Because of its zero mass, however, the neutrino does not participate in electromagnetic interactions, and therefore the transition from $[\boldsymbol{\alpha}\cdot\mathbf{p}+E]\,\psi_-(E)=0$ to the anti-particle equation $[\boldsymbol{\alpha}\cdot\mathbf{p}-E]\,\psi_{\bar{\nu}}(E)=0$ is possible only with the aid of (3).

It is not evident that (3) must be true also for the neutrino (see Gell-Mann and Pais[4]). In particular, the C matrix is necessary to interchange the large and small components of a bispinor so that the wave function of a real antiparticle will be different from zero even in the nonrelativistic limit. For a neutrino, however, such a matrix is not necessary.

Thus assuming (3), we find that a Hamiltonian of the form of (1), where

$$\Phi^{(\pm)}=(\psi_\nu\pm\psi_{\bar{\nu}})/\sqrt{2}$$

[which is equivalent, from the analytic point of view, to (2)] gives the same cross sections for decay as does the two-component theory. In this way, the reason for the asymmetry in decay is not assumed due the properties of one of the particles, but to nonconservation of the lepton charge nonconserving in the interaction itself. At the same time it is seen that only mixtures of the form $\nu+\bar{\nu}$ or $\nu-\bar{\nu}$ have a definite type of interaction* (which means that it is just these which are emitted in β, μ, and π decays). The selectivity of the interaction lies in the choice of the phase factor of the emitted mixture.

We note that with our approach it is possible, though less preferable, to take mixtures of ν and $\bar{\nu}$ with different statistical weights in the form

$$\Phi=a\psi_\nu+b\psi_{\bar{\nu}}, \tag{6}$$

which would correspond to the more general assumption[2] that

$$\Phi=(1+\lambda\gamma_5)\,\psi_\nu. \tag{7}$$

It should be noted that the difference between the analytical expressions obtained from our approach and from the two-component theory will become evident if one finds "analyzers" (nuclei or particles) capable of absorbing from a mixture those Dirac particles which in themselves conserve parity (compare with Pontecorvo[5]). According to Landau[1] such "analyzers" cannot exist, since the longitudinal neutrino will not reduce to any particle with other properties.

In conclusion the authors consider it their duty to thank Professor V. I. Mamasakhlisov for valuable discussion and interest in the work.

*The situation is then similar to that for neutral K mesons.[4]

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Translated by E. J. Saletan
50

THE STATISTICAL WEIGHTS OF K^+ AND K^- MESONS PRODUCED IN PION-NUCLEON COLLISIONS

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By projecting the isotopic space of the initial pion-nucleon system in the subspaces of the individual strange particles, we find the probability of production of one or more strange particles of particular signs of charge. For the statistical weight of the particles produced, independent of the charge, we have used the data of reference 1.

We furthermore take into account the fact that a number of pions may be produced together with the strange particles,[2] and also that isobaric states may exist.[3]

In this way we have calculated the statistical weights on two sets of assumptions: those of Schwinger and Gell-Mann[4] about a global interaction of pions with baryons, which we denote by W_1; and that in which it is assumed that the interaction of pions with K, Λ, Σ, and Ξ particles is much smaller than that with nucleons, which we denote by W_2.

In particular, for pions of energy 5 Bev we find the following values for the statistical weights on the hypotheses stated; we compare these results with the experimental data:

Experiment	W_1(theoretical)	W_2(theoretical)
K^+ 2.8 ± 1.2%	3.341%	0.399%
K^- 1.2 ± 0.6%	0.655%	0.741%

Since K^- (or $\tilde{K}^+$) occurs only in the group $K\tilde{K}$, for which there is no essential difference between the hypotheses stated above, we cannot expect any difference between the corresponding values. For K^+, however, which occurs also in the group $K\Sigma$, we get a marked difference, since in this case there is a decided difference between the two hypotheses.

As can be seen from the data given above, the hypothesis of Schwinger and Gell-Mann is in better agreement with experiment.

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51

REFLECTION OF ELECTRONS FROM A HIGH-FREQUENCY POTENTIAL BARRIER

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In the works of Gaponov and the author[1,2] it was shown that the nonrelativistic motion of a charged particle in a high-frequency electromagnetic field is determined by the time-averaged distribution of the high-frequency potential $\Phi = (\eta/2\omega)^2 |E|^2$, where η is the charge-to-mass ratio, **E** the field strength, and ω the angular frequency of the field. In particular, the average trajectory of the motion is found directly from the energy integral

$$^1/_2\,\dot{\mathbf{r}}^2 + \Phi(\mathbf{r}) = \text{const.} \tag{1}$$

The simplest experimental test of these conclusions involves studying the reflection of particles from high-frequency potential barriers. Let the barrier be given by the function $\Phi(z)$, which has a maximum at the point $z = z_1$. Then a particle flying toward the barrier with a speed $\dot{z}$ $(v = \sqrt{2|\eta|V})$ will, as can be seen from (1), be reflected from it if the condition

$$|\mathbf{E}|_{z=z_1} > 2\omega\sqrt{V/|\eta|}. \tag{2}$$

is fulfilled.

The experiment was conducted with a continuously evacuated electron tube comprising a rectangular resonator $(2.9 \times 1.3 \times 10$ cm), excited through a narrow inductive "window" and tuned to resonance by a special vacuum piston (wave mode TE_{105}, resonant frequency $\omega = 5.8 \times 10^{10}$ sec.$^{-1}$). Cylindrical pipes (0.97 cm in diameter) were soldered from the outside into the two wide walls of the resonator in such a way that their axis would go through the antinode of the field **E**. Since only exponentially decreasing waves were excited inside the cylinders, the distribution of the potential Φ along their axis had the shape of a potential barrier with a maximum in the center of the resonator and zero points deep inside the cylindrical pipes. In one of the pipes we placed a two-electrode electron gun, and in the second a disc-shaped collector. To prevent dispersion of the electrons, a weak-focusing magnetic field (on the order of 40 oersteds) was superimposed. The absence of high frequency fields near the surface of the electrodes eliminated the detected current due to phase sorting of the electrons.

The resonator was excited by high-frequency pulses of 10^{-6} sec duration. The height of the barrier was measured by the value of the positive compensating voltage pulse applied to the electron-gun anode, i.e., by the value of the minimal speed of electrons necessary to overcome the barrier. The results are presented in the figure. The power P (in kilowatts) fed into the resonator is plotted on the abscissa and the height of the barrier V (in volts) is plotted on the ordinate. The dotted line in the same figure is calculated from formula (2), taking into account the configuration of the fields in the resonator and its Q factor. The discrepancies do not exceed the error limits of the measurements.

The experiment was conducted at relatively low power levels, although, in principle, peak powers up to 10^6 w may be fed into such systems,