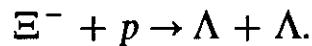


DUE: FRIDAY, APRIL 9, 1993

- ① The Σ^0 -hyperon decays electromagnetically in the mode $\Sigma^0 \rightarrow \Lambda + \gamma$. Show how the relative parity of Σ^0 and Λ determines the multipolarity of the γ -ray emitted. From the polarization vector ϵ of the photon, and the propagation vector \mathbf{k} and spin σ 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 $\Sigma \rightarrow \Lambda e^+ e^-$. Which of the parity assignments has the steeper distribution in the invariant mass of the $e^+ e^-$ pair?

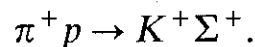
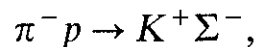
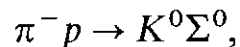
SKETCH THE FAVORED ORIENTATIONS OF THE PHOTON POLARIZATION $\vec{\epsilon}$ SUPPOSING THE Λ SPIN $\vec{\sigma}$ IS \perp TO THE MOMENTUM VECTOR \vec{k} (IN Σ^0 REST FRAME, OF COURSE).

- 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:



The polarization of the Λ -hyperons can be determined from the asymmetry in the weak decay $\Lambda \rightarrow p + \pi^-$ (see Section 7.7). State what is the polarization (if any) of the Λ s 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



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