scalar contribution would make the explanation of the neutron asymmetry easier.

TELEGDI: There are two sets of data (besides this experiment) from which one can extract the pseudoscalar term. The asymmetry data are most useful for getting the sign which is in agreement with theory. But there is the series of experiments on the μ capture in C^{12} and the decay back, which have been done in a number of places and recently with great accuracy at Carnegie Tech. The results there are quite sensitive to the magnitude of the pseudoscalar term. I think if you double the pseudoscalar term from 8 to 16 G_A the $C^{12} \to B^{12}$ ground state capture rate would no longer agree with the experiments.

WOLFENSTEIN: There are actually two slightly different things. The pseudoscalar term enters into the neutron asymmetry in a rather unique way, that distinguishes it from the other contributions to the Gamow-Teller coupling. But what one is really thinking of here, in the case of the Rubbia-Hildebrand experiment as well as in the C^{12} capture, is simply to decrease the effective Gamow-Teller coupling by increasing the pseudoscalar contribution. The statement then is that increasing the pseudoscalar term too much would lead to disagreement with the observed C^{12} rate.

TELEGDI: And we wish to maintain the axial vector at least temporarily at its standard strength because of the $(\pi\mu)/(\pi e)$ decay ratio, which is at least a plausible if not a totally convincing argument.

WOLFENSTEIN: Well, whether one considers a change in the axial vector or the pseudoscalar coupling the question is one of form factors, since one knows the one-pion-contribution to the pseudoscalar quite well.

YAMAGUCHI: I have a naive question. Is it possible to calculate the nuclear matrix element for $\mu^- + C^{12} \to B^{12} + \nu$ to such an accuracy as to make it possible to distinguish between the two different strengths of pseudoscalar coupling constant under discussion: 8 versus 16?

WOLFENSTEIN: The estimate I made of the uncertainty of the theory is of the order of 20%, which is about the same as the difference in the capture rate between 8 and 16.

HILDEBRAND: The theoretical rates for capture in hydrogen are based on Primakoff's figures. There has been another estimate by Adams which predicts a higher capture rate.

SENS: This estimate was later corrected, there was an error. The new number is in good agreement with Primakoff's calculation, if the same experimental G_A/G_V ratio is used.

SEARCH FOR THE $\mu \to 3e$ DECAY

A. I. Alikhanov, A. I. Babaev, M. Ya. Balats, V. S. Kaftanov, L. G. Landsberg, V. A. Lyubimov, Yu. V. Obukhov

Institute of Theoretical and Experimental Physics, Academy of Sciences of the USSR, Moscow

(presented by V. S. Kaftanov)

In the modern theory of weak interactions with one neutrino there is no strict interdiction for $\mu \to e+\gamma$ and $\mu \to 3e$ decays simultaneously. Reliable quantitative relations between them are not obtained, too. That is why the study of each of these reactions is of independent interest. Up to now, however, none of them was found experimentally [1, 2].

In our previous report [1], a search for the $\mu \to e+\gamma$ decay was carried out and an upper limit for this reaction of 4×10^{-7} (90% confidence) was obtained. In the present paper, a search for the $\mu \to 3e$ decay is described with an arrangement very close to the one described in [1]. The experimental set-up is represented in Fig. 1. A 70 MeV π^+ beam was defined by

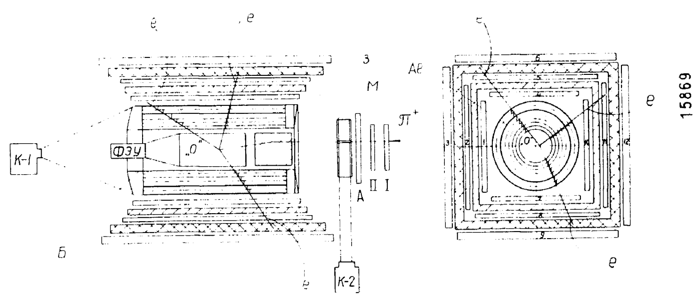

Fig. 1 Schema of the experimental set-up for $\mu \rightarrow 3e$ decays registration.

B: 6 gap cylindrical spark chamber;

M: 1 gap plane spark chamber;

K-1, *K*-2: photo-cameras;

3: mirror system for stereoscopic image of spark chamber traks;

0, I, II, $\bar{A}$, 1, 2, $\bar{3}$, 4, 5, $\bar{6}$, 7, 8, $\bar{9}$, 10, 11, $\overline{12}$: scintillation counters.

The experimental set up was shielded by *Pb* and paraffin with *B*.

a coincidence (*I*, *II*, 0) and the number of π^+ meson stops in the target-counter 0 was determined by $\mu \rightarrow e+\nu+\bar{\nu}$ decays, which were recorded as coincidences 0, $\bar{A}$ (4, 5, $\bar{6}$+7, 8, $\bar{9}$, +1, 2, $\bar{3}$+10, 11, $\overline{12}$).

A fast coincidence of any three of the four side telescopes with the central counter (0, 4, 5, 7, 8, 1, 2, $\bar{3}$, $\bar{6}$, $\bar{9}$, $\overline{12}$, $\bar{A}$); (0, 4, 5, 7, 8, 10, 11, $\bar{3}$, $\bar{6}$, $\bar{9}$, $\overline{12}$, $\bar{A}$); (0, 4, 5, 1, 2, 10, 11, $\bar{3}$, $\bar{6}$, $\bar{9}$, $\overline{12}$, $\bar{A}$); (0, 7, 8, 1, 2, 10, 11, $\bar{3}$, $\bar{6}$, $\bar{9}$, $\overline{12}$, $\bar{A}$) with a resolving time of 10^{-8} to 2×10^{-8} produced a master signal, which triggered the generator producing the high voltage pulse to the electrodes of two spark chambers. Charged particle tracks were photographed in two projections. The time interval between the π^+ meson stop and the master-signal was measured on the oscilloscope trace at the same time. Besides that, pulses from all charged particles in counter 0, were photographed during a time interval $\sim$7 μsec before the master-signal. An aluminum 6-gap cylindrical spark chamber was used to record electron tracks from $\mu \rightarrow 3e$ decay. The one-gap spark chamber M measured the π^+ meson entrance co-ordinates into counter 0. In order to be registered by the side telescope (0, 4, 5 and so on), each of the three electrons had to pass through 3.8 g/cm^2 Al, 3,4 g/cm^2 C and from 0 to 9.6 g/cm^2 of the target scintillator.

For calculating the total efficiency a constant matrix element for the $\mu \rightarrow 3e$ decay was assumed. When computed by the Monte Carlo method, the value of the efficiency was 1.53%. In ref [3] the matrix element for $\mu \rightarrow 3e$ decay is given when this process is caused as in Feynman diagram of Fig. 2. In this case, each positive electron spectrum is described by $(3-2\epsilon)\epsilon^2 d\epsilon$ and the negative electron spectrum by $(1-\epsilon)\epsilon^2 d\epsilon$, where ϵ is the electron energy in units of the maximum electron energy. The calculated total efficiency for this matrix element is 25% higher.

The exact shape of the matrix element is unknown, and thus there is some uncertainty in efficiency calculations. However, as it came out from [2], the efficiency does not change much when the matrix element shape is varied rather widely. Only when the $\mu \rightarrow 3e$ decay is described by the Feynman diagram of Fig. 3, two electrons of three have a small angle between them and the efficiency is much less than in other cases. However, it can be derived for this diagram that the $\mu \rightarrow 3e$ process comes through $\mu \rightarrow e+\gamma$ decay as a result of electromagnetic interaction and thus has a probability two orders of magnitude lower.

Events registered by the experimental set-up can be considered as $\mu \rightarrow 3e$ decays, when they satisfy the following criteria:

(1) three electron tracks outgoing from a single point in the target, within the accuracy given by multiple scattering, must be visible on the cylinder spark chamber picture;

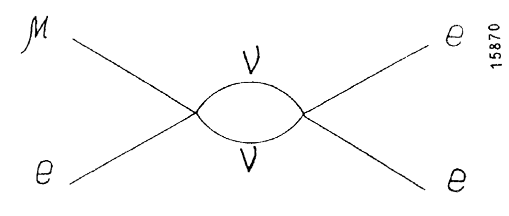

Fig. 2 Feynman diagram of $\mu \rightarrow 3e$ decay.

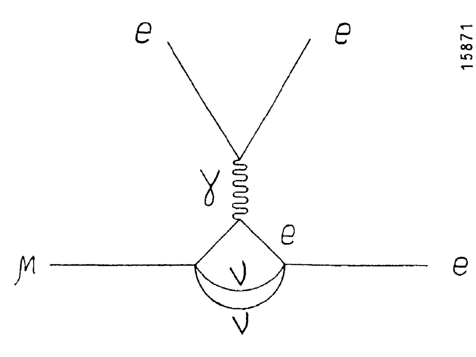

Fig. 3 Feynman diagram of $\mu \rightarrow 3e$ decay.

(2) the track angles satisfy the kinematics in the allowed region of the Dalitz diagram. (Coplanarity could be checked within 7°);

(3) the time interval between π^+ meson stop and master pulse must correspond to the μ-meson life time;

(4) there must be correspondence between the point of μ-decay and the point of π^+ entrance in the target.

During a ~140 hours run, 1.54×10^9 mesons were stopped in counter 0. No cases were found which could be considered as $\mu \to 3e$ decays according to the criteria stated above. After all criteria had been used, 20% of statistics were rejected.

The expected number of $\mu \to 3e$ decays during the time of our experiment is $M = \rho N_\mu \epsilon f$, where ρ is the relative probability of $\mu \to 3e$ decay as compared with $\mu \to e+\nu+\bar{\nu}$ decay, $N_\mu = 1.23 \times 10^9$ the corrected number of $\mu \to e+\nu+\bar{\nu}$ decays, $\epsilon = 0.0153$ the registration efficiency of $\mu \to 3e$ decay, $f = 0.76$ the correction for the counter and electronics inefficiency and for the registration of $\mu \to 3e$ decays by the anti-coincidence counters ($\bar{3}$, $\bar{6}$, $\bar{9}$, $\overline{12}$).

Using Poisson's formula one gets $\rho_{\mu \to 3e} < 1.8 \times 10^{-7}$ with 90% confidence if a constant matrix element is assumed (possible errors in the efficiency determination were taken into account). When the matrix element of Fig. 3 is assumed one gets $\rho < 1.3 \times 10^{-7}$.

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ASYMMETRY IN THE ANGULAR DISTRIBUTION OF NEUTRONS ARISING FROM THE CAPTURE OF μ^--MESONS IN CALCIUM

V. S. Evseev, V. S. Roganov, V. A. Chernogorova, M. M. Szymczak, Chang Run-Hwa

Joint Institute for Nuclear Research, Dubna

(presented by R. M. Sulya'ev)

The results of measurements of the asymmetry coefficient in the angular distribution of neutrons arising from capture of μ^--mesons in calcium have been given by us earlier [1]. The asymmetry was measured by the method of precession of the μ^--meson spin in the magnetic field and neutron counting for two opposite values of the field. In the present note we report the results of measurements of the asymmetry based on a larger amount of statistical material, and using the oscilloscope as amplitude and time analyser simultaneously.

The angular distribution of neutrons from the direct process produced in the capture of μ^- by a nucleus is described by [1, 2]

$$N(E, \theta) \sim 1 + A \cos \theta , \qquad (1)$$