efficiency of (3.1±0.4)%, compatible with the value $\epsilon=3.3\%$ computed with the formula given above. Reversely, the experimental result together with the computed efficiency can be considered as a check on the v/c law for the polarization of electrons emitted in β decay.

We have made $\beta-\gamma$ coincidence measurements with Co^{60}. The difference in coincidence counting rates (corrected as described in the foregoing) with opposite field directions was (0.92±0.19)%. This value is the average of 9 runs with different sources and under slightly different conditions. This result, together with the fact that in the average $v/c=0.69$ for the electrons selected by the β discriminator, leads to a value $A=-0.40\pm0.09$, in agreement with the theoretical[1,2] value, -0.33.

Recently we were informed that Schopper[9] had made experiments in a very similar arrangement. His result for Co^{60} is $A=-0.41\pm0.07$.

A measurement of A may be used to obtain data about nuclear spins. We have applied this method to Au^{198} and Hg^{203}. Au^{198} is essentially a simple first forbidden 960-kev β transition to a 2^+ 411-kev excited state followed by a single $E2$ γ ray to a 0^+ ground state. The Au^{198} ground state was first thought to have a spin 3,[10] but later measurements indicate a spin 2.[11,12] Hg^{203} has a first-forbidden 210-kev β transition to a $\frac{3}{2}^+$ 279-kev excited state followed by a mixed $M1-E2$ γ ray ($\delta=1.45$)[13] to a $\frac{1}{2}^+$ ground state. The spin of the Hg^{203} ground state is unknown. The very low intensity of the ground-state transition[14] is most easily explained by assuming a spin $\frac{5}{2}$.

The measurements were made with the arrangement described in the preceding letter. For Au^{198} a coincidence counting rate difference of (0.71±0.17)% was found, corresponding to a value $A=+0.52\pm0.16$. This result excludes a spin 3 for the Au^{198} ground state, which should have yielded $A=-0.32$. Figure 2 gives A as a function of the mixing parameter x for a spin 2. Our experiment indicates that the spin changes direction in roughly $\frac{2}{3}$ of the Au^{198} decays. The sign of x is negative.

The measurements on Hg^{203} are more difficult, due to the lower energy of both β and γ rays. Preliminary measurements yielded a coincidence counting rate difference of (0.07±0.24)%, corresponding to a value, $A=+0.10\pm0.30$. The precision is not sufficient to exclude a spin $\frac{5}{2}$ for Hg^{203}, which would give $A=-0.21$; our result, however, agrees better with a spin $\frac{3}{2}$.

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Possible Existence of a Heavy Neutral Meson*

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IN an attempt to account for the charge distributions of the proton and the neutron as indicated by the electron scattering experiments,[1] we would like to consider the possibility that there may be a heavy neutral meson which can contribute to the form factor of the nucleon. We assume that this meson, ρ^0, is a vector field with isotopic spin zero and a mass two to three times that of the ordinary pion, coupled strongly to the nucleon field. An isolated ρ^0 would decay through virtual nucleon pair formation according to the following schemes:

$$\text{(a)}\quad \rho^0\rightarrow\pi^0+\gamma,\quad 2\pi^0+\gamma,\quad \pi^++\pi^-+\gamma;$$

$$\text{(b)}\quad \rho^0\rightarrow e^++e_-,\quad \mu^++\mu^-;$$

$$\text{(c)}\quad \rho^0\rightarrow\pi^++\pi^-.$$

The process (a) would have a decay probability roughly of the order of $P_a\sim(\mu c^2/\hbar)(G^2/\hbar c)(e^2/\hbar c)(\mu/M)^2$, where G is the nuclear coupling constant, μ and M the ρ^0 and the nucleon masses, respectively. For the process (b), the probability would be $P_b\sim(\mu c^2/\hbar)(G^2/\hbar c)(e^2/\hbar c)^2\times(\mu/M)^2$. The process (c) is a forbidden transition, so that it can take place only in violation of the isotopic spin conservation, with a decay rate comparable to that for (b).

Now the process (b) gives rise to a short-range interaction between a nucleon and an electron (or a muon) by exchange of a ρ^0. This will contribute a form factor $F'(k^2)\sim Gg/(\mu^2+k^2)$ to the electron-nucleon scattering, where g is the effective ρ^0-electron coupling, $g^2/\hbar c\sim(G^2/\hbar c)(e^2/\hbar c)^2(\mu/M)^2$. Since ρ^0 is an isotopic scalar, F' has the same sign for both proton and neutron, whereas the corresponding form factor F

due to the pion cloud should change sign. Relativistic field theory shows on general grounds that $F(k^2)$ has the form

$$F(k^2)=\int_{2m_\pi}^{\infty}\frac{\rho(m)}{m^2+k^2}dm,$$

where the lower limit of integration corresponds to the threshold for pion pair creation by an external electromagnetic field. With our assumptions about ρ^0, it is thus possible that the two form factors F and F' cancel approximately for the neutron but reinforce for the proton, in agreement with observation. If we equate tentatively the mean square radius of the proton with the one due to ρ^0:

$$Gg/\mu^2 \sim e^2\langle a^2\rangle/b,$$

we get

$$(G^2/\hbar c)(g^2/\hbar c)\sim[(e^2/\hbar c)/b]^2\sim 10^{-6},$$

which checks with the previous estimate since $G^2/\hbar c$ would be of the order one. The decay lives become, very approximately,

$$\tau_a\sim 10^{-19}\text{—}10^{-20}\text{ sec},$$

$$\tau_b\sim\tau_c\sim 10^{-17}\text{—}10^{-18}\text{ sec}.$$

We can pursue further consequences of our assumption.

(1) ρ^0 could be produced by any strong nuclear reactions, but it would instantly decay mostly into a high-energy $\gamma(\gtrsim 140$ Mev) and a ρ^0. The ratio of charged to neutral components in high-energy reactions should accordingly be influenced.

(2) The second maximum of the pion-nucleon scattering around 1 Bev[2] could be attributed to the reaction

$$\pi^-+p\rightarrow n+\rho^0,$$

if a resonance should occur for such a system.

(3) ρ^0 would contribute a repulsive nuclear force of Wigner type and short range $(\lesssim 0.7\times 10^{-13}$ cm), more or less similar to the phenomenological hard core.

(4) The anomalous moment of the nucleon[3] should be affected by ρ^0. The main effect seems to be that ρ^0 and the usual pion give opposite contributions to the isotopic scalar part of the core moment, thus tending to bring better agreement between theory and experiment.

(5) If it is energetically possible, we ought to expect that K mesons and hyperons would sometimes decay by emitting a ρ^0.

It should perhaps be added that the neutral meson considered here is similar in nature to the one introduced by Teller for quite different purposes.[4]

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Possible Detection of Parity Nonconservation in Hyperon Decay*

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RECENTLY, various experiments[1–3] established the nonconservation of parity in β decay, π decay, and μ decay. The purpose of this note is to emphasize that, in view of these developments, experiments on hyperon production and decay in $(\pi+p)$ collisions of the type done by various groups using bubble chambers,[4] seem now to be especially important for a clarification of the following related questions: (i) whether parity conservation is violated in hyperon decays[5] and (ii) whether parity doublets exist.[6]

A detailed analysis concerning the possible detection of parity doublets exists in the literature.[6] In the following we shall make a phenomenological study of the problem of possible detection of parity nonconservation in hyperon decay under the assumption that there exist no parity doublets for either K mesons or hyperons.[7]

To make the analysis unambiguous and to draw conclusions that are relatively definite, it is necessary that one knows something about the polarization of the hyperons produced. It seems that a good plan is to study hyperon production and decay near threshold.

Production and decay of Σ^-. For example, let us consider the production of Σ^- from (π^-+p) collisions:

$$\pi^-+p\rightarrow\Sigma^-+K^+.\qquad(1)$$

It is perhaps worthwhile to try to do the experiments at laboratory kinetic energies of the pion of, say, 955 Mev and 1 Bev, corresponding to center-of-mass total