magnetic nickel monoxide is dependent on the presence of a domain structure. This is indicated by the decrease of magnetostriction with increasing temperature, and also by the opposite signs of the longitudinal and transverse magnetostriction. The presence of a critical field is connected, in our opinion, with the existence of a coercive force, which is of order 10^4 oe for antiferromagnets according to an estimate given by Néel[2] and by Labhart.[3]

We also observed, in the specimens studied, a decrease of Young's modulus on application of a strong magnetic field (the antiferromagnetic ΔE-effect); this also indicates the existence of magnetostriction in antiferromagnetic nickel monoxide.

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SPACE ASYMMETRY OF LOW ENERGY POSITRONS FROM π^+-μ^+-e^+ DECAY

A. O. VAĬSENBERG

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THE aim of this note is to discuss the totality of the data obtained in this laboratory and given in the literature on the asymmetry in the space distribution of low energy positrons from the π^+-μ^+-e^+ decay.

We shall be interested in the asymmetry coefficient $a_{0-\epsilon}$ averaged over the spectrum from $\epsilon = 0$ up to the energy ϵ. The two component neutrino theory[1] gives for this coefficient the following expression

$$a_{0-\varepsilon} = a(-2\varepsilon^3 + 3\varepsilon^4)/(2\varepsilon^3 - \varepsilon^4). \quad (1)$$

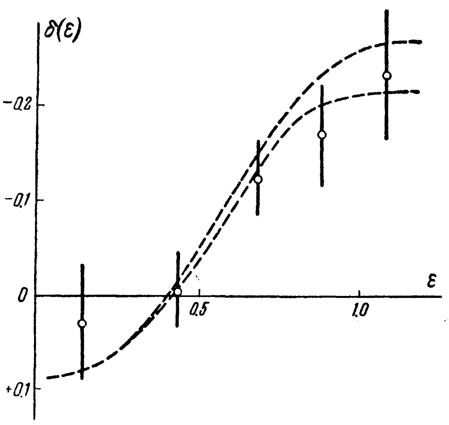
Here a is the asymmetry coefficient averaged over the entire spectrum and it is, as is well known, negative; ϵ is expressed in units of the maximum positron energy in the μ-e decay. It follows from this expression that for small energies the asymmetry coefficient $a_{0-\epsilon}$ should decrease from the positive value of $-a$, at the very beginning of the spectrum, to zero at $\epsilon = 2/3$. Until now this prediction of the theory has not been verified with sufficient accuracy because the number of low energy particles in the spectrum of the decay positrons is small. Radiative corrections to the spectrum (Kinoshita and Sirlin[2] and also V. P. Kuznetsov, private communication) and the dispersion in the energy measurement in photoemulsion[3] result in a decrease of $a_{0-\epsilon}$ by approximately 40% in comparison with (1), and in a shift of the energy at which $a_{0-\epsilon}$ goes through zero from $\epsilon = 2/3$ to $\epsilon = 0.55 - 0.60$.

The following measurements were carried out in our laboratory: 1) a measurement of the entire spectrum for 1102 particles with $a = 0.077$;[4] 2) a measurement of the spectrum of slow electrons in which 345 particles were selected with energy $\epsilon < 0.6$ with $a = 0.077$;[4*] 3) a measurement of the entire spectrum for 565 positrons with $a = 0.28$.[3] Measurements 1) and 2) were performed in the usual emulsion NIKFI-R and measurement 3) in the same emulsion but placed in a magnetic field of 17 kgauss.

It is convenient to discuss the resultant experimental data in terms of the relative difference of the number of positrons emitted forwards and backwards

$$\delta = (N_F - N_B)/(N_F + N_B).$$

In the graph and in Table I are shown values of N_F, N_B, and the excess δ in the energy intervals $0 - 0.3$, $0.3 - 0.6$, $0.6 - 0.8$, $0.8 - 1.0$, and > 1.0. These results were obtained by combining data from all three above-mentioned spectra. These data show that the asymmetry falls sharply



The dependence of the excess $\delta = (N_F - N_B)/(N_F + N_B)$ on the positron energy ε. The dashed line shows the dependence $\delta(\varepsilon)$ predicted by the two-component theory under the conditions of small (upper curve) and large (lower curve) dispersion of measurements. Eighty percent of the positrons were measured with intermediate values of dispersion.

TABLE I

N_F	149	352	211	134	79
N_B	140	361	270	189	124
N	289	713	481	323	206
δ	$+0.03\pm0.06$	-0.01 ± 0.04	-0.12 ± 0.04	-0.17 ± 0.05	-0.25 ± 0.07

TABLE II

Reference	$\varepsilon = 0-0.3$			$\varepsilon = 0-0.6$			a_i	k_i
	N_i	N_{iF}	N_{iB}	N_i	N_{iF}	N_{iB}		
4	245	130	115	784	398	386	0.08	0.64
3	42	19	23	218	103	115	0.28	0.90
5	74	41	33	373	184	189	0.14	0.64
6	24	15	9	209	105	104	0.14	0.64
7	32	12	20	205	89	116	0.14	0.64
8	183	103	80	—	—	—	0.19	0.50
Totals	600	320	280	1179	879	910		
Excess δ observed	$+0.07\pm0.04$			-0.02 ± 0.02				
Excess δ expected	$+0.04$			0.0				

as one goes from the high end of the spectrum towards low energies and is practically absent for $\epsilon < 0.5$.

The statistical accuracy of the low-energy results will be significantly improved if one considers not only these data but also all other known data on the asymmetry at low energies obtained by the photoemulsion method. These are given in Table II (N_i stands for the number of particles in the energy interval indicated). All these measurements were carried out under quite similar conditions by the same method and with approximately the same experimental accuracy. They form a group of data which are in good agreement with each other. Table II also contains data obtained with a propane bubble chamber since the method of measurement and selection used by the author is analogous to the photoemulsion methods.[8] In the last two lines of Table II we give the observed and expected values of the excess δ. For the interval $0-0.3$ the expected value of δ was found from the formula $\delta = \alpha\Sigma N_i a_i k_i/\Sigma N_i$ where k_i is a coefficient determined by the geometry of the experiment, and $\alpha = 0.6$ serves to approximate the decrease of the expected excess due to averaging over the interval $0-0.3$, due to radiative corrections and due to the dispersion in the measurements. In the interval $0-0.6$ the expected excess equals zero. A comparison of the values of the excess δ in the last two lines of Table II shows that the observed values do not contradict the values expected on the basis of the two component theory.

Measurements of the asymmetry at low energies have also been performed by the magnetic spectrometer method.[9] The results so obtained are in agreement with those given here.

*The data as given here differ somewhat from the values given in reference 4. This is due in the first place to the fact that an analysis of the data showed that the scattering constant had to be changed from K = 25 used in reference 4 to K = 23.5/100μ used in this work. In the second place, three newly measured particles were added to spectrum 1, which in reference 4 consisted of 1099 particles.

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