^{209}Bi(t,pγ) 1989Ma12

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan, C. M. Baglin, O. Gorbachenko, N. Todorovic	NDS 114, 661 (2013)	28-Feb-2013

$J^\pi(^{209}Bi)=9/2^-$.

E(t)=11.5 to 17 MeV; Compton-suppressed Ge and a Ge GAMMA-X detector (for measurement of Eγ, Iγ, $\gamma\gamma$ coin, γ(t)); superconducting solenoid magnet transporter and Si(Li) detector (for measurement of E(ce), I(ce), p-ce, p-ce(t)).

^{211}Bi Levels

Searched for α decaying isomer. Concluded that, if there were an α decaying isomer with 1 s>$T_{1/2}$>10 h in ^{211}Bi, it would be populated with <0.5% of the g.s. intensity at E(t)=16 to 17 MeV.

σ(70 ns *1227*.2 level)/σ(g.s.)=0.10 at E(t)=16 to 17 MeV.

The proposed level scheme is based on γ and ce measurements, and on $\gamma\gamma$, γ(t), p(ce), p(ce)(t) experiments.

p(97.4γ)(t) shows that the 97.4γ lacks a prompt component indicating that this γ ray is the isomeric transition from the $T_{1/2}$=70 ns level.

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0	9/2$^-$		
404.92 *2*	7/2$^-$		
766.46 *3*	(9/2,11/2)$^-$		
828.13 *4*	(13/2)$^-$		
1129.81 *5*	(17/2)$^-$		
1149.71 *11*	(15/2)$^-$		
1227.2 *3*	(21/2$^-$)	70 ns *5*	$T_{1/2}$: from γ(t) with 301.7, 766.5 and 828.1 γ rays. Other: 60 ns *20* from p-ce(t) for 97.4 keV transition.
1304.4 *6*			

† From least-squares fit to Eγ, excluding 19.9γ and 61.6γ for which Eγ was not measured.
‡ From Adopted Levels.

γ(^{211}Bi)

E$_\gamma$	I$_\gamma$†	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.	α#	Comments
(19.90‡)		1149.71	(15/2)$^-$	1129.81	(17/2)$^-$	[M1]	219	α(L)=167.2 *24*; α(M)=39.7 *6*; α(N+..)=12.47 *18* α(N)=10.15 *15*; α(O)=2.07 *3*; α(P)=0.247 *4* E$_\gamma$: from level-energy difference. Mult.: branching strength in $\gamma\gamma$ spectrum indicates M1.
(61.67‡)		828.13	(13/2)$^-$	766.46	(9/2,11/2)$^-$	[M1]	7.82	α(L)=5.99 *9*; α(M)=1.410 *20*; α(N+..)=0.443 *7* α(N)=0.361 *5*; α(O)=0.0737 *11*; α(P)=0.00877 *13* E$_\gamma$: from level-energy difference. Mult.: branching strength in $\gamma\gamma$ spectrum indicates M1.
97.4 *3*		1227.2	(21/2$^-$)	1129.81	(17/2)$^-$	(E2)	7.59 *15*	α(K)=0.459 *7*; α(L)=5.30 *11*; α(M)=1.41 *3*; α(N+..)=0.428 *9* α(N)=0.357 *8*; α(O)=0.0658 *14*; α(P)=0.00505 *11* E$_\gamma$: absence of a prompt component in p-ce(t) studies of this transition indicates that it directly depopulates the 1227-keV isomer. Mult.: from L12/L3(exp)≈1.0.

Continued on next page (footnotes at end of table)

^{209}Bi(t,pγ) 1989Ma12 (continued)

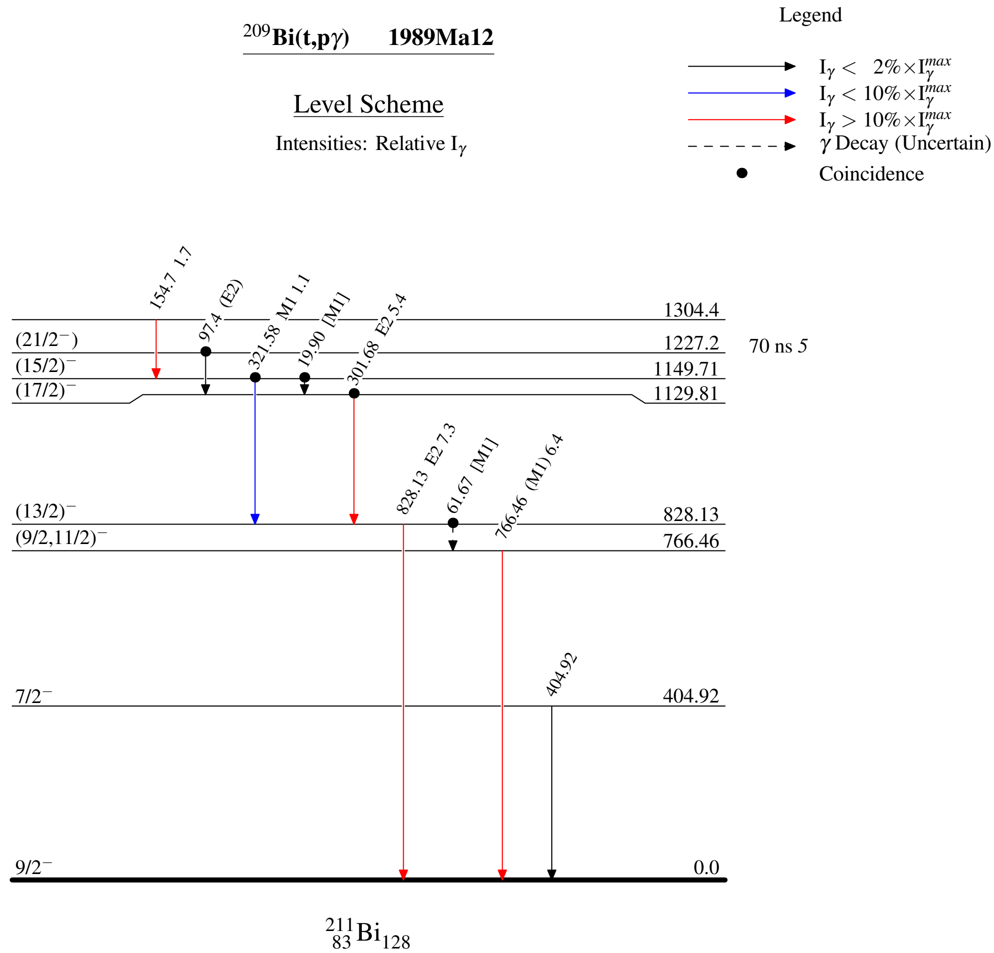
γ(^{211}Bi) (continued)

E_γ	I_γ†	E_i(level)	J^π_i	E_f	J^π_f	Mult.	α#	Comments
154.7 *5*	1.7 *1*	1304.4		1149.71	(15/2)$^-$			
301.68 *3*	5.4 *1*	1129.81	(17/2)$^-$	828.13	(13/2)$^-$	E2	0.1186	α(K)=0.0652 *10*; α(L)=0.0400 *6*; α(M)=0.01032 *15*; α(N+..)=0.00317 *5* α(N)=0.00263 *4*; α(O)=0.000498 *7*; α(P)=4.39×10^{-5} *7* Mult.: from K/L(exp)=1.4 *2*, L12/L3(exp)=3.7 *12* (theory: K/L=1.63 *4*, L12/L3=3.07 *3*).
321.58 *10*	1.1 *2*	1149.71	(15/2)$^-$	828.13	(13/2)$^-$	M1	0.384	α(K)=0.313 *5*; α(L)=0.0540 *8*; α(M)=0.01269 *18*; α(N+..)=0.00399 *6* α(N)=0.00324 *5*; α(O)=0.000663 *10*; α(P)=7.90×10^{-5} *11* Mult.: from K/L(exp)=5.3 *4*; α(K)exp=0.43 *15* from α(K)exp(302γ)/α(K)exp(322γ)=0.15 *5* with α(K)(302)=0.0652 *10* (theory: α(K)=0.313 *5*, K/L=5.80 *12*).
404.92 *2*		404.92	7/2$^-$	0.0	9/2$^-$			I_γ: no intensity reported at E(t)=15 MeV. Iγ=2.5 *1* is reported for E(t)=12 MeV.
766.46 *3*	6.4 *3*	766.46	(9/2,11/2)$^-$	0.0	9/2$^-$	(M1)	0.0382	α(K)=0.0313 *5*; α(L)=0.00527 *8*; α(M)=0.001235 *18*; α(N+..)=0.000388 *6* α(N)=0.000316 *5*; α(O)=6.46×10^{-5} *9*; α(P)=7.71×10^{-6} *11* Mult.: from K/L(exp)=6.7 *10* (theory: K/L=5.94 *12*); this does not exclude E1, but $\Delta\pi$=no from level scheme.
828.13 *4*	7.3 *4*	828.13	(13/2)$^-$	0.0	9/2$^-$	E2	0.01017	α(K)=0.00790 *11*; α(L)=0.001725 *25*; α(M)=0.000417 *6*; α(N+..)=0.0001298 *19* α(N)=0.0001063 *15*; α(O)=2.12×10^{-5} *3*; α(P)=2.30×10^{-6} *4* Mult.: from K/L(exp)=4.4 *8*, α(K)exp=0.0089 *26* from α(K)exp(766γ)/α(K)exp(828γ)=3.5 *10* with α(K)(766γ)=0.0313 *5* (theory: α(K)=0.0089 *11*, K/L=4.58 *9*).

† Values given are measured production cross sections: $\sigma(\gamma)$(mb) at E(t)=15 MeV.

‡ Unobserved transition; existence inferred from $\gamma\gamma$ data.

\# 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.



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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)
Coincidence
154.7 1.7
97.4 (E2)
321.58 M1 1.1
19.90 [M1]
301.68 E2 5.4
1304.4
(21/2$^-$)
1227.2
70 ns 5
(15/2)$^-$
1149.71
(17/2)$^-$
1129.81
828.13 E2 7.3
61.67 [M1]
766.46 (M1) 6.4
(13/2)$^-$
828.13
(9/2,11/2)$^-$
766.46
404.92
7/2$^-$
404.92
9/2$^-$
0.0
$^{211}_{83}Bi_{128}$