CROSS SECTION OF THE REACTION $Si^{28}(\gamma, n)$

B. I. Goryachev, B. S. Ishkhanov, V. G. Shevchenko, and B. A. Yur'ev
Nuclear Physics Research Institute, Moscow State University
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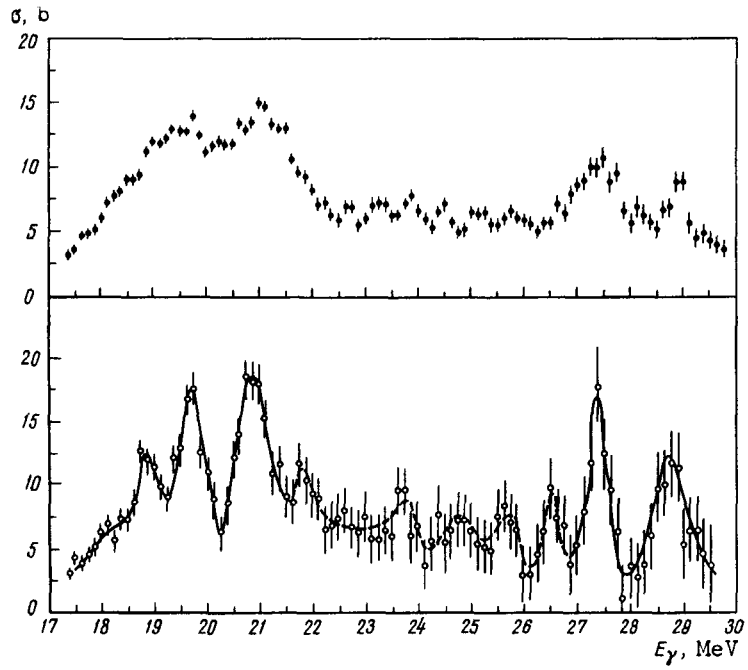
The persistent investigations of dipole giant resonance of nuclei of the 1d - 2s shell, which are being carried out at the present time, are aimed primarily at checking on the existence of configuration splitting of the giant resonance due to the strong difference in the binding energies of nucleons belonging to different oscillator shells [1].

The presence of configuration splitting in 1d - 2s shell nuclei leads to the formation of two groups of dipole transitions: "low energy" from the unfilled 1d - 2s shell, and "high energy" from the filled 1p shell. They differ from each other in the character of the decay [2]. Of special interest in this connection is a study of the features of the absorption curve and of the partial reaction cross sections in the γ-quantum energy region 24 - 30 MeV, where there are states corresponding to the "high-energy" group of transitions. At the same time, experimental investigations of the cross sections in this energy region are very complicated and call for an extremely high statistical measurement accuracy and high apparatus stability.



Cross section of the reaction $Si^{28}(\gamma, n)$, measured every 125 keV: a) counted in steps ΔE = 1 MeV, b) counted in steps ΔE = 0.5 MeV.

We present here the cross section of the reaction $Si^{28}(\gamma, n)$ measured with the 36-MeV betatron of the Moscow University Nuclear Physics Institute. The photoneutron yield curve was obtained with apparatus comprising a paraffin sphere of 80 cm diameter containing 80 proportional BF_3 counters. The apparatus drift was suppressed by automatically switching over the maximum energy $E_{\gamma\ max}$ after each betatron operating cycle [3] and recording the reaction yield corresponding to each $E_{\gamma\ max}$ in a corresponding channel of a multichannel computing system. The yield curve was measured in the interval 17.5 - 30.0 MeV. The statistical errors in the upper part of the curve were smaller than 0.1%.

The data obtained are shown in the figure. The cross-section curve has five clearly pronounced maxima at 18.8 ± 0.1, 19.8 ± 0.1, 20.9 ± 0.1, 27.4 ± 0.2, and 28.8 ± 0.2 MeV. The first three maxima agreed extremely well with tha data obtained in [4] with a quasimonochromatic γ-quantum beam. However, the resolution of the maxima is better in our case than in [4]. The last two maxima, at 27.4 ± 0.2 and 28.8 ± 0.2 MeV, were obtained for the first time. Thier integral cross section is almost 50% of the cross section of the main maxima (18 - 22 MeV). They apparently correspond to "high-energy" transitions; in other words, in the photodisintegration of Si^{28} we encounter a clearly pronounced configuration splitting of giant dipole resonance.

[1] G. Yacob and Th. A. Maris, Rev. Mod. Phys. 38, 121 (1966).

[2] V. G. Neudachin and V. G. Shevchenko, Phys. Lett. 12, 18 (1964).

[3] O. V. Bogdankevich, Atomnaya energiya 12, 198 (1962).

[4] Y. T. Caldwell, R. R. Harvey, R. L. Bramblett, and S. C. Fultz, Phys. Lett. 6, 213 (1963).

QUARK MODEL OF BACKWARD SCATTERING

A. L. Lyubimov
Joint Institute for Nuclear Research

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It is known that elastic π^+p and π^-p scattering at high energies has a peak near 180° [1-3].

It was indicated earlier [4] that from the point of view of the quark model the peak in the elastic meson-baryon backward scattering (and also in some inelastic meson-baryon reactions) can be interpreted qualitatively as the result of quark exchange between colliding particles [1].

In this note we indicate some consequences ensuing to the process of backward scattering from the quark model, and compare them with the available experimental data. We also propose some details of the model, for the purpose of obtaining quantitative relations between the cross sections of different processes.