



MSU SINP CDFE 2007/2008 progress report

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*Progress Report to
the IAEA Technical Meeting of the International Network of Nuclear Reaction Data Centers
22 – 25 September 2008, Obninsk, Russia.*

The Report contains the short review of the works carried out by the Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics Centre for Photonuclear Experiments Data (Centr Danykh Fotoyadernykh Eksperimentov – CDFE) concern the IAEA Nuclear Reaction Data Centres Network activities for the period of time from the 2007 Technical Meeting of the Network of Nuclear Reaction Data Centres (8 – 10 October, IAEA NDS, Vienna, Austria) till the fall of 2008 and main results obtained.

EXFOR Compilations

Three new CDFE EXFOR TRANSES **M044, M045 and M046** have been produced and transmitted to the IAEA NDS. Two old data SUBENTs have been corrected in accordance with comments of Drs. Naohiko Otsuka, and Svetlana Dunaeva and many new data were compiled. On the whole three CDFE TRANSES mentioned contain (**Annex 1**) 14 retransmitted and 37 new ENTRYs with 294 new data SUBENTs.

In accordance with Conclusions of previous NRDC Meetings many photonuclear reaction cross section data were included.

Photonuclear Data Evaluations

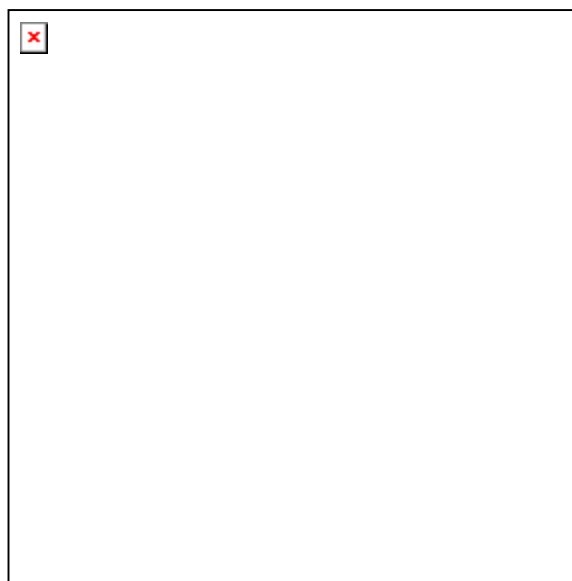
As an continuation of CDFE program of consistent analysis and evaluation of total and partial photonuclear reactions cross sections joint combined evaluation of total (γ, xn) and (γ, sn) and partial (γ, n), ($\gamma, 2n$) and ($\gamma, 3n$) photoneutron reactions cross sections was carried out for many tin isotopes $^{112,114,116,117,118,119,120,122,124}\text{Sn}$. Those were based on the results of investigation of various photonuclear reactions in experiments used the bremsstrahlung and quasimonoenergetic annihilation photon beams. The reasons of data disagreements were analyzed, the values of renormalization factors for putting all data in consistency [1] to each other were obtained. The evaluated cross sections energy dependencies were obtained, integrated cross section values have been calculated.

Many previously evaluated photoneutron reaction cross sections together with photoproton reaction cross section data were used in joint analysis of GDR isospin splitting for several sets of isotopes – $^{56,58,60,62}\text{Ni}$, $^{40,42,44,46,48}\text{Ca}$.

Nuclear Structure Data Evaluations

Investigations of so-called new magic nuclei were continued using possibilities of the CDFE Complete Nuclear Spectroscopy Database "Relational ENSDF". Before many such kind nuclei (^{14}C , $^{14,16,24,28,40,48}\text{O}$, $^{26,28,30}\text{Si}$, $^{30,32}\text{S}$, $^{52,54}\text{Ca}$, $^{90,92,94,96}\text{Sr}$, $^{92,94,96,98}\text{Zr}$) were found out [2]. All of them have the same characteristic structure of upper shells (two closed proton and neutron subshells with identical total moment j (phenomenon named “ $j = j$ ”- connection) and in some special cases - closed subshell with $j = 1/2$ above one of them). Application of that “ $j = j$ ”- connection to various nuclear subshells gave to one possibility to find out one more new magic nuclei pair: ^{68}Zn - ^{70}Ge .

New Databases Development



1) The previously developed electronic Chart (relational database) of Nuclear Quadrupole Deformations (<http://cdfe.sinp.msu.ru/services/defchart/defmain.html>) [3] has been added by modern mean-root-square charge radii data [4 – 6] for many nuclei (900 isotopes of 90 elements ($Z = 1 - 96$, $N = 0 - 152$)).

Because the new database contains now data on quadrupole moments, quadrupole deformation parameters and nuclear radii it has been transformed into the “Chart of Nucleus Shape and Size Parameters” - (<http://cdfe.sinp.msu.ru/services/radchart/radmain.html>).

2) Using the data of previously developed database “Giant Dipole Resonance Parameters, Photonuclear Reaction Cross Sections” and special system data transportation from EXFOR database the test version of new electronic Chart of main Giant Dipole Resonance containing data on several main GDR parameters was produced (<http://cdfe.sinp.msu.ru/services/gdrchart/gdrmain.html>).

The data on the GDR energy, amplitude, width and integrated cross section are included. Data were obtained from cross sections of all total ((γ, abs) , (γ, xn) and (γ, sn)) and many partial ((γ, n) , $(\gamma, 2\text{n})$, $(\gamma, 3\text{n})$, (γ, p) , (γ, d) , (γ, t) , (γ, α)) reactions.

Access to data and data presentations are similar to those of the Chart of Nucleus Shape and Size Parameters.

Upgrading of Databases

The main CDFE relational nuclear data databases

- Nuclear Reaction Database (EXFOR) - <http://cdfe.sinp.msu.ru/exfor/index.php>;
- Complete Nuclear Spectroscopy Database "Relational ENSDF" - <http://cdfe.sinp.msu.ru/services/ensdfr.html>;
- Nuclear Physics Publications ("NSR" Database) - http://cdfe.sinp.msu.ru/services/nsr/Search_form.shtml;
- Giant Dipole Resonance Parameters, Photonuclear Reaction Cross Sections - <http://cdfe.sinp.msu.ru/services/gdrsearch.html>;
- Photonuclear Data Index from 1955 - <http://cdfe.sinp.msu.ru/services/pnisearch.html>

have been upgraded significantly – needed corrections, many additions.

Short-term (2007/2008) 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 listed in the **Annex 2**.

References

1. V.V.Varlamov, N.N.Peskov, D.S.Rudenko, M.E.Stepanov. Consistent evaluation of photoneutron reaction cross sections using data obtained in experiments with quasimonoeenergetic annihilation photon beams at Livermore (USA) and Saclay (France) in Articles Translated from Journal Yadernye Konstanty (Nuclear Constants). INDC(CCP)-440, IAEA NDS, Vienna, Austria, 2004, p. 37.

2. I.N.Boboshin, V.V.Varlamov, B.S.Ishkhanov, S.Yu.Komarov, E.A.Romanovsky. Shell Structure of New Magic Nuclei: Systematics of Features. *Bull.Rus.Acad.Sci.Phys.* 72 (2008) 283.
3. I.N.Boboshin, V.V.Varlamov, S.Yu.Komarov, N.N.Peskov, M.E.Stepanov, V.V.Chesnokov. MSU SINP CDFE Nuclear Data Processing Activity in 2006– 2007. Report on the IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres, 8 – 10 October 2007, Vienna, Austria. INDC(NDS)-0519, IAEA NDS, Vienna, Austria, 2007, p. 51.
4. E. G. Nadjakov, K. P. Marinova, Yu. P. Gangrsky. *Atomic Data and Nuclear Data Tables*, 56 (1994) 133; K. P. Marinova, Yu. P. Gangrsky, data updated, private communication, 2008.
5. I. Angeli. *Atomic Data and Nuclear Data Tables*, 87 (2004) 185.
6. G. Fricke, K. Heilig. *Landolt-Bornstein: Numerical Data and Functional Relations in Science and Technology. New Series, Group I: Elementary Particles, Nuclei and Atoms*, Volume 20 (2004).

Annex 1. The new CDFE's EXFOR TRANSEs M044, M045, and M046 contents

(old corrected and new ENTRYs)

TRANS M044		TRANS M045		TRANS M046	
ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs
<i>L0005</i>	<i>1</i>	M0731	14	<i>M0635</i>	<i>2</i>
<i>L0006</i>	<i>1</i>	M0732	8	<i>M0656</i>	<i>2</i>
<i>L0007</i>	<i>1</i>	M0733	6	M0742	4
<i>L0031</i>	<i>17</i>	M0734	3	M0743	2
<i>L0050</i>	<i>5</i>	M0735	3	M0744	19
<i>L0058</i>	<i>16</i>	M0736	2	M0745	13
<i>M0273</i>	<i>13</i>	M0737	5	M0746	33
<i>M0322</i>	<i>8</i>	M0738	3	M0747	15
<i>M0349</i>	<i>2</i>	M0739	2	M0748	6
<i>M0469</i>	<i>3</i>	M0740	5	M0749	2
<i>M0470</i>	<i>3</i>	M0741	10	M0750	6
<i>M0686</i>	<i>3</i>			M0751	2
M0722	21			M0752	19
M0723	7			M0753	3
M0724	3			M0754	3
M0725	9			M0755	10
M0726	5			M0756	2
M0727	4			M0757	2
M0728	10			M0760	3
M0729	13				
M0730	2				
Total new:	Total new:	Total new:	Total new:	Total new:	Total new:
9	84	11	61	17	149
Sum of new ENTRYs: 37					
Sum of new SUBENTs: 294					

Annex 2. The main items of the CDFE future short-term program.

The following traditional CDFE nuclear data compilation and procession activities will be continued:

1. Continuation of photonuclear data compilation using EXFOR format, new TRANSES (M047, M048, etc.) production.

2. Continuation of joint analysis and evaluation of photonuclear reaction cross sections obtained using various methods, first of all in experiments with bremsstrahlung and quasimonoenergetic annihilation photons, with the aim of definition and excluding of systematical discrepancies and obtaining of more accurate and reliable data on photonuclear reaction cross sections.

3. Checking and improvement of the test version of new electronic Chart of main Giant Dipole Resonance containing data on several main GDR parameters and their preparation for putting on the CDFE Web-site (<http://cdfe.sinp.msu.ru>).

4. Upgrading (corrections and additions) of all databases put upon the CDFE Web-site (<http://cdfe.sinp.msu.ru>).

5. Investigation of possibilities of production of new photonuclear databases, containing data for energies higher GDR, first of all for meson photoproduction reaction data.

6. Investigations of new non-traditional magic nuclei properties and of their existence conditions using the search possibilities of the CDFE database "Relational ENSDF".