symmetrical with respect to 90° and small absolute values, thus favoring the compound-nucleus mechanism.

In the reaction $O^{16}(d, \alpha)N^{14}$ the cross sections for the ground and second-excited states of N^{14} increase radically in the region of angles close to 180° (see Fig. 2). A similar picture was observed by other authors at deuteron energies near 4 MeV[1] and 14.7 MeV[2]. This suggests that the increase in the cross section at angles close to 180° is a characteristic feature of the (d, α) reaction in O^{16} for the ground and second-excited levels of N^{14} over a wide energy range. Our curves can be roughly represented by a sum of a Legendre polynomial of low degree and a peak in the region of backward angles, that is, as the result of interference between the processes of the compound nucleus and the stripping of an alpha particle from the target nucleus. Specific calculations are now under way. It is interesting to note that the elastic scattering of an alpha particle with energy 18—22 MeV by even-even nuclei[3] also yields strong peaks in the region of backward angles, ascribable to the stripping of alpha particles from the target nucleus.

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THE REACTIONS (p, pn) AND (p, n) ON Sc^{45} *INDUCED BY HIGH-ENERGY PROTONS*

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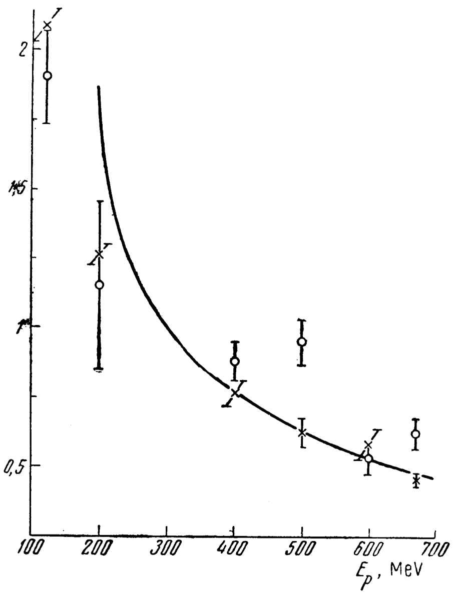
THE present work continues experiments on radiochemical studies of simple nuclear reactions at bombarding-proton energies on the order of several hundred MeV.

The table lists the cross sections of the investigated reactions, the ratios of the cross sections for the production of the isomers Sc^{44g} and Sc^{44m}, and the cross sections of the monitor reaction. The table also lists for comparison the cross sections of the (p, pn) and (p, n) reactions on Ca^{48}[1].

The difference in the values of the cross sections of the reactions (p, pn) on nuclei that have close values of A and Z offers evidence of the strong influence of the structure of the target nucleus. An analysis of the results of the present work, of the earlier work[1], and also a comparison of the data obtained in them with the calculations of Benioff[2], supports our previous hypothesis that the mechanism of direct knock-on of a neutron in the reaction (p, pn) becomes predominant already in the energy range on the order of several hundred MeV.

Starting from this mechanism, we can calculate the ratio of the cross sections for the production of the isomers in the reaction (p, pn), similar to what was done by Porile and Tanaka[3]. The agreement with experiment is attained when the parameter σ contained in the expression for the dependence of the density of the nuclear levels on the spin assumes a value $\sigma \approx 4$. A theoretical esti-

Reaction	Cross Section, mb						
	E_p=120	200	300	400	500	600	670
$Sc^{45}(p, pn)$	70.1±1.8	50.4±1.2	48.5±1.2	47.7±1.0	43.1±1.0	42.0±0.7	39.4±0.7
$Sc^{45}(p, n)$	3.80±0.07	2.29±0.03	1.82±0.04	1.40±0.07	1.14±0.09	1.07±0.09	0.83±0.02
$Ca^{48}(p, pn)$	118±2	106±10	106±4	101±4	101±4	110±8	110±2
$Ca^{48}(p, n)$	7.8±0.3	4.7±1.2	4.1±0.3	3.6±0.1	3.9±0.2	2.2±0.2	2.6±0.1
$Al^{27}(p, 3pn)$	10.2	9.1	11.0	11.3	11.1	11.0	10.9
Sc^{44g}/Sc^{44m}	2.10±0.06	2.21±0.03	2.19±0.01	2.22±0.01	2.19±0.06	2.18±0.02	2.20±0.04



Energy dependence of the differential cross section of energy scattering (continuous curve) and the cross sections $\sigma_{p,n}$ [× – Sc^{45}(p,n), ○ – Ca^{48}(p,n)].

mate of the value of σ by the formula given by Bloch [4] with account of the spin-orbit interaction is $\sigma = 3.9$. Such an agreement is one more proof in favor of the initial hypothesis of the predominant role of the direct knock-on mechanism.

Comparison of the cross sections of the reaction (p, n) and of the ratios $\sigma_{p,pn}/\sigma_{p,n}$ on different nuclei leads to the assumption that only neutrons of the uppermost completely or partially filled level participate in the (p, n) reaction.

It can also be assumed that the mechanism of the (p, n) reaction consists of quasielastic scattering of the proton by the neutron of the nucleus. The proton scattered at a large angle is captured here by the nucleus, and the neutron carries away the greater part of the energy. Indeed, the energy dependences of $\sigma_{p,n}$ and of the differential cross section for np scattering by angles close to 90° (l.s.) at $E_p \geq 300$ MeV practically coincide (see the figure).

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ISOMERIC TRANSITION MULTIPOLARITY IN THE $_{58}Ce^{138}$ *NUCLEUS*

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WE studied the decay of the metastable state of the Ce^{138} nucleus which is produced when a lanthanum target is bombarded with protons of energy ~ 20 MeV by the $La^{139}(p, 2n)Ce^{138m}$ reaction. The half-life of this isomer is $T_{1/2} \approx 9.2$ msec, and the excitation energy is E = 2.14 MeV. It has been detected and investigated before [1,2] by means of scintillation methods. In these investigations it was observed that the decay of the isomeric state results from a γ cascade of energies 0.13, 1.04, and 0.8 MeV. Remaev et al. [2] attempted to determine the spin and parity assignments of this state by measuring the total conversion and K-conversion coefficient by means of scintillation γ and β spectrometers. This resulted in the assignment of the spin value 6 and negative parity to the isomeric level of the Ce^{138} nucleus.

For our investigations, we used a magnetic β spectrometer in which the operation of the electronic recording circuit was modulated according to the pulsed cycle operation of the linear accelerator in such a way that the measurement of the conversion spectrum was carried out between the accelerator proton pulses on to the target which was the conversion electron source. The electron detector used was an anthracene crystal 0.5 mm thick with an FÉU-11 photomultiplier.

Figure 1 shows the internal-conversion electron spectrum which we obtained for the Ce^{138} isomeric transition. The background is due to