change energy of the electrons which, since it refers to a single particle, is e^2/R in magnitude. The third term in Eq. (1) is the result of the self-consistent interaction between the particles; its order of magnitude is $(e^2/R)(e^2/RT)^{1/2}$ (for a single particle).

We may note that the result given in reference 2 is not correct: this result does not take account of the exchange energy of the electrons and the self-consistent term has been computed incorrectly. This term was computed by means of the Debye-Hückel method; however, this approach cannot be used because the mean wavelength of an electron in a compressed plasma is comparable to the mean distance between particles R.

We are indebted to Academician L. D. Landau for discussion of this problem.

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118

INTERACTION BETWEEN K AND π MESONS

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THE question of the existence of a direct interaction between K and π mesons has been discussed in several papers.[1-5] Because of the pseudoscalar nature of π mesons, a direct three-boson coupling of the type $KK\pi$ is possible only if the K mesons do not have a definite parity[2] or if only combined parity IC is conserved in this interaction.

In a recent paper, Pais[5] discussed the original hypothesis that the parity of charged and neutral K mesons is different. In this case, the demand of charge independence in the pion-nucleon system places strong restrictions on the Lagrangian for strong interactions. Many reactions, for example, the charge exchange one $K^+ + n \to K^0 + p$, turn out to be forbidden. In order to avoid this difficulty, the parity-conserving $[K\pi]$-interaction

$$[K\pi] = f(2m_K)[\bar{K}^+K^0\pi^+ + \bar{K}^0K^+\pi^-], \qquad (1)$$

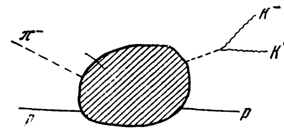
is introduced. Here m_K is the mass of the K meson. This coupling violates, of course, the symmetry property of strong interactions.[5,6*] Pais considers that the coupling of Eq. (1) makes the main contribution to the "forbidden" reaction noted above. The coupling constant f evaluated from the charge-exchange reaction, turns out to be of the order of the electromagnetic constant e (the real expansion parameter is $(f^2/4\pi)(m_K/m_\pi)^2 \sim 0.3$).

In discussing the consequences of his hypothesis, Pais finds it necessary not only to resort to perturbation theory for the $[K\pi]$- and $[NKY]$-couplings, but also to make assumptions about the behavior of the S matrix far from the energy shell.

The pair production of K mesons

$$\pi^- + p \to K^- + K^0 + p. \qquad (2)$$

seems to us to be of interest in verifying the existence of the $[K\pi]$-interaction (1). This reaction is, according to Pais,[6] forbidden by the symmetry properties of the baryon-meson interactions, and would occur only as a result of the interaction (1). Therefore, the pair production (2) can be represented by the graph (see the figure): after virtual



π^--p scattering; the π^- turns into K^- and K^0. If we go over into the system A in which the momentum of the final proton is equal to the sum of momenta of the π^- meson and the initial proton, then the momenta of the K mesons will be equal in magnitude and opposite in direction.

If, in fact, a pair of K mesons is produced as a result of the reaction (1), in the system A the angular distribution of K mesons should be isotropic. Such a reference system always exists. Its velocity relative to the laboratory system is

$$\mathbf{v} = c^2(\mathbf{l} - \mathbf{p})/(\omega + Mc^2 - E), \qquad (3)$$

where $\mathbf{l}$, ω, and $\mathbf{p}$, E are the momenta and total energy of the π^- meson and final proton, respectively, in the laboratory system; M is the mass of the proton.†

There will not, of course, be complete isotropy, since the final state interaction has not been taken into account, and the $[K\pi]$-coupling was calculated only to first order. However, here it is not necessary to resort to assumptions about the behavior of the S matrix off the energy shell.

Such assumptions can lead to more detailed predictions. For example, if the virtual π^- meson goes off mainly in the direction of the initial π^- meson, just as a real π^- meson resulting from shadow scattering at high energies, then in the center-of-mass system, the summed K-meson momentum is directed mainly forward. Similar assumptions have been used widely by Pais[5] in describing the reaction $\pi + N \rightarrow Y + K$ and others.

The author is deeply grateful to Chou Kuang-Chao for valuable discussion.

*If the K^+ and K^0 have the same parity, then only the combined parity IC is conserved in the interaction of Eq. (1).

†If the K^+ and K^0-mesons have the same parity and strong baryon-meson couplings are symmetrical according to Pais,[6] then one might introduce a 4-boson coupling to avoid the difficulties. Then for non-derivative couplings, for example, $\overline{K}(\tau, \pi)K\pi^0$, considerations about the isotropy of K^- and K^0 in the system A remain valid.

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119

POLARIZATION OF Au^{198} *NUCLEI IN A SOLUTION OF GOLD IN IRON*

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KHUTSISHVILI[1] proposed a method for the polarization of ferromagnetic nuclei. We undertook to apply this method to nuclei of non-ferromagnetic elements introduced into a ferromagnet. In this communication we report the results of experiments on the polarization of nuclei of Au^{198} in a gold-iron alloy. A specimen (with 0.3% gold by weight), made into a disk 0.3 cm in diameter and 0.01 cm thick, was exposed to thermal neutrons in a reactor. The activity of the Au^{198} nuclei formed in the specimen was approximately 4 microcurie during the time of the experiment. After irradiation, the specimen was annealed in vacuo and soldered to the end of a copper "cold pipe," joined to copper plates pressed into a potassium-chrome-alum block. The salt was adiabatically demagnetized at initial field and temperature values of 20000 gauss and 1.05°K. The gamma rays were registered by two scintillation counters with CsI crystals (diameter 40 mm, height 40 mm).

The Au^{198} disintegrates via β decay ($2^- \rightarrow 2^+$ transition), followed by emission of 411-kev gamma rays ($2^+ \rightarrow 0^+$ transition). At a temperature near 0.015°K the anisotropy of this gamma radiation is $\epsilon = 1 - N(0)/N(\pi/2)$ (where $N(0)$ and $N(\pi/2)$ are the readings of the counters placed parallel and perpendicular to the direction of the polarizing field of the permanent magnet) was found to be 3.3%. The magnetization of the specimen in the field of the permanent magnet was ~ 0.6 of saturation. The true value of the anisotropy, corresponding to 100%magnetization of the specimen, was therefore $\epsilon = 3.3/0.6 = 5.5\%$. It follows from this value of ϵ that the quantity $\beta = \mu H/kTI$ (μ is the magnetic moment of Au^{198}, I the spin of Au^{198}, and H the magnetic field on the Au^{198} nucleus) ranges from 0.3 to 0.4, while the polarization f_1 of Au^{198} ranges from 0.25 to 0.35. The values of β and f_1 were computed from the values of ϵ by the Tolhoek and Cox formulas.[2] The indeterminacy in β and f_1 is caused by the fact that the parameter λ, which depends on the matrix elements of the forbidden Au^{198} transition ($2^- \rightarrow 2^+$), is unknown.

The magnetic moment of Au^{198} is 0.5 ± 0.04 nuclear magnetons.[3] This, together with a value $\beta = 0.3$ to 0.4 measured at $T = 0.015°$, makes $H = (0.5 \text{ to } 0.7) \times 10^6$ oe.

So strong a field can be apparently explained only by the presence of a magnetic moment at the electron shells of the gold atoms in the gold-iron alloy (unlike the gold atoms in the metallic gold, which are diamagnetic). This magnetic moment may be due to an exchange interaction between the electron shells of the gold and iron atoms in the alloy, similar to the interaction between the electrons of the iron atoms. However, it is not impossible for the gold atoms in the alloy to be paramagnetic ions having no exchange bonds with the iron atoms.

It is hoped that the method of introducing nuclei into ferromagnetic alloys will increase considerably the number of elements capable of polariza-