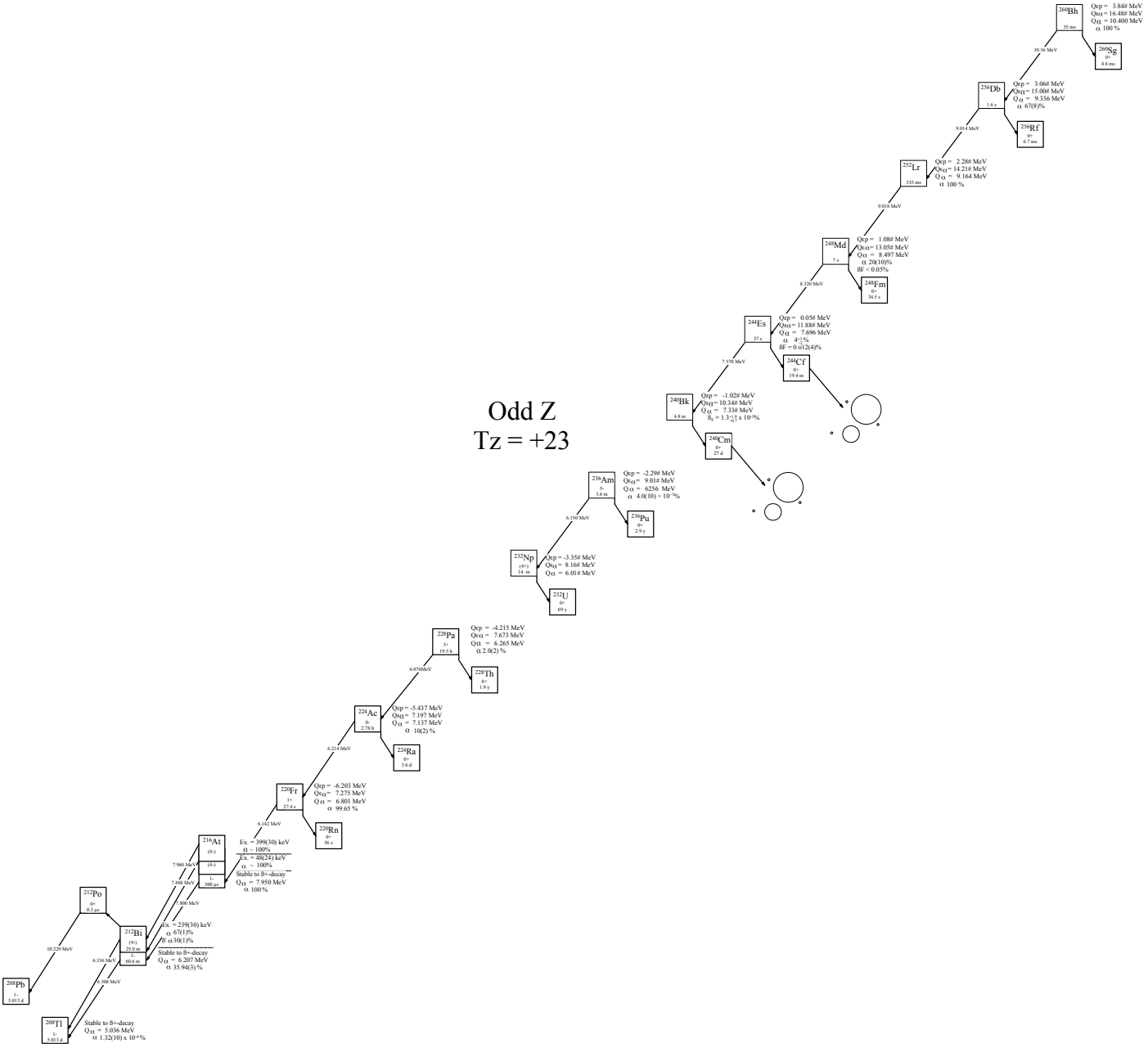

Fig. 1: Known experimental values for heavy particle emission of the odd-Z T_z= +23 nuclei.

Last updated 10/21/2024

Table 1
Observed and predicted β-delayed particle emission from the odd-Z, T_z = +23 nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. The J^π value for ^{208}Tl is taken from ENSDF.

Nuclide	Ex.	J^π	$T_{1/2}$	Q_ε	Q_{β^-}	$Q_{\beta^- \alpha}$	$BR_{\beta^- \alpha}$	$BR_{\varepsilon F}$	Experimental
^{208}Tl(ThC")*		5^+	3.0527(33) m	-3.480(30)	4.998(2)	5.695(2)			[**1971Ac02**]
^{212}Bi(ThC)		1^-	60.600(43) m	-0.569(2)	2.252(2)	11.386(2)			[**1961Ap03**]
^{212m}Bi	0.239(30)	(9^-)	25.0(2) m	-0.340(30)	2.491(30)	11.625(30)	30(1)%		[**2013Ch12, 1984Es01, 1980Le27**, 1978Ba44, 1978BaYL, 1978BaZI]
					$Q_{\varepsilon p}$	$Q_{\varepsilon \alpha}$			
^{216}At		1^-	300(30) μs	0.474(4)	-6.662(7)	7.381(4)			[**1951Me10**]
^{216m1}At	0.048(24)	(4^-)		0.522(24)	-6.614(25)	7.429(24)			[**1994Li10, 1971Br13, 1965Br11**]
^{216m2}At	0.399(30)	(9^-)		0.873(30)	-6.263(31)	7.780(30)			[**1994Li10, 1971Br13, 1965Br11**]
^{220}Fr		1^+	27.4(3) s	0.870(4)	-6.203(5)	7.275(4)			[**1971Br13**]
^{224}Ac		0^-	2.78(16) h**	1.408(4)	-5.437(4)	7.197(4)			[**1951Me10, 1987Mi10**]
^{228}Pa		3^+	19.5(4) h	2.153(4)	-4.215(5)	7.673(5)			[**2021Km01**]
^{232}Np		(4^+)	14.7(3) m	2.75(10)#	-3.35(10)#	8.16(10)#			[**1970Ho27**]
^{236}Am		5^-	3.6(2) m	3.14(12)#	-2.29(12)#	9.01(12)#			[**2005As01**]
^{240}Bk			4.8(8) m	3.94(15)#	-1.02(15)#	10.34(15)#		$1.3^{+1.8}_{-0.7}\times10^{-3}$%	[**1983Ga05**, 1980Ga07, 1980GaZZ]
^{244}Es			37(4) s	4.55(18)#	0.05(18)#	11.88(18)#		0.012(4) %	[**2002Sh02**, 1980Ga07, 1980GaZZ]
^{248}Md			13^{+3}_{-2} s	5.05(18)#	1.08(19)#	13.05(18)#		< 0.05%	[**2024PoXY**]
^{252}Lr			410^{+70}_{-50} ms	5.67(19)#	2.28(19)#	14.21(19)#			[**2024PoXY**]
^{256}Db			$1.4^{+0.3}_{-0.2}$ s	6.08(19)#	3.06(19)#	15.00(19)#			[**2024PoXY**]
^{260}Bh			35^{+19}_{-9} ms	6.58(20)#	3.84(20)#	16.48(20)#			[**2008Ne01**]

* 100% β^- emitter.
** Weighted average of 2.9(2) h [1951Me10] and 2.55(28) h [1987Mi10].

Table 2
Particle separation, Q-values, and measured values for direct particle emission of the odd-Z, T_z = +23 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
^{208}Tl(ThC")	7.552(30)	1.22(20)			
^{212}Bi(ThC)	4.914(3)	6.207	35.94(3) %*		[**1971Gr17, 1962Be09, 1960Sc07, 1960Wa14**, 1984Es01, 1969Gr28, 1966Il01, 1966KlZZ, 1963Co28, 1961Ap03, 1961Ba12, 1961Fe04, 1960Ga15, 1960Gi07, 1960Ha19, 1958De25, 1956Ho11, 1956Ko60, 1955We10, 1949Me54, 1948Gh01, 1943Ka05, 1933Ru03]
^{212m}Bi	4.675(30)	6.446(30)	67(1)%		[**1984Es01**, 1978Ba44]
^{216}At	4.491(4)	7.950(3)	100%		[**1994Li10, 1971Br13, 1965Br11**, 1973BoXL, 1973BoXW, 1964Br16, 1964Mc21, 1962Wa28, 1951Me10, 1949Me54, 1948Gh01]
^{216m1}At	4.443(24)	7.998(24)	obs		[**1994Li10, 1971Br13, 1965Br11**]
^{216m2}At	4.092(20)	8.349(30)	obs		[**1994Li10, 1971Br13, 1965Br11**]
^{220}Fr	4.636(4)	6.801(2)	99.65%		[**1996Sh05, 1971Br13**, 1974Ho27, 1973ChZH, 1970Br29, 1968Ba73, 1964Br16, 1964Mc21, 1951Me10, 1949Me54, 1948Gh01]
^{224}Ac	4.288(4)	6.327(1)	10(2)%		[**1968Le17, 1992Li31, 1951Me10**, 1987Mi10, 1976MiZR, 1973ChZH, 1970Br31, 1969LeZW, 1968Ba73, 1968Br15, 1967Br15, 1964Mc21, 1958Hi78, 1949Me54, 1948Gh01]
^{228}Pa	4.170(5)	6.265(1)	2.0(2)%		[**1994Ah03**, 1993Sh07, 1964Ge08, 1958Hi78, 1951Me10, 1949Me54, 1948Gh01]
^{232}Np	3.74(10)#	6.01(10)#			
^{236}Am	3.43(12)#	6.256(64)	$4.0(10)\times10^{-3}$%		[**2004Sa05, 2002As08**, 1989HaZO]
^{240}Bk	2.77(21)#	7.20(19)#			
^{244}Es	2.25(26)#	7.696(20)**	4^{+3}_{-2}%		[**1973Es02**]
^{248}Md	2.01(26)#	8.785(47)$^{@}$	61(16)-68(22)%		[**2024PoXY, 1973Es01**, 2008Ne01, 1971EsZY, 1971EsZZ]
^{252}Lr	1.60(26)#	9.132(47)$^{@@}$	70-90%		[**2024PoXY, 2001He35**, 2008Ne01, 1999He07, 1999HeZX]
^{256}Db	1.32(26)#	9.265(47)$^{@@@}$	90(4)%	10(4)%	[**2024PoXY, 2001He35**, 2020Ku23, 1999He07, 1999He11, 1999HeZX]
^{260}Bh	0.69(27)#	10.400(59)	100%	<18%	[**2008Ne01**, 1983OgZX]

* Weighted average of 35.81(4) % [1962Be09], 35.96(6) % [1960Sc07] and 36.00(3) % [1962Wa14].
** Deduced from α energy, 7.94(10) MeV in [2021Wa16].
*** Weighted average of 70(11) % [2008Ne01] and 64(12) % [2001He35].
$^{@}$ Deduced from α energy, 8.497(30) MeV in [2021Wa16].
$^{@@}$ Deduced from α energy, 9.164(17) MeV in [2021Wa16].
$^{@}$ Deduced from α energy, 9.336(30) MeV in [2021Wa16].

Table 3
direct α emission from ^{212}Bi, $J^{\pi} = 1^{-}$, $T_{1/2}$ = 60.600(43) m*, BR_{α} = 35.94(3) %**.

E_{α}(c.m.)	E_{α}(lab)***	I_{α}(rel)@@	I_{α}(abs)	$J_f^{\pi a}$	$E_{daughter}$(^{208}Tl)	coincident γ-rays[a]	R_0 (fm)[b]	HF
5.399	5.297***	$1.6(4)\times10^{-4}$%	$1.4(4)\times10^{-5}$%		0.803	0.0399, 0.0430, 0.1420, 0.1436, 0.2669, 0.2854, 0.2888, 0.3104, 0.4337, 0.4530, 0.4730	1.495(21)	$1.8^{+1.1}_{-0.7}\times10^{4}$
5.443	5.340***	1.4×10^{-3}%	3.6×10^{-4}%		0.759	0.0399, 0.1420, 0.1436, 0.2669, 0.2854, 0.2888, 0.4337, 0.4530, 0.4730	1.495(21)	3.4×10^{3}
5.581	5.476***	0.020%	5.0×10^{-3}%		0.521		1.495(21)	3.8×10^{3}
5.710	5.602***	1.7%	0.43%	$(3)^{+}$	0.492	0.0399, 0.4530	1.495(21)	60
5.729	5.621***	0.24%	0.06%	(4^{+})	0.473	0.0399, 0.4337, 04730	1.495(21)	540
5.874	5.763***	2.3(2)%	0.59(4)%@@@	5^{+}	0.328	0.0399, 0.2882, 0.3280	1.495(21)	260^{+150}_{-100}
6.63291(26)	6.50776(26)@	100.0(4)%@@@	25.2(1)%	4^{+}	0.0398	0.0399	1.495(21)	110^{+70}_{-40}
6.20699(34)	6.08988(34)@	38.5(7)%@@@	9.7(2)%	5^{+}	0.0	——	1.495(21)	430^{+250}_{-160}

* [1961Ap03].
** Weighted average of 35.81(4) % [1962Be09], 35.96(6) % [1960Sc07] and 36.00(3) % [1962Wa14].
*** Values from [1960Wa14], adjusted by -0.7 MeV in [1991Ry01].
@ Values from [1991Ry01], based on measured values from [1971Gr17].
@@ Values from [1960Wa14], except where noted.
@@@ [1982Be09].
[a] [2007Ma45].
[b] Interpolated between 1.449(21) fm (^{210}Pb) and 1.539616(24) fm (^{214}Po).

Table 4
direct α emission from ^{212m}Bi*, Ex. = 239(30) keV**, $J^{\pi} = (9^{-})$, $T_{1/2}$ = 25.0(2) m, BR_{α} = 67(1) %.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}	$E_{daughter}$(^{208}Tl)	coincident γ-rays	R_0 (fm)***	HF
5.861	5.750	1.4(6)%	0.5(2)%	(6^{+})	0.617	0.0399, 0.1436, 0.2882, 0.2888, 0.3280, 0.4337, 0.4730	1.495(21)	80^{+80}_{-40}
6.129	6.013	14(3)%	5(1)%	5^{+}	0.3280	0.0399, 0.2882, 0.3280	1.495(21)	160^{+100}_{-70}
6.418	6.297	74(4)%	26(1)%	4^{+}	0.0399	0.0399	1.495(21)	480^{+270}_{-180}
6.458	6.336	100(3)%	35(1)%	5^{+}	0.0	——	1.495(21)	520^{+290}_{-190}

* All values from [1984Es01], except where noted.
** [2013Ch12].
*** Interpolated between 1.449(21) fm (^{210}Pb) and 1.539616(24) fm (^{214}Po).

Table 5
β^{-}-delayed α emission from ^{212m}Bi*, $BR_{\beta^{-}\alpha}$ = 30(1) %**.

E_{α} (c.m.)	E_{α} (lab.)	I_{α}(rel)%***	I_{α}(abs)%	$E_{emitter}$ (^{212}Po)	$E_{daughter}$(^{208}Pb)
10.702(10)	10.500(10)	≈2%	≈1.5%	1.75	0.0
10.610(10)	10.410(10)	≈9%	≈6%	1.655	0.0
10.565(10)	10.366(10)	≈7%	≈4.5%	1.610	0.0
10.531(10)	10.332(10)	≈9%	≈6%	1.575	0.0
10.500(10)	10.302(10)	≈11%	≈7.5%	1.545	0.0
10.426(5)	10.229(5)	≈100%	≈66	1.474	0.0
10.304(5)	10.110(5)	≈95%	≈63%	1.354	0.0
10.201(10)	10.009(10)	≈5%	≈3%	1.247	0.0
10.086(5)	9.896(5)	≈18%	≈12%	1.131	0.0

* All values taken from [1980Le27], except where noted.
** [1984Es01].
*** estimated by the evaluator based on Fig. 1 in [1980Le27].

Table 6
direct α emission from ^{216}At*, $J^{\pi} = 1^{-}$, $T_{1/2}$ = 300(30) μs**, BR_{α} = 100 %.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{212}Bi)	coincident γ-rays	R_0 (fm)$^{@@}$	HF
7.457(17)	7.319(17)	≈0.09%	≈0.09%	(3^{-})	0.4946(3)	0.1512, 0.3793	1.55012(74)	≈ 77
7.534(17)	7.394(17)	≈0.28%$^{@}$	≈0.27%$^{@}$	(2^{-})	0.4179(2)	0.0979, 0.1512, 0.2048, 0.4179	1.55012(74)	≈ 45
7.536(17)	7.396(17)	≈0.28%$^{@}$	≈0.27$^{@}$	1^{-}	0.4153(3)	0.1512, 0.1767, 0.2386, 0.3000	1.55012(74)	≈ 46
7.701(17)	7.558(17)	0.07(3)%	0.07(3)%	(4^{-})	0.2507(4)	0.0376, 0.0979, 0.1152	1.55012(74)	600^{+500}_{-200}
7.738(17)	7.595(17)	0.16(5)%	0.16(5)%	3^{-}	0.2131(2)	0.0979, 0.1152	1.55012(74)	330^{+200}_{-110}
7.836(17)	7.691(17)	1.4(2)%	1.4(2)%	2^{-}	0.1152(1)	0.1152	1.55012(74)	73^{+22}_{-16}
7.947(10)	7.800(10)	100%	97.5(2)%	1^{-}	0.0	——	1.55012(74)	2.29(28)

* All values taken from [1994Li10], except where noted. This work states that the resolution of the α detector had a resolution of 17 keV (see Fig. 1 from this Ref.). Note that [1965Br11, 1971Br13] see the same α transitions without listing uncertainties.

** [1951Me10].

*** [1964Mc21].

$^{@}$ unresolved doublet. The I_{α} = 0.27% is shared between them.

$^{@@}$ Interpolated between 1.539616(24) fm (^{214}Po) and 1.56062(74) fm (^{218}Rn).

Table 7
direct α emission from ^{216m1}At*, Ex. = 48(24) keV, $J^{\pi} = (4^{-})$, BR_{α} = obs.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{212}Bi)	coincident γ-rays	R_0 (fm)	HF
7.629(17)	7.488(17)	obs	(6^{-})	0.381	0.1034		

* All values taken from [1994Li10].

Table 8
direct α emission from ^{216m2}At*, Ex. = 399(30) keV, $J^{\pi} = (9^{-})$, BR_{α} = obs.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{212}Bi)	coincident γ-rays	R_0 (fm)	HF
8.110	7.960	obs	(6^{-})	0.239(30)			

* All values taken from [1994Li10].

Table 9
direct α emission from ^{220}Fr*, $J^{\pi} = 1^{+}$, $T_{1/2}$ = 27.4(3) s**, BR_{α} = 99.65%***.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}[@]	$E_{daughter}$(^{216}At)	coincident γ-rays[@]	R_0 (fm)[@@]	HF
6.3759	6.260[@]	<0.008%	<0.005%[@]		0.423		1.5549(19)	$> 2.6\times10^3$
6.4198(30)	6.3031(30)	≈0.024%	≈0.015%		0.3790(36)	0.0446, 0.1421, 0.1545 0.1634, 0.1730, 0.1821, 0.2080, 0.3239, 0.3810	1.5549(19)	$\approx1.3\times10^3$
6.4818(25)	6.3639(25)	≈0.02%	≈0.01%		0.3171(32)		1.5549(19)	$\approx 3.6\times10^3$
6.4963(20)	6.3782(20)	0.57%	0.35%		0.3025(28)	0.0446, 0.0613, 0.0649, 0.1969, 0.2582, 0.3028	1.5549(19)	119
6.5207(20)	6.4021(20)	2.04%	1.25%	(4^-)	0.2782(28)	0.0446, 0.0613, 0.0649, 0.1561, 0.2211, 0.2336 0.0964 0.1059	1.5549(19)	42
6.5466(20)	6.4276(20)	0.39%	0.24%		0.2522(28)	0.0446, 0.0964, 0.1328	1.5549(19)	280
6.5641(25)	6.4448(25)	<0.02%[@]	<0.01%[@]		0.2347(32)	0.0446, 0.0613, 0.0649, 0.1059, 0.1287	1.5549(19)	$>7.8\times10^3$
6.5913(25)	6.4715(25)	2.1%	1.3%	$(1,2)^-$	0.2075(32)	0.0446, 0.1634, 0.2080	1.5549(19)	77
6.6001(25)	6.4801(25)	1.0%	0.6%	$(3)^-$	0.1987(32)	0.0446, 0.1421, 0.1545	1.5549(19)	180
6.6291(25)	6.5086(25)	≈1.0%	≈0.6%	(3^-)	0.1697(32)	0.0446, 0.1121	1.5549(19)	≈ 240
6.6372(25)	6.5165(25)	4.9%	3.0%	$(1)^-$	0.1616(32)	0.0446, 0.0548, 0.0613, 0.0649, 0.1059, 0.1162, 0.1607	1.5549(19)	51
6.6450(25)	6.5242(25)	4.1%	2.5%	$(2)^-$	0.1538(32)	0.0446, 0,1088, 0.1534	1.5549(19)	66
6.6744	6.5530[@]	<1.0%	<0.6%[@]	(5^-)	0.1245(20)	0.0446, 0.0964	1.5549(19)	> 360
6.6929(20)	6.5712(20)	16.0%	9.8%	$(0)^-$	0.1059(28)	0.0446, 0.0613, 0.0649, 0.1059	1.5549(19)	26
6.7421(25)	6.6195(25)	10.6%	6.5%	(4^-)	0.0567(32)	0.0446	1.5549(19)	61
6.7538(20)	6.6310(20)	19.9%	12.2%	$(2)^-$	0.0450(28)	0.0446	1.5549(19)	36
6.7988(20)	6.6752(20)	100%	61.3%	1^-	0.0	——	1.5549(19)	10.6

* All values taken from [1968Ba73], except where noted. Energy values are adjusted by +1.5 keV from [1991Ry01] due to changes in calibration energies.
** [1974Ho27].
*** [1971Br13] reported 0.35% β^+.
[@] [1996Sh05].
[@@] Interpolated between 1.56062(74) fm (^{218}Rn) and 1.5492(18) fm (^{222}Ra).

Table 10
direct α emission from ^{224}Ac*, $J^{\pi} = 0^{-}$, $T_{1/2}$ = 2.78(16) h**, BR_{α} = 10(2)%***.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}@	$E_{daughter}$(^{220}Fr)	coincident γ-rays@	R_0 (fm)@@	HF
5.7469(25)	5.6443(25)	0.23%	0.006%		0.5799(26)		1.5433(19)	100
5.8167(20)	5.7128(20)	0.47%	0.012%		0.5101(21)	0.4912	1.5433(19)	120
5.8258(20)	5.7218(20)	0.47%	0.012%		0.5009(21)	0.0486, 0.0555, 0.0791, 0.0819, 0.0973, 0.2013, 0.2253, 0.2277, 0.2613, 0.2631, 0.2738, 0.2876, 0.300	1.5433(19)	130
5.8472(25)	5.7428(25)	≈0.20%	≈0.005%		0.4796(26)		1.5433(19)	400
5.8767(20)	5.7718(20)	0.94%	0.024%	(5^{+})	0.4500(21)	0.0484, 0.0555, 0.0791, 0.0819, 0.0973, 0.2631, 0.2876, 0.300	1.5433(19)	120
5.8847(20)	5.7796(20)	0.23%	0.006%		0.4421(21)		1.5433(19)	330
5.9123(25)	5.8067(25)	≈0.08%	≈0.002%		0.4145(26)		1.5433(19)	210
5.9468(15)	5.8406(15)	1.02%	0.026%		3.800(17)		1.5433(19)	230
5.9508(7)	5.8445(7)	2.2%	0.055%		0.3760(10)	0.1031, 0.3284, 0.3643	1.5433(19)	120
5.9610(25)	5.8546(25)	≈0.27%	≈0.007%	(4^{-})	0.3657(26)	0.016, 0.0204, 0.0246, 0.0484, 0.0498, 0.0531, 0.0543, 0.0607, 0.0730, 0.0923, 0.1042, 0.1289, 0.1633, 0.1648, 0.1869, 0.2715	1.5433(19)	1×10^{3}
5.9642(20)	5.8577(20)	0.98%	0.025%	2^{-}	0.3626(21)	0.0484, 0.0875, 0.2253, 0.2613, 0.2738	1.5433(19)	290
5.9706(14)	5.8640(14)	2.9%	0.075%		0.3562(16)	0.0484, 0.0555, 0.0791, 0.0819, 0.2631, 0.2876, 0.300	1.5433(19)	110
5.9777(10)	5.8710(10)	0.39%	0.01%	(3^{+})	0.3490(12)	0.3280	1.5433(19)	90
5.9872(14)	5.8803(14)	6.6%	0.17%	0^{-}	0.3396(16)	0.0246, 0.0404, 0.0484, 0.0531, 0.0607, 0.0666, 0.0923, 0.1284, 0.1407, 0.1995, 0.2253, 0.2613, 0.2738, 0.2876, 0.300	1.5433(19)	56
6.0128(14)	5.9054(14)	0.59%	0.015%	(4^{-})	0.3140(16)		1.5433(19)	80
6.0200(20)	5.9125(20)	0.59%	0.015%		0.3068(21)		1.5433(19)	90
6.0272(14)	5.9196(14)	3.7%	0.094%	1^{+}	0.2995(16)	0.0484, 0.2876, 0.300	1.5433(19)	160
6.0537(14)	5.9456(14)	17.2%	0.44%		0.2731(16)	0.0484, 0.2253, 0.2613, 0.2738	1.5433(19)	45
6.0699(20)	5.9615(20)	≈0.16%	≈0.004%		0.2569(21)		1.5433(19)	5.8×10^{3}
6.0801(14)	5.9715(14)	0.78%	0.02%		0.2467(16)		1.5433(19)	1.3×10^{3}
6.1128(14)	6.0036(14)	26%	0.67%	4^{-}	0.2140(16)	0.016, 0.0204, 0.0246, 0.0359, 0.0373, 0.0484, 0.0498, 0.0531, 0.0543, 0.0730, 0.0923, 0.1042, 0.1289, 0.1415, 0.1586, 0.1648, 0.1945, 0.2076	1.5433(19)	55
6.1270(14) 0.0730	6.0176(14)	5.5%	0.14%	5^{+}	0.1998(16)	0.0543, 0.0669, 0.0728,	1.5433(19)	310
6.1700(7)	6.0598(7)	85.6%	2.19%	2^{-}	0.1568(10)	0.016, 0.0543, 0.0730, 0.0923	1.5433(19)	31
6.2534(7)	6.1417(7)	100%	2.56%		0.0734((10))	0.0246, 0.0484, 0.0531, 0.0607	1.5433(19)	63
6.2709(7)	6.1589(7)	4.02%	0.103%	5^{+}	0.0559(10)	0.0359	1.5433(19)	1.9×10^{3}
6.3199(7)	6.2070(7)	46.5%	1.19%	3^{+}	0.0069(10)		1.5433(19)	280
6.3268(7)	6.2138(7)	79.7%	2.04%	1^{+}	0.0	——	1.5433(19)	170

* All values taken from [1968Le17], except where noted. Energy values are adjusted by +3.8 keV from [1991Ry01] due to changes in calibration energies.
** Weighted average of 2.9(2) h [1951Me10] and 2.55(28) h [1987Mi10].
*** [1951Me10].
@ [1992Li31].
@@ Interpolated between 1.5492(18) fm (^{222}Ra) and 1.53749(45) fm (^{226}Th)

Table 11
direct α emission from ^{228}Pa*, $J^{\pi} = 3^{+}$, $T_{1/2}$ = 19.5(4) h**, BR_{α} = 2.0(2)%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J_f^{π}	$E_{daughter}$(^{224}Ac)	coincident γ-rays	R_0 (fm)***	HF
5.813(2)	5.711(2)[@]	5.1(6)%	0.020(2)%		0.448, 0.451	0.0260, 0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0411, 0.0433, 0.0465, 0.0486, 0.0498, 0.0518, 0.0520, 0.0521, 0.0531, 0.0542, 0.0603, 0.0674, 0.0693, 0.0741, 0.0760, 0.0801, 0.0812, 0.1103, 0.1225, 0.1955, 0.3178, 0.3556	1.53473(54)	40^{+8}_{-6}
5.861(2)	5.758(2)	15.4(13)%	0.060(4)%		0.4028	0.0283, 0.0433, 0.3224	1.53473(54)	23^{+4}_{-3}
5.868(2)	5.765(2)	13.3(11)%	0.052(4)%		0.3956	0.3172, 0.3470	1.53473(54)	29^{+5}_{-4}
5.883(2)	5.780(2)	6.7(8)%	0.026(3)%		0.3807	0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0433, 0.0486, 0.0498, 0.0518, 0.0521, 0.0812, 0.2505, .3003, 0.3286, 0.3510	1.53473(54)	70^{+14}_{10}
5.904(2)	5.800(2)	54.9(37)%	0.214(12)%	(3^{+})	0.3602	0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0433, 0.0486, 0.0498, 0.0518, 0.0521, 0.0812, 0.2300, 0.2795, 0.3080, 0.3304	1.53473(54)	$10.8^{+1.7}_{-1.3}$
5.910(2)	5.806(2)	35.4(24)%	0.138(8)%		0.3539	0.0603, 0.2375, 0.2447, 0.3168	1.53473(54)	$17.9^{+2.8}_{-2.2}$
5.931(2)	5.827(2)	29.7(37)%	0.116(14)%	(3^{+})	0.3330	0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0433, 0.0486, 0.0498, 0.0518, 0.0521, 0.0603, 0.0672, 0.0812, 0.2027, 0.2225, 0.2425,0.2526, 0.2801, 0.2840, 0.2959, 0.3032	1.53473(54)	27^{+6}_{4}
5.948(2)	5.844(2)	≈2.1%≈	0.008%		0.316		1.53473(54)	≈480
5.964(2)	5.859(2)	≈1.5%	≈0.006%		0.301		1.53473(54)	≈760
5.980(2)	5.875(2)	6.7(6)%	0.026(2)%		0.2834	0.2601, 0.2462	1.53473(54)	210^{+40}_{-30}
6.010(2)	5.905(2)	5.1(5)%	0.020(2)%		0.2526	0.0260, 0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0411, 0.0433, 0.0465, 0.0486, 0.0498, 0.0518, 0.0520, 0.0521, 0.0531, 0.0542, 0.0603, 0.0674, 0.0693, 0.0741, 0.0760, 0.0801, 0.0812, 0.1103, 0.1225	1.53473(54)	390^{+80}_{-60}
6.027(2)	5.921(2)	4.1(5)%	0.016(2)%		0.2365	0.0260, 0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0411, 0.0433, 0.0465, 0.0486, 0.0498, 0.0518, 0.0520, 0.0521, 0.0542, 0.0598, 0.0603, 0.0674, 0.0734, 0.0812	1.53473(54)	590^{+130}_{-90}
6.046(2)	5.940(2)	2.6(5)%	0.010(2)%		0.218		1.53473(54)	$1.2\ ^{+0.4}_{-0.2}\times10^{3}$
6.052(2)	5.946(2)	3.1(5)%	0.012(2)%		0.212		1.53473(54)	$1.0\ ^{+0.3}_{-0.2}\times10^{3}$
6.081(2)	5.974(2)	12.8(11)%	0.050(4)%	(5^{-})	0.1833	0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0433, 0.0486, 0.0498, 0.0518, 0.0521, 0.0531, 0.0542, 0.0603, 0.0741, 0.0801, 0.0812	1.53473(54)	340^{+60}_{-50}
6.088(2)	5.981(2)	13.3(11)%	0.052(4)%		0.1767	0.0260, 0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0411, 0.0433, 0.0465, 0.0486, 0.0498, 0.0518, 0.0520, 0.0521, 0.0542, 0.0603, 0.0674, 0.0734, 0.0812	1.53473(54)	350^{+60}_{-50}
6.095(2)	5.988(2)	5.1(5)%	0.020(2)%		0.169		1.53473(54)	990^{+150}_{-140}
6.104(2)	5.997(2)	≈1.5%	≈0.006%		0.160		1.53473(54)	$\approx 3.6\times10^{3}$
6.117(2)	6.010(2)	4.1(5)%	0.016(2)%		0.147		1.53473(54)	$1.5\ ^{+0.3}_{-0.2}\times10^{3}$
6.135(2)	6.027(2)	43.6(26)%	0.170(8)%	(4^{+})	0.1302	0.0263, 0.0283, 0.0288, 0.0298, 0.0346, 0.0433, 0.0486, 0.0498, 0.0518, 0.0521, 0.0812	1.53473(54)	$178\ ^{+24}_{-20}$
6.148(2)	6.040(2)	11.3(16)%	0.044(6)%	(4^{-})	0.1164	0.0260, 0.0283, 0.0411, 0.0433, 0.0520	1.53473(54)	800^{+180}_{-130}
6.155(3)	6.047(3)	≈1.5%	≈0.006%	(4^{-})	0.1093	0.0603	1.53473(54)	$\approx 6.3\times10^{3}$
6.160(3)	6.052(3)	≈3.6%	≈0.014%	(4^{+})	0.1032	0.0542	1.53473(54)	$\approx2.9\times10^{3}$
6.173(2)	6.065(2)	5.1(10%	0.020(4)%	+	0.0905	0.0672	1.53473(54)	$2.3^{+0.7}_{-0.5}\times10^{3}$
6.185(2)	6.076(2)	100(5)%	0.390(15)%		0.0804	0.0283, 0.0433	1.53473(54)	133^{+19}_{-15}
6.198(2)	6.089(2)	11.3(16)%	0.044(6)%	(3^{+})	0.0644	0.0411	1.53473(54)	$1.4^{+0.3}_{-0.2}\times10^{3}$
6.213(2)	6.104(2)	57.9(37)%	0.226(12)%	(2^{+})	0.0521	0.0288, 0.0346, 0.0521	1.53473(54)	310^{+50}_{-40}
6.226(2)	6.117(2)	50.8(31)%	0.198(10)%	(2^{-})	0.0371		1.53473(54)	420^{+60}_{-50}
6.235(3)	6.126(3)	≈5.1%	≈0.020%	(1^{+})	0.0298	0.0298	1.53473(54)	$\approx4.4\times10^{3}$

* All values taken from [1994Ah03], except where noted.
** [2021Ku01].
*** Interpolated between 1.53749(45) fm (^{226}Th) and 1.53197(29) fm (^{230}U).
[@] Unresolved doublet feeding 448 and 451 keV states [1994Ah03].

Table 12
direct α emission from ^{236}Am*, $J^{\pi} = 5^{-}$, $T_{1/2}$ = 3.6(2) m**, $BR_{\alpha} = 4.0(10)\times10^{-3}$%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{224}Ac)	coincident γ-rays	R_0 (fm)***	HF
≈6.256	≈6.150	$4.0(10)\times10^{-3}$%	(4^{+})	0.0	——	1.499(28)	$0.9^{+1.0}_{-0.5}$

* All values taken from [2002As08, 2004Sa05], except where noted.
** [2005As01].
*** Interpolated between 1.518(27) fm (^{234}Pu and 1.4805(90) fm (^{238}Cm).

Table 13
direct α emission from ^{244}Es*, $T_{1/2}$ = 37(4) s, $BR_{\alpha} = 4^{+3}_{-2}$%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{240}Bk)	coincident γ-rays	R_0 (fm)**	HF	
7.696(20)	7.570	(20)	4^{+3}_{-2}%		0.0?	——	1.502(14)	5^{+6}_{-3}

* All values taken from [2002As08, 2004Sa05], except where noted.
** Interpolated between 1.4986(78) fm (^{242}Cf and 1.506(12) fm (^{246}Fm).

Table 14
direct α emission from ^{248}Md*, $T_{1/2} = 13^{+3}_{-2}$ s, BR_{α} = 61(16)-68(22)%.

E_{α}(c.m.)	E_{α}(lab)***	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{244}Es)	coincident γ-rays	R_0 (fm)	HF
8.182(47)	8.050(47)	100%	≈28-31%			1.499(20)	≈1.8-2.0	
8.253(47)	8.120(47)	≈44%	≈12-13%			1.499(20)	≈7-8	
8.334-8.741	8.200-8.600	≈66%	≈19-20%			1.499(20)	≈9-170	
8.785(47)	8.643(47)	≈11%	≈3.1-3.4%			1.499(20)	$\approx1.3\text{-}1.5\times10^{-3}$	

* All values taken from [2024PoXY], except where noted.
** Interpolated between 1.506(12) fm (^{246}Fm) and 1.491(16) fm (^{250}No.

Table 15
direct α emission from ^{252}Lr*, $T_{1/2} = 410^{+70}_{-50}$ ms, BR_{α} = 70-90%.

E_{α}(c.m.)	E_{α}(lab)***	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{248}Md)	coincident γ-rays	R_0[@@@] (fm)	HF[@]
8.306(20)	8.174(20)**						1.484(53)	6.9**
9.027(47)	8.884(47)	≈56%	18-23%				1.484(53)	≈5-7
9.073(47)	8.929(47)	≈100%	32-41%				1.484(53)	≈4-5
9.132(47)	8.987(47)	≈67%	21-27%		0.0?		1.484(53)	≈10-11

* All values taken from [2024PoXY], except where noted.
** [2001He25].
*** In addition to these transitions, [2008Ne01] report correlated α's of 8.82 and 9.61 MeV.
[@] Interpolated between 1.491(16) fm (^{250}No and 1.477(51) fm (^{254}Rf).

Table 16
direct α emission from ^{256}Db*, $T_{1/2} = 1.4^{+0.4}_{-0.2}$ ms**, BR_{α} = 90(4)%**.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{252}Lr)	coincident γ-rays	R_0 (fm)	HF[@]
9.032(20)	8.891(20)***	≈16%	≈7%		0.233			22
9.157(20)	9.014(20)	100%	≈45%		0.108			11
9.219(20)	9.075(20)***	≈16%	≈7%		0.046			86
9.265(20)	9.120(20)***	≈16%	≈7%		0.0?	——		114

* All values taken from [2001He25], except where noted.
** [2024PoXY].
*** Tentative assignment [2001He25]. Similar values of 8.890(47) MeV (≈20%), 8.930(47) MeV (≈20%), 8.980(47) MeV (≈30%) and 9.02-9.20 MeV (≈30%) reported in [2024PoXY].
[@] Taken directly from [2001He25].

References used in the Tables

[1] **1933Ro03** E. Rutherford, Nature(London) **131**, 388 (1933).

[2] **1943Ka05**B. Karlik, T. Bernert, Naturwissenschaften 31, 492 (1943). https://doi.org/10.1007/bf01621675

[3] **1948Gh01** A. Ghiorso, W. W. Meinke, G.T.Seaborg, Phys.Rev. **74**, 695 (1948). https://doi.org/10.1103/PhysRev.74.695

[4] **1949Me54** W. W. Meinke, A. Ghiorso, G. T. Seaborg, Phys. Rev. **75**, 314 (1949). https://doi.org/10.1103/PhysRev.75.314

[5] **1951Me10** W. W. Meinke, A. Ghiorso, G. T. Seaborg, Phys. Rev. **81**, 782 (1951). https://doi.org/10.1103/PhysRev.81.782

[6] **1955We10** J. W. Weale, Proc. Phys. Soc. (London) **68**A, 35 (1955). https://doi.org/10.1088/0370-1298/68/1/306

[7] **1956Ho11** J. W. Horton, Phys. Rev. **101**, 717 (1956). https://doi.org/10.1103/PhysRev.101.717

[8] **1956Ko60**V. A. Korolev, L. A. Kulchitskii, A. I. Zhernovoi, Izvest. Akad. Nauk SSSR, Ser. Fiz. **20**, 1451 (1956); Columbia Tech. Transl. **20**, 1327 (1957)

[9] **1958De25**F. Demichelis, B. Chinaglia, G. Trivero, Nuovo Cimento **8**, 369 (1958). https://doi.org/10.1007/BF02828745

[10] **1958Hi78** M. W. Hill, Thesis, Univ. California (1958); UCRL-8423 (1958).

[11] **1960Ga15**Y. N. Gangrskii, G. M. Gusinskii, I. K. Lemberg, Izv. Akad. Nauk SSSR, Ser. Fiz. **24**, 1449 (1960); Columbia Tech. Transl. **24**, 1443 (1961).

[12] **1960Gi07**M. Giannini, D. Prosperi, S. Sciuti, Nucl. Phys. **19**, 380 (1960). https://doi.org/10.1016/0029-5582(60)90249-2

[13] **1960Ha19** U. Hauser, W. Kerler, Z. Phys. 158, 405 (1960). https://doi.org/10.1007/BF01327018

[14] **1960Wa14** R. J. Walen, G. Bastin-Scoffier, Nuclear Phys. **16**, 246 (1960). https://doi.org/10.1016/S0029-5582(60).81035-8

[15] **1961Ap03** K. R. Applegate, E. M. Morimoto, M. Kahr, J. D. Knight, J. Inorg. Nucl. Chem. **19**, 375 (1961). https://doi.org/10.1016/0022-1902(61)80130-9

[16] **1961Ba12** S. Barkan, Nuovo Cimento **20**, 450 (1961). https://doi.org/10.1007/BF02731493

[17] **1961Fe04** J. G. Ferreira, M. T. Goncalves, L. Ferreira-Salgueiro, Compt. Rend. **253**, 98 (1961).

[18] **1962Be09**G. Bertolini, F. Cappellani, G. Restelli, A. Rota, Nuclear Phys. **30**, 599 (1962). https://doi.org/10.1016/0029-5582(62)90080-9

[19] **1962Wa28**R. J. Walen, Compt. Rend. **255**, 1604 (1962).

[20] **1963Co28**W. C. Cobb, Phys. Rev. **132**, 1693 (1963). https://doi.org/10.1103/PhysRev.132.1693

[21] **1964Br16**J. P. Briand, M. Lefort, Phys. Lett. **10**, 90 (1964). https://doi.org/10.1016/0031-9163(64)90591-8

[22] **1964Ge08**C. Gerschel, M. Pautrat, R. Ricci, J. Vanhorenbeeck, J. Teillac, Phys. Nucl. Annuaire 1962-63, Faculte Sci. L'Univ. Paris Inst. Rad., p. 47 (January 1964).

[23] **1964Mc21** J. D. McCoy, Soc. Sci. Fennica, Commentationes Phy. Math. **30**, No. 4 (1964).

[24] **1965Br11**J. -P. Briand, P. Chevallier, Compt. Rend. **260**, 5251 (1965).

[25] **1966Il01** K. Ilgen, Z. Physik 197, 328 (1966). https://doi.org/10.1007/BF01326188

[26] **1966KlZZ**S. S. Klein, Thesis, Univ. Amsterdam (1966); NP-16835 (1966).

[27] **1967Br15**J. P. Briand, Nucl. Phys. A**99**, 28(1967). https://doi.org/10.1016/0375-9474(67)90206-0

[28] **1968Ba73** G. Bastin, C. F. Leang, R. J. Walen, J. Phys. (Paris), Suppl. No. 1, Colloq. C1-181 (1968).

[29] **1968Le17** C. F. Leang, G. Bastin, R. J. Walen, Compt. Rend. **267**B, 303 (1968).

[30] **1969Gr28** B. Grennberg, A. Rytz, Compt. Rend. 269B, 652 (1969).

[31] **1969LeZW** C. -F. Leang, Thesis, Univ. Paris (1969).

[32] **1970Br29** J. -P. Briand, P. Chevallier, A. Touati, C. R. Acad. Sci. , Ser. B, 271, 162 (1970).

[33] **1970Br31** J. -P. Briand, P. Chevallier, C. R. Acad. Sci., Ser. B, **271**, 58 (1970).

[34] **1970Ho27** M. Hollstein, H. Munzel, G. Pfennig, R. Reuter-Weiss, J. Inorg. Nucl. Chem. **32**, 3159 (1970). https://doi.org/10.1016/0022-1902(70)80193-2

[35] **1971Ac02**R. Ackerhalt, P. Ellerbe, G. Harbottle, Radiochim. Radioanal. Lett. **8**, 75 (1971).

[36] **1971Br13** J. P. Briand, P. Chevallier, A. Touati, J. Phys. (Paris) **32**, 101 (1971). https://doi.org/10.1051/jphys:01971003202-3010100

[37] **1971EsZY** P. Eskola, UCRL-20426, p. 35 (1971).

[38] **1971EsZZ** P Eskola, REPT UCRL-20426, P35 (1971).

[39] **1971Gr17** B. Grennberg, A. Rytz, Metrologia **7**, 65 (1971). https://doi.org/10.1088/0026-1394/7/2/005

[40] **1973BoXL** J. D. Bowman, E. K. Hyde, R. E. Eppley, LBL-1666, p. 4 (1973).

[41] **1973BoXW** J. D. Bowman, E. K. Hyde, R. E. Eppley, LBL-1666, p. 4 (1973).

[42] **1973ChZH**P. Chevallier, Thesis, Univ. Paris (1973); FRNC-TH-431 (1973).

[43] **1973Es01** P. Eskola, Phys. Rev. C**7**, 280 (1973). https://doi.org/10.1103/PhysRevC.7.280

[44] **1973Es02** P. Eskola, K. Eskola, M. Nurmia, A. Ghiorso, Phys. Fenn. **8**, 357 (1973).

[45] **1974Ho27** P. Hornshoj, P. G. Hansen, B. Jonson, Nucl. Phys. A**230**, 380 (1974). https://doi.org/10.1016/0375-9474(74)90144-4

[46] **1976MiZR** B. S. Dzhelepov, R. B. Ivanov, M. A. Mikhailova, A. V. Mozzhukhin, Ts. Vylov, N. A. Golovkov, V. G. Chumin, Proc. Intern. Conf. Selected Topics in Nucl. Struct. , Dubna (1976), Vol. 1, p. 192 (1976)

[47] **1978Ba44** P A Baisden, R E Leber, M Nurmia, J M Nitschke, M Michel, A Ghiorso, Phys Rev Lett **41**, 738 (1978). https://doi.org/10.1103/PhysRevLett.41.738

[48] **1980Ga07** Yu. P. Gangrsky, M. B. Miller, L. V. Mikhailov, I. F. Kharisov, Yad. Fiz. **31**, 306 (1980); Sov. J. Nucl. Phys. **31**, 162 (1980)

[49] **1980GaZZ** Yu. P. Gangrsky, M. B. Miller, L. V. Mikhailov, I. F. Kharisov, Preprint of the Joint Institute for Nuclear Research. Dubna 1979, P7 - 12584.

[50] **1980Le27**P. Lemmertz, L. J. Alquist, R. Fass, H. Wollnik, D. Hirdes, H. Jungclas, R. Brandt, D. Schardt, J. Zylicz, Z. Phys. A**298**, 311 (1980). https://doi.org/10.1007/BF01425163

[51] **1983Ga05** D. Galeriu, J. Phys. (London) G**9**, 309 (1983). https://doi.org/10.1088/0305-4616/9/3/011

[52] **1983OgZX**Yu. Ts. Oganesyan, JINR-D7-83-644 (1983)

[53] **1984Es01** K Eskola, P Eskola, M M Fowler, H Ohm, E N Treher, J B Wilhelmy, D Lee, G T Seaborg, Phys Rev C**29**, 2160 (1984). https://doi.org/10.1103/PhysRevC.29.2160

[54] **1987Mi10** G. J. Miller, J. C. McGeorge, I. Anthony, R. O. Owens, Phys. Rev. C**36**, 420 (1987). https://doi.org/10.1103/PhysRevC.36.420

[55] **1989HaZO** H. L. Hall, LBL-27878 (1989).

[56] **1992Li31**C. F. Liang, P. Paris, R. K. Sheline, Int. J. Mod. Phys. E1, 363 (1992). https://doi.org/10.1142/S0218301392000187

[57] **1993Sh07** R. K. Sheline, J. Kvasil, C. F. Liang, P. Paris, J. Phys. (London) G19, 617 (1993). https://doi.org/10.1088/0954-3899/19/4/017

[58] **1994Ah03**I. Ahmad, J. E. Gindler, M. P. Carpenter, D. J. Henderson, E. F. Moore, R. V. F. Janssens, I. G. Bearden, C. C. Foster, Nucl. Phys. A**576**, 246 (1994). https://doi.org/10.1016/0375-9474(94)90259-3

[59] **1994Li10** C. F. Liang, P. Paris, R. K. Sheline, Phys. Rev. C**49**, 1872 (1994). https://doi.org/10.1103/PhysRevC.49.1872

[60] **1996Sh05**R. K. Sheline, C. F. Liang, P. Paris, Phys. Rev. C**53**, 2152 (1996). https://doi.org/10.1103/PhysRevC.53.2152

[61] **1999He07** F. P. Hessberger,Acta Phys. Slovaca **49**, 43 (1999).

[62] **1999He11** F. P. Hessberger, J. Phys. (London) G**25**, 877 (1999). https:doi.org/10.1088/0954-3899/25/4/059

[63] **1999HeZX**F. P. Hessberger, S. Hofmann, V. Ninov, P. Armbruster, G. Munzenberg, Ch. Stodel, A. Yu. Lavrentev, A. G. Popeko, A. V. Yeremin, S. Saro, M. E. Leino, GSI 99-1, p. 11 (1999).

[64] **2001He35** F. P. Hessberger, S. Hofmann, D. Ackermann, V. Ninov, M. Leino, G. Munzenberg, S. Saro, A. Lavrentev, A. G. Popeko, A. V. Yeremin, Ch. Stodel, Eur. Phys. J. A**12**, 57 (2001). https://doi.org/10.1007/s100500170039

[65] **2002As08** M. Asai, M. Sakama, K. Tsukada, S. Ichikawa, H. Haba, I. Nishinaka, Y. Nagame, S. Goto, K. Akiyama, A. Toyoshima, Y. Kojima, Y. Oura, H. Nakahara, M. Shibata, K. Kawade, J. Nucl. Radiochem. Sci. **3**, No 1, 187 (2002).

[66] **2002Sh02**D. A. Shaughnessy, K. E. Gregorich, J. L. Adams, M. R. Lane, C. A. Laue, D. M. Lee, C. A. McGrath, V. Ninov, J. B. Patin, D. A. Strellis, E. R. Sylwester, P. A. Wilk, D. C. Hoffman, Phys. Rev. C**65**, 024612 (2002). https://doi.org/10.1103/PhysRevC.65.024612

[67] **2004Sa05** M. Sakama, M. Asai, K. Tsukada, S. Ichikawa, I. Nishinaka, Y. Nagame, H. Haba, S. Goto, M. Shibata, K. Kawade, Y. Kojima, Y. Oura, M. Ebihara, H. Nakahara, Phys. Rev. C **69**, 014308 (2004). https://doi.org/10.1103/PhysRevC.69.014308

[68] **2005As01**M. Asai, M. Sakama, K. Tsukada, S. Ichikawa, H. Haba, I. Nishinaka, Y. Nagame, S. Goto, Y. Kojima, Y. Oura, H. Nakahara, M. Shibata, K. Kawade, Eur. Phys. J. A **23**, 395 (2005). https://doi.org/10.1140/epja/i2004-10096-6

[69] **2007Ma45** M. J. Martin, Nucl. Data Sheets **108**, 1583 (2007). https://doi.org/10.1016/j.nds.2007.07.001

[70] **2008Ne01** S. L. Nelson, K. E. Gregorich, I. Dragojevic, M. A. Garcia, J. M. Gates, R. Sudowe, H. Nitsche, Phys. Rev. Lett. **100**, 022501 (2008). https://doi.org/10.1103/PhysRevLett.100.022501

[71] **2013Ch12**L. Chen, P. M. Walker, H. Geissel, Yu. A. Litvinov, K. Beckert, P. Beller, F. Bosch, D. Boutin, L. Caceres, J. J. Carroll, D. M. Cullen, I. J. Cullen, B. Franzke, J. Gerl, M. Gorska, G. A. Jones, A. Kishada, R. Knobel, C. Kozhuharov, J. Kurcewicz, S. A. Litvinov, Z. Liu, S. Mandal, F. Montes, G. Munzenberg, F. Nolden, T. Ohtsubo, Z. Patyk, W. R. Plass, Zs. Podolyak, S. Rigby, N. Saito, T. Saito, C. Scheidenberger, E. C. Simpson, M. Shindo, M. Steck, B. Sun, S. J. Williams, H. Weick, M. Winkler, H. -J. Wollersheim, T. Yamaguchi, Phys. Rev. Lett. **110**, 122502 (2013). https://doi.org/10.1103/PhysRevLett.110.122502

[72] **2020Ku23** A. A. Kuznetsova, A. V. Yeremin, A. Lopez-Martens, K. Hauschild, A. G. Popeko, O. N. Malyshev, V. I. Chepigin, A. I. Svirikhin, A. V. Isaev, Yu. A. Popov, M. L. Chelnokov, O. Dorvaux, B. Gall, M. S. Tezekbayeva, Bull. Rus. Acad. Sci. Phys. **84**, 932 (2020). https:doi.org/10.3103/S1062873820080225

[73] **2021Km01** K. N. Kmak, D. A. Shaughnessy, J. Vujic, Phys. Rev. C **103**, 034610 (2021). https://doi.org/10.1103/PhysRevC.103.034610

[74] **2021Wa16** M. Wang, W. J. Huang, F. G. Kondev, G. Audi, S. Naimi, Chin. Phys. C **45**, 030003 (2021). https://doi.org/10.1088/1674-1137/abddaf

[75] **2024PoXY** J. L. Pore, J. M. Gates, R. Orford, F. H. Garcia, H. L. Crawford, P. Fallon, J. A. Gooding, M. Kireeff Covo, M. McCarthy, M. A. Stoyer, Phys. Rev. C **110**, 044313 (2024).