PARTIAL AND TOTAL PHOTONEUTRON REACTION CROSS SECTIONS NEW DATA FOR ^{91,94}Zr ISOTOPES

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Systematic investigations of experimental partial photoneutron cross sections for many medium and heavy nuclei [1] show that many of them do not satisfy specially introduced criteria of data reliability [2]. That was found out that in various energy ranges of initial photons the ratios $F_1 = \sigma(\gamma,1n)/\sigma(\gamma,xn) = \sigma(\gamma,1n)/\sigma[(\gamma,1n) + 2(\gamma,2n) + 3(\gamma,3n) + \dots]$ have physically forbidden negative values and at the same time corresponding ratios $F_2 = \sigma(\gamma,2n)/\sigma(\gamma,xn)$ have physically unreliable values larger 0.50. That means that experimental neutron multiplicity sorting has been done erroneously because of large systematic uncertainties.

New data free of such kind uncertainties were evaluated for ^{91,94}Zr [3] using new experimentally-theoretical method [4]. The only experimental reaction cross section $\sigma^{exp}(\gamma,xn)$ [5] used was shared into partial parts using the equations $F^{theor}_i = \sigma^{theor}(\gamma,1n)/\sigma^{theor}(\gamma,xn)$ of combined pre–equilibrium exciton model of photonuclear reactions [6, 7]. The way of new cross sections evaluation - $\sigma^{eval}(\gamma,in) = F^{theor}_i \cdot \sigma^{exp}(\gamma,xn)$ – means that competition between partial reactions is in accordance with model free from neutron multiplicity sorting problems and their sum $\sigma^{eval}(\gamma,xn)$ is equal to $\sigma^{exp}(\gamma,xn)$ also free from problems mentioned.

New cross sections were evaluated for (γ,n) and (γ,2n) reactions in the case of ^{91}Zr and for (γ,n), (γ,2n) and (γ,3n) in the case of ^{94}Zr. Using evaluated partial reactions cross sections for both isotopes new data were obtained for total photoneutron reaction $\sigma[(\gamma,1n) + (\gamma,2n) + (\gamma,3n) + \dots] \approx \sigma(\gamma,abs)$.

Large deviations of evaluated cross sections from experimental ones are discussed in details.

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