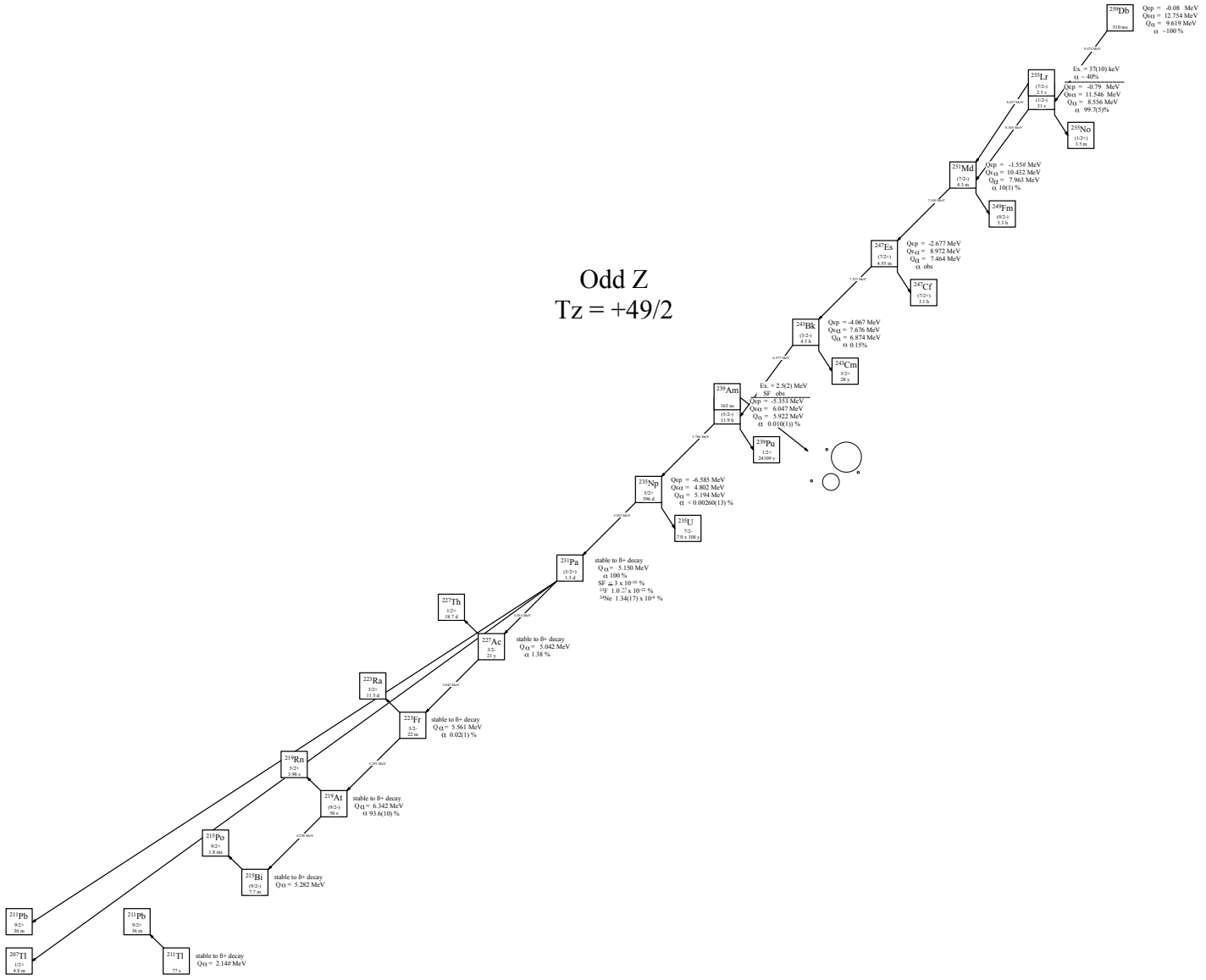

Fig. 1: Known experimental values for heavy particle emission of the odd-Z T_z= +49/2 nuclei.

Last updated 10/21/2024

Table 1
Observed and predicted β-delayed particle emission from the odd-Z, T_z = +49/2 nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein.

Nuclide	Ex.	J^π	$T_{1/2}$	Q_ε	Q_{β^-}	$Q_{\beta^- \alpha}$	Experimental
^{211}Tl*			76.5(178) s	-5.69#	4.420(40)	8.162(50)	[**2017Ca12**]
^{215}Bi*		($9/2^-$)	7.7(2) m	-2.710(50)	2.171(6)	9.877(6)	[**1990Ru02**]
^{219}At		($9/2^-$)	56(3) s	-2.285(16)	1.567(2.9)	8.693(4)	[**2015Fi07**]
^{223}Fr		$3/2^-$	22.00(7) m	-2.007(8)	1.149(0)	7.308(3)	[**1993Ab01**]
^{227}Ac		$3/2^-$	21.778^{+29}_{-32} y	-1.328(2)	0.045(1)	6.382(3)	[**1967JoZX**]
^{231}Pa		$3/2^-$	$3.257(13)\times10^4$ y	-0.392(2)	-0.382(2)	——	[**2020Je01**]
					$Q_{\varepsilon p}$	$Q_{\varepsilon \alpha}$	
^{235}Np		$5/2^+$	396.1(12) d	0.124(1)	-6.585(4)	4.802(2)	[**1970La08**]
^{239}Am		($5/2^-$)	11.9(1) h	0.802(2)	-5.353(2)	6.047(2)	[**1972Po04**]
^{239m}Am	2.5(2)		163(12) ns	3.3(2)	-2.8(2)	8.5(2)	[**1972Br35**]
^{243}Bk		($3/2^-$)	4.5(1) h	1.508(5)	-4.067(4)	7.676(5)	[**1953Hu60**]
^{247}Es	x	($7/2^+$)	4.55(26) m	2.469(24)	-2.677(63)	8.972(19)	[**1989Ha27**]
^{251}Md		($7/2^-$)	4.28(12) m	3.008(24)	-1.55(10)#	10.432(24)	[**2021Go26**]
^{255}Lr		($1/2^-$)	31.1(13) s	3.135(23)	-0.79(10)#	11.564(23)	[**2006Ch52**]
^{255m}Lr	0.037(10)	($7/2^-$)	2.53(5) s	3.172(25)	-0.42(14)#	11.601(25)	[**2008An16**]
^{259}Db			510(160) ms	3.620(90)#	-0.08(12)#	12.754(58)#	[**2001Ga20**]
^{263}Bh				4.30(32)#	0.95(34)#	13.70(31)#	
^{267}Mt				5.13(51)#	2.40(53)#	15.17(51)#	

* 100% β^- emitter.
** Unclear if this is the ground state.

Table 2
Particle separation, Q-values, and measured values for direct particle emission of the odd-Z, T_z = +49/2 nuclei. Unless otherwise stated, all S and Q-values are taken from [2021Wa16] or deduced from values therein.

Nuclide	S_p	Q_α	BR_α	BR_{SF}	$BR_{cluster}$	type	Experimental
^{211}Tl	8.07(21)#	2.14(30)#					
^{215}Bi	5.477(6)	5.282(42)					
^{219}At	5.250(4)	6.342(5)	93.6(10)%				[**2015Fi07**, 1989Bu09, 1953Hy83]
^{223}Fr	5.279(2)	5.561(3)	0.02(1)%				[**2001Li44**, 1982AlZL, 1956Pe27, 1955Ad10, 1953Hy83, 1950WaZZ]
^{227}Ac	5.107(2)	5.042(0)	1.3800(36)%				[**1995Sh03, 1986Ry04, 1970Ki12, 1966Ba19, 1959No41**, 1995Ma82, 1981Va28, 1974Mo05, 1972GaZR, 1972HeYM, 1950WaZZ, 1949Pe03]
^{231}Pa	4.727(1)	5.150(1)	100%	$\leq3\times10^{-10}$%	$1.34(17)\times10^{-9}$%	^{24}Ne	**2019Ga34, 1992Pr05, 1983Ba77, 1968Ba25, 1961Ba42**, **1961Ba42**, 2020Je01, 2020Km01, 2009Mo37, 1995Ar33, 1986BaYK, 1986Tr10, 1985Sa40, 1979Te02, 1974De11, 1971Le10, 1970De19, 1970Le11, 1969Ba20, 1969La04, 1969Ro33, 1968Ha22, 1966Ba14, 1960Fo05, 1956Hu96, 1955Hu37]
					$1.0^{+4.8}_{-0.7}\times10^{-12}$%	^{23}F	
^{235}Np	4.391(1)	5.194(1)	$2.60(13)\times10^{-3}$%				[**1986AgZV, 1973Br12**, 1987Ha07, 1984Wh02, 1970BrZX, 1970La08, 1957Th37, 1956Ho46]
^{239}Am	4.062(2)	5.922(1)	0.010(1)%				[**1971Go01**, 1972Po04, 1960Gl01, 1952Hi63]
^{239m}Am	1.5(2)	8.4(2)		obs			[**1972Br35**, 1983Ra36, 1971Br39, 1971Fe09, 1970Vi05, 1969La14]
^{243}Bk	3.403(4)	6.874(4)	0.15%				[**1966Ah02, 1953Hu60**, 1956Ch77]
^{247}Es	2.801(19)#	7.464(20)	obs				[**1989Ha27**, 1989HaZG, 1986HaZM, 1985MaZK, 1973Es01, 1967Mi06]
^{251}Md	2.394(20)	7.963(4)	10(1)%				[**2006Ch52**, 2021Go26, 2006An13, 2005ChZQ, 2005He27, 2005He27, 1973Es01, 1971EsZZ, 1971EsZY]
^{255}Lr	2.065(20)	8.556(7)	99.7(5)%				[**2008An16, 2008Ha31, 2006Ch52**, 2006An13, 2005ChZQ, 2004HeZZ, 2002Gu33, 2001Ga20, 1976BeYM, 1976BeZY, 1971Es01]
^{255m}Lr	2.028(22)	8.593(12)	≈40%				[**2008Ha31, 2006Ch52**, 2008An16, 2005ChZQ, 2004HeZZ]
^{259}Db	1.642(59)#	9.619(54)	≈ 100%				[**2001Ga20**, 2002Gu33]
^{263}Bh	1.16(31)#	10.08(30)#					
^{267}Mt	0.64(50)#	10.87(40)					

Table 3
direct α emission from ^{219}At*, J^{π} = (9/2$^-$), $T_{1/2}$ = 56(3) s, BR_{α} = 93.6(10)%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_f	$E_{daughter}$(^{215}Bi)	coincident γ-rays (keV)	R_0 (fm)	HF
6.343(5)	6.228(5)	93.6(10)%	(9/2$^-$)	0.0	——	1.54668(15)	1.33(10)

* All values from [2015Fi07].

Table 4
direct α emission from ^{223}Fr*, J^{π} = 3/2$^-$, $T_{1/2}$ = 22.00(7) m**, BR_{α} = 0.02(1)%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_f	$E_{daughter}$(^{219}At)	coincident γ-rays (keV)	R_0 (fm)	HF
5.266(5)	5.172(5)	≈14%	$\approx 1\times10^{-3}$%	(3/2$^-$)	0.296	0.1453, 0.1509	1.54540(11)	≈2.7
5.388(4)	5.291(4)	100(66)%	$7(3)\times10^{-3}$%	(3/2$^-$)	≈0.174	150.9	1.54540(11)	$1.7^{+3.4}_{-0.7}$
5.411(4)	5.314(4)	86(55)%	$6(3)\times10^{-3}$%	(5/2$^-$)	0.1509	0.1509	1.54540(11)	3^{+7}_{-1}
5.502(3)	5.403(3)	71(46)%	$5(2)\times10^{-3}$%	(7/2$^-$)	0.0589	0.0589	1.54540(11)	10^{+18}_{-4}
5.562(3)	5.462(3)	57(29)%	$4(2)\times10^{-3}$%	(9/2$^-$)	0.0	——	1.54540(11)	30^{+70}_{-10}

* All values from [2001Li44], except where noted.
** [1993Ab01].

Table 5
direct α emission from ^{227}Ac, J^{π} = 3/2$^-$, $T_{1/2}$ = 21.778$^{+29}_{-32}$ y*, BR_{α} = 1.3800(36)%**.

E_{α}(c.m.)	E_{α}(lab)***	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}@	$E_{daughter}$(^{223}Fr)@	coincident γ-rays (keV)@	R_0 (fm)	HF
4.441(7)	4.363(7)	$\approx 6\times10^{-3}$%@@	$\approx 4.1\times10^{-5}$%	7/2$^-$	0.601@@		1.53667(29)	≈7.8
4.502(5)	4.423(5)	0.021%	$.4\times10^{-4}$%	(5/2$^-$)	0.5407	44.7, 55.0, 86.7, 69.3, 88.1, 82.2, 99.6, 101.0, 106.8, 176.1 351.7, 441.0	1.53667(29)	6.6
4.525(4)	4.445(4)	0.11%	6.9×10^{-4}%	3/2$^-$	0.5152	44.7, 55.0, 86.7, 99.6, 415.6, 460.2	1.53667(29)	2.1
4.539(7)	4.459(7)	0.011%	6.9×10^{-5}%		0.503		1.53667(29)	25
4.593(5)	4.512(5)	$\approx 6\times10^{-3}$%@@	$\approx 4.1\times10^{-5}$%		0.449@@		1.53667(29)	≈110
4.663(7)	4.581(7)	$\approx 6\times10^{-3}$%@@	$\approx 4.1\times10^{-5}$%		0.379@@		1.53667(29)	≈330
4.671(4)	4.589(4)	0.021%@@	1.4×10^{-4}%		0.371@@		1.53667(29)	112
4.676(4)	4.594(4)	0.064%	4.1×10^{-4}%	(9/2$^+$)	0.3655	33.5, 35.0, 44.7, 53.7, 55.0, 69.3, 70.6, 72.5, 79.5, 86.7, 88.1, 82.2, 90.0, 99.6, 101.0, 106.8, 108.0, 118.7, 121.6, 121.8, 134.5, 137.4, 142.6, 143.0, 147.6, 172.0, 176.1, 176.5, 206.8, 229.7, 242.5, 283.4	1.53667(29)	41
4.744@	4.660@	0.043%	2.8×10^{-4}%	(9/2$^-$)	0.2988	69.3, 82.2, 216.6	1.53667(29)	180
4.797@	4.712@	0.085%	5.5×10^{-4}%	(9/2$^+$)	0.2448	44.7, 55.0, 69.3, 72.5, 72.8, 82.2, 86.7, 90.0, 99.6, 147.6, 162.6, 172.0	1.53667(29)	210
4.799@	4.714@	0.15%	9.7×10^{-4}%	(7/2$^-$)	0.2437	69.3, 82.2, 161.4, 230.9, 243.8	1.53667(29)	121
4.800(4)	4.715(4)	0.43%	2.8×10^{-3}%	(7/2$^-$)	0.2426	33.5, 35.0, 44.7, 53.7, 55.0, 69.3, 70.6, 72.5, 79.5, 86.7, 88.1, 82.2, 90.0, 99.6, 101.0, 106.8, 108.0, 121.6, 134.5, 143.0, 147.6, 172.0, 176.1, 229.7, 242.5	1.53667(29)	43
4.819@	4.734@	0.064%	4.1×10^{-4}%	(7/2$^+$)	0.223	69.3, 82.2, 140.9	1.53667(29)	390
4.823(4)	4.738(4)	0.13%	8.3×10^{-4}%	7/2$^+$	0.2196	69.3, 88.1, 82.2,101.0, 118.7, 137.4, 206.8	1.53667(29)	210
4.854(3)	4.768(3)	2.3%	0.015%	7/2$^-$	0.189	69.3, 88.1, 82.2, 101.0, 106.8, 176.1	1.53667(29)	1.1
4.856@	4.770@	0.64%	4.1×10^{-3}%		0.1872	69.3, 82.2, 105.0, 174.3	1.53667(29)	67
4.871(4)	4.785(4)	0.17%	1.1×10^{-3}%	5/2$^+$	0.172	44.7, 55.0, 69.3, 72.5, 82.2, 86.7, 90.0, 99.6, 147.6, 172.0	1.53667(29)	320
4.882(3)	4.796(3)	1.72%	0.011%	3/2$^+$	0.1605	44.7, 55.0, 59.4, 60.6, 86.7, 88.1, 99.6, 101.0, 147.6, 160.5	1.53667(29)	37
4.908(4)	4.822(4)	0.15%	9.7×10^{-4}%	3/2$^+$	0.1345	33.5, 35.0, 44.7, 55.0, 79.5, 86.7, 88.1, 99.6, 101.0, 121.6, 134.5	1.53667(29)	640
4.941@	4.854@	1.5%	9.7×10^{-3}%	5/2$^-$	0.101	88.1, 101.0	1.53667(29)	106
4.942(2)	4.855(2)	6.4%	0.04.1%	3/2$^-$	0.0996	44.7, 55.0, 86.7, 99.6	1.53667(29)	25
4.960(2)	4.873(2)	13%	0.08.4%	7/2$^-$	0.0822	69.3, 82.2	1.53667(29)	16
4.988@	4.900@	0.23%	1.5×10^{-3}%	1/2$^-$	0.055	55.0	1.53667(29)	1.3×10^{3}
5.0293(8)	4.9407(8)	85%	0.55%	5/2$^-$	0.0129		1.53667(29)	6.8
5.04211(14)	4.95326(14)	100%	0.65%	3/2$^-$	0.0	——	1.53667(29)	6.9

* [1967JoZX].
** [1970Ki12].
*** [1966Ba19], except where noted.
@ [1995Sh03], except where noted.
@@ [1959No41].

Table 6
direct α emission from ^{231}Pa, J^{π} = 3/2$^-$, $T_{1/2}$ = 3.257(13)$\times 10^4$ y*, BR_{α} = 100%.

E_{α}(c.m.)	E_{α}(lab)**	I_{α}(rel)	I_{α}(abs)	J_f^{π}@@	$E_{daughter}$@@ (^{227}Ac)	coincident γ-rays (keV)@@	R_0 (fm)	HF
4.493	4.4156***	0.0052(8)%	0.0013(2)%	(7/2$^+$)	0.6564(4)	16.5, 25.5, 27.4, 30.0, 35.8, 38.2, 40.2, 44.1, 54.6, 57.2, 63.6, 546.5, 546.5, 571.6, 583, 609	1.53103(70)	64^{+12}_{-9}
4.5878(30)	4.5084(30)	0.012(1)%	0.0030(3)%	(3/2$^+$,5/2)	0.5628(1)	16.5, 27.4, 30.0, 38.2, 40.2, 44.1, 54.6, 57.2, 478.4, 486.8, 516.2, 535.6	1.53103(70)	141^{+17}_{-14}
4.6474(30)	4.5669(30)	0.075(4)%	0.0189(11)%	(3/2$^-$,5/2$^-$)	0.5013(1)	16.5, 24.5, 27.4, 30.0, 38.2, 44.1, 54.6, 57.2, 146.9, 198.9, 226.6, 228.0, 243.1, 245.6, 246.0, 255.8, 273.2, 283.7, 300.1, 302.7, 327.1, 330.1, 354.5, 427.0, 471.3, 501.4	1.53103(70)	63(4)
4.6807(30))	4.5996(30)	0.10(1)%	0.0258(30)%	9/2$^+$	0.4693(1)	16.5, 25.5, 27.4, 30.0, 35.8, 38.2, 40.2, 44.1, 54.6, 57.2, 63.6, 359.3, 384.7	1.53103(70)	79^{+11}_{-9}
4.7139(30)	4.6323(30)	0.58(2)%	0.145(4)%	1/2$^+$	0.4352	16.5, 30.0, 390.4, 407.8, 435.2	1.53103(70)	24.6(8)
4.7256(25)	4.6438(25)	0.53(1)%	0.1335(13)%	5/2$^+$	0.4256	16.5, 27.4, 30.0, 38.2, 40.2, 44.1, 54.6, 57.2 341.1, 351.5, 379.4, 395.5, 398.1	1.53103(70)	31.2(6)
4.7636(24)	4.6811(24)	6.27(3)%	1.572(4)%	7/2$^-$	0.3872	16.5, 25.5, 27.4, 30.0, 35.8, 38.2, 40.2, 44.1, 54.6, 57.2, 63.6, 96.8, 198.9, 226.6, 243.1, 245.6, 246.0, 255.8, 260.2, 273.2, 277.2, 283.7, 300.1, 302.7, 312.9, 330.1, 340.7, 357.1, 387.0	1.53103(70)	4.94(9)
4.7964(24)	4.7133(24)	4.15(7)%	1.041(18)%	1/2$^-$	0.3545	16.5, 24.5, 27.4, 30.0, 38.2, 40.2, 44.1, 54.6, 57.2, 198.9, 226.6, 243.1, 245.6, 246.0, 255.8, 273.2, 283.7, 300.1, 302.7, 327.1, 330.1, 354.5	1.53103(70)	12.6(3)
4.8195(8)	4.7360(8)@	34.37(13)%	8.613(10)%	3/2$^-$	0.3304	16.5, 27.4, 30.0, 38.2, 40.2, 44.1, 54.6, 57.2, 198.9, 226.6, 243.1, 245.6, 246.0, 255.8, 273.2, 283.7, 300.1, 302.7, 330.1	1.53103(70)	2.23(4)
4.8451	4.7612***	0.20(9)%	0.051(22)%	(5/2$^+$)	0.3047(1)	16.5, 27.4, 30.0, 38.2, 40.2, 44.1, 54.6, 57.2, 219.9, 230.0, 258.4, 277.4	1.53103(70)	600^{+400}_{-200}
4.8798(22)	4.7953(22)	6.00(9)%	1.503(22)%	(5/2)$^-$	0.2732	16.5, 27.4, 30.0, 40.2, 44.1, 198.9, 226.6, 243.1, 246.0, 273.2	1.53103(70)	31.3(7)
4.9385(21)	4.8530(21)	5.6(6)%	1.40(15)%	13/2$^+$	0.2108(1)	16.5, 25.5, 27.4, 30.0, 35.8, 38.2, 40.2, 44.1, 54.6, 57.2, 63.6, 100.9	1.53103(70)	88^{+11}_{-9}
4.9870(21)	4.9006(21)	13.09(9)%	3.281(18)%		0.160(2)		1.53103(70)	80.7(14)
5.0212(21)	4.9343(21)	11.6(12)%	2.9(3)%	9/2$^-$	0.1268	30.0, 40.2, 44.1, 52.7, 96.8	1.53103(70)	150^{+18}_{-15}
5.0385(14)	4.9513(14)@	89.1(3)%	22.32(2)%	9/2$^+$	0.1100	16.5, 25.5, 27.4, 30.0, 35.8, 38.2, 40.2, 44.1, 54.6, 57.2, 63.6	1.53103(70)	25.0(4)
5.0628(20)	4.9751(20)	2.19(10)%	0.550(25)%	7/2$^+$	0.0845	27.4, 30.0, 38.2, 54.6, 57.2	1.53103(70)	$1.47(7)\times 10^3$
5.0737(10)	4.9858(10)	6.87(7)%	1.721(16)%	7/2$^-$	0.0741	30.0, 40.2, 44.1	1.53103(70)	548(11)
5.1021(14)	5.0138(14)@	100.0(4)%	25.06(9)%	5/2$^+$	0.0464	16.5, 30.0	1.53103(70)	56.3(10)
5.1170(10)	5.0284(10)@	92.1(4)%	23.09(6)%	5/2$^-$	0.0300	30.0	1.53103(70)	77.4(13)
5.1186(14)	5.0300(14)@	11.2(12)%	2.8(3)%	3/2$^+$	0.0274	27.4	1.53103(70)	660^{+80}_{-70}
5.1477(15)	5.0586(15)@	43.24(18)%	10.837(25)%	3/2$^-$	0.0	——	1.53103(70)	254(7)

* [2020Je01].
** Values from [1961Ba42], except where noted. Values are adjusted by [1991Ry01] to match newer calibration energies.
*** [2019Ga34].
@ Recommended values from [1991Ry01].
@@ [2016Ko07].

Table 7
direct α emission from ^{235}Np*, $J^\pi = 5/2^+$, $T_{1/2}$ = 396.1(12) d**, $BR_\alpha = 2.60(13)\times10^{-3}$%***.

E_α(c.m.)	E_α(lab)***	I_α(rel)	I_α(abs)	J^π_f	$E_{daughter}$(^{231}Pa)	coincident γ-rays (keV)@	R_0 (fm)	HF
4.892(7)	4.809(7)	≈0.2%	$\approx2.6\times10^{-6}$%	$(9/2^+)$	0.304		1.51623(36)	≈53
4.946(3)	4.862(3)	1.3(3)%	$1.8(3)\times10^{-5}$%	$7/2^+$	0.250		1.51623(36)	$17.6^{+3.2}_{-2.4}$
5.010(2)	4.925(2)	22(3)%	$3.0(2)\times10^{-4}$%	$5/2^+$	0.1834	58.5, 61.2, 102.2, 125, 185	1.51623(36)	2.9(2)
5.026(6)	4.940(6)	≈1.1%	$\approx1.6\times10^{-5}$%	$(11/2^-)$	0.1693	58.5, 110.8	1.51623(36)	≈ 70
5.084(4)	4.997(4)	11(4)%	$1.6(3)\times10^{-4}$%	$9/2^+$	0.113		1.51623(36)	17^{+9}_{-4}
5.094(4)	5.007(4)	45(13)%	$6.2(16)\times10^{-4}$%	$7/2^+$	0.103		1.51623(36)	$4.8^{+1.7}_{-1.0}$
5.112(2)	5.025(2)	100(15)%	$1.4)2)\times10^{-3}$%	$5/2^+$	0.0842	84.2	1.51623(36)	$2.9^{+0.6}_{-0.4}$
5.138(2)	5.051(2)	3.4(8)%	$4.7(8)\times10^{-5}$%	$7/2^-$	0.0585	58.5	1.51623(36)	124^{+27}_{-19}
5.188(3)	5.100(3)	≈0.4%	$\approx5\times10^{-6}$%	$1/2^-$	0.008		1.51623(36)	$\approx2.3\times10^3$
5.196(4)	5.108(4)	2.8(6)%	$3.9(5)\times10^{-5}$%	$3/2^-$	0.0	——	1.51623(36)	350^{+60}_{-50}

* All values from [1973Br12], except where noted.
** 1970La08
*** [1986AgZV].

Table 8
direct α emission from ^{239}Am*, $J^\pi = (5/2^-)$, $T_{1/2}$ = 11.9(1) h**, BR_α = 0.010(1)%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J^π_f	$E_{daughter}$(^{235}Np)	coincident γ-rays (keV)	R_0 (fm)	HF
5.777(2)	5.680(2)	2.37(4)%	$1.98(20)\times10^{-4}$%	$(9/2^-)$	0.1468(7)		1.50108(92)	16(2)
5.832(2)	5.734(2)	16.43(11)%	$1.38(14)\times10^{-3}$%	$(7/2^-)$	0.0916(3)		1.50108(92)	$4.7^{+0.5}_{-0.5}$
5.874(2)	5.776(2)	100.0(5)%	$8.37(84)\times10^{-3}$%	$(5/2^-)$	0.0490(1)		1.50108(92)	$1.30^{+0.17}_{-0.15}$
5.924(4)	5.825(4)	0.39(2)%	$3.30(39)\times10^{-5}$%	$(5/2^+)$	0.0	——	1.50108(92)	600^{+90}_{-70}

* All values from [1971Go01], except where noted.
** [1972Po04].

Table 9
direct α emission from ^{243}Bk*, $J^\pi = (5/2^-)$, $T_{1/2}$ = 4.5(1) h**, BR_α = 0.15%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J^π_f***	$E_{daughter}$(^{239}Am)	coincident γ-rays (keV)	R_0 (fm)	HF
6.289(4)	6.185(4)	15(2)%	$\approx5.9\times10^{-3}$	$(5/2^-)$	0.587(6)		1.500(30)	11
6.317(4)	6.213(4)	53.13%4.84%	≈0.020	$(3/2^-)$	0.558(6)		1.500(30)	4
≈6.504	≈6.397	≈0.78%	$\approx3\times10^{-4}$	$(13/2^+)$	≈0.370		1.500(30)	$\approx2.3\times10^3$
6.557(5)	6.449(5)	2.73%0.80%	$\approx1.1\times10^{-3}$	$(11/2^+)$	0.317(6)		1.500(30)	21.2×10^3
6.614(4)	6.505(4)	26.95%3.21%	≈0.010	$(9/2^+)$	0.260(6)		1.500(30)	210
6.655(4)	6.545(4)	75.78%6.94%	≈0.029	$(7/2^+)$	0.220(6)		1.500(30)	110
6.687(4)	6.577(4)	100.00%8.84%	≈0.038	$(5/2^+)$	0.187(6)	146.4, 187.1	1.500(30)	120
6.719(5)	6.608(5)	≈2.73%	$\approx1.1\times10^{-3}$	$(11/2^-)$	0.156(6)		1.500(30)	$\approx6\times10^3$
6.781(4)	6.669(4)	≈4.69%	$\approx1.8\times10^{-3}$	$(9/2^-)$	0.094(6)		1.500(30)	$\approx7\times10^3$
6.833(4)	6.721(4)	48.83%4.66%	≈0.019	$(7/2^-)$	0.041(6)		1.500(30)	1.1×10^3
6.874(4)	6.761(4)	60.16%5.42%	≈0.023	$(5/2^-)$	0.0	——	1.500(30)	1.3×10^3

* All values from [1966Ah02], except where noted. E_α(lab) is adjusted by +3.0 keV by [1991Ry01].
** [1953Hu60].
*** [2014Br18].

Table 10
direct α emission from ^{247}Es*, $T_{1/2}$ = 4.55(26) m, BR_α = obs.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J^π_f	$E_{daughter}$(^{243}Bk)	coincident γ-rays (keV)	R_0 (fm)	HF
7.332(5)	7.213(5)	2.3(8)%						
7.395(3)	7.275(3)	14(2)%						
7.444(1)	7.323(1)	100(7)%						

* All values from [1989Ha27].

Table 11
direct α emission from ^{251}Md, J^{π} = (7/2$^-$), $T_{1/2}$ = 4.28(12) m**, BR_{α} = 10(1)%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_f	$E_{daughter}$(^{247}Es)	coincident γ-rays (keV)	R_0 (fm)	HF
7.672(1)	7.550(1)	10(1)%		0.293+x	243, 293	1.4788(62)	74^{+16}_{-14}

* All values from [2006Ch52], except where noted.
** [2021Go26].

Table 12
direct α emission from ^{255}Lr*, J^{π} = (1/2$^-$), $T_{1/2}$ = 31.1(13) s**, BR_{α} = 99.7(5)%**.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_f	$E_{daughter}$(^{251}Md)	coincident γ-rays (keV)	R_0 (fm)	HF
8.422(5)	8.290(5)	1.8(6)%	0.7(2)%	(11/2$^-$)	0.135		1.467(15)	50^{+40}_{-20}
8.498(2)	8.365(2)	100(3)%	37.3(8)%	1/2$^-$	0.055		1.467(15)	$1.7^{+0.8}_{-0.5}$
8.554(10)	8.420(10)	5.4(8)%	2.0(3)%	(7/2$^-$)	0.0	——	1.467(15)	48^{+23}_{-17}

* All values from [2006Ch52], except where noted.
** [12008Ha31].

Table 13
direct α emission from ^{255m}Lr*, Ex. = 37(10) keV, J^{π} = (1/2$^-$), $T_{1/2}$ = 2.53(5) s**, BR_{α} = ≈40%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_f	$E_{daughter}$(^{251}Md)	coincident γ-rays (keV)	R_0 (fm)	HF
8.455(10)	8.322(10)	8.1(19)%	≈7.5(18)%	(11/2$^-$)	0.135		1.467(15)	≈3.2
8.592(2)	8.457(2)	100(3)%	≈92(3)%	(7/2$^-$)	0.0	——	1.467(15)	≈0.7

* All values from [2006Ch52], except where noted.
** [2008An16].

Table 14
direct α emission from ^{259}Db, $T_{1/2}$ = 510(160) ms, BR_{α} = ≈ 100%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_f	$E_{daughter}$(^{255}Lr)	coincident γ-rays (keV)	R_0 (fm)	HF
9.623	9.474	≈ 100%		0.0?		1.463(13)	11^{+6}_{-5}

* All values from [2001Ga20].

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