PH 406 SET 8

DUE: FRIDAY, APRIL 9, 1993

(1) The Σ^0-hyperon decays electromagnetically in the mode $\Sigma^0 \to \Lambda + \gamma$. Show how the relative parity of Σ^0 and Λ determines the multipolarity of the γ-ray emitted. From the polarization vector $\boldsymbol{\varepsilon}$ of the photon, and the propagation vector $\mathbf{k}$ and spin $\boldsymbol{\sigma}$ of the Λ, deduce the simplest forms for the matrix element for even or odd relative parity. The experimental determination of the Σ-Λ parity has been based on the analysis of the Dalitz decay $\Sigma \to \Lambda e^+ e^-$. Which of the parity assignments has the steeper distribution in the invariant mass of the e^+e^- pair?

SKETCH THE FAVORED ORIENTATIONS OF THE PHOTON POLARIZATION $\bar{\epsilon}$ SUPPOSING THE Λ SPIN $\bar{\sigma}$ IS $\perp$ TO THE MOMENTUM VECTOR $\bar{k}$ (IN Σ^0 REST FRAME, OF COURSE).

(2) The intrinsic parity of the hyperon Ξ^-, of strangeness -2, can in principle be determined from observations on capture in hydrogen from an S-orbit:

$$\Xi^- + p \to \Lambda + \Lambda.$$

The polarization of the Λ-hyperons can be determined from the asymmetry in the weak decay $\Lambda \to p + \pi^-$ (see Section 7.7). State what is the polarization (if any) of the Λs produced in the above reaction and how the relative polarizations are determined by the Ξ-parity.

(3) a) Find a relation between the total cross-sections (at a given energy) the reactions

$$\pi^- p \to K^0 \Sigma^0,$$

$$\pi^- p \to K^+ \Sigma^-,$$

$$\pi^+ p \to K^+ \Sigma^+.$$

b) Deduce through which isospin channels the following reactions may proceed: (a) $K^+ + p \to \Sigma^0 + \pi^0$, (b) $K^- + p \to \Sigma^+ + \pi^-$. Find the ratio of cross-sections for (a) and (b), assuming that one or other channel dominates.