Nuclear Data Sheets for $A = 248^*$

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Abstract: Detailed level schemes, decay schemes, and the experimental data on which they are based are presented for all nuclei with mass number $A=248$. The experimental reaction and decay data are evaluated; inconsistencies and discrepancies are noted; and adopted values are given for various level properties (including spin and parity, half-life, and configuration), γ properties (including energy, intensity, and multipole character) and α properties (including energy, intensity, and hindrance factor). This evaluation replaces the $A=248$ evaluation published by A. Akovali in *Nuclear Data Sheets* 87, 249 (1999).

Cutoff Date: All data received by September 2014 have been included.

General Policies and Organization of Material: see <http://www.nndc.bnl.gov/nds/NDSPolicies.pdf>.

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NUCLEAR DATA SHEETS

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S(n) 6860^{SY}

S(p) 2606^{SY}

S(n) 7850^{SY}

S(p) 1810^{SY}

S(p) 5830^{SY}

S(n) 4660^{SY}

S(p) 7050^{SY}

S(n) 6212⁵

S(n) 5481^{SY}

S(p) 4743^{SY}

S(n) 6935¹⁶

S(p) 5540⁸

S(n) 6349^{SY}

S(p) 3092^{SY}

..... >1074

Skeleton Scheme for A=248

NUCLEAR DATA SHEETS

Ground-State and Isomeric-Level Properties

Nuclide	Level	J π	T _{1/2}	Decay Modes
²⁴⁸ Am	0.0			
²⁴⁸ Cm	0.0	0+	3.48×10 ⁵ y 6	%α=91.61 16; %SF=8.39 16
²⁴⁸ Bk	0.0+z	(6+, 8-)	>9 y	
	0.0+x	1(-)	23.7 h 2	%β ⁻ =70 5; %ε=30 5
²⁴⁸ Cf	0.0	0+	333.5 d 28	%α=99.9971 3; %SF=0.0029 3
²⁴⁸ Es	0.0	(2-, 0+)	24 min 3	%ε=99.7 3; %α=0.25
²⁴⁸ Fm	0.0	0+	34.5 s 12	%α=95 5; %SF=0.10 5; %ε=5 5
	>1074		10.1 ms 6	
²⁴⁸ Md	0.0		7 s 3	%ε=80 10; %α=20 10
²⁴⁸ No	0.0		<2 μs	
²⁵² Cf	0.0	0+	2.645 y 8	%α=96.908 8; ...
²⁵² Es	0.0	(5-)	471.7 d 19	%α=78 2; ...
²⁵² Fm	0.0	0+	25.39 h 4	%α=99.9977 2; ...
²⁵² No	0.0	0+	2.44 s 4	%α=67.8 19; ...
²⁵² Lr	0.0		0.36 s +11-7	%α=?; ...

Adopted Levels

$Q(\beta^-)=3170$ SY; $S(n)=4660$ SY; $S(p)=5830$ SY; $Q(\alpha)=4940$ SY 2012Wa38.

The systematics uncertainties are 200, 230, 280, and 360 for $Q(\beta^-)$, $S(n)$, $S(p)$, and $Q(\alpha)$, respectively.

Other than an update to the Q values, there are no new data on ^{248}Am since the 1999 Nuclear Data Sheets, 1999Ak02.

 ^{248}Am Levels

E(level)	Comments
(0.0)	<p>^{248}Am has not been observed.</p> <p>The systematics of orbitals for this region (see, for example, 1972El21) suggests that the 153rd neutron is probably in the 1/2[620] Nilsson orbital, and the 95th proton is in either the 5/2[523] or the 5/2[642] orbital.</p> <p>$T_{1/2}$: $T_{1/2}(\beta^-)$: A partial half-life for β decay was calculated by 1973Ta30 using β decay gross theory as >700 s. Calculations of 1997Mo25 yield >100 s. From systematics, 2012Au07 report $\approx$180 s.</p> <p>A partial α half-life, of 1×10^{11} d – 4×10^{11} d is calculated by the evaluator for an unhindered (unobserved)=4600-keV α to a level with the same configuration as that of the ^{248}Am g.s.; the energy of this level is expected at about 250–350 keV above the ^{244}Np g.s. (with configuration $\pi 5/2[642]$, $\nu 9/2[734]$). The excitation energy of this level is estimated from 1/2[620] state energies in ^{245}Pu (305 keV) and in ^{247}Cm (403.6 keV). The energy differences between the 1/2[620] and the 9/2[734] neutron orbitals are 223 keV in ^{243}Pu, 403.6 keV in ^{247}Cm and 434.4 keV in ^{249}Cf. The α energy of $\approx$4600 keV is calculated from $Q(\alpha)(^{248}\text{Am})=4940$, a systematics value from 2012Wa38.</p>

Adopted Levels, Gammas

Q(β⁻)=-687 SY; S(n)=6212 5; S(p)=7050 SY; Q(α)=5161.73 25 2012Wa38.

The systematics uncertainties are 71 and 100 keV for Q(β⁻) and S(p), respectively.

²⁴⁸Cm Levels

Cross Reference (XREF) Flags

A ²⁵²Cf α Decay
B ²⁴⁸Bk ε Decay
C Coulomb Excitation
D ²⁴⁸Cm(α,α'),(d,d')
E ²⁴⁶Cm(t,p)

E(level) [@]	Jπ ^{&}	XREF	T _{1/2} ^b	Comments
0.0 [†]	0+	ABCDE	3.48×10 ⁵ y 6	%α=91.61 16; %SF=8.39 16. T _{1/2} : recommended by 1989Ho24 from a weighted average of 3.52 4 (1969Me01), 3.60 4 (1971Ma32), and 3.40 3 (1971Mc19) in units of 10×10 ⁵ y. T _{1/2} (SF)=4.15×10 ⁶ 3 is recommended by 2000Ho27 from a weighted average of 4.22 12 (1969Me01), 4.20 5 (1971Ma32), and 4.11 3 (1971Mc19) in units of 10×10 ⁶ years. %α,%SF: from the adopted values for T _{1/2} and T _{1/2} (SF). Jπ: HF=3.4 in α decay. T _{1/2} : other: T _{1/2} =126 ps 10 in ²⁵² Cf α decay (1970To08). Jπ: HF=62 30 in α decay.
43.40 [†] 3	2+a	A CDE	122.5 ps 25	Jπ: L=0 in ²⁴⁸ Cm(t,p) reaction. From the strong population of the 0+ level in (t,p) reaction, 1977Fl06 proposed that the level is a two-particle two-hole-pair vibrational state. B(E3)↑=0.41 10.
143.80 [†] 21	4+a	A CD	80 ps +14-19	
298.9 [†] 3	6+a	A CD	34 ps +11-3	
506.4 [†] 4	8+a	A CD	16.0 ps +31-23	
762.8 [†] 4	10+a	C	7.5 ps +7-6	
1050 [§] 2	(2+)	CD	1.23 ps +18-16	
1050 [‡] 2	1-	D		
1064.1 [†] 4	12+a	C	3.71 ps +22-18	
1084 [#]	0+	C E		
1095 [‡] 2	3-	CD		
1131 [#] 3	2+	CD		
1144 [§] 2	4+	CD		
1172 [‡] 3	5-	CD		
1222 [#] 3	4+	CD		
1236 2	(3-)	D		
1284.4 [§] 8	6+	C		
1295.1 [‡] 5	7-	C		
1305 3	(3-)	D		
1319 3		D		
1358 3		D		
1399 3		D		
1406.2 [†] 5	14+a	C	1.75 ps +9-7	
1440 3		D		
1452.3 [§] 6	8+	C		
1465.9 [‡] 5	9-	C		
1466.1 [#] 4	8+	C		
1469 4		D		
1484 2	(3-)	D		
1514 3		D		
1552 4		D		
1651 4		D		
1651.8 [#] 5	10+	C		
1669.3 [§] 5	10+	C		
1682.4 [‡] 5	11-	C		
1784.0 [†] 5	16+a	C	1.43 ps +9-11	
1880.2 [#] 5	12+	C		
1883 3		D		
1929.1 [§] 5	12+	C		
1938 4		D		
1942.1 [‡] 5	13-	C		
1969 4		D		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)
²⁴⁸Cm Levels (continued)

E(level) [@]	Jπ ^{&}	XREF	T _{1/2} ^b	E(level) [@]	Jπ ^{&}	XREF	T _{1/2} ^b
2000 4		D		3347.2 [‡] 7	21-	C	
2150.1 [#] 5	14+	C		3559.6 [†] 6	24+ ^a	C	0.41 ps +9-6
2192.7 [†] 5	18+ ^a	C	0.87 ps +9-7	3601.9 [#] 11	22+	C	
2229.5 [§] 5	14+	C		3738.3 [§] 7	22+	C	
2242.1 [‡] 5	15-	C		3775.2 [‡] 8	23-	C	
2460.6 [#] 6	16+	C		4041.0 [#] 12	24+	C	
2566.8 [§] 5	16+	C		4055.4 [†] 7	26+ ^a	C	0.32 ps +9-6
2578.2 [‡] 5	17-	C		4158.1 [§] 9	24+	C	
2627.1 [†] 5	20+ ^a	C	0.76 ps +11-8	4229.6 [‡] 9	25-	C	
2808.6 [#] 8	18+	C		4572.4 [†] 8	28+ ^a	C	0.27 ps +18-9
2937.2 [§] 6	18+	C		4599.5 [§] 10	26+	C	
2947.2 [‡] 6	19-	C		4709.5 [‡] 10	27-	C	
3083.5 [†] 6	22+ ^a	C	0.44 ps 4	5114.0 [†] 10	30+	C	
3190.1 [#] 9	20+	C		5216.1 [‡] 12	29-	C	
3331.7 [§] 6	20+	C		5680.7 [‡] 11	(32+)	C	

[†] (A): Kπ=0+ g.s. band.

[‡] (B): Kπ=1- octupole-vibrational band.

[§] (C): Kπ=2+ γ-vibrational band.

[#] (D): Kπ=0+ band.

[@] No decay from the lower members of the Kπ=1- octupole-vibrational band up to 5-, or from the Kπ=2+ γ-vibrational and Kπ=0+ bands up to 6+ has been observed. Also, the 6+ member of the Kπ=0+ band has not been seen in any dataset.

[&] From assignments to bands. Confirming arguments are given where available.

^a E2 γ to level with J=J-2.

^b Values for the excited levels are from B(E2) in Coulomb excitation.

 $\gamma(^{248}\text{Cm})$

B(E2)(W.u.) the B(E2)(W.u.) values have been calculated directly from the B(E2) values as given in the Coulomb excitation dataset.

E(level)	E _γ [†]	I _γ [‡]	Mult. [§]	α	Comments
43.40	43.399 25		E2	1000 15	B(E2)(W.u.)=324 4.
143.80	100.4 2		E2	18.4 3	B(E2)(W.u.)=380 +120-50.
298.9	155.1 2		E2	2.71 4	B(E2)(W.u.)=550 +40-140.
506.4	207.4 2		E2	0.858 12	B(E2)(W.u.)=540 90.
762.8	256.4 2		E2	0.401 6	B(E2)(W.u.)=530 50.
1064.1	301.3 2		E2	0.236 4	B(E2)(W.u.)=540 30.
1295.1	789.0 5	#			
	996.4 5	#			
1406.2	342.0 3		E2	0.1608 23	B(E2)(W.u.)=640 30.
1452.3	167.9 5	≤76			
	946.1 5	≤100			
1465.9	171.2 5	22 5			
	703.1 4	100 8			
	959.0 5	5.1 47			
1466.1	1167.3 4				
1651.8	185.9 4	100 21			
	1145.4 4	44 19			
1669.3	217.1 5	<52			I _γ : the authors report I _γ :I _γ (907γ)=22 30:100 33.
	906.6 4	100 33			
1682.4	216.4 4	16 7			
	618.3 3	100 10			
	919.6 4	≤15			
1784.0	377.8 2		E2	0.1210 17	B(E2)(W.u.)=500 40.
1880.2	228.4 4	100 9			
	1117.4 5	10 5			
1929.1	259.9 4	47 12			
	865.2 4	100 14			
1942.1	259.6 3	39 5			
	535.9 3	100 6			
	877.9 4	9 4			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{248}\text{Cm})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	Mult.§	α	Comments
2150.1	270.0 5	100 3			
	1085.5 5	6.3 56			
2192.7	408.6 2		E2	0.0978 14	B(E2)(W.u.)=560 50.
2229.5	300.8 4	100 60			
	822.9 4	93 15			
2242.1	300.0 3	89 24			
	458.1 3	100 7			
	835.9 4	7 3			
2460.6	310.2 5	100 12			
	1054.7 5	<13			
2566.8	337.4 3	100 4			
	782.7 4	26.4 24			
2578.2	336.2 3	100 4			
	385.7 3	26.4 24			
	794.3 4	9.2 22			
2627.1	434.4 2		E2	0.0834 12	B(E2)(W.u.)=480 60.
2808.6	348.0 5				
2937.2	370.3 3	100 12			
	744.6 4	31 10			
2947.2	320.1 5	9 3			
	369.4 4	100 6			
	754.0 5	7 3			
3083.5	456.4 2		E2	0.0735 11	B(E2)(W.u.)=660 +60-50.
3190.1	381.5 5				
3331.7	394.6 4	100 20			
	704.5 5	≤ 18			
3347.2	263.5@ 5	≤ 12			
	400.0 4	100 11			
	719.6@ 5	≤ 10			
3559.6	476.1 2		E2	0.0662 10	B(E2)(W.u.)=570 100.
3601.9	411.8 5				
3738.3	406.6 4				
3775.2	428.0 4				
4041.0	439.1 5				
4055.4	495.8 3		E2	0.0601 9	B(E2)(W.u.)=610 +140-130.
4158.1	419.8 5				
4229.6	454.4 4				
4572.4	517.0 4		E2	0.0544 8	B(E2)(W.u.)=580 +290-130.
4599.5	441.4 5				
4709.5	479.9 5				
5114.0	541.6 5				
5216.1	506.6 5				
5680.7?	566.7@ 5				

[†] E_{γ} for the levels up to 8+ are weighted averages of values from ^{252}Cf α decay and Coulomb excitation. Values for the higher levels are from Coulomb excitation.

[‡] From branching ratios as given in Coulomb excitation.

§ From Coulomb excitation.

$I_{\gamma}(789\gamma):I_{\gamma}(996\gamma) = \leq 5.0 \text{ } 48:\leq 100 \text{ } 20$.

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

²⁴⁸Bk ε Decay 1978Gr10

Parent ²⁴⁸Bk: E=0.0+x; Jπ=1(-); T_{1/2}=23.7 h 2; Q(g.s.)=706 21; %ε decay=30 5.

²⁴⁸Bk-Q(ε): from Q(β⁻)=860 20 for the 23.7-h ²⁴⁸Bk (1978Gr10) and E(²⁴⁸Cm)-E(²⁴⁸Cf)=154 7 (2012Wa38), one gets

Q(ε)=706 21. Q(ε)=687 71, a systematics value, is given by 2012Wa38 for the g.s. decay.

No γ's were observed in ²⁴⁸Bk ε decay. Since Q(ε)=687 for ²⁴⁸Bk decay, no known low-spin states other than the g.s. and 43.40-keV level are expected to be populated in the ε decay of low-spin ²⁴⁸Bk; nonobservation of any photons is consistent with 23.7-h ²⁴⁸Bk being a low spin parent.

²⁴⁸Cm Levels

E(level)	Jπ
0.0	0+
43.399 25	2+

β⁺,ε Data

Eε	E(level)	Iε ^{†‡}	Log ft	I(ε+β ⁺) [†]
(663+x 21)	43.399	22 5	7.64 13	22 5
(706+x 21)	0.0	78 5	7.15 9	78 5

[†] For intensity per 100 decays, multiply by 0.30 5.

[‡] 1978Gr10 deduced intensity of the ε branch to the 43.4-keV level to be (18±2) and (35±10) per 100 ε decays from their measured (L x ray)(L x ray) and (Kα₁ x ray)(L x ray) coincidence intensities, respectively. The weighted average of 22±5 per 100 ε decays was suggested by 1978Gr10 for the ε decay intensity to the 2+ state.

γ(²⁴⁸Cm)

Eγ	E(level)	Mult.	α	I(γ+ce) [†]	Comments
(43.399 25)	43.399	E2	1000 15	22 5	Eγ,Mult.: from adopted gammas. This transition has not been seen in 23.7-h ²⁴⁸ Bk ε decay. Iγ,I(γ+ce): an intensity balance at the g.s. yields I(γ+ce)=22 5 and Iγ=0.022 5 per 100 ε decays.

[†] For absolute intensity per 100 decays, multiply by 0.30 5.

Decay Scheme

Intensity: I(γ+ce)
per 100 ε decays

²⁵²Cf α Decay

Parent ²⁵²Cf: E=0.0; Jπ=0+; T_{1/2}=2.645 y 8; Q(g.s.)=6216.87 4; %α decay=96.908 8.
²⁵²Cf-Q(α):

²⁴⁸Cm Levels

E(level)	Jπ	T _{1/2}	Comments
0.0 [†]	0+		
43.40 [†] 3	2+	126 ps 10	T _{1/2} : from (α)(ce)(t) (1970To08).
143.6 [†] 4	4+		
298.1 [†] 5	6+		
505.0 [†] 5	8+		

[†] (A): Kπ=0+ g.s. band.

α radiations

(α)(H,θ): see 1975AlYO.

Eα [‡]	E(level)	Iα [†] #	HF [§]	Comments
5616	505.0	=6×10 ⁻⁵	=2800	Eα,Iα: from 1970Ba18.
5826.3	298.1	0.0020	1180	Iα,HF: the measured Iα value and that deduced from Iγ are not consistent. Iα=0.0020 (1970Ba18) whereas from Iγ=0.0020 6 (1963Le17) and α, the requirement of an intensity balance at the 298 level gives Iα=0.0075 23. Conversely, from Iα, one deduces Iγ=0.00054. Note that HF=1180 for Iα=0.0020 and 320 100 for Iα=0.0075 23. Note further that 1963Le17 quote HF=1170 350, so there is an inconsistency in 1963Le17. The evaluator adopts the Iα value of 1970Ba18 and the Iγ(155γ) value deduced from Iα.
5976.6	143.6	0.25 12	62 30	Iα: from an intensity balance at the 144 level. Measured values of Iα are 0.28 (1958As64) and 0.2 (1970Ba18).
6075.64 11	43.40	15.0 9	3.39 21	Iα: from an intensity balance at the 43 level. Measured values of Iα are 15.5 (1955As42) and 15.8 (1970Ba18).
6118.10 4	0.0	84.1 4	1.0	Iα: from 1976BaZZ. Others: 84.0 (1970Ba18), 84.5 (1955As42).

[†] For α intensity per 100 decays, multiply by 0.96908 8.

[‡] The energies of the 6118- and 6076-keV α's are from 1986Ry04. The original energies have been decreased by 0.14 and 0.13 keV, respectively, as recommended by 1991Ry01. All other energies are the measurements of 1970Ba18; the original energies are increased here by 1.6 keV by recalibrating the energies at 6118.10 keV for the highest energy α (transition to the g.s. of ²⁴⁸Cm).

[§] r₀(²⁴⁸Cm)=1.5012 6 is calculated from the requirement that HF(6118.1α)=1.0.

Iα values can be obtained from directly measured α intensities or from intensity balance arguments using the measured Iγ values and theoretical conversion coefficients. The evaluator has chosen, in each case, the approach where intensities with quoted uncertainties are available.

γ(²⁴⁸Cm)

L x ray=7.8 4 per 100 α decays (1971Wa28). See 1971Wa28 for measured energies and intensities of L X-ray components and for deduced L subshell-fluorescence yields. See also 1964Ha14 for L fluorescence yield, obtained from L x ray intensity in singles, γγ and αγ spectra.

L x ray and M x ray radiations were observed by 1990Po14.

K x ray=0.007 per 100 α decays (1955As42).

No photons with Eγ>400 were observed: I(Eγ>400)<0.002, and no electrons with E(ce)>400 were observed:

I(E(ce)>400)<0.00006 per 100 α decays (1963Bj03).

No photons with Eγ>225 were observed: Iγ(Eγ>225)<0.002 per α decays (1963Le17).

Eγ	E(level)	Iγ [†]	Mult. [‡]	α [§]	Comments
43.399 25	43.40	0.0153 9	E2	1000 15	Eγ: from 1971Wa28. Others: 42 (1955As42), 43.4 (1956Ho54). Iγ: Iγ per 100 α decays (1971Wa28). Other: 0.014 (1955As42).
100.2 4	143.6	0.013 6	E2	18.4 3	Eγ: from 1964As10. Iγ: from 1955As42.
155.1 2	298.1	0.00054	E2	2.73 5	Eγ: from adopted gammas. Eγ=160 15 is reported by 1963Le17 in α decay. Iγ: see comment on Iα(5826α).

Continued on next page (footnotes at end of table)

²⁵²Cf α Decay (continued)

γ(²⁴⁸Cm) (continued)

Eγ	E(level)	Iγ [†]	Mult. [‡]	α [§]	Comments
(207.4 2)	505.0	≈3×10 ⁻⁵	E2	0.864 13	Eγ,Iγ: this transition is not seen in α decay. Eγ is from adopted gammas, and Iγ is from I(γ+ce)=Iα with α as given.

[†] For absolute intensity per 100 decays, multiply by 0.97.
[‡] From adopted gammas.
[§] From adopted gammas for the corresponding adopted energy.

²⁴⁶Cm(t,p) 1977F106

E=17 MeV (1977F106).
Observation of strong transition strengths to the g.s. and to the first excited 0+ state in this two-neutron stripping reaction was interpreted by 1977F106 as an indication of a gap at N=152 in the single-particle orbitals that is larger than the pairing gap.

²⁴⁸Cm Levels

E(level)	Jπ	L [†]	Comments
0.0	0+	0	Population of ²⁴⁸ Cm g.s. was observed to be 1.6 times stronger than the ²⁴⁶ Cm g.s. population in (t,p) reaction.
43	2+	2	
1084	0+	0	Large cross section for the 1084-keV level was observed. The strength was 36% of that for the g.s. (1977F106). This level was interpreted by 1977F106 as a two-particle two-hole-pair vibrational state.

[†] From angular distribution. σ(θ)'s were measured between θ=10° and 60° in 5° intervals (1977F106).

²⁴⁸Cm(α, α'), (d, d') 1975Th11, 1975Ya13

1975Th11: E(d)=15 MeV. FWHM = 8 keV. $\theta=90^\circ, 125^\circ$

1975Ya13: E(d)=16 MeV. FWHM = 14 keV. $\theta=90^\circ, 125^\circ$

E(α)=29 MeV. $\theta=125^\circ$

B(EL) values given here are from 1975Th11. The values were normalized to B(E3)(1094 level)=0.41, obtained in Coulomb excitation, but note that the uncertainty of 0.10 in this normalization value is not included.

²⁴⁸Cm Levels

E(level) [†]	J π [#]	Comments
0.0	0+ [@]	
43 1	2+ [@]	
144 1	4+ [@]	
299 2	6+ [@]	
509 § 4	(8+)	
1050 ‡ 2	(2+) ^a	B(E2)=0.17 4.
1050 ? ‡ 2	(1-)&	
1095 2	3-&	BE3=0.41 (normalization value from Coulomb excitation).
1131 § 3	2+ ^b	
1144 2	(4+) ^a	
1172 3	(5-)&	
1222 4	4+ ^b	
1236 2	(3-)	B(E3)=0.15.
1305 3	(3-)	
1319 § 3		
1358 § 3		
1399 § 3		
1440 § 3		
1469 § 4		
1484 2	(3-)	B(E3)=0.10.
1514 § 3		
1552 § 4		
1651 4		
1883 3		
1938 4		
1969 4		
2000 4		E(level): weakly populated. Seen only at 125°.

[†] From 1975Ya13, except where noted otherwise.

[‡] The peak at 1950 has a B(E2) value agreeing with that for a 2+ excitation at this energy in Coulomb excitation, suggesting that the main contribution to this peak is from this same 2+ level; however, based on the members of the K π =1- band seen in Coulomb excitation beginning at the 7- member (E=1295), and with the assumption that the 3- and 5- band members are the levels seen here at 1094 and 1172, respectively, the 1- band head energy is expected at 1050. The peak at this energy in (d, d') thus possibly includes both a 2+ and a 1- level.

§ From 1975Th11. From a comparison with adopted levels, the energies of these authors are $\approx$ 5 keV too low. The evaluator has increased the authors' values by 5 keV.

From the ratio of cross sections at 90° and 125°, and a fit to a rotational band (1975Th11, 1975Ya13). The assignment for the 1131 and 1222 levels comes from adopted levels.

@ K π =0+ g.s. band.

& K π =1- octupole-vibrational band.

^a K π =2+ γ -vibrational band.

^b K π =0+ band.

Coulomb Excitation

1971Fo17	(α, α')	E=17, 18 MeV
1973Be44	(α, α')	E=17 MeV
1974Mc15	(α, α')	E=17 MeV
1986Cz02	(¹³⁶ Xe, ¹³⁶ Xe' γ)	E=641 MeV
	(⁵⁸ Ni, ⁵⁸ Ni' γ)	E=260 MeV
1993Pi07	(²⁰⁸ Pb, ²⁰⁸ Pb' γ)	E=1100 MeV
1998Ha08	(²⁰⁸ Pb, ²⁰⁸ Pb' γ)	E=1300 MeV
2002AbZV	(²⁰⁹ Bi, ²⁰⁹ Bi' γ)	E=1450 MeV

²⁴⁸Cm Levels

The B(E2) values for the 6+ and higher levels are weighted averages of values from 1986Cz02 and 1993Pi07, except for the 26+ and 28+ which are reported only by 1993Pi07.

E(level) [†]	J π	T _{1/2} [‡]	Comments
0.0\$	0+		
43.40\$	2+	122.5 ps 25	B(E2)=14.99 19 (1973Be44). An earlier value of 15.0 6 from this same group was published in 1971Fo17. Other: 13.7 9 (1986Cz02).
143.80\$ 20	4+	80 ps +14-19	B(E2)(2+ to 4+)=6.4 +19-9 (1986Cz02). B(E4)=0.00 +36-0 (1973Be44).
298.9\$ 3	6+	34 ps +11-3	B(E2)(4+ to 6+)=7.3 +5-18.
506.4\$ 4	8+	16.0 ps +31-23	B(E2)(6+ to 8+)=6.5 11.
762.8\$ 4	10+	7.5 ps +7-6	B(E2)(8+ to 10+)=6.0 5.
1050@ 2	(2+)	1.23 ps +18-16	B(E2)=0.180 23 (1974Mc15).
1050# 2	1-		
1064.1\$ 4	12+	3.71 ps +22-18	B(E2)(10+ to 12+)=5.9 3.
1084&	0+		
1095# 2	3-		B(E3)=0.41 10 (1974Mc15).
1131& 3	2+		
1144@ 2	4+		
1172# 3	5-		
1222& 3	4+		
1284.4@ 8	6+		
1295.1# 5	7-		
1406.2\$ 5	14+	1.75 ps +9-7	B(E2)(12+ to 14+)=6.9 3.
1452.3@ 6	8+		
1465.9# 5	9-		
1466.1& 4	8+		
1651.8& 5	10+		
1669.3@ 5	10+		
1682.4# 4	11-		
1784.0\$ 5	16+	1.43 ps +9-11	B(E2)(14+ to 16+)=5.2 +4-3.
1880.2& 5	12+		
1929.1@ 5	12+		
1942.1# 5	13-		
2150.1& 5	14+		
2192.6\$ 5	18+	0.87 ps +9-7	B(E2)(16+ to 18+)=5.8 5.
2229.4@ 5	14+		
2242.1# 5	15-		
2460.6& 6	16+		
2566.8@ 5	16+		
2578.2# 5	17-		
2627.1\$ 5	20+	0.76 ps +11-8	B(E2)(18+ to 20+)=4.9 6.
2808.6& 8	18+		
2937.1@ 6	18+		
2947.2# 6	19-		
3083.5\$ 6	22+	0.44 ps 4	B(E2)(20+ to 22+)=6.7 +6-5.
3190.1& 9	20+		
3331.7@ 6	20+		
3347.2# 7	21-		
3559.6\$ 6	24+	0.41 ps +9-6	B(E2)(22+ to 24+)=5.7 10.
3601.9& 11	22+		
3738.3@ 7	22+		
3775.2# 8	23-		
4041.0& 12	24+		
4055.4\$ 7	26+	0.32 ps +9-6	B(E2)(24+ to 26+)=6.1 +14-13.
4158.1@ 9	24+		

Continued on next page (footnotes at end of table)

Coulomb Excitation (continued)

²⁴⁸Cm Levels (continued)

E(level) [†]	J π	T _{1/2} [‡]	Comments
4229.6 # 9	25-		
4572.4 § 8	28+	0.27 ps +18-9	B(E2)(26+ to 28+)=5.8 +29-23.
4599.5 @ 10	26+		
4709.5 # 10	27-		
5114.0 § 10	30+		
5216.1 # 12	29-		
5680.7 ? § 11	(32+)		

[†] No γ decay from the lower members of the $K\pi=1-$ octupole- vibrational band up to 5-, or from the $K\pi=2+$ γ -vibrational and $K\pi=0+$ bands up to 6+ has been observed. Energies for these levels have been taken from adopted levels, but note that the 6+ member of the $K\pi=0+$ band has not been seen in any dataset.

[‡] From B(E2).

§ (A): $K\pi=0+$ g.s. band.

(B): $K\pi=1-$ octupole-vibrational band.

@ (C): $K\pi=2+$ γ -vibrational band.

& (D): $K\pi=0+$ band.

$\gamma(^{248}\text{Cm})$

E γ [†]	E(level)	I γ [‡]	Mult.#	α	I γ [§]	Comments
43.40	43.40		E2	1000 15		E γ : rounded-off value from adopted gammas. The transition was obscured in this reaction.
100.4 2	143.80	32.7 20	E2	18.4 3		E γ : other: 100.8 6 (1986Cz02). The line was obscured in 1993Pi07.
155.1 2	298.9	75 6	E2	2.71 4		E γ : others: 154.5 2 (1993Pi07), 155.3 5 (1986Cz02).
167.9 5	1452.3	≤ 0.32			0.57 12	I γ : the authors report $I\gamma \leq 0.13$ 19.
171.2 5	1465.9	0.6 5			0.48 10	
185.9 4	1651.8	0.44 32				
207.4 2	506.4	72 5	E2	0.858 12		E γ : others: 206.9 1 (1993Pi07), 207.4 4 (1986Cz02).
216.4 4	1682.4	0.49 23			0.39 17	
217.1 5	1669.3	< 0.43			0.08 11	I γ : the authors report $I\gamma = 0.17$ 26.
228.4 4	1880.2	0.33 22			1.65 15	
256.4 2	762.8	100 3	E2	0.401 6		E γ : others: 255.7 1 (1993Pi07), 256.1 3 (1986Cz02).
259.6 3	1942.1	1.37 25			1.76 21	
259.9 4	1929.1	0.56 22			0.50 12	
263.5 @ 5	3347.2	≤ 0.073				I γ : the authors report $I\gamma \leq 0.058$ 15.
270.0 5	2150.1	0.16 16			1.26 4	
300.0 3	2242.1	7 4			4.1 11	
300.8 4	2229.4	0.6 4			1.0 6	
301.3 2	1064.1	84 11	E2	0.236 4		E γ : others: 300.6 1 (1993Pi07), 301.0 3 (1986Cz02).
310.2 5	2460.6	< 0.19			1.06 12	I γ : the authors report $I\gamma = 0.094$ 96.
320.1 5	2947.2	0.078 20			0.39 13	
336.2 3	2578.2	4.8 7			9.8 4	
337.4 3	2566.8	1.0 6			2.49 20	
342.0 2	1406.2	76 5	E2	0.1608 23		E γ : others: 341.2 2 (1993Pi07), 1986Cz02).
348.0 5	2808.6	0.08 8			4.25 24	
369.4 4	2947.2	0.92 8			0.93 11	
370.3 3	2937.1	1.2 7				
377.8 2	1784.0	60 4	E2	0.1210 17		E γ : others: 377.1 2 (1993Pi07), 377.4 3 (1986Cz02).
381.5 5	3190.1	0.03 3			2.59 23	
385.7 3	2578.2	1.15 10			0.51 10	
394.6 4	3331.7	0.41 26				
400.0 4	3347.2	0.64 7				
406.6 4	3738.3	0.23 16				
408.6 2	2192.6	41 3	E2	0.0978 14		E γ : others: 408.0 2 (1993Pi07), 407.9 3 (1986Cz02).
411.8 5	3601.9	0.008 8				
419.8 5	4158.1	0.05 4				
428.0 4	3775.2	0.34 4				
434.4 2	2627.1	23.6 14	E2	0.0834 12		E γ : others: 433.8 2 (1993Pi07), 433.9 3 (1986Cz02).
439.1 5	4041.0	0.004 4				
441.4 5	4599.5	≤ 0.064				I γ : the authors report $I\gamma \leq 0.036$ 28.

Continued on next page (footnotes at end of table)

Coulomb Excitation (continued) $\gamma(^{248}\text{Cm})$ (continued)

$E_{\gamma}^{\dagger}$	E(level)	$I_{\gamma}^{\ddagger}$	Mult. #	α	$I_{\gamma}^{\S}$	Comments
454.4 4	4229.6	0.120 17				
456.4 2	3083.5	13.5 11	E2	0.0735 11		E γ : others: 455.7 3 (1993Pi07), 456.0 5 (1986Cz02).
458.1 3	2242.1	5.8 26			4.6 3	
476.1 2	3559.6	4.1 5	E2	0.0662 10		E γ : other: 475.2 2 (1993Pi07).
479.9 5	4709.5	0.036 8				
495.8 3	4055.4	2.2 3	E2	0.0601 9		E γ : other: 495.8 5 (1993Pi07).
506.6 5	5216.1	≤ 0.033				I γ : the authors report $I_{\gamma} \leq 0.027$ 6.
517.0 4	4572.4	0.50 10	E2	0.0544 8		E γ : other: 516.3 7 (1993Pi07).
535.9 3	1942.1	2.8 4			4.46 27	
541.6 5	5114.0	0.06 4				
566.7@ 5	5680.7?	≤ 0.065				I γ : the authors report $I_{\gamma} \leq 0.042$ 23.
618.3 3	1682.4	2.1 3			2.42 23	
703.1 4	1465.9	1.23 25			2.56 19	
704.5 5	3331.7	≤ 0.07			0.04 5	I γ : the authors report $I_{\gamma} = 0.03$ 4.
719.6@ 5	3347.2	≤ 0.063				I γ : the authors report $I_{\gamma} \leq 0.045$ 18.
744.6 4	2937.1	0.39 19			0.29 9	
754.0 5	2947.2	0.060 24			0.31 12	
782.7 4	2566.8	0.36 19			0.95 15	
789.0 5	1295.1	≤ 0.55				I γ : the authors give $I_{\gamma} \leq 0.46$ 9.
794.3 4	2578.2	0.33 10			0.90 21	
822.9 4	2229.4	0.52 16			0.93 15	
835.9 4	2242.1	0.56 16			0.33 14	
865.2 4	1929.1	0.95 25			1.06 15	
877.9 4	1942.1	0.24 14			0.39 16	
906.6 4	1669.3	0.54 23			0.37 12	
919.6 4	1682.4	0.15 15			0.17 18	
946.1 5	1452.3	0.21 21				
959.0 5	1465.9	0.06 6			0.13 12	
996.4 5	1295.1	≤ 0.045				I γ : the authors give $I_{\gamma} \leq 0.023$ 22.
1054.7 5	2460.6	< 0.014			0.06 7	I γ : the authors report $I_{\gamma} = 0.006$ 8.
1085.5 5	2150.1	< 0.018			0.08 7	I γ : the authors report $I_{\gamma} = 0.008$ 10.
1117.4 5	1880.2	0.022 18			0.16 8	
1145.4 4	1651.8	0.11 9			0.21 9	
1167.3 4	1466.1	0.297 17				

† From 2002AbZV, except where noted otherwise. The authors state that the uncertainties are 0.2 keV for the strongest transitions and 0.5 keV for the weakest. The evaluator has assigned uncertainties as follows: 0.2 for $I_{\gamma} > 10$, 0.3 for $I_{\gamma} = 1$ to 10, 0.4 for $I_{\gamma} = 0.1$ to 1, and 0.5 for $I_{\gamma} < 0.1$. Others: 1993Pi07 and 1986Cz02 report values for the g.s. band. Some values of 1993Pi07 are quoted with uncertainties of 0.1 keV; however, except for the 495.8 γ from the 26+ level, where the energies are the same, the values from 1993Pi07 are all lower than those of 2002AbZV by 0.5 to 0.9 keV. For consistency among the several bands, values from 2002AbZV are adopted here and in adopted gammas.

‡ Relative photon intensities (2002AbZV) normalized to $I_{\gamma} = 100$ for the 256 γ in the g.s. band.

§ Relative photon branching from each level (2002AbZV). In addition to the relative photon intensities, the authors give photon branching ratios for some of the levels as deduced from using double coincidence gates above the level of interest.

From $\gamma(0)$ (1986Cz02, 1993Pi07) with the assumption that quadrupole transitions are E2.

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Q(β⁻)=841 SY; S(n)=5481 SY; S(p)=4743 SY; Q(α)=5775 SY 2012Wa38.

The systematics uncertainty is 71 keV for all four entries.

²⁴⁸Bk Levels

Cross Reference (XREF) Flags

A ²⁵²Es α Decay

E(level)	Jπ	XREF	T _{1/2}	Comments
0.0+z	(6+, 8-)		>9 y	Assignment: ²⁴⁶ Cm(α,pn) chem, ms (1965Mi08). Jπ: the odd proton may be in the 7/2[633] Nilsson state in analogy to ²⁴⁹ Bk, and the odd neutron in the 9/2[734] state in analogy to ²⁴⁷ Cm and ²⁴⁹ Cf. The Gallagher-Moszkowski rule predicts the parallel coupled 8- state to be lower in energy than the 1- member of the doublet. The long-lived state might be the 8- member of this doublet. However, it is also possible that this may be the (6+) level at E=0.0+y fed in α decay of ²⁵² Es rather than the 8- level proposed by 1973Fi06. An assignment of either 6+ or 8- is consistent with the absence of any β ⁻ decay to ²⁴⁸ Cf. T _{1/2} : deduced by 1965Mi08 from observation of no change in ²⁴⁸ Bk/ ²⁴⁷ Bk mass ratio of their sample for a period of ten months within the limits of analysis. T _{1/2} (β ⁻)>1×10 ⁴ y was deduced by 1965Mi08 from nonobservation of ²⁴⁸ Cf α activities.
0.0+x	1(-)		23.7 h 2	%β ⁻ =70 5; %ε=30 5. The ratio of ε decay/β ⁻ decay was determined by 1978Gr10 from measured I(Curium K x ray from ε decay)/I(550.7γ from β ⁻ decay)= 4.25 28 and I(550.7γ)=7.1 5 per 100 β ⁻ decays. E(level): Q(β ⁻)=860 20 measured by 1978Gr10, compared with the systematics value of 841 71 from 2012Wa38, suggests that E(level)=20 +74-20. T _{1/2} : from 1978Gr10. Others: 16 h 3 (1956Ch77), and 23 h 5 (1956Hu27). Jπ: log ft=7.6 to 2+ and 7.1 to 0+ in ε decay (7.6 to 2+ and 7.8 to 0+ in β ⁻ decay) give J=1. Probable configuration of π7/2[633]@v9/2[734] gives π=-. E(level): Q(α)(²⁵² Es)=6739 3 from Eα=6632 3, and Q(α)=6789 50 from systematics as given in 2012Wa38, suggest that this level lies within 100 keV of the g.s. Jπ: from the ratio of energy spacings, K=6 was assigned by 1973Fi06 for the rotational band based on this level, and a π3/2[521]@v9/2[734] configuration was proposed. The α hindrance factor for the α transition from ²⁵² Es is consistent with this configuration.
0.0+y [†]	(6+)	A		Jπ: E2 γ to 6+. Member of the Kπ=6+ band. The α hindrance factor is consistent with this assignment.
70.65+y [†] 5	(7+)	A		Jπ: E1 γ to (7+). No γ to (6+).
136+y 7	(8-)	A		Jπ: 1973Fi06 suggest the configuration Kπ=8-, π7/2[633]@v9/2[734]; however, this configuration is not consistent with the α hindrance factor of 2710. The transition would require changes in both the neutron and proton orbitals, and hindrance factors for such transitions are typically much larger.
145+y 3		A		
151.3+y [†] 1	(8+)	A		Jπ: γ's to (6+) and (7+). Member of the Kπ=6+ band. The α hindrance factor is consistent with this assignment.
171.5+y 8	(4-, 5-, 6-)	A		Jπ: 418.5γ from (5-) state is M1. The authors of 1973Fi06 propose Jπ=4-. Although a probable configuration of K=4, π3/2[521]@v5/2[622] is consistent with the M1 transition from the 5-, π3/2[521]@v7/2[613] state, the hindrance factor for the α from ²⁵² Es is not. One would expect the HF to be about a factor of hundred less than the experimental value of 2250.
179+y 3		A		
212.6+y 8	(4-, 5-, 6-)	A		Jπ: 377.4γ from (5-) state is M1. The authors of 1973Fi06 propose that it may be the Jπ=5- member of a band based on the 171.5+y level.
262+y 6		A		
339+y 6		A		
373+y 5		A		
399.7+y 3	(5+)	A		Jπ: M1 γ to (6+) but not to (7+) or (8+) members of the proposed Kπ=6+ band.
424+y 6		A		
458+y 6		A		
483+y 6		A		
529.1+y 7		A		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

²⁴⁸Bk Levels (continued)

E(level)	J π	XREF	Comments
590.0+y [‡] 7	(5-)	A	J π : HF=5.1 from (5-) suggests probable configuration $\pi 3/2[521] \otimes \nu 7/2[613]$, the same as that of the ²⁵² Es g.s.
624+y [§] 5	(7+)	A	J π : A K π =7+, $\pi 7/2[633] \otimes \nu 7/2[613]$ configuration is suggested by 1973Fi06. The α hindrance factor is consistent with this assignment.
657+y [‡] 5	(6-)	A	J π : The energy spacing and the α hindrance factor suggest that the level is the 6- member of the K π =5- band built on the 590.0+Y level.
700+y [§] 5	(8+)	A	J π : The energy spacing and the α hindrance factor suggest that the level is the 8+ member of a rotational band built on the 624+Y level.

[†] (A): K π =6+, $\pi 3/2[521] \otimes \nu 9/2[734]$ band.

[‡] (B): K π =5-, $\pi 3/2[521] \otimes \nu 7/2[613]$ band.

[§] (C): K π =7+, $\pi 7/2[633] \otimes \nu 7/2[613]$ band.

$\gamma(^{248}\text{Bk})$

All data are from ²⁵²Es α decay.

E(level)	E γ	I γ	Mult.	δ	α
70.65+y	70.65 5		E2		104.5 15
136+y	64.42 5		E1		0.450 7
151.3+y	80.7 1	44 8	M1+E2	1.4 +14-4	43 8
	151.3 1	100 10	[E2]		3.26 5
373+y	193.5 1	100 12	M1		5.33 8
	228.0 4	53 9	M1		3.36 5
399.7+y	399.7 3		M1		0.709 10
529.1+y	529.1 7				
590.0+y	377.4 3	55 7	M1		0.830 12
	418.5 3	100 10	M1		0.625 9
	590.0 7	38 4	[E1]		0.0116 2

²⁵²Es α Decay 1973Fi06

Parent ²⁵²Es: E=0.0; J π =(5-); T_{1/2}=471.7 d 19; Q(g.s.)=6739 3; % α decay=78 2.

²⁵²Es-Q(α): from E α =6632 3. 2012Wa38 report a systematics value of 6789 50.

²⁴⁸Bk Levels

E(level)	J π	Comments
0.0+y	(6+)	E(level): Q(α)(²⁵² Es)=6739 3 from E α =6632 3, and Q(α)=6789 50 from systematics as given in 2012Wa38, suggest that this level lies within 100 keV of the g.s.
70.65+y 5	(7+)	
136+y 7	(8-)	

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²⁵²Es α Decay 1973Fi06 (continued)

²⁴⁸Bk Levels (continued)

E(level)	J π	E(level)	J π	E(level)	J π
145+y 3		339+y 6		529.1+y 7	
151.3+y 1 (8+)		373+y 5		590.0+y 7 (5-)	
171.5+y 8 (4-, 5-, 6-)		399.7+y 3 (5+)		624+y 5 (7+)	
179+y 3		424+y 6		657+y 5 (6-)	
212.6+y 8 (4-, 5-, 6-)		458+y 6		700+y 5 (8+)	
262+y 6		483+y 6			

 α radiations

E $\alpha^\dagger$	E(level)	I $\alpha^\dagger$ §	HF#	Comments
5943 4	700+y	0.040 15	34 13	
5985 4	657+y	0.050 15	46 14	
6017 4	624+y	0.12 3	28 8	
6051 3	590.0+y	1.02 9	5.0 5	
6109 5	529.1+y	0.12 3	86 22	
6156 5	483+y	=0.04	=449	
6181 5	458+y	0.08 3	300 120	
6215 5	424+y	0.10 3	360 110	
6239 3	399.7+y	0.57 5	83 8	
6265 3	373+y	0.75 7	85 9	
6298 5	339+y	=0.04	=2306	
6374 5	262+y	0.07 3	3.1 $\times$ 10 ³ 14	
6424 5	212.6+y	0.45 5	840 100	
6461 3	171.5+y	0.25 4	2250 370	
6482 3	151.3+y	2.19 9	323 17	
6498 5	136+y	0.31 4	2710 370	
6562 3	70.65+y	13.6 3	123 5	
6632 3	0.0+y	80.2 9	43.5 14	The 6632- and 6562-keV α 's are not seen in coincidence with 80- to 400-keV γ 's within the coincidence resolving time of 100 ns (1973Fi06).

[†] For α intensity per 100 decays, multiply by 0.78 2.

[‡] Measurements of 1973Fi06. The original energies are increased by 1 keV, as recommended by 1991Ry01, due to changes in calibration energies. No higher-energy α 's were observed and 1973Fi06 assumed that the 6632 α feeds the ²⁴⁸Bk g.s. Other: 1965Mc11.

[§] I α per 100 α decays (1973Fi06).

[#] $r_0(^{248}\text{Bk})=1.4851$ 7 is used in calculations of the hindrance factors. $r_0=1.4851$ 14 was used in the previous evaluation, 1999Ak02.

 $\gamma(^{248}\text{Bk})$

x-rays measured by 1973Fi06:

E(x ray)	I(per 100 α decays)	
107.20 5	0.37 3	Bk K α_2 x ray
115.02 5	0.58 5	Bk K α_1 x ray
125.4 1		Bk K β_3 x ray
	0.23 2	
126.5 1		Bk K β_1 x ray
130.7 2	0.082 8	Bk K β_2 ' x ray

$\alpha\gamma$, $\gamma\gamma$ and $\gamma\epsilon$ coincidences were taken by 1973Fi06. See 1973Fi06 for data.

E $\gamma^\ddagger$	E(level)	I $\gamma^\ddagger$ §	Mult.#	α	Comments
^x 52.33 5		0.72 6			The 52.33 γ was observed in coincidence with the 6461 α ; therefore, it deexcites a level below the 171.5+y level.
64.42 5	136+y	0.36 3	E1	0.450	Mult.: the requirement of an intensity balance at the 151.3+y level is consistent only with mult=E1.
70.65 5	70.65+y	0.16 2	E2	104.5	Mult.: from an intensity balance at the 70.65+y level one gets $\alpha=99$ +15-12.

Continued on next page (footnotes at end of table)

²⁵²Es α Decay 1973Fi06 (continued)

 $\gamma(^{248}\text{Bk})$ (continued)

$E\gamma^\ddagger$	E(level)	$I\gamma^\ddagger$	Mult.#	δ	α	Comments
80.7 1	151.3+y	0.042 7	M1+E2	1.4 +14-4	42 10	Mult., δ : the requirement of an intensity balance at the 151.3+y level gives $\alpha(80.7\gamma)=42+9-7$ from which one gets mult(80.7 γ)=M1+E2 with $\delta=1.4+14-7$.
^x 149.1 2		0.026 4				
151.3 1	151.3+y	0.096 9	[E2]		3.26	
193.5 1	373+y	0.068 8	M1		5.33	
228.0 4	373+y	0.036 6	M1		3.36	
^x 230.9 4		0.032 6				
^x 326.0 4		0.031 6				
377.4 3	590.0+y	0.16 2	M1		0.830	
399.7 3	399.7+y	0.30 3	M1		0.709	
418.5 3	590.0+y	0.29 3	M1		0.625	
^x 428.3 5		=0.012				
^x 452.4 5		0.04 1				
^x 523 1		=0.016				
529.1 7	529.1+y	0.07 1				
^x =548		=0.01				
590.0 7	590.0+y	0.11 1	[E1]		0.01161	

[†] For absolute intensity per 100 decays, multiply by 0.78 2.

[‡] From 1973Fi06.

[§] $I\gamma$ per 100 α decays (1973Fi06).

Except where noted otherwise, mults are from K x ray/ γ in coincidence with α 's (1973Fi06) (E2 admixtures to M1's are not ruled out). The multipolarities within square brackets are not directly measured but are deduced from the decay scheme.

^x γ ray not placed in level scheme.

Decay Scheme

Intensities: $I(\gamma+\text{ce})$ per 100 decays by this branch

(5-) 0.0 471.7 d
²⁵²Es₁₅₃ α =78 2
 $Q_\alpha=6739^3$

Adopted Levels, Gammas

$Q(\beta^-) = -3061$ SY; S(n)=6935 16; S(p)=5540 8; $Q(\alpha) = 6361$ 5 2012Wa38.

$Q(\beta^-)$: the systematics uncertainty is 53.

^{248}Cf Levels

Cross Reference (XREF) Flags

- A $^{249}\text{Cf}(\text{d}, \text{t})$
- B $^{252}\text{Fm} \alpha$ Decay
- C $^{248}\text{Bk} \beta^-$ Decay (23.7 h)
- D $\text{Cf}(^{18}\text{O}, \text{xn}\gamma)$

E(level) [†]	$J\pi^{\ddagger}$	XREF	$T_{1/2}$	Comments
0.0 §	0+	ABCD	333.5 d 28	$\% \alpha = 99.9971$ 3; $\% \text{SF} = 0.0029$ 3. $T_{1/2}, \% \text{SF}$: 1973Hu01 report $T_{1/2} = 333.5$ d 28 and $a/\text{SF} = 3.5 \times 10^4$ 3. These data give $T_{1/2}(\text{SF}) = 3.2 \times 10^4$ y 3 (recommended by 2000Ho27). Other $T_{1/2}(\text{SF})$: 4.1×10^4 y 4 (1968Sk01). $T_{1/2}$: from 1973Hu01. $J\pi$: HF=3.8 from 0+ ($^{252}\text{Fm} \alpha$ decay).
41.53 § 6	2+	ABCD		
137.81 § 9	4+	AB D		
287.4 § 1	6+	AB D		
488.0 § 2	8+	A D		
592.2 # 2	(2)-	C		$J\pi$: E1 γ to 2+. $\log ft = 6.85$ from 1(-). No feeding to 0+ or 4+.
630 # 1	3-	A		
677 # 1	4-	A		
735 # 1	5-	A		
737.3 § 5	10+	D		
779 2		A		
806 # 1	6-	A		
885 # 1	7-	A		
979 # 2	8-	A		
1021 2		A		
1048 2		A		
1079 2		A		
1112 2		A		
1179 2		A		
1261 @ 2	8-	A		
1293 2		A		
1319 2		A		
1351 @ 2	9-	A		
1391 2		A		
1432 2		A		
1463 & 1	5-	A		
1477 a 2	2-	A		
1509 a 1	3-	A		
1530 & 1	6-	A		
1557 a 1	4-	A		
1577 b 1	7-	A		
1605 & 1	7-	A		
1621 a 1	5-	A		
1640 c 1	4-	A		
1663 b 1	8-	A		
1686 a 3	6-	A		
1698 c 2	5-	A		
1731 & 2	8-	A		
1766 c 2	6-	A		
1781 b 3	9-	A		
1839 & 3	(9-)	A		
1852 c 1	7-	A		
1927 d 1	5+	A		
1946 c 3	8-	A		
1968 1		A		
1992 d 1	6+	A		
2018 3		A		
2072 e 1	4+	A		
2105 f 1	(4-)	A		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)**248Cf Levels (continued)**

E(level) [†]	Jπ [‡]	XREF	E(level) [†]	Jπ [‡]	XREF	E(level) [†]	Jπ [‡]	XREF
2131 ^e 1	5+	A	2281 ⁱ 2	2+	A	2533 1		A
2161 ^f 2	(5-)	A	2314 ⁱ 2	3+	A	2557 ^j 1	4+	A
2184 ^g 2	6-	A	2368 ⁱ 2	(4+)	A	2580 1		A
2207 ^e 1	6+	A	2463 2		A	2602 ^k 1	6+	A
2241 ^h 1	7+	A	2492 2		A	2634 ^j 2	(5+)	A
2262 ^g 1	(7-)	A	2512 ^j 1	3+	A	2682 ^k 2	(7+)	A

[†] Except where noted otherwise, the energies are from (d,t).

[‡] Except where noted otherwise, the Jπ assignments are from (d,t) based on band assignments which in turn are based on a comparison of experimental and calculated cross sections at 90, 120, and 135 degrees.

§ Kπ=0+ g.s. band.

Kπ=2- 9/2-[734],5/2+[622]@PHONON.

@ Kπ=8- 9/2-[734],7/2+[624].

& Kπ=5- 9/2-[734],1/2+[631].

a Kπ=2- 9/2-[734],5/2+[622]@PHONON.

b Kπ=7- 9/2-[734],5/2+[622].

c Kπ=4- 9/2-[734],1/2+[631].

d Kπ=5+ 9/2-[734],1/2-[501].

e Kπ=4+ 9/2-[734],1/2-[501].

f Kπ=3-? 9/2-[734],3/2+[631].

g Kπ=6- 9/2-[734],3/2+[631].

h Kπ=7+ 9/2-[734],5/2-[503].

i Kπ=2+ 9/2-[734],5/2-[503].

j Kπ=3+ 9/2-[734],3/2-[501].

k Kπ=6+ 9/2-[734],3/2-[501].

γ(248Cf)

E(level)	Eγ	Mult.	α	Comments
41.53	41.53 6	[E2]	1461 23	Eγ: from α decay.
137.81	96.28 6	[E2]	26.5 4	Eγ: from α decay.
287.4	149.6 1	[E2]	3.70 6	Eγ: from (18O,xnγ).
488.0	200.6 1	[E2]	1.129 16	Eγ: from (18O,xnγ).
592.2	550.7 1	E1	0.0136 2	Eγ,Mult.: from β ⁻ decay.
737.3	249.3 5	[E2]	0.507 8	Eγ: from (18O,xnγ).

248Bk β⁻ Decay (23.7 h) 1978Gr10

Parent 248Bk: E=0.0+x; Jπ=1(-); T_{1/2}=23.7 h 2; Q(g.s.)=860 20; %β⁻ decay=70 5.

248Bk-Q(β⁻): authors' average of β⁻ end point measurements of 870 20 to the g.s. and 257 20 to the 592 level.

2012Wa38 quote a systematics value of 840 70.

248Cf Levels

E(level)	Jπ
0.0	0+
41.53 6	2+
592.2 2	(2)-

β⁻ radiations

Eβ ⁻	E(level)	Iβ ^{-†‡}	Log ft	Comments
257 20	592.2	5.0 4	6.85 12	Eβ ⁻ : obtained by 1978Gr10 from the Fermi-Kurie end point energy of the β ⁻ spectrum taken in coincidence with the 550.7γ.
818 20	41.53	20 10	7.83 23	Eβ ⁻ : from Q(β ⁻) and E(level).

Continued on next page (footnotes at end of table)

²⁴⁸Bk β⁻ Decay (23.7 h) 1978Gr10 (continued)

β⁻ radiations (continued)

Eβ ⁻	E(level)	Iβ ^{-†‡}	Log ft	Comments
870 20	0.0	45 10	7.55 11	Eβ ⁻ : measured by 1978Gr10 (the Fermi-Kurie endpoint energy of singles β spectrum).

[†] For β⁻ intensity per 100 decays, multiply by 1.00 8.

[‡] β intensity per 100 23.7-h ²⁴⁸Bk decays, measured by 1978Gr10.

γ(²⁴⁸Cf)

Kα₁ x ray(Cf)/I(550γ)=0.0055 8 (1978Gr10).

Eγ	E(level)	Iγ [†]	Mult.	α	Comments
(41.53 6)	41.53				Transition was not observed, Eγ is from ²⁵² Fm α decay.
550.7 1	592.2	7.1 5	E1	0.01365	Iγ: Iγ per 100 β ⁻ decays from Iγ/ΣI(β ⁻) and also from Iγ/Iα(²⁴⁸ Bk). Mult.: α(K)exp=0.009 2 deduced by 1978Gr10 from Cf K x ray/Iγ(550.7γ).

[†] For absolute intensity per 100 decays, multiply by 0.70 5.

Decay Scheme

²⁴⁸Es ε Decay

Parent ²⁴⁸Es: E=0.0; Jπ=(2-,0+); T_{1/2}=27 min 5; Q(g.s.)=3061 syst; %ε+%β⁺ decay=99.7 3.
The ε+β⁺ decay of ²⁴⁸Es has not been studied.

²⁵²Fm α Decay 1984Ah02

Parent ²⁵²Fm: E=0.0; Jπ=0+; T_{1/2}=25.39 h 4; Q(g.s.)=7152.7 20; %α decay=99.9977 2.

²⁴⁸Cf Levels

E(level)	Jπ
0.0 [†]	0+
41.53 [†] 6	2+
137.81 [†] 9	4+
285 [†] 4	6+

[†] (A): Kπ=0+ g.s. band.

²⁵²Fm α Decay 1984Ah02 (continued)
α radiations

Eα [†]	E(level)	Iα ^{†§}	HF [#]
6759 3	285	0.023 5	225 49
6904 2	137.81	0.97 4	23.0 10
6998 2	41.53	15.0 2	3.77 6
7039 2	0.0	84.0 5	1.000

[†] For α intensity per 100 decays, multiply by 0.999977 2.

[‡] Others: 1977Be36, 1967Ch17, and 1956Fr07.

[§] Intensity per 100 α decays.

[#] r₀(²⁴⁸Cf)=1.4670 8 is calculated from HF(7039α)=1.0.

γ(²⁴⁸Cf)

I_γ normalization: from I(γ+ce)(41γ-96γ)=Iα(6998α). This is consistent with the intensity balance at the g.s.,
I(γ+ce)(41γ)=100-Iα(7039α)=16.0 5 from which one gets a normalization factor of 0.0109 3.

Eγ	E(level)	Iγ ^{†‡}	Mult.	α	Comments
41.53 6	41.53	1.0	[E2]	1461 23	α(L)=1076; α(M)=305.6.
96.28 6	137.81	3.3 3	[E2]	26.5 4	α(L)=19.5; α(M)=5.549; α(N+...)=2.217.

[†] For absolute intensity per 100 decays, multiply by 0.0109 3.

[‡] Relative photon intensity.

Decay Scheme

Intensities: I(γ+ce)
per 100 decays by this
branch

0+ 0.0 25.39 h
²⁵²₁₀₀Fm₁₅₂ → ²⁴⁸₉₈Cf₁₅₀ α=99.9977 2
Q_α=7152.7²⁰

²⁴⁹Cf(d,t) 2008Ka27

E=11.0, 12.0, 13.0, 14.0 MeV. FWHM=15 keV.

Other: 1975Ya11. E=12 MeV. The authors report levels in the range 593 to 1781. The energy agreement with data of 2008Ka27 is good, and the configuration assignments are the same.

²⁴⁸Cf Levels

E(level) [†]	Jπ [‡]	Comments
0.0 #	0+	
44 # 2	2+ §	
138 # 2	4+ §	
290 # 2	6+ §	
490 # 2	8+	
593 @ 1	2-	
630 @ 1	3-	
677 @ 1	4-	
735 @ 1	5-	
779 2		Jπ: assigned by the authors as the possible 10+ member of the g.s. band; however, the 10+ member is assigned at E=737.3 in (¹⁸ O,xnγ).

Continued on next page (footnotes at end of table)

$^{249}\text{Cf}(\text{d,t})$ 2008Ka27 (continued) **^{248}Cf Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$
806@ 1	6-	1577 ^c 1	7-	2131 ^f 1	5+
885@ 1	7-	1605 ^a 1	7-	2161 ^g 2	(5-)
979@ 2	8-	1621 ^b 1	5-	2184 ^h 2	6-
1021 2		1640 ^d 1	4-	2207 ^f 1	6+
1048 2		1663 ^c 1	8-	2241 ⁱ 1	7+
1079 2		1686 ^b 3	6-	2262 ^h 1	(7-)
1112 2		1698 ^d 2	5-	2281 ^j 2	2+
1179 2		1731 ^a 2	8-	2314 ^j 2	3+
1261& 2	8-	1766 ^d 2	6-	2368 ^j 2	(4+)
1293 2		1781 ^c 3	9-	2463 2	
1319 2		1839 ^a 3	(9-)	2492 2	
1351& 2	9-	1852 ^d 1	7-	2512 ^k 1	3+
1391 2		1927 ^e 1	5+	2533 1	
1432 2		1946 ^d 3	8-	2557 ^k 1	4+
1463 ^a 1	5-	1968 1		2580 1	
1477 ^b 2	2-	1992 ^e 1	6+	2602 ^l 1	6+
1509 ^b 1	3-	2018 3		2634 ^k 2	(5+)
1530 ^a 1	6-	2072 ^f 1	4+	2682 ^l 2	(7+)
1557 ^b 1	4-	2105 ^g 1	(4-)		

[†] The uncertainties given represent the absolute error. The relative uncertainties for the strongly populated levels are 1 keV.

[‡] Except where noted otherwise, the $J\pi$ assignments are those of the authors based on a comparison of experimental and calculated values of the cross sections at 90, 120, and 135 degrees.

§ From adopted levels.

$K\pi=0+$ g.s. band.

@ $K\pi=2-$ 9/2-[734],5/2+[622]@2- phonon.

& $K\pi=8-$ 9/2-[734],7/2+[624].

^a $K\pi=5-$ 9/2-[734],1/2+[631].

^b $K\pi=2-$ 9/2-[734],5/2+[622]@2- phonon.

^c $K\pi=7-$ 9/2-[734],5/2+[622].

^d $K\pi=4-$ 9/2-[734],1/2+[631].

^e $K\pi=5+$ 9/2-[734],1/2-[501].

^f $K\pi=4+$ 9/2-[734],1/2-[501].

^g $K\pi=3-?$ 9/2-[734],3/2+[631].

^h $K\pi=6-$ 9/2-[734],3/2+[631].

ⁱ $K\pi=7+$ 9/2-[734],5/2-[503].

^j $K\pi=2+$ 9/2-[734],5/2-[503].

^k $K\pi=3+$ 9/2-[734],3/2-[501].

^l $K\pi=6+$ 9/2-[734],3/2-[501].

 $\text{Cf}(^{18}\text{O},\text{xn}\gamma)$ 2010Ta10

E=153 MeV. Target consisted of 635 ^{249}Cf , 13% ^{250}Cf , and 24% ^{251}Cf .

 ^{248}Cf Levels

E(level)	$J\pi$
0.0	0+
41.5 [†]	2+ [†]
137.8 [†]	4+ [†]
287.4 1	6+ [‡]
488.0 2	8+ [‡]
737.3 5	10+ [‡]

[†] E is a rounded-off value from adopted levels. J is from adopted levels. The transition deexciting the level was not observed.

[‡] From the authors based on their assignment of the level as a member of the g.s. band.

Cf(¹⁸O,xnγ)

2010Ta10 (continued)

γ(²⁴⁸Cf)

Eγ	E(level)	Iγ	Mult.	α
149.6 1	287.4	9.4 5	[E2]	3.70 6
200.6 1	488.0	6.8 6	[E2]	1.129 16
249.3 5	737.3	2.4 13	[E2]	0.507 8

Adopted Levels

$Q(\beta^-) = -1598$ SY; $S(n) = 6349$ SY; $S(p) = 3092$ SY; $Q(\alpha) = 7160$ SY 2012Wa38.

The systematics uncertainties are 53, 56, 55, and 50 for $Q(\beta^-)$, $S(n)$, $S(p)$, and $Q(\alpha)$, respectively.

 ^{248}Es Levels

E(level)	$J\pi$	$T_{1/2}$	Comments
0.0	(2-, 0+)	24 min 3	<p>$\% \epsilon = 99.7$ 3; $\% \alpha = 0.25$.</p> <p>$J\pi$: analogy to ^{249}Es, ^{251}Es, ^{253}Es isotopes suggests either $\pi 3/2[521]$ or $\pi 7/2[633]$ Nilsson state for the 99th proton and analogy to ^{243}Pu, ^{245}Cm, ^{247}Cf suggests $\nu 7/2[624]$ orbital for the 149th neutron state. Therefore, the configuration is either $K\pi = 2^-: \pi 3/2[521]$, $\nu 7/2[624]$ or $K\pi = 0^+: \pi 7/2[633]$, $\nu 7/2[624]$.</p> <p>$T_{1/2}$: weighted average (min) of 23 3 (2001Sh09), 28 5 (1970Ah01), and 25 5 (1956Ch67). Other: 19 13 (1989Ha27).</p> <p>$\% \epsilon$: $\epsilon/\alpha = 400$ was estimated by 1956Ch67 from observed α counts of ^{248}Es and ^{248}Cf decays. This gives $\% \alpha = 0.25$. The evaluator assigns this as < 0.6 to get $\epsilon = 99.7$ 3.</p> <p>ϵ-delayed fission has been measured by 1980Ga07, who report $3 \times 10^{-5}\%$ and by 2001Sh09 who report $3.5 \times 10^{-4}\%$ 18, a factor of 10 larger.</p>

Adopted Levels, Gammas

Q(β⁻)=-5250 SY; S(n)=7850 SY; S(p)=3969 21; Q(α)=7994 9 2012Wa38.

The systematics uncertainties are 240 and 120 for Q(β⁻) and S(n), respectively.

²⁴⁸Fm Levels

Cross Reference (XREF) Flags

A ²⁵²No α Decay
B ²⁰²Hg(⁴⁸Ca,2nγ)

E(level) [‡]	Jπ [§]	XREF	T _{1/2}	Comments
0.0 [†]	0+	AB	34.5 s 12	%α=95 5; %SF=0.10 5; %ε=5 5. %α: from 100-%ε. 1993An10 measured %α=93 17. %SF: from T _{1/2} (SF)=10 h 5 (1967Nu01). %ε: from the assumption that log ft>6 for any ε branch, one has %ε varying from <0.7% for decay to the expected 0+ level at or near the g.s., to <0.08 for decay to states at or near 1000 keV. The evaluator adopts a conservative upper limit of 10% for the total ε feeding (%β ⁺ will be negligible). T _{1/2} : weighted average of 32.3 s 15 from 2010KeZY in ²⁰² Hg(⁴⁸ Ca,2nγ) and 35.1 s 8 from 2011Ga19 in ²⁵² No α decay. T _{1/2} : from ²⁰² Hg(⁴⁸ Ca,2nγ). Others: 24 s 7 (1973Es01), 32 s 6 (1970Dr05), and 36 s 4 (1966Ak01). T _{1/2} (SF)=10 h 6 (1967Nu01). Recommended by 2000Ho27. Other: =60 h (1970Dr05).
46 [†] 1	2+	AB		
152 [†]	4+	B		
317.2 [†] 3	6+	B		
538.6 [†] 4	8+	B		
813.3 [†] 5	10+	B		
>1074?			10.1 ms 6	E(level),Jπ: see ²⁰² Hg(⁴⁸ Ca,2nγ) for a discussion of the energy and possible configuration assignment for this isomer.
1137.3 [†] 6	12+	B		
1507.7 [†] 7	14+	B		
1921 [†] 2	16+	B		
2372 [†] 2	18+	B		

[†] (A): Kπ=0+ g.s. band.

[‡] From the Eγ data relative to E=152 for the 4+ level.

[§] Member of the g.s. rotational band.

γ(²⁴⁸Fm)

E(level)	Eγ ^{†‡}	Mult.	α
46	(46 1)	[E2]	1050 120
152	(106 1)	[E2]	20.2 10
317.2	165.2 3	[E2]	2.88 5
538.6	221.4 4	[E2]	0.905 14
813.3	274.7 3	[E2]	0.419 6
1137.3	324.0 3	[E2]	0.246 4
1507.7	370.4 3	[E2]	0.165 3
1921	413 1	[E2]	0.122 2
2372	451 1	[E2]	0.0967 15

[†] For unplaced γ's see ²⁰²Hg(⁴⁸Ca,2nγ).

[‡] From ²⁰²Hg(⁴⁸Ca,2nγ). The 46 and 106 transitions are not observed in that reaction. The energies are from a fit to a rotational band formula. See the source dataset for details and for unplaced γ's. Eγ(2+ to 0+)=44 10 in α decay.

Adopted Levels, Gammas (continued)

(A) $K\pi=0+$ g.s. band.

^{252}No α Decay

Parent ^{252}No : $E=0.0$; $J\pi=0+$; $T_{1/2}=2.44$ s 4; $Q(\text{g.s.})=8548$ 6; $\% \alpha$ decay=67.8 19.

$^{252}\text{No}-\% \alpha$ decay: from $\% \text{SF}=31.5$ 12 and $(\epsilon+\beta^+)/a<0.016$ 5 (2002He01), one gets $\% \alpha=67.8$ 19 and $\% \epsilon+\beta^+=0.7$ 7. The value for $\% \text{SF}$ is a weighted average of 29.3 9 (2011Ga19) and 32.2 5 (2001Og08). Other $\% \text{SF}$: 1977Be09, 1993An10, and 2003Be18.

^{248}Fm Levels

E(level)	$J\pi$	$T_{1/2}$	Comments
0.0 [†]	0+	35.1 s 8	$T_{1/2}$: from 2011Ga19.
44 [†] 10	2+		E(level): from $\Delta Q(\alpha)$.

[†] (A): $K=0+$ g.s. band.

α radiations

$E\alpha^{\ddagger}$	E(level)	$I\alpha^{\ddagger\S}$	HF [#]
8372 8	44	≈ 25	≈ 2.2
8415 6	0.0	≈ 75	1.0

[†] For α intensity per 100 decays, multiply by 0.678 19.

[‡] Measurements by 1977Be09. Other measurement: 1967Gh01, 1967Mi03.

[§] Intensity per 100 α decays, measured by 1977Be09.

[#] $r_0=1.479$ 2 for ^{248}Fm is calculated from $\text{HF}(8415\alpha)=1$ with the uncertainty in $I\alpha$ set at 10.

$^{202}\text{Hg}(^{48}\text{Ca}, 2n\gamma)$ $^{2010}\text{KeZY}$

$E=211$ MeV.

^{248}Fm Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$
0.0	0+	32.3 s 15
46 1	2+	
152 2	4+	
317.2 3	6+	
538.6 4	8+	
813.3 5	10+	

Continued on next page (footnotes at end of table)

$^{202}\text{Hg}(^{48}\text{Ca}, 2n\gamma)$ $^{2010}\text{KeZY}$ (continued) **^{248}Fm Levels (continued)**

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}$	Comments
>1074?		10.1 ms 6	E(level): the 904 γ which follows decay of the 10.1-ms isomer, is in coincidence with electrons with energy up to =170 keV. J π : no definitive configuration assignment can be made. See 2010KeZY for a discussion of several possibilities.
1137.3 6	12+		
1507.7 7	14+		
1921 2	16+		
2372 2	18+		

† Relative to E(4+)=152.

‡ From the authors and based on a fit to a rotational band.

 $\gamma(^{248}\text{Fm})$

$E\gamma$	E(level)	$I\gamma^\#$	Mult.	α	$I\gamma^\ddagger$
46 † § 1	46		[E2]	1050 120	
106 † § 1	152		[E2]	20.2 10	
165.2 3	317.2	26 7	[E2]	2.88 5	
^x 181.1 4					11 4
221.4 4	538.6	45 8	[E2]	0.905 14	
274.7 3	813.3	30 7	[E2]	0.419 6	
324.0 3	1137.3	26 7	[E2]	0.246 4	
370.4 3	1507.7	26 7	[E2]	0.165 3	
^x 383 1					7 3
^x 396 1					8 3
413 1	1921	11 5	[E2]	0.122 2	
^x 423 1					7 3
451 1	2372	9 5	[E2]	0.0967 15	
^x 805 † § 1					
^x 904 † § 1					

† The transitions from the 2+ and 4+ levels are not seen. The energies of these transitions are deduced by the authors from the energy-J relationship $E(J)=a[1+bJ(J+1)]^{1/2}-a$ of Holmberg and Lipas.

‡ Values are peak intensities uncorrected for detector efficiency and are relative to $I(\gamma+\text{ce})(165\gamma)=100$ 25.

§ The 805 and 904 γ 's follow decay of the 10.1-ms isomer. The 904 γ is the stronger of the two and the author suggests that it decays directly from the isomer or from an intermediate state.

Relative photon intensity normalized to $I(\gamma+\text{ce})(165\gamma)=100$ 25.

^x γ ray not placed in level scheme.

Adopted Levels

$Q(\beta^-) = -3470$ SY; $S(n) = 6860$ SY; $S(p) = 1810$ SY; $Q(\alpha) = 8700$ SY 2012Wa38.

The systematics uncertainties are 330, 320, 270, and 160 keV for $Q(\beta^-)$, $S(n)$, $S(p)$, and $Q(\alpha)$, respectively.

 ^{248}Md Levels

Assignment: $^{241}\text{Am}(^{12}\text{C}, 5n)$, parent of ^{248}Fm (1973Es01).

Cross Reference (XREF) Flags

A ^{252}Lr α Decay

E(level)	XREF	$T_{1/2}$	Comments
0.0	A	7 s 3	$\% \varepsilon = 80$ 10; $\% \alpha = 20$ 10 (1973Es01). $\% \alpha$: other: 58 20 (2008Ne01). $T_{1/2}$: from 1973Es01. Other: 13 s +15-4 (2008Ne01). Probability of ε delayed fission was found by 1980Ga07 to be <0.05%.
45 24	A		

 ^{252}Lr α Decay 2001He35

Parent ^{252}Lr : $E=0$; $J\pi=?$; $T_{1/2}=0.36$ s +11-7; $Q(\text{g.s.})=9164$ 17; $\% \alpha$ decay=?

$^{252}\text{Lr}-Q(\alpha)$: from 2012Wa38.

The authors quote $HF=6.9$ and 15 for the 9018 and 8974 α 's, respectively, but no details are given. The $\% \alpha$ branch of the parent is not known, and except for ^{248}Fm , the radius parameters are not available in this mass region.

 ^{248}Md Levels

E(level)	$T_{1/2}$	Comments
0.0	7 s 3	$T_{1/2}$: from adopted levels.
45 24		$E(\text{level})$: from $\Delta Q(\alpha)$ with the assumption that the 9018 α feeds the g.s. The systematic component of $E\alpha$ is 10 keV, added quadratically by the authors and subtracted out here to get the uncertainty in $\Delta Q(\alpha)$.

 α radiations

$E\alpha$	E(level)	$I\alpha^\dagger$	Comments
8974 20	45	=25	$E\alpha$: other: 8990 (2008Ne01).
9018 20	0.0	=75	$E\alpha$: other: 9020 (2008Ne01).

† Relative α intensity per 100 α decays.

Adopted Levels

S(p)=2606 SY; Q(α)=9230 SY 2012Wa38.

The systematics uncertainties are 305 and 100 keV for S(n) and Q(α), respectively.

^{248}No has not been produced. From the bombardment of ^{204}Pb by a 236-MeV ^{48}Ca beam, 2003Be18 conclude that the half-life of ^{248}No must be <2 μs , the time needed for the evaporation residue to pass through the recoil separator.

 ^{248}No Levels

<u>E(level)</u>	<u>T_{1/2}</u>
0 . 0	<2 μs

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