

Dissemination of nuclear structure and decay data @ IAEA

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Agency

ICTP, 6 Oct. 2025



Nuclear Data Section



International Atomic Energy Agency

Nuclear Data Services

Provided by the Nuclear Data Section



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NEW

TALYS-2.0 - Nuclear reaction model code and related packages [\[page\]](#)

IDB - An International Database of Reference Gamma Spectra [\[page\]](#)

Stopping Power - Electronic Stopping Power of Matter for Ions [\[page\]](#)

Web-API for EXFOR/ENDF/IBANDL - software search/download for EXFOR/ENDF/IBANDL [\[page\]](#)

Main | [All](#) | [Reaction Data](#) | [Structure & Decay](#) | [by Applications](#) | [Doc & Codes](#) | [Index](#) | [Events](#) | [Links](#) | [News](#)



EXFOR

Experimental nuclear reaction data



LiveChart of Nuclides

Interactive Chart of Nuclides
Mobile App: Isotope Browser



CINDA

Nuclear reaction bibliography



ENDF

Evaluated nuclear reaction libraries



ENSDF

evaluated nuclear structure and decay data (+XUNDL) **



NSR

Nuclear Science References *

NuDat-3

selected evaluated nuclear structure data **

RIPL

reference parameters for nuclear model calculations

IBANDL

Ion Beam Analysis Nuclear Data Library

PGAA

Prompt gamma rays from neutron capture

FENDL

Fusion Evaluated Nuclear Data Library

Photonuclear

- IAEA Photonuclear Data Library, 2019
- EPICS Electron & Photon Interaction Data, 2017

Charged particle reference cross section

Beam monitor reactions

NAA

Neutron Activation Analysis Portal

Safeguards Data

Last updated: May 2021

Medical Portal

Medical Portal

Standards

- Neutron cross-sections, 2017
- Decay data, 2005

*Database at the IAEA, Vienna

**Database at the US NNDC

IAEA Nuclear Data Section



IAEA-NDS
Mission



A+M
Atomic and
Molecular
Data



Meetings
Workshops



Newsletters



Coordinated
Research
Projects



Nuclear Reaction
Data Center
Network



Nuclear Structure
& Decay Data
Network



International
Network of Nuclear
Data Evaluators



Technical Documents
INDC Reports
Publications



Computer
Codes

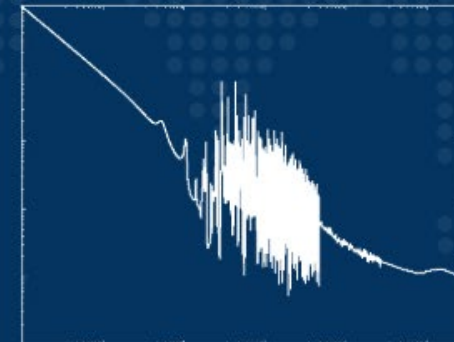


IAEA-NA
Department of
Nuclear Sciences
and Applications

New webpage

IAEA Nuclear Data

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



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](#) | ...

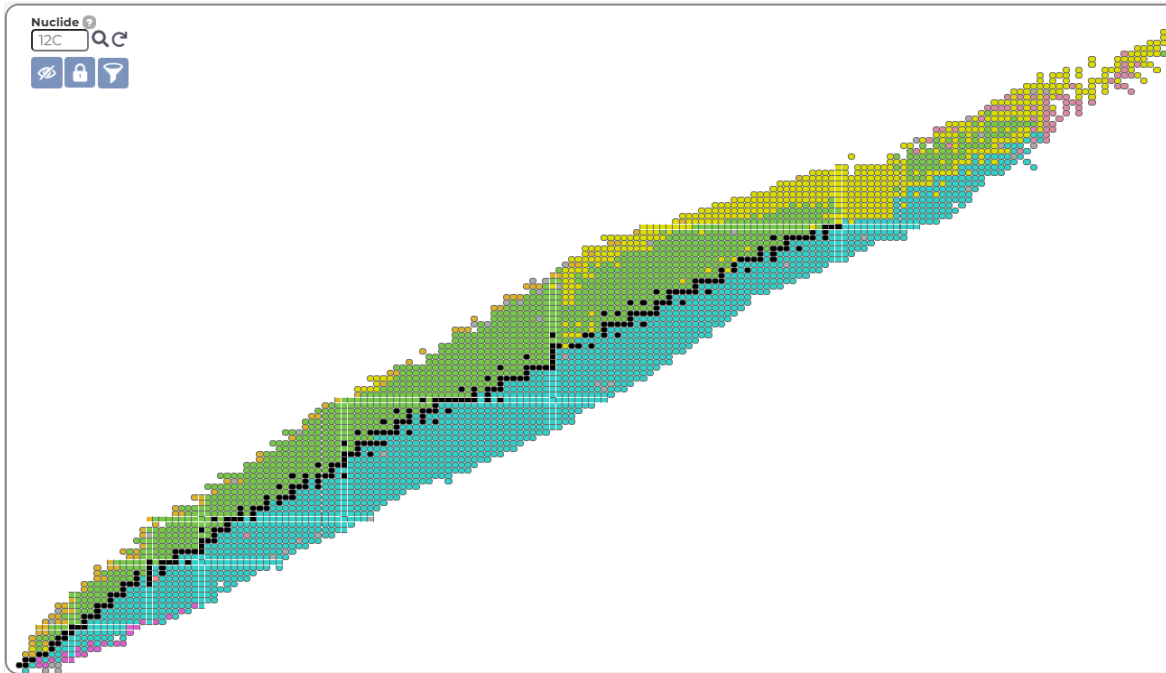
Meetings and Events

[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

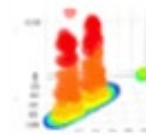
List of updates
Oct 2024 - Mar 2025

- 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 Nd ₆₀ 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)

	¹³⁹ Pr	¹⁴⁰ Pr	¹⁴¹ Pr	¹⁴² Pr	¹⁴³ Pr	¹⁴⁴ Pr	¹⁴⁵ Pr	¹⁴⁶ Pr	¹⁴⁷ Pr	¹⁴⁸ Pr	¹⁴⁹ Pr	¹⁵⁰ Pr	¹⁵¹ Pr	¹⁵² Pr	¹⁵³ Pr	¹⁵⁴ Pr	¹⁵⁵ Pr	¹⁵⁶ Pr	¹⁵⁷ Pr	¹⁵⁸ Pr	¹⁵⁹ Pr	¹⁶⁰ Pr	¹⁶¹ Pr	¹⁶² Pr	¹⁶³ Pr	¹⁶⁴ Pr	¹⁶⁵ Pr	¹⁶⁶ Pr	¹⁶⁷ Pr	¹⁶⁸ Pr	¹⁶⁹ Pr	¹⁷⁰ Pr	¹⁷¹ Pr	¹⁷² Pr	¹⁷³ Pr	¹⁷⁴ Pr	¹⁷⁵ Pr	¹⁷⁶ Pr	¹⁷⁷ Pr	¹⁷⁸ Pr	¹⁷⁹ Pr	¹⁸⁰ Pr	¹⁸¹ Pr	¹⁸² Pr	¹⁸³ Pr	¹⁸⁴ Pr	¹⁸⁵ Pr	¹⁸⁶ Pr	¹⁸⁷ Pr	¹⁸⁸ Pr	¹⁸⁹ Pr	¹⁹⁰ Pr	¹⁹¹ Pr	¹⁹² Pr	¹⁹³ Pr	¹⁹⁴ Pr	¹⁹⁵ Pr	¹⁹⁶ Pr	¹⁹⁷ Pr	¹⁹⁸ Pr	¹⁹⁹ Pr	²⁰⁰ Pr	²⁰¹ Pr	²⁰² Pr	²⁰³ Pr	²⁰⁴ Pr	²⁰⁵ Pr	²⁰⁶ Pr	²⁰⁷ Pr	²⁰⁸ Pr	²⁰⁹ Pr	²¹⁰ Pr	²¹¹ Pr	²¹² Pr	²¹³ Pr	²¹⁴ Pr	²¹⁵ Pr	²¹⁶ Pr	²¹⁷ Pr	²¹⁸ Pr	²¹⁹ Pr	²²⁰ Pr	²²¹ Pr	²²² Pr	²²³ Pr	²²⁴ Pr	²²⁵ Pr	²²⁶ Pr	²²⁷ Pr	²²⁸ Pr	²²⁹ Pr	²³⁰ Pr	²³¹ Pr	²³² Pr	²³³ Pr	²³⁴ Pr	²³⁵ Pr	²³⁶ Pr	²³⁷ Pr	²³⁸ Pr	²³⁹ Pr	²⁴⁰ Pr	²⁴¹ Pr	²⁴² Pr	²⁴³ Pr	²⁴⁴ Pr	²⁴⁵ Pr	²⁴⁶ Pr	²⁴⁷ Pr	²⁴⁸ Pr	²⁴⁹ Pr	²⁵⁰ Pr	²⁵¹ Pr	²⁵² Pr	²⁵³ Pr	²⁵⁴ Pr	²⁵⁵ Pr	²⁵⁶ Pr	²⁵⁷ Pr	²⁵⁸ Pr	²⁵⁹ Pr	²⁶⁰ Pr	²⁶¹ Pr	²⁶² Pr	²⁶³ Pr	²⁶⁴ Pr	²⁶⁵ Pr	²⁶⁶ Pr	²⁶⁷ Pr	²⁶⁸ Pr	²⁶⁹ Pr	²⁷⁰ Pr	²⁷¹ Pr	²⁷² Pr	²⁷³ Pr	²⁷⁴ Pr	²⁷⁵ Pr	²⁷⁶ Pr	²⁷⁷ Pr	²⁷⁸ Pr	²⁷⁹ Pr	²⁸⁰ Pr	²⁸¹ Pr	²⁸² Pr	²⁸³ Pr	²⁸⁴ Pr	²⁸⁵ Pr	²⁸⁶ Pr	²⁸⁷ Pr	²⁸⁸ Pr	²⁸⁹ Pr	²⁹⁰ Pr	²⁹¹ Pr	²⁹² Pr	²⁹³ Pr	²⁹⁴ Pr	²⁹⁵ Pr	²⁹⁶ Pr	²⁹⁷ Pr	²⁹⁸ Pr	²⁹⁹ Pr	³⁰⁰ Pr	³⁰¹ Pr	³⁰² Pr	³⁰³ Pr	³⁰⁴ Pr	³⁰⁵ Pr	³⁰⁶ Pr	³⁰⁷ Pr	³⁰⁸ Pr	³⁰⁹ Pr	³¹⁰ Pr	³¹¹ Pr	³¹² Pr	³¹³ Pr	³¹⁴ Pr	³¹⁵ Pr	³¹⁶ Pr	³¹⁷ Pr	³¹⁸ Pr	³¹⁹ Pr	³²⁰ Pr	³²¹ Pr	³²² Pr	³²³ Pr	³²⁴ Pr	³²⁵ Pr	³²⁶ Pr	³²⁷ Pr	³²⁸ Pr	³²⁹ Pr	³³⁰ Pr	³³¹ Pr	³³² Pr	³³³ Pr	³³⁴ Pr	³³⁵ Pr	³³⁶ Pr	³³⁷ Pr	³³⁸ Pr	³³⁹ Pr	³⁴⁰ Pr	³⁴¹ Pr	³⁴² Pr	³⁴³ Pr	³⁴⁴ Pr	³⁴⁵ Pr	³⁴⁶ Pr	³⁴⁷ Pr	³⁴⁸ Pr	³⁴⁹ Pr	³⁵⁰ Pr	³⁵¹ Pr	³⁵² Pr	³⁵³ Pr	³⁵⁴ Pr	³⁵⁵ Pr	³⁵⁶ Pr	³⁵⁷ Pr	³⁵⁸ Pr	³⁵⁹ Pr	³⁶⁰ Pr	³⁶¹ Pr	³⁶² Pr	³⁶³ Pr	³⁶⁴ Pr	³⁶⁵ Pr	³⁶⁶ Pr	³⁶⁷ Pr	³⁶⁸ Pr	³⁶⁹ Pr	³⁷⁰ Pr	³⁷¹ Pr	³⁷² Pr	³⁷³ Pr	³⁷⁴ Pr	³⁷⁵ Pr	³⁷⁶ Pr	³⁷⁷ Pr	³⁷⁸ Pr	³⁷⁹ Pr	³⁸⁰ Pr	³⁸¹ Pr	³⁸² Pr	³⁸³ Pr	³⁸⁴ Pr	³⁸⁵ Pr	³⁸⁶ Pr	³⁸⁷ Pr	³⁸⁸ Pr	³⁸⁹ Pr	³⁹⁰ Pr	³⁹¹ Pr	³⁹² Pr	³⁹³ Pr	³⁹⁴ Pr	³⁹⁵ Pr	³⁹⁶ Pr	³⁹⁷ Pr	³⁹⁸ Pr	³⁹⁹ Pr	⁴⁰⁰ Pr	⁴⁰¹ Pr	⁴⁰² Pr	⁴⁰³ Pr	⁴⁰⁴ Pr	⁴⁰⁵ Pr	⁴⁰⁶ Pr	⁴⁰⁷ Pr	⁴⁰⁸ Pr	⁴⁰⁹ Pr	⁴¹⁰ Pr	⁴¹¹ Pr	⁴¹² Pr	⁴¹³ Pr	⁴¹⁴ Pr	⁴¹⁵ Pr	⁴¹⁶ Pr	⁴¹⁷ Pr	⁴¹⁸ Pr	⁴¹⁹ Pr	⁴²⁰ Pr	⁴²¹ Pr	⁴²² Pr	⁴²³ Pr	⁴²⁴ Pr	⁴²⁵ Pr	⁴²⁶ Pr	⁴²⁷ Pr	⁴²⁸ Pr	⁴²⁹ Pr	⁴³⁰ Pr
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☐ **Decay radiation** order by intensity

Ground State isomers	Levels	Gammas	Decay Radiation	Nuclear Moments	Neutron Capture	Fission Yields
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 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](https://doi.org/10.1016/j.nds.2022.03.001)

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-~~10~~ **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^+} [keV]
¹⁴⁷ Nd _{60 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)

#	Z	Nuclide	Initial Level			Final Level		E_γ [keV]	$I_\gamma(\text{rel})$ [%]	Mult.	δ	a_T	B(EL) [W.u.]	B(BL) [W.u.]	Additional data	Comments
			E_i [keV]	J^π_{order}	$T_{1/2}$ or Width	E_f [keV]	J^π_{order}									
16	β^-	$^{147}_{60}\text{Nd}_{87}$	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		
		$^{147}_{60}\text{Nd}_{87}$	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		
		$^{147}_{60}\text{Nd}_{87}$	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		
76	β^- e ν	$^{147}_{60}\text{Nd}_{87}$	190.291 6	(9/2)-		49.9268 10	7/2-	140.364 6	100	[M1+E2]		0.6 6				
		$^{147}_{60}\text{Nd}_{87}$	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			
		$^{147}_{60}\text{Nd}_{87}$	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	β^-	$^{147}_{60}\text{Nd}_{87}$	314.6799 23	3/2-	≤ 0.1 ns	214.5949 12	1/2-	100.078 3	2.4 3	[M1]		1.413				
		$^{147}_{60}\text{Nd}_{87}$	314.6799 23	3/2-	≤ 0.1 ns	127.9189 10	5/2- 2	186.752 6	5.6 7	E2		0.247				
		$^{147}_{60}\text{Nd}_{87}$	314.6799 23	3/2-	≤ 0.1 ns	49.9268 10	7/2-	264.70 4	1.9 5	[E2]		0.0779				
10	β^-	$^{147}_{60}\text{Nd}_{87}$	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				
		$^{147}_{60}\text{Nd}_{87}$	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				
		$^{147}_{60}\text{Nd}_{87}$	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		$^{147}_{60}\text{Nd}_{87}$	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 -



Data API

#	$\langle E_{\beta} \rangle$ [keV]	$I_{\beta}(\text{abs})$ [%]	Daughter level [keV]	J^{π}	$E_{\beta-, \text{max}}$ [keV]	logft	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	1 st non-unique	
3	59.02 18	0.0782 18	680.432 20	7/2+	(214.8)	8.50 1	1 st non-unique	
4	70.92 19	0.0051 5	641.11 5	(5/2)+	(254.1)	9.92 5	1 st non-unique	
5	85.75 23	< 0.006	632.85 4 ?	1/2+	(262.3)	> 9.6	1 st unique	
6	105.86 20	15.25 21	530.998 9	5/2+	(364.2)	6.947 7	1 st non-unique	
7	119.67 20	0.819 15	489.247 13	7/2+	(406.0)	8.372 9	1 st non-unique	
8	146.49 21	0.62 3	410.515 9	3/2+	(484.7)	8.75 2	1 st non-unique	
9	263.80 24	81.0 3	91.1051 16	5/2+	(804.1)	7.392 3	1 st non-unique	
10	299.26 24	< 0.3	0.0 ?	7/2+	(895.2)	> 10.0	1 st non-unique	

X-rays



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



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 K LX		
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

Warning

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

γ without intensity are expected but not observed

Gamma



Data API

#	E_{γ} [keV]	$I_{\gamma}(\text{abs})$ [%]	Initial level [keV]	J^{π}	Final level [keV]	J^{π}	Mult.	δ	α_T	I_{Tot} [%]	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				

LiveChart

Decay radiation

Beta -



Data API

#	$\langle E_{\beta} \rangle$ [keV]	$I_{\beta}(\text{abs})$ [%]	Daughter level [keV]	J^{π}	$E_{\beta-, \text{max}}$ [keV]	logft	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	1 st non-unique	
3	59.02 18	0.0782 18	680.432 20	7/2+	(214.8)	8.50 1	1 st non-unique	
4	70.92 19	0.0051 5	641.11 5	(5/2)+	(254.1)	9.92 5	1 st non-unique	
5	85.75 23	< 0.006	632.85 4 ?	1/2+	(262.3)	> 9.6	1 st unique	
6	105.86 20	15.25 21	530.998 9	5/2+	(364.2)	6.947 7	1 st non-unique	
7	119.67 20	0.819 15	489.247 13	7/2+	(406.0)	8.372 9	1 st non-unique	
8	146.49 21	0.62 3	410.515 9	3/2+	(484.7)	8.75 2	1 st non-unique	
9	263.80 24	81.0 3	91.1051 16	5/2+	(804.1)	7.392 3	1 st non-unique	
10	299.26 24	< 0.3	0.0 ?	7/2+	(895.2)	> 10.0	1 st non-unique	

Warning

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

γ without intensity are expected but not observed

Gamma



Data API

#	E_{γ} [keV]	$I_{\gamma}(\text{abs})$ [%]	Initial level [keV]	J^{π}	Final level [keV]	J^{π}	Mult.	δ	α_T	I_{tot} [%]	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



Data API

#	E [keV]	$I(\text{abs})$ [%]	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]	$I(\text{abs})$ [%]	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



Data API

#	E [keV]	$I(\text{abs})$ [%]	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
10	51.4 - 52.1 20	0.0026 15	CE M	53.1	3.73 9

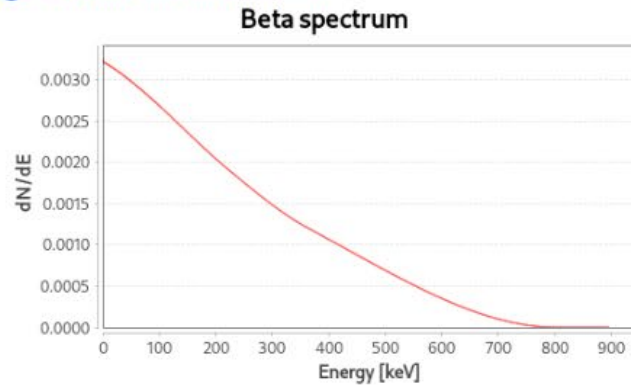
Atomic shell transition yields : see [E.Schönfeld, H.Janßen](#) and its references.

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

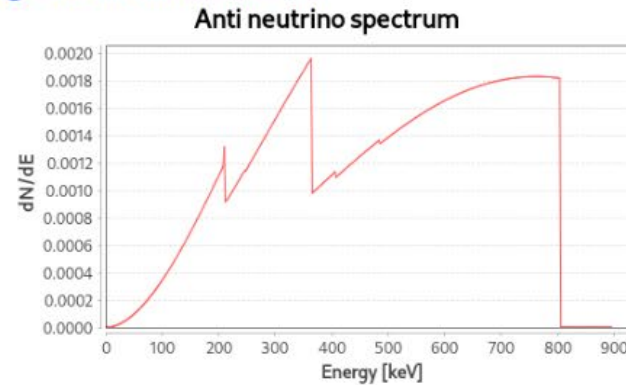
LiveChart

Decay radiation: decay scheme and emitted spectra

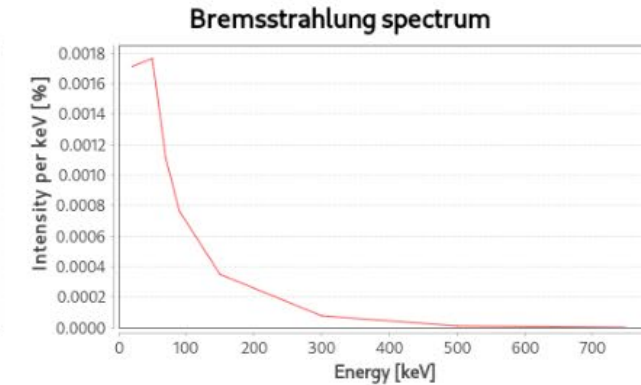
Large plot with each transition



Large plot with each transition



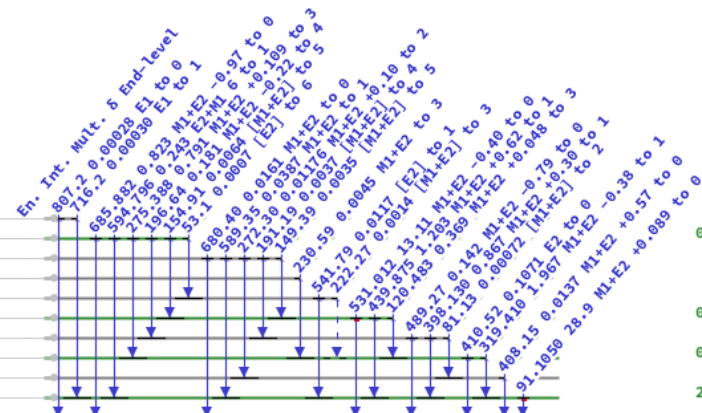
Show data table



$^{147}_{60}\text{Nd}$ 5/2- 0.0 11.03 d 3
Q⁺ 895.2 keV 6

B⁻ : 100.0 % 0--> $^{147}_{61}\text{Pm}$ 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



$^{147}_{61}\text{Pm}$ 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 Public

Nuclide	Energy [keV]	J^π	$T_{1/2}$ or Width Abund. [mole fract.]	$T_{1/2}$ [s]	Decay Modes BR [%]	Isospin	μ [nM]
¹⁴⁷ ₆₀ Nd	0.0	5/2-	11.03 d 3	952992 2592	β- 100		0.554 10

Link to  Nubase2020 evaluation of ¹⁴⁷Nd nuclear properties

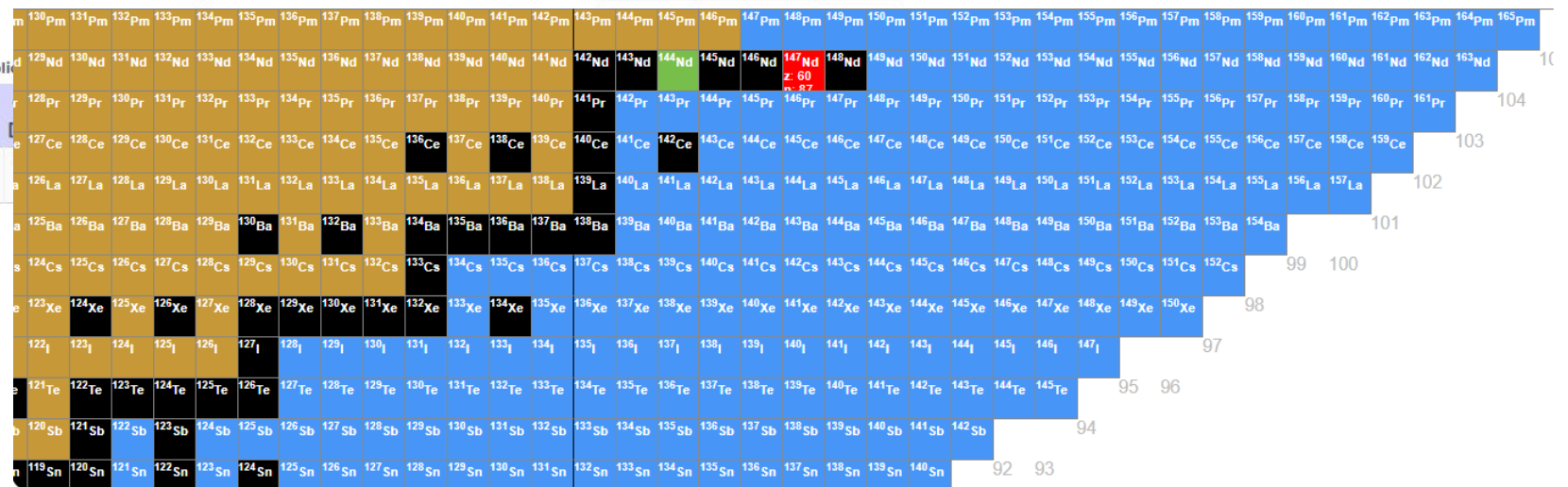
ENSDF datasets related to ¹⁴⁷Nd

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 absolute 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	J^π	$T_{1/2}$ Abund. [%]	Decay Modes BR [%] ?	Discovery	Q_{β^-} [keV]	Q_{α} [keV]	Q_{EC} [keV]	S_n [keV]	S_p [keV]	Binding/A [keV]	Atomic Mass [u AMU]
¹⁴⁷ ₆₀ Nd	-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)

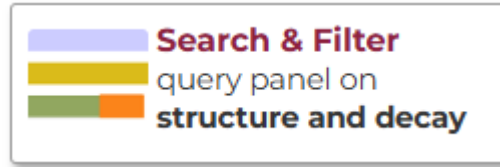
Parent	T _{1/2} or Width	E _x [keV]	Jp order	Decay	Q _{decay} [keV] see the note	Daughter	Comments	Total energy by radiation type, per 1 decay of the parent [keV]							
								Alpha	Beta	CE & Auger	γ & X	Recoil	Neutrino	Total	Q * BR
¹⁴⁷ Nd 60 87	11.03 d 3	0.0	5/2-	β- 100 %	895.2 6	¹⁴⁷ Pm 61 86			233.5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

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 AUTH: Laboratoire National Henri Becquerel Half life: 10.987 ± 0.011(d) Spin & Parity: unknown Nuclide: Nd-147 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 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



NUCLIDE Ground State

Nuclide Element Z N A Z range N range A range Z N A Z N A
even odd even 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** ☐ **DECAY RADIATION** emitted by the daughter

☐ Energy ≤ keV ≤ any ☒ α ☐ β^- ☐ β^+ ☐ γ ☐ e ☐

☐ End level en. ≤ keV ≤ delayed n ☐ p ☐ α ☐

☐ J order ☐ π any weak ☐

☐ Conversion coeff. • Multipolarity • Mixing ratio

☐ 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}

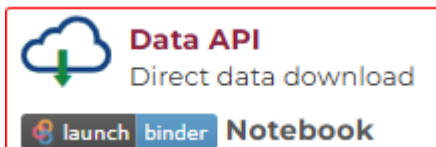
☐ BR ☐ μ ☐ Q ☐ Erad ☐ Irad ☐ Log ft ☐ HF ☐ Ey ☐ α ☐ B(E) ☐ B(M) ☐ δ

Plotting X Axis Y Axis

Ground States Levels Gammas Decay Radiation

- ✓ 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



Introduction

Examples

Jupyter lab

Notebook

API description

Service URL

API parameters

fields

nuclides

parents

products

rad_types

Fields content

Notes

Data sources

Field groups

ground_states

levels

gammas

decay_rads

bin_beta

fission_yelds

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Errors

Return codes

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

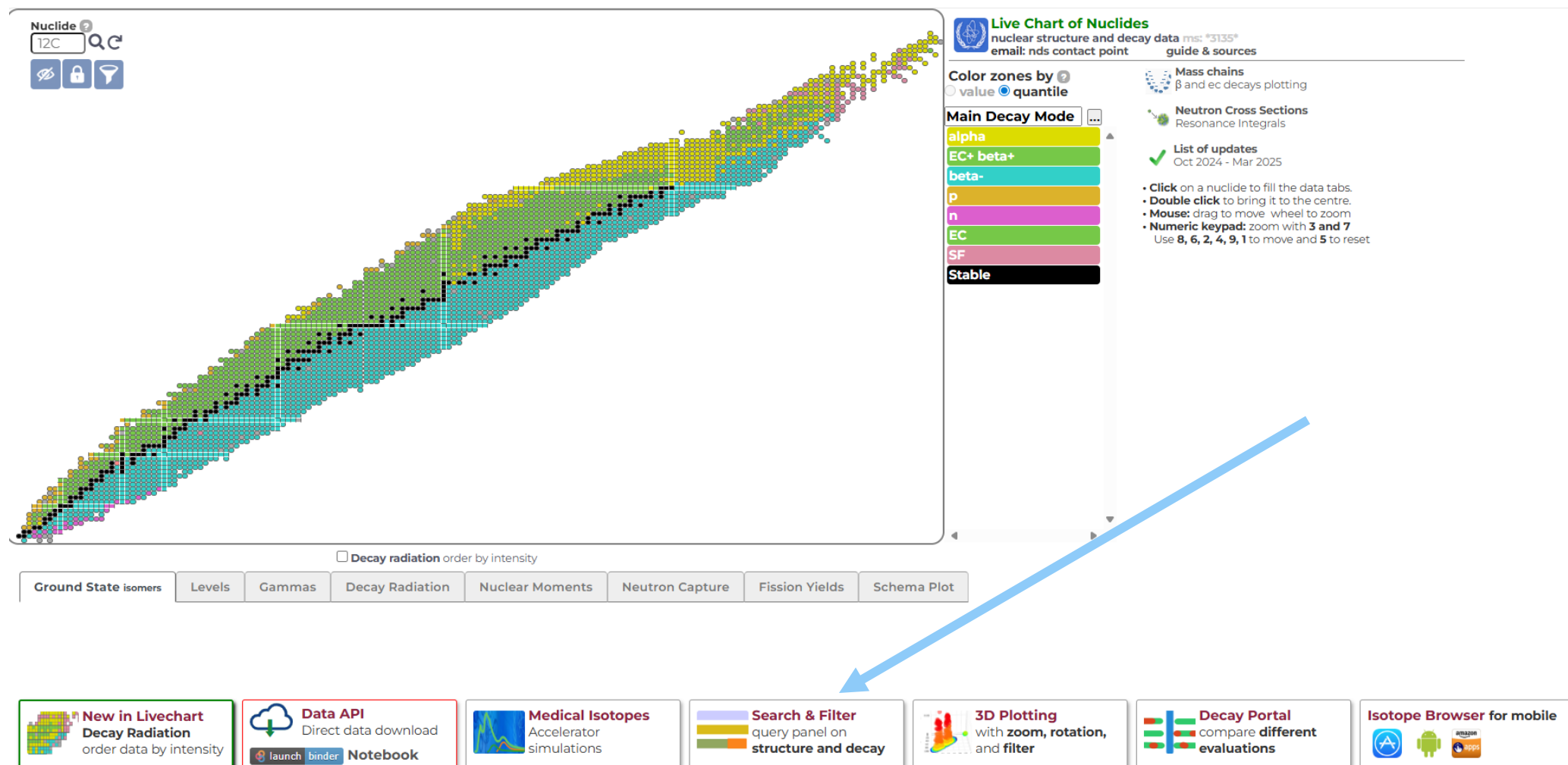
In short :

```
$ 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	Z N A
								even	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 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	☐ E _{rad}	☐ I _{rad}	☐ Log ft	☐ HF	☐ E _γ	☐ 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

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

Order by: Z A $T_{1/2}$

☒ 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 ☐ Ey ☐ α ☐ B(E) ☐ B(M) ☐ δ

Plotting X Axis Y Axis

☐ Log X ☒ Log Y ☐ scatter height ☐ show data



LiveChart Filter

2) Plot Sn for Pb isotopes

LiveChart Filter

2) Plot Sn for Pb isotopes

NUCLIDE Ground State

Nuclide	Element	Z	N	A	Z range	N range	A range	Z N A	Z N A
	Pb							even	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 most intense lines

Order by: Z A T_{1/2}

☒ Z ☒ A ☐ N ☐ Q(β) ☐ Q(α) ☐ Q(EC) ☐ Q(β n) ☐ S_n ☐ S_p ☐ R ☐ AM ☐ E ☐ T_{1/2}
☐ BR ☐ μ ☐ Q ☐ E_{rad} ☐ I_{rad} ☐ Log ft ☐ HF ☐ E_y ☐ α ☐ B(E) ☐ B(M) ☐ δ

Plotting

X Axis A Y Axis Sn



Ground States

Levels

Gammas

Decay Radiation



LiveChart Filter

3) Measured beta-delayed neutron decays vs theoretically possible

LiveChart Filter

3) Measured beta-delayed neutron decays vs theoretically possible

LEVELS

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

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

☐ β^- ☒ $\beta^- n$ ☐ $\beta^- 2n$ ☐ $2\beta^-$ ☐ $\beta^- 3n$ ☐ $\beta^- 4n$ ☐ $\beta^- \alpha$ ☐ $\beta^- p$

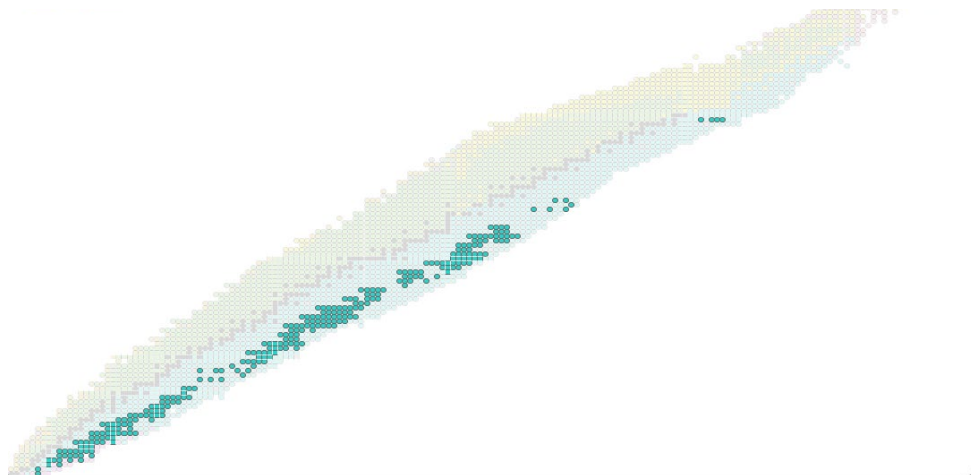
☐ β^+ ☐ $\beta^+ 2p$ ☐ $\beta^+ \alpha$ ☐ $\beta^+ p$

☐ ec ☐ 2ec ☐ ec β^+ ☐ ec p ☐ ec 2p ☐ ec 3p ☐ ec α

☐ α ☐ IT ☐ SF ☐ p ☐ n ☐ 2p

☐ ^{12}C ☐ ^{14}C ☐ ^{20}Ne ☐ ^{24}Ne ☐ ^{28}Mg ☐ ^{34}Si ☐ Mg ☐ Ne

☐ Nuclear moments



NUCLIDE Ground State

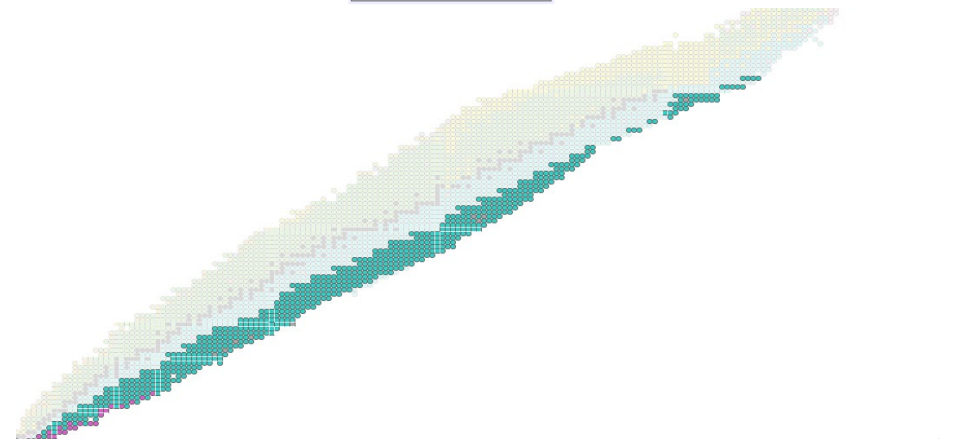
Nuclide	Element	Z	N	A	Z range	N range	A range	Z N A	Z N A
								even	odd

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

☐ Q(β) ≤ keV ≤ ☐ Q(EC) ≤ keV ≤ ☐ Q(α) ≤ keV ≤

☒ Q(β -n) ≤ keV ≤ ☐ S(n) ≤ keV ≤ ☐ S(p) ≤ keV ≤

☐ R fm ☐ Atomic mass AM ≤ μ AMU ≤

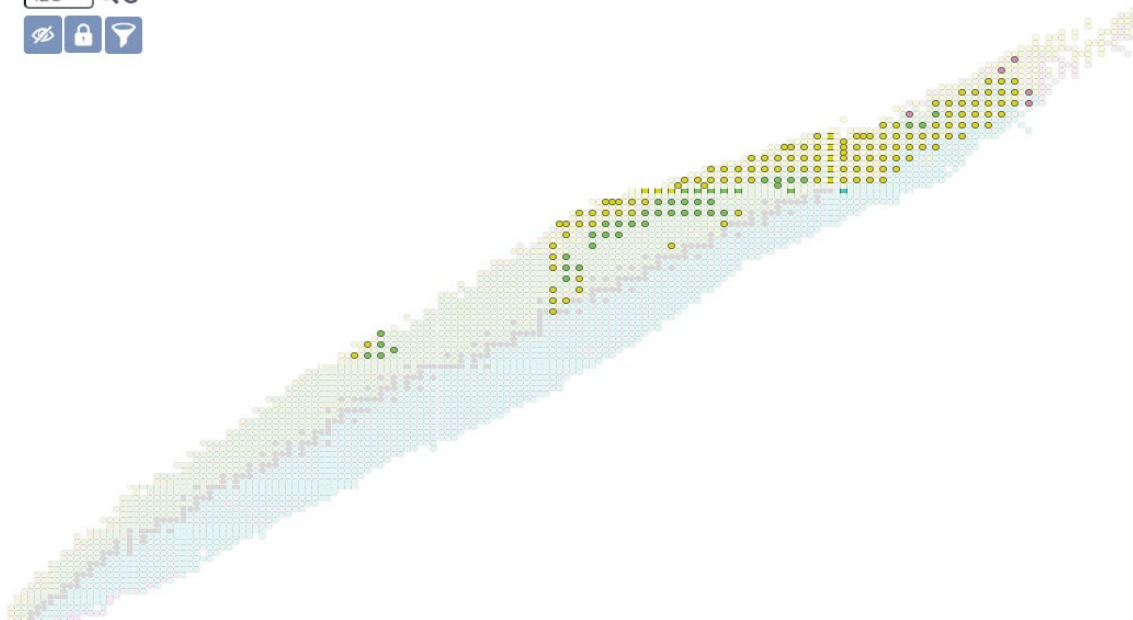


LiveChart Filter

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 ≤ HF ≤

LiveChart Filter

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

LiveChart Filter

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

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. 0 ≤ keV ≤ 0

☒ J 0 order π + ☐ weak ☐

☒ Conversion coeff. • Multipolarity • Mixing ratio

☐ Conv. coeff. ≤ α ≤ **Total**

☒ Polarity E2 ≤ B ≤ **no mix**

☐ Mixing ratio ≤ δ ≤

☐ **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) ☐ S_n ☐ S_p ☐ R ☐ AM ☐ E ☐ T_{1/2}

☐ BR ☐ μ ☐ Q ☐ E_{rad} ☐ I_{rad} ☐ Log ft ☐ HF ☐ E_γ ☐ α ☐ B(E) ☐ B(M) ☐ δ

Plotting X Axis E Y Axis B(E)

LiveChart Filter

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

LiveChart Filter

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

☒ GAMMA transitions

☒ Energy $\leq$ keV $\leq$

☐ End level en. $\leq$ keV $\leq$

☐ J order π weak ☐

☐ Conversion coeff. • Multipolarity • Mixing ratio

☐ DECAY RADIATION emitted by the daughter

any ☒ α ☐ β^- ☐ β^+ ☐ γ ☐ e ☐

delayed n ☐ p ☐ α ☐

☐ Energy $\leq$ keV $\leq$

☐ Intensity $\leq$ % $\leq$

☐ show only most intense lines



LiveChart Filter

8) Plot $T_{1/2}$ vs E_{2+}

LiveChart Filter

8) Plot T_{1/2} 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

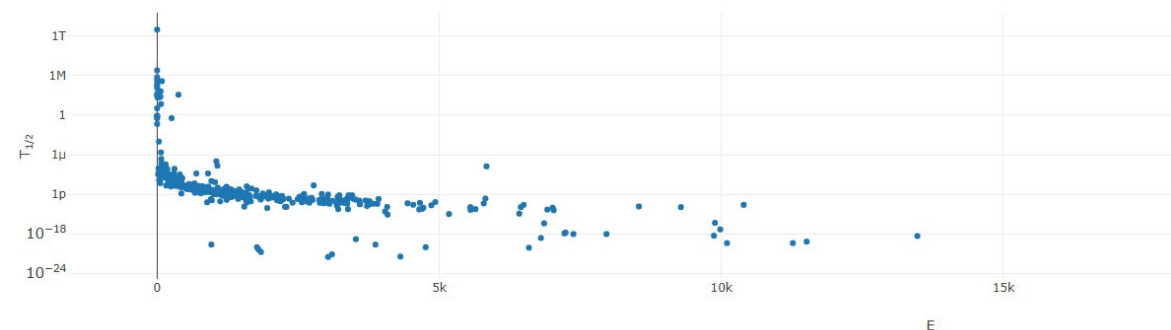
Order by: Z A

☒ 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 ☐ Ey ☐ α ☐ B(E) ☐ B(M) ☐ δ

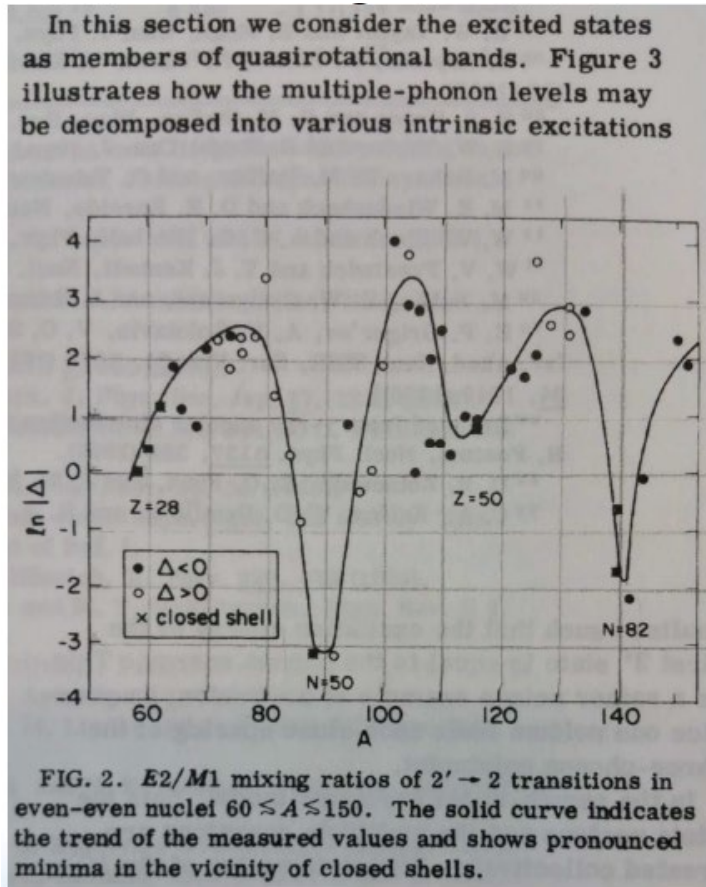
Plotting X Axis E Y Axis T_{1/2}

☐ Log X ☒ Log Y ☐ scatter height ☐ show data



LiveChart Filter

8) Plot A vs δ mixing ratio for E2/M1 transitions from $J^\pi 2^+ \rightarrow 2^+$ 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 $2' \rightarrow 2$ 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 $J^\pi_i 2^+ \rightarrow 2^+$ 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

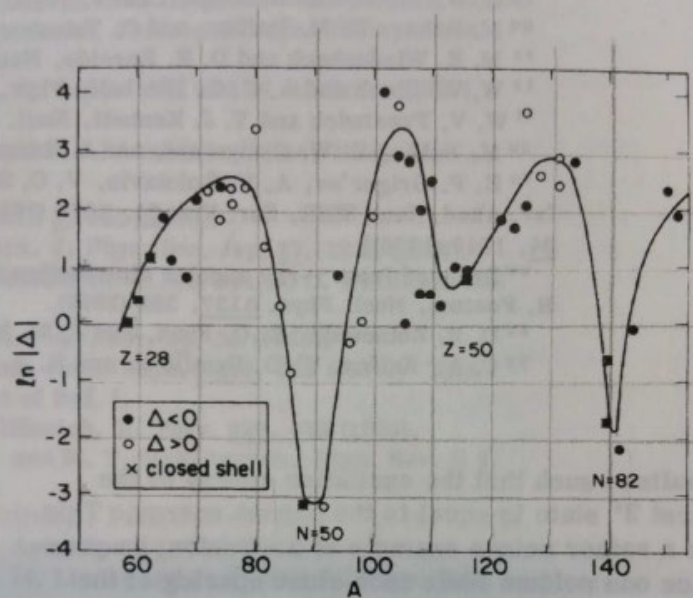


FIG. 2. $E2/M1$ mixing ratios of $2^+ \rightarrow 2^+$ transitions in even-even nuclei $60 \leq A \leq 150$. The solid curve indicates the trend of the measured values and shows pronounced minima in the vicinity of closed shells.

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

NUCLIDE Ground State

Nuclide	Element	Z	N	A	Z range	N range	A range	Z N A	Z N A
							60 150	even ☒ ☒ ☒	odd ☐ ☐ ☐

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

LEVELS

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

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

☐ Nuclear moments

☒ GAMMA transitions

☐ Energy ≤ keV ≤

☐ End level en. ≤ keV ≤

☒ J 2 order 1 ☐ π + weak ☐

☒ Conversion coeff. • Multipolarity • Mixing ratio

☐ Conv. coeff. ≤ α ≤ Total mixed

☐ Polarity E2 ≤ B ≤

☐ Mixing ratio ≤ δ ≤

☐ 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) ☐ S $_n$ ☐ S $_p$ ☐ R ☐ AM ☐ E ☐ T $_{1/2}$

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

Plotting X Axis A Y Axis δ

☐ Log X ☒ Log Y ☐ scatter height ☐ show data

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

LiveChart API

Examples

- 1) Retrieve all gammas for ^{133}Xe : **`nds.iaea.org/relnsd/v1/data?fields=gammas&nuclides=133xe`**
- 2) Retrieve X-rays from ^{133}Xe :
`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 ^{147}Nd :
`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 ^{135}Xe :
`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
```

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!
