for small angles was obtained also by Hon Jeong et al. [3] at $E_p = 9.8$ MeV for the case of A^{40}. This small-angle behavior of the differential cross section casts doubts on the normalization method used by us and by Seward. The inelastic distribution of the protons is shown in Fig. 2b, together with the data of Nemets and Prokopets [1], obtained at $E_p = 6.8$ MeV (curve 2) and normalized to our data at an angle $\theta_{c.m.} = 52°$. At angles below 30°, our data do not agree with theirs. This may be partially due to a difference in the incident-proton energies. We are then dealing with a relatively strong change in the elastic cross section with changing energy in the small-angle region, which may be due to the contribution from the compound-nucleus formation mechanism. The change in the forms of the angular distributions of the curves in this region of energies was noted also by Seward [2] for medium and large angles.

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POSSIBLE VERIFICATION OF NONCONSERVATION OF TIME PARITY IN COLLIDING BEAM EXPERIMENTS

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To explain the recently observed $K_2^0 \to 2\pi$ decay [1], in which CP-invariance is clearly violated, several hypotheses were proposed. In particular, Okun' [2] and Prentky and Veltman [3] pointed out that the observed decay can be explained by assuming that there exists a new P-even but C- and CP(T)-odd interaction, the dimensionless coupling constant of which is $\sim 10^{-2}$. On the other hand, Bernstein, Feinberg, and Lee [4] called attention to the fact that at the present time there is no experimental proof whatever that electromagnetic interactions of strongly interacting particles are C- and T(CP)-invariant. Inasmuch as the coupling constant of the hypothetical interaction indicated above is of the order of the fine-structure constant α, they assumed this interaction to be electromagnetic. In the same paper [4], the authors discuss a larger number of experiments, with the aid of which their hypothesis can be checked.

In this letter we point out that the hypothesis of Bernstein, Feinberg, and Lee can also be verified in a series of experiments with colliding positron-electron beams. Installations with colliding positron-electron beams are now being readied for operation in several laboratories (Novosibirsk, Frascati, Orsay) (see [5]).

In the single photon approximation, C-invariance forbids many processes in the annihilation of a positron-electron pair into a pair of strongly interacting particles. However, these processes, namely

$$\begin{array}{llll} \text{a)} & e^+ + e^- \to \gamma \to \pi^0 + \eta^0, & \text{b)} & e^+ + e^- \to \gamma \to \Phi^0 + \rho^0, \\ \text{c)} & e^+ + e^- \to \gamma \to \omega^0 + \rho^0, & \text{d)} & e^+ + e^- \to \gamma \to \Phi^0 + \omega^0, \end{array} \qquad (1)$$

can occur if the transition current of the strongly interacting particles contains a C-odd term (these processes proceed in the C-invariant theory via exchange of two photons, $e^+ + e^- \rightarrow 2\gamma \rightarrow \pi^0 + \eta^0$, and then the cross section contains an additional factor α^2, so that it is in general strongly suppressed). Let us consider for concreteness the process (a). Taking the conservation law into account, the transition current is

$$\langle \eta^0 \, \pi^0 | J_\mu | 0 \rangle = \langle \eta^0 \, \pi^0 | K^v_\mu | 0 \rangle = f_1 [P_\mu - \frac{m_\eta^2 - m_\pi^2}{\Delta^2} \Delta_\mu], \tag{2}$$

where $\Delta = p_\eta + p_\pi$, $P = p_\eta - p_\pi$, K^v_μ is the isovector part of the C-odd current, and s_1 is the form factor of the "mixed" charge distribution between the η^0 and π^0 mesons. Neglecting the electron mass, we represent the c.m.s. cross section of the process in the form

$$\frac{d\sigma}{d\Omega_\eta} = \frac{\alpha^2}{32E^2} (\frac{p}{E})^3 |f_1|^2 \sin^2\vartheta. \tag{3}$$

Here E is the energy of the initial electron, ϑ the angle between the direction of motion of the initial particles and the momentum of the η^0 meson, and p the momentum of the final particles:

$$p^2 = \frac{1}{4\Delta^2} [\Delta^4 - 2\Delta^2(m_\eta^2 + m_\pi^2) + (m_\eta^2 - m_\pi^2)^2]. \tag{4}$$

In the space-like region of momentum transfer, the authors of [4] expanded the form factor and assumed that the radius of the "charge distribution" is of the order of the electric radius of the proton, so that the form factor turned out to be quite large ($\sim 10^{-1}$) in the essential region. If it is also large in the time-like region of momentum transfer, then the cross section (4) is sufficiently large. However, the observation of this process is quite difficult, since it becomes necessary to register the η^0 and π^0 meson decay products ($2\gamma + 2\gamma$, $\pi^+ + \pi^- + 2\gamma + 2\gamma$, etc.).

Processes (b), (c), and (d) can be analogously treated.

The most realistic in colliding-beam experiments would apparently be an investigation of the asymmetries of the products of reactions of the type

$$\text{e)} \quad e^+ + e^- \rightarrow \pi^+ + \pi^- + \gamma, \qquad \text{f)} \quad e^+ + e^- \rightarrow K^+ + K^- + \gamma. \tag{5}$$

We shall henceforth consider, for concreteness, the reaction (e). If there is no C- or T-invariance, then there are two forms of asymmetry: 1) different energy distributions of the positive and negative pions, and 2) different distributions of the photon emission directions relative to the positive and negative pion momenta. Of particular interest is the latter asymmetry, since it can be directly observed in a "symmetrical" experiment (symmetrical detectors are used to measure the π^+ and π^- mesons and the photons, and the numbers of photons traveling in the directions of the positive and negative pions are compared).

The emission of a photon in two-pion annihilation of a positron-electron pair was considered in detail in [6]. In this process the photons can be emitted both by pions and by electrons. The photons emitted by the electrons are of no interest to us, for the C-odd current makes no contribution in this case. We note, however, that these photons are emitted essentially along the direction of motion of electrons, and therefore are not registered by detectors which are placed at large angles. In the case of a symmetrical arrangement of the experiment, the term due to interference between the contributions of the radiation from the electrons and from the pions vanishes [6]. As to the photons emitted by the pions, we are interested only in the hard photons, and therefore the emission of soft photons can be described by the classical-current approximation [6] which is naturally T-invariant, since it is assumed that the strong interactions are T-invariant. For these hard photons we can expect an asymmetry on the order of unity.

Of particular interest is the energy region near the ρ-meson peak (E = 380 MeV), since the cross section of the process has a peak in this region. This cross section is sufficiently large to be measurable with modern techniques, but the main difficulty lies apparently in the identification of the events.

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CONTRIBUTION TO THE THEORY OF WEAK INTERACTION

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We analyze in this note the baryon-lepton weak interaction on the basis of the hypothesis that there exists an intermediate boson possessing baryon and lepton charges. This hypothesis implies a number of interactions with neutral lepton currents, with coupling constant satisfying the single condition

$$G_{ee}\, G_{\nu_e \nu_e} = G_{\mu\mu}\, G_{\nu_\mu \nu_\mu} = G^2. \qquad (1)$$

The corresponding generalization of the octet theory of Cabibbo [1] is obtained under simple assumptions concerning the unitary properties of the baryon-boson.

The scalar baryon-boson was proposed in [2] (see also [3,4]) as an alternative to the intermediate vector boson. Estimates for the lower limits of the baryon-boson mass are at