The Weak Production of Λ Particles Near Threshold in Electron-Proton Scattering

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- We obtain differential cross sections as a function of laboratory Λ angle for a number of incoming electron energies from 195 MeV to 210 MeV for the reaction:

  $$e^- + p \longrightarrow \Lambda + \nu_e$$

  near threshold which is at 194 MeV. This process has taken on renewed interest because it has been proposed as a possible test for neutrino mass[1].

  The proposed experiment would be done at the Thomas Jefferson National Accelerator Facility at energies below that for normal operation. The proposed experiment would make use of electron beams polarized in the left and right handed directions and from the difference in cross sections a neutrino mass might be obtained[1].

  In this calculation we make use of SU(3) relations to related the weak vector current form factors governing the $p - \Lambda$ transition matrix to proton and neutron electromagnetic form factors. We make use of data for the beta decay:

  $$\Lambda \longrightarrow p + e^- + \bar{\nu}_e$$

  to obtain the axial current form factor. Thus we keep our calculation as phenomenological as possible.

  We find that the differential cross sections are very peaked toward the maximal scattering angle and that as the electron energy falls, the maximal scattering angle of the Λ approaches zero. We also obtain the contributions of the various form factors to the differential cross section. We find that at these threshold energies that the axial current form factor, F_A dominates the differential cross sections in the regions where they might be observed. We also compare our results with those at higher energy[2].

References

[1]O.K. Baker, TJNAF Proposal,2001.
[2]S.L. Mintz,Nucl. Phys. A **657** (1999),303