MULTINUCLEON PHOTONUCLEAR REACTIONS ON ^{209}BI: EXPERIMENT AND EVALUATION

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Determination of the cross sections of photonuclear reactions with several nucleons in the final state poses a serious problem. A large part of experimental cross sections of reactions with 1–3 outgoing neutrons obtained with quasimonoenergetic annihilation photon sources using method of photoneutron multiplicity sorting [1] do not satisfy the objective criteria of reliability introduced in [2]. It was shown that the problem of separation of reaction channels with different neutron multiplicities can be overcome using a new experimentally–theoretical approach for evaluation of partial reaction cross sections.

Reliability of the channel separation can be verified experimentally using the photon activation technique which allows to identify individual partial reactions by the final nuclei they produce. In this work a bismuth target was irradiated with bremsstrahlung photons produced using the electron beam of the 55 MeV racetrack microtron RTM-55 [3]. Using a high-purity germanium detector, spectra of induced activity were measured and yields of photonuclear reactions up to (γ, 5n1p) and (γ, 6n) on the ^{209}Bi isotope were calculated.

Experimental yields of photoneutron reactions were compared to the results of a previous measurement [4] and to the predictions of evaluation [2, 5, 6]. Shortcomings of the photoneutron multiplicity sorting techniques, that were used to measure a large part of photoneutron reaction cross sections, are discussed.

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