Polarized Partons

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Spin-structure of the proton

- Deep inelastic scattering with longitudinally polarized beam and target

$$\frac{d\bar{\sigma}}{dx\,dQ^2} = \frac{4\pi\alpha^2}{xQ^4}\left[\left(1 - y + \frac{y^2}{2}\right)F_2(x,Q^2) + \frac{y^2}{2}F_L(x,Q^2)\right] \qquad \frac{d\Delta\sigma}{dx\,dQ^2} = \frac{16\pi\alpha^2 y}{Q^4}\left(1 - \frac{y}{2}\right)g_1(x,Q^2)$$

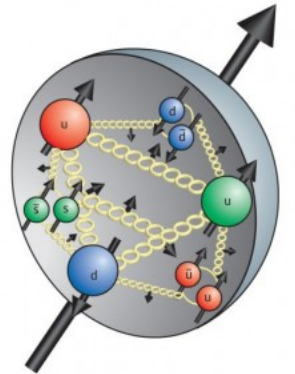- Polarized parton distributions $\quad q = q^{\rightarrow} + q^{\leftarrow} \qquad \Delta q = q^{\rightarrow} - q^{\leftarrow}$

$$F_2(x,Q^2) = x\sum_q e_q^2\left(q(x,Q^2) + \bar{q}(x,Q^2)\right)$$

$$g_1(x,Q^2) = \frac{1}{2}\sum_q e_q^2\left(\Delta q(x,Q^2) + \Delta\bar{q}(x,Q^2)\right)$$

- Experimental measurements:
  - Polarized DIS: CERN EMC, SMC, COMPASS, SLAC E142/3, DESY HERMES
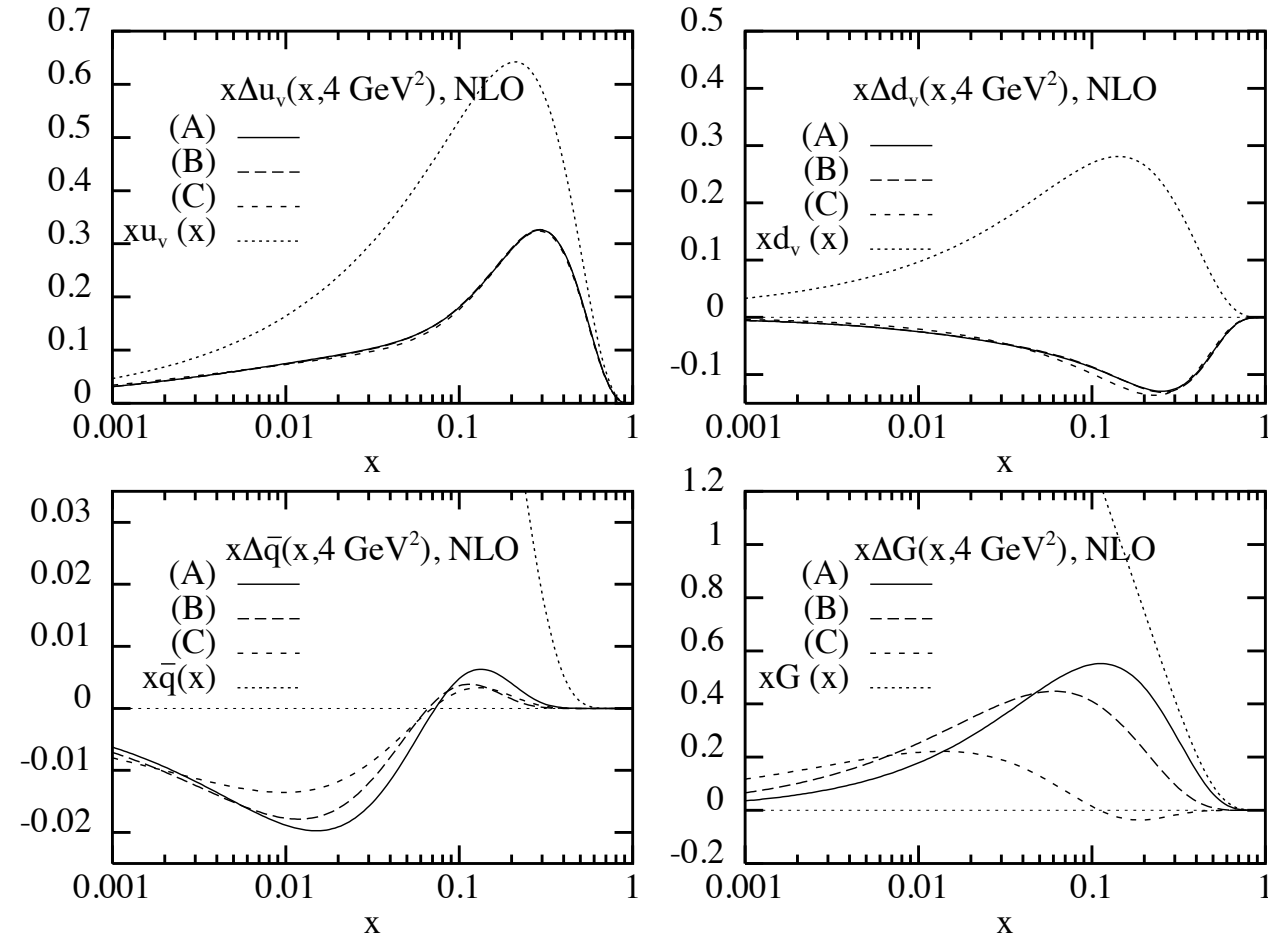 - Polarized proton-proton collisions: BNL RHIC

Polarized parton distributions

- Global fit to polarized DIS data: proton, neutron, deuteron (GS95)
  T. Gehrmann, W.J. Stirling, hep-ph/9512406, PRD53(1996) 6100

- First polarized NLO set

- Broadly used in preparation of BNL RHIC and COMPASS

Before IPPP: 1995 HERA workshop

- ## First set of HERA precision measurements
  - F_2, jets, diffraction, small-x, …
  - Snapshot of HERA program
  - Passionate, heated discussions (DGLAP vs. BFKL and many more)

- ## Unique experience for Durham PhD students

HERA Workshop on proton, photon and pomeron structure

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Introduction

The fourth UK Phenomenology Initiative Workshop and the second devoted to HERA Physics took place in St John's College, Durham between 18 and 23 September 1995. Since the first HERA Workshop at Durham in March 1993 [1] a number of surprising and profound results have been established at HERA and many data in many areas have been published. In deep inelastic scattering (DIS) the rise of F_2 as Bjorken-x decreases, first seen in the data of the H1 experiment unveiled at Durham in 1993, has been confirmed over a wide range of x and Q^2. At least superficially, the HERA data appear to be consistent with the next-to-leading order approximation to the QCD evolution (DGLAP) equations down to rather small values of Q^2. A very likely related phenomenon is the rather large proportion of DIS events that have a large rapidity gap, a signature characteristic of diffractive scattering. This

James as PhD advisor and mentor