²⁵²Cf SF decay 2009Si21,1995Zh15

History					
Туре	Author	Citation	Literature Cutoff Date		
Full Evaluation	C. W. Reich	NDS 113, 2537 (2012)	1-Mar-2012		

Parent: ²⁵²Cf: E=0; $J^{\pi}=0^+$; $T_{1/2}=2.645$ y 8; %SF decay=3.092 8 Additional information 1.

The data are primarily from the study by 2009Si21, with additional information from 1995Zh15, 1997Do20, 1997Ha64, and 1998Ga12. The middle two of these listed papers have many authors in common. In all of these studies, ¹⁵⁶Sm is only one of a number of nuclides that were investigated.

- 2009Si21: ¹⁵⁶Sm produced as a product of the SF of ²⁵²Cf. Fission fragments were detected using the Gammasphere array of anti-Compton spectrometers at Argonne National Laboratory. Measured E γ , I γ , T_{1/2}, $\gamma\gamma$ coin in various combinations of prompt and delayed γ 's. Report members of the g.s. band up through the 16⁺ member and a rotational band up through the (15⁻) member built on the (5⁻) isomeric level. Comparison with the results of quasiparticle-rotor model calculations.
- 1995Zh15: $\gamma\gamma$ and $\gamma\gamma\gamma$ coincidences measured using an array of 20 Compton-suppressed Ge detectors and the early implementation of Gammasphere, consisting of 36 Ge detectors. XXG and X γ coincidences measured using two x-ray detectors, FWHM=280 eV at 14 keV, and three Ge detectors. Report E γ , I γ , ¹⁵⁶Sm g.s. band up to 14⁺ level, two 5⁻ levels and one 6⁻ level.

1997Do20: measured $\gamma\gamma\gamma$ coincidences using 72 large-volume Compton-suppressed Ge detectors in the Gammasphere array. XXG, X γ and $\gamma\gamma$ coincidences measured using two high-resolution LEPS detectors and two large-volume Compton-suppressed Ge detectors. Report E γ and the g.s. band up through the 14⁺ member.

1997Ha64: experimental methods largely similar to those of 1995Zh15. report E γ and g.s. band up through the 14⁺ member.

1998Ga12: fission fragments were detected in the SAPhIR detector, consisting of 48 photovoltaic cells, each having an active area of 3 cm² and a thickness of 500 microns. γ 's detected using the EUROGAM II array, composed of 54 Compton-suppressed Ge detectors: 30 coaxial detectors at forward and backward angles; and 24 "clover" detectors around 90°. Prompt and delayed γ 's (0 to 1 μ s) following fission were detected using the Ge detectors of EUROGAM II. Measured fragment-fragment- γ and fragment-fragment- $\gamma\gamma\gamma$ coincidences. Report one isomeric level with two deexciting γ 's and the g.s. band up through the 12⁺ member, together with nuclear-model calculations of the spectrum of the low-lying two-quasiparticle states.

1974CIZX: γ 's and x's measured in coincidence with fission fragments with Ge and Si detectors. Delay of the γ 's was measured. Report one γ and one half-life.

Some earlier studies (prior to 1974): 1970ChZH; 1970Jo20; 1970Wi16; 1972Ho08. For a brief description of the experimental details, see the ENSDF file.

¹⁵⁶Sm Levels

E(level) [†]	J ^π ‡	T _{1/2}	Comments
0#	0^{+}		
75.7 <mark>#</mark> 2	2^{+}	>2 ns	T _{1/2} : From 1970ChZH, $\gamma\gamma(t)$, involving Doppler-shift considerations.
249.9 [#] 3	4+		
517.3 [#] 4	6+		
871.8 [#] 4	8+		
1307.6 [#] 5	10^{+}		
1397.6 [@] 4	5-	186 ns 44	$T_{1/2}$: From 2009Si21. (Note that, in their comparison of experimental and theoretical γ -ray branching ratios within the 5 ⁻ band (their Table IV), 2009Si21 list $T_{1/2}$ =210 ns.) This is probably a misprint. For the results from other studies, see the adopted values. 1974CIZX report the existence of an isomer in ¹⁵⁶ Sm with $T_{1/2}$ =160 ns 40, but do not associate it with a specific level. This 1397 level is probably the same as the isomer observed by 1974CIZX.
1511.2 ^{&} 4	(6 ⁻)		
1515.4 ^{<i>a</i>} 4	5-	4.5 ns 2	$T_{1/2}$: From β^- decay. The SF studies do not report a value of $T_{1/2}$ for this isomeric state.
$1643.8^{\circ} 4$ 1753.2 ^a 5	(7^{-})		
1794.4 ^{&} 4	(7)		

Continued on next page (footnotes at end of table)

²⁵²Cf SF decay 2009Si21,1995Zh15 (continued)

¹⁵⁶Sm Levels (continued)

E(level) [†]	J ^{π‡}	E(level) [†]	Jπ‡	E(level) [†]	Jπ‡
1818.9 [#] 5	12+	2355.0 [@] 4	(11-)	2815.0 [@] 5	(13-)
1963.5 [@] 4	(9 ⁻)	2400.3 [#] 6	14^{+}	3044? [#]	(16 ⁺)
2150.6 ^{&} 4	(10 ⁻)	2577.0 ^{&} 5	(12 ⁻)	3069.6 ^{&} 5	(14 ⁻)
				3335? [@]	(15 ⁻)

[†] From a least-squares fit by the evaluator to the listed $E\gamma$ values.

^{\ddagger} From the adopted values. (For the levels observed only in these studies, the values are from this source data set and are based on the decay properties of the levels together with the usual considerations of rotational-band properties in strongly deformed nuclei).

Band(A): $K^{\pi}=0^+$, g.s. band.

^(a) Band(B): $K^{\pi}=5^{-}$ band, $\alpha=1$ branch. Probable conf is v5/2[642]+v5/2[523]. 1998Ga12, from model considerations, propose this as the two-proton-quasiparticle state with conf= $\pi5/2[532]+\pi5/2[413]$.

& Band(b): $K^{\pi}=5^{-}$ band, $\alpha=0$ branch. See the comment on the $\alpha=1$ branch.

^{*a*} Band(C): $K^{\pi}=5^{-}$ band. Probable conf is $\pi 5/2[532]+\pi 5/2[413]$.

E _i (level)	\mathbf{J}_i^{π}	E_{γ}^{\dagger}	I_{γ}	\mathbf{E}_{f}	\mathbf{J}_{f}^{π}	Mult.
75.7	2+	75.7 2		0	0^{+}	
249.9	4+	174.2 2		75.7	2+	
517.3	6+	267.4 2		249.9	4+	
871.8	8+	354.5 2		517.3	6+	
1307.6	10^{+}	435.8 2		871.8	8+	
1397.6	5-	880.4 2	100 [#] 15	517.3	6+	E1
		1147.7 2	160 [#] 20	249.9	4+	E1
1511.2	(6 ⁻)	113.6 2		1397.6	5-	
1515.4	5-	$117.8^{\textcircled{0}}{2}$		1397.6	5^{-}	
1643.8	(7^{-})	132.6 2	230 40	1511.2	(6 ⁻)	
		246.1 2	100	1397.6	5-	
1753.2	(7^{-})	237.8 [@] 2		1515.4	5-	
1794.4	(8-)	150.1 2	90 14	1643.8	(7^{-})	
		283.4 2	100	1511.2	(6 ⁻)	
1818.9	12^{+}	511.3 2		1307.6	10^{+}	
1963.5	(9 ⁻)	168.9 2	120 18	1794.4	(8 ⁻)	
		320.0 2	100	1643.8	(7^{-})	
2150.6	(10^{-})	187.2 2	50 11	1963.5	(9 ⁻)	
		356.1 2	100	1794.4	(8 ⁻)	
2355.0	(11^{-})	204.4 2	80 16	2150.6	(10^{-})	
		391.6 2	100	1963.5	(9 ⁻)	
2400.3	14^{+}	581.4 2		1818.9	12^{+}	
2577.0	(12^{-})	222.2 2	35 12	2355.0	(11^{-})	
		426.2 2	100	2150.6	(10^{-})	
2815.0	(13 ⁻)	460.0 2		2355.0	(11^{-})	
3044?	(16^{+})	644 [@]		2400.3	14^{+}	
3069.6	(14-)	492.6 2		2577.0	(12 ⁻)	
3335?	(15^{-})	520 [@]		2815.0	(13^{-})	

$\gamma(^{156}\text{Sm})$

[†] From 2009Si21, unless noted otherwise.

²⁵²Cf SF decay 2009Si21,1995Zh15 (continued)

 $\gamma(^{156}\text{Sm})$ (continued)

[±] Unless noted otherwise, from 2009Si21. [#] 1995Zh15 report I $\gamma(880)/I\gamma(1147)=41/27$. 1990He11, from ¹⁵⁶Pm β^- decay, report I $\gamma(880)/I\gamma(1148)=0.507$ 25. 1998Ga12 report that I $\gamma(880)/I\gamma(1148)=0.87$.

^(a) Placement of transition in the level scheme is uncertain.





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¹⁵⁶₆₂Sm₉₄