in double scattering of a polarized electron beam than scattering of a non-polarized beam.[1,2]

If we neglect recoil of the nucleus for a two-component neutrino the β-electron longitudinal polarizations is $\eta = v/c$.

Experiments on double scattering of a polarized beam are difficult because of the relatively low activity of β-active samples. However, experiments of this type are of great interest both for verifying the calculation given above as well as for understanding the phenomenology of β-decay. At the present time attempts are being made to verigy this effect experimentally.

On the other hand, neglect of the azimuthal symmetry in double scattering of decay electrons may lead to its own experimental error. The first scattering is over small angles ($5 - 15°$) and is likely to be lost in the cover which protects the sample. It should be noted that the factor in the expression for δ_2 which depends on ϑ_1 is changed by only a factor of three as the angle varies from $10 - 90°$ so that even for a first scattering at small angles, δ_2 in Eq. (1) remains large.

It is of interest, in this regard, to point out a possible connection between double scattering and the so-called "anomalous" electron scattering which has been observed by a number of authors.[3,4] These observations refer to a discrepancy between the experimental and theoretical electron distribution over the angle ϑ. It is of interest to note that the "anomalous" scattering has been observed in investigations of β-radiation of radioactive materials while, on the other hand, there has been good agreement with theory in investigations using accelerator beams.[2,5]

We wish to express our gratitude to Academician I. E. Tamm for valuable discussions in connection with this paper.

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THEORY OF THE PRODUCTION OF ELECTRON-POSITRON PAIRS IN COLLISIONS OF SLOW μ^--MESONS WITH NUCLEI

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In Refs. 1—5 several approximate formulas have been obtained for the cross sections for the production of electron-positron pairs in collisions of non-relativistic heavy charged particles. The most complete analysis of the problem has been given by Okun'[5] who has derived expressions for the pair-production cross sections in Born approximation as well as the quasi-classical approximation. Thus, almost the entire non-relativistic region of heavy-particle energies has been investigated; the only exception is the small region near threshold.

In the present report we present the results of calculations which have been carried out for the threshold region for the production of electron-positron pairs in the collision of negative μ^--mesons with nuclei. The calculations have been carried out in the framework of quantum electrodynamics; two cases have been considered: the first corresponds to the condition:

$$T_0 - 2m < 2m, \tag{1}$$

where T_0 is the initial energy of the μ^--meson and m is the mass of the electron.

In the second case it is assumed that the following condition is satisfied:*

$$2\pi Z/137 \gg \beta_1,\ \beta,\ \beta_+, \beta_-;\ 2\pi/137 \ll \beta_\pm, \tag{2}$$

where β_0, β, β_+ and β_- are correspondingly the velocities of the μ-mesons and the pair particles with respect to the nucleus, $\beta_\pm$ is the relative velocity of the particles of the pair.

In this approximation the total cross section for the production of electron-positron pairs by μ^--mesons on nuclei is:

$$\sigma = 8\pi^3\left(\frac{Z}{137}\right)^6\left(\frac{e^2}{m}\right)^2\frac{m}{T_0}\left(\frac{T_0-2m}{2m}\right)^2\left\{\eta^4\left(\frac{1}{4!}-\frac{1}{2\eta^2}\right)\mathrm{Ei}(-\eta)+I(\eta)\exp(-\eta)\right\}\exp\left\{-\frac{\pi Z}{137}\left(\frac{2\mu}{T_0}\right)^{1/2}\right\}. \tag{3}$$

Here: μ is the mass of the μ-meson,

$$I(\eta)=\sum_{k=0}^{1}\frac{(-1)^k\eta^k}{2\ldots(2-k)}-\sum_{k=0}^{3}\frac{(-1)^k\eta^k}{4\ldots(4-k)};\quad \eta=\frac{\pi Z}{137}\left(\frac{T_0-2m}{2m}\right)^{-1/2}.$$

The function $\mathrm{Ei}(-\eta)$ is the exponential integral, the values of which are tabulated in Ref. 6.

The second case corresponds to the Born approximation for the pair particles:

$$2\pi Z/137 \ll \beta_+,\ \beta_-,\ \beta_\pm;\ 2\pi Z/137 \gg \beta_0,\ \beta. \tag{4}$$

In this approximation the total effective cross section for pair production is

$$\sigma=\frac{\pi^2}{6}\left(\frac{Z}{137}\right)^4\left(\frac{e^2}{m}\right)^2\frac{m}{T_0}\left(\frac{T_0-2m}{2m}\right)^3\cdot\exp\left\{-\frac{\pi Z}{137}\left(\frac{2\mu}{T_0}\right)^{1/2}\right\}. \tag{5}$$

The formulas in (3) and (5) do not go over directly to Eq. (11) of Ref. 5 which pertains to a region of considerably higher energies. We may note, however, that the exponential factor in Eq. (11) of Ref. 5 becomes approximately the same as the exponential factor in Eqs. (3) and (5) when $T_0 \to 2m$.

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*Here and in the following we will not specifically state the condition

$$2\pi/137 \ll \beta_{e-\mu}$$

[where $\beta_{e-\mu}$ is the relative velocity of the scattered μ-meson and electron (positron)] since it is easily satisfied.

SOFT COMPONENT IN AN ELECTRON-NUCLEAR SHOWER AT ENERGIES OF 10^{14} EV

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In an earlier note[1] we presented a short report concerning an investigation in an emulsion of the angle-energy characteristics of the rare case of a nuclear interaction between an α-particle with an energy of $(8^{+3}_{-4}) \times 10^{13}$ ev and a nucleon. The observation conditions were such that it was also possible to develop