Contribution ID: **300** Type: **Oral**

New data for ^{52}Cr and ^{68}Zn from experiments using bremsstrahlung

Saturday 5 July 2025 14:30 (20 minutes)

New cross sections of photoneutron reactions $^{52}Cr(\gamma,2n)^{50}Cr$, $^{68}Zn(\gamma,1n)^{67}Zn$ and $^{68}Zn(\gamma,2n)^{66}Zn$ not determined before experimentally were obtained at the first time using the experimental-theoretical method for evaluation of photoneutron partial reaction cross-section meeting physical criteria of reliability method [1]. This method was proposed to solve the problem of significant disagreements between the results of experiments carried out using the beams of quasimonoenergetic annihilation photons and the method for photoneutron multiplicity sorting based on measured neutron energies [2]. Partial reaction cross sections $\sigma^{eval}(\gamma,in) = F_i^{theor} \times \sigma^{exp}(\gamma,xn)$ for ^{52}Cr and ^{68}Zn, were evaluated using the experimental yield cross sections $\sigma^{exp}(\gamma,xn) = \sigma^{exp}(\gamma,1n) + 2\sigma^{exp}(\gamma,2n) + 3\sigma^{exp}(\gamma,3n)$ and the ratios $F_i^{theor} = \sigma^{theor}(\gamma,in)/\sigma^{theor}(\gamma,xn)$ calculated for $i = 1,2,3$ in Combined photonuclear reaction model (CPNRM) [3]. The published cross sections $\sigma(\gamma,sn) = \sigma(\gamma,1n) + \sigma(\gamma,2n)$ and $\sigma(\gamma,1n)$ for ^{52}Cr [4] and $\sigma(\gamma,xn)$ for ^{68}Zn [5] obtained on the beams of bremsstrahlung were used.
It was found that cross sections of reactions $^{52}Cr(\gamma,1n)^{51}Cr$ and $68Zn(\gamma,1n)^{67}Zn$ obtained before using the method of introducing statistical theory corrections to the yield cross-section $\sigma^{exp}(\gamma,xn)$ are significantly underestimated, but those of reactions $^{52}Cr(\gamma,2n)^{50}Cr$ and $^{68}Zn(\gamma,2n)^{66}Zn$ overestimated in comparison with evaluated ones and therefore both do not meet physical criteria [6]. The reason is that at photon energies where reactions $(\gamma,1n)$ and $(\gamma,2n)$ compete with each other, the statistical evaporation model became less accurate because processes of the pre-equilibrium decay of a composite system become more important. The CPNRM [3] used in the evaluation method [1] is free from those shortcomings.
New data for cross sections of reactions $^{52}Cr(\gamma,1n)^{51}Cr$, $^{52}Cr(\gamma,2n)^{50}Cr$, $^{68}Zn(\gamma,1n)^{67}Zn$ and $^{68}Zn(\gamma,2n)^{66}Zn$ [6,7] were evaluated in accordance with reliability criteria [1].

1. V.V. Varlamov et al., Bull. Rus. Acad. Sci. **74**, 883 (2010).
2. V.V. Varlamov et al., Atom. Data and Nucl. Data Tables, **161**, 101697 (2025).
3. B.S. Ishkhanov et al., Phys. Atom. Nucl. **74**, 19 (2011).
4. B.I. Goryachev, et al., Bull. Rus. Acad. Sci. Phys. **33**, 1588 (1969).
5. B.S. Ishkhanov et al., Sov. J. Nucl. Phys. **20**, 233 (1975)
6. V.V. Varlamov et al., Phys. Atom. Nucl. **87**, 669 (2024).
7. V.V. Varlamov et al., Phys. Atom. Nucl. **88** (2025), in print.

Primary authors: DAVYDOV, Aleksandr (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University); MOSTAKOV, Ivan (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University); ORLIN, Vadim (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University); VARLAMOV, Vladimir (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University)

Presenter: DAVYDOV, Aleksandr (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University)

Session Classification: 2. Experimental and theoretical studies of nuclear reactions

Track Classification: Section 2. Experimental and theoretical studies of nuclear reactions.