Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh et al. ,	NDS 175, 1 (2021)	19-May-2021

Q(β^-)=1566.7 *29*; S(n)=5776 *12*; S(p)=5250 *4*; Q(α)=6342 *5* 2021Wa16
S(2n)=10141 *6*, S(2p)=12912 *18* (2021Wa16).

Additional information 1.

1953Hy83: descendant of ^{227}Ac. Assignment to ^{219}At based on chemical separation and on the genetic relationship to its α parent nucleus ^{223}Fr. Measured half-life of decay of ^{219}At.

1989Bu09: ^{219}At activity was produced by spallation of 600-MeV protons on targets of ^{232}Th. Assignment to ^{219}At based on mass separation and on identification of the daughter nucleus ^{215}Bi in the source. The disintegration rate was determined by measuring the β^- activity with a 4π plastic scintillator detector.

2015Fi07: ^{219}At activity from β^- decay of ^{219}Po produced in ^{238}U(p,F),E=1.4 GeV from CERN synchrotron (PS) Booster. Target=ISOLDE UC_x. Pure laser-ionized beam of ^{219}Po is extracted from the reaction products using a Laser-Ion Source and Trap (LIST) system, which suppresses contamination from Francium activity by more than a factor of 1000. Measured Eα and Iα of ^{219}At activity, branching ratio for decay of ^{219}At.

Mass measurement: 2017Ma29: time-of-flight ion-cyclotron-resonance (ToF-ICR) technique using ISOLTRAP at ISOLDE-CERN.

2019Ba22: hyperfine structure measurements using in-source resonance ionization spectroscopy at CERN-ISOLDE. Deduced isotope shift, change in mean square charge radius, magnetic dipole and electric quadrupole moments for the ground state.

2002Sh19: analyzed levels, α-decay data, hindrance factors.

Theoretical calculations: 15 primary references in the NSR database (www.nndc.bnl.gov/nsr) related to radioactivity.

All data are from ^{223}Fr α decay.

^{219}At Levels

Cross Reference (XREF) Flags

A ^{223}Fr α decay (22.00 min)

E(level)	J^π[†]	$T_{1/2}$	XREF	Comments
0.0	(9/2$^-$)	56 s *4*	A	%α=93.6 *10* (2015Fi07); %β^-=6.4 *10* μ=+3.502 *70* (2019Ba22) Q=−1.17 *64* (2019Ba22) %α determined by 2015Fi07 by comparing the intensities of 6228α (from ^{219}At decay), and 6819α (from the decay of ^{219}Rn β^- daughter of ^{219}At decay), together with Iα=79.4% *10* for the 6819α, taken from ^{219}Rn α decay dataset in the ENSDF database (Sept 2013 update). %β^-=100−%α. Other: %$\alpha\approx$97 (1953Hy83). Measured isotope shift $\delta\nu$(^{219}At,^{205}At)=−16580 MHz *120* (2019Ba22, hyperfine structure using in-source resonance ionization spectroscopy at CERN-ISOLDE). Measured change in nuclear mean-square charge radius δ<r^2>(^{219}At,^{205}At)=+1.435 fm^2 *10*(stat) *74*(syst) (2019Ba22, hyperfine structure using in-source resonance ionization spectroscopy at CERN-ISOLDE). $T_{1/2}$: weighted average of 57 s *4* (1989Bu09) and 54 s *6* (1953Hy83). Based on measurements of charge radius and moments, 2019Ba22 suggest spherical configuration of $\pi h_{9/2}$ or π9/2[505]$h_{9/2}$, with possible octupole collectivity. Other: 2001Li44 proposed configuration=$\pi h^3_{9/2}\otimes\nu g^{-2}_{9/2}$. Measured E$\alpha$=6228 *5* from the decay of ^{219}At (2015Fi07). μ,Q: hyperfine structure using in-source resonance ionization spectroscopy at CERN-ISOLDE (2019Ba22).
58.9 *2*	(7/2$^-$)		A	Proposed configuration=$\pi(h^2_{9/2}f_{7/2})\otimes\nu g^{-2}_{9/2}$.
150.9 *2*	(5/2$^-$)[‡]		A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{219}At Levels (continued)

E(level)	J^{π}[†]	XREF
174 *5*	$(3/2^-)$[‡]	A
296.2 *4*	$(3/2^-)$[‡]	A

[†] As assigned by 2001Li44 (also 2002Sh19) based on multipolarity assignments to gamma-ray transitions, and shell-model configurations in comparison with level structures of ^{215}At and ^{217}At.

[‡] Configuration may involve parts of seniority three protons, $h^3_{9/2}$ and $h^2_{9/2}f_{7/2}$, as in ^{215,217}At. For 174 and 296 levels, $(3/2^-)$ is also supported by low hindrance factors (<3) in ^{223}Fr α decay from $3/2^{(-)}$ parent state.

$\gamma(^{219}At)$

E_i(level)	J^{π}_i	E_γ	I_γ	E_f	J^{π}_f	Mult.	δ	α[†]	$I_{(\gamma+ce)}$	Comments
58.9	$(7/2^-)$	58.9 *2*	100	0.0	$(9/2^-)$	M1		10.87 *19*		α(L)=8.27 *15*; α(M)=1.96 *4*; α(N)=0.508 *9*; α(O)=0.1088 *19*; α(P)=0.0150 *3*
150.9	$(5/2^-)$	150.9 *2*	100	0.0	$(9/2^-)$	E2		1.417		α(K)=0.287; α(L)=0.836; α(M)=0.224; α(N)=0.0578; α(O)=0.01138; α(P)=0.001171
174	$(3/2^-)$	(23 *5*)		150.9	$(5/2^-)$				100	I(γ+ce) given as the transition is expected to be heavily converted.
296.2	$(3/2^-)$	145.3 *3*	100	150.9	$(5/2^-)$	(M1(+E2))	<0.9	3.6 *6*		α(K)=2.69 *69*; α(L)=0.69 *9*; α(M)=0.17 *3* α(N)=0.044 *7*; α(O)=0.0092 *13*; α(P)=0.00116 *7*

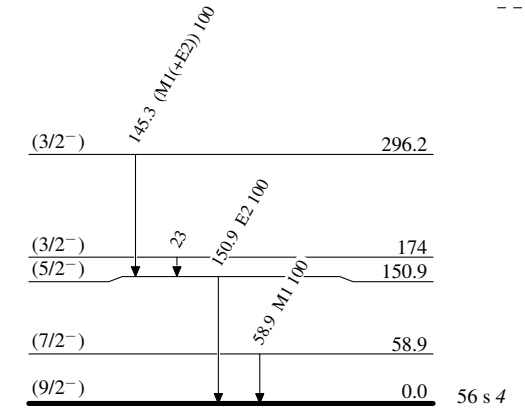
[†] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level



$^{219}_{85}At_{134}$