^{194}At α decay (323 ms) 2009An11,2013An03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, [1] and Jun Chen[2]	NDS 169, 1 (2020)	15-Oct-2020

Parent: ^{194}At: E=0+y; J^{π}=(9$^-$,10$^-$); $T_{1/2}$=323 ms *7*; Q(α)=7454 *11*; %α decay≈100.0

^{194}At-E: y=46 *60* Deduced by evaluators from Q(α)=7454 *11* for ^{194}At decay, and measured Eα=7178 *15* to the 171 *62*, (10$^-$) state in ^{190}Bi. Other: −20 keV *40* (2017Au03) from α-energy difference.

^{194}At-J^{π}: proposed by 2009An11 based on favored α decay to (10$^-$) isomer in ^{190}Bi and a configuration=π(7/2$^-$[514])⊗ν(1$i_{13/2}$).

^{194}At-$T_{1/2}$: Measured by 2013An03 (supersedes 310 ms *8* in 2009An11). Other: 300 ms *+50−40* (2013Ny01).

^{194}At-Q(α): From 2017Wa10.

^{194}At-%α decay: %α≈100 for ^{194}At decay (323 ms).

2009An11, 2013An03: ^{194}At produced in ^{141}Pr(^{56}Fe,3n) E=259 MeV reaction using UNILAC heavy ion accelerator at GSI facility. Evaporation residues were separated by the velocity filter SHIP, transported through three time-of-flight detectors and implanted into a 16-strip position-sensitive silicon detector (PSSD) for detection of subsequent α and fission decays. The γ rays were detected with a large-volume clover Ge detector. Measured Eα, Iα, Eγ, $\alpha\gamma$ coin, (recoil)α correlations, fission spectra, half-lives. Deduced upper limits on TKE, $T_{1/2}$, β-delayed fission probability. See 2001An11 for the identification of the parent state in ^{194}At.

2013Ny01: ^{194}At produced in ^{147}Sm(^{51}V,4n),E=224 MeV reaction at JYFL, Jyvaskyla accelerator facility followed by separation using RITU separator. Measured Eα, Iα, Eγ, $\alpha\gamma$-coin, $T_{1/2}$ of ^{194}At activities.

All data are from 2009An11, unless otherwise noted.

^{190}Bi Levels

E(level)	J^{π}‡	$T_{1/2}$	Comments
191 *65*	(10$^-$)		Additional information 1. E(level): from the Adopted Levels.
231.3† *5*	(9$^+$,10$^+$,11$^+$)		
287.7† *5*	(9$^-$,10$^-$,11$^-$)		
465.0† *5*	($^-$)	1.0 μs *+10−5*	$T_{1/2}$: measured by 2009An11. Other: 0.50 μs *10* from decay loss of ^{190}Bi nuclei during the flight through the velocity filter SHIP at GSI (2001An11), assuming that the isomer decays 100% to the (10$^-$) level.

† From Eγ data, relative to the energy of the 171-keV level kept as fixed. Absolute uncertainty is 57 keV, as for the 171-keV level.

‡ From the Adopted Levels.

α radiations

Eα	E(level)	Iα‡	HF†	Comments
6908 *15*	465.0	1.0 *3*	111 *35*	Reduced α-decay width δ^2_α=1.1 keV *4* (2009An11). Hindrance factor=9 *3*, relative to 1.0 for 7178α (2009An11).
7087 *15*	287.7	13 *2*	36 *7*	Eα: 7085 in Fig. 7 of 2009An11. Reduced α-decay width δ^2_α=3.5 keV *7* (2009An11). Hindrance factor=2.9 *6*, relative to 1.0 for 7178α (2009An11).
7135 *15*	231.3	8 *2*	86 *23*	Reduced α-decay width δ^2_α=1.5 keV *4* (2009An11). Hindrance factor=6.7 *20*, relative to 1.0 for 7178α (2009An11).
7178 *15*	191	78 *5*	12.4 *13*	Eα: from 2009An11. Other: 7156 *5* (2013Ny01). Value from 2009An11 is preferred by evaluators due to higher statistics in this experiment, although, energy precision is lower than in 2013Ny01. Reduced α-decay width δ^2_α=10.0 keV *14* (2009An11).

† Deduced by evaluators using r_0(^{190}Bi)=1.550 *22*, obtained from unweighted average of r_0=1.5137 *13* for ^{188}Pb, 1.5113 *39* for

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α radiations (continued)

^{190}Pb, 1.590 *11* for ^{190}Po and 1.585 *15* for ^{192}Po taken from 2020Si16 evaluation of r_0 parameters. Relative hindrance factors and reduced α-decay widths from 2009An11 are given under comments.

‡ For absolute intensity per 100 decays, multiply by ≈1.

γ(^{190}Bi)

E_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α†	Comments
x≈15							
x29.0 5							
x34.9 5							
40.3 5	231.3	(9+,10+,11+)	191	(10−)	(E1)	1.09 *4*	Mult.: from intensity balance arguments (2009An11).
x68.7 5							
96.7 5	287.7	(9−,10−,11−)	191	(10−)	(M1)	11.2 *2*	Mult.: from intensity balance arguments (2009An11).
x99.3 5							
x107.7 5							
x122.6 5							
x131.6 5							
x134.4 5							
x148.8 5							
274.0 5	465.0	(−)	191	(10−)	(E2+M1)	0.38 *22*	E_γ: from text of 2009An11. Other: 273 *1* (2001An11). Mult.: from α(K)exp=0.20 *5* determined from (γ)(K x-ray)-coin (2001An11) gives E2 or M1+E2 with δ≈1.5.

† 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.

x γ ray not placed in level scheme.

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Decay Scheme