beta interaction by the scalar S rather than by the vector type V, which is in accordance with the latest experimental findings[8].

It is of no practical significance but only of theoretical interest that in the case of the vector interaction type V we should expect the equality

$$g_{F(V)} \equiv g'_{F(V)}$$

to any order of the meson-nucleon coupling constant, taking nucleon recoil into account and allowing also for interaction of the nucleon with the electromagnetic field, etc. This result might be forseen by analogy with Ward's identity for the interaction of a charged particle with the electromagnetic field; in this case virtual processes involving particles (self-energy and vertex parts) do not lead to charge renormalization of the particle.

3) We have calculated the meson corrections by invariant perturbation theory, using pseudoscalar coupling between pion and nucleon (coupling constant g).

In the expression for the self-energy and vertex parts a convergence factor $C(k^2)$ was introduced, where k is the momentum 4-vector of a virtual meson:

$$\sum = \int \tau_i \gamma_5 (\hat{p} - \hat{k} - m)^{-1} \gamma_5 \tau_i (k^2 - \mu^2)^{-1} C(k^2)\, d^4k,$$

$$\Gamma_0 = \int \tau_i \gamma_5 (\hat{p} - \hat{k} - m)^{-1} \tau_+ \hat{O} (\hat{p} - \hat{k} - m)^{-1} \gamma_5 \tau_i (k^2 - \mu^2)^{-1} C(k^2)\, d^4k,$$

$$C(k^2) = \lambda^2 / (\lambda^2 - k^2).$$

In addition to integration over momentum space ($d^4 k$), a summation was carried out over the index i of meson isotopic spin. The beta process operator was represented as the product of the operator τ_+ which transforms a neutron into a proton, and the operator $\hat{O}$ which consists of the γ matrix ($\hat{O} = 1$ for S; $\hat{O} = \gamma_i \gamma_k$ for the T interaction type).

The meson mass renormalization term was calculated from Σ in the usual way: m is the mass of the nucleon, μ is the mass of the meson, and terms of the order of μ/m are neglected. Taking renormalization of the wave functions into account, the result becomes

$$g_{F(S)} = g'_{F(S)} \left[1 - \frac{g^2}{32\pi^2}\left(5 \ln\left(\frac{\lambda^2}{m^2}\right) - \frac{1}{2}\right)\right],$$

$$g_{GT(T)} = g'_{GT(T)} \left[1 - \frac{g^2}{32\pi^2}\left(3 \ln\left(\frac{\lambda^2}{m^2}\right) + \frac{1}{2}\right)\right],$$

For small g and large λ a relativistic calculation also gives a decrease of g'_{GT}/g'_F compared with g_{GT}/g_F.

In the present state of the theory of interactions of pions with nucleons one cannot give preference to a relativistic perturbation theory calculation over the calculations of Finkelstein and Moszkowski[1], who employ coupling constants derived from experimental data.

* In the notation of Finkelstein and Moszkowski[1], $P_1 = 3\delta$.

** In the case of virtual mesons (Fig. 3) $\pi \to \mu + \nu$ decay is obviously forbidden by energy considerations.

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Electrical After-Effects in Rochelle Salt

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A decrease of residual charge resulting from an increase in the duration of charging of samples of Rochelle salt has been reported[1]. A similar decrease of residual charge in the presence of a number of sequential electrical impulses has been observed by other investigators[2,3]. As is known[4], Rochelle salt, besides this phenomenon of fatigue, also has inherent unipolarity, which results in the asymmetrical polarization P_a relative to the forward and reverse polarization. This asymmetry P_a has been investigated[5] as a necessary consequence of the existence of large regions of spontaneous polarization. However, considering the question of fatigue and unipolarity, Kosman and Sozina[6] arrive at the conclusion that in reality there exists no distinction between fatigue and unipolarity, and that both are dependent on a shut-off layer, arising as a result of the action of polarization on the specimen.

Markedly contradictory opinions concerning the nature of unipolarity stimulated us to investigate in more detail the after effects produced by means of continuous action of electrical polarization on the specimen.

The experiment was carried out using the arrangement, dimensions of specimens, and assembly of electrodes which has been reported previously[7]. The method used in the present work consisted of a superposition onto the specimen of short electrical impulses in the forward and reverse directions. In the intervals between two consecutive impulses the specimen remained undisturbed. The condition of the specimen was determined by the charge or discharge of a quantity of electricity Q, which was determined by means of a galvanometer. Typical curves, characteristic of the initial condition, are presented in Fig. 1 *a*. It is established that the majority of investigated specimens have, for one of the directions of polarization and with a voltage

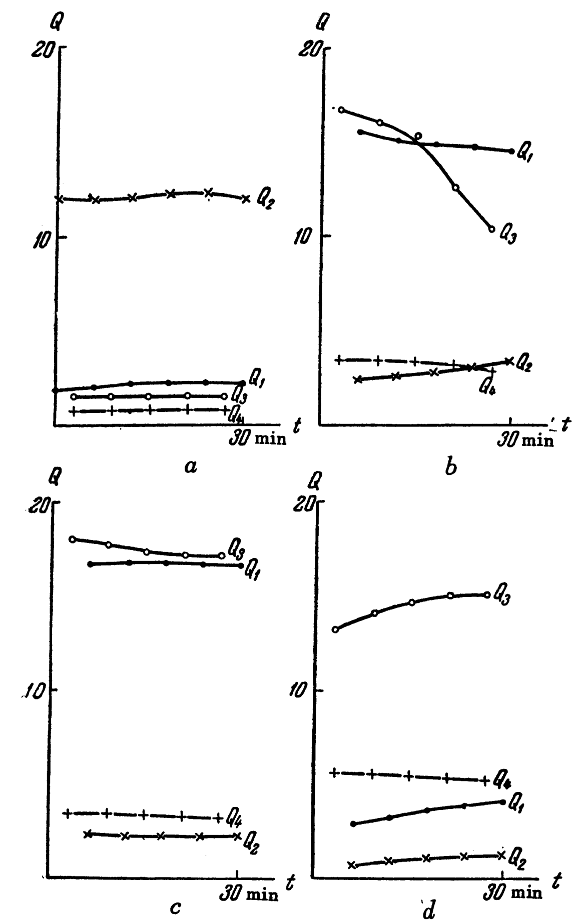

FIG. 1. The dependence of the charge-discharge quantities of electricity on the duration of action of the polarization. Q_1 and Q_2 are the charge-discharge quantities of electricity produced by superposition of impulses in the forward direction. Q_3 and Q_4 are the same quantities with impulses in the reverse direction. $E = 75$ volts/cm; $T = 18°C$. (Q is in units of 5.4×10^{-8} coulomb). The duration of the interval between two impulses in three minutes. *a*– is the initial condition; *b* – is after the action of polarization 48 times; *c* – is after 70 times; and *d* – is after the action of polarization 172 times.

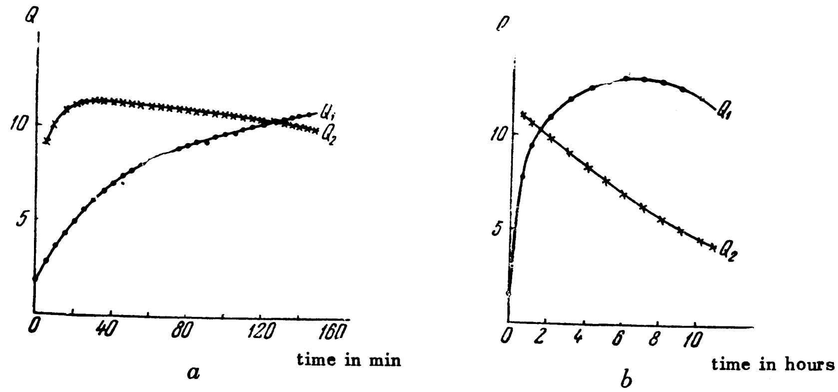

FIG. 2. Dependence of the charge-discharge quantities of electricity Q_1 and Q_2 on the increase of number of superimposed pulses with $E = 75$ volts/cm and $T = 18°$C. (Q is in units of 5.4×10^{-8} coulombs). Duration of interval between pulses is 10 seconds. At *a* the duration of each pulse is 5 minutes. At *b* the duration of each pulse is 1 hour.

of 50 to 100 volts/cm, residues in discharging which considerably surpass the residues in charging.

Fig. 2 shows the change of charge-discharge residues with an increase of number of impulses, according to the sign and magnitude of the electrical impulses. As is apparent from the adduced facts, the average rate of establishing polarizations and depolarizations changes over wide ranges in its dependence on the duration of action of the polarizing force. The smallest rate of establishing polarization results in a practically final value in no more than 5 minutes. Complete discharge is initially provided by isolating the sample for ten seconds, even in the case of the largest variation of accumulated charge produced from preceding impulses. This complete discharge results in an initial increase of the rate of establishing polarization. Subsequently, the rate of establishing polarization and depolarization decreases until the sample practically does not discharge, even with greater intervals of isolation. In this case superposition of sequential pulses of the opposite sign in fact produces overcharging. The result is that after the uninterrupted continuous action of the applied potential difference, the overcharging is able in turn to cause considerable delayed action.

The investigations showed that considerable unipolarity is inherent on most of the specimens and that this unipolarity is a permanent characteristic. However, prolonged action of electrical polarization is able to alter the unipolarity considerably, in particular to cause its disappearance. The disappearance of unipolarity indicates a transition from an "inherent" condition, in which the sample exists predominantly in one direction of spontaneous polarization, to a condition in which the forward and reverse directions of spontaneous polarization are equally likely. The maximum change of condition shows itself by a change of the predominant orientation of domains into opposition. The mechanisms of the processes, taking place in the samples over such a long interval of time, still remain insufficiently explained.

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Formation of a μ-Meson Pair in Positron Annihilation

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IF there is no specific interaction peculiar to μ-mesons more essential than the electro-