



MSU SINP CDFE 2010/2011 progress report

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*Progress Report to the IAEA Technical Meeting
on the International Network of Nuclear Reaction Data Centres (NRDC)
23 – 24 May 2011, IAEA, Vienna, Austria.*

This report contains the short review of the main items of works carried out at the Centre for Photonuclear Experiments Data (Centr Dannykh Fotoyadernykh Eksperimentov – CDFE) of Skobeltsyn Institute of Nuclear Physics of Lomonosov Moscow State University concern the IAEA Nuclear Reaction Data Centres Network activities for the period of time from the IAEA Technical Meeting of “International Network of Nuclear Reaction Data Centers” (20 – 23 April 2010, Sapporo, Japan) till the spring of 2011 and main results obtained.

EXFOR Compilations

Four new CDFE EXFOR transes **TRANS.M054**, **TRANS.M055**, **TRANS.M056**, and **TRANS.M057** have been produced and transmitted to the IAEA NDS. The new trans **PRELIM.M058** was prepared also and is now under checking and correction.

The main CDFE task of the compilation for period under report was the correction of area M (and partially several of area L) entries in accordance with the NRDC Network experts comments and recommendations (http://www-nds.iaea.org/nrdc/error/exfor_err1.html and http://www-nds.iaea.org/nrdc/error/exfor_err3.html).

On the whole CDFE TRANSES have been developed in the reported period 2010/2011 contain (Annex) *47 retransmitted ENTRYs* (266 *SUBENTs*) and **21 new ENTRYs with 158 new data SUBENTs**.

Photonuclear Data Evaluations

Analysis of reliability of experimental data on cross sections of total ((γ, xn) and (γ, sn)) and partial ((γ, n) , $(\gamma, 2n)$ and $(\gamma, 3n)$) photonuclear reactions obtained in various experiments was continued in the frame of the CDFE photonuclear research program of consistent analysis and evaluation of photonuclear reactions cross sections based on the new experimental-theoretical approach [1 - 3].

Using specially introduced transition multiplicity functions (partial/total reaction cross sections ratios) there was shown that majority of data on partial photoneutron reaction cross

sections are of very low reliability. The most important feature of this is existence of energy ranges in which (γ, n) reaction cross sections have non-physical negative values. That means that some part of neutrons from that reaction was erroneously attributed to reaction $(\gamma, 2n)$.

Detailed analysis of such phenomena was carried out for many nuclei mentioned in previous CDFE report (^{63}Cu , ^{115}In , $^{112,114,116,117,118,119,120,122,124}\text{Sn}$, ^{169}Tm , ^{197}Au , ^{209}Bi) and additionally for ^{89}Y , ^{90}Zr , ^{159}Tb , ^{165}Ho , ^{181}Ta . Using new experimental-theoretical approach new reliable data free from well-known shortcomings of experimental methods of photoneutron multiplicity sorting were evaluated for all nuclei mentioned above and for reactions (γ, n) , $(\gamma, 2n)$, $(\gamma, 3n)$ and $(\gamma, \text{sn}) = (\gamma, n) + (\gamma, 2n) + (\gamma, 3n)$ (is very important for estimation of (g, abs) – main reaction for Giant Dipole Resonance - main features).

Some of data were included into EXFOR database (DB) [1, 2], other are in processing.

Upgrading of Databases

The main CDFE relational nuclear data DB put upon the CDFE Web-site (<http://cdfe.sinp.msu.ru>) have been upgraded – needed corrections, many additions, Search Engines improvements.

The most important upgrading was made for DB “Giant Dipole Resonance Parameters. Photonuclear Reaction Cross Sections” (data on GDR energy positions, amplitudes, widths and some integrated characteristics). That was directly connected to the DB “Nuclear Reaction Database (EXFOR) and transformed into new relational DB – digital “Chart of Giant Dipole Resonance Main Parameters” (<http://cdfe.sinp.msu.ru/saladin/gdrmain.html>).

Using new possibilities of advanced “Calculator and Graph Engine for Atomic Nuclei Parameters and Nuclear Reactions and Radioactive Decays Features” described in previous report and data on radioactive decays from the USA NNDC Nuclear Wallet Cards new significantly improved version of DB “Nucleus Ground and Isomeric State Parameters” (<http://cdfe.sinp.msu.ru/services/gsp.en.html>) was produced. Now it contains many important characteristics of nuclear ground and isomeric states and various radioactive decays.

Nuclear Structure Data Evaluations

On the base of CDFE Complete Nuclear Spectroscopy Database "Relational ENSDF" (<http://cdfe.sinp.msu.ru/services/ensdfr.html>) using previously developed method of joint analysis and evaluation of data on nucleon stripping and pick-up nuclear reactions the investigations of single-nucleon nuclear subshells properties were continued. New evaluated

data for energies and nucleon occupation numbers were obtained both for proton and neutron subshells for many nuclei ($^{58,60,62,64}\text{Ni}$, $^{64,66,68,70}\text{Zn}$, $^{70,72,74,76}\text{Ge}$ and others). Data were compared with results of theoretical calculations in frame of dispersive optical model.

Short-term (2011/2012) Program

The main items of CDFE future short-term one-year program, main priorities and several most important new tasks in fields both photonuclear reaction and nuclear structure data are traditional and the following:

- continuation of photonuclear data compilation using EXFOR format, new TRANSES (M058, M059, etc.) production;
- correction of old ENTRYs in accordance with NRDC Network experts comments and recommendations and EXFOR coding rule changes;
- continuation of joint analysis and evaluation of total and partial photonuclear reaction cross sections obtained using various methods in experiments with quasimonoenergetic annihilation and bremsstrahlung photons;
- upgrading (corrections and additions) of all databases put upon the CDFE Web-site (<http://cdfe.sinp.msu.ru>).

Additionally the new special program of searching and compilation of old articles missed in EXFOR will start.

References

1. V.V.Varlamov, B.S.Ishkhanov, V.N.Orlin, V.A.Chetvertkova. Evaluated Cross Sections of the (γ, nX) and $(\gamma, 2nX)$ Reactions on $^{112,114,116,117,118,119,120,122,124}\text{Sn}$ Isotopes. Bull.Rus.Acad.Sci.Phys. 74 (2010) 833. M0768.
2. V.V.Varlamov, B.S.Ishkhanov, V.N.Orlin, S.Yu.Troshchiev. New Data for $^{197}\text{Au}(\gamma, nX)$ and $^{197}\text{Au}(\gamma, 2nX)$ Reaction Cross Sections. Bull.Rus.Acad.Sci.Phys. 74 (2010) 842. M0798.
3. V.V.Varlamov, B.S.Ishkhanov, V.N.Orlin, A.V.Sopov. Evaluation of partial photoneutron reaction cross sections for ^{115}In free from shortcomings of experimental methods of photoneutron multiplicity sorting. Preprint MSU SINP-2010-8/864, -M., 2010.

Annex.

The contents of new 2010/2011 CDFE's EXFOR transes
(*new and old corrected* ENTRYs and SUBENTs)

TRANS.M054		TRANS.M055		TRANS.M056		TRANS.M057		PRELIM.M058	
ENT N	SUB N	ENT N	SUB N	ENT N	SUB N	ENT N	SUB N	ENT N	SUB N
M0680	1	M0057	12	L0037	3	M0041	14	M0186	11
M0725	2	M0070	21	M0014	7	M0479	6	M0203	1
M0790	14	M0103	4	M0019	4	M0804	3	M0280	1
M0792	2	M0125	11	M0073	13	M0805	3	M0306	1
M0793	5	M0165	11	M0133	8	M0806	5	M0310	1
M0794	7	M0221	8	M0186	21	M0808	4	M0811	11
		M0360	4	M0188	19	M0809	3	M0812	4
		M0538	3	M0269	2	M0810	5	M0813	2
		M0645	11	M0309	7				
		M0656	2	M0310	5				
		M0680	1	M0431	3				
		M0737	2	M0571	3				
		M0741	3	M0617	1				
		M0760	3	M0635	2				
		M0768	1	M0638	13				
		M0792	2	M0692	2				
		M0793	5	M0739	2				
		M0795	7	M0752	1				
		M0796	4	M0758	2				
		M0797	55	M0775	2				
		M0798	5	M0797	4				
				M0799	4				
				M0800	2				
				M0801	8				
				M0802	2				
Total									
New: 4	New: 28	New: 4	New: 64	New: 4	New: 16	New: 6	New: 23	New: 3	New: 17
<i>corr.: 25</i>	<i>corr.: 3</i>	<i>corr.: 175</i>	<i>corr.: 104</i>	<i>corr.: 21</i>	<i>corr.: 124</i>	<i>corr.: 2</i>	<i>corr.: 20</i>	<i>corr.: 5</i>	<i>corr.: 15</i>
Sum of new ENTRYs: 21									
Sum of new SUBENTs: 158									
<i>Sum of retransmitted ENTRYs: 47</i>									
<i>Sum of retransmitted SUBENTs: 266</i>									