Phy 523
PARTICLE PHYSICS
Midsemester -I

Attempt all questions; All questions carry equal marks.

February 21st 2009

allowed 90 minutes

Q1. If the decay rate of $\Delta^{++} = \Gamma^{++}$ what is the decay rate of Δ^{+}?

Q2. A particle X of mass M_X decays to two paricls Y (mass M_Y). The decay distribution is isotropic in the rest frame of X. Consider a frame in which X is travelling with energy E_X along the 3rd direction. Show that the energy distribution in the moving frame is constant- that is if dN_Y is the number emitted in the energy range E_Y to $E_Y + dE_Y$ show that

$$\frac{dN_Y}{dE_Y} = constant$$

and

$$\frac{\gamma}{2}[M_X - \beta\sqrt{(M_X^2 - 4M_Y^2)}] < E_Y < \frac{\gamma}{2}[M_X + \beta\sqrt{(M_X^2 - 4M_Y^2)}$$

where $\gamma = E_X/M_X$ and $\beta = \sqrt{(E_X^2 - M_X^2)}/E_X$

Q3. A ρ^0 meson is in the rest frame in the eigenstate of spin operator S_3 with eigenvalue 0. Write the matrix element for the decay of ρ^0 to $\pi^+\pi^-$. Find the angular distribution of the decay products. (You can use the matrix element

$$M = g\epsilon^{\mu}(p_{\pi^+} - p_{\pi^-})_{\mu}$$

where g is a constant.) ϵ^{μ} represents the polarization vector of ρ^0 meson and p_{π^+}, p_{π^-} are the four momenta of the π^+, π^- respectively.