
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/ ct10.00.pds	5	2
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m. pds/ctq66.00.pds	5	2

Plot All PDFs

In[81]:= **pdfSetInterpolator ["ManeParse "]**
pdfSetXpower [1.5]

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1.5

In[83]:= **pdfSetListDisplay []**

Out[83]=

Set Number	File Name	Max Flavors	Valance Flavors
1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/ abm12lhc_5_nnlo_0000.dat	5	n/a
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat	5	n/a
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat	5	n/a
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/ HERAPDF20_NLO_VAR_0000.dat	6	n/a
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl / MSTW2008nnlo68cl_ 0000.dat	5	n/a
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_ 1_1_0000.dat	5	n/a
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/ nCTEQ15_208_82_0000.dat	5	n/a
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118 _nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat	6	n/a
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/ ct10.00.pds	5	2
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m. pds/ctq66.00.pds	5	2

In[84]:= **pdfFunction[3, 6, 0.1, 1000.]**

Out[84]= 0.

In[85]:= **q0 = 2.0**

Out[85]= 2.

In[86]:= **baseSty = {FontSize → 18, FontFamily → "Times"};**

```
In[87]:=  ticksX = {
             {.001, MaTeX[".001", FontSize -> 30]},
             {.01, MaTeX[".01", FontSize -> 30]},
             {.1, MaTeX[".1", FontSize -> 30]},
             {1, MaTeX["1", FontSize -> 30]}
           };
         ticksY = {
             {0, MaTeX["0.0", FontSize -> 30]},
             {.2, MaTeX["0.2", FontSize -> 30]},
             {.4, MaTeX["0.4", FontSize -> 30]},
             {.6, MaTeX["0.6", FontSize -> 30]},
             {.8, MaTeX["0.8", FontSize -> 30]}
           };
```

In[89]:=
```
LogLinearPlot[
   Table[x^1.0 pdf[i, 2, x, q0], {i, 1, isetMax}] // Evaluate
   , {x, 0.8 * 10^-3, 1},
   BaseStyle → baseSty,
   FrameLabel → {MaTeX["x", FontSize -> 36], MaTeX["f^A_u(x,Q)", FontSize -> 36]},
   Frame → {True, True, True, True},
   FrameTicks → {{ticksY, None}, {ticksX, None}},
   ImageSize → 800
]
```

Out[89]=
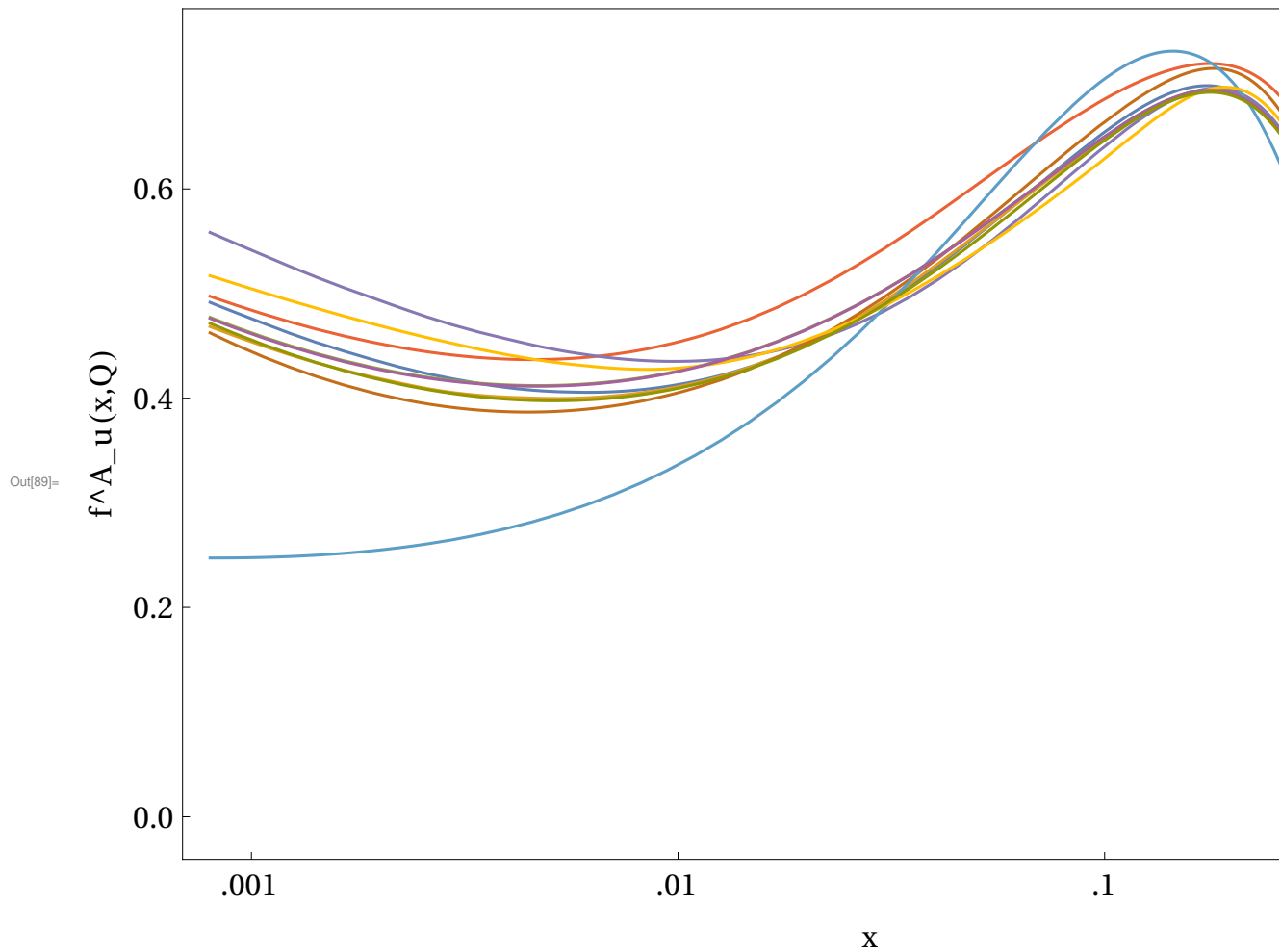
In[91]:=
```
LogLinearPlot[
  Table[x^1.0 pdf[i, 2, x, q0], {i, 1, isetMax}] // Evaluate
  , {x, 0.8 * 10^-3, 1},
  BaseStyle → baseSty,
  FrameLabel → {"x", "x  f_u(x,Q)"},
  Frame → {True, True, False, False},
  FrameTicks → {True, True, None, None},
  PlotStyle → colors
]
```

Out[91]=
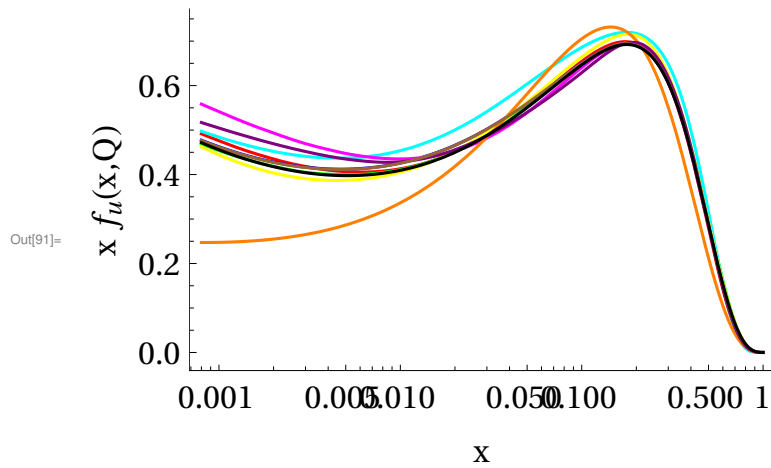
In[92]:=
```
LogLinearPlot[
  Table[x^1.0 pdf[i, 2, x, q0], {i, 1, isetMax}] // Evaluate
  , {x, 0.8 * 10^-3, 1}, BaseStyle → baseSty, PlotLegends → True]
```

Out[92]=
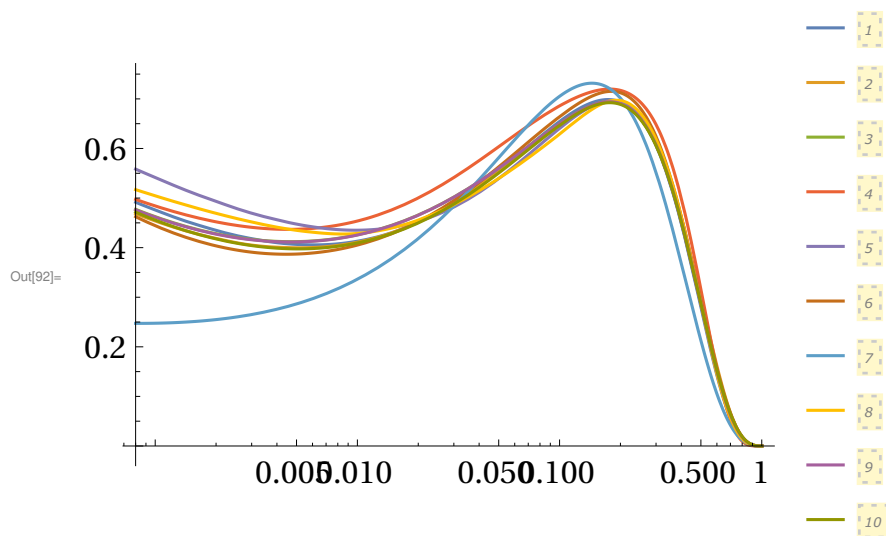
```
In[93]:=  ticksX = {
            {.001, MaTeX[".001", FontSize -> 30]},
            {.01, MaTeX[".01", FontSize -> 30]},
            {.1, MaTeX[".1", FontSize -> 30]},
            {1, MaTeX["1", FontSize -> 30]}
          };
          ticksY = {
            {.8, MaTeX["0.8", FontSize -> 30]},
            {.9, MaTeX["0.9", FontSize -> 30]},
            {1, MaTeX["1.0", FontSize -> 30]},
            {1.1, MaTeX["1.1", FontSize -> 30]},
            {1.2, MaTeX["1.2", FontSize -> 30]}
          };
```

In[95]:=
```
iset0 = 9;
LogLinearPlot[
  Table[ pdf[i, 2, x, q0] / pdf[iset0, 2, x, q0] , {i, 1, isetMax, 1}] // Evaluate
  , {x, 0.7 * 10^-3, 0.7},
  BaseStyle → baseSty,
  PlotPoints → 100,
  Ticks → {{0.001, 0.01, 0.1, 1}, Automatic},
  PlotRange → {{0.5 * 10^-3, 1}, Automatic},
  BaseStyle → baseSty,
  FrameLabel → {MaTeX["x", FontSize -> 36], MaTeX["Ratio", FontSize -> 36]},
  Frame → {True, True, True, True},
  FrameTicks → {{ticksY, None}, {ticksX, None}},
  ImageSize → 800]
```

Out[96]=
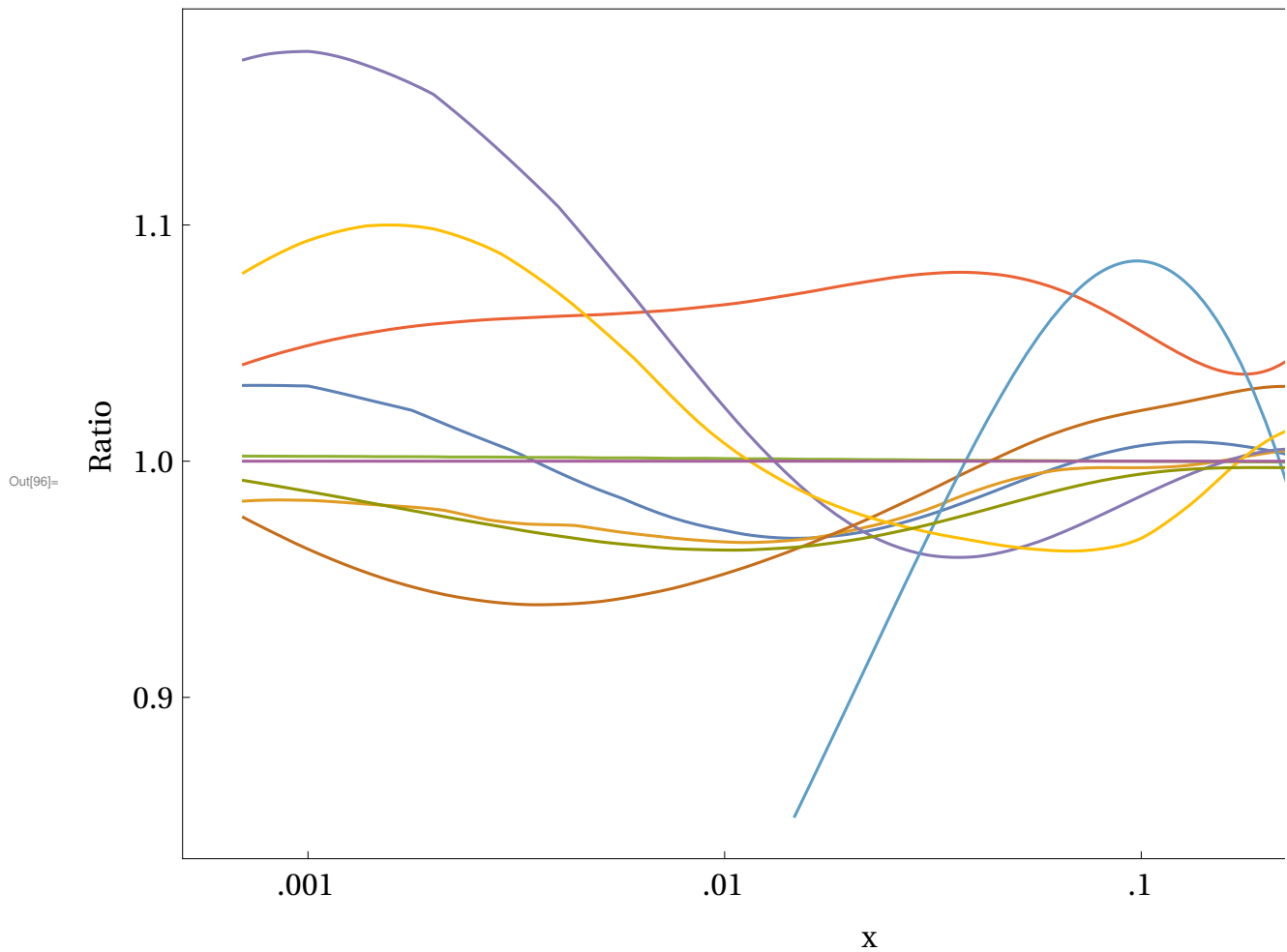
In[97]:= **pdfSetXpower [0]**

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 0

In[98]:= **pdfSetInterpolator ["ManeParse "]**
pdfSetXpower [3]

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 0

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 3

In[100]:= **pdfSetInterpolator ["MMA"]**
pdfSetXpower [4]

q0 = 3.;
LogLinearPlot [

Table [$\dfrac{\text{pdf[i, 1, x, q0]}}{\text{pdf[i, 2, x, q0]}}$, {i, 5, 5}] // Evaluate

, {x, 0.8 * 10^-3, 0.05}, BaseStyle → baseSty , PlotPoints → 100,
Ticks → {{0.001, 0.003, 0.01, 0.03, 0.1, 0.3}, Automatic },
AxesOrigin → {Automatic , 0.75}]

Default Mathematica   interpolator   will be used .

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 4

Out[103]=
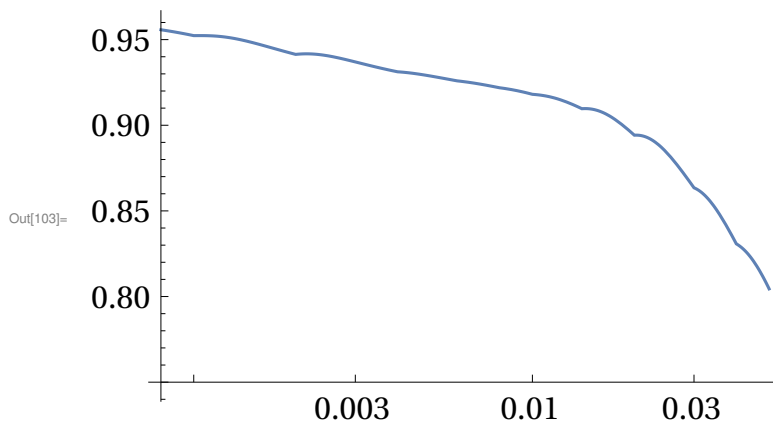
In[104]:= **pdfSetInterpolator ["MMA"]**

pdfSetXpower [1]

q0 = 3.;

LogLinearPlot [

Table [$\dfrac{\text{pdf[i, 1, x, q0]}}{\text{pdf[i, 2, x, q0]}}$, {i, 5, 5}] // Evaluate

, {x, 0.8 * 10 ^ -3, 0.05}, BaseStyle → baseSty , PlotPoints → 100,

Ticks → {{0.001 , 0.003 , 0.01, 0.03, 0.1, 0.3}, Automatic },

AxesOrigin → {Automatic , 0.75}]

Default Mathematica interpolator will be used.

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1

Out[107]=

In[108]:= **pdfSetListDisplay []**

Out[108]=

Set Number	File Name	Max Flavors	Valance Flavors
1	/usr/local/share/LHAPDF/abm12lhc_ 5_nnlo/ abm12lhc_ 5_nnlo_0000.dat	5	n/a
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat	5	n/a
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat	5	n/a
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/ HERAPDF20_NLO_VAR_0000.dat	6	n/a
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl / MSTW2008nnlo68cl_ 0000.dat	5	n/a
6	/usr/local/share/LHAPDF/nCTEQ15_ 1_1/nCTEQ15_ 1_1_0000.dat	5	n/a
7	/usr/local/share/LHAPDF/nCTEQ15_ 208_82/ nCTEQ15_ 208_82_0000.dat	5	n/a
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118 _nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat	6	n/a
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/ ct10.00.pds	5	2
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m. pds/ctq66.00.pds	5	2

In[109]:=
```
pdfSetInterpolator ["MMA"]

ticksX = {
    {.005 , MaTeX[".005" , FontSize -> 30]},
    {.05 , MaTeX["0.05" , FontSize -> 30]},
    {.5 , MaTeX["0.5" , FontSize -> 30]},
    {5 * 10 ^ - 4 , MaTeX[".0005" , FontSize -> 30]}
  };
ticksY = {
    {.2 , MaTeX["0.2" , FontSize -> 30]},
    {.4 , MaTeX["0.4" , FontSize -> 30]},
    {.6 , MaTeX["0.6" , FontSize -> 30]},
    {.8 , MaTeX["0.8" , FontSize -> 30]},
    {1.0 , MaTeX["1.0" , FontSize -> 30]}
  };

LogLinearPlot [
  Table[ pdf[i, 0, x, 100.] / pdf[9, 0, x, 100.] , {i, 5, 5}] // Evaluate
  , {x, 0.8 * 10 ^ - 3, 0.7},
  BaseStyle → baseSty ,
  PlotLegends → Automatic ,
  Ticks → {{0.001 , 0.01, 0.1, 1}, Automatic},
  AxesOrigin → {Automatic , 0.15},
  FrameLabel → {MaTeX["x" , FontSize -> 36], MaTeX["Ratio" , FontSize -> 36]},
  Frame → {True , True , True , True},
  FrameTicks → {{ticksY , None}, {ticksX , None}},
  ImageSize → 800]
```
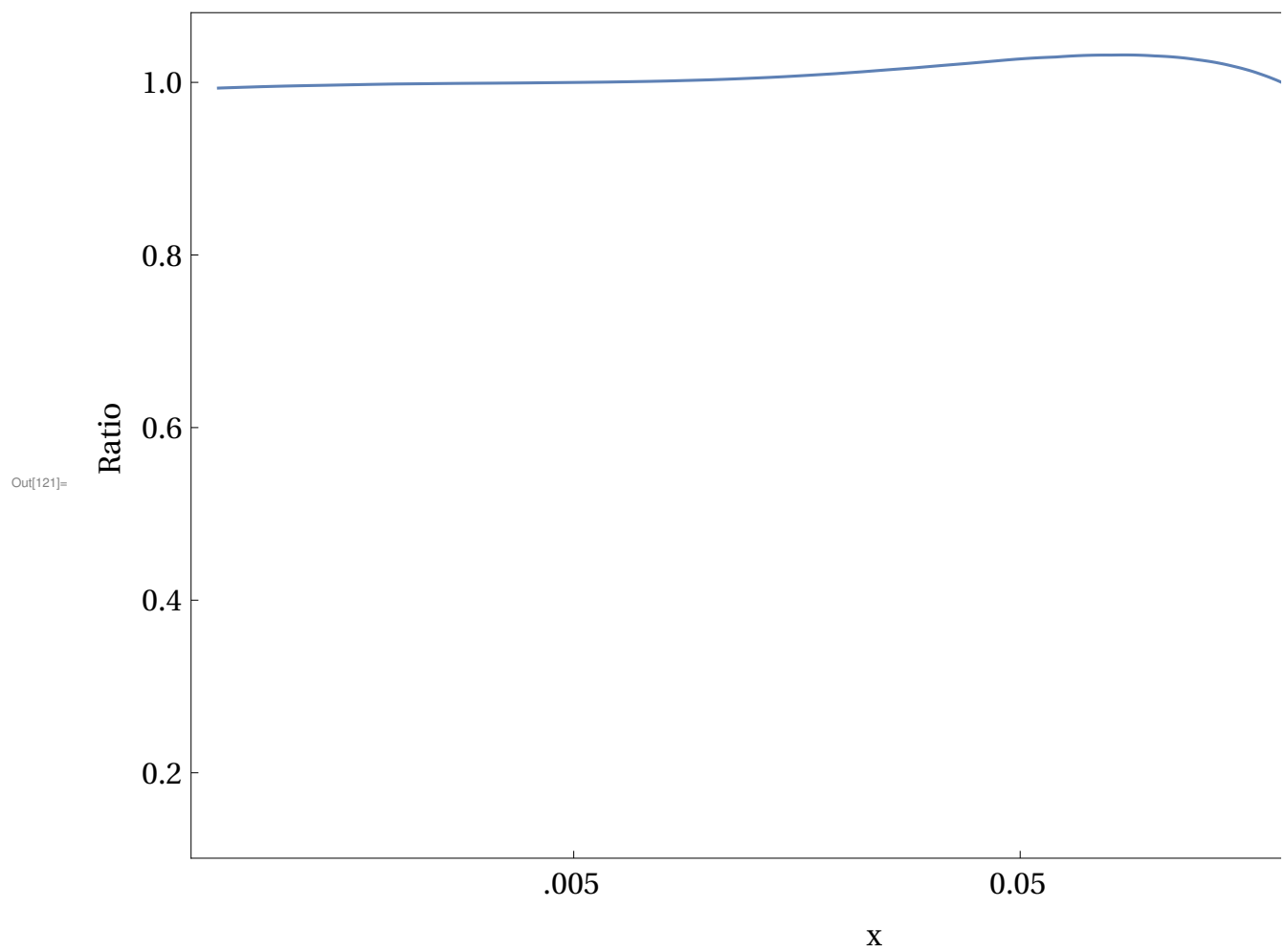
Default Mathematica interpolator will be used.

Out[112]=
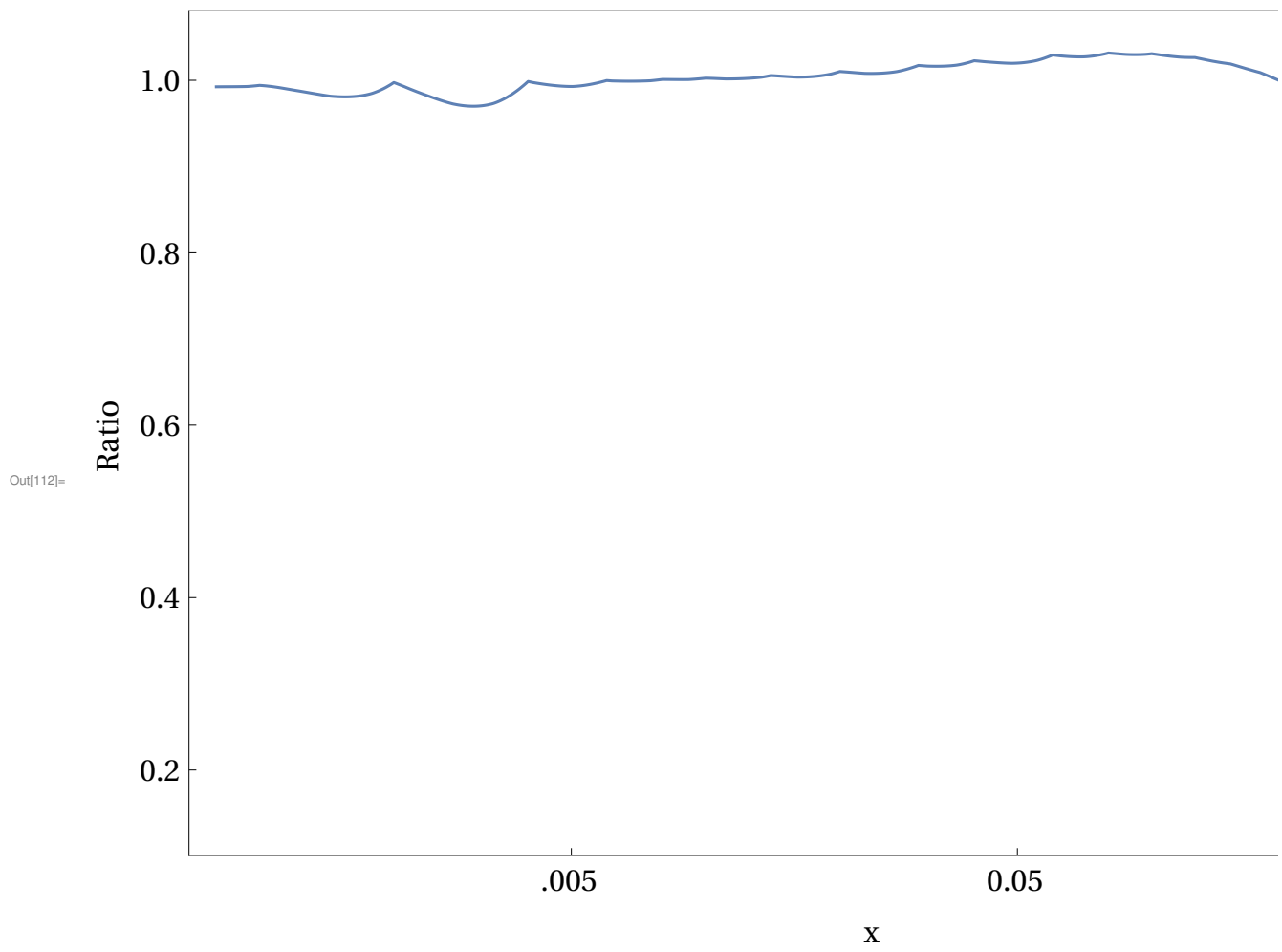
In[113]:= **pdfSetInterpolator ["ManeParse "]**

pdfSetXpower [1.0]

LogLinearPlot $\Big[$

$\quad$ **Table** $\Big[\dfrac{\text{pdf[i, 0, x, 100.]}}{\text{pdf[9, 0, x, 100.]}}$, {i, 5, 5}$\Big]$ **// Evaluate**

$\quad$ **, {x, 0.8 * 10 ^ -3, 0.7},**

$\quad$ **BaseStyle → baseSty ,**

$\quad$ **PlotLegends → Automatic ,**

$\quad$ **Ticks → {{0.001, 0.01, 0.1, 1}, Automatic},**

$\quad$ **AxesOrigin → {Automatic , 0.15},**

$\quad$ **FrameLabel → {"x", "f$_g$(x,Q) Ratio"},**

$\quad$ **Frame → {True, True, False, False},**

$\quad$ **FrameTicks → {True, True, None, None},**

$\quad$ **BaseStyle → {FontSize → 18, FontFamily → "Times"}**$\Big]$

ManeParse cubic interpolation will be used .

The x-power of the interpolation is set to 1

ManeParse cubic interpolation will be used .

The x-power of the interpolation is set to 1.

Out[115]=
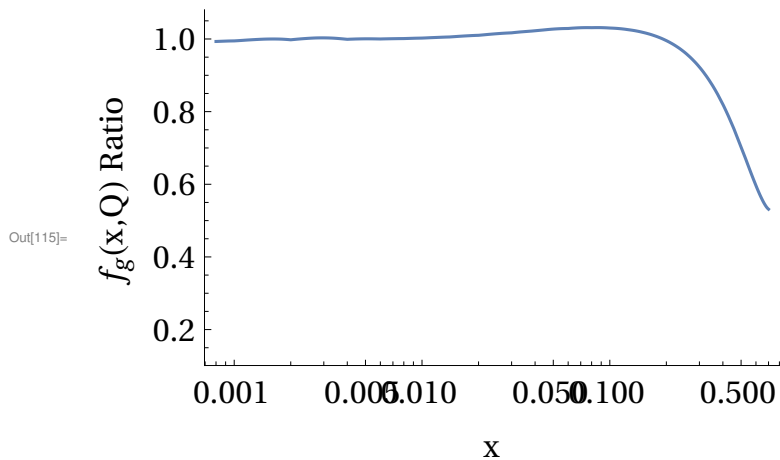
In[116]:=

```
In[117]:=  pdfSetInterpolator ["ManeParse "]
           pdfSetXpower [1.5]

           ticksX = {
               {.005 , MaTeX[".005", FontSize -> 30]},
               {.05 , MaTeX["0.05", FontSize -> 30]},
               {.5 , MaTeX["0.5", FontSize -> 30]},
               {5 * 10 ^ -4 , MaTeX[".0005", FontSize -> 30]}
             };
           ticksY = {
               {.2 , MaTeX["0.2", FontSize -> 30]},
               {.4 , MaTeX["0.4", FontSize -> 30]},
               {.6 , MaTeX["0.6", FontSize -> 30]},
               {.8 , MaTeX["0.8", FontSize -> 30]},
               {1.0 , MaTeX["1.0", FontSize -> 30]}
             };

           LogLinearPlot[
             Table[ pdf[i, 0, x, 100.]
                    ─────────────────── , {i, 5, 5}] // Evaluate
                    pdf[9, 0, x, 100.]
             , {x, 0.8 * 10 ^ -3, 0.7},
             BaseStyle → baseSty ,
             PlotLegends → Automatic ,
             Ticks → {{0.001 , 0.01 , 0.1 , 1}, Automatic },
             AxesOrigin → {Automatic , 0.15},
             FrameLabel → {MaTeX["x", FontSize -> 36], MaTeX["Ratio", FontSize -> 36]},
             Frame → {True , True , True , True},
             FrameTicks → {{ticksY , None}, {ticksX , None}},
             ImageSize → 800]
```
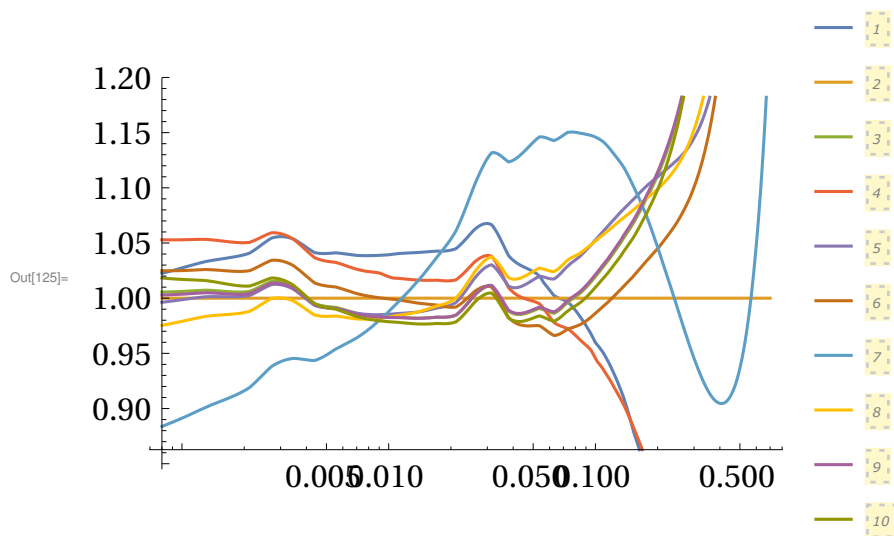
ManeParse cubic interpolation will be used .

The x-power of the interpolation   is set to 1.

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1.5

Out[121]=

In[122]:=

In[123]:= **pdfSetInterpolator ["ManeParse "]**

pdfSetXpower [1.5]

LogLinearPlot$\Big[$

Table$\Big[$ $\dfrac{\text{pdf[i, 0, x, 100.]}}{\text{pdf[2, 0, x, 100.]}}$ **, {i, 1, isetMax}**$\Big]$ **// Evaluate**

, {x, 0.8 ∗ 10^-3, 0.7}, BaseStyle → baseSty , PlotLegends → Automatic$\Big]$

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1.5

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1.5

Out[125]=

In[126]:=
```
pdfSetInterpolator ["ManeParse "]
pdfSetXpower [1.5]
```

```
LogLinearPlot[
  Table[ pdf[i, 0, x, 2.]/pdf[2, 0, x, 2.], {i, 1, isetMax, 1}] // Evaluate
  , {x, 0.8 * 10^-3, 0.7},
  BaseStyle → baseSty,
  PlotPoints → 100,
  Ticks → {{0.001, 0.01, 0.1, 1}, Automatic},
  PlotRange → {{0.5 * 10^-3, 1}, Automatic},
  FrameLabel → {"x", "f_g(x,Q) Ratio"},
  Frame → {True, True, False, False},
  FrameTicks → {True, True, None, None},
  BaseStyle → {FontSize → 18, FontFamily → "Times"}]
```

ManeParse cubic interpolation   will be used.

The x-power of the interpolation   is set to 1.5

ManeParse cubic interpolation   will be used.

The x-power of the interpolation   is set to 1.5

Out[128]=
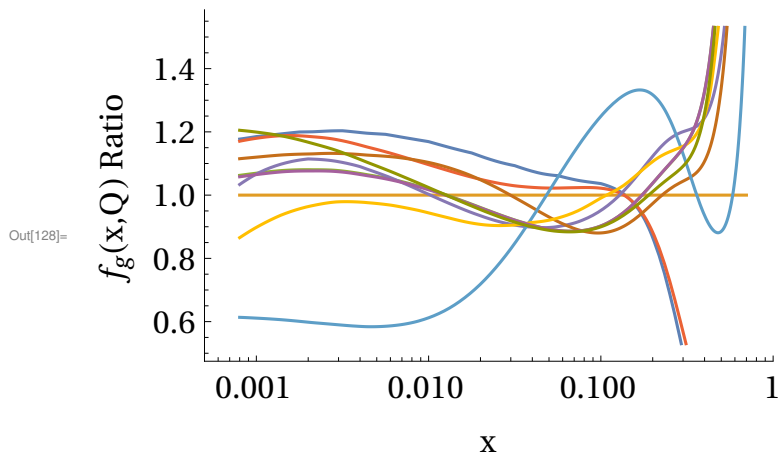
```
In[129]:= pdfSetInterpolator ["ManeParse "]
       pdfSetXpower [1.5]

       ticksX = {
           {.001, MaTeX["0.001", FontSize -> 30]},
           {.01, MaTeX["0.01", FontSize -> 30]},
           {.1, MaTeX["0.1", FontSize -> 30]},
           {1, MaTeX["1", FontSize -> 30]}
         };
       ticksY = {
           {.4, MaTeX["0.4", FontSize -> 30]},
           {.6, MaTeX["0.6", FontSize -> 30]},
           {.8, MaTeX["0.8", FontSize -> 30]},
           {1.0, MaTeX["1.0", FontSize -> 30]},
           {1.2, MaTeX["1.2", FontSize -> 30]},
           {1.4, MaTeX["1.4", FontSize -> 30]},
           {1.6, MaTeX["1.6", FontSize -> 30]}
         };

       LogLinearPlot[
         Table[ pdf[i, 0, x, 2.]/pdf[2, 0, x, 2.], {i, 1, isetMax}] // Evaluate
         , {x, 0.8 * 10 ^ -3, 0.7}, BaseStyle → baseSty ,
         FrameLabel → {MaTeX["x", FontSize -> 36], MaTeX["Ratio", FontSize -> 36]},
         Frame → {True, True, True, True},
         FrameTicks → {{ticksY , None}, {ticksX , None}},
         ImageSize → 800]
```

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1.5

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1.5

Out[133]=
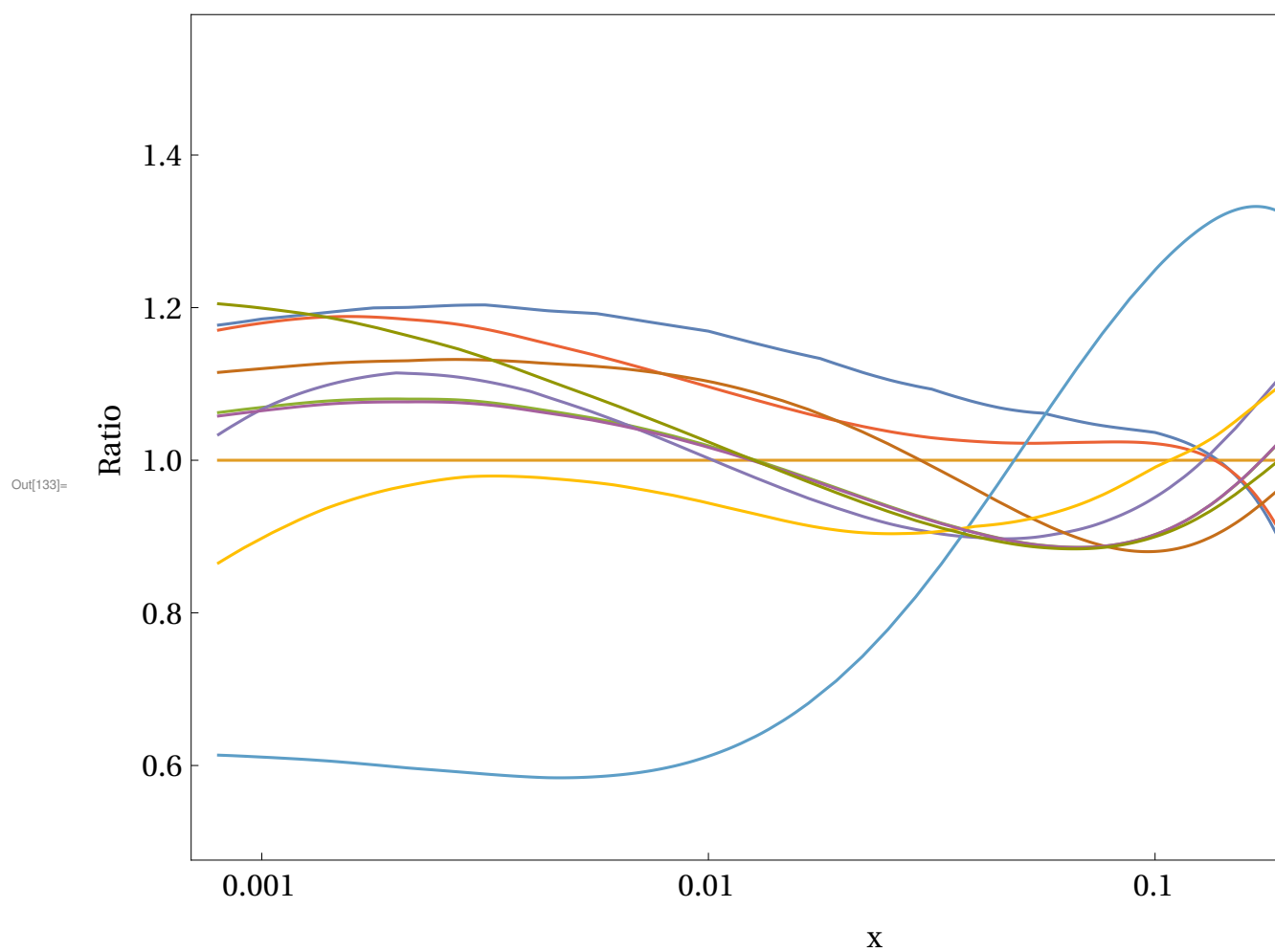
In[134]:=

```
In[135]:=  pdfSetInterpolator ["ManeParse "]
           pdfSetXpower [1.5]

           ticksX = {
               {0.0, MaTeX["0.0", FontSize -> 30]},
               {.1, MaTeX["0.1", FontSize -> 30]},
               {.2, MaTeX["0.2", FontSize -> 30]},
               {.3, MaTeX["0.3", FontSize -> 30]},
               {0.4, MaTeX["0.4", FontSize -> 30]},
               {.5, MaTeX["0.5", FontSize -> 30]},
               {.6, MaTeX["0.6", FontSize -> 30]},
               {.7, MaTeX["0.7", FontSize -> 30]}
             };
           ticksY = {
               {2.0, MaTeX["2.0", FontSize -> 30]},
               {1.5, MaTeX["1.5", FontSize -> 30]},
               {1, MaTeX["1.0", FontSize -> 30]},
               {0.5, MaTeX["0.5", FontSize -> 30]},
               {0.0, MaTeX["0.0", FontSize -> 30]}
             };

           Plot[
             Table[ (pdf[i, 0, x, 2.])/(pdf[2, 0, x, 2.]), {i, 1, isetMax}] // Evaluate
             , {x, 0.8 * 10^-3, 0.7}, BaseStyle -> baseSty,
             FrameLabel -> {MaTeX["x", FontSize -> 36], MaTeX["Ratio", FontSize -> 36]},
             Frame -> {True, True, True, True},
             FrameTicks -> {{ticksY, None}, {ticksX, None}},
             ImageSize -> 800]

           ManeParse  cubic  interpolation   will  be  used .
           The  x-power  of the interpolation   is set  to 1.5
           ManeParse  cubic  interpolation   will  be  used .
           The  x-power  of the interpolation   is set  to 1.5
```

Out[139]=
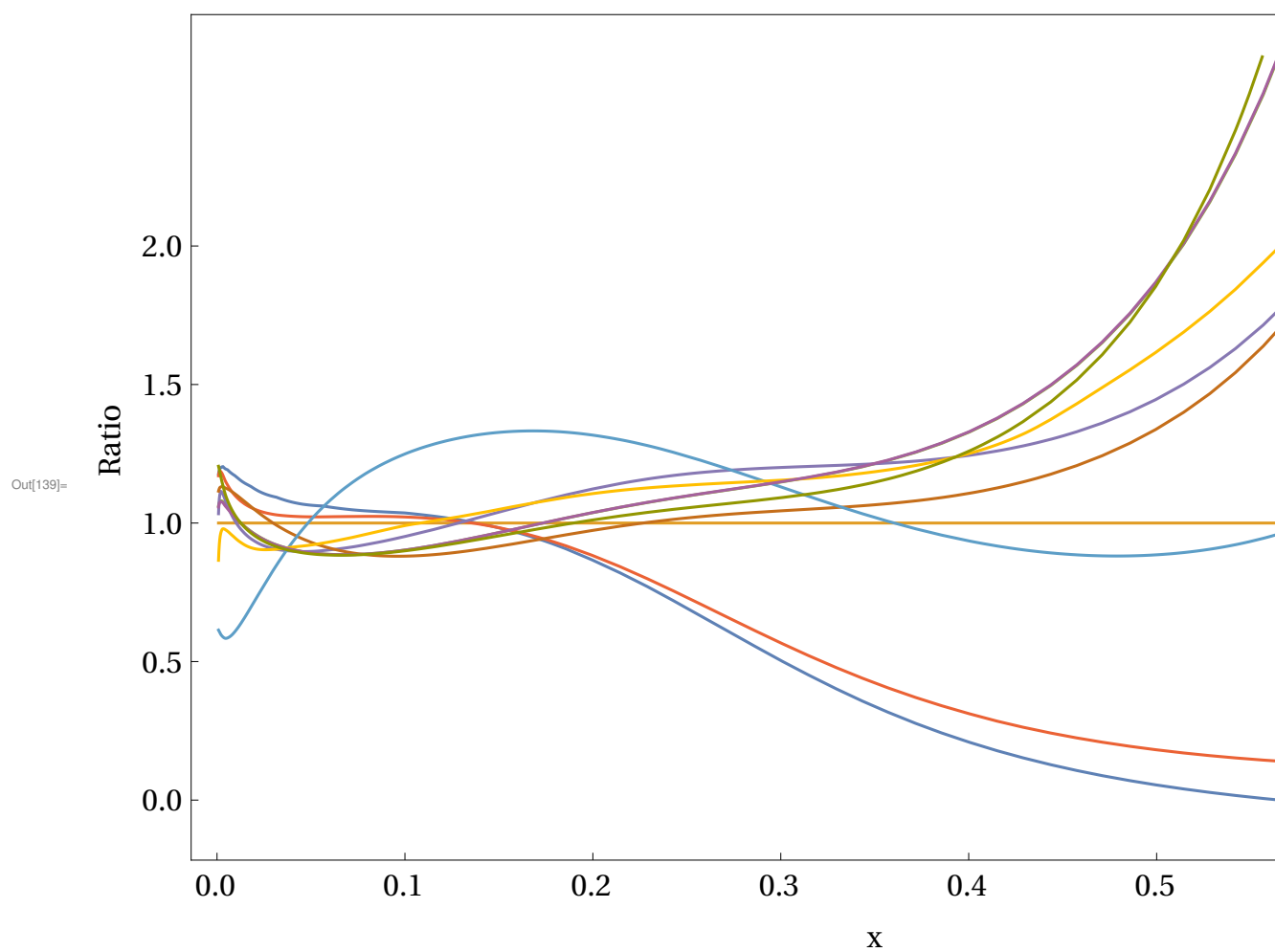
In[140]:=

Look at MSWT disc

In[141]:= **pdfSetListDisplay []**

Out[141]=

Set Number	File Name	Max Flavors	Valance Flavors
1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/ abm12lhc_5_nnlo_0000.dat	5	n/a
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat	5	n/a
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat	5	n/a
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/ HERAPDF20_NLO_VAR_0000.dat	6	n/a
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl / MSTW2008nnlo68cl_ 0000.dat	5	n/a
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_ 1_1_0000.dat	5	n/a
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/ nCTEQ15_208_82_0000.dat	5	n/a
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118 _nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat	6	n/a
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ct10.pds/ ct10.00.pds	5	2
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ctq66m. pds/ctq66.00.pds	5	2

In[142]:= **iMSTW =**
  Position[StringMatchQ[pdfSetList[[All, 2]], "*MSTW2008nnlo68cl *"], True] // First // First

Out[142]= 5

In[143]:= **pdf[iMSTW, 0, 0.1, 10.]**

Out[143]= 11.714

In[144]:= **pdfGetInfo[iMSTW] // TableForm**

Out[144]//TableForm=

SetDesc → "MSTW 2008 NNLO (68% C.L.). This set has 41 member PDFs. mem=0 => centra

SetIndex → 21200

Authors → A.D. Martin, W.J. Stirling, R.S. Thorne and G. Watt

Reference → arXiv:0901.0002

Format → lhagrid1

DataVersion → 3

NumMembers → 41

Particle → 2212

Flavors → {-5, -4, -3, -2, -1, 1, 2, 3, 4, 5, 21}

OrderQCD → 2

FlavorScheme → variable

NumFlavors → 5

ErrorType → hessian

XMin → $\frac{1}{1\,000\,000}$

XMax → 1

QMin → 1

QMax → 31622.8

MZ → 91.1876

MUp → 0

MDown → 0

MStrange → 0

MCharm → 1.4

MBottom → 4.75

MTop → 1e+10

AlphaS_MZ → 0.11707

AlphaS_OrderQCD → 2

AlphaS_Type → ipol

AlphaS_Qs → {1., 1.11803, 1.22475, 1.4, 1.4, 1.58114, 1.78885, 2., 2.23607, 2.52982, 2.82{

AlphaS_Vals → {0.45077, 0.411423, 0.384629, 0.351733, 0.353019, 0.330371, 0.310416, 0.29

In[145]:= **{pdf[iMSTW, 0, 10.^-4, 4.749], pdf[iMSTW, 0, 10.^-4, 4.751]}**

Out[145]= {166838., 170296.}

In[146]:= **x0 = 10.^-1;**

sty = {Blue, Thickness[0.015]};

baseSty = {FontSize → 18, FontFamily → "Times"};

```
In[149]:=  ipart = 0;
       ticksX = {
           {4.5, MaTeX["4.5", FontSize -> 30]},
           {4.6, MaTeX["4.6", FontSize -> 30]},
           {4.7, MaTeX["4.7", FontSize -> 30]},
           {4.8, MaTeX["4.8", FontSize -> 30]},
           {4.9, MaTeX["4.9", FontSize -> 30]},
           {5.0, MaTeX["5.0", FontSize -> 30]}
          };
       ticksY = {
           {15.5, MaTeX["15.5", FontSize -> 30]},
           {16.0, MaTeX["16.0", FontSize -> 30]},
           {16.5, MaTeX["16.5", FontSize -> 30]},
           {17.0, MaTeX["17.0", FontSize -> 30]},
           {17.5, MaTeX["17.5", FontSize -> 30]},
           {18.0, MaTeX["18.0", FontSize -> 30]}
          };

       p1 = Plot[Piecewise[{{x0 pdf[iMSTW, ipart, x0, q], q < 4.75},
             {x0 pdf[iMSTW, ipart, x0, q], q ≥ 4.75}}], {q, 4.5, 5.00}, PlotStyle → sty];
       (*p1=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.5,4.75},PlotStyle→sty];
       p2=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.75,5.00},PlotStyle→sty];*)
       Show[p1, (*p2,*)PlotRange → All,
        AxesOrigin → {Automatic, Automatic}, BaseStyle → baseSty,
        FrameLabel → {MaTeX["Q", FontSize -> 36], MaTeX["x f_g(x,Q)", FontSize -> 36]},
        Frame → {True, True, True, True},
        FrameTicks → {{ticksY, None}, {ticksX, None}},
        ImageSize → 800]
```

Out[153]=
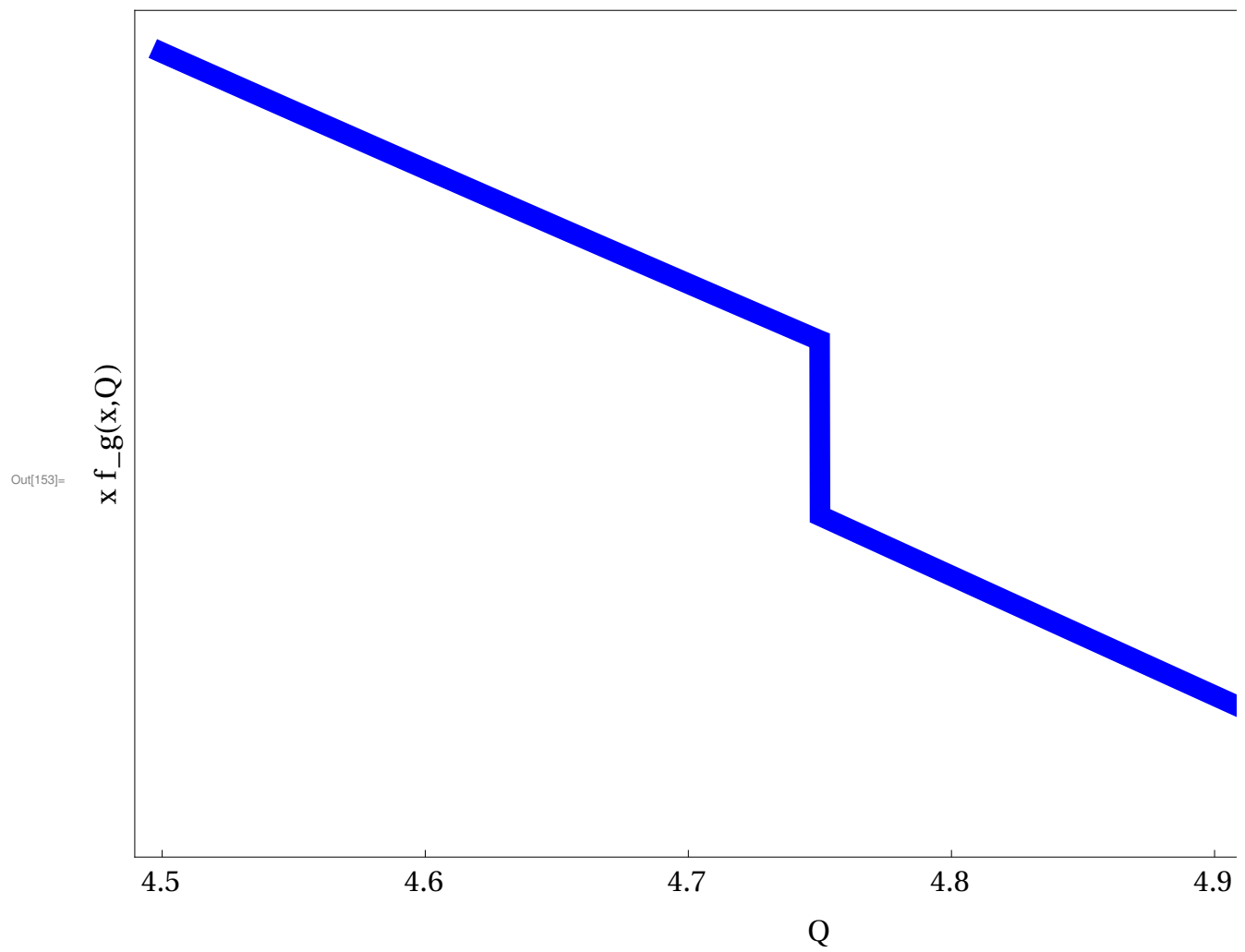
In[154]:=
```
x0 = 10.^-1;
sty = {Blue, Thickness[0.015]};
ipart = 5;
p1 = Plot[Piecewise[{{x0 pdf[iMSTW, ipart, x0, q], q ≤ 4.75},
      {x0 pdf[iMSTW, ipart, x0, q], q > 4.75}}], {q, 4.5, 5.00}, PlotStyle → sty];
(*p1=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.5,4.75},PlotStyle→sty];
p2=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.75,5.00},PlotStyle→sty];*)
Show[p1, (*p2,*)PlotRange → All,
  AxesOrigin → {Automatic, -0.0005}, BaseStyle → baseSty,
  FrameLabel → {"Q", "x f_b(x,Q)"},
  Frame → {True, True, False, False},
  FrameTicks → {True, True, None, None},
  BaseStyle → {FontSize → 18, FontFamily → "Times"}]
```

Out[158]=
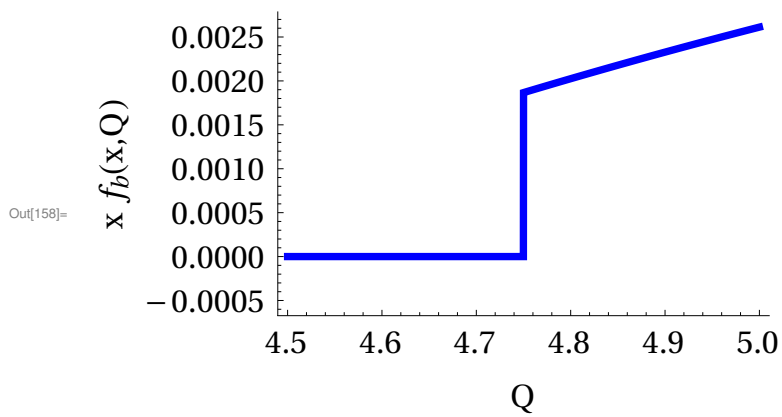
In[159]:=
```
x0 = 10. ^-4;
sty = {Blue, Thickness[0.015]};
ipart = 0;
p1 = Plot[Piecewise[{{x0 pdf[iMSTW, ipart, x0, q], q < 4.75},
        {x0 pdf[iMSTW, ipart, x0, q], q ≥ 4.75}}], {q, 4.5, 5.00}, PlotStyle → sty];
(*p1=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.5,4.75},PlotStyle→sty];
p2=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.75,5.00},PlotStyle→sty];*)
Show[p1, (*p2,*)PlotRange → All,
 AxesOrigin → {Automatic, Automatic}, BaseStyle → baseSty,
 FrameLabel → {"Q", "x f_g(x,Q)"},
 Frame → {True, True, False, False},
 FrameTicks → {True, True, None, None},
 BaseStyle → {FontSize → 18, FontFamily → "Times"}]
```

Out[163]=
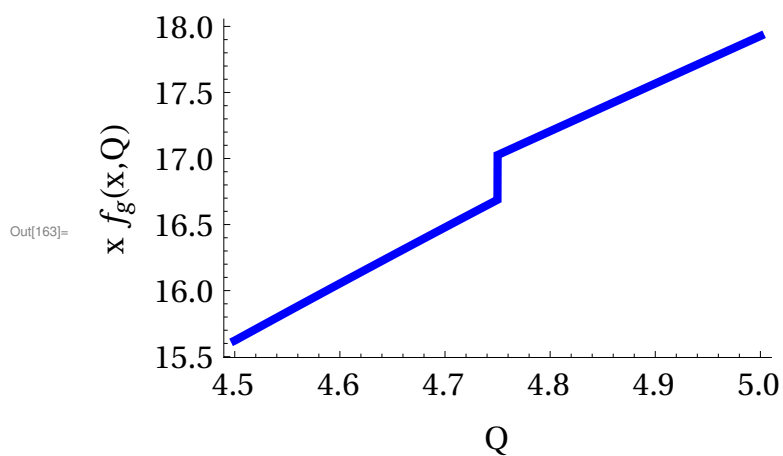
In[164]:=

```
In[165]:=  x0 = 10.^-4;
          sty = {Blue, Thickness[0.015]};
          ipart = 5;
          ticksX = {
              {4.5, MaTeX["4.5", FontSize -> 30]},
              {4.6, MaTeX["4.6", FontSize -> 30]},
              {4.7, MaTeX["4.7", FontSize -> 30]},
              {4.8, MaTeX["4.8", FontSize -> 30]},
              {4.9, MaTeX["4.9", FontSize -> 30]},
              {5.0, MaTeX["5.0", FontSize -> 30]}
            };
          ticksY = {
              {0.0, MaTeX["0.00", FontSize -> 30]},
              {-0.02, MaTeX["-0.02", FontSize -> 30]},
              {-0.04, MaTeX["-0.04", FontSize -> 30]},
              {-0.06, MaTeX["-0.06", FontSize -> 30]},
              {-0.08, MaTeX["-0.08", FontSize -> 30]},
              {-0.1, MaTeX["-0.10", FontSize -> 30]}
            };

          p1 = Plot[Piecewise[{{x0 pdf[iMSTW, ipart, x0, q], q < 4.75},
                {x0 pdf[iMSTW, ipart, x0, q], q ≥ 4.75}}], {q, 4.5, 5.00}, PlotStyle → sty];
          (*p1=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.5,4.75},PlotStyle→sty];
          p2=Plot[x0 pdf[iMSTW,ipart,x0,q],{q,4.75,5.00},PlotStyle→sty];*)
          Show[p1, (*p2,*)PlotRange → All,
           AxesOrigin → {Automatic, -0.10}, BaseStyle → baseSty,
           FrameLabel → {MaTeX["Q", FontSize -> 36], MaTeX["x f_b(x,Q)", FontSize -> 36]},
           Frame → {True, True, True, True},
           FrameTicks → {{ticksY, None}, {ticksX, None}},
           ImageSize → 800]
```
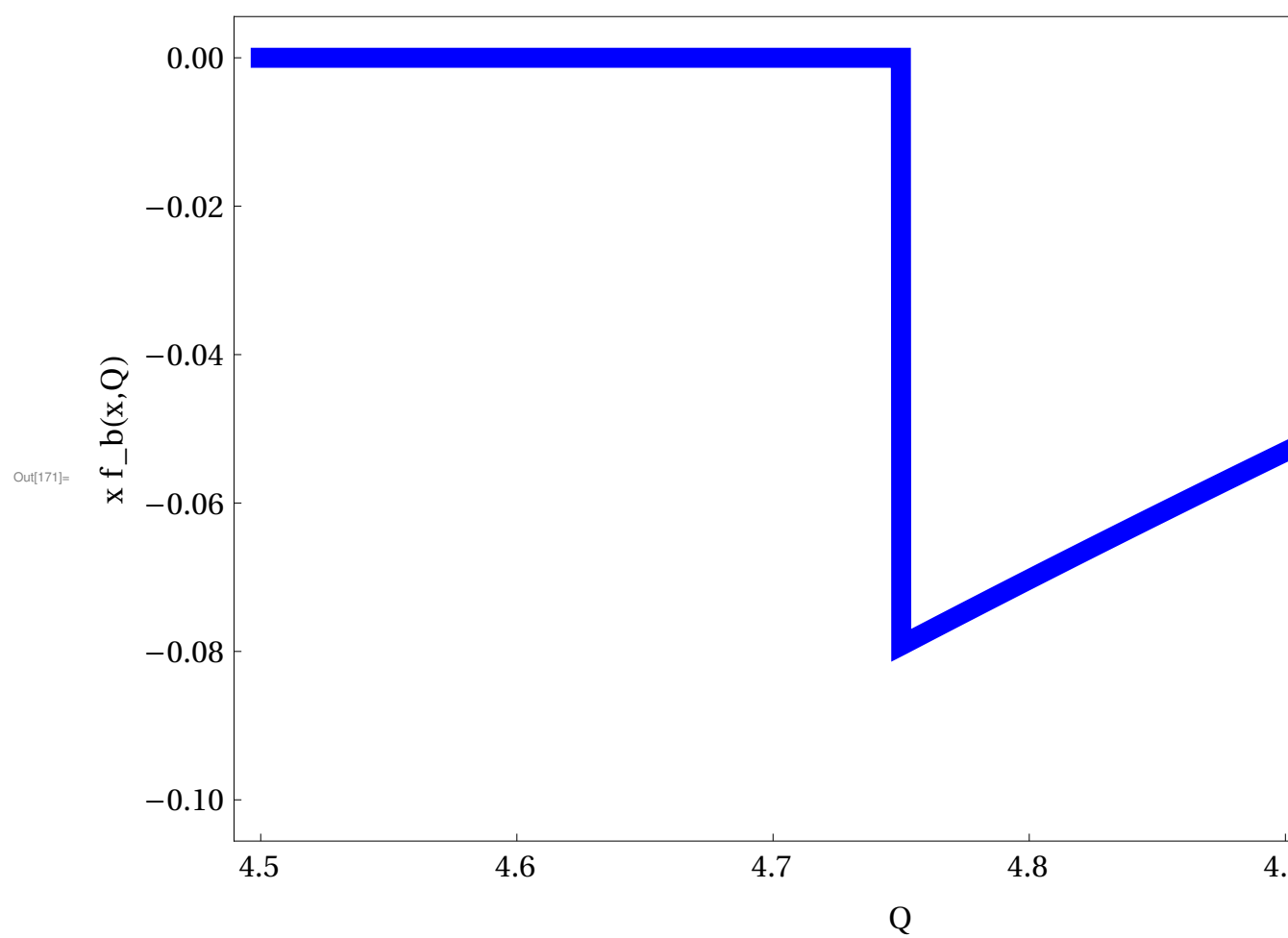
Out[171]=

Plotting Single Functions

In[172]:=
```
isetMax = 10;
q0 = 10.;
ipart = 1;
Plot[Table[ x pdf[iset, ipart, x, q0], {iset, 1, isetMax}] // Evaluate , {x, 10.^-4, 1}]
```
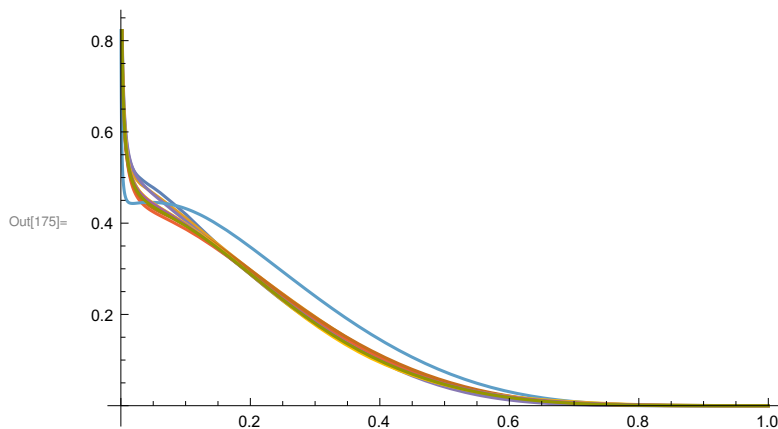
Out[175]=

In[176]:=
```
pdfSetList // TableForm
```

Out[176]//TableForm=

1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/abm12lhc_5_nnlo_0000.dat
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_0000.dat
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_0000.dat
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/HERAPDF20_NLO_VAR_0000.dat
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl /MSTW2008nnlo68cl_ 0000.dat
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_1_1_0000.dat
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/nCTEQ15_208_82_0000.dat
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118_nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m.p(

In[177]:=
```
Plot[Range[8] // Evaluate , {x, 0, 1}, PlotStyle → Thick ,
  AxesOrigin → {0, 0}, Ticks → {None, Range[8]}, PlotLabel → "Line Colors"]
```

Out[177]=

In[178]:=
```
q0 = 10.;
iset0 = 1;
pdfSetList[[iset0, 2]]
Do[
 title = {"ipart=" <> ToString[ipart] <> "=" <> pdfFlavor[ipart], "Q=" <> ToString[q0]};
 GraphicsGrid[{{
    Plot[Table[x pdf[iset, ipart, x, q0], {iset, 1, isetMax}] // Evaluate,
     {x, 10.^-4, 1}, PlotLabel → title, ImageSize → Medium],
    LogLinearPlot[Table[x pdf[iset, ipart, x, q0], {iset, 1, isetMax}] // Evaluate,
     {x, 10.^-4, 1}, PlotLabel → title, ImageSize → Medium],
    LogLinearPlot[Table[
      x pdf[iset, ipart, x, q0]
      ───────────────────────, {iset, 1, isetMax}] // Evaluate,
      x pdf[iset0, ipart, x, q0]
     {x, 10.^-4, 1}, PlotLabel → title, ImageSize → Medium]
   }}] // Print;
 , {ipart, -2, 5, 1}]
```

Out[180]= /usr/local/share/LHAPDF/abm12lhc_5_nnlo/abm12lhc_5_nnlo_0000.dat

{ipart =1=down , Q=10.} {ipart =1=down , Q=10.} {ipart =1=down , Q=10.}

{ipart =2=up , Q=10.} {ipart =2=up , Q=10.} {ipart =2=up , Q=10.}

{ipart =3=strange , Q=10.} {ipart =3=strange , Q=10.} {ipart =3=strange , Q=10.}

{ipart =4=charm , Q=10.} {ipart =4=charm , Q=10.} {ipart =4=charm , Q=10.}

{ipart =5=bottom , Q=10.} {ipart =5=bottom , Q=10.} {ipart =5=bottom , Q=10.}
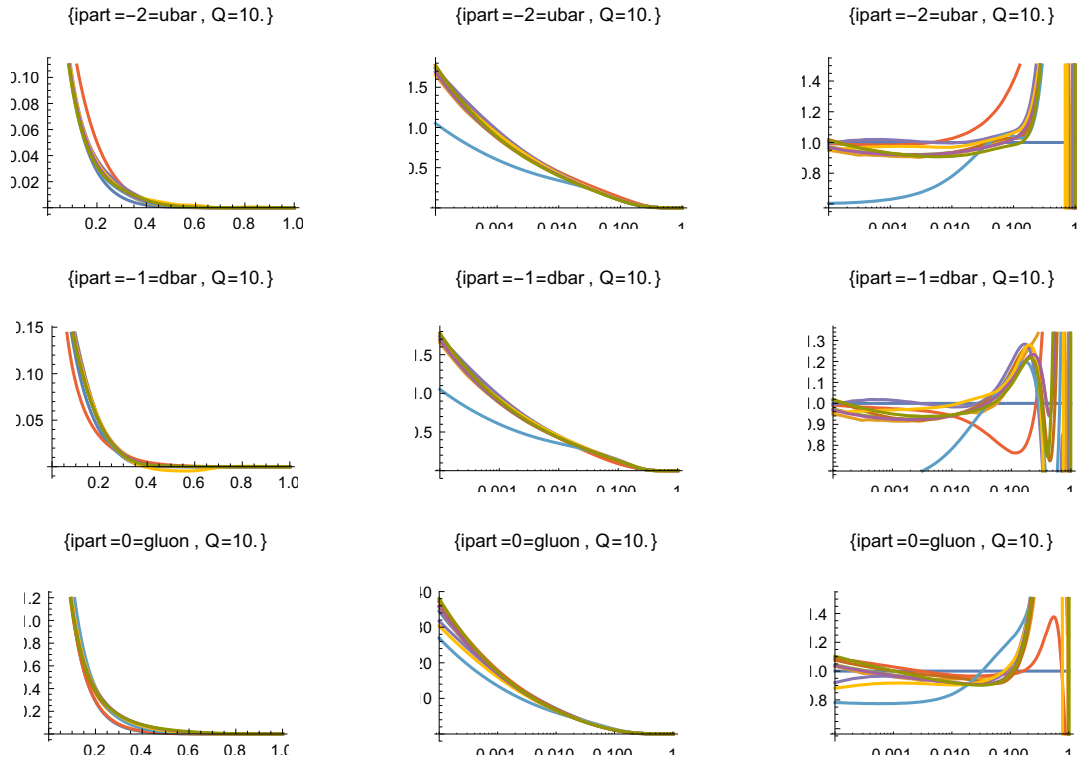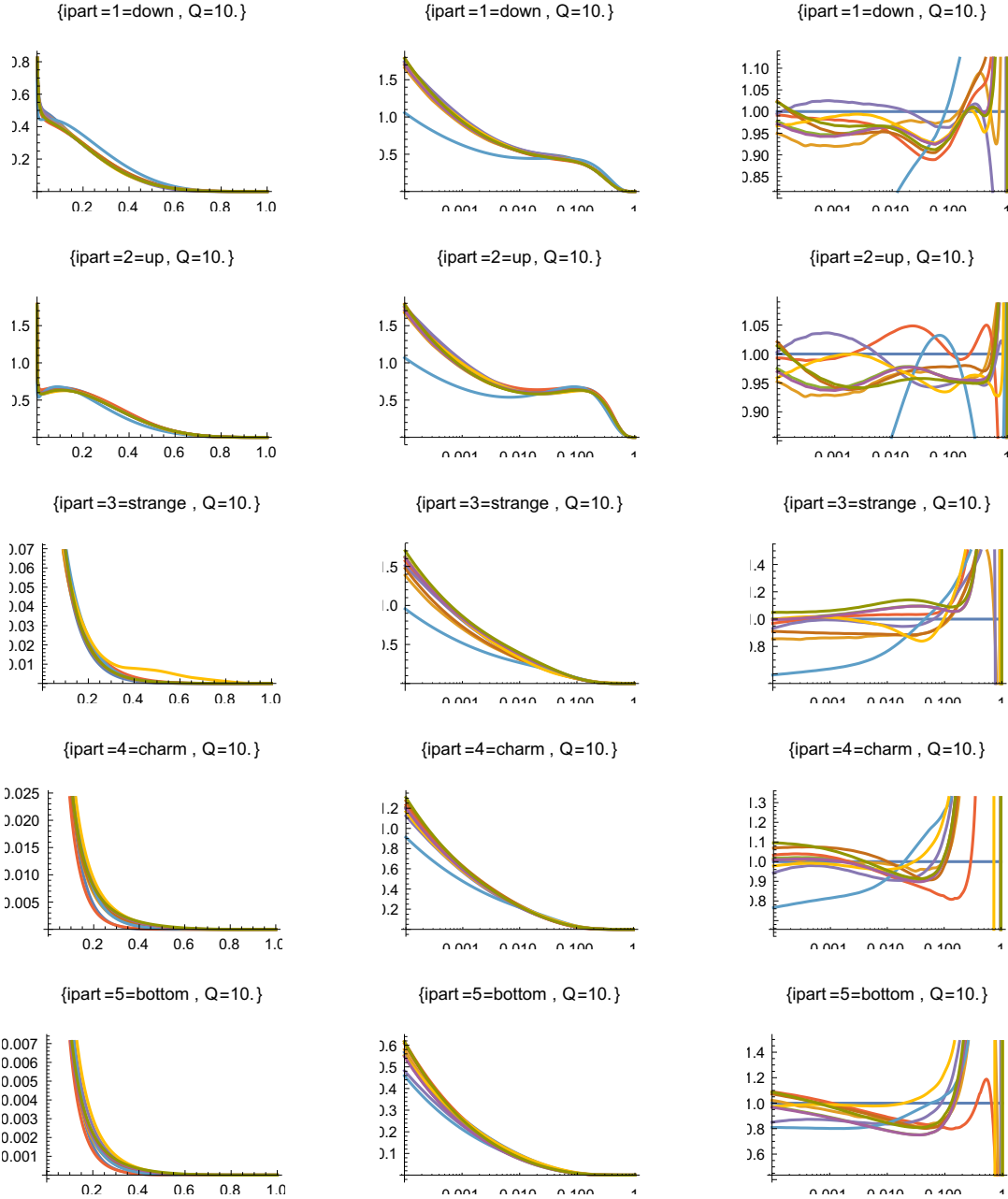
Testing : Not for demo file

In[182]:=
```
Do[
  Print["iset =", iset];
  Print[pdfSetList[[iset, 2]]];
  Table[pdf[1, RandomInteger[{-5, 5}], RandomReal[], q0], {i, 1000}] // Timing // First //
   Print;
  , {iset, 1, isetMax}]
```

iset =1

/usr/local/share/LHAPDF/abm12lhc_ 5_nnlo/abm12lhc_ 5_nnlo_0000.dat

0.666816

iset =2

/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat

0.697799

iset =3

/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat

0.667981

iset =4

/usr/local/share/LHAPDF/HERAPDF20_NLO _VAR/HERAPDF20_NLO _VAR_0000.dat

0.680412

iset =5

/usr/local/share/LHAPDF/MSTW2008nnlo68cl /MSTW2008nnlo68cl_ 0000.dat

0.678595

iset =6

/usr/local/share/LHAPDF/nCTEQ15_ 1_1/nCTEQ15_ 1_1_0000.dat

0.674949

iset =7

/usr/local/share/LHAPDF/nCTEQ15_ 208_82/nCTEQ15_ 208_82_0000.dat

0.67155

iset =8

/usr/local/share/LHAPDF/NNPDF30_nnlo _as_0118_nf_6/NNPDF30_nnlo _as_0118_nf_6_0000.dat

0.688471

iset =9

/home/olness/Dropbox /mp/ManeParse5_DEMO /FOR WEB/ManeParse5_Demo //PDFDIR /PDS/ct10 .pds/ct10 .00.pds

0.702047

iset =10

/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR
   WEB/ManeParse5_Demo//PDFDIR/PDS/ctq66m.pds/ctq66.00.pds

0.688518

Mom Frac

In[183]:= **pdfSetInterpolator ["ManeParse "]**
pdfSetXpower [1]

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1.5

ManeParse cubic interpolation   will be used .

The x-power of the interpolation   is set to 1

In[185]:= **qlist = Join[Table[10.^i, {i, 0, 1, 1/16}], Table[10.^i, {i, 1, 5, 1/8}]] // Sort**

Out[185]= {1., 1.15478, 1.33352, 1.53993, 1.77828, 2.05353, 2.37137, 2.73842,
   3.16228, 3.65174, 4.21697, 4.86968, 5.62341, 6.49382, 7.49894, 8.65964,
   10., 10., 13.3352, 17.7828, 23.7137, 31.6228, 42.1697, 56.2341, 74.9894,
   100., 133.352, 177.828, 237.137, 316.228, 421.697, 562.341, 749.894, 1000.,
   1333.52, 1778.28, 2371.37, 3162.28, 4216.97, 5623.41, 7498.94, 10 000.,
   13 335.2, 17 782.8, 23 713.7, 31 622.8, 42 169.7, 56 234.1, 74 989.4, 100 000.}

In[186]:= **momF[ipart_ , q_] := NIntegrate [x pdf[iset0 , ipart , x, q], {x, 0, 1}]**
SetAttributes [momF , Listable]

In[188]:= **pdfSetListDisplay []**

Out[188]=

Set Number	File Name	Max Flavors	Valance Flavors
1	/usr/local/share/LHAPDF/abm12lhc_5_nnlo/ abm12lhc_5_nnlo_0000.dat	5	n/a
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat	5	n/a
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat	5	n/a
4	/usr/local/share/LHAPDF/HERAPDF20_NLO_VAR/ HERAPDF20_NLO_VAR_0000.dat	6	n/a
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl / MSTW2008nnlo68cl_0000.dat	5	n/a
6	/usr/local/share/LHAPDF/nCTEQ15_1_1/nCTEQ15_ 1_1_0000.dat	5	n/a
7	/usr/local/share/LHAPDF/nCTEQ15_208_82/ nCTEQ15_208_82_0000.dat	5	n/a
8	/usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118 _nf_6/NNPDF30_nnlo_as_0118_nf_6_0000.dat	6	n/a
9	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/ ct10.00.pds	5	2
10	/home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m. pds/ctq66.00.pds	5	2

In[189]:= **iset0 = 4;**
iset0 = 3;

In[191]:= **tab1 = Outer[momF, Range[-6, 6], qlist];**

In[192]:= **tab1[[4]]**

Out[192]= {0.0155646 , 0.0166695 , 0.0176523 , 0.0185322 , 0.0193256 , 0.0200465 , 0.0207063 ,
0.0213139 , 0.0218765 , 0.0223998 , 0.0228881 , 0.0233473 , 0.0237825 , 0.0241934 ,
0.02458 , 0.0249455 , 0.0252916 , 0.0252916 , 0.0259328 , 0.0265152 , 0.027048 , 0.0275386 ,
0.0279893 , 0.0284085 , 0.0288018 , 0.0291647 , 0.0295089 , 0.0298304 , 0.0301351 ,
0.0304225 , 0.0306958 , 0.0309536 , 0.0312032 , 0.0314345 , 0.0316663 , 0.0318738 ,
0.0320817 , 0.0322807 , 0.0324651 , 0.032654 , 0.0328262 , 0.0329913 , 0.0331629 ,
0.0333165 , 0.0334634 , 0.0336178 , 0.0337814 , 0.0339479 , 0.0340956 , 0.034174}

In[193]:= **tab1[[5 ;; 12]] // Length**

Out[193]= 8

In[194]:= `tab2 = Transpose /@ (Join[{qlist, #}] & /@ (100 * tab1[[5 ;; 13]]));`

In[195]:= `tab2[[1]]`

Out[195]= {{1., 2.64518}, {1.15478, 2.70782}, {1.33352, 2.76446},
  {1.53993, 2.81604}, {1.77828, 2.86333}, {2.05353, 2.90691}, {2.37137, 2.94728},
  {2.73842, 2.98485}, {3.16228, 3.01996}, {3.65174, 3.0529}, {4.21697, 3.08384},
  {4.86968, 3.11323}, {5.62341, 3.14149}, {6.49382, 3.1683}, {7.49894, 3.19349},
  {8.65964, 3.21734}, {10., 3.23995}, {10., 3.23995}, {13.3352, 3.2819},
  {17.7828, 3.32008}, {23.7137, 3.35507}, {31.6228, 3.38736}, {42.1697, 3.41707},
  {56.2341, 3.44476}, {74.9894, 3.47077}, {100., 3.49482}, {133.352, 3.51766},
  {177.828, 3.53902}, {237.137, 3.5593}, {316.228, 3.57846}, {421.697, 3.5967},
  {562.341, 3.61393}, {749.894, 3.63065}, {1000., 3.64616}, {1333.52, 3.66171},
  {1778.28, 3.67566}, {2371.37, 3.68964}, {3162.28, 3.70305}, {4216.97, 3.71549},
  {5623.41, 3.72825}, {7498.94, 3.7399}, {10 000., 3.75108}, {13 335.2, 3.76272},
  {17 782.8, 3.77314}, {23 713.7, 3.78313}, {31 622.8, 3.79363},
  {42 169.7, 3.80477}, {56 234.1, 3.81612}, {74 989.4, 3.82621}, {100 000., 3.83159}}

In[196]:= `? pdf*`

Out[196]=

⌄ Global`

pdf

⌄ pdfCalc`

pdfAlphaS	**pdfFunction**	**pdfGetInfo**	**pdfGetXlist**	**pdfLuminosity**	**pdfReset**	**pdfSetList**	**pdfSetXpower**
pdfFlavor	**pdfFunctionX**	**pdfGetQlist**	**pdfLowFunction**	**pdfNumQpartition**	**pdfSetInterpolator**	**pdfSetListDisplay**	**pdfXmin**

⌄ pdfErrors`

pdfError	**pdfHessianCorrelation**	**pdfMCCentral**	**pdfMCCorrelation**
pdfFamilyFunction	**pdfHessianError**	**pdfMCCentralInterval**	**pdfMCError**

⌄ pdfParseCTEQ`

pdfFamilyParseCTEQ	**pdfParseCTEQ**

⌄ pdfParseLHA`

pdfFamilyParseLHA	**pdfParseLHA**

In[197]:=
```
tmp1 = {tab1 // Transpose // Last, Table[pdfFlavor[i], {i, -6, 6}]} // Transpose;
tmp1 // TableForm
```

Out[198]//TableForm=
```
0.            tbar
0.0218099     bbar
0.0269499     cbar
0.034174      sbar
0.0383159     ubar
0.0415864     dbar
0.491546      gluon
0.0954754     down
0.169417      up
0.034174      strange
0.0269499     charm
0.0218099     bottom
0.            top
```

In[199]:=
```
tmp1[[5 ;; 12]] // Sort // Reverse // TableForm
```

Out[199]//TableForm=
```
0.491546      gluon
0.169417      up
0.0954754     down
0.0415864     dbar
0.0383159     ubar
0.034174      strange
0.0269499     charm
0.0218099     bottom
```

In[200]:=
```
ticksY = {
    {.1, MaTeX["10^{-1}", FontSize -> 30]},
    {1, MaTeX["10^{0}", FontSize -> 30]},
    {10, MaTeX["10^{1}", FontSize -> 30]},
    {100, MaTeX["10^{2}", FontSize -> 30]}
   };
ticksX = {
    {1, MaTeX["10^{0}", FontSize -> 30]},
    {10, MaTeX["10^{1}", FontSize -> 30]},
    {100, MaTeX["10^{2}", FontSize -> 30]},
    {1000, MaTeX["10^{3}", FontSize -> 30]},
    {10 000, MaTeX["10^{4}", FontSize -> 30]}
   };
```

```
In[202]:= ListLogLogPlot[tab2, Joined → True, PlotRange → {{0.5, 1*10^4}, {10.^-1, 100}},
    BaseStyle → {FontSize → 18, FontFamily → "Times"}, PlotStyle → Thick,
    FrameLabel → {MaTeX["Q (GeV)", FontSize -> 36],
      MaTeX["Momentum∼Fraction∼\%", FontSize -> 36]},
    Frame → {True, True, True, True},
    FrameTicks → {{ticksY, None}, {ticksX, None}},
    ImageSize → 800
    ]
```
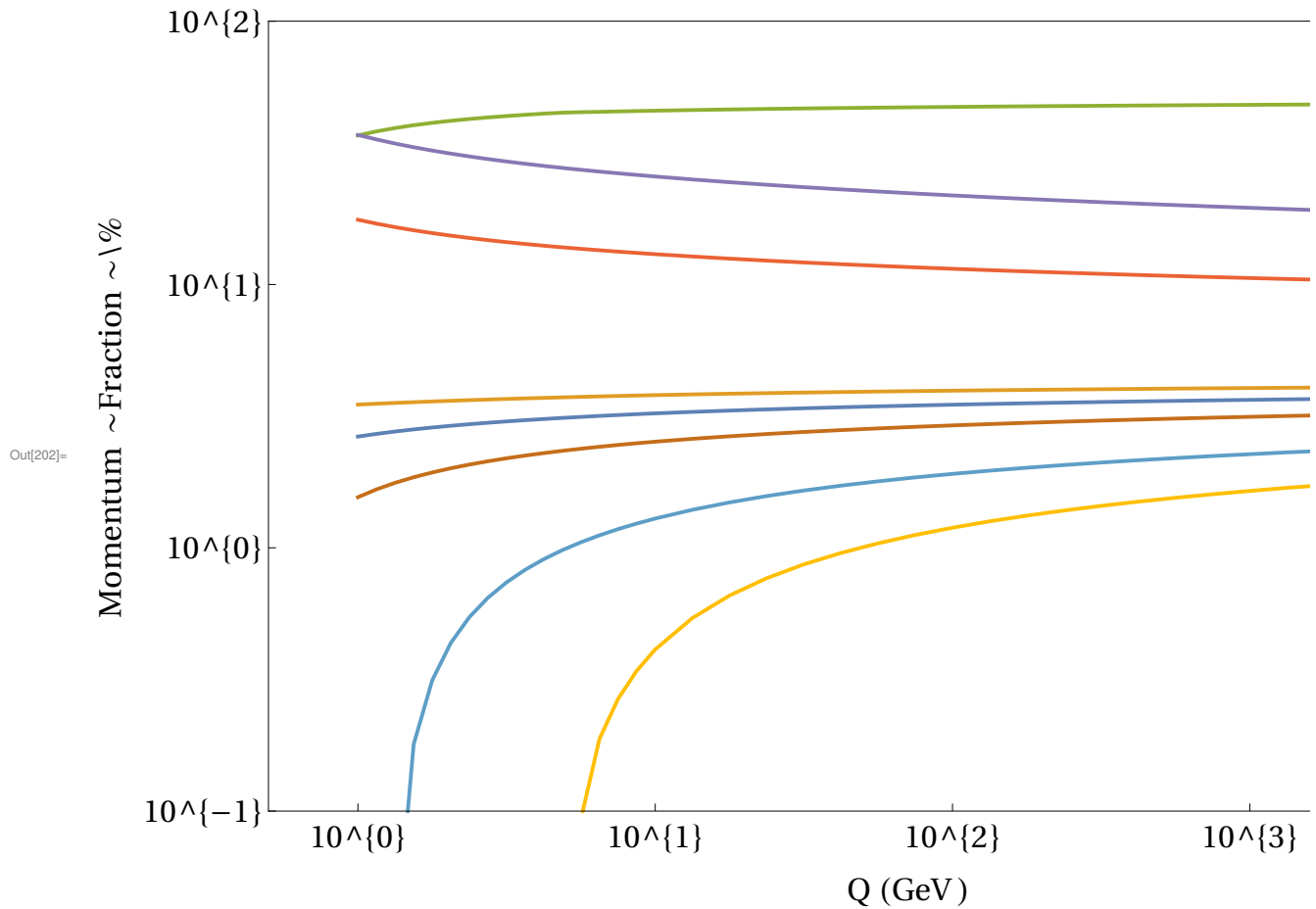
In[203]:= `ListLogLogPlot[tab2, Joined → True, PlotRange → {{0.5, 10^3}, {10.^-1, 100}},`
`BaseStyle → {FontSize → 18, FontFamily → "Times"}, Ticks →`
`{{1, 3, 10, 30, 100, 300, 1000}, {0.3, 1, 3, 10, 30, 100}}, PlotLegends → Automatic]`
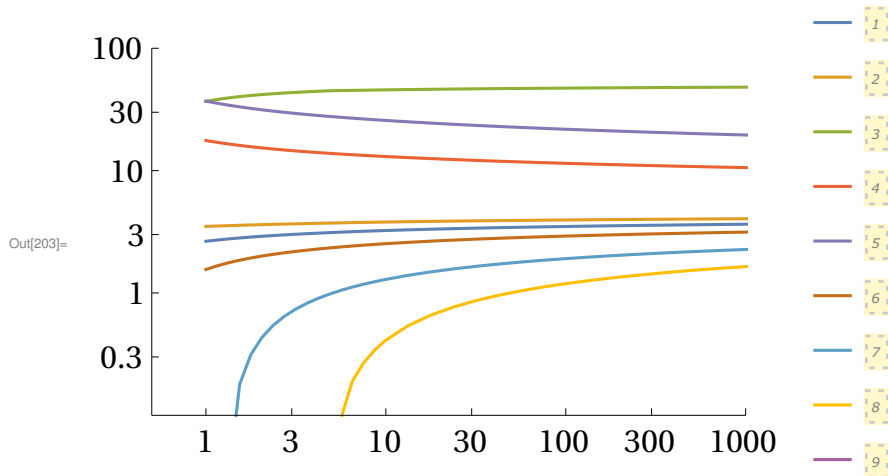
Out[203]=

Error PDF

In[204]:= `pdsList // dropPath`

Out[204]= {ct10.pds, ctq66m.pds}

In[205]:= `xPower = 1;`
`q0 = 10.;`

In[207]:= `file = Select[pdsList, StringMatchQ[#, "*ctq66m.pds"] &] // First`

Out[207]= /home/olness/Dropbox/mp/ManeParse5_DEMO/FOR WEB/ManeParse5_Demo//PDFDIR/PDS/ctq66m.pds

In[208]:= `set66 = pdfFamilyParseCTEQ[file]`

Included 45 files in the PDF family.

Out[208]= {11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55}

In[209]:= `lhaList // dropPath // Short`

Out[209]//Short= {abm12lhc_5_nnlo, ABMP16_3_nlo, CJ15nlo, CT10, CT10nlo, ≪98≫, nuanua1FullNuc_13_7, nuanua1FullNuc_16_8, nuanua1FullNuc_208_82, nuanua1FullNuc_40_18, nuanua1FullNuc_56_26}

In[210]:= `file = Select[lhaList, StringMatchQ[#, "*nCTEQ15_208_82"] &] // First`

Out[210]= /usr/local/share/LHAPDF/nCTEQ15_208_82

In[211]:= **set208 = pdfFamilyParseLHA [file]**

Successfully read /usr/local/share/LHAPDF /nCTEQ15_ 208_82/nCTEQ15_ 208_82.info.

Included 33 files in the PDF family .

Out[211]= {56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70,
71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88}

In[212]:= **xlist = Table[10. ^i, {i, -4, 0, 1 / 20}] // Drop[#, -1] &**

Out[212]= {0.0001 , 0.000112202 , 0.000125893 , 0.000141254 , 0.000158489 , 0.000177828 ,
0.000199526 , 0.000223872 , 0.000251189 , 0.000281838 , 0.000316228 , 0.000354813 ,
0.000398107 , 0.000446684 , 0.000501187 , 0.000562341 , 0.000630957 , 0.000707946 ,
0.000794328 , 0.000891251 , 0.001, 0.00112202 , 0.00125893 , 0.00141254 ,
0.00158489 , 0.00177828 , 0.00199526 , 0.00223872 , 0.00251189 , 0.00281838 ,
0.00316228 , 0.00354813 , 0.00398107 , 0.00446684 , 0.00501187 , 0.00562341 ,
0.00630957 , 0.00707946 , 0.00794328 , 0.00891251 , 0.01, 0.0112202 , 0.0125893 ,
0.0141254 , 0.0158489 , 0.0177828 , 0.0199526 , 0.0223872 , 0.0251189 , 0.0281838 ,
0.0316228 , 0.0354813 , 0.0398107 , 0.0446684 , 0.0501187 , 0.0562341 , 0.0630957 ,
0.0707946 , 0.0794328 , 0.0891251 , 0.1, 0.112202 , 0.125893 , 0.141254 , 0.158489 ,
0.177828 , 0.199526 , 0.223872 , 0.251189 , 0.281838 , 0.316228 , 0.354813 ,
0.398107 , 0.446684 , 0.501187 , 0.562341 , 0.630957 , 0.707946 , 0.794328 , 0.891251}

In[213]:= **set0 = set66**

Out[213]= {11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33,
34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55}

In[214]:=

```
Clear[doit]
doit[ipart_, color_, set_ : set0] := Module[{central, error, mid, up, down, p1},
   central = pdf[set[[1]], ipart, xlist, q0] * xlist ^ xPower;
   error = (#^xPower * pdfHessianError[set, ipart, #, q0]) & /@ xlist;
   mid = Transpose[{xlist, central}];
   up = Transpose[{xlist, central + error}];
   down = Transpose[{xlist, central - error}];
   p1 = ListLogLinearPlot[{up, mid, down},
      Joined → True,
      Filling → {2},
      FillingStyle → LightBlue,
      PlotStyle → ({#, color} & /@ {Thin, Thick, Thin})
     ];
   Return[p1];
  ]
```

```
doit[1, Red, set66]
```

Out[216]=
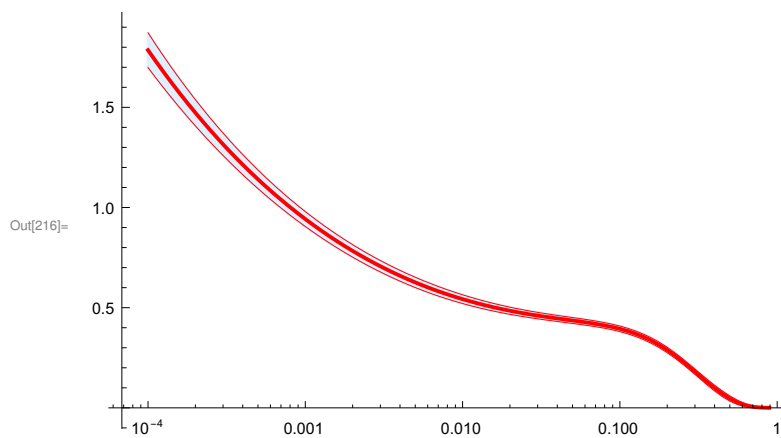
```
In[217]:=  Clear[doit2]
          doit2[ipart_, color_, set_ : set0] := Module[{central, error, mid, up, down, p1},
            central = pdf[set[[1]], ipart, xlist, q0] * xlist ^ xPower;
            error = (#^xPower * pdfHessianError[set, ipart, #, q0]) & /@ xlist;
            mid = Transpose[{xlist, central}];
            up = Transpose[{xlist, central + error}];
            down = Transpose[{xlist, central - error}];
            p1 = ListPlot[{up, mid, down},
               Joined → True,
               Filling → {2},
               FillingStyle → LightBlue,
               PlotStyle → ({#, color} & /@ {Thin, Thick, Thin})
              ];
            Return[p1];
           ]
```

doit2[1, Red]

Out[219]=
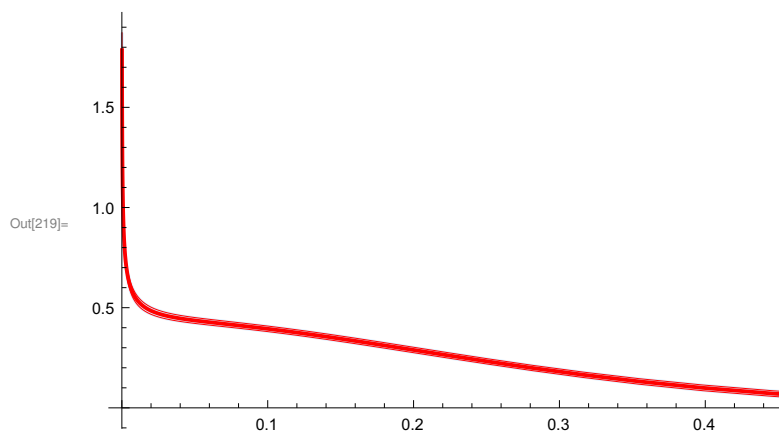
```
In[220]:=  Clear[doitR]
           doitR[ipart_, colorList_ ?ListQ, set_ : set0] :=
            Module[{central, error, mid, up, down, p1},
              central = pdf[set[[1]], ipart, xlist, q0] * xlist^xPower;
              error = (#^xPower * pdfHessianError[set, ipart, #, q0]) & /@ xlist;
              mid = Transpose[{xlist, central/central}];
              up = Transpose[{xlist, 1 + error/central}];
              down = Transpose[{xlist, 1 - error/central}];
              p1 = ListLogLinearPlot[{up, mid, down},
                 Joined → True,
                 Filling → {2},
                 FillingStyle → colorList[[2]],
                 PlotStyle → ({#, colorList[[1]]} & /@ {Thin, Thick, Thin}),
                 PlotRange → {{0.0001, 1}, All},
                 Ticks → {{0.0001, 0.001, 0.01, 0.1, 1}, Automatic},
                 BaseStyle → {FontSize → 18, FontFamily → "Times"}

                ];
              Return[p1];
             ]
```

```
doitR[1, {Red, LightRed}]
```
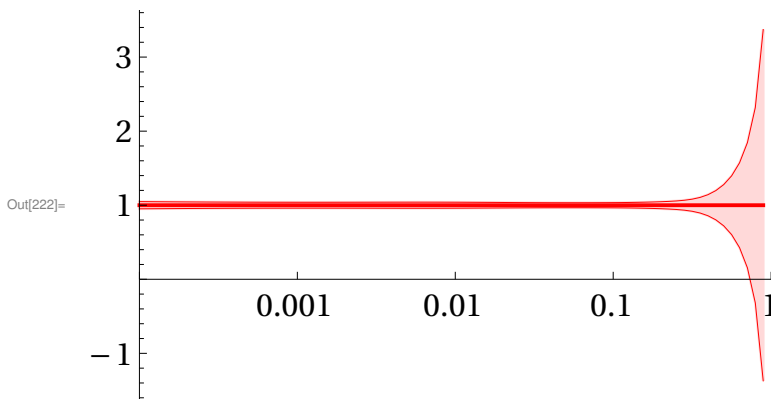


```
In[223]:=  q0
Out[223]=  10.
```

```
In[224]:=  set0
Out[224]=  {11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33,
            34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55}
```

In[225]:= **p1 = doitR[0, {Red, LightRed}, set66]**

Out[225]=
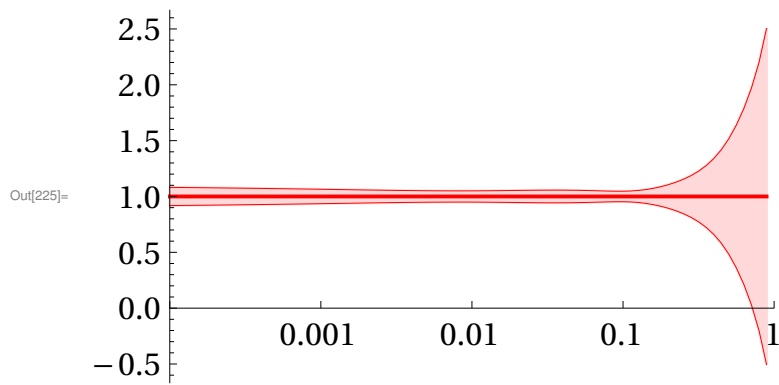
In[226]:= **p2 = doitR[0, {Blue, LightBlue}, set208]**

Out[226]=

In[227]:= **Show[p2, p1]**

Out[227]=
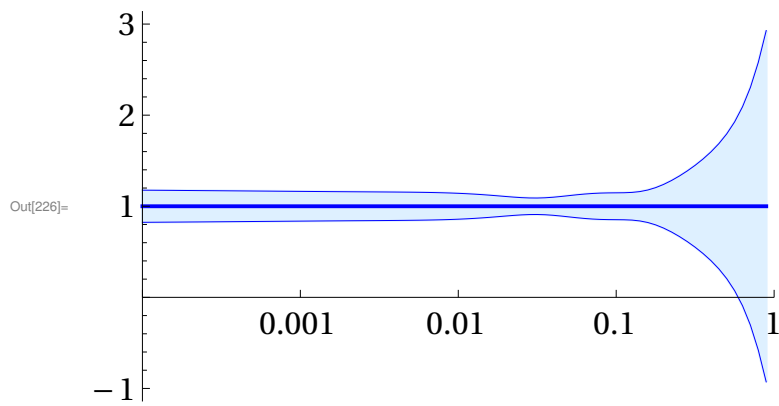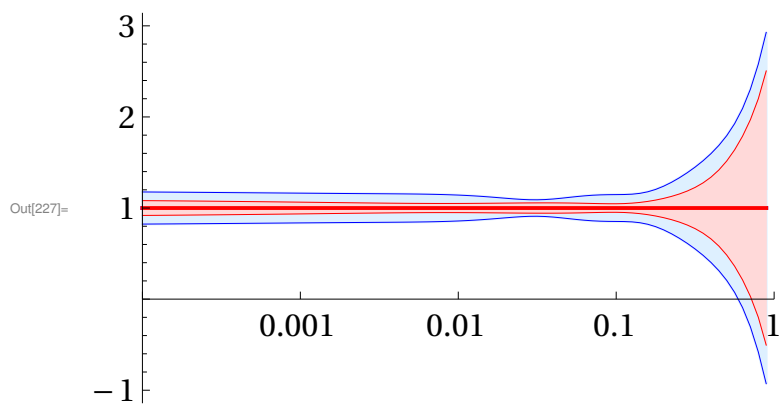
In[228]:=
```
tab1 = Table[10.^i, {i, -5, 0, 1}];
xxlist = {0.3 * tab1, tab1} // Flatten // Sort;
xticks = {Log[xxlist], xxlist} // Transpose
```

Out[230]=
$\{\{-12.7169, 3. \times 10^{-6}\}, \{-11.5129, 0.00001\}, \{-10.4143, 0.00003\},$
$\{-9.21034, 0.0001\}, \{-8.11173, 0.0003\}, \{-6.90776, 0.001\}, \{-5.80914, 0.003\},$
$\{-4.60517, 0.01\}, \{-3.50656, 0.03\}, \{-2.30259, 0.1\}, \{-1.20397, 0.3\}, \{0., 1.\}\}$

In[231]:=
```
tab1 = Table[10.^i, {i, -5, 0, 1}];
xxlist = {tab1} // Flatten // Sort;
xticks = {Log[xxlist], xxlist} // Transpose
```

Out[233]=
$\{\{-11.5129, 0.00001\}, \{-9.21034, 0.0001\},$
$\{-6.90776, 0.001\}, \{-4.60517, 0.01\}, \{-2.30259, 0.1\}, \{0., 1.\}\}$

In[234]:=
```
ticksX = {
   {Log[.001], MaTeX["0.001", FontSize -> 30]},
   {Log[.01], MaTeX["0.01", FontSize -> 30]},
   {Log[.1], MaTeX["0.1", FontSize -> 30]},
   {Log[1], MaTeX["1", FontSize -> 30]}
  };
ticksY = {
   {.7, MaTeX["0.7", FontSize -> 30]},
   {.8, MaTeX["0.8", FontSize -> 30]},
   {.9, MaTeX["0.9", FontSize -> 30]},
   {1, MaTeX["1.0", FontSize -> 30]},
   {1.1, MaTeX["1.1", FontSize -> 30]},
   {1.2, MaTeX["1.2", FontSize -> 30]},
   {1.3, MaTeX["1.3", FontSize -> 30]}
  };

plots = Show[p2, p1,
  PlotRange -> {{Log[2 * 10.^-4], Log[1]}, {0.7, 1.3}},
  AxesOrigin -> {Log[0.5 * 10.^-4], 0.7},
  FrameLabel ->
   {MaTeX["x", FontSize -> 36], MaTeX["Uncertainty~Ratios", FontSize -> 36]},
  Frame -> {True, True, True, True},
  FrameTicks -> {{ticksY, None}, {ticksX, None}},
  ImageSize -> 800
 ]
```

Out[236]=
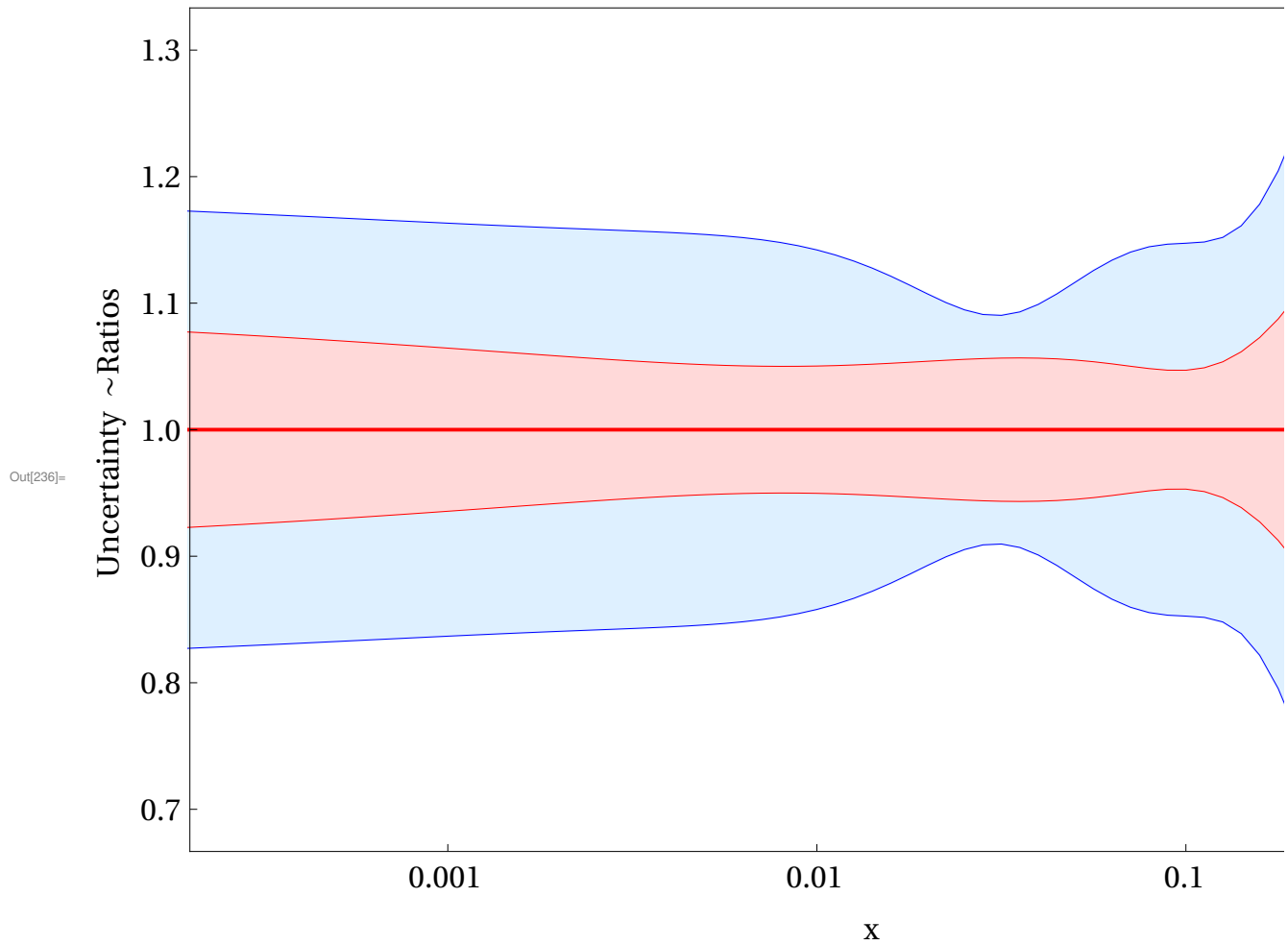
```
In[237]:=  keyList = {"", "CTEQ6.6", "nCTEQ15~{}^{208}_{82}Pb"};

In[238]:=  colorList = {Red, Blue};
          directList = {{colorList[[1]], Thick},
              {colorList[[2]], Thick}};
          Table[Graphics[{Directive[directList[[i]]], Circle[{0, 0}, .01]}], {i, 1, 2}]
```

Out[240]=
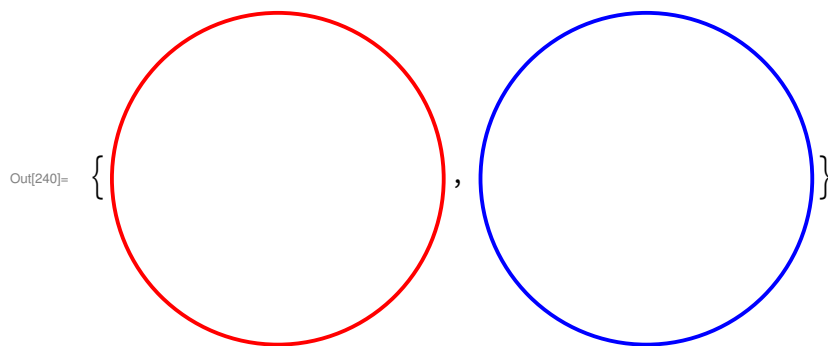
```
In[241]:= lin = Line[{Offset[{0, 20}, {0, 0}], Offset[{0, 20}, {30, 0}]}];
title = MaTeX["\\mathrm{Down}~@~Q=10\\, \\mathrm{GeV}", FontSize → 48];
namers = Table[
    MaTeX["\\mathrm{" <> keyList[[i + 1]] <> "}", FontSize → 48], {i, 1, Length[keyList] - 1}];
legTable = Table[{Graphics[{Directive[directList[[i]]], lin}], namers[[i]]},
    {i, 1, Length[namers]}];
leg2 =
 LineLegend[
  Table[Directive[directList[[i]]], {i, 1, Length[namers]}],
  namers,
  LegendLayout → {"Column", 2},
  LegendMarkers → Graphics[lin],
  LegendMarkerSize → {90, 12},
  LegendLabel → title

  ]
```

<div style="text-align:center">\mathrm{Down}~@~Q=10\, \mathrm{GeV}</div>

Out[245]= ————————— \mathrm{CTEQ6.6}   ————————— \mathrm{nCTEQ15~{}^{208}_{82}Pb}

In[246]:= **Show[**
   Legended[plots,
    Placed[Pane[leg2, 350, ImageSizeAction → "ResizeToFit"], {{0, 0}, {-.41, -7.1}}]]]

Out[246]=
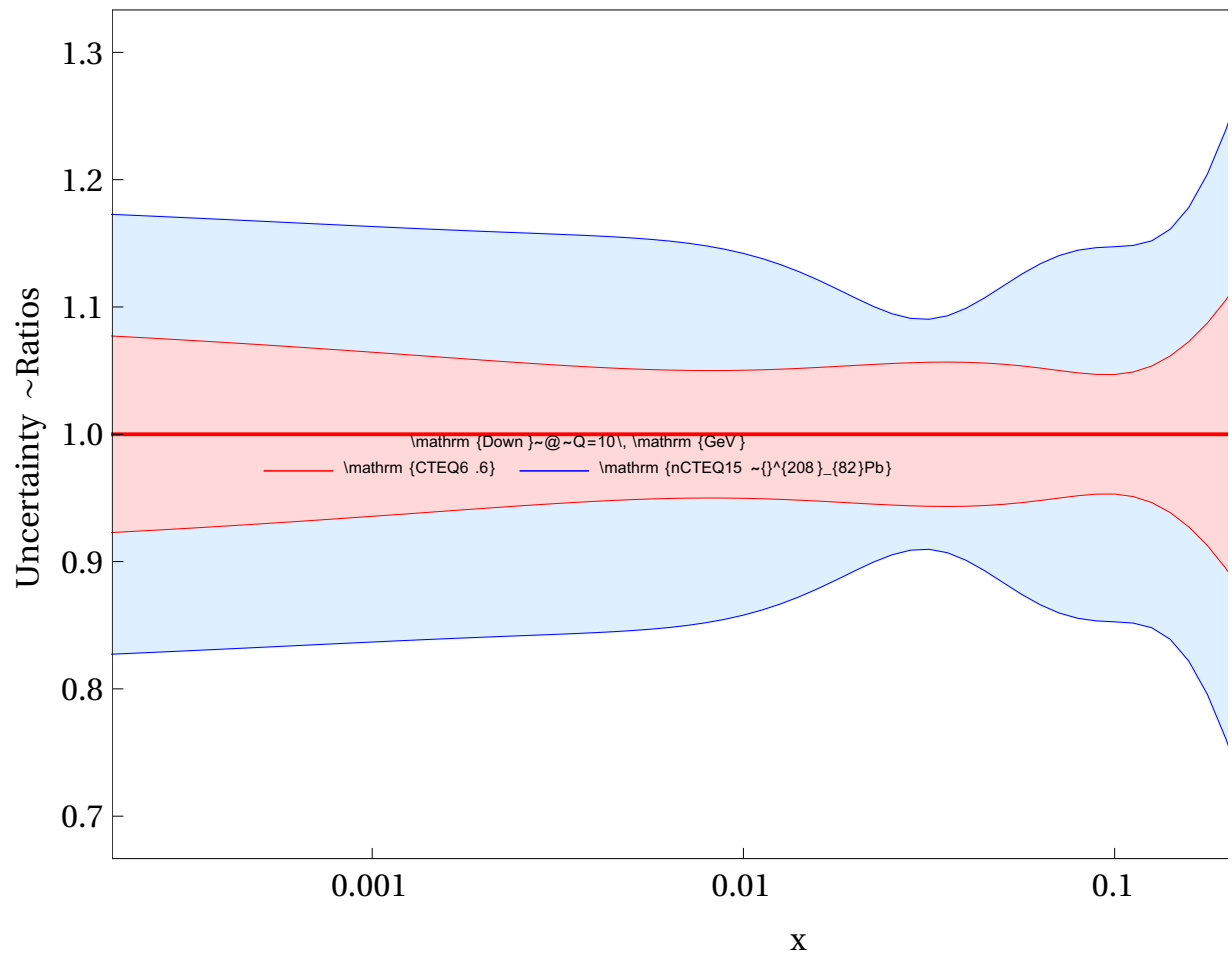
In[247]:= **Log[2 * 10.^-4]**

Out[247]= -8.51719

In[248]:= **Show[**
   doit[-2, Cyan],
   doit[-1, Magenta],
   doit[1, Red],
   doit[2, Green],
   doit[3, Blue]
   ]

Out[248]=
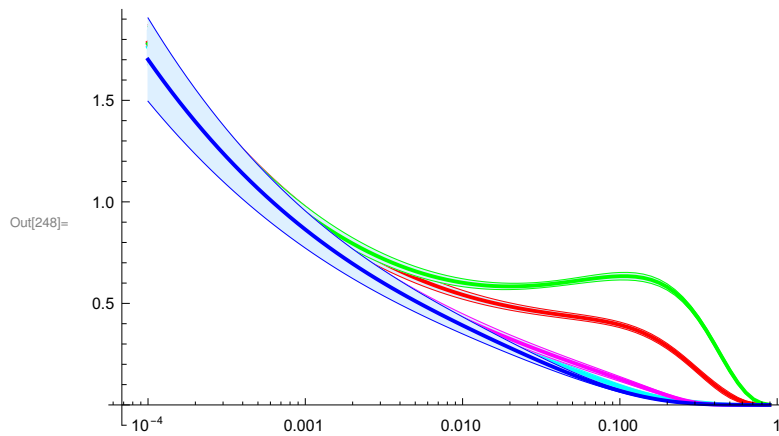
In[249]:= **Show[**
   doit2[-2, Cyan],
   doit2[-1, Magenta],
   doit2[1, Red],
   doit2[2, Green],
   doit2[3, Blue],
   PlotRange → {0, 0.7}
   ]

Out[249]=
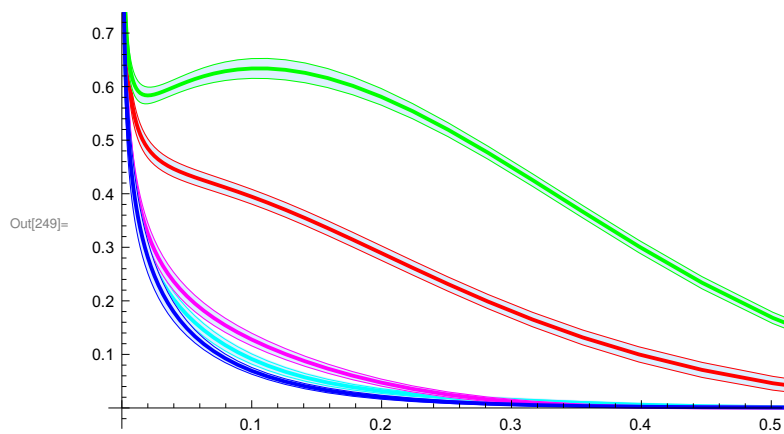
Error PDF

In[250]:= `lhaList // dropPath // Short`

Out[250]//Short= {abm12lhc_5_nnlo, ABMP16_3_nlo, CJ15nlo, CT10,
  CT10nlo, «98», nuanua1FullNuc_13_7, nuanua1FullNuc_16_8,
  nuanua1FullNuc_208_82, nuanua1FullNuc_40_18, nuanua1FullNuc_56_26}

In[251]:= `file = Select[lhaList, StringMatchQ[#, "*CT14nlo"] &] // First`

Out[251]= /usr/local/share/LHAPDF/CT14nlo

In[252]:= `ct14 = pdfFamilyParseLHA[file]`

Successfully read /usr/local/share/LHAPDF/CT14nlo/CT14nlo.info.

Included 57 files in the PDF family.

Out[252]= {89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103,
  104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117,
  118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131,
  132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145}

In[253]:= `file = Select[lhaList, StringMatchQ[#, "*NNPDF30_nnlo_as_0118_nf_6"] &] // First`

Out[253]= /usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118_nf_6

In[254]:= `nn3 = pdfFamilyParseLHA[file]`

Successfully read
 /usr/local/share/LHAPDF/NNPDF30_nnlo_as_0118_nf_6/NNPDF30_nnlo_as_0118_nf_6.info.

Included 101 files in the PDF family.

Out[254]= {146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163,
  164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180,
  181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197,
  198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213,
  214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229,
  230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246}

Why do we need this function ????

In[255]:= `pdf[nn3, 0, 0.1, 10.] == pdfFamilyFunction[nn3, pdfFunction[#, 0, 0.1, 10.] &]`

Out[255]= True

In[256]:= `nlist = pdf[nn3, 0, 0.1, 10.];`
`clist = pdf[ct14, 0, 0.1, 10.];`

In[258]:=
```
{pdfHessianError[ct14, 0, 0.1, 10.],
 pdfHessianError[ct14, 0, 0.1, 10., "sym"],
 pdfHessianError[ct14, 0, 0.1, 10., "plus"],
 pdfHessianError[ct14, 0, 0.1, 10., "minus"]
}
```

Out[258]= {0.680753, 0.680753, 0.648835, 0.847602}

In[259]:=
```
{clist[[1]],
 pdfHessianError[clist],
 pdfHessianError[clist, "sym"],
 pdfHessianError[clist, "plus"],
 pdfHessianError[clist, "minus"]
}
```

Out[259]= {11.4642, 0.680753, 0.680753, 0.648835, 0.847602}

In[260]:=
```
xxlist = Table[10.^i, {i, -4, 0, 1/20}] // Drop[#, -3] &
```

Out[260]= {0.0001, 0.000112202, 0.000125893, 0.000141254, 0.000158489, 0.000177828,
 0.000199526, 0.000223872, 0.000251189, 0.000281838, 0.000316228, 0.000354813,
 0.000398107, 0.000446684, 0.000501187, 0.000562341, 0.000630957, 0.000707946,
 0.000794328, 0.000891251, 0.001, 0.00112202, 0.00125893, 0.00141254,
 0.00158489, 0.00177828, 0.00199526, 0.00223872, 0.00251189, 0.00281838,
 0.00316228, 0.00354813, 0.00398107, 0.00446684, 0.00501187, 0.00562341,
 0.00630957, 0.00707946, 0.00794328, 0.00891251, 0.01, 0.0112202, 0.0125893,
 0.0141254, 0.0158489, 0.0177828, 0.0199526, 0.0223872, 0.0251189, 0.0281838,
 0.0316228, 0.0354813, 0.0398107, 0.0446684, 0.0501187, 0.0562341, 0.0630957,
 0.0707946, 0.0794328, 0.0891251, 0.1, 0.112202, 0.125893, 0.141254,
 0.158489, 0.177828, 0.199526, 0.223872, 0.251189, 0.281838, 0.316228,
 0.354813, 0.398107, 0.446684, 0.501187, 0.562341, 0.630957, 0.707946}
```

In[261]:= $\mathbf{e1} = \left(\dfrac{\mathbf{pdfHessianError\,[ct14,\ 0,\ \#,\ 10.]}}{\mathbf{pdf[ct14[[1]],\ 0,\ \#,\ 10.]}}\right)\ \&\ /@\ \mathbf{xxlist}$

Out[261]= {0.133185 , 0.125563 , 0.118562 , 0.112078 , 0.106141 , 0.100742 , 0.0958575 ,
0.0914063 , 0.0872289 , 0.0833838 , 0.0799073 , 0.0767871 , 0.0739723 , 0.0712883 ,
0.0687416 , 0.0663859 , 0.0642326 , 0.0622856 , 0.0604076 , 0.0585694 , 0.056803 ,
0.0551856 , 0.0538017 , 0.0526334 , 0.0516676 , 0.0508653 , 0.0502023 , 0.0496609 ,
0.0492266 , 0.0488904 , 0.0486467 , 0.0484933 , 0.0484299 , 0.0484569 , 0.0485738 ,
0.0487821 , 0.0490809 , 0.0494655 , 0.0499258 , 0.050445 , 0.0510066 , 0.0515907 ,
0.0521358 , 0.0526353 , 0.0530196 , 0.0532488 , 0.0532844 , 0.053048 , 0.0525517 ,
0.0517137 , 0.0505857 , 0.0491832 , 0.0476118 , 0.0460744 , 0.0447862 , 0.0441769 ,
0.0445451 , 0.0462567 , 0.0493961 , 0.0538128 , 0.0593806 , 0.0655196 , 0.072329 ,
0.0791756 , 0.0864241 , 0.0941563 , 0.1028 , 0.113394 , 0.128259 , 0.151814 ,
0.190672 , 0.25242 , 0.344451 , 0.474166 , 0.650358 , 0.884348 , 1.19304 , 1.59824}

In[262]:= $\mathbf{e1p} = \left(\dfrac{\mathbf{pdfHessianError\,[ct14,\ 0,\ \#,\ 10.,\ "plus"]}}{\mathbf{pdf[ct14[[1]],\ 0,\ \#,\ 10.]}}\right)\ \&\ /@\ \mathbf{xxlist}$

Out[262]= {0.19163 , 0.176127 , 0.161949 , 0.149006 , 0.137225 , 0.126537 , 0.11688 ,
0.108196 , 0.100421 , 0.0935045 , 0.0873879 , 0.0820161 , 0.0773328 , 0.0732838 ,
0.0698104 , 0.066851 , 0.064395 , 0.0623595 , 0.0606709 , 0.0592756 , 0.0581224 ,
0.0570549 , 0.0559742 , 0.0548888 , 0.0538086 , 0.052742 , 0.0518545 , 0.0510455 ,
0.0502533 , 0.0494874 , 0.048752 , 0.048054 , 0.0474011 , 0.0473317 , 0.0473961 ,
0.0475392 , 0.0477827 , 0.0481409 , 0.0485824 , 0.0491344 , 0.049876 , 0.0506297 ,
0.05132 , 0.0519295 , 0.052387 , 0.0526525 , 0.0527041 , 0.0524838 , 0.0520469 ,
0.0513382 , 0.0504584 , 0.0493929 , 0.0482121 , 0.0469643 , 0.0458253 , 0.0451985 ,
0.0451355 , 0.0460896 , 0.0483648 , 0.0519092 , 0.0565965 , 0.0623408 , 0.0704601 ,
0.0800412 , 0.0910087 , 0.102923 , 0.116652 , 0.134273 , 0.156208 , 0.18471 ,
0.224342 , 0.289868 , 0.397332 , 0.558624 , 0.78915 , 1.11826 , 1.59557 , 2.30395}

In[263]:= $\mathbf{e1m} = \left(\dfrac{\mathbf{pdfHessianError\,[ct14,\ 0,\ \#,\ 10.,\ "minus"]}}{\mathbf{pdf[ct14[[1]],\ 0,\ \#,\ 10.]}}\right)\ \&\ /@\ \mathbf{xxlist}$

Out[263]= {0.0842707 , 0.0839209 , 0.0835387 , 0.0830324 , 0.0825164 , 0.0820466 , 0.0816503 ,
0.0812533 , 0.0806249 , 0.0799191 , 0.0792659 , 0.0787061 , 0.0782004 , 0.0774209 ,
0.0764026 , 0.0753012 , 0.0741867 , 0.0731218 , 0.0717608 , 0.0699983 , 0.0678876 ,
0.065652 , 0.0636318 , 0.0618336 , 0.060345 , 0.0590559 , 0.0579463 , 0.0569812 ,
0.0569483 , 0.0570426 , 0.0570855 , 0.057082 , 0.0570559 , 0.0570245 , 0.0570132 ,
0.0570245 , 0.0570351 , 0.0570278 , 0.0569943 , 0.056961 , 0.0569618 , 0.0570441 ,
0.0571574 , 0.0573222 , 0.0574839 , 0.0576072 , 0.0576438 , 0.0575017 , 0.0571585 ,
0.0565138 , 0.0555803 , 0.0543026 , 0.0527017 , 0.0508558 , 0.0504783 , 0.0516851 ,
0.0535476 , 0.0568092 , 0.0618503 , 0.0675229 , 0.0739345 , 0.0803166 , 0.0859808 ,
0.0900996 , 0.0936 , 0.0973515 , 0.101459 , 0.105961 , 0.114133 , 0.133479 ,
0.1725 , 0.23467 , 0.317558 , 0.424282 , 0.556601 , 0.711513 , 0.876195 , 1.01606}

In[264]:= $\mathbf{e2} = \left( \dfrac{\text{pdfMCError}[\text{nn3}, 0, \#, 10.]}{\text{pdf}[\text{nn3}[[1]], 0, \#, 10.]} \right)$ & /@ xxlist

Out[264]= {0.0660002 , 0.0643759 , 0.0624472 , 0.0600921 , 0.0575694 , 0.0549511 , 0.0521479 ,
0.0493553 , 0.046786 , 0.0442453 , 0.0417461 , 0.0393481 , 0.0370189 , 0.0347741 ,
0.0327037 , 0.0307588 , 0.0289266 , 0.0272241 , 0.0256485 , 0.0241919 , 0.0228672 ,
0.0216823 , 0.020625 , 0.0197016 , 0.0189256 , 0.0182809 , 0.0177655 , 0.0173808 ,
0.0171094 , 0.0169396 , 0.0168482 , 0.0168204 , 0.0168508 , 0.0169292 , 0.0170483 ,
0.0172122 , 0.0174131 , 0.0176155 , 0.0178131 , 0.0179946 , 0.0181244 , 0.0182025 ,
0.0182149 , 0.0180284 , 0.0177187 , 0.0174275 , 0.0173116 , 0.0176052 , 0.0185183 ,
0.0198667 , 0.0209761 , 0.0218622 , 0.0223545 , 0.022065 , 0.0213582 , 0.0205681 ,
0.0200311 , 0.019578 , 0.019383 , 0.0197347 , 0.0214102 , 0.0244712 , 0.0276775 ,
0.0302472 , 0.0329451 , 0.0363244 , 0.0409156 , 0.0477261 , 0.0572339 , 0.0710948 ,
0.0940707 , 0.134755 , 0.19998 , 0.284176 , 0.394059 , 0.556242 , 0.949386 , 2.90284}

In[265]:= $\mathbf{e2p} = \left( \dfrac{\text{pdfMCError}[\text{nn3}, 0, \#, 10., "plus"]}{\text{pdf}[\text{nn3}[[1]], 0, \#, 10.]} \right)$ & /@ xxlist

Out[265]= {0.0473574 , 0.0467264 , 0.0450485 , 0.0435047 , 0.0422069 , 0.0404794 , 0.0383357 ,
0.0363098 , 0.0346973 , 0.0331118 , 0.0317302 , 0.0300574 , 0.0285674 , 0.0270128 ,
0.0257814 , 0.0244007 , 0.0234199 , 0.0222864 , 0.0212338 , 0.0196577 , 0.0188355 ,
0.0180604 , 0.0173216 , 0.0160944 , 0.0153073 , 0.0147098 , 0.0137366 , 0.0131547 ,
0.0126406 , 0.0125517 , 0.0123377 , 0.011628 , 0.0115824 , 0.0115902 , 0.0118893 ,
0.0121294 , 0.0124633 , 0.0130561 , 0.0134596 , 0.0138753 , 0.0146016 , 0.0150477 ,
0.0150669 , 0.0153367 , 0.0150447 , 0.0148691 , 0.0141119 , 0.0138841 , 0.0127431 ,
0.0124285 , 0.0121694 , 0.012551 , 0.0128368 , 0.0133229 , 0.0139081 , 0.0148552 ,
0.0155732 , 0.0153529 , 0.013739 , 0.0133227 , 0.0135274 , 0.0150911 , 0.0175663 ,
0.0210279 , 0.0242104 , 0.0264428 , 0.029593 , 0.0352569 , 0.040348 , 0.05029 ,
0.0686057 , 0.103235 , 0.158842 , 0.236839 , 0.380485 , 0.453833 , 0.75226 , 1.5189}

In[266]:= $\mathbf{e2m} = \left( \dfrac{\text{pdfMCError}[\text{nn3}, 0, \#, 10., "minus"]}{\text{pdf}[\text{nn3}[[1]], 0, \#, 10.]} \right)$ & /@ xxlist

Out[266]= {0.0571136 , 0.0556417 , 0.0548248 , 0.0528477 , 0.0501222 , 0.0477634 , 0.0455586 ,
0.041573 , 0.0391584 , 0.036706 , 0.0356808 , 0.0329113 , 0.0295561 , 0.0283058 ,
0.0260069 , 0.0241233 , 0.0227938 , 0.0210911 , 0.0195017 , 0.0176669 , 0.0161926 ,
0.0152016 , 0.0140531 , 0.0130832 , 0.0123166 , 0.0119238 , 0.0113958 , 0.0108938 ,
0.010606 , 0.010519 , 0.0103137 , 0.0102507 , 0.010371 , 0.0103056 , 0.0104594 ,
0.010522 , 0.0106334 , 0.0105827 , 0.0106891 , 0.0108091 , 0.011684 , 0.0115692 ,
0.0111374 , 0.0115497 , 0.011381 , 0.0119319 , 0.0122829 , 0.0117674 , 0.0128256 ,
0.0129791 , 0.0133019 , 0.0131804 , 0.0134023 , 0.0135534 , 0.0141545 , 0.0139556 ,
0.0136867 , 0.0139207 , 0.0143457 , 0.0151232 , 0.0182904 , 0.021173 , 0.0227825 ,
0.0217097 , 0.020926 , 0.0233992 , 0.0291964 , 0.0370561 , 0.045406 , 0.0523999 ,
0.066098 , 0.0851997 , 0.124969 , 0.172211 , 0.238913 , 0.370879 , 0.713007 , 2.13791}

In[267]:= **baseSty**

Out[267]= {FontSize → 18, FontFamily → Times}

In[268]:= **ListLogLogPlot[**
**  {Transpose[{xxlist, e1}],**
**   Transpose[{xxlist, e1p}],**
**   Transpose[{xxlist, e1m}],**
**   Transpose[{xxlist, e2}],**
**   Transpose[{xxlist, e2p}],**
**   Transpose[{xxlist, e2m}]**
**  },**
**  Joined → True, BaseStyle → {FontSize → 18, FontFamily → "Times"},**
**  PlotStyle → {{Thick, Red}, Red, Red, {Thick, Blue}, Blue, Blue},**
**  AxesOrigin → {Automatic, Log[0.01]}]**

Out[268]=



In[269]:= **keyList = {"", "CT14", "NNPDF"};**

In[270]:= **colorList = {Red, Blue};**
**directList = {{colorList[[1]], Thick},**
**    {colorList[[2]], Thick}};**
**Table[Graphics[{Directive[directList[[i]]], Circle[{0, 0}, .01]}], {i, 1, 2}]**

Out[272]= {



,



}

In[273]:=
```
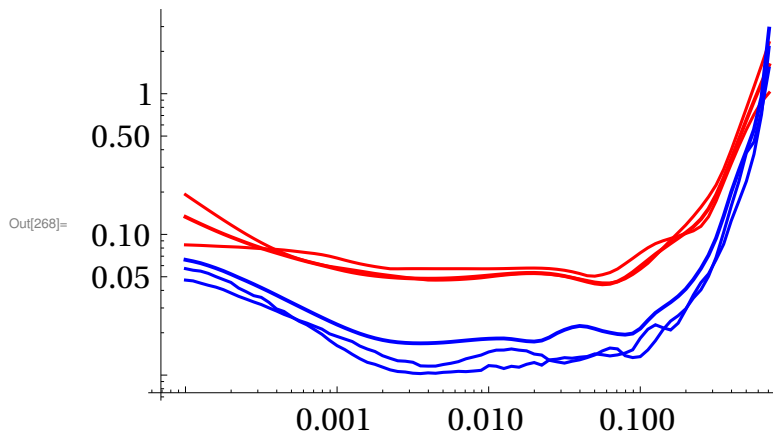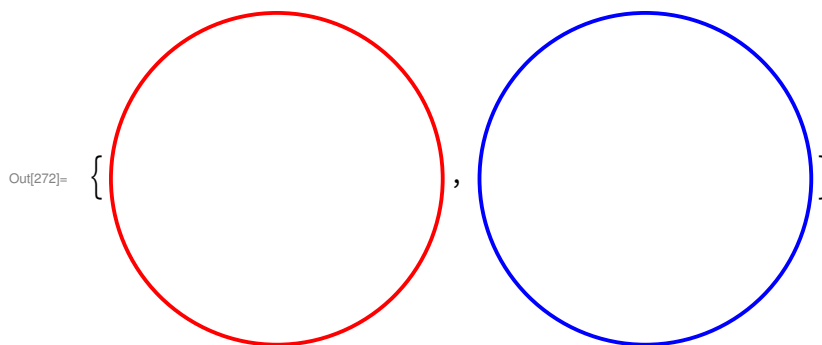lin = Line[{Offset[{0, 20}, {0, 0}], Offset[{0, 20}, {30, 0}]}];
title = MaTeX["\\mathrm{Gluon}~@~Q=10\\, \\mathrm{GeV}", FontSize → 36];
namers = Table[
    MaTeX["\\mathrm{" <> keyList[[i + 1]] <> "}", FontSize → 30], {i, 1, Length[keyList] - 1}];
legTable = Table[{Graphics[{Directive[directList[[i]]], lin}], namers[[i]]},
    {i, 1, Length[namers]}];
leg2 =
 LineLegend[
  Table[Directive[directList[[i]]], {i, 1, Length[namers]}],
  namers,
  LegendLayout → {"Column", 2},
  LegendMarkers → Graphics[lin],
  LegendMarkerSize → {90, 12},
  LegendLabel → title

  ]
```

Out[277]=
\mathrm{Gluon}~@~Q=10\, \mathrm{GeV}
———————— \mathrm{CT14}     ———————— \mathrm{NNPDF}

```
In[278]:= ticksX = {
       {.001, MaTeX["0.001", FontSize -> 30]},
       {.01, MaTeX["0.01", FontSize -> 30]},
       {.1, MaTeX["0.1", FontSize -> 30]},
       {1, MaTeX["1", FontSize -> 30]}
     };
   ticksY = {
       {1, MaTeX["1", FontSize -> 30]},
       {.3, MaTeX["0.3", FontSize -> 30]},
       {.1, MaTeX["0.1", FontSize -> 30]},
       {.03, MaTeX["0.03", FontSize -> 30]},
       {.01, MaTeX["0.01", FontSize -> 30]}
     };

   p2 = ListLogLogPlot[
     {Transpose[{xxlist, e1}],
      Transpose[{xxlist, e2}]},
     Joined → True,
     PlotStyle → {{Thick, Red}, {Thick, Blue}},
     AxesOrigin → {Automatic, 0.01},
     FrameLabel → {MaTeX["x", FontSize -> 36], MaTeX["Fractional ~Error", FontSize -> 36]},
     Frame → {True, True, True, True},
     FrameTicks → {{ticksY, None}, {ticksX, None}},
     ImageSize → 800
    ]
```

Out[280]=

In[281]:= **Show[**
  Legended[p2,
   Placed[Pane[leg2, 260, ImageSizeAction → "ResizeToFit"], {{0, 0}, {-.6, -8.1}}]]]

Out[281]=

Fractional ~Error

\mathrm{Gluon}~@~Q=10\, \mathrm{GeV}
\mathrm{CT14}   \mathrm{NNPDF}

x

In[282]:= **Plot[** $\dfrac{\text{pdfHessianError [ct14, 0, x, 10.]}}{\text{pdf[ct14[[1]], 0, x, 10.]}}$ **, {x, 0, 1}]**

Out[282]=

In[283]:=
```
{pdf[nn3[[1]], 0, 0.1, 10.],
  pdfMCCentral[pdf[nn3, 0, 0.1, 10.]],
  pdfMCError[pdf[nn3, 0, 0.1, 10.]],
  pdfMCError[pdf[nn3, 0, 0.1, 10.], "sym"],
  pdfMCError[pdf[nn3, 0, 0.1, 10.], "plus"],
  pdfMCError[pdf[nn3, 0, 0.1, 10.], "minus"]
}
```

Out[283]= {11.8291, 11.8291, 0.253264, 0.253264, 0.160017, 0.21636}

In[284]:=
```
{nlist[[1]],
  pdfMCCentral[nlist],
  Mean[nlist],
  StandardDeviation[nlist // Drop[#, 1] &],
  pdfMCError[nlist],
  pdfMCError[nlist, "sym"],
  pdfMCError[nlist, "plus"],
  pdfMCError[nlist, "minus"]
}
```

Out[284]= {11.8291, 11.8291, 11.8291, 0.25454, 0.253264, 0.253264, 0.160017, 0.21636}

Lumi

In[285]:= **? pdfLuminosity**

Symbol

Out[285]=

pdfLuminosity [setNumber ,sqrtS ,mX ,flavor1 ,flavor2 ,[precisionGoal]]: This function
  returns the integrated parton –parton luminosity for collider energy $sqrtS = S^{1/2}$,
  particle mass mX, and PDF flavors *flavor1* and *flavor2*, for the set *setNumber*.

The numerical integral is performed with the precision goal in the optional
  parameter *precisionGoal*, which has a default value of *precisionGoal* = 3.

The parton luminosity is defined according to
  Eq.(46) in Campbell, Huston, Stirling, arXiv:hep–ph/0611148 v1

In[286]:= **pdfLuminosity[1, 14000, 80.3, 1, -2]**

Out[286]= 0.00134961

In[287]:= `mtable = Table[10.^i, {i, 1, 3, 1/10}]`

Out[287]= `{10., 12.5893, 15.8489, 19.9526, 25.1189, 31.6228, 39.8107,`
` 50.1187, 63.0957, 79.4328, 100., 125.893, 158.489, 199.526,`
` 251.189, 316.228, 398.107, 501.187, 630.957, 794.328, 1000.}`

In[288]:= `lum[i_] := lum[i] = Transpose[{mtable, pdfLuminosity[1, 14000, #, i, -i] & /@ mtable}]`

In[289]:= **Table[lum[i], {i, 1, 5}]**

Out[289]= {{{10., 0.242954}, {12.5893, 0.149028}, {15.8489, 0.0893069},
    {19.9526, 0.0523621}, {25.1189, 0.0300832}, {31.6228, 0.0169574},
    {39.8107, 0.00938472}, {50.1187, 0.00510262}, {63.0957, 0.00272653},
    {79.4328, 0.0014327}, {100., 0.000739877}, {125.893, 0.000375674},
    {158.489, 0.000187405}, {199.526, 0.0000917814}, {251.189, 0.0000440728},
    {316.228, 0.0000207134}, {398.107, 9.50156×10^{-6}}, {501.187, 4.23811×10^{-6}},
    {630.957, 1.82823×10^{-6}}, {794.328, 7.56979×10^{-7}}, {1000., 2.97643×10^{-7}}},
   {{10., 0.296286}, {12.5893, 0.18337}, {15.8489, 0.110966},
    {19.9526, 0.065763}, {25.1189, 0.0382311}, {31.6228, 0.0218302},
    {39.8107, 0.0122533}, {50.1187, 0.00676501}, {63.0957, 0.00367647},
    {79.4328, 0.00196693}, {100., 0.00103611}, {125.893, 0.000537362},
    {158.489, 0.000274171}, {199.526, 0.00013758}, {251.189, 0.0000677757},
    {316.228, 0.0000327226}, {398.107, 0.0000154396}, {501.187, 7.09129×10^{-6}},
    {630.957, 3.15358×10^{-6}}, {794.328, 1.34769×10^{-6}}, {1000., 5.4793×10^{-7}}},
   {{10., 0.131758}, {12.5893, 0.0794505}, {15.8489, 0.0466339},
    {19.9526, 0.0267312}, {25.1189, 0.0149677}, {31.6228, 0.00819375},
    {39.8107, 0.00438354}, {50.1187, 0.0022925}, {63.0957, 0.0011715},
    {79.4328, 0.000585053}, {100., 0.000284724}, {125.893, 0.000135131},
    {158.489, 0.0000624063}, {199.526, 0.0000279519}, {251.189, 0.0000121072},
    {316.228, 5.05496×10^{-6}}, {398.107, 2.0231×10^{-6}}, {501.187, 7.71702×10^{-7}},
    {630.957, 2.78048×10^{-7}}, {794.328, 9.36598×10^{-8}}, {1000., 2.90824×10^{-8}}},
   {{10., 0.063812}, {12.5893, 0.0406526}, {15.8489, 0.0249133},
    {19.9526, 0.014742}, {25.1189, 0.00845221}, {31.6228, 0.00470971},
    {39.8107, 0.00254226}, {50.1187, 0.00133645}, {63.0957, 0.000683662},
    {79.4328, 0.000339615}, {100., 0.000163616}, {125.893, 0.0000765254},
    {158.489, 0.0000346213}, {199.526, 0.0000150913}, {251.189, 6.31284×10^{-6}},
    {316.228, 2.52387×10^{-6}}, {398.107, 9.57137×10^{-7}}, {501.187, 3.41747×10^{-7}},
    {630.957, 1.13605×10^{-7}}, {794.328, 3.46829×10^{-8}}, {1000., 9.56069×10^{-9}}},
   {{10., 0.012459}, {12.5893, 0.0101162}, {15.8489, 0.00733231},
    {19.9526, 0.00489412}, {25.1189, 0.00306743}, {31.6228, 0.00182439},
    {39.8107, 0.00103751}, {50.1187, 0.000566464}, {63.0957, 0.000298095},
    {79.4328, 0.000151022}, {100., 0.0000737615}, {125.893, 0.0000347774},
    {158.489, 0.0000157849}, {199.526, 6.87796×10^{-6}}, {251.189, 2.86656×10^{-6}},
    {316.228, 1.13934×10^{-6}}, {398.107, 4.28806×10^{-7}}, {501.187, 1.51849×10^{-7}},
    {630.957, 5.01079×10^{-8}}, {794.328, 1.52163×10^{-8}}, {1000., 4.19279×10^{-9}}}}}

In[290]:= `ListLogLogPlot [Table[lum[i], {i, 0, 5}], Joined → True , BaseStyle → baseSty ,`
` PlotStyle → Thick , Ticks → {Automatic , Table[10 ^-i, {i, 10, 0, 2}]}]`

Out[290]=

In[291]:= `ListLogLogPlot [Table[lum[i], {i, 0, 5}],`
` Joined → True ,`
` PlotStyle → Thick ,`
` PlotRange → {0.1 * 10 ^-9, 99},`
` FrameLabel → {"M_X  (GeV)", "Luminosity "},`
` Frame → {True , True , False , False},`
` FrameTicks → {True , True , None , None},`
` BaseStyle → {FontSize → 18, FontFamily → "Times"}`
` ]`

Out[291]=

In[292]:=
```
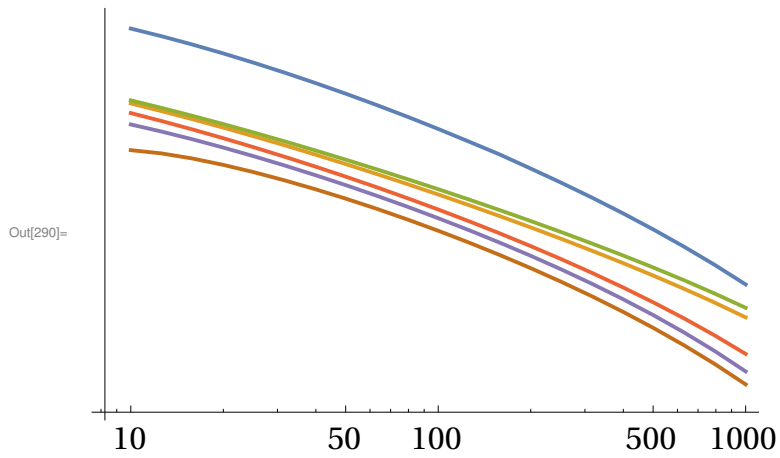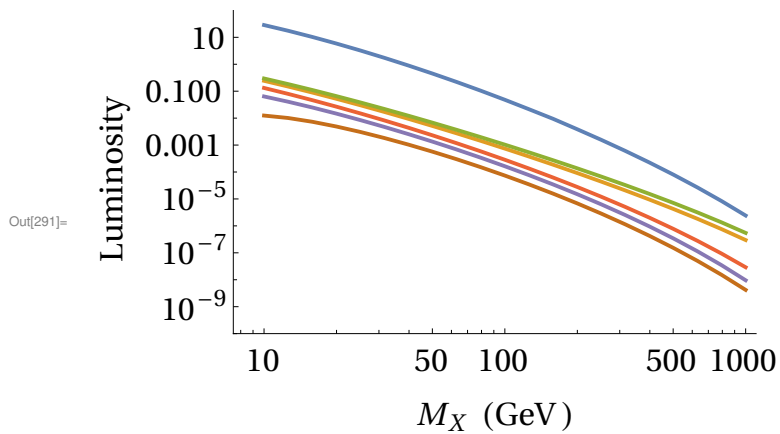ticksY = {
    {1, MaTeX["10^{0}", FontSize -> 30]},
    {10^-2, MaTeX["10^{-2}", FontSize -> 30]},
    {10^-4, MaTeX["10^{-4}", FontSize -> 30]},
    {10^-6, MaTeX["10^{-6}", FontSize -> 30]},
    {10^-8, MaTeX["10^{-8}", FontSize -> 30]}
   };
ticksX = {
    {10, MaTeX["10^{1}", FontSize -> 30]},
    {100, MaTeX["10^{2}", FontSize -> 30]},
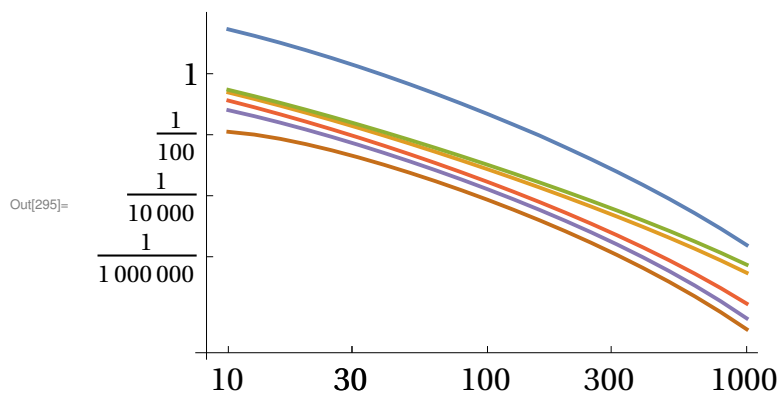    {1000, MaTeX["10^{3}", FontSize -> 30]}
   };
```

In[294]:=
```
ListLogLogPlot [Table[lum[i], {i, 0, 5}], Joined → True ,
    BaseStyle → baseSty ,
    FrameLabel →
     {MaTeX["M_{X}(GeV)", FontSize -> 36], MaTeX["Luminosity ", FontSize -> 36]},
    Frame → {True , True , True , True},
    FrameTicks → {{ticksY , None}, {ticksX , None}},
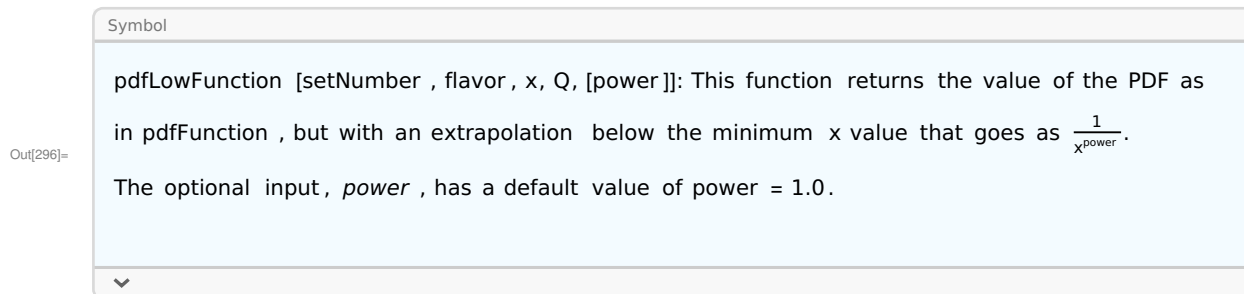    ImageSize → 800
    ]
```

Out[294]=

In[295]:= `ListLogLogPlot[Table[lum[i], {i, 0, 5}], Joined → True, BaseStyle → baseSty,`
`PlotStyle → Thick, Ticks → {{10, 30, 30, 100, 300, 1000}, {10^-6, 10^-4, 10^-2, 1}}]`

Out[295]=

Small x

In[296]:= **? pdfLowFunction**

Out[296]=

Symbol

pdfLowFunction [setNumber, flavor, x, Q, [power]]: This function returns the value of the PDF as in pdfFunction, but with an extrapolation below the minimum x value that goes as $\frac{1}{x^{power}}$.

The optional input, *power*, has a default value of power = 1.0.

In[297]:= `LogLogPlot[pdfLowFunction [7, 0, x, 100.], {x, 10.^-10, 1}, BaseStyle → baseSty]`

Out[297]=

In[298]:= `LogLogPlot[Table[pdfLowFunction[7, 0, x, 100., i], {i, 0.4, 1.6, 0.2}],`
`{x, 10.^-12, 1}, BaseStyle → baseSty, PlotRange → {Log[10^-1], Log[10^15]}]`

Out[298]=

In[299]:=
```
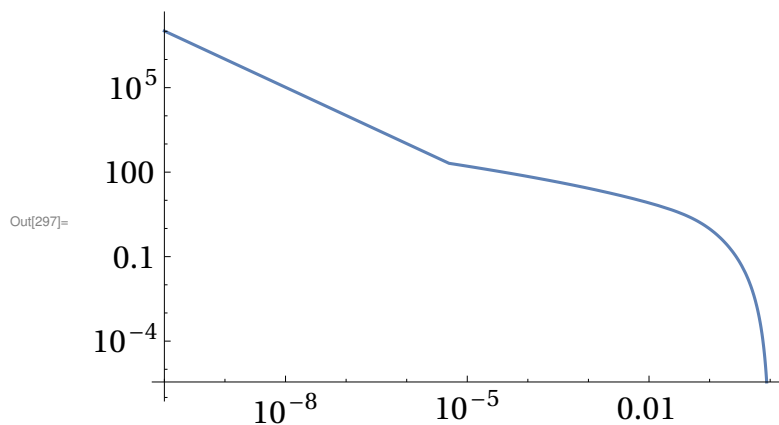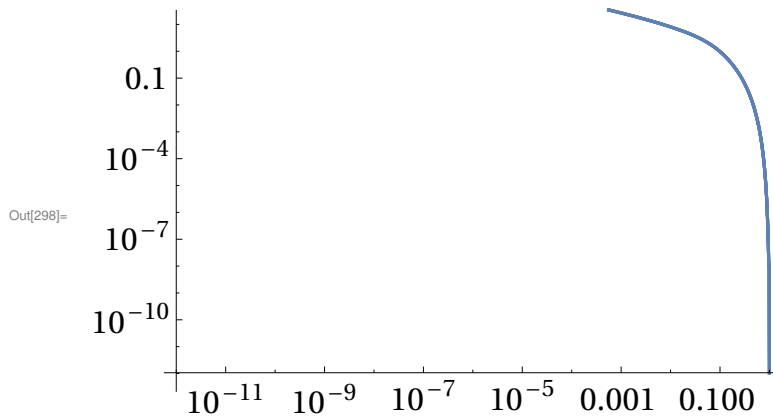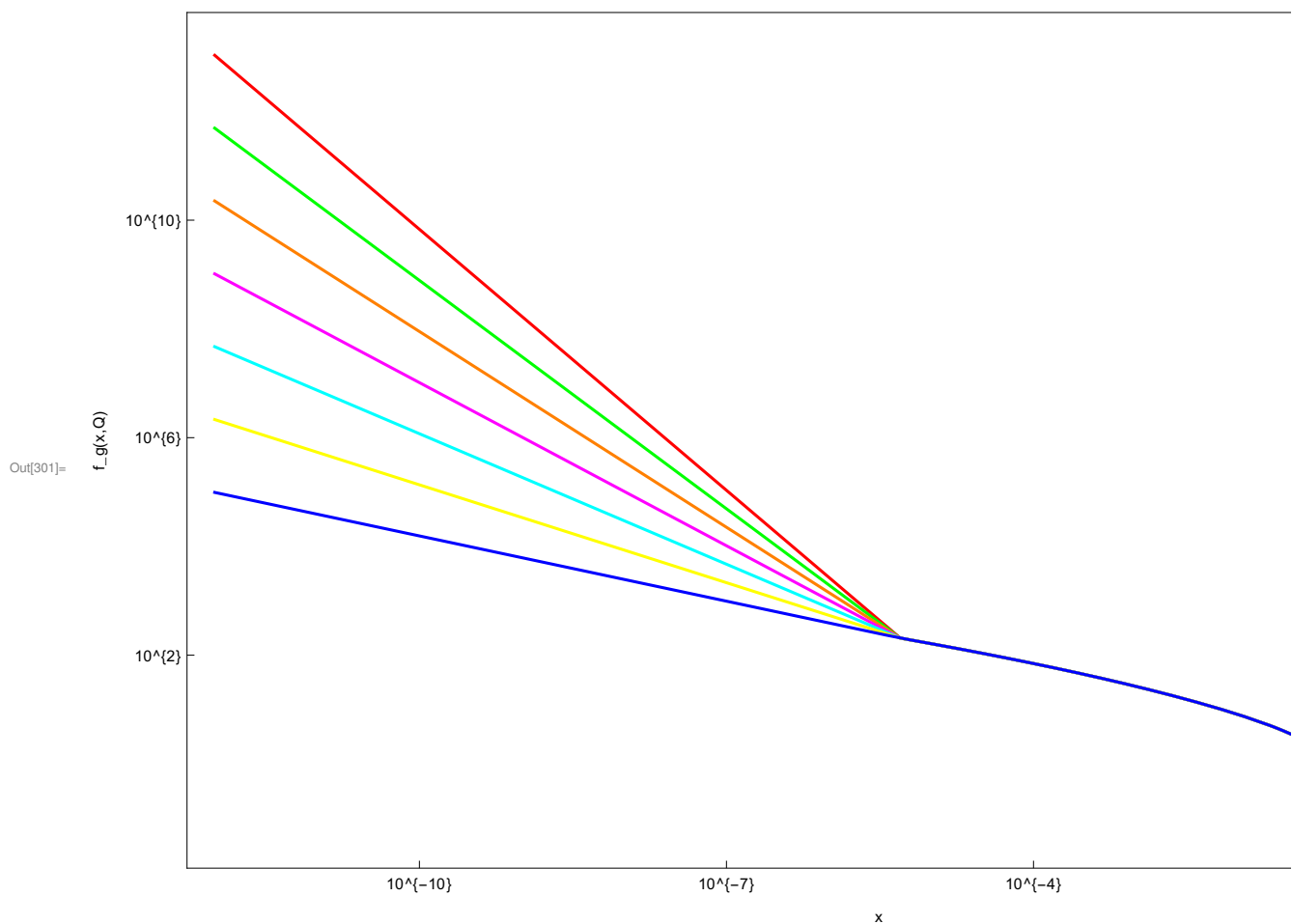ticksX = {
    {10^-10, MaTeX["10^{-10}", FontSize -> 30]},
    {10^-7, MaTeX["10^{-7}", FontSize -> 30]},
    {10^-4, MaTeX["10^{-4}", FontSize -> 30]},
    {.1, MaTeX["10^{-1}", FontSize -> 30]}
  };
ticksY = {
    {10^18, MaTeX["10^{18}", FontSize -> 30]},
    {10^14, MaTeX["10^{14}", FontSize -> 30]},
    {10^10, MaTeX["10^{10}", FontSize -> 30]},
    {10^6, MaTeX["10^{6}", FontSize -> 30]},
    {100, MaTeX["10^{2}", FontSize -> 30]},
    {.01, MaTeX["10^{-2}", FontSize -> 30]}
  };
```

In[301]:=
```
LogLogPlot[
  Table[pdfLowFunction[7, 0, x, 100., i], {i, 0.4, 1.6, 0.2}] // Reverse // Evaluate ,
  {x, 10.^-12, 0.3},
  PlotStyle → {Red, Green, Orange, Magenta, Cyan, Yellow, Blue, Purple},
  PlotRange → {{-1.1, 18.1}, All},
  FrameLabel → {MaTeX["x", FontSize -> 36], MaTeX["f_g(x,Q)", FontSize -> 36]},
  Frame → {True, True, True, True},
  FrameTicks → {{ticksY, None}, {ticksX, None}},
  ImageSize → 800
]
```

Out[301]=

In[302]:=
```
tmp = Table[NIntegrate[x pdfLowFunction[7, 0, x, 100., i], {x, 0, 1}], {i, 0.4, 1.6, 0.2}]
```
Out[302]= {0.0232817 , 0.0232817 , 0.0232817 , 0.0232817 , 0.0232817 , 0.0232817 , 0.0232817}

In[303]:=
```
tmp2 = (tmp[[1]] - tmp[[-1]])
```
Out[303]= -1.1764×10^{-8}

In[304]:=
```
tmp2 / tmp[[1]]
```
Out[304]= -5.05288×10^{-7}

In[305]:= **pdfGetInfo[7] // TableForm**

Out[305]//TableForm=

SetDesc → "nCTEQ15 fit: for nucleus (208,82): mem=0 => central value; mem=1-32 => 90%

SetIndex → 101100

Authors → K. Kovarik, A. Kusina, T. Jezo, D. B. Clark, C. Keppel, F. Lyonnet, J. G.

Reference → arXiv:1509.00792

Format → lhagrid1

DataVersion → 1

NumMembers → 33

Particle → 2212

Flavors → {-5, -4, -3, -2, -1, 1, 2, 3, 4, 5, 21}

OrderQCD → 1

FlavorScheme → variable

NumFlavors → 5

ErrorType → hessian

ErrorConfLevel → 90

XMin → $\frac{1}{200\,000}$

XMax → 1.

QMin → 1.3

QMax → 10 000.

MZ → 91.188

MUp → 0.0

MDown → 0.0

MStrange → 0.0

MCharm → 1.3

MBottom → 4.5

MTop → 174.0

AlphaS_MZ → 1.179973 e-01

AlphaS_OrderQCD → 1

AlphaS_Type → ipol

AlphaS_Qs → {1.3, 1.49426, 1.73673, 2.0429, 2.43436, 2.94169, 3.60881, 4.5, 5.86604, 7.82

AlphaS_Vals → {0.396765, 0.361268, 0.330375, 0.303188, 0.27903, 0.257386, 0.237861, 0.22

AlphaS_Lambda4 → 0.326

AlphaS_Lambda5 → 0.226

In[306]:= **"XMin" /. pdfGetInfo[7] // N**

Out[306]= $5. \times 10^{-6}$

In[307]:= **s**

Out[307]= s

Alpha-s ISSUES FOR ERIC OLD

In[308]:= **? pdfAlphaS**

> Symbol
>
> pdfAlphaS [setNumber , Q]:This function returns the value of α_S
>
> at hard scattering   energy Q when this information   is available
>
> in the .pds or .info file .
>
> *Warning* : This function will print a text message   and return
>
> a Null value if the α_S information   is not available .

Out[308]=

In[309]:= **pdfSetList[[1 ;; 10]] // TableForm**

Out[309]//TableForm=

1	/usr/local/share/LHAPDF/abm12lhc_ 5_nnlo/abm12lhc_ 5_nnlo_0000.dat
2	/usr/local/share/LHAPDF/CJ15nlo/CJ15nlo_ 0000.dat
3	/usr/local/share/LHAPDF/CT10nlo/CT10nlo_ 0000.dat
4	/usr/local/share/LHAPDF/HERAPDF20_NLO _VAR/HERAPDF20_NLO _VAR_0000.dat
5	/usr/local/share/LHAPDF/MSTW2008nnlo68cl /MSTW2008nnlo68cl_ 0000.dat
6	/usr/local/share/LHAPDF/nCTEQ15_ 1_1/nCTEQ15_ 1_1_0000.dat
7	/usr/local/share/LHAPDF/nCTEQ15_ 208_82/nCTEQ15_ 208_82_0000.dat
8	/usr/local/share/LHAPDF/NNPDF30_nnlo _as_0118_nf_6/NNPDF30_nnlo _as_0118_nf_6_0000.dat
9	/home/olness/Dropbox /mp/ManeParse5_DEMO /FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ct10.pds/
10	/home/olness/Dropbox /mp/ManeParse5_DEMO /FOR WEB/ManeParse5_Demo //PDFDIR/PDS/ctq66m.p

```
In[310]:=  Table[{i, pdfAlphaS[i, 91.0]}, {i, 1, 10}] // TableForm
```

```
Created pdfAlphaS for iSet = 2

2 has  1 sub-grid

Created pdfAlphaS for iSet = 3

3 has  1 sub-grid

Created pdfAlphaS for iSet = 4

4 has  1 sub-grid

Created pdfAlphaS for iSet = 5

PDF Set = 5 has  3 sub-grids

Created pdfAlphaS for iSet = 6

6 has  1 sub-grid

Created pdfAlphaS for iSet = 7

7 has  1 sub-grid

Created pdfAlphaS for iSet = 8

PDF Set = 8 has  4 sub-grids
```

Out[310]//TableForm=

```
1     Null[]
2     0.118076
3     0.118037
4     0.118036
5     0.117106
6     0.118028
7     0.118028
8     0.118095
9     Null[]
10    Null[]
```

NNPDF

```
In[311]:=  pdfAlphaS[3, 96.]
```

Out[311]= 0.117092

```
In[312]:=  pdfAlphaS[3, 91.]
```

Out[312]= 0.118037

In[313]:= `aData = {"AlphaS_Qs ", "AlphaS_Vals "} /. pdfGetInfo[3] // Transpose ;`
`aData // TableForm`

Out[314]//TableForm=

1.3	0.371896
1.50148	0.343231
1.75494	0.317077
2.07777	0.29315
2.49452	0.27121
3.0404	0.251055
3.76679	0.232506
4.75	0.21541
6.13307	0.200797
8.09076	0.187109
10.9247	0.174294
15.1284	0.162299
21.5306	0.151077
31.5646	0.140583
47.7865	0.130774
74.911	0.121609
91.1876	0.118001
121.953	0.11305
206.837	0.105058
366.727	0.0976021
682.274	0.0906471
1337.31	0.0841626
2773.76	0.0781194
6116.88	0.0724903
14 416.3	0.0672479
36 514.7	0.0623682
100 000.	0.0578277

In[315]:= `aData // Length`

Out[315]= 27

In[316]:= `aData2 = aData // DeleteDuplicatesBy [#, First] &;`
`aData2 // Length`

Out[317]= 27

In[318]:= `fredAs = Interpolation [aData2]`

Out[318]= InterpolatingFunction [Domain : {{1.3, 1.00 × 10^5}} Output : scalar]

In[319]:= `fredAs[91.2]`

Out[319]= 0.117998

In[320]:= **p1 = ListLogLinearPlot [aData , PlotStyle → {Red , PointSize[0.015]}]**

Out[320]=

In[321]:= **p2 = LogLinearPlot [fredAs[q], {q, 1, 10^5}, PlotRange → All, PlotStyle → Thick]**

Out[321]=

In[322]:= **Show[p1 , p2]**

Out[322]=

Play

In[323]:= **Table[{i, pdfAlphaS[i, 91.2]}, {i, Length[pdfSetList]}] // TableForm**

```
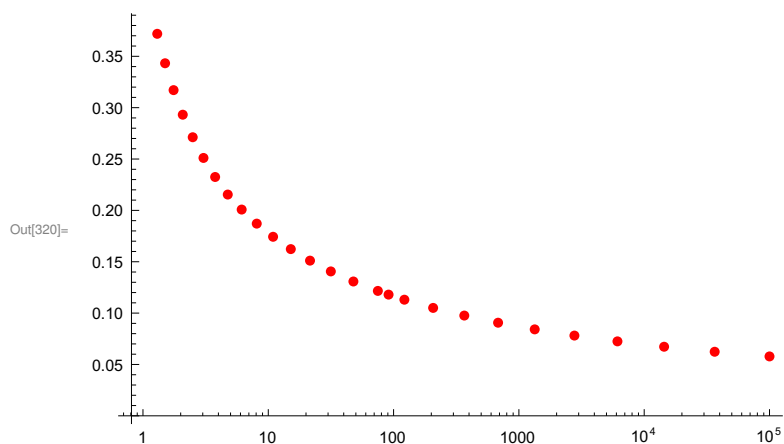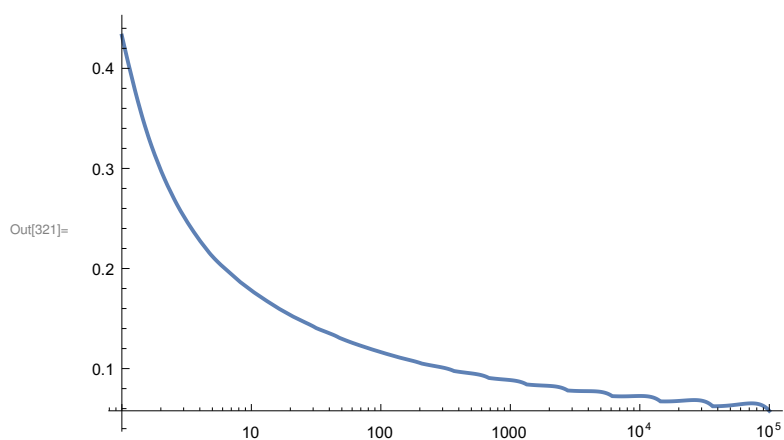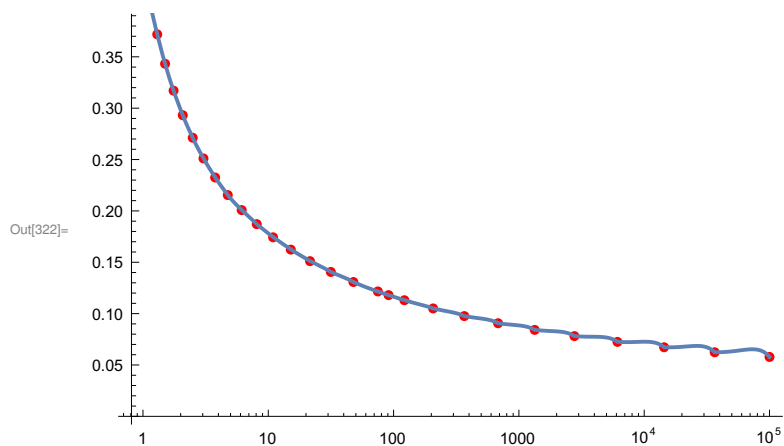Created  pdfAlphaS  for  iSet = 56
56 has   1 sub-grid
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57 has   1 sub-grid
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58 has   1 sub-grid
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PDF Set = 218 has  4 sub-grids

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PDF Set = 220 has  4 sub-grids

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PDF Set = 221 has  4 sub-grids

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PDF Set = 222 has  4 sub-grids

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PDF Set = 223 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 224

PDF Set = 224 has  4 sub-grids

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PDF Set = 225 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 226

PDF Set = 226 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 227

PDF Set = 227 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 228

PDF Set = 228 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 229

PDF Set = 229 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 230

PDF Set = 230 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 231

PDF Set = 231 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 232

PDF Set = 232 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 233

PDF Set = 233 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 234

PDF Set = 234 has  4 sub-grids

Created  pdfAlphaS  for  iSet = 235

PDF Set = 235 has  4 sub-grids
```

```
Created  pdfAlphaS  for  iSet  =  236

PDF  Set  =  236  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  237

PDF  Set  =  237  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  238

PDF  Set  =  238  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  239

PDF  Set  =  239  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  240

PDF  Set  =  240  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  241

PDF  Set  =  241  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  242

PDF  Set  =  242  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  243

PDF  Set  =  243  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  244

PDF  Set  =  244  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  245

PDF  Set  =  245  has   4  sub-grids

Created  pdfAlphaS  for  iSet  =  246

PDF  Set  =  246  has   4  sub-grids
```

Out[323]//TableForm=

```
1      Null[]
2      0.118037
3      0.117998
4      0.117997
5      0.117068
6      0.117988
7      0.117988
8      0.118055
9      Null[]
10     Null[]
11     Null[]
12     Null[]
13     Null[]
14     Null[]
15     Null[]
16     Null[]
17     Null[]
18     Null[]
19     Null[]
```

```
20    Null[]
21    Null[]
22    Null[]
23    Null[]
24    Null[]
25    Null[]
26    Null[]
27    Null[]
28    Null[]
29    Null[]
30    Null[]
31    Null[]
32    Null[]
33    Null[]
34    Null[]
35    Null[]
36    Null[]
37    Null[]
38    Null[]
39    Null[]
40    Null[]
41    Null[]
42    Null[]
43    Null[]
44    Null[]
45    Null[]
46    Null[]
47    Null[]
48    Null[]
49    Null[]
50    Null[]
51    Null[]
52    Null[]
53    Null[]
54    Null[]
55    Null[]
56    0.117988
57    0.117988
58    0.117988
59    0.117988
60    0.117988
61    0.117988
62    0.117988
63    0.117988
64    0.117988
65    0.117988
66    0.117988
67    0.117988
68    0.117988
69    0.117988
```

70	0.117988
71	0.117988
72	0.117988
73	0.117988
74	0.117988
75	0.117988
76	0.117988
77	0.117988
78	0.117988
79	0.117988
80	0.117988
81	0.117988
82	0.117988
83	0.117988
84	0.117988
85	0.117988
86	0.117988
87	0.117988
88	0.117988
89	0.117995
90	0.117995
91	0.117995
92	0.117995
93	0.117995
94	0.117995
95	0.117995
96	0.117995
97	0.117995
98	0.117995
99	0.117995
100	0.117995
101	0.117995
102	0.117995
103	0.117995
104	0.117995
105	0.117995
106	0.117995
107	0.117995
108	0.117995
109	0.117995
110	0.117995
111	0.117995
112	0.117995
113	0.117995
114	0.117995
115	0.117995
116	0.117995
117	0.117995
118	0.117995
119	0.117995

```
120    0.117995
121    0.117995
122    0.117995
123    0.117995
124    0.117995
125    0.117995
126    0.117995
127    0.117995
128    0.117995
129    0.117995
130    0.117995
131    0.117995
132    0.117995
133    0.117995
134    0.117995
135    0.117995
136    0.117995
137    0.117995
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139    0.117995
140    0.117995
141    0.117995
142    0.117995
143    0.117995
144    0.117995
145    0.117995
146    0.118055
147    0.118055
148    0.118055
149    0.118055
150    0.118055
151    0.118055
152    0.118055
153    0.118055
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161    0.118055
162    0.118055
163    0.118055
164    0.118055
165    0.118055
166    0.118055
167    0.118055
168    0.118055
169    0.118055
```

```
170    0.118055
171    0.118055
172    0.118055
173    0.118055
174    0.118055
175    0.118055
176    0.118055
177    0.118055
178    0.118055
179    0.118055
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181    0.118055
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187    0.118055
188    0.118055
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191    0.118055
192    0.118055
193    0.118055
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200    0.118055
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202    0.118055
203    0.118055
204    0.118055
205    0.118055
206    0.118055
207    0.118055
208    0.118055
209    0.118055
210    0.118055
211    0.118055
212    0.118055
213    0.118055
214    0.118055
215    0.118055
216    0.118055
217    0.118055
218    0.118055
219    0.118055
```

```
220    0.118055
221    0.118055
222    0.118055
223    0.118055
224    0.118055
225    0.118055
226    0.118055
227    0.118055
228    0.118055
229    0.118055
230    0.118055
231    0.118055
232    0.118055
233    0.118055
234    0.118055
235    0.118055
236    0.118055
237    0.118055
238    0.118055
239    0.118055
240    0.118055
241    0.118055
242    0.118055
243    0.118055
244    0.118055
245    0.118055
246    0.118055
```

In[324]:= **{"MCharm", "MBottom", "MTop"} /. pdfGetInfo[1]**

Out[324]= {MCharm , MBottom , MTop}

In[325]:= **Plot[pdfAlphaS[1, q], {q, 4.7, 4.8}]**

In[326]:= `pdfGetInfo[1]`

Out[326]= {SetDesc → "NNLO 5-flavour PDFs for the ABM12 set", SetIndex → 42360,

Authors → S. Alekhin, J. Bluemlein, S. Moch, Reference → arXiv:1310.3059,

Format → lhagrid1, DataVersion → 3, NumMembers → 29, Particle → 2212,

Flavors → {-5, -4, -3, -2, -1, 1, 2, 3, 4, 5, 21}, OrderQCD → 2,

FlavorScheme → fixed, NumFlavors → 5, ErrorType → symmhessian,

XMin → $\frac{1}{10\,000\,000}$, XMax → 1, QMin → 4.47214, QMax → 14142.1, MZ → 91.1876}

Alpha-s revised

In[327]:= `iMSTW =`
`Position[StringMatchQ[pdfSetList[[All, 2]], "*MSTW2008nnlo68cl *"], True] // First //`
`  First`
`iset =`
`  iMSTW`

Out[327]= 5

Out[328]= 5

In[329]:=

```
Do[
 {iset, pdfAlphaS[iset, 91.2], pdfAlphaS[iset, 91.2], pdfAlphaS[iset, 91.2]} // Print;
 Print["=== === === === === === === === === === === === === ==="];
 , {iset, 1, 5}]
```

{1, Null[], Null[], Null[]}

=== === === === === === === === === === === === === ===

{2, 0.118037, 0.118037, 0.118037}

=== === === === === === === === === === === === === ===

{3, 0.117998, 0.117998, 0.117998}

=== === === === === === === === === === === === === ===

{4, 0.117997, 0.117997, 0.117997}

=== === === === === === === === === === === === === ===

{5, 0.117068, 0.117068, 0.117068}

=== === === === === === === === === === === === === ===

In[330]:= `{"MCharm", "MBottom", "MTop"} /. pdfGetInfo[3]`

Out[330]= {1.3, 4.75, 172}

In[331]:= **pdfAlphaS[iMSTW, 1]**

Out[331]= 0.45077

In[332]:= **pdfGetInfo[iMSTW]**

Out[332]= {SetDesc →

"MSTW 2008 NNLO (68% C.L.). This set has 41 member PDFs. mem=0 => central
value; mem=1-40 => 20 eigenvectors (+/- directions). See Section
6 of paper for error calculation. http://mstwpdf.hepforge.org",

SetIndex → 21200, Authors → A.D. Martin, W.J. Stirling, R.S. Thorne and G. Watt,

Reference → arXiv:0901.0002,

Format → lhagrid1,

DataVersion → 3,

NumMembers → 41, Particle → 2212,

Flavors → {-5, -4, -3, -2, -1, 1, 2, 3, 4, 5, 21},

OrderQCD → 2, FlavorScheme → variable,

NumFlavors → 5, ErrorType → hessian,

XMin → $\frac{1}{1\,000\,000}$, XMax → 1, QMin → 1, QMax → 31622.8,

MZ → 91.1876, MUp → 0, MDown → 0, MStrange → 0,

MCharm → 1.4, MBottom → 4.75, MTop → 1e+10,

AlphaS_MZ → 0.11707, AlphaS_OrderQCD → 2, AlphaS_Type → ipol,

AlphaS_Qs → {1., 1.11803, 1.22475, 1.4, 1.4, 1.58114, 1.78885, 2., 2.23607, 2.52982,
2.82843, 3.16228, 3.4641, 4.75, 4.75, 5.09902, 6.32456, 8., 10., 12.6491, 15.4919,
20., 25.2982, 31.6228, 42.4264, 56.5685, 74.8332, 91.1876, 100., 134.164, 178.885,
236.643, 316.228, 424.264, 565.685, 748.332, 1000., 1341.64, 1788.85, 2366.43,
3162.28, 4242.64, 5656.85, 7483.32, 10000., 13416.4, 17888.5, 23664.3, 31622.8},

AlphaS_Vals → {0.45077, 0.411423, 0.384629, 0.351733, 0.353019, 0.330371,
0.310416, 0.294502, 0.280257, 0.266132, 0.254616, 0.244118, 0.236201,
0.212548, 0.212831, 0.208639, 0.196898, 0.185561, 0.175981, 0.166941,
0.159879, 0.151814, 0.145101, 0.139268, 0.132284, 0.12611, 0.120646, 0.11707,
0.115474, 0.110675, 0.106355, 0.102473, 0.0987433, 0.095235, 0.0920386,
0.0891325, 0.0863121, 0.0836325, 0.0811684, 0.0789093, 0.0766995, 0.0745841,
0.072625, 0.0708172, 0.0690379, 0.0673244, 0.0657286, 0.0642483, 0.0627841}}

In[333]:= `Plot[pdfAlphaS[iMSTW, q], {q, 1.38, 1.42}]`

Out[333]=

In[334]:=
```
ticksX = {
    {4.170, MaTeX["4.170", FontSize -> 30]},
    {4.175, MaTeX["4.175", FontSize -> 30]},
    {4.180, MaTeX["4.180", FontSize -> 30]},
    {4.185, MaTeX["4.185", FontSize -> 30]}
  };
ticksY = {
    {0.2242, MaTeX["0.2242", FontSize -> 30]},
    {0.2241, MaTeX["0.2241", FontSize -> 30]},
    {0.2240, MaTeX["0.2240", FontSize -> 30]},
    {0.2239, MaTeX["0.2239", FontSize -> 30]}
  };
```

In[336]:= `Plot[pdfAlphaS[iMSTW, q], {q, 4.70, 4.80}, BaseStyle → baseSty,`
   `PlotRange → {Automatic, Automatic}, PlotStyle → {Thick, Blue},`
   `FrameLabel → {MaTeX["Q (GeV)", FontSize -> 36], MaTeX["\alpha_s (Q)", FontSize -> 36]},`
   `Frame → {True, True, True, True},`
   `FrameTicks → {{Automatic, None}, {Automatic, None}},`
   `ImageSize → 800`
`]`

Out[336]=

In[337]:= `Plot[pdfAlphaS[iMSTW, q], {q, 172, 174}]`

Out[337]=

In[338]:=
```
ticksX = {
    {0, MaTeX["0", FontSize -> 30]},
    {20, MaTeX["20", FontSize -> 30]},
    {40, MaTeX["40", FontSize -> 30]},
    {60, MaTeX["60", FontSize -> 30]},
    {80, MaTeX["80", FontSize -> 30]},
    {100, MaTeX["100", FontSize -> 30]}
  };
ticksY = {
    {.1, MaTeX["0.10", FontSize -> 30]},
    {.12, MaTeX["0.12", FontSize -> 30]},
    {.14, MaTeX["0.14", FontSize -> 30]},
    {.16, MaTeX["0.16", FontSize -> 30]},
    {.18, MaTeX["0.18", FontSize -> 30]},
    {.20, MaTeX["0.20", FontSize -> 30]},
    {.22, MaTeX["0.22", FontSize -> 30]},
    {.24, MaTeX["0.24", FontSize -> 30]}
  };
```

In[340]:= `Plot[pdfAlphaS[iMSTW, q], {q, 1, 100},`
`    PlotStyle → {Thick, Blue},`
`    PlotRange → {0.10, 0.24},`
`    FrameLabel → {MaTeX["Q (GeV)", FontSize -> 36], MaTeX["\alpha_s (Q)", FontSize -> 36]},`
`    Frame → {True, True, True, True},`
`    FrameTicks → {{ticksY, None}, {ticksX, None}},`
`    ImageSize → 800`
`    ]`

Out[340]=

More Alpha-s

In[341]:= **`pdfSetList // Length`**

Out[341]= `246`

In[342]:= **`pdfAlphaS[1.1, 91.2]`**

Out[342]= `pdfCalc`Private`pdfAlphaStmp [1.1, 91.2]`

In[343]:= `ListPlot[pdfAlphaS[#, 91.2] & /@ Range[Length[pdfSetList]],`
`PlotStyle → {Red, PointSize[0.03]}]`

Out[343]=

In[344]:= `Do[`
`LogLogPlot[pdfAlphaS[i, q], {q, 0.5, 10 000}, PlotPoints → 100, PlotLabel → i] // Print`
`, {i, 1, 10}]`

⋯ InterpolatingFunction : Input value {0.50005 } lies outside the range of data in the interpolating function . Extrapolation will be used .

⋯ InterpolatingFunction : Input value {0.50005 } lies outside the range of data in the interpolating function . Extrapolation will be used .

⋯ InterpolatingFunction : Input value {0.50005 } lies outside the range of data in the interpolating function . Extrapolation will be used .

⋯ General : Further output of InterpolatingFunction ::dmval will be suppressed during this calculation .

5

6

7

8

9

10

In[345]:= **pdfAlphaS[9, 91.]**

Out[345]= Null[]

Compare Interpolations :

In[346]:= **pdfSetInterpolator ["MMA"]**

Default Mathematica interpolator will be used.

In[347]:= **xlist = Table[10.^i, {i, -4, -3, 1/16}] // Drop[#, -1] &**

Out[347]= {0.0001, 0.000115478, 0.000133352, 0.000153993, 0.000177828, 0.000205353,
0.000237137, 0.000273842, 0.000316228, 0.000365174, 0.000421697,
0.000486968, 0.000562341, 0.000649382, 0.000749894, 0.000865964}

In[348]:=

In[349]:=

```
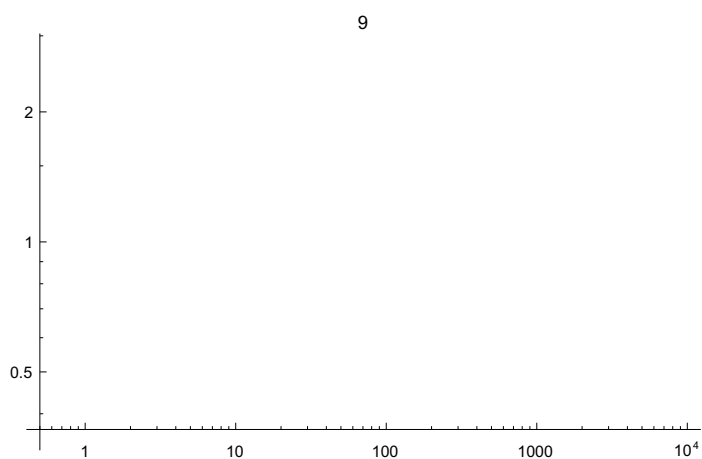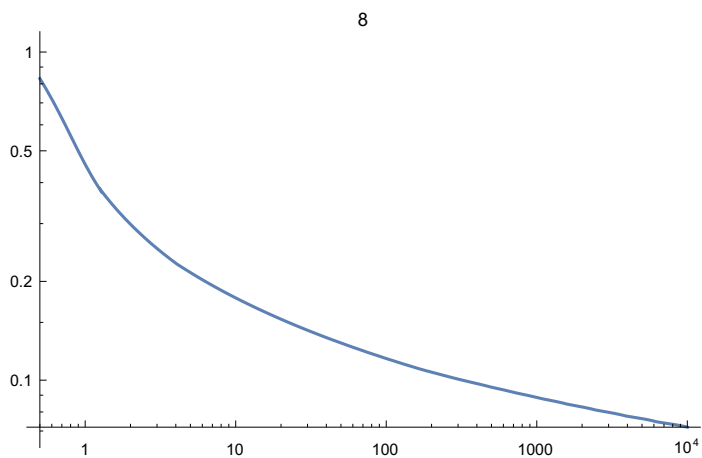iparton = 2;
q0 = 3.;
iset0 = 1;
iset0 = 3;
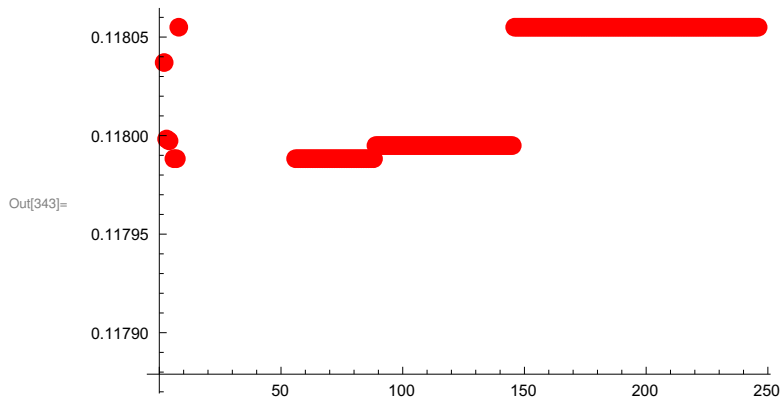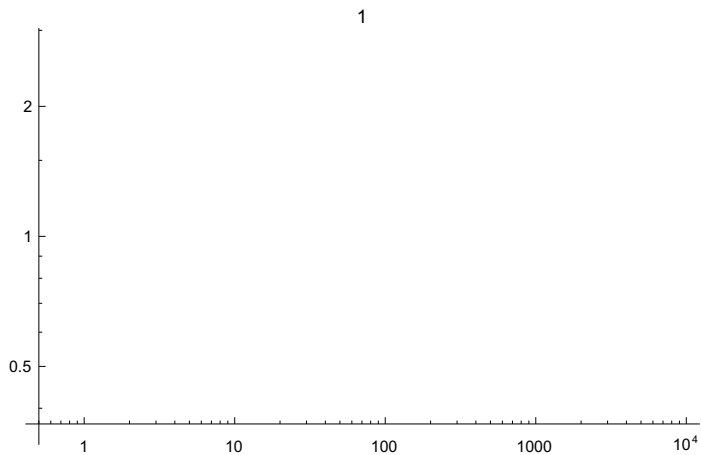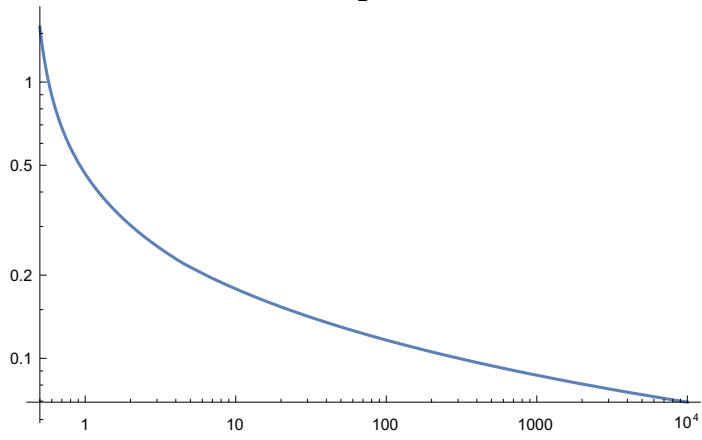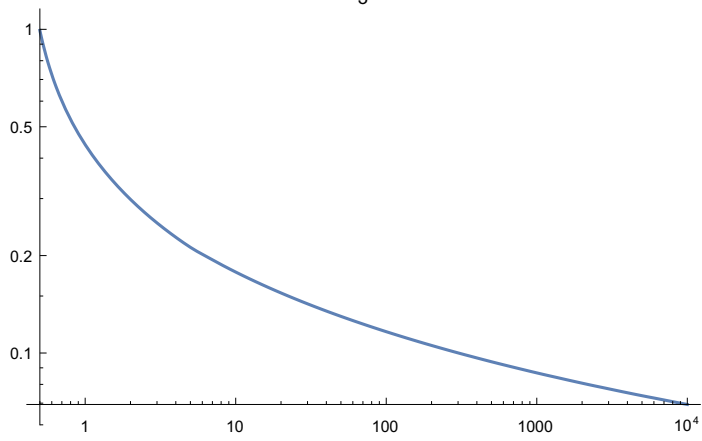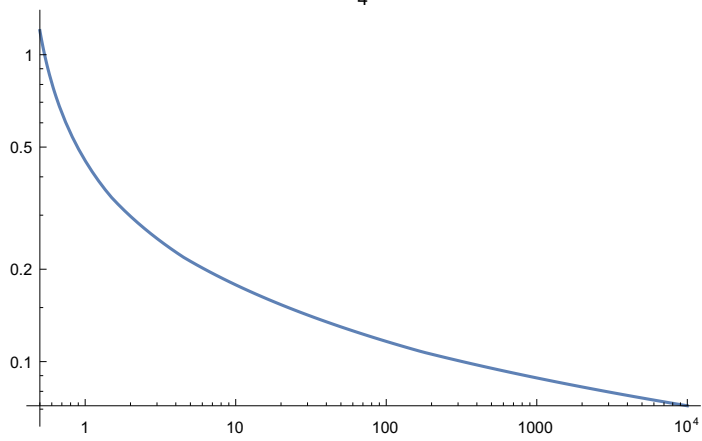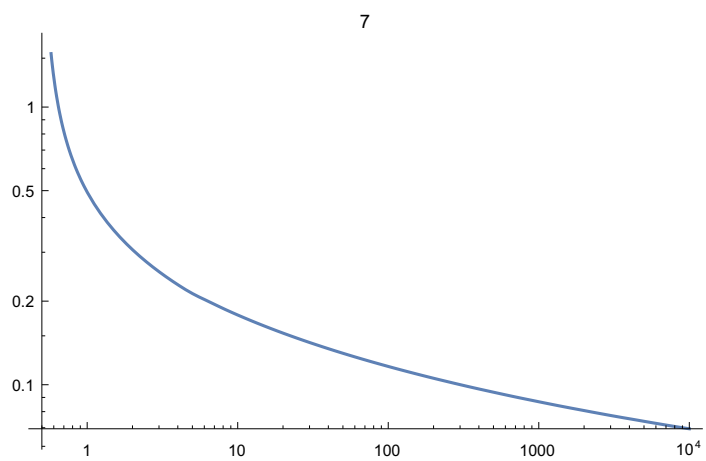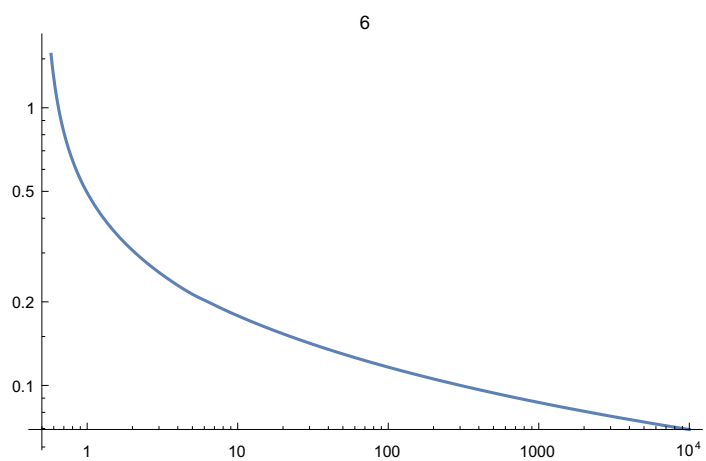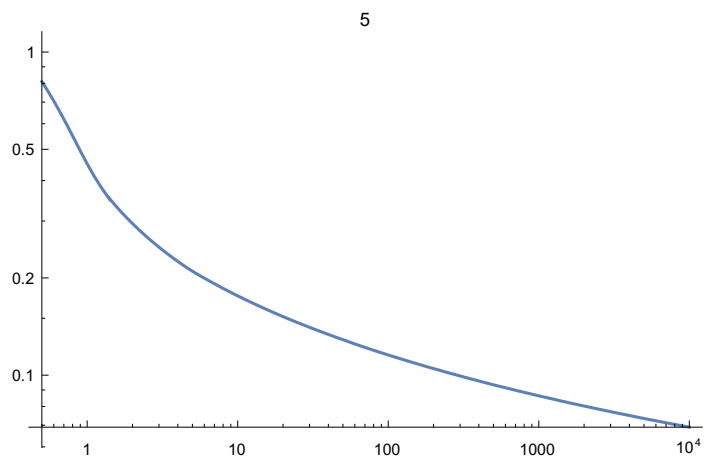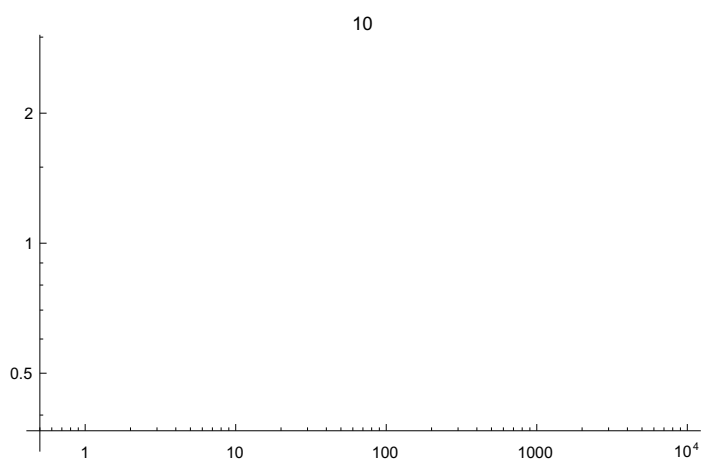

pdfSetXpower [1]
list1 = pdf[iset0, iparton, xlist, q0];


pdfSetXpower [0.5]
list2 = pdf[iset0, iparton, xlist, q0];


pdfSetXpower [1.5]
list3 = pdf[iset0, iparton, xlist, q0];
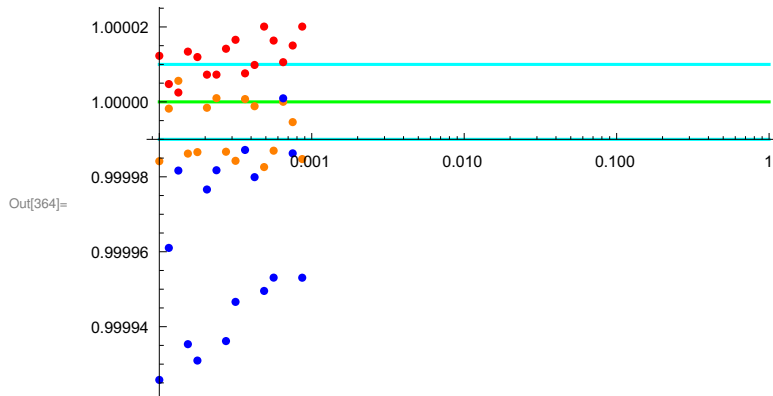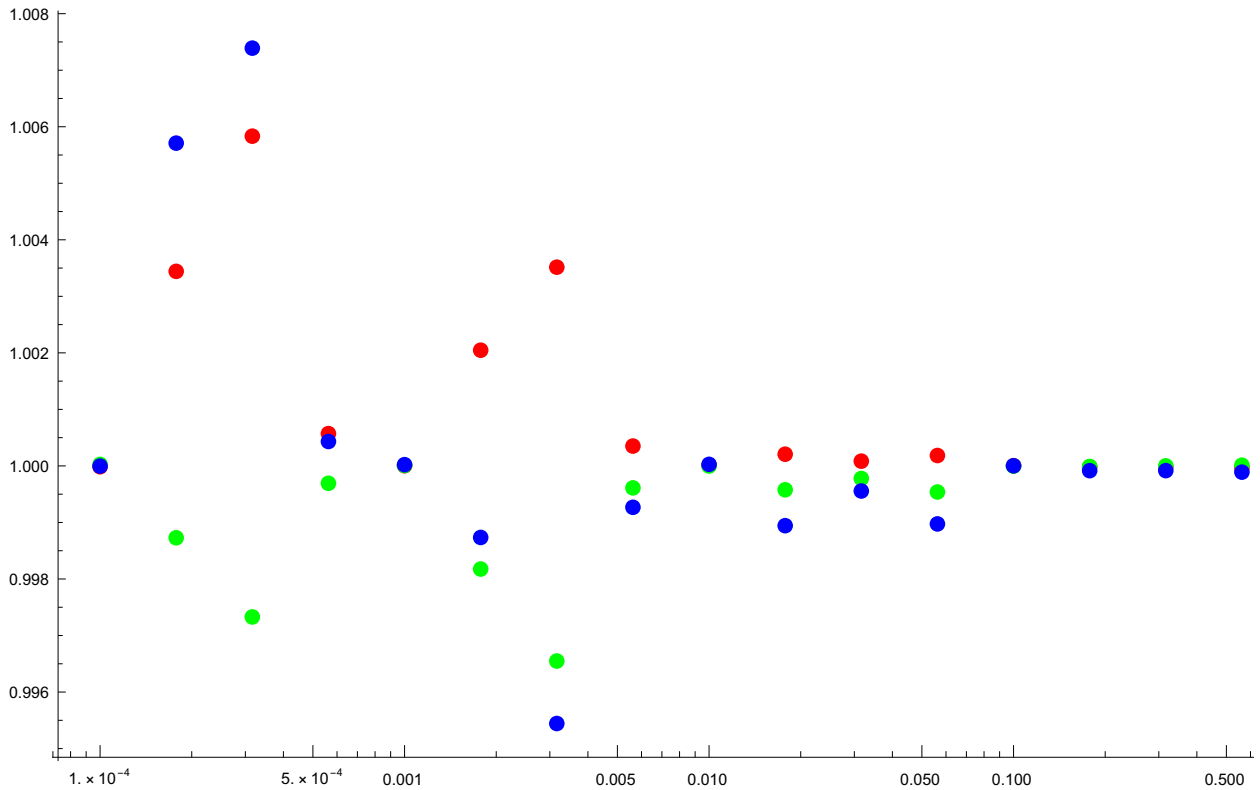

pdfSetInterpolator ["MMA"]
list4 = pdf[iset0, iparton, xlist, q0];
```

$$\text{tab1} = \left(\frac{\#}{\text{list1}}\right) \& \text{ /@ \{list1, list2, list3, list4\} // Drop[\#, 1] \&;}$$

```
p1 =
  LogLinearPlot [{1.00001, 1, 0.99999}, {x, 10.^-4, 1}, PlotStyle → {Cyan, Green, Cyan}];
p2 = ListLogLinearPlot [Transpose[{xlist, #}] & /@ tab1,
    PlotStyle → {Red, Orange, Blue}, PlotRange → All];
Show[p1, p2, PlotRange -> All]
```

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 0.5

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1.5

Default Mathematica   interpolator   will be used .

Out[364]=

Default Mathematica   interpolator   will be used .

The x-power of the interpolation is set to 1.5

ManeParse cubic interpolation   will be used .

The x-power of the interpolation is set to 0.5

ManeParse cubic interpolation   will be used .

The x-power of the interpolation is set to 1

ManeParse cubic interpolation   will be used .

ManeParse cubic interpolation   will be used . 0.00

The x-power of the interpolation is set to 1

ManeParse cubic interpolation   will be used .

The x-power of the interpolation is set to 0.5

ManeParse cubic interpolation   will be used .

The x-power of the interpolation is set to 1.5

Default Mathematica   interpolator   will be used .

In[365]:= **pdfSetXpower [1]**

list1 = pdf[iset0 , 0, xlist, 10.]

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1

Out[366]= {359 799. , 298 132. , 246 981. , 204 524. , 169 313. , 140 119. , 115 905. , 95 850.4 ,
79 231.1 , 65 461.9 , 54 069. , 44 633.9 , 36 827.8 , 30 373.3 , 25 034.1 , 20 623.6}

In[367]:= **pdfSetXpower [1.5]**

list2 = pdf[iset0 , 0, xlist, 10.]

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 1.5

Out[368]= {359 832. , 298 163. , 247 008. , 204 540. , 169 325. , 140 130. , 115 914. , 95 856. ,
79 234.9 , 65 466.1 , 54 072. , 44 635.1 , 36 828.9 , 30 374.5 , 25 034.8 , 20 623.8}

In[369]:= **pdfSetXpower [0.5]**

list3 = pdf[iset0 , 0, xlist, 10.]

ManeParse cubic interpolation will be used.

The x-power of the interpolation is set to 0.5

Out[370]= {359 867. , 298 187. , 247 029. , 204 565. , 169 347. , 140 148. , 115 929. , 95 871.1 ,
79 249. , 65 476.5 , 54 081.4 , 44 644.6 , 36 836.5 , 30 380.7 , 25 040.3 , 20 628.7}

In[371]:= **pdfSetInterpolator ["MMA"];**

list4 = pdf[iset0 , 0, xlist, 10.]

Default Mathematica interpolator will be used.

Out[372]= {359 983. , 298 298. , 247 127. , 204 632. , 169 400. , 140 201. , 115 974. , 95 900.5 ,
79 274. , 65 501.3 , 54 100.7 , 44 657.7 , 36 847.4 , 30 391.9 , 25 048.7 , 20 634.2}

In[373]:= **tab1 = $\left(\dfrac{\text{\#}}{\text{list1}}\right)$ & /@ {list1 , list2 , list3 , list4} // Drop[#, 1] &**

Out[373]= {{1.00009 , 1.00011 , 1.00011 , 1.00008 , 1.00008 , 1.00008 , 1.00008 , 1.00006 ,
1.00005 , 1.00006 , 1.00006 , 1.00003 , 1.00003 , 1.00004 , 1.00002 , 1.00001},
{1.00019 , 1.00019 , 1.00019 , 1.0002 , 1.0002 , 1.00021 , 1.00021 , 1.00022 ,
1.00023 , 1.00022 , 1.00023 , 1.00024 , 1.00024 , 1.00024 , 1.00025 , 1.00025},
{1.00051 , 1.00056 , 1.00059 , 1.00053 , 1.00052 , 1.00059 , 1.0006 , 1.00052 ,
1.00054 , 1.0006 , 1.00059 , 1.00053 , 1.00053 , 1.00061 , 1.00058 , 1.00051}}

In[374]:= **ListLogLinearPlot [Transpose[{xlist , #}] & /@ tab1,**
PlotStyle → {Red, Green , Blue}, PlotRange → All]

Out[374]=

In[375]:= **pdf[iset0 , 0, 0.1, 10.]**

Out[375]= 11.2014

In[376]:= **pdf[iset0, 2, .343, 5.]**

Out[376]= 1.28106

In[377]:= **1/(4797/4800.)-1 // ScientificForm**

Out[377]//ScientificForm=
6.25391×10^{-4}

In[378]:= **1/(4797/4800.)-1 // ScientificForm**

Out[378]//ScientificForm=
6.25391×10^{-4}

In[379]:= **pdf[iset0, 2, .512, 5.]**

Out[379]= 0.372151