Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	31-Dec-2016

Q(β^-)=8038 *4*; S(n)=3740 *3*; S(p)=10546 *4*; Q(α)=−4089 *4* 2012Wa38
S(2n)=6910 *4*, S(2p)=26800 *200* (syst), Q(β^-n)=4775 *4* (2012Wa38).
Additional information 1.

^{135}Sb Levels

Cross Reference (XREF) Flags

A ^{135}Sn β^- decay (515 ms)
B ^{136}Sn β^-n decay (327 ms)
C ^{248}Cm SF decay

E(level)†	J$^\pi$	T$_{1/2}$	XREF	Comments
0.0&	(7/2$^+$)‡@	1.679 s *15*	ABC	%β^-=100; %β^-n=22 *3* (2002Sh08) T$_{1/2}$: weighted average of 1.696 s *21* (1968To19,1968To18), 1.706 s *14* (1977Ru04), 1.662 s *10* (1993Ru01). Others: 1.82 s *4* (1976Lu02 superseded by 1993Ru01), 2.0 s *2* (1966To02, superseded by 1968To19), 1964Be06, 1967De01, 1973Bo42, 1978Cr03. %β^-n is adopted from 2002Sh08 (same value in 2002Pf04 evaluation) based on the least-squares fit of their β-delayed neutron curves. Use of %β^-n=17.6 *22* recommended by 1993Ru01 (from weighted average of 21.0 *11* (1993Ru01), 14 *1* (1978Cr03), 22 *4* (revision by 1993Ru01 of 19.9 *21* in 1977Ru04), 25 *4* (revision by 1993Ru01 of 8 in 1968To19)) gave a very poor fit (by a factor of 10 or so) to the decay curve obtained by 2002Sh08 (according to an e-mail reply of April 30, 2002 by the lead author of 2002Sh08). If one excludes the low value of 14 *1* in 1978Cr03, the weighted average of other three values quoted by 1993Ru01 is 21.3 *11*, which is consistent with that obtained by 2002Sh08 and the value adopted by 2002Pf04. Measurements: 1966To02, 1968To19, 1968To18, 1974Sh18, 1974Fr09, 1976Lu02, 1976Kr18, 1977Ru04, 1978Cr03, 1979Kr03, 1980Lu04, 1981Ho07, 1993Ru01. See 2002Pf04, 1993Ru01, 1989BrZI, 1984Ma39, 1982Ru01, 1977Ru10, 1975Iz03 for analysis, reviews and compilations. Additional information 2.
281.8 *1*	(5/2$^+$)‡	6.1 ns *4*	AB	T$_{1/2}$: from $\beta\gamma\gamma$(t) in ^{135}Sn β^- decay. Configuration=$\pi d_{5/2}\otimes$(^{134}Sn core).
439.9 *3*	(3/2$^+$)‡		AB	
523 *1*	(1/2$^+$)	1.2 ns *1*	B	J$^\pi$: shell-model calculations (2005Sh36) predict first 1/2$^+$ at 527 keV. T$_{1/2}$: preliminary value from $\beta\gamma\gamma$(t); advanced time-delay method (2007Ma40).
706.9& *1*	(11/2$^+$)‡@		A C	
798.0 *3*	(9/2$^+$)‡		A	
1014.1 *2*	(5/2$^+$,7/2,9/2$^+$)#		A	J$^\pi$: γ rays to (5/2$^+$) and (9/2$^+$). 2005Sh36 suggest (7/2$^+$).
1026.8 *2*	(7/2$^+$,9/2)#		A	J$^\pi$: γ rays to (11/2$^+$) and (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (9/2$^+$).
1112.9 *3*	(5/2$^+$,7/2$^+$)#		A	J$^\pi$: γ rays to (3/2$^+$) and (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (5/2$^+$).
1118.1& *2*	(15/2$^+$)@		C	
1206.9 *3*	(5/2$^+$,7/2,9/2$^+$)#		A	J$^\pi$: γ rays to (5/2$^+$) and (9/2$^+$). 2005Sh36 suggest (7/2$^+$).
1333.0 *3*	(7/2$^+$,9/2)#		A	J$^\pi$: γ rays to (7/2$^+$) and (11/2$^+$); possible β feeding from (7/2$^-$).

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Adopted Levels, Gammas (continued)

^{135}Sb Levels (continued)

E(level)[†]	J^π	$T_{1/2}$	XREF	Comments
				2005Sh36 suggest (9/2$^+$).
1343.2[&] *2*	(19/2$^+$)[@]	≈20 ns	C	$T_{1/2}$: from γ(t) (1998Bh09).
1352.9 *6*	(5/2,7/2$^+$)[#]		A	J^π: γ to (3/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (5/2$^+$).
1386.9 *2*	(5/2,7/2,9/2$^+$)[#]		A	J^π: γ rays to (5/2$^+$) and (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (7/2$^+$).
1455.9 *3*	(5/2,7/2,9/2$^+$)[#]		A	J^π: γ rays to (5/2$^+$) and (7/2$^+$); β feeding from (7/2$^-$). 2005Sh36 suggest (7/2$^+$).
1549.0 *5*			A	J^π: γ to (7/2$^+$) suggests (3/2$^+$ to 11/2$^+$).
1596.9 *4*	(7/2$^+$,9/2)[#]		A	J^π: γ rays to (9/2$^+$) and (11/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (9/2$^+$).
1630.0 *4*	(5/2,7/2,9/2$^+$)[#]		A	J^π: γ to (5/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (7/2$^+$).
1733.9 *3*	(5/2,7/2$^+$)[#]		A	J^π: γ rays to (3/2$^+$) and (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (5/2$^+$).
1830.9 *6*	(5/2,7/2,9/2)[#]		A	J^π: γ to (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (5/2$^+$).
1855.2 *3*	(5/2,7/2,9/2$^+$)[#]		A	J^π: γ rays to (5/2$^+$) and (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (7/2$^+$).
1972.7 *3*	(23/2$^+$)		C	J^π: proposed configuration=$\pi g_{7/2}\otimes\nu(f_{7/2}h_{9/2})$ based on shell-model calculations by 1998Bh09.
2037.8 *5*			A	J^π: γ to (5/2$^+$) suggests (1/2$^+$ to 9/2$^+$).
2088.9 *3*	(5/2,7/2$^+$)[#]		A	J^π: γ rays to (3/2$^+$) and (7/2$^+$); β feeding from (7/2$^-$). 2005Sh36 suggest (5/2$^+$).
2169.9 *4*	(5/2$^+$,7/2,9/2)[#]		A	J^π: γ to (9/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (7/2$^+$,9/2$^+$).
2211.9 *5*			A	J^π: γ to (11/2$^+$) suggests (7/2$^+$ to 15/2$^+$).
2440.0 *5*			A	J^π: γ to (7/2$^+$) suggests (3/2$^+$ to 11/2$^+$).
2461.9 *4*	(5/2,7/2,9/2$^+$)[#]		A	J^π: γ rays to (5/2$^+$) and (7/2$^+$); possible β feeding from (7/2$^-$). 2005Sh36 suggest (5/2$^+$,7/2$^+$).
2764.0 *5*			A	J^π: γ to (7/2$^+$) suggests (3/2$^+$ to 11/2$^+$).
2837.7 *4*	(21/2,23/2)		C	J^π: 23/2$^-$ suggested from proposed configuration= $\pi h_{11/2}\otimes\nu f^2_{7/2}\ _{6+}$. However, a 21/2$^+$ state is also predicted (see Figure 3 in 2015Ko05) in shell-model calculations.
3249.2 *4*	(27/2$^-$)		C	Configuration=$\pi g_{7/2}\otimes\nu(i_{13/2}f_{7/2})_{10-}$.
3263.0 *5*			A	J^π: γ to (7/2$^+$) suggests (3/2$^+$ to 11/2$^+$).
3687.9 *5*	(29/2$^-$)		C	Configuration=$\pi g_{7/2}\otimes\nu(i_{13/2}h_{9/2})_{11-}$.

† From least-squares fit to Eγ data.

‡ From consistency of experimental and calculated (using shell model) level spectrum for the first five states up to ≈900 keV. It should be pointed out, however, that a 1/2$^+$ state at ≈530 keV predicted by calculations has not been observed.

2005Sh36 assign tentative single spin value on the assumption that M1 transitions are more likely than E2 transitions for near closed-shell Z=51 nuclide.

@ Probable member of $\pi g_{7/2}\nu(f^2_{7/2})$ multiplet.

& $\pi g_{7/2}\nu(f^2_{7/2})$ multiplet. This multiplet together with the long half-life of 19/2$^+$ state is consistent with the calculated (1998Bh09) spectrum from shell model.

Adopted Levels, Gammas (continued)

γ(^{135}Sb)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[#]	α[@]	Comments
281.8	(5/2+)	281.7 *1*	100	0.0	(7/2+)	[M1,E2]	0.041 *4*	
439.9	(3/2+)	158.0 *5*	15 *8*	281.8	(5/2+)			
		440.0 *5*	100 *5*	0.0	(7/2+)			
523	(1/2+)	241[‡]	100	281.8	(5/2+)	[E2]	0.0765	B(E2)(W.u.)=13 *1*
706.9	(11/2+)	706.9 *1*	100	0.0	(7/2+)	Q		
798.0	(9/2+)	798.0 *5*	100	0.0	(7/2+)			
1014.1	(5/2+,7/2,9/2+)	216.0 *5*	16.5 *3*	798.0	(9/2+)			
		732.4 *2*	100 *5*	281.8	(5/2+)			
		1014.0 *5*	29.5 *11*	0.0	(7/2+)			
1026.8	(7/2+,9/2)	320.0 *5*	5.0 *17*	706.9	(11/2+)			
		1027.0 *5*	100 *8*	0.0	(7/2+)			
1112.9	(5/2+,7/2+)	673.0 *5*	24 *4*	439.9	(3/2+)			
		831.0 *5*	100 *12*	281.8	(5/2+)			
		1113.0 *5*	76 *16*	0.0	(7/2+)			
1118.1	(15/2+)	411.2 *1*	100	706.9	(11/2+)	Q		
1206.9	(5/2+,7/2,9/2+)	180.0 *5*	3.4 *9*	1026.8	(7/2+,9/2)			
		409.0 *5*	10.6 *3*	798.0	(9/2+)			
		925.0 *5*	100 *6*	281.8	(5/2+)			
		1207.0 *5*	48.3 *17*	0.0	(7/2+)			
1333.0	(7/2+,9/2)	535.0 *5*	48 *6*	798.0	(9/2+)			
		626.0 *5*	35 *3*	706.9	(11/2+)			
		1333.0 *5*	100 *10*	0.0	(7/2+)			
1343.2	(19/2+)	225.1 *1*	100	1118.1	(15/2+)	(E2)	0.0964	B(E2)(W.u.)≈1.1
1352.9	(5/2,7/2+)	913.0 *5*	100	439.9	(3/2+)			
1386.9	(5/2,7/2,9/2+)	180.0 *5*	17 *3*	1206.9	(5/2+,7/2,9/2+)			
		274.0 *5*	10.0 *17*	1112.9	(5/2+,7/2+)			
		360.0 *5*	6.7 *17*	1026.8	(7/2+,9/2)			
		1105.0 *5*	22 *3*	281.8	(5/2+)			
		1387.0 *5*	100 *7*	0.0	(7/2+)			
1455.9	(5/2,7/2,9/2+)	429.0 *5*	13.7 *16*	1026.8	(7/2+,9/2)			
		1174.0 *5*	35 *4*	281.8	(5/2+)			
		1456.0 *5*	100.0 *24*	0.0	(7/2+)			
1549.0		1549.0 *5*	100	0.0	(7/2+)			
1596.9	(7/2+,9/2)	570.0 *5*	57 *4*	1026.8	(7/2+,9/2)			
		799.0 *5*	56 *12*	798.0	(9/2+)			
		890.0 *5*	100 *19*	706.9	(11/2+)			
1630.0	(5/2,7/2,9/2+)	243.0 *5*	41 *12*	1386.9	(5/2,7/2,9/2+)			
		1630.0 *5*	100 *24*	0.0	(7/2+)			
1733.9	(5/2,7/2+)	1294.0 *5*	51 *7*	439.9	(3/2+)			
		1452.0 *5*	100 *7*	281.8	(5/2+)			
		1734.0 *5*	14.6 *24*	0.0	(7/2+)			
1830.9	(5/2,7/2,9/2)	1391.0 *5*	100	439.9	(3/2+)			
1855.2	(5/2,7/2,9/2+)	829.0 *5*	52 *7*	1026.8	(7/2+,9/2)			
		1573.0 *5*	21.4 *24*	281.8	(5/2+)			
		1855.0 *5*	100 *5*	0.0	(7/2+)			
1972.7	(23/2+)	629.5 *2*	100	1343.2	(19/2+)	Q		
2037.8		1756.0 *5*	100	281.8	(5/2+)			
2088.9	(5/2,7/2+)	633.0 *5*	25.2 *10*	1455.9	(5/2,7/2,9/2+)			
		976.0 *5*	23 *6*	1112.9	(5/2+,7/2+)			
		1649.0 *5*	22.9 *21*	439.9	(3/2+)			
		1807.0 *5*	100 *8*	281.8	(5/2+)			
		2089.0 *5*	38.3 *13*	0.0	(7/2+)			
2169.9	(5/2+,7/2,9/2)	1143.0 *5*	100 *10*	1026.8	(7/2+,9/2)			
		1372.0 *5*	50 *15*	798.0	(9/2+)			
2211.9		1505.0 *5*	100	706.9	(11/2+)			

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Adopted Levels, Gammas (continued)

$\gamma(^{135}Sb)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π
2440.0		2440.0 *5*	100	0.0	(7/2$^+$)
2461.9	(5/2,7/2,9/2$^+$)	2179.0 *5*	100 *19*	281.8	(5/2$^+$)
		2463.0 *5*	84 *11*	0.0	(7/2$^+$)
2764.0		2764.0 *5*	100	0.0	(7/2$^+$)
2837.7	(21/2,23/2)	1494.5 *3*	100	1343.2	(19/2$^+$)
3249.2	(27/2$^-$)	1276.5 *2*	100	1972.7	(23/2$^+$)
3263.0		3263.0 *5*	100	0.0	(7/2$^+$)
3687.9	(29/2$^-$)	438.7 *3*	100	3249.2	(27/2$^-$)

† From either ^{135}Sn β^- decay or ^{248}Cm SF decay; unless otherwise specified. Most levels are populated independently in these two datasets, low-spin (J<11/2) levels in β^- decay and high-spin (J>9/2) levels in SF decay.

‡ From ^{136}Sn β^-n decay.

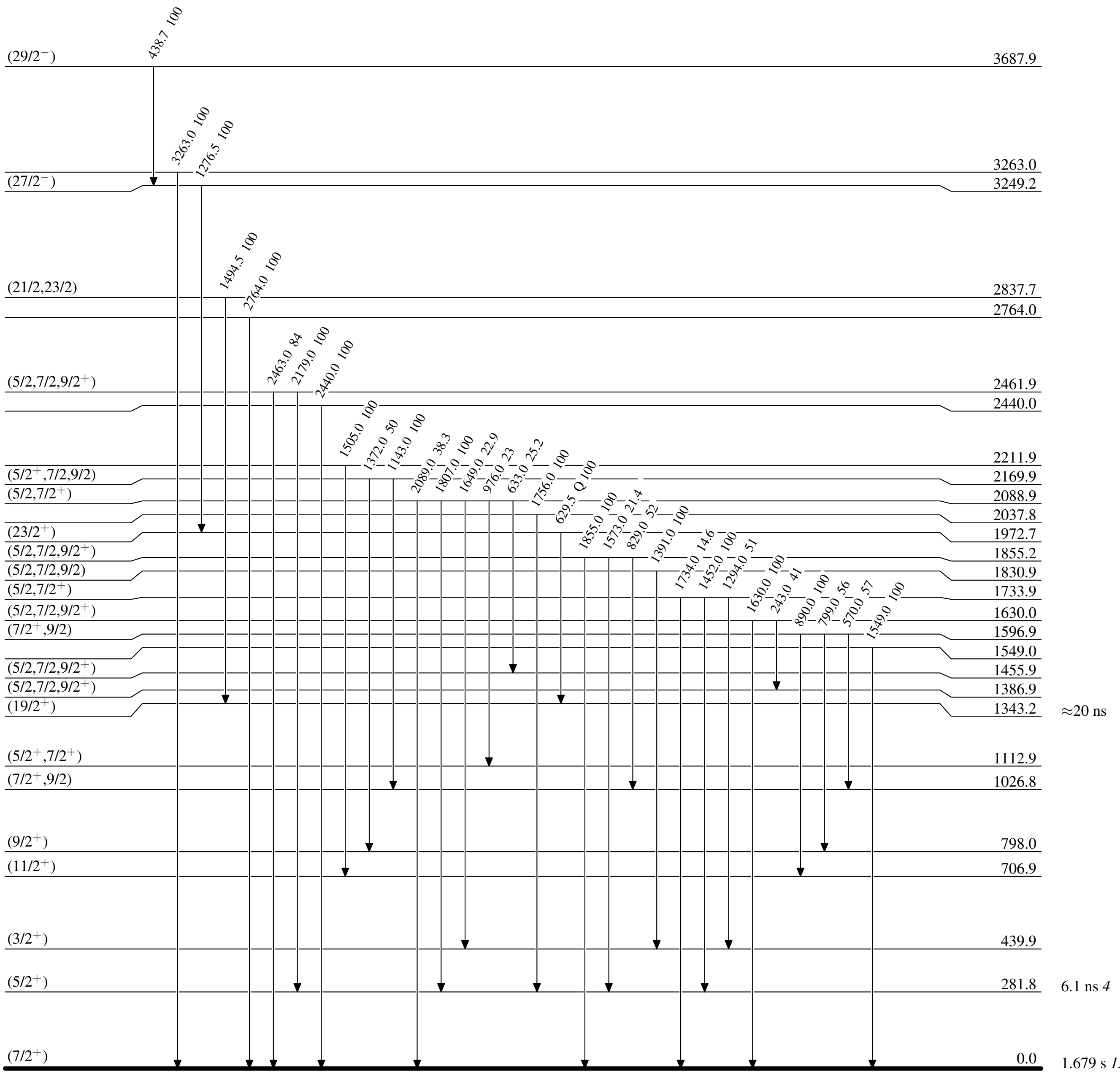
Stretched quadrupole from $\gamma\gamma(\theta)$ in ^{248}Cm SF decay, assigned as (E2) in 2015Ko15. Evaluator assigns Q, in the absence of strong supporting data for parity assignment.

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

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{135}_{51}Sb_{84}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level