^{209}Bi(α,2nγ) 1970Be37,1970Be53,1985Ka07

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	B. Singh, S. Singh, H. X. Nguyen and M. Patial	NDS 114, 661 (2013)	28-Feb-2013

1970Be37, 1970Be53: E=26-43 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$, γ(t), ce. See also 1972As04 for uncertainties of level half-lives.
1985Ka07: E=32.9 MeV. Measured γ, ce.
Others:
1971Ma36: E=34 MeV. Measured Eγ, Iγ, excitation functions for delayed and prompt γ rays.
1975In01: E=30, 33 MeV. Measured $\gamma(\theta$,H,t), deduced g factors.
1975ReZU: E=51 MeV.
1983Ma08: E=45,60 MeV. Measured Q.
1985Be22: E=35 MeV. Measured g factors.
1991Sc15 (also 1990Ha30): E=35 MeV. Measured Q.
Additional information 1.

^{211}At Levels

The level scheme is that proposed by 1970Be37 and 1970Be53 with additions by 1985Ka07. The proposed levels are based on Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$, $\gamma\gamma$(t) measurements (1970Be37,1970Be53); and prompt and delayed Iγ, Ice and $\alpha\gamma$(t) measurements (1985Ka07). For the description of these levels, the authors rely heavily on shell-model calculations. The lower levels belong primarily to the configuration $\pi h^3_{9/2}$, $\pi h^2_{9/2}\otimes\pi f^1_{7/2}$ or $\pi h^2_{9/2}\otimes\pi i^1_{13/2}$; the higher levels include core excitation.

The g-factor measurements have been corrected by the authors for diamagnetic shielding and Knight shift.

E(level)	J$^\pi$[†]	T$_{1/2}$	Comments
0.0	9/2$^-$		Configuration=$\pi h^3_{9/2}$ (1970Be37).
674.0	(7/2)$^-$		
866.0	(7/2)$^-$		
947.3	(5/2)$^-$		
1066.9	(13/2)$^-$		
1116.0	(3/2)$^-$		
1123.2	(11/2)$^-$		
1270.3	(15/2)$^-$	13.0 ns *15*	T$_{1/2}$: from $\alpha\gamma$(t) (1970Be37); uncertainty from 1972As04.
1320.3	(17/2)$^-$		Configuration=$\pi h^3_{9/2}$ (1970Be37).
1355.0	(13/2)$^+$		
1416.3	(21/2)$^-$	50 ns *5*	g=+0.917 *16* Configuration=$\pi h^3_{9/2}$ (1970Be37,1975In01,1983Ma08). T$_{1/2}$: from $\alpha\gamma$(t) (1970Be37); uncertainty from 1972As04. g: from 1975In01.
1927.9[‡]	(23/2)$^-$		Configuration=$\pi h^2_{9/2}\otimes\pi f_{7/2}$ (1970Be53).
2616.8[‡]	(25/2$^+$)		Configuration=$\pi h^2_{9/2}\otimes\pi i^1_{13/2}$ (1970Be53).
2641.2[‡]	(29/2)$^+$	70 ns *5*	g=+1.073 *31*; Q=1.01 *19* Configuration=$\pi h^2_{9/2\ 8+}\otimes\pi i^1_{13/2}$ (1970Be53,1975In01, 1983Ma08). T$_{1/2}$: from (α)(688.9γ,713.3γ)(t) (1970Be53). g: from (511.6γ)(θ,H,t) (1975In01). Others: 1.04 *2* from (713.3γ)(θ,H,t) (1975ReZU), 1.056 *7* (1976Ha62). Q: from $\gamma(\theta$,H,t) (1983Ma08).
4177.4[#]	(31/2$^+$)	<1.3 ns	Configuration=$\pi h^3_{9/2\ 21/2-}\otimes\nu[g^1_{9/2}p^{-1}_{1/2})]_{5-}$ (1985Be22). T$_{1/2}$: from (1536.0γ)(t) (1985Ka07).
4381.1[#]	(33/2$^+$)		Configuration=$\pi[h^2_{9/2}f^1_{7/2})]_{23/2-}\otimes\nu[p^{-1}_{1/2}g^1_{9/2}]_{5-}$ + small admixture of configuration= $\pi h^3_{9/2\ 21/2-}\otimes\nu[i^1_{11/2}p^{-1}_{1/2})]_{6-}$ (1985Be22).
4816.2[#]	(39/2$^-$)	4.23 μs *7*	g=0.690 *7*; Q=1.91 *25* g: from (435.1γ)(θ,H,t) (1985Be22). Q: from LEMS method (1991Sc15).

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^{209}Bi(α,2nγ) 1970Be37,1970Be53,1985Ka07 (continued)

^{211}At Levels (continued)

E(level)	J^{π}[†]	$T_{1/2}$	Comments
			$T_{1/2}$: from Adopted Levels. Configuration=$\pi[h^2_{9/2}i^1_{13/2})]_{29/2+}\otimes \nu[p^{-1}_{1/2}g^1_{9/2}]_{5-}$ + small admixture of configuration= $\pi[h^2_{9/2}f^1_{7/2})]_{23/2-}\otimes\nu[j^1_{15/2}p^{-1}_{1/2})]_{8+}$ (1985Be22).

[†] From Adopted Levels.
[‡] Level from 1970Be53.
[#] Level from 1985Ka07.

$\gamma(^{211}At)$

Prompt intensities

Eγ	Iγ (1971Ma36)
96	5.0 *10*
204	1.1 *3*
253	6.5 *2*
435	1.0
511	5.3 *6*
689	3.5 *10*
714	3.5 *10*
1067	7.6 *6*
1536	1.2 *2*

E_γ[‡]	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.	δ	α[†]	Comments
96.0	≈3.9[#]	1416.3	(21/2)$^-$	1320.3	(17/2)$^-$	(E2)		9.17	α(L)=6.75; α(M)=1.805; α(N+..)=0.620 I_γ: Iγ from α and I(γ+ce)≈40 (1970Be37). Mult.: αγ(θ) suggests a stretched E2 transition (1970Be37). α: α excludes α(K). K-shell binding energy=95.73 keV.
147.1	2.7[#]	1270.3	(15/2)$^-$	1123.2	(11/2)$^-$	(E2)		1.567	α(K)=0.300 *5*; α(L)=0.937 *14*; α(M)=0.251 *4* α(N)=0.0648 *9*; α(O)=0.01275 *18*; α(P)=0.001310 *19* Mult.: D or E2 from RUL; (E2) from ΔJ^π.
168.9	≈0.2[#]	1116.0	(3/2)$^-$	947.3	(5/2)$^-$				
191.8	0.3[#]	866.0	(7/2)$^-$	674.0	(7/2)$^-$				
203.4	≤5.7[#]	1270.3	(15/2)$^-$	1066.9	(13/2)$^-$	(M1,E2)		1.0 *6*	α(K)=0.7 *6*; α(L)=0.231 *5*; α(M)=0.058 *3* α(N)=0.0150 *8*; α(O)=0.00308 *5*; α(P)=0.00037 *5* I_γ: Iγ may include I(203.7γ) from the 4381.1 level. Mult.: D or E2 from RUL; M1, E2 from ΔJ^π.
203.7[&]	14[&] *1*	4381.1	(33/2$^+$)	4177.4	(31/2$^+$)	M1+E2	0.8 *4*	1.2 *3*	α(K)=0.9 *3*; α(L)=0.230 *4*; α(M)=0.0570 *16* α(N)=0.0148 *4*; α(O)=0.00306 *5*; α(P)=0.000384 *25* Mult.,δ: α(exp)=1.6 *3* from relative

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^{209}Bi(α,2nγ) 1970Be37,1970Be53,1985Ka07 (continued)

$\gamma(^{211}At)$ (continued)

E_γ[‡]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[†]	Comments
								cascading intensities, α(L)exp=0.20 *3*, L/M=4.3 *9*. (α(L)exp measured relative to α(K)(1066.9γ) for E2 transition, 1985Ka07).
231.7	0.9[#]	1355.0	$(13/2)^+$	1123.2	$(11/2)^-$			
250.7[a]		1116.0	$(3/2)^-$	866.0	$(7/2)^-$			
253.4	60[#]	1320.3	$(17/2)^-$	1066.9	$(13/2)^-$	(E2)	0.223	α(K)=0.0988 *14*; α(L)=0.0921 *13*; α(M)=0.0243 *4* α(N)=0.00627 *9*; α(O)=0.001250 *18*; α(P)=0.0001350 *19* Mult.: $\alpha\gamma(\theta)$ suggests a stretched E2 transition (1970Be37).
288.0	2.5[#]	1355.0	$(13/2)^+$	1066.9	$(13/2)^-$			
435.1[&]	35[&] *2*	4816.2	$(39/2^-)$	4381.1	$(33/2^+)$	E3	0.184	α(K)=0.0780 *11*; α(L)=0.0787 *11*; α(M)=0.0210 *3* α(N)=0.00547 *8*; α(O)=0.001103 *16*; α(P)=0.0001236 *18* Mult.: from α(K)exp=0.083 *8*, K/L=1.06 *11* (1985Ka07). (α(K)exp measured relative to α(K)(1066.9γ) E2 transition.).
442.0	1.1[#]	1116.0	$(3/2)^-$	674.0	$(7/2)^-$			
511.6[@] *5*	30[@] *2*	1927.9	$(23/2)^-$	1416.3	$(21/2)^-$	(D)		I_γ: prompt I$\gamma\approx$30 (1970Be37). Mult.: from $\gamma(\theta)$ (1970Be53).
674.0	12.5[#]	674.0	$(7/2)^-$	0.0	$9/2^-$			
688.9[@]	22[@] *2*	2616.8	$(25/2^+)$	1927.9	$(23/2)^-$			I_γ: prompt Iγ=16 (1970Be53).
713.3[@]	9[@] *1*	2641.2	$(29/2)^+$	1927.9	$(23/2)^-$	E3	0.0418	α(K)=0.0265 *4*; α(L)=0.01142 *16*; α(M)=0.00294 *5* α(N)=0.000763 *11*; α(O)=0.0001567 *22*; α(P)=1.89×10^{-5} *3* I_γ: prompt Iγ=3.4 (1970Be53). Mult.: from α(K)exp=0.032 *6* mult=E3 or M1+E2; from K/L=2.5 *4* mult.=E3 or M4. (α(K)exp measured relative to α(K)(1066.9γ) E2 transition, 1985Ka07).
866.2	3.9[#]	866.0	$(7/2)^-$	0.0	$9/2^-$			
947.6	4.0[#]	947.3	$(5/2)^-$	0.0	$9/2^-$			
1066.9	100[#]	1066.9	$(13/2)^-$	0.0	$9/2^-$	(E2)	0.00683	α(K)=0.00540 *8*; α(L)=0.001086 *16*; α(M)=0.000261 *4* α(N)=6.75×10^{-5} *10*; α(O)=1.423×10^{-5} *20*; α(P)=1.88×10^{-6} *3* Mult.: $\alpha\gamma(\theta)$ suggests a stretched E2 transition (1970Be37).
1123.2	14[#]	1123.2	$(11/2)^-$	0.0	$9/2^-$			
1355.0	4.6[#]	1355.0	$(13/2)^+$	0.0	$9/2^-$			
1536.0[&]	37[&] *4*	4177.4	$(31/2^+)$	2641.2	$(29/2)^+$	(M1)	0.00757	α(K)=0.00609 *9*; α(L)=0.001030 *15*; α(M)=0.000242 *4* α(N)=6.27×10^{-5} *9*; α(O)=1.344×10^{-5} *19*; α(P)=1.87×10^{-6} *3*; α(IPF)=0.0001365 *20* Mult.: α(K)exp=0.0063 *7* (1985Ka07) indicates M1 or E3; M1 from RUL.

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^{209}Bi(α,2nγ) 1970Be37,1970Be53,1985Ka07 (continued)

$\gamma(^{211}At)$ (continued)

† Additional information 2.
‡ From 1970Be37, unless otherwise noted.
# From prompt spectrum (1970Be37).
@ From 1970Be53. Intensity from delayed γ spectrum, normalized to Iγ(511.6γ)=30.
& From 1985Ka07. Intensity from delayed γ spectrum, normalized to Iγ(713.6γ)=9.
a Placement of transition in the level scheme is uncertain.

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Level Scheme

Intensities: Relative I_γ

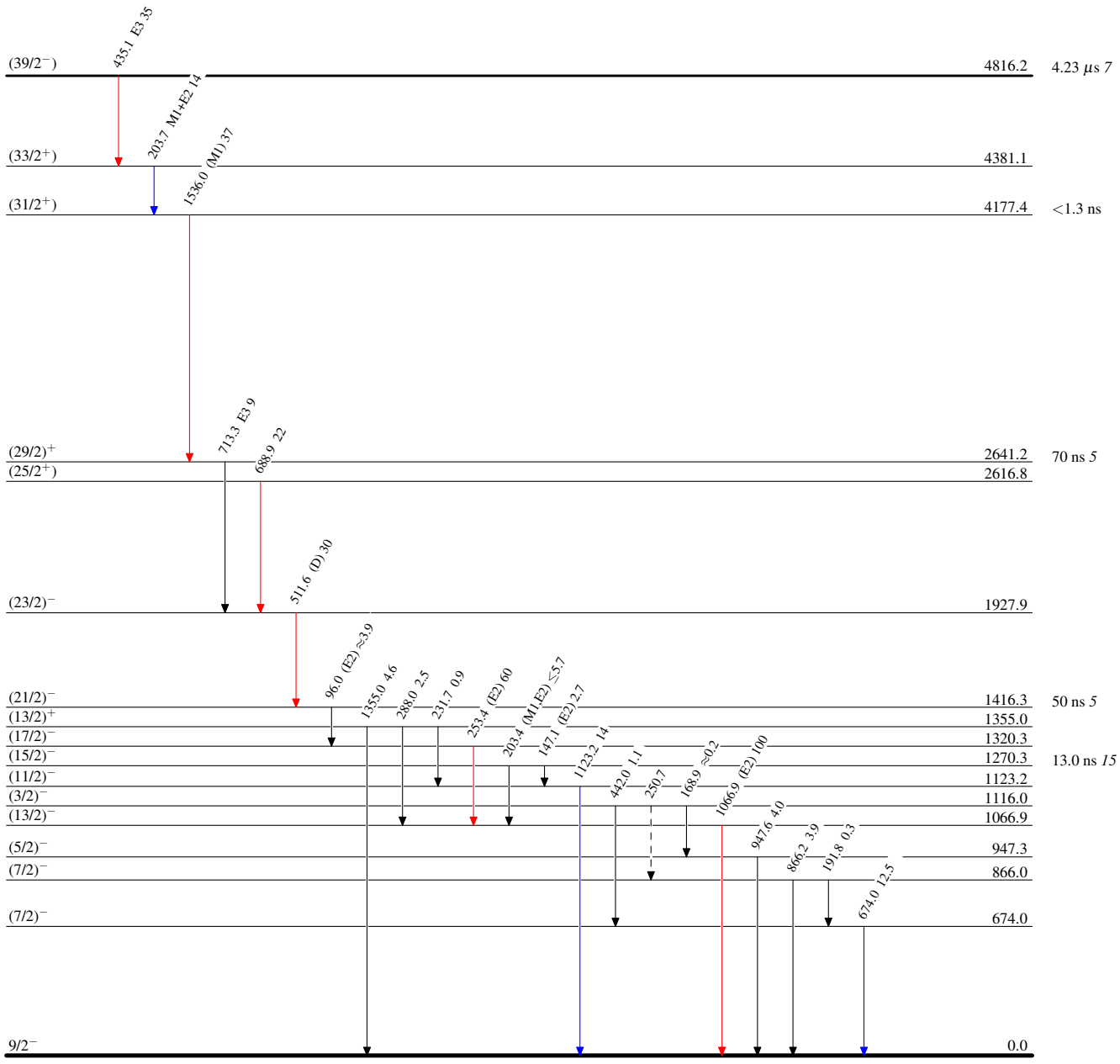
Legend

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

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

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

γ Decay (Uncertain)



$^{211}_{85}At_{126}$