

PHYS 576: Particle Physics

Homework #2

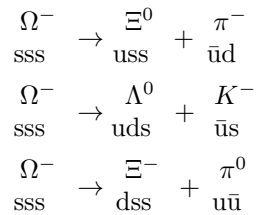
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1. Discuss the possible decay modes of the Ω^- allowed by conservation laws, and show how weak decay is the only remaining choice.

Solution:

There are three decay modes of Ω^- . They are



All of these processes violate the strangeness conservation. So they can't proceed via strong interaction, so weak interaction is the only choice. \square

2. Determine which isospin states the following combination of particles can exist in

(a) $\pi^0\pi^-\pi^0$

Solution:

Using the Clebsch Gordan coefficients to write the state composition we get.

$$\begin{aligned} |\pi^+\pi^-\pi^0\rangle &= |11\rangle|1-1\rangle|10\rangle \\ |11\rangle|1-1\rangle &= \frac{1}{\sqrt{6}}|20\rangle + \frac{1}{\sqrt{2}}|10\rangle + \frac{1}{\sqrt{3}}|00\rangle \\ |20\rangle|10\rangle &= \sqrt{\frac{3}{5}}|30\rangle - \sqrt{\frac{2}{5}}|10\rangle \\ |10\rangle|10\rangle &= \sqrt{\frac{2}{3}}|20\rangle - \sqrt{\frac{1}{3}}|00\rangle \\ |00\rangle|10\rangle &= |10\rangle \end{aligned}$$

So the possible isospin combinations are $I = \{0, 1, 2, 3\}$ \square

(b) $\pi^0\pi^0\pi^0$

$$\begin{aligned} |\pi^0\pi^-\pi^0\rangle &= |10\rangle|10\rangle|10\rangle \\ |10\rangle|10\rangle &= \sqrt{\frac{2}{3}}|20\rangle - \sqrt{\frac{1}{3}}|00\rangle \\ |10\rangle|00\rangle &= |10\rangle \\ |20\rangle|10\rangle &= \sqrt{\frac{3}{5}}|30\rangle - \sqrt{\frac{2}{5}}|10\rangle \end{aligned}$$

So the possible isospin combinations are $I = \{1, 3\}$