tion, we consider it unavoidable to postulate a Riemann "isentropic discontinuity"[3] in the flow parameters within a compression wave of any amplitude, by analogy with the isothermal discontinuity for purely heat-conducting gases.[4] At such a discontinuity, those gradients whose effect on the dissipation can be ignored must become infinite; i.e., at the discontinuity only the entropy and the magnetic field strength may not change abruptly. Inclusion of the thermal conductivity can smooth out the discontinuity only at sufficiently small amplitudes, above which an isothermal discontinuity sets in,[5] abruptly lowering the entropy. (The isomagnetic discontinuity is discussed in a number of papers,[2,5,6] which show that it must occur for sufficiently large amplitudes; the relationship between the field discontinuity and the entropy discontinuity is discussed in the work of Golitsyn and Stanyukovich,[7] but only in connection with the variation of the shock-front thickness.) If dissipation occurs by way of viscosity in addition to Joule heating, then the isentropic discontinuity mentioned above will be smoothed out for all amplitudes, since for vanishing viscosity the curves for continuous evolution of the flow parameters pass arbitrarily close to the isentropic line S_{max}, coinciding with it only in a single point, at $+\infty$. Even if there is no viscosity, structural continuity is still guaranteed in a shock wave in a heat-conducting medium if there is a sufficiently high density of radiation after the liquidation of the isothermal discontinuity.[8] For discussions of the present work the author is indebted to his coworkers in the Theoretical Section of the Institute of Chemical Physics, in particular to K. E. Gubkin.

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THE K_{e3} AND $K_{\mu 3}$ DECAYS

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THE A-V interaction scheme[1,2] has recently had a series of experimental confirmations in the phenomena of β decay, μ and π decays, and decays of strange particles (decay of the Λ^0 hyperon, $K_{\mu 2}$ decay).[3-5] In connection with this, it is of interest to investigate the three-particle lepton K decays $K \to l + \nu + \pi$, where l denotes the electron or μ meson.

The matrix element for this process in the theory of universal A-V interaction, in which the electron and μ meson have the same status, has the following form (in the rest system of the K meson):

$$M^{-3/2}E_\pi^{-1/2}\left\{\frac{m_l}{M}X\left(\bar{l}\left(1+\gamma_5\right)\nu\right)+Y\left(\bar{l}\gamma_4\left(1+\gamma_5\right)\nu\right)\right\}, \quad (1)$$

where E_π is the total energy of the π-meson, m_l and M are the mass of the lepton and K meson, respectively, while X and Y are real functions of the π-meson energy E_π, and are identical in K_{e3} and $K_{\mu 3}$ decays. If we neglect dependence of X and Y on E_π, assuming that X = const and Y = const, then it is possible to determine these quantities from experiment.

Such considerations were carried out by Gatto.[6*] Calculating the probabilities of $K_{\mu 3}$ and K_{e3} decays from Eq. (1) and comparing them with experimental values for the decay probabilities, Gatto obtained two possible pairs of values for X and Y, for which the ratio was either X/Y = 4.2 (solution I) or X/Y = −0.34 (solution II).

Knowing the constants X and Y, one can calculate the μ-meson energy spectrum for each of the possible solutions I and II and, using the experiments, choose one of them. However, as follows from Gatto's work, the μ-meson energy spectra turn out to be very complex, and this makes the selection difficult. We would like to remark that the task of choosing between the two indicated solutions can be greatly simplified if the longitudinal polarization of the μ mesons in $K_{\mu3}$ decay is measured.

It follows from Eq. (7) of reference 9 that the longitudinal polarization $\overline{P}$ of the μ meson is the following function of μ-meson energy in the A-V interaction scheme

$$\overline{P} = \frac{v - \alpha - 2\alpha \frac{X}{Y}\frac{m_\mu}{M}\frac{m_\mu}{E_\mu} - \left(\frac{X}{Y}\right)^2\left(\frac{m_\mu}{M}\right)^2 (v+\alpha)}{1 - v\alpha + 2\frac{X}{Y}\frac{m_\mu}{M}\frac{m_\mu}{E_\mu} + \left(\frac{X}{Y}\right)^2\left(\frac{m_\mu}{M}\right)^2 (1+v\alpha)},$$

$$\alpha = \frac{\sqrt{E_\mu^2 - m_\mu^2}}{M - E_\mu}, \qquad (2)$$

where v is the μ-meson velocity in the rest system of the K particle, E_μ is the μ-meson energy, and c = 1.

Figure 1 shows $\overline{P}$ as a function of the kinetic energy of the μ meson ($\kappa = E_{kin}/E_{kin}^{max}$) for the experimental value $\nu \equiv \tau(K_{e3})/\tau(K_{\mu3}) = 0.96$. It is seen from the figure that solutions (I) and (II) give opposite signs and a completely different behavior for the longitudinal polarization as a function of energy. This makes it possible to determine X and Y unambiguously.

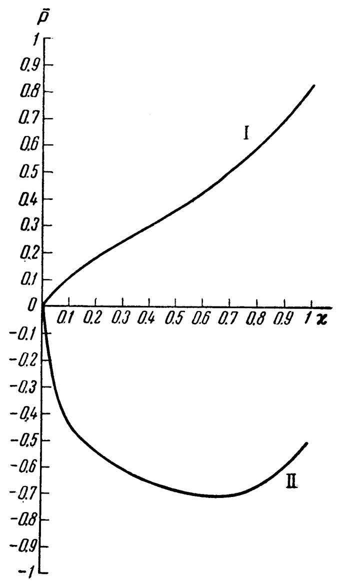

FIG. 1

Since the ratio ν is not accurately determined, it is of interest to investigate how $\overline{P}$ changes with ν (i.e., with X/Y) for given μ-meson energy. In Fig. 2, P is given as a function of ν (and X/Y) for $\kappa = 0.4$ and 0.8; for convenience, both abscissa axes corresponding to values of X/Y smaller and larger than 2 (X/Y = 2 corresponds to the limiting value $\nu = 1/2$) are laid off to the right of the ordinate.

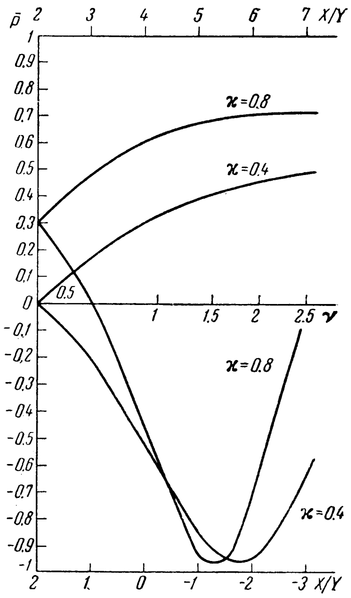

FIG. 2

If the experimental measurement of $\overline{P}$ gives results in disagreement with predictions, then (for a well-determined ν) this will mean that either the assumption of the weak energy dependence of X and Y is incorrect, or that the A-V interaction does not apply to K decays.

*Similar considerations were also given in reference 7 (see also reference 8).

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