Dissemination of nuclear structure and decay data @ IAEA

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Nuclear Data Section, Division of Physical and Chemical Sciences, International Atomic Energy Agency

ICTP, 6 Oct. 2025

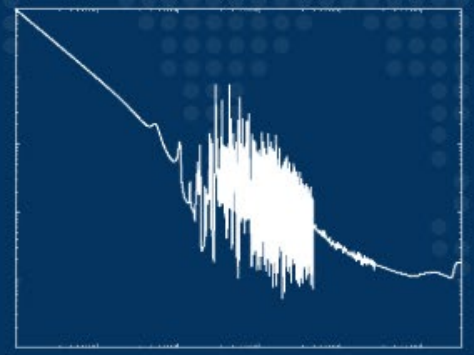
Nuclear Data Section

New webpage

IAEA Nuclear Data

The IAEA Nuclear Data Section provides fundamental nuclear and atomic data for nuclear science and applications.

Search | Search



Focus on

Resources

Nuclear Reaction Data

Data Explorer | EE-View | EXFOR Master File | HPRL | Photonuclear | TENDL | ...

Nuclear Structure and Decay Data

Actinide Decay Data Library | Beta-Delayed Neutrons | Decay Data Portal | ENSDF | Nuclear Moments | ...

Nuclear Data for Applications

ADS-Lib | CoNDERC | FENDL | IBANDL | Medical Isotope Browser | Safeguards | Stopping Powers | ...

Documents

IAEA-NDS Reports | IAEA Proceedings and TECDOC | INDC Reports | Meeting Presentations | NDS Newsletters

Software

NDS GitHub | EMPIRE 3.2 | ENDF Checking and Utility Codes | ENSDF Codes | Nuclear Data for Geant4 | PREPRO | TALYS | ...

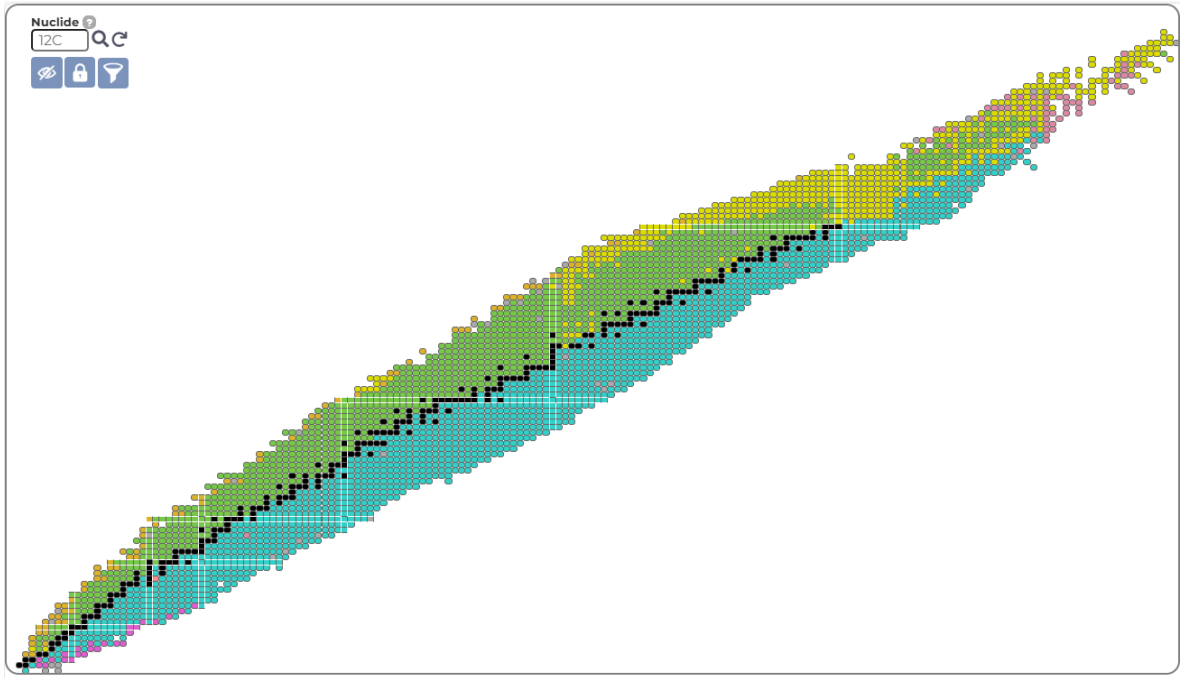
Meetings and Events

All Meetings and Events | Consultant and Technical Meetings | Research Coordination Meetings (RCM) | Training Workshops

ENSDF interactive @ IAEA

LiveChart

30% of user traffic @ IAEA



Live Chart of Nuclides
nuclear structure and decay data
email: nds contact point
guide & sources

Color zones by
value quantile

Main Decay Mode ...
alpha
EC+ beta+
beta-
p
n
EC
SF
Stable

Mass chains
β and ec decays plotting

Neutron Cross Sections
Resonance Integrals

List of updates
Oct 2024 - Mar 2025

- **Click** on a nuclide to fill the data tabs.
- **Double click** to bring it to the centre.
- **Mouse:** drag to move wheel to zoom
- **Numeric keypad:** zoom with **3 and 7**
  Use **8, 6, 2, 4, 9, 1** to move and **5** to reset

New in Livechart
Decay Radiation
order data by intensity

Data API
Direct data download
launch binder **Notebook**

Search & Filter
query panel on
structure and decay

3D Plotting
with **zoom, rotation,**
and **filter**

Decay Portal
compare **different**
evaluations

Isotope Browser for mobile

Live Chart

Decay radiation order by intensity

Ground State isomers | Levels | Gammas | Decay Radiation | Nuclear Moments | Neutron Capture | Fission Yields | Schema Plot

Comments · Click on a column header to open the guide · Uncertainty for numeric values refers to the last digits of the value: 12.1 *23* means 12.1 ± 2.3 · Data from: ENSDF Angeli & Marinova AME2020

· Definitions & Sources

· Evaluation: N. Nica and B. Singh Publication cut-off: 9-Mar-2022 ENSDF insertion: 2022-03 Publication: Nuclear Data Sheets 181, 1 (2022) 10.1016/j.nds.2022.03.001

Nuclide	Energy [keV]	J^{π}	$T_{1/2}$ or Width Abund. [mole fract.]	$T_{1/2}$ [s]	Decay Modes BR [%]	Isospin	μ [μ_N]	Q [barn]	R [fm]	Q_{β^-} [keV]	Q_α [keV]	Q_{EC} [keV]	Q_{β^-n} [keV]	S_n [keV]	S_p [keV]	Binding/A [keV]	Atomic Mass [μ AMU]	Mass Excess [keV]	Discovery
$^{147}_{60}Nd_{87}$	0.0	5/2-	11.03 d *3*	952992 *2592*	β- 100		0.554 *10*	0.9 *3*		895.2 *6*	1034.7 *22*	-2703 *16*	-6764 *4*	5292.20 *9*	8762 *34*	8283.604 *9*	146916106.0 *14*	-78146.8 *13*	1947

Link to Nubase2020 evaluation of 147-Nd nuclear properties

ENSDF datasets related to 147-Nd

Evaluated Nuclear Structure Data File

- ADOPTED LEVELS, GAMMAS
- 147PR B- DECAY (13.44 M) to **147ND**
- **147ND** B- DECAY (11.03 D) to 147PM
- 146ND(N,G) E=TH
- 146ND(D,P)
- 148ND(D,T),(POL D,T)

#	Nuclide	E_x [keV]	J^{π}_{order}	Band	$T_{1/2}$ or Width	$T_{1/2}$ [s]	Decay modes BR [%]	Isospin	μ [μ_N]	Q [b]	Additional data	Comments
1	$^{147}_{60}Nd_{87}$	0.0	5/2-	1	11.03 d *3*	952992 *2592*	β- 100		0.554 *10*	0.9 *3*		
2	$^{147}_{60}Nd_{87}$	49.9268 *10*	7/2-		1.0 ns *3*	1.0E-9 *3*						
3	$^{147}_{60}Nd_{87}$	127.9189 *10*	5/2- *2*		0.4 ns *1*	40E-12 *1*						
4	$^{147}_{60}Nd_{87}$	190.291 *6*	(9/2)-	1								
5	$^{147}_{60}Nd_{87}$	214.5949 *12*	1/2-		4.53 ns *6*	4.53E-9 *6*						
6	$^{147}_{60}Nd_{87}$	314.6799 *23*	3/2-		≤ 0.1 ns	10E-12						
7	$^{147}_{60}Nd_{87}$	463.614 *3*	3/2- *2*		≤ 0.1 ns	10E-12						
8	$^{147}_{60}Nd_{87}$	516.679 *5*	5/2- *3*									
9	$^{147}_{60}Nd_{87}$	581.0 *3*	7/2- *2*									
10	$^{147}_{60}Nd_{87}$	596.2 *3*	(13/2-)	1								
11	$^{147}_{60}Nd_{87}$	604.511 *4*	1/2- *2*		< 0.8 ns	80E-12						
12	$^{147}_{60}Nd_{87}$	631.479 *4*	3/2- *3*									

☐ **Decay radiation** order by intensity

Ground State isomers | Levels | Gammas | Decay Radiation | Nuclear Moments | Neutron Capture | Fission Yi

Comments ◯ · **Click** on a column header to open the guide · **Uncertainty** for numeric values refers to the last digits of the value: **12.1 2**

· **Definitions & Sources**

· **Evaluation**: N. Nica and B. Singh **Publication cut-off**: 9-Mar-2022 **ENSDF insertion:** 2022-03 **Publication:** Nuclear Data Sheets 181, 1 (2022) **10.1016/**

Nuclide	Energy [keV]	J^{π}	$T_{1/2}$ or Width Abund. [mole fract.]	$T_{1/2}$ [s]	Decay Modes BR [%]	Isospin	μ [μ_N]	Q [barn]	R [fm]	Q_{β^-} [keV]	Q_{α} [keV]	Q_{EC} [keV]	Q_{β^-} [ke
$^{147}_{60}Nd_{87}$	0.0	5/2-	11.03 d *3*	952992 *2592*	β- 100		0.554 *10*	0.9 *3*		895.2 *6*	1034.7 *22*	-2703 *16*	-676

Link to Nubase2020 evaluation of **147-Nd** nuclear properties

ENSDF datasets related to 147-Nd

Evaluated Nuclear Structure Data File

- ADOPTED LEVELS, GAMMAS
- 147PR B- DECAY (13.44 M) to **147ND**
- **147ND** B- DECAY (11.03 D) to 147PM
- 146ND(N,G) E=TH
- 146ND(D,P)
- 148ND(D,T),(POL D,T)

CSV Data API **Evaluation**: N. Nica and B. Singh **Publication cut-off**: 9-Mar-2022 **ENSDF insertion:** 2022-03 **Publication:** Nuclear Data Sheets 181, 1 (2022) **10.1016/j.nds.2022.03.001**

#	Nuclide	Initial Level E_x[keV]	Initial Level J^{π}_{order}	Initial Level $T_{1/2}$ or Width	Final Level E_x[keV]	Final Level J^{π}_{order}	E_{γ} [keV]	I_{γ}(rel) [%]	Mult.	δ	α_T	B(EL) [W.u.]	B(ML) [W.u.]	Additional data	Comments
1	$^{147}_{60}Nd_{87}$	49.9268 *10*	7/2-	1.0 ns *3*	0.0	5/2-	49.927 *1*	100	M1+E2	< 0.42	12 *16*		0.012 *+11-4*		
2	$^{147}_{60}Nd_{87}$	127.9189 *10*	5/2- *2*	0.4 ns *1*	49.9268 *10*	7/2-	77.9921 *3*	100 *6*	M1+E2	< 0.48	3.13 *24*		0.017 *+13-5*		
3	$^{147}_{60}Nd_{87}$	127.9189 *10*	5/2- *2*	0.4 ns *1*	0.0	5/2-	127.919 *6*	76 *4*	M1(+E2)	< 0.40	0.718 *18*		0.0032 *+24-10*		
4	$^{147}_{60}Nd_{87}$	190.291 *6*	(9/2)-		49.9268 *10*	7/2-	140.364 *6*	100	[M1+E2]		0.6 *6*				
5	$^{147}_{60}Nd_{87}$	214.5949 *12*	1/2-	4.53 ns *6*	127.9189 *10*	5/2- *2*	86.6759 *6*	100 *6*	E2		3.68	111.8 *20*			
6	$^{147}_{60}Nd_{87}$	214.5949 *12*	1/2-	4.53 ns *6*	0.0	5/2-	214.594 *6*	23.9 *15*	E2		0.1548	0.287 *24*			
7	$^{147}_{60}Nd_{87}$	314.6799 *23*	3/2-	≤ 0.1 ns	214.5949 *12*	1/2-	100.078 *3*	2.4 *3*	[M1]		1.413				
8	$^{147}_{60}Nd_{87}$	314.6799 *23*	3/2-	≤ 0.1 ns	127.9189 *10*	5/2- *2*	186.752 *6*	5.6 *7*	E2		0.247				
9	$^{147}_{60}Nd_{87}$	314.6799 *23*	3/2-	≤ 0.1 ns	49.9268 *10*	7/2-	264.70 *4*	1.9 *5*	[E2]		0.0779				
10	$^{147}_{60}Nd_{87}$	314.6799 *23*	3/2-	≤ 0.1 ns	0.0	5/2-	314.675 *4*	100 *5*	M1+E2	1.3 *+9-4*	0.051 *4*				
11	$^{147}_{60}Nd_{87}$	463.614 *3*	3/2- *2*	≤ 0.1 ns	314.6799 *23*	3/2-	148.7 *3*	0.8 *3*	[M1+E2]		0.5 *4*				
12	$^{147}_{60}Nd_{87}$	463.614 *3*	3/2- *2*	≤ 0.1 ns	214.5949 *12*	1/2-	249.029 *4*	28 *3*	M1+E2	0.8 *+35-9*	0.105 *10*				
13	$^{147}_{60}Nd_{87}$	463.614 *3*	3/2- *2*	≤ 0.1 ns	127.9189 *10*	5/2- *2*	335.700 *5*	100 *5*	E2(+M1)	3.6 *+20-8*	0.038 *8*				

LiveChart

Decay radiation

Beta -

CSV Data API

#	<Eβ-> [keV]	Iβ-(abs) [%]	Daughter level [keV]	Jπ	Eβ-, max [keV]	log *ft*	Transition type	Comments
1	22.88 *17*	0.00058 *12*	807.25 *15*	5/2-,7/2-	(87.9)	9.42 *9*		
2	57.39 *18*	2.19 *4*	685.899 *12*	5/2+	(209.3)	7.015 *9*	1st non-unique	
3	59.02 *18*	0.0782 *18*	680.432 *20*	7/2+	(214.8)	8.50 *1*	1st non-unique	
4	70.92 *19*	0.0051 *5*	641.11 *5*	(5/2)+	(254.1)	9.92 *5*	1st non-unique	
5	85.75 *23*	< 0.006	632.85 *4* ?	1/2+	(262.3)	> 9.6	1st unique	
6	105.86 *20*	15.25 *21*	530.998 *9*	5/2+	(364.2)	6.947 *7*	1st non-unique	
7	119.67 *20*	0.819 *15*	489.247 *13*	7/2+	(406.0)	8.372 *9*	1st non-unique	
8	146.49 *21*	0.62 *3*	410.515 *9*	3/2+	(484.7)	8.75 *2*	1st non-unique	
9	263.80 *24*	**81.0 *3***	91.1051 *16*	5/2+	(804.1)	7.392 *3*	1st non-unique	
10	299.26 *24*	< 0.3	0.0 ?	7/2+	(895.2)	> 10.0	1st non-unique	

Warning

γ without initial level have not been placed in the level schema

γ without intensity are expected but not observed

Gamma

CSV Data API

#	Eγ [keV]	Iγ-(abs) [%]	Initial level [keV]	Jπ	Final level [keV]	Jπ	Mult.	δ	αT	ITot [%]	Comments
1	53.1 *2*	0.0007 *4*	685.899 *12*	5/2+	632.85	1/2+	[E2]		25.1 *6*	0.018 *10*	
2	81.13 *8*	0.00072 *18*	489.247 *13*	7/2+	408.14	9/2+	[M1+E2]		3.8 *11*	0.0035 *12*	
3	91.1050 *16*	**28.9 *5***	91.1051 *16*	5/2+	0.0	7/2+	M1+E2	0.089 *5*	2.03	87.6 *17*	
4	120.483 *9*	0.369 *5*	530.998 *9*	5/2+	410.515	3/2+	M1+E2	0.048 *21*	0.911	0.705 *11*	
5	149.39 *6*	0.0035 *4*	680.432 *20*	7/2+	530.998	5/2+	[M1+E2]		0.52 *3*	0.0053 *6*	
6	154.91 *5*	0.0064 *5*	685.899 *12*	5/2+	530.998	5/2+	[M1+E2]		0.466 *18*	0.0094 *7*	
7	191.19 *6*	0.0037 *4*	680.432 *20*	7/2+	489.247	7/2+	[M1+E2]		0.243 *9*	0.0046 *5*	
8	196.64 *3*	0.181 *4*	685.899 *12*	5/2+	489.247	7/2+	M1+E2	-0.22 *10*	0.231	0.223 *5*	
9	222.27 *6*	0.0014 *4*	632.85 *4* ?	1/2+	410.515	3/2+	[M1+E2]		0.154 *12*	0.0016 *5*	
10	230.59 *5*	0.0045 *4*	641.11 *5*	(5/2)+	410.515	3/2+	M1(+E2)		0.138 *13*	0.0051 *5*	
11	272.30 *4*	0.0118 *3*	680.432 *20*	7/2+	408.14	9/2+	M1+E2	0.10 *3*	0.0962	0.0129 *3*	
12	275.388 *15*	0.791 *16*	685.899 *12*	5/2+	410.515	3/2+	M1+E2	0.109 *7*	0.0931	0.865 *18*	
13	319.410 *12*	1.97 *3*	410.515 *9*	3/2+	91.1051	5/2+	M1+E2	-0.38 *2*	0.0607	2.09 *3*	
14	398.130 *16*	0.867 *13*	489.247 *13*	7/2+	91.1051	5/2+	M1+E2	0.30 *1*	0.0345 *5*	0.897 *13*	
15	408.15 *5*	0.0137 *5*	408.14 *4*	9/2+	0.0	7/2+	M1+E2	0.57 *3*	0.0304	0.0141 *5*	
16	410.52 *3*	0.1071 *21*	410.515 *9*	3/2+	0.0	7/2+	E2		0.0212	0.1094 *21*	
17	439.875 *17*	1.203 *16*	530.998 *9*	5/2+	91.1051	5/2+	M1+E2	0.62 *5*	0.0247 *5*	1.233 *16*	
18	489.27 *3*	0.142 *5*	489.247 *13*	7/2+	0.0	7/2+	M1+E2	-0.8 *3*	0.0179 *18*	0.145 *5*	
19	531.012 *18*	13.11 *13*	530.998 *9*	5/2+	0.0	7/2+	M1+E2	-0.40 *3*	0.0162 *3*	13.32 *13*	
20	541.79 *5*	0.0117 *8*	632.85 *4*	1/2+	91.1051	5/2+	[E2]		0.00994	0.0118 *8*	
21	589.35 *3*	0.0387 *12*	680.432 *20*	7/2+	91.1051	5/2+	(M1+E2)		0.011 *3*	0.0391 *12*	
22	594.796 *21*	0.243 *4*	685.899 *12*	5/2+	91.1051	5/2+	E2(+M1)	≥ 6	0.00790 *13*	0.245 *4*	
23	680.40 *4*	0.0161 *8*	680.432 *20*	7/2+	0.0	7/2+	M1+E2		0.0074 *18*	0.0162 *8*	
24	685.88 *3*	0.823 *17*	685.899 *12*	5/2+	0.0	7/2+	M1+E2	-1.0 *3*	0.0073 *7*	0.829 *17*	
25	716.2 *2*	0.00030 *9*	807.25 *15*	5/2-,7/2-	91.1051	5/2+	E1				
26	807.2 *2*	0.00028 *8*	807.25 *15*	5/2-,7/2-	0.0	7/2+	E1				

X-rays

CSV Data API

#	E [keV]	I(abs) [%]	Line
1	4.811 - 7.407	7.5 *4*	L
2	38.171	13.3 *5*	K-L_2
3	38.724	24.1 *9*	K-L_3
4	43.712 - 44.156	7.5 *3*	K-$M_{2,3,4}$
5	43.712 - 45.061	9.4 *4*	K-MN
6	44.927 - 44.948	1.92 *9*	K-$N_{2,3,4,5}O_{2,3}$

X-rays from each γ transition

#	E [keV]	I(abs) [%]	Line	γ Energy [keV]	α_{shell}
1	4.811	0.00075 *3*	L3-M1	120.483	
2	5.364	0.000330 *14*	L2-M1	120.483	
3	5.407	0.00190 *9*	L3-M4	120.483	
4	5.432	0.00190 *9*	L3-M5	120.483	
5	4.811 - 6.458	0.0229 *10*	L_3	120.483	0.0018 4
6	5.956	0.00106 *4*	L1-M2	120.483	
7	5.960	0.0120 *5*	L2-M4	120.483	
8	6.070	0.00157 *6*	L1-M3	120.483	

Electrons

CSV Data API

#	E [keV]	I(abs) [%]	Origin	γ En. [keV]	α_{shell}
1	3.158 - 7.401	**43.4 *15***	AU L		
2	30.324 - 32.260	2.53 *16*	AU KLL		
3	36.103 - 38.718	1.27 *8*	AU KLX		
4	30.324 - 45.138	4.0 *3*	AU K		
5	41.882 - 45.138	0.160 *11*	AU KXY		
6	7.9 *20*	0.0031 *18*	CE K	53.1	4.40 7
7	35.94 *8*	0.0016 *4*	CE K	81.13	2.24 16
8	45.7 - 46.6 *20*	0.011 *6*	CE L	53.1	16.1 4
9	45.9170 *16*	50.0 *19*	CE K	91.1050	1.73 6
10	51.4 - 52.1 *20*	0.0026 *15*	CE M	53.1	3.73 9

LiveChart

Decay radiation

Beta -

CSV Data API

#	<Eβ-> [keV]	Iβ-(abs) [%]	Daughter level [keV]	Jπ	Eβ-, max [keV]	log *ft*	Transition type	Comments
1	22.88 *17*	0.00058 *12*	807.25 *15*	5/2-,7/2-	(87.9)	9.42 *9*		
2	57.39 *18*	2.19 *4*	685.899 *12*	5/2+	(209.3)	7.015 *9*	1st non-unique	
3	59.02 *18*	0.0782 *18*	680.432 *20*	7/2+	(214.8)	8.50 *1*	1st non-unique	
4	70.92 *19*	0.0051 *5*	641.11 *5*	(5/2)+	(254.1)	9.92 *5*	1st non-unique	
5	85.75 *23*	< 0.006	632.85 *4* ?	1/2+	(262.3)	> 9.6	1st unique	
6	105.86 *20*	15.25 *21*	530.998 *9*	5/2+	(364.2)	6.947 *7*	1st non-unique	
7	119.67 *20*	0.819 *15*	489.247 *13*	7/2+	(406.0)	8.372 *9*	1st non-unique	
8	146.49 *21*	0.62 *3*	410.515 *9*	3/2+	(484.7)	8.75 *2*	1st non-unique	
9	263.80 *24*	**81.0 *3***	91.1051 *16*	5/2+	(804.1)	7.392 *3*	1st non-unique	
10	299.26 *24*	< 0.3	0.0 ?	7/2+	(895.2)	> 10.0	1st non-unique	

Warning

γ without initial level have not been placed in the level schema

γ without intensity are expected but not observed

Gamma

CSV Data API

#	Eγ [keV]	Iγ-(abs) [%]	Initial level [keV]	Jπ	Final level [keV]	Jπ	Mult.	δ	αT	ITot [%]	Comments
1	53.1 *2*	0.0007 *4*	685.899 *12*	5/2+	632.85	1/2+	[E2]		25.1 *6*	0.018 *10*	
2	81.13 *8*	0.00072 *18*	489.247 *13*	7/2+	408.14	9/2+	[M1+E2]		3.8 *11*	0.0035 *12*	
3	91.1050 *16*	**28.9 *5***	91.1051 *16*	5/2+	0.0	7/2+	M1+E2	0.089 *5*	2.03	87.6 *17*	
4	120.483 *9*	0.369 *5*	530.998 *9*	5/2+	410.515	3/2+	M1+E2	0.048 *21*	0.911	0.705 *11*	
5	149.39 *6*	0.0035 *4*	680.432 *20*	7/2+	530.998	5/2+	[M1+E2]		0.52 *3*	0.0053 *6*	
6	154.91 *5*	0.0064 *5*	685.899 *12*	5/2+	530.998	5/2+	[M1+E2]		0.466 *18*	0.0094 *7*	
7	191.19 *6*	0.0037 *4*	680.432 *20*	7/2+	489.247	7/2+	[M1+E2]		0.243 *9*	0.0046 *5*	
8	196.64 *3*	0.181 *4*	685.899 *12*	5/2+	489.247	7/2+	M1+E2	-0.22 *10*	0.231	0.223 *5*	
9	222.27 *6*	0.0014 *4*	632.85 *4* ?	1/2+	410.515	3/2+	[M1+E2]		0.154 *12*	0.0016 *5*	
10	230.59 *5*	0.0045 *4*	641.11 *5*	(5/2)+	410.515	3/2+	M1(+E2)		0.138 *13*	0.0051 *5*	
11	272.30 *4*	0.0118 *3*	680.432 *20*	7/2+	408.14	9/2+	M1+E2	0.10 *3*	0.0962	0.0129 *3*	
12	275.388 *15*	0.791 *16*	685.899 *12*	5/2+	410.515	3/2+	M1+E2	0.109 *7*	0.0931	0.865 *18*	
13	319.410 *12*	1.97 *3*	410.515 *9*	3/2+	91.1051	5/2+	M1+E2	-0.38 *2*	0.0607	2.09 *3*	
14	398.130 *16*	0.867 *13*	489.247 *13*	7/2+	91.1051	5/2+	M1+E2	0.30 *1*	0.0345 *5*	0.897 *13*	
15	408.15 *5*	0.0137 *5*	408.14 *4*	9/2+	0.0	7/2+	M1+E2	0.57 *3*	0.0304	0.0141 *5*	
16	410.52 *3*	0.1071 *21*	410.515 *9*	3/2+	0.0	7/2+	E2		0.0212	0.1094 *21*	
17	439.875 *17*	1.203 *16*	530.998 *9*	5/2+	91.1051	5/2+	M1+E2	0.62 *5*	0.0247 *5*	1.233 *16*	
18	489.27 *3*	0.142 *5*	489.247 *13*	7/2+	0.0	7/2+	M1+E2	-0.8 *3*	0.0179 *18*	0.145 *5*	
19	531.012 *18*	13.11 *13*	530.998 *9*	5/2+	0.0	7/2+	M1+E2	-0.40 *3*	0.0162 *3*	13.32 *13*	
20	541.79 *5*	0.0117 *8*	632.85 *4*	1/2+	91.1051	5/2+	[E2]		0.00994	0.0118 *8*	
21	589.35 *3*	0.0387 *12*	680.432 *20*	7/2+	91.1051	5/2+	(M1+E2)		0.011 *3*	0.0391 *12*	
22	594.796 *21*	0.243 *4*	685.899 *12*	5/2+	91.1051	5/2+	E2(+M1)	≥ 6	0.00790 *13*	0.245 *4*	
23	680.40 *4*	0.0161 *8*	680.432 *20*	7/2+	0.0	7/2+	M1+E2		0.0074 *18*	0.0162 *8*	
24	685.88 *3*	0.823 *17*	685.899 *12*	5/2+	0.0	7/2+	M1+E2	-1.0 *3*	0.0073 *7*	0.829 *17*	
25	716.2 *2*	0.00030 *9*	807.25 *15*	5/2-,7/2-	91.1051	5/2+	E1				
26	807.2 *2*	0.00028 *8*	807.25 *15*	5/2-,7/2-	0.0	7/2+	E1				

X-rays

CSV Data API

#	E [keV]	I(abs) [%]	Line
1	4.811 - 7.407	7.5 *4*	L
2	38.171	13.3 *5*	K
3	38.724	24.1 *9*	K
4	43.712 - 44.156	7.5 *3*	K
5	43.712 - 45.061	9.4 *4*	K
6	44.927 - 44.948	1.92 *9*	K-$N_{2,3,4,5}O_{2,3}$

X-rays from each γ transition

#	E [keV]	I(abs) [%]	Line	γ Energy [keV]	α_{shell}
1	4.811	0.00075 *3*	L3-M1	120.483	
7	5.960	0.0120 *5*	L2-M4	120.483	
8	6.070	0.00157 *6*	L1-M3	120.483	

Electrons

CSV Data API

#	E [keV]	I(abs) [%]	Origin	γ En. [keV]	α_{shell}
1	3.158 - 7.401	**43.4 *15***	AU L		
8	45.7 - 46.6 *20*	0.011 *6*	CE L	53.1	16.1 4
9	45.9170 *16*	50.0 *19*	CE K	91.1050	1.73 6

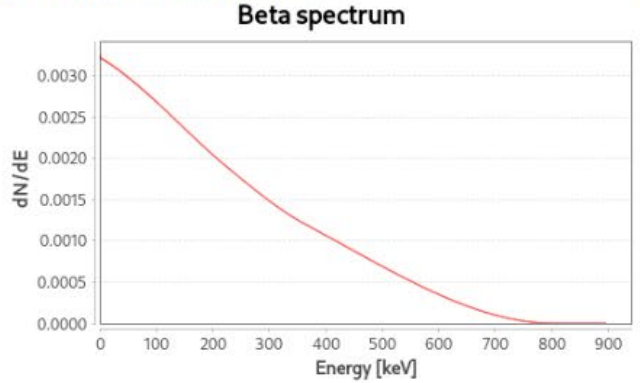
Atomic shell transition yields : see [E.Schönfeld, H.Janßen](#) and its references.

Atomic shell energies from [Evaluated Atomic Data Library](#)

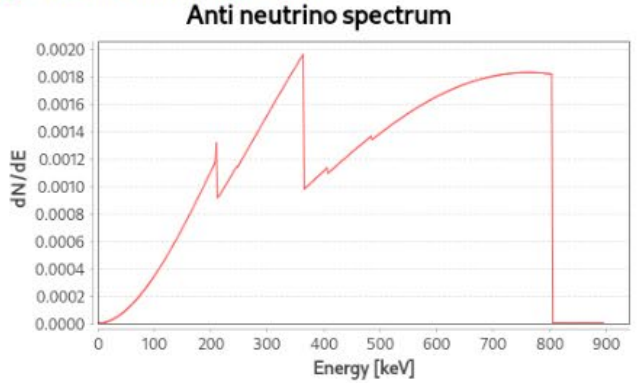
LiveChart

Decay radiation: decay scheme and emitted spectra

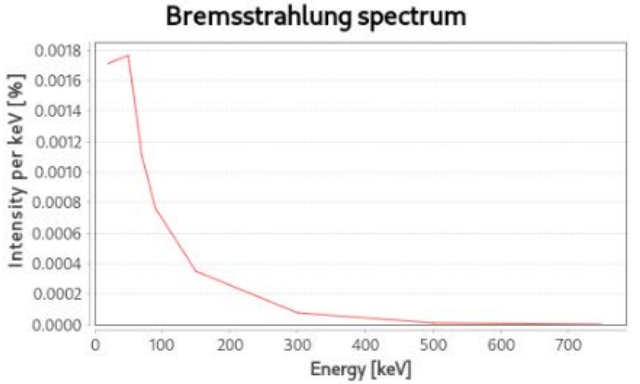
Large plot with each transition



Large plot with each transition



Show data table



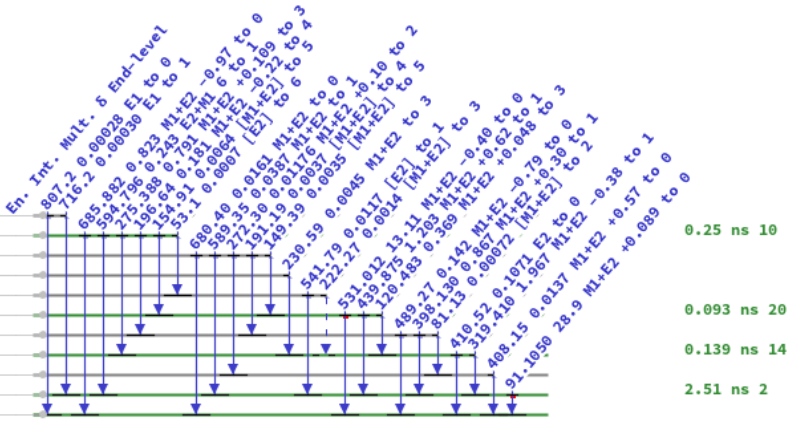
$^{147}_{60}Nd_{87}$

5/2− 0.0 11.03 d 3

Q⁺ 895.2 keV 6

B− : 100.0 % 0--> $^{147}_{61}Pm_{86}$

I%	Log ft	#	Jp	En [keV]
0.00058	9.42	10	5/2−,7/2−	807.25
2.19	7.015	9	5/2+	685.899
0.0782	8.50	8	7/2+	680.432
0.0051	9.92	7	(5/2)+	641.11
0.006	>9.6	6	1/2+	632.85
15.25	6.947	5	5/2+	530.998
0.819	8.372	4	7/2+	489.247
0.62	8.75	3	3/2+	410.515
		2	9/2+	408.14
81.0	7.392	1	5/2+	91.1051
0.3	>10.0	0	7/2+	0.0



$^{147}_{61}Pm_{86}$ 2.6234 Y 4

LiveChart to Nubase

Decay radiation order by intensity

Ground State isomers | Levels | Gammas | Decay Radiation | Nuclear Moments | Neutron Capture | Fission Yields | Schema Plot

Comments · Click on a column header to open the guide · Uncertainty for numeric values refers to the last digits of the value: 12.1 *23* means 12.1 ± 2.3 · Data from: ENSDF Angeli & Marinova AME2020

· Definitions & Sources

· Evaluation: N. Nica and B. Singh Publication cut-off: 9-Mar-2022 ENSDF insertion: 2022-03 Publi

Nuclide	Energy [keV]	Jπ	T1/2 or Width Abund. [mole fract.]	T1/2 [s]	Decay Modes BR [%]	Isospin	μ [μN]
$^{147}_{60}Nd_{87}$	0.0	5/2-	11.03 d *3*	952992 *2592*	β- 100		0.554 *10*

Link to Nubase2020 evaluation of 147-Nd nuclear properties

ENSDF datasets related to 147-Nd

Evaluated Nuclear Structure Data File

- ADOPTED LEVELS, GAMMAS
- 147PR B- DECAY (13.44 M) to **147ND**
- **147ND** B- DECAY (11.03 D) to 147PM
- 146ND(N,G) E=TH
- 146ND(D,P)
- 148ND(D,T),(POL D,T)

Uncertainties are in absoulte value, apart from the decay branching ratio given in ENSDF style: 12.1 23 means 12.1 ± 2.3

Nuclide	Mass Excess [keV]	Energy [keV]	Flags ?	Isospin	Jπ	T1/2 Abund. [%]	Decay Modes BR [%] ?	Discovery	Qβ- [keV]	Qα [keV]	QEC [keV]	Sn [keV]	Sp [keV]	Binding/A [keV]	Atomic Mass [μ AMU]
$^{147}_{60}Nd_{87}$	-78146.8 ± 1.3				5/2-*	10.98 d 0.01	β- 100	1947	895.2 ± 0.6	1034.7 ± 2.2	-2703 ± 16	5292.20 ± 0.09	8762 ± 34	8283.604 ± 0.009	146916106.0 ± 1.4

LiveChart

Decay radiation

Warning : **Q values** are the ones at the time of the evaluation

Completeness of decay scheme

Evaluation: N. Nica and B. Singh **Publication cut-off**: 9-Mar-2022 **ENSDF insertion:** 2022-03 **Publication:** Nuclear Data Sheets 181, 1 (2022)

Parent	$T_{1/2}$ or Width	E_x [keV]	Jp order	Decay	Q_{decay}[keV] see the note	Daughter	Comments	Total energy by radiation type, per 1 decay of the parent [keV] Alpha	Beta	CE & Auger	γ & X	Recoil	Neutrino	Total	Q * BR	Delta	Unplaced
$^{147}_{60}Nd_{87}$	11.03 d *3*	0.0	5/2-	β- 100 %	895.2 *6*	$^{147}_{61}Pm_{86}$			233.5 *10*	36.7 *9*	141.7 *10*		487.3 *20*	899 *3*	895.2 *6*	0 %	

ENSDF source Compare decay libraries **(allow pop-up)**

#1. ENDF/B-VIII.0 Nd-147	#2. JEFF-3.3 Nd-147	#3. JENDL-5 Nd-147	#4. DDEP-2021 Nd-147	#5. ENSDF-2025 Nd-147
Nucleus: Nd-147 ZA=60147 Library: ENDF/B-VIII.0, MAT=2034 AUTH: Conversion from ENSDF EDATE: EVAL-NOV05 Half life: 10.98 ± 0.01(d) AWR: 145.654 Isomer number: LISO=0 Level number: LIS=0 Spin & Parity: 5/2- Ebeta: 268.0441 ± 4.939273 (keV) Egamma: 144.1973 ± 5.807435 (keV) Ealpha: 0 ± 0 (keV) Decay modes: 1 Radiation types:4	Nucleus: Nd-147 ZA=60147 Library: JEFF-3.3, MAT=2047 AUTH: A.L. NICHOLS EDATE: EVAL-JUN94 ↗Half life: 11.02 ± 0.02(d) AWR: 145.654 Isomer number: LISO=0 Level number: LIS=0 Spin & Parity: 5/2- ↗Ebeta: 270.598 ± 15.5005 (keV) ↘Egamma: 138.133 ± 7.8428 (keV) Ealpha: 0 ± 0 (keV) Decay modes: 1 Radiation types:4	Nucleus: Nd-147 ZA=60147 Library: JENDL-5, MAT=2165 AUTH: Conversion from ENSDF EDATE: EVAL-NOV21 ↘Half life: 10.98 ± 0.01(d) AWR: 145.654 Isomer number: LISO=0 Level number: LIS=0 Spin & Parity: 5/2- ↗Ebeta: 295.9469 ± 6.593113 (keV) ↘Egamma: 126.056 ± 1.614941 (keV) Ealpha: 0 ± 0 (keV) Decay modes: 1 Radiation types:4	Nucleus: Nd-147 ZA=60147 Library: DDEP-2021 LNHB, 2013-01-04 Laboratoire National Henri Becquerel ↗Half life: 10.987 ± 0.011(d) Spin & Parity: unknown Nuclide ; Nd-147 LARA Element ; Neodymium Z ; 60 Daughter(s) ; (B-) ; Pm-147 ; 100 Q- ; 895.7 Possible parent(s) ; (B-) ; Pr-147 ; 100 Half-life (d) ; 10.987 ; 0.011 Half-life (s) ; 949.3E3 ; 1.0E3 Decay constant (1/s) ; 730.2E-9 ; 0.7E-9 Specific activity (Bq/g) ; 2.9913E15 ; 0.0030E15 Reference ; CEA/LNE-LNHB - 2011 Emissions (30 lines) sorted by increasing energy Decay modes: 1 Radiation types:2	Nucleus: Nd-147 ZA=60147 Library: ENSDF-2025 ↗Half life: 11.03 ± 0.03(d) Spin & Parity: 5/2- Library ; ENSDF 202503 by livechart20241016 LARA Nuclide ; Nd-147 Element ; Neodymium Z ; 60 Daughter(s) ; (B-) ; Pm-147 ; 100 Q- ; 895.2 Possible parent(s) ; Jp ; 5/2- Half-life (d) ; 11.03 ; 0.03 Half-life (s) ; 9.53E5 ; 2.592E3 Decay constant (1/s) ; 7.272E-7 ; 2E-9 Specific activity (Bq/g) ; 2.981E15 ; 8.198E12 Reference ; ENSDF 202203 / Author(s) N. Nica and B. Singh Emissions (42 lines) sorted by increasing energy Decay modes: 1 Radiation types: 2
#M1. Decay mode: RTYP=1 β- Decay Q=895.7 ± 0.9 keV	#M1. Decay mode: RTYP=1 β- ↗Decay Q=896.1 ± 0.9 keV	#M1. Decay mode: RTYP=1 β- ↘Decay Q=896 ± 0.9 keV	#M1. Decay mode: RTYP=1 β- ↘Decay Q=895.7 keV	#M1. Decay mode: RTYP=1 β- ↘Decay Q=895.2 keV

#R1. Radiation type: STYP=0 γ
AveDecayEne=125.91 ± 5.7016 keV
⊞DiscreteSpectrum: 26 lines ☐ plot
	#R1. Radiation type: STYP=0 γ
	↘AveDecayEne=119.63 ± 7.6213 keV
	⊞DiscreteSpectrum: ↘14 lines ☐ plot
		#R1. Radiation type: STYP=0 γ
		↗AveDecayEne=125.91 ± 1.6149 keV
		⊞DiscreteSpectrum: ↗26 lines ☐ plot
			#R1. Radiation type: STYP=0 γ
			AveDecayEne: ?
			⊞DiscreteSpectrum: ↘25 lines ☐ plot
				#R1. Radiation type: STYP=0 γ
				AveDecayEne: ?
				⊞DiscreteSpectrum: ↗26 lines ☐ plot

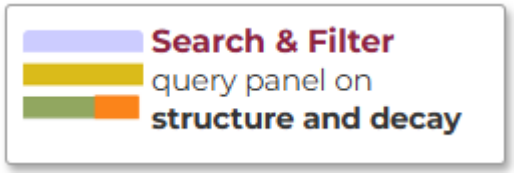
#R2. Radiation type: STYP=1 β-
AveDecayEne=231.88 ± 4.9069 keV
⊞DiscreteSpectrum: 9 end-points ☐ plot
	#R2. Radiation type: STYP=1 β-
	↗AveDecayEne=233.69 ± 15.144 keV
	⊞DiscreteSpectrum: ↘6 end-points ☐ plot
		#R2. Radiation type: STYP=1 β-
		↘AveDecayEne=231.98 ± 0.095672 keV
		⊞DiscreteSpectrum: ↗9 end-points ☐ plot
		⊞ContinuousSpectrum:82 ☐ plot
			-no-	*-no-*

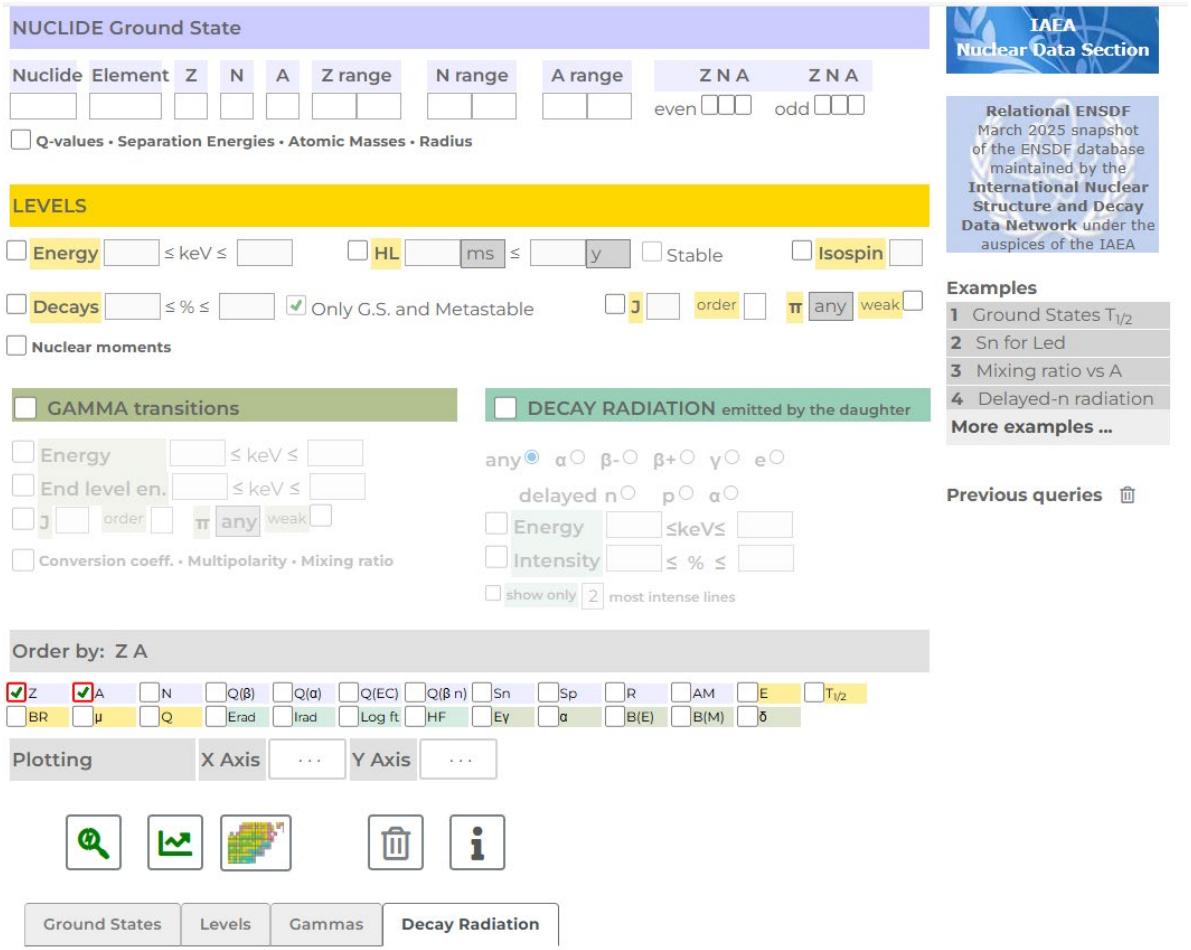
#R3. Radiation type: STYP=8 disc. e-
AveDecayEne=36.159 ± 0.56474 keV
⊞DiscreteSpectrum: 138 lines ☐ plot
	#R3. Radiation type: STYP=8 disc. e-
	↗AveDecayEne=36.908 ± 3.6908 keV
	⊞DiscreteSpectrum: ↘39 lines ☐ plot
		#R3. Radiation type: STYP=8 disc. e-
		↗AveDecayEne=63.964 ± 1.7447 keV
		⊞DiscreteSpectrum: ↗280 lines ☐ plot
			-no-	*-no-*

#R4. Radiation type: STYP=9 X-rays
AveDecayEne=18.285 ± 1.1034 keV
⊞DiscreteSpectrum: 14 lines ☐ plot
	#R4. Radiation type: STYP=9 X-rays
	↗AveDecayEne=18.508 ± 1.8508 keV
	⊞DiscreteSpectrum: ↘6 lines ☐ plot
		#R4. Radiation type: STYP=9 X-rays
		↘AveDecayEne=0.144 ± 4.022e-3 keV
		⊞DiscreteSpectrum: ↗33 lines ☐ plot
			#R2. Radiation type: STYP=9 X-rays
			AveDecayEne: ?
			⊞DiscreteSpectrum: ↘5 lines ☐ plot
				#R2. Radiation type: STYP=9 X-rays
				AveDecayEne: ?
				⊞DiscreteSpectrum: ↗6 lines ☐ plot

LiveChart

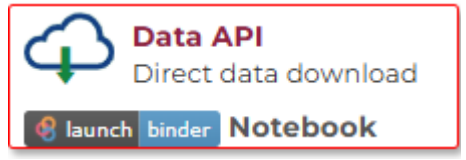
Filter – search engine





- ✓ Search per quantity of choice from GS, levels, gamma and decay radiation records
- ✓ Plot per Z, A, N, Q, …
- ✓ Download csv files
- ✓ Examples

LiveChart Data API



Livechart Data Download API

This API allows the direct download of data. At the moment the format provided is CSV (comma separated values). Future developments will include more formats, and more options to build custom queries.

Examples

The service URL is **nds.iaea.org/relnsd/v1/data?** followed by request parameters.
(please note that using 'v0' is the same as using 'v1')
Here some examples of data request parameters:

`fields=levels&nuclides=135xe` try it »
Xe-135 levels

`fields=gammas&nuclides=135xe` try it »
Xe-135 gamma transitions

`fields=ground_states&nuclides=all` try it »
all ground states in the database

`fields=cumulative_fy&parents=233u` try it »
U-233 cumulative fission yields

`fields=cumulative_fy&products=135xe` try it »
cumulative fission yields producing Xe-135

`fields=decay_rads&nuclides=135xe&rad_types=e` try it »
electrons (Auger and conversion) from Xe-135 decays

`fields=bin_beta&nuclides=135xe&rad_types=bm` try it »
Beta and (anti)neutrino energy distributions from Xe-135 G.S. decays

Jupyter lab

The **Livechart API** works very effectively with Python data analysis libraries (**pandas** and **plotly** in these examples), the first step to build models for Machine Learning.
Many examples, including 3D plotting, are detailed in this **Notebook**

Livechart API + Data Science packages

Version 1

This notebook makes use of

Pandas : a library for data manipulation: https://pandas.pydata.org
Plotly http://plotly.com : a package for interactive data visualization, here how to get it work with jupyter lab

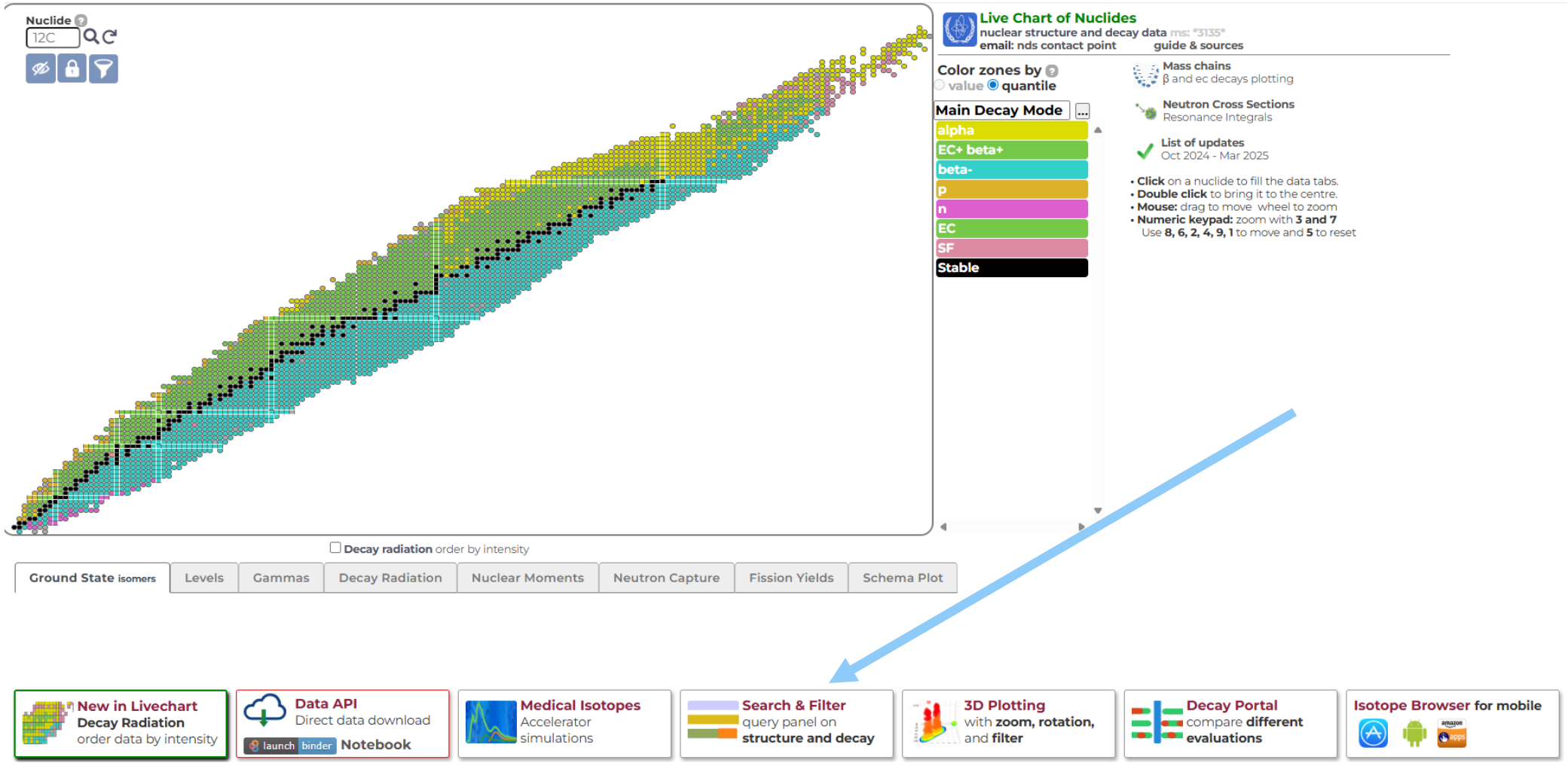
In short :

```
$ pip install pandas
$ pip install plotly
$ pip install ipywidgets
$ jupyter labextension install jupyterlab-plotly
```

Write your feedback to nds.contact-point@iaea.org

LiveChart

https://nds.iaea.org/livechart



NUCLIDE Ground State

Nuclide | Element | Z | N | A | Z range | N range | A range | Z N A even | Z N A odd

☐ Q-values • Separation Energies • Atomic Masses • Radius

LEVELS

☐ Energy ≤ keV ≤ ☐ HL ms ≤ y ☐ Stable ☐ Isospin

☐ Decays ≤ % ≤ ☑ Only G.S. and Metastable ☐ J order π any weak

☐ Nuclear moments

☐ GAMMA transitions

☐ Energy ≤ keV ≤

☐ End level en. ≤ keV ≤

☐ J order π any weak

☐ Conversion coeff. • Multipolarity • Mixing ratio

☐ DECAY RADIATION emitted by the daughter

any ◉ α ○ β- ○ β+ ○ γ ○ e ○

delayed n ○ p ○ α ○

☐ Energy ≤keV≤

☐ Intensity ≤ % ≤

☐ show only 2 most intense lines

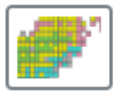
Order by: Z A

☑ Z ☑ A ☐ N ☐ Q(β) ☐ Q(α) ☐ Q(EC) ☐ Q(β n) ☐ Sn ☐ Sp ☐ R ☐ AM ☐ E ☐ $T_{1/2}$

☐ BR ☐ μ ☐ Q ☐ Erad ☐ Irad ☐ Log ft ☐ HF ☐ Eγ ☐ α ☐ B(E) ☐ B(M) ☐ δ

Plotting | X Axis ··· | Y Axis ···





Ground States | Levels | Gammas | Decay Radiation

LiveChart Filter

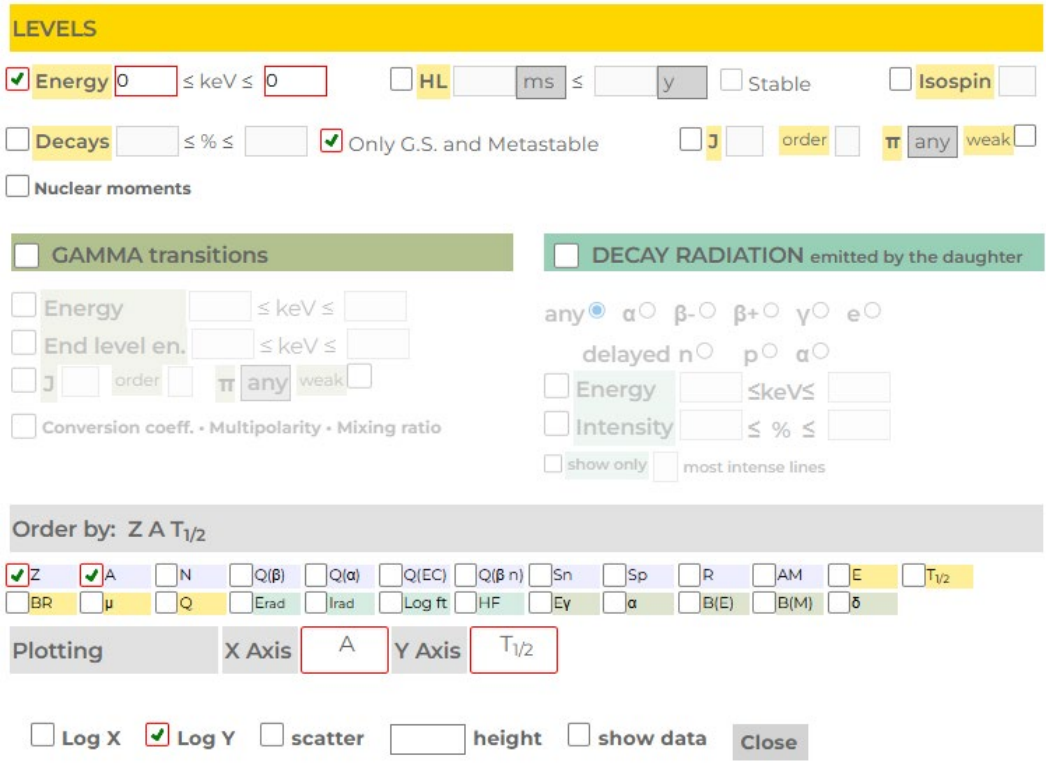
How to define queries

1) Plot g.s. $T_{1/2}$ vs A

LiveChart Filter

How to define queries

1) Plot g.s. $T_{1/2}$ vs A

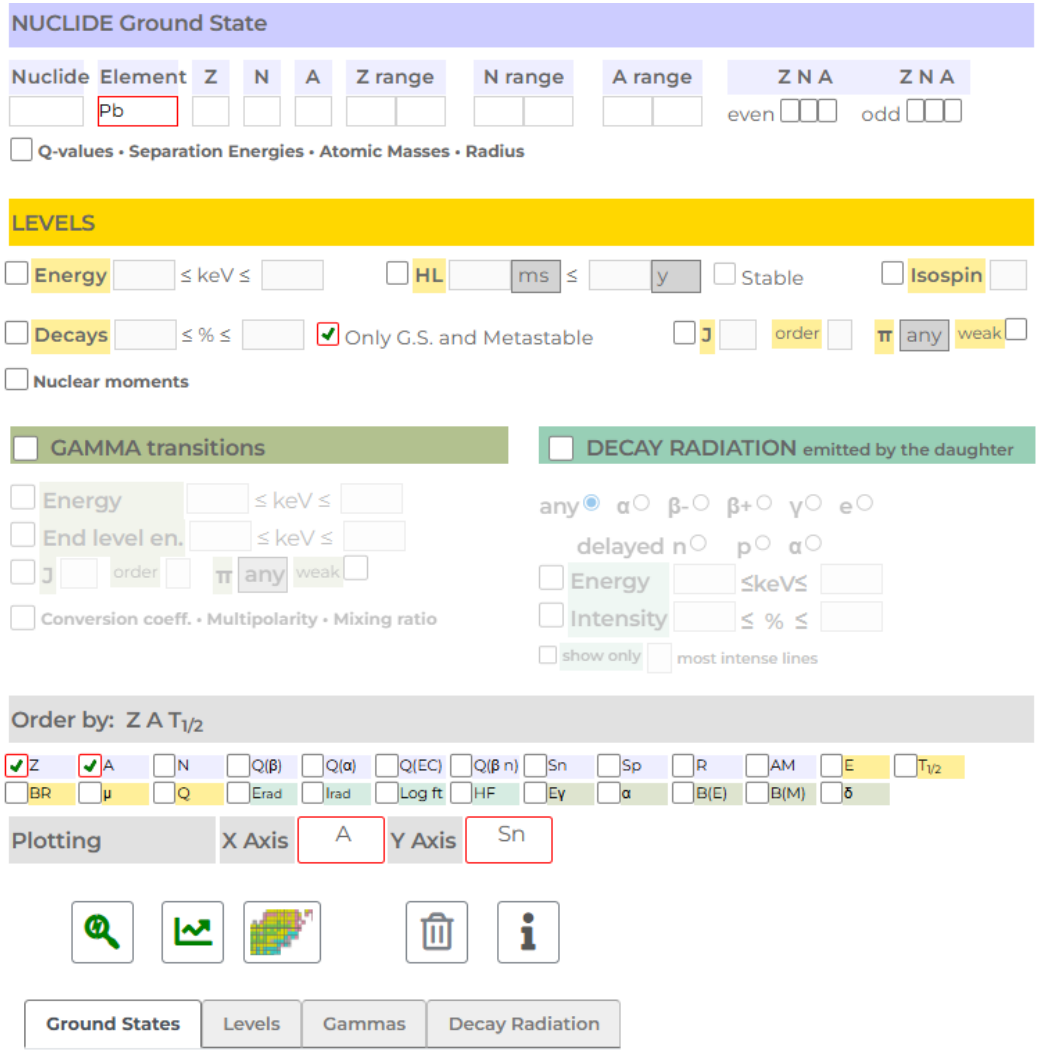


LiveChart Filter

2) Plot Sn for Pb isotopes

LiveChart Filter

2) Plot Sn for Pb isotopes

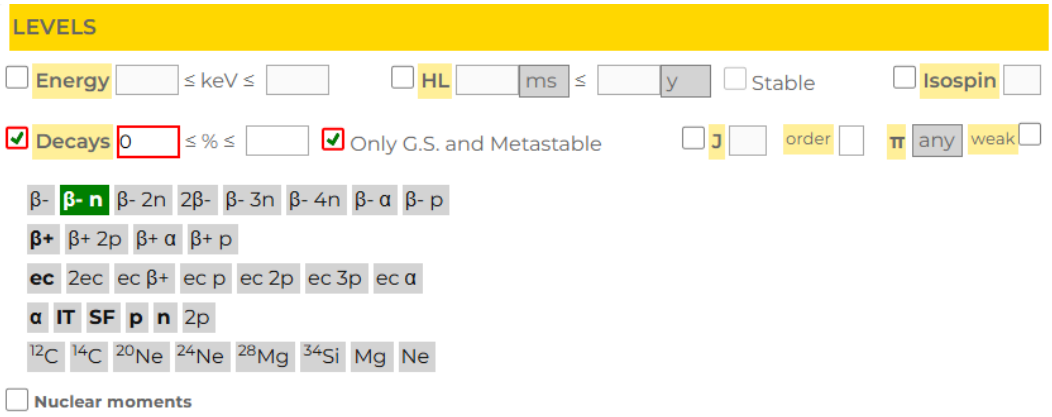


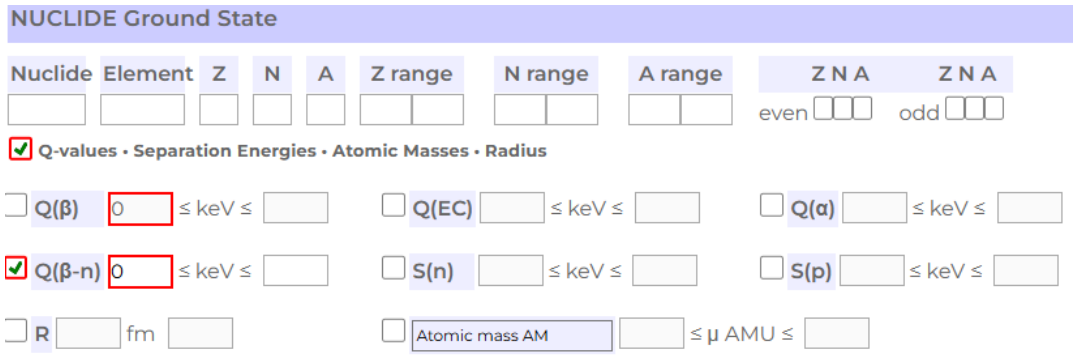
LiveChart Filter

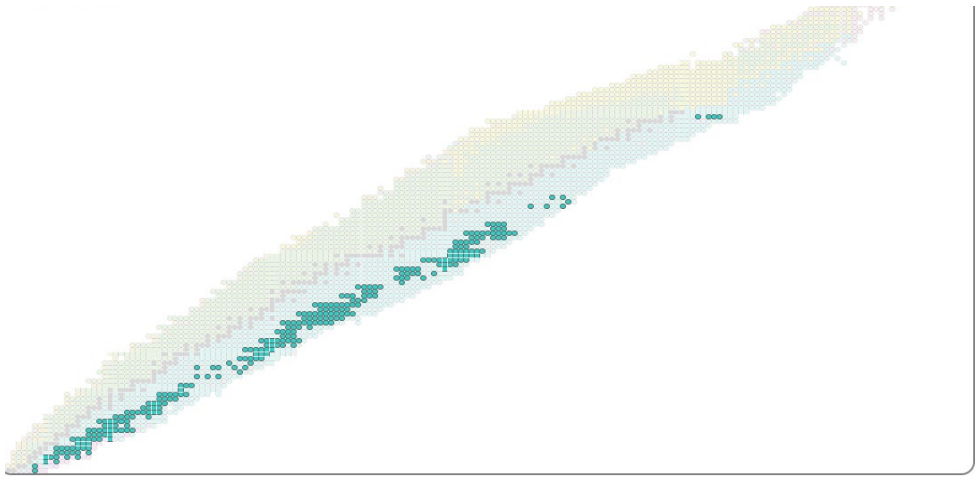
3) Measured beta-delayed neutron decays vs theoretically possible

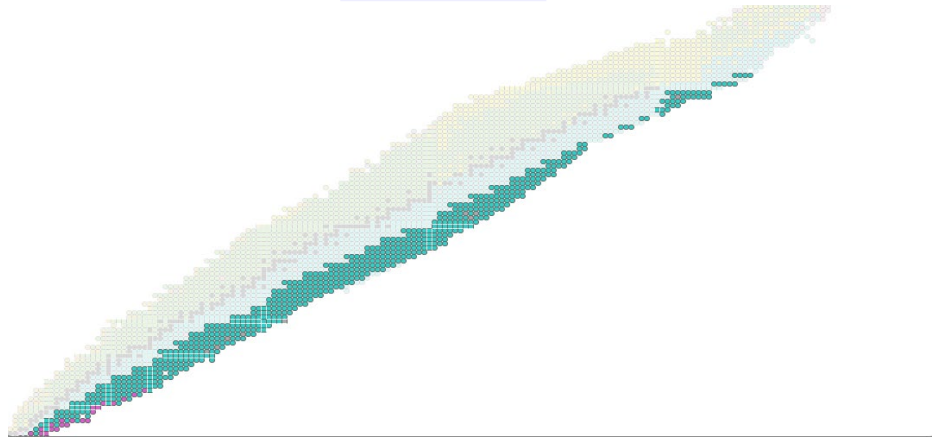
LiveChart Filter

3) Measured beta-delayed neutron decays vs theoretically possible







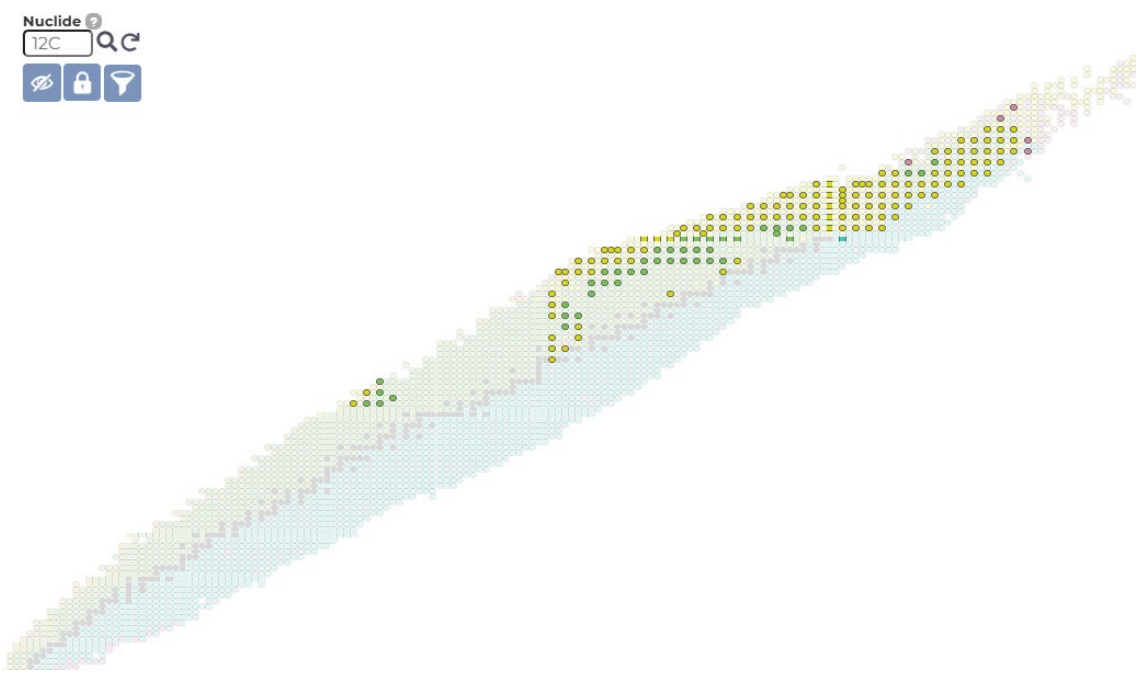


LiveChart Filter

5) Hindrance factor in alpha decay: find alpha-decaying nuclei with HF=1

LiveChart Filter

5) Hindrance factor in alpha decay: find alpha-decaying nuclei with HF=1



LEVELS

Energy ≤ keV ≤ HL ms ≤ y Stable Isospin

Decays ≤ % ≤ Only G.S. and Metastable J order π any weak

Nuclear moments

GAMMA transitions

Energy ≤ keV ≤

End level en. ≤ keV ≤

J order π any weak

Conversion coeff. • Multipolarity • Mixing ratio

DECAY RADIATION emitted by the daughter

any α β- β+ γ e

delayed n p α

Energy ≤keV≤

Intensity ≤ % ≤

show only most intense lines

Hindrance 1 ≤ HF ≤ 1

LiveChart Filter

6) Plot B(E2) strengths of transitions from first excited 2+ states to the ground state vs 2+ energies

LiveChart Filter

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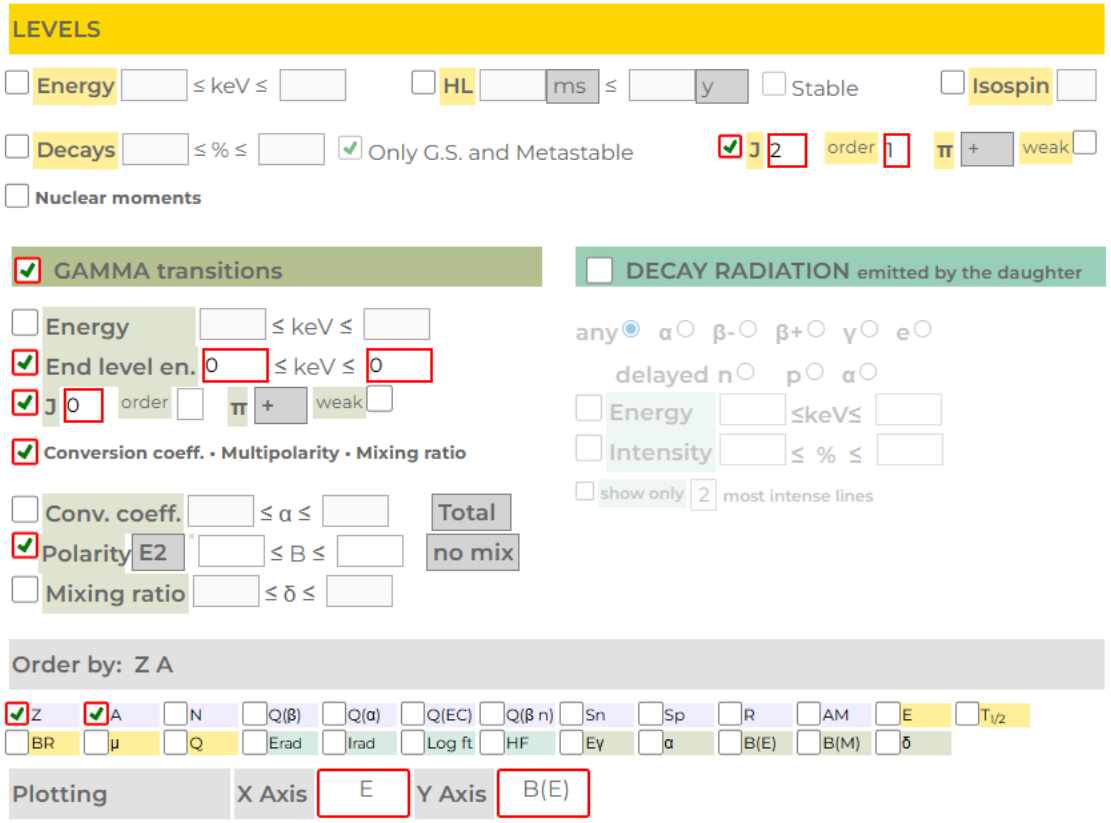

LiveChart Filter

7) Find nuclides which emit γ rays of energy 197.2 keV (no decay)

LiveChart Filter

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LiveChart Filter

8) Plot T1/2 vs E2+

LiveChart Filter

8) Plot T1/2 vs E2+

LEVELS

Energy ≤ keV ≤ HL ms ≤ y Stable Isospin

Decays ≤ % ≤ Only G.S. and Metastable J 2 order 1 π + weak

Nuclear moments

GAMMA transitions

Energy ≤ keV ≤

End level en. ≤ keV ≤

J order π any weak

Conversion coeff. • Multipolarity • Mixing ratio

DECAY RADIATION emitted by the daughter

any α β- β+ γ e

delayed n p α

Energy ≤keV≤

Intensity ≤ % ≤

show only 2 most intense lines

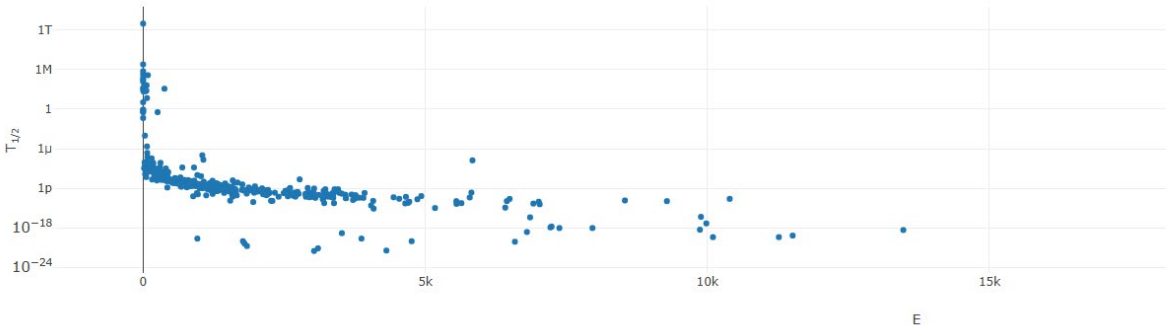
Order by: Z A

Z A N Q(β) Q(α) Q(EC) Q(β n) Sn Sp R AM E $T_{1/2}$

BR μ Q Erad Irad Log ft HF Eγ α B(E) B(M) δ

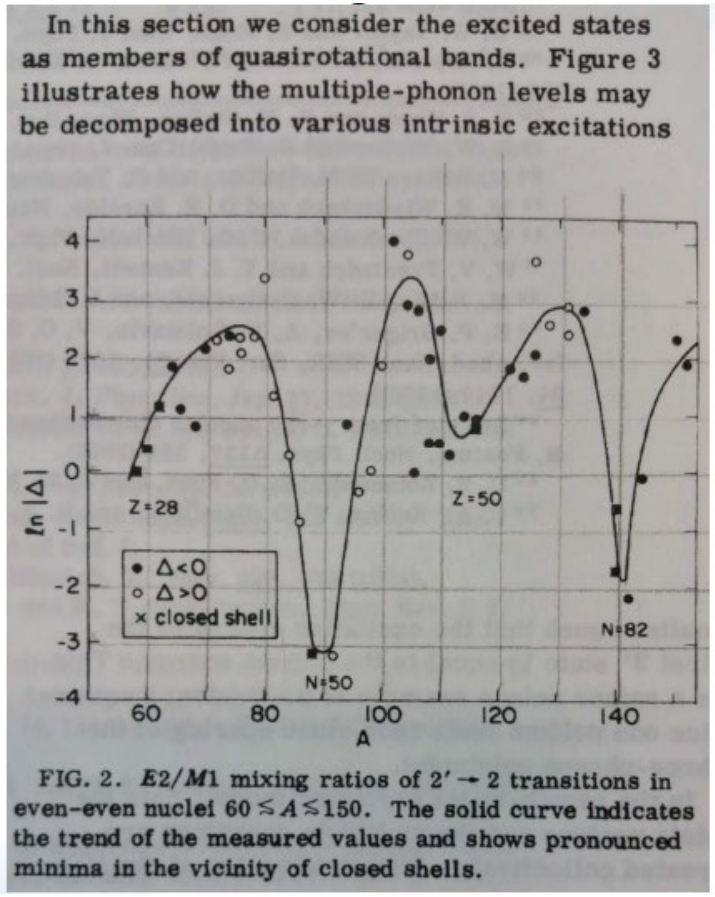
Plotting X Axis E Y Axis $T_{1/2}$

Log X Log Y scatter height show data Close



LiveChart Filter

8) Plot A vs δ mixing ratio for E2/M1 transitions from Jpi 2`+ to 2+ for e-e nuclides having 60 <A <150



K.S. Krane, Phys.Rev. C 10 (1974) 1197 (Δ is a function of δ) $E2$ $M1$

E2/M1 multipole mixing ratios of 2' →2 gamma transitions in even-even spherical nuclei

It is shown that the systematics of both magnitudes and phases of the mixing ratios are explained quite well for a number of nuclei by a model proposed by Greiner, in which the magnitude of the mixing ratio is parametrized in terms of the deviation of the g factor of the first 2+ state from the value Z/A.

LiveChart Filter

8) Plot A vs δ mixing ratio for E2/M1 transitions from Jpi 2`+ to 2+ for e-e nuclides having 60 <A <150

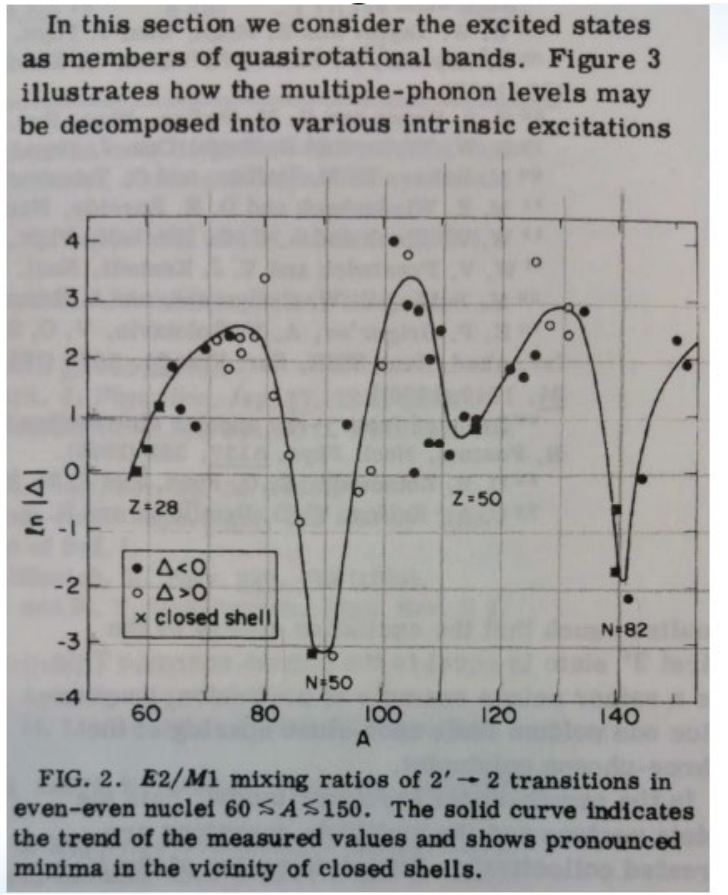
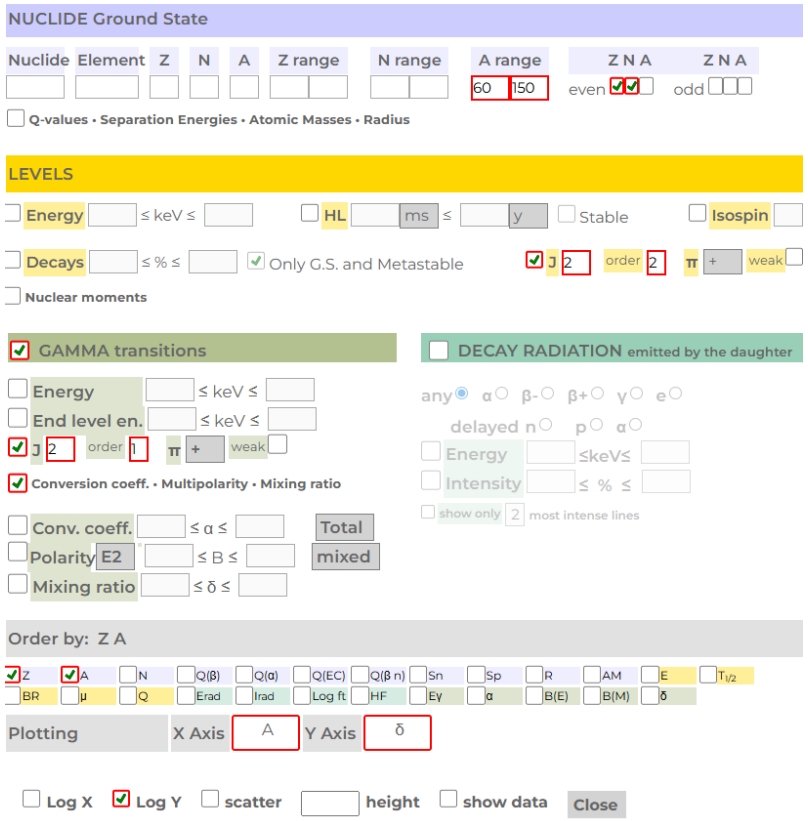

In this section we consider the excited states as members of quasirotational bands. Figure 3 illustrates how the multiple-phonon levels may be decomposed into various intrinsic excitations

FIG. 2. $E2/M1$ mixing ratios of $2' \rightarrow 2$ transitions in even-even nuclei $60 \lesssim A \lesssim 150$. The solid curve indicates the trend of the measured values and shows pronounced minima in the vicinity of closed shells.

K.S. Krane, Phys.Rev. C 10 (1974) 1197 (Δ is a function of δ)



LiveChart API

URL service: nds.iaea.org/relnsd/v1/data?

Fields:
ground_states or levels or gammas or decay_rads or cumulative_fy or independent_fy or bin_beta

Nuclides:

Nuclides=147Nd or

Nuclides=all – only for ground_states

Parents and products

Only for cummulative_fy or independent_fy – only one parent or product

Rad_type

For decay_rads: **a bp bm g e x** (α, β^-, β^+, γ, Auger and conversion electron, X-ray)

For bin_beta – only one type (**bp bm** (β^-, β^+))

LiveChart API

Examples

1) Retrieve all gammas for 133Xe:
2) Retrieve X-rays from 133Xe:
3) Retrieve all ground states:
4) Retrieve cumulative fission yields for fission product 147Nd:
5) Retrieve beta and antineutrino spectra for decay of ground state:

LiveChart API

Examples

1) Retrieve all gammas for 133Xe: **nds.iaea.org/relnsd/v1/data?fields=gammas&nuclides=133xe**

2) Retrieve X-rays from 133Xe:
nds.iaea.org/relnsd/v1/data?fields=decay_rad&nuclides=133xe&rad_types=x

3) Retrieve all ground states: **nds.iaea.org/relnsd/v1/data?fields=ground_states&nuclides=all**

4) Retrieve cumulative fission yields for fission product 147Nd:
nds.iaea.org/relnsd/v1/data?fields=cumulative_fy&product=147nd

nds.iaea.org/relnsd/v1/data?fields=cumulative_fy&parent=u235&product=147nd

5) Retrieve beta and antineutrino spectra for decay of ground state:
nds.iaea.org/relnsd/v1/data?fields=bin_beta&nuclides=135xe&rad_types=bm

1st metastable state of 135Xe:
nds.iaea.org/relnsd/v1/data?fields=bin_beta&nuclides=135xe&rad_types=bm&metastable_seqno=1

LiveChart Data API

Jupyter Notebook

$pip install pandas

$pip install plotly

$pip install ipywidgets

$jupyter labextension install jupyterlab-plotly

In **Python**:def lc_read_csv(url): req = urllib.request.Request(url) req.add_header(User-Agent , Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:77.0) Gecko/20100101 Firefox/77.0) content = urllib.requ

LiveChart Data API

Set up

Import pandas as pd

Import plotly.express as px

Import plotly.graph_objects as go

#service URL

livechart = https://nds.iaea.org/relnsd/v1/data? Or add user agent

In **Python**:

```
def lc_read_csv(url):
    req = urllib.request.Request(url)
    req.add_header('User-Agent',
        'Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:77.0) Gecko/20100101 Firefox/77.0')
    content = urllib.request.urlopen(req)
    return content
```

LiveChart Data API

Example: plot half-lives of Ac isotopes

```
url=livechart+”fields=ground_states&nuclides=all”

df=lc_pd_dataframe(url)[ [ ‘symbol’, ‘n’, ‘half_life_sec’ ] ].query( ‘ symbol==“Ac” ’ )

fig = px.scatter(df, x= “n”, y=“half-life”, log_y=True)

Fig.show()
```

LiveChart Data API

Plot beta and anti-neutrino spectra from decay of Xe-135, metastable 526 keV state

```
url=liverchart+”fields=bin_beta&nuclides=135xe&rad_types=bm&metastable_seqno=1”

df=lc_pd_dataframe(url)

fig = px.scatter(df, x=“bin_en”, y=“dn_de”)

fig.add_trace(go.Scatter(x=df[“bin_en”], y=df[“dn_de_nu”]))

fig.show
```

Thank you!