LIGHT AND MEDIUM-HEAVY NUCLEI PHOTONEUTRON REACTION CROSS-SECTIONS IN BREMSSTRAHLUNG BEAM EXPERIMENTS

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In cases for many (~50) nuclei from ⁵¹V to ²⁰⁹Bi the experimental data on photoneutron partial reactions (γ ,1n), (γ ,2n), (γ ,3n) cross sections directly obtained using beams of quasimonoenergetic annihilation photons [1] do not satisfy objective physical criteria of data reliability [2–5]. The reasons are systematic uncertainties of experimental photoneutron multiplicity sorting method basing on partial reactions separation via measurement of neutron energies. Therefore, the experimental-theoretical method for partial reaction cross-section evaluation basing on physical criteria was used for analysis of reliability of data obtained using quite different method on the beams of bremsstrahlung [6]. Partial reaction cross sections are separated and determined in such kind experiment using statistical theory corrections to the neutron yield cross section $\sigma(\gamma, xn) = \sigma(\gamma, 1n) + 2\sigma(\gamma, 2n) + 3\sigma(\gamma, 3n) + \dots$ measured at first. Experimental cross sections of the reactions $(\gamma, 1n)$ and $(\gamma, 2n)$ are definitely unreliable in the cases of ⁵¹V, ⁵²Cr, ⁵⁹Co, but enough reliable in the case of ⁹⁰Zr. The reason is that the role of two-nucleon reaction $(\gamma, 1n1p)$ was not taken into account, though this reaction competes with also two-nucleon reaction (γ ,2n). It was shown via the results of calculation in the frame of the Combined photonuclear reaction model [5] that energy positions and amplitudes of cross sections of $(\gamma, 1n1p)$ and $(\gamma, 2n)$ reactions are very close to each other in the cases of ⁵¹V, ⁵²Cr, ⁵⁹Co, but in the case of ⁹⁰Zr the value of (γ ,1n1p) reaction cross section is very small and could be negligible. This conclusion is analogous to that of the preliminary investigation of the cases of ¹²⁷I, ¹⁶⁵Ho, ¹⁸¹Ta [7]. It means that in the cases of relatively light nuclei ⁵¹V, ⁵²Cr, ⁵⁹Co, as well as ^{58,60}Ni [8] the reaction (γ ,1n1p) plays important role in nucleus photodisintegration but its contribution is not correctly described by statistical theory corrections.

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