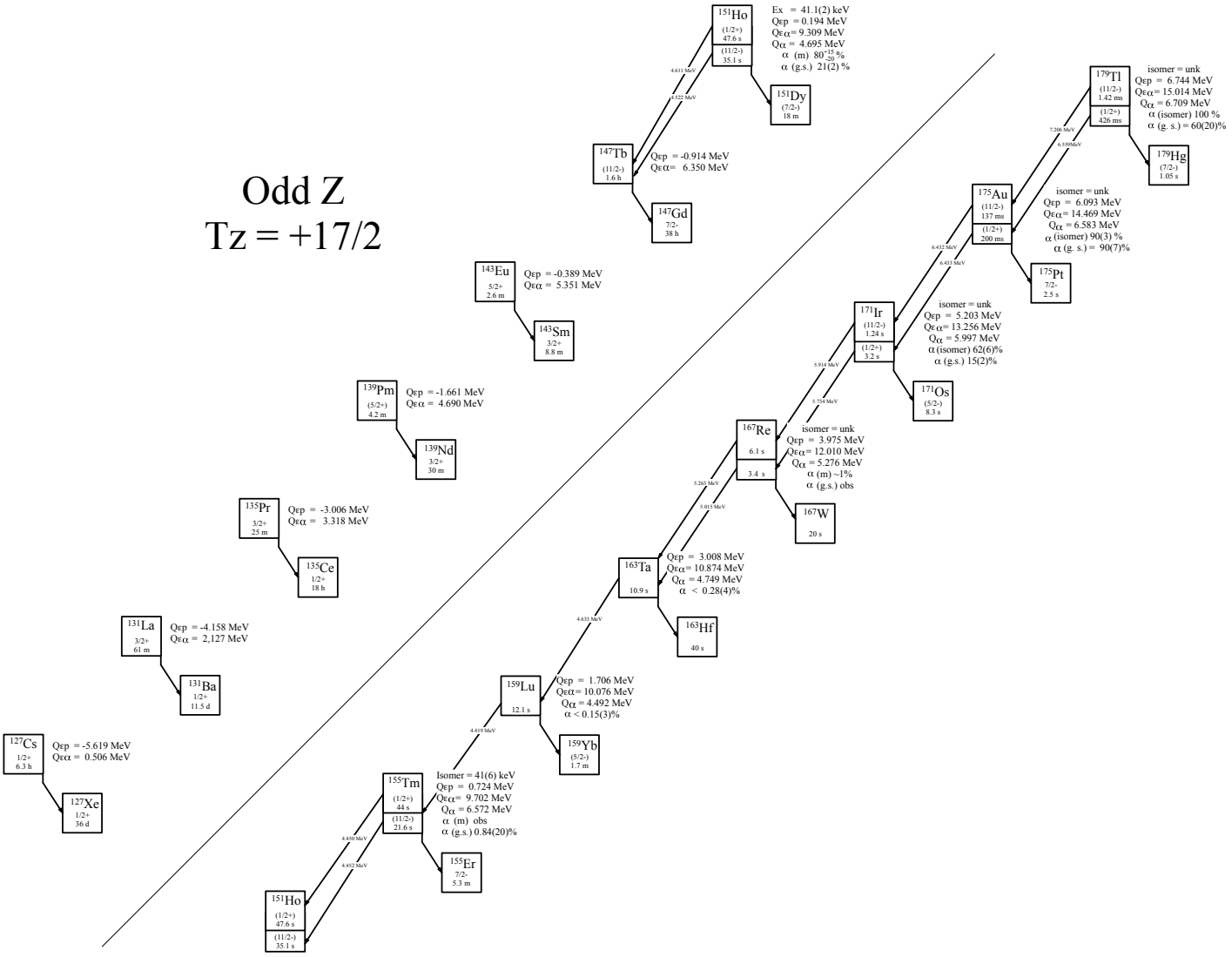

Fig. 1: Known experimental values for heavy particle emission of the odd-Z T_z= +17/2 nuclei. Unless otherwise stated, all Q-values are taken from [2021Wa16] or deduced from values therein. $J^{|pi}$ values for ^{127}Cs, ^{131}La, ^{135}Pr, ^{139}Pm, ^{143}Eu, ^{147}Tb, are taken from ENSDF.

Last updated 3/23/23

Table 1
Observed and predicted β-delayed particle emission from the odd-Z, T_z = +17/2 nuclei

Nuclide	Ex	J^π	$T_{1/2}$	Q_ε	$Q_{\varepsilon p}$	$Q_{\varepsilon 2p}$	$Q_{\varepsilon \alpha}$	Experimental
^{127}Cs		$1/2^+$	6.25(10) h	2.081(6)	-5.619(6)	-11.796(6)	0.506(6)	[**1954Ma54**]
^{131}La		$3/2^+$	61(2) m	2.910(28)	-4.158(29)	-9.651(28)	2.127(28)	[**1960Cr01**]
^{135}Pr		$3/2^+$	25.4(5) m	3.680(16)	-3.006(23)	-7.960(12)	3.318(12)	[**1970Ab07**]
^{139}Pm		$(5/2^+)$	4.15(5) m	4.516(26)	-1.661(17)	-6.160(14)	4.690(17)	[**1977De06**]
^{143}Eu		$5/2^+$	2.57(3) m	5.276(11)	-0.389(26)	-4.628(11)	5.351(30)	[**1993Al03**]
^{147}Tb		$(1/2^+)$	1.64(3) h	4.614(8)	-0.914(10)	-4.669(8)	6.350(9)	[**1997Wa04**]
^{151}Ho		$(11/2^-)$	35.1(2) s	5.130(9)	0.194(11)	-3.074(9)	9.309(9)	[**1982Bo04**]
^{151m}Ho	0.0411(2)	$(1/2^+)$	47.6(13) s*	5.171(9)	0.265(11)	-3.071(9)	9.350(9)	[**1991To08, 1982Bo04, 1982Ba75**]
^{155}Tm		$(11/2^-)$	21.6(2) s	5.583(12)	0.724(13)	-2.061(11)	9.702(10)	[**1991To08**]
^{155m}Tm	0.041(6)	$(1/2^+)$	44(4) s	5.624(13)	0.765(14)	-2.020(12)	9.743(11)	[**1991To08, 1990Po13**]
^{159}Lu			12.1(10) s**	6.120(40)	1.706(45)	-0.873(46)	10.076(38)	[**1992Ha10, 1980Al04**]
^{163}Ta			10.9(12) s***	6.730(50)	3.008(84)	0.722(41)	10.874(42)	[**1992Ha10, 1985Li14**]
^{167}Re			3.4(4) s	7.260(40)#	3.975(49)#	2.223(49)#	12.010(48)#	[**1992Me10**]
^{167m}Re	x[@]		6.1(2) s	7.260(40)#+x	3.975(49)#+x	2.223(49)#+x	12.010(48)#+x	[**1992Me10, 1984Sc06**]
^{171}Ir		$(1/2^+)$	$3.2^{+1.7}_{-0.7}$ s	7.890(40)	5.203(40)	3.928(41)	13.256(43)	[**2013An01**]
^{171m}Ir	x	$(11/2^-)$	1.24(4) s[@@]	7.890(40)+x	5.203(40)+x	3.928(41)+x	13.256(43)+x	[**2023Zh03, 2014Pe02, 2013An01**]
^{175}Au		$(1/2^+)$	200(3) ms	8.300(40)	6.093(40)	5.457(41)	14.469(43)	[**2017Ba46**]
^{175m}Au	x	$(11/2^-)$	137(1) ms[@@@]	8.300(40)+x	6.093(40)+x	5.457(41)+x	14.469(43)+x	[**2017Ba46, 2011Wa37**]
^{179}Tl		$(1/2^+)$	426(10) ms	8.660(50)	6.744(40)	6.523(41)	15.014(43)	[**2017Ba46**]
^{179m}Tl[a]		$(11/2^-)$	1.42(3) ms[a]	8.660(50)	6.744(40)	6.523(41)	15.014(43)	[**2017Ba46, 2010An01**]

* Weighted average of 47.9(13) s [1982Bo14], 47(2) s [1982Ba75].
** Weighted average of 12.3(10)s [1980Al14] and 9.2(35) s [1992Ha10].
*** Weighted average of 10.5(18)s [1985Li14] and 11.2(16) s [1992Ha10].
[@] May be the ground state.
[@@] Weighted average of 1.14(5) s [2014Pe02], 1.4(1) s [2013An01],and 1.28(4) [2023Zh03].
[@@@] Weighted average of 136(1) ms [2017Ba46] and 139(2) ms [2011Wa37].
[a] Weighted average of 1.40(3) ms [2017Ba46], and 1.46(4) ms [2010An01].

Table 2
Particle separation and emission from the odd-Z, T_z = +17/2 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
^{127}Cs	4.383(6)		11.982(6)	-0.722(7)		
^{131}La	3.801(28)		10.848(28)	0.046(28)		
^{135}Pr	3.392(24)		10.019(30)	0.408(30)		
^{139}Pm	2.773(18)		8.877(16)	1.010(18)		
^{143}Eu	2.548(11)		8.296(18)	0.835(17)		
^{147}Tb	1.946(9)		7.329(9)	1.074(14)		
^{151}Ho	1.602(9)		6.712(9)	4.695(2)	21(2)%	[**1987Li09, 1990Po13, 1991To08, 1982Ba75, 1982Bo04, 1982De11**, **1979Ho10, 1974Sc19, 1963Ma17**, 1996Pa01, 1995Wa31, 1995WaZO, 1995WaZS, 1991VaZY, 1990KaZM, 1990VaZO, 1989KaYU, 1989KaZK, 1989KaZI, 1989PoZR, 1973BoXL, 1973BoXW, 1970Ma23, 1961Ma40, 1960Ma47]
^{151m}Ho*	1.561(9)		6.671(9)	4.736(2)	80^{+15}_{-20}%	[**1987Li09, 1991To08, 1982Ba75, 1982Bo04, 1981De22, 1979Ho10**, 1963Ma17 1995Wa31, 1995WaZO, 1995WaZS, 1991VaZY, 1990Po13, 1990KaZM, 1990VaZO, 1989KaYU, 1989KaZK, 1989KaZI, 1989PoZR, 1974Sc19, 1974ToZN, 1974ToZQ, 1973BoXL, 1973BoXV, 1970Ma23, 1970To16, 1961Ma40, 1960Ma47]
^{155}Tm	1.310(11)		6.192(11)	4.572(5)	0.84(20)%	[**1991To08, 1992Ha10, 1990Po13, 1971To10**, 1991VaZT, 1990KaZM, 1990PoZU, 1989KaYU, 1988KaZK, 1987KaZI, 1988KaZK, 1978AfZZ, 1977Ag01]
^{155m}Tm	1.269(12)		6.151(12)	4.613(8)	obs	[**1991To08, 1992Ha10, 1990Po13, 1971To10**, 1991VaZY, 1990KaZM, 1990PoZU, 1989KaYU, 1988KaZK, 1989KaZI, 1988KaZK, 1978AfZZ, 1977Ag01]
^{159}Lu	0.988(38)		5.577(47)	4.492(39)	<0.15(3)%	[**1992Ha10, 1980Al04**, 1980AlZN]
^{163}Ta	0.655(39)		4.550(47)	4.749(5)	<0.28(4)%	[**1992Ha10, 1986Ru05**, 1988MeZY, 1987HaZO, 1983Sc18]
^{167}Re	0.235(41)#		3.564(42)#	5.276(13)#	obs	[**1992Me10**, 1992MeZW]
^{167m}Re***	0.235(41)#-x		3.564(42)#-x	5.276(13)#+x	≈1%	[**1992Me10**, 1992MeZW, 1984Sc06]
^{171}Ir	-0.225(40)		2.581(40)	5.997(12)	15(2)%	[**2013An01**]
^{171m}Ir@	-0.225(40)-x		2.581(40)-x	5.997(12)+x	62(6)%	[**2023Zh03, 2014Pe02, 2013An01**, 2010An01, 2002Ro17, 1996Pa01, 1992Sc16, 1982De11, 1981DeZL, 1978Ca11, 1978Sc26]
^{175}Au	-0.625(40)		1.713(40)	6.583(3)	90(7)%	[**2017Ba46, 2013An10**, 2010An01, 2002Ro17, 1996Pa01, 1983Sc24]
^{175m}Au@	-0.625(40)-x		1.713(40)-x	6.583(3)+x	90(3)%	[**2017Ba46, 2011Wa37, 2010An01**, 2013An10, 2004GoZZ, 2002Ro17, 1996Pa01, 1983Sc24]
^{179}Tl	-0.757(40)		1.302(40)	6.709(3)	60(20)%	[**2017Ba46, 2013An10**, 2002Ro17, 1998To14, 1996Pa01, 1983Sc24]
^{179m}Tl@	-0.757(40)		1.302(40)	6.709(3)	100%	[**2017Ba46, 2010An01**, 2002Ro17, 1998To14, 1996Pa01, 1983Sc24]

* Excitation energy = 41.1(2) keV [1991To08].
** Excitation energy = 41(6) keV [1990Po13].
*** Excitation is unknown, may be the ground state.
@ Excitation is unknown.

Table 3
direct α emission from ^{151}Ho, J^π = (11/2$^-$), $T_{1/2}$ = 35.1(2) s*, BR_α = 21(2)%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	$J_f^{\pi\,@@@}$	$E_{daughter}$(^{147}Tb)	coincident γ-rays	R_0 (fm)	HF
4.335(6)	4.220(6)@	0.36(4)%@	0.076(8)%	(5/2$^+$)	0.354@	0.101, 0.253	1.5642(20)	$9.3^{+1.7}_{-1.3}$
4.435	4.318@@	< 0.01%@	< 0.002%	(3/2$^+$)	0.254			
4.645(2)	4.522(2)***	100%@	21(2)%		0.0506(9)@	(11/2$^-$)	1.5642(20)	1.60(17)
4.689	4.565@@	< 0.7%@	< 0.15%	(1/2$^+$)	0.0			

* [1982Bo04].
** Weighted average of 28(7)% [1991To08], 22(3)% [1990Po13], 22(3)% [1982Bo75], 18(5)% [1979Ho10], 18(5)% [1974Sc19], and 20(5)% [1963Ma17].
*** Weighted average of 4.523(3) MeV [1982Bo04] (adjusted to 4.529(3) MeV in [1999Ry01]), 4.524(5) MeV [1979Ho10] (adjusted to 4.524(5) MeV in [1999Ry01]), and 4.521(3) MeV [1981De22].
@ [1987Li09]
@@ Transition not observed.
@@@ [2022Ni03].

Table 4
direct α emission from ^{151m}Ho, Ex = 41.1(2) keV**, $J^\pi = (1/2^+)$, $T_{1/2}$ = 47.6(13) s*, $BR_\alpha = 80^{+15}_{-20}$%**.

E_α(c.m.)	E_α(lab)	I_α(rel)	I_α(abs)	$J_f^{\pi@@@}$	$E_{daughter}$(^{147}Tb)	coincident γ-rays	R_0 (fm)	HF
4.376(6)	4.260(6)$^{@}$	0.26(4)%$^{@}$	0.076(8)%	$(5/2^+)$	0.354$^{@}$	0.101, 0.253	1.5642(20)	$7.9^{+2.8}_{-1.8}$
4.478	4.359$^{@@}$	< 0.05%$^{@}$	< 0.01%	$(3/2^+)$	0.254			
4.682	4.558$^{@@}$	< 1.1%$^{@}$	< 0.2%	$(11/2^-)$	0.0506(9)			
4.736(2)	4.611(2)***	100%$^{@}$	80^{+15}_{-20}%	$(1/2^+)$	0.0		1.5642(20)	1.7^{+5}_{-3}

** Weighted average of 47.9(13) s [1982Bo14], 47(2) s [1982Ba75].
** [1991To08].
*** Weighted average of 4.523(3) MeV [1982Bo04] (adjusted to 4.529(3) MeV in [1999Ry01]), 4.524(5) MeV [1979Ho10] (adjusted to 4.524(5) MeV in [1999Ry01]), and 4.521(3) MeV [1981De22].
$^{@}$ [1987Li09]
$^{@@}$ Transition not observed.
$^{@@@}$ [2022Ni03].

Table 5
direct α emission from ^{155}Tm, $J^\pi = (11/2^-)$, $T_{1/2}$ = 21.6(2) s*, BR_α = 0.84(20)%**.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{151}Ho)	coincident γ-rays	R_0 (fm)	HF
4.570(8)	4.452(8)***	0.84(20)%**	$(11/2^-)$	0.0	1.573(14)	$1.2^{+0.5}_{-0.4}$	

* [1991To08].
** Weighted average of 1.2(6)% [1990Po13] and 2.1(3)% (adjusted to 0.80(21)% by evaluator in 2009Si01).
*** From [1992Ha10]. [1991To08] report that the ground state and isomer have nearly identical α energies. Their measured $T_{1/2}$ value of 26(3) s indicates that this value is mostly from the $11/2^-$ ground state decay.

Table 6
direct α emission from ^{155m}Tm, Ex = 41(6) keV**, $J^\pi = (1/2^+)$, $T_{1/2}$ = 44(4) s**, BR_α = obs*.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{151}Ho)	coincident γ-rays	R_0 (fm)	HF
4.568(10)	4.450(10)***			0.0411(2)		1.573(14)	

** [1991To08].
** [1990Po13].
*** Unresolved doublet from [1991To08] who report that the ground state and isomer have nearly identical α energies.

Table 7
direct α emission from ^{159}Lu, J^π = , $T_{1/2}$ = 12.1(10) s*, BR_α = <0.15(3)%**.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{155}Tm)	coincident γ-rays	R_0 (fm)	HF
4.533(10)	4.419(10)***	<0.15(3)%**		?		1.539(29)	

* Weighted average of 12.3(10)s [1980Al14] and 9.2(35) s [1992Ha10].
** [1992Ha10], based on comparison of the α intensity to the reported [1980Al14] intensities of the 151 keV γ-ray.
*** Weighted average of 4.420(10) MeV [1980Al14] and 4.417(10) MeV [1992Ha10].

Table 8
direct α emission from ^{163}Ta, J^π = , $T_{1/2}$ = 10.9(12) s*, BR_α = <0.28(4)%**.

E_α(c.m.)	E_α(lab)	I_α(abs)	J_f^π	$E_{daughter}$(^{159}Lu)	coincident γ-rays	R_0 (fm)	HF
4.750(10)	4.633(10)***	<0.28(4)%**		0.0	——	1.575(13)	$0.17^{+0.07\,@}_{-0.05}$

* Weighted average of 10.5(18)s [1985Li14] and 11.2(16) s [1992Ha10].
** [1992Ha10], based on comparison of the α intensity to the reported [1985Li14] intensities of the 449 and 451 keV γ doublet.
*** Weighted average of 4.630(10) MeV [1986Ru05] and 4.635(7) MeV [1992Ha10].
$^{@}$ This unphysical result likely indicaties that the absolute γ-ray intensities are much weaker than the reported relative ones.

Table 9
direct α emission from ^{167}Re*, J^{π} = , $T_{1/2}$ = 3.4(4) s, BR_{α} = obs.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{163}Ta)	coincident γ-rays	R_0 (fm)	HF
5.138(10)	5.015(10)			?		1.540(14)	

* All values from [1992Me10].

Table 10
direct α emission from ^{167m}Re*, Ex = unk., J^{π} = , $T_{1/2}$ = 6.1(2) s**, BR_{α} = ≈1%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{163}Ta)	coincident γ-rays	R_0 (fm)	HF
5.392(10)	5.263(12)			0.0?		1.540(14)	$2.9^{+3.2}_{-1.3}$

* All values from [1992Me10], except where noted.
** [1984Sc06].

Table 11
direct α emission from ^{171}Ir*, J^{π} = $(1/2^{+})$, $T_{1/2}$ = $3.2^{+1.7}_{-0.7}$ s, BR_{α} =15(2)%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{167}Re)	coincident γ-rays	R_0 (fm)	HF
5.871(7)	5.734(7)	15(2)%		x		1.5595(50)	

* All values from [2013An01].

Table 12
direct α emission from ^{171m}Ir, Ex = unk., J^{π} = $(11/2^{-})$, $T_{1/2}$ =1.24(4) s**, BR_{α} = 62(6)%**.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{167}Re)	coincident γ-rays	R_0 (fm)	HF
6.061(4)	5.919(4)	100%	53(5)%***		0.0921(2)	0.0921(2)	1.5595(50)	
6.155(5)	6.011(5)	15(2)%	9(1)%	$(11/2^{-})$	0.0	——	1.5595(50)	

* All values from [2023Zh03]. except where noted.
** Weighted average of 1.14(5) s [2014Pe02], 1.4(1) s [2013An01],and 1.28(4) [2023Zh03].
*** [2014Pe02].

Table 13
direct α emission from ^{175}Au*, J^{π} = $(1/2^{+})$, $T_{1/2}$ = 200(3) ms, BR_{α} =90(7)%**.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{171}Ir)	coincident γ-rays	R_0 (fm)	HF
6.583(4)	6.433(4)	90(7)%**	$(11/2^{-})$	x		1.5504(54)	

* All values from [2017Ba46], except where noted.
** [2013An10].

Table 14
direct α emission from ^{175m}Au, Ex = unk., J^{π} = $(11/2^{-})$, $T_{1/2}$ =1.19(5) s*, BR_{α} = 90(3)%**.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{171}Ir)	coincident γ-rays	R_0 (fm)	HF
6.583(4)	6.432(4)***	90(3)%**	$(1/2^{+})$	0.0	——	1.5504(54)	

* Weighted average of 136(1) ms [2017Ba46] and 139(2) ms [2011Wa37].
** [2010An01].
*** Weighted average of 6.433(4) MeV [2017Ba46], 6.430(6) MeV [2011Wa37], and 6.432(5) MeV [2010An01].

Table 15
direct α emission from ^{179}Tl, J^{π} = $(1/2^{+})$, $T_{1/2}$ = 426(10) ms*, BR_{α} =60(2)%**.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{175}Au)	coincident γ-rays	R_0 (fm)	HF
6.709(4)	6.559(4)	60(2)%**	$(1/2^{+})$	0.0	——	1.5297(36)	2.16(19)

* [2017Ba46].
** [2013An10].

Table 16
direct α emission from ^{179m}Tl, Ex = unk., J^{π} = $(11/2^{-})$, $T_{1/2}$ =1.42(3) ms*, BR_{α} = 100%.

E_{α}(c.m.)	E_{α}(lab)	I_{α}(rel)	I_{α}(abs)	J^{π}_{f}	$E_{daughter}$(^{175}Au)	coincident γ-rays	R_0 (fm)	HF
7.258(10)	7.096(10) [@]	25(11)%	20(9)%[@]		x + 0.113		1.5297(36)	
7.371(4)	7.206(4)***	100(25)%	80(20)%[@]	$(11/2^{-})$	x		1.5297(36)	

* Weighted average of 1.40(3) ms [2017Ba46], and 1.46(4) ms [2010An01].
** [2010An01].
*** Weighted average of7.206(4) MeV [2017Ba46], and 7.207(5) MeV [2010An01].
[@] [1998To14].

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