Physics G6050 – Assignment 5

Due: Monday November 27, 2006

Problems from Griffiths:

Chpt 10 – 10.1, 10.2, 10.11, 10.12, 10.19

Other Problems:

(1) Griffiths problem 10.20 (but note that the Z cannot decay to top-antitop since it is kinematically forbidden). Also, note that the completeness relation for massive spin 1 particles implies that summing over the initial Z^0 polarization states will give rise to a factor of $-g_{\mu\nu}+p_\mu p_\nu/M^2$.

(2) From the accurately known values of M_Z = 91.1876 GeV, $G_F = 1.16639 \times 10^{-5}$ /GeV^2 , and $\alpha_{EM} = 1/137.036$, determine the mass of the W boson and the electroweak mixing angle, $\sin^2\theta_W$. (This is a modification of Griffiths problem 10.17.)

(3) A beam of neutral kaons of momentum 4.0 GeV travels in vacuo along the positive x axis. At the source (x=0), the beam is known to consist entirely of K^0 mesons. The intensity of K^0 and $\overline{K}^0$ states are measured as a function of increasing x in the lab frame. What are the lowest two values of x at which you would expect equal K^0 and $\overline{K}^0$ intensities?

(4) Read the accompanying paper on the experimental discovery of the W intermediate vector boson. Explain briefly how the W candidate events were identified and how their characteristics were consistent with the hypothesis that they were evidence for W boson production and decay.