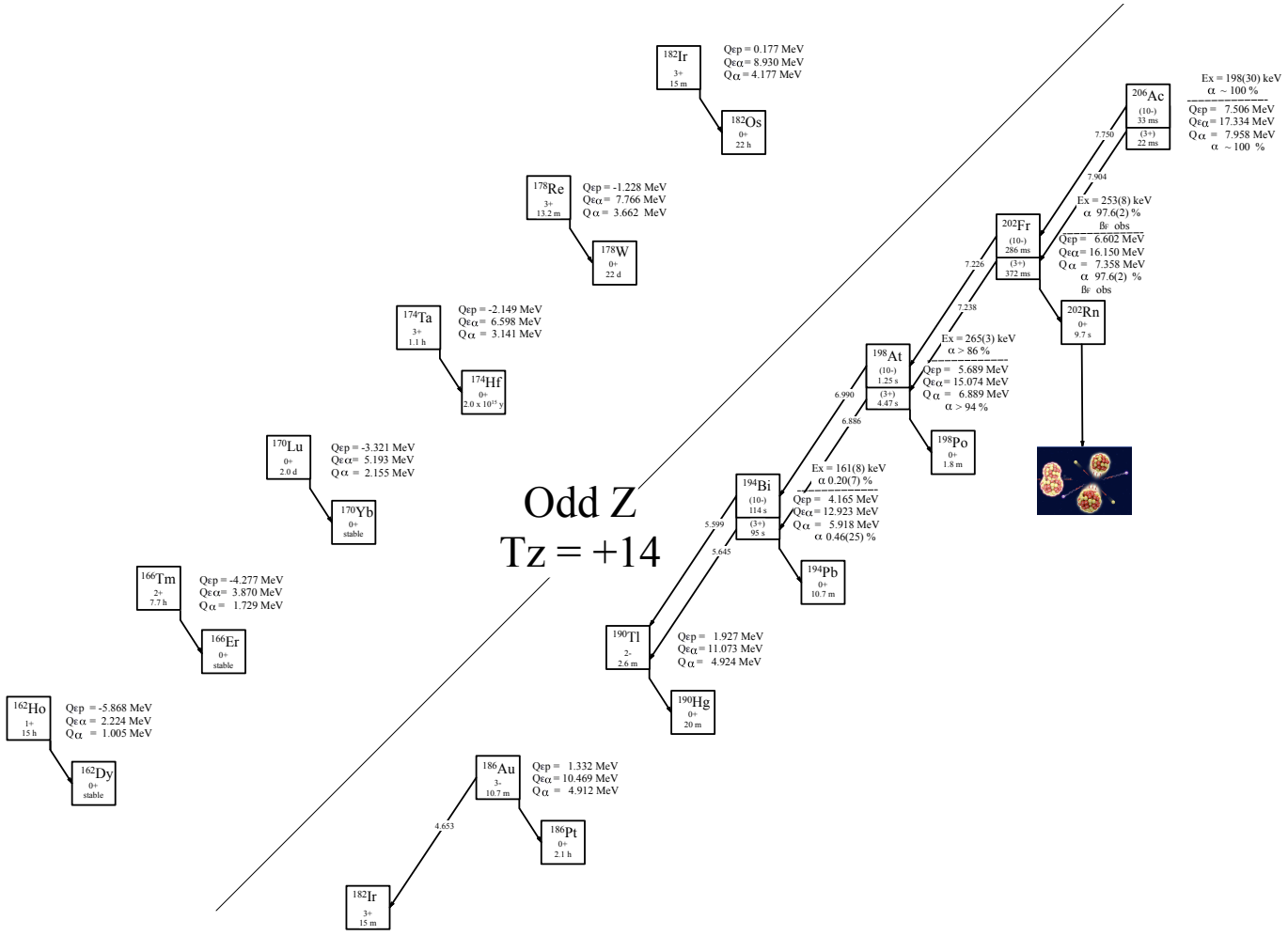

Fig. 1: Known experimental values for heavy particle emission of the odd-Z T_z= +14 nuclei.

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Table 1
Observed and predicted β-delayed particle emission from the odd-Z, T_z = +14 nuclei. J^π values for ^{162}Ho, ^{1466}Tm, ^{170}Lu, ^{174}Ta, ^{178}Re, ^{182}Ir, and ^{190}Tl are taken from ENSDF. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein.

Nuclide	Ex	J^π	$T_{1/2}$	Q_ε	$Q_{\varepsilon p}$	$Q_{\varepsilon\alpha}$	BR_F	Experimental
^{162}Ho		1^+	15.0(10) h	0.294(3)	-5.868(3)	2.224(3)		[**1965St08**]
^{166}Tm		2^+	7.70(4) h*	3.038(12)	-4.277(12)	3.870(12)		**1960Wi12, 1960Gr15**]
^{170}Lu		0^+	2.03(3) d**	3.458(17)	-3.321(17)	5.193(17)		[**1970Ka23, 1960Wi14**]
^{174}Ta		3^+	1.06(4) h	4.104(28)	-2.149(28)	6.598(28)		[**1985Sz03**]
^{178}Re		3^+	13.2(2) m	4.750(30)	-1.228(28)	7.766(28)		[**1970Go20**]
^{182}Ir		3^+	15(1) m	5.560(30)	0.177(24)	8.930(26)		[**1972Ak03**]
^{186}Au		3^-	10.7(5) m	6.150(30)	1.332(35)	10.469(30)		[**1970Jo02**]
^{190}Tl		2^-	2.6(3) m	7.004(17)	1.927(21)	11.073(23)		[**1976Bi09**]
^{194}Bi		(3^+)	95(3) s	8.185(18)	4.165(9)	12.923(17)		[**1991Va04**]
^{194m}Bi	0.161(8)	(10^-)	114(4) s	8.346(20)	4.326(12)	13.084(19)		[**2019Gi11, 1991Va04**]
^{198}At		(3^+)	4.47(5) s	8.765(18)	5.689(10)	15.074(18)		[**2019Gi11**]
^{198m}At	0.265(3)	(10^-)	1.25(5) s***	9.028(18)	5.954(10)	15.339(18)		[**2019Gi11, 2014Ka23**]
^{202}Fr		(3^+)	372(10) ms	9.376(19)	6.602(10)	16.150(18)	obs	[**2014Ka23, 2014Gh09**]
^{202m}Fr	0.253(8)	(10^-)	286(13) ms	9.629(21)	6.855(13)	16.403(20)	obs	[**2014Ka23, 2014Gh09**]
^{206}Ac		(3^+)	22^{+9}_{-5} ms	9.920(70)	7.506(66)	17.334(67)		[**1998Es02**]
^{206m}Ac	0.198(30)	(10^-)	33^{+22}_{-9} ms	10.118(76)	7.704(72)	17.532(73)		[**1998Es02**]

* Weighted average of 7.69(5) h [1960Wi12] and 7.74(8) h [1960Gr15].
** Weighted average of 2.02 d [1970Ka23] and 2.05(5) h [1960Wi14].
*** Weighted average of 1.28(10) s [2019Gh11] and 1.24(6) s [2014Ka23].

Table 2
Particle separation, Q-values, and measured values for direct particle emission of the odd-Z, T_z = +14 nuclei. Unless otherwise stated, all S and Q-values are taken from [2021Wa16] or deduced from values therein.

Nuclide	S_p	S_{2p}	Q_α	BR_α	Experimental
^{162}Ho	5.274(3)	12.782(3)	1.005(3)		
^{166}Tm	4.654(12)	11.484(12)	1.729(12)		
^{170}Lu	4.220(17)	10.572(17)	2.155(20)		
^{174}Ta	3.618(40)	9.583(28)	3.141(33)		
^{178}Re	3.241(40)	8.866(42)	3.662(40)		
^{182}Ir	2.791(33)	7.792(30)	4.177(35)		
^{186}Au	2.316(33)	6.682(35)	4.912(14)	$8(2)\times10^{-4}$%	[**1990Ak04**, 1995Bi01, 1993BiZY, 1992BiZZ]
^{190}Tl	2.029(32)	6.573(8)	4.924(22)		
^{194}Bi	1.083(12)	4.729(32)	5.918(5)	0.46(25)%	[**1991Va04**, 1988Hu03, 1985HuZY]
^{194m}Bi	0.922(14)	4.568(33)	6.079(9)	0.20(7)%	[**1991Va04**, 1988Hu03, 1985HuZY, 1974Le02, 1970Ta14]
^{198}At	0.605(11)	3.278(25)	6.889(2)	>94%	[**2019Gi11, 2014Ka23, 1995BiZZ**, 2015We13, 2005Uu02, 2005Uu03, 1999Ta03, 1998Bo14, 1992Hu04, 1980Ew03, 1967Tr04, 1967Tr06
^{198m}At	0.340(11)	3.013(25)	7.154(4)	>86%	[**2019Gi11, 2014Ka23, 1995BiZZ**, 2005Uu02, 2005Uu03, 1999Ta03, 1998Bo14, 1996En01, 1992Hu04, 1980Ew03, 1967Tr04, 1967Tr06
^{202}Fr	0.080(12)	2.489(25)	7.385(4)	97.6(2)%*	[**2019Gh11**, 2014Ka23, 2014Ly01, 2005Uu02, 1996En01, 1995BiZZ, 1992Hu04, 1980Ew03, 1976HaYQ, 1976HoZD]
^{202m}Fr	-0.173(14)	2.236(26)	7.638(9)	97.6(2)%*	[**2019Gh11**, 2014Ka23, 2014Ly01, 1996En01, 1995BiZZ, 1992Hu04]
^{206}Ac	-0.392(69)	1.700(70)	7.958(65)	$\approx$ 100%**	[**2014Zh03, 1998Es02**, 1998LuZV]
^{206m}Ac	-0.590(75)	1.502(76)	8.156(71)	$\approx$ 100%**	[**1998Es02**]

* [2019Gh11] estimate a β-branching ratio for a combination of the ground state and isomer of 2.4(2)%.
** Based on short half-life.

Table 3
direct α emission from ^{186}Au*, $J_i^\pi = 3^-$, $T_{1/2}$ = 10.7(5) m**, $BR_\alpha = 8(2)\times10^{-4}$%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{182}Ir)	coincident γ-rays	R_0 (fm)***	HF
4.755(15)	4.653(15)	$8(2)\times10^{-4}$%	0^+	0.0	——	1.519(23)***	$2.2^{+1.7}_{-1.1}$

* All values from [1990Ak04], except where noted.
** [1970Jo02].
*** Interpolated between 1.542(27) fm (^{184}Pt) and 1.480(15) fm (^{188}Hg).

Table 4
direct α emission from ^{194}Bi*, $J_i^\pi = (3^+)$, $T_{1/2}$ = 95(3) s, BR_α = 0.46(25)%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{190}Tl)	coincident γ-rays	R_0 (fm)**	HF
5.764(5)	5.645(5)	100%	$4.6(25)\times10^{-3}$%	(3^+)	0.1513	0.1513	1.5066(90)	$1.4^{+1.8}_{-0.6}$
5.921(5)	5.799(5)	0.59(7)%	$2.7(15)\times10^{-3}$%	(2^-)	0.0	——	1.5066(90)	1200^{+1600}_{-500}

* All values from [1991Va04], except where noted.
** Interpolated between 1.5126(28) fm (^{192}Pb) and 1.5005(86) fm (^{196}Po).

Table 5
direct α emission from ^{194m}Bi*, Ex. = 161(8) keV, $J_i^\pi = (10^-)$, $T_{1/2}$ = 114(4) s, BR_α =0.20(7)%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{190}Tl)	coincident γ-rays	R_0 (fm)	HF
5.447(5)	5.335(5)	0.16(3)%	$2.9(12)\times10^{-6}$%	(11^-)	0.572	0.069, 0.2724	1.5066(90)	60^{+50}_{-20}
5.717(5)	5.599(5)	100%	$1.8(6)\times10^{-3}$%	(10^-)	0.300	0.069	1.5066(90)	$2.3^{+1.5}_{-0.8}$
5.779(5)	5.660(5)	2.2(2)%	$4.0(15)\times10^{-5}$%	(9^-)	0.236		1.5066(90)	210^{+140}_{-70}
5.903(5)	5.781(5)	3.0(2)%	$5.5(20)\times10^{-5}$%	$(6^+, 7^+)$	0.1122	0.1122	1.5066(90)	600^{+400}_{-200}
6.016(5)	5.892(5)	3.9(2)%	$7.1(25)\times10^{-5}$%	7^+	0.0	——	1.5066(90)	$1.4^{+0.9}_{-0.5}\times10^{+3}$

* All values from [1991Va04], except where noted.
** Interpolated between 1.5126(28) fm (^{192}Pb) and 1.5005(86) fm (^{196}Po).

Table 6
direct α emission from ^{198}At*, $J_i^\pi = (3^+)$, $T_{1/2}$ = 4.47(5) s, BR_α = >94%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{194}Bi)	coincident γ-rays	R_0 (fm)@	HF
6.404(8)	6.275(8)	0.08(1)%	>0.075%		0.486	0.103, 0.218, 0.267, 0.382, 0.486	1.511(13)	<36
6.489(8)	6.358(8)	0.11(1)%	>0.10%		0.400	0.181, 0.218, 0.400	1.511(13)	<59
6.492(9)	6.361(9)	0.008(2)%	>0.0075%		0.382	0.382	1.511(13)	<1000
6.670(8)	6.535(8)	0.020(3)%	>0.019%		0.218	0.218	1.511(13)	<1700
6.886(5)	6.747(5)***	100 %	>94%	(3^+)	0.0	——	1.511(13)	<2.2

* All values from [2019Gh11], except where noted.
** [1995BiZZ].
*** [2014Ka23].
@ Interpolated between 1.5005(86) fm (^{196}Po) and 1.5205(93) fm (^{200}Rn).

Table 7
direct α emission from ^{198m}At*, Ex.=265(3) keV$J_i^\pi = (10^-)$, $T_{1/2}$ = 1.25(5) s**, BR_α = >86%***.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{194}Bi)	coincident γ-rays	R_0 (fm)$^{@@}$	HF
6.452(12)	6.322(12)	0.005(3)%	>0.0043%		0.699(8)	0.538	1.511(13)	<340
6.469(8)	6.338(8)	0.09-0.13%	>0.08-0.11%		0.686(8)	0.525	1.511(13)	<15-20
6.892(8)	6.753(8)	0.05-0.34%	>0.04-0.29%		0.266(8)	0.105	1.511(13)	< 230-1700
6.990(5)	6.849(5)$^{@}$	100%	>86%	(10^-)	0.161(8)		1.511(13)	<1.5

* All values from [2019Gh11], except where noted.
** Weighted average of 1.28(10) s [2019Gh11] and 1.24(6) s [2014Ka23].
*** [1995BiZZ].
$^{@}$ [2014Ka23].
$^{@@}$ Interpolated between 1.5005(86) fm (^{196}Po) and 1.5205(93) fm (^{200}Rn).

Table 8
direct α emission from ^{202}Fr*, $J_i^\pi = (3^+)$, $T_{1/2}$ = 372(10) ms**, BR_α = 97.6(2)%***.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{198}At)	coincident γ-rays	R_0 (fm)$^{@}$	HF
7.229(8)	7.086(8)	0.03-0.11%	0.03-0.11%		0.154	0.154	1.523(17)	620-2300
7.249(8)	7.105(8)	0.09(2)%	0.09(2)%		0.130	0.130	1.523(17)	900^{+500}_{300}
7.384(5)	7.238(5)**	100%	97.6(2)%	(3^+)	0.0	——	1.523(17)	$2.4^{+1.0}_{-0.7}$

* All values from [2019Gh11], except where noted.
** [2014Ka23].
*** [2019Gh11] estimate a β-branching ratio for a combination of the ground state and isomer of 2.4(2)%.
$^{@}$ Interpolated between 1.5205(93) fm (^{200}Rn) and 1.525(14) fm (^{204}Ra).

Table 9
direct α emission from ^{202m}Fr*, Ex. = 253(8) keV, $J_i^\pi = (10^-)$, $T_{1/2}$ = 286(13) ms**, BR_α = 97.6(2)%***.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{198}At)	coincident γ-rays	R_0 (fm)$^{@}$	HF
6.860(8)	6.724(8)	0.06(1)%	0.06(1)%	(8^-)	0.792(3)	0.130, 0.151, 0.511(3), 0.527	1.523(17)	34^{+18}_{-13}
7.253(8)	7.109(8)	0.28-0.53%	0.27-0.52%	$(8^-, 9^-)$	0.391(3)	0.126	1.523(17)	110-220
7.311(8)	7.166(8)	0.06(1)%	0.06(1)%		0.334(7)	0.053(7), 0.130, 0.151	1.523(17)	$1.5^{+0.8}_{-0.6}\times10^3$
7.363(8)	7.217(8)	0.23(5)%	0.22(5)%	(6^-)	0.281	0.130, 0.151	1.523(17)	600^{+400}_{-300}
7.372(5)	7.226(5)**	100%	97.6(2)%	(10^-)	0.265(3)		1.523(17)	$1.6^{+0.7}_{-0.5}$
7.530(26)	7.381(26)	0.014(6)%	0.014(6)%	(5^+)	0.130	0.130	1.523(17)	$3.2^{+3.0}_{-1.4}\times10^3$
7.635(32)	7.484(32)	<0.008	<0.008	(3^+)	0.0	——	1.523(17)	$>1.5\times10^5$

* All values from [2019Gh11], except where noted.
** [2014Ka23].
*** [2019Gh11] estimate a β-branching ratio for a combination of the ground state and isomer of 2.4(2)%.
$^{@}$ Interpolated between 1.5205(93) fm (^{200}Rn) and 1.525(14) fm (^{204}Ra).

Table 10
direct α emission from ^{206}Ac*, $J_i^\pi = (3^+)$, $T_{1/2} = 22^{+9}_{-5}$ ms , $BR_\alpha = \approx 100\%$.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{202}Fr)	coincident γ-rays	R_0 (fm)***	HF
7.958(21)	7.804(21)**	100%	(3^+)	0.0	——	1.540(23)	$2.6^{+2.0}_{-1.5}$

* All values from [1998Es02], except where noted.
** Weighted average of 7.817(30) MeV [2014Zh03] and 7.790(30) MeV [1998Es02].
*** Interpolated between 1.555(18) fm (^{208}Th) and 1.525(14) fm (^{204}Ra).

Table 11
direct α emission from ^{206m}Ac*, Ex. = 198(30) keV, $J_i^\pi = (10^-)$, $T_{1/2} = 33^{+22}_{-9}$ ms , $BR_\alpha = \approx 100\%$.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{202}Fr)	coincident γ-rays	R_0 (fm)**	HF
7.903(20)	7.750(20)	100%	(10^-)	0.253(8)		1.540(23)	$2.6^{+2.4}_{-2.0}$

* All values from [1998Es02].
** Interpolated between 1.555(18) fm (^{208}Th) and 1.525(14) fm (^{204}Ra).

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