Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	07-June-2023

Q(β^-)=3836 *7*; S(n)=5027 *8*; S(p)=10391 *6*; Q(α)=−2349 *11* 2021Wa16
S(2n)=11673 *7*, S(2p)=20292 *6* (2021Wa16).

1986Ma12: ^{159}Sm produced and identified in ^{235}U(n,F), followed by mass separation of fission fragments at the TRISTAN facility of Brookhaven National Laboratory. Measured half-life of the decay of ^{159}Sm and two γ rays of 114 and 190 keV.

1987Wi14 (also 1986GrZX,1987Gr12,1988GrZY,1990An31): ^{159}Sm produced and identified in SF decay of ^{252}Cf, followed by online mass separation of fission fragments. Measured Eγ, Iγ for 16 γ rays.

2012Va02: measured mass of the g.s. from cyclotron frequency ratios using the Canadian Penning Trap mass spectrometer at the CARIBU-ANL facility.

Theoretical structure calculations:

2022An05: calculated charge radii and odd-even staggering (OES) effects using the relativistic mean field (RMF-BCS) and the modified RMF(BCS) approaches.

2020Li53: calculated energy levels, J^π, ground-state band, moments of inertia, bandhead energy of isomeric state using modified Nilsson parameters to generate deformed bases for the projected shell model.

2015El05: calculated ground state energy, S(2n) using HFB method with SLy5 Skyrme and Gogny forces.

1984Al30: calculated quadrupole and hexadecapole moments, g.s. energy.

Additional information 1.

^{159}Sm Levels

Cross Reference (XREF) Flags

- A ^{159}Pm β^- decay (1.634 s)
- B ^{159}Sm IT decay (115 ns)
- C ^{252}Cf SF decay

E(level)†	J$^\pi$‡	T$_{1/2}$	XREF	Comments
0.0#	5/2$^-$	11.37 s *15*	ABC	%β^-=100 J$^\pi$: from log *ft*=5.0 of the β^- decay to 1051 level in ^{159}Eu, which is interpreted as a ν5/2[523] → π7/2[523] β transition, the 'au' β transition expected in this mass region. ν5/2[523] is found as the ground state in the heavier N=97 isotones (1971Bu16,1990Ja11). T$_{1/2}$: from 1987Gr12 (also 1990An31, weighted average of the half-lives of the Eu x-rays and the γ rays from ^{159}Sm decay). Other: 15 s *2* (1986Ma12).
71.8# *5*	(7/2$^-$)		A	E(level),J$^\pi$: from the expected energy spacing of the 7/2$^-$ member of the ν5/2[523], and the predicted energy of 72 keV (2009Ur04).
163.1# *9*	(9/2$^-$)		C	
406.3# *12*	(13/2$^-$)		C	
727.3# *13*	(17/2$^-$)		C	
1123.2# *14*	(21/2$^-$)		C	
1275.9& *14*	(11/2$^-$)	115 ns *10*	C	%IT=100 E(level),J$^\pi$: from ν11/2[505] bandhead assignment in ^{252}Cf SF decay (2009Ur04). 2017Pa25 assigned (15/2$^+$) and interpreted this level as a 3-qp state with configuration=ν(5/2[523])⊗π5/2[532]⊗π5/2[413], and predicted level energy of 1040 keV from their Nilsson-BCS calculations. Note, however, that these calculations by 2017Pa25 predicted an energy of 1255 keV for the ν11/2[505] bandhead, close to the experimental energy of 1277 keV. The quasiparticle rotor model calculations by 2009Ur04 predicted the energy of the ν11/2[505] bandhead at 1362 keV.

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Adopted Levels, Gammas (continued)

^{159}Sm Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
			$T_{1/2}$: from 869.7γ(t) in ^{252}Cf SF decay (2009Ur04); note that authors quote 116 ns *8* in the abstract, but 115 ns *10* in level-scheme Fig. 5 and in the text. Other: 50 ns *17* in ^{159}Sm IT decay (2017Pa25). Value from 2009Ur04 is preferred due to higher statistics in this experiment, as shown in authors′ Fig. 4, as compared to that in 2017Pa25, as shown in authors′ Fig. 7.
1418.9[@] *15*	(13/2$^-$)	C	
1578.3[&] *15*	(15/2$^-$)	C	
1591.3[#] *15*	(25/2$^-$)	C	
1754.0[@] *15*	(17/2$^-$)	C	
1946.0[&] *15*	(19/2$^-$)	C	
2128.0[#] *16*	(29/2$^-$)	C	
2154.2[@] *15*	(21/2$^-$)	C	
2378.0[&] *16*	(23/2$^-$)	C	
2616.6[@] *16*	(25/2$^-$)	C	
2871.9[&] *16*	(27/2$^-$)	C	
3141.7[@] *17*	(29/2$^-$)	C	

[†] From least-squares fit to Eγ data, assuming $\Delta E\gamma$=0.5 keV or 1 keV, when not states, the former when Eγ stated to nearest tenth of a keV, the latter when stated to nearest keV.
[‡] Based on the observed γ-decay patterns and expected band structure.
[#] Band(A): ν5/2[523]. Band assignment from 2009Ur04 and 2008Hw03. The unfavored branch of this band was not observed (2009Ur04).
[@] Band(B): ν11/2[505],α=+1/2. Band assignment from 2009Ur04.
[&] Band(b): ν11/2[505],α=−1/2. Band assignment from 2009Ur04.

γ(^{159}Sm)

E$_i$(level)	J$_i^{\pi}$	E$_\gamma$[†]	I$_\gamma$[†]	E$_f$	J$_f^{\pi}$	Mult.	α[#]	Comments
71.8	(7/2$^-$)	71.8	100	0.0	5/2$^-$	[M1+E2]	6.2 *19*	E$_\gamma$: from ^{159}Pm β^- decay.
163.1	(9/2$^-$)	163.1[‡] *9*	100[‡]	0.0	5/2$^-$	[E2]	0.417 *10*	
406.3	(13/2$^-$)	243.2[‡] *7*	100[‡]	163.1	(9/2$^-$)	[E2]	0.1095 *19*	
727.3	(17/2$^-$)	321.0		406.3	(13/2$^-$)	[E2]	0.0456 *7*	
1123.2	(21/2$^-$)	395.9		727.3	(17/2$^-$)	[E2]	0.0245 *4*	
1275.9	(11/2$^-$)	869.6[‡] *8*	100[‡]	406.3	(13/2$^-$)	[M1+E2]	0.0044 *11*	If M1, B(M1)(W.u)=2.91×10^{-7} *25*. If E2, B(E2(W.u.)=0.000194 17.
1418.9	(13/2$^-$)	142.7		1275.9	(11/2$^-$)			
1578.3	(15/2$^-$)	159.2	330 *70*	1418.9	(13/2$^-$)			
		302.7	100	1275.9	(11/2$^-$)			E$_\gamma$: Level-energy difference=301.8.
1591.3	(25/2$^-$)	468.1		1123.2	(21/2$^-$)			
1754.0	(17/2$^-$)	175.8	210 *40*	1578.3	(15/2$^-$)			
		335.1	100	1418.9	(13/2$^-$)			
1946.0	(19/2$^-$)	191.8		1754.0	(17/2$^-$)			
		367.5		1578.3	(15/2$^-$)			
2128.0	(29/2$^-$)	536.7		1591.3	(25/2$^-$)			
2154.2	(21/2$^-$)	207.9		1946.0	(19/2$^-$)			
		400.5		1754.0	(17/2$^-$)			
2378.0	(23/2$^-$)	223.9		2154.2	(21/2$^-$)			
		432.0		1946.0	(19/2$^-$)			
2616.6	(25/2$^-$)	238.5		2378.0	(23/2$^-$)			

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Adopted Levels, Gammas (continued)

$\gamma(^{159}Sm)$ (continued)

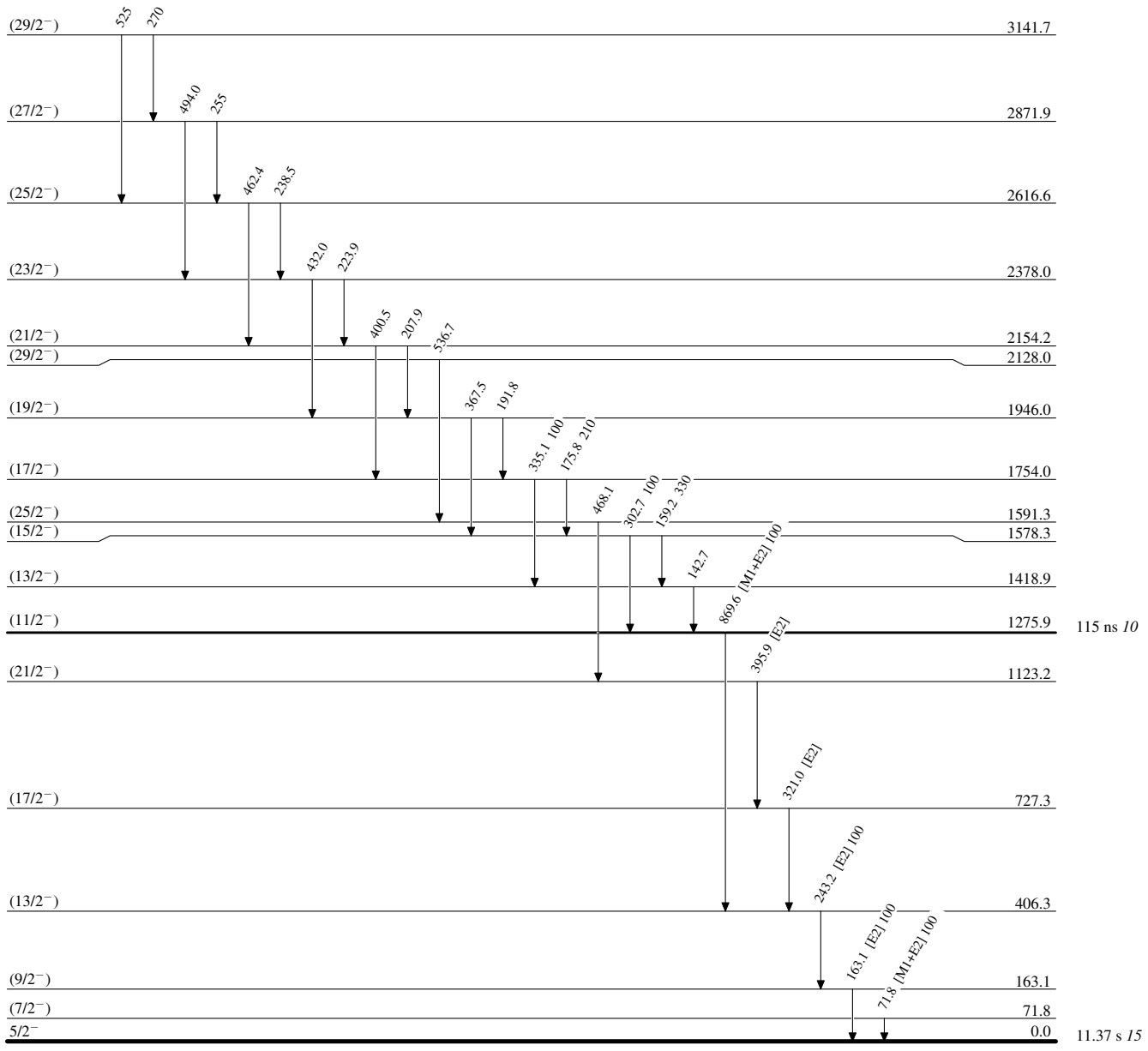
E_i(level)	J_i^π	E_γ †	E_f	J_f^π
2616.6	$(25/2^-)$	462.4	2154.2	$(21/2^-)$
2871.9	$(27/2^-)$	255	2616.6	$(25/2^-)$
		494.0	2378.0	$(23/2^-)$
3141.7	$(29/2^-)$	270	2871.9	$(27/2^-)$
		525	2616.6	$(25/2^-)$

† From ^{252}Cf SF decay, unless stated otherwise.
‡ From ^{159}Sm IT decay.
# 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

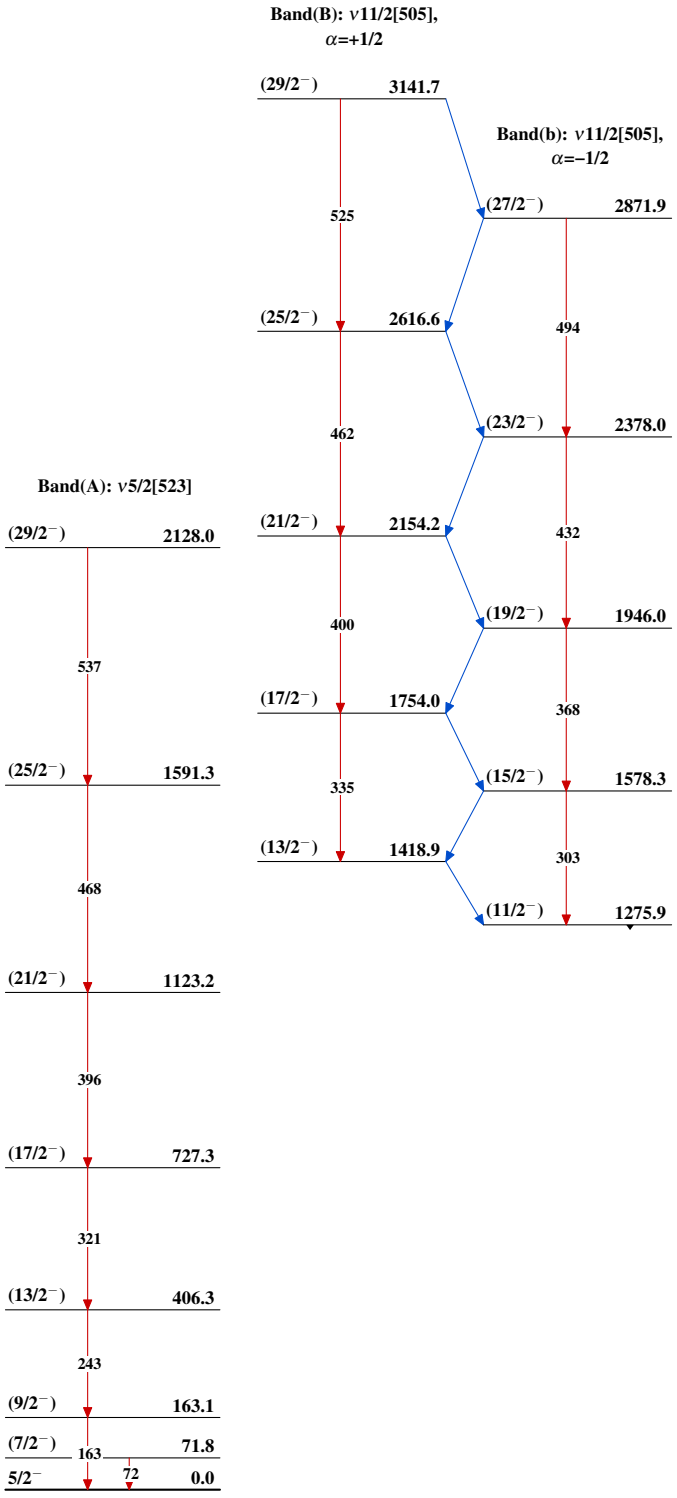
Level Scheme

Intensities: Relative photon branching from each level



$^{159}_{62}Sm_{97}$

Adopted Levels, Gammas



$^{159}_{62}Sm_{97}$