table, Cameron's set of quantities does not satisfy the experimental cross sections. This must be attributed to the influence of shell effects as well as of direct interactions (particularly for Sn^{117}). Inasmuch as the chosen procedure does not make it possible to separate the contribution from the compound nucleus to the cross section of the (n, p) reaction, we do not present the values of the corrected δ-quantities, as was done in [1].

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PHOTOPROTONS FROM CALCIUM

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RECENTLY Balashov et al. [1] and Brown et al. [2] have carried out calculations of the photodisintegration of Ca^{40} according to the many-particle shell model, which helped to remove the difficulties encountered in explaining the nature of the giant resonance by the single-particle shell model. Consideration of the residual interaction led to agreement of the position of the peaks of the calculated and experimental cross sections. However, a more detailed comparison of the theoretical results with the experimental data disclosed some contradictions, particularly in the explanation of the photoproton spectra. The difficulties which arose could be the result of inadequacy of the experimental data. Thus, up to the present time no measurements have been made of the cross section for the (γ, p) reaction on Ca^{40}, and the angular and energy distributions of photoprotons which have been obtained [3,4] do not agree completely among themselves.

In the present work we have measured angular and energy distributions of photoprotons from Ca^{40} for $E_{\gamma\,max} = 22$ MeV, and also have obtained cross sections for the reactions $Ca^{40}(\gamma, p)$.

The measurements were made on the 35 MeV betatron at the Institute of Nuclear Physics of the Moscow State University. The angular and energy distribution measurements were made by the photographic emulsion method [5], and the measurements of the photoproton yield curves were made with scintillation spectrometers [6].

Figure 1 shows a histogram of the energy distribution of photoprotons formed in the photodisintegration of Ca^{40} by bremsstrahlung with $E_{\gamma\,max} = 22$ MeV. In the histogram and the curve obtained from it by the method of Ferreyr and Valoshek, four peaks are involved, two of which are in the energy region of 2—5 MeV, the third at ~ 6.5 MeV, and the fourth at ~ 9 MeV. The angular distributions obtained for all groups of photoprotons are practically isotropic, with the exception of the low energy group (3—5 MeV) whose angular distribution has the form $1 - 0.5 \sin^2 \theta$. Yield curves for photoprotons with energies E_p of 3—5 MeV, 5—7 MeV, ≥ 8 MeV, and ≥ 3 MeV were measured for

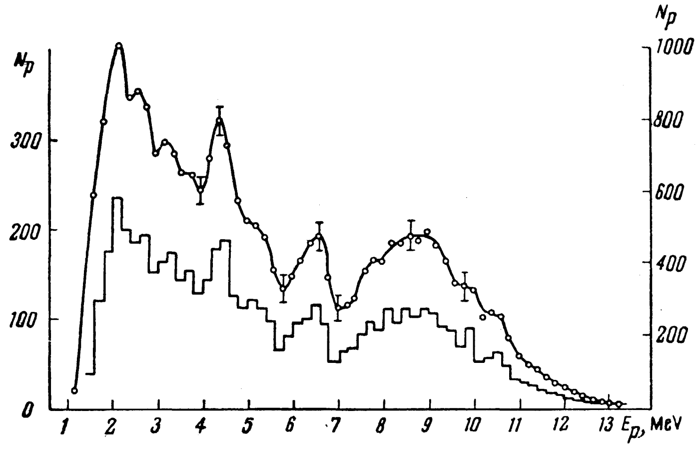

FIG. 1. Energy spectrum of photoprotons from calcium for $E_{\gamma\,max} = 22$ MeV. The histogram is plotted to the left ordinate scale, and the curve to the right scale.

Proton energy, MeV	Maximum cross section, mb	Location of peak, MeV	Half-width of peak, MeV	Integrated cross section $\int_0^{33} \sigma dE$ (MeV-mb)
3—5	53±8	20.0±0.5	5.5±0.5	0.42±0.08
5—7	9.0±0.13	21.0±0.5	6.5±0.5	0.07±0.02
⩾8	19±3	22.0±0.5	6.5±0.5	0.15±0.03
⩾3	80±12	19.5±0.5	6.5±0.5	0.63±0.12

bremsstrahlung energies $E_{\gamma max}$ from 14.5 to 32.5 MeV in 1 MeV steps. The results of the measurements for $E_p \geq 3$ MeV, and also the cross section curve calculated by the method of Penfold and Leiss, are shown in Fig. 2. The cross section results for the remaining photoproton groups are given in the table. The position of the peak in the cross section for the (γ, p) reaction is in agreement with the theoretical calculations of Balashov, Shevchenko, and Yudin[1]. The integrated cross section agrees both with the sum rule calculations and with the shell model calculations. The positions of the cross section peaks for the individual groups of protons show that the transitions go either from a single dipole level of Ca^{40} lying at an energy of the order of 20 MeV, or from two closely lying levels, which also is in good agreement with the theoretical results. Consequently, we actually have a mixing of configurations leading to coherent effects, that is, to the formation of an isolated level which absorbs in itself almost the entire dipole sum.

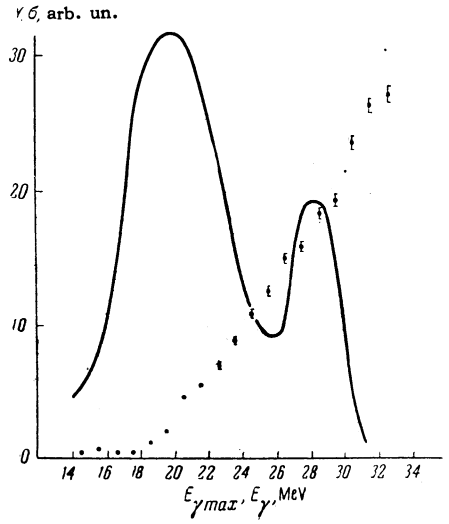

FIG. 2. Variation of the yield of the (γ,p) reaction on calcium with the maximum energy of the bremsstrahlung spectrum (experimental points). The solid curve is the differential cross section for this reaction.

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