^{213}Bi α decay 2013Ma13

History

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

Parent: ^{213}Bi: E=0.0; $J^{\pi}=9/2^{-}$; $T_{1/2}$=45.61 min *6*; Q(α)=5988 *4*; %α decay=2.140 *10*

^{213}Bi-J^{π}: From Adopted Levels of ^{213}Bi.

^{213}Bi-$T_{1/2}$: Weighted average of 45.59 min *6* (1973Po16) and 45.62 min *6* (2013Ma13,2013Su13). Others: 47 min *1* (1950Ha52), 46 min *1* (1964Gr11) and 46 min (1947En03).

^{213}Bi-Q(α): From Eα=5875 *4*, weighted average of 5860 *30* (1947En03), 5870 *6* (1967Dz02), 5869 *10* (1964Gr11) and 5878 *4* (2013Ma13). Q(g.s.)=5982 *6* from 2012Wa38.

^{213}Bi-%α decay: From a high-resolution α spectroscopy in 2013Ma13. Others: %α=2.20 *3* (1997Ch53), 2.09 *3* (1998Ar03), 2.022 *26* (1986He06) and 2.16 *11* (1964Gr11).

2013Ma13: ^{213}Bi activities were produced from an open ^{225}Ac source. α-particles were detected with a high-resolution ion-implanted planar silicon detector (PIPS). Measured Eα, Iα, α(t). Deduced levels, $T_{1/2}$, α-branching ratios.

2000Gr35: Measured Eγ, Iγ, I(x-ray), $\gamma\gamma$-coin, xγ-coin. Deduced levels, conversion coefficients.

1997Ch53: ^{213}Bi activities were produced from a ^{225}Ac source. Measured Eα, Iα.

1989Ko26: ^{213}Bi activities were produced from a 20 μg ^{229}Th sample. γ-rays were detected by a 17% efficient HPGe coaxial detector (FWHM=1.9 keV at 1.33 MeV) and a 2 cm^3 LEPS (FWHM=190 eV at the Fe K_{α} x-line and a 8% efficient Ge(Li) detector for $\gamma\gamma$-coincidence measurements. Measured Eγ, Iγ, $\gamma\gamma$-coin. Deduced levels.

1981Di14: ^{213}Bi activities were produced from a ^{229}Th sample. Measured γ-rays using a 90 cm^3 Ge(Li) detector (FWHM=3.75 keV at E=2614 keV) and a 200 cm^3 high-resolution intrinsic Ge detector (FWHM≈0.6 keV for E<200 keV).

1977Vy02: ^{213}Bi activities were produced from a ^{221}Rn sample. Measured Eγ, Iγ using Ge(Li) detectors.

Others: 2002Mo46, 1998MaZO, 1998Ar03, 1994Ar23, 1992Li26, 1986He06, 1972Dz14, 1969ArZV, 1968GuZW, 1967VrZZ, 1964Gr11.

^{209}Tl Levels

E(level)†‡	J^{π}#
0.0	$1/2^{+}$
323.70 *2*	$3/2^{+}$

† from a least-squares fit to Eγ.

‡ 1989Ko26 proposed a level at 868.3-keV based on the observation of 544.9 keV *3* and 868.0 keV *2* γ-rays. However, the later work of 1998Ar03 showed that 868γ belongs to the β^{-} branch of ^{213}Bi, rather than to its α branch. The 544.9γ includes a contribution from the double-escape peak of the 1567γ in ^{209}Tl β^{-} decay and without the parallel 868γ to define the level energy, the placement of the residual component of the 544.9γ to ^{213}Bi α decay cannot be established.

From Adopted Levels.

α radiations

Eα	E(level)	Iα‡	HF†	Comments
5558 *4*	323.70	8.45 *11*	90 *9*	Eα: weighted average of 5560 keV *4* (2013Ma13) and 5549 keV *10* (1964Gr11). Iα: from 2013Ma13. Others: 6.8 *1* (1997Ch53), 7.4 *14* (1964Gr11).
5875 *4*	0.0	91.55 *11*	264 *26*	Eα: weighted average of 5860 keV *30* (1947En03), 5870 keV *6* (1967Dz02), 5869 keV *10* (1964Gr11) and 5878 keV *4* (2013Ma13). Iα: from 2013Ma13. Others: 93.2 *14* (1997Ch53), 92.6 *14* (1964Gr11).

† $r_0(^{209}Tl)$=1.51 *3*, average of 1.5396 *1* for ^{210}Pb (deduced from Hf(7686.82α)=1) and 1.48 *5* for ^{208}Hg, estimated from $r_0(^{206}Hg)$=1.45 *4* and the systematics of 1998Ak04.

‡ For absolute intensity per 100 decays, multiply by 0.02140 *10*.

^{213}Bi α decay 2013Ma13 (continued)

γ(^{209}Tl)

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[‡]	α[†]	Comments
323.70 *2*	0.167 *3*	323.70	3/2$^+$	0.0	1/2$^+$	M1+E2	1.30 *+23−19*	0.174 *18*	α(K)=0.131 *16*; α(L)=0.0330 *15*; α(M)=0.0080 *3* α(N)=0.00202 *8*; α(O)=0.000377 *17*; α(P)=2.80×10^{-5} *25* E_γ: weighted average of 323.81 keV *5* (1977Vy02), 323.7 keV *2* (1981Di14), 323.71 keV *3* (1989Ko26), 323.69 keV *5* (1998Ar03), 323.69 keV *1* (1994Ar23) and 323.80 keV *4* (2000Gr35). Other measurement: 1964Gr11. I_γ: from Iγ(323γ)/Iγ(440γ in ^{213}Po)=0.00639 *12* (weighted average of 0.0062 *3* (2000Gr35), 0.0057 *5* (1998Ar03), 0.0057 *4* (1994Ar23), 0.0062 *6* (1989Ko26) and 0.00660 *15* (1981Di14)) and %Iγ(440γ)=26.10 *17* (weighted average of 26.1 *3* (1986He06) and 26.1 *2* (2002Mo46). The latter value supersedes that of 25.4 *3* (2000Gr35), which is from the same laboratory). The value of Iγ(323γ)/Iγ(440γ in ^{213}Po)=0.0112 *8* (1977Vy02) is excluded from the average, since it is much higher than others and is also superseded by 2000Gr35. Other: %Iγ=0.154 *3* from %Iα=8.45 *11*, %α=2.140 *10* and α. Mult.,δ: from α(K)exp=0.131 *15* (2000Gr35). Other (from the same group): α(K)exp=0.40 *9* (1998MaZO).
[x]544.9[@] *3*	0.0167 *24*								E_γ: from 1989Ko26. I_γ: from Iγ(544.9γ)/Iγ(323.7γ)= 0.100 *14* (1989Ko26) and Iγ(323.7γ)= 0.167 *3*, as deduced in the present work.

[†] Additional information 1.
[‡] Additional information 2.
[#] Absolute intensity per 100 decays.
[@] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

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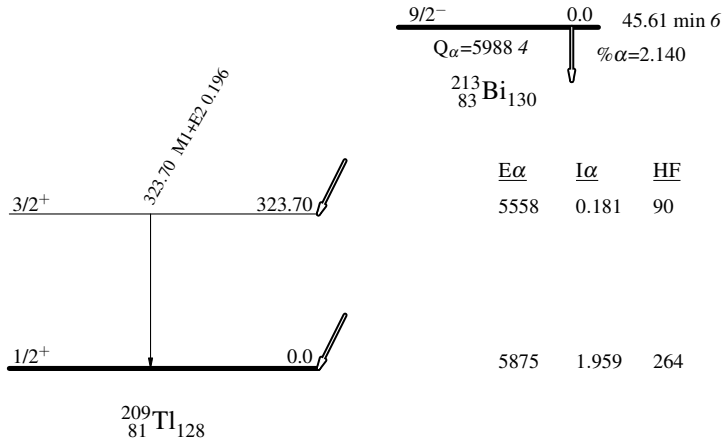
Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



Eα	Iα	HF
5558	0.181	90
5875	1.959	264