

Proton Spin in DIS

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Ellis & Jaffe

$$\int_0^1 g_1^{\text{ep}}(\xi) d\xi = \frac{g_A}{12} \left(1 + \frac{5}{3} \frac{3 \frac{F}{D} - 1}{\frac{F}{D} + 1} \right)$$

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SU3 Model of Cabbibo

Three quarks u,d and s are the basis of the SU3

Nota bene: constituent quarks may have a complicated structure but as entire fit the axial

vector transitions $n \rightarrow p, \Lambda \rightarrow p e^- \nu,$

$\Sigma^- \rightarrow n e^- \nu, X^- \rightarrow \Lambda e^- \nu, X^0 \rightarrow \Sigma^+ e^- \nu$ with two

parameters g_A^{np} and $g_A^{\Sigma n}$ (F and D)

Static model vs. Experiment

- They predict:

$$\int dx g_1^{ep}(x) = \frac{g_A}{6} \left(1 - \frac{3}{4}a \right) = 0.175 \text{ (0.123)}$$

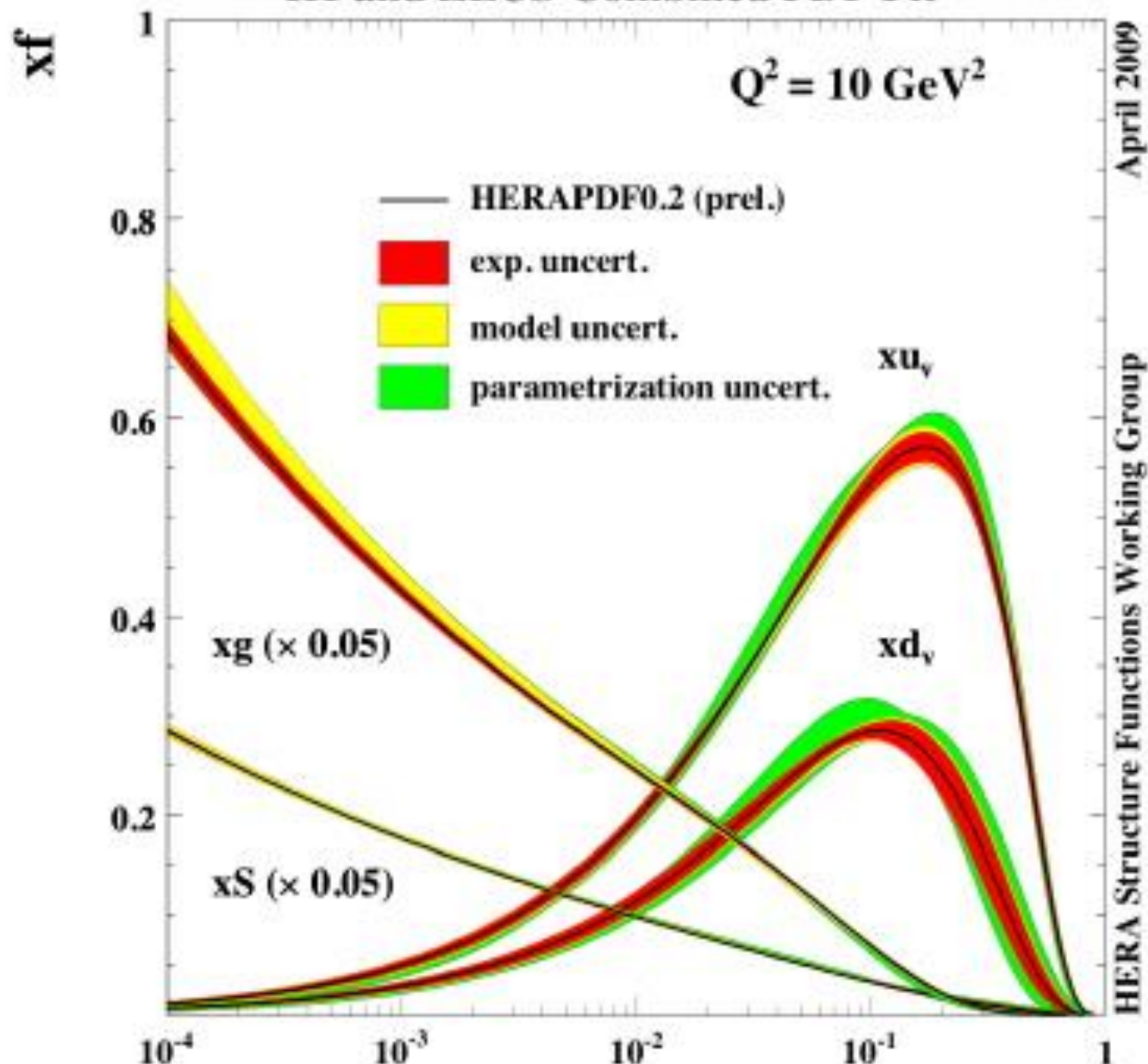
$$\int dx g_1^{en}(x) = \frac{g_A}{6} \left(-\frac{3}{4}a \right) = -0.025 \text{ (-0.027)}$$

$$a = 0.18$$

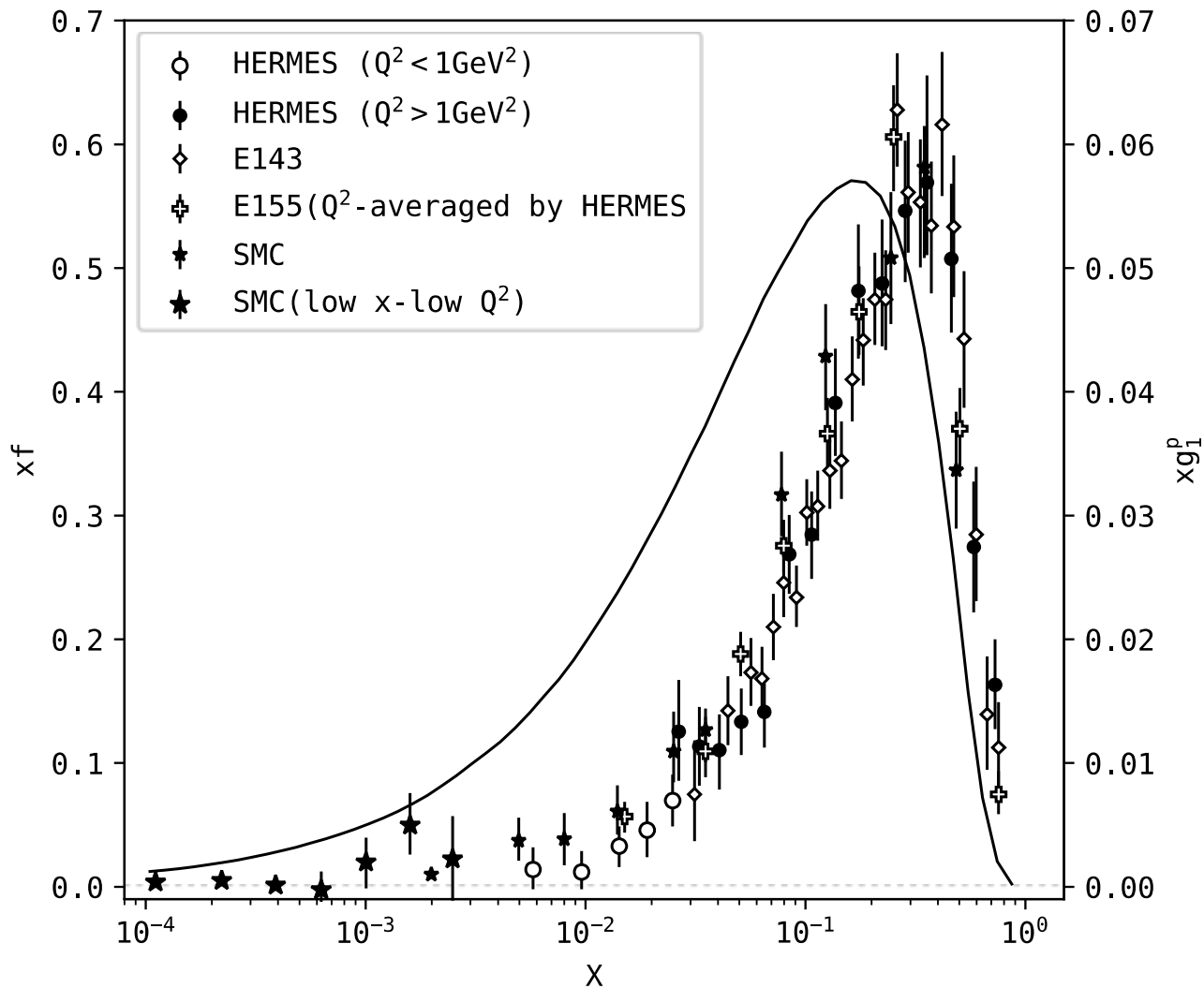
ASSUMPTIONS

- Ellis&Jaffe calculation is correct for the static nucleon
- Spin measurement is correct
- There is physics behind the disagreement between the two

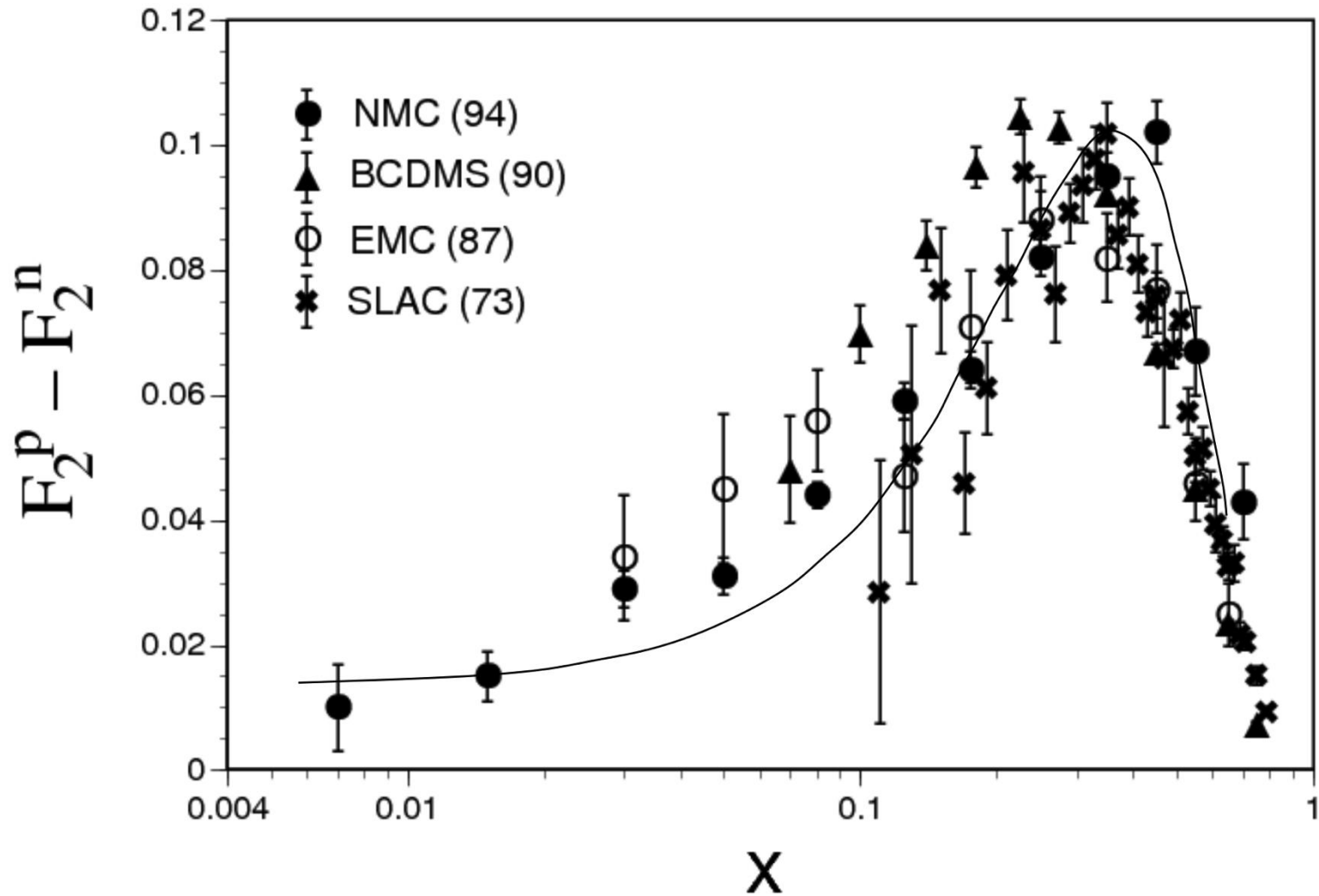
H1 and ZEUS Combined PDF Fit



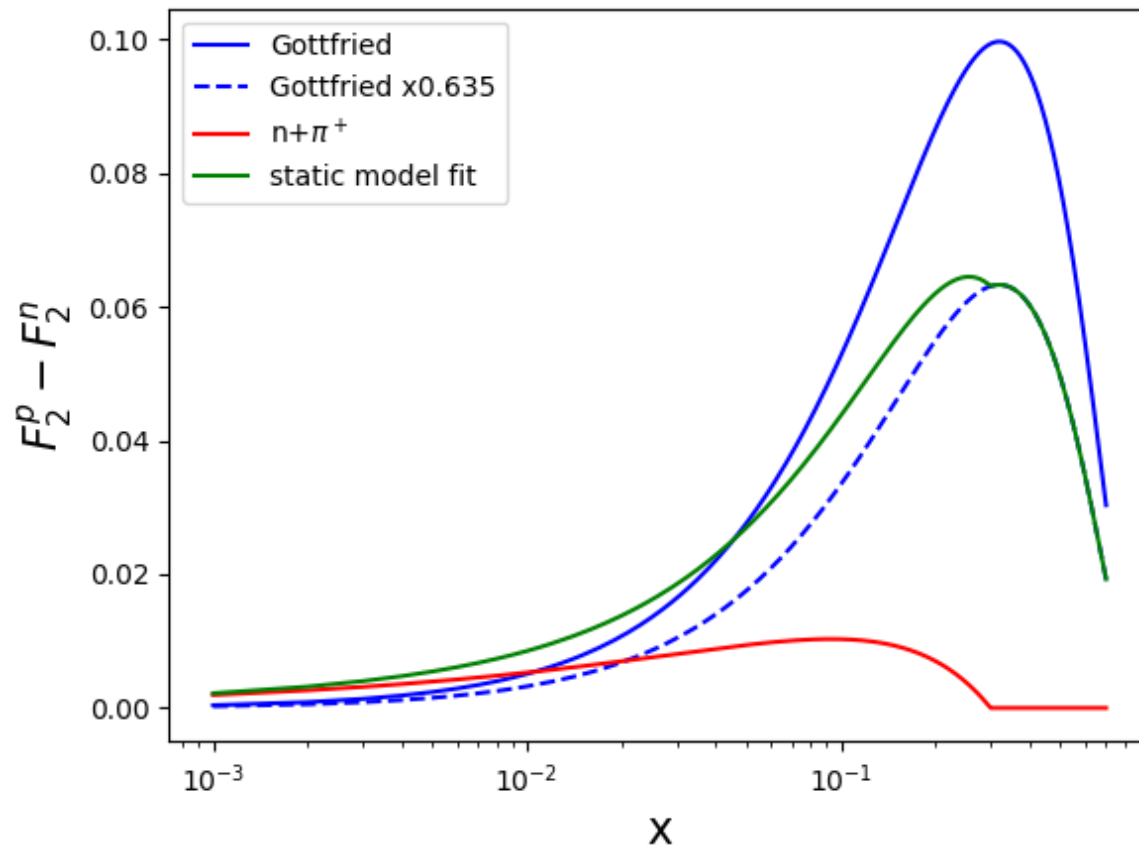
u-quark vs. polarized quark distribution



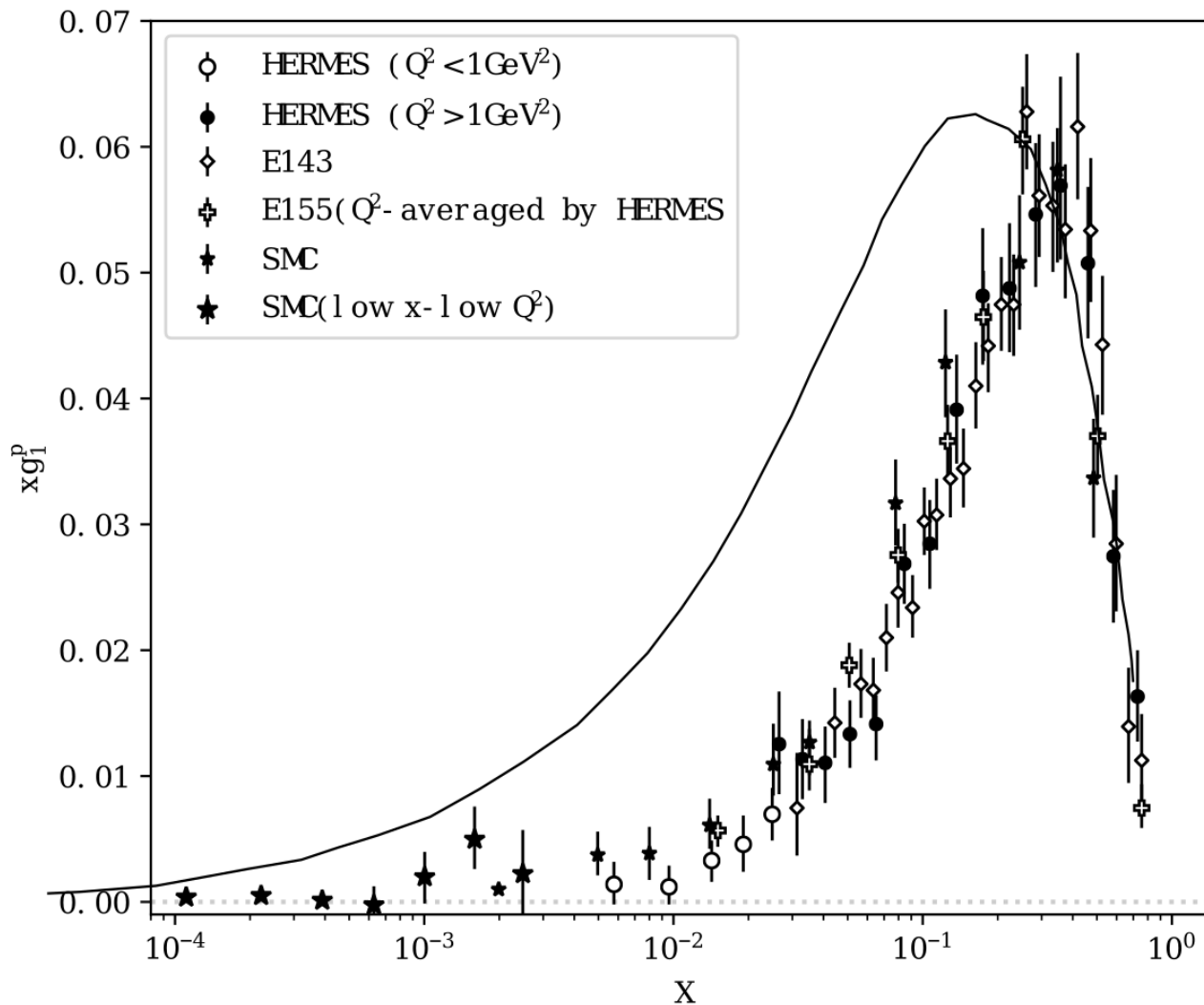
Fit to NMC data--Sg=0.235



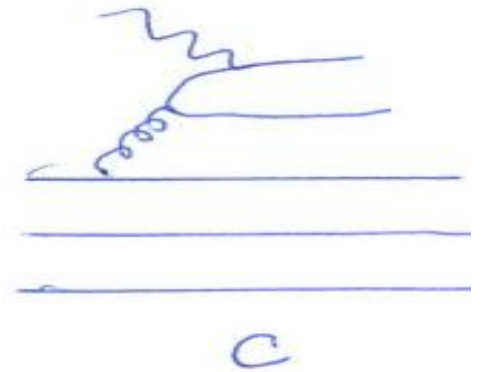
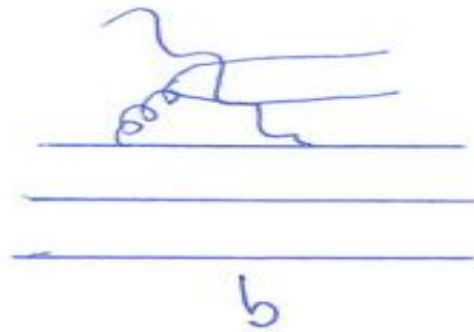
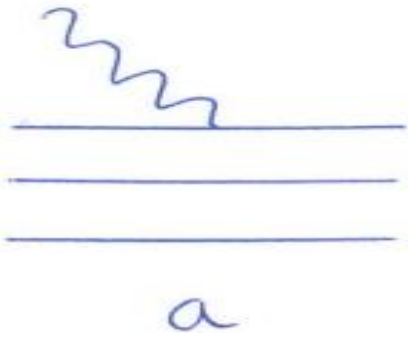
Prediction of the static model green curve



Static model vs experiment



Scattering off the constituent quark



Evidences for two scales in hadrons

- Kopeliovich et al.
- Phys.Rev.D.76 094020 (2007)
- J.Phys.G 30 5999 (2004)
- Phys.Rev.D 62 054022 (2000)

Conclusion

- Spin measurements support the idea of the constituent quark (quark of Gell Mann and Zweig) to be a Nambu-Jona-Lasino current quark with a gluon condensate. It presents the step in the ladder between the current quark and the hadron.