the interval 0 — 90°, relative to the direction of the projection of the initial momentum of the μ^+ mesons, is 1.19. This corresponds to a coefficient $A = -0.22 \pm 0.03$ in the expression $(1 + A\cos\vartheta)$ for the distribution of spatial angles.

As mentioned above, the measured coefficient A is not equal to the coefficient a of Eq. (1). If one denotes by γ the degree of quenching of the μ^+ mesons at the instant of decay, then $A = a \times (1-\gamma)$. Assuming, as Chadwick et al.[4] do, no disorientation of μ^+ mesons in hydrogen, and using for the determination of $\gamma(C_3H_8)$ the data of Swanson et al.,[5] we find $\gamma(C_3H_8) = 0.33 \pm 0.10$; hence $a = 0.33 \pm 0.06$ and $\lambda = 0.99 \pm 0.18$. The analogous value of λ found by Chadwick et al. from the data in G-5 emulsions equals 0.85 ± 0.18.

We take this opportunity to express our gratitude to Professor V. P. Dzhelepov for making it possible for us to perform this experiment at the synchrocyclotron.

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ENERGY DEPENDENCE OF ANGULAR CORRELATION IN $\mu^- - e^-$ DECAY

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According to the two-component neutrino theory[1,2] the angular asymmetry in the μ—e decay depends strongly on the electron energy. If ϵ stands for the ratio of the electron energy to the maximum energy in the μ—e decay, then the angular distribution is described by the function

$$dN = N(a + b\lambda\cos\vartheta)\, d\varepsilon\, d\cos\vartheta, \quad (1)$$

where ϑ is the angle between the momentum direction of the decay electron and the μ-meson spin; λ is a theoretical parameter;

$$a = 2\varepsilon^2(3 - 2\varepsilon); \; b = 2\varepsilon^2(2\varepsilon - 1).$$

Several authors, in particular Vaisenberg and Smirnitskii[3,4] have analyzed the angular distribution of positrons of various energies in the π^+—μ^+—e^+ decay and found an increase with energy of the "backward-forward" asymmetry. We have studied the angular correlation in the decay of negative μ mesons, which decayed in an emulsion.

A stack of NIKFI-R photoemulsion 10 cm in diameter and 400μ thick was irradiated by a negative μ-meson beam from the synchrocyclotron of the Joint Institute for Nuclear Research. The μ^- mesons were formed from the decay of 350-Mev π^- mesons and were then separated from other particles by a carbon absorber 90 cm thick. The emulsion chamber was surrounded by a thick layer of iron, which screened it from the stray field of the accelerator.

The geometry of the experiment was such that μ^- mesons of energy close to maximum were registered in the emulsion. The momentum direction of such μ^- mesons changes only slightly in going from the coordinate system in which the π^- meson is at rest to the laboratory coordinate system. For this reason, the μ^--meson beam was considered polarized.

In the scanning of separate emulsion layers tracks of long-range μ^- mesons with decay electrons were noted.

Altogether 630 cases of μ^-—e^- decays were analyzed in which μ^- mesons stopped at a distance of not less than 50μ from any of the emulsion surfaces. In 135 cases of μ^-—e^- decays, an estimate of the electron energy was made when the electron track length was more than 500μ. 83 electrons had a track length of over 1 mm.

The electron energy was measured by the multiple-scattering method; the error in the energy determination ranged from 30 to 18%, depending on the electron track length.

In order to compare the experiment with formula (1) and the consequences resulting from it, it was necessary to measure the angle ϑ, which in our case was taken to be the same as the angle between the direction of the electron motion and the axis of the μ^--meson beam.

In 135 cases of μ^-—e^- decays, 64 electrons were emitted forwards (i.e., $0 \leq \vartheta \leq 90°$) and 71 electrons were emitted backwards (i.e., $90° \leq \vartheta \leq 180°$). This circumstance may serve as an indication that the spin direction of the μ^- meson,

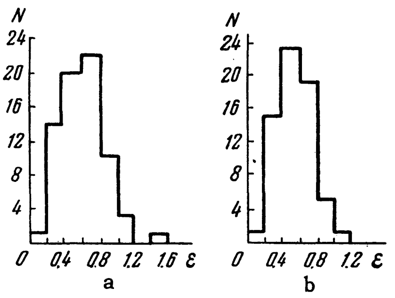

FIG. 1 Electron energy spectra: a – electrons emitted backwards, b – electrons emitted forwards.

at least for some particles, keeps its initial direction in the emulsion up to the instant of decay.

In Fig. 1 the energy spectrum is shown separately for the electrons emitted forwards and backwards. Here the number of electrons N is plotted against the ratio ϵ of the electron energy to the maximum energy $E_{max} = 55$ Mev.

Angles	Direction	Electron Number	Theoretical ratio ($\lambda = -1$)
0—20°	forward	3	1 : 2.6
160—180°	backward	9	
0—60°	forward	11	1 : 2
120—180°	backward	19	
60—90°	forward	8	1 : 1.2
90—120°	backward	13	

For energies $\epsilon > 0.6$ the "forward-backward" electron ratio was 25 : 36. In the low energy region ($\epsilon < 0.6$), 39 particles were emitted forwards and 35 backwards. The observed change in sign of the asymmetry for fast and slow electrons is in qualitative agreement with formula (1).

In addition, we have studied the asymmetry in various angular intervals. The table gives the ratio of "forward-backward" electrons for various angular intervals in the energy region > 35 Mev.

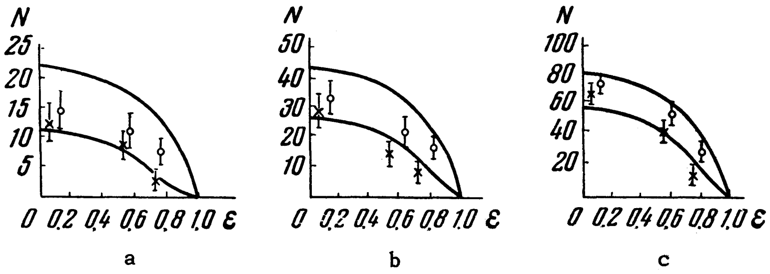

FIG. 2. Electron energy spectra in various angular intervals: a) 0 – 20° and 160° – 180°, b) 0 – 45° and 135° – 180°, c) 0 – 90° and 90° – 180°; o – backward emitted electrons, x – forward emitted electrons.

In Fig. 2 the energy spectra in various angular intervals are compared with theoretical curves. The upper curve is for electrons emitted backwards, and the lower curve for electrons emitted forwards. The slight disagreement between the experimental points and the expected distribution is, apparently, due to a partial depolarization of the μ^- mesons before decaying.

From the above given analysis of the angular correlation in the μ^-—e^- decay one can see a qualitative agreement with the two-component neutrino theory. Unfortunately, the accumulated statistics are not sufficient for quantitative conclusions.

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