



Fig. 1: Known experimental values for heavy particle emission of the even-Z $T_z = +9/2$ nuclei.

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Table 1

Observed and predicted β -delayed particle emission from the even- Z , $T_z = +9/2$ nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. All J^π values taken from ENSDF.

Nuclide	Ex	J^π	$T_{1/2}$	Q_ϵ	$Q_{e\beta}$	$BR_{\beta\beta}$	Q_{e2p}	$Q_{e\alpha}$	Experimental
^{105}Cd		$5/2^+$	55.4(4) m*	2.737(4)	-2.228(2)	—	-10.880(3)	0.654(6)	[1953Jo20, 1968Bo25, 1969St18]
^{109}Sn		$5/2^+$	18.1(2) m**	3.859(9)	-0.667(8)	—	-8.801(8)	2.016(9)	[1969Ba04, 1972Ba41, 1956Pe56]
^{113}Te		$(7/2^+)$	1.6(2) m	6.07(30)	3.019(28)		-4.533(28)	5.718(28)	[1976Wi11]
^{117}Xe		$5/2^+$	61(2) s	6.253(28)	3.789(26)	0.0029(6)%	-1.760(19)	7.807(20)	[1971Ho07]
^{121}Ba		$5/2^+$	29.7(15) s	6.36(14)	4.14(14)	obs	-1.545(144)	7.27(14)	[1974Ka31]
^{125}Ce		$(7/2^-)$	9.9(5) s***	7.10(20)#	5.14(20)#	obs	-0.19(20)#	8.02(20)#	[1998Be64, 1983Ni05, 1986Wi15]
^{129}Nd		$(5/2^+)$	6.7(4) s	7.40(20)#	5.87(20)#	obs	0.94(20)#	8.96(20)#	[2010Xu12, 1985Wi07, 2011MaZL, 1977Bo02]
^{133}Sm	y [@]	$(1/2^-)$	3.4(5) s ^a	8.18(30)#	6.91(30)#	obs	2.49(30)#	10.12(30)#	[2006Xu07, 2001Xu04, 1993BrZU, 1985Wi07, 1977Bo02]
^{133m}Sm	x [@]	$(5/2^+)$	2.8(5) s	8.18(30)#+x	6.91(30)#+x	obs	2.49(30)#+x	10.12(30)#+x	[2006Xu07, 2001Xu04, 1985Wi07, 1977Bo02]
^{137}Gd		$(7/2)$	2.2(2) s	8.93(30)#	8.301(30)#	obs	4.27(31)#	11.77(30)#	[2005Xu04]
^{141}Dy		$(9/2^-)$	0.9(2) s	9.16(32)#	9.11(30)#	obs	5.44(30)#	12.34(30)#	[2006Xu03, 1984Ni03, 1986Wi15]
^{145}Er		$(1/2^+)$		9.88(20)#	10.04(20)#	obs	6.60(21)#	12.88(23)#	[2010Ma20]
^{145m}Er	@	$(11/2^-)$	0.9(3) s	10.13(20)#	10.29(20)#	obs	6.86(21)#	13.13(23)#	[2010Ma20, 2006Ta08, 1989Vi02, 1988WiZN]
^{149}Yb		$(1/2^+)$	0.7(2) s	10.61(36)#	10.86(30)#	$\approx 6\%$	7.849(30)#	13.37(30)#	[2005Xu04]
^{153}Hf			> 200 ns	11.08(34)#	11.68(34)#		8.89(30)#	14.22(36)#	[2006Xu07]
^{157}W		$(7/2^-)$	275(40) ms	9.91(43)#	10.84(43)#		8.28(40)#	6.26(423)#	[2019Hi06, 2010Bi03, 2008PaZV]
^{161}Os		$(7/2^-)$	640(60) μs	10.65(43)#	11.84(43)#		9.67(40)#	16.97(43)#	[2010Bi03, 2019Hi06, 2008BiZT, 2008PaZV]
^{165}Pt		$(7/2^-)$	0.26 ⁺²⁶ ₋₀₉ ms	11.28(43)#	12.82(43)#		11.11(40)#	18.10(43)#	[2019Hi06]

* Weighted average of 54.7(8) m [1953Jo20], 57.0(6) m [1968Bo25] and 56.0(5) [1969St18].

** Weighted average of 518.0(2) m [1969Ba04], 18.3(3) m [1972Ba41] and 18.1(3) m [1956Pe56].

*** Weighted average of 10.5(5) s [1998Be64], 8.9(7) s [1983Ni05] and 9.2(10) s [1986Wi15].

^a Weighted average of 3.2(7) s [2006Xu07], 3.4(5) s [2001Xu04], 3.7(7) s [1993BrZU].

@ The relative energy placement of the two isomers is unknown.

Table 2

Particle separation and emission from the even- Z , $T_z = +9/2$ 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	BR_α	Experimental
^{105}Cd	6.506(4)	—	11.455(2)	-1.327(5)	—	
^{109}Sn	5.799(12)	—	10.218(8)	-0.721(8)	—	
^{113}Te	4.037(33)	—	6.986(28)	1.858(29)		
^{117}Xe	4.054(76)	—	6.701(30)	1.737(30)		
^{121}Ba	4.15(142)	—	6.53(14)	1.02(14)		
^{125}Ce	3.69(20)#	—	5.58(20)#	1.66(24)#		
^{129}Nd	3.33(20)#	—	4.97(20)#	1.86(28)#		
^{133}Sm	2.89(33)#	—	4.04(30)#	2.72(36)#		
^{133m}Sm	2.89(33)#-x	—	4.04(30)#-x	2.72(36)#+x		
^{137}Gd	2.26(36)#	—	2.93(34)#	3.59(42)#		
^{141}Dy	2.19(85)#	—	2.33(36)#	3.41(42)#		
^{145}Er	1.92(20)#	—	1.65(20)#	3.72(36)#		
^{145m}Er	1.67(20)#	—	1.90(20)#	3.97(36)#		
^{149}Yb	1.85(30)#	—	1.30(30)#	3.49(36)#		
^{153}Hf	1.17(36)#	—	0.34(43)#	3.61(42)#		
^{157}W	0.98(50)#	—	-0.04(50)#	5.19(50)#		
^{161}Os	0.61(50)#	—	-0.66(50)#	7.069(11)#	5.9(27)%	[2010Bi03, 2019Hi06, 2008BiZT]
^{165}Pt	0.12(51) #	—	-1.44(50)#	7.453(14)#	100%	[2019Hi06]

Table 3direct α emission from $^{161}\text{Os}^*$, $J^\pi = (7/2^-)$, $T_{1/2} = 640(60) \mu\text{s}$, $BR_\alpha = 5.9(27)\%$.

$E_\alpha(\text{c.m.})$	$E_\alpha(\text{lab})$	$I_\alpha(\text{rel})$	$I_\alpha(\text{absb})$	J_f^π	$E_{\text{daughter}}(^{157}\text{W})$	coincident γ -rays
6.747(30)	6.580(30)	100%	5.9(27)%	(9/2 ⁻)	0.318	—
7.066(12)	6.890(12)	100%	5.9(27)%	(7/2 ⁻)	0.0	—

* All values from [2010Bi03].

Table 4direct p emission from $^{165}\text{Pt}^*$, $J^\pi = (7/2^-)$, $T_{1/2} = 0.26_{-9}^{+26} \mu\text{s}$, $BR_\alpha = 100\%$.

$E_\alpha(\text{c.m.})$	$E_\alpha(\text{lab})$	$I_\alpha(\text{rel})$	$I_p(\text{abs})$	J_f^π	$E_{\text{daughter}}(^{161}\text{Os})$	coincident γ -rays	R_0 (fm)	HF
7.453(14)	7.272(14)	100%	100%	(7/2 ⁻)	0.0	—	1.551(19)	$2.6_{-1.2}^{+1.5}$

* All values from [2019Hi06].

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