^{198}At α decay (1.25 s) 2019Gh11,1992Hu04,2005Uu02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 177, 1 (2021)	3-Sep-2021

Parent: ^{198}At: E=265 *3*; J^{π}=(10$^-$); $T_{1/2}$=1.25 s *6*; Q(α)=6889.4 *19*; %α decay=93 *7*

^{198}At-E: Deduced by 2019Gh11 from α-decay data in their work. Other: 287 *12* deduced by 2013St25 from analysis of measured mass excesses and linkage through α-decay chains.

^{198}At-J^{π}: From ^{198}At Adopted Levels in the ENSDF database (Dec 2015 update).

^{198}At-$T_{1/2}$: weighted average of 1.28 s *10* (2019Gh11), 1.24 s *6* (2014Ka23), 1.04 s *15* (2005Uu02), 1.3 s *+8−3* (1996En01), 1.0 s *2* (1992Hu04), and 1.5 s *3* (1967Tr06). Half-life of 1.21 s *6* in ^{198}At Adopted Levels in the ENSDF database (Dec 2015 update) is revised here with the inclusion of 2019Gh11 measurement.

^{198}At-Q(α): From 2021Wa16.

^{198}At-%α decay: From %α≥86 (1995BiZZ). Others: %α=76 *21* (1998Bo14), >67 (1992Hu04), 26 *7* (1980Ew03).

2019Gh11: ^{198}At from α decay of ^{202}Fr, which was produced in U(p,X),E=1.4 GeV at ISOLDE-CERN facility using UC_x target and pulsed proton beam. Francium atoms were ionized and accelerated to 30 keV, followed by mass separation using High-Resolution separator (HRS). Measured Eα, Iα, $\alpha\gamma$-coin using Si surface barrier detectors for α particles and two single-crystal HPGe detectors for γ detection. FWHM≈33 keV for Eα=5-8 MeV range. The two activities of ^{202}Fr could not be separated in this work.

1992Hu04: online mass-separated source from ^{202}Fr α decay produced in Ir(^{20}Ne,xn)^{202}Fr and ^{181}Ta(^{32}S,2p9n)^{202}Fr, and directly in Re(^{20}Ne,xn)^{198}At. Measured α particles, γ rays, conversion electrons, $\alpha\gamma$(t) coin using Ge and Si(Li) detectors.

2005Uu02, 2005Uu03: ^{198}At produced in α decay of ^{202}Fr produced in ^{141}Pr(^{63}Cu,pn),E=278-288 MeV and in ^{170}Yb(^{36}Ar,p3n), E=180-185 MeV.

2014Ka23: ^{198}At source from ^{202}Fr α decay, which was produced in ^{149}Sm(^{56}Fe,p2n), E(^{56}Fe)=244-275 MeV reaction, with beam from GSI accelerator facility. Target=370 μg/cm^2 thick enriched to 96.9% in ^{149}Sm, and backed with 40 μg/cm^2 thick carbon backing and covered with a 10 μg/cm^2 layer of carbon. It was mounted on a rotating wheel. Evaporation residues were separated using SHIP facility at GSI, and implanted into the detection system consisting of 16-strip position sensitive Si detectors (PSSD), a pack of six Si strip detectors (BOX) at the back to detect escaping α particles, and three time-of-flight detectors in front of PSSDs. Measured position and time correlations between evaporation residues (Er) and α events, Eα, half-lives of ground states and isomers of ^{202}Fr and ^{198}At, Er-α-α correlations. Comparison with previous experimental results. (ER)$\alpha\alpha$ correlated events were assigned to ^{202}Fr -> ^{198}At -> ^{194}Bi decay chain.

Others:

1998Bo14: measured α-decay branching ratios.

1996En01: online mass separated (gas-filled recoil separator) source from ^{202}Fr α decay produced in ^{170}Yb(^{35}Cl,3n), E=171-186 MeV. Measured α particles using semiconductor detector.

1988Wo11: measured α anisotropy.

1967Tr06: measured Eα, $T_{1/2}$.

^{194}Bi Levels

E(level)†	J^{π}‡	Comments
161 *8*	(10$^-$)	E(level): deduced by 2019Gh11 from α-decay data in their work. Other: 184 *12* in 2013St25.
265.5 *2*	(9$^-$)	
686.4 *2*	(11$^-$)	
699.2 *4*	(10$^-$)	

† From Eγ values, keeping energy of the 161 level as fixed without its uncertainty. Absolute uncertainty in each level energy is 8 keV, same as in the 161-keV level.

‡ From the Adopted Levels.

^{198}At α decay (1.25 s) 2019Gh11,1992Hu04,2005Uu02 (continued)

α radiations

Eα†	E(level)	Iα†#	HF‡	Comments
6322 *12*	699.2	0.005 *3*	3.3×10^2 *20*	Reduced α width δ_α^2=0.2 *1* (2019Gh11).
6338 *8*	686.4	0.11 *2*	17 *4*	Iα: 0.09 to 0.13 in 2019Gh11. Reduced α width δ_α^2=3.3 to 4.8 (2019Gh11).
6753 *8*	265.5	0.19 *14*	4.0×10^2 *30*	Iα: 0.05 to 0.34 in 2019Gh11. Reduced α width δ_α^2=0.04 to 0.28 (2019Gh11).
6852 *4*	161	99.70 *14*	1.8 *2*	Eα: weighted average of 6849 *5* (2014Ka23), 6850 *6* (2005Uu02), 6855 *4* (1996En01), 6856 *4* (1992Hu04), 6853 *10* (1980Ew03) and 6847 *5* (1967Tr06). Other: 6856 (1995BiZZ). Iα: Relative Iα=100 (2019Gh11). Reduced α width δ_α^2=26 keV *1* (2019Gh11), 39 keV *3* (2014Ka23).

† From 2019Gh11, unless otherwise stated.
‡ The nuclear radius parameter $r_0(^{194}Bi)$=1.5187 *42* (2020Si16) deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides, as given in 2020Si16: ^{192}Pb, ^{194}Pb, ^{194}Po, and ^{196}Po.
# For absolute intensity per 100 decays, multiply by 0.93 *7*.

γ(^{194}Bi)

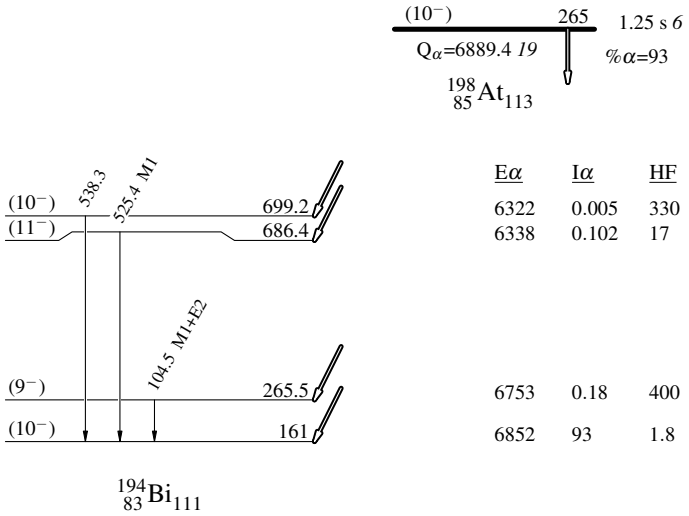
Intensities from αγ-coin data are given under comments, and are relative to 100 for I(6358α-218.2γ-coin) in the decay of (3^+) g.s. of ^{218}At (2019Gh11).

Eγ†	Ei(level)	J_i^π	E_f	J_f^π	Mult.	α#	Comments
104.5 *2*	265.5	(9^-)	161	(10^-)	M1+E2	7.3 *17*	I(6753α-104.5γ-coin)=21 *3*. Mult.: from the Adopted Gammas.
x258.8‡ *1*							I(6338α-258.8γ-coin)=24 *4*.
x336.3‡ *5*							I(6338α-336.3γ-coin)=15 *3*.
x363.6‡ *2*							I(6338α-363.6γ-coin)=12 *3*.
525.4 *2*	686.4	(11^-)	161	(10^-)	M1	0.1024	I(6338α-525.4γ-coin)=5 *2*. Mult.: from the Adopted Gammas.
538.3 *4*	699.2	(10^-)	161	(10^-)			I(6322α-538.4γ-coin)=2.8 *14*.

† From 2019Gh11.
‡ Unplaced γ observed in coincidence with 6338α from the decay of (10^-) isomer of ^{198}At (2019Gh11).
# 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.

^{198}At α decay (1.25 s) 2019Gh11,1992Hu04,2005Uu02

Decay Scheme



Eα	Iα	HF
6322	0.005	330
6338	0.102	17
6753	0.18	400
6852	93	1.8