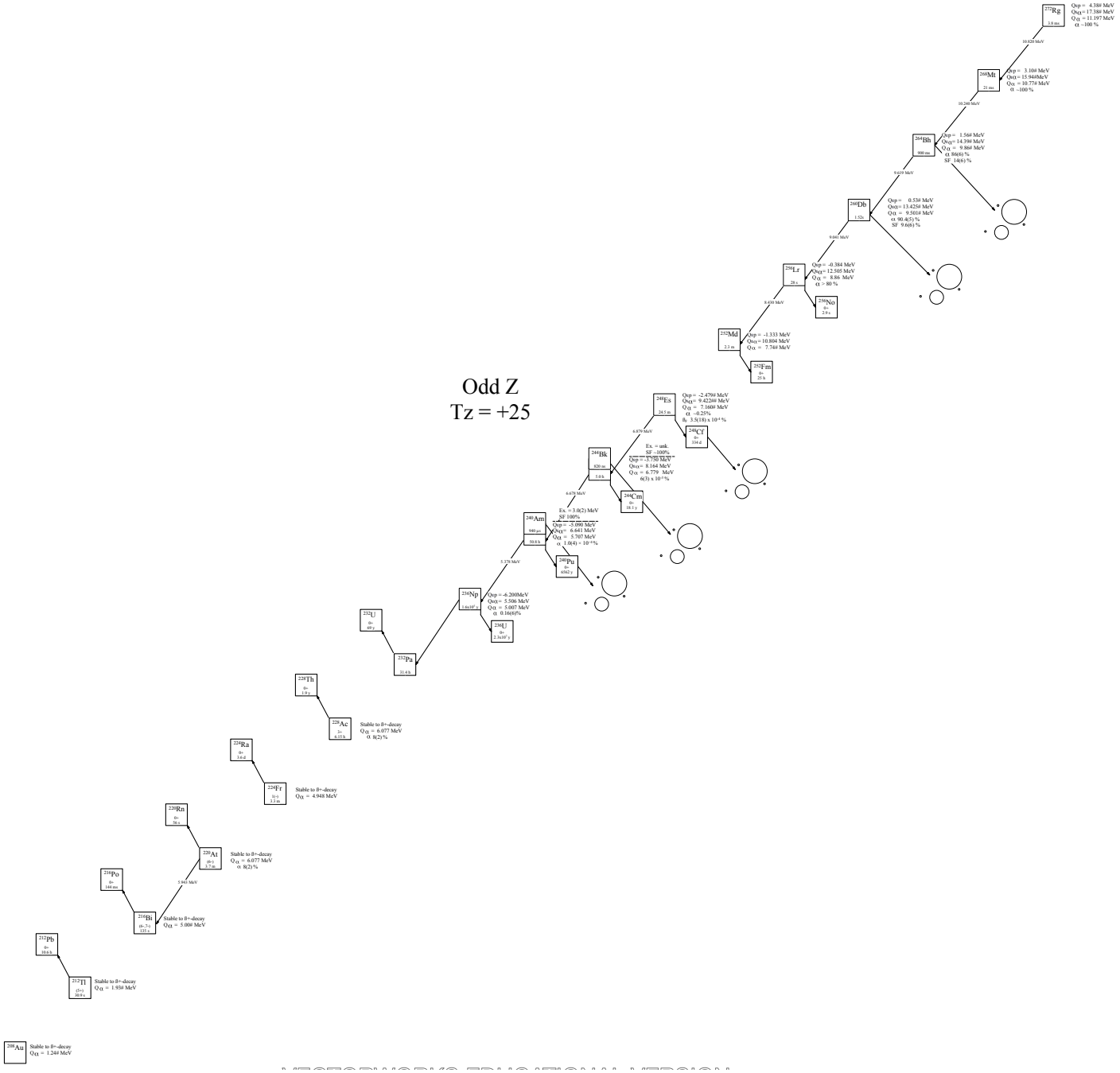

Fig. 1: Known experimental values for heavy particle emission of the odd-Z T_z= +25 nuclei.

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Table 1
Observed and predicted β-delayed particle emission from the odd-Z, T_z = +25 nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. J^π values for ^{208}Au, ^{212}Tl, ^{220}At, ^{224}Fr, ^{228}Ac, ^{232}Pa, and ^{236}N are taken from ENSDF.

Nuclide	Ex.	J^π	$T_{1/2}$	Q_ε	Q_β-	$Q_{\beta^-\alpha}$	$BR_{\varepsilon\ F}$	Experimental
^{208}Au*			obs	-5.41(50)#	7.360(30)#	1.42(50)#		[**2010Al24**]
^{212}Tl*		(5^+)	30.9(80) s	-4.57(36)#	6.00(20)#	3.476(30)		[**2016Ca25**]
^{216}Bi*		$(6^-,7^-)$	135(5) s	-1.640(20)#	4.092(11)	11.178(11)		[**2000Ku06**]
^{220}At		(6^-)	3.7(4) m	-0.888(23)	3.764(14)	10.349(14)		[**1989Li04**]
^{224}Fr*		$1^{(-)}$	3.33(10) m	-0.696(15)	2.923(11)	8.892(11)		[**1981Ku02**]
^{228}Ac(MsTh)		3^+	6.15(2) h	-0.046(1)	2.124(3)	7.824(3)		[**1985Sk02**]
^{232}Pa*			31.4(2) h**	0.500(8)	-1.337(7)	6.931(8)		[**1950Ja51**]
					$Q_{\varepsilon p}$	$Q_{\varepsilon\alpha}$		
^{236}Np			$1.55(1)\times10^5$ y	0.930(50)	-6.200(52)	5.506(50)		[**1981Li30**]
^{240}Am			50.8(3) h	1.385(14)	-5.090(14)	6.641(14)		[**1972Ah07**]
^{240m}Am	3.0(2)		940(40) μs	4.4(2)	-2.1(2)	9.6(2)		[**1979Be46, 1971Br39**]
^{244}Bk			5.02(3) h	2.262(14)	-3.750(14)	8.164(14)		[**2014So17**]
^{244m}Bk	x		820(60) ns	2.262(14)+x	-3.750(14)+x	8.164(14)+x		[**1972Wo07**]
^{248}Es			24.5(23) m***	3.060(50)#	-2.479(53)#	9.422(52)#	$3.5(18)\times10^{-4}$%	[**2001Sh09, 1989Ha27, 1956Ch67**, 1980Ga07, 1980GaZZ]
^{252}Md			2.3(8) m	3.650(90)	-1.333(91)	10.804(91)		[**1973Es01**]
^{256}Lr			28(1) s	3.920(80)	-0.384(83)	12.505(83)		[**2014Sa21**]
^{260}Db			1.52(13) s	4.53(22)#	0.53(12)#	13.425(93)#		[**1977Be36**]
^{264}Bh			$0.9^{+0.3}_{-0.2}$ s	5.18(33)#	1.56(24)#	14.39(27)#		[**2004Mo26, 2004Mo27**]
^{268}Mt			21^{+8}_{-5} ms	6.18(38)#	3.10(35)#	15.94(37)#		[**2004Mo26, 2004Mo27**]
^{272}Rg			$3.8^{+1.4}_{-0.8}$ ms	6.69(48)#	4.38(40)#	17.38(38)#		[**2004Mo26, 2004Mo27**]

* 100% β^- emitter.
** Weighted average of 32.3(4) h and 31.2(2) h [1950Ja51].
** Weighted average of 23(3) m [2001Sh09], 28(5) m [1989Ha27] and 25(5) m [1956Ch67].

Table 2
Particle separation, Q-values, and measured values for direct particle emission of the odd-Z, T_z = +25 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}	Experimental
^{208}Au	9.06(50)#	1.24(50)#			
^{212}Tl	8.45(28)#	1.93(36)#			
^{216}Bi	5.757(54)	5.00(20)#			
^{220}At	5.595(21)	6.077(18)	8(2)%		[**1989Bu09, 1989Li04**]
^{224}Fr	5.930(14)	4.948(18)			
^{228}Ac(MsTh)	5.572(2)	4.721(11)			
^{232}Pa	5.158(8)	4.627(8)			
^{236}Np	4.830(50)	5.007(51)	0.16(6)%*		[**1981Li30**]
^{240}Am	4.367(14)	5.707(52)	1.9×10^{-4}%		[**1970Go42**]
^{240m}Am	1.4(2)	8.7(2)		100%	[**2015Ba55, 1985Be58, 1979Be46, 1971Br39**, 1981Lu06, 1976BeZM, 1973Be04, 1972Wo07]
^{244}Bk	3.757(14)	6.779(4)	$6(3)\times10^{-3}$%		[**1966Ah02, 1956Ch77**, 1950Th55]
^{244m}Bk	3.757(14)-x	6.779(4)+x		≈100%	[**1972Wo07, 1972Ga42**, 1972WoZP]
^{248}Es	3.099(54)#	7.160(50)#	≈0.25%		[**1989Ha27, 1956Ch67**, 2001Sh09, 1970Ah01]
^{252}Md	2.781(92)	7.74(11)#			
^{256}Lr	2.354(84)	8.86(12)	>80%		[**2014Sa21, 1971Es01**, 2010SaZV, 2008An16, 2004Fo08, 2004Mo14, 2004Mo26, 2002Ho11, 2001HoZY, 1976BeYM, 1976BeZY, 1970Dr08, 1968Do19, 1968Fl08, 1967Fl06]
^{260}Db	1.98(12)#	9.501(42)#	90.4(5)%	9.6(6)%	[**1977Be36**, 2004Fo08, 2004Mo14, 2004Mo26, 2004Mo27, 2002Ho11, 2001HoZY, 1995Ho04, 1976DiZY, 1970FlZY, 1970ZvZZ, 1968Fl09]
^{264}Bh	1.53(20)#	9.86(15)#	86(6)%	14(6)%	[**2004Mo027, 1995Ho04**, 2004Fo08, 2004Mo26, 2004Mo14, 2002Ho11, 2001HoZY]
^{268}Mt	0.80(25)#	10.77(15)#	≈100%		[**2004Mo027, 1995Ho04**, 2004Fo08, 2004Mo26, 2004Mo14, 2002Ho11, 2001HoZY]
^{272}Rg	0.47(25)#	11.197(13)	≈100%		

* α decay was not observed. It was inferred to have happened from the observation of the α daughter ^{232}Pa arising from ^{236}Np [1981Li30].

Table 3
direct α emission from ^{220}At*, $T_{1/2}$ = 3.7(4) m**, BR_α = 8(2)%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{216}Bi)	coincident γ-rays (keV)	R_0 (fm)**	HF
6.053(6)	5.943(6)	8(2)%	$(6^-,7^-)$	0.0	——	1.5433(25)	3.8^{+18}_{-11}

* All values from [19Bu09], except where noted.
** [1989Li04].
*** Interpolated between 1.53788(19) fm (^{218}Po) and 1.54863(17) fm (^{222}Rn).

Table 4
direct α emission from ^{240}Am*, $T_{1/2}$ = 50.8(3) h**, $BR_\alpha = 1.9\times10^{-4}$%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{236}Np)	coincident γ-rays (keV)	R_0 (fm)***	HF
5.376(3)	5.286(3)	1.42(12)%	2.3×10^{-4}%				1.50436(14)	111
5.427(2)	5.337(2)	13.8(5)%	2.3×10^{-3}%				1.50436(14)	23
5.469(1)	5.378(1)	100(1)%	0.017%				1.50436(14)	5.5

* All values from [1970Go42], except where noted.
** [1972Ah07].
*** Interpolated between 1.50745(13) fm (^{238}Pu) and 1.501258(57) fm (^{242}Cm).

Table 5
direct α emission from ^{244}Bk*, $T_{1/2}$ = 5.02(3) h**, $BR_\alpha = 6(3)\times10^{-3}$%***.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{240}Am)	coincident γ-rays (keV)	R_0 (fm)@	HF
6.736(4)	6.626(4)	≈50%	$\approx3\times10^{-3}$%				1.49827(10)	$\approx3\times10^3$
6.779(4)	6.668(4)	≈50%	$\approx3\times10^{-3}$%		0.0?		1.49827(10)	$\approx4\times10^3$

* All values from [1966Ah02], except where noted. E_α(lab) are modified by +1.5 keV as reccommended int [1991Ry01].
** [2014So17].
*** [1956Ch77].
@ Interpolated between 1.501258(57) fm (^{242}Cm) and 1.49528(88) fm (^{246}Cf).

Table 6
direct α emission from ^{248}Es*, $T_{1/2}$ = 24.5(23) m**, BR_α = ≈0.25%***.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{244}Bk)	coincident γ-rays (keV)	R_0 (fm)@	HF
6.960(14)	6.848(14)	14(13)%	≈0.02%				1.4871(39)	≈40
6.992(5)	6.879(5)	100(22)%	≈0.16%				1.4871(39)	≈7
7.020(5)	6.907(5)	44(21)%	≈0.07%				1.4871(39)	≈20

* All values from [1989Ha27], except where noted.
** Weighted average of 23(3) m [2001Sh09], 28(5) m [1989Ha27] and 25(5) m [1956Ch67].
*** [1956Ch67].
@ Interpolated between 1.49528(88) fm (^{246}Cf) and 1.4789(38) fm (^{250}Fm).

Table 7
direct α emission from ^{256}Lr*, $T_{1/2}$ = 28(1) s, BR_α = >80%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{252}Md)	coincident γ-rays (keV)	R_0 (fm)@	HF
8.462(10)	8.330(10)	17(4)%	>4.8%				1.469(18)	< 25
8.523(10)	8.390(10)	71(13)%	>20%				1.469(18)	< 10
8.564(10)	8.430(10)	100(20)%	>28%				1.469(18)	< 9
8.604(10)	8.470(10)	23(7)%	>6.4%				1.469(18)	< 50
8.645(10)	8.510(10)	57(10)%	>16%				1.469(18)	< 29
8.737(10)	8.600(10)	11(3)%	>3.2%				1.469(18)	< 280
8.767(10)	8.630(10)	9(3)%	>2.4%				1.469(18)	< 460

* All values from [2014Sa21], except where noted.
** [1971Es01].

[@] Interpolated between 1.4672(33) fm (^{254}No) and 1.470(18) fm (^{258}Rf).

Table 8
direct α emission from ^{260}Db*, $T_{1/2}$ = 1.52(13) s, BR_α = 90.4(6)%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{256}Lr)	coincident γ-rays (keV)	R_0 (fm)**	HF
9.182(14)	9.041(14)	100(10)%	43(5) %				1.466(41)	5^{+18}_{-4}
9.216(14)	9.074(14)	52(8)%	23(3)%				1.466(41)	12^{+21}_{-8}
9.263(17)	9.120(17)	35(7)%	15(3)%				1.466(41)	20^{+40}_{-20}

* All values from [1977Be36].
** Interpolated between 1.470(18) fm (258Rf), and 1.462(37) fm (^{262}Sg).

Table 9
direct α emission from ^{264}Bh, $T_{1/2} = 0.9^{+0.3}_{-0.2}$ s*, BR_α = 86(6)%.

E_α(c.m.)	E_α(lab)**	I_α(rel)**	I_α(abs)	J_f^π	$E_{daughter}$(^{260}Db)	coincident γ-rays (keV)	R_0 (fm)***	HF
9.621(20)	9.475(20)	≈50%	≈28%				1.472(39)	≈30
9.767(20)	9.619(20)	100%	≈57%				1.472(39)	≈30

* [2004Mo27, 2004Mo26].
** Values are taken from [1995Ho04], which reported 2 events at 9.619(20) MeV and 1 event at 9,475(20) MeV. [2004Mo27] report 12 events from the α decay of ^{264}Bh, and 2 fission events. They report: "Observed decay energy ranges from 8.86 to 9.83 MeV showing broad distribution, although the 'peak' is located at 9.7 MeV. " Figure 2a from this reference roughly supports the assignment of the two peaks reported in [1995Ho04].
*** Interpolated between 1.462(37) fm (^{262}Sg) and 1.481(12) fm (^{266}Hs).

Table 10
direct α emission from ^{268}Mt, $T_{1/2} = 21^{+8}_{-5}$ ms*, BR_α = ≈100%**.

E_α(c.m.)	E_α(lab)**	I_α(rel)**	I_α(abs)	J_f^π	$E_{daughter}$(^{264}Bh)	coincident γ-rays (keV)	R_0 (fm)[@]	HF
10.250(20)	10.097(20)	≈50%	≈33%				1.477(17)	≈6
10.395(20)	10.240(20)	100%	≈67%				1.477(17)	≈7

* [2004Mo27, 2004Mo26].
** Only α-decay has been observed.
*** Values are taken from [1995Ho04], which reported 2 events at 10.240(20) MeV and 1 event at 10.097(20) MeV. [2004Mo27] report 14 events from the α decay of ^{268}Mt, and 2 fission events. They report: "Observed decay energy ranges from 9..40 to 10.77 MeV showing broad distribution, althogh the ' peak ' is located at 10.4 MeV." Figure 2a from this reference shows a peak with 7 counts at roughly 10.3 MeV, 1 count at roughly 19,1 MeV and three counts from 10.5-10.8 MeV.
[@] Interpolated between 1.481(12) fm (^{266}Hs) and 1.472(12) fm (^{270}Ds).

Table 11
direct α emission from ^{272}Rg, $T_{1/2} = 3.8^{+1.4}_{-0.8}$ ms*, BR_α = ≈100%**.

E_α(c.m.)	E_α(lab)**	I_α(abs)**	J_f^π	$E_{daughter}$(^{268}Mt)	coincident γ-rays (keV)	R_0 (fm)[@]	HF
10.981(20)	10.820(20)	≈100%				1.47	≈5

* [2004Mo27, 2004Mo26].
** Only α-decay has been observed.
*** Values are taken from [1995Ho04], which reported 2 events at 10.240(20) MeV and 1 event at 10.097(20) MeV. [2004Mo27] report 14 events from the α decay of ^{264}Bh, and 2 fission events. They report: "Observed decay energy ranges from 10.20 to 11.56 MeV showing broad distribution, althogh the ' peak ' is located at 11.0 MeV." Figure 2a from this reference shows a peak with 7 counts at roughly 11 MeV.
[@] 1.47 fm is used to calculate HF.

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