We have not carried out detailed comparisons with the numerous experimental data in the present note because there are frequently other factors in plasma diffusion, such as effects due to neutral gas and the longitudinal current, that are not taken into account. However, the results given here verify the possibility of observing an anomalous plasma diffusion proportional to 1/H.

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125

POSSIBILITY OF DETERMINING $\pi\pi$-SCATTERING PHASES FROM ANGULAR CORRELATIONS IN K_{e4} DECAY

E. P. SHABALIN

Institute of Theoretical and Experimental Physics, Academy of Sciences, U.S.S.R.

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EXPERIMENTS on K_{e4} decay are evidently to be initiated in the near future (one case of this decay has already been observed[1]). In this connection we wish to call the attention of experimental physicists to the fact that an investigation of angular correlations in K_{e4} decay can give information on the π-π interaction.

The effect of the interaction of the π mesons in the final state in K_{e4} decay has been discussed earlier by Chadan and Oneda[2] and by Chioccetti.[3] These authors have computed the "gain factor" for the decay probability due to the mutual attraction of the π mesons as compared with the decay probability in the absence of an interaction in the final state. It should be noted, however, that an estimate of the probability of K_{e4}-decay that neglects the π-π interaction is based on rather arbitrary assumptions as to the magnitude of the constant for this decay.[4-7] Hence, any experimental deviation of the probability from the value given by this estimate could be due to the interaction of the π mesons and/or to an incorrect estimate.

We consider here another effect related to the interaction of the π-mesons. Consider the asymmetry in positron emission in the decay

$$K^+ \rightarrow \pi^+ + \pi^- + e^+ + \nu \qquad (1)$$

with respect to the plane formed by the tracks of the π-mesons.

Let us analyze the decay of a K meson at rest. The momentum of the π^+, $\mathbf{k}_1$, and the momentum of the π^-, $\mathbf{k}_2$, define a plane; the normal to this plane $\mathbf{n}$ is defined in such a way that for an observer looking from the end of the vector $\mathbf{n}$ the smallest rotation from the direction of the track of the π^+ to the track of the π^- is in the counterclockwise direction.

If we neglect the particle interaction in the final state the angular distribution of positrons must be symmetric with respect to the plane defined by $\mathbf{n}$. The absence of a term $(\mathbf{p}_e \cdot \mathbf{n})$ in the expression for the probability is a direct consequence of the conservation of time parity. The quantity $(\mathbf{p}_e \cdot \mathbf{n})$ changes sign under the T-transformation $\mathbf{k}_1 \rightarrow -\mathbf{k}_1$, $\mathbf{k}_2 \rightarrow -\mathbf{k}_2$, $\mathbf{p}_e \rightarrow -\mathbf{p}_e$. The situation is changed if we take account of the interaction in the final state. In this case $(\mathbf{p}_e \cdot \mathbf{n})$ can contain an odd function of the $\pi\pi$-scattering phase as a factor. Inasmuch as the signs of the phases are reversed under the T-transformation the term as a whole is T-invariant. However, it implies the violation of the symmetry indicated above.

We will assume the existence of the rule $|\Delta T| = 1/2$ for lepton decay of strange particles.[8-10] Then, using the S-matrix formalism for multichannel reactions[11] and assuming that decay leading to the formation of the system of π-mesons with orbital moment $l \geq 2$ is forbidden because of the high centrifugal barrier, we can write the decay amplitude (1) in the form

$$A = \frac{G}{\sqrt{2}} \bar{u}_\nu \{ f_1 e^{i\varphi_0} (\hat{k}_1 + \hat{k}_2) + f_2 e^{i\varphi_1} (\hat{k}_1 - \hat{k}_2)\} (1 + \gamma_5) u_e \varphi_K \varphi_{\pi^+} \varphi_{\pi^-}. \qquad (2)$$

In this expression we have neglected the axial part of the current of the strongly interacting particles since its contribution must be small.[7] The real quantities f_1 and f_2 are functions of the invariants (k_1k_2), (k_1q), (k_2q) (where q is the four-momentum of the K-meson); we assume that φ_0 and φ_1, the $\pi\pi$-scattering phases in the S and P states respectively, are constants.

The fact that the coefficients $f_1e^{i\varphi_0}$ and $f_2e^{i\varphi_1}$ are complex leads to an asymmetry in the angular distribution of the positrons with respect to the plane defined by **n**. The difference in the number of decays with the emission of positrons upwards and downwards referred to the interval of effective mass of the two π mesons is given by the expression

$$\frac{d(N_\uparrow - N_\downarrow)}{dQ} = \frac{f_1 f_2 G^2 \sin(\varphi_0 - \varphi_1)}{2^8\pi^4 7!!}\left(1 - \frac{4m^2}{Q^2}\right)(M-Q)^6\left(1 + \frac{6Q}{M}\right), \quad (3)$$

where m is the mass of the π meson, M is the mass of the K meson, and $Q = [(E_1+E_2)^2 - (\mathbf{K}_1+\mathbf{K}_2)^2]^{1/2}$ is the effective mass of the π-meson. The phases φ_0 and φ_1 depend only on the energy and the center of mass of the π mesons, i.e., the quantity Q.

The obtained distribution can be used to find the phase shift for $\pi\pi$-scattering in the energy range $2m \leq Q \leq M$ if the quantities f_1 and f_2 are known. The latter can be determined from other correlations in K_{e4} decay, for example, from the effective mass spectrum for the two π mesons[4] or the energy spectrum of the electrons.[7]

It follows from (3) that experimental observation of the asymmetry is possible if the phases of the $\pi\pi$-scattering are different in the S and P states and if the contributions of these states are not small.

Thus, the correlations in the K_{e4} decay can yield information on the $\pi\pi$-interaction. There is one other possibility of obtaining information on strong interactions from this decay, specifically the πK interaction; this has been recently pointed out by Nguen Van Hieu.[12]

The author is indebted to L. B. Okun' for directing his attention to the possibility of the existence of the considered effect and for his interest in the work.

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126

AN ESTIMATE OF THE LIMITING VALUES OF THE CRITICAL FIELDS FOR HARD SUPERCONDUCTORS

L. P. GOR'KOV

Institute for Physics Problems, Academy of Sciences, U.S.S.R.

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VERY high critical fields ($\approx 10^5$ G) have recently been reported for several superconductors.[1] In the present note we give an estimate of the order of magnitude of the upper limit of the critical magnetic field in the case of weak current. A similar estimate was obtained by Clogston.[2] Clogston assumed that the maximum field is governed by the condition that the energy in the magnetic field of electron spins forming a Cooper pair is comparable with the binding energy of the pair

$$\mu H \sim T_c, \quad (1)$$

where μ is Bohr magneton. This mechanism does not allow for the fact that the superconductors which we are discussing here are always superconducting alloys. The high value of the critical field for such alloys is possible only due to the short mean free path of electrons. A field of the order of that given in Eq. (1) is obtained if we assume that the mean free path becomes comparable with the interatomic distances.

We shall consider first the situation in pure superconductors. The majority of known superconductors undergoes a transition of the first kind to the normal state at some critical value of the magnetic field equal, according to the theory of Bardeen, Cooper, and Schrieffer[3] (at T = 0), to

$$H_c = (T_c/\hbar\gamma)\sqrt{2\pi m p_F/\hbar} \quad (\gamma = 1.78). \quad (2)$$

ERRATA

Volume 16 (Russ. v. 43)

No. 1, p. 81 (Russ. p. 112), article by B. M. Smirnov.

The article contains an error. In the calculation of the matrix element $(\partial H/\partial t)_{km}$ contained in the formula of the adiabatic perturbation theory, an error was made in the sign of one of the terms, leading to a non-zero result, and the order of the expansion in the small parameter is lower than actual. A corrected paper will be published in "Optika i spekroskopiya."

Volume 17 (Russ. v. 44)

No. 2, p. 518 (Russ. p. 766), article by E. P. Shabalin

Right hand side of Eq. (3) should read

$$\frac{f_1 f_2 G^2 \sin(\varphi_0 - \varphi_1)}{2^8 \pi^4 7!! M}(Q^2 - 4m^2)(M - Q)^5\left(1 + \frac{5Q}{M} + \frac{Q^2}{M^2}\right)$$

No. 5 p. 999 (Russ. p. 1485), article by D. K. Kopylova et al.

Caption to Fig. 7 should read:

Distribution of two-prong stars by "target mass": Continuous histogram - cases with $M_X^2 > 0$, dashed - with $M_X^2 < 0$.

Volume 18 (Russ. v. 45)

No. 4, p. 1100 (Russ. p. 1598), article by S. I. Syrovat-skiĭ et al.

Values of the fragmentation coefficient: in place of $a_{321} = -4.3618$ read $a_{321} = -3.3618$.