graphs were taken, all the operated hodoscopic cells were quenched, the film advanced, and circuit "a" was unblocked.

The mechanical registrator made it possible to count coincidences and anticoincidences. Figure 1 shows a clear picture of the proposed decay of a long-lived particle $X_1^{\pm}$ decaying in accordance with the scheme $X_1^{\pm} \rightarrow X_2^{\pm} + X_3^0 + \ldots + Q$. The minimum kinetic energy of the particle X_2 for our set-up was 12 MeV. Accordingly, the mass of the decaying particle should be 48 m_e if particle X_2 is an electron.

The measurements were made at 960 meters above sea level under a layer of ground corresponding to a muon energy of 2 BeV. In practice all the stopped particles can be identified as muons.

The obtained pictures were scanned and processed with the aid of special templets which made it possible to reconstruct the observed event in space (Fig. 1). The number of stoppings in the copper absorber was approximately 5 per minute. During the entire measurement time we registered 2.2 x 10^5 stoppings. Processing of the entire material demonstrated the absence of "joining" tracks at the particle-stopping site, as should have been observed in the case of decay of the X_1 particle. All the pictures obtained had the character of random coincidences.

Thus, the present experiment, with account taken of the solid angle of emission of the X_2^+ particle and the capture by the nucleus of the X_2^- particle, both particles resulting from the decay of an $X_1^{\pm}$ particle stopping in a copper absorber, shows that the intensity of the charged X_1^+ particles with lifetimes 10^{-4} - 10^{-1} sec is less than 4.5 x 10^{-3}% of the muon intensity. The foregoing result holds true if the X_1 particles, like the muons, are nuclear-active.

The authors thank A. T. Dadayan for suggesting the idea of this work.

[1] J. W. Kenffel, R. L. Call, et al. Phys. Rev. Lett. 1, 203 (1958).

1) V^a -- counters 1 - 6, 15 - 20; V^b -- counters 7 - 14; VI^a -- counters 1 - 8, 24 - 45; VI^b -- counters 9 - 23; VII^a -- counters 1 - 5, 15 - 19; VII^b -- counters 5 - 14; $VIII^a$ -- counters 1 - 6, 25 - 30; $VIII^b$ -- counters 7 - 24.

ANGULAR DISTRIBUTIONS OF α PARTICLES FROM THE REACTIONS $C^{12}(d, \alpha)B^{10}$ AND $O^{16}(d, \alpha)N^{14}$

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The experimental results reported in this note are part of a study of nucleon clusters in light nuclei.

The deuterons were accelerated with the Moscow State University cyclotron to 12.4 MeV. The deuteron energy was changed by means of aluminum foils placed in the path of the beam. The reactions $C^{12}(d, \alpha)B^{10}$ and $O^{16}(d, \alpha)N^{14}$ were investigated at two values of the deuteron

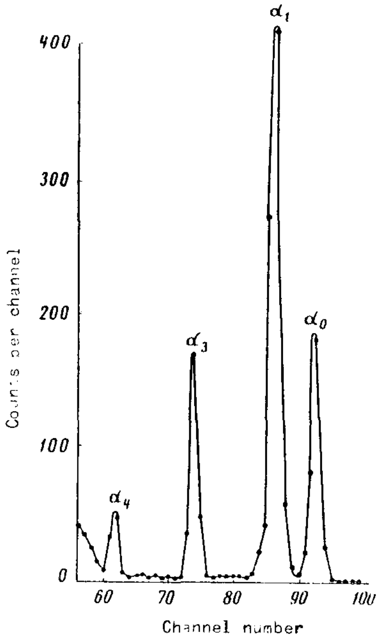

Fig. 1. Spectrum of α particles from the reaction $C^{12}(d, \alpha)B^{10}$ at a 15° angle (*l*.s.) at E_d = = 12.4 MeV.

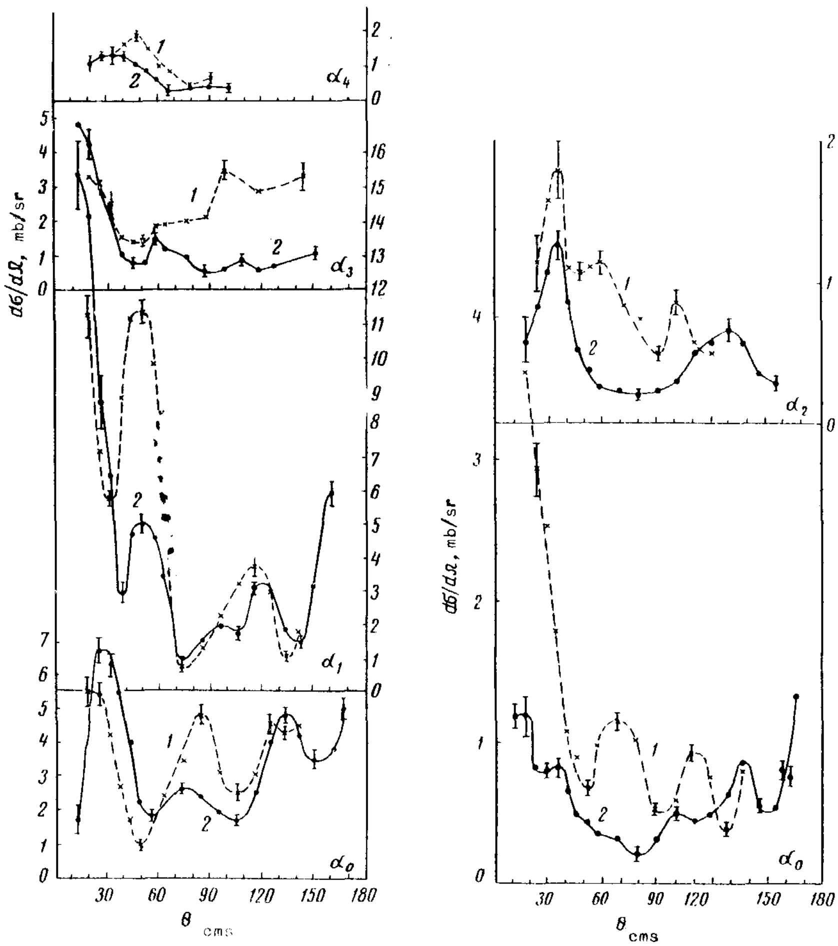

Fig. 2. Angular distributions of α particles from the reaction $C^{12}(d, \alpha)B^{10}$: 1 - E_d = = 11.4 MeV, 2 - 12.4 MeV

energy, 12.4 and 11.4 MeV. The target for the first reaction was a carbon film 130 μg/cm² thick, and for the second, a lavsan film 890 μg/cm² thick. The collimated deuteron beam incident on the target measured 1 x 6 mm (in cross section). The particles were registered with silicon surface-barrier detectors. The detector was located 110 mm from the target and had a 2 x 10 mm diaphragm. By varying the bias voltage, the depth of the sensitive layer was selected such that the paths of the α particles with maximum energy were contained within the layer. The angle between the detector and the deuteron beam could be varied from 10 to 165°. A sample of the α-particle spectrum is shown in Fig. 1. In addition to the movable detector, a stationary detector placed at an angle of 90° was used as a monitor in the measurement of the angular distributions. The detector-monitor was also used to measure the deuteron energy by comparing the amplitudes of the pulses from the α particles of the reaction $C^{12}(d, \alpha)B^{10}$, corresponding to the ground or first excited states of the final nucleus, with the amplitudes of pulses from an α-active Cm^{242} compound. The elastic scattering of deuterons by gold at 25°

was measured to determine the absolute values of the differential cross sections; this scattering is purely Coulomb at these deuteron energies.

Figures 2 and 3 show the angular distributions of four groups of α particles from the reaction $C^{12}(d, \alpha)B^{10}$, corresponding to the ground (α_0) and three excited states (α_1, α_2, α_3 - 0.72, 2.15, and 3.58 MeV) of B^{10}, and two groups of α particles (α_0 and α_2) from the reaction $O^{16}(d, \alpha)N^{14}$, corresponding to the ground and second-excited (3.94 MeV) states of N^{14}. The absolute values of the differential cross sections were determined accurate to ± 15%.

The characteristic peculiarities of the angular distributions, and the relatively weak dependence of the distribution on the deuteron energy, indicate that the direct interaction plays a predominant role. The obtained data are presently the subject of a theoretical analysis from the point of view of various direct-reaction mechanisms.

PHENOMENOLOGICAL WAVE FUNCTION OF A SUPERFLUID LIQUID IN A POROUS MEDIUM

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It was shown in [1] that the density of the superfluid component of stationary helium II in an infinite plane gap is described by a function that has a maximum at the center of the gap and zeros on its walls, and vanishes identically at $d = d_c$, where d_c is the critical width of the gap, $d_c = \pi a_0$ (a_0 is a characteristic dimension that depends on the temperature; $a_0 \approx 4.3 \times 10^{-8} (T_\lambda - T)^{1/2}$ cm). It can be shown that the density of the superfluid component of stationary helium behaves in similar fashion in a cylindrical capillary, the critical radius being $R_c = j_{01}a_0 \approx 2.4a_0$, where j_{01} is the first root of the Bessel function J_0. It is therefore natural to assume that critical dimensions $\delta_c \equiv D_c/a_0 \sim 3 - 5$ and a gradient of ρ_s across the channel when $\delta \geq \delta_c$ are general properties of narrow channels (pores) of arbitrary shape.

In this connection, in considering the problem of the distribution of the density of a "stationary" superfluid component in a porous medium, it is natural to attempt to get around the difficulties connected with the need for taking into account the complicated boundary conditions by averaging the wave function $\psi = f \exp(i\varphi)$ over a volume containing sufficiently many pores ($\rho_S = mf^2\alpha/\beta$, where m is the mass of the helium atom, $\alpha \approx 4.5 \times 10^{-17}(T_\lambda - T)$ erg, and $\beta \approx 4 \times 10^{-40}$ erg-cm^3; in stationary helium φ = const). It is accordingly necessary to modify the equation for f, representing for this purpose the gradient of the unaveraged function f by a sum of an average gradient ∇f and a "small-scale" gradient $\sim f/\delta$ transverse to the channel (∇ denotes differentiation with respect to the coordinates, which are measured in units of a_0). After averaging, the free energy per unit volume is written in the form (see [1])

$$F = (\nabla f)^2 - a^2f^2 + (1/2)f^4 + F_0 \quad (1)$$

where F is measured in units of α^2/β, $a \sim (1 - 1/\delta^2)^{1/2}$ or, more accurately, $a = (1 - \delta_c^2/\delta^2)^{1/2}$ (this form of <u>a</u> will be justified below)