Neutron structure function from inclusive scattering on nuclei

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A recent proposal suggests extraction of the ratio F_2^n/F_2^p of the n, p structure functions (SF) from a generalized EMC ratio $\sigma(^3\mathrm{H})/\sigma(^3\mathrm{He})$ [1]. Realization depends on the upgrading of the electron beam at JLab and data are not foreseen before 2006.

In this contribution we study a relation between total nuclear and nucleon SF averaged over (Z, N) of the nucleus A and which is of the form [2]

$$F_2^A(x, Q^2) = \int_x^A \frac{dz}{z^{2-k}} f^{PN}(z, Q^2) F_2^{\langle N \rangle}(x, Q^2), \tag{1}$$

with f^{PN} the SF of a nucleus composed of point-particles. Above the p, n SF are for N on their mass shell. We try to extract F_2^n from (1) for known nuclear SF and, computed f. We introducee Mellin transforms

$$\tilde{g}(u) = \int_0^\infty dx x^{u-1} g(x) \tag{2}$$

and solve from (1)

$$\tilde{F}_2^n(u, Q^2) = \frac{A}{N} \frac{\tilde{F}_2^A(u, Q^2)}{\tilde{f}^{PN}(u+1, Q^2)} - \frac{Z}{N} \tilde{F}_2^p(u, Q^2) \tag{3}$$

Direct inversion of (3) appears to be difficult and we chose instead a parametrization

$$F_2^n(x, Q^2; d_n) = F_2^p(x, Q^2) \exp[\sum_{k=1,m} d_k(Q^2) x^k] \tag{4}$$

The parameters d_k are produced by a least square fit of the extracted $\tilde{F}_2^n(u, Q^2)$ and the Mellin transform (2) of (4). The ration $C = F_2^n/F_2^p$ contains much relevant information [3].

From existing data on C, Fe we could only extract $F_2^n(x, Q^2)$ for $Q^2 \approx 3.5$ GeV^2. We shall discuss the above and other methods leading to $C(x)$ smoothly descending to $C(1) \approx$ 0.35-0.55. For the D there are data for a range of Q^2. For the common Q^2 we shall compare results, discuss the Q^2- dependence of F_2^n from the D data and mention implications.

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