Elementary Particle Physics: Assignment # 10

Due Wednesday April 30 before class

1 Imagine a theory in which there is a weak charge interacion with a vertex $\gamma^{\mu}(g_V - g_A \gamma^5)$ and still short range (ie due to a very massive charged gauge boson).

(1.1) Write the amplitude for the process $\mu^- \rightarrow e^- \bar{\nu}_e \nu_\mu$ in this theory assuming that the mass of the gauge boson is much heavier than the mass of the muon.

(1.2) Compute the energy dependence of the emitted e^- in that theory (you will have to to the traces and integrate the phase space following for example in Halzen and Martin pages 261-263)

(1.3) Plot the ratio of the electron energy distribution of the events for the V-A interacton ($g_V = g_A$) over that of a vector interaction ($g_A = 0$) (normalized to the same total number of events). Which interaction gives the larger number of more energetic electrons?

2 Draw the dominant diagrams for the decay of a D^0 meson ($D^0 = (c\bar{u})$ meson) in the following channels: $D^0 \rightarrow K^- \pi^+$, $D^0 \rightarrow K^+ \pi^-$.

Derive the expected ratio of the decay branching ratios in these channels neglecting mixing with the third generation. Compare with results in the review of Particle Data Group.