CDFE photonuclear data processing and evaluation activity, 2023/2024.

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Progress report for the Technical Meeting of the International Network of Nuclear Reaction Data Centres, 14 - 17 May 2024 for the period of time from the previous Meeting (the IAEA's Headquarters, Vienna, Austria, 9 - 12 May 2023).

The report shortly describes the main activity of the Centre for Photonuclear Experiments Data (Centr Dannykh Fotoyadernykh Eksperimentov - CDFE) of the Russia Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics in photonuclear data processing, compilation and evaluation.

EXFOR Compilation

7 CDFE EXFOR final TRANSes **trans.m123 – trans.m129** and 2 preliminary ***prelim.m130*** **and** ***prelim.m131*** have been produced and transmitted to the IAEA Nuclear Data Section.

CDFE TRANSes contain **81** ENTRYs – **10** new ones compiled in accordance with the contents of the NRDC Network Memos, the NDS database "Articles for compilation" (https://www-nds.iaea.org/nrdc/alloc/ and *71 old ones* corrected in accordance with the new EXFOR format rules and the comments and recommendations of the NRDC experts, first of all, Naohiko Otsuka, Daniela Foligno, and Svetlana Dunaeva.

New and *Old* trans.m* and ***prelim.m**** contents

TRANS	Numbers of ENTRYs		
	Old	**New**	Total (SUBENTs)
m123	*7*	1	8 (80)
m124	*4*	0	4 (12)
m125	*10*	**2**	12 (41)
m126	*1*	**4**	5 (52)
m127	*9*	**1**	10 (67)
m128	8	**2**	10 (41)
m129	9	**0**	9 (79)
prelim.m130	*11*	***0***	*11 (68)*
prelim.m131	*12*	***0***	*12 (64)*
Common	71	**10**	81 (504)

Photonuclear Data Evaluation

The CDFE program of analysis of reliability of photonuclear reaction cross sections obtained in various experiments using objective physical criteria of data reliability and of evaluation of newly such kind data satisfied those criteria using the experimental-theoretical method was continued.

It was found before that in cases of about 50 nuclei from ^{51}V to ^{209}Bi investigated using beams of quasimonoenergetic annihilation photons cross sections of partial photoneutron reactions (γ,1n) and (γ,2n) do not satisfy physical criteria because of significant systematic uncertainties of the experimental method for photoneutron multiplicity sorting. Therefore, the

reliability of data obtained for several nuclei using quite different method on the beams of bremsstrahlung was investigated. It was found out that in cases of relatively light nuclei ^{51}V, ^{59}Co, ^{58,60}Ni, unlike medium and heavy nuclei ^{112,114,119}Sn, ^{127}I, ^{165}Ho, and ^{181}Ta, partial photoneutron reaction cross sections obtained using statistical model corrections to neutron yield cross sections $\sigma(\gamma,Sn) = \sigma(\gamma,1n)+2\sigma(\gamma,2n)+3\sigma(\gamma,3n)+\ldots$ also are not reliable because of some shortcomings of such procedure. Using comparisons in detail of experimental cross sections and ones evaluated using experimental-theoretical method for nuclei ^{51}V, ^{52}Cr, and ^{90}Zr in addition to ^{58,60}Ni it was found that the main source of such method systematic uncertainties is that the contributions of (γ,1n1p) reaction were not taken into account.

New Experimental Methods

In the same time it was found out before that photoneutron cross sections obtained using alternative methods of direct photoneutron multiplicity determination, for example activation method and the suitable method realized on the beams of new laser Compton scattering photons, give to one possibility to obtain reliable data. Because of that the relevant partial reaction cross sections were obtained using activation method for Se, Nb, Mo and the discussions of new laser Compton scattering photons facility project was started.

Main publications

1. V.V.Varlamov, A.I.Davydov. Reliability of ^{159}Tb partial photoneutron reaction cross sections obtained in various experiments. Phys. Atom. Nucl., 85, N6 (2023) 361–371.

2. V.V.Varlamov, A.I.Davydov, I.A.Mostakov, V.N.Orlin. Cross sections of partial photoneutron reactions on ^{59}Co in experiments with bremsstrahlung. Phys. Atom. Nucl., 86, N5 (2023) 600–612.

3. P.D.Remizov, M.V.Zheltonozhskaya, A.P.Chernyaev, V.V.Varlamov. Measurements of flux-weighted yields for (γ, α*Xn*) reactions on molybdenum and niobium. Eur. Phys. J. A, 59 (2023) 141.

4. V.V.Varlamov, A.I.Davydov, V.N.Orlin. Similarities and differences in processes of ^{58,60}Ni photodisintegration. Bull. Rus. Acad. Sci. Phys., 87, №8 (2023), 1179–1187.

5. V.V.Varlamov, A.I.Davydov, V.N.Orlin. Cross sections of partial photoneutron reactions in experiments on beams of bremsstrahlung γ- radiation. Bull. Rus. Acad. Sci. Phys., 87, №8 (2023) 1188–1195.

6. S.S.Belyshev, V.V.Varlamov, L.Z.Dzhilavyan, A.A.Kuznetsov, A.M.Lapik, A.L.Polonski, A.V.Rusakov, V.I.Shvedunov. On monitoring on the under-development source based on backward Compton scattering for photonuclear research at $E_\gamma \leq 40$ MeV. Mos. Univ. Phys. Bull., 78, N 3 (2023) 278–283.

7. S.S.Belyshev, V.V.Varlamov, L.Z.Dzhilavyan, A.A.Kuznetsov, A.M.Lapik, A.L.Polonski, A.V.Rusakov, V.I.Shvedunov. On the program of photonuclear research using the backward Compton quasi-monochromatic γ quanta with tunable energy $E_\gamma \leq 40$ MeV. Mos. Univ. Phys. Bull., 78, N 3 (2023) 284–290.

8. A.I.Davydov, V.V.Varlamov, V.N.Orlin. Cross sections of partial photoneutron reactions: problems of reliability and new data. Mos. Univ. Phys. Bull., 78, N. 3 (2023) 291–302.

9. V.V.Varlamov, A.I.Davydov, V.N. Orlin. Status of experimental photonuclear results. Mos. Univ. Phys. Bull., 78, N. 3 (2023) 303–315.

10. V.V.Varlamov, A.I.Davydov, I.A.Mostakov. Reliability of ^{51}V photoneutron reaction cross sections obtained using bremsstrahlung. Eur. Phys. J. A., 60 (2024) 44.

11. V.V.Varlamov, A.I.Davydov. Photonuclear experiments: from the bremsstrahlung to the Compton backward scattering photons. Mos. Univ. Phys. Bull., V. 79, N. 2 (2024), in print.

12. V.V.Varlamov, A.I.Davydov, I.A.Mostakov, V.N.Orlin. Photoneutron reaction cross sections for ^{90}Zr in different experiments. Phys. Atom. Nucl., 87, N5 (2024), in print.

13. V.V.Varlamov, A.I.Davydov, I.A.Mostakov, V.N.Orlin. Photoneutron reaction cross sections for light and medium-heavy nuclei in experiments on the beams of bremsstrahlung. Bull. Rus. Acad. Sci. Phys. (2024), in print.

14. V.V.Varlamov, A.I.Davydov, I.A.Mostakov. Reliability of cross sections of photoneutron reactions on ^{51}V and ^{59}Co in experiments with bremsstrahlung. Bull. Rus. Acad. Sci. Phys. (2024), in print.

Short-term 2024/20245 Program

The main items of CDFE 2024/2025 program, main priorities and most important tasks are traditional and the following:

- continuation of new photonuclear data compilation using EXFOR format, production of new TRANSes (trans.m132, trans.m133, etc.);
- correction of old ENTRYs in accordance with new EXFOR coding rules and the NRDC Network expert's comments and recommendations;
- continuation of analysis and evaluation using objective physical criteria of total and partial photonuclear reaction cross sections obtained in various experiments, carried out using different sources of photons (quasimonoenergetic annihilation photons, laser Compton backscattering photons, bremsstrahlung photons);
- continuation of development of methods for direct photoneutron multiplicity determination.