^{252}Cf,^{248}Cm SF decay 1998Zh12,1995Zh39,1994Sm07

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 200,2 (2025)	22-Aug-2022

Parent: ^{252}Cf: E=0; $J^{\pi}=0^+$; $T_{1/2}$=2.645 y *8*; %SF decay=8.39 *16*

Parent: ^{248}Cm: E=0; $J^{\pi}=0^+$; $T_{1/2}=3.48\times10^5$ y *6*; %SF decay=3.092 *8*

The level scheme is that proposed by 1998Zh12. It is in essential agreement with, but considerably more extensive than, the studies of 1995Zh39 and 1994Sm07, who report only the gs (yrast) band up through the 16^+ level. 1998Ga12 add another level.

All studies involve the spontaneous fission of ^{252}Cf, except that of 1994Sm07 which is from the spontaneous fission of ^{148}Cm.

1998Zh12: experimental details are not given, but are presumably similar to those of 1995Zh39.

1998Ga12: γ's measured in Eurogam II array with 54 Compton-suppressed Ge detectors. Authors report two delayed γ's ($T_{1/2}$ > 1 μs).

1995Zh39: $\gamma\gamma$ and $\gamma\gamma\gamma$ coincidences were measured using an array of 20 Compton-suppressed Ge detectors in an early version of Gammasphere having 36 Ge detectors and one LEPS detector.

1994Sm07: study the γ rays produced in the spontaneous fission of ^{248}Cm. The Eurogam phase 1 array of Compton-suppressed Ge detectors was used. Measured level lifetimes by a modified DSAM technique (the Doppler profile method).

1974JaYY: Measured γ(t). See also 1974JaZN, by the same authors.

1973TaZG: Measured Eγ and γ(t).

1972Ho08: Measured Eγ.

1972ClZN: Measured Eγ. See also 1974ClZX, by the same authors.

1971Ch44: measured Eγ and γ(t). Also 1970ChYJ, 1970ChZH, 1970ChZM, and 1970Wi16 from the same authors.

1970Jo20: Measured Eγ and γ(t), but Z not unique.

^{154}Nd Levels

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	Comments
0.0[@]	0^+	25.9 s *2*	$T_{1/2}$: Adopted value; other: 40 s *10* (1974Bu09).
70.8[@] *1*	2^+	7.7 ns *20*	$T_{1/2}$: From 1974JaYY; other: > 2 ns (1970Wi16).
233.2[@] *1*	4^+		
481.8[@]	6^+		
810.0[@]	8^+		
1002.5[&]	(2^-)		
1128.2[&]	(4^-)		
1210.7[@]	10^+		
1297.97 *22*	(4^-)	3.0 μs *3*	E(level),J^{π},$T_{1/2}$: Adopted values. E(level): 1974ClZX in (^{252}Cf SF decay) report two isomeric decays, 162.6 *2* ($T_{1/2}$=1.300 μs 41) in ^{154}Nd that primarily decays to the 4^+ level and very little to the 6^+ level, and a 169.9 *2* ($T_{1/2}$=1.003 μs 37) assigned to mass 154. Similarly, 1970Jo20 also in (^{252}Cf SF decay) report two isomeric decays, 162.5 ($T_{1/2}$=2.1 μs) and 169.9 ($T_{1/2}$=1.7 μs) both in mass 154. In (n,Fγ) a 169.8 *3* γ ray was identified at this (4^-) isomer, but no 162 γ ray. Overall, despite the missing evidence, the evaluator would tentatively place the 162 transitions also to this isomer.
1325.7[&]	(6^-)		
1349	(5^-)	>1 μs	E(level): Level reported by 1998Ga12 only. J^{π},$T_{1/2}$: From 1998Ga12.
1594.2[&]	(8^-)		
1677.2[@]	12^+	1.9 ps	
1932.5[&]	(10^-)		
2202.3[@]	14^+	1.0 ps	
2338.3[&]	(12^-)		
2778.9[@]	16^+	0.69 ps	

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^{252}Cf,^{248}Cm SF decay 1998Zh12,1995Zh39,1994Sm07 (continued)

^{154}Nd Levels (continued)

E(level)[†]	Jπ[‡]
2808.3[&]	(14⁻)
3339.0[&]	(16⁻)
3399.3?[@]	(18⁺)

† Unless otherwise noted, the values are from a least-squares fit to the listed γ energies. Where no uncertainty is given, the calculational procedure assumes an uncertainty of 1 keV for the Eγ value.
‡ From ^{154}Nd Adopted Levels.
# Unless noted otherwise, the values are from 1994Sm07.
@ Band(A): $K^{\pi}=0^{+}$ yrast band.
& Band(B): Side band. Probable octupole vibration. Configuration assignment is that suggested by 1998Zh12 and mentioned by 1999HaZV, from the same group as 1998Zh12.

γ(^{154}Nd)

Eγ[†]	Iγ[‡]	Ei(level)	Jiπ	Ef	Jfπ	Mult.	α[#]	Comments
70.8 *1*		70.8	2⁺	0.0	0⁺	[E2]	7.79	α(K)=2.96 *5*; α(L)=3.76 *6*; α(M)=0.861 *14* α(N)=0.186 *3*; α(O)=0.0235 *4*; α(P)=0.0001258 *18* Eγ: From 1988Ka16, ^{154}Pr β⁻ decay; values from SF: 70.7 (1994Sm07), 72.8 (1995Zh39), and 71.1 (1998Zh12).
125.8		1128.2	(4⁻)	1002.5	(2⁻)			
162.4 *1*	100	233.2	4⁺	70.8	2⁺	[E2]	0.398	α(K)=0.279 *4*; α(L)=0.0931 *14*; α(M)=0.0209 *3* α(N)=0.00454 *7*; α(O)=0.000607 *9*; α(P)=1.353×10⁻⁵ *19* Eγ: From 1988Ka16, ^{154}Pr β⁻ decay; values from SF: 162.4 (1994Sm07), 162.1 (1995Zh39), and 162.8 (1998Zh12).
197.5	12	1325.7	(6⁻)	1128.2	(4⁻)			
248.6	80	481.8	6⁺	233.2	4⁺	[E2]	0.0954	α(K)=0.0736 *11*; α(L)=0.01713 *24*; α(M)=0.00378 *6* α(N)=0.000828 *12*; α(O)=0.0001146 *16*; α(P)=3.91×10⁻⁶ *6* Eγ: Others: 247.7 (1995Zh39); 248.5 (1994Sm07).
268.5	12	1594.2	(8⁻)	1325.7	(6⁻)			
328.2	52	810.0	8⁺	481.8	6⁺	[E2]	0.0397	α(K)=0.0317 *5*; α(L)=0.00624 *9*; α(M)=0.001362 *19* α(N)=0.000300 *5*; α(O)=4.25×10⁻⁵ *6*; α(P)=1.767×10⁻⁶ *25* Eγ: Others: 327.9 (1995Zh39); 328.2 (1994Sm07).
338.3	10	1932.5	(10⁻)	1594.2	(8⁻)			
400.7	26	1210.7	10⁺	810.0	8⁺	[E2]	0.0219	α(K)=0.01782 *25*; α(L)=0.00318 *5*; α(M)=0.000690 *10* α(N)=0.0001524 *22*; α(O)=2.19×10⁻⁵ *3*; α(P)=1.020×10⁻⁶ *15* Eγ: Others: 400.6 (1995Zh39); 400.8 (1994Sm07).
405.8	5.5	2338.3	(12⁻)	1932.5	(10⁻)			
466.5	13	1677.2	12⁺	1210.7	10⁺	[E2]	0.01422	α(K)=0.01172 *17*; α(L)=0.00197 *3*; α(M)=0.000424 *6* α(N)=9.40×10⁻⁵ *14*; α(O)=1.365×10⁻⁵ *20*; α(P)=6.83×10⁻⁷ *10* Eγ: Others: 466.1 (1995Zh39); 466.6 (1994Sm07).
470.0	3.2	2808.3	(14⁻)	2338.3	(12⁻)			
525.1	5.6	2202.3	14⁺	1677.2	12⁺	[E2]	0.01033	α(K)=0.00858 *12*; α(L)=0.001379 *20*; α(M)=0.000297 *5* α(N)=6.58×10⁻⁵ *10*; α(O)=9.62×10⁻⁶ *14*;

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^{252}Cf,^{248}Cm SF decay 1998Zh12,1995Zh39,1994Sm07 (continued)

$\gamma(^{154}Nd)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α [#]	Comments
								α(P)=5.05×10^{-7} *7* E_γ: Others: 524.7 (1995Zh39); 525.3 (1994Sm07).
530.7	1.2	3339.0	(16$^-$)	2808.3	(14$^-$)			
576.6	1.7	2778.9	16$^+$	2202.3	14$^+$	[E2]	0.00809	α(K)=0.00676 *10*; α(L)=0.001054 *15*; α(M)=0.000226 *4* α(N)=5.02×10^{-5} *7*; α(O)=7.38×10^{-6} *11*; α(P)=4.00×10^{-7} *6* E_γ: Others: 576.4 (1995Zh39); 576.9 (1994Sm07).
620.4[@]		3399.3?	(18$^+$)	2778.9	16$^+$			
784.8[@]		1594.2	(8$^-$)	810.0	8$^+$			
843.8	6.8	1325.7	(6$^-$)	481.8	6$^+$			
870		1349	(5$^-$)	481.8	6$^+$			E_γ: From 1998Ga12. I_γ: See 1113 γ.
895.0	13	1128.2	(4$^-$)	233.2	4$^+$			
931.8		1002.5	(2$^-$)	70.8	2$^+$			
1113		1349	(5$^-$)	233.2	4$^+$			E_γ: From 1998Ga12; energy fit is poor. I_γ: Iγ(870)/Iγ(1113) ≈ 7 (1998Ga12).

† From 1998Zh12, unless noted otherwise. These values, with one exception, lie between those reported by 1995Zh39 and 1994Sm07. No uncertainties are given for the Eγ values in these spontaneous fission studies, but some have been included from ^{154}Pr β^- decay (1988Ka16).

‡ Values are from 1998Zh12.

Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with "Frozen Orbitals" approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Placement of transition in the level scheme is uncertain.

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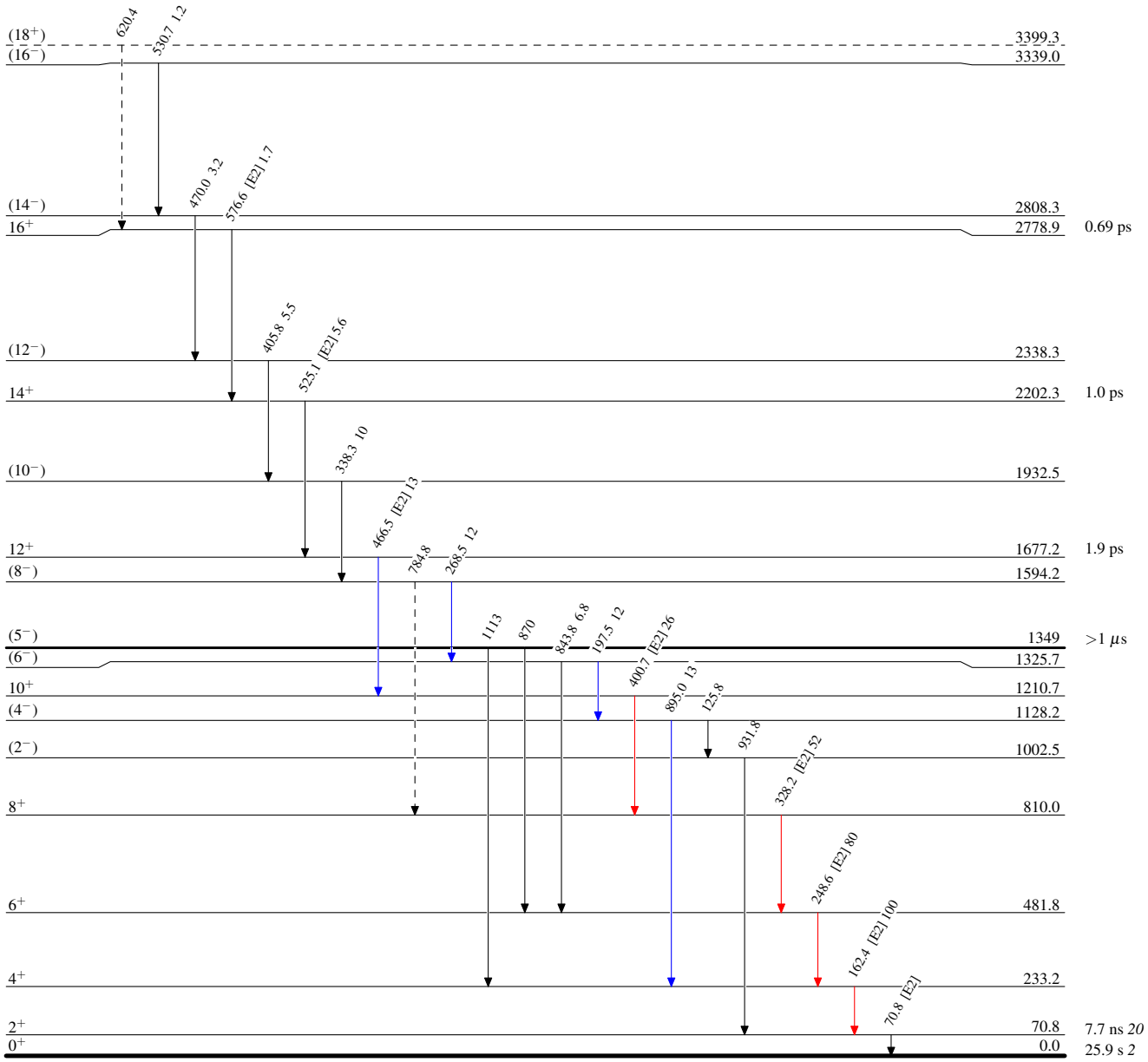
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)

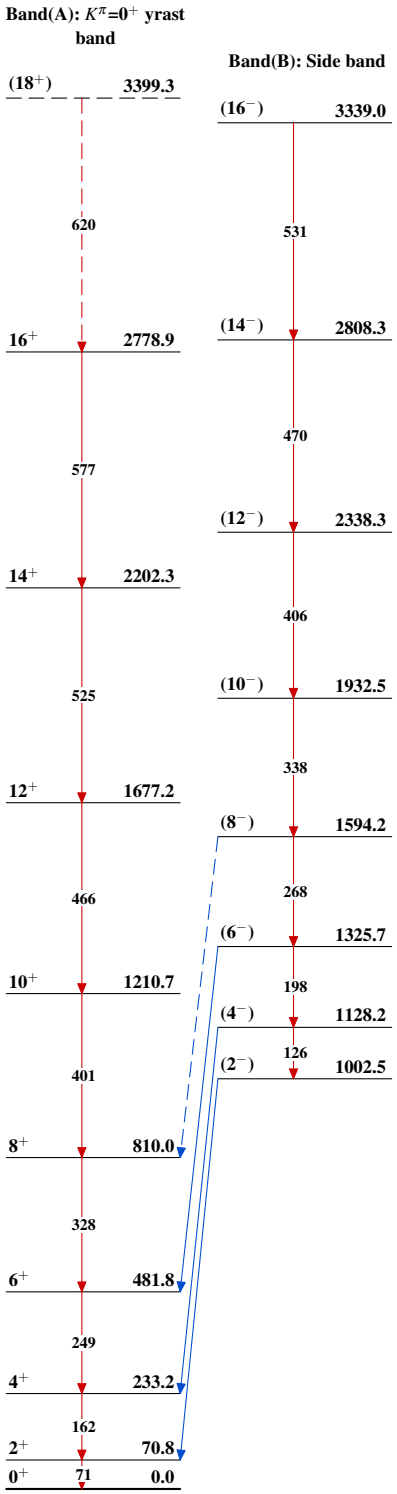
Level Scheme

Intensities: Relative I_γ



$^{154}_{60}Nd_{94}$

^{252}Cf,^{248}Cm SF decay 1998Zh12,1995Zh39,1994Sm07



$^{154}_{60}Nd_{94}$