^{166}Gd IT decay (950 ns) 2014Pa55

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	25-Jan-2015

Parent: ^{166}Gd: E=1601.5 *11*; J$^{\pi}$=(6^{-}); $T_{1/2}$=950 ns *60*; %IT decay=100.0

2014Pa55: ^{166}Gd produced in ^{9}Be(^{238}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 ^{166}Gd 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 Eγ, Iγ, $\gamma\gamma$-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_6 deformation.

^{166}Gd Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
0[#]	0^{+}	4.8 s *10*	$T_{1/2}$: from Adopted Levels.
70.0[#] *10*	(2^{+})		
230.8[#] *11*	(4^{+})		
479.6[#] *11*	(6^{+})		
1240.1[@] *11*	(3^{+})		
1318.9[@] *11*	(4^{+})		
1350.1[&] *11*	(4^{+})		There is a non-physical intensity balance of −24 *7* relative units. According to e-mail reply of Jan 22, 2015 from one of the authors (Z. Podolyak) of 2014Pa55, this situation cannot be resolved from the present data, and that there may be some missing transitions from the 1350-keV level.
1418.4[@] *11*	(5^{+})		
1455.2[&] *11*	(5^{+})		
1601.5 *11*	(6^{-})	950 ns *60*	%IT=100 Configuration=ν5/2[512]$\otimes\nu$7/2[633], β_2=0.291, β_4=0.014, β_6=−0.017. $T_{1/2}$: from decay curves obtained from (ion implantation)(γ)(t) correlations for 146-, 161-, 183-, 249-, 1088-, 1170- and 1188-keV γ rays.

[†] From least-squares fit to Eγ data.

[‡] 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 multipolarities obtained from intensity balances.

[#] Band(A): The g.s. band. Calculations suggest β_2=0.296, β_4=0.015, β_6=−0.020 for ground state.

[@] Band(B): γ-vibrational band. The 2^{+} bandhead is expected at ≈1190 keV.

[&] Band(C): π3/2[411]$\otimes\pi$5/2[413],K^{π}=(4^{+}). Calculations suggest β_2=0.299, β_4=0.017, β_6=−0.022 for 4^{+} bandhead.

γ(^{166}Gd)

Iγ normalization: Summed transition intensity=100 for 146.3- and 183.1-keV transitions.

E$_{\gamma}$	I$_{\gamma}$[a]	E$_i$(level)	J$^{\pi}_i$	E$_f$	J$^{\pi}_f$	Mult.[#]	α[&]	I$_{(\gamma+ce)}$[a]	Comments
(37)	7 *4*	1455.2	(5^{+})	1418.4	(5^{+})	[M1]	5.7 *5*	47 *27*	α(L)=4.49 *7*; α(M)=0.976 *14*; α(N)=0.225 *4*; α(O)=0.0347 *5*; α(P)=0.00230 *4* E$_{\gamma}$,I$_{\gamma}$: existence of this transition is implied from $\gamma\gamma$-coin data. Intensity is obtained from transition intensity balance at 1418 level.
70[†] *1*	16[†] *2*	70.0	(2^{+})	0	0^{+}	[E2]	9.7 *6*		α(K)=2.58 *8*; α(L)=5.5 *4*; α(M)=1.30 *10*;

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γ(^{166}Gd) (continued)

E_γ	I_γ[a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	Comments
								α(N)=0.290 *21*; α(O)=0.038 *3*; α(P)=0.000132 *5* I_γ: deduced by the evaluator from intensity balance. 2014Pa55 list 15 *1*.
78[†] *1*	7[†] *2*	1318.9	(4$^+$)	1240.1	(3$^+$)	(M1)[@]	4.12 *17*	α(K)=3.47 *14*; α(L)=0.50 *2*; α(M)=0.109 *5*; α(N)=0.025 *1*; α(O)=0.0039 *2*; α(P)=0.00026 *1*
99.8 *3*	24 *3*	1418.4	(5$^+$)	1318.9	(4$^+$)	(M1)[@]	2.02 *4*	α(K)=1.71; α(L)=0.247 *4*; α(M)=0.0537 *9*; α(N)=0.01235 *21*; α(O)=0.00191 *4*; α(P)=12.8×10^{-5} *2*
105.0 *3*	12 *2*	1455.2	(5$^+$)	1350.1	(4$^+$)	(M1(+E2))	1.93 *18*	α(K)=1.25 *23*; α(L)=0.5 *4*; α(M)=0.12 *8*; α(N)=0.027 *17*; α(O)=0.0037 *21*; α(P)=8.E−5 *3*
137[†] *1*	5[†] *3*	1455.2	(5$^+$)	1318.9	(4$^+$)	(M1(+E2))	0.817 *23*	α(K)=0.59 *11*; α(L)=0.18 *8*; α(M)=0.041 *20*; α(N)=0.009 *5*; α(O)=0.0013 *5*; α(P)=3.8×10^{-5} *14*
146.3 *2*	66 *5*	1601.5	(6$^-$)	1455.2	(5$^+$)	(E1)	0.1047	α(K)=0.0884 *13*; α(L)=0.01281 *19*; α(M)=0.00277 *4* α(N)=0.000629 *10*; α(O)=9.36×10^{-5} *14*; α(P)=5.20×10^{-6} *8* Reduced hindrance f_ν=3.77×10^7 *24* (2014Pa55), assuming the the 146-keV transition feeds the K^π=5$^+$ band with ν=1.
160.8 *2*	82 *6*	230.8	(4$^+$)	70.0	(2$^+$)	(E2)	0.465	α(K)=0.299 *5*; α(L)=0.1289 *20*; α(M)=0.0300 *5* α(N)=0.00672 *10*; α(O)=0.000907 *14*; α(P)=1.630×10^{-5} *24*
178.3 *2*	11 *2*	1418.4	(5$^+$)	1240.1	(3$^+$)	[E2]	0.327	α(K)=0.219 *4*; α(L)=0.0836 *13*; α(M)=0.0194 *3* α(N)=0.00435 *7*; α(O)=0.000591 *9*; α(P)=1.224×10^{-5} *18*
183.1 *2*	100	1601.5	(6$^-$)	1418.4	(5$^+$)	(E1)	0.0574	α(K)=0.0486 *7*; α(L)=0.00692 *10*; α(M)=0.001497 *22* α(N)=0.000341 *5*; α(O)=5.11×10^{-5} *8*; α(P)=2.94×10^{-6} *5* Reduced hindrance f_ν=356 *7* (2014Pa55), assuming the the 183-keV transition feeds the γ band with ν=3.
^{x}220[‡]								
248.7 *3*	21 *3*	479.6	(6$^+$)	230.8	(4$^+$)	(E2)	0.1087	α(K)=0.0802 *12*; α(L)=0.0222 *4*; α(M)=0.00507 *8* α(N)=0.001142 *17*; α(O)=0.0001597 *24*; α(P)=4.83×10^{-6} *7*
^{x}269[‡]								
938.6 *4*	15 *4*	1418.4	(5$^+$)	479.6	(6$^+$)			
1009.1 *7*	14 *4*	1240.1	(3$^+$)	230.8	(4$^+$)			
1088.1 *3*	30 *6*	1318.9	(4$^+$)	230.8	(4$^+$)			
1119.3 *3*	8 *3*	1350.1	(4$^+$)	230.8	(4$^+$)			
1169.9 *3*	34 *7*	1240.1	(3$^+$)	70.0	(2$^+$)			
1187.5 *3*	36 *7*	1418.4	(5$^+$)	230.8	(4$^+$)			
1224.3 *3*	10 *4*	1455.2	(5$^+$)	230.8	(4$^+$)			
1249.2 *3*	18 *5*	1318.9	(4$^+$)	70.0	(2$^+$)			
1280.1 *2*	3 *1*	1350.1	(4$^+$)	70.0	(2$^+$)			

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γ(^{166}Gd) (continued)

† The γ ray seen in $\gamma\gamma$-coin spectrum, not in (ion)γ correlated spectrum. Intensity is obtained from transition intensity balances at relevant levels and theoretical internal conversion coefficients.

‡ Weak γ ray. This γ ray does not belong to lower-mass isotopes with one, two or three electrons (H-, He- or Li-like) as shown by the known γ-ray data for these isotopes.

As implied from transition intensity balances and ΔJ^{π}. These are not given explicitly in 2014Pa55.

@ Dominant M1 according to e-mail reply of Jan 22, 2015 from one of the authors (Z. Podolyak) of 2014Pa55, and that small E2 admixture is possible.

& Value overlaps M1 and E2 when δ(E2/M1) is not given for mult=(M1(+E2)).

[a] For absolute intensity per 100 decays, multiply by 0.560 *17*.

[x] γ ray not placed in level scheme.

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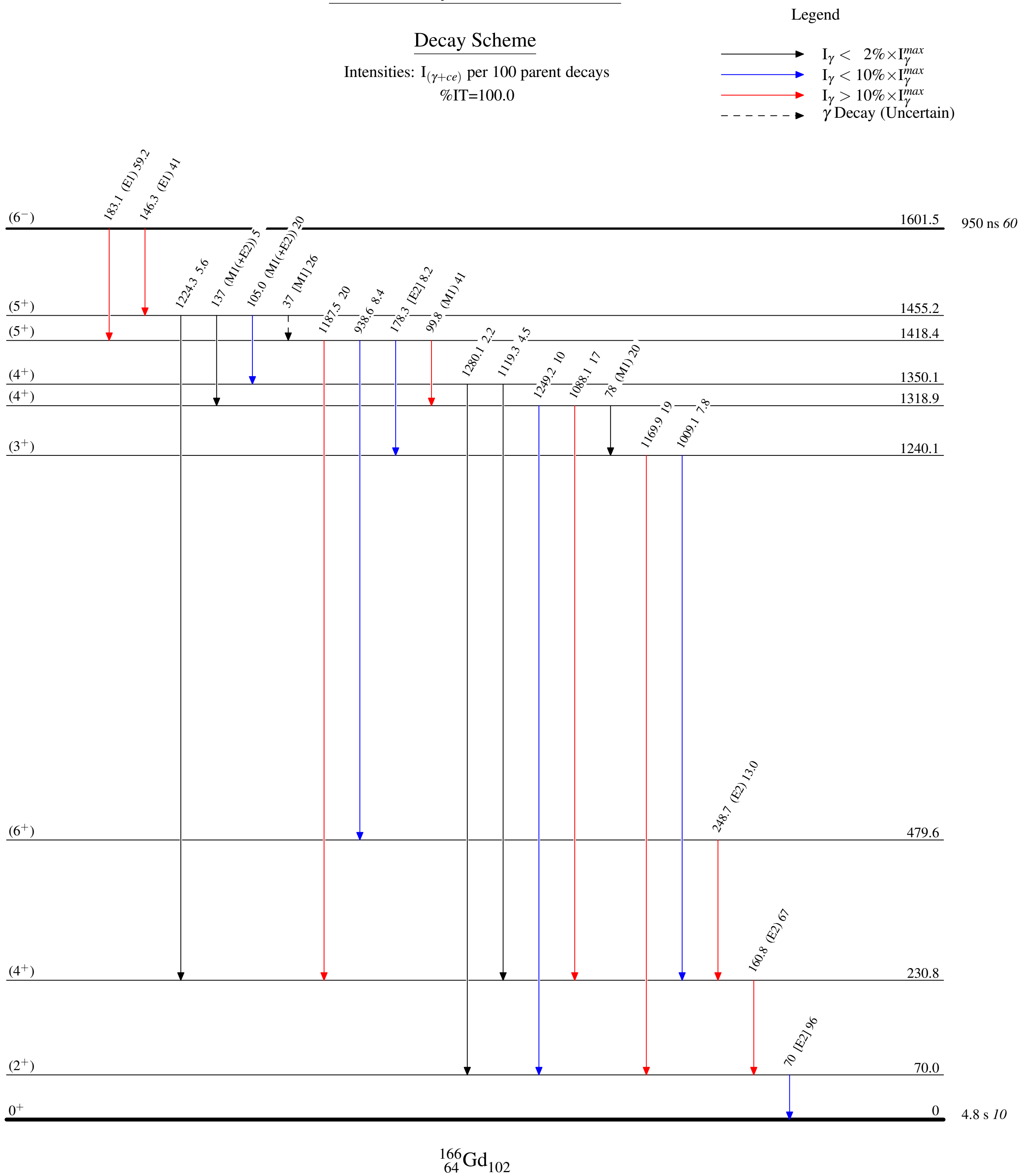

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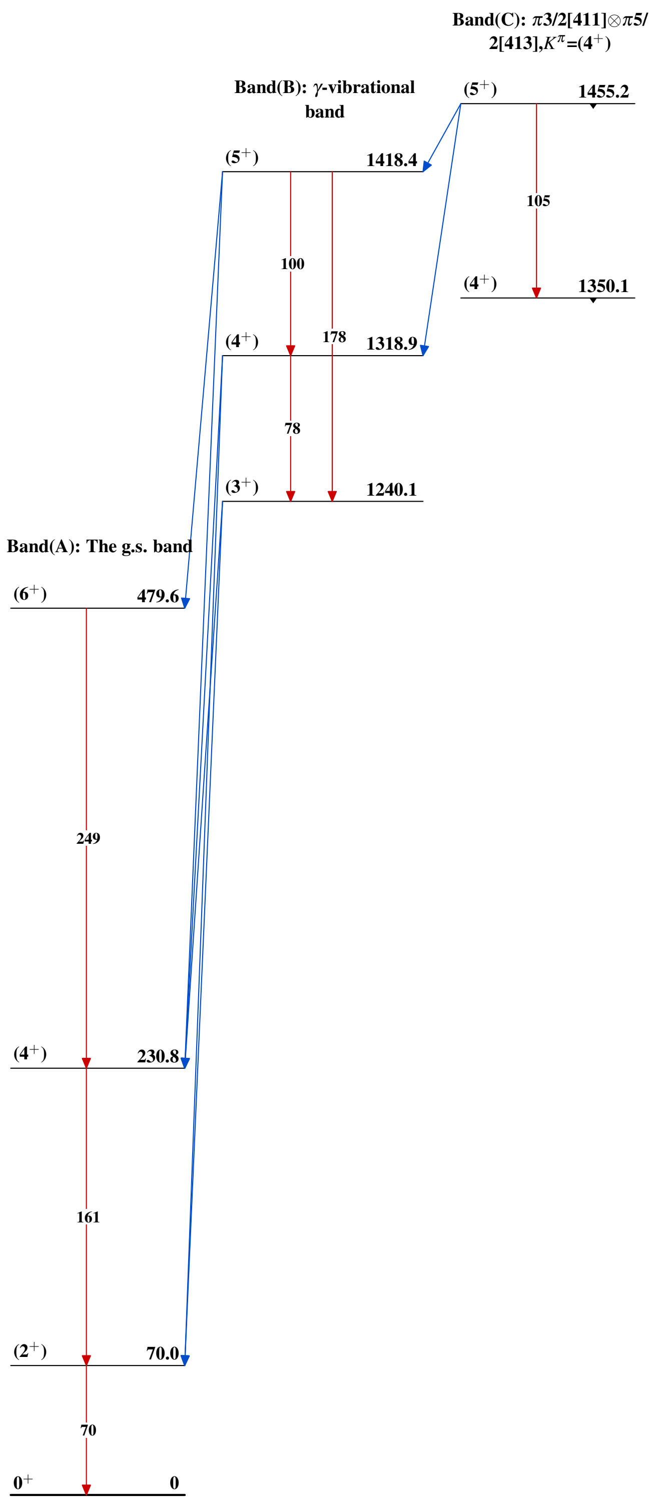

$^{166}_{64}Gd_{102}$