the conversion probabilities in these subshells should be made to check this interpretation. Uranium has six valence electrons,[8] namely $5f^3 6d7s^2$. The chemical effect on the half-life would be due to changes of the screening produced by the valence electrons on the conversion subshells.

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MEASUREMENTS OF THE BRANCHING RATIO AND FORM OF INTERACTION FOR THE BETA DECAY OF THE Λ HYPERON*

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In a stopping-K^- exposure of the Brookhaven National Laboratory 30-in. hydrogen bubble chamber, we have found 204 Λ β decays, $\Lambda \rightarrow p + e^- + \bar{\nu}_e$, with a scanning efficiency of 0.97 ± 0.02. We obtain a branching ratio of $(0.80 \pm 0.08) \times 10^{-3}$. Using SU(3) and conservation of vector current to determine the weak-magnetism to vector form-factor ratio in the baryon current, we find an axial-vector–to–vector ratio of $0.72^{+0.19}_{-0.14}$. The results are in good agreement with Cabibbo theory and are insensitive to the relative strength of weak magnetism.

In a scan of 109 000 pictures of the Brookhaven National Laboratory 30-in. hydrogen bubble chamber exposed to a stopping K^- beam,[1] we have found 204 beta decays of the Λ hyperon, $\Lambda^0 \rightarrow p + e^- + \bar{\nu}_e$.

To insure a satisfying scanning efficiency we instructed the scanners to examine all Λ events and only Λ events. At intervals of 100 pictures, all Λ events were recorded. Elsewhere, only those events considered as leptonic decays were recorded. The signatures by which the events are identified are the curvature and the ionization of the negatively charged decay track. 95% of our expected events have an electron lab momentum less than or equal to 140 MeV/c. The track of a π meson with this momentum has twice minimum ionization and its distinction from the minimum ionization of an electron track is not difficult in our film.

To negate the effect on our branching ratio of any bias, we required our events to satisfy the criteria shown in Table I. Events for which the lambda or proton projected length was obviously less than 1 mm were cut on the scanning table. After the measurement of an event, length and dip cuts were applied and the identity of the event was established by means of a microscopic measurement of gap-length distribution. We accepted 143 events in a total of 130 500 charged Λ decays. Based on a rescan of 24 000 pictures, our scanning efficiency for Λ beta decays is 0.97 ± 0.02. The energy limit in our criteria eliminates 5.5% of the electron spectrum in the leptonic decay.

Table I. Acceptance criteria for the branching ratio.

(1) $D_\Lambda \geq 4$ cm, D_Λ = distance from production vertex to the nearest chamber wall
(2) $l_\Lambda \geq 1$ mm, l_Λ = length of Λ track projected onto the scanning plane
(3) $l_p \geq 1$ mm, l_p = length of p track projected onto the scanning plane
(4) $\lvert\sin\delta_p\rvert \leq 0.94$, δ_p = dip of p track
(5) $\lvert\sin\delta_-\rvert \leq 0.94$, δ_- = dip of negative decay track
(6) $T_e^{\text{cm}} \leq 133$ MeV, T_e^{cm} = c.m. kinetic energy of e^- in the leptonic decay

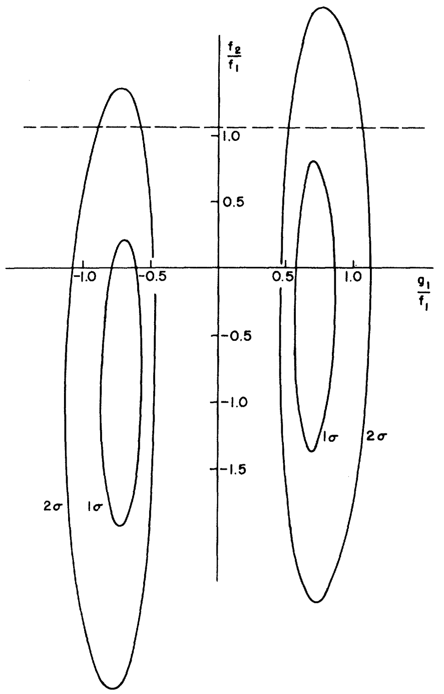

FIG. 1. The one- (1σ) and two- (2σ) standard-deviation contours defined by our likelihood function of the weak-magnetism–to–vector ratio (f_2/f_1) and the axial-vector–to–vector ratio (g_1/f_1). The dashed line represents the value obtained from SU(3) and conserved vector current, i.e., $f_2/f_2 = 1.066$.

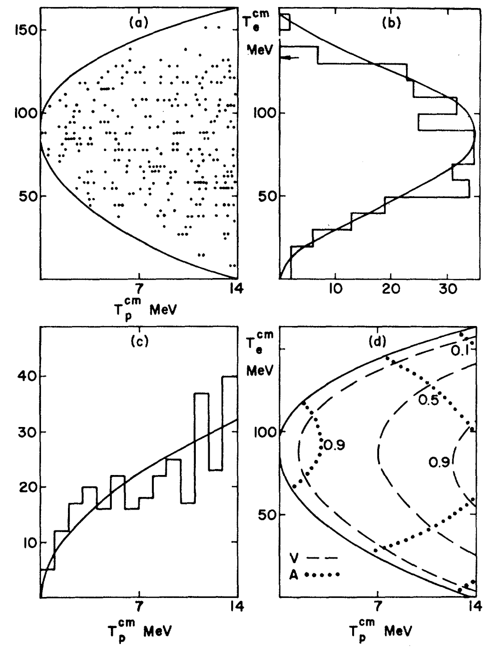

FIG. 2. (a) A Dalitz plot of our 285 solutions (corresponding to 148 events), and the projections onto the c.m. kinetic-energy axes of (b) the electron and (c) the proton. The arrow in (b) indicates the 133-MeV limit in the branching-ratio criteria. The curves in (b) and (c) indicate the distributions expected for our axial-vector–to–vector ratio. The relative probability contours in (d) are shown for pure axial-vector (A) and pure vector (V) baryon currents, respectively.

After correcting for the neutral decay mode and for the leptonic efficiency and energy limit, we obtain the branching ratio

$$\frac{\Lambda \to p + e^- + \bar{\nu}_e}{\text{All } \Lambda \text{ Decays}} = (0.80 \pm 0.08) \times 10^{-3}.$$

This is in good agreement with previously determined values.[2]

In the analysis that follows we shall adopt the standard current-current coupling[3] for the baryon-lepton interaction Hamiltonian,

$$H(x) = (G/\sqrt{2})J^{\mu}(x) j_{\mu}(x).$$

We have used vector, axial-vector, and weak-magnetism components[4] in the baryon current,

$$J^{\mu}(x) = \bar{\psi}_p(x)(f_1\gamma^{\mu} - if_2 M_{\Lambda}^{-1}\sigma^{\mu\nu}Q_{\nu} + g_1\gamma^{\mu}\gamma^5)\psi_{\Lambda},$$

where $Q = p_{\Lambda} - p_p = p_e + p_{\nu}$ is the four-momentum transfer. In Fig. 1 we have plotted the 1- and 2-standard-deviation contours for the log of our likelihood function on the plane defined by the relative magnitudes of the axial-vector and weak-magnetism components. It is obvious that our data are not statistically able to distinguish the sign of the axial-vector–to–vector ratio. Since our results are quite insensitive to the relative magnitude of the weak magnetism component, we have used SU(3) and conservation of vector current to determine f_2 in terms of f_1 and the anomalous magnetic moment of the proton:

$$f_2/f_1 = 0.5\mu_p M_{\Lambda} M_p^{-1} = 1.066.$$

The fitting analyses of our measurements were processed through the TVGP-SQUAW system. At the decay vertex, the four unknown variables are the three components of the neutrino momentum and the magnitude of the lambda momentum. The zero-constraint calculation at this point generally has two solutions. Monte Carlo calculations indicate that this ambiguity occurs with 93% of our events and that the inclusion of all solutions has a negligibly small effect on all the distributions discussed below. Thus we treated each solution as an event with subsequent consideration of this event duality in the determination of the standard deviations.

In our matrix-element calculation we have evaluated the probability density as a function of the c.m. kinetic energies of the proton and the electron. A Dalitz plot of our events on the plane defined by these variables is shown in Fig. 2(a).

The projections of these events onto the electron and proton axes are shown in Figs. 2(b) and 2(c), respectively. In these histograms the curves shown are the distributions expected for the best-fit value of the axial-vector-to-vector ratio stated below. These distributions were obtained from a Monte Carlo calculation which included the characteristic generation of two solutions in the zero-constraint fit and which included the geometric acceptance criteria. In Fig. 2(d) the contours of relative probability density on the Dalitz plane show the characteristic peaking at the low and high baryon-energy limits for the pure axial-vector (A) and pure vector (V) baryon currents, respectively.

We used 148 events contributing 285 solutions to our likelihood function for the axial-vector-to-vector ratio in the baryon current. With proper consideration of the two-solution ambiguity we obtain the ratio

$$|g_1/f_1| = 0.72^{+0.19}_{-0.14}$$

at the 68% confidence level. With 95% confidence we obtain the limits $0.48 \leq |g_1/f_1| \leq 1.22$. If we neglect the effect of weak magnetism, our ratio becomes 0.69. Filthuth[5] has recently reviewed the latest available data on the baryon leptonic decays in the context of the Cabibbo theory.[6] The best fit for the single-angle Cabibbo theory[5] predicts an axial-vector-to-vector ratio $g_1/f_1 = 0.74$ for the leptonic Λ decay, in good agreement with our experimental result.

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A MEASUREMENT OF THE BRANCHING RATIO $(K_L^0 \to \pi\mu\nu)/(K_L^0 \to \pi e\nu)$ *

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We present the results of a study of K_L^0 decays observed in the CERN 1.1-m^3 heavy-liquid bubble chamber. About 75 000 frames were scanned, and yielded some 7500 examples of isolated K_L^0 decays to charged particles. Based on a sample of 4000 events in a restricted fiducial region, the following branching ratios were found:

$$N(K_L^0 \to \pi^\pm\mu^\mp\nu)/N(K_L^0 \to \pi^\pm e^\mp\nu) = 0.648 \pm 0.030,$$

$$N(K_L^0 \to \pi^+\pi^-\pi^0)/N(K_L^0 \to \text{all charged}) = 0.157 \pm 0.010.$$

The CERN 1.1-m^3 heavy-liquid bubble chamber was exposed to a neutral beam taken at 30° from an internal beryllium target in the CERN proton synchrotron. Approximately 2×10^{11} protons/pulse with a momentum of 19.2 GeV/c impinged on the target, giving rise to a flux at the bubble