



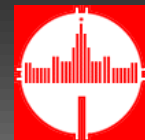
*The CDFE photonuclear data
Compilations and evaluations
in 2015 – 2016*

*Vladimir Varlamov,
Aleksandr Davydov,
Sergei Komarov,
Nikolai Peskov,
Mikhail Stepanov*



6/13/2016

1



The CDFE photonuclear data compilations and evaluations in 2015 – 2016.

V.V.Varlamov, A.I.Davydov, S.Yu.Komarov, N.N.Peskov, M.E.Stepanov

*Progress Report to the Technical Meeting on the International Network of Nuclear Reaction Data Centres at the Nuclear Data Centre,
Atomic Energy of China (CAEA), Beijing, China,
7 – 10 June 2016*

This short report contains review of the main results obtained at the Russia Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics Centre for Photonuclear Experiments Data (Centr Dannykh Fotoyadernykh Eksperimentov – CDFE) concern nuclear data compilation and correction, analysis and evaluation for the period of time from the IAEA's Technical Meeting On International Network of Nuclear Reaction Data Centers" (NRDC), 21 – 23 April 2015, IAEA's Headquarters, Vienna, Austria till the summer of 2016.

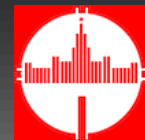
The main CDFE responsibility in the NRDC Network is compilation and processing of photonuclear data. The main CDFE scientific activity is evaluating of photonuclear data obtained in various experiments.

The CDFE total permanent staff includes now five professional, three general service officers and several students of the MSU Physics Faculty.

The CDFE nuclear data activities in the whole are dissemination of international nuclear data for providing Lomonosov Moscow State University (Skobeltsyn Institute of Nuclear Physics, primarily) and scientific and educational institutes and organizations of Russian Academy of Science for basic research, education and various applications. The CDFE maintains several nuclear databases available through the CDFE Web-site – <http://cdfe.sinp.msu.ru>.



CDFE EXFOR Compilation



Five new CDFE EXFOR **TRANS.M078 - 082** and **one PRELIM.M083** transes have been produced and transmitted to the IAEA NDS. All TRANSes are prepared in addition to a number of new ENTRYs contain many old ENTRYs corrected in accordance with the NRDC Network experts comments and recommendations.

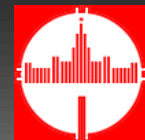
On the whole new CDFE transes have been produced in the reported period contain **121** corrected and **19** new ENTRYs:

TRANS	Old	New	Total
m078	5	7	12
m079	7	3	10
m080	3	5	8
m081	33	3	36
m082	57	1	58
prelim.m083	16	0	16
All	121	19	140



The majority of prepared ENTRYs contains old photonuclear data corrected in accordance with new EXFOR format rules.

I would like to acknowledge very much [Svetlana Dunaeva](#) for great help and assistance in finding mistakes and doing corrections and [Naohiko Otsuka](#) and [Oscar Cabellos](#) for many very important and useful comments.

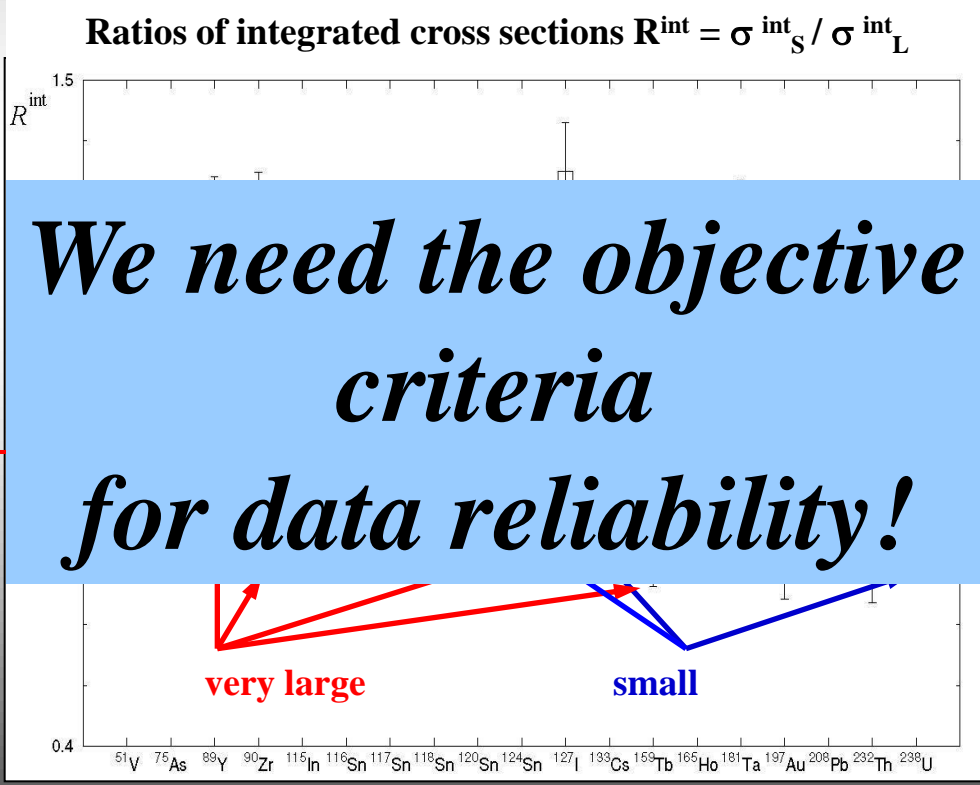
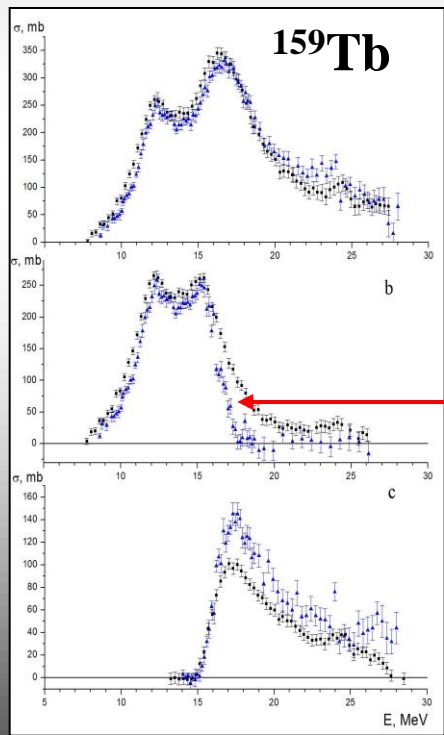


CDFE Photonuclear Data Evaluation



Main problem for 19 nuclei investigated in both Labs:
 ($\gamma, 1n$) cross sections are larger at Saclay but those for ($\gamma, 2n$) - at Livermore.

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 Quasimonoenergetic Annihilation Photon Beams at Livermore (USA) and Saclay (France). INDC(CCP)-440, IAEA NDS, Vienna, Austria, 2004, p. 37.



Squares - ■ -
 ratios for ($\gamma, 1n$)
 reactions – are
 larger than 1.0:
 $\langle R \rangle \sim 1.07$.

Triangles - △ -
 ratios for ($\gamma, 2n$)
 reactions – are
 smaller than 1.0:
 $\langle R \rangle \sim 0.84$.

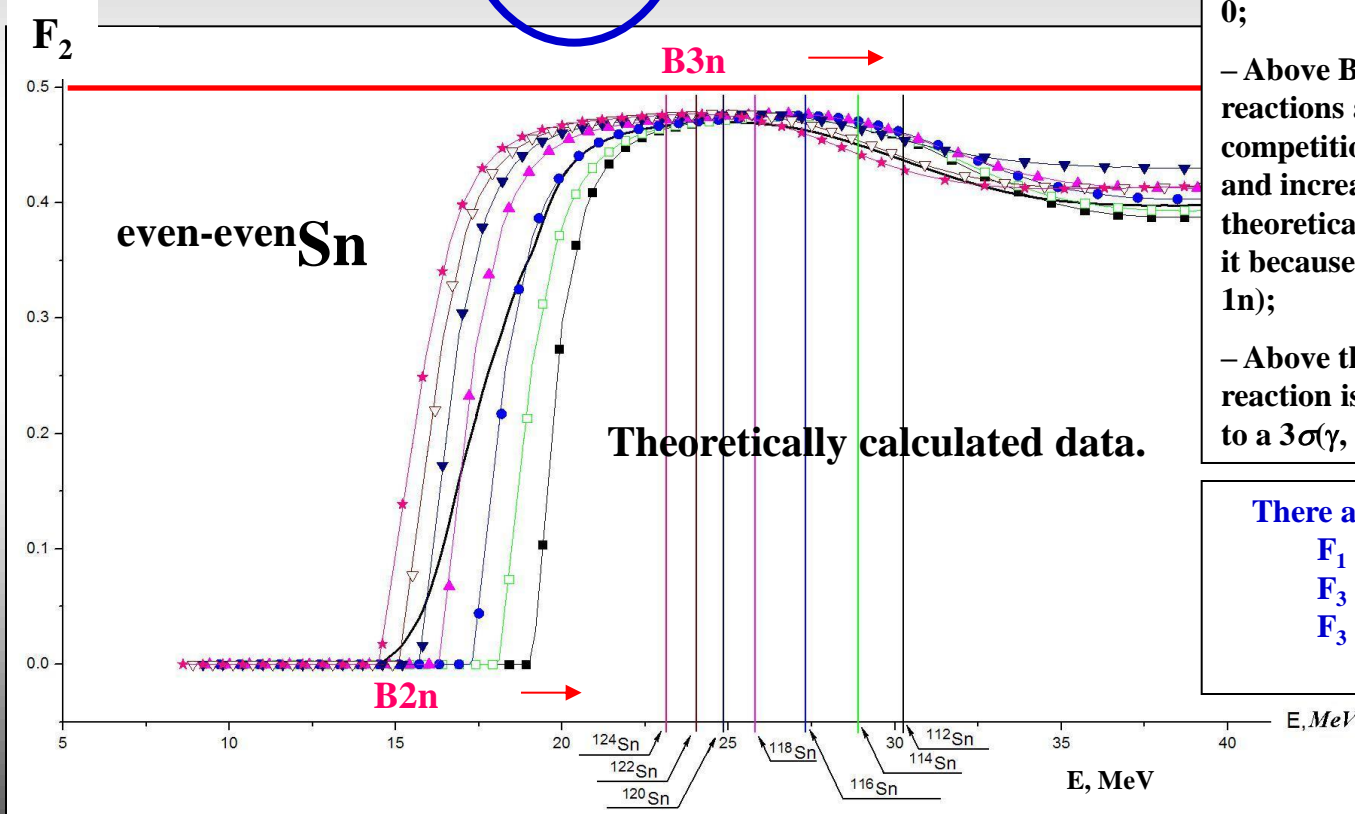


Main objective physical criterion for data reliability

$$F_2 = \frac{\sigma(\gamma, 2n)}{\sigma(\gamma, 1n) + 2\sigma(\gamma, 2n) + 3\sigma(\gamma, 3n) + \dots} < 0.50 (!)$$

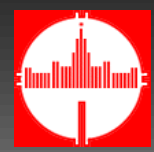
The natural and physically reliable energy dependence of F_2 should be following:

- Below the $(\gamma, 2n)$ reaction threshold B_{2n} only the $(\gamma, 1n)$ reaction is possible: $F_2 = 0$;
- Above B_{2n} both $(\gamma, 1n)$ and $(\gamma, 2n)$ reactions are possible, F_2 increases due to competition between decreasing $\sigma(\gamma, 1n)$ and increasing $\sigma(\gamma, 2n)$, going to the theoretical limit of 0.50, but never reach it because of a high-energy part in $\sigma(\gamma, 1n)$;
- Above the B_{3n} threshold the $(\gamma, 3n)$ reaction is also possible, F_2 decreases due to a $3\sigma(\gamma, 3n)$.

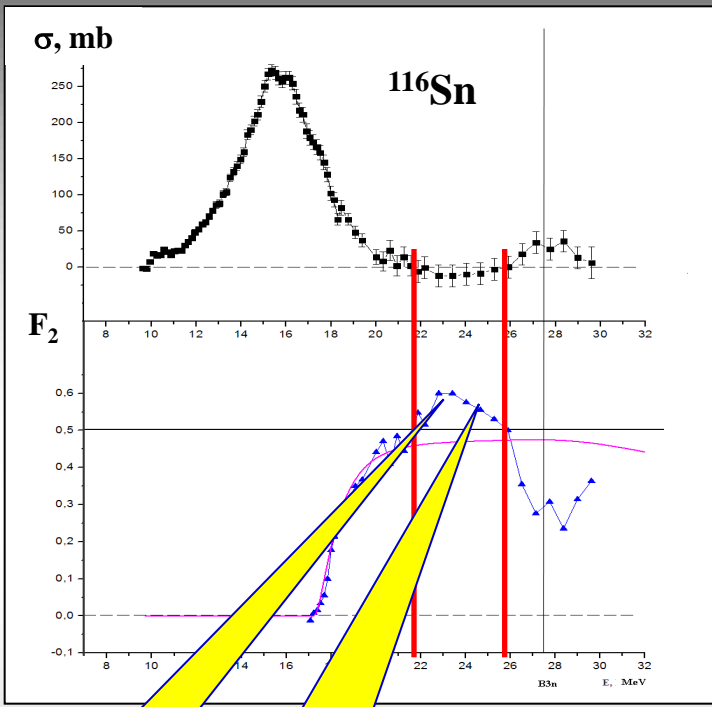


There are additional physical criteria:

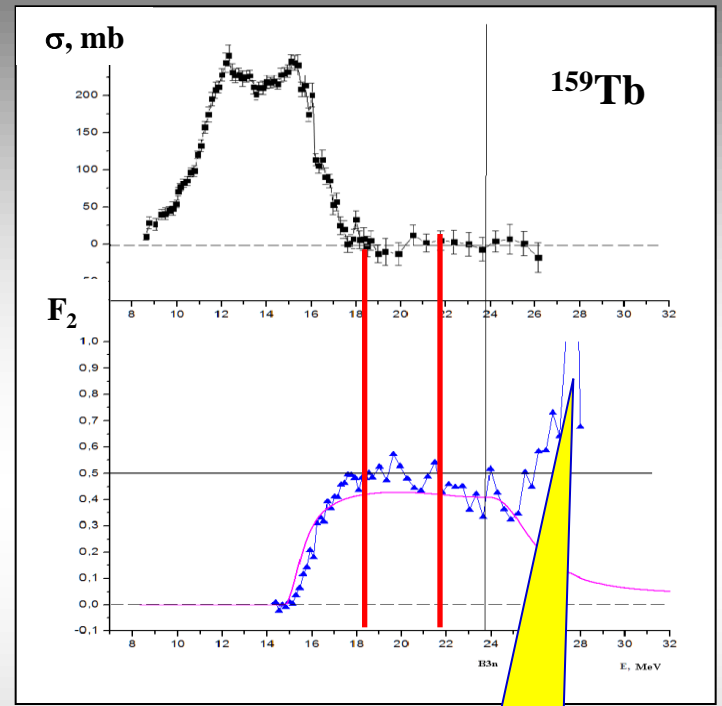
- $F_1 = \sigma(\gamma, 1n) / \sigma(\gamma, xn) < 1.00$
- $F_3 = \sigma(\gamma, 3n) / \sigma(\gamma, xn) < 0.33$
- $F_3 = \sigma(\gamma, 4n) / \sigma(\gamma, xn) < 0.25$
- etc.



Some examples of Livermore data



$\sigma(\gamma, 1n)$
 negative values
 $F_2 > 0.50$

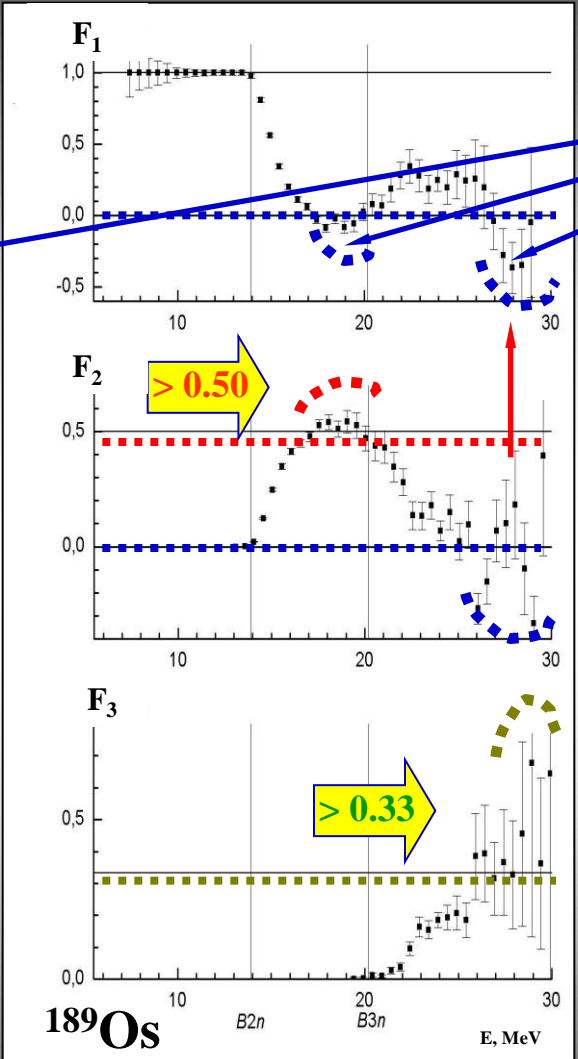
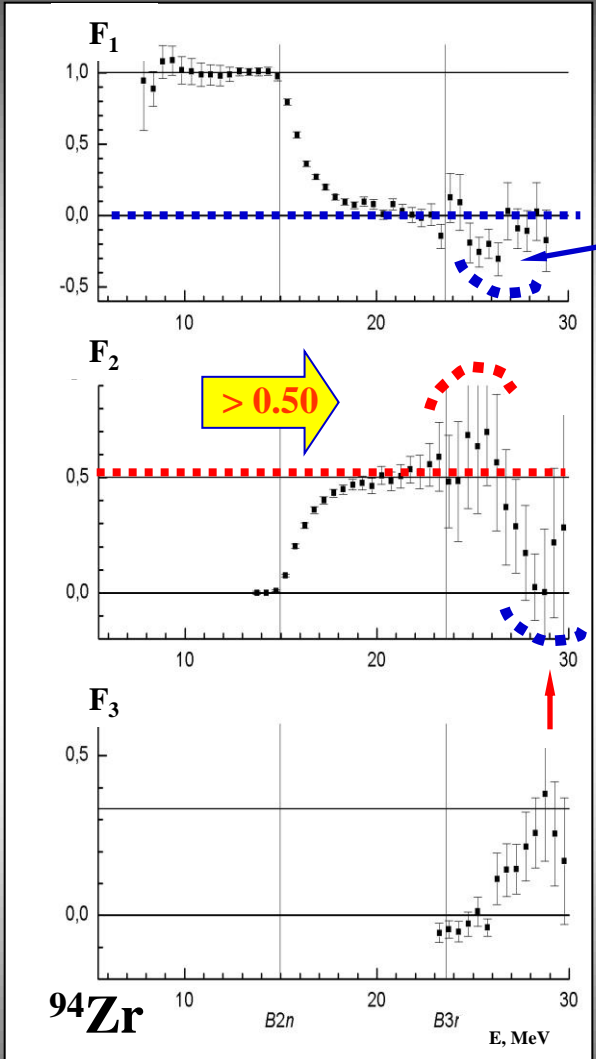


$F_2 > 0.50!$
 Decrease before B3n

$$F_2 = \frac{\sigma(\gamma, 2n)}{\sigma(\gamma, 1n) + 2\sigma(\gamma, 2n) + 3\sigma(\gamma, 3n) + \dots} < 0.50 (!)$$

$F_2 \approx 2.00?!$

Physically not reliable negative cross section values
 are correlated with physically forbidden values $F_2 > 0.50$



Physically forbidden negative values

**Physically unreliable values:
 $F_2 > 0.50$**

Physically forbidden negative values

**Physically unreliable values:
 $F_3 > 0.33$**

The reliability of many data is doubtful.

Many data should be reanalyzed and reevaluated!



New experimentally-theoretical method of evaluation

using combined model of photonuclear reactions:

- initial data – experimental (γ, Sn) reaction cross section;**
- competition of partial reactions based on theoretical model.**

Theoretically calculated transitional multiplicity functions

$$F_i^{\text{theor}} = \sigma^{\text{theor}}(\gamma, \text{in}) / \sigma^{\text{theor}}(\gamma, Sn)$$

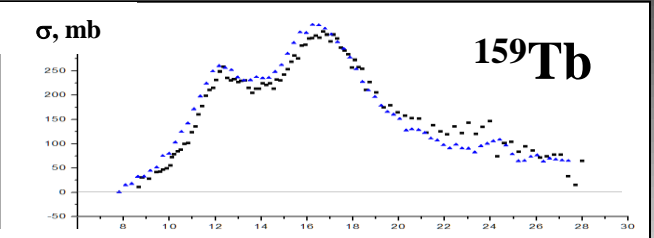
are used for cross section evaluation by following way

$$\sigma^{\text{eval}}(\gamma, \text{in}) = F_i^{\text{theor}}(\gamma, \text{in}) \bullet \sigma^{\text{exp}}(\gamma, Sn).$$

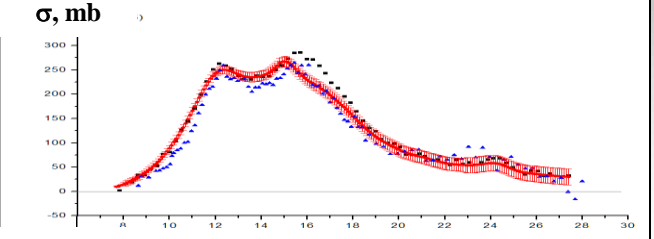
Such evaluation method means that competition of partial reactions is described by model and their correspondent sum is equal to the experimental (γ, Sn) reaction cross section.



$\sigma(\gamma, xn)$

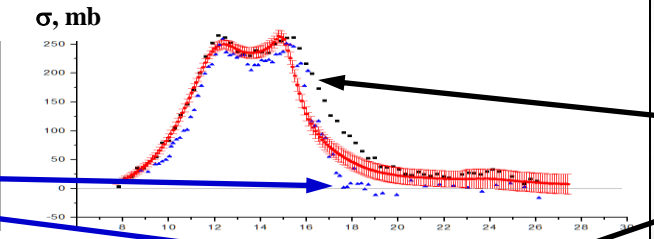


$\sigma(\gamma, Sn)$



$^{91,94}\text{Zr}$, ^{15}In , $^{116-124}\text{Sn}$, ^{159}Tb ,
 $^{186-192}\text{Os}$, ^{181}Ta , ^{197}Au , ^{208}Pb ,
 ^{209}Bi

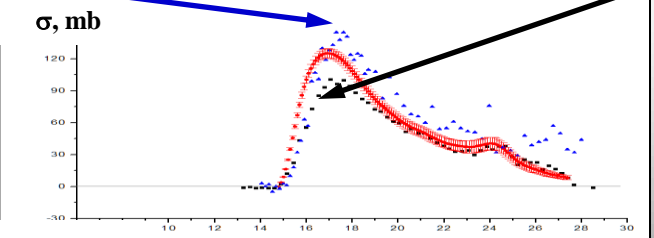
$\sigma(\gamma, 1n)$



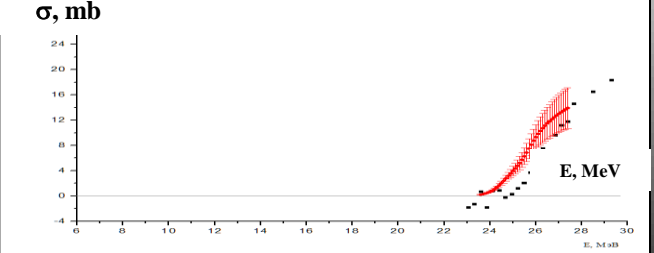
Livermore
data

Saclay
data

$\sigma(\gamma, 2n)$

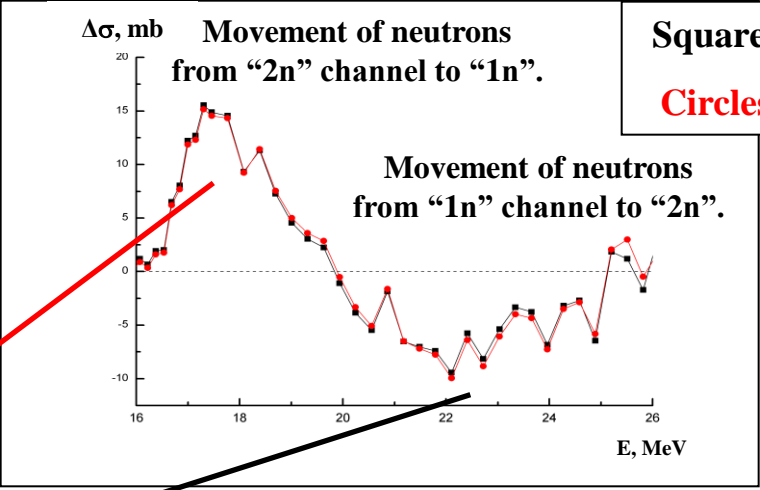
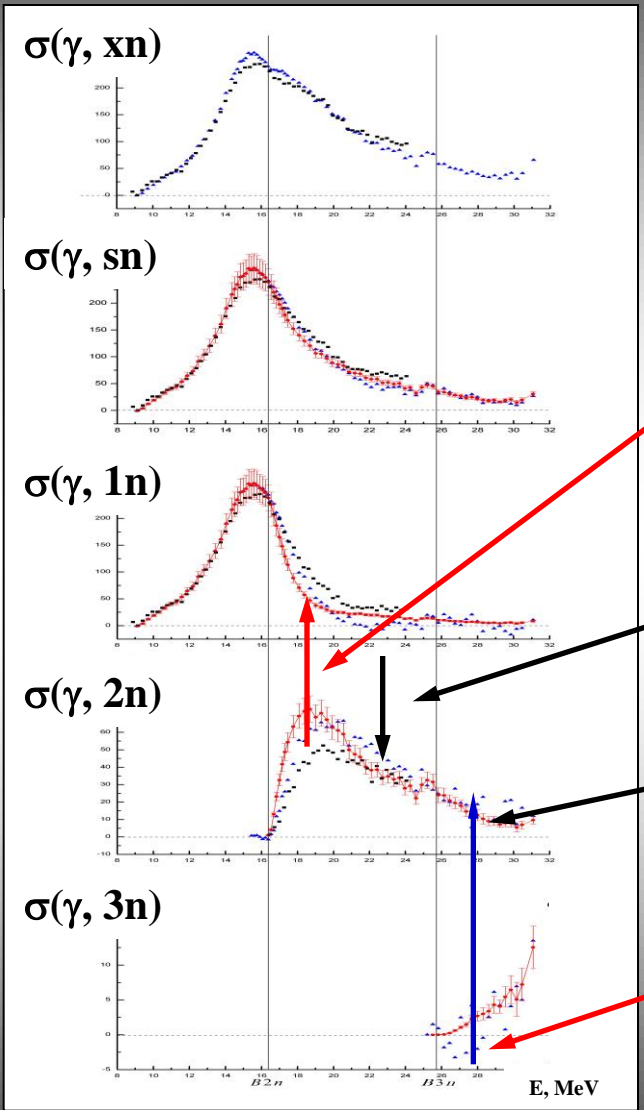


$\sigma(\gamma, 3n)$



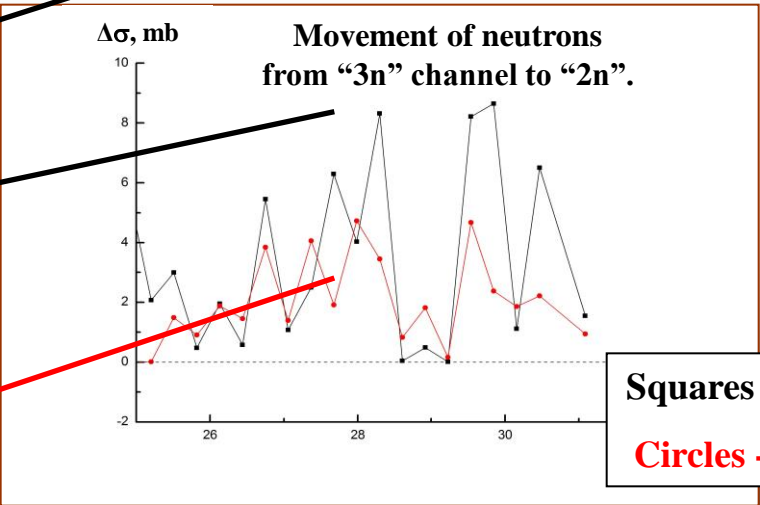


Comparison of *evaluated* and experimental (Saclay, Livermore) reaction cross sections for ^{115}In .

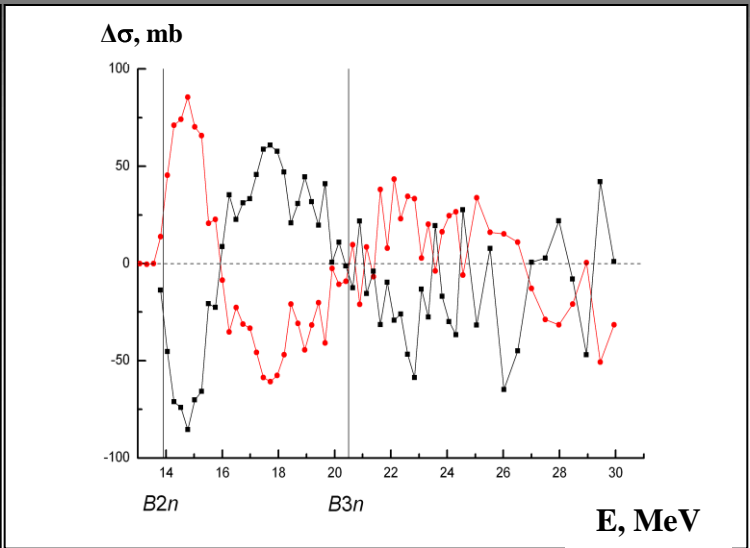
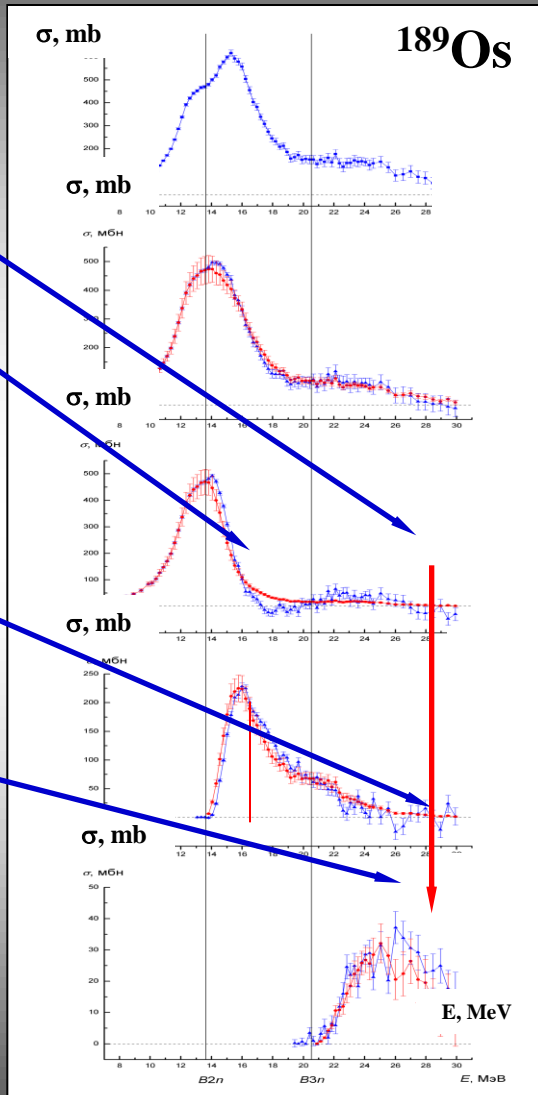
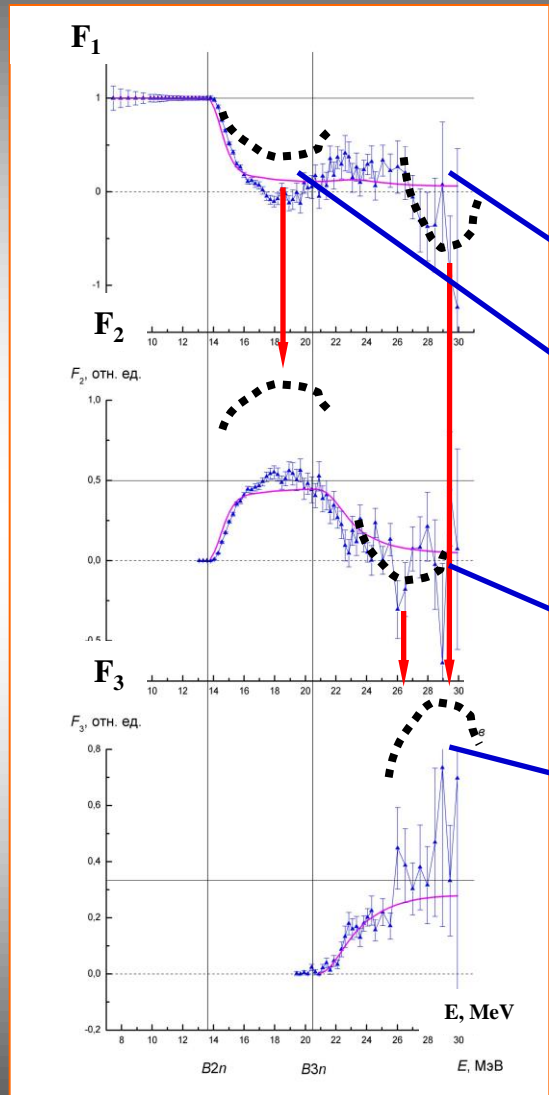


Squares - $[\sigma^{\text{exp}}(\gamma, 1n) - \sigma^{\text{eval}}(\gamma, 1n)]$
 Circles - $[\sigma^{\text{eval}}(\gamma, 2n) - \sigma^{\text{exp}}(\gamma, 2n)]$

That means that erroneous moving some number of neutrons from “1n” channel to “2n” decrease $(\gamma, 1n)$ cross section down to physically forbidden negative values and at the same time increase F_2 up to not reliable values “> 0.50”.
 The analogous is the situation for “2n” and “3n” channels.



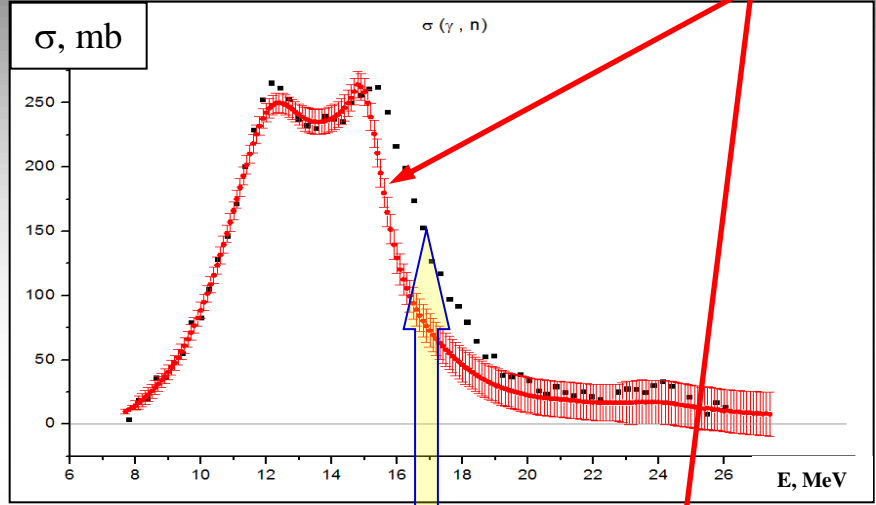
Squares - $[\sigma^{\text{exp}}(\gamma, 2n) - \sigma^{\text{eval}}(\gamma, 2n)]$
 Circles - $[\sigma^{\text{eval}}(\gamma, 3n) - \sigma^{\text{exp}}(\gamma, 3n)]$



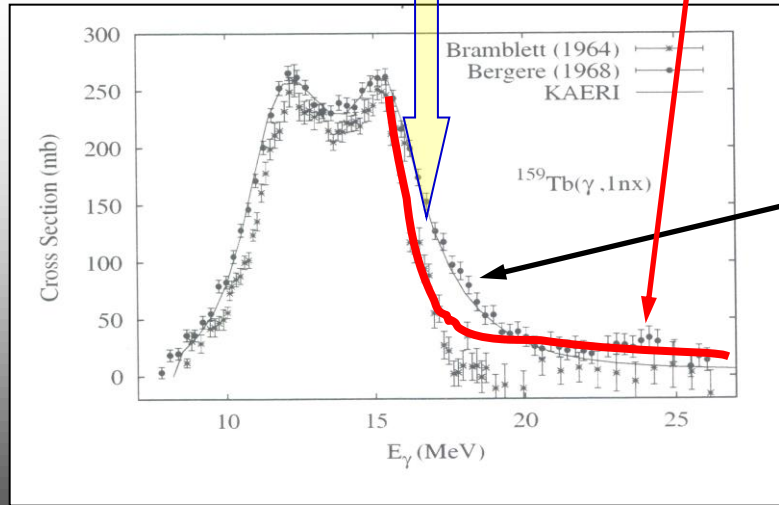
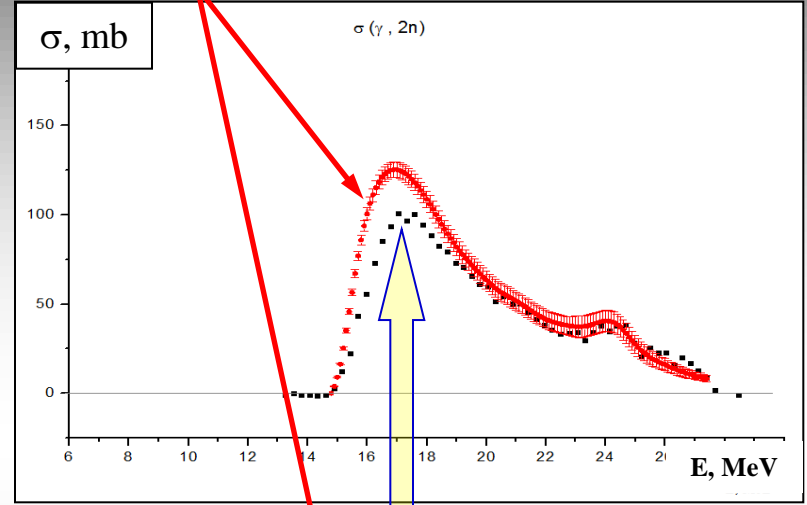
Analogous erroneous moving some number of neutrons from one decay channel to another.



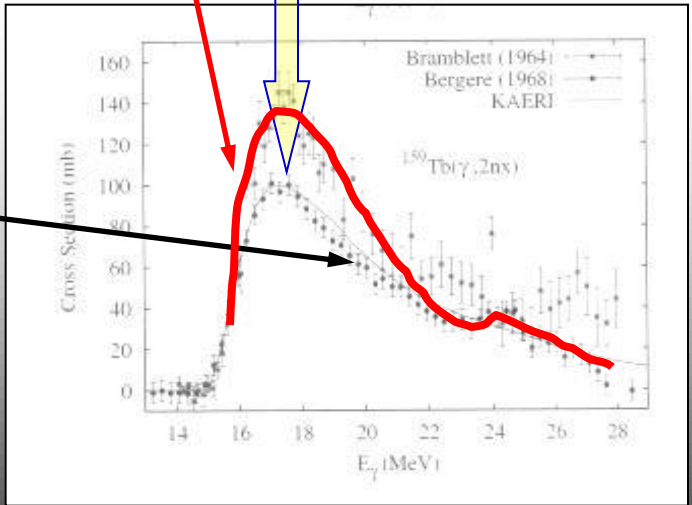
**IAEA CRP (1996 – 1999) evaluations are quite different from
 our evaluations based on F-functions**

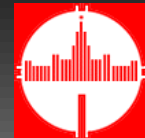


¹⁵⁹Tb



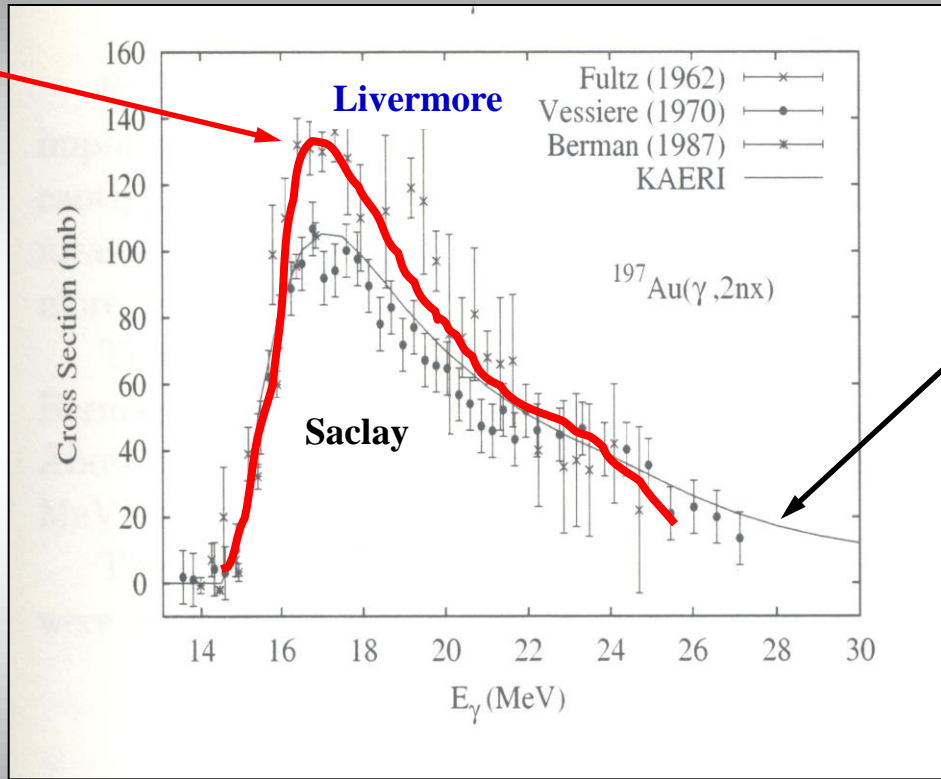
**CRP evaluations
 have been done
 using GUNF and
 GNASH codes in
 order to model
 accurately
 Saclay (gamma, tot)
 data.**



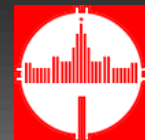


$^{197}\text{Au} (\gamma, 2n)$

**Our evaluations based on F-functions:
 Livermore data are much more reliable.**



Previous CRP evaluation has been done using GUNF and GNASH codes in order to model accurately Saclay (γ, tot) data.



The CDFE has the program of investigation of reliability of experimental photonuclear total and partial reaction cross sections data obtained using various methods.

The correspondent analysis and evaluations were carried out for many nuclei:

$^{91,94}\text{Zr}$, ^{115}In , $^{116-124}\text{Sn}$, ^{181}Ta , $^{186-192}\text{Os}$, ^{197}Au , ^{208}Pb , ^{209}Bi .

Those will be continued for other nuclei in the frame of the IAEA Coordinated Research Project N F41032 (Research Contract N 20501).

Evaluated data will be presented at the International Conference on Nuclear Data for Science and Technology (Bruges, Belgium, 11-16 September, 2016) .

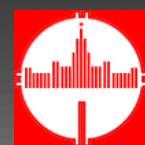
Evaluated data are included into the EXFOR database.



CDFE Nuclear Database Service



The main CDFE nuclear database service activities are dissemination of modern international nuclear data for providing Lomonosov Moscow State University (Skobeltsyn Institute of Nuclear Physics, primarily) staff and students and also scientific and educational institutes and organizations of Russian Academy of Science with nuclear data for basic research, education and various applications



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LOMONOSOV MOSCOW STATE UNIVERSITY, SKOBELTSYN INSTITUTE OF NUCLEAR PHYSICS,

CENTRE FOR PHOTONUCLEAR EXPERIMENTS DATA

CENTR DANNYKH FOTUYADERNYKH EKSPERIMENTOV

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What are you looking for?

Database

All known about atomic nuclei and nuclear reactions. Numerical data, graphics, and bibliography

Nuclei and Reactions Unified Digital Information System
[\[description\]](#)
 Last updated: May 6th, 2014

Abundances, atomic masses, mass excesses, binding energies, spin-parities, moments, deformations, decay modes of ground and metastable states, energies of first isobar-analog states

Nucleus Ground and Isomeric State Parameters
[\[description\]](#)
 Last updated: June 15th, 2011

Parameters and features of various nuclear reactions with incident photons, neutrons, charge particles, and heavy ions from the international EXFOR data fund

Nuclear Reaction Database (EXFOR)
[\[description\]](#)
 Last updated: April 14th, 2015

Nucleus state parameters: Energies, spin-parities half-times (decay modes), metastabilities, isospins, angular momenta, spectroscopic strengths, etc.; α -, β -, γ -transition parameters; Energies, intensities, multipolarities, branching ratios, mixing ratios, etc.

Complete Nuclear Spectroscopy Database "Relational ENSDF"
[\[description\]](#)
 Last updated: May 6th, 2014

Quadrupole deformation parameters; quadrupole moments; charge radii

Chart of Nucleus Shape and Size Parameters
[\[description\]](#)
 Last updated: April 4th, 2015

Reference-bibliography information on articles concern physics of atomic nuclei and nuclear reactions: Author, title, year, full reference, keywords etc...

Nuclear Physics Publications ("NSR" Database)
[\[description\]](#)
 Last updated: March 1th, 2014

Energies, amplitudes, widths, integrated cross sections and moments of Giant Dipole Resonances

Chart of Giant Dipole Resonance Main Parameters
[\[description\]](#)
[\[guide \(in Russian\)\]](#)
 Last updated: September 27th, 2011

Nuclear, reactions, energies, angles, abstracts (in codes), references, authors

Photonuclear Data Index since 1955
[\[description\]](#)
 Last updated: June 2nd, 2005

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Calculator and Graph Engine for Atomic Nuclei Parameters and Nuclear Reactions and Radioactive Decays Features
[\[description\]](#)
 Last updated: March 22th, 2010

Reaction energy, threshold, binding energy, decays

Chart of Atomic Nuclei
 Last updated: March 19th, 2013
 Atomic Nuclei. Main Characteristics (in Russian)

$T_{1/2}$ decay mode

Low Energy Isomer Transition Internal Conversion Probabilities
[\[description\]](#)
 Last updated: May 15th, 2002

Low energy isomer transition internal conversion probabilities

CAJAD Charged Particle Reaction Cross Sections Catalogue
[\[description\]](#)
 Last updated: December 28th, 2000
 Contains obsolete data. Please use EXFOR instead.

p -, d -, t -, ^3He -, α -, and HI-induced reactions yields and cross sections

Together with SINP [Division of the atomic nuclear physics \(DANP\)](#)

Wave functions of atoms and ions, He-like, Li-like, excited states, cross sections, variational method, matrix elements, single and double ionization, charge transfer, two bound electrons, hydrogenic wave functions, minimum of the energy, Hylleraas, Slater, Hartree - Fock, one-electron amplitude

Wave Function Value Database
[\[description\]](#)
 Last updated: February 15th, 2015

Charge-Changing Cross Sections in Ion-Atom Collisions
[\[description\]](#)
 Last updated: February 15th, 2015

Charge-Changing Cross Sections, Electron Capture Cross Section, Electron Loss Cross Sections.

EXFOR, ENSDF, and NSR databases are based on the international data sources (USA NNDC and NSDD) but have original Search Engines.



Technical Meeting on the International Network of Nuclear Reaction Data Centres

Nuclear Reaction Database (EXFOR)
 [Direct Geometry]
 Inverse Geometry

The source of data is the EXFOR fund prepared and maintained by the [Nuclear Reaction Data Centres Network](#).

Each field in this form is optional - may be blank.

Number ENTRY / SUBENTRY M0025 - M0040
 A0075002 - A0080012
 C0128, L0028002

Reaction

Target Nucleus :
 Z (digits) or Chemical symbol (letters) and Mass number (digits)
 Z or Symbol : Y A : 89

Incident Particle :
 D Deuterons
 E Electrons
 G Gammas
 HE3 He-3
 KN Kaons, negative
 or **Ions** Sequence : Be-8, Pb-208, L...

Inc-Source :
 Source of the incident particle beam
 any
 A-RE Alpha-Beryllium
 ARAD Annihilation radiation
 ATOMI Atomic beam source
 BRST Bremsstrahlung

Outgoing Particle / Process :
 any
 O No outgoing particle
 A Alphas
 B- Decay Beta-
 D Deuterons
 or **Sum** (e.g., n + p)

Product Nucleus :
 Z (digits) or Chemical symbol (letters) and Mass number (digits)
 Z or Symbol : A :

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cdfe.sinp.msu.ru/exfor/index.php

Quantity :
 Reaction parameter

Energy / Angle range :
 Low limit (X-min) : any
 High limit (X-max) : ADEG
 AMIN

Status :
 Various types of information
 any
 APRVD Approved by author
 COREL Data correlated with another data set
 CPX Data taken from data file of McGowan, et al.
 CURVE Data read from a curve

Angular correlation
Angular distributions, general
Angular distributions, partial reactions
Double differential data
Energy/momenta/mass correlation (photonuclear data)
Fission fragment data
Fitting coefficients
Integral cross sections, general
Integral cross sections, partial
Nuclear quantities
Outgoing energy spectra
Polarisation of outgoing particles
Product yields
Resonance parameters
Special quantities
Special quantities for scattering
Thick target yields
Triple differential data
 SFS: SFG: SF7: SFB: SFG:
 branch parameter hot/self-evident/particle modifier data-type

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Methodic

Method :
 any
 ABSFY Absolute fission yield measurement
 ACTV Activation
 AMS Accelerator mass spectrometry
 ASEP Separation by mass-separator

Facility :
 any
 BETAT Betatron
 COW Cockcroft-Walton accelerator
 CDFP Fast chopper
 CHOPS Slow chopper

Detector :
 any
 BF3 Boron Trifluoride neutron detector
 BGO Bismuth-Germanate crystal detector
 BPAIR Electron-pair spectrometer
 CEREN Cerenkov detector

Bibliography

Reference :
 Type, code and year of publication
 Code : [help](#)
 Year : 1999 1965 1975 1948, 1965, 1997

Author :
 Name of any author of publication
 Institute(s) at which experiment was performed
[help](#)

Number of subentries founded / page 50

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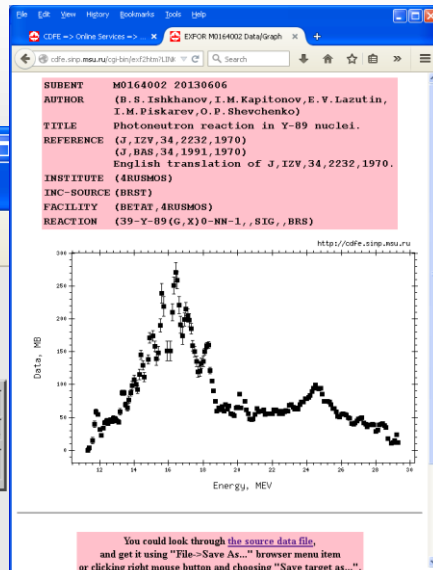
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CDFE search engine.

cdfe.sinp.msu.ru/cgi-bin/exfV3.cgi?entry=&ztarg=

Recordings from 1 to 1

Subent	First Author	Reference (+ NSR)	Target Nucleus	Reaction <small>*means combination</small>	Final Nucleus	Quantity	Field of Measurement		
							Unit	Minimum	Maximum
<input type="checkbox"/> M0164002	B.S.Ishkhanov+	J,IZV,34,2232,1970	39-Y-89	(G,X)	0-NN-1	SIG_BRS	MEV	11.3	29.3



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CDFE => Online Services => ... x

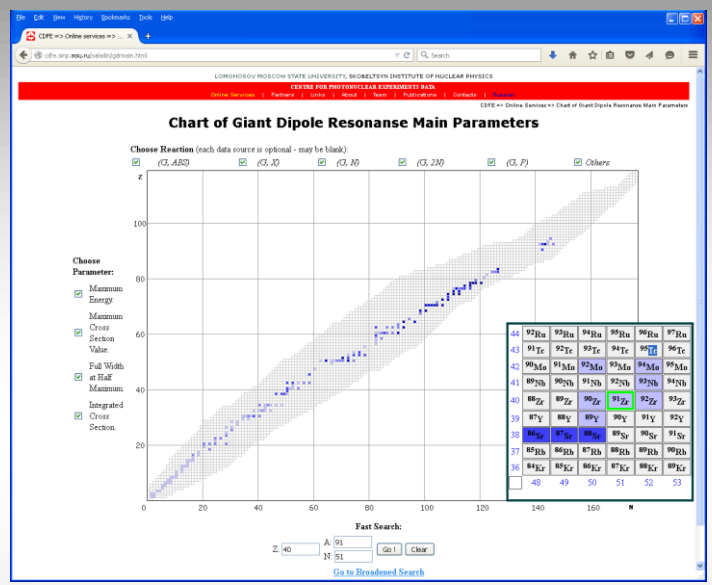
cdfe.sinp.msu.ru/cgi-bin/exfV3.cgi?entry=&ztarg=

SUBENT	First Author	Reference (+ NSR)	Target Nucleus	Reaction	Final Nucleus	Quantity	Field of Measurement
M0164001	20130606						
BIB	13	15					
TITLE	Photoneutron reaction in Y-89 nuclei.						
AUTHOR	(B. S. Ishkhanov, I. M. Kapitonov, E. V. Lazutin, I. M. Piskarev, O. P. Shevchenko)						
INSTITUTE	(4RUSMOS)						
REFERENCE	(J, IZV, 34, 2232, 1970)						
	(J, BRS, 34, 1991, 1970)						
	English translation of J, IZV, 34, 2232, 1970.						
FACILITY	(BETAT, 4RUSMOS)						
INC-SOURCE	(BRST)						
METHOD	(EXTB, SITA)						
DETECTOR	(BFS)						
COMMENT	Photoneutron yield curve was measured in energy region of gamma-quanta from the threshold to 29 MeV with step 0.1 MeV.						
ANALYSIS	(FIA) Cross section was calculated from the yield curve by Pentio-Lelas method with the step 0.2 MeV in energy range up to 16 MeV, 0.5 MeV in energy range 16 - 21 MeV and 1 MeV for energies higher than 21 MeV.						
ERR-ANALYS	(DATA-ERR) Root-mean-squared errors.						
STATUS	(CURVE)						
HISTORY	(19870610C) Corrected by V.Varlamov, V.Molane. (20110604A) Corrected by V.Varlamov, REFINANCE, FACILITY, REACTION, DATA-ERR, dates, lowercase.						
ENDBIB	0						
ENDSUBENT	25						
SUBENT	M0164002 20130606						
BIB	2						
REACTION	(39-Y-89(G, X)0-NN-1, SIG, BRS)						
HISTORY	(20130604A) Corrected by V.Varlamov: BRS -> BRS.						
ENDBIB	2						
ENDSUBENT	0						
DATA	4 173						
EN	RB						
MEV	RB						
11.3	0.						
11.4	3.3 0.2						
11.6	15. 0.2						
11.7	40. 0.2						
11.8	59. 4. 0.2						
11.9	55. 1. 0.2						
12.0	32. 1. 0.2						
12.1	22. 1. 0.2						
12.2	34. 3. 0.2						

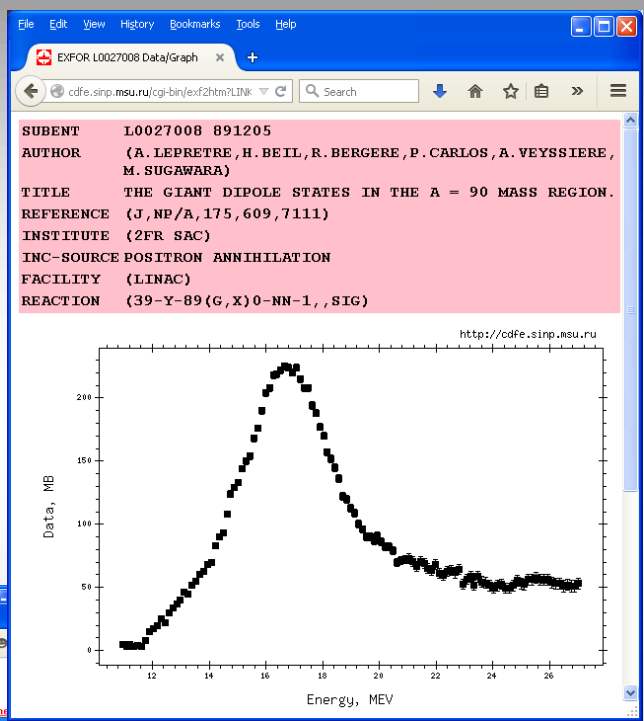


Technical Meeting on the International Network of Nuclear Reaction Data Centres

“Chart of Giant Dipole Resonance Main Parameters”:
 data on main parameters (energy position, amplitude, width, integrated cross section) of GDR



⁸⁹Y



CDFE search engine, Giant Dipole Resonance Parameters Data Base.

The 18 following data sets matched to your request...

EXFOR SUBENT Number	Target ZSymbol	Target A	Reaction	Final ZSymbol	Final A	Maximum Energy (MeV)	Maximum Cross Section Value (mb)	Full Width at Half Maximum (MeV)	Integration Energy Limit (MeV)	Integrated Cross Section (MeV * mb)	First Moment of Integrated Cross Section (mb)	Reference	NSR keyno	First Author
m0550012	39-Y	89	G,ABS			16.8	234.4	4.4	23.9	1144.8	62.5	J,IZV67 696-2003		V.V.VARLAMOV+
m0550014	39-Y	89	G,X			16.65	228	4.2	26.95	1409	78.9	J,YK,1-2,46-2003		V.V.VARLAMOV+
L0027008	39-Y	89	G,N			16.669	225	4.5	27	1427				
	39-Y	89	G,N			16.3	191	4	23	670				
	39-Y	89	G,N			16.685	184.5	4.5	28	1158				
	39-Y	89	G,N			17	215	3.7	30	1504.7				
	39-Y	89	G,N			16.4	271	3.7	30	1504.7				
	39-Y	89	G,N			15.6	238	3.7	30	1504.7				
	39-Y	89	G,N	39-Y	88	17.118	211.31	4	18.1	641				
	39-Y	89	G,N	39-Y	88	16.685	184.3	4.5	28	960				
	39-Y	89	G,N	39-Y	88	16.669	225	4.5	27	1279				
	39-Y	89	G,N*	39-Y	88	16.9	222.3	4.9	27	1204.4				
	39-Y	89	G,N*	39-Y	88	16.665	184.3	4.5	28.1	962.9				
	39-Y	89	G,N*	39-Y	88	16.669	225	4.5	27.02	1280.9				
	39-Y	89	G,N	39-Y	88	17.118	211.31	3.7	18.092	612.6				
	39-Y	89	G,N	39-Y	87	25.386	18.3	8	27	74				
m0550003	39-Y	89	G,P	38-Si	88	22	20.26	15	24	144				
m0550003	39-Y	89	G,P	38-Si	88	17	18.43	15	24	144				

1 documents found (from 1 to 1 Visible).

“1971LE28” search results:

Get All Data

NSR KEYNO: 1971LE28

REFERENCE: Nucl Phys A175, 609 (1971) (NSR code JOUR.NUCL.A175.609)

AUTHORS: A.Lepretre, H.Beil, R.Bergere, P.Carlos, A.Veyssiere, M.Sugawara

TITLE: The Giant Dipole States in the A = 90 Mass Region

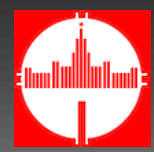
KEYWORDS: NUCLEAR REACTIONS 89, Si, (+69) Y, (+90) Zr, (+93) Nb, (d, p), (p, n), E=10-26 MeV, measured j(0), deduced integrated j(0), Lorentz line parameters, proposed integrated j(0), (10^4) Natural targets for 89, 89, 89 Enriched (+90) Zr target

SELECTS: TRB:A TSL:A T89Y:A T90Zr:A T93Nb:A R(G,5)A N89Y:A N89Zr:A N93Nb:A R(G,5)A N87Y:A N88Zr:A N91Nb:A M SIGMAint(A) M DSIGMAint(A) D SIGMAint(A) A D PARAMETERint(A) X OTHER(A)

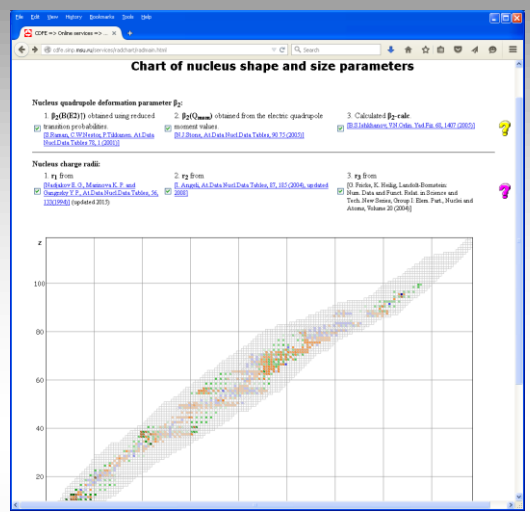
DOI: 10.1016/0575-9474(71)90454-4

Link to EXFOR >>

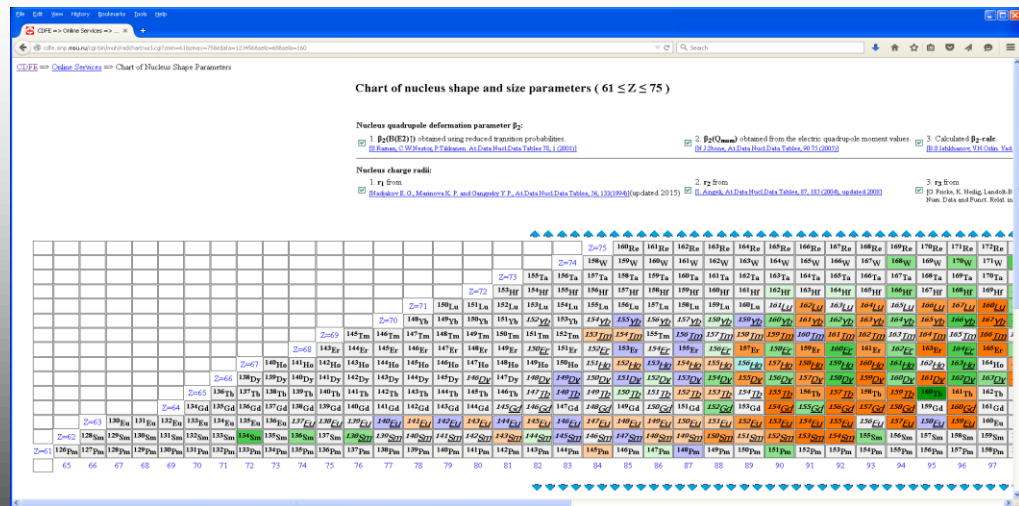
6/13/2016



“Chart of Nucleus Shape and Size Parameters”:
data on quadrupole moments, parameters of quadrupole deformation and charge radii



^{165}Ho



^{165}Ho ($Z=67$)

Chart of nucleus shape and size parameters

$\beta_2(Q_{\text{mom}})$

Parameter	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6
Q-moment (barn) for 7/2 ⁻ state at E = 0.000 MeV:	$+3.49 \pm 0.03$	3.58 ± 0.02	$+2.716 \pm 0.009$	3.6 ± 0.02	3.41 ± 0.08	3.53 ± 0.08
$\beta_2(Q_{\text{mom}})$	$+0.322 \pm 0.019$	0.33 ± 0.018	$+0.251 \pm 0.013$	0.332 ± 0.018	0.315 ± 0.023	0.326 ± 0.024
NSR Reference:	1976Po05/1974Da10	1983O103	1982Bu13	1981Ba07	1981Ba07	1978Eb01
Journal Reference:	NP A262 493 (76)/ZP 267 229 (74)	NP A403 572 (83)	ZP A307 193 (82)	NP A355 383 (81)	NP A355 383 (81)	NP A296 493 (78)

β_2 -calc

Parameter	Data
β_2 -calc:	$+0.306 \pm 0$

Nucleus radii

Parameter	r_1	r_2	r_3
Radius (fm):	5.2022 ± 0.0308	5.2022 ± 0.0312	5.19
NSR Reference:	1989AL27		
Journal Reference:	G.D. Alkharov et al., NP A504, 549 (1989)		

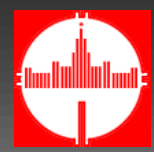
1 documents found (from 1 to 1 Visible).

"1981Ba07" search results:

Get All Data

NSR KEYNO	1981Ba07
REFERENCE	Nucl Phys. A 355, 383 (1981) (NSR code: JOUR NUPAB 355 383)
AUTHORS	C.J.Batty, S.F.Biagi, R.A.J.Riddle, B.L.Roberts, G.J.Pyle, G.T.A.Sauser, D.M.Asbury, A.S.Clough
TITLE	Nuclear Quadrupole Deformation Effects on Pionic and Kaonic X-Rays
KEYWORDS	NUCLEAR MOMENTS In, Ho, (+168) Er, Yb, Ta, Bi; measured pionic X-rays, hfs; Ho, Yb, Ta measured kaonic X-rays, hfs; deduced strong interaction shifts, widths In, Ho, Ta deduced quadrupole moments. Deformed optical model calculations.
SELECTRS	NINA, NHO, A N168ER, A NYE, A NTA, A NBLA, MX-RAYS[desc], A HYPERFINE[desc], A CX-RAYS[desc], A XHYPERFINE[desc], A D-OTHER, A NINE, NHO, B, NTA, B, D MULTIPOLE[desc], B, D QUADRUPOLE[desc], B.
DOI	10.1016/0375-9474(81)90534-0

6/13/2016



“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)

LOMONOSOV MOSCOW STATE UNIVERSITY, SKOBELTSYN INSTITUTE OF NUCLEAR PHYSICS

CENTRE FOR PHOTONUCLEAR EXPERIMENTS DATA

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CDFE => Online Services => Nucleus Ground and Isomeric States Parameters Search Engine

The source of data is the [Nuclear Wallet Cards](#) database prepared and maintained by the USA NNDC.
 Each field in this form is optional - may be blank. [\[Click here for help... \]](#)

Search for: **Examples**

Z: 12 | 10;Pb | Ag-Sn;10-14
 A: 16 | 13;24;98 | 4-65

[Show nuclear moments/deformations for selected nuclei](#)

Dataset:
 all known isotopes stable only only natural

Metastable states:
 exclude include only metastable

T_{1/2}: | 30y-300y | > 12d | <= 10m

Output fields:

<input checked="" type="checkbox"/> Abundance	<input checked="" type="checkbox"/> Atomic mass
<input checked="" type="checkbox"/> J ^π	<input checked="" type="checkbox"/> Mass excess
<input checked="" type="checkbox"/> Decay mode	<input checked="" type="checkbox"/> Binding energy

Select [all](#) / [none](#)

[Click here to submit query! See another window for results!](#)

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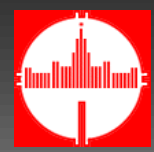
Nucleus Ground and Isomeric States Parameters - results

⁸²Pb

The source of data is the current version of [Nuclear Wallet Cards](#) database prepared and maintained by the USA NNDC [\[See description \]](#)

A	JP	T _{1/2} , G, Abundance	Atomic Mass M, Micro-U	Atomic Mass M, MeV	Mass Excess M-A, MeV	Nucleus Mass, MeV	Binding Energy, MeV	BE, MeV	B _n , MeV	B _p , MeV	Qβ-, MeV	Qβ+, MeV	Qα, MeV	Qα, MeV	Decay Modes	Ground State Isospin T ₀ = (N-Z)/2	First T ₁ State Energy = T ₀ + 1, MeV
Pb - Lead - Свинец																	
178	0+	0.23 mc	178.003830 ±0.000026	165809.500 ±7.691	3.568 ±24.000	165767.598	1368.998 ±0.026	7.691	0.000	0.391	7.296	8.318	7.790		g, g?	7	
179		3 mc	179.002147 ±0.000215	166739.426 ±7.702	2.000 ±200.000	166697.524	1378.637 ±0.215	7.702	9.640	0.539	9.278	10.300	7.566		g?	15/2	
180	0+	4.5 mc	179.997918 ±0.000023	167666.981 ±7.726	-1.939 ±21.000	167625.079	1390.648 ±0.023	7.726	12.011	0.928	6.439	7.461	7.415		g ≤100%	8	
181	(13/2+)	45 mc	180.996629 ±0.000097	168597.274 ±7.734	-3.140 ±90.000	168555.372	1399.920 ±0.097	7.734	9.273	1.029	8.639	9.661	7.215		g <100%	17/2	
182	0+	55 mc	181.992672 ±0.000015	169525.082 ±7.756	-6.826 ±14.000	169483.180	1411.678 ±0.015	7.756	11.758	1.314	5.502	6.524	7.066		g ≤100%	9	
183	(3/2-)	536 mc	182.991873 ±0.000032	170455.832 ±7.762	-7.570 ±30.000	170413.930	1420.494 ±0.032	7.762	8.816	1.509	7.995	9.017	6.925		g ≈90%	19/2	

[RETURN TO CDFE](#)



“Calculator and Graph Engine for Atomic Nuclei Parameters and Nuclear Reactions and Radiative Decays

Features:

many useful data for “Nucleus Binding Energies”, “Nucleons and Nuclei Separation Energies”, “Decays Energies”, “Decays Energies”, “Nuclei fission”.

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cdfe.sinp.msu.ru/services/calc_thr/calc_

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 CDFE => Online Services => Calculator and Graph Engine for Atomic Nuclei Parameters and Nuclear Reactions and Radioactive Decays Features

Calculator and Graph Engine for Atomic Nuclei Parameters and Nuclear Reactions and Radioactive Decays Features

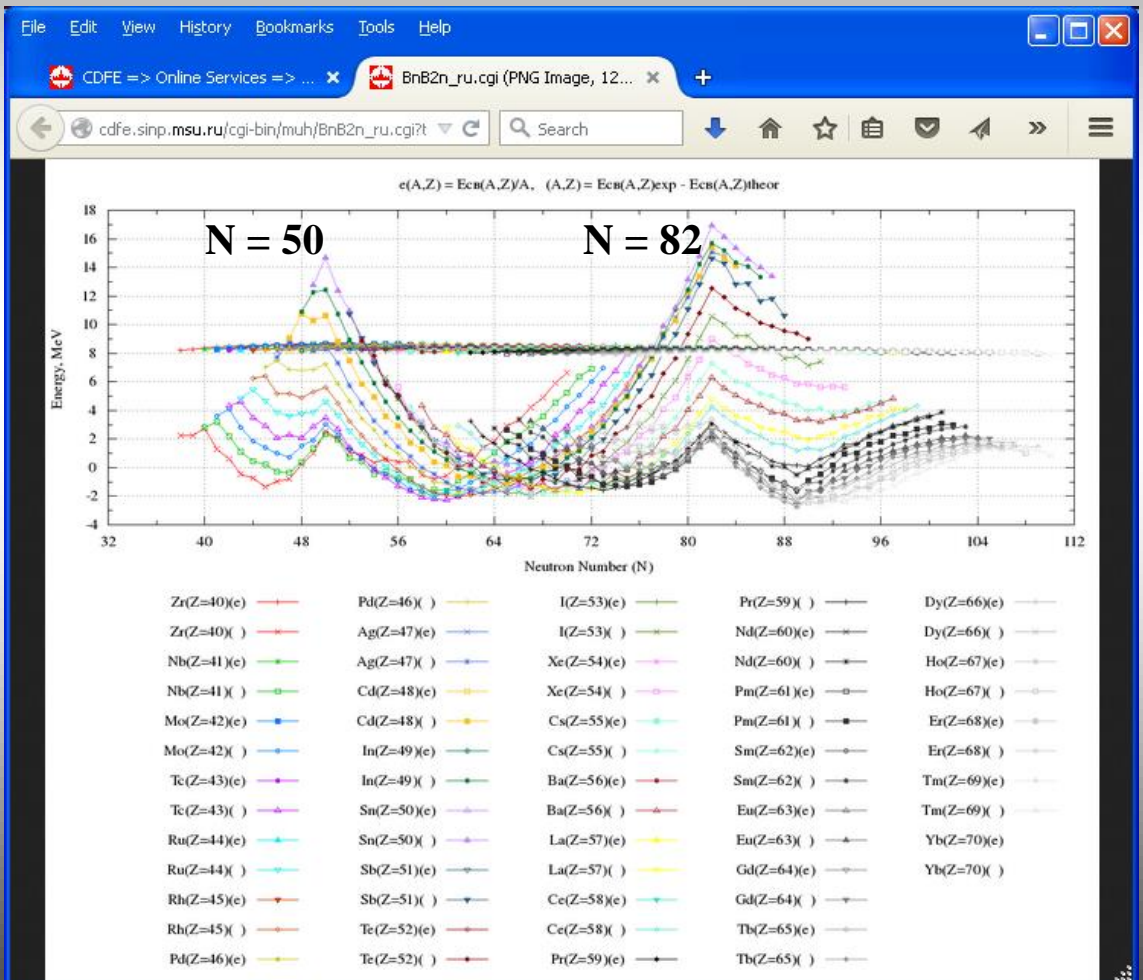
The source:
 current version (July 2010)
 "Nuclear Wallet Cards"
 USA National Nuclear Data Center - NNDC

1. Nucleus Binding Energies

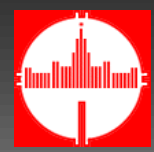
Each field in this form is optional - may be blank. [Help...]

Input parameters	
Z:	<input type="text" value="40-70"/> Example: 20, 40-60
N:	<input type="text"/> Example: 20, 40-60
A:	<input type="text"/> Example: 20, 40-60
Calculation Versions:	<input type="checkbox"/> Binding Energy
	<input checked="" type="checkbox"/> (Binding Energy)/A
	<input checked="" type="checkbox"/> Binding Energy(exp) - Binding Energy(theor)
Abscissa:	<input type="radio"/> Z <input checked="" type="radio"/> N <input type="radio"/> A

Calculate Create Graph Clear ALL



6/13/2016



“Calculator and Graph Engine for Atomic Nuclei Parameters and Nuclear Reactions and Radiative Decays

Features:

many useful data for “Nucleus Binding Energies”, “Nucleons and Nuclei Separation Energies”, “Decays Energies”, “Decays Energies”, “Nuclei fission”.

2. Nucleons and Nuclei Separation Energies

Each field in this form is optional - may be blank. [Help...]

Input parameters	
Z:	<input type="text" value="55,57,59,61,63,65"/> Example: 20, 40-60
N:	<input type="text"/> Example: 20, 40-60
A:	<input type="text"/> Example: 20, 40-60
Separation Versions:	<input type="text" value="2n"/> Examples: n, 2n, 2d, 160+2+n, n+p, 13C+α, 62Ni, 13C+1H
Nuclei Selection:	<input checked="" type="radio"/> All nuclei <input type="radio"/> Only even <input type="radio"/> Only odd
Abscissa:	<input type="radio"/> Z <input type="radio"/> N <input type="radio"/> A

Calculate Create Graph Clear ALL

3. Decays Energies

Each field in this form is optional - may be blank.

Input parameters	
Z:	<input type="text" value="85, 87, 89, 91, 93"/> Example: 20, 40-60
N:	<input type="text"/> Example: 20, 40-60
A:	<input type="text"/> Example: 20, 40-60
Decay Type:	<input checked="" type="checkbox"/> α decay <input type="checkbox"/> β ⁻ decay <input type="checkbox"/> β ⁺ decay <input type="checkbox"/> ε (electron capture)
Abscissa:	<input type="radio"/> Z <input checked="" type="radio"/> N <input type="radio"/> A

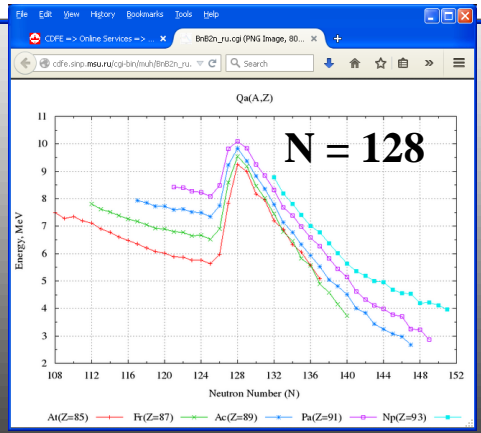
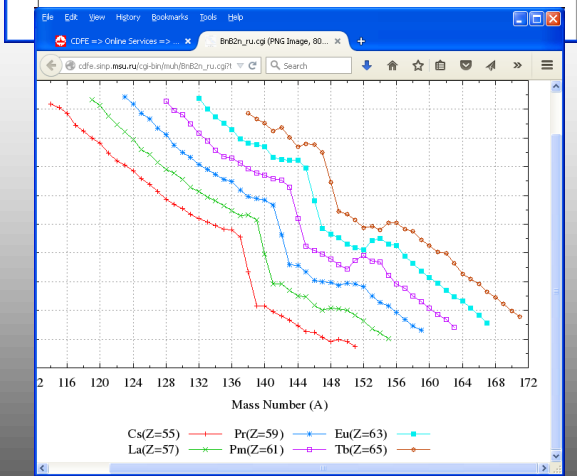
Calculate Create Graph Clear ALL

4. Reactions Thresholds and Energies

Each field in this form is optional - may be blank. [Help...]

Input parameters:	Z:	A:	Number of Particles
Target Nucleus:	<input type="text"/>	<input type="text"/>	1
Incident Particle:	<input type="text" value="No incident particle"/> (for nucleus >>>)		
Outgoing Particle 1:	<input type="text"/>	<input type="text"/>	0
Outgoing Particle 2: (if more particles >>>)	<input type="text"/>	<input type="text"/>	0
Final Nucleus:	0	0	1

Calculate Clear ALL



5. Nuclei fission

Each field in this form is optional - may be blank. [Help...]

Input parameters:	Z:	A:	Number of Particles
Target Nucleus:	<input type="text"/>	<input type="text"/>	1
Incident Particle:	<input type="text" value="No incident particle"/> (for nucleus >>>)		
Selected (by User) Fission Fragment:	<input type="text"/>	<input type="text"/>	1
Defined (by Program) Fission Fragment:	0	0	1
Prompt Particle 1, Accompanied Fission:	<input type="text"/>	<input type="text"/>	0
Prompt Particle 2, Accompanied Fission: (if more particles >>>)	<input type="text"/>	<input type="text"/>	0

Calculate Clear ALL

6/13/2016



Short-term (2016/2017) CDFE Program

The main items of the CDFE (2016/2017) program, main priorities and most important tasks are traditional:

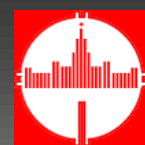
- continuation of photonuclear data compilation using EXFOR format, new TRANSEs (M084, M085, etc.) production;
- correction of old ENTRYs in accordance with new EXFOR coding rule changes and the NRDC Network experts comments and recommendations;
- continuation of joint analysis and evaluation using objective physical criteria of total and partial photonuclear reaction cross sections obtained in various experiments;
- upgrading of all databases put upon the CDFE Web-site (<http://cdfe.sinp.msu.ru>).



**THANKS A LOT
FOR ATTENTION!**

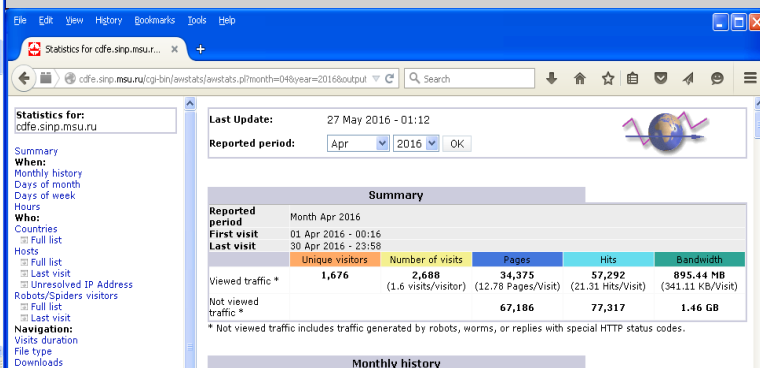
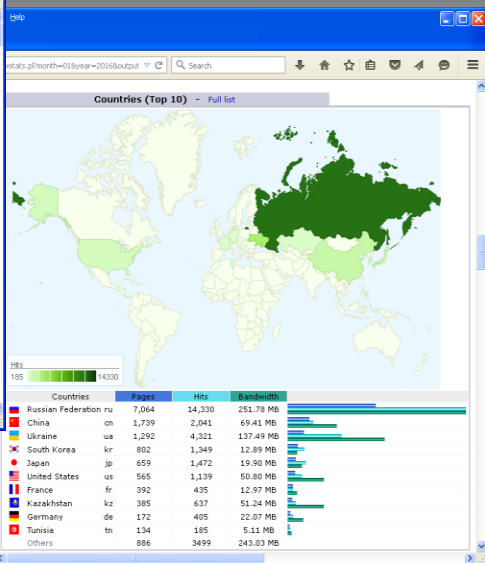
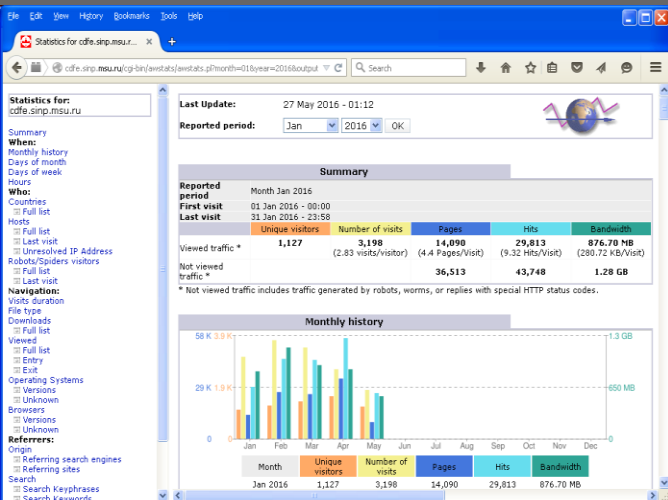
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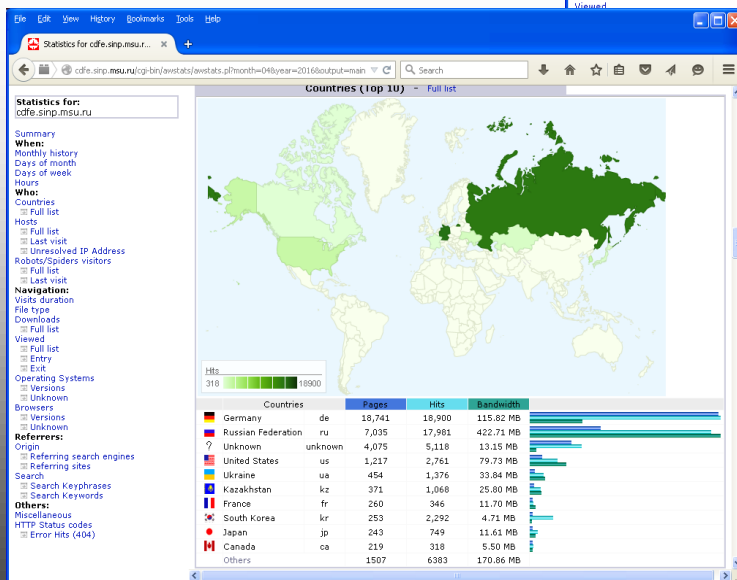
Technical Meeting on the International Network of Nuclear Reaction Data Centres

AWSTATS – Advanced Web Statistics



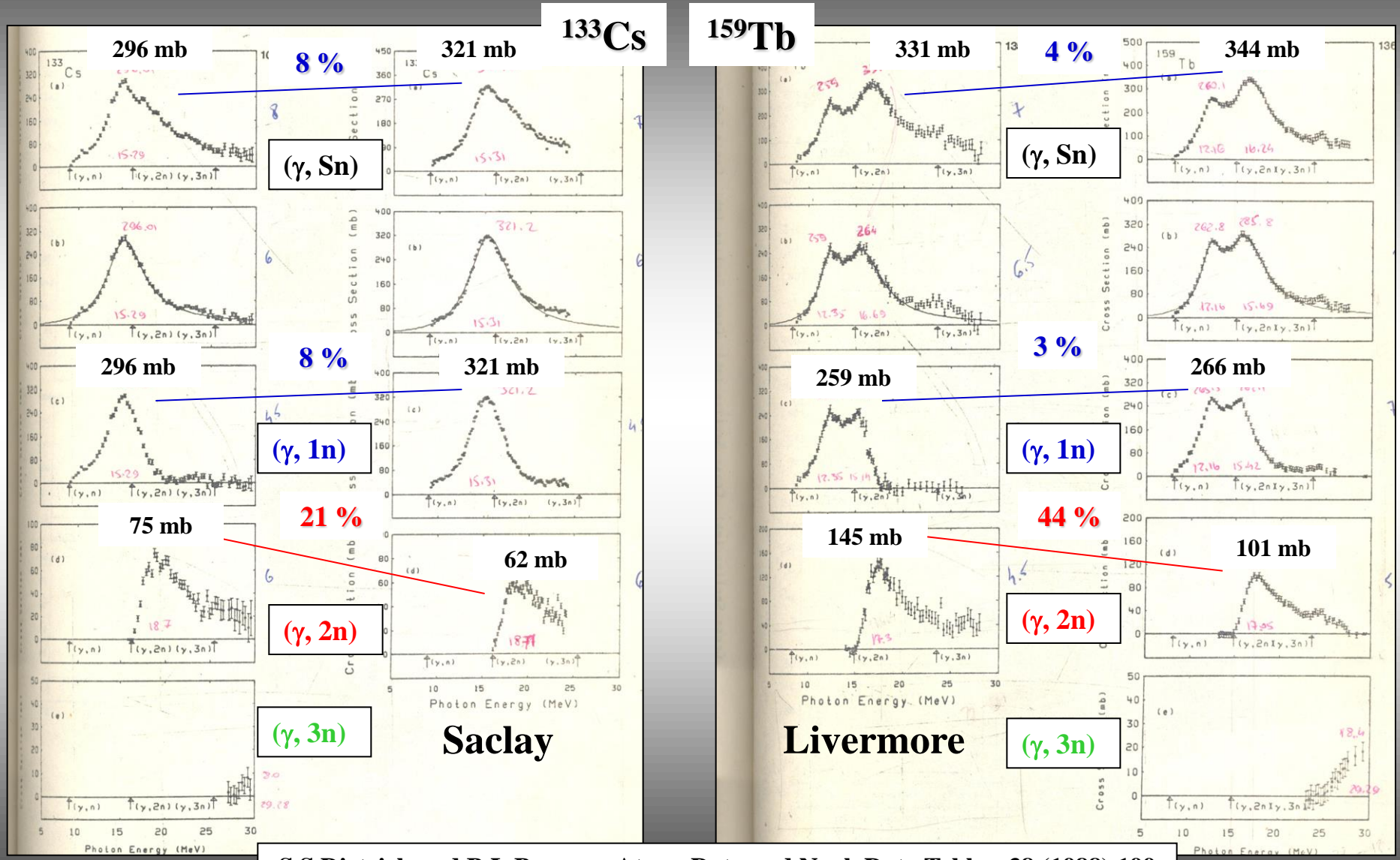
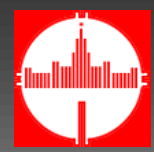
January 2016

April 2016



6/13/2016

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6/13/2016

S.S.Dietrich and B.L.Berman. *Atom. Data and Nucl. Data Tables*, 38 (1988) 199

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