^{209}Bi(γ,γ') 1980Ch22,1977Co10,1974Sw05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. Chen # and F. G. Kondev	NDS 126, 373 (2015)	30-Sep-2013

1980Ch22: source=bremsstrahlung from electron beams produced from the University of Illinois accelerator MUSL-2. A 10 cm square target of ^{209}Bi was used. γ-rays were detected by a 55 cm^3 Ge(Li) detector. Measured Eγ, Iγ. Deduced levels, J, widths.
1977Co10: source=bremsstrahlung from electron beams produced from MUSL-1. A square sample of target ^{209}Bi was used. γ-rays were detected by a 50 cm^3 Ge(Li) detector. Measured Eγ, Iγ, resonance fluorescence. Deduced levels, widths.
1974Sw05: source=bremsstrahlung from electrons produced from the Bartol accelerator. γ-rays were detected by a 45 cm^3 Ge(Li) detector. Measured Eγ, Iγ, resonance fluorescence yields. Deduced levels, widths.
1969Me21: source=bremsstrahlung with electron beams from the Bartol Van de Graaff accelerator. γ-rays were detected by a 40 cm^3 Ge(Li) detector. Measured Eγ, Iγ. Deduced levels, widths.
Others:
1967Gi15: source=^{47}Ti(n,γ).
1969Be71: source=^{47}Ti(n,γ).
1969Ce02: source=^{63}Cu(n,γ).
1969Ra09: source=^{76}Se(n,γ).
1971Be22: source=Ti(n,γ).
1972Wo21: source=I(γ+ce)(n,γ).
1973Ak04: source=^{76}Se(n,γ).
1973Me07: source=^{59}Co(n,γ).
1973Ha38: source=bremsstrahlung.
1973Sw01: source=Doppler−broadened γ's from ^{19}F(p,$\alpha\gamma$).
1974Te01: source=^{59}Co(n,γ).
1974Wo05: source=Cu(n,γ).
1977Ja13: source=Fe(n,γ) with Cd and Pb scatterers.
1979La01: source=bremsstrahlung.
1980Sh12: source=bremsstrahlung.
1983Ru03,1979Ru01: source=Ni(n,γ), Cr(n,γ).
1983Ka26: source=Fe(n,γ).
1987Ka43: source=cadmium−109.
1988Da20: source=bremsstrahlung.
1989No03,1986No06: source=Ni(n,γ).
1994Ka27: source=Ni(n,γ), deduced GDR parameters.
2009HeZW: E=11-30 MeV polarized γ, deduced yields, isovector giant dipole resonance (IVGDR).
2011He18: E=15-26 Mev polarized γ, deduced IVGQR.

^{209}Bi Levels

ε, as used below, is defined as the energy difference between the source γ and the excited level.

E(level)†	J$^\pi$	g$\Gamma(\gamma_0)^2/\Gamma$&	Comments
0.0	9/2$^-$		J$^\pi$: from Adopted Levels.
896			E(level): rounded-off value from Adopted Levels.
2563 *1*			$\Gamma(\gamma_0)^2/\Gamma$=3.0E−2 eV *5* (1969Me21) for J=9/2.
2583			$\Gamma(\gamma_0)^2/\Gamma$ LE 0.005 eV (1969Me21) for J=7/2.
2598 *2*			$\Gamma(\gamma_0)^2/\Gamma$=0.0090 eV *24* (1969Me21) for J=11/2 using.
2826		0.034[a] *4*	$\Gamma(\gamma_0)^2/\Gamma$=0.699 eV *25* for J=5/2.
3980 *4*		0.82[a] *8*	
4085		0.28[a] *3*	
4144		0.07[a] *2*	

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^{209}Bi Levels (continued)

E(level)[†]	J$^\pi$	g$\Gamma(\gamma_0)^2/\Gamma$[&]	Comments
4156		0.21[a] *4*	
4176		0.21[a] *4*	
4206		0.25[a] *3*	
4228?[‡] *5*		≈3[c]	
4501?[‡] *5*		≈3[c]	
4757 *2*		2.8[b] *4*	
4797 *2*		2.9[b] *5*	
4831 *2*		1.4[b] *2*	
5183? *4*		0.9 *3*	
5236 *2*		1.4 *3*	
5281 *2*		5.5 *11*	
5293 *2*		2.2 *6*	g$\Gamma(\gamma_0)^2/\Gamma$: g$\Gamma(\gamma_0)^2/\Gamma$=12 *6* for E=5293 keV *5* (1977Co10). This probably includes the 5281-keV and 5293-keV levels.
5314 *2*		3.0 *9*	
5354 *4*		3.3 *8*	
5410[#]		3.3 *8*	g$\Gamma(\gamma_0)^2/\Gamma$: g$\Gamma(\gamma_0)^2/\Gamma$=8 *4* for E=5422 keV *5* (1977Co10).
5424? *4*		1.7 *5*	
5440 *4*		1.6 *5*	
5462 *4*		1.4 *4*	
5485 *2*		4.0[d] *8*	
5497 *2*		4.8[d] *9*	
5509[#]		6.8[d] *12*	
5536[#]		4.4 *10*	g$\Gamma(\gamma_0)^2/\Gamma$: g$\Gamma(\gamma_0)^2/\Gamma$=7 *3* for E=5549 keV *5* (1977Co10).
5554 *2*		2.6 *8*	
5573 *4*		1.7 *10*	
5590 *2*		3.2 *9*	
5609 *5*	11/2$^-$[@]		Γ=0.95 eV *20*; $\Gamma(\gamma_0)/\Gamma$=1 (1974Te01).
5662 *2*		1.6 *4*	
6392 *8*			
6556			
6911? *4*		2.4 *5*	
6945? *4*		2.1 *6*	
6983 *4*		2.6 *5*	
7106? *4*		1.0 *3*	
7168	9/2$^+$[@]		$\Gamma(\gamma_0)/\Gamma$=1.0; $\Gamma(\gamma_0)$=0.82 eV *4* (1972Wo21). Others: 1967Gi15, 1969Be71; ε<2 eV (1967Gi15), 4.5 eV *17* (1969Be71), 5.8 eV *8* (1972Wo21, as quoted by 1974Wo05).
7171 *4*		4.7 *10*	
7179? *5*		24 *5*	E(level),g$\Gamma(\gamma_0)^2/\Gamma$: from 1973Sw01. Level not confirmed by 1980Ch22.
7202? *5*		30 *5*	E(level),g$\Gamma(\gamma_0)^2/\Gamma$: from 1973Sw01. Level not confirmed by 1980Ch22.
7246 *4*		3.7 *8*	
7264 *4*		2.4 *9*	
7279			g$\Gamma_{\gamma 0}$=0.043 eV *8*; ε≈196 eV (1977Ja13).
7279+x			E(level): x≈200 eV based on ε(7279 level)≈196 eV, deduced from an absorption spectrum, and ε(7279+x)≈20 eV, deduced from a scattering experiment ε≈20 eV (1977Ja13).
7287 *4*		2.6 *7*	
7360 *4*		4.3 *11*	
7416	(9/2)		J$^\pi$: from 1969Ra09 based on $\gamma(\theta)$. $\Gamma(\gamma_0)/\Gamma$=0.65 *30* (1973Ak04), 0.6 *2* (1969Ra09), weighted average=0.62 *23*; $\Gamma(\gamma_0)$=0.14 eV *9* (1969Ra09), 0.16 eV *11* (1973Ak04), weighted average=0.15 eV *9*; ε=3.4 eV *16* (1969Ra09), 4.5 eV *12* (1973Ak04), weighted average=4.1 eV *12*.
7632	(9/2)		J$^\pi$: from $\gamma(\theta)$ and γ(pol) in 1974Wo05. $\Gamma(\gamma_0)$>0.03 eV; Γ>0.5 eV (1974Wo05); g$\Gamma_{\gamma 0}$=0.092 eV *12* (1977Ja13); ε=404 eV

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^{209}Bi(γ,γ') 1980Ch22,1977Co10,1974Sw05 (continued)

^{209}Bi Levels (continued)

E(level)[†]	Comments
	(1977Ja13).
13450	E(level): from 1983Ru03. Giant dipole resonance. Other: 1964Ha33. Γ=3.97 MeV (1983Ru03).

[†] From Eγ. See the γ listing for sources. Where correspondence between data of 1977Co10 and 1980Ch22 needs to be made, as pointed out by 1980Ch22, their Eγ values are systematically ≈12 keV lower than those of 1977Co10.
[‡] From 1977Co10. Not confirmed by 1974Sw05 or 1980Ch22.
[#] Probable unresolved multiplet (1980Ch22).
[@] From deduced γ-ray transition multipolarities from γ(θ) and γ(pol) in 1972Wo21. Also see 1974Wo05 for E=7168 and 7637 levels.
[&] Values are $g\Gamma(\gamma_0)^2/\Gamma$ in eV, where $\Gamma(\gamma_0)$ is the γ decay width to the ground state and g=(2J+1)/(2J(g.s.)+1). Values are from 1980Ch22 except where noted otherwise, and are corrected for angular distributions under the assumption that the excitations are dipole.
[a] From 1974Sw05.
[b] Weighted average of values of 1974Sw05 and 1980Ch22. 1977Co10 report $\Sigma(g\Gamma(\gamma_0)^2/\Gamma)\approx10$ for levels at 4771, 4808, and 4845, which are probably the same as those at 4757, 4797, and 4831 reported by 1974Sw05 and 1980Ch22.
[c] From 1977Co10. Authors state uncertainty is in excess of 50%.
[d] $\Sigma(g\Gamma(\gamma_0)^2/\Gamma)=17\ 6$ for 5485-5509 levels (1977Co10).

γ(^{209}Bi)

E_γ[†]	E_i(level)	E_f	J^π_f	Comments
2563 *1*	2563	0.0	$9/2^-$	E_γ: from 1969Me21.
2583[b]	2583	0.0	$9/2^-$	E_γ: not seen in 1969Me21. Energy is rounded-off value from Adopted Levels.
2598 *2*	2598	0.0	$9/2^-$	E_γ: from 1969Me21.
2826[#]	2826	0.0	$9/2^-$	
3980 *4*	3980	0.0	$9/2^-$	
4085[#]	4085	0.0	$9/2^-$	
4144[#]	4144	0.0	$9/2^-$	
4156[#]	4156	0.0	$9/2^-$	
4176[#]	4176	0.0	$9/2^-$	
4206[#]	4206	0.0	$9/2^-$	
4228[ad] *5*	4228?	0.0	$9/2^-$	
4501[ad] *5*	4501?	0.0	$9/2^-$	
4757[@] *2*	4757	0.0	$9/2^-$	
4797[@] *2*	4797	0.0	$9/2^-$	
4831[@] *2*	4831	0.0	$9/2^-$	
5183[d] *4*	5183?	0.0	$9/2^-$	
5236 *2*	5236	0.0	$9/2^-$	
5281 *2*	5281	0.0	$9/2^-$	
5293 *2*	5293	0.0	$9/2^-$	
5314 *2*	5314	0.0	$9/2^-$	
5354 *4*	5354	0.0	$9/2^-$	
5410[‡]	5410	0.0	$9/2^-$	
5424[d] *4*	5424?	0.0	$9/2^-$	
5440 *4*	5440	0.0	$9/2^-$	

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^{209}Bi(γ,γ') 1980Ch22,1977Co10,1974Sw05 (continued)

$\gamma(^{209}Bi)$ (continued)

E_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
5462 *4*	5462		0.0	$9/2^-$		
5485 *2*	5485		0.0	$9/2^-$		
5497 *2*	5497		0.0	$9/2^-$		
5509[‡]	5509		0.0	$9/2^-$		
5536[‡]	5536		0.0	$9/2^-$		
5554 *2*	5554		0.0	$9/2^-$		
5573 *3*	5573		0.0	$9/2^-$		
5590 *2*	5590		0.0	$9/2^-$		
5609 *5*	5609	$11/2^-$	0.0	$9/2^-$	M1[c]	E_γ: from 1973Me07. 1974Te01 report 5603 keV.
5662 *2*	5662		0.0	$9/2^-$		
6382[&]	7279+x		7279			
6392 *8*	6392		0.0	$9/2^-$		E_γ: from 1969Ce02.
6556	6556		0.0	$9/2^-$		E_γ: from 1974Wo05.
6911[d] *4*	6911?		0.0	$9/2^-$		
6945[d] *4*	6945?		0.0	$9/2^-$		
6983 *4*	6983		0.0	$9/2^-$		
7106[d] *4*	7106?		0.0	$9/2^-$		
7168	7168	$9/2^+$	0.0	$9/2^-$	E1[c]	E_γ: from 1972Wo21. 1969Ra09 report 7149. Mult.: A_2=+0.20 *2* (1972Wo21,1974Wo05), +0.18 *7* (1969Ra09). δ: <0.05 if J(7168 level)=9/2 (1972Wo21).
7171 *4*	7171		0.0	$9/2^-$		E_γ: 1969Ce02 report 7172 *4*, 1974Wo05 report 7176.
7179[d] *5*	7179?		0.0	$9/2^-$		E_γ: from 1973Sw01. Not confirmed by 1980Ch22.
7202[d] *5*	7202?		0.0	$9/2^-$		E_γ: from 1973Sw01. Not confirmed by 1980Ch22.
7246 *4*	7246		0.0	$9/2^-$		
7264 *4*	7264		0.0	$9/2^-$		
7279[&]	7279+x					
7279[&]	7279		0.0	$9/2^-$		
7287 *4*	7287		0.0	$9/2^-$		
7360 *4*	7360		0.0	$9/2^-$		
7416	7416	(9/2)	0.0	$9/2^-$	(D)	E_γ: from 1969Ra09. Mult.: A_2=+0.20 *3* (1969Ra09).
7632[&]	7632	(9/2)	0.0	$9/2^-$	(D)	E_γ: 1974Wo05 report 7637. Mult.: A_2=+0.24 *4* (1974Wo05).

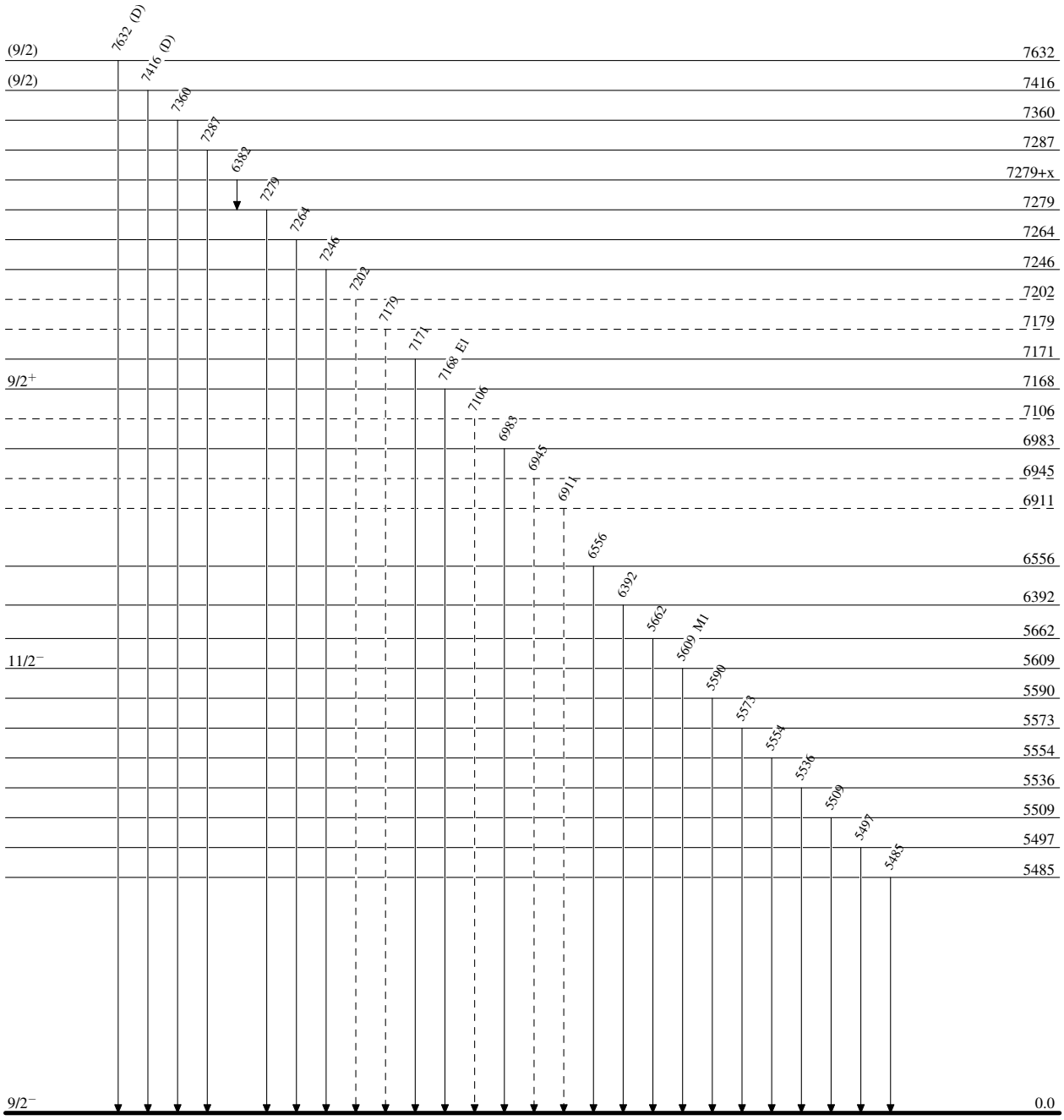
[†] From 1980Ch22 except where noted otherwise. No uncertainties are given in 1980Ch22 for Eγ and the evaluators have taken the values from those for level energies.
[‡] Probable unresolved multiplet (1980Ch22).
[#] From 1974Sw05.
[@] Other: 1974Sw05. Authors' original value should be increased by 11 keV (private communication from the authors, June 1977). The revised energy agrees well with the value of 1980Ch22.
[&] From 1977Ja13.
[a] From 1977Co10. Transition not confirmed by 1974Sw05 or 1980Ch22.
[b] Not seen in 1969Me21. Energy is rounded-off value from adopted Eγ data.
[c] From $\gamma(\theta)$ and γ(pol) (1972Wo21).
[d] Placement of transition in the level scheme is uncertain.

^{209}Bi(γ,γ') 1980Ch22,1977Co10,1974Sw05

Legend

γ Decay (Uncertain)

Level Scheme



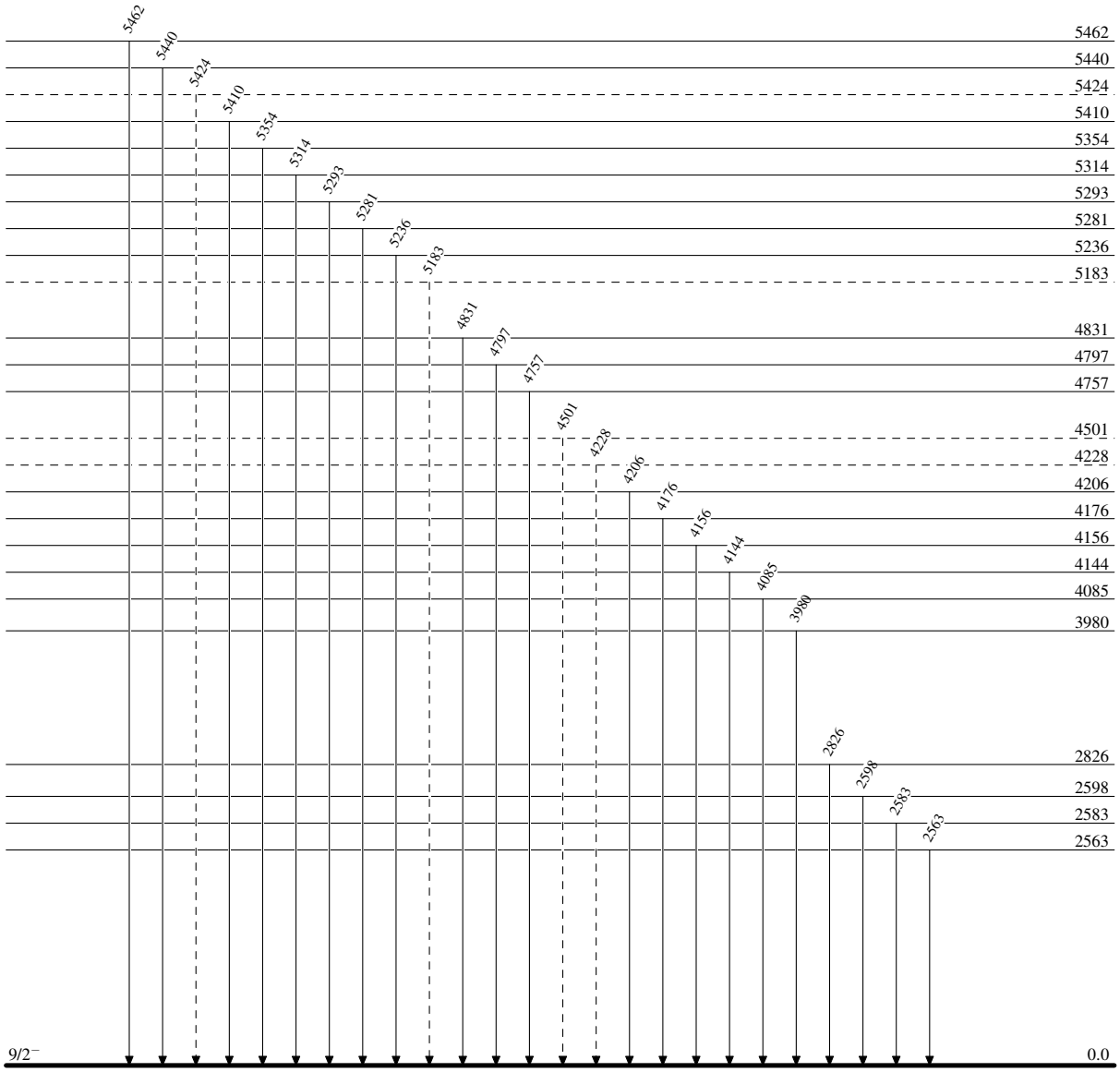
$^{209}_{83}Bi_{126}$

Legend

^{209}Bi(γ,γ′) 1980Ch22,1977Co10,1974Sw05

Level Scheme (continued)

- - - - - - ► γ Decay (Uncertain)



$^{209}_{83}Bi_{126}$