



**The CDFE 2012/2013 progress report:  
photonuclear data compilation and evaluation activity**

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*Progress Report to the IAEA's Technical Meeting  
On International Network of Nuclear Reaction Data Centres (NRDC)  
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The report contains short review of the main results of the Centre for Photonuclear Experiments Data (Centr Dannyykh Fotoyadernyykh Eksperimentov – CDFE) of Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics nuclear data activity and results obtained for the period of time from the IAEA Meeting of the International Network of Nuclear Reaction Data Centers” (NRDC), 16 – 19 April 2012, OECD/NEA headquarters in Issy-les-Moulineaux, France till the spring of 2013. All works were carried out in close co-operation with the Nuclear Data Section in the frame of the IAEA Nuclear Reaction Data Centres Network

### ***General***

The CDFE provides scientific and educational institutes and organizations of Russian Academy of Science with nuclear reaction and nuclear spectroscopy data for basic research, education and various applications. CDFE services include the compilation, verification, evaluation and dissemination of modern international nuclear data. CDFE maintains several relational nuclear databases available through the CDFE Web-site – <http://cdfe.sinp.msu.ru>.

### ***Organization***

The CDFE has a status of Nuclear Data Analysis Laboratory within the Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics. The total permanent staff includes the Centre head (Vladimir Varlamov), 4 professional (Sergei Komarov, Nikolay Peskov, Mikhail Stepanov, Valery Viazovsky) and 2 general service officers. CDFE exists inside Moscow University and therefore there are 3 – 4 MSU Physics Department students per year participating in nuclear data activity.

### ***EXFOR Compilation***

Four new CDFE EXFOR transes **TRANS.M063 - 066** have been produced and transmitted to the IAEA NDS in 2012/2013 period of time. All transes traditionally contain both new and old entries (the **TRANS.M065** was fully devoted to systematics of many (124)

area M entries corrections) corrected in accordance with the NRDC Network experts comments and recommendations (Actions from the NRDC 2012 Meeting):

A35	WP2012-22
A37	WP2011-26
A38	WP2012-24

On the whole contents of new CDFE trances have been produced in the reported period 2012/2013 are presented in Annex: there are 161 corrected ENTRYs (Many SUBENTs) and 19 new ENTRYs (105 new SUBENTs).

### ***Photonuclear Data Evaluation***

In accordance with CDFE report for previous NRDC meeting (16 – 19 April 2012, OECD/NEA, France) the investigations of reliability and authenticity of data for partial photonuclear reaction cross sections were continued. Using new proposed objective criteria of data reliability and new experimental-theoretical method for evaluation many new reliable and authentic data for total  $(\gamma, xn) = (\gamma, n) + 2(\gamma, 2n) + 3(\gamma, 3n)$  and  $(\gamma, sn) = (\gamma, n) + (\gamma, 2n) + (\gamma, 3n)$  and partial  $(\gamma, n)$ ,  $(\gamma, 2n)$ ,  $(\gamma, 3n)$  reaction cross sections were obtained for many nuclei  $^{63}\text{Cu}$ ,  $^{89}\text{Y}$ ,  $^{90}\text{Zr}$ ,  $^{115}\text{In}$ ,  $^{112,114,116,117,118,119,120,122,124}\text{Sn}$ ,  $^{159}\text{Tb}$ ,  $^{165}\text{Ho}$ ,  $^{181}\text{Ta}$ ,  $^{197}\text{Au}$ ,  $^{208}\text{Pb}$ . New data reliability, new evaluation method and new reliable data were presented as International Conference on Nuclear Data for Science and Technology (ND2013) poster [1].

### ***Nuclear Database Service***

Main CDFE international databases (DB) are produced and maintained using data funds of Nuclear Reaction Data Centres Network and USA NNDC and NSDD:

- “Nuclear Reaction Database (EXFOR)”;
- “Complete Nuclear Spectroscopy Database "Relational ENSDF" (Evaluated Nuclear Structure Data File);
- “Nuclear Physics Publications ("NSR" Database)”.

Another CDFE-produced and maintained DB are:

- digital “Chart of Giant Dipole Resonance Main Parameters” contains data on main parameters (energy position, amplitude, width, integrated cross section) of GDR for many nuclei;
- digital “Chart of Nucleus Shape and Size Parameters” contains data on quadrupole moments, parameters of quadrupole deformation and charge radii for many nuclei;

- “Nucleus Ground and Isomeric State Parameters” combines many useful information on the nucleus as whole and its ground and isomeric states properties (masses, binding energy, nucleon separation energy, decay mode, energy of various decays, etc);
- “Calculator and Graph Engine for Atomic nuclei Parameters and Nuclear reactions and Radioactive Decays Features” gives to one possibility for convenient calculation of: i) nucleus binding energy, ii) nucleon and nucleus separation energy, iii) decay energy, iv) reaction threshold and energy, v) nucleus fission parameters.

All CDFE DB available through the CDFE Web-site (<http://cdfe.sinp.msu.ru>) were corrected added and upgraded. Those databases contents and their powerful and flexible original Search Engines were presented as International Conference on Nuclear Data for Science and Technology (ND2013) poster [2].

### ***Short-term (2013/2014) Program***

The main items of CDFE (2012/2013) program, main priorities and most important tasks are traditional and the following:

- continuation of photonuclear data compilation using EXFOR format, new TRANSES (M067, M068, etc.) production;
- correction of old ENTRYs in accordance with new EXFOR coding rule changes and the NRDC Network experts comments and recommendations;
- 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>).

### ***References***

1. B.S.Ishkhanov, V.N.Orlin, V.V.Varlamov. The New Approach to Analysis and Evaluation of Reliable Partial Photoneutron Reactions Cross Sections. Program and Abstracts of International Conference on Nuclear Data for Science and Technology, New York, USA, 04 – 08 March 2013, pp. 291 – 292.  
URL: <http://www.bnl.gov/nd2013/files/pdf/ND2013-ProgramAbstracts.pdf>.
2. S.Yu.Komarov, N.N.Peskov, M.E.Stepamov, V.V.Varlamov. MSU SINP CDFE Nuclear Databases for Science Research and Education. Program and Abstracts of International Conference on Nuclear Data for Science and Technology, New York, USA, 04 – 08 March 2013, pp. 253 – 254.  
URL: <http://www.bnl.gov/nd2013/files/pdf/ND2013-ProgramAbstracts.pdf>

Annex.

The contents of new 2012/2013 CDFE's EXFOR transes  
(*new and old corrected* ENTRYs and SUBENTs)

TRANS.M063		TRANS.M064		TRANS.M065		TRANS.M066	
ENT N	SUB N	ENT N	SUB N	ENT N	SUB N	ENT N	SUB N
M0368	7	M0116	1	M0001	26	M0018	7
M0415	1	M0141	5	1	M	M0033	3
M0501	1	M0149	8	2	A	M0037	6
M0543	2	M0150	10	4	N	M0167	41
M0656	6	M0163	3		Y	M0187	15
M0663	2	M0193	3			M0809	3
M0676	2	M0219	2	C	C	M0831	1
M0686	2	M0222	12	O	O	<b>M0855</b>	<b>4</b>
M743	2	M0281	5	R	R	<b>M0856</b>	<b>3</b>
M0758	1	M0291	3	R	R	<b>M0857</b>	<b>6</b>
M0775	2	M0362	9	E	E	<b>M0858</b>	<b>11</b>
<b>M0843</b>	<b>2</b>	M0364	45	C	C	<b>M0859</b>	<b>3</b>
<b>M0844</b>	<b>6</b>	M0368	3	T	T	<b>M0860</b>	<b>2</b>
<b>M0845</b>	<b>16</b>	M0373	5	E	E	<b>M0861</b>	<b>5</b>
<b>M0846</b>	<b>4</b>	M0385	4	D	D		
<b>M0847</b>	<b>6</b>	M0415	1				
<b>M0848</b>	<b>4</b>	M0435	12	O	O		
<b>M0849</b>	<b>4</b>	M0476	7	L	L		
<b>M0850</b>	<b>11</b>	M0591	8	D	D		
		<b>M0851</b>	<b>2</b>				
		<b>M0852</b>	<b>3</b>	E	S		
		<b>M0853</b>	<b>2</b>	N	U		
		<b>M0854</b>	<b>8</b>	T	B		
				R	E		
				Y	N		
				S	T		
				...	S		
				...	...		
				M0807	2		
Total							
<b>New: 8</b> corr.: 11	<b>New: 53</b> corr.: 28	<b>New: 4</b> corr.: 19	<b>New: 15</b> corr.: 145	<b>New: 0</b> corr.: 124	<b>New: 0</b> corr: many	<b>New: 7</b> corr.: 7	<b>New: 37</b> corr.: 76
<b>Sum of new ENTRYs: 19</b>							
<b>Sum of new SUBENTs: 105</b>							
<i>Sum of retransmitted ENTRYs: 161</i>							
<i>Sum of retransmitted SUBENTs: MANY</i>							