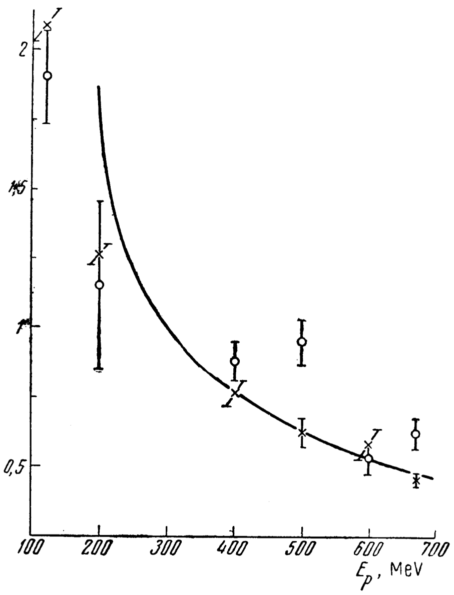

Energy dependence of the differential cross section of energy scattering (continuous curve) and the cross sections $\sigma_{p,n}$ [× – Sc^{45}(p,n), o – Ca^{48}(p,n)].

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

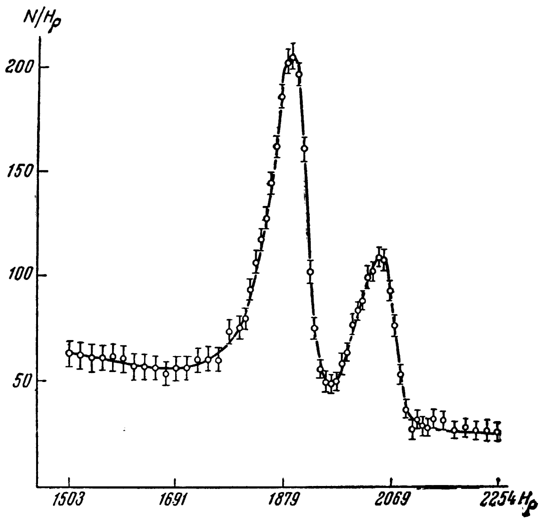

FIG. 1. Conversion-electron spectrum of the transition (E_γ = 301 keV).

the short-lived radiation (T ~ 1—3 msec) which occurs after each pulse of protons.

The transition energy, determined in accordance with the hard K-line boundary, is 301 ± 1 keV, which is in agreement with the data obtained by Remaev et al.[2]

The ratio of the K and L internal-conversion coefficients ($L = L_I + L_{II} + L_{III}$) obtained from the spectrum was 2.44 ± 0.20. The calculated value of this ratio for various transitions with energies 0.3 MeV and Z = 58 is 7.75 for E1, 7.35 for M1, 5.16 for E2, 6.20 for M2, 2.58 for E3, 4.70 for M3, 1.29 for E4 and 1.51 for M4. The one closest to the experimental value is that corresponding to the E3 transition, 2.58.

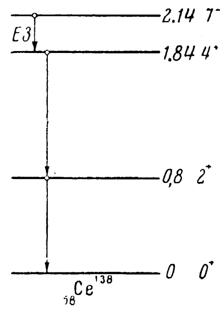

FIG. 2. Decay scheme of the $_{58}Ce^{138m}$ nucleus.

The ground state of the even-even Ce^{138} nucleus has zero spin and positive parity. If the order of sequence of the excited states as suggested by a number of authors [1,2] is assumed to be correct, it can be maintained that the isomeric state has a spin value of 7 and negative parity. The decay scheme will then take the form shown in Fig. 2.

Owing to its negative parity, the 2.14 MeV level can be regarded as a two-particle excitation caused by the break-up of a neutron pair and the transition of one neutron from the $h_{11/2}$ state to the $d_{3/2}$ state.

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