^{248}Cm SF decay 2013Rz01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	N. Nica and B. Singh	NDS 181, 1 (2022)	9-Mar-2022

Parent: ^{248}Cm: E=0.0; $J^\pi=0^+$; $T_{1/2}=3.48\times10^5$ y *6*; %SF decay=?

Data set based on XUNDL file compiled by B. Singh (McMaster).

2013Rz01: measured Eγ, Iγ, γγ, γγ(θ) for prompt γ rays using EUROGAM2 array of anti-Compton Clover Ge detectors and four LEPS detectors. Deduced levels, bands, J^π.

1996Jo14: measured γγγ, Eγ, Iγ, DCO ratios, linear polarization with EUROGAM2 (anti-Compton shielded Ge detectors and four LEPS detectors). γ-rays assigned by x-ray coincidence and coincidence with gammas from Zr isotopes.

According to 2013Rz01, 1996Jo14 and 2013Rz01 share the same experimental data with improved analysis method for 2013Rz01.

^{147}Ba Levels

E(level)[†]	J^π	Comments
0.0	(5/2⁻)	J^π: assigned by 2013Rz01 from (13/2⁺) for 451 level based on systematics (see discussion at level), decayed by the 90.7 E2 γ to (9/2⁺) 360 level, then by the 250.5γ-109.7γ cascade of stretched dipoles to the g.s., hence J=(5/2) for the g.s. ^{147}Ba. The absence of a 360γ from the 360 level to the g.s. allows 2013Rz01 to state that the g.s. and 360 levels are of opposite parities, whence the tentative assignment of the g.s. $J^\pi=(5/2^-)$. This rules out previous assignments of (3/2⁻) (in 2009Ni02 evaluation based on shell correction approach with axially-deformed Woods-Saxon potential and 3/2⁻ for ^{149}Ce g.s. parent in β^- decay (2005Sy01)), and (3/2⁺) (based on 3/2[651] (1995Zh34)). No evidence of static octupole deformation in g.s. (2013Rz01) since no parity doublets were found in the low-energy region.
46.13[a] *8*	(3/2,(5/2))	J^π: based on observed branching; 3/2 is preferred since this band is weakly populated in fission, suggesting its non-yrast character. Based on calculated alignment (2.6 ħ) this level and the upper band levels resemble the 3/2⁻ g.s. band in ^{149}Ce.
85.27[‡] *7*	(5/2⁻)	J^π: E2, 153.4γ from (9/2⁻), 239 level.
109.70 *7*	(7/2⁻)	J^π: ΔJ=1, M1+E2 transition to (7/2⁻), g.s.
185.59[a] *8*	(7/2)	J^π: ΔJ=1, D 174.6γ from (9/2⁺), 360 level.
238.63[‡] *11*	(9/2⁻)	J^π: (9/2) from unstretched ΔJ=0, D 121.4γ from (9/2⁺), 360 level; negative parity from (E2) 238.6γ to (5/2⁻) g.s.
279.32[#] *11*	(9/2⁻)	J^π: ΔJ=1, M1+E2 169.6γ to (7/2⁻), 110 level.
360.17[&] *9*	(9/2⁺)	J^π: E2 90.7γ from (13/2⁺), 451 level.
427.2?[a] *3*		
450.87[&] *14*	(13/2⁺)	J^π: calculated alignment of 5.4° relative to g.s. of ^{146}Ba (consistent with configuration originating from $i_{13/2}$ neutron orbital); this alignment is nealy identical with the alignment in the 3/2⁺[651] band in ^{149}Ce and supports (13/2⁺) adopted here.
473.72 *23*	(11/2)	J^π: postulated by 2013Rz01 (based probably on band-like cascade).
547.33[‡] *15*	(13/2⁻)	J^π: E2, 308.7γ to (9/2⁻), 239 level.
573.02[@] *15*	(11/2)	J^π: ΔJ=1, D 293.7γ to (9/2⁻), 279 level.
670.32[#] *23*	(13/2⁻)[b]	
690.77[&] *17*	(17/2⁺)	J^π: E2, 239.9γ to (13/2⁺), 451 level.
782.3 *4*	(15/2)[b]	J^π: postulated by 2013Rz01 (based probably on band-like cascade).
843.02[@] *18*	(15/2)[b]	
971.53[‡] *18*	(17/2⁻)	J^π: E2, 424.2γ to (13/2⁻), 547 level.
1067.38[&] *20*	(21/2⁺)	J^π: E2, 376.6γ to (17/2⁺), 691 level.
1133.3[#] *4*	(17/2⁻)[b]	
1226.6[@] *3*	(19/2)[b]	
1476.3[‡] *3*	(21/2⁻)[b]	
1557.9[&] *3*	(25/2⁺)[b]	

Continued on next page (footnotes at end of table)

^{248}Cm SF decay 2013Rz01 (continued)

^{147}Ba Levels (continued)

E(level)[†]	Jπ
1695.0[@] *4*	(23/2)[b]
2008.0[‡] *4*	(25/2⁻)[b]
2141.7[&] *4*	(29/2⁺)[b]
2192.3[@] *5*	(27/2)[b]
2496.1[‡] *5*	(29/2⁻)[b]
2794.5[&] *5*	(33/2⁺)[b]

[†] From least-squares fit to Eγ data.
[‡] Band(A): K^π=5/2⁻ band based on 85, (5/2⁻) ν5/2⁻[523] configuration. In analogy with g.s. band in ^{145}Ba (based on alignment of 2.8° and ħω ≈ 270 keV). Same configuration also observed in N=91 isotones of Sm, Gd, Dy, and Er.
[#] Band(B): Band based on 279, (9/2⁻).
[@] Band(C): Octupole vibration band. Based on 573, (11/2) 3⁻ octupole vibration coupled to low lying (5/2⁻) (either g.s. or 85 level).
[&] Band(D): K^π=3/2⁺ band based on 360, (9/2⁺) ν3/2⁺[651] configuration. In analogy with yrast bands in ^{145}Ba and ^{149}Ce.
[a] Band(E): K^π=(3/2⁻) band based on 46 level. Similar g.s. band in ^{149}Ce.
[b] Based on assignment to fast ΔJ=2, E2 band.

γ(^{147}Ba)

Eγ	Iγ	Ei(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
24.4[‡] *1*		109.70	(7/2⁻)	85.27	(5/2⁻)		
39.2[‡] *1*		85.27	(5/2⁻)	46.13	(3/2,(5/2))		
46.2[‡] *1*		46.13	(3/2,(5/2))	0.0	(5/2⁻)		
53.0 *3*	8 *3*	238.63	(9/2⁻)	185.59	(7/2)		
75.8 *2*	7 *2*	185.59	(7/2)	109.70	(7/2⁻)		
80.8 *2*	3 *1*	360.17	(9/2⁺)	279.32	(9/2⁻)	E1	Mult.: from intensity balance considerations of 90.7 –> 80.8 cascade, where 90.7γ is assumed E2 from its stretched quadrupole character.
85.2 *1*	6 *2*	85.27	(5/2⁻)	0.0	(5/2⁻)		
90.7 *1*	25 *2*	450.87	(13/2⁺)	360.17	(9/2⁺)	E2	Mult.: Q,E2 based on angular correlation and α(K)exp; α(K)exp=2.4 *4* (2013Rz01). (90.7γ)(250.6γ)(θ) consistent with quadrupole-dipole cascade. 1996Jo14 found M1+E2 based on α(exp) and α(K)exp but values are not incompatible with E2.
100.4 *2*	2 *1*	185.59	(7/2)	85.27	(5/2⁻)		
109.7 *1*	100 *4*	109.70	(7/2⁻)	0.0	(5/2⁻)	M1+E2	α(K)exp=1.1 *2* (2013Rz01) Mult.: ΔJ=1, M1+E2 transition based on α(K)exp.
121.4 *2*	7 *1*	360.17	(9/2⁺)	238.63	(9/2⁻)	D	Mult.: unstretched ΔJ=0, D transition. (239.9γ)[90.7γ](121.4γ)(θ) consistent with quadrupole-unstretched (ΔJ=0) dipole for 239 –> 121 cascade with intermediate 90.7γ.
128.8 *2*	13 *2*	238.63	(9/2⁻)	109.70	(7/2⁻)	D	
139.6 *3*	3 *1*	185.59	(7/2)	46.13	(3/2,(5/2))		
153.4 *2*	10 *3*	238.63	(9/2⁻)	85.27	(5/2⁻)	E2	Mult.: Q,E2 from angular correlation. (308.7γ)(153.4γ)(θ) consistent with quadrupole-quadrupole cascade.
169.6 *1*	21 *2*	279.32	(9/2⁻)	109.70	(7/2⁻)	M1+E2	Mult.: D+Q transition, adopted as M1+E2.

Continued on next page (footnotes at end of table)

^{248}Cm SF decay 2013Rz01 (continued)

$\gamma(^{147}Ba)$ (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
							(169.6γ)(109.7γ)(θ) consistent with dipole-D+Q cascade.
174.6 *1*	20 *2*	360.17	(9/2$^+$)	185.59	(7/2)	D	(239.9γ)[90.7γ](174.6γ)(θ) consistent with quadrupole-dipole for 239 –> 174 cascade with intermediate 90.7γ.
185.6 *1*	40 *3*	185.59	(7/2)	0.0	(5/2$^-$)		
194.4 *2*	5 *1*	473.72	(11/2)	279.32	(9/2$^-$)		
238.6 *2*	26 *4*	238.63	(9/2$^-$)	0.0	(5/2$^-$)	(E2)	Mult.: consistent with stretched Q transition from angular correlation of 121.4-239.9-keV cascade, (E2) from being a prompt decay (2013Rz01).
239.9 *1*	53 *3*	690.77	(17/2$^+$)	450.87	(13/2$^+$)	E2	(239.9γ)(90.7γ)(θ) consistent with quadrupole-quadrupole cascade. (239.9γ)[90.7γ](250.6γ)(θ) consistent with quadrupole-dipole for 239 –> 250 cascade with intermediate 90.7γ.
241.6 *3*	2 *1*	427.2?		185.59	(7/2)		
250.5 *1*	61 *4*	360.17	(9/2$^+$)	109.70	(7/2$^-$)	D	(250.5γ)(109.7γ)(θ) consistent with dipole-dipole cascade. This result excludes 3/2 for g.s.
270.0 *1*	8 *1*	843.02	(15/2)	573.02	(11/2)		
293.7 *1*	9 *1*	573.02	(11/2)	279.32	(9/2$^-$)	D	(293.7γ)(169.6γ)(θ) consistent with dipole-dipole cascade.
308.6 *3*	2 *1*	782.3	(15/2)	473.72	(11/2)		
308.7 *1*	40 *5*	547.33	(13/2$^-$)	238.63	(9/2$^-$)	E2	(308.7γ)(153.4γ)(θ) consistent with quadrupole-quadrupole cascade. (308.7γ)(128.8γ)(θ) consistent with quadrupole-dipole cascade. (308.7γ)(238.6γ)(θ) consistent with quadrupole-quadrupole cascade.
360[#]	<0.4	360.17	(9/2$^+$)	0.0	(5/2$^-$)		E_γ: transition is definitely not observed in 2013Rz01, only an upper limit of 0.7% of I(251γ) is given (adopted here).
376.6 *1*	34 *3*	1067.38	(21/2$^+$)	690.77	(17/2$^+$)	E2	(376.6γ)(239.9γ)(θ) consistent with quadrupole-quadrupole cascade.
383.6 *2*	4 *1*	1226.6	(19/2)	843.02	(15/2)		
391.0 *2*	5 *2*	670.32	(13/2$^-$)	279.32	(9/2$^-$)		
424.2 *1*	20 *3*	971.53	(17/2$^-$)	547.33	(13/2$^-$)	E2	(424.2γ)(308.7γ)(θ) consistent with quadrupole-quadrupole cascade.
463.0 *3*	2 *1*	1133.3	(17/2$^-$)	670.32	(13/2$^-$)		
468.4 *2*	3 *1*	1695.0	(23/2)	1226.6	(19/2)		
488.1 *3*	3 *1*	2496.1	(29/2$^-$)	2008.0	(25/2$^-$)		
490.5 *2*	14 *2*	1557.9	(25/2$^+$)	1067.38	(21/2$^+$)		
497.3 *3*	1.3 *5*	2192.3	(27/2)	1695.0	(23/2)		
504.8 *2*	13 *2*	1476.3	(21/2$^-$)	971.53	(17/2$^-$)		
531.7 *3*	9 *2*	2008.0	(25/2$^-$)	1476.3	(21/2$^-$)		
583.8 *3*	8 *2*	2141.7	(29/2$^+$)	1557.9	(25/2$^+$)		
652.8 *3*	0.8 *3*	2794.5	(33/2$^+$)	2141.7	(29/2$^+$)		

[†] From $\gamma\gamma(\theta)$ data in 2013Rz01. Mult=Q and D indicate stretched quadrupole and dipole, respectively, unless otherwise stated. Based on the heavy-ion reaction type, E2 was adopted for the quadrupole type.

[‡] 2013Rz01 take value from 2005Sy01 (β^- decay dataset).

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

^{248}Cm SF decay 2013Rz01

Level Scheme

Intensities: Relative I_γ

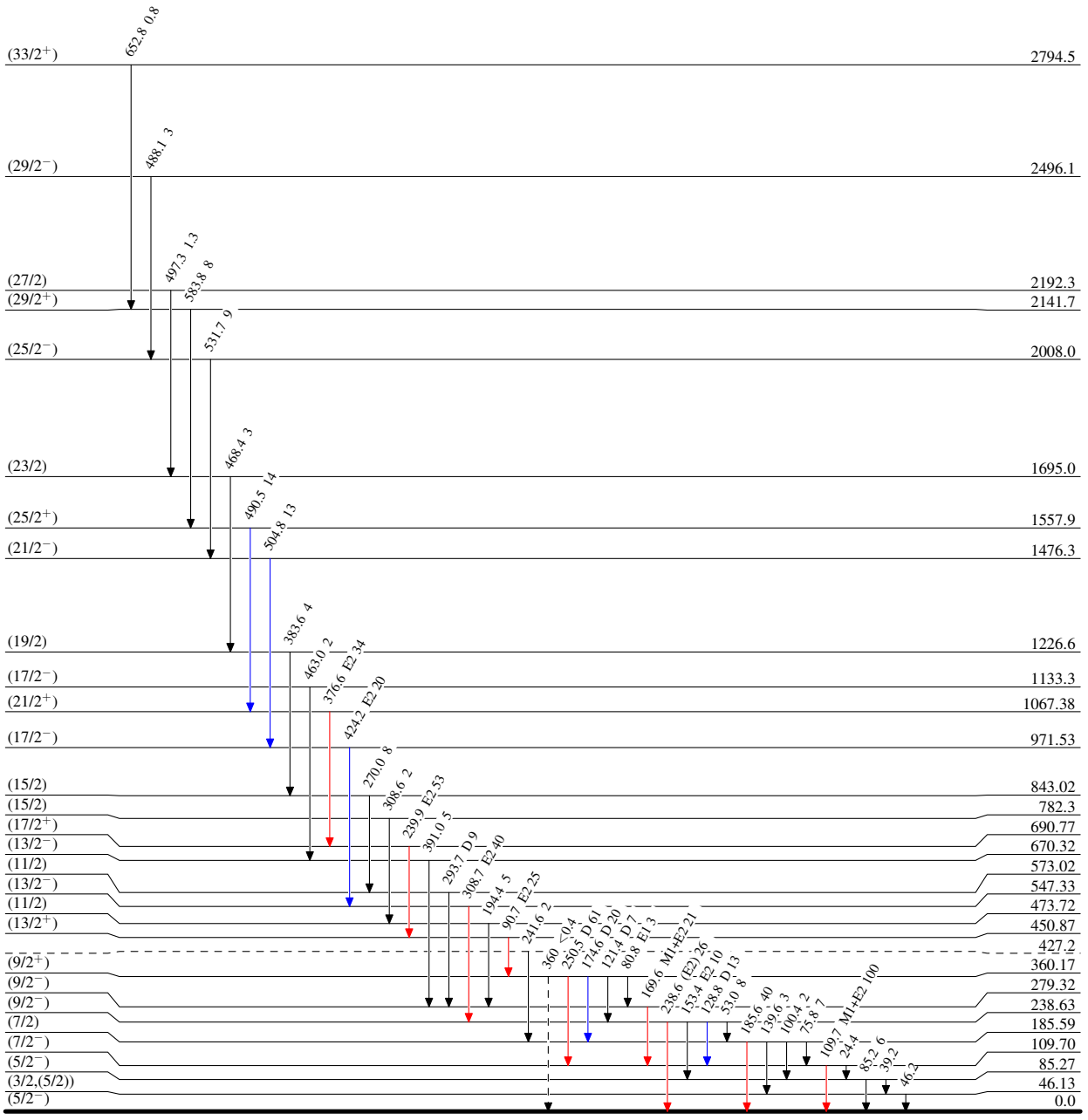
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

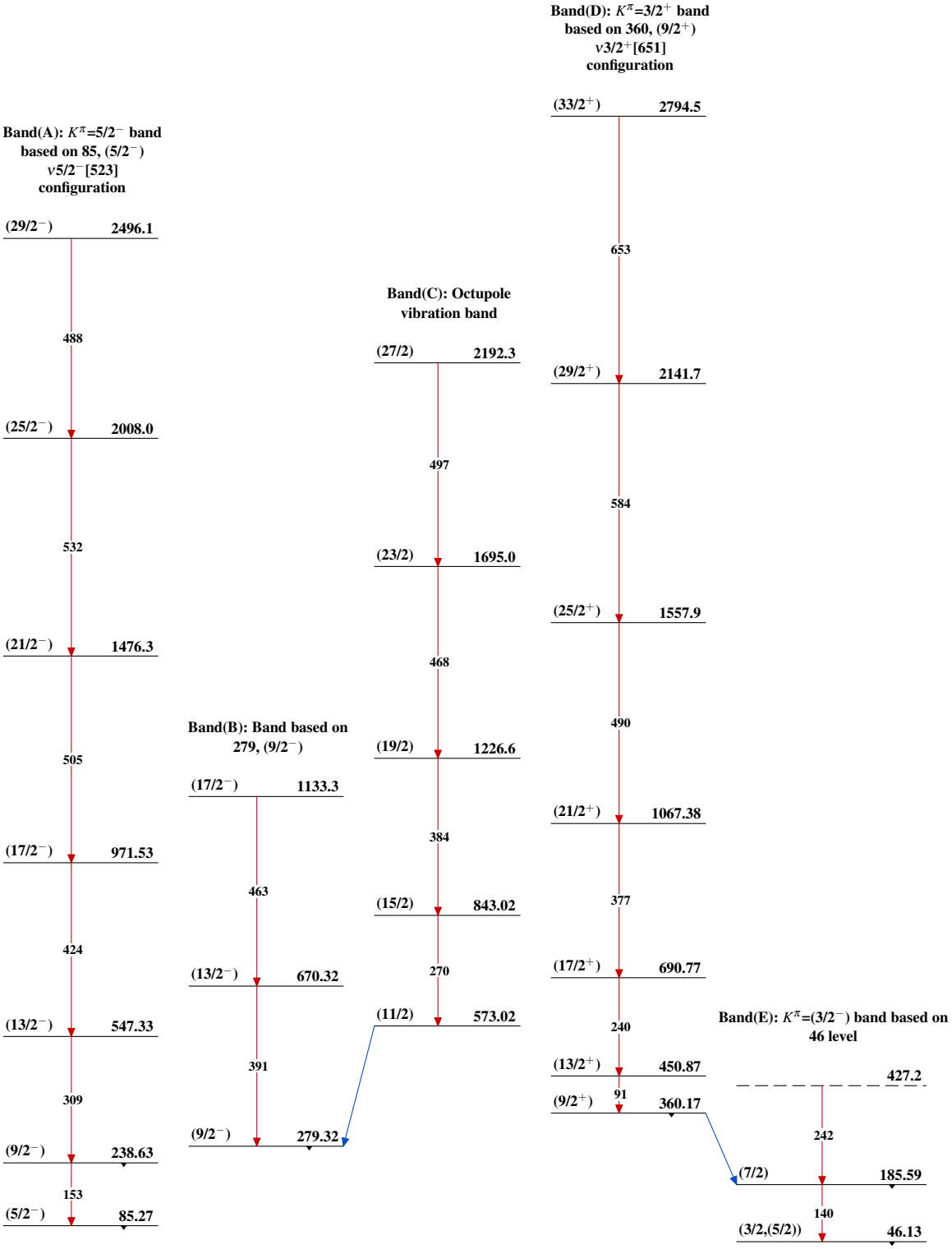
$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{147}_{56}Ba_{91}$

^{248}Cm SF decay 2013Rz01



$^{147}_{56}Ba_{91}$