

# Massachusetts Institute of Technology

## Department of Physics

8.276 Nuclear and Particle Physics

March 8, 2007

### Reading Assignment for 3/13 and 3/15

*Particles and Nuclei*, Chapter 10

### Problem Set #4 (due 3/15)

1. *P&N*, 7-5

2. Give a qualitative physical explanation for the differing shapes of the valence and sea quark momentum distributions shown in Fig. 7.7.

3. From electron-proton scattering experiments it is found that

$$\int_0^1 F_2^p(x) dx = 0.18.$$

From electron-deuteron scattering experiments one can deduce an equivalent result for the neutron:

$$\int_0^1 F_2^n(x) dx = 0.12.$$

Use this information to find the ratio of the integrated quark distribution functions

$$\int_0^1 xu_v^p(x) dx$$

and

$$\int_0^1 xd_v^p(x) dx.$$

4. From Eqs. (8.1) and (8.2), show that the inequality

$$\frac{1}{4} \leq \frac{F_2^{en}(x)}{F_2^{ep}(x)} \leq 4$$

holds for all values of  $x$ . What quark structure of the proton is implied by the lower and upper limits?

5. *P&N*, 8-1