

Particle Physics Homework Assignment 8

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Problem 1: Consider an experiment where negative pions, π^- , at rest are being captured by a Hydrogen nuclei.

- 1) Draw conclusions about the spin of the π^- given that the experiment observed the reaction $\pi^- p \rightarrow n \gamma$.
- 2) Can the reaction $\pi^- p \rightarrow n$ occur if the initial state proton is free (not bound in a nucleus) ?
- 3) Draw conclusions about the parity of the π^0 and π^- given that the experiment observed the reaction $\pi^- p \rightarrow n \pi^0$.
- 4) Draw conclusions about the π^0 spin provided that it decays into two photons:
 $\pi^0 \rightarrow \gamma \gamma$.

(Justify all your answers)

Problem 2: The ρ^0 is a vector boson, that is an 1^- state. Explain why the decay $\rho^0 \rightarrow \pi^+ \pi^-$ is allowed and why the decay $\rho^0 \rightarrow \pi^0 \pi^0$ is forbidden.

Problem 3: The η meson is a 0^- state. Explain why the decay $\eta \rightarrow \pi^- \pi^+$ is forbidden whilst the decay $\eta \rightarrow \pi^- \pi^\pm \pi^0$ is allowed via the electromagnetic interaction.