^{194}At α decay (286 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+x; J^π=(4$^-$,5$^-$); $T_{1/2}$=286 ms *7*; Q(α)=7454 *11*; %α decay≈100.0

^{194}At-E: x=0 assumed in 2017Au03.

^{194}At-J^π: favored α decay to (5$^-$) isomer in ^{190}Bi.

^{194}At-$T_{1/2}$: Measured by 2013An03 (supersedes 253 ms *10* in 2009An11). Others: 240 ms *+40−30* (2013Ny01), 320 ms *+230−90* and 280 ms *+200−90* (2013Uu01), ≈250 ms (1995Le15), 0.18 s *8* (1984YaZY).

^{194}At-Q(α): From 2017Wa10.

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.

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.

2013Uu01: ^{194}At activity from ^{198}Fr α decay, the latter produced ^{141}Pr(^{60}Ni,3n),E=268 MeV reaction at JYFL, Jyvaskyla accelerator facility followed by separation using RITU separator. Measured Eα, Iα, $\alpha\alpha$-correlations, $T_{1/2}$ of ^{194}At activity.

1995Le15: ^{194}At Activity produced in ^{141}Pr(^{56}Fe,3n),E=256 MeV reaction and separated in a gas-filled recoil mass separator. The measured fine structure of α particles was not definite due to possible α-conversion electron summing in the detector.

1984YaZY: a 0.18 s *8* α activity with Eα=7200 keV *20* was produced in heavy-ion reactions and assigned to ^{194}At by mass separation and $\alpha\alpha$(t) correlation with daughter nuclei.

All data are from 2009An11, unless otherwise noted.

^{190}Bi Levels

E(level)	J^π‡	$T_{1/2}$	Comments
0	(3$^+$)		E(level): (3$^+$) determined to be g.s. by 2020St11. See Adopted Levels. J^π: 2013Ny01 suggest that J^π could also be (2$^-$) connecting 121 and g.s. through 76.5, E1 transition from 121, 3$^+$ → 0.0, 2$^-$ with a possible configuration=$\pi 3s^{-1}_{1/2}\otimes\nu 3p_{3/2}$.
45 *15*	(4$^+$)		
121.5† *3*	(5$^-$)	175 ns *8*	$T_{1/2}$: measured by 2009An11.
168.0† *5*	(6$^+$)		

† From Eγ data, relative to the energy of the 45-keV level kept as fixed. Absolute uncertainty is 15 keV, as for the 45-keV level.

‡ From the Adopted Levels.

α radiations

Eα	E(level)	Iα‡	HF†	Comments
7145 *15*	168.0	9 *3*	73 *26*	Reduced α-decay width δ^2_α=2.0 keV *7* (2009An11). Hindrance factor=6 *2*, relative to 1.0 for 7190α (2009An11).
7190 *15*	121.5	83 *3*	11.3 *11*	Eα: from 2009An11. Others: 7174 *8* (2013Ny01), 7188 *12* and 7189 *12* (2013Uu01). Value from 2009An11 is preferred by evaluators due to higher statistics in this experiment, although, energy precision is somewhat lower than in 2013Ny01 and 2013Uu01. Reduced α-decay width δ^2_α=12 keV *1* (2009An11).
7266 *15*	45	7 *3*	24×10^1 *11*	Reduced α-decay width δ^2_α=0.6 keV *3* (2009An11). Hindrance factor=20 *10*, relative to 1.0 for 7190α (2009An11).
7310 *15*	0	<1.5	>1420	Iα: ≤1.0 *5*.

Continued on next page (footnotes at end of table)

^{194}At α decay (286 ms) 2009An11,2013An03 (continued)

α radiations (continued)

Eα	E(level)	Comments
		Reduced α-decay width $\delta^2_\alpha \leq 0.06$ keV *2* (2009An11). Hindrance factor ≥200 *100*, relative to 1.0 for 7190α (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 ^{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)

Eγ	E_i(level)	J^π_i	E_f	J^π_f	Mult.	α†	Comments
x≈15							
x29.0 *5*							
x34.9 *5*							
(45 *15*)	45	(4+)	0	(3+)	[M1]		Eγ: not observed, γ probably totally converted (2009An11); not reported by 2013Ny01. Mult.: M1 is required from the intensity balance (2009An11).
46.5 *5*	168.0	(6+)	121.5	(5−)	(E1)	0.744 *25*	Eγ: γ from 2009An11, not reported by 2013Ny01. Mult.: from intensity balance arguments (2009An11).
x68.7 *5*							
76.5 *3*	121.5	(5−)	45	(4+)	E1	0.194 *4*	Eγ: weighted average of 76.0 *5* (2009An11) and 76.7 keV *3* (2013Ny01). Mult.: from α(total)exp=0.4 *1* in 2009An11.
x99.3 *5*							
x107.7 *5*							
x122.6 *5*							
x131.6 *5*							
x134.4 *5*							
x148.8 *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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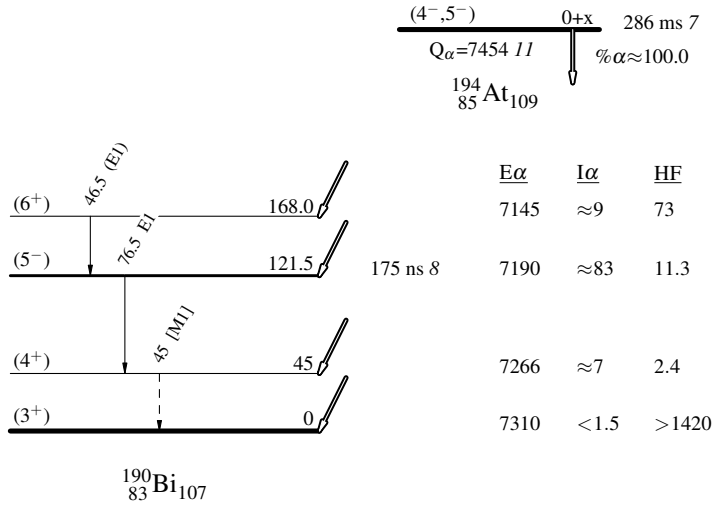
Legend

- - - - - - ► γ Decay (Uncertain)

Decay Scheme



	Eα	Iα	HF
	7145	≈9	73
	7190	≈83	11.3
	7266	≈7	2.4
	7310	<1.5	>1420