

Odd Z $T_z = +27$

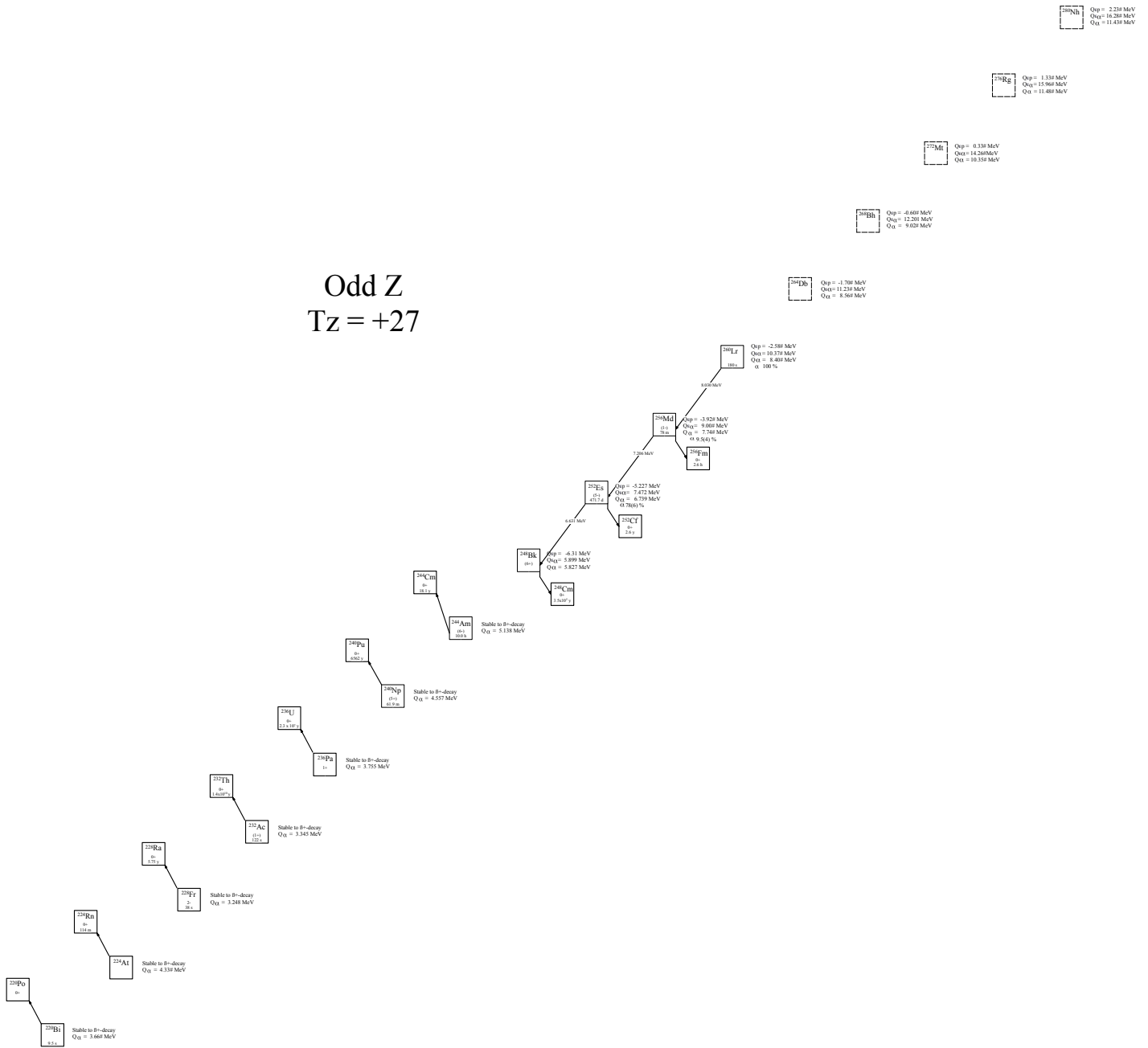


Fig. 1: Known experimental values for heavy particle emission of the odd-Z $T_z = +27$ nuclei.

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Table 1

Observed and predicted β -delayed particle emission from the odd- Z , $T_z = +27$ nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. J^π values are taken from ENSDF.

Nuclide	J^π	$T_{1/2}$	Q_ε	Q_{β^-}	$Q_{\beta^- \alpha}$	$BR_{\beta^- F}$	Experimental
$^{220}\text{Bi}^*$		9.5(57) s	-3.17(50)#	5.70(30)#	16.93(30)#		[2017Ca17]
$^{224}\text{At}^*$		obs	-2.20(20)#	5.266(24)	10.203(28)		[2012Ch19]
$^{228}\text{Fr}^*$	2^-	38*1) s	-1.859(19)	4.444(7)	8.694(12)		[1982Ru04]
$^{232}\text{Ac}^*$	(1^+)	119(5) s	-1.343(16)	3.708(13)	7.969(13)	$<2.7 \times 10^{-7}\%$	[2025Ba22, 1986Gi08]
$^{236}\text{Pa}^*$	1^+		-0.921(20)	2.889(14)	7.642(14)		[1984Mi02]
$^{240}\text{Np}^*$	(5^+)	61.9(2) m	-0.399(17)	2.191(17)	7.626(17)		[1982Pa23]
				$Q_{\varepsilon p}$	$Q_{\varepsilon \alpha}$		
$^{244}\text{Am}^*$	(6^-)	10.01(3) h	0.073(3)	-7.220(30)#	4.739(3)		[2019Tr05]
$^{248}\text{Bk}^*$	(6^+)		0.740(50)	-6.31(11)#	5.899(50)		[1973Fi06]
^{252}Es	(5^-)	471.7(17) d	1.260(50)	-5.227(51)	7.472(50)		[1977Ah03]
^{256}Md	(1^-)	78.1(18) m	1.97(12)#	-3.92(12)#	9.00(12)#		[1993Mo18]
^{260}Lr		180(30) s	2.67(24)#	-2.58(16)#	10.37(13)#		[1971Es01]
^{264}Db			3.19(43)#	-1.70(33)#	11.23(31)#		
^{268}Bh			3.91(61)#	-0.60(54)#	12.201(53)#		
^{272}Mt			4.48(70)#	0.33(62)#	14.26(68)#		
^{276}Rg			4.85(83)#	1.33(74)#	15.96(81)#		
^{280}Nh			5.59(71)#	2.23(58)#	16.28(68)#		

* 100% β^- emitter.

** Taken from α decay of ^{252}Es [1973Fi06], might not be the ground state.

Table 2

Particle separation, Q-values, and measured values for direct particle emission of the odd- Z , $T_z = +27$ 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
^{220}Bi	6.95(50)#	3.66(42)#			
^{224}At	6.66(20)#	4.33(30)#			
^{228}Fr	6.791(16)	3.248(23)			
^{232}Ac	6.351(17)	3.345(15)			
^{236}Pa	5.973(19)	3.755(19)			
^{240}Np	5.545(17)	4.557(22)			
^{244}Am	5.164(3)	5.138(17)			
^{248}Bk	4.691(50)	5.827(50)			
^{252}Es	4.129(50)	6.739(1)	78(6)%		[1973Fi06, 1977Ah03, 1973AhZQ, 1965Mc11, 1956Ha80]
^{256}Md	3.63(12)#	7.74(11)#	9.5(4)%*		[2000Ah02, 1993Mo18, 1971Ho16, 1970Fi12, 2019Ah04, 1965Si14, 1955Gh02]
^{260}Lr	3.09(13)#	8.40(14)#	100%		[1971Es01]
^{264}Db	2.78(28)#	8.56(20)#			
^{268}Bh	2.39(46)#	9.02(30)#			
^{272}Mt	1.50(56)#	10.35(30)#			
^{276}Rg	1.57(72)#	11.48(40)#			
^{280}Nh	1.07(56)#	11.43(75)#			

* Weighted average of 9.9(5)% [1971Ho16] and 8.5(8)% [1970Fi12].

Table 3direct α emission from $^{252}\text{Es}^*$, $J^\pi = (5^-)$, $T_{1/2} = 471.7(19)$ d**, $BR_\alpha = 78(6)\%$.

E_α (c.m.)	E_α (lab)	I_α (rel)	I_α (abs)	J_f^π	$E_{daughter}(^{248}\text{Bk})$	coincident γ -rays (keV)	R_0 (fm)***	HF
6.038(4)	5.942(4)	0.050(19)%	0.031(12)%	8^+	0.700(5)		1.48566(81)	35^{+22}_{-10}
6.081(4)	5.984(4)	0.062(19)%	0.039(12)%	6^-	0.657(5)		1.48566(81)	47^{+22}_{-12}
6.113(4)	6.016(4)	0.15(4)%	0.09(2)%	7^+	0.625(5)		1.48566(81)	29^{+11}_{-6}
6.148(3)	6.050(3)	1.27(11)%	0.80(9)%	5^-	0.590(4)	377.4, 418.5, 590.0	1.48566(81)	$5.1^{+0.8}_{-0.6}$
6.207(5)	6.108(5)	0.15(4)%	0.09(2)%		0.531(6)	529.1	1.48566(81)	87^{+32}_{-20}
6.254(5)	6.155(5)	$\approx 0.05\%$	$\approx 0.03\%$		0.483(6)		1.48566(81)	≈ 500
6.280(5)	6.180(5)	0.10(4)%	0.06(2)%		0.458(6)		1.48566(81)	300^{+190}_{-90}
6.314(5)	6.214(5)	0.12(4)%	0.08(2)%		0.424(6)		1.48566(81)	360^{+170}_{-90}
6.339(3)	6.238(3)	0.71(6)%	0.44(5)%		0.399(4)	399.7	1.48566(81)	83^{+13}_{-10}
6.365(3)	6.264(3)	0.94(9)%	0.59 (7)%		0.373(4)	193.5, 228.0	1.48566(81)	85^{+13}_{-11}
6.399(5)	6.297(5)	$\approx 0.05\%$	$\approx 0.03\%$		0.339(6)		1.48566(81)	$\approx 2 \times 10^3$
6.476(5)	6.373(5)	0.09(4)%	0.05(2)%		0.262(6)		1.48566(81)	$3.1^{+2.4}_{-1.0} \times 10^3$
6.527(5)	6.423(5)	0.56(6)%	0.35(5)%	(5^-)	0.211(6)		1.48566(81)	840^{+150}_{-120}
6.564(3)	6.460(3)	0.31(5)%	0.20(3)%	(4^-)	0.174(4)		1.48566(81)	$1.6^{+0.3}_{-0.2} \times 10^3$
6.586(3)	6.481(3)	2.73(12)%	1.71(15)%	8^+	0.152(4)	70.7, 80.7, 151.3	1.48566(81)	$326(34)$
6.602(5)	6.497(5)	0.39(5)%	0.24(4)%		0.136(6)	64.4, 70.7	1.48566(81)	$2.7(5) \times 10^3$
6.667(3)	6.561(3)	17.0(4)%	10.6(9)%	7^+	0.071(4)	70.7	1.48566(81)	123(12)
6.738(3)	6.631(3)	100%	62.6(7)%	(6^+)	0.0	—	1.48566(81)	44(4)

* All values from [1973Fi06], except where noted.

** [1977Ah03].

*** Interpolated between 1.48260(30) fm (^{250}Cf) and 1.48871(75) fm (^{254}Fm).**Table 4**direct α emission from $^{256}\text{Md}^*$, $J^\pi = (1^-)$, $T_{1/2} = 78.1(18)$ m**, $BR_\alpha = 9.5(4)\%$ ***.

E_α (c.m.)	E_α (lab)	I_α (rel)	I_α (abs)	J_f^π	$E_{daughter}(^{252}\text{Es})$	coincident γ -rays (keV)	R_0 (fm) [@]	HF
7.255(5)	7.142(5)	31(2)%	2.1(1)%		0.542(9)		1.483(24)	$3.6^{+3.0}_{-1.7}$
7.320(4)	7.206(4)	100(3)%	6.8(3)%		0.477(9)		1.483(24)	$2.1^{+1.7}_{-1.0}$
7.362(5)	7.247(5)	3.5(7)%	0.24(5)%		0.436(9)		1.483(24)	90^{+70}_{-40}
7.763(8)	7.642(8)	3.0(7)%	0.20(5)%		0.035(11)		1.483(24)	$3.4^{+3.0}_{-1.7} \times 10^3$
7.798(8)	7.676(8)	3.5(7)%	0.24(5)%	(5^-)	0.0	—	1.483(24)	$3.8^{+3.3}_{-1.9} \times 10^3$

* All values from [2000Ah02], except where noted.

** [1993Mo18].

*** Weighted average of 9.9(5)% [1971Ho16] and 8.5(8)% [1970Fi12].

[@] Interpolated between 1.48871(75) fm (^{254}Fm) and 1.477(24) fm (^{258}No).**Table 5**direct α emission from $^{260}\text{Lr}^*$, $T_{1/2} = 180(30)$ s, $BR_\alpha = 100\%$.

E_α (c.m.)	E_α (lab)	I_α (abs)	J_f^π	$E_{daughter}(^{256}\text{Md})$	coincident γ -rays (keV)	R_0 (fm)**	HF
8.155(20)	8.030(20)	100%	(1^-)	0.0	—	1.479(28)	$1.1^{1.2}_{-0.6}$

* All values from [1971Es01].

** Interpolated between 1.477(24) fm (^{258}No) and 1.480(14) fm (^{262}Rf).**References used in the Tables**

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