Coulomb excitation

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. J. Martin, C. D. Nesaraja	NDS 186, 261 (2022)	31-Dec-2021

(x,x′).
1971Fo17, 1973Be44, 1974Mc15: x=α, E=17 MeV.
(x,x′γ).
1965Fr11: x=d.
1971EiZS: x=^{40}Ar, E=145 MeV.
1983Sp03: x=^{208}Pb, E=5.1 and 5.3 MeV/u.
2007WaZV: x=^{208}Pb, E=1300 MeV (unsafe Coulomb Excitation). Measurements performed at ATLAS-Argonned facility using Gammasphere array consisting of 99 Compton-supressed Ge detectors.
2008WaZN: x=^{208}Pb, E=1300 MeV.
The quadrupole and hexadecapole deformations were deduced by 1973Be44.
The intrinsic quadrupole moment and the deformation parameter were deduced by 1965Fr11 from the measured cross section for Coulomb excitation of the 2$^+$ state at 44.5 keV: Q(0)=11.8 *5*, β=0.28 *1*.

^{242}Pu Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	Comments
0.0[@]	0$^+$		
44.50[@] *10*	2$^+$	160 ps *3*	B(E2)↑=13.47 *18* (1973Be44) B(E2)↑: Other: 13.9 *12* (1965Fr11). T$_{1/2}$: Calculated from B(E2)=13.47 *18*, Eγ=44.545 *9* and α=748 *11* (adopted values of Eγ and α).
147.30[@] *15*	4$^+$		B(E4)↑=0.55 *+53−41* (1973Be44)
305.80[@] *25*	6$^+$		
517.1[@] *3*	8$^+$		
777.8[@] *4*	10$^+$		
780.45[#&] *5*	1$^-$[#]		
832.3[&] *2*	3$^-$		B(E3)↑=0.42 *7* (1974Mc15) E(level): From Adopted Levels. E=833 *5* was measured in Coulomb excitation by 1974Mc15.
927[#&]	5$^-$[#]		
956[#b]	0$^+$[#]		
992.5[#b] *3*	(2$^+$)[#]		
1019.5[a] *8*	3$^-$		B(E3)↑=0.45 *7* (1974Mc15) E(level): From Adopted Levels. E=1021 6 was measured in Coulomb excitation by 1974Mc15.
1070.8?[&]	7$^-$		
1084.0[@] *4*	12$^+$		
1102 *4*	(2$^+$)		B(E2)↑=0.157 *18* (1974Mc15) E(level): from 1974Mc15.
1122[#a]	5$^-$[#]		
1186.3?[c] *6*	(7$^-$)		
1242.8[&] *4*	9$^-$		
1277.1[a] *4*	7$^-$		
1358.7[c] *5*	(9$^-$)		
1431.7[@] *4*	14$^+$		
1466.8[&] *4*	11$^-$		
1478.5[a] *4*	9$^-$		
1577.9[c] *4*	(11$^-$)		
1724.9[a] *4*	11$^-$		

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Coulomb excitation (continued)

^{242}Pu Levels (continued)

E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]
1733.4[&] 4	13⁻	2386.9[&] 4	17⁻	3167.2[@] 5	22⁺	4103.6[&] 5	25⁻
1817.4[@] 4	16⁺	2483.6[b] 4	(16⁺)	3185.1[&] 5	21⁻	4180.2[@] 6	26⁺
1842.2[c] 4	(13⁻)	2494.7[c] 5	(17⁻)	3297.5[c] 6	(21⁻)	4221.5[c] 8	(25⁻)
1885.9[b] 4	(12⁺)	2616.8[d] 5		3374.3[d] 6		4368.0[b] 6	(26⁺)
1995.7[d] 4		2688.6[@] 5	20⁺	3509.5[b] 5	(22⁺)	4599.4[&] 7	27⁻
2013.4[a] 4	13⁻	2707.1[a] 5	17⁻	3538.5[a] 5	21⁻	4691.2[@] 8	28⁺
2040.6[&] 4	15⁻	2769.3[&] 5	19⁻	3631.0[&] 5	23⁻	5117.0[&] 8	29⁻
2147.7[c] 5	(15⁻)	2806.8[b] 4	(18⁺)	3667.7[@] 5	24⁺	5201.2[@] 11	30⁺
2170.8[b] 4	(14⁺)	2879.2[c] 5	(19⁻)	3747.2[c] 7	(23⁻)	5648.4[&] 9	31⁻
2237.5[@] 4	18⁺	2979.4[d] 5		3799.6?[d] 8		5723.9[@] 11	32⁺
2289.5[d] 4		3106.5[a] 5	19⁻	3915.0[b] 5	(24⁺)		
2339.5[a] 4	15⁻	3142.1[b] 4	(20⁺)	4000.5[a] 7	23⁻		

[†] From a least-squares fit to the Eγ data except where noted otherwise.
[‡] Assignments are from 2007WaZV based on band structure.
[#] From Adopted Levels. Not seen in Coulomb excitation.
[@] Band(A): K^π=0 g.s. band.
[&] Band(B): K^π=0⁻ octupole vibration band.
[a] Band(C): K^π=3⁻ band.
[b] Band(D): K^π=0⁺ band.
[c] Band(E): K^π=? band.
[d] Band(F): K^π=? band.

γ(^{242}Pu)

Eγ[†]	Iγ[#]	Ei(level)	Jπi	Ef	Jπf	Mult.[@]	Comments
44.5[‡] 1		44.50	2⁺	0.0	0⁺	E2	
102.8[‡] 1	100 4	147.30	4⁺	44.50	2⁺	Q	A_2=+0.30 3, A_4=−0.12 5.
143.8[&] 10	2.8	1070.8?	7⁻	927	5⁻		
149.4 4	0.09 10	2386.9	17⁻	2237.5	18⁺		
158.5 2	75 5	305.80	6⁺	147.30	4⁺	Q	A_2=+0.19 3, A_4=−0.10 5.
172.0[&] 5	0.23 19	1242.8	9⁻	1070.8?	7⁻		
172.4[&] 4	0.24 16	1358.7	(9⁻)	1186.3?	(7⁻)		
201.4 3	0.24 9	1478.5	9⁻	1277.1	7⁻	Q	A_2=+0.19 11, A_4=−0.07 14.
211.3 2	106 7	517.1	8⁺	305.80	6⁺	Q	A_2=+0.21 4, A_4=−0.05 5.
219.2 3	0.43 16	1577.9	(11⁻)	1358.7	(9⁻)	Q	A_2=+0.22 13, A_4=−0.07 16.
223.2 4	0.30 17	2040.6	15⁻	1817.4	16⁺		
224.0 3	0.36 24	1466.8	11⁻	1242.8	9⁻	Q	A_2=+0.26 9, A_4=−0.10 16.
246.4 2	0.10 4	1724.9	11⁻	1478.5	9⁻	Q	A_2=+0.27 17, A_4=−0.13 11.
260.7 2	91 9	777.8	10⁺	517.1	8⁺	Q	A_2=+0.22 4, A_4=−0.04 5.
264.3 3	0.26 16	1842.2	(13⁻)	1577.9	(11⁻)		A_2=+0.27 11, A_4=−0.11 12.
266.6 2	1.3 6	1733.4	13⁻	1466.8	11⁻	Q	A_2=+0.34 20, A_4=−0.07 25.
284.9 3	0.15 8	2170.8	(14⁺)	1885.9	(12⁺)	Q	A_2=+0.23 9, A_4=−0.09 7.
288.5 2	0.11 10	2013.4	13⁻	1724.9	11⁻	(Q)	A_2=+0.22 14, A_4=−0.10 18.
293.8 3		2289.5		1995.7			
301.7 2	0.39 26	1733.4	13⁻	1431.7	14⁺		
305.5 3	0.25 56	2147.7	(15⁻)	1842.2	(13⁻)		

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Coulomb excitation (continued)

$\gamma(^{242}Pu)$ (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
306.2 2	67 8	1084.0	12^+	777.8	10^+	Q	A_2=+0.19 3, A_4=−0.06 3.
307.2 2	3.6 12	2040.6	15^-	1733.4	13^-	Q	A_2=+0.24 10, A_4=−0.05 7.
312.8 3	0.16 7	2483.6	(16^+)	2170.8	(14^+)	(Q)	A_2=+0.27 15, A_4=−0.05 20.
323.2 2	0.20 7	2806.8	(18^+)	2483.6	(16^+)	(Q)	A_2=+0.13 17, A_4=−0.15 22.
326.1 2	0.15 9	2339.5	15^-	2013.4	13^-	(Q)	A_2=+0.3 3, A_4=−0.04 39.
327.3 3		2616.8		2289.5			
335.3 2	0.06 3	3142.1	(20^+)	2806.8	(18^+)	(Q)	A_2=+0.27 16, A_4=−0.15 21.
346.3 2	6.4 32	2386.9	17^-	2040.6	15^-	Q	A_2=+0.34 2, A_4=−0.08 3.
347.0 3	0.23 57	2494.7	(17^-)	2147.7	(15^-)		
347.7 2	47 5	1431.7	14^+	1084.0	12^+	Q	A_2=+0.18 3, A_4=−0.06 3.
362.6 3		2979.4		2616.8			
367.4 2		3509.5	(22^+)	3142.1	(20^+)		
367.6 2	0.30 13	2707.1	17^-	2339.5	15^-	(Q)	A_2=+0.20 12, A_4=−0.15 17.
382.4 3	0.97 26	2769.3	19^-	2386.9	17^-	Q	A_2=+0.19 8, A_4=−0.08 10.
382.8 2	0.24 19	1466.8	11^-	1084.0	12^+		
384.5 3	0.33 57	2879.2	(19^-)	2494.7	(17^-)		
385.7 2	29 3	1817.4	16^+	1431.7	14^+	Q	A_2=+0.23 5, A_4=−0.08 7.
394.9 4		3374.3		2979.4			
399.4 3		3106.5	19^-	2707.1	17^-		
405.5 3		3915.0	(24^+)	3509.5	(22^+)		
415.8 2	1.2 5	3185.1	21^-	2769.3	19^-	Q	A_2=+0.40 14, A_4=−0.06 8.
418.3 3	0.27 56	3297.5	(21^-)	2879.2	(19^-)		
420.1 2	16.3 17	2237.5	18^+	1817.4	16^+	Q	A_2=+0.18 4, A_4=−0.11 6.
425.3[&] 4		3799.6?		3374.3			
432.0 3		3538.5	21^-	3106.5	19^-		
435.9 3	0.04 2	4103.6	25^-	3667.7	24^+		
445.9 2	1.0 5	3631.0	23^-	3185.1	21^-	Q	A_2=+0.19 7, A_4=−0.04 11.
449.7 4		3747.2	(23^-)	3297.5	(21^-)		
451.1 2	98 12	2688.6	20^+	2237.5	18^+	Q	A_2=+0.30 7, A_4=−0.09 10.
453.0 3		4368.0	(26^+)	3915.0	(24^+)		
453.5 3		3142.1	(20^+)	2688.6	20^+		
462.0 4		4000.5	23^-	3538.5	21^-		
463.8 3	0.14 5	3631.0	23^-	3167.2	22^+		
465.0 3	0.46 25	1242.8	9^-	777.8	10^+		
472.6 3	0.8 5	4103.6	25^-	3631.0	23^-	Q	A_2=+0.20 10, A_4=−0.12 16.
474.3 4		4221.5	(25^-)	3747.2	(23^-)		
478.6 2	4.9 8	3167.2	22^+	2688.6	20^+	Q	A_2=+0.26 6, A_4=−0.12 7.
495.8 4		4599.4	27^-	4103.6	25^-		
496.5 2	0.34 6	3185.1	21^-	2688.6	20^+	D	A_2=−0.29 17, A_4=+0.02 21.
500.5 2	2.4 6	3667.7	24^+	3167.2	22^+	Q	A_2=+0.32 10, A_4=−0.12 14.
510.0 7	0.12 4	5201.2	30^+	4691.2	28^+		
511.0 5	0.39 12	4691.2	28^+	4180.2	26^+		
512.5 3	0.76 19	4180.2	26^+	3667.7	24^+		
517.6 4		5117.0	29^-	4599.4	27^-		
522.7 4	0.034 9	5723.9	32^+	5201.2	30^+		
531.4 4		5648.4	31^-	5117.0	29^-		
531.8 2	0.53 9	2769.3	19^-	2237.5	18^+	D	A_2=−0.22 11, A_4=−0.01 14.
553.7[&] 2	2.8	1070.8?	7^-	517.1	8^+		
569.3 3		2806.8	(18^+)	2237.5	18^+		
569.5 2	1.8 6	2386.9	17^-	1817.4	16^+	D	A_2=−0.17 8, A_4=+0.02 4.
608.9 2	1.28 22	2040.6	15^-	1431.7	14^+	D	A_2=−0.15 10, A_4=+0.03 5.
640.9 3	0.49 34	1724.9	11^-	1084.0	12^+	D	A_2=−0.35 23, A_4=+0.10 13.
641.7 5		2879.2	(19^-)	2237.5	18^+		
649.4 2	1.21 21	1733.4	13^-	1084.0	12^+	D	A_2=−0.22 10, A_4=+0.06 5.
666.2 4	0.09 3	2483.6	(16^+)	1817.4	16^+		

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Coulomb excitation (continued)

$\gamma(^{242}Pu)$ (continued)

E_γ [†]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [@]	Comments
677.3 *5*	0.07 *3*	2494.7	(17⁻)	1817.4	16⁺		
689.0 *2*	0.92 *17*	1466.8	11⁻	777.8	10⁺	D	A_2=−0.24 *8*, A_4=−0.08 *10*.
700.7 *4*	0.80 *73*	1478.5	9⁻	777.8	10⁺		
716.0 *4*	0.14 *4*	2147.7	(15⁻)	1431.7	14⁺		
725.7 *2*	0.60 *14*	1242.8	9⁻	517.1	8⁺	D	A_2=−0.29 *11*, A_4=+0.11 *9*.
739.1 *2*	0.10 *3*	2170.8	(14⁺)	1431.7	14⁺	(D+Q)	A_2=−0.23 *11*, A_4=−0.08 *12*. Mult.: ΔJ=0?
747.8 *3*		3915.0	(24⁺)	3167.2	22⁺		
758.2 *3*	0.17 *4*	1842.2	(13⁻)	1084.0	12⁺		
760.0 *5*	1.1 *16*	1277.1	7⁻	517.1	8⁺		
765.0[&] *2*	2.8 *4*	1070.8?	7⁻	305.80	6⁺		
800.1 *2*	0.36 *7*	1577.9	(11⁻)	777.8	10⁺		A_2=−0.3 *7*, A_4=+0.01 *90*.
801.9 *2*	0.12 *4*	1885.9	(12⁺)	1084.0	12⁺		
820.9 *3*		3509.5	(22⁺)	2688.6	20⁺		
841.6 *5*	0.26 *12*	1358.7	(9⁻)	517.1	8⁺	(D)	A_2=−0.15 *19*, A_4=+0.06 *24*.
849.9 *4*		3538.5	21⁻	2688.6	20⁺		
869.0 *4*	0.10 *3*	3106.5	19⁻	2237.5	18⁺		
880.5[&] *5*		1186.3?	(7⁻)	305.80	6⁺		
889.7 *4*	0.11 *3*	2707.1	17⁻	1817.4	16⁺		
904.6 *2*	0.13 *3*	3142.1	(20⁺)	2237.5	18⁺		
907.8 *3*	0.21 *5*	2339.5	15⁻	1431.7	14⁺	(D)	A_2=−0.3 *2*, A_4=−0.05 *26*.
911.7 *3*		1995.7		1084.0	12⁺		
929.4 *2*	0.34 *6*	2013.4	13⁻	1084.0	12⁺	D	A_2=−0.4 *2*, A_4=−0.04 *27*.
947.1 *2*	0.24 *6*	1724.9	11⁻	777.8	10⁺	D	A_2=−0.23 *31*, A_4=+0.04 *39*.
961.4 *4*	0.35 *10*	1478.5	9⁻	517.1	8⁺	D	A_2=−0.21 *9*, A_4=+0.02 *5*.
971.3 *5*	0.53 *18*	1277.1	7⁻	305.80	6⁺	D	A_2=−0.27 *16*, A_4=+0.06 *19*.
989.4 *2*	0.24 *5*	2806.8	(18⁺)	1817.4	16⁺		
1051.9 *2*	0.19 *4*	2483.6	(16⁺)	1431.7	14⁺	Q	A_2=+0.21 *7*, A_4=−0.04 *9*.
1086.8 *2*	0.12 *4*	2170.8	(14⁺)	1084.0	12⁺	(Q)	A_2=+0.15 *10*, A_4=−0.06 *11*.
1108.1 *4*	0.08 *3*	1885.9	(12⁺)	777.8	10⁺		
1162.0 *4*		2979.4		1817.4	16⁺		
1185.1 *4*		2616.8		1431.7	14⁺		
1205.5 *3*		2289.5		1084.0	12⁺		
1217.9 *3*		1995.7		777.8	10⁺		

† From 2007WaZV except where noted otherwise. 1983Sp03 also report Eγ data for the ground-state band up to the 26⁺ level.

‡ From 1971EiZS.

\# From 2007WaZV normalized to Iγ=100 for the 102.8γ.

@ Mult for the 44.5γ is from adopted γ's. The others have been assigned by the evaluators based on the directional correlation coefficients given by 2007WaZV. Assignments for the gs-band transitions up to 26⁺ are confirmed by 1983Sp03. See the general comment on J^π.

& Placement of transition in the level scheme is uncertain.

Coulomb excitation

Level Scheme

Intensities: Relative I_γ

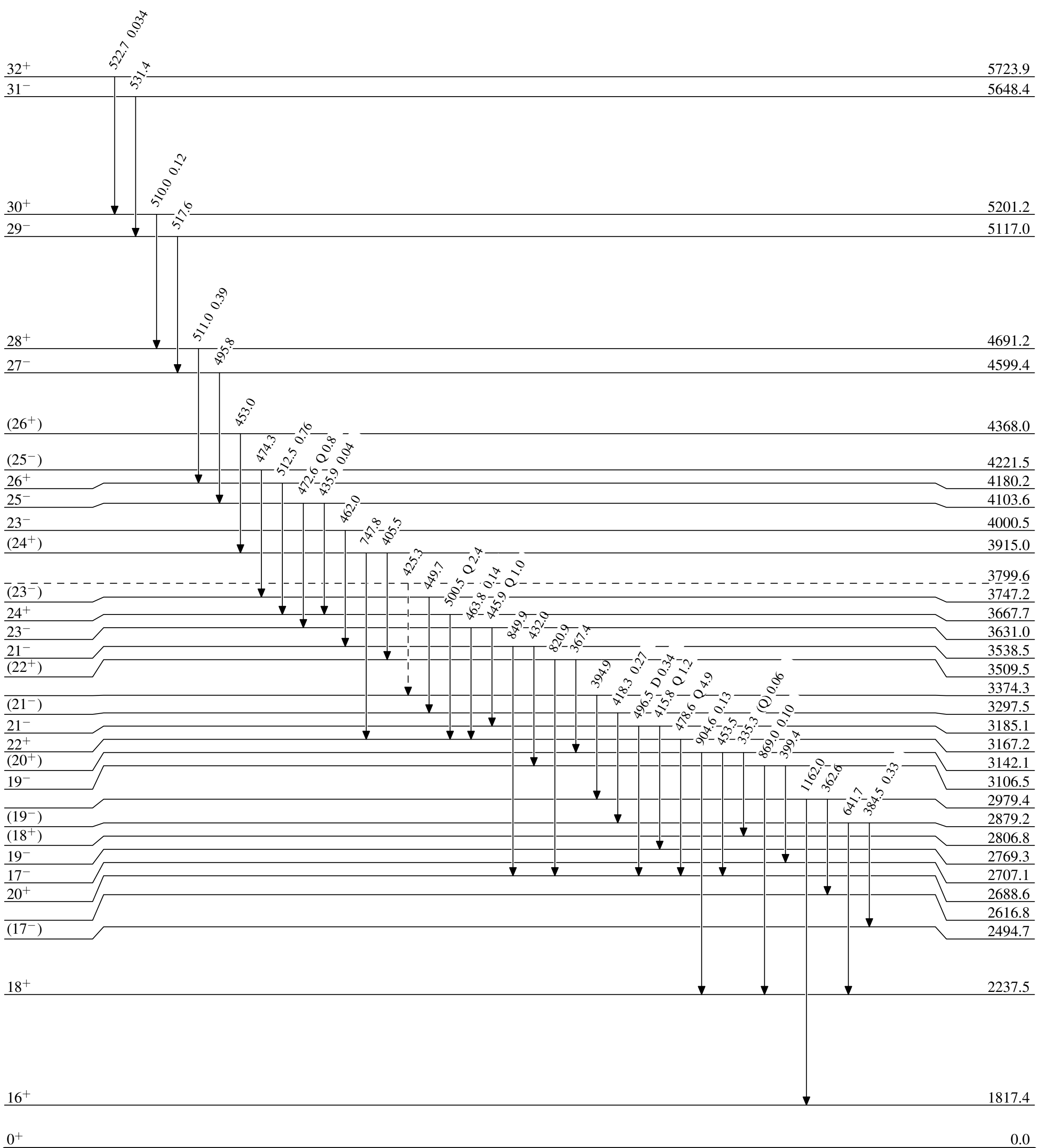
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)

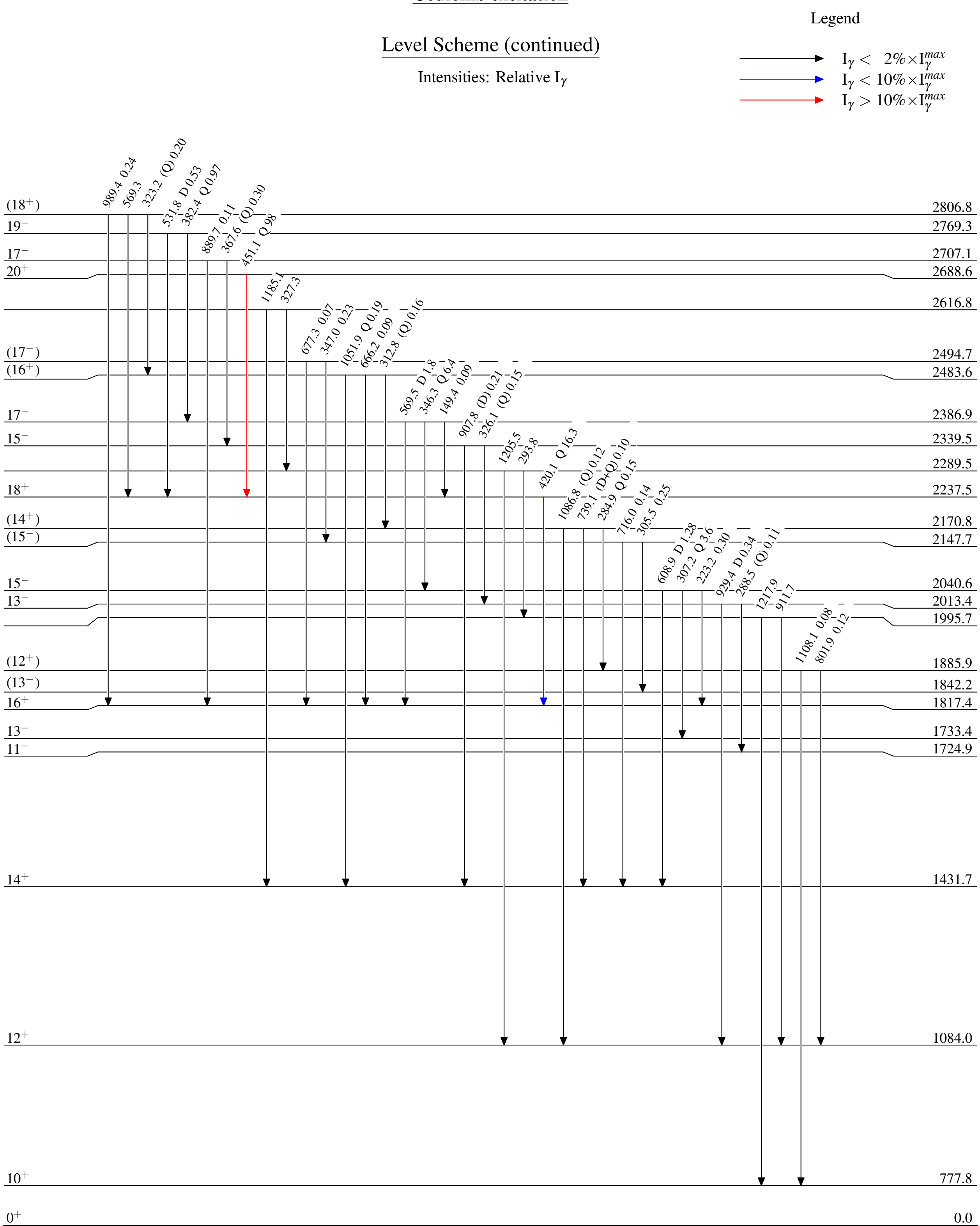


$^{242}_{94}Pu_{148}$

Coulomb excitation

Level Scheme (continued)

Intensities: Relative I_γ

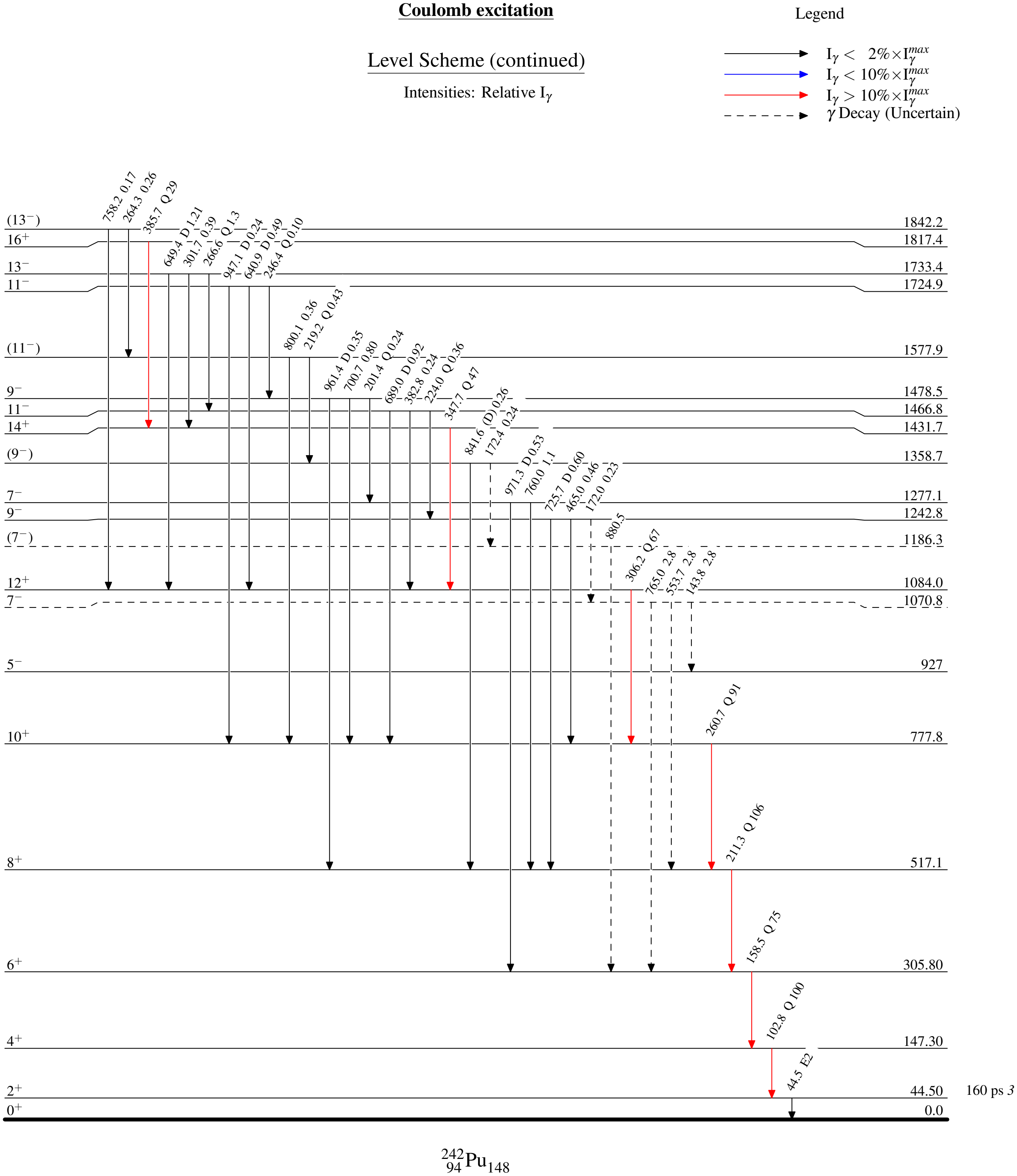


$^{242}_{94}Pu_{148}$

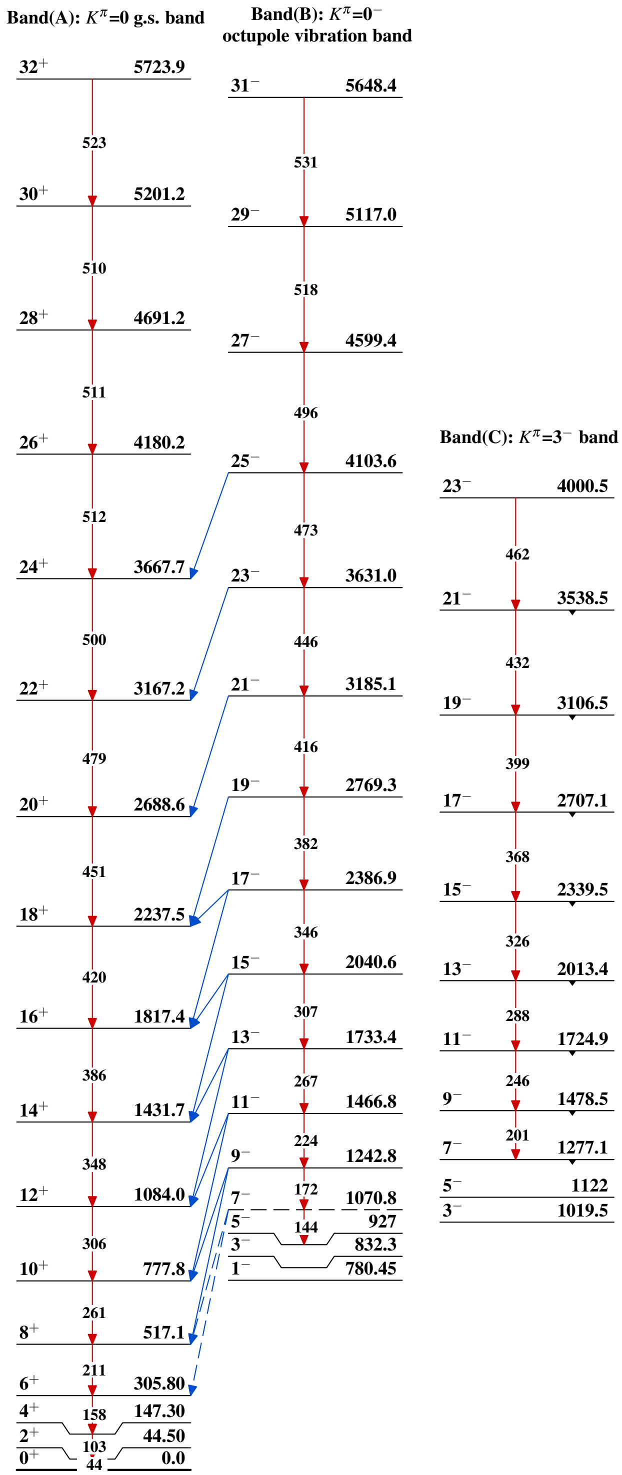
Coulomb excitation

Level Scheme (continued)

Intensities: Relative I_γ

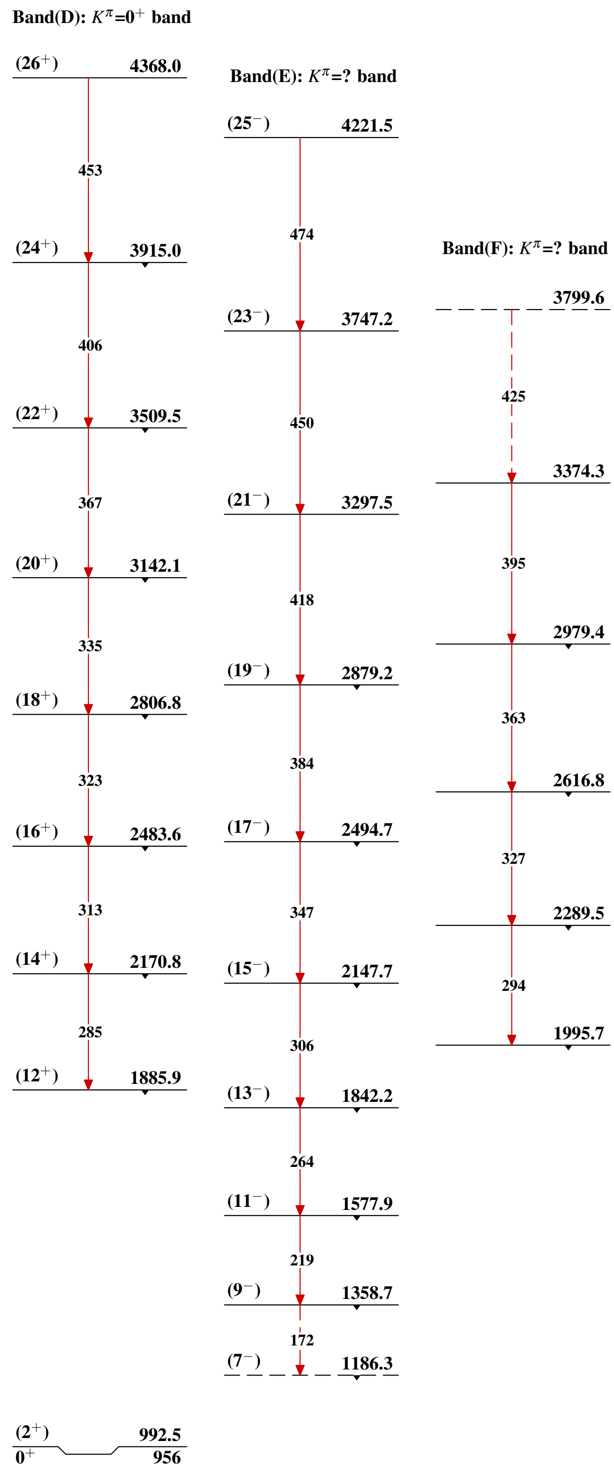


Coulomb excitation



$^{242}_{94}Pu_{148}$

Coulomb excitation (continued)



$^{242}_{94}Pu_{148}$