



MSU SINP CDFE Nuclear Data Processing Activity in 2006 – 2007

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*Progress Report to
the IAEA Coordination Meeting of the International Network
of Nuclear Reaction Data Centres
(8 – 10 October 2007, Vienna, Austria).*

The following 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 Technical Co-ordination Meeting of the Network of Nuclear Reaction Data Centres (25 – 28 September 2006, IAEA NDS, Vienna, Austria) till the fall of 2007 and main results obtained.

EXFOR Compilations

Three new CDFE EXFOR TRANSEs **M041, M042 and M043** have been produced and transmitted to the IAEA NDS. Many old data have been corrected in accordance with comments of O.Schwerer, D.Rochman, N.Otsuka, and S.Dunaeva. On the whole the CDFE TRANSEs mentioned contain (**Annex 1**) 16 retransmitted and 28 new ENTRYs with 160 new data SUBENTs.

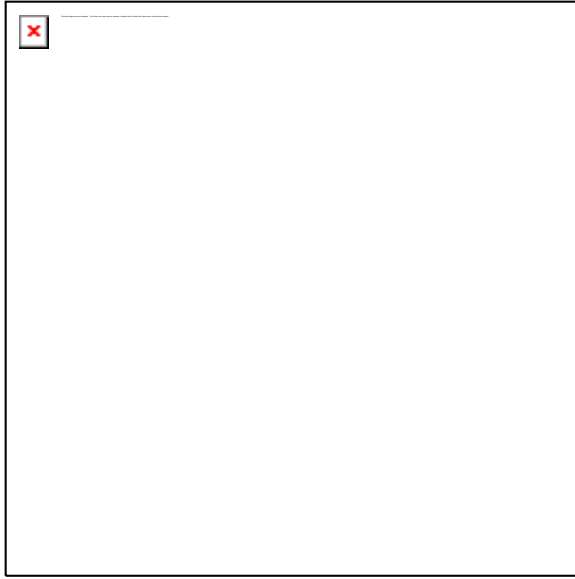
In accordance with C5 Conclusion of the previous 2006 NRDC Meeting “*In particular, photoneutron and photofission data, as well as (γ,p) and (γ,α) cross sections, should be covered completely*” 36 SUBENTs with such kind of data were prepared (**Annex 2**).

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/ensdf.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>;



- Chart (relational database really) of Nuclear Quadrupole Deformations - <http://cdfe.sinp.msu.ru/services/defchart/defmain.html>

have been upgraded significantly – needed corrections, many additions.

Nuclear Structure Evaluations

The last one mentioned New Chart of Nuclear Quadrupole Deformations has been upgraded using new source of related information (quadrupole moments Q and parameters of quadrupole deformation β_2 obtained by Dr. N.J.Stone /1/ and sent to the CDFE directly as numerical data file).

Now the Chart contains about 2000 data sets for about 1500 nuclei.

New evaluated nuclear structure data on nuclear static and dynamic deformations have been obtained using new Chart of Nuclear Quadrupole Deformations - the clear systematical disagreements of those parameters obtained from nuclear quadrupole moments data (Q-type) and from reduced transition probability $B(E2)^\uparrow$ data (B-type).

The results obtained and version of their description were submitted as report to the International Conference on Nuclear Data for Science and Technology at Nice, France (ND-2007) /2/.

Many new non-traditional magic nuclei (^{14}C , $^{14,16,24,28,40,48}\text{O}$, $^{26,28,30}\text{Si}$, $^{30,32}\text{S}$, $^{52,54}\text{Ca}$, $^{90,92,94,96}\text{Sr}$, $^{92,94,96,98}\text{Zr}$) have been found out. It was revealed that near to Fermi energy all new magic nuclei mentioned have the same characteristic structure: there are two closed proton and neutron subshells with identical total moment j (phenomenon named “ $j = j$ ”- connection) and in some special cases - closed subshell with $j = \frac{1}{2}$ above one of them. Some additional

neutron-proton interaction like a n-p pairing was used for description of new magic nuclei features investigated /3/.

Photonuclear Data Evaluations

As the result of the discussion of actinides nuclei photoneutron and photofission reaction cross section evaluations at Nice Conference /4/ the detailed systematical analysis of the (γ, xn) , (γ, sn) , (γ, n) , $(\gamma, 2n)$ and (γ, f) reaction cross section data obtained by using quasimonoenergetic annihilation photon beams at Livermore (USA) and Saclay (France) was carried out for 4 actinides nuclei ^{232}Th , ^{238}U , ^{237}Np , and ^{239}Pu . For overcoming of significant disagreements between the data the special method proposed before for taking into account both laboratories neutron multiplicity sorting procedure features was applied to move the data into consistence. For all 4 nuclei the jointly corrected reaction cross sections were evaluated /5/.

Now data are in preparation for EXFOR (M044).

Short-term (2007 – 2008) Program

The main items of CDFE future short-term program, main priorities and several most important new tasks in fields both photonuclear reaction and nuclear structure data are listed in the **Annex 3**.

References

1. N.J.Stone, Atomic Data and Nuclear Data Tables, 90 (2005) 75.
2. Igor Boboshin, Boris Ishkhanov, Sergei Komarov, Vadim Orlin, Nikolai Peskov, Vladimir Varlamov. Investigation of Quadrupole Deformation of Nucleus and Its Surface Dynamic Vibrations. International Conference on Nuclear Data for Science and Technology, April 22 – 27, 2007, Nice, France. Book of Summaries, p. 39 (#103).
3. I.N.Boboshin, B.S.Ishkhanov, E.A.Romanovsky, V.V.Varlamov. New Magic Nuclei Shell Structure: Systematics of Features. LVII International Conference on Nuclear Physics NUCLEUS 2007 “Fundamental Problems of Nuclear Physics, Atomic Power Engineering and Nuclear Technilgies”, June 25 – 29, 2007, Voronezh, Russia. Book of Abstracts. ISBN 598340052-5. Saint-Petersburg, 2007, p. 92.
4. Emmeric Dupont, Imante Raskinyte, Danas Ridikas. Photonuclear Data Evaluations of Actinides up to 130 MeV. International Conference on Nuclear Data for Science and Technology, April 22 – 27, 2007, Nice, France. Book of Summaries, p. 55 (#497).

5. V.V.Varlamov, N.N.Peskov. Evaluation of (γ, xn) , (γ, sn) , (γ, n) , $(\gamma, 2n)$, and (γ, f) Reactions Cross Sections for Actinides Nuclei ^{232}Th , ^{238}U , ^{237}Np , and ^{239}Pu : Consistency Between Data Obtained Using Quasimonoenergetic Annihilation and Bremsstrahlung Photons. Preprint MSU SINP 2007-8/829.

Annex 1. The CDFE new EXFOR TRANSES M041, M042, and M043 contents
(*old corrected* and **new ENTRYs**)

TRANS M041		TRANS M042		TRANS M043	
ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs
<i>M0382</i>	<i>4</i>	<i>M0626</i>	<i>6</i>	<i>M0420</i>	<i>4</i>
<i>M0383</i>	<i>5</i>	<i>M0632</i>	<i>22</i>	<i>M0670</i>	<i>1</i>
<i>M0509</i>	<i>2</i>	<i>M0646</i>	<i>2</i>	<i>M0711</i>	<i>5</i>
<i>M0516</i>	<i>3</i>	<i>M0656</i>	<i>2</i>	M0712	3
<i>M0525</i>	<i>30</i>	<i>M0683</i>	<i>1</i>	M0713	6
<i>M0526</i>	<i>7</i>	M0704	3	M0714	4
<i>M0527</i>	<i>33</i>	M0705	2	M0715	4
<i>M0634</i>	<i>3</i>	M0706	4	M0716	5
M0693	11	M0707	3	M0717	3
M0694	6	M0708	17	M0718	6
M0695	3	M0709	33	M0719	7
M0696	3	M0710	7	M0721	3
M0697	3	M0711	5		
M0698	5				
M0699	3				
M0700	2				
M0701	2				
M0702	4				
M0703	3				
Total new:	Total new:	Total new:	Total new:	Total new:	Total new:
11	45	8	74	9	41
Sum of new ENTRYs: 28					
Sum of new SUBENTs: 160					

Annex 2. The cross section data compiled.

REACTION	ADDRESS
(53-I-127(G,X)0-NN-1,,SIG,,EVAL)	M0693 2 3
(53-I-127(G,X)0-NN-1,UNW,SIG,,EVAL)	M0693 3 3
(53-I-127(G,N)53-I-126,,SIG,,EVAL)	M0693 4 3
(53-I-127(G,2N)53-I-125,,SIG,,EVAL)	M0693 5 3
(53-I-127(G,3N)53-I-124,,SIG,,EVAL)	M0693 6 3
(57-LA-139(G,N)57-LA-138,,SIG)	M0696 2 3
(59-PR-141(G,N)59-PR-140,,SIG)	M0696 3 3
(82-PB-208(G,X)0-NN-1,,SIG,,BRS)	M0700 2 3
(59-PR-141(G,X)0-NN-1,,SIG,,BRS)	M0701 2 3
(8-O-16(G,X)0-NN-1,UNW,SIG,,BRS)	M0702 2 3
(82-PB-208(G,X)0-NN-1,UNW,SIG,,BRS)	M0702 3 3
(83-BI-209(G,X)0-NN-1,UNW,SIG,,BRS)	M0702 4 3
(49-IN-115(G,X)0-NN-1,,SIG,,BRS)	M0703 2 3
(53-I-115(G,X)0-NN-1,,SIG,,BRS)	M0703 3 3
(24-CR-52(G,X)0-NN-1,,SIG,,BRS)	M070500200003
(39-Y-89(G,X)0-NN-1,UNW,SIG,,BRS)	M070600200003
(49-IN-115(G,X)0-NN-1,UNW,SIG,,BRS)	M070600300003
(53-I-127(G,X)0-NN-1,UNW,SIG,,BRS)	M070600400003
(73-TA-181(G,X)0-NN-1,,SIG,,BRS)	M070700200003
(73-TA-181(G,X)0-NN-1,UNW,SIG,,BRS)	M070700300003
(2-HE-4(G,N)2-HE-3,,SIG)	M070801600003
((20-CA-40(G,N)20-CA-39,,SIG,,BRS)+	M071400200003
((20-CA-40(G,N)20-CA-39,,SIG,,BRS)+	M071400300003
((20-CA-40(G,N)20-CA-39,,SIG,,BRS)+	M071400400003
(14-SI-28(G,P)13-AL-27,PAR,SIG,,BRS)	M071700200003
(14-SI-28(G,P)13-AL-27,PAR,SIG,,BRS)	M071700300003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800200003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800300003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800400003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800500003
(42-MO-92(G,X)0-NN-1,,SIG,,BRS)	M071900200003
(42-MO-92(G,X)0-NN-1,UNW,SIG,,BRS)	M071900300003
((42-MO-92(G,N)42-MO-91,,SIG,,BRS)+	M071900400003
(42-MO-98(G,X)0-NN-1,,SIG,,BRS)	M071900500003
(42-MO-98(G,X)0-NN-1,UNW,SIG,,BRS)	M071900600003
((42-MO-98(G,N)42-MO-97,,SIG,,BRS)+	M071900700003

Annex 3. 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 (M044, M045, etc.) production.

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

3. 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.

4. Development of the structure and the testing version of the new Giant Dipole Resonance Chart (produced in analogy to the Chart of Nuclear Quadrupole Deformations) containing the main GDR parameters (energy, amplitude, width, integrated cross section data) for 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.

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