the usual theory of β decay if, in addition, $g_i = f_i$, $g_i' = f_i'$.

A similar breakdown into positive and negative frequency components may be carried out as well for the nucleon operators in (1). It is not clear, however, whether this has meaning, since as a result of the strong interaction with π mesons, β decay may pass through a virtual antinucleon state. In the presence of an external Coulomb field it must be contained in the projection operators $S^{\pm}$.

The Hamiltonian appears to be nonlocal, which leads to the fact that $[H(x_1), H(x_2)] \neq 0$ when x_1 and x_2 are separated by a space-like interval. Precisely speaking, instead of the function $S(x_1 - x_2)$, this commutator contains $S^{\pm}(x_1 - x_2)$, which do not vanish outside of the light cone. In the case where the operators S^+ and S^- refer to electrons, this indicates a violation of causality in weak interactions at distances of the order $\hbar/m_e c$; for a neutrino field there is no such localization (when the mass is equal to zero, the $S^{\pm}(x_1 - x_2)$ diminish outside of the light cone as $|x_1 - x_2|^{-3}$). This situation appears to raise a serious objection to ideas which have been expressed. However, since in weak interactions the theoretical principles previously considered absolute (conservation of parity and invariance with respect to charge conjugation) are in general violated, it becomes expedient to make an experimental verification of the developed scheme. In particular, it would be useful to compare carefully the β decay and K capture probabilities in the same nucleus with the values predicted by ordinary theory.

An analogous although more difficult experiment is the comparison of β decay with the absorption of an antineutron by a proton.*

After completion of the present paper, K. A. Ter-Martirosian informed the authors that similar considerations have been developed in an article by Arnovit and Feldman (at present unpublished).

We are grateful to V. N. Grilov and to K. A. Ter-Martirosian for their comments.

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*If we maintain symmetry between the electron and positron then $g_i \lambda_i$, $f_i = \mu_i$, and the processes $\bar{\nu} + p = n + e^+$ and $n = p + e^- + \bar{\nu}$ must occur as a result of one and the same interaction.

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LIFETIME OF THE K_2^0 MESON

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GELL-MANN and Pais[1] predicted the existence of the long-lived neutral K meson (K_2^0), which was later discovered experimentally. In connection with the establishment of the noninvariance of weak interactions under space inversion and charge conjugation, the original arguments of Gell-Mann and Pais have to be modified, as was shown in a series of papers.[2] Below we shall assume that the weak interactions are invariant under time reversal and that the K_2^0 meson has negative "time-parity".

The following decays of K_2^0 will be possible (we shall denote the respective probabilities by w_n, where n is the number of the reaction):

1) $K_2^0 \to e^+ + \nu + \pi^-$, 4) $K_2^0 \to \mu^- + \nu + \pi^+$,
2) $K_2^0 \to e^- + \tilde{\nu} + \pi^+$, 5) $K_2^0 \to \pi^+ + \pi^- + \pi^0$,
3) $K_2^0 \to \mu^+ + \nu + \pi^-$, 6) $K_2^0 \to \pi^0 + \pi^0 + \pi^0$.

The decays 1, 2 and 3, 4 are the analogs of the decays

7) $K^+ \to e^+ + \nu + \pi^0$, 8) $K^+ \to \mu^+ + \nu + \pi^0$,

whereas the decays 5, 6 are analogous to the τ^+ decays

9) $K^+ \to \pi^+ + \pi^+ + \pi^-$, 10) $K^+ \to \pi^+ + \pi^0 + \pi^0$.

Here it is essential that in the decays 5, 6, as in the decays 9, 10, the outgoing π mesons are in the S state.

It has been shown[3] that if the decays of all strange particles take place by way of the decays of Λ hyperons, then the rule $\Delta T = \frac{1}{2}$, considered earlier in connection with the π-mesonic decays of strange particles, applies also to their leptonic decays. We use this rule to calculate the probabilities of the different decays of the K_2^0 meson, and to estimate its lifetime. With the help of the rule $\Delta T = \frac{1}{2}$ we easily obtain

$$w_1 = w_2 = w_7, \quad w_3 = w_4 = w_8; \tag{1}$$

$$w_6 / w_5 = {}^3/_2, \quad w_{10} / w_9 = {}^1/_4, \quad (w_5 + w_6) / (w_9 + w_{10}) = 1. \tag{2}$$

The ratios (2), however, do not take into account the mass difference of $\pi^{\pm}$ and π^0 mesons. The correction due to this mass difference was considered by Dalitz,[4] who allowed for it not only in the phase volumes, but also in the corresponding matrix elements, using essentially perturbation theory. In this work we consider the corrections only in the statistical weights. The statistical weight for the decay of a particle with mass M into three particles with masses m_1, m_2, m_3 is proportional to

$$\rho \sim m_1 m_2 m_3 (m_1 + m_2 + m_3)^{-3/2} \quad (M - m_1 - m_2 - m_3)^2.$$

Denoting the statistical weights of the respective decays by ρ_n, we obtain:

$$\rho_5 / \rho_9 = 1.09, \quad \rho_{10} / \rho_9 = 1.20, \quad \rho_6 / \rho_9 = 1.31.$$

Using these ratios we obtain, instead of (2),;

$$w_6 / w_5 = 3\rho_6 / 2\rho_5 \approx 2, \quad w_{10} / w_9 \approx \rho_{10} / 4\rho_9 \approx 0{,}30, \tag{3}$$

$$(w_5 + w_6) / (w_9 + w_{10}) \approx ({}^2/_5\rho_5 + {}^3/_5\rho_6) / ({}^4/_5\rho_9 + {}^1/_5\rho_{10}) = 1{,}2.$$

Using the data on the lifetime of the K^+ meson[5] ($\tau_{K^+} = 1.17 \times 10^{-8}$ sec) and on the abundance of the different types of K^+ decays[6] ($K_{\mu 3} \sim 5.9\%$, $K_{e3} \sim 5.1\%$, $K_{\pi 3} \sim 7.9\%$), we find that the lifetime of the K_2^0 meson must be equal to

$$\tau_{K_2^0} = \tau_{K^+} \cdot 100 / (2 \cdot 5{,}9 + 2 \cdot 5{,}1 + 1{,}2 \cdot 7{,}9)$$
$$= 3.8 \cdot 10^{-8} \text{ sec}, \tag{4}$$

and the probabilities of the different decays must add up to the total disintegration probability of the K_2^0 meson in the percentages, respectively,

$$w_1 = w_2 \sim 16\%; \quad w_5 = w_4 \sim 19\%;$$
$$w_5 \sim 10\%; \quad w_6 \sim 20\%. \tag{5}$$

The experimental verification of these results [relations (1), (3), (4), and (5)] could be useful for the clarification of the validity of the rule $\Delta T = \frac{1}{2}$ for the leptonic and non-leptonic decays of K mesons. We note that the experimentally established lower limit for the lifetime of the K_2^0 meson is equal to 3×10^{-8} sec, (Ref. 5) which is very close to the value obtained by us, but still below it.

In our investigation we neglected the probability of the decay $K \rightarrow 2\pi + \gamma$ and of other possible decays of the K_2^0 meson. The inclusion of these decays lowers, of course, somewhat the value for $\tau_{K_2^0}$ obtained by us.

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POLARIZATION EFFECTS IN SCATTERING OF ELECTRONS BY PROTONS

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AKHIEZER, Rozentsveig, and Shmushkevich[1] have shown that if the scattering of electrons by protons is considered in the first approximation with respect to e, but with account of all the meson-radiation corrections, the structure of the proton reduces to two real form factors $a(q^2)$ and $b(q^2)$. Here $q^2 = (p_1 - p_2)^2$, where p_1 and p_2 are the four-dimensional momenta of the electrons before and after the collision. In the same article, the authors calculated the cross section for the scattering of polarized electrons by polarized protons and the recoil-proton polarization which occurs when polarized electrons are scattered by unpolarized protons.

In this note we calculate the polarization of electrons, ζ_2^0, and recoil protons, Z_2^0, resulting from the scattering of a beam of electrons with polarization ζ_1^0 by protons with polarization Z_1^0, which makes it possible to determine a and b by means of suitable experiments. (The polari-