SPECTRUM OF PHOTOPROTONS FROM Mg^{26}

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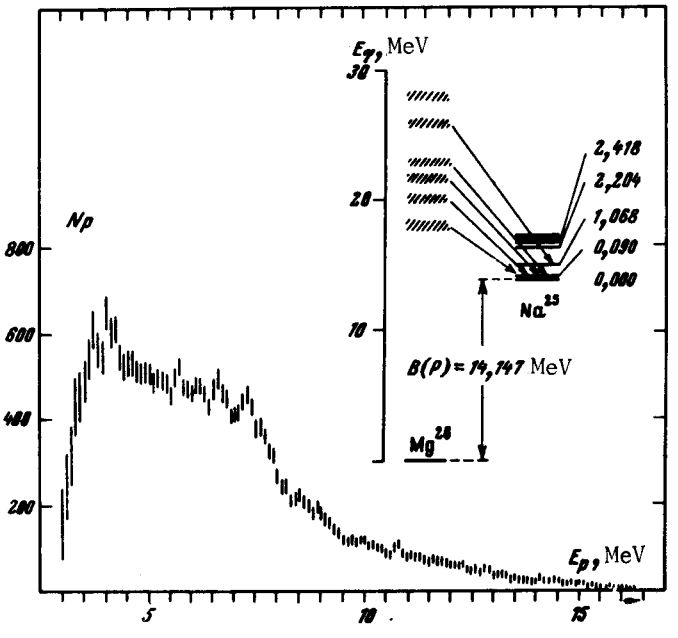
We report an investigation of the spectrum of the photoprotons from the nucleus Mg^{26}, obtained with the aid of bremsstrahlung with maximum energy E_γ = 32.0 MeV. The experimental results are analyzed on the basis of data on the cross section for the photoproton reaction on the nucleus Mg^{26} and data on the positions of the excited states of the final nucleus Na^{25}.

Extensive experimental material on the photodisintegration of the nucleus Mg^{26} has been accumulated by now. It suffices to mention the cross section for the photoneutron reaction [1], the photoneutron spectra [2], and the cross section for inelastic scattering of electrons [3]. The main features of the photodisintegration of Mg^{26} were interpreted by the authors within the framework of the concept of isospin splitting of giant dipole resonance. The cross section of the reaction $Mg^{26}(\gamma, p)$ was recently obtained [4] up to the energy E_γ = 30.0 MeV; according to the isospin splitting concepts, this cross section should be governed principally by states with isospin $T_>$. A number of maxima were observed in the reaction cross section in the energy range from 18.0 to 28.0 MeV.

Since in the region of light nuclei the energy spread of the states with definite isospin exceeds the theoretically predicted separation of the components with different isospins, it follows that an analysis of the states of the giant dipole resonance, from the point of view of their isospin characteristics, encounters definite difficulties.

In the present paper we study the decay characteristics of the states of giant resonance in the nucleus Mg^{26} in the energy range from threshold to E_γ = 30.0 MeV.

Using bremsstrahlung with maximum energy 32.0 MeV, we measured the energy distribution of the photoprotons from the nucleus Mg^{26}. We used a target of metallic magnesium in the form of a foil 6.8 Mg/cm^2 thick. The photoproton spectrum was measured with semiconductor silicon detectors having a sensitive region $\sim$ 3 mm thick, making it possible to register protons with energies up to 20.0 MeV. The total number of experimentally registered protons exceeded 33,000. The obtained spectrum of the photoprotons from the nucleus Mg^{26} is shown in the figure.



The spectrum is characterized by a broad maximum in the energy region 4.0 – 7.0 MeV and a sharp fall-off at 8.0 – 9.5 MeV. In the region of the maximum, one can see quite clearly singularities located at the energies 3.7, 4.0, 5.7, 6.5, and 7.3 MeV. Weak singularities are observed in the fall-off region of the spectrum at $\sim$ 9.0 and 11.0 MeV.

From an analysis of the structural singularities of the cross section of the reaction $Mg^{26}(\gamma, p)Na^{25}$ from [4] and from the energy positions of the low-excited states of the nucleus Na^{25} (upper part of the figure) we can interpret the main singularities of the obtained photoproton spectrum in the following manner. Protons with energies 4.0, 5.7, 7.3, and 9.0 MeV

are identified with transitions from the Mg^{26} states at energies 18.0, 20.0, 21.5, and 23.0 MeV, respectively, to the ground and first excited state of Na^{25}. The group of protons with energy $\sim$ 11.0 MeV can be connected with transitions from 26.0-MeV states of Mg^{26} to the 1.68-MeV excited state of Na^{25}.

The results are preliminary. For a more complete description of the excitation of the giant dipole resonance in the Mg^{26} nucleus it is necessary to investigate the decay characteristics of the states excited in the nucleus at other maximal bremsstrahlung energies. These investigations are presently under way.

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