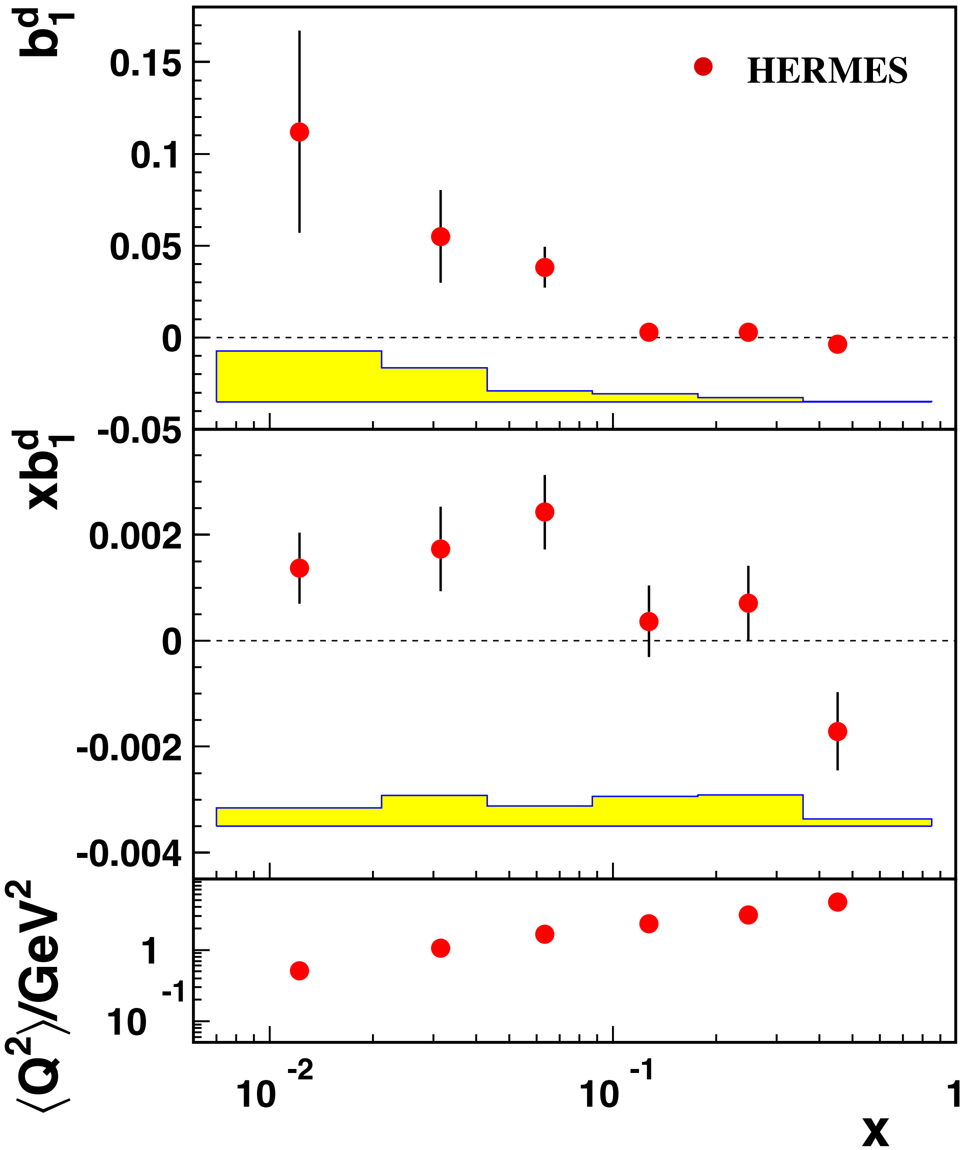
Nucleon (spin) structure

- tensor polarized deuteron b_1 structure function



Airapetian et al., PRL ***95****, 242001 (2005)*

$$\int_{0.02}^{0.85} dx\, b_1(x) = 0.35\,(10)\,(18) \times 10^{-2}$$

$(Q^2 > 1\,\mathrm{GeV}^2)$

→ Close-Kumano sum rule $\int_0^1 dx\, b_1(x) = 0$ assumes valence quark dominance

→ various small-x mechanisms (shadowing, pion-exchange,...) violate sum rule

Nucleon (spin) structure

- electroweak structure functions

→ neutral current

$e.g.$ unpolarized lepton + longitudinally polarized hadron gives (spin-dependent) parity-violating asymmetry

$$A_{\rm PV} = \frac{\sigma^{\rm PV}(S_L) - \sigma^{\rm PV}(-S_L)}{\sigma^{\rm PV}(S_L) + \sigma^{\rm PV}(-S_L)}$$

$$= \frac{G_F Q^2}{4\sqrt{2}\pi\alpha} \left[g_A^e\, f(y)\, \frac{g_1^{\gamma Z}}{F_1^{\gamma Z}} + g_V^e\, \frac{g_5^{\gamma Z}}{F_1^{\gamma Z}} \right]$$

$$g_1^{\gamma Z} = \sum_q e_q\, g_V^q\, (\Delta q + \Delta \bar{q})$$

$$g_5^{\gamma Z} = \sum_q e_q\, g_A^q\, (\Delta q - \Delta \bar{q})$$

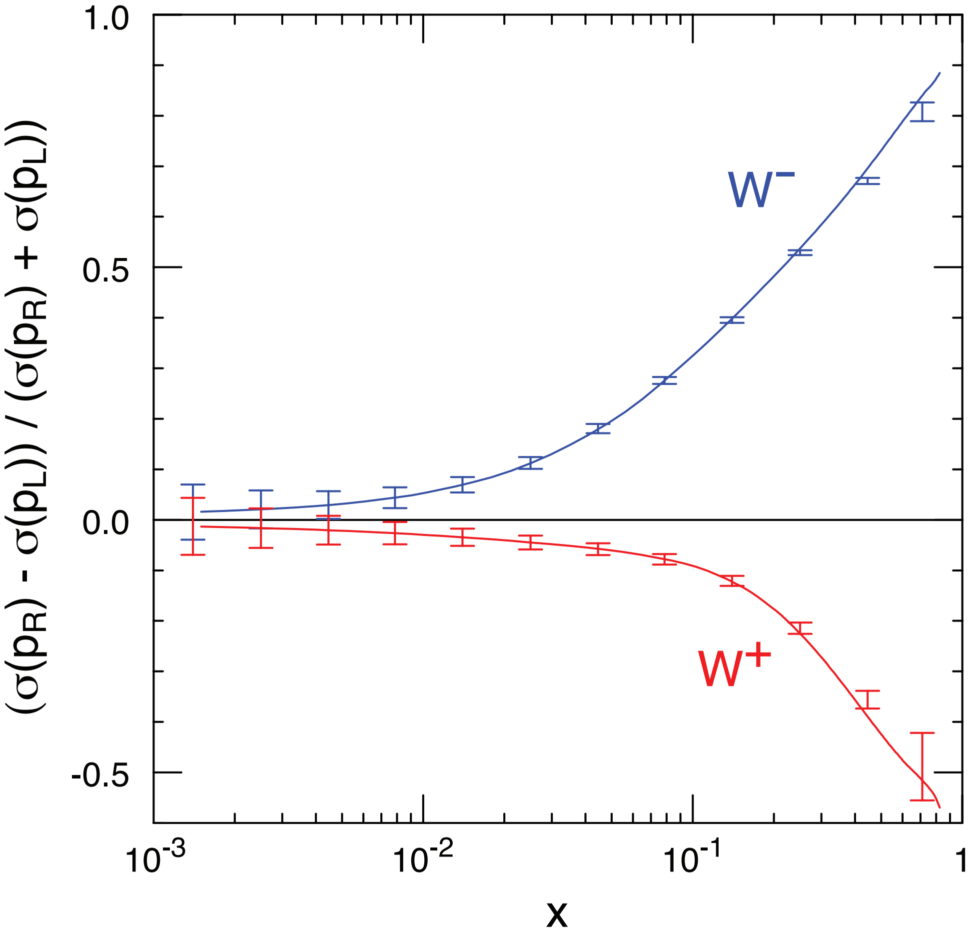
← analog of F_3

→ unique window on spin−flavor decomposition

Nucleon (spin) structure

- electroweak structure functions

→ charged current



Accardi et al., arXiv:1212.1701

$$g_1^{W^-} = \Delta u + \Delta\bar{u} + \Delta c + \Delta\bar{s}$$

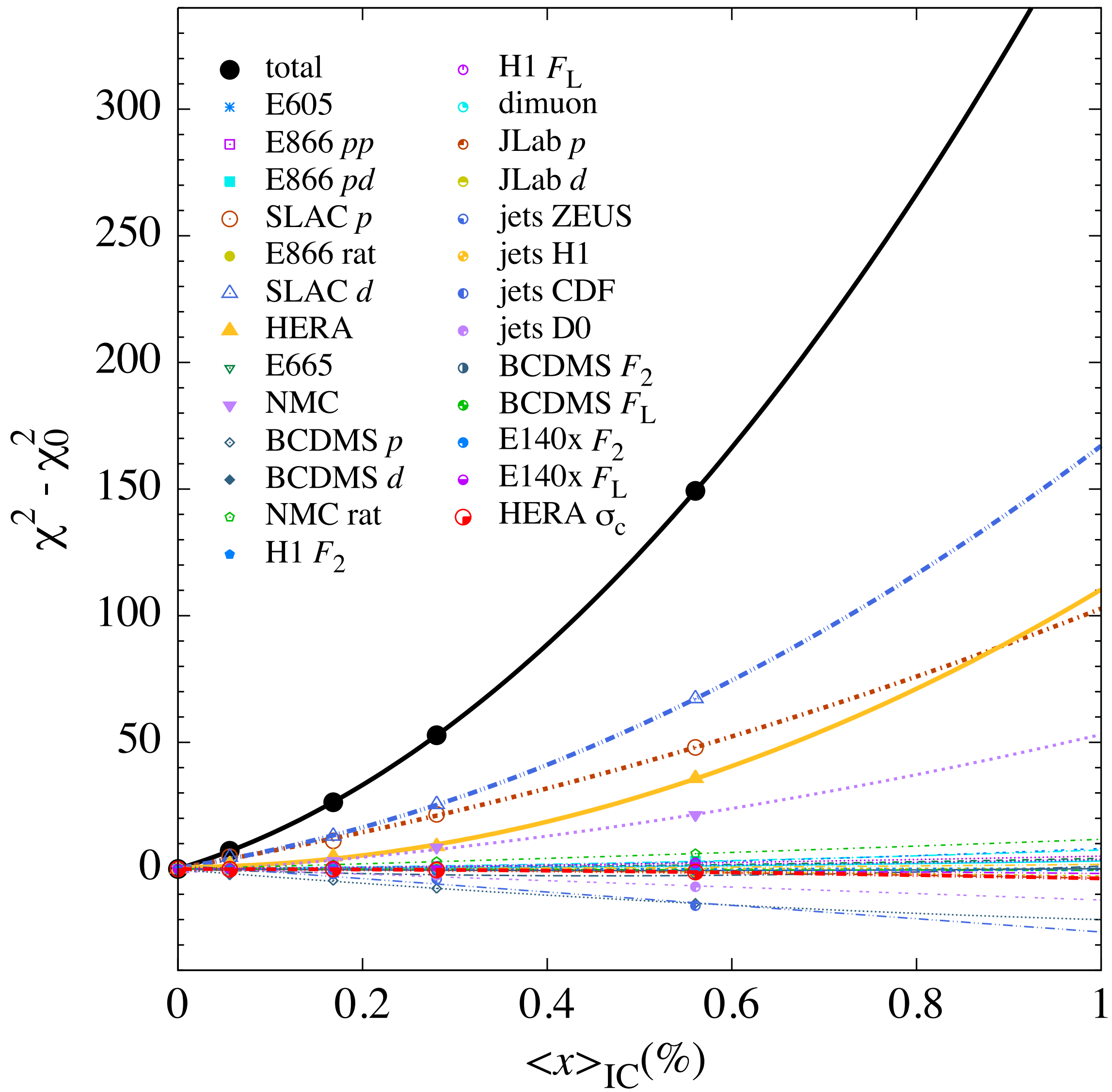
$$g_5^{W^-} = -\Delta u + \Delta\bar{u} - \Delta c + \Delta\bar{s}$$

→ flavor decomposition of polarized nucleon sea

$\Delta s - \Delta\bar{s},\ \Delta c - \Delta\bar{c},\ \ldots$

Nucleon (sea) structure

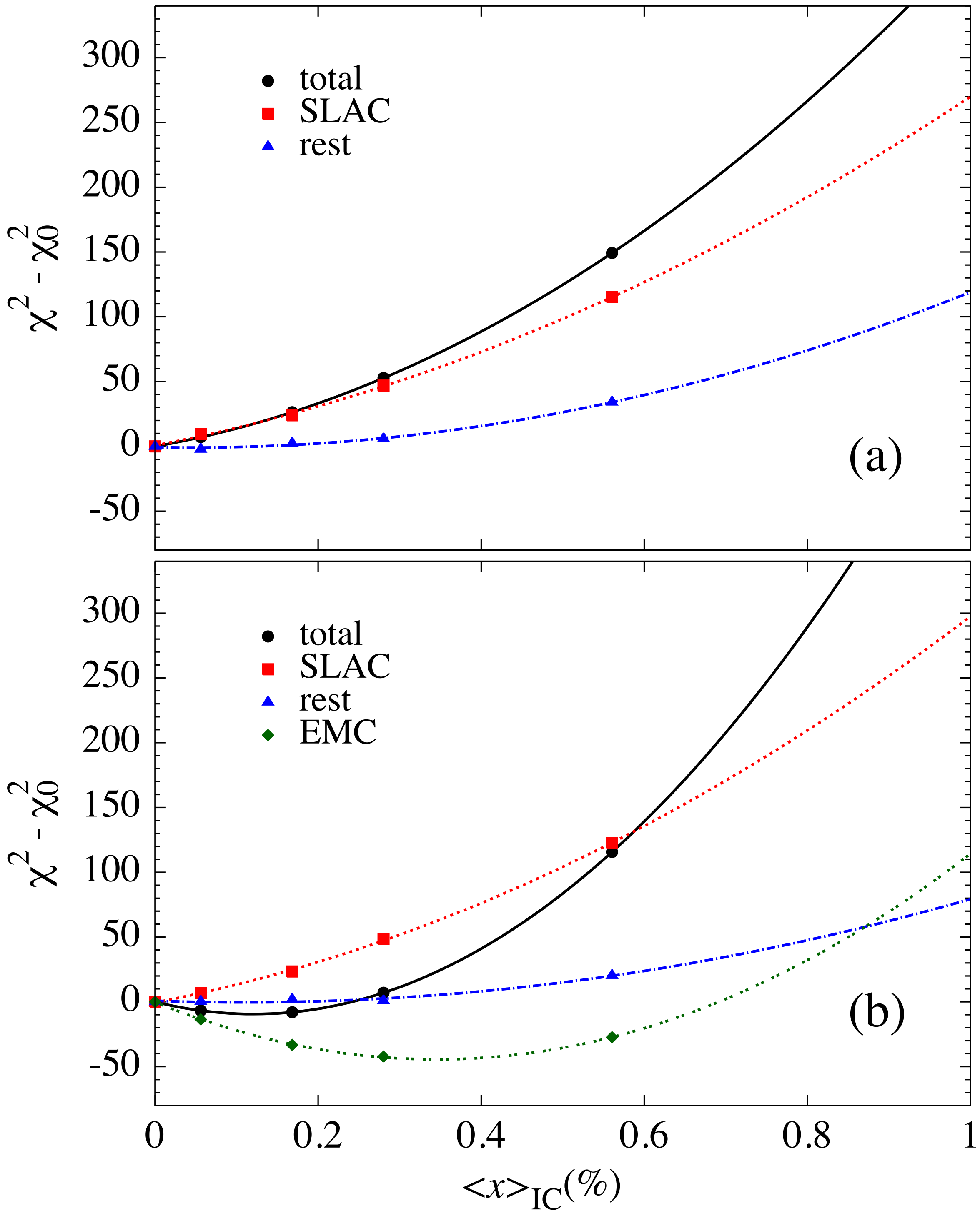
- intrinsic sea (charm)



$$\chi^2/N_{\rm dat} = 1.25$$

$$N_{\rm dat} = 4296$$

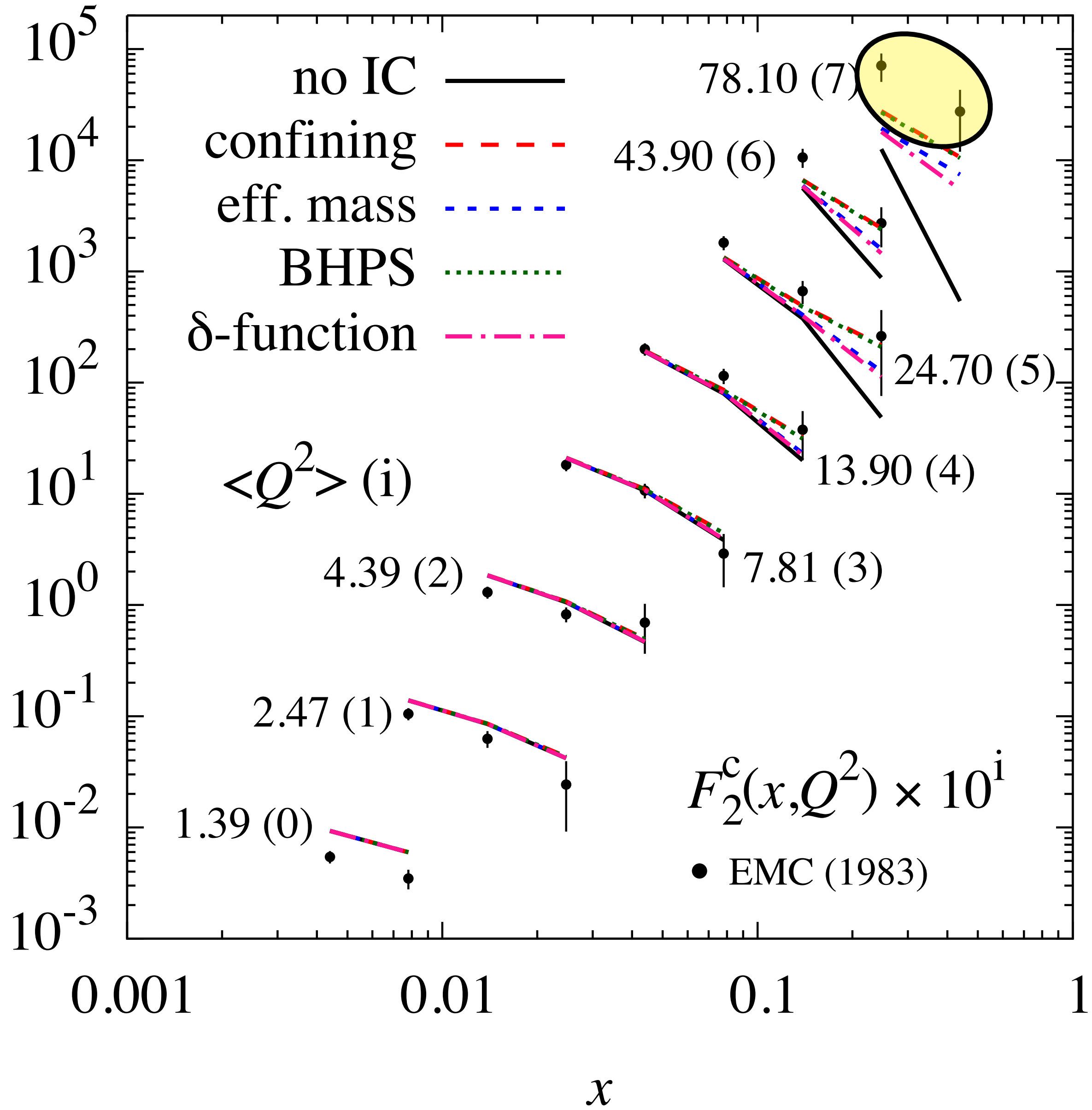
Jimenez-Delgado, Hobbs, Londergan, WM, arXiv:1408.1708



$\langle x \rangle_{\text{IC}} < 0.1\%$ at 5σ

$\langle x \rangle_{\text{IC}} = 0.13(4)\%$

with EMC data

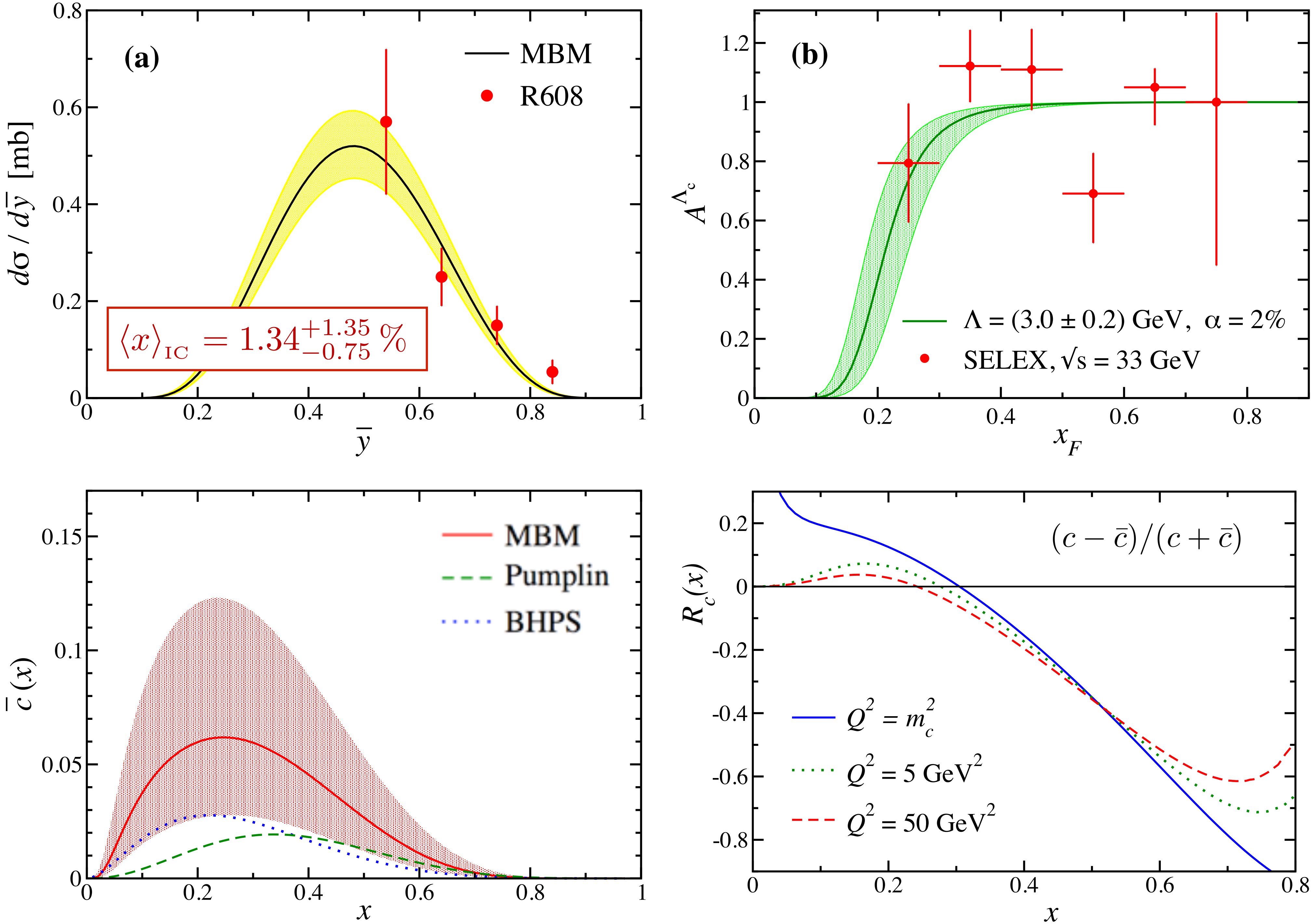


$N_{\rm IC}^{\rm BHPS} = 1\%$

$\langle x \rangle_{\rm IC}^{\rm BHPS} = 0.57\%$

$\chi^2 / N_{\rm dat}^{\rm EMC} = 4.3$

→ could EIC "discover" intrinsic charm in DIS?



*Hobbs, Londergan, WM, PRD **89**, 074008 (2014)*

DEEP INELASTIC STRUCTURE FUNCTIONS FROM ELECTRON SCATTERING ON HYDROGEN, DEUTERIUM, AND IRON AT 0.6 GeV$^2 \leq Q^2 \leq$30.0 GeV^2*

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E_0 (GeV)	E' (GeV)	θ (deg)	ϵ	C^{RC}	σ^{meas} (pb/sr GeV)	$\pm\delta^{ST}$	$\pm\delta^{SS}$
$x = .20,\ Q^2 = 1.0$							
3.748	1.084	28.728	.485	.773	.1820 E05	.009	.005
4.006	1.342	24.906	.559	.803	.2472 E05	.009	.006
4.251	1.586	22.205	.616	.825	.3248 E05	.008	.006
5.507	2.843	14.520	.792	.889	.8708 E05	.008	.006
6.251	3.586	12.124	.845	.915	.1334 E06	.007	.007
$x = .20,\ Q^2 = 1.5$							
5.507	1.510	24.519	.476	.779	.1133 E05	.009	.005
6.250	2.253	18.783	.611	.835	.2018 E05	.006	.006
7.002	3.005	15.343	.703	.869	.3243 E05	.006	.006
7.498	3.502	13.727	.748	.885	.4235 E05	.006	.006
8.251	4.254	11.866	.799	.905	.5950 E05	.006	.006
$x = .20,\ Q^2 = 2.5$							
8.251	1.589	25.220	.348	.721	.3761 E04	.014	.006
10.243	3.582	14.999	.606	.850	.1158 E05	.004	.006
11.744	5.083	11.746	.716	.889	.2013 E05	.007	.006
$x = .20,\ Q^2 = 5.0$							
16.005	2.683	19.647	.314	.713	.1466 E04	.011	.006
17.255	3.933	15.600	.422	.790	.2423 E04	.008	.006
18.491	5.169	13.134	.508	.832	.3538 E04	.007	.006
19.493	6.171	11.702	.566	.854	.4624 E04	.006	.006
$x = .35,\ Q^2 = 1.5$							
3.748	1.464	30.304	.604	.933	.1133 E05	.007	.006
4.007	1.723	26.950	.660	.953	.1472 E05	.007	.006
4.250	1.966	24.459	.704	.967	.1823 E05	.007	.006
5.507	3.223	16.715	.838	1.025	.4398 E05	.007	.006
7.002	4.718	12.232	.907	1.072	.8930 E05	.013	.007
$x = .35,\ Q^2 = 2.5$							
5.501	1.695	30.008	.506	.914	.3794 E04	.008	.005
6.250	2.443	23.345	.633	.959	.6539 E04	.007	.006
7.081	3.274	18.900	.726	.994	.1053 E05	.007	.006
7.498	3.692	17.283	.761	1.008	.1306 E05	.006	.006
9.710	5.904	11.986	.870	1.062	.2977 E05	.007	.006

→ W^2 up to $\sim 25\,\mathrm{GeV}^2$

$(> 4m_c^2)$