Adopted Levels, Gammas

Type	Author	Citation	Literature Cutoff Date
	History		
Full Evaluation	D. Abriola, P. Demetriou, B. Singh, R. Gowrishankar	NDS 114,2023 (2013)	23-Sep-2013

Q(β^-)=2189 *15*; S(n)=5223 *19*; S(p)=5460 *15*; Q(α)=5300 *40* 2012Wa38
S(2n)=9264 *16*, S(2p)=14710 *30* (2012Wa38).

^{215}Bi evaluated by D. Abriola, P. Demetriou, B. Singh, ranching. Gowrishankar, K. Vijay Sai.

1953Hy83: β^- decay inferred by measurements of the α decay of the ^{215}Po daughter nucleus, measured half-life.
1965Nu03: descendant of radioactive source ^{227}Ac. Measured $T_{1/2}$.
1990Ru02: source produced by spallation of 200-MeV protons on targets of ^{232}Th. ^{215}Bi(7.6 min) activity was identified by mass separation and by the observation of known γ rays in the daughter nucleus ^{215}Po. Measured $T_{1/2}$. The β^- particles were detected in a 4π plastic scintillator.
2008We02: precise mass measurement using ISOLTRAP Penning-trap mass spectrometer.

^{215}Bi Levels

Cross Reference (XREF) Flags

A ^{215}Pb β^- decay (147 s)
B ^{215}Bi IT decay (36.9 s)
C ^{219}At α decay (56 s)

E(level)[†]	J$^\pi$	$T_{1/2}$	XREF	Comments
0.0	(9/2$^-$)	7.6 min *2*	ABC	%β^-=100 RMS charge radius <r^2>$^{1/2}$=5.576 fm *9*; deduced from extrapolation of evaluated rms charge radii of ^{209}Bi to ^{213}Bi (2013An02), with slope k_z=0.35 in formula 9 of 2004An14. %β^-: only β^- decay mode observed (1990Ru02,1953Hy83). %$\alpha\approx 8.\times10^{-5}$ from systematics of α branching versus Q(α) for ^{212}Bi, ^{213}Bi, and ^{214}Bi. J$^\pi$: analogy to ^{209}Bi, ^{211}Bi, and ^{213}Bi suggests $\pi h_{9/2}$ configuration. Strong β feeding of 293, (11/2$^+$) level in ^{215}Po corroborates this configuration assignment. $T_{1/2}$: weighted average of 7.7 min *2* (1990Ru02), 7.5 min *4* (1989Bu09), and 7.4 min *6* (1965Nu03). Other value: 8 min *2* (1953Hy83). <r^2>$^{1/2}$=5.552 fm *3* (extrapolation from ^{209}Bi value using formula (4) in 2004An14).
183.5 *3*	(7/2$^-$)		A	J$^\pi$: M1 γ to (9/2$^-$); analogy to ^{211}Bi, ^{213}Bi, suggests $\pi h_{7/2}$ configuration. Large HF for α decay parent nuclei to a corresponding 7/2$^-$ state observed in ^{211}Bi and ^{213}Bi corroborates this configuration assignment.
746.60?[‡] *10*	(13/2$^-$)[#]		B	
854.5 *10*			A	
1022.5 *10*			A	
1160.70?[‡] *14*	(17/2$^-$)[#]		B	
1168.5 *10*			A	
1199.8 *7*			A	
1347.50 *17*	(21/2$^-$)[#]		B	
1347.50+x	(25/2 to 29/2)$^{(-)}$	36.9 s *6*	B	%IT=76.9 *5*; %β^-=23.1 *5* %β^-: deduced by the evaluators from weighted average of gamma transition intensities for five strong γ rays in 2003Ku26. Value of

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{215}Bi Levels (continued)

E(level)[†]	XREF	Comments
		%β^-=23.8 *4* in 2003Ku26 is slightly different but could not be reproduced by the evaluators. E(level): x=40 *+80−40* (2003Ku26, from non-observation of Bi K-x rays in coin with 186.8γ). Other estimate: 20 *20* (2012Au07). $T_{1/2}$: from weighted average (2003Ku26) of 37.1 s *5* and 36.4 s *8* from the decay curves of 187, 414, 747 γ rays in isomer decay and 226, 256, 308, 419 γ rays in β^- decay, respectively. Note that reduced χ^2=9 for the second set of γ decay curves. From the same data, evaluators obtain weighted average of 36.7 s *5* with reduced χ^2=5.7. J^π: possible configuration= $\pi h_{9/2}\otimes((\nu g_{9/2})^5)_{9/2}\otimes\nu i_{11/2}(10^+)$ 2003Ku26 further propose 27/2$^-$ from expected M3 transition to 1347, (21/2$^-$) level, based on partial half-life of the isomeric transition of <80 keV.
1959.8 *12*	A	

† From Eγ data.
‡ The ordering of the 187-414-747 cascade is not established, the one given here is just one of the possibilities. Thus the positions of the intermediate levels at 747 and 1161 could be different.
# E2 –> (E2) –> (E2) γ cascade feeding (9/2$^-$) g.s. suggests (21/2$^-$) –> (17/2$^-$) –> (13/2$^-$) spin-parity sequence.

$\gamma(^{215}Bi)$

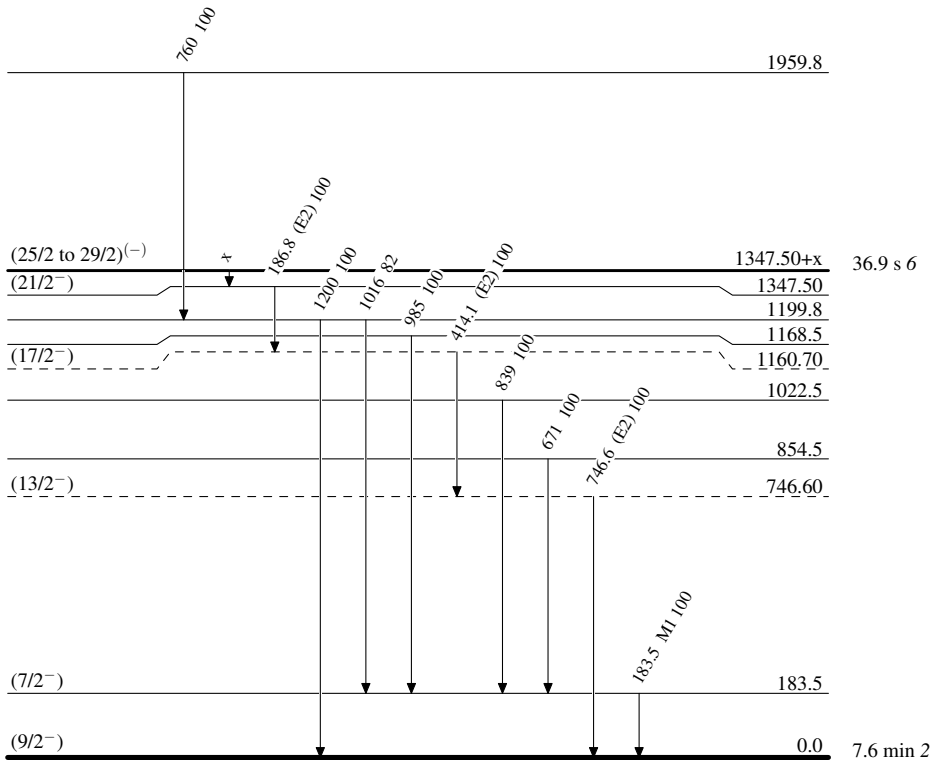
E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α[‡]	Comments
183.5	(7/2$^-$)	183.5 *3*	100	0.0	(9/2$^-$)	M1	1.82 *3*	α(K)=1.478 *22*; α(L)=0.258 *4*; α(M)=0.0606 *9*; α(N)=0.01550 *23* Mult.: from measured α(K)exp in ^{215}Pb β^- decay. Some E2 admixture is possible.
746.60?	(13/2$^-$)	746.6 *1*	100	0.0	(9/2$^-$)	(E2)[†]	0.01258	α(K)=0.00962 *14*; α(L)=0.00224 *4*
854.5		671 *1*	100	183.5	(7/2$^-$)			
1022.5		839 *1*	100	183.5	(7/2$^-$)			
1160.70?	(17/2$^-$)	414.1 *1*	100	746.60?	(13/2$^-$)	(E2)[†]	0.0491	α(K)=0.0320 *5*; α(L)=0.01282 *18*; α(M)=0.00325 *5*
1168.5		985 *1*	100	183.5	(7/2$^-$)			
1199.8		1016 *1*	82 *30*	183.5	(7/2$^-$)			
		1200 *1*	100 *65*	0.0	(9/2$^-$)			
1347.50	(21/2$^-$)	186.8 *1*	100	1160.70?	(17/2$^-$)	(E2)	0.571	α(K)=0.195 *3*; α(L)=0.280 *4*; α(M)=0.0737 *11*; α(N)=0.0188 *3* Mult.: from measured α(K)exp in ^{215}Bi IT decay.
1347.50+x	(25/2 to 29/2)$^{(-)}$	x		1347.50	(21/2$^-$)			E_γ: x=40 *+80−40* (2003Ku26). There may be one or more γ transitions from the isomer, but each should be lower than 80 keV. from non-observation of Bi K-x rays in coin with 186.8γ.
1959.8		760 *1*	100	1199.8				

† From γ intensity balance in 187-414-747 γ cascade in IT decay. See details in ^{215}Bi IT decay dataset.
‡ 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.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{215}_{83}Bi_{132}$