cable here.

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ASYMMETRY PARAMETER IN MUON DECAY*

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Increasingly convincing data have established the primary interaction in the weak interactions as V-A. Although it is known that $|C_V| \neq |C_A|$ in β decay, a fact generally attributed to meson cloud effects, no such renormalization effects are expected in muon decay. A precise measurement of the muon decay asymmetry would constitute a sensitive test of the theory, but such a measurement has heretofore been frustrated by the unknown polarizations of cyclotron extracted muon beams. In this experiment, the use of muons emitted near the cutoff angle from π^+ decays in flight results in an accurate knowledge of their polarization; and hence in a much smaller uncertainty in the asymmetry parameter than could be obtained in the original experiment of this kind.[1]

The arrangement used to define the transversely polarized muon beam is shown in Fig. 1. The energy of the incident pions and the muon energy interval defined by the thickness of the bromoform target determine the polarization of the stopped muons. The angular and energy distributions of the muons were studied to verify that the beam had the properties predicted by the

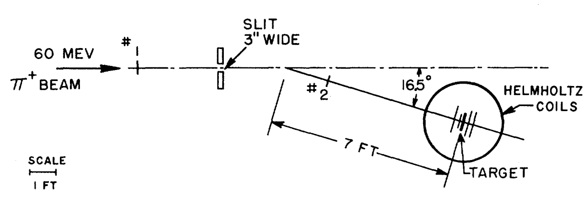

FIG. 1. The bromoform target is placed about two feet from the π^+ beam. Two counters, No. 2($2\frac{1}{2}$ in. ×5 in. ×1/4 in.) and No. 3(3 in. × 6 in. × 1/4 in.), define muons emitted within 0.75° on each side of the cutoff angle. Counter No. 1(5 in. × 5 in. × $\frac{1}{2}$ in.) is placed in the π^+ beam. A set of Helmholtz coils is used to reduce the 15-gauss cyclotron fringing field to less than 0.5 gauss.

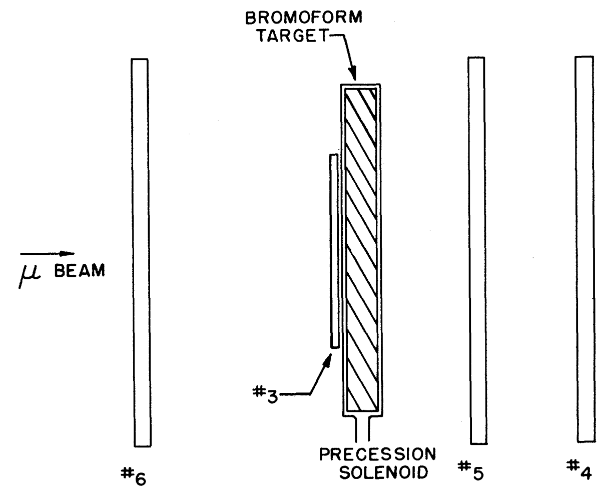

FIG. 2. The target is a Teflon container, 10 in. × 10 in. × 1 in., filled with bromoform. Two sets of counters are used to detect the electrons. They are No. 3 and No. 6, in anticoincidence with No. 5(referred to as telescope 1); and No. 4 and No. 5, in anticoincidence with No. 3 and No. 6(referred to as telescope 2). Counters No. 4, No. 5, and No. 6 are 12 in. × 12 in. × $\frac{1}{2}$ in. The target is wound with an eleven-turn solenoid used to obtain the ± 90° precession.

kinematics. The setup for counting the μ- decay electrons is shown in Fig. 2. A stopped μ signature, $123\bar{5}$, triggers a pulsed magnetic field of 1 μsec duration which is obtained from the discharge of a condenser through a solenoid wound around the target. After a 1.5-μsec delay, this count also opens a 3-μsec gate during which electrons are counted in telescope 1 and telescope 2. The pulsed magnetic field is used to cause a precession of the transversely polarized muons through ± 90°, first so that the spins point into one telescope, then away from it, in one-hour cycles repeated fifty times. The magnetic field was calibrated by placing the target in the direct muon beam and observing the angular distribution of electrons from the decays of stopped muons.

The electron anisotropy observed with this apparatus is of the form $1+Ka\cos\theta$; where a is the muon decay asymmetry parameter averaged over the electron energy spectrum, θ is the angle between the muon spin and the axis of the detecting telescope; and K is a factor which depends on the polarization of the stopped muons, the energy selection made by the electron detector, and the extent of the target and electron counters. About 5000 events were obtained in each telescope, and 9% of that number were measured to be accidental counts and counts resulting from mesons stopping in the target walls and in the precession solenoid. Correcting only for this small background, we obtain for the asymmetry in each telescope

$$Ka = 0.274 \pm 0.016 \quad \text{for telescope 1}$$
$$= 0.276 \pm 0.016 \quad \text{for telescope 2},$$

where the uncertainties indicated are statistical only.

The factors K for the polarization and the counting arrangement in this experiment are:

$$K = 0.850 \pm 0.024 \quad \text{for telescope 1}$$
$$= 0.844 \pm 0.024 \quad \text{for telescope 2}.$$

To compute K, it was necessary to know the fraction of electrons which has insufficient energy to be counted in the detecting telescopes. The energy and angular dependence of the muon decay electrons was assumed to be the one predicted by the two-component neutrino theory.[2] The probability of counting an electron as a function of energy and material traversed was obtained with Wilson's range formula,[3] and the measured distribution of muons stopping in the target. The errors indicated in K are due primarily to a 2% uncertainty in the polarization resulting from the uncertainty in the muon energy interval defined by the bromoform target, and to a 2% uncertainty which is contributed by the energy dependence of the electron counting efficiency; and also to an additional 1% uncertainty due to the fact that the current required to obtain the $\pm 90°$ precession is known to 10%.

Combining the data from the two telescopes, the asymmetry parameter is found to be

$$|a| \geqslant 0.325 \pm 0.015,$$

where the inequality arises from the possible depolarization of the muons stopping in bromoform. These depolarization effects are unknown; but, of a large number of materials tested, bromoform has been shown[4] to cause the least depolarization.

With the assumption of two-component neutrino theory, and with the coupling scheme $(e\nu)(\nu\mu)$,

$$3|a| = |\xi| = \left|\frac{|g_S|^2 - 4|g_V|^2}{|g_S|^2 + 4|g_V|^2}\right|;$$

then we have shown that

$$|\xi| \geqslant 0.97 \pm 0.05.$$

Measurements of the μ spin direction[5] indicate that ξ is negative, so that we have, in terms of the coupling constants,

$$|g_S|^2/|g_V|^2 \leqslant 0.05 \pm 0.09.$$

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POSSIBLE DETERMINATION OF $K\Lambda$ RELATIVE PARITY*

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Okun' and Pomeranchuk[1] have suggested that a study of the absorption of bound K^- mesons in hydrogen according to the infrequently occurring reactions

$$K^- + p \rightarrow \Lambda^0 + \pi^0 + \pi^0, \qquad (1)$$

$$K^- + p \rightarrow \Lambda^0 + \pi^+ + \pi^-, \qquad (2)$$

might yield information regarding $P_{K\Lambda}$, the $K\Lambda$ relative parity. The K^- meson was assumed to be initially in an S state. For reaction (2) it was found that an angular correlation between the directions of the relative momentum $\vec{p}_\pi$ of the two pions and the momentum $\vec{p}_\Lambda$ of the Λ^0 hyperon would indicate $P_{K\Lambda} = -1$. Also, $P_{K\Lambda} = -1$ would result in the Λ^0 from reaction (2) being polarized with respect to the reaction plane. In addition, the probability for reaction (1) relative to that for reaction (2) depends on $P_{K\Lambda}$. However, as Okun' and Pomeranchuk have emphasized, the interpretation of experimental data