Phy 523
PARTICLE PHYSICS
Problem sheet IV

3rd February 2009

February 10th 2009

16. Relate the matrix elements of the decay $\Delta^{++}, \Delta^{+}, \Delta^{0}$ and Δ^{-} to pions and nucleons assuming isospin invasriance. ($I(\Delta) = 3/2$) .

17. Genralised statistics states that isospin wave funtion $\times$ spin wave function $\times$ spatial wave function should be symmetric (antisymmetric) for bosons (fermions). Find the combinations allowed (isospin,spin and spatial) for (a) two pions (b) two nucleons .

18. Isospin (J^P) of ω^0 is I=1 and 1^-.(It's mass is $780 Mev/c^2$) Show that it can not decay into two pions if isospin is conserved. Given that deuteron is in $l = 0, S = 1$ find the isospin of deuteron.

19. η^0 is an I=0 and $J^P = 0^-$ particle .(It's mass $=550 Mev/c^2$) Show that it can not decay to two pions if parity is conserved in the decay.

20. ω^0 decays to three pions, $\omega^0 \rightarrow \pi^0 + \pi^+ + \pi^-$. Let the average energies of π^+, π^- be $< E_+ >, < E_- >$ respectively. (a) Write down an expression for the average values $< E_+ >$ and $< E_- >$ in terms of $|M|^2$ and phase space integral over the three momenta of pions. ($|M|^2$ is the square of the approriate matrix element.) (b) Show that if C or CP is a conserved in the decay $< E_+ >=< E_- >$.