Many authors[2,3] have shown that the rule $|\Delta \mathrm{I}| = \frac{1}{2}$ holds only for $a_0 = b_- = 0$ or $a_- = b_0 = 0$. To choose from among the three cases the one that exists in nature, one could use measurements of the polarization of the nucleons from the decay of polarized $\Sigma^{\pm}$ particles produced in reactions $\pi^{\pm} + p \rightarrow \Sigma^{\pm} + K^{+}$.

Denoting the polarization vectors of nucleons and Σ hyperons by $\mathbf{P}$ and $\mathbf{P}_{\Sigma}$, we get

$$\mathbf{P} = \frac{2\mathrm{Re}\,(ab^*)}{|a|^2 + |b|^2}\mathbf{k} + \frac{|a|^2 - |b|^2}{|a|^2 + |b|^2}\mathbf{P}_{\Sigma} + \frac{2|b|^2}{|a|^2 + |b|^2}(\mathbf{P}_{\Sigma}\mathbf{k})\,\mathbf{k} + \frac{2\,\mathrm{Im}\,(ab^*)}{|a|^2 + |b|^2}[\mathbf{k}\times\mathbf{P}_{\Sigma}]. \tag{2}$$

In particular $\mathbf{P} = 2(\mathbf{P}_{\Sigma}\mathbf{k})\mathbf{k} - \mathbf{P}_{\Sigma}$ for $a = 0$; $\mathbf{P}_{\Sigma} = \mathbf{P}$ for $b = 0$; and for the third case $\mathbf{P}$ has a component along the direction of $\mathbf{k} \times \mathbf{P}_{\Sigma}$.

It is obvious that a measurement of the direction of the polarization vector of the nucleons will not only give information to test the rule $|\Delta \mathrm{I}| = \frac{1}{2}$, but can also help to choose one solution from the two that are possible ($a_0 = b_- = 0$ or $a_- = b_0 = 0$) if this rule holds.

If there is no transverse polarization of the neutrons from Σ^- decay, this means that the initial Σ^- particle is unpolarized. In this case the absence of asymmetry in the Σ^- decay does not lead to Eq. (1). The quantity $\mathrm{Re}\,(ab^*)$ can be determined from a measurement of the longitudinal polarization of the neutrons.

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ON THE PROCESS $e^- + p \rightarrow \Lambda + \nu$

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So far only two decays $\Lambda \rightarrow p + e^- + \bar{\nu}$ have been found,[1] although according to the universal V-A interaction theory (without, however, taking into account the renormalization of the decay coupling constants) approximately 20 times as many events should have been seen. The rarity of hyperon leptonic decays makes the study of them very difficult. For this reason it becomes of interest to study the inverse process

$$e^- + p \rightarrow \Lambda + \nu, \tag{1}$$

which is due to the same interaction as the β decay of the Λ hyperon, but whose statistics may, in principle, be made rather large.

The threshold for reaction (1) in the laboratory system is $(m_{\Lambda}^2 - m_p^2)/2m_p = 194$ Mev, and, up to the threshold for Λ photoproduction ($e^- + p \rightarrow e^- + \Lambda + K^+$), which is equal to $[(m_{\Lambda} + m_K)^2 - m_p^2]/2m_p = 912$ Mev, reaction (1) is the only source of Λ hyperons (together with $e^- + p \rightarrow \Sigma^0 + \nu$, $\Sigma^0 \rightarrow \Lambda + \gamma$).

The matrix element for process (1) (in the notation introduced in reference 3) has the form (where we ignore the electron mass)

$$M = (\bar{u}_{\Lambda}\{\gamma_{\alpha}(C_V - C_A\gamma_5) - \sigma_{\alpha\beta}(p_{\Lambda} - p_p)_{\beta}(B_V + B_A\gamma_5)\}u_p) \times (\bar{u}_{\nu}\gamma_{\alpha}(1 + \gamma_5)u_e), \tag{2}$$

with the form factors C_V, C_A, B_V, B_A functions of the square of the momentum transfer

$$-Q^2 = (p_p - p_{\Lambda})^2 = 2m_pW + (m_{\Lambda} - m_p)^2, \tag{3}$$

where W is the kinetic energy of the Λ hyperon in the laboratory system. If E is the energy of the incident electron and $\epsilon \equiv 2m_pE + m_p^2$ is the total energy in the center-of-mass system then

$$0 \leqslant -Q^2 \leqslant 2m_pE\left(1 - \frac{m_{\Lambda}^2}{\varepsilon^2}\right) = \varepsilon^2\left(1 - \frac{m_p^2}{\varepsilon^2}\right)\left(1 - \frac{m_{\Lambda}^2}{\varepsilon^2}\right). \tag{4}$$

The cross section for process (1) for a given E and Q^2 is given by*

$$d\sigma = \frac{d(-Q^2)}{16\pi E^2 m_p^2}\{(C_V^2 + C_A^2)[8m_p^2E^2 - (4m_pE + Q^2)(m_{\Lambda}^2 - m_p^2 - Q^2)] - (C_A^2 - C_V^2)\,2m_{\Lambda}m_pQ^2 - (B_A^2 - B_V^2)\,2m_{\Lambda}m_pQ^4$$
$$+ (B_V^2 + B_A^2)[-8m_p^2E^2 + (4m_pE - m_{\Lambda}^2 + m_p^2)(m_{\Lambda}^2 - m_p^2 - Q^2)] - 2C_VB_VQ^2(m_{\Lambda} + m_p)[(m_{\Lambda} - m_p)^2 - Q^2]$$
$$+ 2C_AB_AQ^2(m_{\Lambda} - m_p)[(m_{\Lambda} + m_p)^2 - Q^2] - 2[C_VC_A + C_AB_V(m_{\Lambda} + m_p) - C_VB_A(m_{\Lambda} - m_p)$$
$$- B_VB_A(m_{\Lambda}^2 - m_p^2)]\,Q^2[-4m_pE + m_{\Lambda}^2 - m_p^2 - Q^2]\}. \tag{5}$$

For a "pure" V-A interaction ($C_V = -C_A \equiv F/\sqrt{2}$, $B_V = B_A = 0$) formula (5) simplifies into

$$d\sigma = \frac{d(-Q^2)F^2}{4\pi E m_p}(\varepsilon^2 - m_\Lambda^2); \quad \sigma = \frac{F^2}{2\pi}\varepsilon^2\left(1 - \frac{m_\Lambda^2}{\varepsilon^2}\right)^2. \quad (6)$$

The second of these formulas is valid to the extent that the Q^2 dependence of F may be ignored. This dependence will become important, presumably, at $-Q^2 \sim m_K^2$.[6] In any case the magnitude of the form factors should fall off rapidly for $-Q^2 \gg m_K^2$. Therefore, at high energies the effective range of variation of $-Q^2$ is smaller than is given by Eq. (4). One may suppose that in effect $0 \leq -Q^2 \leq Q_0^2$, $Q_0^2 \sim m_K^2$. If at the same time $E \gg m_\Lambda$, and consequently $m_p E \gg -Q^2$, then only the first term in Eq. (5) is important so that

$$d\sigma = \frac{d(-Q^2)}{2\pi}(C_V^2 + C_A^2). \quad (7)$$

For $C_V^2 + C_A^2 \equiv F^2 \approx \text{const}$ $(0 \leq -Q^2 \leq Q_0^2)$

$$\sigma \sim \frac{F^2}{2\pi}Q_0^2 \sim \frac{F^2}{2\pi}m_K^2 \sim \frac{F^2}{G^2}\cdot 2\cdot 10^{-39}\ \text{cm}^2 \quad (8)$$

where $G = 1.41 \times 10^{-49}$ erg cm^3 is the Feynman–Gell-Mann constant.[2] If $F^2/G^2 \sim 1/20$ then $\sigma \sim 10^{-40}$ cm^2. In a similar fashion we find

$$\sigma \approx (F/G)^2\cdot 7\cdot 10^{-40}\ \text{cm}^2 \approx 0.35\cdot 10^{-40}\ \text{cm}^2, \quad (9)$$

for E = 400 Mev, when the upper limit on the range of variation of $-Q^2$ in Eq. (4) is of order m_K^2 and we may use for estimate purposes the second of the formulas (6).

With a cross section of the order of 10^{-40} cm^2 the probability for the process (1) is equal to 10^{-17} for a 10 cm path length of an electron in liquid hydrogen of density $\sim 10^{22}$ atoms/cm^3. Consequently, approximately $10^{18} - 10^{19}$ electrons are needed to observe the reaction. With accelerator intensities of 10^{13} electrons per second this figure is not so fantastic. If instead of hydrogen heavier elements are used then for the same number of atoms in 1 cm^3 the necessary number of electrons is decreased by a factor Z. Theoretically, however, the analysis of the experimental results becomes in this case much more complicated since the proton is initially bound. We only remark that in the case of a nucleus some of the reactions $e^- + p \rightarrow \Lambda + \nu$ will result in the formation of Λ hyperfragments.

The experimental study of the process (1) presents, naturally, a number of difficulties, connected in part with the necessity of observing a Λ hyperon in the presence of considerable background. Nevertheless such a study is of interest particularly since by varying the energy E it is possible in this way to directly investigate the Q^2 dependence of the form factors.

Along with the reaction (1) it is possible to study the reactions $e^- + p \rightarrow \Sigma^0 + \nu$ and $e^- + n \rightarrow \Sigma^- + \nu$. In view of the absence of intense μ^--meson beams the corresponding processes involving μ^- mesons in place of e^- are hardly possible experimentally.

The author is grateful to I. M. Shmushkevich for pointing out the feasibility of studying process (1) and for discussions.

*If one neglects the mass difference between the Λ hyperon and the proton (in which case, according to Eq. (3), $-Q^2 = 2m_p W$) as well as the "magnetic" form factors of the type B_V and B_A, then the expression for the cross section with all covariants of the 4-fermion interaction taken into account is the same as the expression describing the cross section for electron-neutrino scattering.[4] (In formula (1) of reference 4 g_s^2 should stand next to $W^2 + 2WE$ and not $W^2 + WE$, and $(2g_V g_A + g_S g_T + g_P g_T)$ next to $W^2 - 2WE$, not $W^2 - WE$).

For $B_A = 0$, $m_\Lambda \approx m_p$, expression (5) coincides with the result obtained by Berestetskiĭ and Pomeranchuk[5] for the cross section for the process $e^- + p \rightarrow n + \nu$.

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INELASTIC INTERACTIONS OF 9 Bev PROTONS WITH FREE AND BOUND NUCLEONS IN EMULSION

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In an emulsion stack exposed to the proton synchrotron of the High-Energy Laboratory of the Joint Institute for Nuclear Research, 243 cases of inelastic interactions (140 pp and 103 pn) of

ERRATA TO VOLUME 10

page	reads	should read
Article by A. S. Khaĭkin		
1044, title	. . . resonance in lead	. . . resonance in tin
6th line of article	~ 1000 oe	~ 1 oe
Article by V. L. Lyuboshitz		
1223, Eq. (13), second line	$\ldots - \mathrm{Sp}_{1,2}\,\mathscr{E}(\mathbf{e}_1)$	$\ldots - \mathrm{Sp}_{1,2}\,\mathscr{E}(\mathbf{e}_2)\ldots$
1226, Eq. (26), 12th line	$\cdots\{(\mathbf{p}+\mathbf{q},\ \mathbf{p}$	$\cdots\{(\mathbf{p}+\mathbf{q},\mathbf{p}) - (\mathbf{p}+\mathbf{q},\ \mathbf{n})\cdot\cdot(\mathbf{pn})\}$
1227, Eqs. (38), (41), (41a) numerators and denominators	$(\mathbf{p}^2 - \mathbf{q})$	$(\mathbf{p}^2 - \mathbf{q}^2)^2$
1228, top line	$\mathbf{m}_2 = \begin{matrix}\mathbf{q}_1 - \mathbf{p}_1\\ \mathbf{q}_1 - \mathbf{p}_1\end{matrix}$	$\mathbf{m}_2 = [\mathbf{m}_3\ \mathbf{m}_1]$

ERRATA TO VOLUME 12

page	reads	should read
Article by Dzhelepov et al.		
205, figure caption	54	5.4
Article by M. Gavrila		
225, Eq. (2), last line	$-2\gamma\Theta^{-4}\,{}^1\!/_8$	$-2\gamma\Theta^{-4} - {}^1\!/_8$
Article by Dolgov-Savel'ev et al.		
291, caption of Fig. 5, 4th line	$p_0 = 50 \times 10^{-4}$ mm Hg	$p_0 = 5 \times 10^{-4}$ mm Hg.
Article by Belov et al.		
396, Eq. (24) second line	$\ldots - (4 - 2\eta)\,\sigma_1 + \ldots$	$\ldots + (4 - 2\eta)\,\sigma_1 + \ldots$
396, 17th line (r) from top	. . less than 0.7	. . less than 0.07
Article by Kovrizhnykh and Rukhadze		
615, 1st line after Eq. (1)	$\omega_{0e}^2 = 2\pi e^2 n_e/m_e,$	$\omega_{0e}^2 = 4\pi e^2 n_e/m_e,$
Article by Belyaev et al.		
686, Eq. (1), 4th line	$\ldots b_{\rho_2 m_2}\,(s_2') + \cdots$	$\ldots b_{\rho_1 m_1}\,(s_1') + \cdots$
Article by Zinov and Korenchenko		
798, Table X, heading of last column	$\sigma_{\pi^-\to\pi^+} =$	$\sigma_{\pi^-\to\pi^-} =$
Article by V. M. Shekhter		
967, 3d line after Eq. (3)	$\varepsilon \equiv 2m_pE + m_p^2$	$\varepsilon \equiv (2m_pE + m_p^2)^{1/2}$
967, Eq. (5), line 2	$+ (B_V^2 + B_A^2)\ldots$	$+ (B_V^2 + B_A^2)\,Q\ldots$
968, Eq. (7)	$\ldots(C_V^2 + C_A^2).$	$\ldots C_V^2 + C_A^2 - Q^2(B_V^2 + B_A^2).$
968, line after Eq. (7)	for $C_V^2 + C_A^2 \equiv \ldots$	for $C_V^2 + C_A^2 - Q^2(B_V^2 + B_A^2) \equiv \ldots$
Article by Dovzhenko et al.		
983, 11th line (r)	$\gamma = 1.8 \pm$	$\gamma = 1{,}8 \pm 0{,}2$
Article by Zinov et al.		
1021, Table XI, col. 4	$-1{,}22$	$1{,}22$
Article by V. I. Ritus		
1079, line 27 (1)	$-\Lambda_{\pm}(t),$	$\Lambda_{\pm}(t),$
1079, first line after Eq. (33)	$\frac{1}{2}(1+\beta).$	$\frac{1}{2}(1\pm\beta).$
1079, 3d line (1) from bottom	$\ldots\mathfrak{N}(q'p;\ pq')\ldots$	$\ldots\mathfrak{N}(p'q;\ pq')\ldots$
Article by R. V. Polovin		
1119, Eq. (8.2), fourth line	$U_{0x}u_xg(\gamma) - [\gamma\cdots$	$-U_{0x}u_xg(\gamma)\,[\gamma\ldots$
1119, Eq. (8.3)	$\cdots$sign $u.$	$\cdots$sign $u_g.$
Article by V. P. Silin		
1138, Eq. (18)	$\cdots + \frac{4}{5}c^2k^2$	$\cdots + \frac{6}{5}c^2k^2.$