

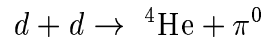
Homework 1, due 10-20

1. Using isospin symmetry, compute the ratio

$$R = \frac{\sigma(p + d \rightarrow \pi^0 + {}^3\text{He})}{\sigma(p + d \rightarrow \pi^+ + {}^3\text{H})}.$$

Here, d is the deuteron (a bound state of p and n), and ${}^3\text{He}$, ${}^3\text{H}$ are three nucleon bound states with charge $Q = +e$ and $+2e$, respectively. You can use the fact that there are no two or three neutron bound states.

2. ${}^4\text{He}$ is a bound state of two protons and two neutrons with $I = 0$. Explain why the reaction



is forbidden by isospin symmetry.

3. The ρ meson is a spin one meson (a “vector” meson) with $I = 1$. Using isospin symmetry compute the ratios

$$R = \frac{\rho^0 \rightarrow \pi^0 + \pi^0}{\rho^0 \rightarrow \pi^+ + \pi^-}$$

and

$$R = \frac{\rho^+ \rightarrow \pi^+ + \pi^0}{\rho^0 \rightarrow \pi^+ + \pi^-}.$$