^{166}Er(^{28}Si,4nγ) 1998Dr06,2001Dr05,2005Wi10

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, [1] and Jun Chen[2]	NDS 169, 1 (2020)	15-Oct-2020

2001Dr05, 1998Dr06: E=140 MeV ^{28}Si beam was produced from the ANU 14UD pelletron accelerator. Target was enriched ^{166}Er on a gold foil. γ rays were detected with the CAESAR array of six Compton suppressed Ge detectors and two LEPS detectors. Measured Eγ, Iγ, γγ-coin, γ(t). Internal conversion coefficients were measured by 2001Dr05 using a superconducting-solenoidal spectrometer. Deduced levels, J, π, lifetimes, band structures, γ-ray multipolarities. Energy systematics of neighboring nuclei. Comparisons with theoretical calculations.

2005Wi10: E=143 MeV ^{28}Si beam was produced from the 88-inch cyclotron at BNL. Target was 1 mg/cm^2 layer of ^{166}Er on a Pb backing. γ rays were detected with the Gammasphere array of 102 Ge detectors. Measured Eγ, Iγ, γγ-coin, γγ(DCO). Deduced SD band.

^{190}Pb Levels

E(level)[†]	Jπ[#]	$T_{1/2}$	Comments
0.0[@]	0+		
773.9[@] 4	2+		
1163.0[&] 4	(2+)		
1229.1[@] 6	(4)+		
1521.3[&] 6	(4+)		
1735.9[@] 7	(6)+		
1905.6[c] 7	(5−)		
1937.2[&] 7	(6+)		
2251.8 8	(8)+		
2276.2 8	(8)+		
2406.4[c] 8	(7−)		
2463.2[&] 7	(8+)		
2606[‡e] 1	(7−)		
2614.8 8	(10)+	150 ns	$T_{1/2}$: measured by 1998Dr06 from γ(t).
2615+x[d]	(12+)	25 μs	E(level): x ≈ 120 from Fig. 1 of 1998Dr06. $T_{1/2}$: from mean lifetime τ=36 μs quoted by 1998Dr06 from an annual report by A.M. Baxter et al.: ANU-P/1352 (1997). This level probably decays to 2615, (10+) level, through a transition of energy x.
2622.8[c] 8	(9−)		
2658.2[a] 8	(11)−	7.2 μs 6	$T_{1/2}$: from 2001Dr05.
2825.3 9	(10+)		
2973[‡e] 1	(9−)		
3055.3[c] 10	(11−)		
3180.2[a] 9	(12−)		
3196.7 10	(12+)		
3238.3[c] 11	(12−)		
3350[‡e] 1	(11−)		
3435.3 14	(12+)		
3512.0+x[d] 10	(14+)		
3601.3[a] 9	(13−)		
4030.0+x[d] 15	(15+)		
4093.2[a] 10	(14−)		
4328.1[a] 10	(15−)		
4507.0+x[d] 18	(16+)		
4516.8[b] 11	(16+)	≈14 ns	
4865.2[b] 12	(17+)		

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^{166}Er(^{28}Si,4nγ) 1998Dr06,2001Dr05,2005Wi10 (continued)

^{190}Pb Levels (continued)

E(level)[†]	Jπ[#]	Comments
5111.3[b] 13	(18+)	
5330.3[b] 14	(19+)	
y[f]	J≈(10+)	Jπ: the interband SD band transitions of 310, 350, 389 and 428 seen in coincidence with a large number of low-lying transitions from (9−) to (12+) levels. Most of the decay out of the band is from the two lowest states in the SD band.
309.7+y[f] 8	J+2	
660.0+y[f] 11	J+4	
1048.8+y[f] 13	J+6	
1476.7+y[f] 16	J+8	
1942.7+y[f] 18	J+10	
2446.7+y[f] 20	J+12	
2985.7+y?[f] 23	J+14	

† From a least-squares fit to Eγ values, assuming Δ(Eγ)=0.5 keV for each γ ray.
‡ Level from 2005Wi10 only.
\# As proposed by 1998Dr06.
@ Band(A): g.s. band.
& Band(B): $K^\pi=2^+$ band.
a Seq.(D): γ cascade based on (11)−.
b Seq.(E): γ cascade based on (16+).
c Seq.(F): γ cascade based on (5−).
d Seq.(G): γ cascade based on (12+).
e Seq.(H): γ cascade based on (7−).
f Band(C): SD band (2005Wi10). Population intensity=0.5% of the reaction channel.

γ(^{190}Pb)

E_i(level)	J^π_i	Eγ[†]	E_f	J^π_f	Mult.[b]	α[c]	Comments
773.9	2+	774.0	0.0	0+	E2	0.01113	α(K)exp=0.0077 7; α(L)exp=0.0023 4 α(K)=0.00862 12; α(L)=0.00191 3; α(M)=0.000461 7 α(N)=0.0001168 17; α(O)=2.26×10^{-5} 4; α(P)=2.05×10^{-6} 3
1163.0	(2+)	389.1	773.9	2+			
		1162.9	0.0	0+			
1229.1	(4)+	455.3	773.9	2+	E2	0.0369	α(K)exp=0.0260 18; α(L)exp=0.0084 8 α(K)=0.0254 4; α(L)=0.00873 13; α(M)=0.00218 3 α(N)=0.000553 8; α(O)=0.0001039 15; α(P)=7.78×10^{-6} 11
1521.3	(4+)	292[‡]	1229.1	(4)+			
		358.2	1163.0	(2+)			
		748[‡]	773.9	2+			
1735.9	(6)+	506.8	1229.1	(4)+	E2	0.0284	α(K)exp=0.0186 12; α(L)exp=0.0068 6 α(K)=0.0202 3; α(L)=0.00623 9; α(M)=0.001547 22 α(N)=0.000392 6; α(O)=7.41×10^{-5} 11; α(P)=5.81×10^{-6} 9
1905.6	(5−)	676.5	1229.1	(4)+			
1937.2	(6+)	415.8	1521.3	(4+)			
		708[‡]	1229.1	(4)+			
2251.8	(8)+	515.9	1735.9	(6)+	E2	0.0273	α(K)exp=0.0212 30; α(L)exp=0.0082 16

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^{166}Er(^{28}Si,4nγ) 1998Dr06,2001Dr05,2005Wi10 (continued)

γ(^{190}Pb) (continued)

E$_i$(level)	J^π_i	E$_\gamma$[†]	I$_\gamma$	E$_f$	J^π_f	Mult.[b]	α[c]	Comments
								α(K)=0.0194 3; α(L)=0.00590 9; α(M)=0.001463 21 α(N)=0.000370 6; α(O)=7.01×10^{-5} 10; α(P)=5.54×10^{-6} 8
2276.2	(8)$^+$	338.8	[@]	1937.2	(6$^+$)			
		540.4	[@]	1735.9	(6)$^+$	E2	0.0244	α(K)exp=0.0194 12; α(L)exp=0.0049 10 α(K)=0.01765 25; α(L)=0.00513 8; α(M)=0.001268 18 α(N)=0.000321 5; α(O)=6.09×10^{-5} 9; α(P)=4.91×10^{-6} 7
2406.4	(7$^-$)	500.9	[@]	1905.6	(5$^-$)			
		670.6	[&]	1735.9	(6)$^+$			
2463.2	(8$^+$)	525.9	[a]	1937.2	(6$^+$)			
		727.4	[a]	1735.9	(6)$^+$			
2606	(7$^-$)	700[‡]		1905.6	(5$^-$)			
		870[‡]		1735.9	(6)$^+$			
2614.8	(10)$^+$	338.6	[@]	2276.2	(8)$^+$	E2	0.0813	α(K)exp=0.049 4; α(L)exp=0.0269 24 α(K)=0.0491 7; α(L)=0.0241 4; α(M)=0.00616 9 α(N)=0.001557 22; α(O)=0.000288 4; α(P)=1.87×10^{-5} 3
		362.9		2251.8	(8)$^+$			
2622.8	(9$^-$)	216.4	[a]	2406.4	(7$^-$)			
		370.9	[&]	2251.8	(8)$^+$			
2658.2	(11)$^-$	43.2	22[#] 6	2614.8	(10)$^+$			
		382.0	19.8[#] 22	2276.2	(8)$^+$	(E3)	0.245	α(K)exp=0.11 3 α(K)=0.0979 14; α(L)=0.1090 16; α(M)=0.0289 4 α(N)=0.00735 11; α(O)=0.001350 19; α(P)=8.46×10^{-5} 12
		406.5	58[#] 4	2251.8	(8)$^+$	E3	0.195	α(K)exp=0.097 12; α(L)exp=0.083 8 α(K)=0.0844 12; α(L)=0.0826 12; α(M)=0.0218 3 α(N)=0.00555 8; α(O)=0.001021 15; α(P)=6.57×10^{-5} 10 K/L=1.17 18.
2825.3	(10$^+$)	167[d]	[a]	2658.2	(11)$^-$			
		211[d]	[a]	2614.8	(10)$^+$			
		549	[a]	2276.2	(8)$^+$			
		573	[a]	2251.8	(8)$^+$			
2973	(9$^-$)	367[‡]		2606	(7$^-$)			
		566[‡]		2406.4	(7$^-$)			
3055.3	(11$^-$)	432.5	[&]	2622.8	(9$^-$)			
3180.2	(12$^-$)	522.0	[&]	2658.2	(11)$^-$			
3196.7	(12$^+$)	581.9	[a]	2614.8	(10)$^+$			
3238.3	(12$^-$)	183.0	[a]	3055.3	(11$^-$)			
3350	(11$^-$)	377[‡]		2973	(9$^-$)			
		728[‡]		2622.8	(9$^-$)			
3435.3	(12$^+$)	610	[a]	2825.3	(10$^+$)			
3512.0+x	(14$^+$)	897	[a]	2615+x	(12$^+$)			
3601.3	(13$^-$)	421.2	[&]	3180.2	(12$^-$)			
		943.1	[a]	2658.2	(11)$^-$			

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^{166}Er(^{28}Si,4nγ) 1998Dr06,2001Dr05,2005Wi10 (continued)

γ(^{190}Pb) (continued)

E_i(level)	J_i^π	E_γ[†]	E_f	J_f^π	Mult.[b]	Comments
4030.0+x	(15$^+$)	518	3512.0+x	(14$^+$)		
4093.2	(14$^-$)	491.8	3601.3	(13$^-$)		
		913.0[d]	3180.2	(12$^-$)		
4328.1	(15$^-$)	234.7	4093.2	(14$^-$)		
		726.9	3601.3	(13$^-$)		
4507.0+x	(16$^+$)	477	4030.0+x	(15$^+$)		
4516.8	(16$^+$)	188.7	4328.1	(15$^-$)		
4865.2	(17$^+$)	348.4	4516.8	(16$^+$)		
5111.3	(18$^+$)	246.1	4865.2	(17$^+$)		
5330.3	(19$^+$)	219.0	5111.3	(18$^+$)		
309.7+y	J+2	309.7 *8*	y	J≈(10$^+$)	(E2)	Mult.: DCO=1.9 *3*.
660.0+y	J+4	350.3 *7*	309.7+y	J+2	(E2)	Mult.: DCO=1.6 *3*.
1048.8+y	J+6	388.8 *8*	660.0+y	J+4	(E2)	Mult.: DCO=1.3 *1*.
1476.7+y	J+8	427.9 *8*	1048.8+y	J+6	(E2)	Mult.: DCO=1.3 *2*.
1942.7+y	J+10	466.0 *9*	1476.7+y	J+8		
2446.7+y	J+12	504 *1*	1942.7+y	J+10		E_γ: strongly contaminated by a low-lying 504γ in ^{190}Pb.
2985.7+y?	J+14	539[d] *1*	2446.7+y	J+12		

† From 1998Dr06, and for SD band values are from 2005Wi10.
‡ From level scheme Fig. 4 of 2005Wi10. Intensity is weak as indicated by the thickness of the arrows in the level scheme.
# Branching ratio from 2001Dr05.
@ Strong gamma ray.
& Medium intensity gamma ray.
a Weak gamma ray.
b From ce data of 2001Dr05, and for SD band values are from $\gamma\gamma$(DCO) in 2005Wi10.
c 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.
d Placement of transition in the level scheme is uncertain.

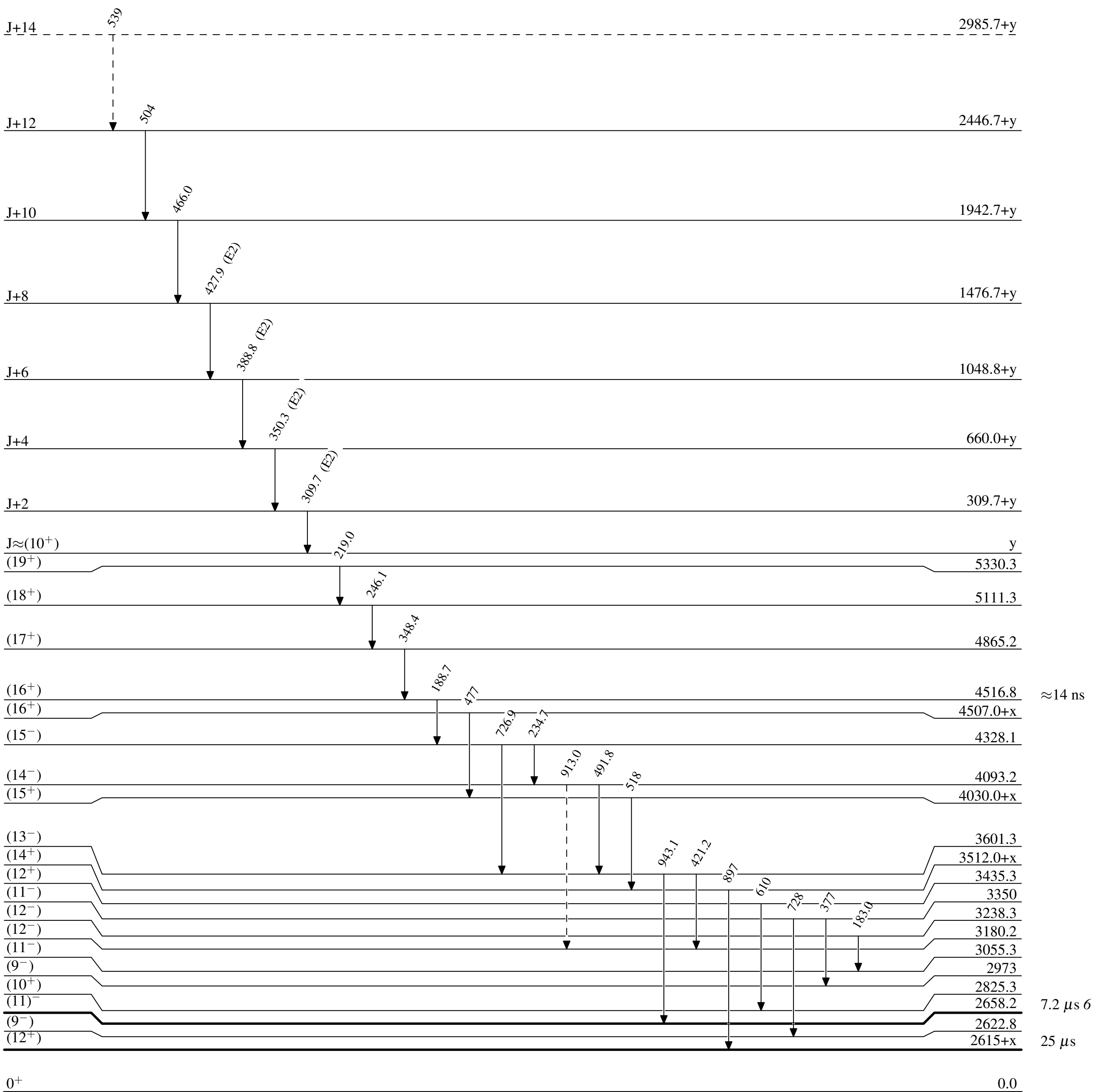
$^{166}Er(^{28}Si,4n\gamma)$ 1998Dr06,2001Dr05,2005Wi10

Legend

Level Scheme

Intensities: % photon branching from each level

γ Decay (Uncertain)

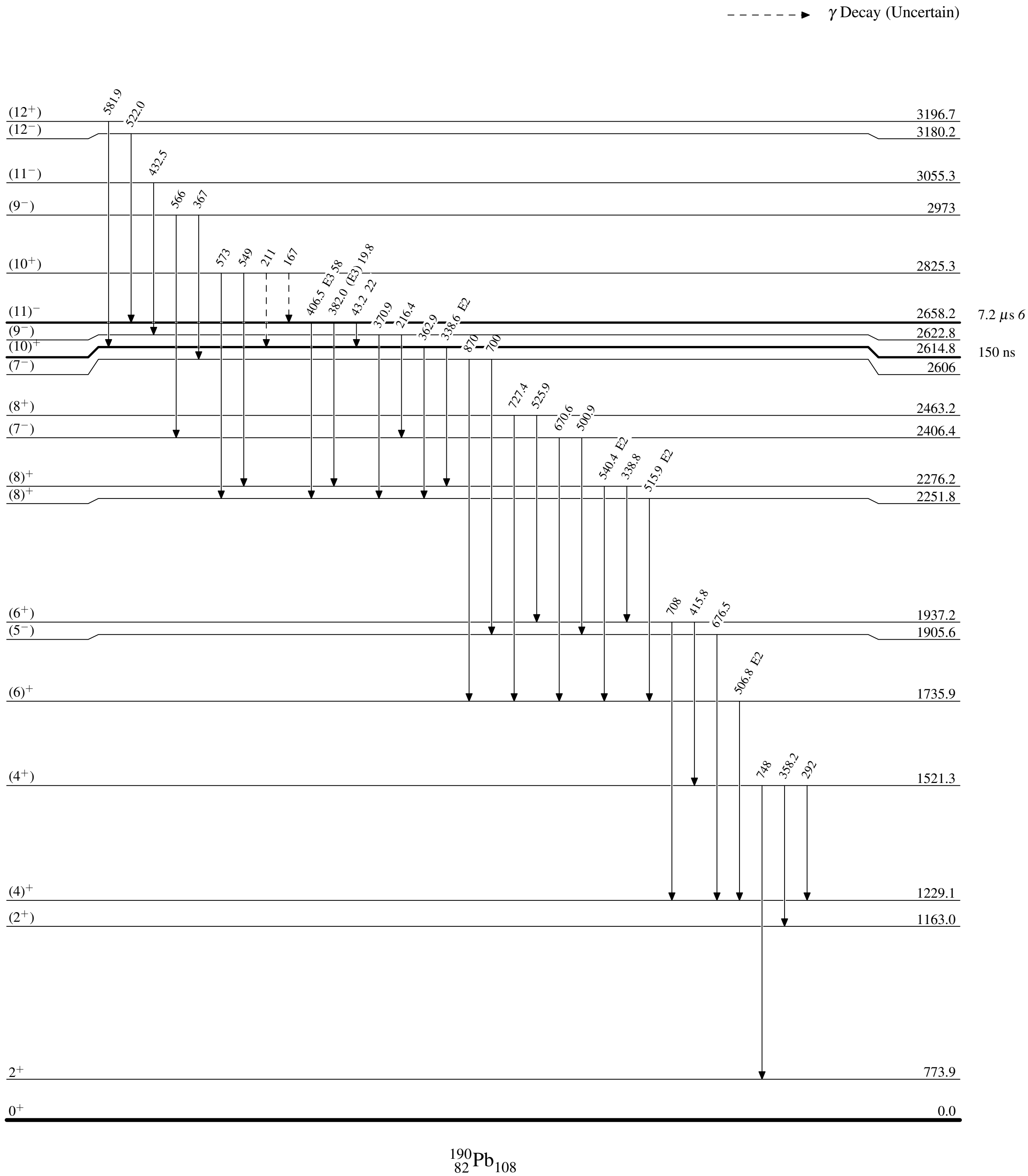


$^{190}_{82}Pb_{108}$

$^{166}Er(^{28}Si,4n\gamma)$ 1998Dr06,2001Dr05,2005Wi10

Level Scheme (continued)

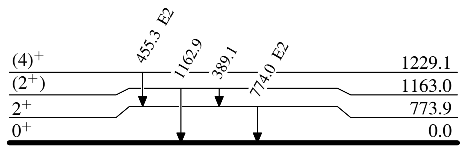
Intensities: % photon branching from each level



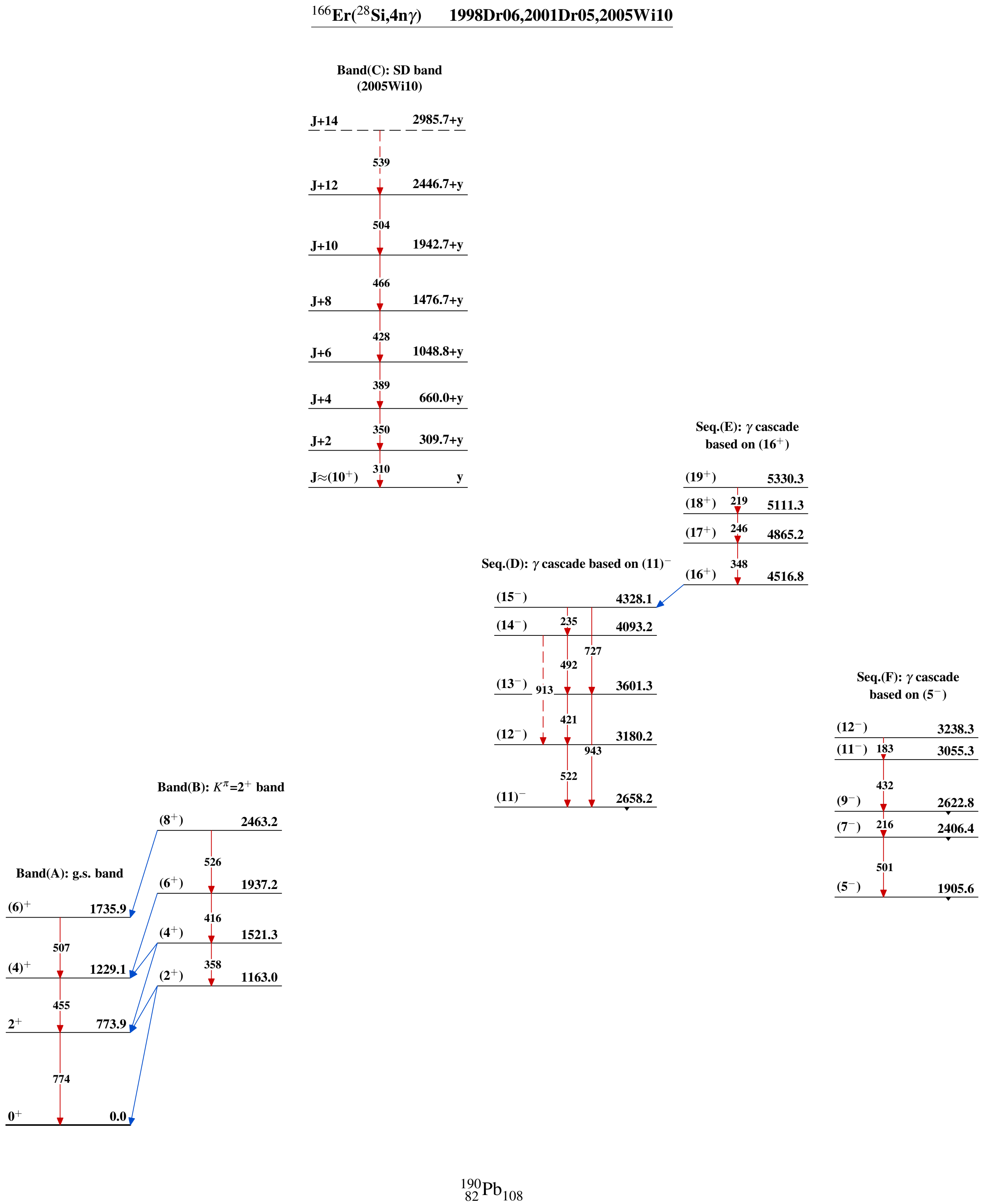
^{166}Er(^{28}Si,4nγ) 1998Dr06,2001Dr05,2005Wi10

Level Scheme (continued)

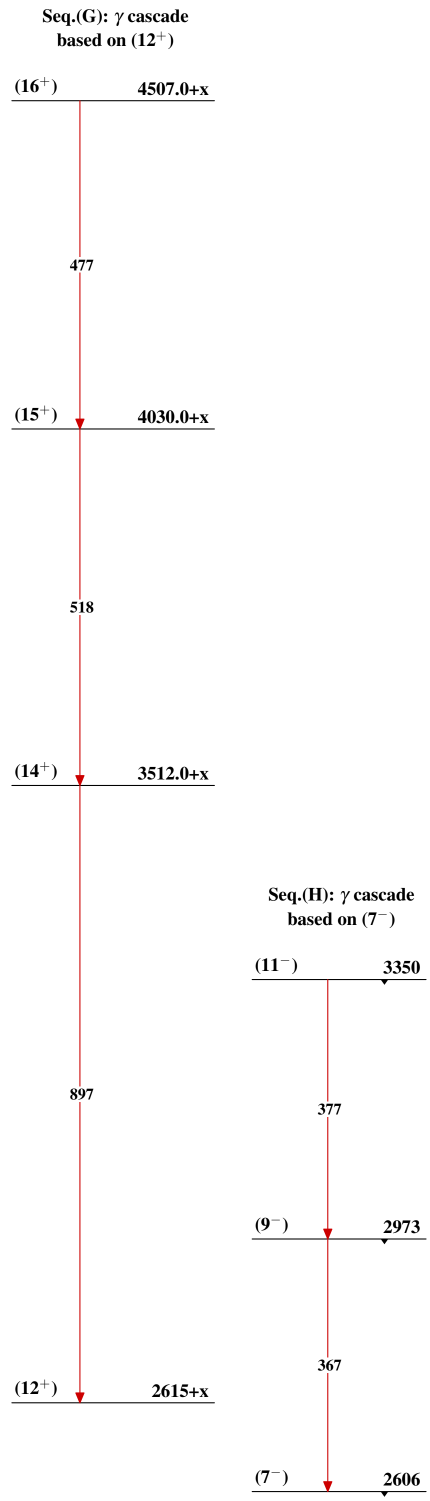
Intensities: % photon branching from each level



$^{190}_{82}Pb_{108}$


166Er(28Si,4nγ) 1998Dr06,2001Dr05,2005Wi10
Band(C): SD band
(2005Wi10)
J+14 2985.7+y
539
J+12 2446.7+y
504
J+10 1942.7+y
466
J+8 1476.7+y
428
J+6 1048.8+y
389
J+4 660.0+y
350
J+2 309.7+y
310
J≈(10+) y
Seq.(E): γ cascade
based on (16+)
(19+) 5330.3
(18+) 219 5111.3
(17+) 246 4865.2
348
(16+) 4516.8
Seq.(D): γ cascade based on (11)−
(15−) 4328.1
(14−) 235 4093.2
727
492
(13−) 913 3601.3
421
(12−) 3180.2
943
522
(11)− 2658.2
Seq.(F): γ cascade
based on (5−)
(12−) 3238.3
(11−) 183 3055.3
432
(9−) 2622.8
(7−) 216 2406.4
501
(5−) 1905.6
Band(B): Kπ=2+ band
(8+) 2463.2
526
(6+) 1937.2
416
(4+) 1521.3
358
(2+) 1163.0
Band(A): g.s. band
(6)+ 1735.9
507
(4)+ 1229.1
455
2+ 773.9
774
0+ 0.0
190 82Pb108

$^{166}Er(^{28}Si,4n\gamma)$ 1998Dr06,2001Dr05,2005Wi10 (continued)



$^{190}_{82}Pb_{108}$