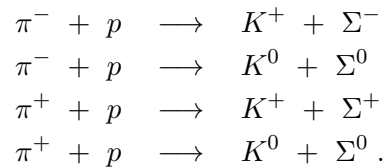


**NUCLEAR AND PARTICLE PHYSICS**  
**PHY 422/622**

**ASSIGNMENT II**

- (1) Given that  $(K^+, K^0)$  form an isospin-doublet and  $(\Sigma^+, \Sigma^0, \Sigma^-)$  form an isospin-triplet, what are the ratio of cross sections for



What are the ratios when the  $I = 3/2$  mode dominates?

- (2) Consider the bound state of a Dirac fermion and anti-fermion  $(f\bar{f})$ , such as a meson  $(q\bar{q}')$  or positronium  $(e^-e^+)$ . Assume that the particle and anti-particle have opposite intrinsic parities. Try to argue that this bound state has eigenvalues for parity and charge conjugation

$$\begin{aligned}P &= -1 \times (-1)^l \\ C &= -1 \times (-1)^{s+1} \times (-1)^l .\end{aligned}$$

$l$  and  $s$ , as usual, are the orbital angular momentum and spin quantum numbers of the bound state.

- (3) Deduce the most general angular distribution for the decay

$$\Lambda^0 \longrightarrow p + \pi^- .$$

What happens if *parity* is a good symmetry for the above decay? How was parity-violation experimentally deduced from  $\beta$ -decay of  $^{60}\text{Co}$ -nuclei?