current makes no contribution in this case. We note, however, that these photons are emitted essentially along the direction of motion of electrons, and therefore are not registered by detectors which are placed at large angles. In the case of a symmetrical arrangement of the experiment, the term due to interference between the contributions of the radiation from the electrons and from the pions vanishes [6]. As to the photons emitted by the pions, we are interested only in the hard photons, and therefore the emission of soft photons can be described by the classical-current approximation [6] which is naturally T-invariant, since it is assumed that the strong interactions are T-invariant. For these hard photons we can expect an asymmetry on the order of unity.

Of particular interest is the energy region near the ρ-meson peak (E = 380 MeV), since the cross section of the process has a peak in this region. This cross section is sufficiently large to be measurable with modern techniques, but the main difficulty lies apparently in the identification of the events.

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CONTRIBUTION TO THE THEORY OF WEAK INTERACTION

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We analyze in this note the baryon-lepton weak interaction on the basis of the hypothesis that there exists an intermediate boson possessing baryon and lepton charges. This hypothesis implies a number of interactions with neutral lepton currents, with coupling constant satisfying the single condition

$$G_{ee}\, G_{\nu_e \nu_e} = G_{\mu\mu}\, G_{\nu_\mu \nu_\mu} = G^2. \qquad (1)$$

The corresponding generalization of the octet theory of Cabibbo [1] is obtained under simple assumptions concerning the unitary properties of the baryon-boson.

The scalar baryon-boson was proposed in [2] (see also [3,4]) as an alternative to the intermediate vector boson. Estimates for the lower limits of the baryon-boson mass are at present much higher than for the vector-boson mass, and reach 60 GeV [5]. It is therefore meaningful now to consider only those consequences of the possible existence of the baryon-boson, which are conserved in the local limit. They are fully covered by the definite rules for the composition of the 4-fermion Lagrangian.

Let the "fundamental" interaction be of the form

$$L_X = g\, \bar{e}^c_\alpha\, (1 + \gamma_5)\, B'^\alpha_\beta\, X^\beta + g\, \bar{e}^\alpha\, (1 - \gamma_5)\, B'^\beta_\alpha\, X_\beta + \text{Herm. conj.}, \qquad (2)$$

so that the two triplets of baryon-bosons: $X^\alpha = ((X^+)^1, (X^0)^2, (X^0)^3)$ and $X_\alpha = ((X^-)_1, (X^0)_2, (X^0)_3)$ realize the coupling of the inverted octet of baryons $B' = \exp(i\lambda_7\theta)\, B\, \exp(-i\lambda_7\theta)$ ($B^1_3 = p$) with the electron and the neutrino: $e_\alpha = (\lambda^{-1/2}\, e, \lambda^{1/2}\, \nu, 0)$. The coupling with μ and ν_μ, which requires for this purpose its own two boson triplets, is omitted to simplify the notation.

The interaction (2) gives rise to an effective 4-fermion Lagrangian

$$\begin{aligned} L' &= \sqrt{2}\, G\, (\bar{e}^c_\alpha\, (1 + \gamma_5)\, B'^\alpha_\beta\, B'^\beta_\gamma\, (1 - \gamma_5)\, e^{c\gamma} + \bar{e}^\gamma\, (1 - \gamma_5)\, B'^\beta_\gamma\, \bar{B}'^\alpha_\beta\, (1 + \gamma_5)\, e_\alpha) \\ &\equiv \frac{G}{\sqrt{2}} (\bar{B}'^\beta_\gamma\, \gamma_n\, (1 + \gamma_5)\, B'^\alpha_\beta - \bar{B}'^\alpha_\beta\, \gamma_n\, (1 - \gamma_5)\, B'^\beta_\gamma)(\bar{e}^\gamma\, \gamma_n\, (1 + \gamma_5)\, e_\alpha). \end{aligned} \qquad (3)$$

If perturbation theory is valid for (2), then $\sqrt{2}\, G = g^2\, M_X^{-2}$.

It is convenient to introduce the lepton-current matrix:

$$J_n = \begin{pmatrix} \lambda^{-1}\, \bar{e}\, O_n\, e & \bar{e}\, O_n\, \nu\, \cos\theta & \bar{e}\, O_n\, \nu\, \sin\theta \\ \bar{\nu}\, O_n\, e\, \cos\theta & \lambda\, \bar{\nu}\, O_n\, \nu\, \cos^2\theta & \lambda\, \bar{\nu}\, O_n\, \nu\, \cos\theta\, \sin\theta \\ \bar{\nu}\, O_n\, e\, \sin\theta & \lambda\, \bar{\nu}\, O_n\, \nu\, \cos\theta\, \sin\theta & \lambda\, \bar{\nu}\, O_n\, \nu\, \sin^2\theta \end{pmatrix}, \quad O_n = \gamma_n(1 + \gamma_5) \qquad (4)$$

and rewrite the Lagrangian (3) in the form

$$L' = \frac{G}{\sqrt{2}} \mathrm{Sp}(\bar{B}\, \gamma_n\, (1 + \gamma_5)\, J_n\, B - \bar{B}\, \gamma_n\, (1 - \gamma_5)\, B\, J_n\, . \qquad (5)$$

The F coupling required for the vector current came in automatically on going from (2) to (5). The strong interactions transform the initial D coupling of the axial current into a mixture of D and F coupling and renormalize the unitary-scalar coupling; all this can be taken into account approximately by introducing the parameters D, F, and E:

$$\begin{aligned} L' = \frac{G}{\sqrt{2}} [&\mathrm{Sp}(\bar{B}\, \gamma_n\, J_n\, B - \bar{B}\, \gamma_n\, B\, J_n) + (D + F)\, \mathrm{Sp}\, \bar{B}\, \gamma_n\, \gamma_5\, J_n\, B \\ &+ (D - F)\, \mathrm{Sp}\, \bar{B}\, \gamma_n\, \gamma_5\, B\, J_n + \tfrac{2}{3}\, (E - D)\, \mathrm{Sp}\, (\bar{B}\, \gamma_n\, \gamma_5\, B)\, \mathrm{Sp}\, J_n]\, . \end{aligned} \qquad (6)$$

We thus arrive at an extended variant of the Cabibbo theory, which includes also several interactions with neutral lepton currents. The coupling constants, as can be readily noted from the form of the matrix (4), satisfy relation (1).

Neutrino experiments yielded the estimate $\sigma(\nu_\mu p \to \nu_\mu p) < 0.03\, \sigma(\nu_\mu n \to \mu^- p)$ [6]. According to (6), the (νp) scattering is essentially the result of the renormalization effects, and $\sigma(\nu_\mu p \to \nu_\mu p) \lesssim 0.01\, \lambda_\mu^2 \sigma(\nu_\mu n \to \mu^- p)$. The intensity of ($\nu n$) scattering should be larger by two orders of magnitude. Apparently λ_μ^2 and λ_e^2 are sufficiently small, for otherwise the decays $K^\pm \to \pi^\pm + \nu + \bar{\nu}$ and $K_1^0 \to \pi^0 + \nu + \bar{\nu}$, whose probabilities relative to the corresponding K_{e3} decay are equal to $2(\lambda_\mu^2 + \lambda_e^2)\cos^2\theta$, would have already been recorded. For the hyperon neutrino decays $\Sigma^+ \to p + \nu + \bar{\nu}$, $\Lambda \to n + \nu + \bar{\nu}$, etc. the analogous probability is equal to half the preceding one. Exact experimental estimates are very desirable here, for with decreasing λ an increase takes place in the intensity of the interaction with the electronic and muonic neutral currents, and it becomes possible to observe its admixture in the competing electromagnetic interaction in (e^+e^-) decays of nuclei, and in the decay $\Sigma^0 \to \Lambda + e^+ + e^-$ in (ep) and (μp) scattering (in the decays $\pi^0 \to e^+ + e^-$, $\mu \to e^+ + e^-$, and $\mu \to \mu^+ + \mu^-$, only the probability changes).

A verification of the inequalities $G_{ee}G_{\nu_e\nu_e} < G^2$ and $G_{\mu\mu}G_{\nu_\mu\nu_\mu} < G^2$ would decisively indicate the existence of some mechanism responsible for the interaction of only charged currents, for example the charged vector boson.

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CHARGE ASYMMETRY IN RADIATIVE DECAYS OF K- AND ρ-MESONS UPON VIOLATION OF CP-INVARIANCE

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Several mechanisms for CP-invariance violation have been proposed recently [1-3], in which charge asymmetry is expected to arise, in general, in meson $\pi^+\pi^-\gamma$ decays. In the present note we wish to point out a rather simple circumstance, namely that no large charge asymmetry will arise under any violation of CP-invariance in decays of this type, if a decay to $\pi^+\pi^-$ without emission of a photon is allowed. We present in connection with this statement several quantitative estimates.

From among known mesons with spin 0 and 1, only K_1^0 and ρ^0 decay into a $\pi^+\pi^-$ pair without any additional hindrances compared with the decay into $\pi^+\pi^-\gamma$. Let us consider the process $K_1^0 \to \pi^+\pi^-\gamma$. The amplitude of such a decay $M^{(k)}$ is equal to the sum of three amplitudes $M^{(k)} = M_b^{(k)} + M_e^{(k)} + M_m^{(k)}$, where