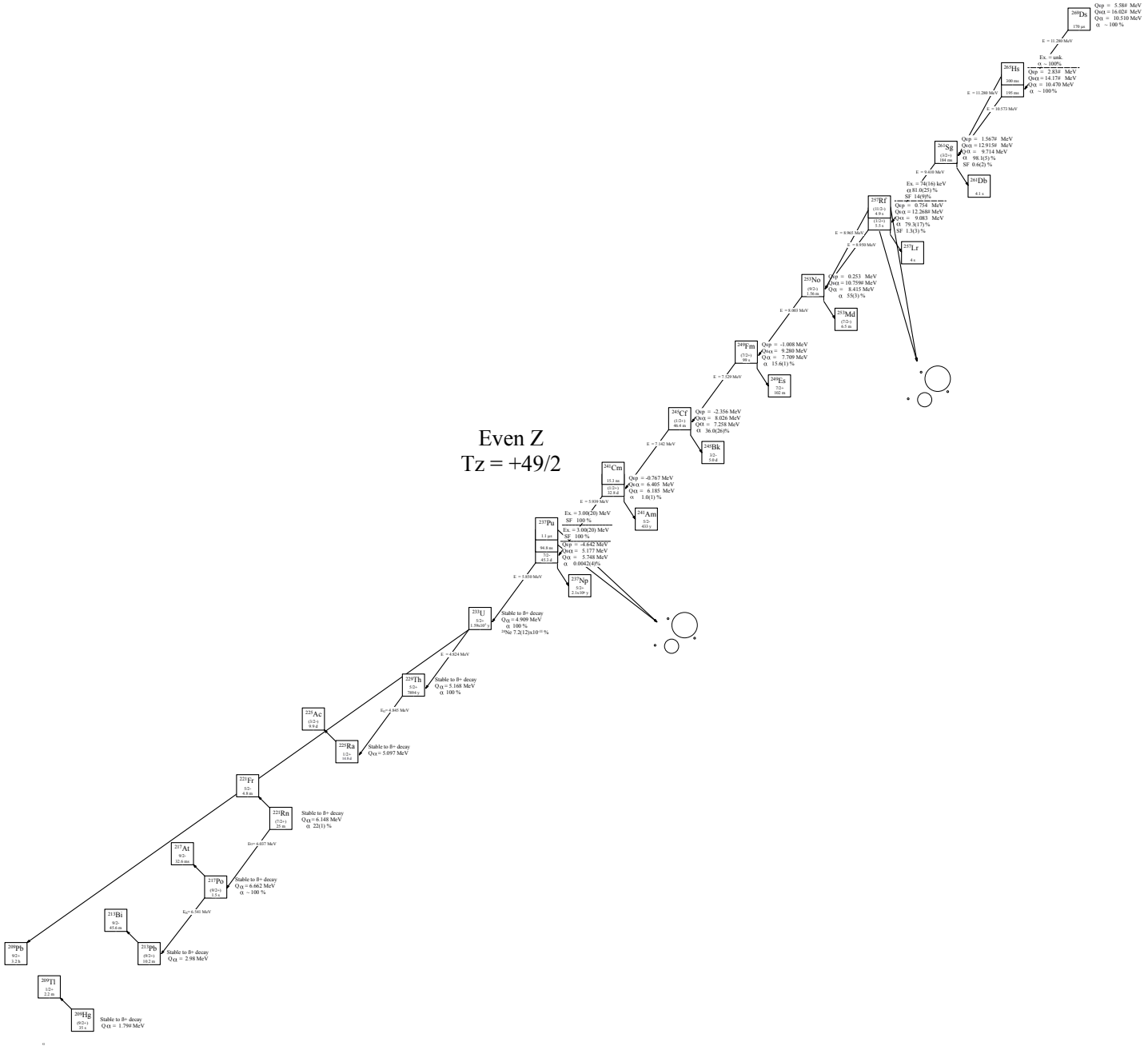

Fig. 1: Known experimental values for heavy particle emission of the even-Z T_z= +49/2 nuclei.

Last updated 10/21/2024

Table 1
Observed and predicted β-delayed particle emission from the even-Z, T_z = +49/2 nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. J^π values for ^{209}Hg, ^{213}Pb, ^{217}Po, ^{221}Rn, ^{225}Ra, ^{237}Pu, ^{241}Cm, ^{245}Cf, and ^{249}Fm are taken from ENSDF.

Nuclide	Ex.	J^π	$T_{1/2}$	Q_ε	Q_{β^-}	$Q_{\beta^- \alpha}$	Experimental
^{209}Hg*		$(9/2^+)$	35^{+9}_{-6} s	-6.38(43)#	5.040(150)#	7.72(26)#	[**1998Zh19**]
^{213}Pb*		$(9/2^+)$	10.2(3) m	-4.987(28)	2.028(8)	8.196(9)	[**1964Bu05**]
^{217}Po		$(9/2^+)$	1.52(3) s**	-2.847(19)	1.489(8)	8.870(9)	[**2003Ku25, 2004Li28**]
^{221}Rn		$(7/2^+)$	25(2) m	-2.311(15)	1.194(7)	7.831(8)	[**1956Mo15**]
^{225}Ra		$1/2^+$	14.8(2) d	-1.828(12)	0.356(5)	6.471(6)	[**1950Ha52**]
^{229}Th		$5/2^+$	7894(40) y***	-1.104(12)	-0.311(4)	—	[**1989Go19, 2014Va04, 2018Es07**]
^{233}U		$5/2^+$	$1.5903(13)\times10^5 y$	-0.570(2)	–1.030(5)	—	[**2009Po15**]
					$Q_{\varepsilon p}$	$Q_{\varepsilon\alpha}$	
^{237}Pu		$7/2^-$	45.31(3) d[@]	0.220(1)	-4.642(1)	5.177(2)	[**1994Ta25, 1981Ba15**]
^{237m1}Pu	2.90(20)[@@]		94.8 ns[@@@]	2.92(20)	-1.74(20)	8.08(20)	[**1971Ru03, 1974Ba82**]
^{237m2}Pu	3.20(25)[a]		1.12(8) μs	3.40(25)	-1.44(25)	8.38(25)	[**1971Ru03**]
^{241}Cm		$(1/2^+)$	32.8(2) d	0.767(1)	-3.713(1)	6.405(2)	[**1974Po08**]
^{241m}Cm	2.45(20)[b]		15.3(10) ns	3.22(20)	-1.26(20)	8.86(20)	[**1972Vy07, 1971Br39, 1971Re11**]
^{245}Cf		$(1/2^+)$	46.4(3) m	1.571(3)	-2.356(2)	8.026(3)	[**1996Ma72**]
^{249}Fm		$(7/2^+)$	99(6) s[c]	2.340(30)#	-1.008(8)	9.280(6)#	[**2004He28, 2006Ni09**]
^{253}No		$(9/2^-)$	1.56(2) m	3.190(30)#	0.253(9)	10.759(31)#	[**2009He23**]
^{257}Rf		$(1/2^+)$	5.5(4) s	3.200(50)#	0.754(13)	12.268(33)#	[**2010St14**]
^{257m}Rf	0.074(16)	$(11/2^-)$	4.9(7) s	3.274(52)#	0.828(21)	12.342(37)#	[**2010St14**]
^{261}Sg		$(3/2^+)$	184(5) ms	3.700(11)#	1.567(20)#	12.915(48)#	[**2010St14**]
^{265}Hs			1.9(2) ms	4.51(24)#	2.83(28)#	14.17(11)#	[**2009He20**]
^{265m}Hs	x[d]		300^{+200}_{-100} μs	4.51(24)#+x	2.83(28)#+x	14.17(11)#+x	[**2009He20**]
^{269}Ds			170^{160}_{70} μs	5.54(31)#	4.58(30)#	16.02(24)#	[**1999He07**]

* 100% β^- emitter.
** Weighted average of 1.53(3) s [2003Ku25] and 1.48(5) s [2004Li28].
*** Weighted average of 7880(120) y [1989Go19], 7917(48) y [2014Va04] and 7825(87) y [2018Es07].
[@] Weighted average of 45.66(4) d [1994Ta25], and 45.12(3) d [1981Ba15].
[@@] [1971Br39].
[@@@] Weighted average of 82(8) ns [1971Ru03], and 110(9) ns [1974Ba82].
[a] [1973Va16] reports 300(150) keV above ^{237m1}Pu.
[b] Weighted average of 2.30(20) MeV [1971Br39], and 2.60(20) MeV [1972Vy07].
[c] Weighted average of 96(9) s [2004He28], and 117(15) s [2006Ni09].
[d] The ordering of the two isomers is uncertain.

Table 2
Particle separation, Q-values, and measured values for direct particle emission of the even-Z, T_z = +49/2 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}	$BR_{cluster}$	type	Experimental
^{209}Hg	9.99(34)#	1.79(34)#					
^{213}1977Vy02Pb	8.94(20)#	2.98(15)					
^{217}Po	7.280(13)	6.662(2)	$\approx$ 100%				[**2004Li28, 2003Ku25**, 1997Li23, 1977Vy02, 1956Mo15]
^{221}Rn	7.193(15)	6.148(2)*	22(1)%				[**2004Li28, 1997Li23, 1977Vy02**, 1956Mo15]
^{225}Ra	7.045(11)	5.097(5)	$2.6(8)\times10^{-3}$%	[**2000Li37**]			
^{229}Th	6.598(3)	5.168(1)	100%				[**2000Ga52, 1987He28, 1970Ba20**, 2018Es07, 2014Va04, 1998Ga48, 1995Vo07, 1987AhZV, 1986He06, 1986He12, 1983Ra01, 1981Di14, 1971Bb10, 1970BaZZ, 1969Ba57, 1968Ba46, 1964Hy02, 1961Ko11, 1961Tr08, 1959Go87, 1950Ha52, 1949SeZU, 1947Ha02]
^{233}U	6.316(8)	4.909(1)	100%		$7.2(12)\times10^{-11}$%	^{24}Ne	[**2003Ba78, 1991Pr01, 1967Ba43**, 2024Gr01, 2020Si22, 2009Po15, 1998Ya17, 1992El01, 1986Ba65, 1985AlZQ, 1984Re05, 1979Ce04, 1977Ca04, 1976Kr03, 1976Va02, 1968 Ba25, 1968Ke15, 1967Ga15, 1967Mo28, 1967Tr07, 1966Ba43, 1964Ba42, 1961An08, 1961Po10, 1960Dz07, 1959Do63, 1958Cl49, 1953AsZZ, 1950Ha52, 1949SeZU, 1947Ha02]
^{237}Pu	5.575(50)	5.748(2)	$4.2(4)\times10^{-3}$%				[**1979El05**, 1957Ho68, 1957Th10]
^{237m1}Pu	2.38(21)	8.65(20)		obs			[**1978De07, 1974Ba82, 1971Br39, 1971Ru03**, 1982Ra04 1979Gu03, 1973Va16, 1972Vi10, 1971Te07, 1970Bu02, 1970Po01, 1970RuZS, 1969Me11, 1979VaZX]
^{237m2}Pu	2.38(26)	8.95(25)		obs			[**1973Va16**, 1979Gu03, 1974Ba82, 1972Vi10, 1971Ru03, 1971Te07, 1970Po01]
^{241}Cm	5.097(14)	6.185(1)	1.0(1)%				[**1975Ah05, 1974Po08**, 1971Bb10, 1969Ba57, 1967Ba42, 1965Ba51, 1952Hi11]
^{241m}Cm	2.65(20)	8.64(20)		obs			[**1972Vy07, 1971Br39, 1971Re11**, 1974SpZS, 1972Ga42, 1970Po01]
^{245}Cf	4.618(15)	7.258(2)	36.0(26)%				[**1996Ma72**, 2004He28, 1968Ku12, 1967Fi04, 1956Ch43]
^{249}Fm	4.069(53)	7.709(6)	15.6(1)%				[**2012He09, 2011Lo06**, 2006Ni09, 2004He28, 1967Mi03, 1966Ak01, 1959Pe27]
^{253}No	3.397(92)	8.415(4)	55(3)%				[**2012He09, 2011An13, 2011Lo06, 2006Lo12**, 2015KaZX, 2008DoZZ, 2006Po10, 2004He04, 2004He28, 1997He29, 1971GhZV, 1967Gh01, 1967Mi03]
^{257}Rf	3.169(84)	9.083(8)	79.3(17)%	1.3(3)%			[**2022Ha04, 2010St14, 1997He29**, 2016He08, 2009He20, 2008Dr05, 2002HeZS, 2001He35, 1985He06, 1985So03, 1974BeYN, 1969Gh01]
^{257m}Rf	3.095(86)	9.157(18)	81.0(25)%	14(9)%			[**2022Ha04, 2010St14, 1997He29, 1985So03**, 2016He08, 2009He20, 2008Dr05, 2002HeZS, 2001He35, 1985He06, 1974BeYN, 1969Gh01]
^{261}Sg	2.957(95)#	9.714(15)	98.1(5)%	0.6(2)%			[**2010St14**, 2010Be16, 2007St12, 2004He23, 1985Mu11, 1984De07, 1984Mu17, 1984Og03, 1983DeZH]
^{265}Hs	2.35(18)#	10.470(15)	$\approx$100%	$<$ 1%			[**2009He20, 2000HoZZ**, 2011Sa41, 1999He11, 1987Mu15, 1984DeZO, 1984Mu17]
^{265m}Hs	2.35(18)#-x	10.470(15)+x	$\approx$100%				[**2009He20**, 2011Sa41, 1999He11, 1984DeZO,
^{269}Ds	1.61(24)#	11.510(30)	100%				[**199He07**, 2002Ho11, 1995Ho03]

* Deduced from α energy, 6.163(3) in [2021Wa16].

Table 3
direct α emission from ^{217}Po, J^π = (9/2$^+$), $T_{1/2}$ = 1.52(3) s*, BR_α = $\approx$ 100%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J^π_f	$E_{daughter}$(^{213}Pb)	coincident γ-rays	R_0 (fm)	HF
6.664(3)	6.541(3)**	$\approx$ 100%	(9/2$^+$)	0.0	——	1.53953(24)	1.63(5)

* Weighted average of 1.53(3) s [2003Ku25] and 1.48(5) s [2004Li28].
** Weighted average of 6.543(4) MeV [2003Ku25] and 6.539(4) MeV (adjusted to 6.537(4) MeV in [1991Ry01]) [1977Vy02].

Table 4
direct α emission from ^{221}Rn*, J^{π} = (7/2$^+$), $T_{1/2}$ = 25(2) m**, BR_{α} = 22(1)%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}***	$E_{daughter}$(^{217}Po)***	coincident γ-rays***	R_0 (fm)	HF
5.882(2)	5.776(2)	9%	1.5%	(11/2$^+$)	0.265	0.265	1.55206(14)	12
5.893(2)	5.786(2)	15%	2.6%	(7/2$^+$)	0.254	0.254	1.55206(14)	8.1
6.148(2)	6.037(2)	100%	17.6%	(9/2$^+$)	0.0	——	1.55206(14)	17

* All values from [1977Vy02], except where noted. E_{α}(lab) values are adjusted by -1.7 keV in [1991Ry01]. [1977Vy02] lists uncertainties as 3 keV, which was reduced to 2 keV in [1997Li23].
** [1956Mo15].
*** [2018Ko01].

Table 5
direct α emission from ^{225}Ra*, J^{π} = 1/2$^+$, $T_{1/2}$ = 14.2(8) d**, BR_{α} = 2.6(8)$\times10^{-3}$%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}	$E_{daughter}$(^{221}Rn)	coincident γ-rays	R_0 (fm)	HF
5.066(5)	4.976(5)	30(17)%	6(3)$\times10^{-4}$%	(3/2$^+$)	0.030(10)			
5.097(5)	5.006(5)	100(25)%	2.0(5)$\times10^{-3}$%7/2$^+$	0.0	——			

* All values from [2000Li37], except where noted.
** [1950Ha52].

Table 6
direct α emission from ^{229}Th, J^{π} = 5/2$^+$, $T_{1/2}$ = 7894(40) y*, BR_{α} = 100% (1 of 3).

E_{α}(c.m.)**	E_{α}(lab)***	I_{α}(rel)	I_{α}(abs)	J_f^{π}@@	$E_{daughter}$ (^{225}Ra)@@	coincident γ-rays (keV)@@	HF@@@
4.5044(10)	4.426**	0.011%	0.006%	(5/2$^+$,7/2$^+$)	0.6632	**11.1**, **17.3**, **23.6**, **25.4**, 28.7, 29.9, **31.4**, **37.8**, 42.4, **42.8**, **44.0**, 49.7, 51.0, **53.8**, 55.2, 56.5, 59.3, 63.7, **65.0**, 68.1, **68.8**, 75.2, 77.6, **78.5**, **86.3**, 89.1, 94.7, 94.8, 98.9, 100.8, 107.1, 109.1, 110.3, 115.9, 118.1, 120.1, 123.2, 124.6, 126.1, 126.5, **131.9**, 134.2, 137.0, 139.8, 142.0, **142.9**, 147.7, 148.2, 149.9, 151.6, 154.3, **156.4**, 166.9, 167.5, 171.2, 174.1, 179.8, 185.6, 190.6, 193.5, 194.9, 200.8, 204.7, **210.3**, 210.9, 217.4, 218.2, 221.2, 225.3, 228.6, 234.8, 236.3, 242.6, **252.4**, 296.2, 303.8, 310.1, 313.3, 317.8, 349.4, 327.9, ***341.1***, 414.6, 419.9, 483.7, 513.5, 543.0, 551.7, 594.4	16
4.5587(10)	4.478@	0.016%	0.0091%		0.6089	11.1, **17.3**, **23.6**, **25.4**, **31.4**, 37.8, 42.4, **42.8**, 44.0, 55.2, 68.8, **75.2**, 86.3, 94.7, **102.5**, **107.1**, 118.1, **124.6**, 149.9, **169.2**, 182.1, 193.5, **216.0**, **225.3**, ***281.3***, 327.9, **459.1**, **565.7**	26
4.5631(10)	4.484(2)	0.070%	0.0396%	(5/2$^+$)	0.6045	11.2, **17.3**, 22.0, **23.6**, **25.4**, 29.9, **31.4**, 33.1, 37.8, 42.4, **42.8**, 44.0, 51.0, 55.2, 59.3, 63.7, **65.0**, 68.1, **68.8**, 75.2, 77.6, **86.3**, 89.1, 94.7, 94.8, 102.5, **107.1**, 109.1, 110.3, **114.8**, 115.9, 118.1, 120.1, 123.2, **124.6**, 126.1, **131.9**, 134.2, **137.0**, 139.8, **142.9**, 147.7, 148.2, 149.9, 151.6, 154.3, 156.4, 166.9, 154.3, 167.5, 169.2, 171.2, 174.1, 179.8, 182.1, 183.0, **185.6**, **189.3**, 190.6, **193.5**, 194.9, 200.8, 204.7, 210.9, 216.0, 217.4, 218.2, 225.3, 228.6, 234.8, 236.3, 242.6, 250.1, 267.4, **276.9**, 298.7, 320.8, 327.9, 349.4, 328.2, 336.7, **344.4**, 358.0, 361.0, 366.5, **368.1**, 377.4, **379.4**, 403.3, 408.5, **424.8**, 452.6, 453.3, ***454.8***, 478.0, **492.9**, 503.6, 523.5, **535.1**, 549.8, **561.8**, **573.0**, 579.2, 592.5	6.5
4.5748(10)	4.4949**	0.048%	0.027%	(3/2$^-$,5/2$^-$)	0.5928	**11.1**, **17.3**, 22.0, 23.6, **25.4**, 29.9, **31.4**, **33.1**, **37.8**, **42.4**, 42.8, **44.0**, 51.0, 55.2, 59.3, 63.7, **65.0**, 68.1,**68.8**, 75.2, 77.6, 86.3, **89.1**, 94.7, 94.8, **110.3**, **107.1**, 109.1, ***114.8***, 118.1, 120.1, 123.2, **124.6**, 126.1, **131.9**, 134.2, 137.0, **139.8**, **142.9**, 148.2, 149.9, 151.6, 154.3, 171.2, 174.1, 179.8, 183.0, **185.6**, **189.3**, 190.6, 194.9, 200.8, **217.4**, 218.2, 228.6, **234.8**, 250.1, 267.4, 298.7, 320.8, 349.4, 328.2, 358.0, 366.5, 377.4, 403.3, 408.5, 453.3, 452.6, 478.0, 523.5, 549.8, 592.5	11.6
4.6323(10)	4.5514**	0.026%	0.0145%	(5/2$^+$)	0.5353	**11.1**, **17.3**, **23.6**, **25.4**, 28.7, 29.9, **31.4**, 37.8, 42.4, **42.8**, 44.0, 49.7, **53.8**, 55.2, 56.5, 59.3, 63.7, **65.0**, 68.1, **68.8**, 75.2, 77.6, **78.5**, **86.3**, 51.0, 89.1, 94.7, 94.8, 98.9, 100.8, 110.3, 107.1, 109.1, 115.9, 118.1, 120.1, 123.2, 124.6, 126.1, 126.5, **131.9**, 134.2, 137.0, 142.0, **142.9**, 147.7, 148.2, 149.9, 151.6, 154.3, **156.4**, 166.9, 167.5, 171.2, 174.1, 179.8, 193.5, 194.9, 200.8, 204.7, 210.3, 210.9, ***213.5***, 218.2, 221.2, 225.3, 236.3, 242.6, 252.4, 296.2, 465, 503.6, 535.1	57

Table 7
direct α emission from ^{229}Th, J^{π} = 5/2^{+}, $T_{1/2}$ = 7894(40) y*, BR_{α} = 100% (continued, 2 of 3).

E_{α}(c.m.)**	E_{α}(lab)***	I_{α}(rel)	I_{α}(abs)	J_f^{π}@@	$E_{daughter}$ (^{225}Ra)@@	coincident γ-rays (keV)@@	HF@@@
4.6804(10)	4.5986**	0.092%	0.0519%		0.4872	11.1, 17.3, 23.6, **25.4**, 28.7, 29.9, 31.4, 37.8, 42.4, 42.8, 44.0, 49.7, 51.0, 53.8, 55.2, 56.5, 59.3, 63.7, 65.0, 68.1, 68.2, 68.8, **75.2**, 77.6, 78.5, 86.3, 89.1, 94.7, 94.8, ***97.0***, 98.9, 100.8, 110.3, 107.1, 109.1, **115.9**, 118.1, 120.1, 123.2, 124.6, 126.1, **126.5**, 131.9, 134.2, 137.0, 142.0, 142.9, 147.7, 148.2, 149.9, 151.6, 154.3, 156.4, **163.2**, 166.9, 1 67.5, 169.2, 171.2, **174.1**, 179.8, 193.5, 194.9, 200.8, 204.7, 210.3, 210.9, 218.2, 221.2, 225.3, 236.3, 242.6, 252.4, 278.7, **289.6**, 296.2	35
4.6808(10)	4.600(2)	0.037%	0.021%	(5/2^{+})	0.4868	**11.1**, **17.3**, 23.6, **25.4**, 29.9, 31.4, 37.8, 42.4, **42.8**, 44.0, 51.0, 55.2, 59.3, 65.0, 68.1, 68.8, 77.6, 86.3, 89.1, 94.7, 94.8, 110.3, 107.1, 118.1, 124.6, **137.0**, 148.2, 149.9, **154.3**, 179.8, ***307.3***, 336.7, 366.5, 375.1, 386.4, 417.4, 444.1, **461.4**, 487.3	87
4.6895(10)	4.608(2)	0.089%	0.05%	(5/2^{+})	0.4781	**11.1**, **17.3**, 22.0, 23.6, **25.4**, 29.9, **31.4**, **33.0**, **37.8**, 42.4, **42.8**, **44.0**, 51.0, 55.2, 59.3, 63.7, 65.0, 68.1, **68.8**, **75.2**, 77.6, **86.3**, 89.1, 94.7, 94.8, 110.3, 107.1, 118.1, 123.2, 124.6, **131.9**, 137.0, **139.8**, **142.9**, 148.2, 149.9, 154.3, 174.1, 179.8, ***185.6***, 190.6, 200.8, **217.4**, 218.2, 228.6, 234.8, 250.1, 267.4, **298.7**, 328.2, 358.0, 366.5, 377.4, 408.5, 453.3,452.6, 478.0	42
4.7211(10)	4.639**	0.082%	0.046%	(7/2^{+},9/2^{-})	0.4465	11.1, 17.3, 22.0, **23.6**, **25.4**, **28.7**, 29.9, **31.4**, **37.8**, 42.4, 42.8, **44.0**, 51.0, 59.3, 63.7, **65.0**, 68.1, 68.8, **75.2**, 77.6, 86.3, 89.1, 94.7, 94.8, 107.1, 110.3, 118.1, 123.2, 124.6, **131.9**, 137.0, **139.8**, **142.9**, 148.2, 149.9,154.3, 174.1, ***174.7***, 179.8, **186.1**, **190.6**, 200.8, 218.2, 217.4, **219.8**, 228.6, 234.8, 250.1, 267.4, 334.7, 345.8	76
4.7508(10)	≈4.667@	0.002%	0.00113%		0.4168	11.1, 17.3, 23.6, **25.4**, **31.4**, **37.8**, 42.4, 42.8, **44.0**, 55.2, 68.8, **75.2**, 86.3, **89.1**, 94.7, **102.5**, **107.1**, 118.1, **124.6**, 149.9, **169.2**, 182.1, 193.5, **216.0**, **225.3**, 327.9, ***347.4***	5×10^{3}
4.7641(10)	4.681**	0.021%	0.012%	(3/2^{+},5/2^{+})	0.4035	**11.1**, **17.3**, **25.4**, 31.4, 37.8, 42.4, **42.8**, 44.0, **49.7**, **68.8**, **75.2**, **86.3**, **109.1**, **120.1**, **126.1**, 151.6, ***183.0***, 194.9, 403.3	580
4.7681(10)	4.685**	0.008%	0.0046%	(3/2^{-})	0.3995	**11.1**, **17.3**, 23.6, **25.4**, 29.9, **31.4**, **37.8**, 42.4, **42.8**, **44.0**, 51.0, 55.2, 59.3, 65.0, 68.1, 68.8, 77.6, 86.3, 89.1, 94.7, 94.8, 110.3, 107.1, 118.1, 124.6, **137.0**, 148.2, 149.9, 154.3, 179.8, ***219.8***, **329,9**, 344.4, 399.9	1.6×10^{3}
4.7731(10)	4.690(2)	0.80%	0.45%	(5/2)$^{+}$	0.3945	**11.1**, **17.3**, 23.6, **25.4**, 28.7, 29.9, **31.4**, 37.8, 42.4, **42.8**, 44.0, 49.7, 51.0, **53.8**, 55.2, **56.5**, 59.3, 63.7, 65.0, 68.1, **68.8**, **72.8**, 75.2, 77.6, **78.5**, **86.3**, 89.1, 94.7, 94.8, 98.9, 100.8, 110.3, **107.1**, 109.1, 115.9, 118.1, 120.1, 123.2, **124.6**, 126.1, 126.5, **131.9**, 134.2, **137.0**, 142.0, **142.9**, 147.7, 148.2, 149.9, **151.6**, 154.3, **156.4**, ***158.4***, 166.9, 167.5, 171.2, 174.1, 179.8, 193.5, 194.9, 200.8, 204.7, **210.3**, **210.9**, 218.2, 221.2, 225.3, 236.3, 242.6, 252.4, 282.6, 293.8, 296.2, 351.7, 395.3	18
4.7734(10)	4.690(2)	0.019%	0.0104%	(3/2^{-},5/2^{-})	0.3942	**17.3**, 22.0, **23.6**, **25.4**, 31.4, **33.0** **37.8**, **42.8**, **44.0**, **51.0**, 55.2, **65.0**, 75.2, 77.6, 89.1, 94.7, 94.8, 101.6, 107.1, 10.3, 118.1, **124.6**, **134.2**, **139.8**, 149.9, ***169.2***, **182.1**, **190.6**, 193.5, 217.4, 225.3, 228.6, 234.8, **244.4**, 250.1, 267.4, 324.6, **368.9**	780
4.7774(10)	4.695(2)	0.21%	0.12%	(11/2^{+})	0.3902	**11.1**, 17.3, 23.6, **25.4**, 28.7, 29.9, **31.4**, **37.8**, 42.4, 42.8, 44.0, 49.7, 51.0, 53.8, 55.2, 56.5, 59.3, 63.7, 65.0, 68.1, 68.2, **68.8**, **75.2**, 77.6, 78.5, 86.3, 89.1, 94.7, 94.8, 98.9, 100.8, 110.3, 107.1, 109.1, **115.9**, 118.1, 120.1, 123.2, 124.6, 126.1, **126.5**, 131.9, 134.2, 137.0, 142.0, 142.9, 147.7, 148.2, 149.9, 151.6, 154.3, 156.4, ***163.2***, 166.9, 167.5, **169.2**, 171.2, **174.1**, 179.8, 193.5, 194.9,200.8, 204.7, 210.3, 210.9, 218.2, 221.2, 225.3, 236.3, 242.6, 252.4, 278.7, **289.6**, 296.2	72
4.8182(10)	≈4.737@	0.019%	0.0107%	(3/2,5/2^{+})	0.3494	**11.1**, **17.3**, 23.6, **25.4**, 31.4, 37.8, **42.8**, 44.0, 51.0, 55.2, 65.0, **68.8** 77.6, ***89.1***, **86.3**, 94.7, 94.8, **107.1**, **110.3**, 118.1, 124.6, **139.8**, 149.9, **190.6**, 217.4, 228.6, 234.8, 317.8, 349.4	860
4.8322(10)	≈4.748@	0.010%	0.0054%	(1/2^{+},3/2,5/2)	0.3354	17.3, 23.6, **125.4**, 31.4, 37.8, 42.8, 44.0, 51.0, 55.2, 65.0, 77.6, 89.1, 94.7, 94.8, 107.1, 110.3, 118.1, 124.6, 139.8, 149.9, **1185.6**, 90.6, 217.4, 228.6, 234.8, 303.8, ***310.1***	3.8×10^{3}
4.8404(10)	≈4.754@	0.23%	0.13%	(3/2^{+},5/2^{+})	0.3277	**11.1**, **17.3**, **23.6**, **25.4**, **31.4**, 37.8, 42.4, **42.8**, 44.0, 55.2, **68.8**, **75.2**, **86.3**, 94.7, ***102.5***, **107.1**, 118.1, 124.6, 149.9, **169.2**, **182.1**, **193.5**, **216.0**, **225.3**, **327.9**	180

Table 8
direct α emission from ^{229}Th, J^{π} = 5/2$^+$, $T_{1/2}$ = 7894(40) y*, BR_{α} = 100% (continued, 3 of 3).

E_{α}(c.m.)**	E_{α}(lab)***	I_{α}(rel)	I_{α}(abs)	J_f^{π}@@	$E_{daughter}$ (^{225}Ra)@@	coincident γ-rays (keV)@@	HF@@@
4.8458(10)	4.760(2)	3.19%	1.79%	(9/2$^+$)	0.3218	**11.1**, **17.3**, 23.6, **25.4**, 28.7, 29.9, **31.4**, 37.8, 42.4, **42.8**, 44.0, 49.7, 51.0, **53.8**, 55.2, 56.5, 59.3, 63.7, 65.0, **68.1**, **68.8**, **75.2**, 77.6, **78.5**, **86.3**, 89.1, **94.7**, 94.8, 98.9, **100.8**, 107.1, 109.1, 110.3, 115.9, 118.1, 120.1, 123.2, 124.6, 126.1, **126.5**, **131.9**, 134.2, 137.0, 142.0, **142.9**, 147.7, 148.2, 149.9, 151.6, 154.3, **156.4**, 166.9, 167.5, 171.2, 174.1, 179.8, 193.5, 194.9, 200.8, 204.7, ***210.3***, 210.9, 218.2, 221.2, 225.3, 236.3, 242.6, **252.4**, 296.2	
4.8833(10)	4.798(2)	2.67%	1.5%	7/2$^+$	0.2843	11.1, 17.3, 23.6, **25.4**, 29.9, **31.4**, 37.8, 42.4, **42.8**, **44.0**, 51.0, 55.2, 59.3, **63.7**, 65.0, 68.1, 68.8, 75.2, 77.6, 86.3, 89.1, 94.7, 94.8, **104.3**, 110.3, 107.1, **109.1**, 118.1, **120.1**, 124.6, 126.1, 134.2, **137.0**, 148.2, 149.9, 151.6, **154.3**, ***172.9***, 179.8, **183.9**, 194.9, **215.1**, 259.1	30
4.8954(10)	≈4.809@	0.75%	0.42%	(7/2$^-$,9/2$^-$)	0.2722	**11.1**, 17.3, 23.6, **25.4**, ***28.7***, **11.1**, 29.9, **31.4**, **37.8**, 42.4, 42.8, **44.0**, 51.0, 55.2, 59.3, 63.7, 65.0, 68.1, **68.8**, **75.2**, 77.6, **86.3**, 89.1, 94.7, 94.8, 98.9, 110.3, 118.1, 123.2, 124.6, **124.9**, **131.9**, 134.2, 137.0, 148.2, 149.9, 154.3, **171.8**, 174.1, 179.8, 200.8, 218.2	129
4.8997(10)	4.815(2)	16.55%	9.3%	7/2$^+$	0.2679	11.1, **17.3**, 23.6, **25.4**, 29.9, **31.4**, 37.8, 42.4, **42.8**, 44.0, 51.0, 55.2, 56.5, 59.3, 65.0, 68.1, **68.8**, 75.2, 77.6, **86.3**, 89.1, 94.7, 94.8, 107.1, 110.3, 115.9, 118.1, **124.6**, 137.0, 147.7, 148.2, 149.9, 154.3, ***156.4***, 166.9, 167.5, 179.8, 193.5, 204.7, 210.9, 225.3, 236.3, 242.6	6.2
4.9074(10)	4.822**	0.05%	0.026%	(5/2)$^-$	0.2602	**11.1**. **17.3**, **23.6**, 25.4, **31.4**, **37.8**, **42.8**, **44.0**, 51.0, 55.2, **65.0**, 77.6, 89.1, 94.7, 94.8, 107.1, **110.3**, 118.1, **124.6**, **139.8**, 149.9, **190.6**, ***217.4***, **228.6**, **234.8**	2.5×10^3
4.919(10)	≈4.833@	0.45%	0.253%	(3/2$^+$,5/2,7/2$^+$)	0.2486	11.1, **17.3**, 23.6, **25.4**, 29.9, 31.4, 37.8, 42.4, **42.8**, 44.0, 51.0, 55.2, 59.3, 65.0, 68.1, **68.8**, 77.6, 86.3, 89.1, 94.7, 94.8, ***98.9***, 110.3, **107.1**, 118.1, **124.6**, **137.0**, 148.2, 149.9, **154.3**, 179.8	310
4.9241(10)	4.838(2)	8.90%	5%	7/2$^+$	0.2435	**11.1**, **17.3**, 23.6, **25.4**, 29.9, **31.4**, **37.8**, 42.4, **42.8**, **44.0**, 51.0, 55.2, 59.3, 63.7, 65.0, 68.1, **68.8**, **75.2**, 77.6, 86.3, 89.1, 94.7, 94.8, 110.3, 107.1, 118.1, 123.2, 124.6, ***131.9***, 137.0, **142.9**, 148.2, 149.9, 154.3, 174.1, 179.8, 200.8, **218.2**	17
4.9313(10)	4.845(2)	100.00%	56.2%	5/2$^+$	0.2363	11.1, **17.3**, 23.6, **25.4**, 29.9, **31.4**, **37.8**, 42.4, **42.8**, **44.0**, 51.0, 55.2, **56.5**, 59.3, 65.0, 68.1, 68.8, 77.6, ***86.3***, 89.1, 94.7, 94.8, 110.3, **107.1**, 115.9, 118.1, **124.6**, **137.0**, 148.2, 149.9, **154.3**, 166.9, 179.8, **193.5**, 204.7,**210.9**, 236.3	1.7
4.9407(10)	≈4.852@	0.053%	0.03%	(11/2$^+$)	0.2269	**25.4**, **31.4**, 37.8, 44.0, **75.2**, ***126.5***	3.6×10^3
4.9425(10)	4.856**	0.023%	0.013%	3/2$^-$	0.2251	**17.3**, **23.6**, **25.4**, **31.4**, **42.8**, **55.2**, **75.2**, 94.7, **107.1**, 118.1, **124.6**, 149.9, **169.2**, ***182.1***, **193.5**, **225.3**	8.5×10^3
4.947(10)	4.860(2)	0.50%	0.28%	(7/2$^+$,9/2$^+$)	0.2206	11.1, **17.3**, **25.4**, **31.4**, **37.8**, 42.4, **42.8**, **44.0**, **49.7**, ***68.8***, **75.2**, **86.3**, **101,6**, **109.1**, **120.1**, **126.1**, 151.6, **194.9**	420
4.9513(10)	≈4.865@	0.073%	0.041%	(13/2$^+$)	0.2163	**25.4**, **31.4**, **37.8**, **44.0**, **75.2**, ***115.9***	3.1×10^3
4.9641(10)	≈4.878@	0.14%	0.077%	(9/2$^-$)	0.2035	**25.4**, **31.4**, **37.8**, **44.0**, ***134.2***	2.0×10^3
4.9879(10)	4.901(2)	18.15%	10.2%	5/2$^+$	0.1797	**11.1**, **17.3**, 23.6, **25.4**, 29.9, **31.4**, **37.8**, 42.4, **42.8**, **44.0**, 51.0, 55.2, 59.3, 65.0, **68.1**, 68.8, **75.2**, 77.6, **86.3**, 89.1, 94.7, 94.8, 110.3, 107.1, 118.1, 124.6, ***137.0***, **148.2**, 149.9, **154.3**, 179.8	21
5.0182(10)	4.930(2)	0.28%	0.16%	3/2$^+$	0.1499	**17.3**, 23.6, **25.4**, 31.4, **42.8**, 55.2, 94.7, ***107.1***, 118.1, **124.6**, 149.9	2.1×10^3
5.056(10)	4.968(2)	10.62%	5.97%	7/2$^+$	0.1116	***11.1***, **17.3**, **25.4**, **31.4**, **37.8**, **44.0**, 42.4, **42.8**, **68.8**, **75.2**, **86.3**	99
5.0671(10)	4.979(2)	5.64%	3.17%	(9/2)$^+$	0.1005	**25.4**, **31.4**, **37.8**, **44.0**, ***75.2***	220
5.0982(10)	5.009(2)	0.16%	0.09%	(7/2)$^-$	0.0694	**25.4**, **31.4**, ***37.8***, **44.0**	1.2×10^4
5.1124(10)	5.023(2)	0.02%	0.009%	(1/2$^-$)	0.0552	***23.6***, **31.4**, 55.2	1.5×10^5
5.1249(10)	5.036(2)	0.43%	0.24%	3/2$^+$	0.0427	***17.3***, **25.4**, **42.8**	6.6×10^3
5.136(10)	5.046**	0.36%	0.2%	3/2$^-$	0.0316	***31.4***	9.1×10^3
5.1422(10)	5.053(2)	11.74%	6.6%	5/2$^+$	0.254	***25.4***	310
5.1676(10)	5.077(2)	0.089%	0.05%	1/2$^+$	0.0	——	5.8×10^4

* Weighted average of 7880(120) y [1989Go19], 7917(48) y [2014Va04] and 7825(87) y [2018Es07].

** Deduced from γ energies [2000Ga52] and Q_{α} = 5167.6(10) keV [2021Wa16].

*** [1987He28]

@ [1970Ba20].

@@ [2000Ga52]. The 100% peak decaying from $E_{daughter}$ (i.e. the state that the α populated) is marked in ***bolditalic***, and peaks 10% or larger of the aforementioned peak are marked in **bold**.

@@@ R_0 (fm) = 1.53355(71) fm

Table 9
direct α emission from ^{233}U, J^{π} = 5/2$^+$, T$_{1/2}$ = 1.5903(13)$\times$10^5 y*, BR_{α} = 100% (1 of 2).

E_{α}(c.m.)**	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}@	$E_{daughter}$@ (^{229}Th)	coincident γ-rays (keV)@@	HF@@@
4.1596	4.0882	1.7×10^{-5}%	1.44×10^{-5}%	(5/2$^+$,7/2,9/2$^+$)	0.7491	25.3, 29.2, **42.4**, 42.6, **54.7**, 67.9, 71.8, 74.6, 76.3, 86.3, 88.7, 97.1, 117.2, 119.0, 146.3, 148.2, 514.7, 652.8, ***707.4***, 740.6, 749.8	13.5
4.2437	4.1708	1.1×10^{-6}%	9.3×10^{-7}%	(1/2,3/2)$^-$	0.6650	**29.2**, **135.3**, **164.5**, ***500.4***, **665.0**	1.1×10^3
4.2518	4.1788	7.0×10^{-6}%	6.1×10^{-6}%	(5/2$^+$,7/2,9/2$^+$)	0.6569	25.3, **29.2**, 37.8, 42.4, **42.6**, **53.6**, 54.7, 66.1, 67.9, 71.8, 83.0, 96.2, 97.1, 120.8, 125.4, 177.9, 315.9, 381.5, 406.6, 436.2, 494.5, 478.6, **531.5**, **559.9**, 584.9, ***614.6***, **627.7**, **657.3**	200
4.2713	4.1979	1.2×10^{-5}%	1.03×10^{-5}%	(5/2$^+$,7/2,9/2$^+$)	0.6375	25.3, **29.2**, 42.4, 42.6, 54.7 67.9, 71.8, 74.6, 76.3, 86.3, 87.3, **88.7**, 97.1, **117.2**, 119.0, **146.3**, 148.2, 212.3, ***402.4***, **425.3**, 480.7, **540.7**, 608.2, 637.3	1.7×10^3
4.2879	4..2143	8.4×10^{-6}%	7.3×10^{-6}%	(5/2$^+$,7/2)	0.6208	**25.3**, **29.2**, **42.4**, 42.6, **54.7**, 67.9, 71.8, 74.6, 97.1, 117.2, **146.3**, **474.4**, **523.6**, ***578.6***, **591.6**, **620.6**	330
4.3035	4.2296	1.0×10^{-5}%	8.7×10^{-6}%	5/2$^+$,7/2$^+$	0.6052	**29.2**, **42.4**, **42.6**, **71.8**, 76.3, 119.0, 148.2, 456.9, **533.5**, **563.0**, **576.1**, ***605.2***	370
4.3236	4.2494	9.5×10^{-6}%	8.3×10^{-6}%	(5/2$^+$,7/2,9/2$^+$)	0.5851	**29.2**, 42.4, **42.6**, **53.6**, **71.8**, 76.3, 119.0, 148.2, ***459.7***, 513.2, 542.4, 584.9	570
4.3394	4.2649	1.8×10^{-5}%	1.58×10^{-5}%	3/2$^+$,5/2$^+$	0.5693	**25.3**, **29.2**, 32.7, **42.4**, **42.6**, **43.7**, 51.0, 52.6, 53.6, **54.7**, 63.8, 67.9, 68.9, **71.8**, 74.6, 76.3, 83.0, 85.2, 86.3, **87.3**, 88.7, 89.4, 91.0, 96.2, 97.1, **97.4**, 101.7, 103.8, 111.9, 114.2, 117.2, 119.0, 125.4, 131.2, **135.3**, 139.7, 146.3, 148.2, 156.2, 162.5, 164.5, 165.6, 172.3, 174.2, 188.0, 208.2, 212.3, 216.1, 217.1, 223.4, 226.2, 248.7, 255.9, **261.9**, 278.1, 291.4, **307.3**, ***313,5***, 320.6, **404.3**, 423.1, **569.3**	350
4.3724	4.2973	3.0×10^{-6}%	2.6×10^{-6}%	(1/2$^-$)	0.5363	**29.2**, **135.3**, **164.5**, ***371.3***, **536.4**	4.5×10^3
4.384	4.309***	9.2×10^{-4}%	8.0×10^{-4}%	(5/2,7/2)$^-$	05265	**29.2**, **42.4**, **42.6**, 52.6, 68.9, **71.8**, **74.6**, 76.3, 86.3, 88.7, 97.4, **117.2**, 119.0, 135.3, 142.7, 145.3, **146.3**, 148.2, 164.5, **167.1**, 188.0, 217.1, 261.9, ***291.5***, **309.6**, **317.2**, 359.4, 455.1, 484.8	18
4.3953	4.3198	5.6×10^{-5}%	4.9×10^{-5}%	(5/2$^+$,7/2,9/2$^+$)	0.5134	**25.3, 29.2, 42.4, 42.6**, 53.6,**54.7**, 67.9, 71.8, 83.0, 96.2, 97.1, 125.4, 387.6, **416.2**, 441.5, ***471.1***, **513.2**	370
4.4301	4.3540	5.7×10^{-5}%	5.0×10^{-5}%	(7/2$^+$,9/2$^+$)	0.4787	25.3, **29.2, 37.8, 42.4, 42.6, 53.6, 54.7, 66.1**, 67.9, 71.8, 83.0, 96.2, 97.1, **120.8**, 125.4, **315.9, 381.5, 406.6**, 436.2, **494.5**, ***478.6***	680
4.4433	4.3670	1.4×10^{-4}%	1.19×10^{-4}%	(5/2$^-$,7/3,9/2$^+$)	0.4654	**25.3, 29.2**, 42.4, **42.6**, 53.6, 54.7, 63.8, 65.6, 67.9, 71.8, 74.6, 76.3 83.0, 89.4, 91.0, 96.2, 97.1, 101.7, 111.9, 117.2, **119.0**, 125.4, 131.2, 146.3, 148.2, 154.8, 162.5, 165.6, 177.9, 205.9, 208.2, 260.5, 273.7, ***291.9***, 303.0, 393.6, 423.1, 465.4	360
4.4719	4.3952	8.3×10^{-4}%	7.2×10^{-4}%	(7/2$^-$)	0.4368	25.3,**29.2**, 32.7, **42.4**, 42.6, 51.0, 52.6, 53.6, 54.7, 63.8, 67.9, 68.9, 71.8, 74.6, 76.3, ***77.1***, 83.0, 85.2, 86.3, 87.3, 88.7, 89.4, 91.0, 96.2, 97.1, 97.4, 101.7, 103.8, 111.9, 114.2, **116.3**, 117.2, 119.0, 125.4, 131.2, 135.3, 139.7, 142.7, 146.3, 148.2, 156.2, 162.5, 164.5, 165.6, 172.3, 174.2, 188.0, 208.2, 212.3, 216.1, 217.1, 223.4, 224.4, 248.7, 261.9, 272.4, 278.1, **291.4**, 311.9, **317.2**, 320.6, 339.2, **359.4**	101
4.481	4.404***	3.3×10^{-4}%	2.90×10^{-4}%	(5/2$^+$	0.4280	25.3, **29.2**, 32.6, 42.4, **42.6, 43.7, 53.6**, 54.7, 63.8, 65.6, 67.9, 71.8, 74.6, 76.3, 83.0, **87.3**, 89.4, 91.0, 96.2, 97.1, 101.7, 111.9, 117.2, 119.0, 125.0, **125.4**, 131.2, ***139.3***, 142.0, 146.3, 148.2, 154.8, 165.6, 177.9, 205.9, 208.2, 212.3, 226.2, 255.9, 259.3, 260.5, 273.7, 288.5, 303.0	290
4.4828	4.4059	6.2×10^{-4}%	5.40×10^{-4}%	(9/2$^+$)	0.4259	25.3, 29.2, 37.8, 42.4, 42.6, 53.6, 54.7, 63.8, 66.1, 67.9, 70.3, 71.8, 74.6, 76.3, **78.2**, 83.0, 89.4, 91.0, 96.2, 97.1, 101.7, 111.9, 116.3, 117.2, 119.0, 120.8, 123.9, 125.4, 131.2, **144.4**, 146.3, 148.2, 153.1, 165.6, **184.1**, 188.7, 208.2, ***230.1***, **328.5, 354.1, 383.5**, 390.6	160
4.488	4.411***	4.6×10^{-4}%	4.0×10^{-4}%***		0.421***		240
4.5262	4.4485	6.6×10^{-5}%	5.70×10^{-5}%	(7/2$^-$,9/2,11/2$^+$)	0.3825	**25.3**, 29.2, **42.4**, 42.6, **71.8**, 76.3, 101.7, **119.0**, 131.2, 148.2, **209.1**, ***310.7***	3.3×10^3
4.535	4.457***	3.1×10^{-3}%	2.70×10^{-3}%	(7/2$^+$)	0.3748	25.3, **29.2, 32.6**, 42.4, **42.6**, 43.7, **53.6**, 54.7, 67.9, 71.8, 74.6, 76.3, ***86.3***, **87.3**, 88.7, 97.1, 117.2, 119.0, 139.3, 142.0, 146.3, 148.2, 212.3, 226.2, 259.3, 288.5, 255.9, 303.0, 374.7	81
4.543	4.465***	5.2×10^{-3}%	4.50×10^{-3}%	7/2$^+$	0.3658	**25.3, 29.2, 42.4, 42.6, 53.6, 54.7**, 67.9, **71.8**, 74.6, 76.3, 83.0, **96.2**, 97.1, 101.7, 117.2, 119.0, 125.4, 131.2, 146.3, 148.2,192.3, **219.4**, **240.4, 268.7, 294.0**, ***323.3***, **336.6, 365.8**	66
4.5491	4.4710	6.9×10^{-4}%	6.00×10^{-4}%	(7/2$^+$)	0.3596	29.2, **42.4**, 97.4, 135.3, 164.5, 261.9, 142.7, ***317.2***, 359.4	470
4.561	4.483***	1.6×10^{-3}%	1.40×10^{-3}%	(5/2$^+$)	0.3478	25.3, 29.2, **42.4**, 42.6, **43.7**, ***44.8***, 53.6, 54.7, 63.8, 65.6, 67.9, 71.8, 74.6, 76.3, 83.0, **87.3**, 89.4, 91.0, **92.2**, 96.2, 97.1, 101.7, 111.9, 117.2, **119.0**, 125.4, 131.2, 146.3, 148.2, **154.8**, 165.6, 177.9, 205.9, 208.2, 212.3, 226.2, 255.9, **260.5**, 273.7, **303.0**	250

Table 10
direct α emission from ^{233}U, J^{π} = 5/2$^+$, $T_{1/2}$ = 1.5903(13)×10^5 y*, BR_{α} = 100% (continued, 2 of 2).

E_{α}(c.m.)**	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}@	$E_{daughter}$@ (^{229}Th)	coincident γ-rays (keV)@@	HF@@@
4.582	4.503***	01.2×10^{-3}%	1.02×10^{-3}%	(15/2$^+$)	0.3278	**29.2, 37.8, 42.4, 42.6, 53.6, 54.7, 66.1**, 71.8, **78.2**, 83.0, 96.2, **120.8**, 125.4, **144.4**, ***164.5***	480
4.586	4.507***	0.024%	0.0205%	(5/2)$^+$	0.3205	**25.3, 29.2, 32.7, 42.4, 42.6, 51.0**, 52.6, 53.6, 54.7, 63.8, 67.9, 68.9, 71.8, 74.6, 76.3, 83.0, 85.2, 86.3, 88.7, 89.4, 91.0, 96.2, 97.1, 101.7, 103.8, 111.9, **114.2**, 117.2, **119.0**, 125.4, 131.2, 135.3, 139.7, 146.3, 148.2, 156.2, 162.5, 164.5, 165.6, 172.3, 174.2, 188.0, **208.2**, 216.1, 217.1, 223.4, **248.7, 278.1**, ***291.4***, **320.6**	27
4.592	4.513***	0.023%	0.020%	(5/2)$^+$	0.3172	**29.2**, **42.6**, 52.6, 68.9, 71.8, 74.6, 76.3, 100.0, 117.2, 119.0, 135.3, 145.3, 146.3, 148.2, 152.6, 164.5, 169.1, 170.8, 188.0, 217.1, **245.3**, 274.7, **288.0**, ***317.2***	30
4.6057	4.5267	5.7×10^{-3}%	5.0×10^{-3}%	(7/2$^+$)	0.3030	**25.3, 29.2, 42.4, 42.6, 53.6**, 54.7, 63.8, **65.6**, 67.9, 71.8, 74.6, 76.3, 83.0, 89.4, **91.0**, 96.2, 97.1, 101.7, 111.9, 117.2, **119.0**, 125.4, **129.3**, 131.2, **146.3**, 148.2, **154.8**, 165.6, **177.9, 205.9, 208.2**, ***260.5***, **273.7**, **303.0**	150
4.617	4.538***	4.6×10^{-3}%	4.0×10^{-3}%***		0.292***		230
4.6202	4.5409	9.2×10^{-4}%	8.00×10^{-4}%		0.2885	25.3, **29.2**, ***32.6***, 42.4, 42.6, 43.7, 54.7, 67.9, 71.8, 74.6, 87.3, 97.1, 117.2, **135.3**, 142.0, 146.3, **164.5**, 212.3, 226.2, **259.3**, 255.9, **261.9**, 288.5	1.2×10^3
4.6208	4.5415	1.1×10^{-3}%	1.0×10^{-3}%	(7/2$^-$)	0.2879	**25.3, 29.2**, 42.4, **42.6**, ***51.0***, 53.6, 54.7, 63.8, 67.9, 71.8, 74.6, 76.3, 83.0, 89.4, 91.0, 96.2, 97.1, 101.7, 111.9, **114.2**, 117.2, **119.0**, 125.4, 131.2, **139.7, 146.3**, 148.2, 162.5, 165.6, **208.2**, **216.1**	980
4.645	4.565***	3.3×10^{-3}%	2.9×10^{-3}%	(1/2$^+$)	0.2619	**29.2**, ***97.4***, **135.3, 164.5, 261.9**	530
4.652	4.572***	1.1×10^{-3}%	1.0×10^{-3}%	(3/2,5/2$^+$,7/2$^+$)	0.2560	**29.2**, 42.4, **42.6**, 43.6, **53.6**, 71.8, 83.0, **87.3, 96.2**, 125.4, ***212.1***, **226.2**, 255.9	1.7×10^3
4.6671	4.5870	1.8×10^{-3}%	1.57×10^{-3}%	13/2$^+$	0.2416	**25.3, 29.2, 37.8, 42.4, 42.6, 53.6, 54.7, 66.1**, 67.9, 71.8, 78.2, 83.0, 96.2, **97.1**, 116.3, **120.8**, 125.4, ***144.4***	1.4×10^3
4.670	4.590	≈3.4×10^{-3}%	≈3.0×10^{-3}%	(7/2$^-$)	0.2374	**25.0, 25.3, 29.2**, 42.4, **42.6, 53.6, 63.8**, 71.8, **74.6**, 76.3, 83.0, **87.3**, **89.4, 91.0**, 96.2, 101.7, 111.9, **117.2, 119.0**, 125.4, 131.2, **146.3**, 148.2, 165.6, ***208.2***	≈770
4.6734	4.5931	8.0×10^{-4}%	7.00×10^{-4}%	(5/2$^-$,7/2$^-$)	0.2351	**29.2, 42.6**, 71.8, **74.6**, 76.3, 86.3, ***88.7***, **117.2**, 119.0, **146.3**, 148.2	3.4×10^3
4.692	4.611***	0.013%	0.0115%	(5/2$^-$)	0.2172	**29.2, 42.6, 52.6, 68.9**, 71.8, 76.3, **119.0, 135.3, 145.3**, 148.2, **164.5**, **188.0**, ***217.1***	280
4.696	4.615***	5.7×10^{-4}%	5.00×10^{-4}%	(5/2$^+$)	0.2123	25.3, **29.2**, 42.4, **42.6**, 53.6, 54.7, 67.9, 71.8, ***87.3***, **96.2, 212.3**	7.0×10^3
4.707	4.626***	<4.6×10^{-3}%	<4×10^{-3}***	11/2$^-$	0.2024		>1.0×10^3
4.715	4.634***	0.016%	0.0137%	(11/2$^+$)	0.1957	25.3, **29.2**, 42.4, **42.6, 53.6**, 54.7, 67.9, ***70.3***, 71.8, **97.1, 123.9**, 153.1	340
4.722	4.641***	3.4×10^{-3}%	3×10^{-3}%***		0.1870***	25.3, **29.2, 42.4, 42.6, 54.7, 67.9**, 71.8, ***92.9***, **97.1**	1.8×10^3
4.7352	4.6539	8.0×10^{-4}%	7.00×10^{-4}%	(9/2$^-$)	0.1735	***25.3***, **29.2**, 42.4, 42.6, 71.8, 76.3, 101.7, **119.0**, 131.2, 148.2	9.5×10^3
4.737	4.656***	≈6×10^{-3}%	≈5×10^{-3}%***		0.171***		≈1.4×10^3
4.7442	4.6627	4.8×10^{-3}%	4.2×10^{-3}%	(3/2$^-$)	0.1645	**29.2, 135.3**, ***164.5***	1.8×10^3
4.745	4.664***	0.074%	0.064%***	11/2$^+$	0.1633	**25.3, 29.2, 37.8, 42.4, 42.6, 53.6, 54.7**, ***66.1***, 71.8, 83.0, **96.2, 97.1**, 120.8, 125.4	123
4.7606	4.6788	1.0×10^{-3}%	9.00×10^{-4}%	(7/2$^-$)	0.1482	**29.2**, 42.6, 71.8, 76.3, ***119.0***, 148.2	1.1×10^4
4.763	4.681***	7.5×10^{-3}%	6.50×10^{-3}%	(5/2$^-$)	0.1464	**29.2, 42.6**, 71.8, 74.6, 117.2, ***146.3***	1.6×10^3
4.769	4.687***	3.2×10^{-3}%	2.8×10^{-3}%***		0.140***	**25.3, 29.2, 42.4, 42.6, 43.7, 54.7, 65.6, 67.9, 71.8, 97.1, 120.8**	4.1×10^3
4.783	4.701***	0.12%	0.107%	(9/2)$^+$	0.1254	**29.2**, 42.4, **42.6**, ***53.6***, **71.8**, 83.0, **96.2**, 125.4	136
4.812	4.729***	1.94%	1.69%	9/2$^+$	0.0971	**25.3, 29.2, 42.4, 42.6**, ***54.7***, 67.9, 71.8, **97.1**	13.6
4.834	4.751***	0.011%	0.01%***		0.075***	***54.7***	3.3×10^3
4.837	4.754***	0.47%	0.41%	(7/2$^+$)	0.0718	**29.2**, ***42.6***, **71.8**	84
4.841	4.758***	0.018%	0.016%***		0.067***	**25.3, 42.4, 67.9**	2.3×10^3
4.867	4.783***	11.49%	10%	7/2$^+$	0.0424	***42.4***	5.5
4.880	4.796***	0.57%	0.5.%	(5/2$^+$)	0.0292	***29.2***	135
4.888	4.804***	0.059%	0.051%***		0.0204***		1.5×10^3
4.9087	4.8244	100.00%	87%	5/2$^+$	0.0	——	1.22

* [2009Po15].

** Deduced from γ energies [2003Ba78] and Q_{α} = 4908.7(12) keV [2021Wa16], except where noted.

*** Measured α energies from[1967Ba43]. I_{α}(abs) indicates the transition was not observed in [2000Ga52].

@ [2008Br17].

@@ γ's from [2003Ba78]. The 100% peak decaying from $E_{daughter}$ (i.e. the state that the α populated) is marked in ***bolditalic***, and peaks 10% or larger of the aforementioned peak are marked in **bold**.

@@@ R_0 (fm) = 1.52555(39) fm

Table 11
direct α emission from ^{237}Pu*, $J^\pi = 7/2^-$, $T_{1/2}$ = 45.31(3) d**, $BR_\alpha = 4.2(4)\times10^{-3}$%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{233}U***)	coincident γ-rays (keV)	R_0 (fm)	HF
5.186(3)	5.099(3)	≈1.1%	$\approx2.1\times10^{-3}$%		0.5615(20)	40.4, 51.5, 92.0, 228.6, 241, 280.4, 320.8, 521.1	1.50884(18)	≈17
5.244(2)	5.155(2)	14.7%	0.027%		0.50362(10)	40.4, 51.5, 92.0, 181.8, 205.0, 228.6, 258.5, 280.4, 298.9, 320.8, 411.1, 463.1, 503.9	1.50884(18)	3.1
5.350(2)	5.260(2)	≈1.6%	$\approx2.9\times10^{-3}$%		0.39755(21)	32.9, 40.4, 43.7, 51.5, 54.8, 63.1, 76.7, 92.0, 114.7, 198.6, 228.6, 258.5, 261.7, 280.4, 298.9, 305.4, 313.3, 320.8	1.50884(18)	≈130
5.394(2)	5.303(2)	28.0%	0.051%		0.35378(12)	32.9, 40.4, 51.5, 54.8, 63.1, 92.0, 114.7, 198.6, 228.6, 258.5, 261.7, 280.4, 298.9, 313.3, 320.8	1.50884(18)	14
5.427(2)	5.335(2)	100%	0.18%	$5/2^-$	0.32077(5)	40.4, 51.5, 92.0, 228.6, 280.4, 320.8	1.50884(18)	5.9
5.449(2)	5.357(2)	39.5%	0.072%	$5/2^-$	0.29882(1)	40.4, 258.5, 298.9	1.50884(18)	20
5.592(2)	5.498(2)	≈16.3%	≈0.030%	$(11/2^+)$	0.15523(8)	40.4, 51.5, 63.1, 114.7	1.50884(18)	≈330
5.656(2)	5.560(2)	16.6%	0.030%	$9/2^+$	0.09215(4)	40.4, 51.5, 92.0	1.50884(18)	730
5.707(2)	5.611(2)	8.3%	0.015%	$7/2^+$	0.04035(1)	40.4	1.50884(18)	2.8×10^3
5.748(2)	5.651(2)	4.8%	8.8×10^{-3}%	$5/2^+$	0.0	——	1.50884(18)	8.0×10^3

* All values from [1979El05], except where noted.
** Weighted average of 45.66(4) d [1994Ta25], and 45.12(3) d [1981Ba15].
*** [2020Si28].

Table 12
direct α emission from ^{241}Cm*, $J^\pi = (1/2^+)$, $T_{1/2}$ = 32.8(2) d**, BR_α = 1.0(1)%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{237}Pu***)	coincident γ-rays (keV)***	R_0 (fm)	HF
5.783(3)	5.687(3)	0.32(8)%	$2.2(5)\times10^{-3}$%	$5/2^+$	0.4042	9.9, 45.7, 55.6, 68.8, 79.1, 123.8, 124.7, 179.9, 203.0, 248.7, 280.2	1.49798(88)	33^{+11}_{-7}
5.816(3)	5.719(3)	0.12(6)%	$8(4)\times10^{-4}$%	$3/2^+$	0.3704	9.9, 214.9, 224.9	1.49798(88)	140^{+150}_{-50}
5.882(3)	5.784(3)	≈0.10%	$\approx7\times10^{-4}$	$9/2^+$	0.304		1.49798(88)	≈360
5.962(3)	5.863(3)	0.20(8)%	$1.4(5)\times10^{-3}$%	$7/2^+$	0.2243	9.9, 68.8	1.49798(88)	480^{+290}_{-130}
5.984(3)	5.885(3)	17(2)%	0.118(13)%	$5/2^+$	0.2012	9.9, 45.7, 55.6	1.49798(88)	$7.5^{+1.0}_{-0.8}$
6.014(3)	5.914(3)	0.17(7)%	$1.2(5)\times10^{-3}$%	$13/2^-$	0.175		1.49798(88)	$1.0^{+0.8}_{-0.3}\times10^3$
6.029(3)	5.929(3)	26.3(27)%	0.0181(19)%	$3/2^+$	0.1555	9.9	1.49798(88)	$8.4^{+1.5}_{-1.1}$
6.039(3)	5.939(3)	100(10)%	0.689(70)%	$1/2^+$	0.1455		1.49798(88)	2.5(3)
6.079(3)	5.978(3)	0.41(11)%	$2.8(8)\times10^{-3}$%	11^-2	0.106		1.49798(88)	$1.0^{+0.4}_{-0.2}\times10^3$
6.138(3)	6.036(3)	0.17(6)%	$1.2(4)\times10^{-3}$%	$9/2^-$	0.0477	47.7	1.49798(88)	$4.5^{+2.4}_{-1.2}\times10^3$
6.185(3)	6.082(3)	0.22(8)%	$1.5(5)\times10^{-3}$%	$7/2^-$	0.0	——	1.49798(88)	$6.2^{+3.4}_{-1.7}\times10^3$

* All values from [1975Ah05], except where noted.
** [1974Po08].
*** [2006Ba41].

Table 13
direct α emission from ^{245}Cf*, $J^\pi = (1/2^+)$, $T_{1/2}$ = 46.4(3) m, BR_α = 36.0(26)%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{241}Cm)	coincident γ-rays (keV)	R_0 (fm)	HF
7.101	6.985	0.34%	0.11%	$9/2^+$	0.160		1.497(31)	150
7.140	7.023	0.34%	0.11%	$7/2^+$	0.122		1.497(31)	220
7.182	7.065	0.74%	0.24%	$5/2^+$	0.080		1.497(31)	150
7.208	7.090	7.6%	2.5%	$5/2^+$	0.0561	50.6, 56.1	1.497(31)	18
7.261(2)	7.142(5)**	100%	33.0%	$1/2^+$	0.0	——	1.497(31)	$2.2^{2.4}_{1.2}$

* All values from [1996Ma72], except where noted.
** [2004He28].

Table 14
direct α emission from ^{249}Fm*, $J^\pi = (7/2^+)$, $T_{1/2}$ = 99(6) s**, BR_α = 15.6(1)%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J^π_f	$E_{daughter}$(^{245}Cf)	coincident γ-rays (keV)	R_0 (fm)	HF
7.652	7.529	15.6(1)%	$(1/2^+)$	0.047	0.047	1.4867(57)	0.73^{+12}_{-10}

* All values from [2012He09], except where noted.
** Weighted average of 96(9) s [2004He28], and 117(15) s [2006Ni09].

Table 15
direct α emission from ^{253}No*, $J^\pi = (9/2^-)$, $T_{1/2}$ = 1.56(2) m, BR_α = 55(3)%***.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J^π_f	$E_{daughter}$(^{249}Fm)	coincident γ-rays (keV)***	R_0 (fm)	HF
7.742(15)	7.620(15)**	0.26(6)%**	0.14(3)%**	$(7/2^-)$	0.6695**	669.5**	1.4730(54)	22^{+8}_{-6}
8.132(5)	8.003(5)	100(1)%	53(3)%	$(9/2^-)$	0.279	58, 71, 129, 150, 221, 279	1.4730(54)	1.4(2)
8.200(10)	8.070(10)	4.4(6)%	2.3(4)%	$(5/2^-+)$	0.211	211	1.4730(54)	56^{+14}_{-11}
8.281(20)	8.150(20)		obs	$(11/2^+)$	0.129	58, 71, 129	1.4730(54)	
8.352(20)	8.220(20)		obs	$(9/2^+)$	0.058	58	1.4730(54)	
8.413(20)	8.280(20)		obs	$(7/2^+)$	0.0	——	1.4730(54)	

* All values from [2006Lo12], except where noted.
** [2012He09].
*** [2011An13].

Table 16
direct α emission from ^{257}Rf*, $J^\pi = (1/2^+)$, $T_{1/2}$ = 5.5(4) s, BR_α = 79.3(17)%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J^π_f	$E_{daughter}$(^{253}No)	coincident γ-rays (keV)	R_0 (fm)	HF
8.584(15)	8.450(15)				0.510		1.468(22)	
8.637(11)	8.503(11)***				0.450	0.167, 0.283	1.468(22)	
8.823(15)	8.686(15)				0.258	0.091, 0.167	1.468(22)	
8.923(5)	8.784(5)**			$(5/2^+)$	0.167	0.167	1.468(22)	
9.092(15)	8.950(15)			$(9/2^-)$	0.0	——	1.468(22)	

* All values from [2010St14], except where noted.
** Weighted average of 8.778(10) MeV [2010St14] and 8.785(5) MeV [2022Ha04].
*** Weighted average of 8.510(15) MeV [2010St14] and 8.497(15) MeV [2022Ha04].

Table 17
direct α emission from ^{257m}Rf*, Ex. = 74(16) keV, $J^\pi = (11/2^-)$, $T_{1/2}$ = 4.9(7) s**, BR_α = 81.0(25)%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J^π_f	$E_{daughter}$(^{253}No)	coincident γ-rays (keV)	R_0 (fm)	HF
8.417(5)	8.286(5)	3.1(9)%	1.8(2)%		0.750		1.468(22)	$3.5^{+2.8}_{-1.7}$
9.107(5)	8.965(5)	100(36)%	58(15)%		0.063		1.468(22)	15^{+13}_{-8}
9.166(5)	9.023(5)	8.1(27)%	4.7(11)%	$(9/2^-)$	0.0	——	1.468(22)	280^{+240}_{-150}

* All values from [2022Ha04], except where noted.
** [2010St14].

Table 18
direct α emission from ^{261}Sg*, $J^\pi = (3/2^+)$, $T_{1/2}$ = 184(5) ms, BR_α = 98.1(5)%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J^π_f	$E_{daughter}$(^{257}Rf)	coincident γ-rays	R_0 (fm)	HF
9.556(10)	9.410(10)	98.1(5)%	$(1/2^+)$	0.157	0.107, 0.157	1.459(22)	$1.2^{+0.9}_{-0.5}$

* All values from [2010St14].

Table 19
direct α emission from ^{265}Hs*, $T_{1/2}$ = 1.9(2) ms, BR_α = ≈100%.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	J_f^π	$E_{daughter}$(^{253}No)	coincident γ-rays (keV)	R_0 (fm)	HF
10.440(15)	10.282(15)							
10.470(15)	10.312(15)							
10.588(15)	10.428(15)							
10.735(15)	10.573(15)							

* All values from [2009He20], From the text of this reference: "α lines were modified by energy summing with conversion electrons; therefore line intensities could not be deduced unambiguously."

Table 20
direct α emission from ^{265}Hs*, Ex. = unk., $T_{1/2} = 300^{+200}_{-100}$) μs, BR_α = ≈100%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{253}No)	coincident γ-rays (keV)	R_0 (fm)	HF
10.700(15)	10.538(15)	≈100%				1.483(18)	$0.7^{+0.6}_{-0.4}$

* All values from [2009He20].

Table 21
direct α emission from ^{269}Ds*, $T_{1/2} = 170^{160}_{70}$ μs, BR_α = 100%.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{217}Po)***	coincident γ-rays***	R_0 (fm)	HF
11.280(20)	11.112(20)	100%		0.0?		1.450(27)	$1.1^{+1.5}_{-1.2}$

* All values from [1999He07].

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