DIS cross section

Neutral Current

$$\frac{d^2\sigma_{NC}^{e^\pm p}}{dx\, dQ^2} = \frac{2\pi\alpha^2}{xQ^4}\left[Y_+\tilde{F}_2(x,Q^2) \mp Y_- x\tilde{F}_3(x,Q^2) - y^2\tilde{F}_L(x,Q^2)\right]$$

$$Y_\pm \equiv 1 \pm (1-y)^2$$

$$\tilde{F}_2 \equiv F_2 - v_e \frac{\kappa_w Q^2}{(Q^2+M_Z^2)} F_2^{\gamma Z} + (v_e^2+a_e^2)\left(\frac{\kappa_w Q^2}{Q^2+M_Z^2}\right)^2 F_2^Z = x\sum A_i(q_i+\bar{q}_i)$$

$$x\tilde{F}_3 \equiv -a_e \frac{\kappa_w Q^2}{(Q^2+M_Z^2)} xF_3^{\gamma Z} + (2v_e a_e)\left(\frac{\kappa_w Q^2}{Q^2+M_Z^2}\right)^2 xF_3^Z = x\sum B_i(q_i-\bar{q}_i)$$

v_e, a_e - *vector and axial couplings,* $\kappa_w^{-1} = 4\frac{M_W^2}{M_Z^2}(1-\frac{M_W^2}{M_Z^2})$

Charged Current

$$\frac{d^2\sigma_{CC}^\pm}{dx\, dQ^2} = \frac{G_F^2 M_W^4}{2\pi x}\frac{1}{(Q^2+M_W^2)^2}\,\phi_{CC}^\pm(x,Q^2)$$

$$\phi_{CC}^+ = x\left[(\bar{u}+\bar{c}) + (1-y)^2(d+s)\right] \qquad (in\ \mathrm{LO})$$

$$\phi_{CC}^- = x\left[(u+c) + (1-y)^2(\bar{d}+\bar{s})\right]$$

Reduced NC and CC cross sections

$$\tilde{\sigma}_{NC}(x,Q^2) \equiv \frac{1}{Y_+}\frac{Q^4\ x}{2\pi\alpha^2}\frac{d^2\sigma_{NC}}{dxdQ^2} = F_2(1+\Delta_{F_2}+\Delta_{F_3}+\Delta_{F_L})$$

$$\tilde{\sigma}_{CC}(x,Q^2) \equiv \frac{2\pi x}{G_F^2}\left(\frac{M_W^2+Q^2}{M_W^2}\right)^2\frac{d^2\sigma_{CC}}{dxdQ^2}$$