^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 121, 561 (2014)	31-Mar-2014

Other: ED=9 MeV (1971El01).
1973Pr11: measured Eγ, Iγ, $\gamma\gamma$ coin, pγ coin, γ(t) pulsed beam. Detectors: semi,Ge(Li).
1973Ca11: measured Eγ, pγ coin, γ-ray branching ratios. Detectors: semi,Ge(Li).

^{210}Bi Levels

The dominant configuration of 7^-,5^- states is ((P,1h$_{9/2}$) (N,2g$_{9/2}$)).

E(level)[†]	J$^\pi$[#]	T$_{1/2}$	Comments
0.0	1^-		
46.539 *1*	0^-		
271.1 *3*	9^-	3.0×10^6 y *1*	E(level): other value: 270.7 (1971El01).
319.5 *2*	2^-		
347.5 *2*	3^-		Branching: Ti(347γ)/Ti(28γ)=0.020 *4* (1971El01).
433.3 *3*	7^-	59.0 ns *15*	T$_{1/2}$: 162γ(t) pulsed beam (1973Pr11). Other value: 58 ns *6* (1971El01).
439.0 *3*	5^-	38.0 ns *10*	T$_{1/2}$: from 320γ(t) pulsed beam (1973Pr11). Other value: 38 ns *6* (1971El01). Branching: Ti(5.8γ)/Ti(91γ)=0.17 predicted (1973Pr11).
502.3 *3*	4^-	<1.4 ns	T$_{1/2}$: from 1971El01.
549.6 *3*	6^-	<1.4 ns	T$_{1/2}$: from 1971El01. Branching: Iγ(110γ)/Iγ(116γ)=1.00 *15* (1971El01), 0.88 *5* (1973Pr11).
563[‡]	1^-		Branching: Iγ(517γ)/Iγ(563γ)=0.43 *14* (1973Ca11).
582.1 *3*	8^-		Branching: Iγ(149γ)/Iγ(311γ)=0.35 *3* (1971El01), 0.41 *6* (1973Pr11).
668.8 *6*	10^-		
915.4 *3*	8^-		Branching: Iγ(482γ)/Iγ(644γ)=0.43 *3* (1973Pr11), 0.47 *6* (1973Ca11).
972[‡]	(2^-)		Branching: Iγ(972γ)/Iγ(408γ)=0.35 *14* (1973Ca11).
993[‡]	(3^+)		Branching: Iγ(673γ)/Iγ(645γ)=0.72 *24* (1973Ca11).
1184.0 *5*	(8^-)		Branching: Iγ(913γ)/Iγ(602γ)=0.67 *17* (1973Ca11).
1209[‡]	(6^-)		Branching: Iγ(776γ)/Iγ(770γ)=1.00 *15* (1973Ca11) does not agree with γ-Branching to 3^-,4^-,5^- states in (n,γ) E=thermal.
1248[‡]	(4^-)		Branching: Iγ(900γ)/Iγ(810γ)=0.35 *20* (1973Ca11).
1338[‡]	(6^-)		Branching: Iγ(789γ)/Iγ(905γ)≈0.64 (1973Ca11).
1375[‡]	(3^-)		
1382[‡]	(7^-)		Branching: Iγ(949γ)/Iγ(833γ)/Iγ(800γ)/Iγ(467γ)= 47 *23*/42 *20*/100/33 *15* (1973Ca11).
1464[‡]	(5^-)		Branching: Iγ(255γ)/Iγ(215γ)=0.85 *22* (1973Ca11).
1477 *1*	(9^-)		
1585.2 *2*	(2^-)		Branching: Iγ(1238γ)/Iγ(1585γ)=0.93 *7* (1973Pr11), 0.45 *11* (1973Ca11).
1924.7 *2*	(2^-)		Branching: Iγ(339γ)/Iγ(1361γ)/Iγ(1577γ)/Iγ(1605γ)/Iγ(1925γ)=54 *15*/64 *16*/54 *24*/100/48 *13* (1973Pr11), 7 *4*/34 *7*/–/100/29 *6* (1973Ca11).
1980.2 *3*	(7^-)		Branching: Iγ(1065γ)/Iγ(1398γ)/Iγ(1430γ)/Iγ(1547γ)/Iγ(1709γ)=29 *2*/44 *2*/53 *2*/16 *2*/100 (1973Pr11), 30 *6*/51 *6*/49 *6*/40 *6*/100 (1973Ca11).
1984.3 *3*	(3^-)		
1989.9 *3*	(3^-)		
2033.9 *3*	(5^-)		Branching: Iγ(1484γ)/Iγ(1531γ)/Iγ(1595γ)/Iγ(1600γ)/Iγ(1686γ)=100/≤35/40 *4*/38 *5*/21 *2* (1973Pr11), 100/55 *13*/55 *13*/–/– (1973Ca11).
2080.9 *2*	(4^-)		J$^\pi$: 3^- (1973Ca11), 4^- (1973Pr11). Other: 4^- via (d,p). Branching: Iγ(495γ)/Iγ(832γ)/Iγ(1733γ)/Iγ(1761γ)=<500/–/100/87 *17* (1973Pr11), 60 *12*/40 *13*/100/74 *15* (1973Ca11).
2108.1 *3*	(6^-)		Branching: Iγ(1526γ)/Iγ(1558γ)/Iγ(1669γ)/Iγ(1675γ)=27 *2*/28 *2*/100/47 *5* (1973Pr11), 35 *6*/23 *5*/100/– (1973Ca11).

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^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11 (continued)

^{210}Bi Levels (continued)

E(level)[†]	J$^{\pi}$[#]	Comments
2177.4 *3*	(4$^-$)	Branching: Iγ(1830γ)/Iγ(1738γ)=0.93 *11* (1973Pr11), 1.27 *26* (1973Ca11).
2237.4 *3*	(6$^-$)	Branching: Iγ(1798γ)/Iγ(1804γ)=0.90 *5* (1973Pr11), 1.00 *10* (1973Ca11).
2524.6 *3*	(4$^-$)	Branching: Iγ(2022γ)/Iγ(2086γ)/Iγ(2177γ)=100/41 *2*/38 *5* (1973Pr11), 100/48 *8*/52 *8* (1973Ca11).
2578.8 *3*	(5$^-$)	Branching: Iγ(2029γ)/Iγ(2076γ)/Iγ(2140γ)=100/17 *1*/5.1 *4* (1973Pr11), 100/15 *3*/4 *2* (1973Ca11).
2610.4 *5*	(4$^-$)	
2736.5 *4*	(8$^-$)	
2764.3 *5*	(3$^+$)	
2840.9 *4*	(6$^-$)	
2967.5 *9*	(4$^-$)	
3038.3 *4*	(3$^-$)	
3107.4 *5*		J$^{\pi}$: (5$^-$) in Adopted Levels.
3141.2 *4*	(6$^-$)	
3182.1 *5*	(4$^-$)	
3209.9 *6*	(5$^-$)	J$^{\pi}$: (5$^-$) in Adopted Levels.
3245.1 *4*	(7$^-$)	

[†] Deduced by evaluator from a least-squares fit to γ-ray energies, except otherwise noted.
[‡] From 1973Ca11.
[#] From Adopted Levels.

γ(^{210}Bi)

E$_\gamma$[†]	I$_\gamma$[#]	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Mult.[@]	Comments
(5.8 *CA*)		439.0	5$^-$	433.3	7$^-$	[E2]	E$_\gamma$: unobserved; inferred from $\gamma\gamma$-coin spectra (1973Pr11).
(28.1 *CA*)	0.40 *CA*	347.5	3$^-$	319.5	2$^-$	[M1]	E$_\gamma$: not directly observed; Iγ calc from level I(γ+ce)-Branching ratio (1971El01).
46.539 *1*		46.539	0$^-$	0.0	1$^-$	M1	E$_\gamma$,Mult.: from Adopted Gammas.
91.2		439.0	5$^-$	347.5	3$^-$	[E2]	E$_\gamma$: from (n,γ) (1971Mo03). Other value: 90.4 *10* (1971El01).
110.3 *3*	73.7 *30*	549.6	6$^-$	439.0	5$^-$		E$_\gamma$: other value: 110.7 (1971El01).
116.2 *3*	83.5 *30*	549.6	6$^-$	433.3	7$^-$		E$_\gamma$: other value: 116.1 (1971El01).
148.7 *3*	44.2 *24*	582.1	8$^-$	433.3	7$^-$	[M1]	E$_\gamma$: others: 1971El01.
154.6 *3*	187 *10*	502.3	4$^-$	347.5	3$^-$		E$_\gamma$: other value: 154.7 (1971El01).
161.9 *3*	885 *20*	433.3	7$^-$	271.1	9$^-$	[E2]	E$_\gamma$: other value: 162.3 (1971El01).
215.5[‡]		1464	(5$^-$)	1248	(4$^-$)		
255[‡]		1464	(5$^-$)	1209	(6$^-$)		
310.8 *3*	108 *13*	582.1	8$^-$	271.1	9$^-$	[M1]	E$_\gamma$: other value: 311.6 (1971El01).
319.4 *3*	2220 *50*	319.5	2$^-$	0.0	1$^-$	[M1]	E$_\gamma$: other value: 320.3 (1971El01).
339.4 *3*	12.9 *19*	1924.7	(2$^-$)	1585.2	(2$^-$)		
347.5 *3*	31.5 *17*	347.5	3$^-$	0.0	1$^-$	[E2]	E$_\gamma$: other value: 348.3 (1971El01).
397.7 *5*	22.6 *20*	668.8	10$^-$	271.1	9$^-$	[M1]	E$_\gamma$: other value: 398 *1* (1973Ca11).
403[‡]		1375	(3$^-$)	972	(2$^-$)		
409[‡]		972	(2$^-$)	563	1$^-$		
466.6[‡]		1382	(7$^-$)	915.4	8$^-$		
481.9 *4*	25.8 *12*	915.4	8$^-$	433.3	7$^-$		
495.6 *5*	16 *CA*	2080.9	(4$^-$)	1585.2	(2$^-$)		
516.5[‡]		563	1$^-$	46.539	0$^-$		
563[‡]		563	1$^-$	0.0	1$^-$		
601.9 *5*	19.9 *14*	1184.0	(8$^-$)	582.1	8$^-$		

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^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11 (continued)

$\gamma(^{210}Bi)$ (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
644.2 *4*	60 *2*	915.4	8^-	271.1	9^-		
645.5[‡]		993	(3^+)	347.5	3^-		
673.5[‡]		993	(3^+)	319.5	2^-		
770[‡]		1209	(6^-)	439.0	5^-		
775.7[‡]		1209	(6^-)	433.3	7^-		
788.4[‡]		1338	(6^-)	549.6	6^-		
799.9[‡]		1382	(7^-)	582.1	8^-		
808.6	<127	1477	(9^-)	668.8	10^-		I_γ: multiplet.
809.5[‡]		1248	(4^-)	439.0	5^-		
832.4[‡]		1382	(7^-)	549.6	6^-		
832.4[‡]	11 *CA*	2080.9	(4^-)	1248	(4^-)		
901[‡]		1248	(4^-)	347.5	3^-		
904.7[‡]		1338	(6^-)	433.3	7^-		
913[‡] *1*	13 *CA*	1184.0	(8^-)	271.1	9^-		
948.7[‡]		1382	(7^-)	433.3	7^-		
972[‡]		972	(2^-)	0.0	1^-		
1064.7 *2*	35.8 *19*	1980.2	(7^-)	915.4	8^-		
1237.7 *3*	31.3 *16*	1585.2	(2^-)	347.5	3^-		
1361.4 *3*	15.3 *15*	1924.7	(2^-)	563	1^-		
1398.1 *2*	54.1 *18*	1980.2	(7^-)	582.1	8^-		
1430.3 *2*	64.8 *20*	1980.2	(7^-)	549.6	6^-		
1482.0 *4*	36 *9*	1984.3	(3^-)	502.3	4^-		
1484.3 *3*	124 *9*	2033.9	(5^-)	549.6	6^-		
1525.9 *2*	29.8 *19*	2108.1	(6^-)	582.1	8^-	[E2]	
1531.3	≤43	2033.9	(5^-)	502.3	4^-		
1544.6 *20*	20 *5*	1984.3	(3^-)	439.0	5^-	[E2]	
1547.2 *5*	19.7 *25*	1980.2	(7^-)	433.3	7^-		
1550.8 *3*	44.4 *26*	1989.9	(3^-)	439.0	5^-	[E2]	
1558.5 *2*	31.0 *20*	2108.1	(6^-)	549.6	6^-		
1577.5 *3*	13 *5*	1924.7	(2^-)	347.5	3^-		
1585.3 *4*	33.5 *21*	1585.2	(2^-)	0.0	1^-		
1594.9 *2*	49.3 *23*	2033.9	(5^-)	439.0	5^-		
1600.2 *2*	47 *5*	2033.9	(5^-)	433.3	7^-	[E2]	
1604.8 *3*	24 *5*	1924.7	(2^-)	319.5	2^-		
1642.6 *4*	96 *14*	1989.9	(3^-)	347.5	3^-		
1664.8 *3*	44 *3*	1984.3	(3^-)	319.5	2^-		
1669.2 *2*	112 *4*	2108.1	(6^-)	439.0	5^-		
1675.2 *8*	11 *6*	2177.4	(4^-)	502.3	4^-		
1675.5 *2*	53 *6*	2108.1	(6^-)	433.3	7^-		
1686.5 *3*	25.8 *21*	2033.9	(5^-)	347.5	3^-	[E2]	
1709.3 *2*	123 *3*	1980.2	(7^-)	271.1	9^-	[E2]	
1733.3 *2*	27 *3*	2080.9	(4^-)	347.5	3^-		
1738.3 *2*	29.6 *26*	2177.4	(4^-)	439.0	5^-		
1761.5 *2*	23.5 *40*	2080.9	(4^-)	319.5	2^-		
1798.4 *2*	57.9 *24*	2237.4	(6^-)	439.0	5^-		
1804.1 *2*	64.2 *25*	2237.4	(6^-)	433.3	7^-		
1829.9 *2*	27.4 *21*	2177.4	(4^-)	347.5	3^-		
1924.9 *5*	11.6 *17*	1924.7	(2^-)	0.0	1^-		
2022.2 *3*	170 *8*	2524.6	(4^-)	502.3	4^-		
2029.1 *3*	502 *8*	2578.8	(5^-)	549.6	6^-		
2076.4 *3*	85 *3*	2578.8	(5^-)	502.3	4^-		
2085.7 *3*	69.4 *19*	2524.6	(4^-)	439.0	5^-		

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^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11 (continued)

$\gamma(^{210}Bi)$ (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Comments
2140.3 *5*	25.8 *18*	2578.8	(5^-)	439.0	5^-	
2154.8 *10*	4 *2*	2736.5	(8^-)	582.1	8^-	
2171.4 *4*	28 *7*	2610.4	(4^-)	439.0	5^-	
2177.0 *3*	64 *8*	2524.6	(4^-)	347.5	3^-	
2261.9 *7*	35 *6*	2764.3	(3^+)	502.3	4^-	
2291.1 *5*	75.6 *24*	2840.9	(6^-)	549.6	6^-	
2402.0 *5*	35.3 *22*	2840.9	(6^-)	439.0	5^-	
2407.7 *5*	126 *3*	2840.9	(6^-)	433.3	7^-	
2416.9 *7*	90	2764.3	(3^+)	347.5	3^-	
2465.3 *3*	29.6 *23*	2736.5	(8^-)	271.1	9^-	
2525.1 *5*	40 *5*	3107.4		582.1	8^-	E_γ: Not adopted. Placement would yield (5^-) to 8^- transition.
2528.5 *9*	17 *5*	2967.5	(4^-)	439.0	5^-	
2535.6 *5*	53 *2*	3038.3	(3^-)	502.3	4^-	
2591.3 *4*	96.3 *24*	3141.2	(6^-)	549.6	6^-	
2599.3 *5*	49 *2*	3038.3	(3^-)	439.0	5^-	
2674.2 *5*	18.5 *21*	3107.4		433.3	7^-	
2679.7 *5*	67.7 *24*	3182.1	(4^-)	502.3	4^-	
2691.1 *5*	69 *4*	3038.3	(3^-)	347.5	3^-	
2695.9 *5*	64 *3*	3245.1	(7^-)	549.6	6^-	
2702.1 *10*	64 *14*	3141.2	(6^-)	439.0	5^-	
2708.2 *4*	144 *7*	3141.2	(6^-)	433.3	7^-	
2743.3	63	3182.1	(4^-)	439.0	5^-	
2805.8 *6*	33 *3*	3245.1	(7^-)	439.0	5^-	
2811.1 *7*	20 *3*	3245.1	(7^-)	433.3	7^-	
2834.5 *10*	22.5 *16*	3182.1	(4^-)	347.5	3^-	
2862.3 *8*	40	3209.9	(5^-)	347.5	3^-	
2890.4 *8*	11.8 *16*	3209.9	(5^-)	319.5	2^-	E_γ: Not adopted. Placement would yield a (5^-) to 2^- transition.

[†] From 1973Pr11, unless otherwise specified.
[‡] Placement in 1973Ca11. γ-ray energy calculated from level energy difference and recoil energy subtraction. These γ rays were not considered in the least-squares fit.
[#] Relative photon intensity for ED=8.0 MeV, and θ=55° (1973Pr11), except otherwise noted.
[@] Inferred from ΔJ(initial to final states), Iγ(prompt vs delayed), and Hf(γ) syst.

^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11

Level Scheme

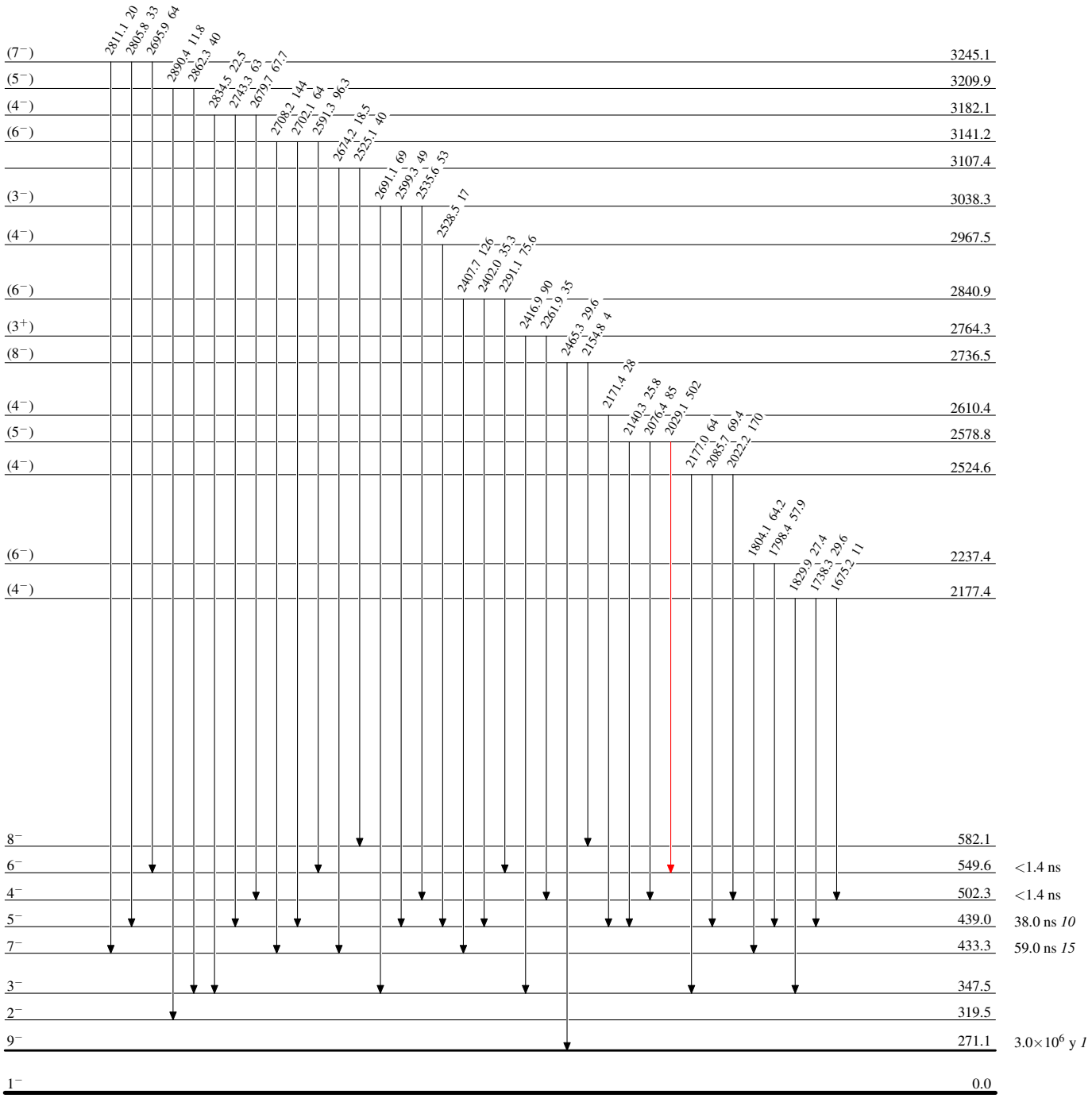
Intensities: Relative I_γ

Legend

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

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

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

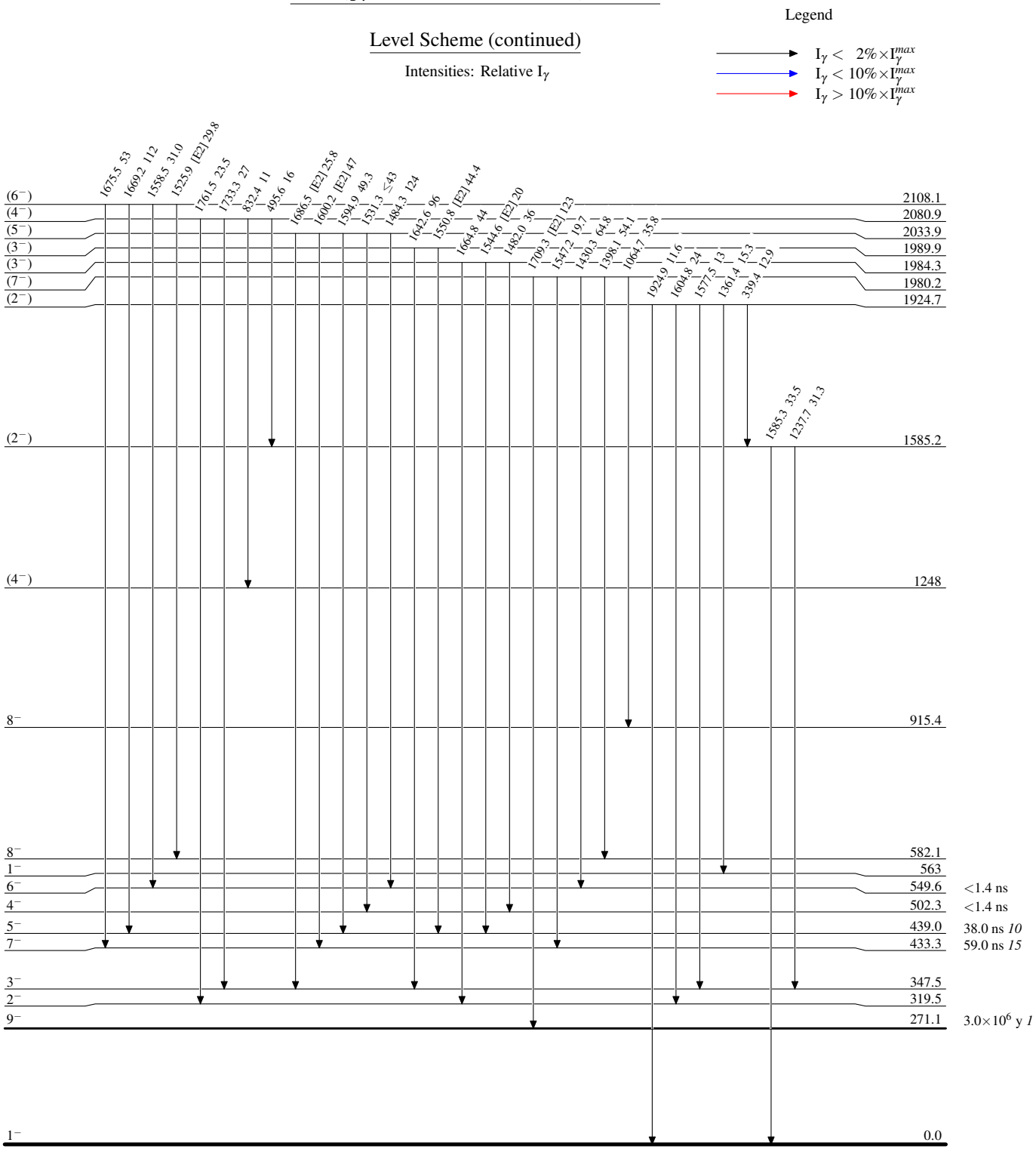


$^{210}_{83}Bi_{127}$

^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11

Level Scheme (continued)

Intensities: Relative I_γ



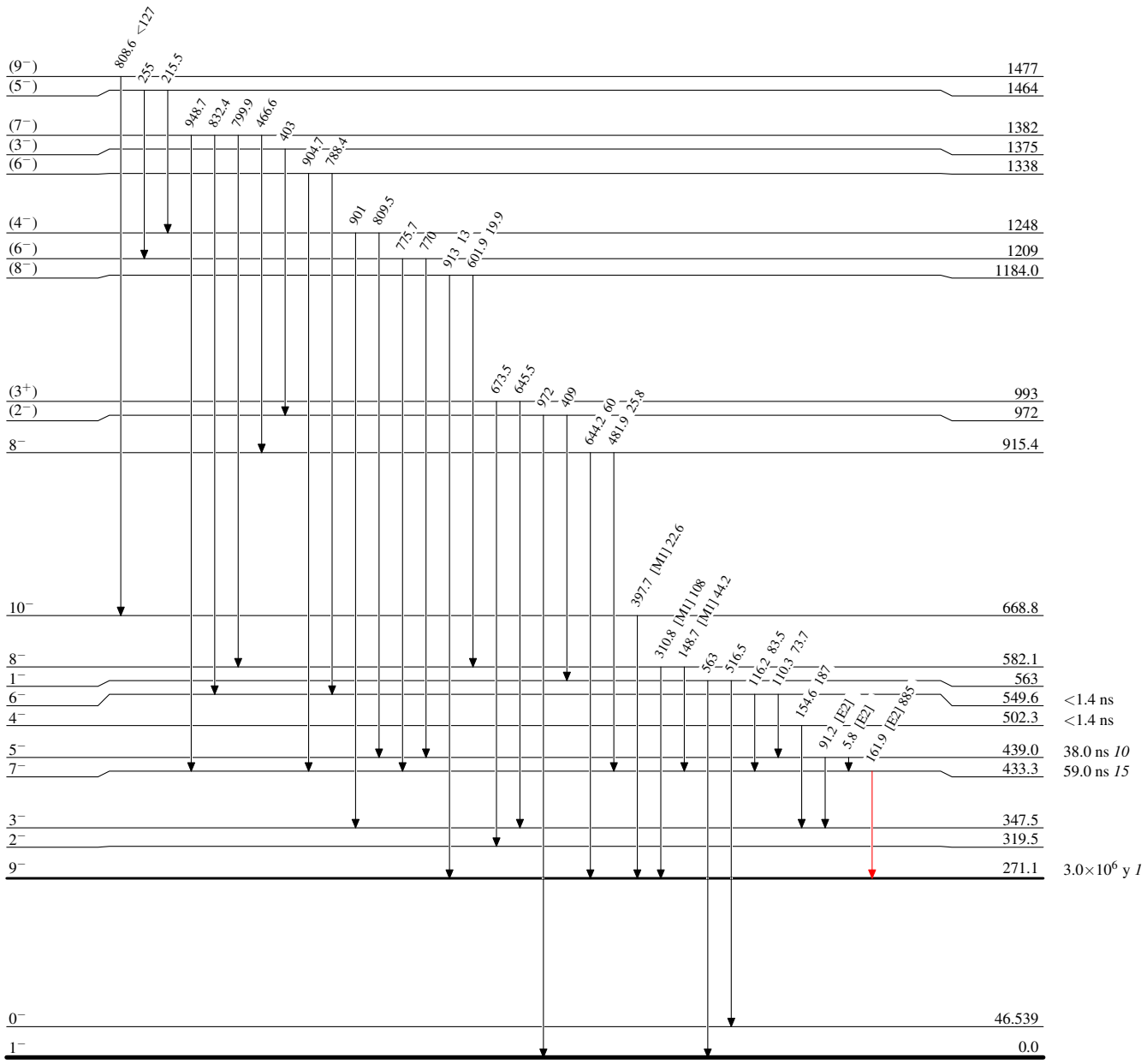
$^{210}_{83}Bi_{127}$

^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11

Level Scheme (continued)

Intensities: Relative I_γ

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



$^{210}_{83}Bi_{127}$

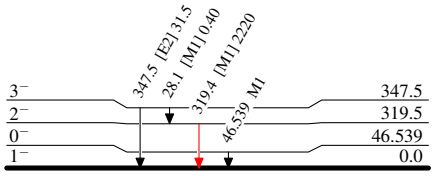
^{209}Bi(d,pγ) E=8-10 MeV 1973Pr11,1973Ca11

Legend

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

Level Scheme (continued)

Intensities: Relative I_γ



$^{210}_{83}Bi_{127}$