



**Fig. 1:** Known experimental values for heavy particle emission of the odd-Z  $T_2 = +24$  nuclei.

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**Table 1**

Observed and predicted  $\beta$ -delayed particle emission from the odd-Z,  $T_z = +24$  nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein.

Nuclide	Ex.	$J^\pi$	$T_{1/2}$	$Q_\epsilon$	$Q_{\beta^-}$	$Q_{\beta^- \alpha}$	$BR_{\beta^- \alpha}$	$BR_{\epsilon F}$	Experimental
$^{210}\text{Tl}^*$		(5 <sup>+</sup> )	1.30(3) m	-3.95(10)#	5.481(12)	9.274(33)			[1964We06]
$^{214}\text{Bi}$		1 <sup>-</sup>	19.71(2) m	-1.018(11)	3.269(11)	11.102(11)	$3.03 \times 10^{-3}\%$		[1991Ma68, 1965Le08, 1975HaZA, 1933RuXX]
$^{218}\text{At}$		(3 <sup>-</sup> )	1.27(6) s	-0.256(12)	2.883(12)	6.217(12)			[2019Cu02]
$^{222}\text{Fr}^*$		2 <sup>-</sup>	14.2(3) m	0.0606(8)	$Q_{\epsilon p}$ -7.694(16)	$Q_{\epsilon \alpha}$ 5.597(8)			[1973AfZV]
$^{226}\text{Ac}$		(1 <sup>-</sup> )	29.37(12) h	0.642(3)	-6.800(12)	5.512(4)			[1987Mi10]
$^{230}\text{Pa}$		2 <sup>-</sup>	17.4(4) d <sup>**</sup>	1.311(3)	-5.805(12)	6.081(4)			[1948St42, 1949Os01]
$^{234}\text{Np}$		(0 <sup>+</sup> )	4.4(1) d	1.810(8)	-4.824(8)	6.667(8)			[1955Pr29]
$^{238}\text{Am}$		1 <sup>+</sup>	98(3) m	2.260(60)	-3.739(59)	7.852(59)			[1972Ah04]
$^{238m}\text{Am}$	x		60(15) $\mu\text{s}$	2.260(60)+x	-3.739(59)+x	7.852(59)+x			[1967Bo23]
$^{242}\text{Bk}$			7.0(13) m	2.95(14)#	-2.47(14)#	9.16(13)#			[1979Wi03]
$^{242m1}\text{Bk}$	x		9.5(20) ns	2.95(14)#+x	-2.47(14)#+x	9.16(13)#+x			[1972Wo07]
$^{242m2}\text{Bk}$	y		600(100) ns	2.95(14)#+y	-2.47(14)#+y	9.16(13)#+y			[1972Wo07]
$^{246}\text{Es}$			7.7(5) m	3.730(90)	-1.284(90)	10.590(90)		$\approx 3 \times 10^{-3}\%$	[2001Sh09, 1980Ga07, 1980GaZZ]
$^{250}\text{Md}$			52(6) s	4.330(90)	-0.065(96)#	11.884(91)		$\approx 0.02\%$	[1973Es01, 1980Ga07, 1991FuZZ, 1980GaZZ]
$^{254}\text{Lr}$		(4 <sup>+</sup> )	18.1(13) s <sup>***</sup>	4.920(90)	1.184(97)#	13.149(92)			[2008An16, 2008Ga25]
$^{258}\text{Db}$		(0 <sup>-</sup> )	2.17(36) s	5.160(90)	1.55(10)#	14.359(92)			[2019Vo03]
$^{258m}\text{Db}$	0.051(14)		4.41(21) s	5.214(91)	1.60(10)#	14.410(93)			[2019Vo03]
$^{262}\text{Bh}^\oplus$	y		87(14) ms <sup>@@</sup>	5.88(10)+y	2.66(14)#+y	15.483(94)+y			[2009He20, 2006Fo02, 1989Mu09]
$^{262m}\text{Bh}^\oplus$	x		11(2) ms <sup>@@@</sup>	5.88(10)+x	2.66(14)#+x	15.483(94)+x			[2009He20, 2006Fo02, 1989Mu09]
$^{266}\text{Mt}$	y		$0.7^{+0.4}_{-0.2}$ ms	6.53(10)+y	3.99(26)#+y	16.879(99)+y			[1999He11]
$^{266}\text{Mt}$	x		$1.2^{+1.0}_{-0.4}$ ms	6.53(10)+x	3.99(26)#+x	16.879(99)+x			[1999He11]

\* 100%  $\beta^-$  emitter.

\*\* Weighted average of 17.0(5) d [1948St42] and 17.7(5) d [1949Os01].

\*\*\* Weighted average of 18.4(18) s [2008An16] and  $17.8^{+1.9}_{-1.6}$  s [2008Ga25].

⊕ The relative ordering of these states is unclear (i.e. which level is the ground state and which is the excited isomer).

@@ Weighted average of 83(14) ms [2009He20],  $84^{+21}_{-16}$  ms [2006Fo02] and 102(26) ms [1989Mu09].

@@@ Weighted average of 22(4) ms [2009He20],  $9.6^{+3.6}_{-2.4}$  ms [2006Fo02] and 8.0(21) ms [1989Mu09].

**Table 2**

Particle separation, Q-values, and measured values for direct particle emission of the odd-Z,  $T_z = +24$  nuclei. Unless otherwise stated, all S and Q-values are taken from [2021Wa16] or deduced from values therein.

Nuclide	$S_p$	$Q_\alpha$	$BR_\alpha$	$BR_{SF}$	Experimental
$^{210}\text{Tl}$	7.93(15)#	2.52(30)#			
$^{214}\text{Bi}$	5.286(13)	5.621(3)	0.0210(13)%		[1960Wa14, 1948Ch22, 1934Le01, 1992Po07, 1939Du01]
$^{218}\text{At}$	5.072(13)	6.876(3)	99.9%		[2019Cu02, 1964Hy02, 1949Wa05, 1990Mo08, 1989Bu09, 1958Wa16, 1952Hi60]
$^{222}\text{Fr}$	5.382(9)	5.853(14)			
$^{226}\text{Ac}$	4.973(4)	5.506(8)	$6(2) \times 10^{-3}\%$		[1975VaZD, 1987Mi10]
$^{230}\text{Pa}$	4.701(4)	5.439(1)	$3.2(1) \times 10^{-3}\%$		[1966Ba14, 1965Br32, 1964Mc21]
$^{234}\text{Np}$	4.253(9)	5.356(9)			
$^{238}\text{Am}$	3.959(59)	6.042(58)	$1.0(4) \times 10^{-4}\%$		[1972Ah04, 1972AhZS]
$^{238m}\text{Am}$	3.959(59)-x	6.042(58)+x		$\approx 100\%$	[1967Bo23]
$^{242}\text{Bk}$	3.24(14)	6.91(15)	<1%	<0.03%	[1979Wi03]
$^{242m1}\text{Bk}$	3.24(14)-x	6.91(15)+x		100%	[1972Wo07]
$^{242m2}\text{Bk}$	3.24(14)-y	6.91(15)+y		100%	[1972Wo07, 1972Ga42]
$^{246}\text{Es}$	2.855(90)	7.64(10)	9.9(18)%		[1989Ha27, 1967Mi06, 1986HaZM, 1973Es01]
$^{250}\text{Md}$	2.409(91)	8.155(28)	7(1)%		[2008An16, 1985He22, 1973Es01, 2009Ne02, 2008Ga25]
$^{254}\text{Lr}$	2.002(92)	8.822(8)	72(2)%		[2019Vo13, 2008An16, 2022Ka45, 2009Ne22, 2008Ga25, 2006Fo02, 2001Ga20, 1986He28, 1985He22, 1982HeZL]
$^{258}\text{Db}$	1.648(92)	9.437(10)	$\approx 96\%$		[2019Vo03, 2022Ka45, 2016He15, 2009He20, 2006Fo02, 1999He11, 1985He22]
$^{258m}\text{Db}$	1.597(93)	9.488(17)	$\approx 57\%$		[2019Vo03, 2016He15, 2009He20, 2008Ga25, 2006Fo02, 2001Ga20, 1985He22]
$^{262}\text{Bh}$	1.042(95)-y	10.319(15)+y	100%		[2009He20, 2006Fo02, 1989Mu09, 2008Ne08, 1997Ho14, 1988Mu15, 1988MuZX, 1986MuZX, 1984Og03, 1983OgZX, 1981Mu06]
$^{262m}\text{Bh}$	1.042(95)-x	10.319(15)+x	100%		[2009He20, 2006Fo02, 1989Mu09, 2008Ne08, 1997Ho14, 1988Mu15, 1988MuZX, 1986MuZX, 1984Og03, 1983OgZX, 1981Mu06]
$^{266}\text{Mt}^*$	0.517(99)-y	10.996(25)+y	100%*	<25%	[2009Ne02, 1999He11, 1997Ho14, 1989Mu16, 1989MuZY, 1988Mu15, 1984Mu07, 1984Og03, 1982Mu15]
$^{266m}\text{Mt}^*$	0.517(99)-x	10.996(25)+x	100%*	<25%	[2009Ne02, 1999He11, 1997Ho14, 1989Mu16, 1989MuZY, 1988Mu15, 1984Mu07, 1984Og03, 1982Mu15]

\*  $^{266}\text{Mt}$  has a very complex  $\alpha$ -decay scheme with  $\alpha$ - $\alpha$  correlations to known  $^{262}\text{Bh}$  and  $^{262m}\text{Bh}$   $\alpha$ 's. The observed  $E_\alpha$  are a broad distribution from 10.5 to 11.7 MeV.

**Table 3**

direct  $\alpha$  emission from  $^{214}\text{Bi}^*$ ,  $J^\pi = 1^-$ ,  $T_{1/2} = 19.71(2)$  m\*\*,  $BR_\alpha = 0.0210(13)\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{\text{daughter}}(^{210}\text{Tl})$	coincident $\gamma$ -rays	$R_0$ (fm)***	HF
5.039(3)	4.945(3)	0.46(9)%	$5.3(11) \times 10^{-5}\%$		0.582(4)		1.495(21)	$48^{+32}_{-20}$
5.123(3)	5.027(3)	0.39(7)%	$4.41(88) \times 10^{-5}\%$		0.498(4)		1.495(21)	$180^{+110}_{-70}$
5.287(3)	5.188(3)	1.13(11)%	$1.28(15) \times 10^{-4}\%$		0.334(4)		1.495(21)	$490^{+300}_{-190}$
5.372(3)	5.272(3)	10.76(19)%	$1.22(8) \times 10^{-3}\%$		0.249(4)		1.495(21)	$150^{+90}_{-50}$
5.556(3)	5.452(3)	100%	$1.13(7) \times 10^{-2}\%$		0.065(4)		1.495(21)	$140^{+80}_{-50}$
5.621(3)	5.516(3)	72.73(69)%	$8.23(51) \times 10^{-3}\%$	(5 <sup>+</sup> )	0.0	—	1.495(21)	$400^{+230}_{-150}$

\* All values from [1960Wa14], except where noted.  $E_\alpha$  (lab) values have been adjusted by +3.8 keV as recommended by [1991Ry01].

\*\* [1991Ma68].

\*\*\* Interpolated between 1.449(21) fm ( $^{210}\text{Pb}$ ) and 1.54117(28) fm ( $^{216}\text{Po}$ ).

**Table 4**

$\beta^-$ -delayed  $\alpha$  emission from  $^{214}\text{Bi}^*$ ,  $J^\pi = 1^-$ ,  $T_{1/2} = 19.71(2)$  m\*\*,  $BR_{\beta^- - \alpha} = 3.03 \times 10^{-3}\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab.)	$I_\alpha$ (rel)%***	$I_\alpha$ (abs)%	$E_{emitter}$ ( $^{212}\text{Po}$ )	$E_{daughter}$ ( $^{208}\text{Pb}$ )
8.445(6)	8.287(6)	5.5%	$1.20 \times 10^{-4}\%$	0.610	0.0
8.591(6)	8.430(6)	2.7%	$6.00 \times 10^{-5}\%$	1.536	0.0
9.120(8)	8.950(8)	0.9%	$2.00 \times 10^{-5}\%$	1.286	0.780
9.253(6)	9.080(6)	100.0%	$2.20 \times 10^{-3}$	1.419	0.0
9.498(6)	9.320(6)	2.3%	$5.10 \times 10^{-5}\%$	1.663	0.0
9.557(8)	9.378(8)	0.9%	$2.00 \times 10^{-5}\%$	1.722	0.0
9.681(6)	9.500(6)	4.5%	$1.00 \times 10^{-4}\%$	1.847	0.0
9.854(8)	9.670(8)	0.5%	$1.00 \times 10^{-5}\%$	2.020	0.0
9.989(6)	9.802(6)	5.5%	$1.20 \times 10^{-4}\%$	2.154	0.0
10.096(6)	9.907(6)	3.2%	$7.00 \times 10^{-5}\%$	2.261	0.0
10.274(6)	10.082(6)	6.4%	$1.40 \times 10^{-4}\%$	2.440	0.0
10.343(8)	10.150(8)	1.0%	$2.10 \times 10^{-5}\%$	2.509	0.0
10.529(6)	10.332(6)	3.6%	$8.00 \times 10^{-5}\%$	2.694	0.0
10.705(10)	10.505(10)	0.9%	$2.00 \times 10^{-5}\%$	2.871	0.0

\* All values taken from [1965Le08], except where noted.

\*\* [1991Ma68].

**Table 5**

direct  $\alpha$  emission from  $^{218}\text{At}^*$ ,  $J^\pi = (3^-)$ ,  $T_{1/2} = 1.27(6)$  s\*\*,  $BR_\alpha = 99.9\%$ \*\*\*.

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{daughter}$ ( $^{214}\text{Bi}$ )	coincident $\gamma$ -rays	$R_0$ (fm)**	HF
6.779(7)	6.655(7)	7.5%	6.9(1)%	( $4^-$ )	0.102(9)		1.54833(30)	21.2(11)
6.819(5)	6.694(5)	100%	92.2%	( $3^-$ )	0.063	0.010, 0.0533	1.54833(30)	2.2(2)
6.882(5)	6.756(5) <sup>@</sup>	1.0%	$\leq 0.9\%$	$1^-$	0.0	—	1.54833(30)	$\geq 390$

\* All values from [1960Wa14], except where noted.

\*\* [2019Cu02].

\*\*\* [1949Wa05].

<sup>@</sup> Value from [1964Hy02], adjusted by -1.2 keV as recommended in [1991Ry01].

\*\* Interpolated between 1.54117(28) fm ( $^{216}\text{Po}$ ) and 1.55548(10) fm ( $^{220}\text{Rn}$ ).

**Table 6**

direct  $\alpha$  emission from  $^{226}\text{Ac}^*$ ,  $J^\pi = (1^-)$ ,  $T_{1/2} = 29.37(12)$  h\*\*,  $BR_\alpha = 6(2) \times 10^{-3}\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{daughter}$ ( $^{222}\text{Fr}$ )	coincident $\gamma$ -rays	$R_0$ (fm)***	HF
5.496(5)	5.399(5)	$6(2) \times 10^{-3}\%$	$2^-$	0.0	—	1.53803(33)	$51_{-13}^{+26}$

\* All values from [1975VaZD], except where noted.

\*\* [1987Mi10].

\*\*\* Interpolated between 1.542177(86) fm ( $^{224}\text{Ra}$ ) and 1.53389(32) fm ( $^{228}\text{Th}$ ).

**Table 7**  
direct  $\alpha$  emission from  $^{230}\text{Pa}^*$ ,  $J^\pi = 2^-$ ,  $T_{1/2} = 17.4(4)$  d<sup>\*\*</sup>,  $BR_\alpha = 3.2(1) \times 10^{-3}\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{\text{daughter}}(^{226}\text{Ac})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>***</sup>	HF
4.850(2)	4.766(2)	0.9(5)%	$2.8(14) \times 10^{-5}$		0.589(2)		1.53137(43)	$7_{-3}^{+8}$
4.883(5)	4.798(5) <sup>@</sup>	0.09-0.22%	$2.8-7.0 \times 10^{-6}$		0.556(5)		1.53137(43)	47-118
5.021(3)	4.934(3)	1.7(9)%	$5.6(29) \times 10^{-5}$		0.418(3)		1.53137(43)	$50_{-0.2}^{+0.5}$
5.061(2)	4.973(2)	3.0(10)%	$9.7(31) \times 10^{-5}$		0.378(2)		1.53137(43)	$49_{-12}^{+22}$
5.150(3)	5.060(3)	1.7(9)%	$5.6(29) \times 10^{-5}$		0.290(3)		1.53137(43)	$310_{-110}^{+320}$
5.174(2)	5.084(2)	3.04%0.96%	$9.7(31) \times 10^{-5}$		0.265(2)		1.53137(43)	$250_{-60}^{+110}$
5.210(3)	5.119(3)	2.6(9)%	$8.3(30) \times 10^{-5}$		0.230(3)		1.53137(43)	$480_{-130}^{+260}$
5.244(2)	5.153(2)	1.7(5)%	$5.6(16) \times 10^{-5}$		0.195(2)		1.53137(43)	$1.2(4) \times 10^3$
5.275(3)	5.183(3)	2.2(9)%	$7.0(3) \times 10^{-5}$		0.165(3)		1.53137(43)	$1.4_{-0.4}^{+1.0} \times 10^3$
5.3089(15)	5.2166(15)	2.17%0.52%	$7.0(2) \times 10^{-5}$		0.1304(17)		1.53137(43)	$2.3_{-0.4}^{+0.7} \times 10^3$
5.3616(7)	5.2684(7)	15.2(29)%	$4.9(9) \times 10^{-4}$		0.0777(10)		1.53137(43)	$660_{-100}^{+110}$
5.3690(7)	5.2756(7)	13.0(28)%	$41.2(9) \times 10^{-4}$		0.0703(10)		1.53137(43)	$850_{-140}^{+200}$
5.3810(15)	5.2874(15)	13.0(39)%	$4.2(12) \times 10^{-4}$		0.058317		1.53137(43)	$1.0_{-0.3}^{+0.4} \times 10^3$
5.3943(7)	5.3005(7)	74(16)%	$2.4(5) \times 10^{-3}$		0.0450(10)		1.53137(43)	$210_{-40}^{+50}$
5.4060(7)	5.3120(7)	57(15)%	$1.8(5) \times 10^{-3}$		0.0333(10)		1.53137(43)	$320_{-70}^{+110}$
5.4205(7)	5.3262(7)	78(17)%	$2.5(5) \times 10^{-3}$		0.0188(10)		1.53137(43)	$280_{-50}^{+70}$
5.4342(10)	5.3397(10)	65(23)%	$2.1(7) \times 10^{-3}$		0.005112		1.53137(43)	$410_{-110}^{+220}$
5.4393(7)	5.3447(7)	100(13)%	0.0032(4)		0.0	—	1.53137(43)	$280_{-40}^{+30}$

\* All values from [1966Ba14], except where noted.

\*\* Weighted average of 17.0(5) d [1948St42] and 17.7(5) d [1949Os01].

\*\*\* Interpolated between 1.53389(32) fm ( $^{228}\text{Th}$ ) and 1.52885(29) fm ( $^{232}\text{U}$ ).

@ Tentative assignment.

**Table 8**  
direct  $\alpha$  emission from  $^{238}\text{Am}^*$ ,  $J^\pi = 1^+$ ,  $T_{1/2} = 98(3)$  m,  $BR_\alpha = 1.0(4) \times 10^{-4}\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{\text{daughter}}(^{234}\text{Np})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>***</sup>	HF
$\approx 6.04$	$\approx 5.94$	$1.0(4) \times 10^{-4}\%$	(0 <sup>+</sup> )			1.5024(17)	$110_{-30}^{+80}$

\* All values from [1972Ah04].

\*\* Interpolated between 1.51022(22) fm ( $^{236}\text{Pu}$ ) and 1.4947(17) fm ( $^{240}\text{Cm}$ ).

**Table 9**  
direct  $\alpha$  emission from  $^{246}\text{Es}^*$ ,  $T_{1/2} = 7.7(5)$  m,  $BR_\alpha = 9.9(18)\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{\text{daughter}}(^{242}\text{Bk})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>***</sup>	HF
7.492(4)	7.370(4) <sup>**</sup>	9.9(18)%				1.496(60)	$4_{-3}^{+12}$

\* All values from [1967Mi08], except where noted.

\*\* [1989Ha27].

\*\*\* Interpolated between 1.498(60) fm ( $^{244}\text{Cf}$ ) and 1.4945(65) fm ( $^{248}\text{Fm}$ ).

**Table 10**  
direct  $\alpha$  emission from  $^{250}\text{Md}$ ,  $T_{1/2} = 52(6)$  s<sup>\*</sup>,  $BR_\alpha = 7(1)\%$ <sup>\*\*</sup>.

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{\text{daughter}}(^{246}\text{Es})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>@</sup>	HF
7.877(20)	7.751(20) <sup>***</sup>	100% <sup>@</sup>	$\approx 5.3\%$			0.1523 <sup>**</sup>	1.4866(99)	$\approx 3.1$
7.964(20)	7.837(20) <sup>***</sup>	$\approx 33\%$ <sup>@</sup>	$\approx 1.8\%$				1.4866(99)	$\approx 19$

\* [1973Es01].

\*\* [2008An16].

\*\*\* [1985He22].

@ Average of 7.751(20) MeV  $\approx 80\%$ , 7.837(20) MeV  $\approx 20\%$  [1985He22] and 7.751(20) MeV  $\approx 70\%$ , 7.837(20) MeV  $\approx 30\%$  [1973Es01].

Interpolated between 1.4945(65) fm ( $^{248}\text{Fm}$ ) and 1.4787(75) fm ( $^{252}\text{No}$ ).

**Table 11**direct  $\alpha$  emission from  $^{254}\text{Lr}^*$ ,  $T_{1/2} = 18.1(13)$  s<sup>\*\*</sup>,  $BR_\alpha = 72(2)\%$ <sup>\*\*\*</sup>.

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{daughter} (^{250}\text{Md})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>@</sup>	HF
8.520(10)	8.386(10)	100(29)%	24(7)%		0.307	0.0963, 0.2091, 0.3068	1.472(27)	$1.8_{-1.0}^{+1.9}$
8.539(15)	8.405(15)	38(12)%	9(1)%		0.284	0.0753, 0.2091	1.472(27)	$5_{-3}^{+5}$
8.572(15)	8.437(15)	88(49)%	21(10)%		0.252	0.0428, 0.2091	1.472(27)	$3_{-2}^{+4}$
8.616(15)	8.480(15)	42(28)%	10(6)%		0.209	0.2091	1.472(27)	$9_{-6}^{+16}$
8.641(10)	8.505(10)	33(23)%	8(5)%		0.184	0.1633	1.472(27)	$13_{-9}^{+29}$

\* All values from [2019Vo03], except where noted.

\*\* Weighted average of 18.4(18) s [2008An16] and  $17.8_{-1.6}^{+1.9}$  s [2008Ga25].

\*\*\* [2008An16].

@ Interpolated between 1.4787(75) fm ( $^{252}\text{No}$ ) and 1.466(26) fm ( $^{256}\text{Rf}$ ).**Table 12**direct  $\alpha$  emission from  $^{258}\text{Db}^*$ ,  $T_{1/2} = 2.17(36)$  s,  $BR_\alpha \approx 96\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{daughter} (^{254}\text{Lr})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>**</sup>	HF
9.203(15)	9.060(15)	$\approx 10\%$	$\approx 7.4\%$		0.235		1.461(27)	$\approx 40$
9.217(10)	9.074(10)	$\approx 11\%$	$\approx 8\%$		0.221	0.221	1.461(27)	$\approx 40$
9.236(10)	9.093(10)	$\approx 11\%$	$\approx 8\%$		0.199	0.043, 0.156, 0.199	1.461(27)	$\approx 50$
9.330(15)	9.185(15)	$\approx 100\%$	$\approx 73\%$		0.108		1.461(27)	$\approx 10$

\* All values from [2019Vo03], except where noted.

\*\* Interpolated between 1.466(26) fm ( $^{256}\text{Rf}$ ) and 1.4562(75) fm ( $^{260}\text{Sg}$ ).**Table 13**direct  $\alpha$  emission from  $^{258m}\text{Db}^*$ , Ex. = 51(14) keV,  $T_{1/2} = 4.41(21)$  s,  $BR_\alpha \approx 57\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab)	$I_\alpha$ (rel)	$I_\alpha$ (abs)	$J_f^\pi$	$E_{daughter} (^{254}\text{Lr})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>**</sup>	HF
9.149(15)	9.007(15)	$\approx 38\%$	$\approx 6\%$		0.338		1.461(27)	$\approx 120$
9.182(15)	9.040(15)	$\approx 44\%$	$\approx 7\%$		0.304		1.461(27)	$\approx 130$
9.213(10)	9.070(10)	$\approx 75\%$	$\approx 12\%$		0.274	0.043, 0.096, 0.134	1.461(27)	$\approx 90$
9.265(15)	9.121(15)	$\approx 56\%$	$\approx 9\%$		0.221	0.221	1.461(27)	$\approx 180$
9.288(10)	9.144(10)	$\approx 100\%$	$\approx 16\%$		0.199	0.043, 0.156, 0.199	1.461(27)	$\approx 110$
9.309(15)	9.165(15)	$\approx 42\%$	$\approx 6.7\%$		0.178	0.043, 0.134	1.461(27)	$\approx 310$

\* All values from [2019Vo03], except where noted.

\*\* Interpolated between 1.466(26) fm ( $^{256}\text{Rf}$ ) and 1.4562(75) fm ( $^{260}\text{Sg}$ ).**Table 14**direct  $\alpha$  emission from  $^{262}\text{Bh}^*$ , Ex. = y,  $T_{1/2} = 87(14)$  ms<sup>\*\*</sup>,  $BR_\alpha = 100\%$ .

$E_\alpha$ (c.m.)	$E_\alpha$ (lab) <sup>***</sup>	$I_\alpha$ (rel) <sup>@</sup>	$I_\alpha$ (abs)	$J_f^\pi$	$E_{daughter} (^{258}\text{Db})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>@@</sup>	HF
9.843(15)	9.693(15)	$\approx 82\%$	$\approx 31\%$		y+0.345		1.471(25)	$\approx 7$
9.878(25)	9.727(25) <sup>@@@</sup>	$\approx 14\%$	$\approx 5\%$		y+0.311		1.471(25)	$\approx 50$
9.961(25)	9.809(25) <sup>@@@</sup>	$\approx 5\%$	$\approx 2\%$		y+0.227		1.471(25)	$\approx 220$
10.089(15)	9.935(15)	$\approx 64\%$	$\approx 24\%$		y+0.100		1.471(25)	$\approx 40$
10.189(15)	10.033(15)	$\approx 100\%$	$\approx 38\%$		y+0.0		1.471(25)	$\approx 40$

\* Which level is the ground state and which is the excited isomer is unknown.

\*\* Weighted average of 83(14) ms [2009He20],  $84_{-16}^{+21}$  ms [2006Fo02] and 102(26) ms [1989Mu09].

\*\*\* Weighted average of values from [1989Mu09] (9.740(25) MeV; 4 counts, 9.910(25) MeV; 4 counts, 10.060(25) MeV; 7 counts), [2006Fo02] (9.657(25) MeV; 2 counts, 9.727(25) MeV; 1 count, 9.809(25) MeV; 3 counts, 9.936(25) MeV; 4 counts, 10.075(25) MeV; 5 counts) and [2009He20] (9.689(15) MeV; 12 counts, 9.943(15) MeV; 6 counts, 10.008(15) MeV; 10 counts).

@ Counts from [2009He20, 2006Fo02, 1989Mu09] summed to determine relative intensities.

@@ Interpolated between 1.4562(75) fm ( $^{260}\text{Sg}$ ) and 1.485(24) fm ( $^{264}\text{Hs}$ ).

@@@ Only observed in [2006Fo02].

**Table 15**direct  $\alpha$  emission from  $^{262m}\text{Bh}^*$ , Ex. = x,  $T_{1/2} = 11(2)$  ms,  $BR_{\alpha} = 100\%$ .

$E_{\alpha}$ (c.m.)	$E_{\alpha}$ (lab) <sup>@</sup>	$I_{\alpha}$ (rel)	$I_{\alpha}$ (abs)	$J_f^{\pi}$	$E_{\text{daughter}}(^{258}\text{Db})$	coincident $\gamma$ -rays	$R_0$ (fm) <sup>@@</sup>	HF
9.978(15)	9.826(15) <sup>@@@</sup>	$\approx 24\%$	$\approx 13\%$		x+0.549		1.471(25)	$\approx 5$
10.371(15)	10.213(15)	$\approx 60\%$	$\approx 33\%$		x+0.156		1.471(25)	$\approx 18$
10.528(15)	10.367(15)	$\approx 100\%$	$\approx 54\%$		x+0.0		1.471(25)	$\approx 27$

\* Which level is the ground state and which is the excited isomer is unknown.

\*\* Weighted average of 22(4) ms [2009He20],  $9.6^{+3.6}_{-2.4}$  ms [2006Fo02] and 8.0(21) ms [1989Mu09].

\*\*\* Weighted average of values from [1989Mu09] 10.240(25) MeV; 6 counts, 10.370(25) MeV; 8 counts), [2006Fo02] (10.231(25) MeV; 1 count, 10.348(25) MeV; 7 counts) and [2009He20] (9.86215) MeV; 6 counts, 10.197(15) MeV; 8 counts, 10.373(15) MeV; 10 counts).

<sup>@</sup> Counts from [2009He20, 2006Fo02, 1989Mu09] summed to determine relative intensities.<sup>@@</sup> Interpolated between 1.4562(75) fm ( $^{260}\text{Sg}$ ) and 1.485(24) fm ( $^{264}\text{Hs}$ ).<sup>@@@</sup> Only observed in [2009He20].**References used in the Tables**

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