Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 130, 183 (2015)	30-Sep-2015

Q(β^-)=20.78 *13*; S(n)=5241.52 *3*; S(p)=6650 *17*; Q(α)=5140.0 *5* 2012Wa38

S(n): From adjusted value of 1998Wh01. The authors′ value of 5241.57 *3* is corrected to 5241.52 *3* by 2012Wa38 to take account of changes in calibration energies used by the authors.

Experimental Studies:

2013Ca16: Investigation of fission fragment yields from transfer induced fission between ^{238} U and ^{12}C. Fission fragments detected with VAMOS spectrometer in GANIL.

2013Cr05: Reanalyzed the $T_{1/2}$ from measured $T_{1/2}$ by 2009We08.

2011Gu21: Study of Photon Strength Function by measuring γ cascade from neutron capture on ^{240}Pu at the n-TOF facility at CERN using the Total Absorption Calorimeter.

2011Ko21, 2010Lo14: Measured β spectrum using a cryogenic detector. 2009We08: Determined $T_{1/2}$ from 15 independent set of measurements over ≈ 31 years using the thermal ionization mass spectrometry (TIMS) on samples of Pu that have been chemically stripped of ^{241}Am and the double ratio method. The measurements were combined with previous measured results and a $t_{1/2}$ was recommended.

1999Dr13: Measured β spectrum and deduced the upper limits for heavy neutrino admixture.

1989Pa21: Re-measurement of ^{241}Pu half-life by gamma ray spectrometry and the ratio method with statistical analysis.

1985Ag02: Measurement of half-life by thermal ionization mass spectrometry and isotope single and double ratio method.

1974Ba73: Measured the fission probability in ^{239}Pu(t,p) and deduced fission barrier parameters.

Theoretical/Systematical Studies:

2015Er03: Calculation of fission probabilities with a dynamic statistical approach.

2014Ga18: Calculated spontaneous fission $T_{1/2}$ in framework of the generalized liquid drop model with new numerical method.

2013IS13: Prediction of spins from systematic studies of preformation probability for α decay and the neutron number of parent.

2013Bo29, 1986Ko28: Calculated (n,F) and (n,n′F) cross sections.

2012Ni16: α decay branching ratio and $T_{1/2}$ for transitions from ground state to favored rotational bands using Multichannel Cluster Model.

2012Sa31: Calculated cluster decay half-lives using the Coulomb and Proximity Potential Model (CPPM).

2011Ad11: One-quasiparticle levels using the microscopic-macroscopic modified TCSM, QPM and the self-consistent SHFB approaches.

2011Zh36: Systematic analysis of α decay to members of favored bands using the Geiger-Nutall law. Calculated the partial half-lives.

2011He12: Compilation of longest lived known in nuclides with Z≥ 82 with half-life, spin, excitation energy, and primary reference.

2010Ni02: Systematics and calculations of $T_{1/2}$ and relative intensities of α decay within the generalized density-dependent cluster model.

2009Go05: Estimation of fission cross section with global renormalization of the barrier height and the microscopic nuclear level densities at the fission saddle points.

2008ChZU: Decay data evaluation project (DDEP) for ^{241}Pu.

2006Sh19: Possible alternative parity bands using the cluster model features of reflection asymmetric states.

2005Pa73: Calculated neutron one quasi-particle states of heaviest nuclei within a macroscopic-microscopic approach.

2005Re16: Calculated spontaneous fission half-lives using Swiatecki′s formula, by its generalized form, and by a new formula where the blocking effect of unpaired nucleon on the half-lives has been taken into account with different mechanisms.

1996St28: Calculated branching ratios using WKB and couple channel transmission matrices.

1990Bh02, 1985Ig01, 1984Ku05, 1984Oh09, 1982Ku09, 1980Ku14, 1972We09: Calculated fission barrier parameters.

1982Li02: Calculated energy band heads, magnetic moments, B(E2) and B(M1) using the rotor plus quasiparticle approximation.

1971Ga20, 1976Ch22: Calculated energies and wave functions for non-rotational single-particle states.

Adopted Levels, Gammas (continued)

^{241}Pu Levels

Cross Reference (XREF) Flags

A	^{240}Pu(n,γ) E=th:secondary γ's	E	^{241}Np β^- decay	I	^{241}Pu(d,d′)
B	^{240}Pu(n,γ) E=th:primary γ's	F	^{240}Pu(d,p)	J	^{242}Pu(d,tγ)
C	^{240}Pu(n,γ) E=res	G	^{242}Pu(d,t)		
D	^{245}Cm α decay	H	^{242}Pu(^{3}He,α)		

E(level)[†]	Jπ[‡#]	$T_{1/2}$	XREF	Comments
0.0[a]	5/2+	14.329 y *29*	A DEFG	%β^-=99.998; %α=2.47×10^{-3}; %SF<2.4×10^{-14} μ=−0.683 *15*; Q=+6 *2* μ measured by optical spectroscopy (1969Ge04). Compiled by 2014StZZ. μ: Others: 1954Bl72, 1963Bl16. See 1982Li02 for theoretical μ calculations. Q measured by optical spectroscopy (1964Ch10) and recommended by 2013StZZ. Compiled by 2014StZZ. Q: Relative isotope shifts for plutonium isotopes were measured, and by using intrinsic Q values of even mass plutonium nuclei, intrinsic Q(^{241}Pu) was deduced by 1985Ge08 as 11.5 *5* which yields Q(^{241}Pu)=4.11 *18*. See 1982Li02 and 1983Ga20 for theoretical calculations of Q. Jπ: From paramagnetic resonance (1976Fu06 and 1968Ah01 and references therein). The measured magnetic moment indicates a 5/2[622] orbital assignments. α/β^-=2.45×10^{-5} *8* (1968Ah01), 2.45×10^{-5} *4* from Iγ(148γ)=1.855 *16* photons per 1×10^6 ^{241}Pu decays, as measured by 1985Wi04, and Iγ(148γ)=7.57 *8* per 100 α decays (1985El03). Others: 1950Th54, 1958BiZZ, 1960Br15, 1961Sm03, 1963Iv01, 1966Be24, 1976GuZN, 1978VaZC. % branching of β, α and SF from $T_{1/2}$ and partial $T_{1/2}$(SF) ≈6×10^{16} y (1985Dr09) and $T_{1/2}(\alpha)$=5.8×10^5 y (1966Be24). $T_{1/2}$: From 2013Cr05 who reanalyzed the data of 2009We08 (thermal ionization mass spectrometry (TIMS) and double ratio method) to include assumptions from experimental uncertainties. The data of 2009We08 with $t_{1/2}$=14.325 y *24* agrees well with the value by 2013Cr05 Others: 14.290 y *6* (1997De54),14.355 y *40* (1989Pa21), 14.57 y *10* (1986Ti04), 14.38 y *2* (double ratio method in 1985Ag02), 14.38 y *6* (1980Ma45). For earlier measurements see 1978El02. See also 1987Ag03 for a compilation of measured half-lives. Discrepancies in the measurements were examined and explained by 1986Ha06 and 1987Ba84 in terms of chemical dependency of low-energy β decay. $T_{1/2}$(SF)≈6×10^{16} y measured by 1985Dr09. See 1992Gr16 for calculation of $T_{1/2}$(SF) using a thermodynamic method.
41.9722[a] *9*	7/2+		A DE G	Jπ: M1+E2 γ to 5/2+ g.s. Reaction data.
95.7795[a] *12*	9/2+		A DEFGH	Jπ: E2 γ to 5/2+ g.s. Reaction data and band ass.
161.314[a] *4*	11/2+		A D FGH	Jπ: M1 γ to 9/2+ 96 level. Energy fit to 5/2[622] band.
161.6853[b] *9*	1/2+	0.88 μs *5*	ABCDEFGH J	Jπ: Strongly fed by primary γ in (n,γ) from 1/2+ capture state. E2 γ to 5/2+. Energy fit to band. $T_{1/2}$: by pulsed beam-γ delay coincidence in ^{242}Pu(d,tγ) reaction (1975Ya03).
170.9399[b] *9*	3/2+		AB FGH	Jπ: M1 γ to 5/2+ g.s. Fed by primary γ in (n,γ) from 1/2+ capture state.
175.0523[c] *14*	7/2+		A DE	Jπ: HF=1.0 for α decay from 7/2+ [624] in ^{245}Cm.
222.9879[b] *11*	5/2+		A GH	Jπ: E2 γ to 1/2+. M1+E2 γ to 7/2+.
231.935[c] *9*	9/2+		A D FG	Jπ: M1+E2 γ's to 7/2+ and 9/2+. α hindrance factor.
235?[a] *4*	(13/2+)		H	E(level): Unresolved in (^{3}He,α).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{241}Pu Levels (continued)

E(level)†	Jπ‡#	XREF	Comments
			Jπ: Reaction data. Fit to 5/2[622] band.
244.8895[b] 13	7/2+	A FGH	Jπ: E2 γ to 3/2+. M1+E2 γ to 9/2+.
301.172[c] 16	11/2+	D FGH	Jπ: M1 γ to 231 9/2+. α hindrance factor. Reaction data.
337	1/2,3/2	C	Jπ: Populated strongly in average resonance (n,γ).
337.1363[b] 23	9/2+	A FGH	Jπ: M1+E2 γ to 9/2+. E2 γ to 5/2+. Energy fit to band. Reaction data.
373[b] 2	11/2+	G	Jπ: Energy fit to band.
376	1/2,3/2	CD	Jπ: Populated strongly in average resonance (n,γ).
385[c] 3	(13/2+)	D G	Jπ: Fit to band.
404.4526[d] 17	(9/2)−	A E	Jπ: E1 γ's to 7/2+ and 9/2+ from the 404 and 409 levels allow Jπ=7/2− or 9/2− for both levels. 1998Wh01 assign these two levels as the 7/2− and 9/2− members of the 7/2[743] band whose 11/2 and 15/2 members have been established by reaction data at 446 and 570 keV. 1998Wh01 point out that the Alaga branching ratios predict that the strongest branch in decay of the 7/2[743] band head to the 5/2[622] band should be to the 5/2+ member of that band. This is the case in ^{239}Pu; however, this transition is not observed here. 1998Wh01 suggest that Coriolis mixing with the unobserved, but expected, 9/2[734] band may depress the 9/2 member of the 7/2[743] band below the 7/2 member, in which case the transition to the 5/2+ g.s., if present, would be very weak.
408.899[d] 3	(7/2)−	A	Jπ: See comment for 404 level.
446[d] 2	11/2−	FGH	Jπ: Reaction data.
473	(1/2,3/2)	C	Jπ: Populated in average resonance (n,γ).
495 10		I	Jπ: Seen only in (d,d′). 1972Br46 suggest that this may be part of a rotational band built on a vibrational state.
503[b] 3	13/2+	GH	Jπ: Reaction data.
518.8121[h] 25	5/2−[@]	A E I	Jπ: E1 γ to 5/2+. E1+M2 to 7/2+. Agreement of branching ratios with Alaga rules for assigned band.
534.202 13	+	A	Jπ: E2 γ to 7/2+.
561.421[h] 5	7/2−[@]	A E I	Jπ: E1+M2 γ's to 7/2+ and 9/2+. Agreement of branching ratios with Alaga rules for the assigned configuration. Also, probable E1+M2 γ to 5/2+.
570[d] 2	15/2−	FGH	Jπ: Reaction data.
614.836[h] 9	(9/2−)[@]	A I	
645 9		H	
681	(1/2,3/2)	C	Jπ: Populated strongly in average resonance (n,γ).
755.1743[e] 21	1/2+	ABC FGH	Jπ: M1 γ to 1/2+. Reaction data.
769.270[i] 4	1/2−	ABC G	Jπ: E1 γ's to 1/2+ and 3/2+. Fit to a band.
779.1502[i] 21	3/2−	A C G	Jπ: E1 γ's to 1/2+ and 5/2+.
784.1524[e] 25	3/2+	AB	Jπ: M1 γ's to 1/2+ and 5/2+.
800.443[f] 5	3/2+	ABC FG	Jπ: M1+E2 γ to 1/2+.
800.479[e] 6	5/2+	A FG	Jπ: M1+E2 γ to 3/2+. E2 γ to 9/2+.
810.946[i] 4	5/2−	A FG	Jπ: E1 γ's to 3/2+ and 7/2+.
831.587[f] 7	5/2+	A FGH	Jπ: M1 γ to 7/2+. M1+E2 γ to 3/2+.
833.34[i] 10	7/2−	A FG	Jπ: E1 γ to 9/2+. Fit to band.
834.839 17	3/2+,5/2+,7/2+	A E	Jπ: M1+E2 γ to 5/2+.
841.9574[j] 22	1/2−	AB FG	Jπ: E1 γ's to 1/2+ and 3/2+. Fit to band.
850.5394[j] 21	3/2−	ABC FG	Jπ: E1 γ′a to 1/2+ and 5/2+.
863 2		FG	
869.383[e] 7	7/2+	A	Jπ: M1+E2 γ's to 5/2+ and 9/2+.
877[f] 2	(7/2+)	F H	Jπ: Fit to band.
897.503?[&j] 22	(5/2−)[&]	A FG	
898[e] 2	(9/2+)	FG	Jπ: Fit to band. Reaction data. Not resolved from 5/2+ in (d,p) and (d,t) datasets.
918[&j] 2	(7/2−)[&]	FG	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{241}Pu Levels (continued)

E(level)[†]	J^π[‡#]	XREF	Comments
929.70 *20*	3/2,5/2,7/2	E	J^π: log *ft*=7.0 from $5/2^+$.
931[f] *2*	$(9/2^+)$	FGH	J^π: Fit to band. Reaction data.
937[i] *2*	$(11/2^-)$	FG	J^π: Fit to band.
940.311 *10*	$3/2^+$	ABC	J^π: M1+E2 γ to $5/2^+$. Fed by primary from $1/2^+$ capture state.
942.584 *5*	$3/2^+$	AB	J^π: M1+E2 γ to $1/2^+$.
950 *3*		FG	
964.940[g] *10*	$1/2^-$	ABC FG	J^π: M1 γ to $1/2^-$. Fit to band. Reaction data.
974 *2*		FG	
994[f] *3*	$(11/2^+)$	FGH	J^π: Fit to band. Reaction data.
995.603[g] *11*	$3/2^-$	ABC FG	J^π: E1 γ's to $1/2^+$ and $5/2^+$.
1009.438 *7*	$3/2^-$	AB G	J^π: M1 γ's to $1/2^-$ and $5/2^-$.
1020 *3*	(1/2,3/2)	C F	J^π: Average resonance capture to E(level)=1016. If different from the 1020 (d,p) level, then there is a (1/2,3/2) level at 1016 and a level at 1020 with unknown J^π.
1049	(1/2,3/2)	C	J^π: Populated strongly in average resonance (n,γ).
1062 *3*		G	
1073	(1/2,3/2)	C F	J^π: Populated in average resonance (n,γ).
1084 *3*		F	
1090.023 *5*	$3/2^-$	ABC GH	J^π: M1+E2 γ to $1/2^-$.
1118 *3*		G	
1173	(1/2,3/2)	C	J^π: Populated in average resonance (n,γ).
1179 *2*	$(9/2^+)$	GH	J^π: From (^{3}He,α).
1196	(1/2,3/2)	C	J^π: Populated in average resonance (n,γ).
1206 *3*		FG	
1223.841 *9*	1/2,3/2	AB F	J^π: Fed by primary from $1/2^+$ capture state. The two deexciting transitions have mult=E1, but the 444γ feeds a $3/2^-$ level and the 1053γ feeds a $3/2^+$ level. One or both of these transitions must belong elsewhere.
1244 *3*		F	
1253.792 *13*	$1/2^-,3/2^-$	AB F	J^π: E1 γ's to $1/2^+$ and $3/2^+$.
1268.86 *5*	1/2,3/2	B	J^π: Fed by primary from $1/2^+$ capture state.
1277 *4*		F	
1288 *4*		F	
1296.70 *5*	$3/2^-$	AB F	J^π: M1+E2 γ to $5/2^-$. Fed by primary from $1/2^+$ capture state.
1309 *4*		F	
1316.24 *10*	1/2,3/2	B	J^π: Fed by primary from $1/2^+$ capture state.
1347 *3*		F	
1351.60 *20*	1/2,3/2	B F	J^π: Fed by primary from $1/2^+$ capture state.
1357.682 *22*	1/2,3/2	AB F	J^π: Fed by primary from $1/2^+$ capture state. The two de-exciting transitions have mult=M1 or M1+E2, but the 516γ feeds a $1/2^-$ level and the 603γ feeds a $1/2^+$ level. One or both of these transitions must belong elsewhere.
1362.83 *8*		B	
1384 *3*		F	
1390 *6*		G	
1441 *4*		F	
1452 *5*		F	
1472.08 *12*		B G	
1478.18 *13*		B	
1489 *5*		F	
1501.32 *21*		B	
1505.21 *19*		B	
1513.97 *10*		B	
1523.73 *5*		B	
1530.91 *20*		B	
1546 *5*		F	
1594		F	
1611.02 *3*		B	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{241}Pu Levels (continued)

E(level)†	Jπ‡#	$T_{1/2}$	XREF	Comments
1762 *3*			F	
1801 *4*			F	
1826 *4*			F	
1868 *5*	(15/2)−		H	Jπ: L=7 in (^{3}He,α). 1971El02 propose the configuration 15/2−,5/2[752].
1944 *5*			H	
1991 *4*			H	
≈2045?			H	
2199	(1/2,3/2)		C	Jπ: Populated strongly in average resonance (n,γ).
≈2200		20.5 μs *22*		%SF=100 Additional information 1. Only SF decay has been observed. Γ(γ)/Γ(SF)<1 (no ce 161γ, 169γ observed) (1976BeZM). Theoretical calculations by 1972We09 estimate $T_{1/2}(SF)/T_{1/2}(\gamma)=4.4\times10^{-6}/2.8\times10^{-4}$. No α with E>7 MeV and $T_{1/2}$=10 μs − 0.01 s was observed (1973Be05). $T_{1/2}$: From 1981Gu04. Others: 23 μs *1* (1970Ga10), 27 μs *3* (1970Po01). E(level): 2.1 MeV (from spacings in neutron resonances, 1968Mi14), 2.90 MeV *15* (from excitation threshold, 1970Ga10), 2.6 MeV *3* (deduced by from data of 1970Ga10), 2.0 MeV *2* (from neutron resonance structure, 1973Br38). See 1972We09 for calculated level energy. Assignment: ^{242}Pu(γ,n) excit (1970Ga10); ^{241}Pu(d,pn) excit; ^{240}Pu(d,p) (1970Po01).
2200+x		32 ns *5*		%SF=100 Additional information 2. Only SF activity has been observed. $T_{1/2}$: Weighted mean from measured values of 30 ns *5* (1969La14) and 34 ns *7* (1981Gu04). E(level): the value of 'x' is not known. It could be a negative number. Systematics of short-lived SF isomers in plutonium isotopes suggest that x ≈100 keV. Assignment: ^{240}Pu(13-MeV d,p) (1969La14); ^{242}Pu(γ,n) (1981Gu04).

† For levels seen in (n,γ), the energies are from a least-squares fit to the Eγ values. An additional uncertainty of 20 ppm due to the uncertainty in the Eγ calibration must be added to get absolute excitation energies.

‡ 1998Wh01 contains a thorough discussion of the spin-parity assignments and the configurations based on their own work and earlier work.

Assignments given as "Reaction data" are based on one or more of the following pieces of data. Cross sections, cross section ratios, measured L transfers, and on a comparison of the observed spectroscopic factors with calculated values. See 1998Wh01, 1972Br46, and 1971El02 for details.

@ Levels at 495 *10*, 520 *10*, 560 *10*, and 620 *10* are reported in (d,d′) and suggested by the authors, 1972Br46, to be part of a rotational band built on a vibrational state. Levels at 519 and 561 are known from β− decay, and 1998Wh01, in (n,γ), propose that these levels are the bandhead and first-excited state of a band with configuration 5/2[622]⊗0−. They further propose that the 9/2− member of this band lies at 615 keV, deexciting via a 573γ. No correspondence in (n,γ) with the 495 (d,d′) level has been found. These levels decay only to the g.s. 5/2[622] band and are expected to have mult=E1; however, except for the 518.8γ, the α(K)exp values measured by 1998Wh01 in (n,γ) are all larger than the theoretical E1 value and require some M2 admixture. For the 561.44γ and 572.86γ, in fact, α(K)exp is larger than the E2 value. For consistency with the proposed configuration, the mults for the 561 and 572γ′s are assumed to be E1+M2 rather than M1+E2. Note that if the 572γ is placed elsewhere, then the energy for the possible 9/2− band member would be 620 *10*, the value from (d,d′).

& 1998Wh01 report a peak at 897 in their (d,p) and (d,t) work that they assign as the 9/2+ member of the 1/2[620] band, in agreement with the earlier assignment of 1972Br46. 1998Wh01 also establish the 1/2− and 3/2− members of the of the 1/2[620]x0− + 1/2[631]x0− band at 842 and 851. Both of these levels are seen in the authors′ (d,p) and (d,t) work. They further propose that

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{241}Pu Levels (continued)

the 5/2$^-$ member of this band is defined by the 726.562γ feeding the 3/2$^+$ 171 level, giving E(5/2$^-$)=897.503 *22*. The 898 level seen in reaction data may thus be a doublet. The 726γ, however, has an α(K)exp that is consistent with E2, not with E1. If the placement is correct, the transition must have an M2 component. From inertial parameters derived from these levels, the authors then propose that the 918 level, also seen in their reaction data, is the 7/2$^-$ member of this band. See 1998Wh01 for a discussion of the configuration of this proposed band.

[a] Band(A): 5/2$^+$[622] band.
[b] Band(B): 1/2$^+$[631] band.
[c] Band(C): 7/2$^+$[624] band.
[d] Band(D): 7/2$^-$[743] band.
[e] Band(E): 1/2$^+$[620] band.
[f] Band(F): 3/2$^+$[631] band.
[g] Band(G): 1/2$^-$[501] band.
[h] Band(H): 5/2$^-$[622]$\otimes$0$^-$ band.
[i] Band(I): 1/2[761] + 1/2[631]$\otimes$0$^-$.
[j] Band(J): 1/2[620]$\otimes$0$^-$ + 1/2[631]$\otimes$0$^-$.

$\gamma(^{241}Pu)$

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[c]	δ[i]	α[h]	Comments
41.9722	7/2+	41.972 *1*	100	0.0	5/2+	M1+E2	0.186 *4*	102.4 *20*	α(L)=76.2 *15*; α(M)=19.4 *4* α(N)=5.30 *11*; α(O)=1.294 *25*; α(P)=0.231 *5*; α(Q)=0.01089 *16*
95.7795	9/2+	53.807 *1*	100	41.9722	7/2+	M1+E2	0.201 *8*	44.7 *11*	α(L)=33.3 *8*; α(M)=8.42 *21* α(N)=2.30 *6*; α(O)=0.563 *14*; α(P)=0.1021 *22*; α(Q)=0.00520 *8*
		95.786 *3*	15 *3*	0.0	5/2+	E2		19.3	α(L)=14.00 *20*; α(M)=3.92 *6* α(N)=1.078 *15*; α(O)=0.254 *4*; α(P)=0.0404 *6*; α(Q)=0.0001375 *20*
161.314	11/2+	65.535 *3*	100	95.7795	9/2+	M1(+E2)	≤0.44	27 *8*	α(L)=20 *6*; α(M)=5.2 *17* α(N)=1.4 *5*; α(O)=0.34 *11*; α(P)=0.061 *16*; α(Q)=0.00281 *20*
161.6853	1/2+	161.685 *1*	100	0.0	5/2+	E2		1.96	α(K)=0.190 *3*; α(L)=1.289 *18*; α(M)=0.360 *5* α(N)=0.0989 *14*; α(O)=0.0234 *4*; α(P)=0.00378 *6*; α(Q)=2.31×10^{-5} *4* B(E2)(W.u.)=0.0221 *13*
170.9399	3/2+	170.940 *1*	100	0.0	5/2+	M1		5.76	α(K)=4.55 *7*; α(L)=0.912 *13*; α(M)=0.222 *4* α(N)=0.0603 *9*; α(O)=0.01501 *21*; α(P)=0.00286 *4*; α(Q)=0.000187 *3*
175.0523	7/2+	79.262 *7*	1.37[a] *11*	95.7795	9/2+	M1+E2	0.65 *+25−22*	22 *6*	α(L)=16 *4*; α(M)=4.3 *12* α(N)=1.2 *4*; α(O)=0.28 *8*; α(P)=0.047 *11*; α(Q)=0.00129 *22*
		133.081 *2*	28.9[a] *3*	41.9722	7/2+	M1+E2	0.222 *9*	11.36 *17*	α(K)=8.80 *13*; α(L)=1.92 *3*; α(M)=0.473 *7* α(N)=0.1287 *19*; α(O)=0.0319 *5*; α(P)=0.00599 *9*; α(Q)=0.000367 *6*
		175.051 *2*	100.0[a] *10*	0.0	5/2+	M1+E2	0.217 *19*	5.21	α(K)=4.07 *7*; α(L)=0.855 *12*; α(M)=0.209 *3* α(N)=0.0570 *8*; α(O)=0.01414 *20*; α(P)=0.00267 *4*; α(Q)=0.000167 *3*
222.9879	5/2+	52.048 *2*	21.6 *24*	170.9399	3/2+	M1+E2	0.498 *6*	100.3 *19*	α(L)=73.6 *14*; α(M)=19.7 *4* α(N)=5.41 *11*; α(O)=1.293 *24*; α(P)=0.215 *4*; α(Q)=0.00506 *8*
		61.303 *1*	36.4 *12*	161.6853	1/2+	E2		160.0	α(L)=116.2 *17*; α(M)=32.5 *5* α(N)=8.92 *13*; α(O)=2.10 *3*; α(P)=0.330 *5*; α(Q)=0.000831 *12*
		181.017 *2*	100.0 *28*	41.9722	7/2+	M1+E2	0.19 *4*	4.77 *9*	α(K)=3.74 *8*; α(L)=0.775 *11*; α(M)=0.189 *3* α(N)=0.0516 *8*; α(O)=0.01281 *18*; α(P)=0.00242 *4*; α(Q)=0.000154 *3*
		222.971 *20*	50.4 *20*	0.0	5/2+	M1+E2	0.609 *23*	2.14 *5*	α(K)=1.61 *4*; α(L)=0.401 *6*; α(M)=0.1005 *15* α(N)=0.0274 *4*; α(O)=0.00674 *10*; α(P)=0.001241 *19*; α(Q)=6.66×10^{-5} *15*
231.935	9/2+	56.89[#] *3*	16.5[b] *11*	175.0523	7/2+	M1+E2[d]	0.68	92.4 *14*	α(L)=67.6 *10*; α(M)=18.4 *3* α(N)=5.03 *8*; α(O)=1.198 *17*; α(P)=0.196 *3*; α(Q)=0.00346 *5*

$^{241}_{94}Pu_{147}$-7

Adopted Levels, Gammas (continued)

$\gamma(^{241}Pu)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[c]	δ[i]	α[h]	Comments
									E_γ,I_γ: Not seen in (n,γ) spectrum. Values are from ^{245}Cm α decay, where Iγ/Iγ(190γ)=0.165 *11*. δ: From ^{245}Cm α decay.
231.935	9/2$^+$	136.127 *20*	55.5[b] *15*	95.7795	9/2$^+$	M1+E2	0.63 *21*	9.0 *10*	α(K)=6.3 *12*; α(L)=2.04 *15*; α(M)=0.53 *5* α(N)=0.144 *14*; α(O)=0.035 *3*; α(P)=0.0062 *4*; α(Q)=0.00027 *5* I_γ: Taken from Iγ/Iγ(190γ)=0.555 *16* in ^{245}Cm α decay. since the measured Iγ of 0.029 *5* from1998Wh01 is too large and apparently includes a contribution from a fission product γ -rays according to the authors. E_γ: From ce spectrum in 1998Wh01.
		189.965 *10*	100.0[b] *15*	41.9722	7/2$^+$	M1+E2	0.63 *+6−7*	3.36 *16*	α(K)=2.46 *15*; α(L)=0.665 *10*; α(M)=0.1680 *25* α(N)=0.0459 *7*; α(O)=0.01125 *16*; α(P)=0.00205 *3*; α(Q)=0.000103 *6*
		231.96[#] *3*	5.9[b] *8*	0.0	5/2$^+$	[E2]		0.497	α(K)=0.1200 *17*; α(L)=0.275 *4*; α(M)=0.0760 *11* α(N)=0.0209 *3*; α(O)=0.00495 *7*; α(P)=0.000816 *12*; α(Q)=8.41$\times$10^{-6} *12*
244.8895	7/2$^+$	73.950 *1*	100 *6*	170.9399	3/2$^+$	E2		65.3	α(L)=47.4 *7*; α(M)=13.27 *19* α(N)=3.65 *6*; α(O)=0.858 *12*; α(P)=0.1356 *19*; α(Q)=0.000381 *6* Mult.: α(L2)exp gives δ=1.8 *+10−4*; however, placement in the level scheme requires ΔJ=2.
		149.107 *6*	62 *9*	95.7795	9/2$^+$	M1		8.48	α(K)=6.69 *10*; α(L)=1.346 *19*; α(M)=0.327 *5* α(N)=0.0891 *13*; α(O)=0.0222 *4*; α(P)=0.00422 *6*; α(Q)=0.000276 *4*
		202.910 *7*	70 *13*	41.9722	7/2$^+$	M1+E2	0.66 *3*	2.72 *7*	α(K)=2.00 *6*; α(L)=0.537 *8*; α(M)=0.1355 *19* α(N)=0.0370 *6*; α(O)=0.00907 *13*; α(P)=0.001655 *24*; α(Q)=8.35$\times$10^{-5} *23*
301.172	11/2$^+$	69.17[#] *6*	78[b] *44*	231.935	9/2$^+$	M1(+E2)[d]	$\le$1.2	38 *22*	α(L)=28 *16*; α(M)=8 *5* α(N)=2.1 *13*; α(O)=0.5 *3*; α(P)=0.08 *5*; α(Q)=0.0020 *6* α: Symmetrized value. δ<1.1 gives α=25 *+35−11*.
		126.09[#] *4*	78[b] *22*	175.0523	7/2$^+$	[E2]		5.59	α(K)=0.1705 *24*; α(L)=3.94 *6*; α(M)=1.101 *16* α(N)=0.303 *5*; α(O)=0.0714 *10*; α(P)=0.01145 *17*; α(Q)=5.13$\times$10^{-5} *8*
		139.87[#] *4*	89[b] *11*	161.314	11/2$^+$	[M1,E2]		7 *4*	α(K)=4 *4*; α(L)=2.0 *5*; α(M)=0.54 *15* α(N)=0.15 *5*; α(O)=0.036 *9*; α(P)=0.0061 *11*; α(Q)=0.00018 *15*
		205.404[#] *20*	100[b] *11*	95.7795	9/2$^+$	[M1,E2]		2.1 *14*	α(K)=1.4 *13*; α(L)=0.50 *5*; α(M)=0.129 *3* α(N)=0.0354 *7*; α(O)=0.0086 *4*; α(P)=0.00152 *18*; α(Q)=6.E−5 *5*
337.1363	9/2$^+$	114.148 *2*	100 *5*	222.9879	5/2$^+$	E2		8.55	α(L)=6.21 *9*; α(M)=1.737 *25*

$\gamma(^{241}Pu)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[c]	δ[i]	α[h]	Comments
									α(N)=0.478 *7*; α(O)=0.1126 *16*; α(P)=0.0180 *3*; α(Q)=7.24×10^{-5} *11*
337.1363	$9/2^+$	241.381 *17*	54 *6*	95.7795	$9/2^+$	M1+E2	1.8 *3*	0.85 *13*	α(K)=0.49 *12*; α(L)=0.259 *9*; α(M)=0.0689 *17* α(N)=0.0189 *5*; α(O)=0.00454 *13*; α(P)=0.00078 *3*; α(Q)=2.2×10^{-5} *5*
404.4526	$(9/2)^-$	308.674 *2*	39.6 *6*	95.7795	$9/2^+$	E1		0.0389	α(K)=0.0308 *5*; α(L)=0.00610 *9*; α(M)=0.001478 *21* α(N)=0.000399 *6*; α(O)=9.76×10^{-5} *14*; α(P)=1.762×10^{-5} *25*; α(Q)=9.23×10^{-7} *13*
		362.479 *2*	100 *1*	41.9722	$7/2^+$	E1		0.0276	α(K)=0.0220 *3*; α(L)=0.00425 *6*; α(M)=0.001028 *15* α(N)=0.000278 *4*; α(O)=6.80×10^{-5} *10*; α(P)=1.238×10^{-5} *18*; α(Q)=6.70×10^{-7} *10*
		≈405[j]		0.0	$5/2^+$				E_γ: From β^- decay.
408.899	$(7/2)^-$	233.844 *3*	32.7 *11*	175.0523	$7/2^+$	E1		0.0719	α(K)=0.0563 *8*; α(L)=0.01169 *17*; α(M)=0.00284 *4* α(N)=0.000768 *11*; α(O)=0.000187 *3*; α(P)=3.33×10^{-5} *5*; α(Q)=1.637×10^{-6} *23*
		313.123 *4*	29.7 *19*	95.7795	$9/2^+$	E1		0.0377	α(K)=0.0299 *5*; α(L)=0.00590 *9*; α(M)=0.001431 *20* α(N)=0.000386 *6*; α(O)=9.45×10^{-5} *14*; α(P)=1.707×10^{-5} *24*; α(Q)=8.97×10^{-7} *13*
		367.10 *8*	100 *4*	41.9722	$7/2^+$	E1		0.0269	α(K)=0.0214 *3*; α(L)=0.00413 *6*; α(M)=0.000999 *14* α(N)=0.000270 *4*; α(O)=6.62×10^{-5} *10*; α(P)=1.204×10^{-5} *17*; α(Q)=6.54×10^{-7} *10*
518.8121	$5/2^-$	476.840 *3*	32.4 *17*	41.9722	$7/2^+$	E1+M2[e]	0.104 *+20−25*	0.025 *4*	α(K)=0.020 *3*; α(L)=0.0042 *8*; α(M)=0.00104 *20* α(N)=0.00028 *6*; α(O)=7.0×10^{-5} *14*; α(P)=1.3×10^{-5} *3*; α(Q)=7.7×10^{-7} *16*
		518.810 *4*	100	0.0	$5/2^+$	E1		0.01340	α(K)=0.01078 *15*; α(L)=0.00198 *3*; α(M)=0.000477 *7* α(N)=0.0001290 *18*; α(O)=3.17×10^{-5} *5*; α(P)=5.86×10^{-6} *9*; α(Q)=3.38×10^{-7} *5*
534.202	+	359.149 *13*	100	175.0523	$7/2^+$	E2		0.1240	α(K)=0.0559 *8*; α(L)=0.0498 *7*; α(M)=0.01350 *19* α(N)=0.00370 *6*; α(O)=0.000885 *13*; α(P)=0.0001503 *21*; α(Q)=2.91×10^{-6} *4* Mult.: α(K)exp gives δ>5.2.
561.421	$7/2^-$	465.646 *5*	54.4 *21*	95.7795	$9/2^+$	E1+M2[e]	0.088 *+21−28*	0.024 *4*	α(K)=0.019 *3*; α(L)=0.0039 *8*; α(M)=0.00097 *20* α(N)=0.00026 *6*; α(O)=6.5×10^{-5} *14*; α(P)=1.2×10^{-5} *3*; α(Q)=7.1×10^{-7} *16*
		519.433 *8*	100 *7*	41.9722	$7/2^+$	E1+M2[e]	0.24 *+9−11*	0.05 *3*	α(K)=0.038 *22*; α(L)=0.009 *6*; α(M)=0.0023 *15* α(N)=0.0006 *4*; α(O)=0.00016 *10*; α(P)=2.9×10^{-5} *19*; α(Q)=1.8×10^{-6} *12*
		561.437 *20*	69 *4*	0.0	$5/2^+$	(E1+M2)[f]	0.27 *4*	0.048 *11*	α(K)=0.036 *8*; α(L)=0.0086 *21*; α(M)=0.0022 *6* α(N)=0.00059 *14*; α(O)=0.00015 *4*; α(P)=2.8×10^{-5} *7*; α(Q)=1.7×10^{-6} *4*
614.836	$(9/2^-)$	572.863 *9*	100	41.9722	$7/2^+$	(E1+M2)[f]	0.18 *5*	0.027 *10*	α(K)=0.021 *7*; α(L)=0.0046 *19*; α(M)=0.0012 *5*

$^{241}_{94}Pu_{147}$-9

$\gamma(^{241}Pu)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[c]	δ[i]	α[h]	Comments
									α(N)=0.00031 *13*; α(O)=8.E−5 *4*; α(P)=1.5×10^{-5} *6*; α(Q)=9.E−7 *4*
755.1743	1/2$^+$	593.488 *4*	100 *1*	161.6853	1/2$^+$	M1		0.186	α(K)=0.1478 *21*; α(L)=0.0289 *4*; α(M)=0.00701 *10* α(N)=0.00191 *3*; α(O)=0.000474 *7*; α(P)=9.02×10^{-5} *13*; α(Q)=5.88×10^{-6} *9* Mult.: α(K)exp gives δ<0.64.
		755.154 *14*	21.5 *19*	0.0	5/2$^+$	E2		0.0214	α(K)=0.01496 *21*; α(L)=0.00479 *7*; α(M)=0.001227 *18* α(N)=0.000335 *5*; α(O)=8.15×10^{-5} *12*; α(P)=1.470×10^{-5} *21*; α(Q)=6.14×10^{-7} *9* Mult.: α(K)exp gives δ>3.2.
769.270	1/2$^-$	598.328 *6*	100 *2*	170.9399	3/2$^+$	E1		0.01021	α(K)=0.00823 *12*; α(L)=0.001490 *21*; α(M)=0.000358 *5* α(N)=9.67×10^{-5} *14*; α(O)=2.38×10^{-5} *4*; α(P)=4.42×10^{-6} *7*; α(Q)=2.61×10^{-7} *4*
		607.580 *5*	62.5 *16*	161.6853	1/2$^+$	E1		0.00992	α(K)=0.00800 *12*; α(L)=0.001446 *21*; α(M)=0.000347 *5* α(N)=9.38×10^{-5} *14*; α(O)=2.31×10^{-5} *4*; α(P)=4.29×10^{-6} *6*; α(Q)=2.54×10^{-7} *4*
779.1502	3/2$^-$	556.164 *3*	100 *17*	222.9879	5/2$^+$	E1		0.01172	α(K)=0.00944 *14*; α(L)=0.001724 *25*; α(M)=0.000414 *6* α(N)=0.0001120 *16*; α(O)=2.76×10^{-5} *4*; α(P)=5.10×10^{-6} *8*; α(Q)=2.98×10^{-7} *5*
		608.229 *9*	14.8 *6*	170.9399	3/2$^+$	E1		0.00990	α(K)=0.00798 *12*; α(L)=0.001443 *21*; α(M)=0.000346 *5* α(N)=9.36×10^{-5} *14*; α(O)=2.31×10^{-5} *4*; α(P)=4.28×10^{-6} *6*; α(Q)=2.53×10^{-7} *4*
		617.457 *5*	73.6 *11*	161.6853	1/2$^+$	E1		0.00962	α(K)=0.00777 *11*; α(L)=0.001401 *20*; α(M)=0.000336 *5* α(N)=9.09×10^{-5} *13*; α(O)=2.24×10^{-5} *4*; α(P)=4.15×10^{-6} *6*; α(Q)=2.47×10^{-7} *4*
784.1524	3/2$^+$	561.168 *4*	100.0 *23*	222.9879	5/2$^+$	M1(+E2)	≤0.66	0.19 *3*	α(K)=0.150 *23*; α(L)=0.030 *4*; α(M)=0.0074 *8* α(N)=0.00200 *22*; α(O)=0.00050 *6*; α(P)=9.4×10^{-5} *11*; α(Q)=6.0×10^{-6} *9*
		622.464 *14*	8.5 *6*	161.6853	1/2$^+$	M1(+E2)	≤0.71	0.142 *23*	α(K)=0.112 *19*; α(L)=0.023 *3*; α(M)=0.0055 *7* α(N)=0.00149 *19*; α(O)=0.00037 *5*; α(P)=7.0×10^{-5} *10*; α(Q)=4.5×10^{-6} *8*
		784.153 *16*	23.0 *7*	0.0	5/2$^+$	E2		0.0198	α(K)=0.01401 *20*; α(L)=0.00434 *6*; α(M)=0.001107 *16* α(N)=0.000302 *5*; α(O)=7.36×10^{-5} *11*; α(P)=1.331×10^{-5} *19*; α(Q)=5.71×10^{-7} *8* Mult.: α(K)exp gives δ>3.1.
800.443	3/2$^+$	638.757 *5*	100.0 *23*	161.6853	1/2$^+$	M1+E2	0.68 *22*	0.114 *18*	α(K)=0.089 *15*; α(L)=0.0186 *23*; α(M)=0.0046 *6* α(N)=0.00124 *15*; α(O)=0.00031 *4*; α(P)=5.8×10^{-5} *8*; α(Q)=3.6×10^{-6} *6*
		758.494[&]	≤37[&]	41.9722	7/2$^+$				
		800.461[@]	≤71[@]	0.0	5/2$^+$				
800.479	5/2$^+$	629.539 *6*	100.0 *20*	170.9399	3/2$^+$	M1+E2	0.57 *23*	0.128 *19*	α(K)=0.100 *16*; α(L)=0.0205 *25*; α(M)=0.0050 *6*

Adopted Levels, Gammas (continued)

γ(^{241}Pu) (continued)

E$_i$(level)	J$_i^π$	E$_γ$[†]	I$_γ$[‡]	E$_f$	J$_f^π$	Mult.[c]	δ[i]	α[h]	Comments
									α(N)=0.00136 *16*; α(O)=0.00034 *4*; α(P)=6.4×10^{-5} *8*; α(Q)=4.0×10^{-6} *6*
800.479	5/2$^+$	704.70 *14*	6.2 *17*	95.7795	9/2$^+$	E2		0.0247	α(K)=0.01687 *24*; α(L)=0.00578 *8*; α(M)=0.001487 *21* α(N)=0.000406 *6*; α(O)=9.87×10^{-5} *14*; α(P)=1.770×10^{-5} *25*; α(Q)=7.03×10^{-7} *10* Mult.: α(K)exp gives δ>4.5.
		758.494[&]	≤27[&]	41.9722	7/2$^+$				
		800.461[@]	≤52[@]	0.0	5/2$^+$				
810.946	5/2$^-$	566.057 *4*	100 *4*	244.8895	7/2$^+$	E1		0.01134	α(K)=0.00913 *13*; α(L)=0.001664 *24*; α(M)=0.000400 *6* α(N)=0.0001081 *16*; α(O)=2.66×10^{-5} *4*; α(P)=4.92×10^{-6} *7*; α(Q)=2.89×10^{-7} *4*
		587.953 *24*	8.5 *9*	222.9879	5/2$^+$	[E1]		0.01055	α(K)=0.00851 *12*; α(L)=0.001543 *22*; α(M)=0.000370 *6* α(N)=0.0001001 *14*; α(O)=2.47×10^{-5} *4*; α(P)=4.57×10^{-6} *7*; α(Q)=2.69×10^{-7} *4*
		640.001 *6*	94 *3*	170.9399	3/2$^+$	E1		0.00900	α(K)=0.00727 *11*; α(L)=0.001306 *19*; α(M)=0.000313 *5* α(N)=8.47×10^{-5} *12*; α(O)=2.09×10^{-5} *3*; α(P)=3.88×10^{-6} *6*; α(Q)=2.31×10^{-7} *4*
831.587	5/2$^+$	586.703 *16*	16.4 *17*	244.8895	7/2$^+$	M1(+E2)	≤0.32	0.185 *8*	α(K)=0.146 *7*; α(L)=0.0289 *11*; α(M)=0.00701 *24* α(N)=0.00191 *7*; α(O)=0.000474 *17*; α(P)=9.0×10^{-5} *4*; α(Q)=5.83×10^{-6} *25*
		608.608 *10*	63.9 *20*	222.9879	5/2$^+$	M1+E2	0.54 *+23−26*	0.142 *22*	α(K)=0.112 *18*; α(L)=0.023 *3*; α(M)=0.0056 *7* α(N)=0.00152 *18*; α(O)=0.00038 *5*; α(P)=7.1×10^{-5} *9*; α(Q)=4.5×10^{-6} *7*
		660.625 *13*	100 *5*	170.9399	3/2$^+$	M1+E2	0.54 *24*	0.114 *17*	α(K)=0.090 *14*; α(L)=0.0183 *23*; α(M)=0.0045 *6* α(N)=0.00121 *15*; α(O)=0.00030 *4*; α(P)=5.7×10^{-5} *8*; α(Q)=3.6×10^{-6} *6*
		789.63 *4*	37 *4*	41.9722	7/2$^+$	M1+E2	0.6 *3*	0.069 *13*	α(K)=0.054 *10*; α(L)=0.0110 *17*; α(M)=0.0027 *4* α(N)=0.00073 *11*; α(O)=0.00018 *3*; α(P)=3.4×10^{-5} *6*; α(Q)=2.2×10^{-6} *4*
833.34	7/2$^-$	496.2 *1*		337.1363	9/2$^+$	E1		0.01462	α(K)=0.01174 *17*; α(L)=0.00217 *3*; α(M)=0.000523 *8* α(N)=0.0001414 *20*; α(O)=3.48×10^{-5} *5*; α(P)=6.41×10^{-6} *9*; α(Q)=3.68×10^{-7} *6*
834.839	3/2$^+$,5/2$^+$,7/2$^+$	834.837 *17*		0.0	5/2$^+$	M1+E2	0.94 *+25−20*	0.048 *7*	α(K)=0.037 *6*; α(L)=0.0079 *10*; α(M)=0.00192 *22* α(N)=0.00052 *6*; α(O)=0.000129 *15*; α(P)=2.4×10^{-5} *3*; α(Q)=1.48×10^{-6} *22*
841.9574	1/2$^-$	57.806 *2*	17.6 *27*	784.1524	3/2$^+$	E1		0.555	α(L)=0.416 *6*; α(M)=0.1037 *15*

Adopted Levels, Gammas (continued)

γ(^{241}Pu) (continued)

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.[c]	δ[i]	α[h]	Comments
									α(N)=0.0277 *4*; α(O)=0.00649 *9*; α(P)=0.001012 *15*; α(Q)=3.26$\times10^{-5}$ *5*
841.9574	1/2$^-$	86.783 *1*	35.6 *16*	755.1743	1/2$^+$	E1		0.191	α(L)=0.1436 *21*; α(M)=0.0354 *5* α(N)=0.00951 *14*; α(O)=0.00226 *4*; α(P)=0.000372 *6*; α(Q)=1.381$\times10^{-5}$ *20*
		671.007 *9*	81 *4*	170.9399	3/2$^+$	E1		0.00824	α(K)=0.00667 *10*; α(L)=0.001192 *17*; α(M)=0.000286 *4* α(N)=7.72$\times10^{-5}$ *11*; α(O)=1.91$\times10^{-5}$ *3*; α(P)=3.54$\times10^{-6}$ *5*; α(Q)=2.13$\times10^{-7}$ *3*
		680.274 *16*	100.0 *27*	161.6853	1/2$^+$	(E1)		0.00804	α(K)=0.00650 *10*; α(L)=0.001161 *17*; α(M)=0.000278 *4* α(N)=7.52$\times10^{-5}$ *11*; α(O)=1.86$\times10^{-5}$ *3*; α(P)=3.45$\times10^{-6}$ *5*; α(Q)=2.08$\times10^{-7}$ *3*
850.5394	3/2$^-$	71.390 *2*	3.15 *23*	779.1502	3/2$^-$	M1+E2	0.10 *+4−5*	15.7 *7*	α(L)=11.8 *5*; α(M)=2.88 *13* α(N)=0.79 *4*; α(O)=0.195 *9*; α(P)=0.0368 *13*; α(Q)=0.00231 *4*
		95.365 *1*	5.8 *3*	755.1743	1/2$^+$	E1		0.1495	α(L)=0.1123 *16*; α(M)=0.0277 *4* α(N)=0.00743 *11*; α(O)=0.001770 *25*; α(P)=0.000294 *5*; α(Q)=1.128$\times10^{-5}$ *16*
		627.552 *5*	100.0 *19*	222.9879	5/2$^+$	E1		0.00933	α(K)=0.00754 *11*; α(L)=0.001357 *19*; α(M)=0.000325 *5* α(N)=8.80$\times10^{-5}$ *13*; α(O)=2.17$\times10^{-5}$ *3*; α(P)=4.03$\times10^{-6}$ *6*; α(Q)=2.40$\times10^{-7}$ *4*
		688.851 *14*	50.8 *18*	161.6853	1/2$^+$	E1		0.00785	α(K)=0.00636 *9*; α(L)=0.001133 *16*; α(M)=0.000271 *4* α(N)=7.34$\times10^{-5}$ *11*; α(O)=1.81$\times10^{-5}$ *3*; α(P)=3.37$\times10^{-6}$ *5*; α(Q)=2.03$\times10^{-7}$ *3*
869.383	7/2$^+$	68.904 *2*	15 *3*	800.479	5/2$^+$	M1+E2	0.14 *5*	18.1 *12*	α(L)=13.6 *9*; α(M)=3.35 *25* α(N)=0.91 *7*; α(O)=0.226 *16*; α(P)=0.0423 *25*; α(Q)=0.00255 *5*
		773.59 *4*	100 *11*	95.7795	9/2$^+$	M1+E2	1.2 *+4−3*	0.050 *11*	α(K)=0.038 *9*; α(L)=0.0084 *14*; α(M)=0.0021 *4* α(N)=0.00057 *9*; α(O)=0.000140 *23*; α(P)=2.6$\times10^{-5}$ *5*; α(Q)=1.5$\times10^{-6}$ *4*
897.503?	(5/2$^-$)	726.562[j] *22*		170.9399	3/2$^+$	(E1+M2)[g]	0.24 *4*	0.021 *5*	α(K)=0.016 *4*; α(L)=0.0035 *9*; α(M)=0.00087 *21* α(N)=0.00024 *6*; α(O)=5.9$\times10^{-5}$ *15*; α(P)=1.1$\times10^{-5}$ *3*; α(Q)=6.9$\times10^{-7}$ *17*
929.70	3/2,5/2,7/2	929.7 *2*		0.0	5/2$^+$				E_γ,I_γ: From β^- decay.
940.311	3/2$^+$	185.132 *22*	0.18 *9*	755.1743	1/2$^+$				
		765.23 *3*	9.6 *7*	175.0523	7/2$^+$				
		940.315 *12*	100 *4*	0.0	5/2$^+$	M1+E2	1.09 *+28−21*	0.032 *5*	α(K)=0.025 *4*; α(L)=0.0053 *7*; α(M)=0.00130 *15* α(N)=0.00035 *4*; α(O)=8.8$\times10^{-5}$ *10*; α(P)=1.65$\times10^{-5}$ *20*; α(Q)=1.00$\times10^{-6}$ *15*

γ(^{241}Pu) (continued)

E$_i$(level)	J^π_i	E$_γ$†	I$_γ$‡	E$_f$	J^π_f	Mult.^{c}	δ^i	α^h	Comments
942.584	3/2+	187.414 *6*	2.2 *5*	755.1743	1/2+	M1+E2	1.1 *3*	2.6 *6*	α(K)=1.7 *6*; α(L)=0.688 *11*; α(M)=0.180 *4* α(N)=0.0493 *11*; α(O)=0.01193 *20*; α(P)=0.00209 *5*; α(Q)=7.3×10^{-5} *21*
		771.64 *4*	8 *5*	170.9399	3/2+	M1+E2	1.5 *+52−7*	0.043 *22*	α(K)=0.033 *18*; α(L)=0.008 *3*; α(M)=0.0019 *7* α(N)=0.00051 *19*; α(O)=0.00013 *5*; α(P)=2.3×10^{-5} *10*; α(Q)=1.3×10^{-6} *7*
		780.889 *8*	100.0 *17*	161.6853	1/2+	M1+E2	0.57 *23*	0.072 *10*	α(K)=0.057 *9*; α(L)=0.0115 *14*; α(M)=0.0028 *4* α(N)=0.00076 *9*; α(O)=0.000189 *23*; α(P)=3.6×10^{-5} *5*; α(Q)=2.3×10^{-6} *4*
		942.58 *4*	26 *3*	0.0	5/2+				
964.940	1/2−	195.669 *10*	3.5 *5*	769.270	1/2−	M1		3.93	α(K)=3.11 *5*; α(L)=0.621 *9*; α(M)=0.1511 *22* α(N)=0.0411 *6*; α(O)=0.01023 *15*; α(P)=0.00195 *3*; α(Q)=0.0001271 *18*
		793.95 *5*	100 *8*	170.9399	3/2+	[E1]		0.00607	α(K)=0.00493 *7*; α(L)=0.000866 *13*; α(M)=0.000207 *3* α(N)=5.60×10^{-5} *8*; α(O)=1.384×10^{-5} *20*; α(P)=2.58×10^{-6} *4*; α(Q)=1.588×10^{-7} *23*
		803.265 *19*	53.9 *15*	161.6853	1/2+	E1		0.00595	α(K)=0.00483 *7*; α(L)=0.000848 *12*; α(M)=0.000203 *3* α(N)=5.48×10^{-5} *8*; α(O)=1.355×10^{-5} *19*; α(P)=2.53×10^{-6} *4*; α(Q)=1.557×10^{-7} *22*
995.603	3/2−	772.645 *21*	60 *6*	222.9879	5/2+	E1		0.00638	α(K)=0.00517 *8*; α(L)=0.000912 *13*; α(M)=0.000218 *3* α(N)=5.90×10^{-5} *9*; α(O)=1.457×10^{-5} *21*; α(P)=2.72×10^{-6} *4*; α(Q)=1.665×10^{-7} *24*
		833.904 *13*	100 *4*	161.6853	1/2+	E1		0.00557	α(K)=0.00452 *7*; α(L)=0.000791 *11*; α(M)=0.000189 *3* α(N)=5.11×10^{-5} *8*; α(O)=1.264×10^{-5} *18*; α(P)=2.36×10^{-6} *4*; α(Q)=1.460×10^{-7} *21*
1009.438	3/2−	240.167 *12*	8.2 *10*	769.270	1/2−	M1(+E2)	≤0.33	2.13 *10*	α(K)=1.67 *9*; α(L)=0.343 *8*; α(M)=0.0838 *15* α(N)=0.0228 *4*; α(O)=0.00567 *11*; α(P)=0.001073 *24*; α(Q)=6.8×10^{-5} *4*
		490.624 *9*	38 *3*	518.8121	5/2−	M1(+E2)	≤0.6	0.28 *4*	α(K)=0.22 *3*; α(L)=0.044 *5*; α(M)=0.0108 *10* α(N)=0.0029 *3*; α(O)=0.00073 *7*; α(P)=0.000138 *14*; α(Q)=8.8×10^{-6} *12*
		786.454 *16*	100 *6*	222.9879	5/2+	[E1]		0.00618	α(K)=0.00501 *7*; α(L)=0.000882 *13*; α(M)=0.000211 *3* α(N)=5.70×10^{-5} *8*; α(O)=1.409×10^{-5} *20*; α(P)=2.63×10^{-6} *4*; α(Q)=1.614×10^{-7} *23*
1090.023	3/2−	239.493 *8*	72 *7*	850.5394	3/2−	M1(+E2)	≤0.35	2.13 *11*	α(K)=1.67 *10*; α(L)=0.346 *8*; α(M)=0.0844 *16* α(N)=0.0230 *5*; α(O)=0.00571 *12*; α(P)=0.00108 *3*; α(Q)=6.8×10^{-5} *4*
		248.066 *6*	100 *8*	841.9574	1/2−	M1+E2	0.28 *5*	1.90 *5*	α(K)=1.49 *5*; α(L)=0.311 *6*; α(M)=0.0760 *12* α(N)=0.0207 *4*; α(O)=0.00513 *9*; α(P)=0.000970 *17*; α(Q)=6.08×10^{-5} *17*
		320.746 *7*	74 *5*	769.270	1/2−	M1(+E2)	≤0.47	0.92 *8*	α(K)=0.72 *7*; α(L)=0.148 *8*; α(M)=0.0363 *17*

$^{241}_{94}Pu_{147}$-13

$\gamma(^{241}Pu)$ (continued)

E_i(level)	J^π_i	E_γ †	I_γ ‡	E_f	J^π_f	Mult.[c]	δ[i]	α[h]	Comments
									α(N)=0.0099 *5*; α(O)=0.00245 *12*; α(P)=0.000463 *25*; α(Q)=2.9×10^{-5} *3*
1223.841	1/2,3/2	444.687[j] *9*	15.4 *22*	779.1502	3/2$^-$	E1		0.0182	α(K)=0.01454 *21*; α(L)=0.00273 *4*; α(M)=0.000659 *10* α(N)=0.0001781 *25*; α(O)=4.37×10^{-5} *7*; α(P)=8.02×10^{-6} *12*; α(Q)=4.51×10^{-7} *7* Mult.: See comment on J^π(1224 level).
		1052.93[j] *3*	100 *5*	170.9399	3/2$^+$	E1		0.00370	α(K)=0.00302 *5*; α(L)=0.000519 *8*; α(M)=0.0001236 *18* α(N)=3.34×10^{-5} *5*; α(O)=8.28×10^{-6} *12*; α(P)=1.555×10^{-6} *22*; α(Q)=9.86×10^{-8} *14* Mult.: See comment on J^π(1224 level).
1253.792	1/2$^-$,3/2$^-$	403.260 *14*	6.9 *10*	850.5394	3/2$^-$	M1+E2	2.9 *+9−6*	0.137 *24*	α(K)=0.085 *20*; α(L)=0.038 *3*; α(M)=0.0100 *6* α(N)=0.00275 *17*; α(O)=0.00066 *5*; α(P)=0.000117 *9*; α(Q)=3.8×10^{-6} *8*
		1082.80 *4*	70 *4*	170.9399	3/2$^+$	E1		0.00353	α(K)=0.00288 *4*; α(L)=0.000493 *7*; α(M)=0.0001176 *17* α(N)=3.18×10^{-5} *5*; α(O)=7.88×10^{-6} *11*; α(P)=1.481×10^{-6} *21*; α(Q)=9.42×10^{-8} *14*
		1092.08 *5*	100 *6*	161.6853	1/2$^+$	E1		0.00348	α(K)=0.00284 *4*; α(L)=0.000486 *7*; α(M)=0.0001158 *17* α(N)=3.13×10^{-5} *5*; α(O)=7.76×10^{-6} *11*; α(P)=1.459×10^{-6} *21*; α(Q)=9.28×10^{-8} *13*
1296.70	3/2$^-$	496.217	≤377	800.443	3/2$^+$	(E1)		0.01462	α(K)=0.01174 *17*; α(L)=0.00217 *3*; α(M)=0.000523 *8* α(N)=0.0001414 *20*; α(O)=3.48×10^{-5} *5*; α(P)=6.41×10^{-6} *9*; α(Q)=3.68×10^{-7} *6*
		777.89 *5*	100 *10*	518.8121	5/2$^-$	M1+E2	0.88 *+30−24*	0.060 *11*	α(K)=0.047 *9*; α(L)=0.0098 *14*; α(M)=0.0024 *4* α(N)=0.00065 *9*; α(O)=0.000162 *23*; α(P)=3.0×10^{-5} *5*; α(Q)=1.9×10^{-6} *4*
1357.682	1/2,3/2	515.70[j] *3*	46 *9*	841.9574	1/2$^-$	M1+E2	1.0 *+5−3*	0.16 *5*	α(K)=0.12 *4*; α(L)=0.028 *6*; α(M)=0.0070 *13* α(N)=0.0019 *4*; α(O)=0.00047 *9*; α(P)=8.8×10^{-5} *17*; α(Q)=5.0×10^{-6} *14* Mult.: See comment on J^π(1358 level).
		602.53[j] *3*	100 *23*	755.1743	1/2$^+$	M1(+E2)	≤0.82	0.15 *3*	α(K)=0.118 *25*; α(L)=0.024 *4*; α(M)=0.0058 *9* α(N)=0.00159 *24*; α(O)=0.00039 *6*; α(P)=7.5×10^{-5} *12*; α(Q)=4.7×10^{-6} *10* Mult.: See comment on J^π(1358 level).

† From (n,γ), except where noted otherwise. See (n,γ) for a listing of unplaced transitions.

‡ Relative photon branching from each level. Data are from (n,γ), except where noted otherwise.

$\gamma(^{241}Pu)$ (continued)

[#] From α decay.

[@] The authors report E=800.461 *11* doubly placed from the 800.44 and 800.48 levels. Iγ/Iγ(638.8γ)=0.688 *28* and Iγ/Iγ(629.5γ)= 0.498 *20*, respectively, for these two placements. These transitions are not included in the least-squares fit. For these placements, the least-squares fit gives Eγ=800.443 *5* and Eγ=800.478 *6*, respectively.

[&] The authors report E=758.494 *15* doubly placed from the 800.44 and 800.48 levels. Iγ/Iγ(638.8γ)=0.349 *16* and Iγ/Iγ(629.5γ)= 0.253 *11*, respectively for these two placements. These transitions are not included in the least-squares fit. For these placements, the least-squares fit gives Eγ=758.470 *6* and Eγ=758.506 *6*, respectively.

[a] Weighted average from (n,γ) and α decay.

[b] From α decay.

[c] From (n,γ), except where noted otherwise.

[d] From α decay.

[e] α(K)exp lies between the theory values for E1 and E2. Its placement in the level scheme requires $\Delta\pi$=yes. See footnote on J^π for the 519 level.

[f] α(K)exp is larger than the E2 theory value; however, placement in the level scheme requires $\Delta\pi$=yes. See footnote on J^π for the 561 level.

[g] α(K)exp is consistent with the E2 theory value; however, placement in the level scheme requires $\Delta\pi$=yes. See footnote on J^π for the 897.5 level.

[h] Additional information 3.

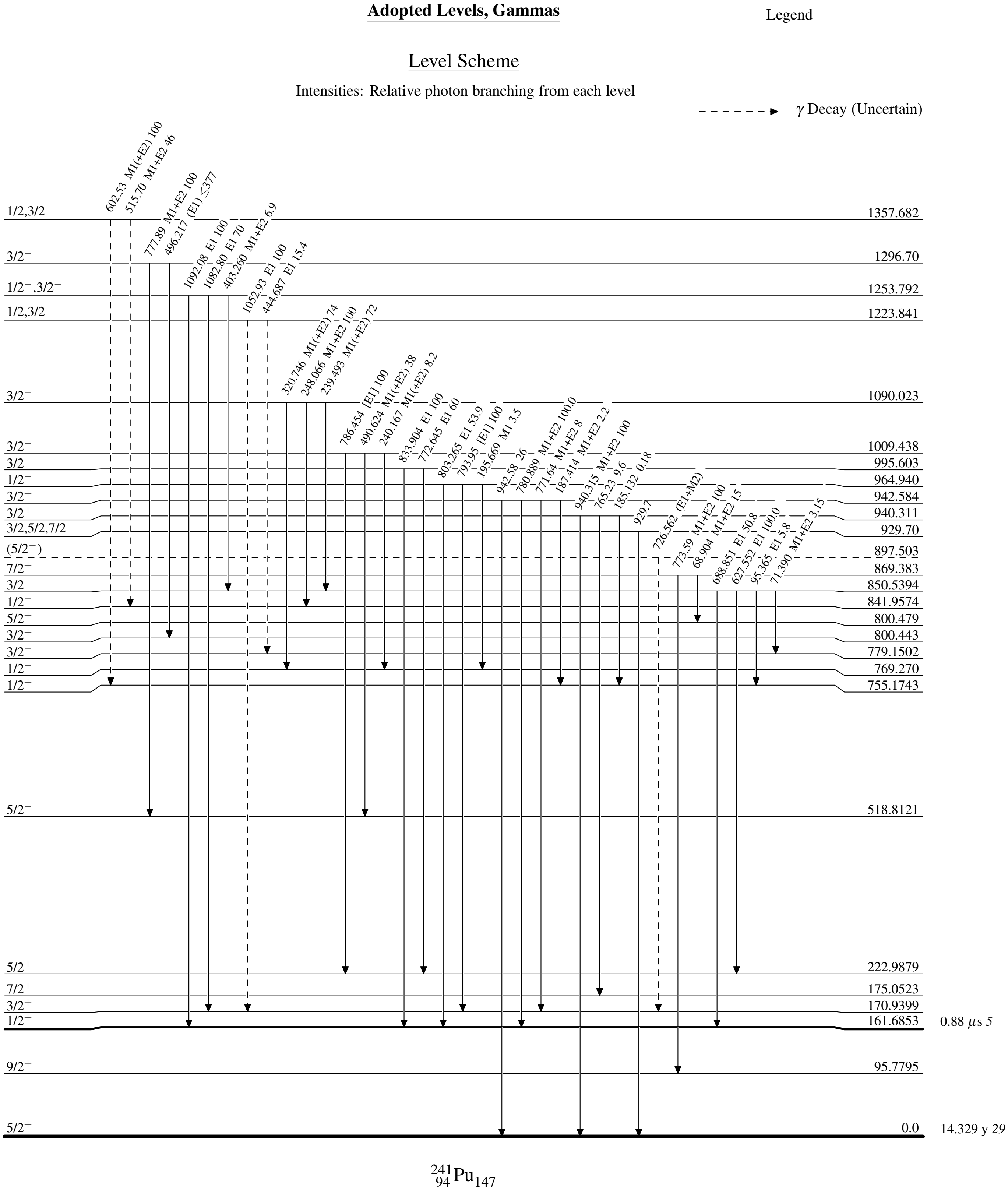
[i] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.

[j] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

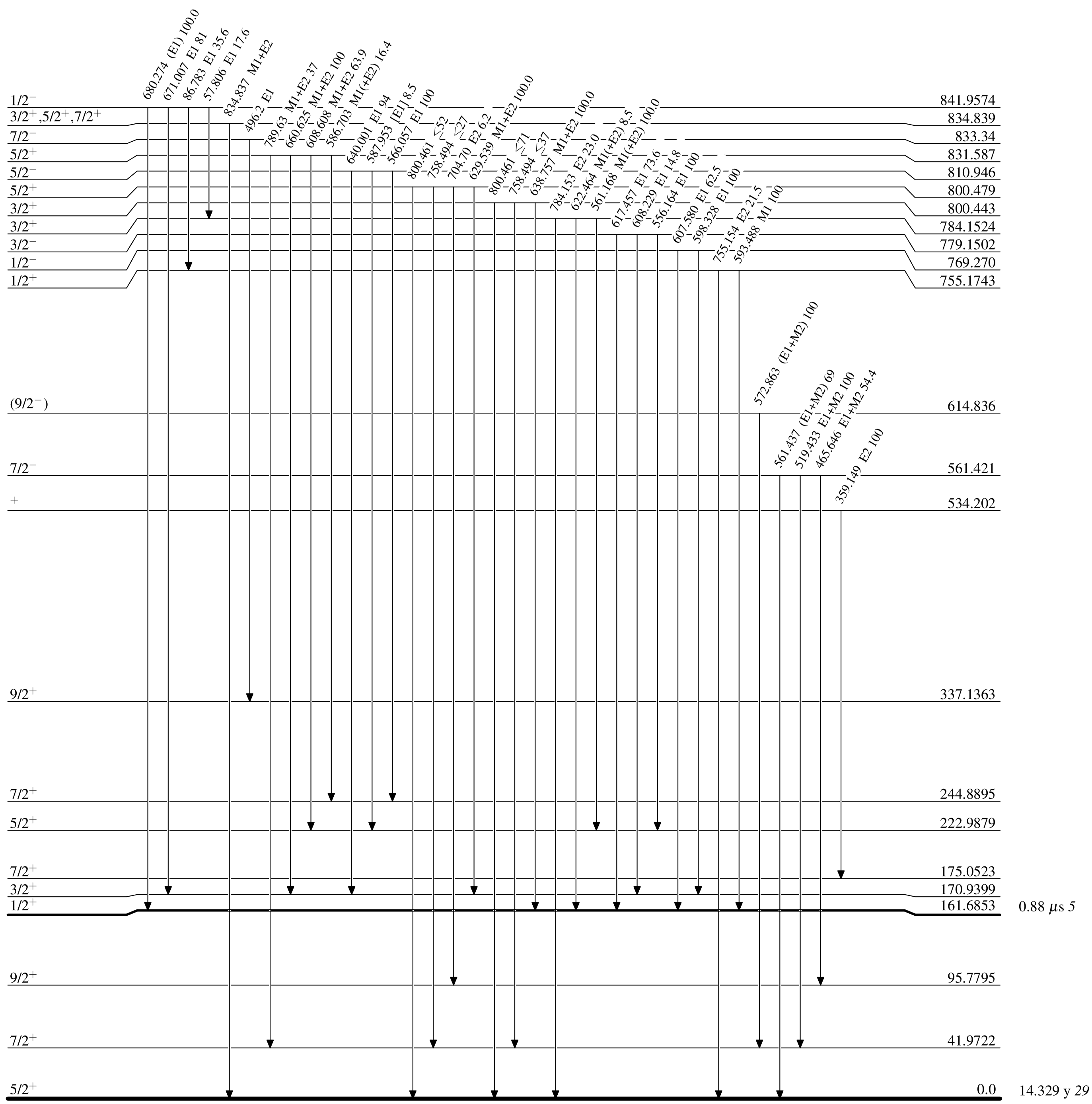
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

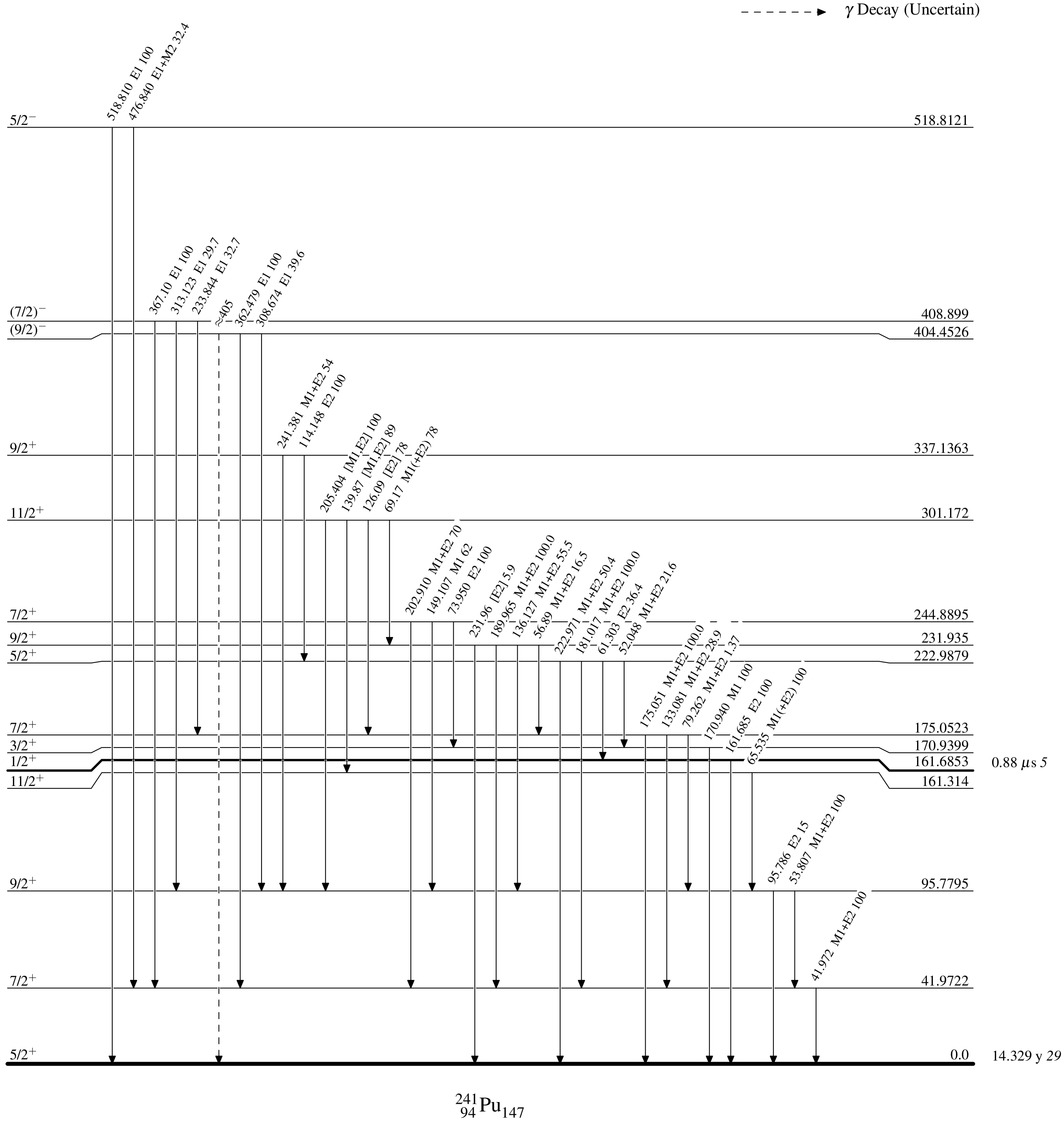


$^{241}_{94}Pu_{147}$

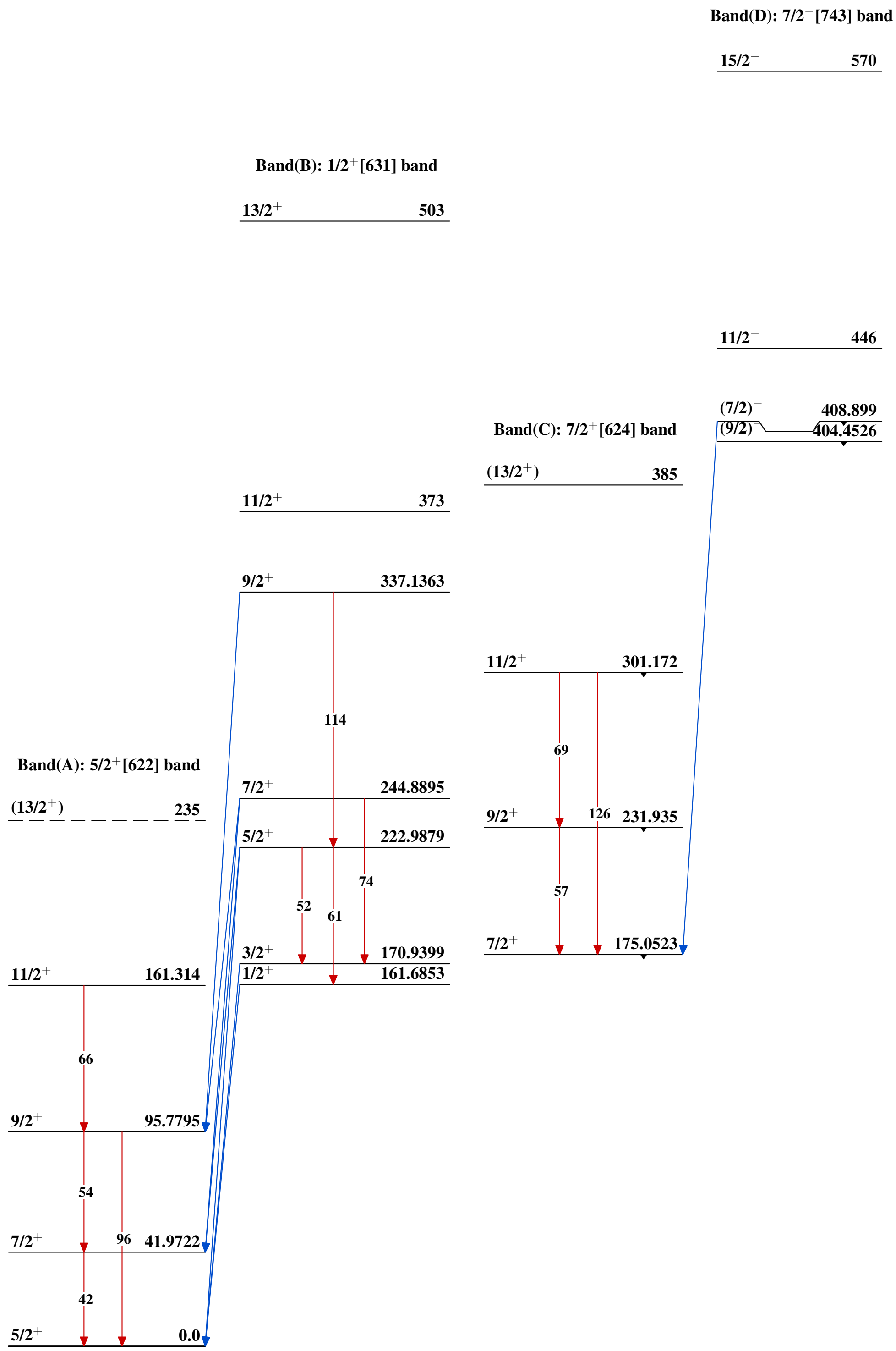
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

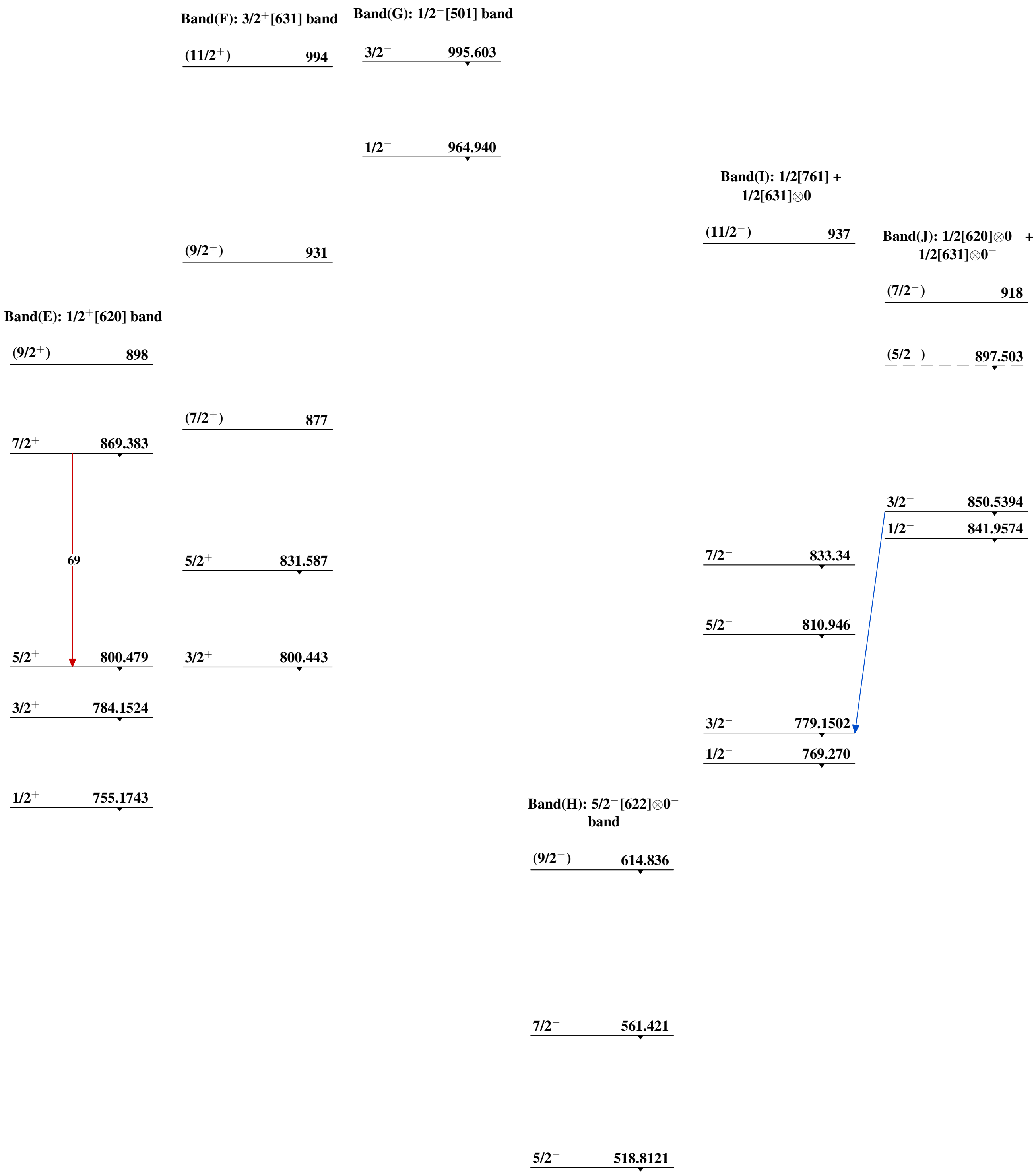


Adopted Levels, Gammas



$^{241}_{94}Pu_{147}$

Adopted Levels, Gammas (continued)



$^{241}_{94}Pu_{147}$