the fall-off of the density of the nucleons is the same as for protons.[1]

Similar results are obtained in the analysis of the cross section of interaction of negative pions with energies of 0.97 Bev with nuclei under the use of a homogeneous smooth model of the nucleus.[6]

The value of the cross section of the interaction of pions with nucleons $\bar{\sigma}(\pi) = 33 \pm 4$ mbn used by us in this research is, in the region under study, in excellent agreement with the results which follow from a direct measurement of the cross section of pion-nucleon interaction in the region of energy reached by present-day accelerators. Thus, for example, the value of $\bar{\sigma}(\pi) = 31 \pm 2$ mbn was obtained[7] by bombardment of hydrogen targets with pions of energy 1.9 Bev. At an energy of 4.4 Bev, $\bar{\sigma}(\pi) = 30 \pm 5$ mbn.[8] It then follows that for energies higher than 1.9 Bev, the interaction cross section of pions with nucleons does not change with energy, at least up to energies of 34 Bev.

Evidently, the cross section of interaction of pions with nucleons in the region of high energies tends to some limit $\sim 30 - 32$ mbn, which coincides with the cross section of nucleon-nucleon interaction for the energies considered.[1] This can be a consequence of the finiteness of the dimensions of the nucleons. Actually, calculation (see Ref. 9) shows that under the assumption of finite dimensions of the nucleons, the limiting value of the cross section of interaction of pions at high energies is $\bar{\sigma}(\pi) = 30$ mbn.

Thus our data show that the nuclear and electromagnetic radii of nuclei coincide if use is made of a homogeneous smooth distribution.

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ELASTIC SCATTERING OF HIGH ENERGY PARTICLES BY DEUTERONS

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THE study of the interaction of high energy particles with deuterons makes it possible to draw some conclusions on the character of the motion of nucleons in the deuteron. In the deuteron the nucleons are preferentially located at great distances from each other; therefore the fast particles interact only with one of the nucleons of the deuteron, leading to breakup of the deuteron or to the reaction of stripping. The theory of these processes has been well studied. However, in the deuteron, the nucleons can be found with some probability at sufficiently small separation distances, and then an incident particle with wavelength $\lambdabar$ less than the separation of the nucleons in the deuteron will be scattered elastically. This means that in such collisions, the incident particle transfers a significant part of its momentum to the deuteron.

In recent experiments carried out by Leksin[1] on the scattering of protons of 675 Mev on deuterons, there was observed, along with the scattered nucleons, a small number of undestroyed deuterons with high energies (up to 660 Mev). An explanation of this phenomenon was proposed by Blokhintsev[2] as the elastic scattering of the protons by the deuteron. However, the quantitative estimates given by him appear to us to be insufficiently accurate, the more so as the relative probability of this process, according to Blokhintsev, does not depend on the momentum of the incidence particle. A quantitative estimate is given below of the relative probability of this process with the use of the wave function of the deuteron obtained by the method of Tamm and Dancoff.[3]

The cross section of elastic scattering of fast particles by deuterons as a whole will be equal to

$$\sigma = \sigma_d w_d(\lambda), \qquad (1)$$

where σ_d is the total cross section of quasi-elastic scattering of particles on the deuteron (with account of the stripping reaction in the case of scattering of nucleons), while the quantity $w_d(\lambda)$ is the probability that the nucleons in the deuteron are found at distances less than λ, where λ is the wavelength of the incident particle. In other words, $w_d(\lambda)$ is the relative probability of the process being studied. If we denote by $\psi_d(r)$ the wave function of the deuteron, then

$$w_d(\lambda) \approx 4\pi \int_0^{\lambda} \psi_d^2(r) r^2 dr \approx \frac{4\pi}{3} \psi_d^2(0) \lambda^3. \qquad (2)$$

The latter equality holds for sufficiently small λ. (For large λ, it is necessary to carry out numerical integration of the integral in (2). In the work of Blokhintsev, the integration is carried out up to R, where R is the radius of strong interaction of nucleons, $R \approx (0.3 - 0.4)\hbar/\mu c$. In the same expression for the relative probability $w_d(R)$ is shown to be independent of the momentum of the incident particle. At small separation distances, the wave function of the deuteron $\psi_d(r)$ contains in practice only the $^3S_1$ wave. Therefore,

$$\psi_d(0) = \lim_{r \to 0} (u(r)/r), \qquad (3)$$

where $u(r)$ is a function of the $^3S_1$ state of the deuteron. Making use of the $u(r)$ computed by the Tamm-Dankoff method,[3] we find $\psi_d(0) \approx 0.7$. (in the system of units for which $\hbar = \mu_\pi = c = 1$) and

$$\omega_d(\lambda) \approx 4\pi\lambda^3/3. \qquad (4)$$

For energies of the incident protons of 675 Mev, $\lambda \approx 0.1$ and, consequently, $w_d(\lambda) \approx 2 \times 10^{-3}$. The experimental value of this quantity[1,2] amounts to 7×10^{-3}.

Strictly speaking, in the computation of $w_d(\lambda)$, the mutual screening of the nucleons in the deuteron must be taken into account. This increases the relative probability $w_d(\lambda)$ somewhat.

From a comparison of the theoretical and experimental values of w_d, we come to the conclusion that the theory agrees qualitatively with experiment.

There is interest in the experimental investigation of the scattering of fast particles by deuterons and the comparison of the energy dependence of the relative elastic scattering probability of fast particles by deuterons with Eq. (2). It should be noted that the study of the scattering of fast pions by deuterons is preferential in this case in order to separate the stripping reaction, which exists concurrently with the elastic scattering of fast nucleons by deuterons.

In conclusion, I express my thanks to Academician I. E. Tamm for suggesting the topic.

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THE INTERACTION OF K-MESONS, PIONS, NUCLEONS AND HYPERONS

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A model was proposed in Refs. 1 —3 for the description of the multiple production of strange particles. The structure of the "composite particle," formed in the collision of two fast particles, depends essentially on the assumption of a magnitude of the interaction of particles of different types. In the formulas of the statistical theory of multiple production, the interaction constants do not enter explicitly. "Strong" or "weak" interaction here is understood in the sense of the magnitude of the cross section obtained after establishment of statistical equilibrium between the produced particles. In our view, it is very probable that conclusions on "strong" or "weak" interaction of particles of different types which follow from a comparison of calculations (in terms of the statistical theory) with experiment over a wide range of energies give information on the relative magnitude of the interaction constants between these particles.* Since there are various opinions at the present time concerning the magnitude of the interaction of pions and K mesons with hyperons, and K mesons with nucleons, then even indirect information on these interactions is of great interest. We shall