lecular and convective flows: $q = q_0 + \delta q$; the molecular flow in a viscous conducting fluid does not depend on the magnetic field. According to linear theory, $d\Theta_c/dH \to 0$ as $H \to 0$; on the other hand, the value of $\Delta(\partial q/\partial\Theta)$ in the absence of a magnetic field is known, and we can get from (6) an expression for the convective flow in a weak magnetic field:

$$\delta q\,(H) \cong \delta q\,(0) - [\Theta_c\,(H) - \Theta_c\,(0)]\,\Delta\,(\partial q\,/\,\partial\Theta)_{H=0}.$$

I am grateful to Academician M. A. Leontovich for a discussion.

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ON THE PROBLEM OF THE D^+ *MESON*

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Submitted to JETP editor April 25, 1962

J. Exptl. Theoret. Phys. (U.S.S.R.) **43**, 335-337 (July, 1962)

AT the 1959 International Conference on High Energy Physics in Kiev, Wang Kang-chang et al[1] suggested that one of the events recorded in a propane bubble chamber could be interpreted as the decay of a particle of strangeness +2 into a K^0 meson and a π^+ meson (D^+ meson). Subsequently, Yamanouchi[2] drew attention to the fact that some previously investigated anomalous cases of strange-particle decays could also be interpreted as a D-meson decay.

The existence of the D^+ meson is allowed by the Gell-Mann–Nishijima scheme, according to which it should be an isotopic singlet ($S = +2$, $T = 0$). The possible channels for the decay of this particle are

$$D^+ \begin{array}{l} \nearrow K^+ + \pi^0, \\ \searrow K^0 + \pi^+, \end{array} \qquad (1)$$

where the probability of the second branch should be double that of the first. The D^+-meson lifetime should be, as noted by Pontecorvo,[3] of the order 10^{-10} sec (the decay occurs with $\Delta T = 1/2$). Another possible isotopic singlet, the D^- meson ($S = -2$, $T = 0$) should have similar properties.

Eisenberg et al[4] and Cook et al[5] conducted a search for the $D^\pm$ mesons among particles of $K^\pm$-meson beams. They showed that the amount of $D^\pm$ mesons in the extracted $K^\pm$-meson beams does not exceed 10^{-4}—10^{-3}. It is obvious, however, that the method used by these workers is suitable only for the observation of long-lived particles ($\tau \approx 10^{-8}$ sec) and is unsuitable if $\tau \approx 10^{-10}$ sec.

An attempt to detect the D^+ meson in the direct vicinity of its assumed point of production was made by Nikol'skiĭ et al[6], who exposed an emulsion stack to a 9-BeV internal proton beam. In this work, however, the more probable branch of the D^+-meson decay ($D^+ \to K^0 + \pi^+$) could not be observed. Moreover, in proton interactions, the D^+ meson should be produced along with two strange particles (if we neglect the small probability of its associated production with a Ξ hyperon), as a result of which the cross section for this process cannot be large.

In this connection, it is of interest to study the reaction

$$K^+ + p \to D^+ + \Sigma^+. \qquad (2)$$

Since only two strange particles (including the D^+ meson) are produced in the final state, it can be hoped that the cross section is much larger.

In the present experiment, we attempted to observe the actual production and decay of the D^+ meson in a bubble chamber.

A propane bubble chamber with a pulsed magnetic field[7] was exposed to a beam of positive particles of momentum ~ 1.8 BeV/c containing, as was shown by the measurements of M. F. Likhachev and V. S. Stavinskiĭ, up to 9% K^+ mesons. A total of 14,000 pairs of pictures were scanned for cases of D^+-meson production and decay:

$$K^+ + p \to D^+ + \Sigma^+, \qquad D^+ \begin{array}{l} \nearrow K^0 + \pi^+ \\ \searrow K^+ + \pi^0 \end{array}$$

Here, the first (more probable) branch of the decay should have a very characteristic appearance (a V-event aiming at the kink in the D^+-meson track).

Events resembling the D^+-meson production and decay were measured on a semi-automatic arrangement, whose output was punched on tape. The spatial reconstruction of the picture and the kinematic analysis were made on an electronic computer with a special program. The method of data reduction was tested on pp elastic scattering and several cases of associated production of a K^+ meson and a Σ^+ hyperon on free protons:

$$\pi^+ + p \to K^+ + \Sigma^+. \tag{3}$$

The cases of pp elastic scattering and reaction (3) were identified by means of kinematic curves. The number of recorded cases of associated production of a K^+ and a Σ^+ hyperon corresponded to the fraction of π^+ in the beam and to the cross section for reaction (3).

This analysis did not disclose any cases of D^+-meson production. We can thus estimate the upper limit for the D^+-meson production cross section in reaction 2:

$$\sigma < 2 \cdot 10^{-29} \text{ cm}^2.$$

A similar conclusion ($\sigma < 3 \times 10^{-29}$ cm^2) can be made for the reaction

$$K^+ + n \to D^+ + \Sigma^0, \tag{4}$$

which was also not found in the scanning. Hence the D^+-meson production cross section in the interactions between K^+ mesons and nucleons is

$$\sigma < 1.2 \times 10^{-29} \text{ cm}^2.$$

It should be noted, that, for the assumed mass of the D^+ meson (≈ 720 MeV), reaction (2) and (4) should be occurring far above threshold.

In conclusion, the authors consider it their pleasant duty to thank V. I. Veksler, I. I. Gurevich, and I. V. Chuvilo for their constant interest in and attention to this work, and also the proton-synchrotron crew for ensuring the proper operation of the accelerator. We are pleased to thank V. I. Baranov L. S. Baturin, A. P. Venediktov, A. A. Kondrashin, A. V. Tel'nov, S. Kh. Khakimov, V. K. Makar'in, V. P. Martem'yanov, A. F. Burtsev, A. I. Maleev, B. V. Sokolov, I. V. Panov, N. S. Moroz, and Z. D. Dobrokhotov for aid in the measurements and reduction of the data.

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Translated by E. Marquit
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DEPOLARIZATION OF THE POSITIVE MUON IN AN ELECTRIC FIELD

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Submitted to JETP editor May 7, 1962

J. Exptl. Theoret. Phys. (U.S.S.R.) **43**, 337-339 (July, 1962)

In the present paper we consider the influence of a strong electric field ($E \sim 10^5$ V/cm) on the depolarization of the positive muons produced by $\pi \to \mu$ decay in emulsion. It can now be regarded as proved that the depolarization of the stopped positive muon is essentially due to the formation of muonium (the μ^+e^- system). This deduction follows from experiments on the dependence of positive-muon depolarization on the magnitude of the longitudinal magnetic field[1] (along the direction of the muon spin), and also from several other investigations[2,3] in which it is indicated directly or indirectly that muonium is produced upon deceleration of positive muons.

At the same time, experiments on the precession of the positive muon spin in a transverse magnetic field[4] have shown that the "stopped" positive muon precesses with a frequency corresponding to the free muon, and that, within the limits of experimental accuracy, it experiences no further depolarization.[1)] It follows therefore that muonium is produced only within a sufficiently short