^{189}Pb IT decay (22.2 μs) 2005Ba51,2009Dr03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	T. D. Johnson, Balraj Singh	NDS 142, 1 (2017)	15-Apr-2017

Parent: ^{189}Pb: E=2475.53 *18*; J^{π}=(31/2$^-$); $T_{1/2}$=22.2 μs *+69−14*; %IT decay=100.0

2005Ba51: ^{158}Gd(^{36}Ar,5nγ): E=178 MeV. Target=0.43 mg/cm^2 92.9% enriched ^{158}Gd. Measured Eγ, Iγ, γγ, particle-γ coin with 10 Compton-suppressed Ge detectors and parallel-grid avalanche counter (PGAC). Fragment mass analyzer (FMA) used to accept evaporation residues recoiling from target according to their mass/charge ratio. Reaction products detected by PGAC via energy loss (ΔE) and focal-plane-position signals. ^{164}Er(^{29}Si,4nγ): E=140 MeV. Target=2.5 mg/cm^2 73.6% enriched ^{164}Er. Measured Eγ, Iγ, γγ, γγ(t), lifetimes with six Compton-suppressed Ge detectors and two planar low energy photon spectrometer (LEPS) detectors of the CAESAR array.

2009Dr03: ^{164}Er beam produced at E=145 MeV by 14UD Pelletron accelerator at Australian National University. Target=700 μg/cm^2. A spectrometer, consisting of the fusion product separator SOLITAIRE, an annular array of six cooled Si(Li) electron detectors, a single large-volume Ge detector and a single LEPS detector, were used to measure both γ rays and conversion electrons. CAESAR array of Ge detectors was used in complementary experiments.

^{189}Pb Levels

E(level)[†]	J^{π}[‡]	$T_{1/2}$	Comments
40 *4*	(13/2$^+$)		Additional information 1. E(level): from Adopted Levels, based on α-decay data in 2013Sa43.
677.60 *23*	(13/2$^+$)		
858.80[a] *10*	(17/2$^+$)		
950.56[&] *17*	(15/2$^+$)		
1181.59[@] *15*	(17/2$^+$)	<6.9[#] ns	In-out transition intensity imbalance of −13 *10* at this level.
1327.25[a] *13*	(21/2$^+$)	<2.1[#] ns	
1340.11[&] *17*	(19/2$^+$)		
1607.45[@] *15*	(21/2$^+$)	<2.8[#] ns	
1813.0[&] *4*	(23/2$^+$)		
1865.43[a] *16*	(25/2$^+$)		
2137.83[@] *16*	(25/2$^+$)	<2.1[#] ns	In-out transition intensity imbalance of 26 *15* at this level.
2280.36 *23*	(27/2$^+$)		
2474.53 *18*	(31/2$^-$)	22.2 μs *+69−14*	E(level): this isomer is interpreted as bandhead of a shears structure with neutrons (in i13/2 orbital) coupled to protons at ≈60°. $T_{1/2}$: deduced from fitting of single exponential decay functions to the decay curves of both the 468 and 819 transitions (2005Ba51).

[†] From least-squares fit to Eγ data, keeping the energy of the 40-keV level as fixed, its uncertainty of 4 keV is not carried over in the energies of the higher levels.

[‡] Assignments are as given in 2005Ba51 and 2009Dr03, based on multipolarities from conversion data, systematics of neighboring isotopes and isotones, and transition strengths.

[#] Estimated from γγ(t).

[@] Band(A): Band based on (17/2$^+$),α=+1/2. 2005Ba51 compared this band with 9/2[624] band in ^{187}Pb.

[&] Band(a): Band based on (15/2$^+$),α=−1/2. 2005Ba51 compared this band with 9/2[624] band in ^{187}Pb.

[a] Band(B): $\nu i^{-3}_{13/2}$ band.

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γ(^{189}Pb)

Iγ normalization: From summed I(γ+ce) of γ rays to 40-keV level=100, deduced using GABS normalization code.
The α(exp) values have been determined from intensity balance considerations.

E_γ[†]	I_γ[‡&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[@]	Comments
142.4 *2*	7 *1*	2280.36	(27/2$^+$)	2137.83	(25/2$^+$)	[M1+E2]	2.5 *10*	%Iγ=5.1 *7* α(K)exp=5.3 *11*; α(L)exp<2.6 *9*; α(M)exp<1.2; K/L>2.0 *8* α(K)=5.08 *8*; α(L)=1.477 *23*; α(M)=0.371 *6*; α(N+..)=0.1158 *18* α(N)=0.0953 *15*; α(O)=0.0187 *3*; α(P)=0.00180 *3* α(K)exp, α(L)exp, α(M)exp from 2009Dr03. L-conversion line contaminated by K lines of 267γ and 272γ, and M conversion line contaminated by K line of 279γ.
193.9 *3*	4 *1*	2474.53	(31/2$^-$)	2280.36	(27/2$^+$)	M2	7.04	%Iγ=2.9 *6*
230.9 *2*	6.2 *24*	1181.59	(17/2$^+$)	950.56	(15/2$^+$)	[M1+E2]	0.6 *3*	%Iγ=4.6 *17*
267.4 *3*	14 *3*	1607.45	(21/2$^+$)	1340.11	(19/2$^+$)	[M1+E2]	0.37 *21*	%Iγ=10.3 *20*
272.4 *2*	11 *2*	2137.83	(25/2$^+$)	1865.43	(25/2$^+$)	E0+M1+E2[#]	1.50 *20*	%Iγ=8.1 *12* α(exp)=1.50 *20* (2005Ba51)
279.7 *2*	5 *1*	1607.45	(21/2$^+$)	1327.25	(21/2$^+$)	[M1+E2]	0.33 *19*	%Iγ=3.7 *8*
323.5 *3*	3.6 *12*	1181.59	(17/2$^+$)	858.80	(17/2$^+$)	E0+M1+E2[#]	1.5 *5*	%Iγ=2.6 *9* α(exp)=1.5 *5* (2005Ba51)
325.0 *5*	4 *2*	2137.83	(25/2$^+$)	1813.0	(23/2$^+$)	[M1+E2]	0.22 *13*	%Iγ=2.9 *15*
336.7 *1*	58 *6*	2474.53	(31/2$^-$)	2137.83	(25/2$^+$)	E3	0.395	%Iγ=43 *9* α(K)exp=0.113 *16*; α(L)exp=0.181 *26*; α(M)exp<0.086; K/L=0.62 *12* α(K)=0.1324 *19*; α(L)=0.195 *3*; α(M)=0.0521 *8* α(N)=0.01325 *19*; α(O)=0.00242 *4*; α(P)=0.0001439 *21* α(K)exp, α(L)exp, α(M)exp from 2009Dr03. Other: α(exp)=0.30 *30* (2005Ba51). Additional information 2.
389.7 *2*	7 *2*	1340.11	(19/2$^+$)	950.56	(15/2$^+$)	[E2]	0.0552	%Iγ=5.1 *14*
425.9 *1*	55 *11*	1607.45	(21/2$^+$)	1181.59	(17/2$^+$)	[E2]	0.0438	%Iγ=40 *4* α(K)=0.0293 *5*; α(L)=0.01086 *16*; α(M)=0.00273 *4* α(N)=0.000691 *10*; α(O)=0.0001294 *19*; α(P)=9.40×10^{-6} *14*
468.4 *1*	79 *4*	1327.25	(21/2$^+$)	858.80	(17/2$^+$)	E2	0.0344	%Iγ=58 *20* α(K)exp=0.023 *3* (2009Dr03) α(K)=0.0239 *4*; α(L)=0.00797 *12*; α(M)=0.00199 *3* α(N)=0.000504 *7*; α(O)=9.49×10^{-5} *14*; α(P)=7.20×10^{-6} *10*
473.0 *5*	4 *2*	1813.0	(23/2$^+$)	1340.11	(19/2$^+$)	[E2]	0.0336	%Iγ=2.9 *15*
481.2 *2*	8 *3*	1340.11	(19/2$^+$)	858.80	(17/2$^+$)	[M1+E2]	0.08 *5*	%Iγ=5.9 *21*
503.8 *3*	10.0 *22*	1181.59	(17/2$^+$)	677.60	(13/2$^+$)	[E2]	0.0288	%Iγ=7.3 *16*
530.3 *1*	66 *14*	2137.83	(25/2$^+$)	1607.45	(21/2$^+$)	E2	0.0255	%Iγ=48 *22* α(K)exp=0.021 *4* (2009Dr03)

Continued on next page (footnotes at end of table)

^{189}Pb IT decay (22.2 μs) 2005Ba51,2009Dr03 (continued)

γ(^{189}Pb) (continued)

E_γ [†]	I_γ [‡&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α [@]	Comments
								α(K)=0.0184 *3*; α(L)=0.00543 *8*; α(M)=0.001343 *19* α(N)=0.000340 *5*; α(O)=6.45×10^{-5} *9*; α(P)=5.16×10^{-6} *8*
538.2 *1*	32 *3*	1865.43	(25/2$^+$)	1327.25	(21/2$^+$)	E2	0.0247	%Iγ=23.5 *19* α(K)exp=0.018 *3* (2009Dr03) α(K)=0.01780 *25*; α(L)=0.00519 *8*; α(M)=0.001284 *18* α(N)=0.000325 *5*; α(O)=6.17×10^{-5} *9*; α(P)=4.96×10^{-6} *7*
609.3 *3*	11 *2*	2474.53	(31/2$^-$)	1865.43	(25/2$^+$)	(E3)	0.0542	%Iγ=8.1 *14* α(K)exp=0.020 *6* (2009Dr03) α(K)=0.0331 *5*; α(L)=0.01582 *23*; α(M)=0.00406 *6* α(N)=0.001031 *15*; α(O)=0.000194 *3*; α(P)=1.478×10^{-5} *21*
637.4 *3*	8 *3*	677.60	(13/2$^+$)	40	(13/2$^+$)	E0+M1+E2[#]	0.49 *19*	%Iγ=5.9 *21* α(K)exp=0.41 *16* (2009Dr03) α(exp): α(K)exp multiplied by a factor of 1.2 to include higher shells. Other: α(exp)=0.40 *35* (2005Ba51).
810.8 *2*	40.0 *24*	2137.83	(25/2$^+$)	1327.25	(21/2$^+$)	E2	0.01012	%Iγ=29.4 *17* α(K)exp=0.012 *3* (2009Dr03) α(K)=0.00788 *11*; α(L)=0.001701 *24*; α(M)=0.000409 *6* α(N)=0.0001037 *15*; α(O)=2.01×10^{-5} *3*; α(P)=1.85×10^{-6} *3*
818.8 *1*	100	858.80	(17/2$^+$)	40	(13/2$^+$)	E2	0.00991	%Iγ=73 *3* α(K)exp=0.008 *2* (2009Dr03) α(K)=0.00773 *11*; α(L)=0.001660 *24*; α(M)=0.000399 *6* α(N)=0.0001012 *15*; α(O)=1.96×10^{-5} *3*; α(P)=1.81×10^{-6} *3*
910.6 *3*	12 *2*	950.56	(15/2$^+$)	40	(13/2$^+$)	[M1+E2]	0.015 *8*	%Iγ=8.8 *14*
1142.1 *6*	11 *2*	1181.59	(17/2$^+$)	40	(13/2$^+$)	[E2]	0.00516	%Iγ=8.1 *14*

[†] From 2005Ba51. Values from 2009Dr03 are in agreement, but given to only the nearest keV.

[‡] Values are from 2005Ba51 in out-of-beam measurements, and scaled down by a factor of five by the evaluators so as to renormalize to 100 for the intensity of the 818 γ-ray. Intensities per 100 decays of the isomer, deduced using GABS code, are listed as %Iγ in continuation records. Intensities from in-beam measurements are given in a separate dataset.

[#] Measured α(exp) implies E0 admixture.

[@] Theoretical values from BrIcc code with "Frozen Orbitals" approximation. For mult=[M1+E2], given value overlaps those for pure M1 and pure E2.

[&] For absolute intensity per 100 decays, multiply by 0.73 *3*.

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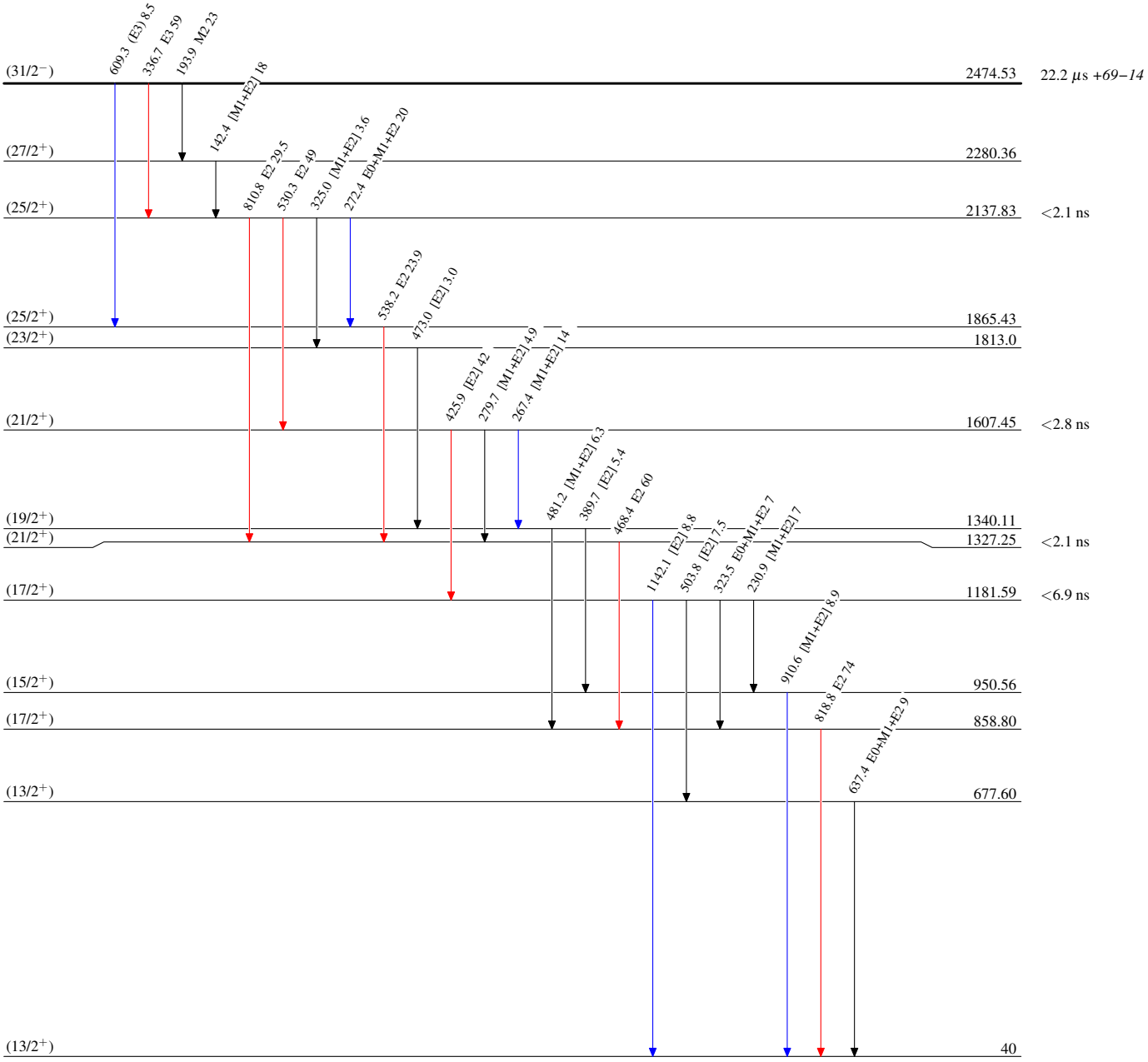
Decay Scheme

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

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{189}_{82}Pb_{107}$

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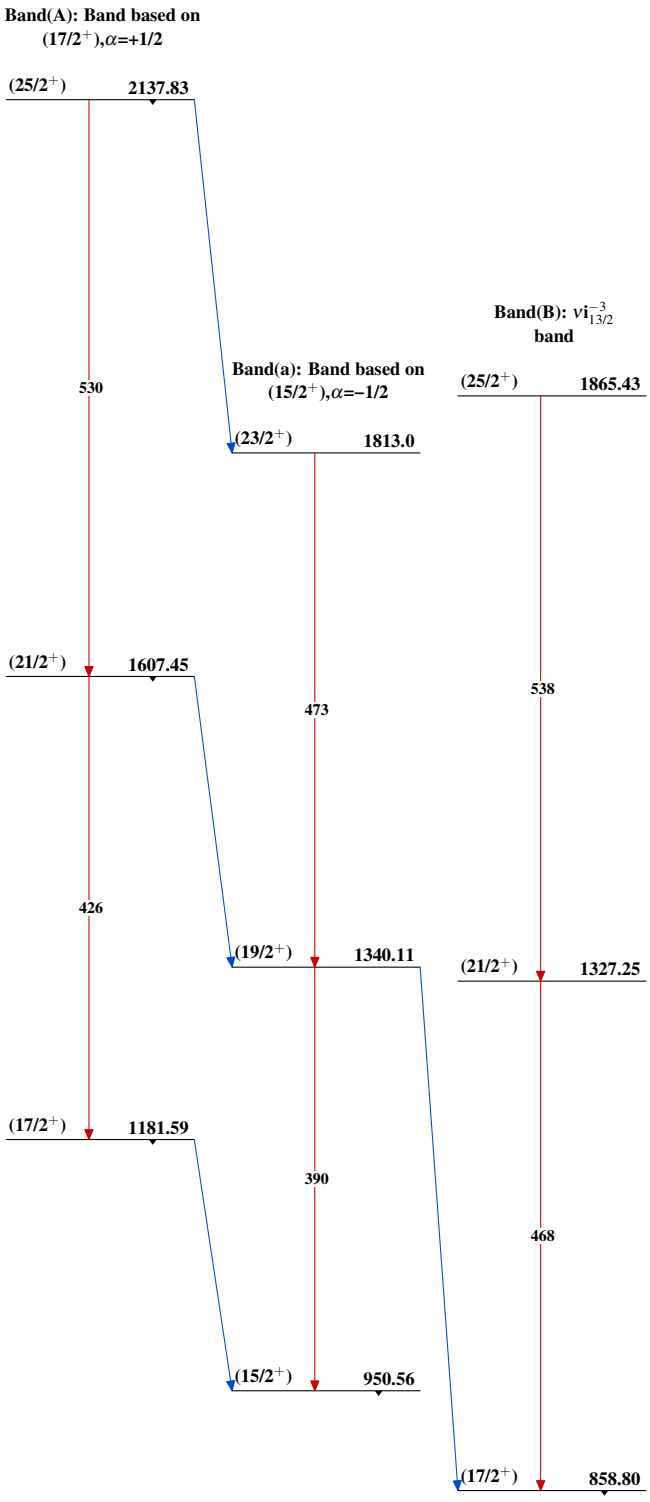

$^{189}_{82}Pb_{107}$