

Adopted Levels

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh		NDS 177, 1 (2021)	3-Sep-2021
<p>Q(β^-)=-6441 29; S(n)=8720 30; S(p)=-320 28; Q(α)=7454 11 2021Wa16 S(2n)=19780 40, S(2p)=1760 40, Q(ϵ)=10288 27, Q(ϵp)=7879 25 (2021Wa16). 1967Tr06: some indication that ¹⁹⁴At may have been produced in ^{185,187}Re(²⁰Ne,X),E=100-200 MeV reaction. 1984YaZY: a 0.18 s α activity with Eα=7200 keV 20 was produced in heavy-ion reactions and assigned to ¹⁹⁴At by mass separation and $\alpha\alpha(t)$ correlation with daughter nuclei. 1995Le15: ¹⁹⁴At Activity produced in ¹⁴¹Pr(⁵⁶Fe,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 (1995Le15). 2013An03 (also 2009An11): measurement of β-delayed fission in the decay of ¹⁹⁴At to ¹⁹⁴Po using 259 MeV ⁵⁶Fe beam with a typical intensity of 400-600 pA from the UNILAC heavy ion accelerator at GSI. The targets were ¹⁴¹PrF₃ with 100% natural abundance. Evaporation residues were separated by the velocity filter SHIP, transported through three time-of-flight detectors and implanted into a position-sensitive silicon detector (PSSD) for detection of subsequent α and fission decays. γ rays were detected with a large-volume four-crystal clover germanium detector. Measured α and fission spectra, time distribution using recoil-fission correlation, reaction yields. Deduced upper limits on TKE, T_{1/2}. Discussed β-delayed fission probability. N_{βDF}/Nα=0.00065 8, where N_{βDF} and Nα are observed counts of β-delayed fissions and α decays of ¹⁹⁴Po, respectively. Total beta-delayed fission from both isomers is estimated as $\approx 1.6\%$; which is divided here equally amongst the two activities by the evaluators. 2013Ny01: ¹⁹⁴At produced in ¹⁴⁷Sm(⁵¹V,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 ¹⁹⁴At activities. 2013Uu01: ¹⁹⁴At activity from ¹⁹⁸Fr α decay, the latter produced ¹⁴¹Pr(⁶⁰Ni,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 ¹⁹⁴At activity. 2014Gh09: measurement of β-delayed fission in the decay of ¹⁹⁴At to ¹⁹⁴Po. ¹⁹⁴At isotope was produced in spallation reactions with the bombardment of a 50 g/cm² thick UC_x target by 1.4 GeV protons from the CERN On-Line Isotope Mass Separator (ISOLDE) facility. At isotopes were laser ionized and accelerated to 30 keV followed by mass separation. Purified ion beams were transported to the detection station and implanted into 20 μg/cm² thick carbon foils. Fission fragments and α particles were measured by two silicon detectors of 300 μm thickness and γ rays were detected by a high-purity germanium detectors. Measured Eγ, Iγ, fission fragments. 2014Gh09 measured the counts of β-delayed fissions (N_{ϵF}) and α decays (Nα), but could not determine the β-delayed fission probability since two states in ¹⁹⁴At can decay via ϵ but their decay branching ratios are unknown. Nα/N_{ϵF}=2.0 $\times 10^3$ +17-8 from data with a high-resolution separator (HRS), 1.7 $\times 10^3$ 1 with a general purpose separator (GPS) (2014Gh09). Theoretical references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 19 primary references dealing with half-lives in different decay modes and structure calculations. Additional information 1.</p>				

¹⁹⁴At Levels

% ϵ F: ≈ 1.6 is estimated by [2013An03](#) for ϵ -delayed fission of the two isomers, with ≈ 0.8 for each if both have similar ϵ -decay branching ratios ([2013An03](#)).

Cross Reference (XREF) Flags

- A ¹⁹⁸Fr α decay (15 ms)
- B ¹⁹⁸Fr α decay (1.1 ms):?

E(level)	J π^\dagger	T _{1/2}	XREF	Comments
0+x	(4 ⁻ ,5 ⁻)	286 ms 7	A	% $\alpha \approx 100$; % ϵ +% β^+ =?; % ϵ F ≈ 0.8 (2013An03) 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), 210 ms +30-20 (2013Ka16); ≈ 40 ms (1995Le15), 0.18 s 8 (1984YaZY). Half-life value of 278

Continued on next page (footnotes at end of table)

Adopted Levels (continued) ^{194}At Levels (continued)

<u>E(level)</u>	<u>J^π[†]</u>	<u>$T_{1/2}$</u>	<u>XREF</u>	<u>Comments</u>
0+y	(9 ⁻ ,10 ⁻)	323 ms 7	B	<p>ms +58-41 was deduced for only the delayed fission events from the recoil-fission correlation analysis (2013An03).</p> <p>Theoretical half-life of 2.09 s for β decay and 0.24 s for α decay (2019Mo01) suggests up to 10% $\varepsilon+\beta^+$ decay, but except for εF decay of ≈ 0.8 (2013An03), no other study of ^{194}At β decay is available in literature.</p> <p>$\% \alpha \approx 100$; $\% \varepsilon + \% \beta^+ = ?$; $\% \text{IT} = ?$; $\% \varepsilon \text{F} \approx 0.8$ (2013An03)</p> <p>E(level): $y = -20\ 40$ (2021Ko07) from α-energy difference, assuming the 286-ms activity as the g.s. of ^{194}At.</p> <p>$T_{1/2}$: measured by 2013An03 (supersedes 310 ms 8 in 2009An11). Others: 300 ms +50-40 (2013Ny01), ≈ 250 ms (1995Le15, $\alpha\alpha$ timing correlation).</p>

[†] Proposed by 2009An11 based on most intense and least hindered α transition, and consideration of possible configurations.