Adopted Levels, Gammas

History

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

Q(β^-)=−751.1 *7*; S(n)=6309.6 *7*; S(p)=6.89×10^3 *10*; Q(α)=4984.2 *10* 2021Wa16
S(2n)=11551.1 *7*, S(2p)=12576.6 *27* (2021Wa16).

For references on theoretical studies refer to the NSR file at the Web site given in the abstract.

^{242}Pu Levels

Cross Reference (XREF) Flags

A	^{246}Cm α decay	E	Coulomb excitation	I	^{241}Pu(n,γ) E=th:primary γ's
B	^{242}Np β^- decay (2.2 min)	F	^{242}Pu(d,d′)	J	^{241}Pu(n,γ) E=th:secondary γ's
C	^{242}Np β^- decay (5.5 min)	G	^{244}Pu(p,t)		
D	^{242}Am ε decay (16.01 h)	H	^{244}Pu(^{208}Pb,^{210}Pbγ)		

E(level)[b]	J$^{\pi}$[c]	T$_{1/2}$	XREF	Comments
0.0[†]	0$^+$	3.73×10^5 y *2*	ABCDEFGHIJ	%α=100; %SF=5.53×10^{-4} *5* %SF: From the adopted values for T$_{1/2}$(α) and T$_{1/2}$(SF). T$_{1/2}$: Based on the following set of measurements. Standards used by the authors are given in parens and their half-lives have been corrected by the evaluators for newer values of the standards as follows: T$_{1/2}$=87.7 y *1* for ^{238}Pu, 6561 y *7* for ^{240}Pu, and 24110 y *30* for ^{239}Pu. The following values are in units of 10^5 y. T$_{1/2}$=3.65 *5* (^{238}Pu) (1956Bu64), 3.79 *5* (specific activity) (1956Bu92), 3.87 *10* (^{240}Pu) (1956Me37), 3.82 *3* (^{239}Pu) (1969Be06), 3.67 *7* (^{238}Pu) (1970Du02), 3.702 *7* (absolute 4π $\alpha\gamma$ coin and radiometry) (1976Bu23), 3.764 *9* (low-temperature heat capacity) (1976Os05), 3.708 *25* (^{239}Pu) (1978MeZL), 3.742 *24* (^{239}Pu) (1979Ag03), 3.766 *25* (^{238}Pu) (1979Ag03). The value of 1976Os05 was recalculated by the evaluators using E(α)=4984.2 *10*. The authors used 4982.3 *12*. The value given by 1969Be06, 3.823 *16*, has been revised by 1976Bu23. These data give a weighted average of 3.730×10^5 y *12*. The evaluators adopt 3.73×10^5 y *2* with the uncertainty increased to overlap the two values quoted to the highest precision. Others:1950Th54, 1956Hu96. T$_{1/2}$(SF) is based on the following set of measurements, given in units of 10^{10} y. The evaluators have applied the same corrections for the T$_{1/2}$ standards as given in the comment on T$_{1/2}$(α): 6.65 *10* (1956Bu64), 6.79 *9* (1956Me37 as revised by 2000Ho27), 6.74 *5* (1978MeZL), 6.86 *26* (1988SeZY), 6.79 *9* (2005ChZU) 6.74 *9* (2013Sa65), 6.72 *8* (2017Ma07), and 6.77 *5* (2018Be29). The values given for 1956Me37 and 2017Ma07 are based on the adopted value for T$_{1/2}$(α) and the authors′ values of T$_{1/2}$(α)/T$_{1/2}$(SF)= 1.819×10^5 *18* and 1.802×10^5 *18* respectively, These data give a weighted average of 6.748 *28*. The evaluators adopt T$_{1/2}$(SF)=6.75×10^{10} *5* with the uncertainty increased to the smallest of the input values. Others: 6.7 *7* (quoted in 1956Me37), 6.5 *7* (1961Dr04), and 7.45 *17* (1963Ma50). See also recommended value: 6.766 ×10^{10} y *37* (2021Cr02). The intrinsic quadrupole and hexadecapole moments were deduced by 1986Zu01 as Q(0)=11.901 *63* and H(0)=2.08 (12) from measured muonic X-ray data (muons were stopped on a ^{242}Pu target.) From Coulomb excitation, 1973Be44 deduced Q(0)=11.64 *9* and H(0)=1.75 *+71−87*. From the intrinsic quadrupole and hexadecapole moments, the quadrupole and hexadecapole deformation parameters were obtained by 1986Zu01 as β(2)=0.2766 *15* and

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Adopted Levels, Gammas (continued)

^{242}Pu Levels (continued)

E(level)[b]	J^{π}[c]	$T_{1/2}$	XREF	Comments
				$\beta(4)$=0.0498 *52*. The relative isotope shifts between ^{242}Pu and ^{240}Pu, and between ^{242}Pu and ^{244}Pu were measured by 1985Ge08 to be 1.0 and 1.03 *2*, respectively. See also 1989Ru07. Energy distribution and yields of long range alpha particles emitted during spontaneous fission were measured by 1998Se17. Cold fission (without neutron emission) in ^{242}Pu spontaneous fission was observed by 1996Da16. Energy and mass distributions of fission fragments were measured by 1982Al13, 1984Th01, 1989Wa29 and 1997De11. Energy and mass distribution of muon-induced fission fragments were measured by 1987Da22; time distribution of fission fragments from muonic ^{242}Pu was measured by 1980Wi06; energy distribution of fission fragments induced by (t,p) reaction was measured by 1974Ba28, and fission probability was deduced. The prompt gamma-ray spectrum for spontaneous fission was measured by 2018Ch34 and 2016Ob01. The prompt gamma-ray spectrum for neutron-induced fission was measured by 2018Ch34. Fission fragments mass distribution was measured by 2017Hi10 populated in the excitation-energy range from 10 to 60 MeV by multinucleon transfer channels in the reaction ^{18}O + ^{238}U. σ and σ(E) for photo fission were measured by 2000So02. The absolute cross section for neutron-induced fission from 1 to 2.5 MeV was measured by 2017Ma07.
44.545[†] *9*	2^+	160 ps *3*	ABCDEFGHIJ	J^{π}: E2 γ to 0^+. $T_{1/2}$: From B(E2) in Coulomb excitation.
147.4[†] *1*	4^+		ABC EFGHIJ	B(E4)↑=0.55 *+53−41*
306.4[†] *2*	6^+		C EF H J	
518.1[†] *5*	8^+		EF H	
778.6[†] *8*	10^+		E H	
780.45[‡] *5*	1^-		B EF J	J^{π}: From systematics of octupole-vibrational state energies. A ratio of reduced-transition rates of gammas to the g.s. band: B(E1,735.93γ)/B(E1,780.44γ)=2.25 observed in β^- decay agrees with 2.0 from the Alaga rule.
832.3[‡] *3*	3^-		B EF IJ	B(E3)↑=0.42 *7* J^{π}: From excit in Coulomb excitation; gammas to 2^+ and 4^+ levels.
865			F	
927[‡]	5^-[d]		EF	
956[@]	0^+		E G	J^{π}: L(p,t)=0.
992.5[@] *3*	(2^+)		B EFG	J^{π}: Spacing of 36 keV above the 956 0^+ state in (p,t) is suggestive of a rotational band. See 1970Ma29.
1019.5[#] *8*	3^-		EF IJ	B(E3)↑=0.45 *7* J^{π}: From excit in Coulomb excitation.
1039.2 *3*	$(1,2^+)$		B I	J^{π}: Fed from $2^+,3^+$ by primary in (n,γ). Possible γ to 0^+.
1064.0 *9*	(4^-)		IJ	J^{π}: Fed from $2^+,3^+$ by primary in (n,γ). γ to 4^+. No γ's to 0^+ or 2^+.
1070.8?[‡]	7^-		E	
1084.0[†] *4*	12^+		E H	
1092.1 *2*	(6^+)		C	J^{π}: gammas to $4^+,6^+$. 1981Fr07 proposed $J^{\pi}=6^+$ and configuration=(ν5/2[622],ν7/2[624]) similar to the 1040.3-keV level in ^{244}Cm.
1102 *4*	2^+[d]		EFG	B(E2)↑=0.157 *18*
1122[#]	5^-[d]		EF	

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Adopted Levels, Gammas (continued)

^{242}Pu Levels (continued)

E(level)[b]	Jπ[c]	$T_{1/2}$	XREF	Comments
1152.5 *13*	(2⁻)		IJ	Jπ: Fed from 2⁺,3⁺ by primary γ in (n,γ). γ to 2⁺; no γ's to 0⁺ or 4⁺.
1154.5 *2*	(2⁺,3⁻)		B	Jπ: γ's to 2⁺ and 4⁺. log*ft*=7.5, log$f^{1u}t$=8.3 from (1⁺).
1181.6 *2*	(2⁺)		B	Jπ: γ's to 0⁺ and 4⁺.
1186.3?[&] *6*	(7⁻)		E	
1204			F	
1242.8[‡] *4*	9⁻		E	
1259			F	
1277.1[#] *4*	7⁻		E	
1357.2? *3*			C	Jπ: by analogy to the 1308.7-keV level in ^{240}Pu, 1981Fr07 proposed a two-proton configuration of 5−(π5/2[642],π5/2[523]). Although this configuration is consistent with a beta branch from a 6+(π5/2[642],ν7/2[624]) parent state, the gamma transition to a 6+(ν5/2[622],ν7/2[624]) state is not. Admixture with two-proton states with large amplitudes would be expected.
1358.7[&] *5*	(9⁻)		E	
1401.0? *2*	(0,1⁺)		B	Jπ: Log*ft*=7.0 from (1⁺) suggests *J*π=0, 1, 2. No γ to 3⁻ implies *J*π=0, 1⁺.
1428.0 *4*	(2⁻)		B	Jπ: log *ft*=7.3 from (1⁺). γ to 2⁺. No γ's to 0⁺. Analogy with 1438.5 level in ^{240}Pu (1979Ha26).
1431.7[†] *16*	14⁺		E H	
1466.8[‡] *4*	11⁻		E	
1478.5[#] *4*	9⁻		E	
1501			F	
1517.6 *1*	(1⁻)		B	Jπ: γ's to 0⁺,2⁺. The ratio of reduced transition intensities of 1517.6 and 1473.1 gammas is in agreement with the Alaga rule for K=0, *J*π=1⁻.
1577.9[&] *4*	(11⁻)		E	
1613			F	
1638			F	
1650	(3⁻)		F	Jπ: Proposed by 1972El08 from (d,d′) data. Assignment is uncertain. B(E3)=0.36 *6* was extracted by 1972El08 from the (d,d′) cross section.
1683			F	
1701			F	
1724.9[#] *4*	11⁻		E	
1733.4[‡] *4*	13⁻		E	
1745.3 *18*			I	
1776			F	
1817.4[†] *4*	16⁺		E H	
1825.8 *10*	(4⁺)		F IJ	Jπ: Fed from 2⁺,3⁺ by primary in (n,γ). γ to 6⁺.
1842.2[&] *4*	(13⁻)		E	
1871.4 *3*			B	
1874.1 *2*			B	
1885.9[@] *4*	(12⁺)		E	
1903.6 *3*			B	
1949.8 *2*	(1,2⁺)		B	Jπ: γ's to 0⁺ and 2⁺.
1969.9 *2*	(1,2⁺)		B	Jπ: γ's to 0⁺ and 2⁺.
1995.7[a] *4*			E	
2000 *CA*		3.5 ns *6*		%SF=? %SF: Only SF decay observed. Assignment: ^{242}Pu(d,pn) excit 1974MeYP. $T_{1/2}$: From 1974MeYP. See 1975Me28 for a review and systematics of fission isomer half-lives. $T_{1/2}$ for SF isomer was calculated by 1972We09 (3.7 ns), 1971Ba30 (30 ns). 1992Bh03 (3.5 ns). $T_{1/2}$ for γ emission was calculated by 1972We09 (3.4 μs). See also

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Adopted Levels, Gammas (continued)

^{242}Pu Levels (continued)

E(level)[b]	J^{π}[c]	$T_{1/2}$	XREF	Comments
				1974Ba28.
				E(level): Level energy has not been experimentally determined. The calculated energy of E≈2000 is given here as the level′s expected approximate location. Energy of the lowest level in the second minimum of the double-humped nuclear potential was calculated by several authors using various methods: E=2.2 MeV (1970AlZT), 2.2 MeV (1971Ba30), 2.6 MeV (1971Pa33), 2.0 MeV (1972Ma11), 2.0 MeV (1972We09), 2.1 MeV (1992Bh03).
≈2000+x		28 ns		%SF=? %SF: Only SF decay observed. $T_{1/2}$: $T_{1/2}$=50 ns *30* was measured by 1969La14 in ^{241}Pu(13-MeV d,p) reaction. This value was reevaluated by 1970Po01 as $T_{1/2}$=28 ns. E(level): From $T_{1/2}$-systematics of SF isomers in even Pu isotopes, 1975Me28 suggested that this isomer is a level lying higher than the 3.5-ns isomer in the second minimum of the double-humped nuclear potential.
2013.4[#] *4*	13⁻		E	
2040.6[‡] *4*	15⁻		E	
2091.8 *20*			IJ	
2147.7[&] *5*	(15⁻)		E	
2170.8[@] *4*	(14⁺)		E	
2237.5[†] *4*	18⁺		E H	
2246.0 *4*	(1,2⁺)		B	J^{π}: γ′s to 0⁺,2⁺.
2289.5[a] *4*			E	
2331.3 *2*	(2⁺)		B	J^{π}: Log*ft*=4.9 for β^- feeding from (1⁺) gives J^{π}=(0⁺,1⁺,2⁺). 1979Ha26 proposed a 2⁺ two-proton state with configuration (π 5/2[642],π 9/2[624]).
2339.5[#] *4*	15⁻		E	
2386.9[‡] *4*	17⁻		E	
2437.5 *21*			I	
2483.6[@] *4*	(16⁺)		E	
2494.7[&] *5*	(17⁻)		E	
2616.8[a] *5*			E	
2688.6[†] *5*	20⁺		E H	
2707.1[#] *5*	17⁻		E	
2769.3[‡] *5*	19⁻		E	
2806.8[@] *4*	(18⁺)		E	
2879.2[&] *5*	(19⁻)		E	
2979.4[a] *5*			E	
3106.5[#] *5*	19⁻		E	
3142.1[@] *4*	(20⁺)		E	
3167.2[†] *5*	22⁺		E H	
3185.1[‡] *5*	21⁻		E	
3297.5[&] *6*	(21⁻)		E	
3374.3[a] *6*			E	
3509.5[@] *5*	(22⁺)		E	
3538.5[#] *5*	21⁻		E	
3631.0[‡] *5*	23⁻		E	
3667.7[†] *5*	24⁺		E H	
3747.2[&] *7*	(23⁻)		E	
3799.6?[a] *8*			E	
3915.0[@] *5*	(24⁺)		E	

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Adopted Levels, Gammas (continued)

^{242}Pu Levels (continued)

E(level)[b]	Jπ[c]	XREF	E(level)[b]	Jπ[c]	XREF	E(level)[b]	Jπ[c]	XREF
4000.5[#] 7	23⁻	E	4368.0[@] 6	(26⁺)	E	5201.2[†] 11	30⁺	E
4103.6[‡] 5	25⁻	E	4599.4[‡] 7	27⁻	E	5648.4[‡] 9	31⁻	E
4180.2[†] 6	26⁺	E H	4691.2[†] 8	28⁺	E	5723.9[†] 11	32⁺	E
4221.5[&] 8	(25⁻)	E	5117.0[‡] 8	29⁻	E			

† Band(A): K^π=0⁺ g.s. band.
‡ Band(B): K^π=0⁻ Octupole-vibrational band.
# Band(C): K^π=3⁻ band.
@ Seq.(F): K^π=0⁺ band.
& Band(D): K^π=? band.
a Band(E): K^π=? band.
b From a least-squares fit to the adopted gamma energies except where noted otherwise as indicated by the XREF column.
c Except where noted otherwise, the assignments come from Coulomb excitation based on assigned band structure. The gs, K^π=0⁻, K^π=3⁻, and K^π=0⁺ bands have well-established intra-band Q transitions and several inter-band D transitions. The two K^π=? side bands are tentative since transitions connecting them to possible bandheads are not seen. Assignments for the gs band up to J^π=26⁺ are confirmed by 1983Sp03 from the systematic impact-parameter dependence of the Iγ yields, particle-γ directional correlation, and from γ multiplicity measurements,
d From (d,d′) based on intensity patterns and ratios of cross sections at θ=90° and θ=125°.

γ(^{242}Pu)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡#]	E_f	J_f^π	Mult.	α[†]	Comments
44.545	2⁺	44.545 9	100	0.0	0⁺	E2	748 10	B(E2)(W.u.)=301 14 α(L)=543 8; α(M)=151.5 21 α(N)=41.6 6; α(O)=9.78 14; α(P)=1.529 21; α(Q)=0.00328 5 Mult.: From ce data in 16.01-h ^{242}Am ε decay.
147.4	4⁺	102.8 1	100	44.545	2⁺	(E2)[@]	13.88 20	α(L)=10.07 15; α(M)=2.82 4 α(N)=0.775 11; α(O)=0.1827 27; α(P)=0.0291 4; α(Q)=0.0001056 15
306.4	6⁺	159.1 1	100	147.4	4⁺	(E2)[@]	2.098 30	α(K)=0.1921 27; α(L)=1.384 20; α(M)=0.386 6 α(N)=0.1062 15; α(O)=0.0251 4; α(P)=0.00406 6; α(Q)=2.430×10⁻⁵ 34
518.1	8⁺	211.3 2	100	306.4	6⁺	(E2)[@]	0.696 10	α(K)=0.1388 20; α(L)=0.406 6; α(M)=0.1125 16 α(N)=0.0309 5; α(O)=0.00732 11; α(P)=0.001201 17; α(Q)=1.077×10⁻⁵ 15
778.6	10⁺	260.7 2	100	518.1	8⁺	(E2)[@]	0.333 5	α(K)=0.0987 14; α(L)=0.1706 24; α(M)=0.0470 7 α(N)=0.01290 19; α(O)=0.00307 4; α(P)=0.000509 7; α(Q)=6.24×10⁻⁶ 9
780.45	1⁻	735.93 7	100	44.545	2⁺			
		780.44 5	53 1	0.0	0⁺			
832.3	3⁻	685.0 1	100 14	147.4	4⁺			
		787.8	113 CA	44.545	2⁺			E_γ: From (n,γ). Transition is obscured in 2.2-min ^{242}Np β- decay.
992.5	(2⁺)	948.0 2	100	44.545	2⁺			

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Adopted Levels, Gammas (continued)

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

E_i(level)	J^{π}_i	E_{γ}[‡]	I_{γ}[‡#]	E_f	J^{π}_f	Mult.	α[†]	Comments
1019.5	3^-	974.9	100	44.545	2^+			
1039.2	$(1,2^+)$	1039.2[ef] *3*	100[e]	0.0	0^+			E_{γ}: Eγ=1039.9 *14* from (n,γ): E=primary. I_{γ}: The 1871.4 level, the parent of the alternate placement, is not populated in (n,γ).
1064.0	(4^-)	915.7	100	147.4	4^+			
1070.8?	7^-	143.8 *10*	100	927	5^-			
		553.7 *2*	100	518.1	8^+			
		765.0 *2*	100 *14*	306.4	6^+			
1084.0	12^+	306.2 *2*	100	778.6	10^+	(E2)[@]	0.1985 *28*	α(K)=0.0745 *10*; α(L)=0.0906 *13*; α(M)=0.02476 *35* α(N)=0.00680 *10*; α(O)=0.001619 *23*; α(P)=0.000272 *4*; α(Q)=4.21×10^{-6} *6*
1092.1	(6^+)	785.7 *1*	100	306.4	6^+			
		944.8 *1*	63 *3*	147.4	4^+			
1152.5	(2^-)	1105.6	100	44.545	2^+			
1154.5	$(2^+,3^-)$	1007.3 *2*	43 *8*	147.4	4^+			
		1110.0 *2*	100 *15*	44.545	2^+			
1181.6	(2^+)	1034.2 *2*	22 *4*	147.4	4^+			
		1137.1 *1*	100 *4*	44.545	2^+			I_{γ}: 1979Ha26 in 2.2-min β decay point out that Iγ relative to the other intensities deexciting the 1181.6 level is much higher than expected based on the Alaga rule. They suggest that the 1137.1γ might be a doublet with a second and stronger component as yet unplaced.
		1181.6 *2*	12 *2*	0.0	0^+			
1186.3?	(7^-)	880.5[f] *5*	100	306.4	6^+			
1242.8	9^-	172.0[f] *5*	38 *32*	1070.8?	7^-			
		465.0 *5*	77 *42*	778.6	10^+			
		725.7 *2*	100 *24*	518.1	8^+	(E1)[&]	0.00714 *10*	α(K)=0.00578 *8*; α(L)=0.001026 *14*; α(M)=0.0002455 *34* α(N)=6.64×10^{-5} *9*; α(O)=1.640×10^{-5} *23*; α(P)=3.05×10^{-6} *4*; α(Q)=1.856×10^{-7} *26*
1277.1	7^-	760.0 *5*	<510	518.1	8^+			
		971.3 *5*	100 *34*	306.4	6^+	(E1)[&]	0.00426 *6*	α(K)=0.00347 *5*; α(L)=0.000599 *8*; α(M)=0.0001429 *20* α(N)=3.86×10^{-5} *5*; α(O)=9.57×10^{-6} *13*; α(P)=1.794×10^{-6} *25*; α(Q)=1.129×10^{-7} *16*
1357.2?		265.1 *1*	100	1092.1	(6^+)			
1358.7	(9^-)	172.4 *4*	92 *62*	1186.3?	(7^-)			
		841.6 *5*	100 *46*	518.1	8^+	(D)[&]		
1401.0?	$(0,1^+)$	620.6 *1*	100	780.45	1^-			
1428.0	(2^-)	647.4 *3*	100 *10*	780.45	1^-			
		1383.6 *4*	45 *19*	44.545	2^+			
1431.7	14^+	347.7 *2*	100	1084.0	12^+	(E2)[@]	0.1360 *19*	α(K)=0.0593 *8*; α(L)=0.0561 *8*; α(M)=0.01523 *22* α(N)=0.00418 *6*; α(O)=0.000998 *14*; α(P)=0.0001691 *24*; α(Q)=3.13×10^{-6} *4*
1466.8	11^-	224.0 *3*	39 *26*	1242.8	9^-	(E2)[@]	0.563 *8*	α(K)=0.1269 *18*; α(L)=0.318 *5*;

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Adopted Levels, Gammas (continued)

γ(^{242}Pu) (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[‡#]	E_f	J^π_f	Mult.	α[†]	Comments
								α(M)=0.0879 *13* α(N)=0.0242 *4*; α(O)=0.00573 *9*; α(P)=0.000942 *14*; α(Q)=9.21×10^{-6} *13*
1466.8	11$^-$	382.8 *2*	26 *21*	1084.0	12$^+$			
		689.0 *2*	100 *19*	778.6	10$^+$	(E1)[&]	0.00785 *11*	α(K)=0.00635 *9*; α(L)=0.001133 *16*; α(M)=0.000271 *4* α(N)=7.34×10^{-5} *10*; α(O)=1.811×10^{-5} *25*; α(P)=3.37×10^{-6} *5*; α(Q)=2.032×10^{-7} *28*
1478.5	9$^-$	201.4 *3*	30 *11*	1277.1	7$^-$	(E2)[@]	0.832 *13*	α(K)=0.1489 *21*; α(L)=0.497 *8*; α(M)=0.1380 *21* α(N)=0.0379 *6*; α(O)=0.00898 *14*; α(P)=0.001470 *23*; α(Q)=1.228×10^{-5} *18*
		700.7 *4*	100 *91*	778.6	10$^+$			
		961.4 *4*	44 *13*	518.1	8$^+$	(E1)[&]	0.00434 *6*	α(K)=0.00353 *5*; α(L)=0.000610 *9*; α(M)=0.0001456 *20* α(N)=3.94×10^{-5} *6*; α(O)=9.75×10^{-6} *14*; α(P)=1.827×10^{-6} *26*; α(Q)=1.148×10^{-7} *16*
1517.6	(1$^-$)	1473.1 *1*	100 *3*	44.545	2$^+$			
		1517.6 *1*	53 *3*	0.0	0$^+$			
1577.9	(11$^-$)	219.2 *3*	100 *37*	1358.7	(9$^-$)	(E2)[@]	0.609 *9*	α(K)=0.1313 *19*; α(L)=0.348 *5*; α(M)=0.0963 *15* α(N)=0.0265 *4*; α(O)=0.00627 *10*; α(P)=0.001031 *16*; α(Q)=9.76×10^{-6} *14*
		800.1 *2*	84 *16*	778.6	10$^+$			
1724.9	11$^-$	246.4 *2*	20 *8*	1478.5	9$^-$	(E2)[@]	0.403 *6*	α(K)=0.1086 *15*; α(L)=0.2144 *31*; α(M)=0.0592 *9* α(N)=0.01625 *23*; α(O)=0.00386 *6*; α(P)=0.000638 *9*; α(Q)=7.19×10^{-6} *10*
		640.9 *3*	100 *70*	1084.0	12$^+$	(E1)[&]	0.00897 *13*	α(K)=0.00725 *10*; α(L)=0.001303 *18*; α(M)=0.000312 *4* α(N)=8.44×10^{-5} *12*; α(O)=2.083×10^{-5} *29*; α(P)=3.87×10^{-6} *5*; α(Q)=2.309×10^{-7} *32*
		947.1 *2*	49 *12*	778.6	10$^+$	(E1)[&]	0.00445 *6*	α(K)=0.00362 *5*; α(L)=0.000627 *9*; α(M)=0.0001496 *21* α(N)=4.05×10^{-5} *6*; α(O)=1.001×10^{-5} *14*; α(P)=1.877×10^{-6} *26*; α(Q)=1.177×10^{-7} *16*
1733.4	13$^-$	266.6 *2*	100 *46*	1466.8	11$^-$	(E2)[@]	0.309 *4*	α(K)=0.0950 *13*; α(L)=0.1560 *22*; α(M)=0.0429 *6* α(N)=0.01178 *17*; α(O)=0.00280 *4*; α(P)=0.000466 *7*; α(Q)=5.90×10^{-6} *8*
		301.7 *2*	30 *20*	1431.7	14$^+$			
		649.4 *2*	93 *16*	1084.0	12$^+$	(E1)[&]	0.00876 *12*	α(K)=0.00708 *10*; α(L)=0.001270 *18*; α(M)=0.000304 *4* α(N)=8.23×10^{-5} *12*; α(O)=2.030×10^{-5} *28*; α(P)=3.77×10^{-6} *5*; α(Q)=2.255×10^{-7} *32*
1817.4	16$^+$	385.7 *2*	100	1431.7	14$^+$	(E2)[@]	0.1017 *14*	α(K)=0.0492 *7*; α(L)=0.0385 *5*; α(M)=0.01039 *15* α(N)=0.00285 *4*; α(O)=0.000682 *10*; α(P)=0.0001165 *16*; α(Q)=2.474×10^{-6} *35*
1825.8	(4$^+$)	1518.6	100	306.4	6$^+$			
1842.2	(13$^-$)	264.3 *3*	100 *62*	1577.9	(11$^-$)	(E2)[@]	0.318 *5*	α(K)=0.0964 *14*; α(L)=0.1615 *24*; α(M)=0.0444 *7*

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Adopted Levels, Gammas (continued)

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

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡#]	E_f	J_f^π	Mult.	α[†]	Comments
								α(N)=0.01220 *18*; α(O)=0.00290 *4*; α(P)=0.000482 *7*; α(Q)=6.03×10^{-6} *9*
1842.2	(13^-)	758.2 *3*	65 *16*	1084.0	12^+			
1871.4		1039.2[e] *3*	≤96[e]	832.3	3^-			
		1826.9 *3*	100 *22*	44.545	2^+			
1874.1		1093.5 *1*	100 *9*	780.45	1^-			
		1874.5 *3*	22 *5*	0.0	0^+			
1885.9	(12^+)	801.9 *2*	100 *34*	1084.0	12^+			
		1108.1 *4*	67 *25*	778.6	10^+			
1903.6		1123.1 *2*	45 *9*	780.45	1^-			
		1859.2 *3*	100 *5*	44.545	2^+			
1949.8	$(1,2^+)$	1905.1 *2*	37 *4*	44.545	2^+			
		1949.9 *2*	100 *4*	0.0	0^+			
1969.9	$(1,2^+)$	1925.4 *2*	43 *5*	44.545	2^+			
		1969.9 *2*	100 *5*	0.0	0^+			
1995.7		911.7 *3*		1084.0	12^+			
		1217.9 *3*		778.6	10^+			
2013.4	13^-	288.5 *2*	32 *30*	1724.9	11^-	(E2)[@b]	0.2392 *34*	α(K)=0.0828 *12*; α(L)=0.1141 *16*; α(M)=0.0313 *4* α(N)=0.00859 *12*; α(O)=0.002044 *29*; α(P)=0.000342 *5*; α(Q)=4.86×10^{-6} *7*
		929.4 *2*	100 *18*	1084.0	12^+	(E1)[&]	0.00460 *6*	α(K)=0.00374 *5*; α(L)=0.000649 *9*; α(M)=0.0001548 *22* α(N)=4.19×10^{-5} *6*; α(O)=1.036×10^{-5} *15*; α(P)=1.942×10^{-6} *27*; α(Q)=1.215×10^{-7} *17*
2040.6	15^-	223.2 *4*	8.3 *47*	1817.4	16^+			
		307.2 *2*	100 *34*	1733.4	13^-	(E2)[@]	0.1965 *28*	α(K)=0.0740 *10*; α(L)=0.0895 *13*; α(M)=0.02445 *35* α(N)=0.00671 *10*; α(O)=0.001599 *23*; α(P)=0.000268 *4*; α(Q)=4.18×10^{-6} *6*
		608.9 *2*	36 *6*	1431.7	14^+	(E1)[&]	0.00987 *14*	α(K)=0.00797 *11*; α(L)=0.001440 *20*; α(M)=0.000345 *5* α(N)=9.34×10^{-5} *13*; α(O)=2.303×10^{-5} *32*; α(P)=4.27×10^{-6} *6*; α(Q)=2.530×10^{-7} *35*
2091.8		941.1[f]	100	1152.5	(2^-)			
2147.7	(15^-)	305.35 *3*	<580	1842.2	(13^-)			
		716.0 *4*	100 *29*	1431.7	14^+			
2170.8	(14^+)	284.9 *3*	100 *54*	1885.9	(12^+)	(E2)[@]	0.249 *4*	α(K)=0.0846 *12*; α(L)=0.1199 *18*; α(M)=0.0329 *5* α(N)=0.00903 *13*; α(O)=0.002148 *31*; α(P)=0.000359 *5*; α(Q)=5.01×10^{-6} *7*
		739.1 *2*	67 *20*	1431.7	14^+	(M1+E2)[ac]	0.06 *4*	α(K)=0.049 *33*; α(L)=0.011 *5*; α(M)=0.0026 *13* α(N)=7.0×10^{-4} *35*; α(O)=1.7×10^{-4} *9*;

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Adopted Levels, Gammas (continued)

γ(^{242}Pu) (continued)

E$_i$(level)	J$^\pi_i$	E$_\gamma$[‡]	I$_\gamma$[‡#]	E$_f$	J$^\pi_f$	Mult.	α[†]	Comments
								α(P)=3.3×10^{-5} *17*; α(Q)=1.9×10^{-6} *13*
2170.8	(14$^+$)	1086.8 *2*	80 *27*	1084.0	12$^+$	(E2)[@b]	0.01056 *15*	α(K)=0.00795 *11*; α(L)=0.001947 *27*; α(M)=0.000486 *7* α(N)=0.0001322 *19*; α(O)=3.25×10^{-5} *5*; α(P)=5.98×10^{-6} *8*; α(Q)=3.08×10^{-7} *4*
2237.5	18$^+$	420.1 *2*	100	1817.4	16$^+$	(E2)[@]	0.0811 *11*	α(K)=0.0422 *6*; α(L)=0.0286 *4*; α(M)=0.00766 *11* α(N)=0.002098 *30*; α(O)=0.000503 *7*; α(P)=8.66×10^{-5} *12*; α(Q)=2.048×10^{-6} *29*
2246.0	(1,2$^+$)	2201.6 *5*	100 *25*	44.545	2$^+$			
		2246.0 *5*	75 *25*	0.0	0$^+$			
2289.5		293.8 *3*		1995.7				
		1205.5 *3*		1084.0	12$^+$			
2331.3	(2$^+$)	813.6 *1*	100 *9*	1517.6	(1$^-$)			
		1550.9 *1*	29 *5*	780.45	1$^-$			
2339.5	15$^-$	326.1 *2*	71 *43*	2013.4	13$^-$	(E2)[@b]	0.1640 *23*	α(K)=0.0665 *9*; α(L)=0.0713 *10*; α(M)=0.01942 *28* α(N)=0.00533 *8*; α(O)=0.001271 *18*; α(P)=0.0002143 *30*; α(Q)=3.63×10^{-6} *5*
		907.8 *3*	100 *24*	1431.7	14$^+$	(E1)[&d]	0.00479 *7*	α(K)=0.00390 *5*; α(L)=0.000677 *9*; α(M)=0.0001616 *23* α(N)=4.37×10^{-5} *6*; α(O)=1.082×10^{-5} *15*; α(P)=2.025×10^{-6} *28*; α(Q)=1.265×10^{-7} *18*
2386.9	17$^-$	149.4 *4*	<3.0	2237.5	18$^+$			
		346.3 *2*	100 *50*	2040.6	15$^-$	(E2)[@]	0.1376 *19*	α(K)=0.0597 *8*; α(L)=0.0569 *8*; α(M)=0.01546 *22* α(N)=0.00424 *6*; α(O)=0.001013 *14*; α(P)=0.0001716 *24*; α(Q)=3.16×10^{-6} *4*
		569.5 *2*	28 *10*	1817.4	16$^+$	(E1)[&]	0.01121 *16*	α(K)=0.00903 *13*; α(L)=0.001644 *23*; α(M)=0.000395 *6* α(N)=0.0001068 *15*; α(O)=2.63×10^{-5} *4*; α(P)=4.86×10^{-6} *7*; α(Q)=2.85×10^{-7} *4*
2483.6	(16$^+$)	312.8 *3*	84 *37*	2170.8	(14$^+$)	(E2)[@b]	0.1860 *27*	α(K)=0.0717 *10*; α(L)=0.0835 *12*; α(M)=0.02280 *33* α(N)=0.00626 *9*; α(O)=0.001491 *22*; α(P)=0.000251 *4*; α(Q)=4.00×10^{-6} *6*
		666.2 *4*	47 *16*	1817.4	16$^+$			
		1051.9 *2*	100 *21*	1431.7	14$^+$	(E2)[@]	0.01122 *16*	α(K)=0.00841 *12*; α(L)=0.002101 *29*; α(M)=0.000525 *7* α(N)=0.0001430 *20*; α(O)=3.51×10^{-5} *5*; α(P)=6.45×10^{-6} *9*; α(Q)=3.27×10^{-7} *5*
2494.7	(17$^-$)	347.0 *3*	<1143	2147.7	(15$^-$)			
		677.3 *5*	100 *43*	1817.4	16$^+$			
2616.8		327.3 *3*		2289.5				
		1185.1 *4*		1431.7	14$^+$			
2688.6	20$^+$	451.1 *2*	100	2237.5	18$^+$	(E2)[@]	0.0676 *9*	α(K)=0.0371 *5*; α(L)=0.02243 *32*; α(M)=0.00598 *8* α(N)=0.001639 *23*; α(O)=0.000394 *6*; α(P)=6.81×10^{-5} *10*; α(Q)=1.755×10^{-6} *25*
2707.1	17$^-$	367.6 *2*	100 *44*	2339.5	15$^-$			

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Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ[‡]	I_γ[‡#]	E_f	J^π_f	Mult.	α[†]	Comments
2707.1	17^-	889.7 *4*	37 *10*	1817.4	16^+			
2769.3	19^-	382.4 *3*	100 *29*	2386.9	17^-	(E2)[@]	0.1041 *15*	α(K)=0.0499 *7*; α(L)=0.0397 *6*; α(M)=0.01072 *15* α(N)=0.00294 *4*; α(O)=0.000703 *10*; α(P)=0.0001201 *17*; α(Q)=2.52×10^{-6} *4*
		531.8 *2*	55 *9*	2237.5	18^+	(E1)[&]	0.01278 *18*	α(K)=0.01028 *14*; α(L)=0.001887 *26*; α(M)=0.000454 *6* α(N)=0.0001226 *17*; α(O)=3.02×10^{-5} *4*; α(P)=5.57×10^{-6} *8*; α(Q)=3.23×10^{-7} *5*
2806.8	(18^+)	323.2 *2*	83 *29*	2483.6	(16^+)	(E2)[@b]	0.1685 *24*	α(K)=0.0676 *9*; α(L)=0.0737 *10*; α(M)=0.02010 *29* α(N)=0.00551 *8*; α(O)=0.001315 *19*; α(P)=0.0002216 *31*; α(Q)=3.71×10^{-6} *5*
		569.3 *3*		2237.5	18^+			
		989.4 *2*	100 *21*	1817.4	16^+			
2879.2	(19^-)	384.5 *3*		2494.7	(17^-)			
		641.7 *5*		2237.5	18^+			
2979.4		362.6 *3*		2616.8				
		1162.0 *4*		1817.4	16^+			
3106.5	19^-	399.4 *3*		2707.1	17^-			
		869.0 *4*		2237.5	18^+			
3142.1	(20^+)	335.3 *2*	46 *26*	2806.8	(18^+)	(E2)[@b]	0.1511 *21*	α(K)=0.0633 *9*; α(L)=0.0642 *9*; α(M)=0.01747 *25* α(N)=0.00479 *7*; α(O)=0.001144 *16*; α(P)=0.0001933 *27*; α(Q)=3.40×10^{-6} *5*
		453.5 *3*		2688.6	20^+			
		904.6 *2*	100 *23*	2237.5	18^+			
3167.2	22^+	478.6 *2*	100	2688.6	20^+	(E2)[@]	0.0584 *8*	α(K)=0.0334 *5*; α(L)=0.01844 *26*; α(M)=0.00490 *7* α(N)=0.001341 *19*; α(O)=0.000323 *5*; α(P)=5.61×10^{-5} *8*; α(Q)=1.547×10^{-6} *22*
3185.1	21^-	415.8 *2*	100 *42*	2769.3	19^-	(E2)[@]	0.0833 *12*	α(K)=0.0429 *6*; α(L)=0.0296 *4*; α(M)=0.00794 *11* α(N)=0.002176 *31*; α(O)=0.000522 *7*; α(P)=8.97×10^{-5} *13*; α(Q)=2.095×10^{-6} *29*
		496.5 *2*	28 *5*	2688.6	20^+	(E1)[&]	0.01460 *20*	α(K)=0.01173 *16*; α(L)=0.002172 *30*; α(M)=0.000523 *7* α(N)=0.0001413 *20*; α(O)=3.47×10^{-5} *5*; α(P)=6.40×10^{-6} *9*; α(Q)=3.67×10^{-7} *5*
3297.5	(21^-)	418.3 *3*	100	2879.2	(19^-)			
3374.3		394.9 *4*	100	2979.4				
3509.5	(22^+)	367.4 *2*		3142.1	(20^+)			
		820.9 *3*		2688.6	20^+			
3538.5	21^-	432.0 *3*		3106.5	19^-			
		849.9 *4*		2688.6	20^+			
3631.0	23^-	445.9 *2*	100 *50*	3185.1	21^-	(E2)[@]	0.0696 *10*	α(K)=0.0379 *5*; α(L)=0.02332 *33*; α(M)=0.00623 *9* α(N)=0.001705 *24*; α(O)=0.000410 *6*; α(P)=7.08×10^{-5} *10*; α(Q)=1.800×10^{-6} *25*
		463.8 *3*	14 *5*	3167.2	22^+			
3667.7	24^+	500.5 *2*	100	3167.2	22^+	(E2)[@]	0.0525 *7*	α(K)=0.0308 *4*; α(L)=0.01596 *22*; α(M)=0.00422 *6* α(N)=0.001156 *16*; α(O)=0.000279 *4*; α(P)=4.86×10^{-5} *7*; α(Q)=1.408×10^{-6} *20*

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Adopted Levels, Gammas (continued)

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

E_i(level)	J_i^π	E_γ‡	I_γ‡#	E_f	J_f^π	Mult.	α†	Comments
3747.2	(23⁻)	449.7 *4*	100	3297.5	(21⁻)			
3799.6?		425.3[f] *4*	100	3374.3				
3915.0	(24⁺)	405.5 *3*		3509.5	(22⁺)			
		747.8 *3*		3167.2	22⁺			
4000.5	23⁻	462.0 *4*	100	3538.5	21⁻			
4103.6	25⁻	435.9 *3*	5.0 *25*	3667.7	24⁺			
		472.6 *3*	100 *63*	3631.0	23⁻	(E2)[@]	0.0603 *8*	α(K)=0.0341 *5*; α(L)=0.01922 *27*; α(M)=0.00511 *7* α(N)=0.001399 *20*; α(O)=0.000337 *5*; α(P)=5.85×10^{-5} *8*; α(Q)=1.589×10^{-6} *22*
4180.2	26⁺	512.5 *3*	100	3667.7	24⁺			
4221.5	(25⁻)	474.3 *4*	100	3747.2	(23⁻)			
4368.0	(26⁺)	453.0 *3*	100	3915.0	(24⁺)			
4599.4	27⁻	495.8 *4*	100	4103.6	25⁻			
4691.2	28⁺	511.0 *5*	100	4180.2	26⁺			
5117.0	29⁻	517.6 *4*	100	4599.4	27⁻			
5201.2	30⁺	510.0 *7*	100	4691.2	28⁺			
5648.4	31⁻	531.4 *4*	100	5117.0	29⁻			
5723.9	32⁺	522.7 *4*	100	5201.2	30⁺			

† Additional information 1.
‡ Eγ and branching ratios are mainly from Coulomb excitation and ^{242}Np β^- decay. Eγ=44.545 *9* is from ^{246}Cm α decay and Eγ's without uncertainties are from ^{241}Pu(n,γ).
# Relative branching ratios normalized to 100 for the strongest transition from each level.
@ From mult=Q in Coulomb excitation from angular distribution measurements and placement in the level scheme.
& From mult=D in Coulomb excitation from angular distribution measurements and placement in the level scheme.
a From mult=D+Q in Coulomb excitation from angular distribution measurements and placement in the level scheme.
b The assignment as Q in Coulomb excitation is tentative.
c The assignment as D+Q in Coulomb excitation is tentative.
d The assignment as D in Coulomb excitation is tentative.
e Multiply placed with undivided intensity.
f Placement of transition in the level scheme is uncertain.

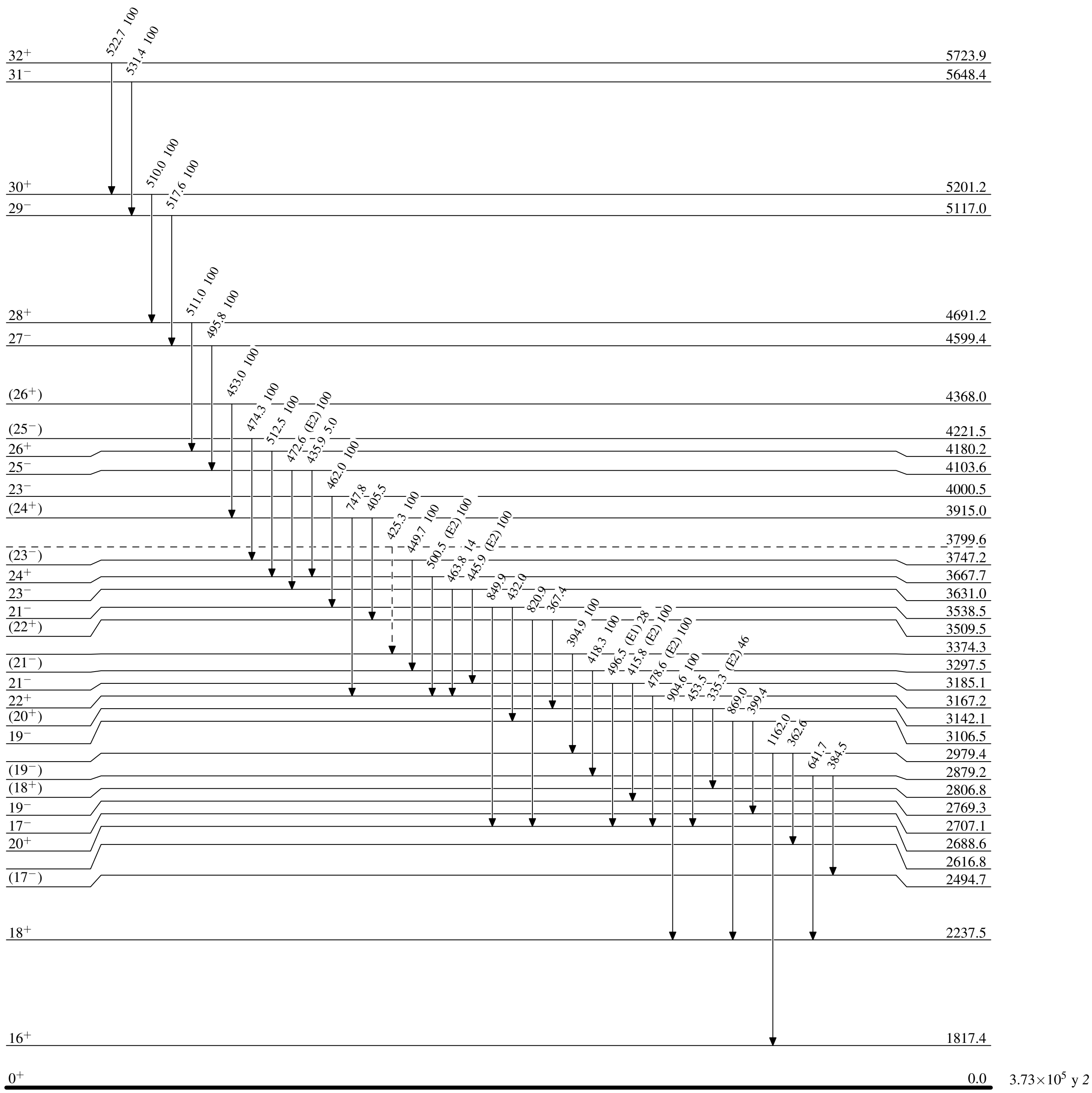
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

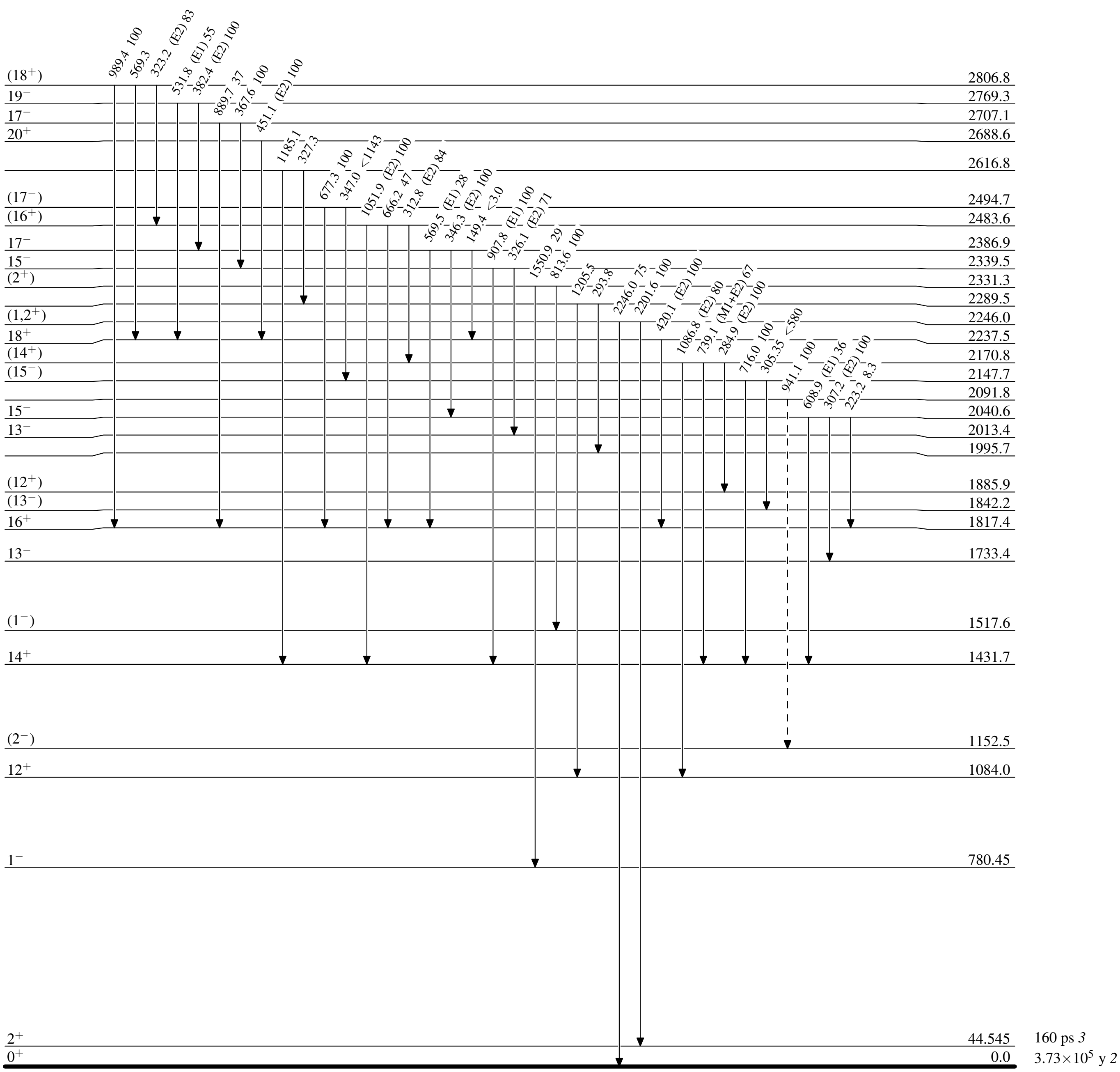


$^{242}_{94}Pu_{148}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

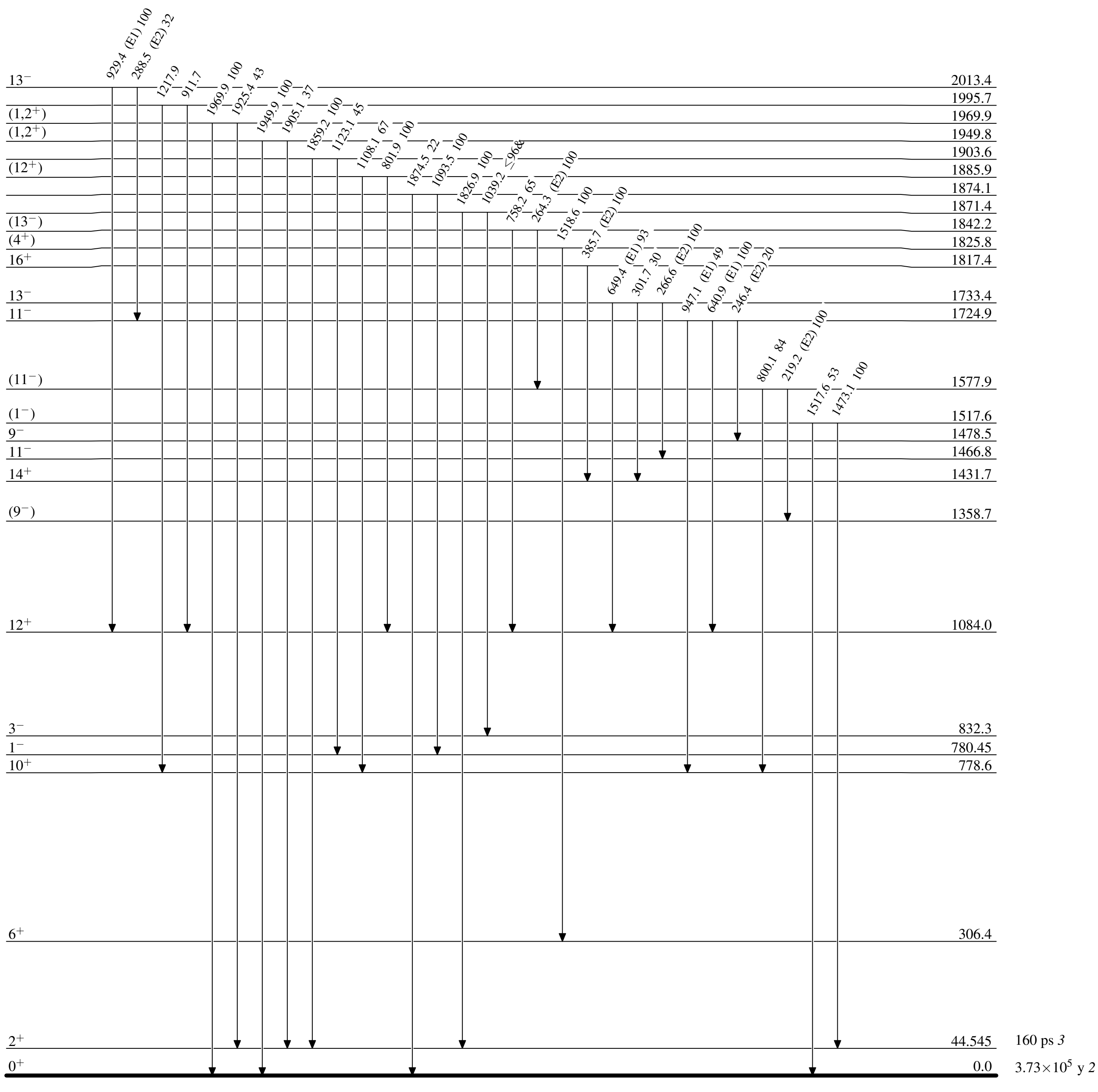


$^{242}_{94}Pu_{148}$

Adopted Levels, Gammas

Level Scheme (continued)

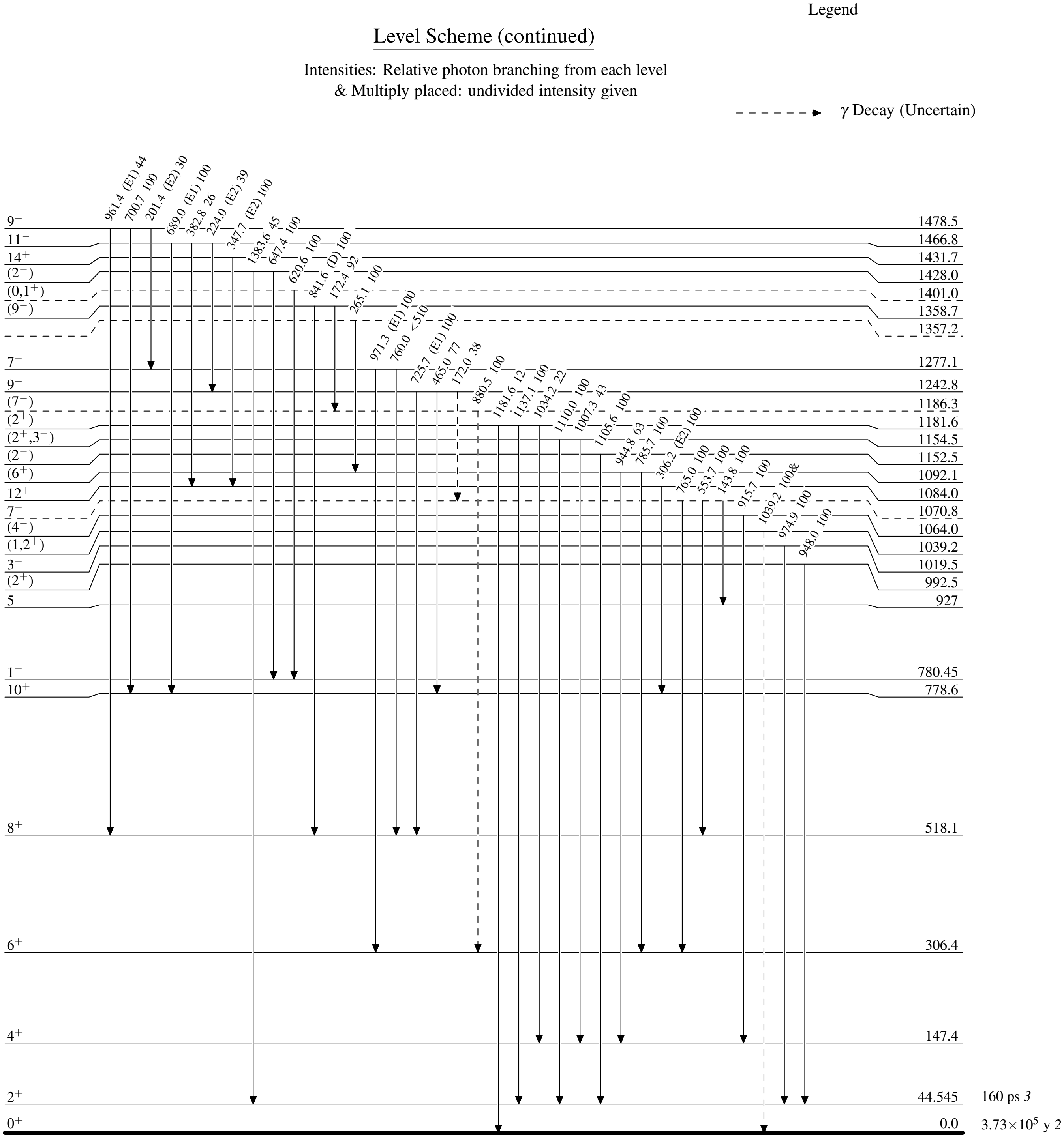
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

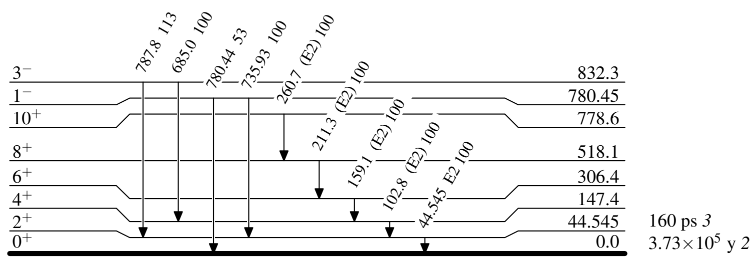


$^{242}_{94}Pu_{148}$

Adopted Levels, Gammas

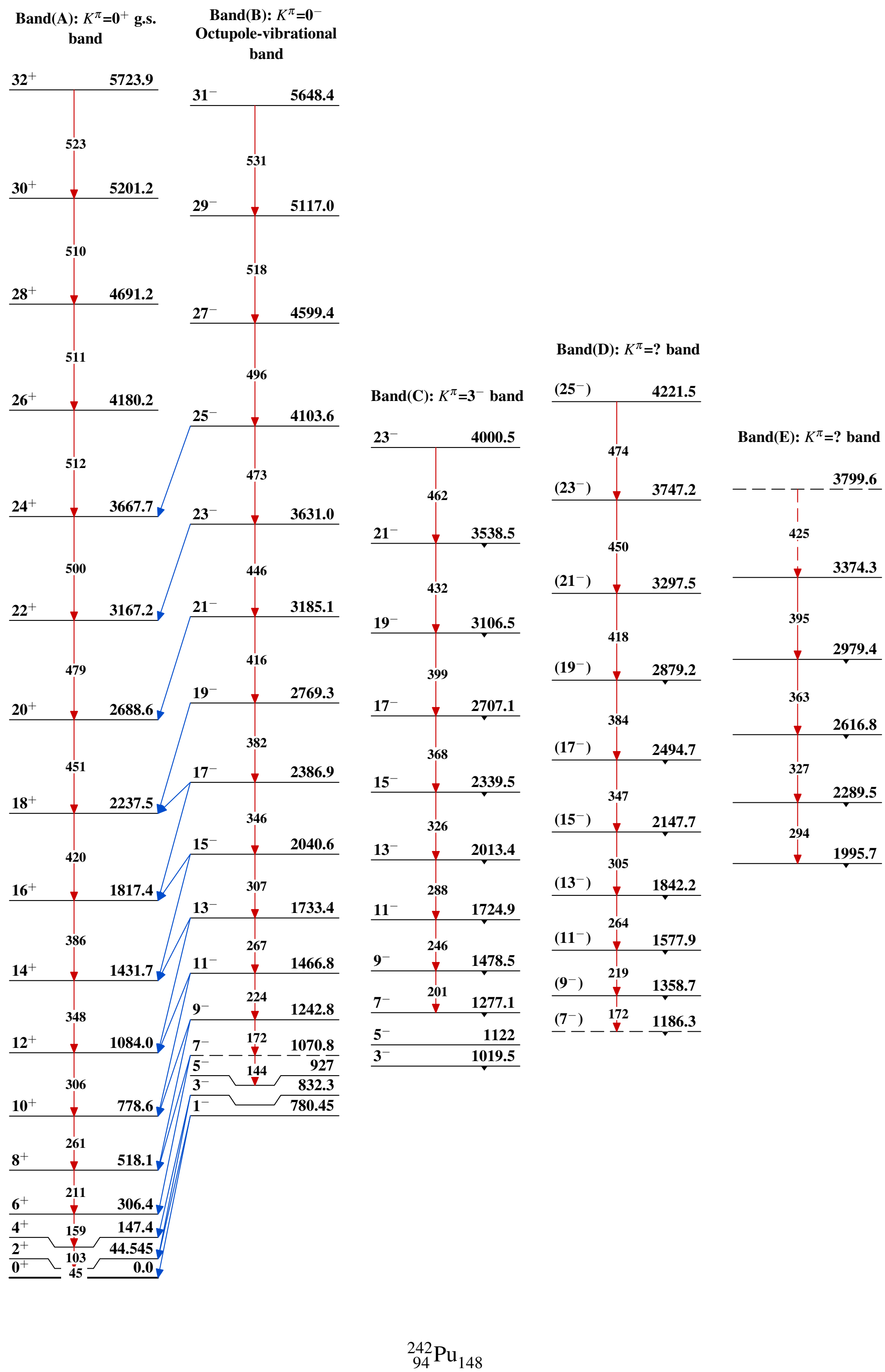
Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



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

Adopted Levels, Gammas



Adopted Levels, Gammas (continued)