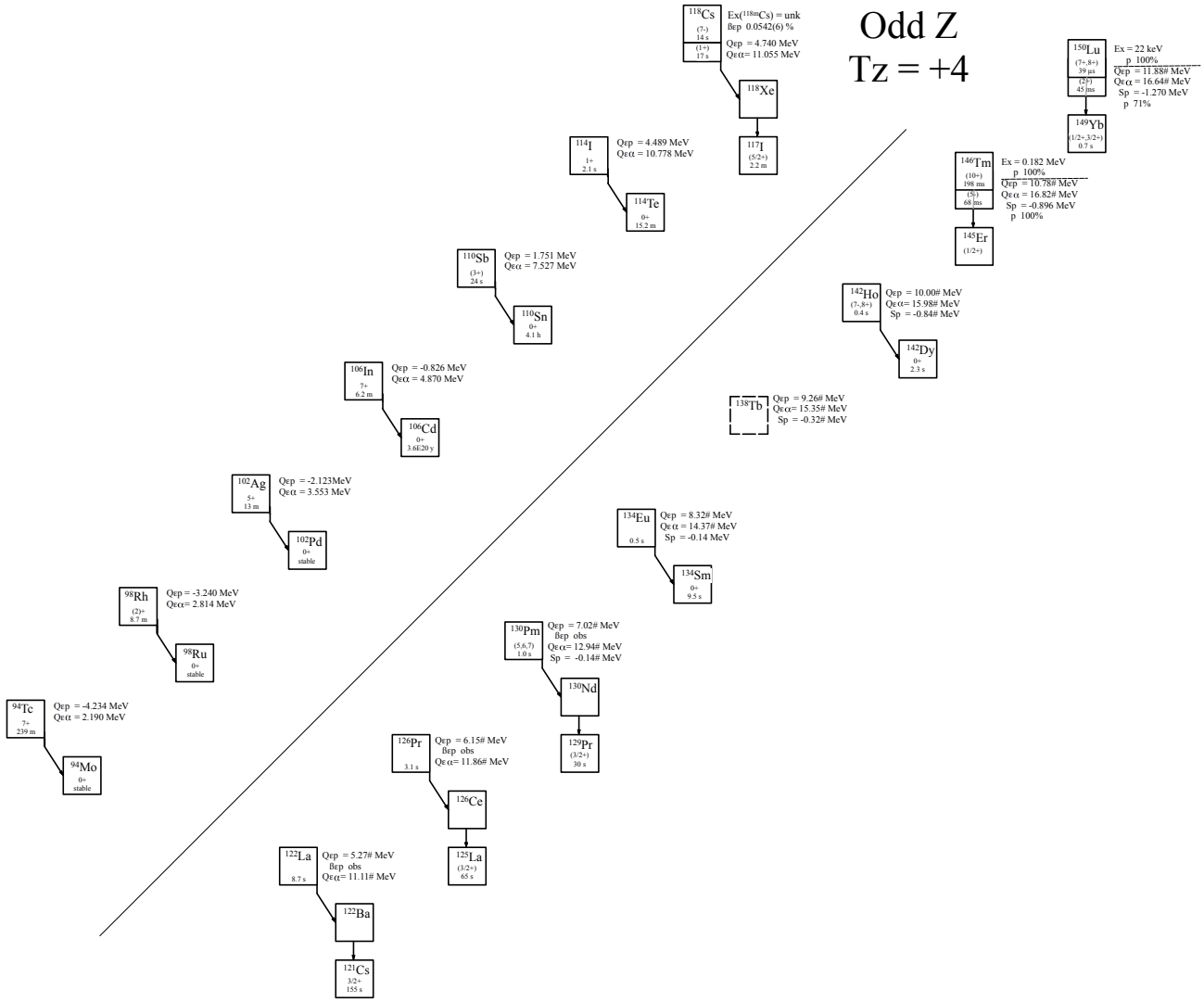

Fig. 1: Known experimental values for heavy particle emission of the even-Z T_z= +4 nuclei.

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Table 1
Observed and predicted β-delayed particle emission from the odd-Z, T_z = +4 nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. J^π

Nuclide	Ex	J^π	$T_{1/2}$	Qε	$Q_{\varepsilon p}$	$BR_{\beta p}$	$Q_{\varepsilon 2p}$	$Q_{\varepsilon \alpha}$	Experimental
^{94}Tc		7^+	293(1) m	4.256(4)	-4.234(4)	——	-10.277(4)	2.189(4)	[**1963Ma21**]
^{98}Rh		$(2)^+$	8.7(1) m	5.05(10)	-3.240(13)	——	-8.958(12)	2.814(12)	[**1956Ka25**]
^{102}Ag		5^+	13.0(4) m	5.656(8)	-2.123(10)	——	-7.597(8)	3.553(10)	[**1967Ch05**]
^{106}In		7^+	6.2(1) m	6.524(12)	-0.826(13)	——	-5.791(12)	4.870(12)	[**1978Hu06**]
^{110}Sb		(3^+)	24.0(3) s	8.392(15)	1.751(7)		-2.775(6)	7.257(6)	[**1976Ox01**]
^{114}I		1^+	2.1(2) s	9.25(30)	4.489(26)		1.438(20)	10.778(24)	[**1977Ki11**]
^{118}Cs		2	14(2) s	9.67(16)	4.740(29)	0.0542(6)%*	2.276(27)	11.055(28)	[**1995Ki07, 1977Bo28, 1977Ge03**, 1978Da07]
^{118m}Cs	x	(7^-)	17(3) s	9.67(16)+x	4.740(29)+x	0.0542(6)%*	2.276(27)+x	11.055(28)+x	[**1995Ki07, 1977Bo28, 1977Ge03**, 1978Da07]
^{122}La			8.7(7) s	10.07(30)#	5.27(30)#	obs	3.05(30)#	11.11(30)#	[**1984Ni03**, 1988WiZN]
^{126}Pr			3.14(22) s	10.50(20)#	6.15(20)#	obs	4.19(20)#	11.86(20)#	[**2002Ka66, 1983Ni05**]
^{130}Pm			2.6(2) s	11.13(20)#	7.02(20)#	obs	5.49(20)#	12.93(20)#	[**1999Xi03, 1985Wi07**]
^{134}Eu			0.5(2) s	11.58(36)#	8.32(30)#		7.05(31)#	14.37(30)#	[**1989Vi04**]
^{138}Tb				12.06(36)#	9.26(30)#		8.63(30)#	15.35(36)#	
^{142}Ho		$(7^-, 8^+)$	0.4(1) s	12.87(83)#	10.00(41)#		15.98(45)#	9.95(40)#	[**2005Xu04**, 2002Xu11, 2001Xu02]
^{146}Tm		(5^-)	68(3) ms	13.27(20)#	10.78(20)#		10.94(20)#	16.64(76)#	[**2006Ta08, 2005Bb02, 2003Gi10, 2001Ry01**, 2001Ry02, 2005Ro40, 2005Se26, 2007BaZQ, 2007DaZU, 2005Bi24, 2005RoZY, 1995PeZY, 1993Li18, 1993WoZY]
^{146m}Tm***	0.182(4)	(10^+)	198(3) ms	13.45(20)#	10.96(20)#		11.12(20)#	16.82(76)#	[**2006Ta08**]
^{150}Lu		(2^+)	45(3) ms**	14.06(42)#	11.88(36)#		12.13(30)# 1993WoZY]	17.13(30)#	[**2003Gi10, 2000Gi01**]
^{150m}Lu	0.022(6)***	$(1^-, 2^-)$	$39^{+8}_{-6}\mu$s	14.09(42)#	11.91(36)#		12.16(30)# 1993WoZY]	17.15(30)#	[**2003Gi10, 2000Gi01**]

* Mixture of ground state and isomer [1995Ki07, 1977Ge03].

** Weighted average of 43(5) ms [2003Ro21], 49(5) ms [2000Gi01].

*** Excitation Energy = 22(6) keV, deduced from the weighted average of the difference in energies of the protons feeding the ground state of ^{149}Yb; 16(9) keV [2000Gi10] and 25(7) keV [2003Ro21].

Table 2
Particle emission from the odd-Z, T_z = +4 nuclei. Unless otherwise stated, all Q-values and separation energies are taken from [2021Wa16] or deduced from values therein.

Nuclide	S_p	BR_p	S_{2p}	Q_α	Experimental
^{94}Tc	4.640(4)	——	12.283(4)	-3.922(5)	
^{98}Rh	4.344(12)	——	11.932(13)	-1.442(13)	
^{102}Ag	4.104(9)	——	11.234(20)	-1.496(14)	
^{106}In	3.563(12)	——	10.070(13)	-0.786(15)	
^{110}Sb	2.109(10)	——	7.908(10)	0.733(14)	
^{114}I	1.581(34)	——	5.618(27)	2.386(21)	
^{118}Cs	1.513(16)	——	5.567(76)	1.805(24)	
^{118m}Cs	1.513(16)-x	——	5.567(76)-x	1.805(24)+x	
^{122}La	1.087(33)#	——	5.23(23)#	1.44(30)#	
^{126}Pr	0.96(28)#	——	4.64(20)#	1.80(36)#	
^{130}Pm	0.38(28)#	——	3.72(20)#	2.43(28)#	
^{134}Eu	-0.14(42)#		2.71(34)#	3.24(36)#	
^{138}Tb	-0.32(42)#		1.94(36)#	3.78(42)#	
^{142}Ho	-0.84(50)#		1.35(90)#	3.93(50)#	
^{146}Tm	-0.896(6)#	100%	1.02(20)#	3.77(45)#	[**2006Ta08, 2005Bb02, 2003Gi10, 2001Ry01**, 2001Ry02, 2005Ro40, 2005Se26, 2007BaZQ, 2007DaZU, 2005Bi24, 2005RoZY, 1995PeZY, 1993Li18, 1993WoZY]
^{146m}Tm	-1.078(7)#	71%	0.84(20)#	3.95(45)#	*
^{150}Lu	-1.270(2)	**	0.58(30)#	3.86(36)#	[**2003Ro21, 2003Gi10, 2000Gi01**, 1999BaZR, 1993Se04, 1993WoZY]
^{150m}Lu	-1.292(2)#	100%***	0.60(30)#	3.88(36)#	**

* References for the isomer are the same as the ground state.
** β-decay from ^{150}Lu not measured. Using the calculated β-decay $T_{1/2}$ = 155 ms from [1997Mo25], I_p = 71(2) %.
*** Implied from the short $T_{1/2}$.

Table 3
direct p emission from ^{146}Tm*, $J^\pi = (5^-)$, $T_{1/2}$ = 68(3)ms, BR_p = 100%.

E_p(c.m.)	E_p(lab)	I_p(rel)%	I_p(absb)%	J_f^π	$E_{daughter}$(^{145}Er)	coincident γ-rays
0.938(4)	0.932(4)	20.0(13)%	13.6(9)%	$(11/2^-)$	0.253	
1.016(4)	1.009(4)	26.8(16)%	18.3(12)%	$(3/2^+)$	0.175	
1.191(1)	1.18391)	100(3)%	68.1(27)%	$(1/2^+)$	0.0	——

* All values from [2006Ta08].

Table 4
direct p emission from ^{146m}Tm*, Ex = 0.182(4) MeV, $J^\pi = (10^+)$, $T_{1/2}$ = 198(3)ms, BR_p = 100%.

E_p(c.m.)	E_p(lab)	I_p(rel)	I_p(absb)	J_f^π	$E_{daughter}$(^{145}Er)	coincident γ-rays
0.889(8)	0.883(8)	1.0(4)%	1.0(4)%	$(13/2^-)$	0.484	
1.120(1)	1.112(1)	100(1)%	99(1)%	$(11/2^-)$	0.253	

* All values from [2006Ta08].

Table 5
direct p emission from ^{150}Lu*, $J^\pi = (2^+)$, $T_{1/2}$ = 45(3)ms**, BR_p = ***.

E_p(c.m.)	E_p(lab)	I_p(rel)	I_p(absb)	J_f^π	$E_{daughter}$(^{149}Yb)	coincident γ-rays
1.261(4)	1.253(4)	100%	71(2)%***	$(1/2^+)$	0.0	——

* All values from [2000Gi01],except where noted.
** Weighted average of 43(5) ms [2003Ro21], 49(5) ms [2000Gi01].
*** β-decay from ^{150}Lu not measured. Using the calculated β-decay $T_{1/2}$ = 155 ms from [1997Mo25], I_p = 71(2) %.

Table 6
direct p emission from ^{150m}Lu*, $J^{\pi} = (1^-, 2^-)$, $T_{1/2} = 39^{+8}_{-6}$, $BR_p = 100\%$.

E_p(c.m.)	E_p(lab)	I_p(rel)	I_p(absb)	J^{π}_f	$E_{daughter}$(^{149}Yb)	coincident γ-rays
1.277(8)	1.268(8)	100%	100%	$(1/2^+)$	0.0	——

* All values from [2000Gi01].

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