construction of bilinear combinations (bosons) having the usual covariance properties (scalar, pseudoscalar, vector, etc.) from spinors of which the first has N = 1 ("mixed") and the second N = 0 ("normal") is impossible even when we use the strong inversions. It is also impossible to construct bosons that behave in the usual way under geometrical inversions from spinors that differ in the values of $(a-b)$ or $(\alpha-\beta)$ (modulo 2). This provides a basis for identifying, for example, N with the baryon number, $(\alpha-\beta)$ with the strangeness S, and $(a-b)$ with the hypercharge Y.

We then have the usual relation $N = Y - S$. Corresponding numbers can be assigned to bosons; then bosons constructed from spinors that differ in N, S, Y form doublets, whose components transform into each other under inversions, i.e., particles of the type of the K mesons. We then get new conservation laws, in which N is conserved strictly (modulo 4), and S and Y are conserved when there is invariance only under the geometrical inversions. Therefore the fact of simultaneous violation of the conservation of P, S, Y, which has seemed accidental, can now receive a legitimate explanation. If we take as a universal invariance condition the conservation of P^S and T^S, then when there is violation of the isotopic group the ordinary parity P is also not conserved.[11]

We point out that it is convenient to carry out the construction of the interaction Lagrangian by means of the $\Psi(1,2)$, since then the invariance with respect to P^S and T^S is most explicitly manifest, and, for example, it can be seen why for two-component spinors one is confined (Feynman) to the vector and pseudovector terms, which are invariant under the Salam-Touschek transformations for the large $\Psi(1,2)$.

In conclusion we remark that it is most natural to characterize the leptons by "normal" spinors, assigning different factors ± 1, i, γ_5 to the particles e, ν, μ, and the baryons by spinors that are "mixed" under strong inversions ($N \neq 0$); bosons are assigned bilinear combinations of spinors. In view of the absence of absolute conservation of the number of baryons in this formalism, they can in principle be converted into mesons and leptons; owing, however, to the existing conservation laws and the necessity of contact interaction of several particles, the probability for this conversion will be extremely small.

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BETA DECAY OF THE NEGATIVE MUON

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ALL experiments on pion beta decay performed to date are devoted to β decay of the stopped positive mesons.[4-6] In two recent papers, the following result is obtained for the relative probability of this process:

$$(\pi^+ \to e^+ + \nu) / (\pi^+ \to \mu^+ + \nu) \approx 1 \cdot 10^{-4} \pm (20\text{—}40\%).$$

This agrees with the value 1.3×10^{-4} which follows from the universal V-A theory of β decay.[7] It follows from relativistic invariance (CPT theorem)[8] that this process should have the same relative probability for negative pions as for the positive ones. However, we deemed it important to determine the relative probability of β decay of negative pions by direct experiment.

Unlike $\pi^+ \to e^+$ decay, $\pi^- \to e^-$ decay can be observed only in flight. We therefore sought for

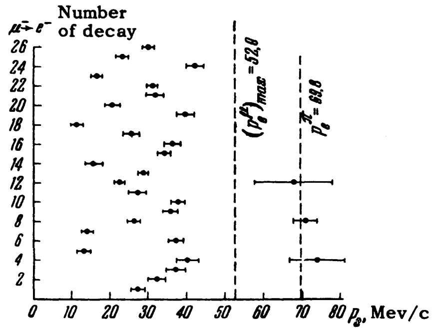

FIG. 1

β decay of negative pions among the data obtained in a diffusion chamber operating in a 9000-gauss field, used to study the interaction of 130-Mev and 160-Mev negative pions with protons as well as rare types of neutral-pion decay.[9,10] By thrice scanning approximately 100,000 stereographs, we found 29 decays in which the secondary particles were deflected by $\theta > 20°$ (the maximum angle for π-μ decay at 130 Mev is 10°). In all cases the primary and secondary particles had minimal ionizations (estimated visually). As a result of the data reduction (the method used to measure momenta and angles was analogous to the one previously described[11]), 26 cases were identified as $\mu^- \to e^-$ decays and 3 cases were classified as $\pi^- \to e^-$ decays. It should be noted that the conditions for separating the $\pi \to e$ and $\mu \to e$ decays in flight by their momenta are somewhat better than for stopped π and μ mesons, for in this case the ratio of the momentum of the $\pi \to e$ decay electron to the maximum $\mu \to e$ decay electron momentum possible at the given angle exceeds, over a wide range of angles, the ratio of these momenta for stopped π and μ mesons. Another favorable circumstance was the lower background of the $\mu \to e$ decays. Figure 1 shows the distribution of the momenta of the electrons from $\pi^- \to e^-$ decay (the three points on the right) and $\mu^- \to e^-$ decay, in the rest system of the π^- and μ^- mesons. The errors listed are the maximum errors in the measurement of the radii of curvatures of the π^- and μ^- mesons and electrons. A photograph of one of the $\pi^- \to e^- + \nu$ decay events, obtain in a diffusion chamber, is shown in Fig. 2.

The reduced data for the $\pi^- \to e^-$ decays are listed in the table.

FIG. 2

As can be seen from Fig. 1 and from the table, the electron momenta in the π^--meson rest system are close to 69.8 Mev/c. If the primary particle is assumed to be the μ^- meson, then in the μ^--meson rest system the electron momenta for these three cases are 80 ± 8, 77 ± 4, and 70 ± 11 Mev/c, respectively, whereas the maximum electron momentum in $\mu \to e$ decay is 52.9 Mev/c.

Other possible processes, which may imitate $\pi^- \to e^-$ decays (inelastic scattering of π^- mesons by complex impurity nuclei in the gas in the chamber, electron bremsstrahlung, successive $\pi^- \to \mu^- \to e^-$ decay in flight with short μ^--meson track) have very low probabilities.

To determine the relative probability of the π^--meson β decay it is necessary to determine the total number of $\pi^- \to \mu^-$ decays. This number, $(5.6 \pm 0.3) \times 10^4$, was calculated from the known total path length of the π^- mesons in the chamber, which amounted to $(7.8 \pm 0.4) \times 10^7$ cm, and from the momentum, $p_\pi = 253$ Mev/c. Considering the detection efficiency of $\pi^- \to e^-$ decays to be the same as that of $\mu^- \to e^-$ decays, which has been

Number of $\pi^- \to e^-$ event	Laboratory system			Rest system of π^- meson	
	π^- meson momentum (Mev/c)	electron momentum (Mev/c)	θ deg	electron momentum (Mev/c)	θ deg
1	228±10	104±8	42.5±0.5	74±7	108±2
2	207±11	103±3	42±0.5	71±4	102±2
3	266±6	156±26	26±0.5	68±11	86±1

estimated to be 70%, and taking into account the contribution from the angle range $\theta < 20$, the relative probability of π^--meson β decay becomes

$$(\pi^- \to e^- + \bar{\nu}) / (\pi^- \to \mu^- + \bar{\nu}) = (1.2 \pm 0.7) \cdot 10^{-4}.$$

Within the limits of errors, this quantity agrees with the relative probability of β decay of positive mesons and with the aforementioned value calculated on the basis of the universal V-A theory of β interaction.

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ON THE SUPERCONDUCTIVITY OF THE COMPOUND BiPt

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THE data of different authors on the transition temperature for the compound BiPt differ considerably one from another. According to Matthias[1] $T_c = 1.21°K$; Alekseevskiĭ found in one case $T_c = 2.4°K$ but other alloys of the composition BiPt did not become superconducting until 1.3° K.[2,3] We may, then, suppose that the different behavior of alloys with composition BiPt at helium temperatures is related to the conditions of preparation.

In their study of the phase diagram of the bismuth-platinum system, Zhuravlev and Kertes[4] found that the compound BiPt has only one crystallographic form, belonging to the hexagonal system with lattice spacings a = 4.20 A and c = 5.55 A, and has the AsNi type structure.[5,6]

We repeated the thermal analysis with differential measurement on a Pk-52 instrument and an x-ray examination from 20 to 600° C and confirmed the existence of only one crystalline form. The measurements showed that the NiAs structure was retained up to high temperatures and the coefficient of thermal expansion was derived. In the direction of the hexagonal axis $\alpha_{||} = 4.0 \times 10^{-6} \pm 1.0 \times 10^{-6}$ deg^{-1}, and perpendicular to the axis $\alpha_{\perp} = 19.0 \times 10^{-6} \pm 2.0 \times 10^{-6}$ deg^{-1}.

We examined alloys that had various heat treatments and corresponded both to the stoichiometric composition BiPt (48.3% Pt by weight) and to higher and lower bismuth content (45 and 53% Pt by weight) than corresponds to BiPt. For alloys annealed and rapidly cooled from various temperatures which did not exceed the liquidus temperature for the given composition, the main phase (the compound BiPt) always had the AsNi type structure with a = 4.315 and c = 5.490 ± 0.005 A.

If these same alloys were rapidly cooled from temperatures 50, 100 and 200° C above the liquidus point, then defect structures are formed.

A reduction in unit cell dimensions of the NiAs phase (BiPt) was found from x-ray powder photographs of these alloys, and the higher the temperature from which the alloys were cooled and the greater the bismuth content, the greater was the