Updates of Reference Input Parameter Library (RIPL)

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Reference Input Parameter Library

RIPL-1 (1998); RIPL-2 (2006); RIPL-3 (2009)

Library of input parameters for use in nuclear reaction calculations for theoretical research and nuclear data evaluation.

Intended for use in nuclear reaction codes used in low energy nuclear reactions:

Incident and outgoing particles: n, p, d, t, 3-He, 4-He, gamma and fission

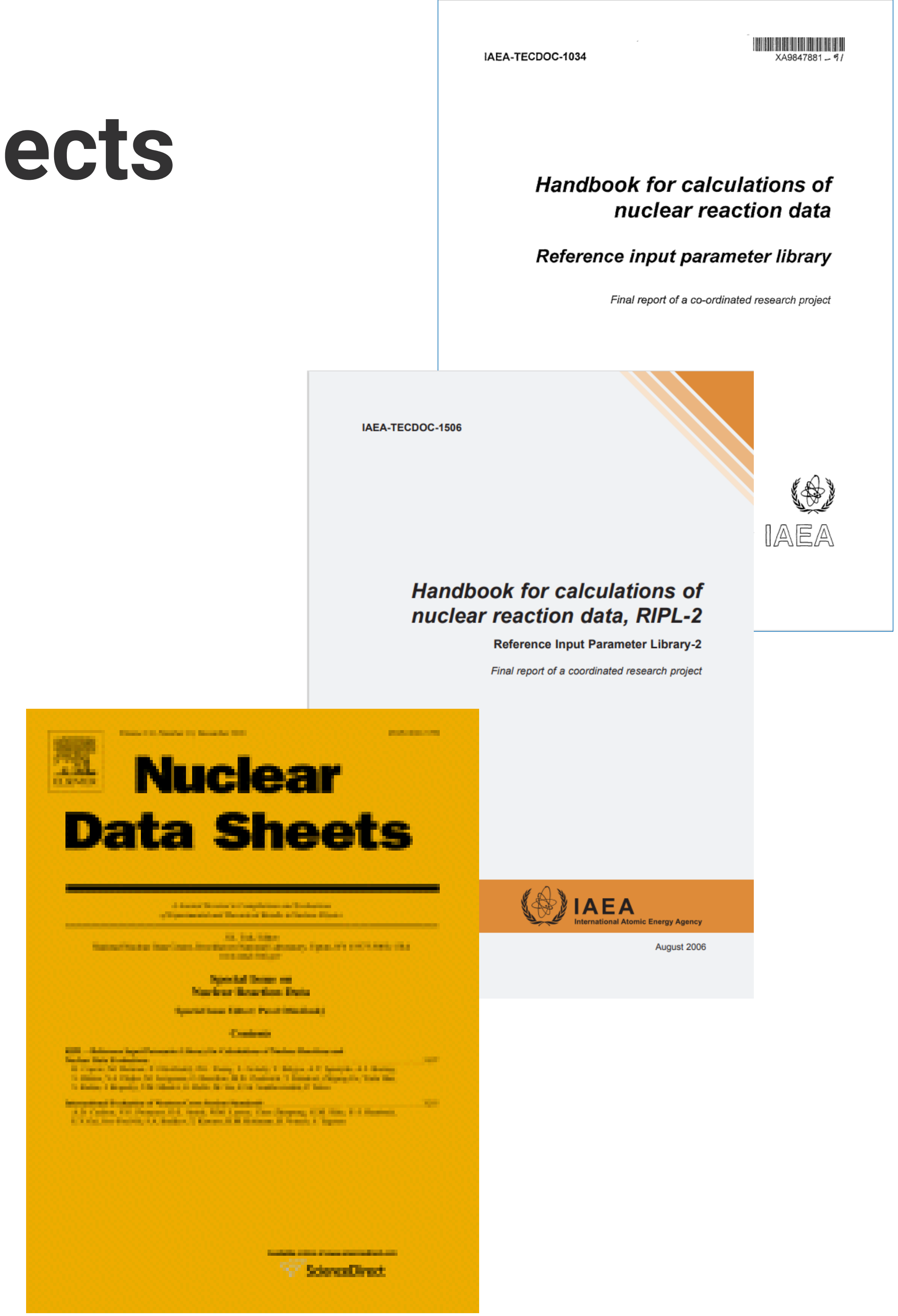
Energies: up to about 100 MeV.

RIPL Coordinated Research Projects

1. CRP on Reference Input Parameter Library: starter file (Phase 1) includes compilation of input parameters collected from various sources (1998) –> RIPL-1

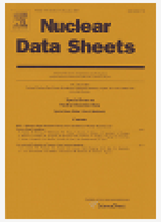
2. CRP on Reference Input Parameter Library (Phase 2) aimed at testing and recommending input parameters (2006) → RIPL-2

3. CRP on Reference Input Parameter Library (RIPL-3): aimed at bringing to completion the testing and validation and recommending input parameters (2009) → RIPL-3



Reference Input Parameter Library (RIPL-3)

R. Capote, M. Herman, P. Oblozinsky, P.G. Young, S. Goriely, T. Belgya, A.V. Ignatyuk, A.J. Koning, S. Hilaire, V.A. Plujko, M. Avrigeanu, O. Bersillon, M.B. Chadwick, T. Fukahori, Zhigang Ge, Yinlu Han, S. Kailas, J. Kopecky, V.M. Maslov, G. Reffo, M. Sin, E.Sh. Soukhovitskii and P. Talou



Nuclear Data Sheets - Volume 110, Issue 12, December 2009, Pages 3107-3214

10 entries of the Optical Model database corrected in December 2010.

Introduction | MASSES | LEVELS | RESONANCES | OPTICAL | DENSITIES | GAMMA | FISSION | CODES | Contacts

Introduction

We describe the physics and data included in the Reference Input Parameter Library, which is devoted to input parameters needed in calculations of nuclear reactions and nuclear data evaluations. Advanced modelling codes require substantial numerical input, therefore the International Atomic Energy Agency (IAEA) has worked extensively since 1993 on a library of validated nuclear-model input parameters, referred to as the Reference Input Parameter Library (RIPL). A final RIPL coordinated research project (RIPL-3) was brought to a successful conclusion in December 2008, after 15 years of challenging work carried out through three consecutive IAEA projects. The RIPL-3 library was released in January 2009, and is available on the Web through *http://www-nds.iaea.org/RIPL-3/*. This work and the resulting database are extremely important to theoreticians involved in the development and use of nuclear reaction modelling (ALICE, EMPIRE, GNASH, UNF, TALYS) both for theoretical research and nuclear data evaluations.

The numerical data and computer codes included in RIPL-3 are arranged in seven segments: **MASSES** contains ground-state properties of nuclei for about 9000 nuclei, including three theoretical predictions of masses and the evaluated experimental masses of Audi *et al.* (2003). **DISCRETE LEVELS** contains 118 datasets (Z from 0 to 117) with all known level schemes, electromagnetic and γ-ray decay probabilities available from ENSDF in April 2014. **NEUTRON RESONANCES** contains average resonance parameters prepared on the basis of the evaluations performed by Ignatyuk and Mughabghab. **OPTICAL MODEL** contains 495 sets of phenomenological optical model parameters defined in a wide energy range. When there are insufficient experimental data, the evaluator has to resort to either global parameterizations or microscopic approaches. Radial density distributions to be used as input for microscopic calculations are stored in the MASSES segment. **LEVEL DENSITIES** contains phenomenological parameterizations based on the modified Fermi gas and superfluid models and microscopic calculations which are based on a realistic microscopic single-particle level scheme. Partial level densities formulae are also recommended. All tabulated total level densities are consistent with both the recommended average neutron resonance parameters and discrete levels. **GAMMA** contains parameters that quantify giant resonances, experimental gamma-ray strength functions and methods for calculating gamma emission in statistical model codes. The experimental GDR parameters are represented by Lorentzian fits to the photo-absorption cross sections for 102 nuclides ranging from ^{51}V to ^{239}Pu. **FISSION** includes global prescriptions for fission barriers and nuclear level densities at fission saddle points based on microscopic HFB calculations constrained by experimental fission cross sections.

Available online at www.sciencedirect.com
ScienceDirect
Nuclear Data Sheets 110 (2009) 3107–3214
Nuclear Data Sheets
www.elsevier.com/locate/nds

RIPL – Reference Input Parameter Library for Calculation of Nuclear Reactions and Nuclear Data Evaluations

R. Capote,[1*] M. Herman,[1,2] P. Obložinský,[1,2] P.G. Young,[3] S. Goriely,[4] T. Belgya,[5] A.V. Ignatyuk,[6] A.J. Koning,[7] S. Hilaire,[8] V.A. Plujko,[9] M. Avrigeanu,[10] O. Bersillon,[8] M.B. Chadwick,[3] T. Fukahori,[11] Zhigang Ge,[12] Yinlu Han,[12] S. Kailas,[13] J. Kopecky,[14] V.M. Maslov,[15] G. Reffo,[16] M. Sin,[17] E.Sh. Soukhovitskii,[15] P. Talou[3]

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[13] *Bhabha Atomic Research Center, Trombay, 400085 Mumbai, India*
[14] *JUKO Research, NL-1817 Alkmaar, The Netherlands*
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[16] *Retired in 1998, Ente Nuove Tecnologie, Energia e Ambiente (ENEA), 40129 Bologna, Italy and*
[17] *Nuclear Physics Department, Bucharest University, 077125 Bucharest-Magurele, Romania*

Update of RIPL after 2009

Performed by segments:

1. LEVELS: updated more frequently – last in 2020 (based on ENSDF+NUBASE)
2. GAMMA SEGMENT: Coordinated Research Project (CRP) on Updating the Photonuclear Data Library and Generating a Reference Photon Strength Function (2016-2019)
3. MASSES, OPTICAL POTENTIAL, FISSION: CRP on Recommended Input Parameter Library (RIPL-4) for Fission Cross Section Calculations (2017-2024)
4. DENSITIES: CRP on Updating Nuclear Level Densities for Applications (2024+)

Segment on Gamma: CRP on Reference Database for Photon Strength Functions (2016-2019)

Introduction | MASSES | LEVELS | RESONANCES | OPTICAL | DENSITIES | GAMMA | FISSION | CODES | Contacts

Gamma-ray Segment

Experimental Giant Dipole Resonance (GDR) Parameters

The values and errors of giant dipole resonance (GDR) parameters are presented which were obtained by a fit of the theoretical photoabsorption cross sections to the experimental data for 121 nuclides from 12-C through 239-Pu. The values and errors of the shape parameters of the Lorentzian-like curves corresponding to the giant dipole resonance excitation are presented.[1-8]

References
[1] J. Kopecky, in Handbook for calculations of nuclear reaction data. Reference Input Parameter Library (RIPL), IAEA-TEDOC-1034, 1998, Ch.6
[2] T. Belgya, O. Bersillon, R. Capote, T. Fukahori, G. Zhigang, S. Goriely, M. Herman, A.V. Ignatyuk, S. Kailas. A. Koning, P. Oblozinsky, V. Plujko, P. Young. Handbook for calculations of nuclear reaction data: Reference Input Parameter Library-2, IAEA-TECDOC-1506, Vienna, 2006, Ch.7.
[3] V.A. Plujko, I.M. Kadenko, E.V. Kulich, S. Goriely, O.I. Davidovskaya, O.M. Gorbachenko, in Proceeding of Workshop on Photon Strength Functions and Related Topics, Prague, Czech Republic, June 17-20, 2007, Proceedings of Science, PSF07, 2008
[4] S.S.Dietrich, B.L.Berman; At. Data Nucl. Data Tables., 199, 38(1988).
[5] M.B. Chadwick, P. Oblozinsky, P.E. Hodgson, G. Reffo. Phys.Rev. C44(1991)814.
[6] M.B.Chadwick, P.Oblozinsky, A.I.Blokhin, T.Fukahori, Y.Han, Y. O.Lee, M.N.Martins, S.F.Mughabghab, V.V.Varlamov, B.Yu, J.Zhang. Handbook on photonuclear data for application. Cross sections and spectra. IAEA TECDOC 1178, Vienna, 2000
[7] Experimental Nuclear Reaction Data Library EXFOR
[8] CERN Program Library, MINUIT (D506), Function Minimization and Error Analysis

README File (16kB)
Standard Lorentzian model (SLO) (22,3kB) Modified Lorentzian model (MLO) (22,0kB)

Theoretical GDR Parameters

Predictions of the GDR energies and widths using Goldhaber-Teller model for about 6000 nuclei with 14<=Z<=110 lying between the proton and the neutron driplines.

Data File (281kB) README File (3.5kB)

Retrieval of GDR Parameters

Atomic number (Z)
Mass number (A)
(blank for all mass numbers)
retrieve reset

Microscopic E1 Photoabsorption Strength-Functions

Predictions of the E1-strength functions for 3317 nuclei with 8<=Z<=84 lying between the proton and the neutron driplines. The E1-strength functions are determined within the QRPA model based on the SLy4 Skyrme force[1,2].

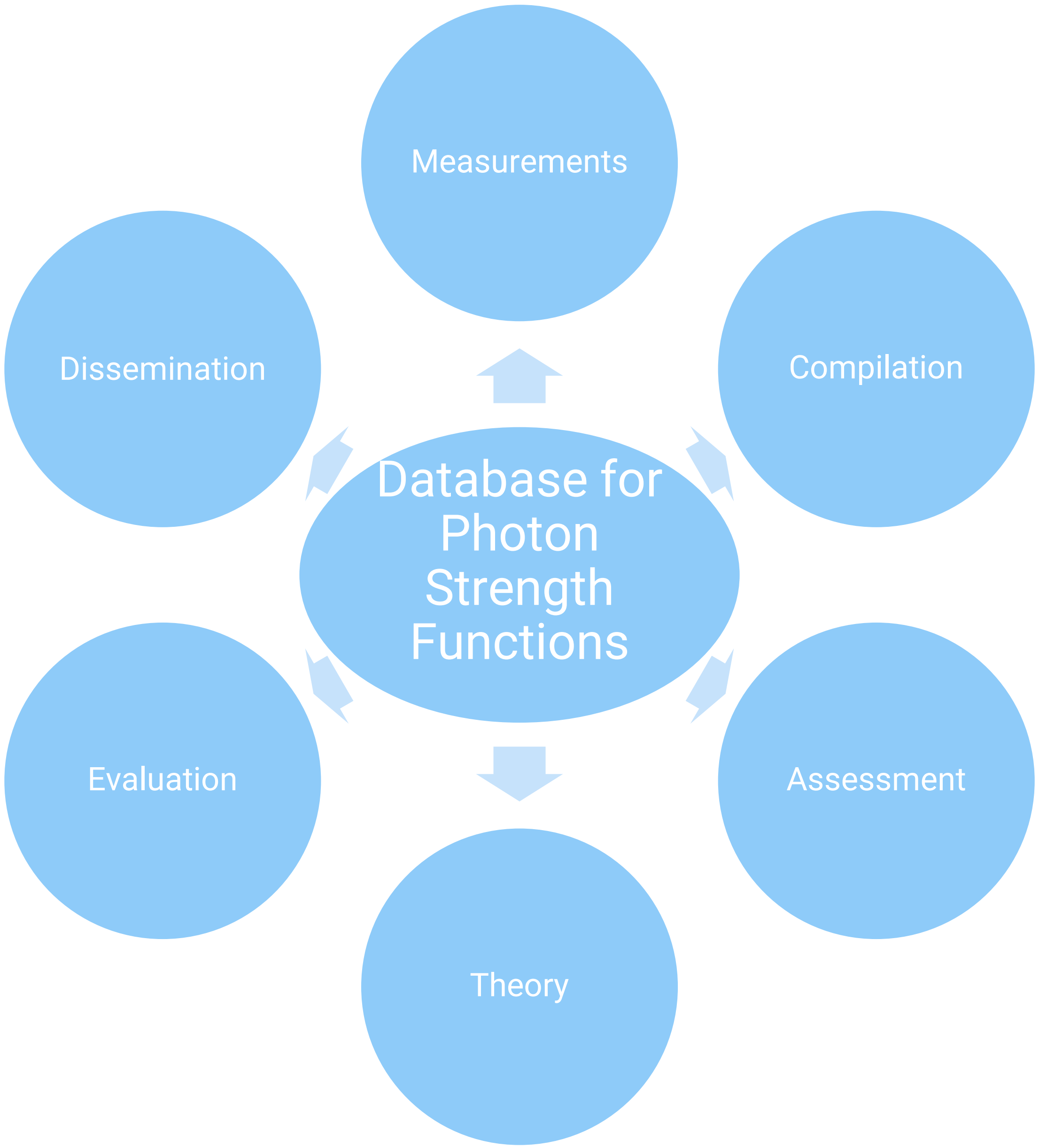
References
[1] S. Goriely, E. Khan, Nucl. Phys. A706, 217 (2002).
[2] E. Khan et al., Nucl. Phys. A694 (2001) 103.

README File (2.8kB)

Retrieval of Microscopic E1 Photoabsorption Strength-Functions

Atomic number (Z)
Mass number (A)
retrieve reset

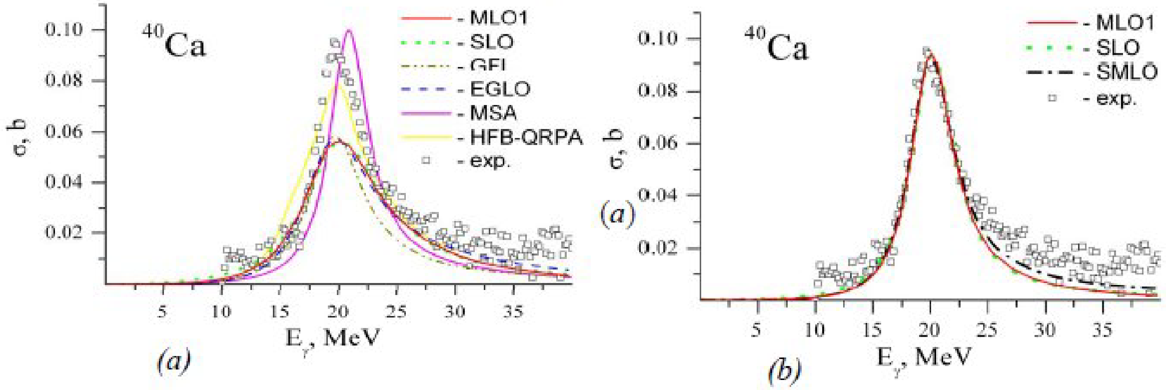
CRP on Photon Strength Functions: Research objectives



Giant Dipole Resonances

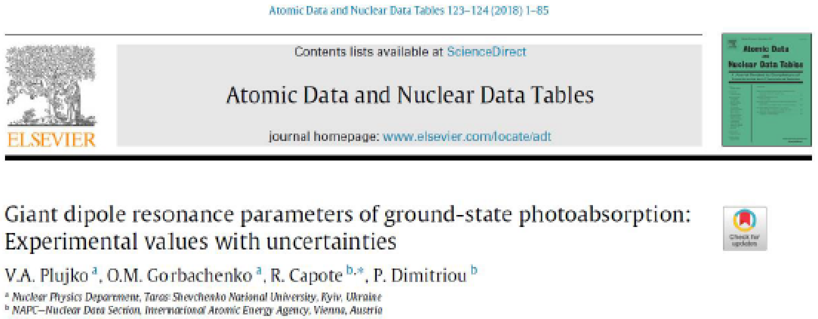
Data for 18 new isotopes are included in the tables. Data are revised for 87 isotopes. 102 new values are added from 23 sources. 12 values were omitted

Impact of using renewed values of the GDR parameters on photoabsorption cross section



Comparison of the photoabsorption cross-sections calculated by different methods and\or with different database for GDR parameters:
***a*- Berman&Fultz systematics , *b* – renewed values.**

Atom. Data Nucl. Data Tables 123-124 (2018) 1-85
(Plujko, Gorbachenko, Capote, Dimitriou,);
arXiv e-Print – 2018: https://arxiv.org/abs/1804.04445



Atomic Data and Nuclear Data Tables 123–124 (2018) 1–85
Contents lists available at ScienceDirect
Atomic Data and Nuclear Data Tables
journal homepage: www.elsevier.com/locate/adt
ELSEVIER

Giant dipole resonance parameters of ground-state photoabsorption: Experimental values with uncertainties

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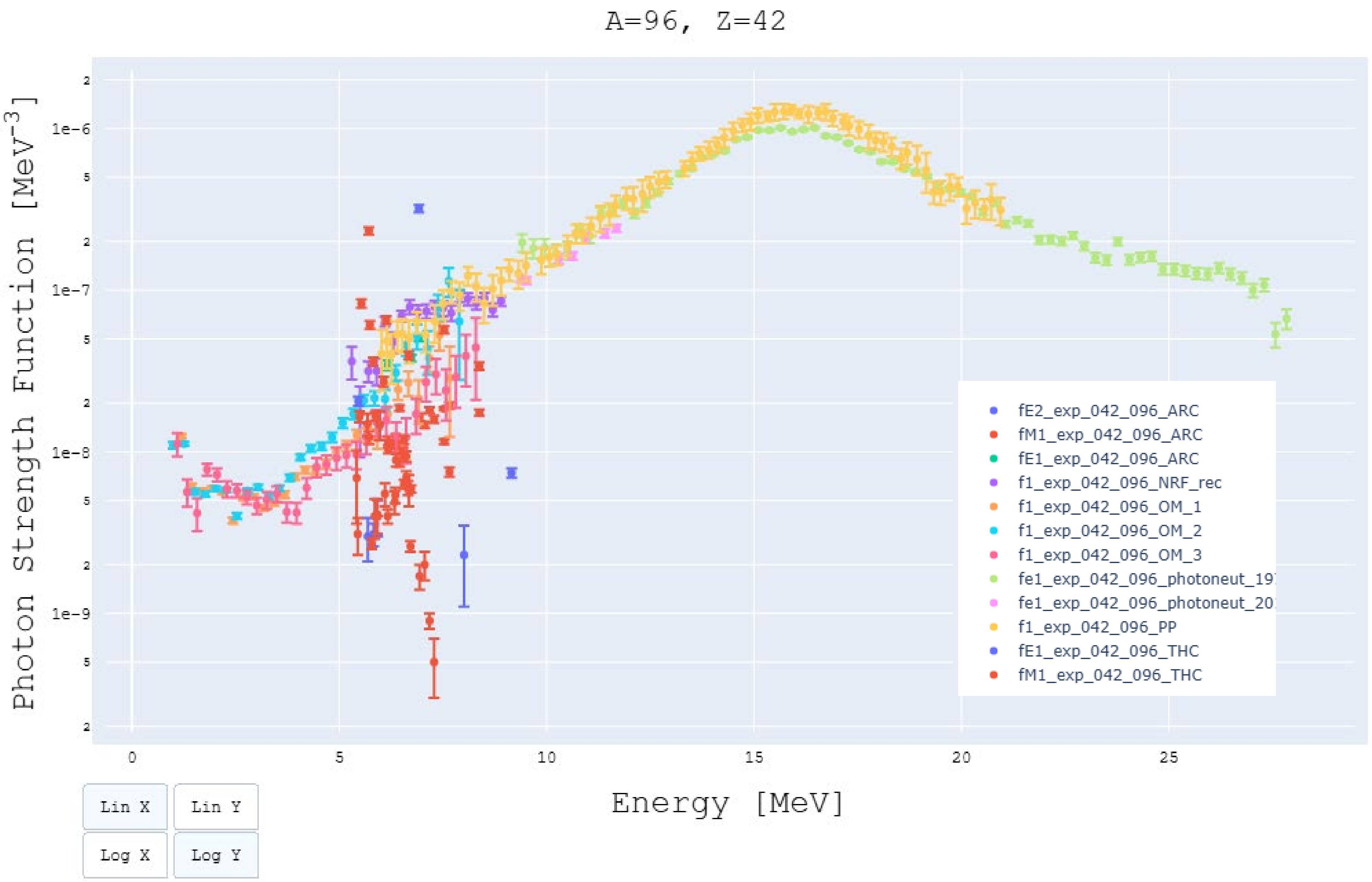
[b] NAPC–Nuclear Data Section, International Atomic Energy Agency, Vienna, Austria

Experimental Photon Strength Function database

New measurements

Group	Nuclides	Technique
S. Siem (Oslo)	$^{111,112,113}Sn$, ^{92}Mo (12/2016) $^{152,153}Sm$ (12/2018), ^{186}W (12/2017) $^{144,145,148,149,150,151}Nd$ (12/2017) ^{234}U, ^{240}Pu (12/2016) $^{203,205}Tl$ (12/2016); ^{192}Os (12/2017), ^{185}Re (12/2017); $^{182,183,184}W$ (12/2018); ^{89}Y (12/2016); ^{64}Zn (2019), $^{66,68}Zn$ (12/2018)	Oslo charged-particles (γ,n)
M. Wiedeking (iThemba)	^{74}Ge (12/2017), $^{180,181,182}Ta$ (12/2016) $^{154,155}Sm$ (05/2018)	Ge (ratio method) ; Ta (Oslo method)
R. Schwengner (HZDR)	^{80}Se (12/2016); ^{54}Fe (12/2017); A~60 (^{62}Ni, ^{64}Zn tbc) (03/2019)	At Elbe and/or Higs (^{54}Fe)
T. Belgya (HAS)	^{233}Th, ^{239}U (12/2017)	thermal n-capture
H.Utsunomiya (Konan)	$^{156,157,158,160}Gd$ (2019) $^{58,60,64}Ni$ (12/2017)	(γ,n)



A=96, Z=42
Photon Strength Function [MeV^-3]
Energy [MeV]
1e-6
1e-7
1e-8
1e-9
0
5
10
15
20
25
fE2_exp_042_096_ARC
fM1_exp_042_096_ARC
fE1_exp_042_096_ARC
f1_exp_042_096_NRF_rec
f1_exp_042_096_OM_1
f1_exp_042_096_OM_2
f1_exp_042_096_OM_3
fe1_exp_042_096_photoneut_19
fe1_exp_042_096_photoneut_20
f1_exp_042_096_PP
fE1_exp_042_096_THC
fM1_exp_042_096_THC
Lin X
Lin Y
Log X
Log Y

Experimental PSF database

Status: 2019

- NRF measurements for 23 nuclei with Z=32-78
- Oslo method data for 72 nuclei with Z=21-94
- ARC/DRC measurements for 88 nuclei with Z=9-94
- (p,γ) measurements for 22 nuclei with Z=22-40
- Ratio method measurement for 1 nucleus, 95Mo
- (p,p’) measurements for 3 nuclei, 96Mo, 120Sn and 208Pb
- E1 photodata for 159 nuclei with Z=3-94

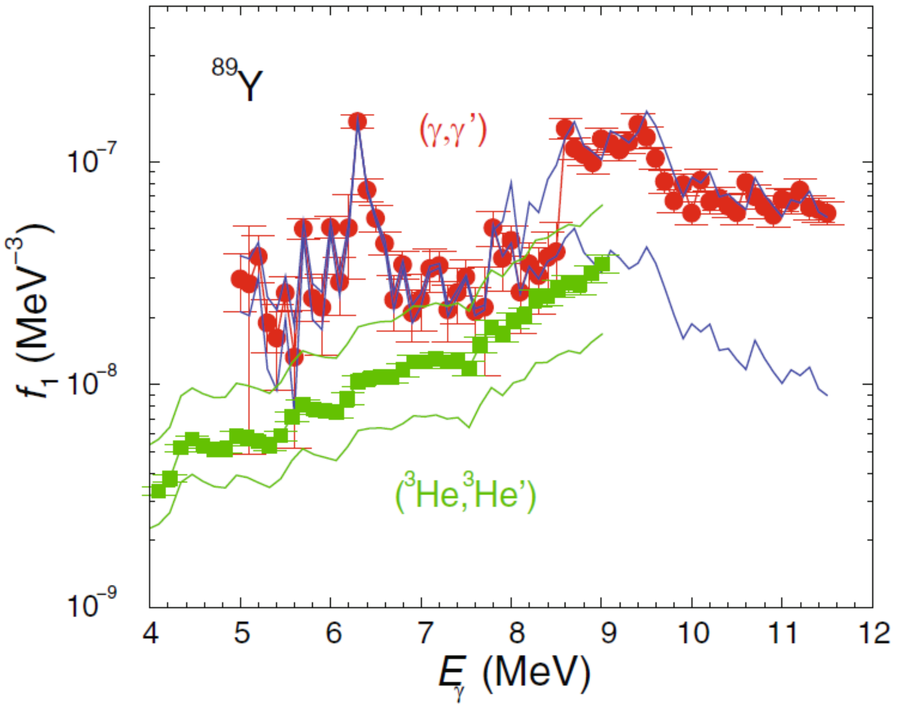
PSF database: will be maintained and updated regularly

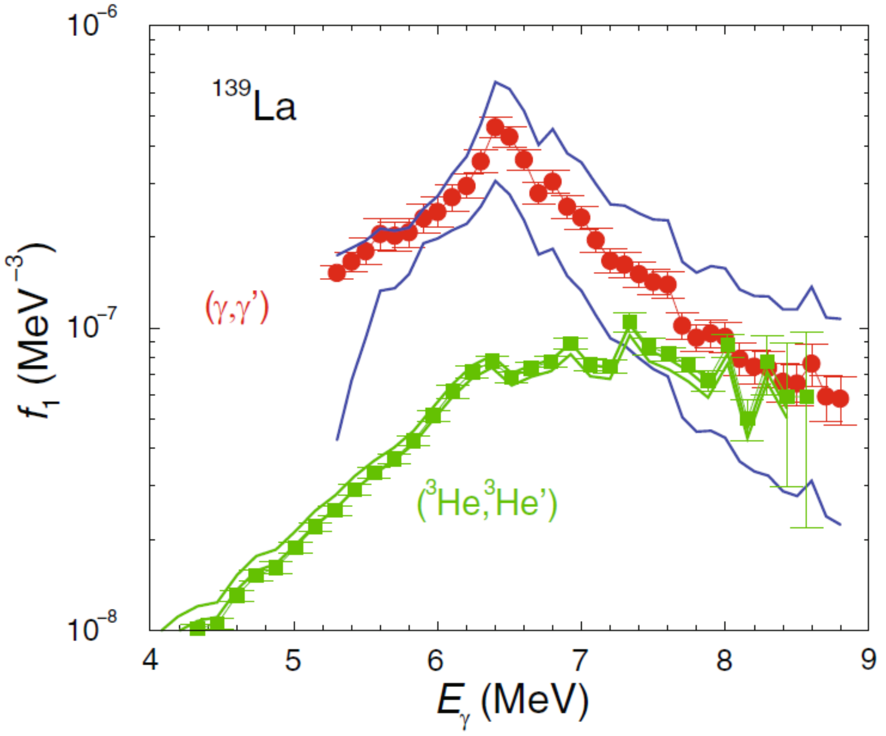
Update: 2024

- NRF measurements for 30 nuclei with Z=26-82
- Oslo method data for 102 nuclei with Z=21-94
- ARC/DRC measurements for 106 nuclei with Z=9-94
- (p,γ) measurements for 22 nuclei with Z=22-40
- Ratio method measurement for 2 nuclei, 56Fe, 95Mo
- New: Shape Method measurements for 9 nuclei, Z=26-66
- (p,p’) measurements for 8 nuclei
- E1 photodata for 154 nuclei with Z=2-94 (derived data removed)
- *NEW - [19 Sep 2022] Thermal Capture (THC) measurements (incl. EGAF) for 98 nuclei with Z=9-90*

Assessment of experimental PSF

Assessment of data/techniques considering all uncertainties (exp+model dependent)





Global PSF models

Microscopic: D1M+QRPA+0lim   Phenomenological: SMLO

For E1 and M1:

- D1M+QRPA+0lim: 7380 nuclei with $8 \leq Z \leq 110$, Goriely et al., Phys. Rev. C 98, 014327 (2018)

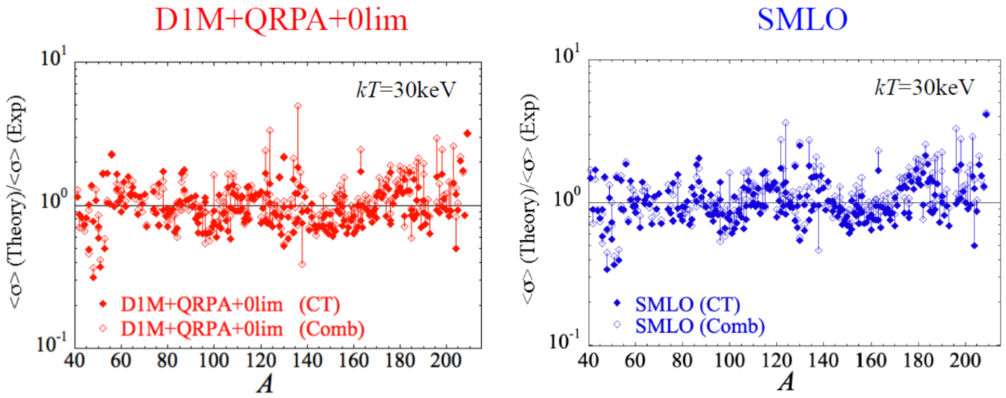
- new Simple Modified Lorentzian (SMLO): 8980 nuclei with $8 \leq Z \leq 124$, Goriely and Plujko, PRC 99, 014303 (2019)

Validation of global models

Conditions for recommending global models: validation by means of other “integral” data

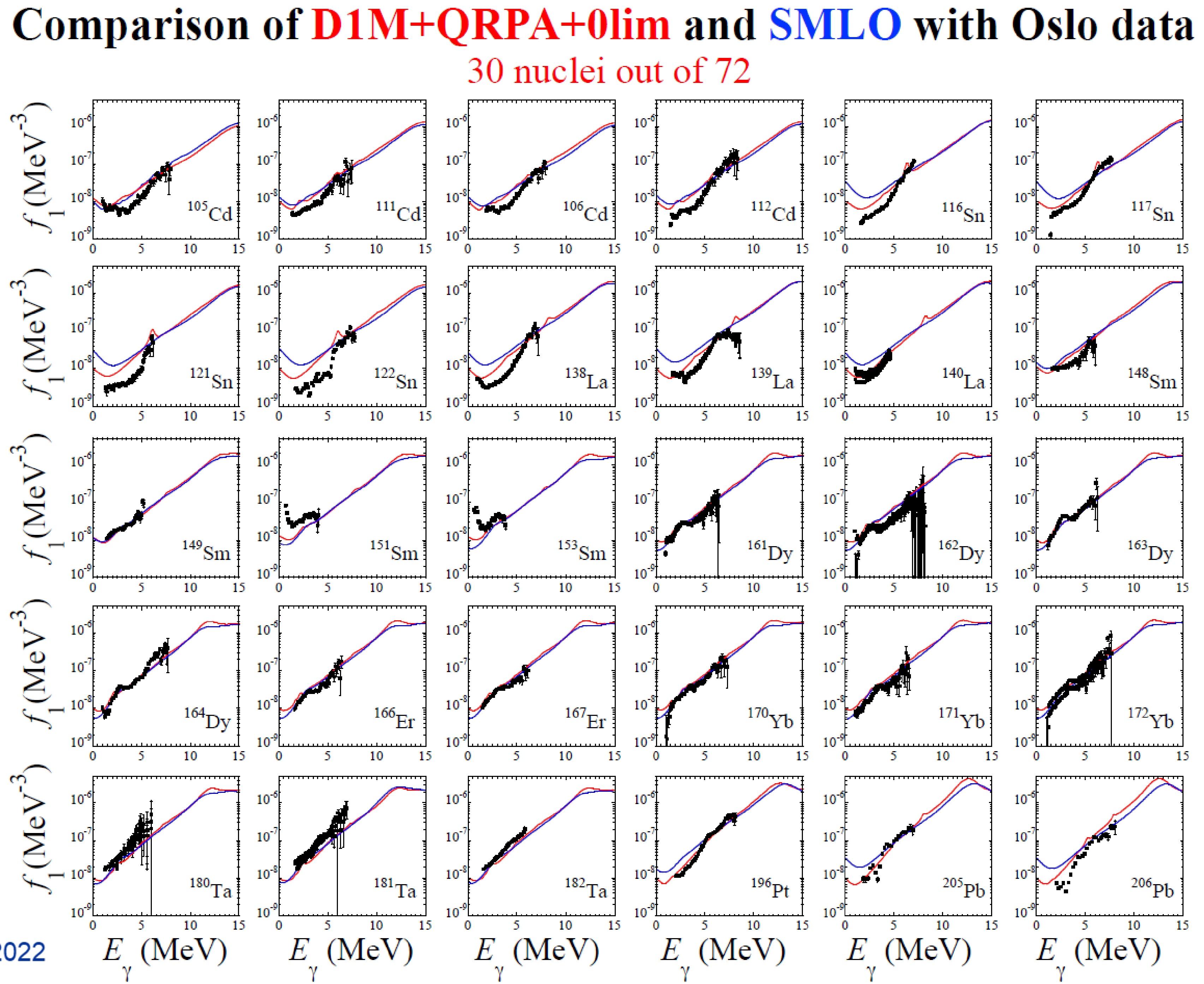
- Two-step cascade spectra MSC: E1+M1 for ~15 nuclei
- Thermal (n,γ) spectra: E1+M1 for 5 nuclei
- Average radiative width <Γγ>: E1+M1 for ~230 nuclei
- MACS: 30 keV (n,γ) E1+M1 for ~240 nuclei

Comparison of D1M+QRPA+0lim and SMLO with MACS



Both PSF models reproduce ~240 MACS within ~ 40-50%

Comparison with data



Slide: S. Goriely, CM on PSF evaluation, Nov. 2022

Publications

[1] S. Goriely et al., The European Physical Journal A 55, 172 (2019).

[2] J. Kopecky, Photon Strength Functions in Thermal Capture, INDC(NDS)-0799.

[3] J. Kopecky, Photon Strength Functions in Thermal Capture II, INDC(NDS)-0815.

[4] J. Kopecky, S. Goriely, Strength Functions Derived from The Discrete And Average Neutron Resonance Capture, INDC(NDS)-0790.

[5] M. Krtička, S. Goriely, S. Hilaire, S. Péru, and S. Valenta, Phys. Rev. C **99**, 044308 (2019).

[5] S. Goriely, S. Hilaire, S. Péru, K. Sieja, Phys. Rev. C 98, 014327 (2018).

[6] V. Plujko, O. Gorbachenko, R. Capote, P. Dimitriou, At. Data Nucl. Data Tables 123, 1 (2018).

[7] S. Goriely, V. Plujko, Phys. Rev. C 99, 014303 (2018).

Eur. Phys. J. A (2019) **55**: 172
DOI 10.1140/epja/i2019-12840-1

THE EUROPEAN PHYSICAL JOURNAL A

Review

Reference database for photon strength functions

S. Goriely[1], P. Dimitriou[2,a], M. Wiedeking[3], T. Belgya[4], R. Firestone[5], J. Kopecky[6], M. Krtička[7], V. Plujko[8], R. Schwengner[9], S. Siem[10], H. Utsunomiya[11], S. Hilaire[12], S. Péru[12], Y.S. Cho[13], D.M. Filipescu[14], N. Iwamoto[15], T. Kawano[16], V. Varlamov[17], and R. Xu[18]

Dissemination

New PSF database: nds.iaea.org/PSFdatabase

PSF

Home Search Data Atlas

This is the new website for the Photon Strength Function Database. The legacy website is still available for a limited time here.

Photon Strength Function Database

Experimental data

The Photon Strength Function (PSF) Database contains all the experimental PSF data that were compiled by the IAEA Coordinated Research Project (CRP) on Generating a Reference Database for Photon Strength Functions. The methods that have been used to extract experimental PSF data are extensively described and assessed in the CRP technical report that is published in [1], and in the recent IAEA reports [2], [3], and [4]. The data files naming convention is self-explanatory and includes: the type and multipolarity of the PSF **XL={E1|E2|M1|1}** (1 stands for E1+M1), if it is **experimental or theoretical** data, **nuclide (Z,A)**, method used: **NRF, OM, ARC/DRC, PG, PP, RM, PHOTONUCLEAR**, and the NSR keynumber is added for photonuclear data. For detailed definitions, please refer to our Glossary page.
Each data file is accompanied by a **README file** with the same naming convention but with the extension `readme`. The README file contains all the information about the measurement, the experimental method, the model dependent analysis and parameters, as well as the reference.

Query the database

You can easily search the database using any combination of the available options: **Z, A, XL, Method, Energy**. A plot will be produced automatically based on your query. To retrieve the entire database, simply click the search button without applying any filters.

Search database

Download the database

You can download the latest version of the PSF Database in compressed format:

Download database
Version v2024.1 - released on the 1st of November, 2024
1,130 Data Files | 47,683 Data Points

Home Search Data Atlas

...ed time here.

GDR
ARC
DRC
THC

Home Search Data Atlas

...ited time

Database Versions
Theoretical Data
Glossary

Theoretical data

Theoretical PSF data recommended by the IAEA CRP on Reference Database for Photon Strength Functions are also available for downloading. These theoretical PSFs were validated according to the CRP prescription [1].

Two global models have been used to perform global calculations of E1 and M1 PSFs for all nuclides across the nuclear chart: the **D1M-QRPA** and **SMLO**. Details about the models and calculations are available in [1], [2], and [3].

The files contain PSFs in units of [MeV-3] at various excitation energies U (QRPA files) or temperature T (SMLO files) so that they can be used for de-excitation processes. Note that for photoabsorption, U=0 or T=0, while for de-excitation the user needs to use the relation: $U=aT^2$ with a=A/10.

Download D1M-QRPA 61Mb | Download SMLO E1 65Mb | Download SMLO M1 15Mb

Other models

Theoretical PSF data generated by the triple Lorentzian model (TLO) [4] are now also available for dowloading. The folder contains the source files for generating the PSF data as well as the data files themselves. These PSFs have not been validated according to the CRP prescription [1].

Download TLO 13Mb

References

1. S. Goriely, P. Dimitriou, M. Wiedeking et al., The European Physical Journal A 55, 172 (2019), 10.1140/epja/i2019-12840-1

Versatile tool

Search the Database

Z: 42

A: Search by A (E.g: 1,2, ...)

Energy from:

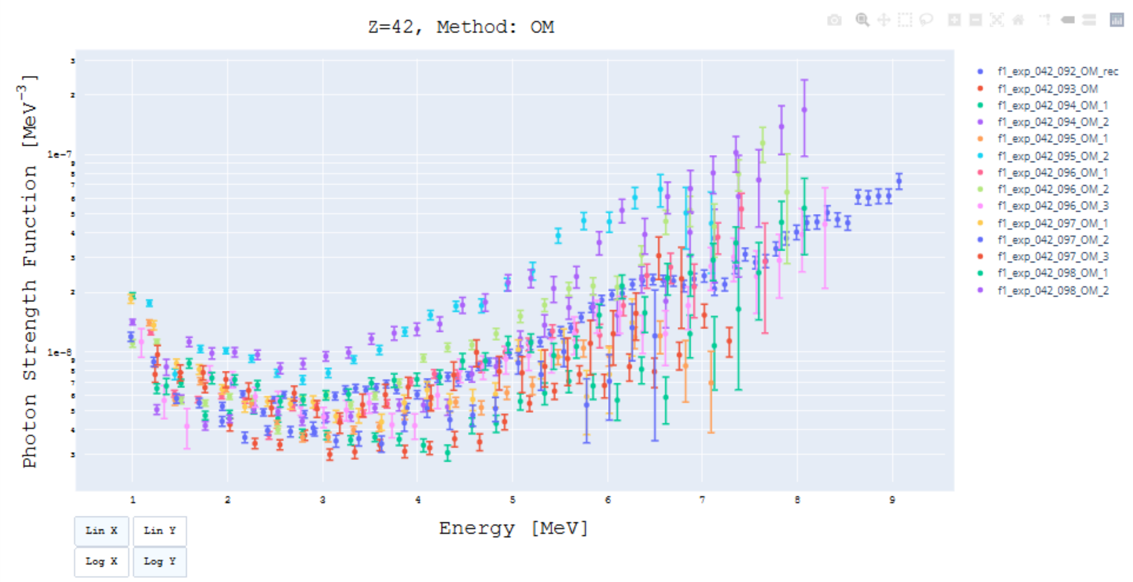
to:

XL: Select Multipolarity

Method: ×OM

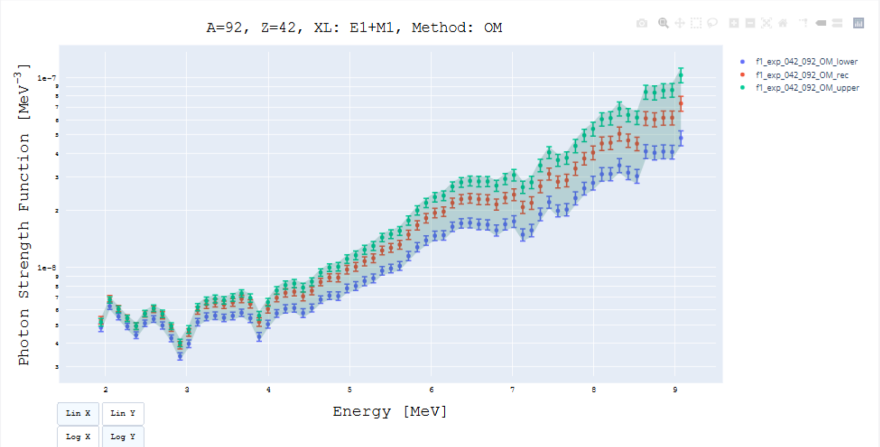
For more detailed information, see the Glossary.

Search Reset



Data last updated: Nov. 1, 2024, 5:08 p.m.

Download All | Download CSV



Data last updated: Nov. 1, 2024, 5:08 p.m.

Compiler	Year	Publication	View Readme	Download All	
M. Wiedeking and V.W. Ingeberg	2016	G. M. Tveten et al., Phys. Rev. C 94, 025804 (2016)	f1_exp_042_092_OM_lower	[data]	[readme]
M. Wiedeking and V.W. Ingeberg	2016	G. M. Tveten et al., Phys. Rev. C 94, 025804 (2016)	f1_exp_042_092_OM_rec	[data]	[readme]
M. Wiedeking and V.W. Ingeberg	2016	G. M. Tveten et al., Phys. Rev. C 94, 025804 (2016)	f1_exp_042_092_OM_upper	[data]	[readme]

Show 10 entries Search:

Z	A	Method	XL	Datapoints	Min E [MeV]	Max E [MeV]	Author	Year	View Readme	Plot
42	92	OM	E1+M1	67	1.944	9.072	G. M. Tveten et al.	2016	f1_exp_042_092_OM_rec	
42	93	OM	E1+M1	24	1.235	7.284	M. Guttormsen et al.	2005	f1_exp_042_093_OM	
42	94	OM	E1+M1	26	0.998	7.381	M. Guttormsen et al.	2005	f1_exp_042_094_OM_1	
42	94	OM	E1+M1	26	0.998	7.381	H. Utsunomiya et al.	2013	f1_exp_042_094_OM_2	
42	95	OM	E1+M1	23	1.175	7.093	M. Guttormsen et al.	2005	f1_exp_042_095_OM_1	
42	95	OM	E1+M1	23	1.175	7.097	H. Utsunomiya et al.	2013	f1_exp_042_095_OM_2	
42	96	OM	E1+M1	27	1.191	7.661	M. Guttormsen et al.	2005	f1_exp_042_096_OM_1	
42	96	OM	E1+M1	28	0.998	7.891	H. Utsunomiya et al.	2013	f1_exp_042_096_OM_2	
42	96	OM	E1+M1	31	1.091	8.291	M. Guttormsen et al.	2005	f1_exp_042_096_OM_3	
42	97	OM	E1+M1	23	0.981	6.261	M. Guttormsen et al.	2005	f1_exp_042_097_OM_1	

Showing 1 to 10 of 14 entries Previous 1 2 Next

Photon Strength Functions

Coordinated effort continued

1. Working group on evaluation of Photon Strength Functions with goal to produce evaluated PSF based on experimental data
2. Maintain and further develop the PSF database: next update Nov. 2025 – will include more data and recommended model calculations in plots

Segment on Level Densities: CRP on NLDS (2024-2028)

Level Densities Segment

Total Level Densities

Back-Shifted Fermi Gas Model (BSFG)

Level density parameters for the BSFG model obtained by fitting the Fermi-gas model formula to the recommended spacings of s-wave neutron resonances and to the cumulative number of low-lying levels.

Data File (34.3kB) README File (2.2kB)

Gilbert-Cameron Model

Level density parameters for the Gilbert-Cameron model obtained by fitting the Fermi-gas model formula to the recommended spacings of s-wave neutron resonances and by matching the corresponding level density to discrete levels.

Data File (42.8kB) README File (2.4kB)

Enhanced Generalized Superfluid Model (EGSM)

Level density parameters for the Enhanced Generalized Superfluid Model (EGSM), which takes into account collective enhancement of the nuclear level density in addition to shell and superfluid effects. The parameters were obtained by fitting the corresponding model formulas to the recommended spacings of s-wave neutron resonances and by matching level densities to discrete levels.

Data File (26.1kB) README File (2.4kB)

Z Systematics:
Data File (1.3kB) README File (1.3kB)

Retrieval of Total Level Density Parameters

Atomic number (Z)
Mass number (A)
(blank for all mass numbers)
retrieve reset

Plot of Total Level Density Parameters (a-parameters)

Select one of below and input no.:
Atomic number (Z)
Mass number (A)
Neutron number (N)

X-axis: A
plot reset

Plot of Total Level Densities

Atomic number (Z)
Mass number (A)
plot reset

HFB Total Level Densities

The data files (*.dat) contains the HFB plus combinatorial nuclear level densities at ground state deformations[1]. The nuclear level density is coherently obtained on the basis of the single-particle level scheme and pairing energy derived at the ground state deformation based on the BSk14 Skyrme force[2]. Additionally, the phenomenological level density parameters ctable and ptable are tabulated in files (*.cor) by fitting the HFB calculated curve to the RIPL II recommended spacings of s-wave neutron resonances D0 and to the cumulative number of low-lying levels.

References:

[1] S. Goriely, S. Hilaire, A.J. Koning, Improved microscopic nuclear level densities within the Hartree-Fock-Bogoliubov plus compbinatorial method, Phys. Rev. C78 (2008) 064307
[2] S. Goriely, M. Samyn, J.M. Pearson, Phys. Rev. C75 (2007) 064312

HFB Data Files (total 486.6MB) HFB README File (3.1kB)

HFB corrections File (30kB) HFB corrections README File (2kB)

Introduction | MASSES | LEVELS | RESONANCES | OPTICAL | DENSITIES | GAMMA | FISSION | CODES | Contacts

Average Resonance Spacings Segment

Average Spacings of Neutron Resonances

296 average spacings for s-wave neutron resonances and 82 average spacings for p-wave neutron resonances.

References:

[1] Sukhoruchkin, S.I. et al. in Low Energy Neutrons and their Interaction with Nuclei and Matter. Ed. H.Schopper, Springer-Verlag, Berlin, 2000, v.16B.
[2] Ignatyuk A.V. Contribution to the Second CRP Meeting on RIPL-2 (Verenna, June 2000).

Data File with s-wave Resonances (22kB)
Data File with p-wave Resonances (9.4kB)
README File (5.1kB)

Retrieval of Average Spacings of Neutron Resonances

Atomic number (Z)
Mass number (A)
(blank for all)
retrieve reset

Plot of Average Spacings of Neutron Resonances in Function of Mass Number (A)

Atomic number (Z)
(blank for all)
s- or p-wave s-wave
plot reset

Level Densities at Saddle Points Calculated within HFB

The files contains the HFB plus combinatorial nuclear level densities at saddle and isomer deformations[1]. The nuclear level density is coherently obtained on the basis of the single-particle level scheme and pairing energy derived at the saddle point deformation or shape isomer deformation. The same BSk14 Skyrme force[2] is used to estimate the fission saddle and isomeric points.

References:

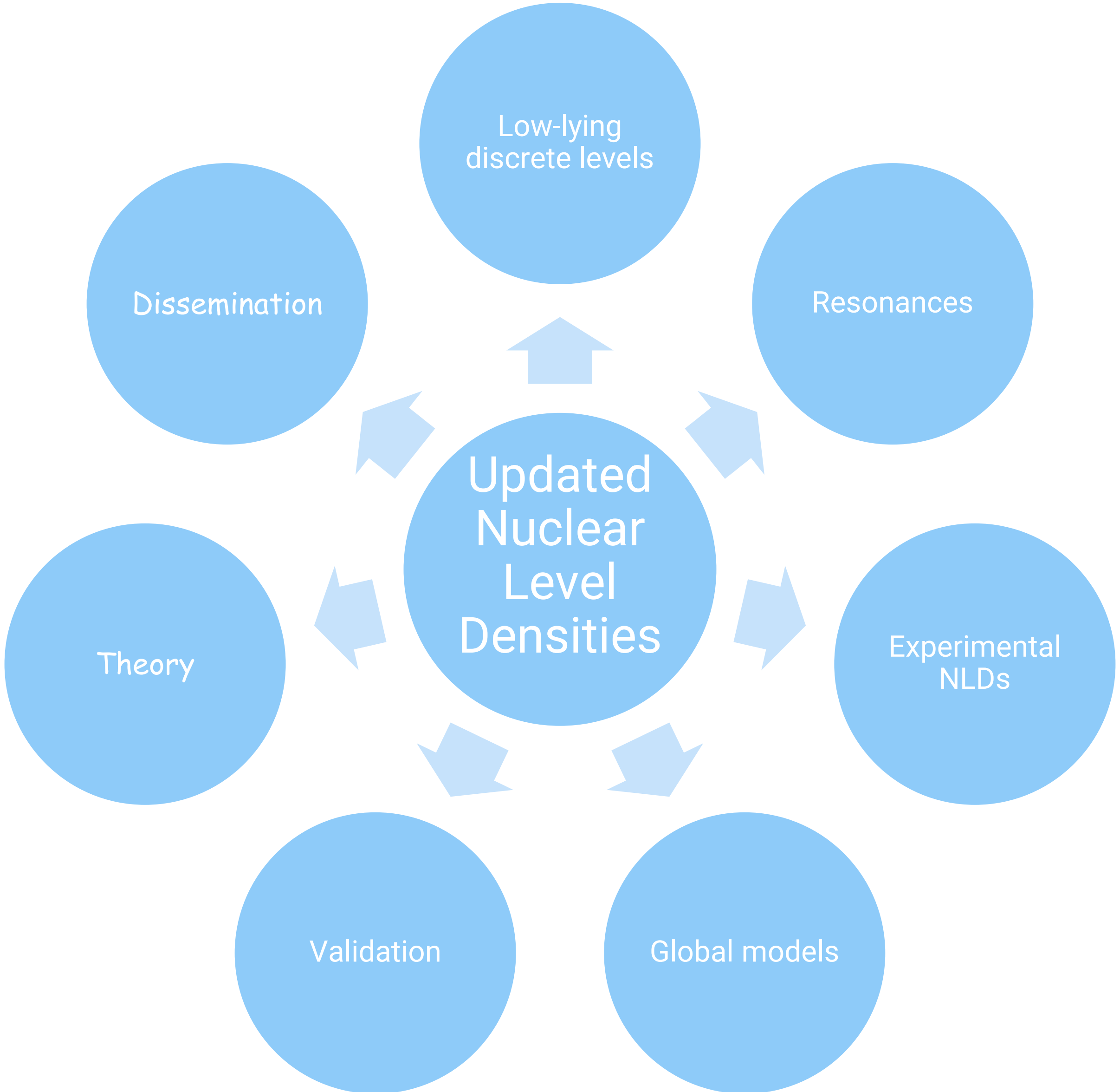
[1] S. Goriely, S. Hilaire, A.J. Koning, Phys. Rev. C (2008) in press
[2] S. Goriely, M. Samyn, J.M. Pearson, Phys. Rev. C75 (2007) 064312

Data Files README File (4.0kB)

Retrieval of Level Densities at Saddle Points

Atomic number (Z)
Mass number (A)
retrieve reset

CRP on Updating Nuclear Level Densities for Applications: Research objectives



Outputs - deliverables

- Recommended NLD models and parameters
- Recommended NLD tables (for both phenomenological and microscopic):
  a. Provide renormalization parameters on low-lying states and D_0
  b. Provide adjustment procedure for tabulated NLDs for practical calculations
- Recommended tables of average resonance spacings D_0,D_1, $\Gamma\gamma$, Strengths
- Compilation of experimental data (derived NLD, resonances, and validation data)
- GitHub repository; interactive interface
- Publication(s) describing technical work and recommendations

Participants

Name (CSI)	Country
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Peter von Neumann-Cosel, Johan Isaak et al.	Univ. Darmstadt, Germany
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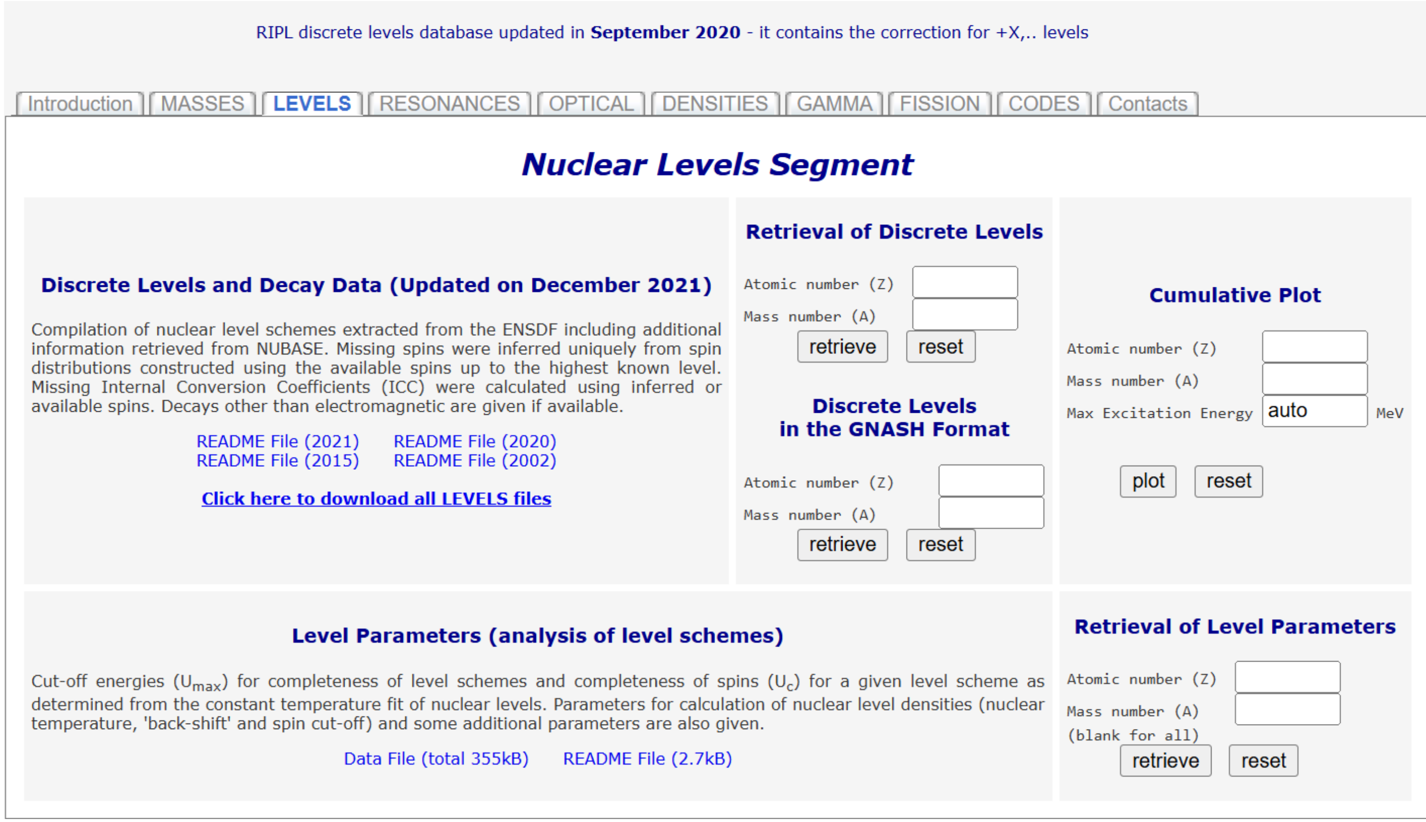
Yi Xu, Pär-Anders Söderström	ELI-NP, Romania
Cenxi Yuan, Shengli Chen, et al.	Sun Yat-sen University

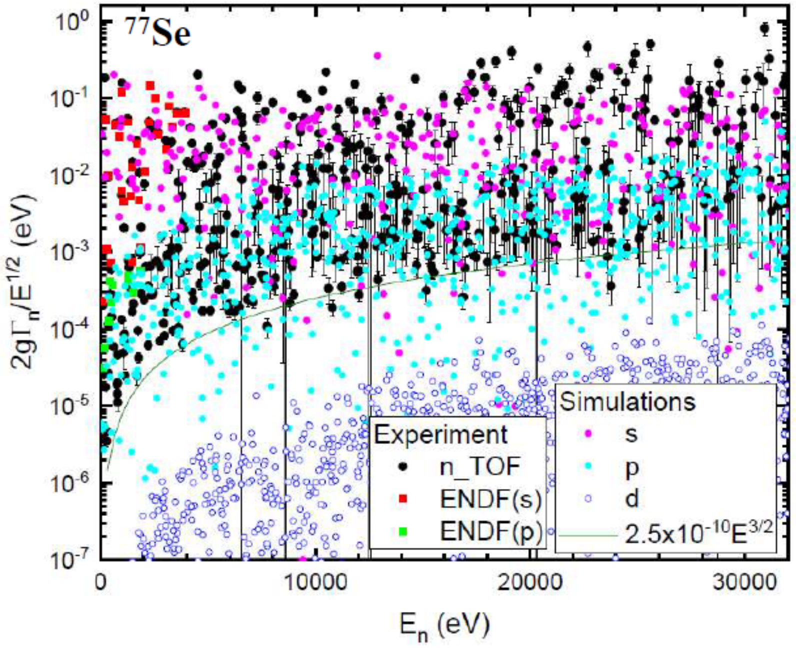
Research Objectives I - Low-lying discrete states

- Update low-lying states in the RIPL database (based on ENSDF and NUBASE)
- Empirical determination of completeness of levels – review method of determination
- Investigate the possible assignment of spin and parities for unknown cases (weak assignments or multiple values in ENSDF); theoretical approaches
- Review the method to assign spin-cutoff on low-lying states – compare with models
- Low-lying discrete levels for exotic nuclei – use theory



Research objectives II - Average Resonance Spacings

Compilation and evaluation



- ➢ Comprehensive compilation of average resonance spacings D_0 and D_1 (not D_2)
- ➢ New evaluation of compiled D_0 and D_1 - provide recommended values and associated uncertainties, and number of resonances considered
- ➢ Compare with RIPL-3 values (Ignatyuk), Mughabghab, other evaluations (ENDF/B, JENDL, …), Sukhoruchkin
- ➢ Outliers when compared to models
- ➢ Comparison of different evaluations

Tables; Metadata
RIPL format

Research objectives III – Compilation of experimental data

Experimentally derived PSF

- Compilation of experimental derived level densities [Oslo method – beta-Oslo, inverse-Oslo; Shape method; proton inelastic scattering; Evaporation method; gamma self-absorption, (α,α'), (γ,γ'), Ericson fluctuations]
- Comparison of results from different measurement techniques (outliers; quality indicators; updated normalization data)
- Comprehensive uncertainty analysis (including model uncertainties)
- Recommendation of experimental derived nuclear level density data

→

Comprehensive experimental NLD database:
Data files; Metadata
Format: PSF format; YAML

Research objectives III cont'

Experimental data for validation of models and evaluations

- Reaction data (e.g. standards, (n,n'), (n,p), neutron spectrum, prompt fission -spectra)
- Isomeric cross section ratios and (n,n'γ) cross section data
- Multi-step cascade gamma spectra
- Average radiative widths
- Maxwellian-Averaged Cross Sections (MACS)
- Isomeric cross-section ratios

Experimental database:
Data files; Metadata

Research objectives IV - Models

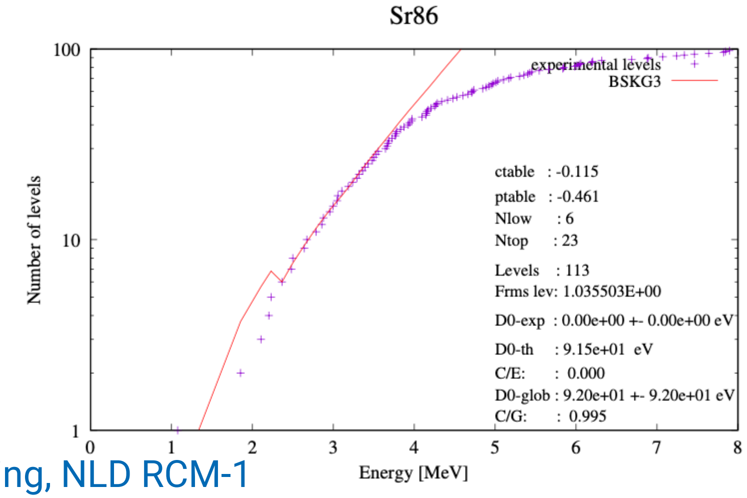
Development of global and semi-global NLD models

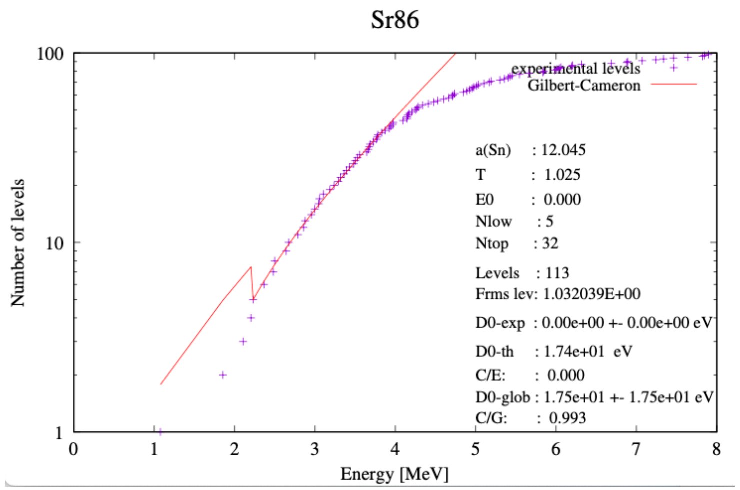
- New phenomenological (Constant Temperature +Fermi Gas, Enhanced Generalized Superfluid Model)
- New Microscopic (QRPA+Boson exchange, Shell Model, HFB+comb., Relativistic HFB+comb)
- Comparison with experimental data: Ncum, D_0, and experimentally derived NLDs
- Recommendations based on best fit

Formulas+ parameters

Tables; RIPL format

Metadata





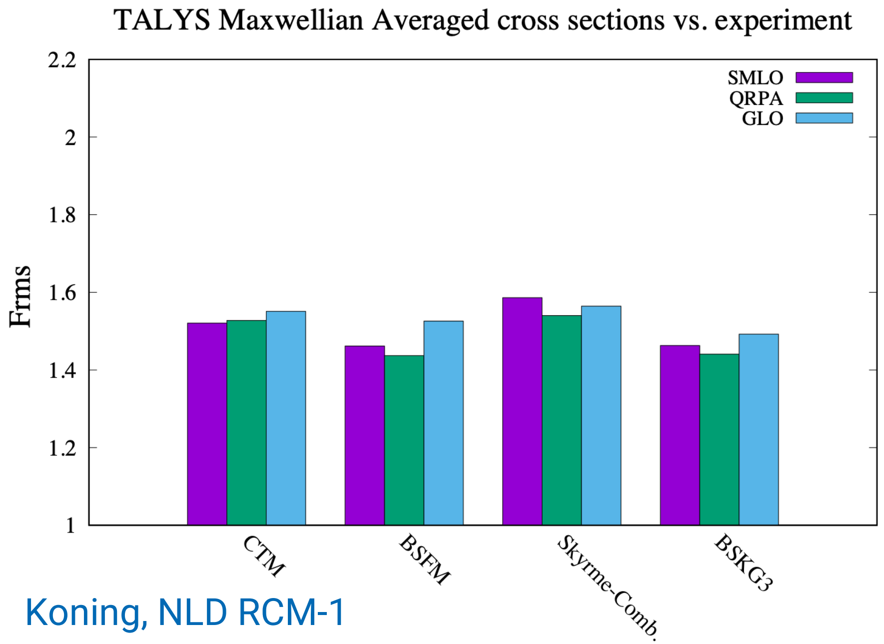
Koning, NLD RCM-1

Research objectives V – Validation of global models

Use validation data

- ➢ Define qualitative and quantitative validation criteria and approaches
- ➢ For validated models provide renormalization parameters on low-lying states and D_0
- ➢ For validated models provide global calculations in tabulated form and adjustment procedure for practical calculations

The validated models will be recommended.

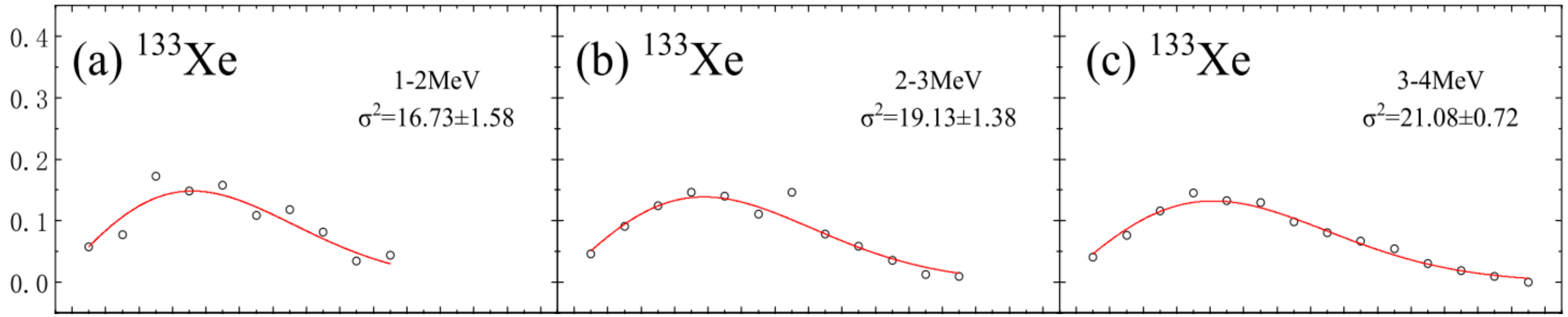


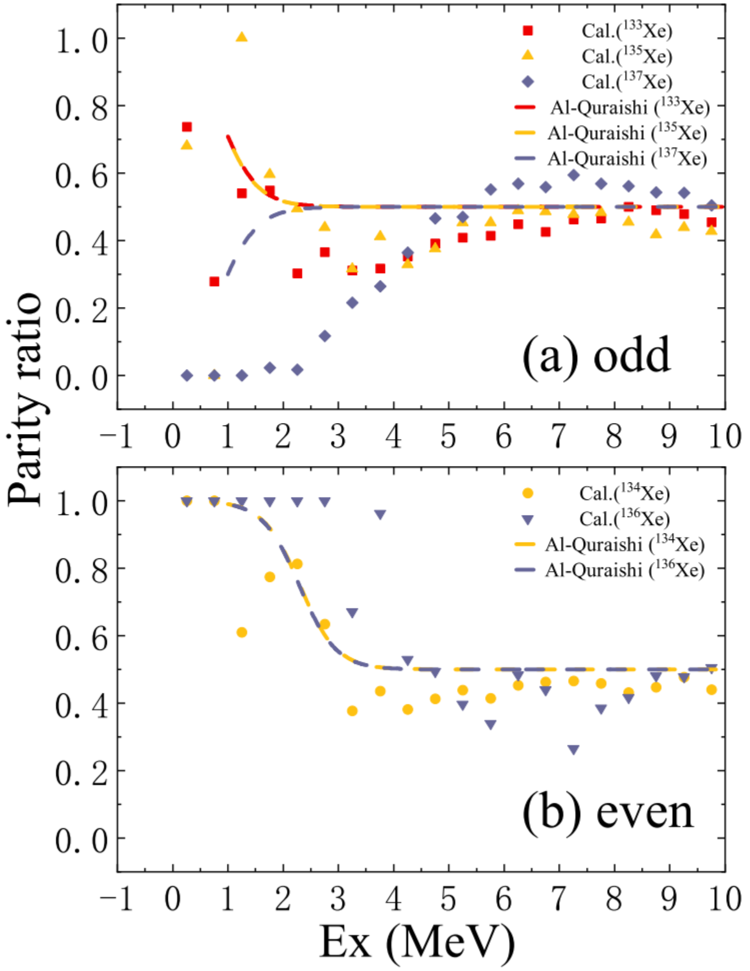
Koning, NLD RCM-1

Research objectives VI – Theoretical developments

To guide practical calculations and improve understanding

- Spin distribution/parity distribution: shell model(Configuration Interaction SM) and microscopic models (HFB+comb., QRPA+BE, RMF+comb)
- Damping of collective enhancement and damping effects: evaporation method
- Damping of rotational effects and vibrational effects: HFB+combinatorial models





Research objective VII - dissemination

Multiple forms of dissemination of data, models and metadata

- Experimental database (data and metadata) [format: PSF and/or yaml]
- Tabulated D_0, D_1
- Tabulated global model calculations [format: RIPL and other]
- Publication

→

- GitHub repository
- Interactive online interface
- APIs

Thank you!

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