Beta (ε)-delayed heavy charged particle emitters (through Tz=+49/
10/21/2024

Table 1
Summary of known β_p Emitters. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	J^π	$T_{1/2}$	$Q_{\varepsilon p}$ (MeV)	BR	other decays	T_z
^{9}C	(3/2-)	126.5(9) ms	16.680(2)	61.1(17)%	β_α,β_p, α	-3/2
^{13}O	$(3/2^-)$	8.58(5) ms	15.826(10)	11.3(20)%	β_α	-3/2
^{17}Ne	$1/2^-$	109.3(6) ms	13.9485(4)	94.4(29)%	β_α	-3/2
^{20}Mg	0^+	90.4(6) ms	8.437(2)	30.0(12)%		-2
^{21}Mg	$5/2^+$	118.6(5) ms	10.657(1)	20.9(13)%	β_α	-3/2
^{22}Al	4^+	91.1(5) ms	13.10(40)#	54.5(25)%	β_{2p}, β_α	-2
^{22}Si	0^+	28.6(14) ms	15.45(50)#	61.8(52)%	β_{2p}	-3
^{23}Al	$5/2^+$	446(6) ms	4.6406(4)	1.22(5)%		-3/2
^{23}Si	$(5/2)^+$	42.3(4) ms	17.06(50)#	81.8(11)%	β_{2p}, β_{3p}	-5/2
^{24}Al	4^+	2.053(4) s	2.19207(23)	0.0012(3)%	β_α	-1
^{24}Si	0^+	141.4(15) ms	8.930(19)	33.3(16)%		-2
^{25}Si	$5/2^+$	220(3) ms	10.472(10)	35.0(20)%		-3/2
^{26}P	3^+	43.6(3) ms	12.775(61)	33.5(20)%	β_{2p}	-2
^{27}P	$(5/2)^+$	260(80) ms	4.262(9)	≈0.07%		-3/2
^{27}S	$(5/2^+)$	16.3(2) ms	17.34(40)#	62.2(29)%	β_{2p}	-5/2
^{28}P	3^+	270.3(5) ms	2.7600(11)	0.0013(4)%	β_α	-1
^{28}S	0^+	125(10) ms	9.17(16)	20.7(20)%		-2
^{29}S	$(5/2^+)$	187(6) ms	11.109(13)	47(5)%		-3/2
^{31}Cl	$3/2^+$	190(1) ms	5.877(3)	2.4(2)%		-3/2
^{31}Ar	$5/2^+$	15.1(3) ms	18.10(20)#	68.3(3)%	β_{2p}, β_{3p}	-5/2
^{32}Cl	1^+	298(1) ms	3.8169(6)	0.026(5)%	β_α	-1
^{32}Ar	0^+	98(2) ms	9.553(2)	35.58(22)%		-2
^{33}Ar	$1/2^+$	173.0(20) ms	9.3423(4)	38.8(14)%		-3/2
^{35}K	$3/2^+$	150(25) ms	5.9782(5)	0.37(15)%		-3/2
^{35}Ca	$(1/2^+)$	25.7(2) ms	16.28(20)#	95.7(15)%	β_{2p}	-5/2
^{36}K	2^+	342(2) ms	4.3075(3)	0.048(14)%	β_α	-1
^{36}Ca	0^+	100.8(20) ms	9.310(40)	54.3(18)%		-2
^{37} Ca	$3/2^+$	181.1(10) ms	9.8065(6)	82.1(8)%		-3/2
^{39}Ti	$(3/2^+)$	28.5(9) ms	16.67(20)#	93.7(28)% #	β_{2p}	-5/2
^{40}Sc	4^-	182.3(7) ms	5.9949(28)	0.44(7)%	β_α	-1
^{40}Ti	0^+	52.4(3) ms	11.000(70)	$99.0(^{+10}_{-16})$%		-2
^{41}Ti	$3/2^+$	81.9(5) ms	11.860(28)	92.4(6)%		-3/2
^{42}Cr	0^+	13.3(10) ms	15.47(30)#	94.4(50)%		-3
^{43}Cr	$(3/2^+)$	21.2(7) ms	15.85(20)#	79.3(30)%	β_{2p}, β_{3p}	-5/2
^{44}Cr	0^+	42.8(6) ms	8.600(50)	14.0(9)%		-2
^{45}Cr	$(7/2^-)$	60.9(4) ms	10.74(4)	34.4(8)%		-3/2
^{45}Fe	$(3/2^+)$	3.76(22) ms	20.54(29)#	18.9(35)%	2p, β_{2p}, β_{3p}	-7/2
^{46}Mn	4^+	36.2(4) ms	12.180(90)	57.0(8)%		-2
^{46}Fe	0^+	13.0(20) ms	13.44(30)#	66(4)%	β_{2p}	-3
^{47}Fe	$(7/2^-)$	21.9(2) ms	15.05(50)#	88.4(9)%		-5/2
^{47}Mn	$(5/2^-)$	88.0(13) ms	7.220(30)	>1.7%		-3/2
^{48}Mn	4^+	158.1(22) ms	5.421(7)	0.280(37)%		-1
^{48}Fe	0^+	51(3) ms	9.270(90)#	14.4(7)%		-2
^{48}Ni	0^+	2.1^{+14}_{-6} ms	18.02(66)#	30(20)%	2p	-4
^{49}Fe	$7/2^-$	64.7(3) ms	10.782(25)	56.7(4)%		-3/2
^{49}Ni	$7/2^-$	7.5(10) ms	18.31(72)#	83(13)%		-7/2
^{50}Co	(6^+)	38.8(2) ms	12.74(13)	70.5(7)%		-2
^{50}Ni	0^+	18.5(12) ms	14.00(50)#	86.7(6)%	β_{2p}	-3
^{51}Ni	$7/2^-$	23.8(2) ms	15.54(50)#	87.2(9)%	β_{2p}	-5/2
^{52}Ni	0^+	42.8(3) ms	10.340(80)#	31.1(5)%		-2
^{53}Ni	$7/2^-$	55.2(7) ms	11.412(13)	222.7(10)%		-3/2
^{55}Cu	$3/2^-$	27(8) ms	9.09(16)	15.0(43)%		-3/2
^{55}Zn	$5/2^-$	19.8(13) ms	17.72(40)#	91.0(51)%		-5/2
^{56}Cu	4^+	80(2) ms	8.098(15)#	0.40(12)%		-1
^{56}Zn	0^+	32.9(8) ms	12.66(40)#	88.5(26)%		-2
^{57}Zn	$(7/2^-)$	43.6(2) ms	14.07(20)#	90(10)%		-3/2
^{58}Zn	0^+	86(2) ms	6.500(50)	0.7(1)%		-1
^{59}Zn	$3/2^-$	174(2) ms	5.7242(7)	0.023(8)%		-1/2
^{59}Ge		13.3(17) ms	18.64(40)#	100%		-5/2

Table 1
Summary of known β_p Emitters. Detailed references for each nucleus can be found in their respective T_z tables.

^{60}Ga	(2^+)	69.4(2) ms	9.48(20)#	1.6(7)%		-1
^{60}Ge	0^+	25.0(3) ms	12.40(30)#	67(3)%		-2
^{61}Ge	$(3/2^-)$	40.7(4) ms	13.10(30)#	78(3)%		-3/2
^{63}Se	$5/2^-$	13.2(39) ms	18.00(52)#	100%		-5/2
^{65}Ge	$3/2^-$	30.8(7) s	2.237(2)	0.011(3)%		+1/2
^{65}Se	$(3/2^-)$	34.2(2) ms	14.01(30)#	94^{+6}_{-4}%		-3/2
^{67}Se	$(5/2^-)$	133(4) ms	7.740(70)	0.5(1)%		-1/2
^{67}Kr		7.4(30) ms	18.82(47)#	63(14)%		-5/2
^{68}Kr	0^+	21.6(33) ms	13.67(51)#	89^{+11}_{-10}%		-2
^{69}Se	$(1/2^-,3/2^-)$	27.4(2) s	3.255(2)	0.052(8)%		+1/2
^{69}Kr	$(5/2^-)$	28(1)ms	14.46(30)#	100%		-3/2
^{71}Kr	$(5/2^-)$	100(3) ms	8.31(13)	2.1(7) %		-1/2
^{73}Kr	$(3/2^-)$	27.3(10) s	4.03(1)	0.25(3)%		+1/2
^{73}Sr	$(3/2^-)$	23.1(14) ms	14.70(40)#	100%		-3/2
^{75}Sr	$(3/2^-)$	88(3) ms	8.42(22)	5.2(9)%		-1/2
^{76}Sr	0^+	7.89(7) s	2.790(40)	$3.4(8)\times10^{-5}$		0
^{77}Sr	$5/2^{(+)}$	9.0(2) s	3.920(10)	0.08(3)%		+1/2
^{81}Zr	$(3/2^-)$	5.5(4) s	5.500(90)	0.12(2)%		+1/2
^{83}Zr	$(1/2^-)$	42(2) s	2.809(9)	obs		+3/2
^{85}Mo	$(1/2^-)$	3.2(2) s	6.623(17)	0.14(2)%		+1/2
^{87}Mo	$(7/2^+)$	14.5(3) s	3.795(5)	15(8)%		+3/2
^{89}Ru	$(9/2^+)$	1.31(3) s	7.028(25)	3.1(2) %		+1/2
^{90m}Rh	(7^+)	0.56(2) s	8.47(30)# + x	9.6(10)%		0
^{91}Rh	$(7/2^+)$	1.60(2) s	4.87(30)#	0.18(4)%		+1/2
^{91m}Ru	$(1/2^-)$	7.6(8)	4.644(4)+x	<0.2%		+3/2
^{91}Pd		32(3) ms	11.43(42)#	$3.0^{+1.1}_{-0.9}$ %		-1/2
^{92}Rh	(6^+)	5.7(1) s	5.699(5)	1.9(1)%		+1
^{92}Pd	0^+	1.06(3) s	6.17(35)	1.6(2)%		0
^{93}Pd	$(9/2^+)$	1.18(2) s	8.03(37)	7.4(2)%		+1/2
^{94m1}Ag	(7^+)	0.47(1) s	9.32(40)# + x	17.0(6)%		0
^{94m2}Ag	$(21/2^+)$	0.39(4) s	15.81(75)#	≈27%	p, 2p	0
^{94}Rh	(4^+)	70.6(6) s	3.410(4)	1.8(5)%		+2
^{95}Pd	$(9/2^+)$	13.3(3)	5.329(4)	0.23(5)%		+3/2
^{95m}Pd	$(21/2^+)$	13.2(4) s	7.204(4)	0.71(7)%		+3/2
^{95}Ag	$(9/2^+)$	1.80(7) s	5.71(40)#	1.76(9)%		+1/2
^{95}Cd		32(3) ms	11.76(57)#	$4.5^{+1.2}_{-1.0}$ %		-1/2
^{96}Ag	(8^+)	4.46(4) s	6.540(90)	4.4(5) %		+1
^{96m}Ag	(2^+)	4.395(85) s	6.540 + x	14.7(24)%		+1
^{96}Cd	0^+	1.02(6) s	7.11(41)#	1.7(4)%		0
^{96m}Cd	16^+	0.53(3) s	12.9(16)#	19.5(29)%		0
^{97}Cd	$(9/2^+)$	1.20(7) s	8.16(42)	7.4(2)%		+1/2
^{97m}Cd	$(25/2^+)$	3.86(6) s	10.78(72)	25.1(5)%		+1/2
^{97}In	$(9/2^+)$	36(6) ms	9.83(41)#	$1.7^{+1.7}_{-0.8}$ %		
^{98}Ag	(6^+)	47.5(3) s	2.240(50)	0.0011(5)%		+2
^{98}In	0^+	30(1) ms	9.71(31)#	<0.13%		0
^{98m}In	(9^+)	0.89(2) s	10.53(79)#	44(2)%		0
^{99}Cd	$(5/2^+)$	17(1) s	4.101(5)	0.21(2)%		+3/2
^{99}In	$(9/2^+)$	3.11(6) s	4.40(30)#	0.29(3)%		+1/2
^{99}Sn		24(4) ms	12.37(58)#	$3.9^{+3.4}_{-1.7}$ %		-1/2
^{100}In	(6^+)	5.62(6) s	5.245(7)	1.66(3)%		+1
^{101}Sn	$(5/2^+)$	2.22(5) s	6.60(30)	23.6(8)%		+1/2
^{102}In	(6^+)	23.3(1) s	3.351(7)	0.0093(13)%		+2
^{103}Sn	$(5/2^+)$	7.0(2) s	5.28(10)#	1.2(1)%		+3/2
^{104}Sb		440^{+150}_{-110} s	8.05(10)#	<7%		+1
^{105}Sn	$(5/2^+)$	32.7(5) s	3.341(4)	0.011(4)%		+5/2
^{108}Te	0^+	2.1(1) s	5.442(8)	2.4(10)%	α	+2
^{109}Te	$(5/2^+)$	4.3(1) s	7.066(7)	9.4(31)%	α	+5/2
^{110}I	(1^+)	0.664(24) s	8.490(60)	11(3)%	α, β_α	+2
^{111}Te	$(5/2)^+$	26.2(6) s	4.966(15)	obs		+7/2
^{112}I	(1^+)	3.34(8)s	6.484(14)	0.88(10)%	β_α, α	+3
^{113}I	$(5/2^+)$	6.6(2) s	3.190(20)	≈3.3e-5%		+7/2
^{115}Ba	$(5/2^+)$	0.45(5) s	10.88(20)#	>15%		+3/2
^{113}Xe	$(5/2^+)$	2.74(8) s	8.075(11)	7(4)%	α, β_α	+5/2
^{114}Cs	(1^+)	0.57(2) s	9.140(90)	8.7(13)%	α, β_α	+2
^{114}Ba	0^+	380^{+190}_{-110} ms	9.01(10)	20(10)%	α	+1

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^{115}Xe	$(5/2^+)$	18(4) s	5.944(27)	obs	β_α	+7/2
^{115}Cs		1.03(10) s	5.65(10)#	0.2(1)%	β_α	+5/2
^{115}Ba	$(5/2^+)$	0.45(5) s	10.78(20)#	>15%		+3/2
^{116}Cs	(1^+)	0.70(4) s	7.01(10)#	0.28(7)%	β_α	+3
^{116m}Cs	$(4^+, 5, 6)$	3.85(13) s	7.11(10)#	0.66(13)%	β_α	+3
^{116}Ba	0^+	1.3(2) s	6.99(20)#	3(1)%		+2
^{117}Xe	$5/2(^+)$	61(2) s	3.789(26)	0.0029(6)%		+9/2
^{117}Ba	(3/2)	1.75(7) s	8.30(25)	13(3)%	β_α	+5/2
^{118}Cs	2	14(2) s	4.740(29)	0.0542(6)%		+4
^{119}Ba	$(5/2^+)$	5.4(3) s	6.20(20)	25(2)%		+7/2
^{120}Cs	$2(^+)$	61.3(11) s	2.588(30)	$7(3)\times10^{-6}$%	β_α	+5
^{120}La		2.8(2) s	7.45(30)#	obs		+3
^{121}Ba	$5/2(^+)$	29.7(15) s	4.14(14)	obs		+9/2
^{121}Ce	$5/2^+$	1.1(1) s	8.91(50)#	≈1%		+5/2
^{122}La		8.7(7) s	5.27(30)#	obs		+4
^{123}Ce	(5/2)	3.8(2) s	7.03(30)#	obs		+7/2
^{124}Pr		1.2(2) s	8.21(45)#	obs		+3
^{125}Nd	(5/2)	0.60(15) s	9.56(50)#	obs		+5/2
^{125}Ce	$(7/2^-)$	9.9(5) s	5.14(20)#	obs		+9/2
^{126}Pr		3.14(22) s	6.15(20)#	obs		+4
^{127}Nd		1.8(4) s	7.62(30)#	obs		+7/2
^{128}Pr		3.1(3) s	4.276(40)	obs		+5
^{128}Pm		1.0(3) s	9.47(36)#	≈6%		+3
^{128}Nd		4(2) s	4.16(20)#	obs?		+4
^{129}Nd	$(5/2^+)$	6.7(4) s	5.87(20)#	obs		+9/2
^{129}Sm	$(1/2^+, 3/2^+)$	0.55(10) s	10.91(54)#	obs		+5/2
^{130}Pm		2.6(2) s	7.02(20)#	obs		+4
^{131}Nd	$(5/2^+)$	25.5(10) s	4.366(39)	obs		+11/2
^{131}Sm		1.2(2) s	9.03(40)#	obs		+7/2
^{132}Pm	(3^+)	6.2(6) s	5.38(16)#	obs		+5
^{133}Sm	$(1/2^-)$	3.4(5) s	6.91(30)#	obs		+9/2
^{133m}Sm	$(5/2^+)$	2.8(5) s	6.91(30)#+x	obs		+9/2
^{134}Eu		0.5(2) s	8.19(30)#	>0%		+4
^{135}Gd	$(5/2^+)$	1.1(2) s	9.84(45)#	≈18%		+7/2
^{135}Sm	$(3/2^+, 5/2^+)$	10.3(5) s	5.50(16)	0.02(1)%		+11/2
^{136}Eu	(7^+)	3.3(3) s	6.53(21)#	obs		+5
^{136m}Eu	(3^+)	3.8(3) s	6.53(21)#+x	obs		+5
^{137}Gd	(7/2)	2.2(2) s	8.301(30)#	obs		+9/2
^{139}Gd		5.8(9) s	6.58(20)#	obs		+11/2
^{139m}Gd		4.8(9) s	6.58(20)#	obs		+11/2
^{139}Dy	$(7/2^+)$	0.6(2) s	10.67(54)#	≈2%		+7/2
^{140}Tb	7^+	2.0(5) s	7.63(80)	obs		+5
^{141}Dy	$(9/2^-)$	0.9(2) s	9.11(30)#	obs		+9/2
^{141}Gd	$1/2^+$	14(4) s	4.943(23)	0.03(1)%		+13/2
^{142}Ho	$(7^-, 8^+)$	0.4(1) s	10.00(51)#	≈7%		+4
^{142}Tb	1^+	597(17) ms	6.08(70)	0.0022(11)%		+6
^{142}Dy	0^+	2.3(3) s	5.82(73)#	0.06(3) %		+5
^{143}Dy	$(1/2^+)$	5.6(10) s	7.502(31)	obs		+11/2
^{143m}Dy	$(11/2^-)$	3.0(3) s	7.833(31)	obs		+11/2
^{144}Dy	0^+	9.1(5) s	4.37(20)	obs		+6
^{144}Ho	(5^-)	0.7(1) s	8.521(52)	obs		+5
^{145}Dy	$(1/2^+)$	6(2) s	6.228(29)	≈50%		+13/2
^{145}Er	$(1/2^+)$		10.04(20)#	>0%		+9/2
^{145m}Er	$(11/2^-)$	1.0(3) s	10.29(20)#	>0%		+9/2
^{146}Ho	(6-)	2.8(5) s	7.77(10)	obs		+6
^{146}Er	0^+	1.7(6) s	6.632(9)	>0%		+5
^{147}Dy	$(1/2^+)$	67(7) s	4.601(10)	≈0.05%		+15/2
^{147}Er	$(1/2^+)$	≈2.5s	8.658(39)	obs		+11/2
^{147m}Er	$(11/2^-)$	2.5(2) s	88.658(39) + x	obs		+11/2
^{148m}Ho	$(5)^-$	9.59(15)s	5.463(84)+x	0.08(1)%		+7
^{148}Er	0^+	4.6(2) s	5.428(14)	obs		+6
^{149}Tm	$(11/2^-)$	0.9(2)s	6.82(21)#	0.2^{+2}_{-1} %		+11/2
^{149}Yb	$(1/2^+)$	0.7(2)s	10.86(30)#	≈6%		+9/2
^{149}Er	$(1/2^+)$	4(2) s	6.823(29)	7(2)%		+13/2
^{149}Tm	$(11/2^-)$	0.9(2) s	6.76(22)#	obs		+11/2

Table 1
Summary of known β_p Emitters. Detailed references for each nucleus can be found in their respective T_z tables.

^{149m}Er	$(11/2^-)$	8.9(2) s	7.571(29)	0.18(7)%		+13/2
^{150}Tm	(6^-)	2.20(7) s	7.88(20)#	1.2(3)%		+6
^{151}Yb	$(1/2^+)$	1.6(1) s	9.00(30)	obs		+11/2
^{151m}Yb	$(11/2^-)$	1.6(1)	9.00(30)+x	obs		+11/2
^{152}Lu		0.7(1)s	10.06(20)#	obs		+5
^{153}Yb	$7/2^-$	4.2(2) s	6.05(20)#	0.008(2)%		+13/2
^{154m}Lu	(9^+)	1.16(5) s	7.02(20)#	≈0.06%		+6
^{179}Hg	$(7/2^-)$	1.06(4) s	7.776(30)	0.37(6)%	α	+19/2
^{179}Hg	$(7/2^-)$	1.05(3) s	7.780(30)	≈0.15%	α	+19/2
^{181}Hg	$(1/2^-)$	3.6(1) s	6.480(18)	0.014(4)%	α, β_α	+21/2
^{183}Hg	$1/2^-$	8.9(2) s	5.075(15)	$2.7(6)\times10^{-4}$%	α	+23/2

Table 2
Summary of known β_{2p}. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	$Q_{\varepsilon 2p}$ (MeV)	BR β_{2p} (%)	other decays	T_z
^{22}Al	10.66(40)#	1.10(11)%	β_p, β_α	-2
^{22}Si	12.21(50)#	0.7(3)%	β_p,	-3
^{23}Si	11.56(50)#	7.73(35)%	β_p, β_{3p}	-5/2
^{26}P	10.505(61)	3.20(42)%	β_p	-2
^{27}S	11.83(40)#	2.4(5)%	β_p	-5/2
^{31}Ar	13.71(20)#	9.0(2)%	β_p, β_{3p}	-5/2
^{35}Ca	11.62(20)#	4.2(3)%	β_p	-5/2
^{39}Ti	12.72(20)#	obs	β_p	-5/2
^{43}Cr	12.09(40)#	11.6(10)%	β_p, β_{3p}	-5/2
^{45}Fe	17.10(40)#	7.8(24)%	2p, β_p, β_{3p}	-7/2
^{46}Fe	10.44(30)#	0.4(6)%	β_p	-3
^{50}Ni	11.26(50)#	14(5)%	β_p	-3
^{51}Ni	11.39(50)#	0.5(2)%	β_p	-5/2

Table 3
Summary of known β_{3p} emitters. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	$Q_{\varepsilon 3p}$ (MeV)	BR β_{3p} (%)	other decays	T_z
^{23}Si	9.13(50)#	$0.029^{+0.038}_{-0.019}$%	β_p, β_{3p}	-5/2
^{31}Ar	10.96(20)#	0.07(2)%	β_p, β_{2p}	-5/2
^{43}Cr	11.01(20)#	$0.13^{+0.18}_{-0.08}$%	β_p, β_{2p}	-5/2
^{45}Fe	17.00(40)#	3.3(19)%	2p, β_p, β_{2p}	-7/2

Table 4
Summary of known β_α emitters. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	J^π	$T_{1/2}$	$Q_{\varepsilon\alpha}$ (MeV)	BR β_α (%)	other decays	T_z
^{9}C	$(3/2^-)$	126.5(9) ms	14.806(50)	37.6(56)%	β_p, α	-3/2
^{12}N	1^+	11.000(16) ms	9.971(1)	0.52(5)%		-1
^{13}O	$(3/2^-)$	8.58(5) ms	8.274(10)	0.078(6)%	β_p	-3/2
^{17}Ne	$1/2^-$	109.3(6) ms	.7300(5)	3.51(16)%	β_p	-3/2
^{20}Na	2^+	447.9(23) ms	9.1626(11)	20.4(4)%	β_p	-1
^{21}Mg	$5/2^+$	118.6(5) ms	6.527(1)	0.115(19)%	β_p	-3/2
^{22}Al	4^+	91.1(5) ms	10.46(40)#	0.038(17)%	β_p, β_{2p}	-2
^{24}Al	4^+	2.053(4) s	4.5680(1)	0.035(6)%	β_p	-1
^{24m}Al	1^+	130(3) ms	4.994(1)	0.028(6)%		-1
^{28}P	3^+	270.3(5) ms	4.3607(11)	0.00086(25)%	β_p	-1
^{32}Cl	1^+	298(1) ms	5.7331(6)	0.054(8)%	β_p	-1
^{36}K	2^+	342(2) ms	6.1734(3)	0.0031(6)%	β_p	-1
^{40}Sc	4^-	182.3(7) ms	7.2832(28)	0.017(5)%	β_p	-1
^{44}V	$(2)^+$	111(7) ms	8.613(7)	obs		-1

Table 4
Summary of known β_α emitters. Detailed references for each nucleus can be found in their respective T_z tables.

^{108}Te	0^+	2.1(1) s	7.976(8)	49(4)%	β_p	+2
^{109}Te	$(5/2^+)$	4.3(1) s	9.501(11)	$<$ 0.00443%	β_p, α	+5/2
^{110}I	(1^+)	0.664(24) s	14.469(60)	1.1(3)%	β_p, α	+2
^{112}I	(1^+)	3.34(8) s	12.582(11)	0.104(12)%	β_p, α	+3
^{113}Xe	$(5/2^+)$	2.74(8) s	11.622(9)	0.007(4)%	β_p, α	+5/2
^{114}Cs	(1^+)	0.57(2) s	15.115(90)	0.16(6)%	β_p, α	+2
^{115}Cs		1.03(10) s	11.46(10)#	0.010(5)%	β_p	+5/2
^{115}Xe	$(5/2^+)$	18(4) s	9.755(15)	0.0003(1)%	β_p	+7/2
^{116}Cs	(1^+)	0.70(4) s	13.08(10)#	0.049(25)%	β_p	+3
^{116m}Cs		3.85(13) s	13.18(12)#	$<$0.0033%	β_p	+3
^{117}Ba	(3/2)	1.75(7) s	11.24(25)	0.011-0.038%	β_p	+5/2
^{118}Cs	2	14(2) s	11.055(31)	$<$0.0024(4)%	β_p	+4
^{120}Cs	$2(^+)$	61.3(11) s	8.955(30)	0.000020(4)%	β_p	+5
^{181}Hg	$(1/2^-)$	3.6(1) s	12.961(25)	9(2)X10^{-6}%	β_p, α	+21/2

Table 5
Summary of known β^-_α emitters. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	J^π	$T_{1/2}$	$Q_{\beta^-\alpha}$ (MeV)	$BR_{\beta^-\alpha}$ (%)	other decays	T_z
^{212m}Bi	(9^-)	25.0(2) m	11.625(30)	30(1)%	α	+23
^{214}Bi	1^-	19.71(2) m	11.102(11)	3.03 $\times$ 10^{-3}%	α	+24

Table 6
Summary of known BR_{ε_F} emitters. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	J^π	$T_{1/2}$	BR_{ε_F}	other decays	T_z
^{178}Tl	$(4^-, 5^-)$	252(20) ms	0.15(6)%	α	+8
^{180}Tl	(5^-)		3.2(3)X10^{-3}%	α	+9
^{186}Bi	(3^+)	14.8(8) ms	$<$0.022(13)%	α	+10
^{186m}Bi	(10^-)	9.8(4) ms	$<$0.022(13)%	α	+10
^{188}Bi	(3^+)	60(3) ms	0.46(9)%	α	+11
^{188m}Bi	(10^-)	265(10) ms	$\approx$0.11%	α	+11
^{190}Bi	(3^+)	6.3(1) s	2.5(5)$\times$10^{-5}	α	+12
^{190m}Bi	(10^-)	6.2(1) s	$4.1^{+0.8}_{-1.5}\times$ 10^{-5}	α	+12
^{192}At		11.5(6) ms	$<$0.42(9)%	α	+11
^{192m}At	$(9^-, 10^-)$	88(6) ms	$<$0.42(9)%	α	+11
^{194}At	(2^-)	253(10) ms	$<$0.059(4)%	α	+12
^{194m}At	$(9^-, 10^-)$	310(8) ms	$<$0.059(4)%	α	+12
^{196}At	(3^+)	371(5) ms	9(1)$\times$10^{-3}%	α	+13
^{200}Fr	(3^+)	48(4) ms	$>$ 1.4%	α	+13
^{202}Fr	(3^+)	372(10) ms	obs	α	+14
^{202m}Fr	(10^-)	286(13) ms	obs	α	+14
^{228}Np		61.4(15) s	0.020(9)%	α	+21
^{230}Am		32^{+22}_{-9} s	$>$30%	α	+20
^{232}Am		79(2) s	0.069(10)%		+21
^{234}Am		2.32(8) m	6.6(18)$\times$10^{-3}	α	+22
^{236}Bk		22^{+13}_{-6} s	4(2)%	α	+21
^{238}Bk		144(5) s	0.048(2)%	α	+22
^{240}Es		5(2) s	4.8(18)%	α	+21
^{240}Bk		4.8(8) m	$1.3^{+1.8}_{-0.7}\times$10^{-3}%		+23
^{242}Es		16.9(8) s	1.5(4)%	α	+22
^{244}Es		37(4) s	0.012(4) %	α	+23
^{246m}Md		4.4(8) s	$>$ 10%	α	+22
^{246}Es		7.7(5) m	$\approx$ 3$\times$10^{-3}%	α	+24
^{250}Md		52(6) s	$\approx$0.02%	α	+24

Table 7
Summary of known $\beta_{p\alpha}$ and $\beta_{\alpha p}$ emitters. Detailed references for each nucleus can be found in their respective T_z tables.

Nuclide	J^π	$T_{1/2}$	$Q_{\varepsilon p\alpha}$ (MeV)	BR (%)	decay type	other decays	T_z
^{17}Ne	$1/2^-$	109.3(6) ms	16.501(1)	0.0014(4)%	$\beta_{p\alpha}$	β_p, β_α	-3/2
^{21}Mg	$5/2^+$	118.6(5) ms	15.641(1)	0.016(3)%	$\beta_{\alpha p}$	β_p, β_α	-3/2