

<sup>164</sup>Sm IT decay (0.60 μs) 2014Pa55

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen <sup>#</sup>		NDS 147, 1 (2018)	30-Nov-2017

Parent: <sup>164</sup>Sm: E=1485.5 12; J<sup>π</sup>=(6<sup>-</sup>); T<sub>1/2</sub>=0.60 μs 14; %IT decay=100.0

2014Pa55: <sup>164</sup>Sm produced in <sup>9</sup>Be(<sup>238</sup>U,F),E=345 MeV/nucleon reaction at the Radioactive Ion Beam Factory (RIBF) at RIKEN accelerator laboratory. Nuclei were separated in terms of mass-to-charge (A/q) ratio and atomic number Z using BigRIPS and ZeroDegree spectrometers. Ions of <sup>164</sup>Sm were implanted in a copper passive stopper, and the gamma rays from the isomer were detected using Euroball-RIKEN Cluster array (EURICA) consisting of 84 HPGe crystals in a 4π configuration. Measured E<sub>γ</sub>, I<sub>γ</sub>, γγ-coin, (ion implants)γ correlations, delayed-gamma-ray spectroscopy, isomer half-life. Deduced levels, J, π, multipolarity. Comparison with potential energy surface calculations including β<sub>6</sub> deformation.

<sup>164</sup>Sm Levels

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	T <sub>1/2</sub>	Comments
0.0 <sup>#</sup>	0 <sup>+</sup>		
69 <sup>#</sup> 1	(2 <sup>+</sup> )		
224.9 <sup>#</sup> 11	(4 <sup>+</sup> )		
467.2 <sup>#</sup> 11	(6 <sup>+</sup> )		
1136.1 11	(5 <sup>+</sup> )		
1485.5 12	(6 <sup>-</sup> )	0.60 μs 14	Possible member of γ-vibrational band. %IT=100 Configuration=ν5/2[512]⊗ν7/2[633], β <sub>2</sub> =0.295, β <sub>4</sub> =0.029, β <sub>6</sub> =-0.020. T <sub>1/2</sub> : from decay curves obtained from (ion implantation)(γ)(t) correlations for 155-, 242-, 349-, 669-, and 911-keV γ rays.

<sup>†</sup> From least-squares fit to E<sub>γ</sub> data, assuming energy of the first 2<sup>+</sup> level at 69 keV 1 from rotational band systematics of nuclei in this mass region.

<sup>‡</sup> As proposed by 2014Pa55 based on systematics of even-even nuclides for low-lying levels and potential-energy surface calculations for higher levels above 1 MeV, supported by multiplicities obtained from intensity balances.

<sup>#</sup> Band(A): The g.s. band. Calculations suggest β<sub>2</sub>=0.301, β<sub>4</sub>=0.030, β<sub>6</sub>=-0.023 for the ground state.

γ(<sup>164</sup>Sm)

I<sub>γ</sub> normalization: Summed transition intensity=100 for 349.4γ.

E <sub>γ</sub>	I <sub>γ</sub> <sup>‡</sup>	E <sub>i</sub> (level)	J <sub>i</sub> <sup>π</sup>	E <sub>f</sub>	J <sub>f</sub> <sup>π</sup>	Mult. <sup>†</sup>	α <sup>@</sup>	I <sub>(γ+ce)</sub> <sup>#</sup>	Comments
(69 1)	10 CA	69	(2 <sup>+</sup> )	0.0	0 <sup>+</sup>	[E2]	9.4 6	100	E <sub>γ</sub> : estimated by evaluators from rotational band systematics of nuclei in this mass region.
155.9 4	79 14	224.9	(4 <sup>+</sup> )	69	(2 <sup>+</sup> )	(E2)	0.332 6		I <sub>(γ+ce)</sub> : from intensity balance. α(K)=0.264 5; α(L)=0.0551 10; α(M)=0.01108 20; α(N)=0.00199 4
242.2 3	28 9	467.2	(6 <sup>+</sup> )	224.9	(4 <sup>+</sup> )	(E2)	0.0723		α(K)=0.0600 9; α(L)=0.00995 15; α(M)=0.00198 3; α(N)=0.000362 6
349.4 2	100	1485.5	(6 <sup>-</sup> )	1136.1	(5 <sup>+</sup> )	(E1)	0.00576	100	α(K)=0.0051 7; α(L)=0.000606 9; α(M)=0.0001179 17; α(N)=2.21×10 <sup>-5</sup> 4
668.8 4	39 14	1136.1	(5 <sup>+</sup> )	467.2	(6 <sup>+</sup> )				Reduced hindrance f <sub>v</sub> =487 38 (2014Pa55), assuming the the 349-keV transition feeds the γ band with ν=3.

Continued on next page (footnotes at end of table)

**$^{164}\text{Sm}$  IT decay (0.60  $\mu\text{s}$ ) 2014Pa55 (continued)**

$\gamma(^{164}\text{Sm})$  (continued)

$E_\gamma$	$I_\gamma^\ddagger$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Comments
<sup>x</sup> 694 911.3 3	79 22	1136.1	(5 <sup>+</sup> )	224.9	(4 <sup>+</sup> )	Weak $\gamma$ ray.

<sup>†</sup> As implied from transition intensity balances and  $\Delta J^\pi$ . These are not given explicitly in 2014Pa55.

<sup>‡</sup> For absolute intensity per 100 decays, multiply by 0.9943.

# Absolute intensity per 100 decays.

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

<sup>x</sup>  $\gamma$  ray not placed in level scheme.

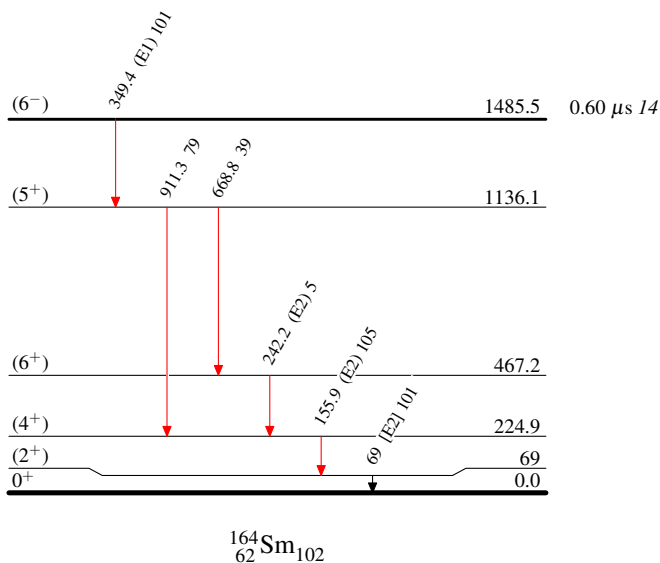
**$^{164}\text{Sm}$  IT decay (0.60  $\mu\text{s}$ ) 2014Pa55**

Decay Scheme

Intensities:  $I_{(\gamma+ce)}$  per 100 parent decays  
%IT=100.0

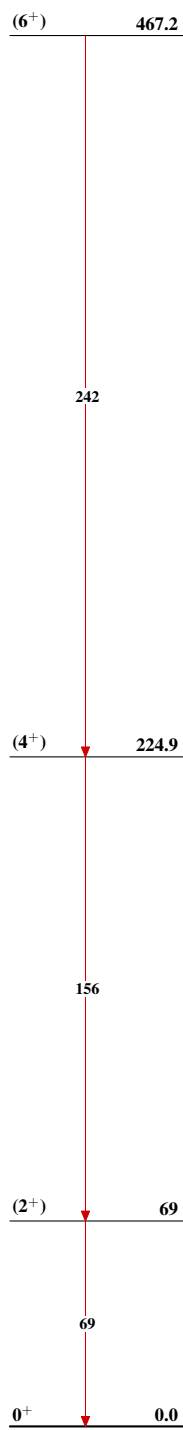
Legend

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



$^{164}\text{Sm}$  IT decay (0.60  $\mu\text{s}$ ) 2014Pa55

Band(A): The g.s. band

 $^{164}_{62}\text{Sm}_{102}$