Concentration of MnO_4^-, mole/liter	Saturated solution	0.1	0.01	0.001	0 (water)
$C_{3\gamma}$, min^{-1}	3.6±0.42	5.08±0.45	5.08±0.12	5.50±0.30	6.04±0.09

It is obvious that the quenching of $C_{3\gamma}$ appears quite strongly even at low concentrations. In experiments with high concentrations of highly active additives, the value of $C_{3\gamma}$ tends to a limit corresponding to the contribution of free 3γ annihilation. Therefore a quantitative comparison of the effects of different additives on the formation and conversion of positronium makes it obligatory to perform the experiments at small concentrations. At the present time we continue systematic investigations of the kinetic characteristics of different reactions of positronium in aqueous solutions.

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ASYMMETRY OF MOTT DOUBLE SCATTERING AND ABSOLUTE VALUES OF LONGITUDINAL POLARIZATION OF BETA PARTICLES

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As a result of relative measurements of longitudinal polarization of the β particles emitted in the decay of P^{32}, Sm^{153}, Lu^{177}, Ho^{166}, In^{114}, and Au^{198}, differences up to 12% have been observed in the magnitude of the longitudinal polarization. This result showed the presence of deviations of the magnitude of the polarization from the predicted value, which for electrons is equal to v/c. The size of these deviations was obtained from results of absolute measurements of the polarization of the electrons from Sm^{153}.[2] The longitudinal polarization of the electrons was converted to a transverse polarization in crossed magnetic and electric fields and was found from the asymmetry of the scattering by gold from the relation

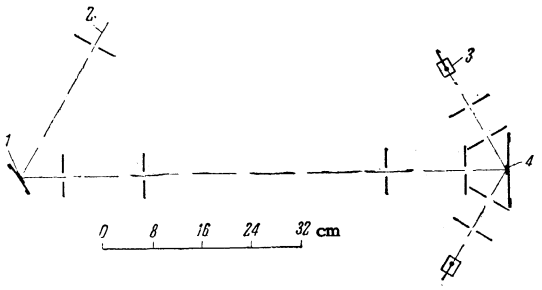
$$\langle\sigma\rangle = (1 + J_l / J_r) / (1 - J_l / J_r) S,$$

where $\langle\sigma\rangle$ is the degree of polarization, J_l and J_r are the scattered intensities to left and right, and S is a function of angle, energy and charge. Using the values of S computed by Sherman,[3] we found that in the case of Ho^{166} and In^{114} the differences of the values of the polarization from the value v/c reached 12 — 15%.

As we have noted,[1,2] for a final judgment concerning the magnitude of the deviation of the polarization from the value v/c we must have trustworthy values of the function S. The existing experimental data concerning this question are in most cases not sufficiently exact, while for the angles and energies which are of interest to us there are no data at all.

In this connection, we undertook a measurement of the quantity S in an experiment on double scattering of unpolarized electrons by gold. In the following we give a brief description of the apparatus and the results of measurements for energies of 245 and 290 kev and scattering angles $\theta_1 = \theta_2 = 120°$. At present, we are carrying out measurements over an energy range 50 — 250 kev and scattering angles 90 — 150°. The detailed description of the work will be published soon.

The geometry of the experiment is shown in the figure. A beam of accelerated electrons 2, after passing through a system of diaphragms, entered a chamber in which there was placed the first scatterer 1. The second scatterer 4 was in a separate chamber at a distance of ~ 1 meter from the first. The twice-scattered electrons were recorded by ring Geiger counters 3 placed at a distance of about 20 cm from the second scatterer. To reduce scattering from the walls of the appa-



ratus, the linear dimensions of the chambers were chosen to be large (around 400 mm) and the internal surface was covered with Plexiglas on which a conducting layer of graphite was deposited. Careful study of the effect of scattering of the electrons from the walls of the first chamber showed that under the conditions of the experiment the relative number of such electrons which impinge on the second scatterer amounts to $(0.4 \pm 0.2)\%$. The effect of scattering in the second chamber did not exceed 0.25%.

Measurement of the energy spectrum of the electrons showed that for the electrons impinging on the second scatterer the energy spread corresponds to a width at half-height of $\pm 1.5\%$. The apparatus asymmetry was eliminated by replacing the first gold scatterer by an aluminim scatterer of thickness 1.4 mg/cm^2. Since the electrons scattered by the aluminum also have some polarization, the experimentally measured quantity differs from S^2_{Au} and is equal to $S^2_{Au}(1 - S_{Al}/S_{Au})$. According to Sherman, $S_{Al}/S_{Au} = 0.1$.

The effect of multiple scattering in the scatterers was determined by making measurements for different thicknesses of the first and second scatterers. Altogether we used four first and four second scatterers whose thicknesses lay in the range from 70 to 300 μg/cm^2. The statistical accuracy of each measurement of the quantity S was $\pm 3\%$. The counting rate was usually 500 — 1500 pulses/min, while the relative magnitude of the background did not exceed 5%. Corrections were made on the experimentally determined scattering asymmetries for: a) scattering from the walls of the first chamber — $(0.4 \pm 0.2)\%$; b) scattering from the backing of the scatterer material — from 2 to 4% depending on the thicknesses of the scatterers; c) for the finiteness of the angles of observation — 0.5%. As a result we obtained the values given in the table.

Electron energy, kev	S^2	S	S/S_T
245	0,168±4 %	0.411±2 %	0,960±2 %
290	0,161±4 %	0,401±2 %	0,941±2 %

Here S/S_T denotes the ratio of the experimentally measured values to the values obtained from Sherman's tables.

The results obtained show that the absolute values of longitudinal polarization previously given by us[2] should be increased by 5%.

In the present work we also had the possibility for experimentally finding the magnitude of the depolarization of the electrons along their path from the source to the scatterer in the system of crossed fields which was used by us earlier.[2] The measurements consisted in first finding the scattering asymmetry for a given pair of scatterers. Then we placed between the scatterers the system with crossed fields and repeated the asymmetry measurement, where the field magnitudes were chosen so that the angle through which the spin turned was 180°. These measurements were carried out for electrons of energy 170 kev, which under our conditions could still have their spin rotated through 180°.

As a result of these measurements, it was found that the depolarization along the path from source to scatterer in the crossed field system reduces the magnitude of the asymmetry by $(2 \pm 2)\%$ in agreement with the estimate made by us earlier.[2]

We give below the absolute values of longitudinal polarization of electrons for an energy of 300 kev, obtained using the results of the present work.

	P^{32}	Sm^{153}	Lu^{177}	Ho^{166}	In^{114}	Au^{198}
Polarization $\langle\sigma\rangle/(v/c)$	1.02	0.97	0.92	0.91	0,93	0.94
Error of relative measurements, %	1.5	—	1.5	1.5	2.5	2.0

The error of the absolute measurements amounts to 3.3%.

Thus it has been established that deviation of the degree of longitudinal polarization from the value v/c is not an exceptional phenomenon, as was thought earlier. The magnitude of these deviations in the cases considered by us reached 8 — 9%. Apparently the observed deviations must be ascribed to an effect of the structure of the nucleus.

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