

¹⁹⁸Fr α decay (15 ms) 2013Ka16,2013Uu01

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

Parent: ¹⁹⁸Fr: E=0+x; T_{1/2}=15 ms 3; Q(α)=7869 20; % α decay \approx 100.0

¹⁹⁸Fr-J ^{π} : 2⁻ for 15-ms and 6⁺,7⁺ for 16-ms proposed by 2013Uu01 with possible configurations of $\pi s_{1/2} \otimes \nu p_{3/2}$, and $\pi s_{1/2} \otimes \nu i_{13/2}$, respectively.

¹⁹⁸Fr-T_{1/2}: From α decay timing (2013Ka16). Other: 16 ms +13-5 (2013Uu01) for E α =7684 15 (five α - α correlated events), and 15 ms +12-5 (2013Uu01) for E α =7613 keV 15 (two α - α correlated events). 2013Uu01 considered two different activities of ¹⁹⁸Fr, one decaying with T_{1/2}=15 ms +12-5 and the other with T_{1/2}=16 ms +13-5, but at the same time mentioned that nearly the same half-lives for the two E α values may correspond to only one activity. Evaluators have considered only one activity with 15 ms half-life, as in 2013Ka16. The same half-life is adopted in ¹⁹⁸Fr Adopted Levels in the ENSDF database (Dec 2015 update).

¹⁹⁸Fr-Q(α): From 2021Wa16, using input E α =7710 keV from 2013Ka16.

¹⁹⁸Fr-% α decay: % α \approx 100 is assumed. Theoretical T_{1/2}(β -decay)=0.78 s and T_{1/2}(α decay)=5 ms (2019Mo01) suggests % ϵ +% β ⁺<1%. Proton decay is also possible from S(p)=-780 40 (2021Wa16), but no information is available about this decay mode.

2013Ka16: ¹⁹⁸Fr activity produced in ¹⁴¹Pr(⁶⁰Ni,3n) reaction at E(⁶⁰Ni)=282-300 MeV using SHIP separator at UNILAC-GSI facility. Evaporation residues (ERs) were implanted in position-sensitive Si detector (PSDD). A BOX system of six Si detectors was used to detect α particles which escaped PSDD detector. Time-of-flight (tof) detectors were used to distinguish decay events from implantation events. A Ge Clover detector was used to detect γ -rays in singles or coincidence with PSSD events. Identification of ¹⁹⁸Fr was based on time and position correlations of implanted ERs with subsequent α decay chains. For ¹⁹⁸Fr, 72 (ERs)- α_1 - α_2 - α_3 correlated events were observed, which was assigned to ¹⁹⁸Fr \rightarrow ¹⁹⁴At \rightarrow ¹⁹⁰Bi \rightarrow ¹⁸⁶Tl α -decay chains on the basis of energies and times of α decays observed in succession. energies and times of α decays observed in succession.

2013Uu01: ¹⁹⁸Fr activity produced in ¹⁴¹Pr(⁶⁰Ni,3n) reaction at E(⁶⁰Ni)=268 MeV in the middle of the target using RITU separator at K=130 MeV cyclotron at JYFL facility. The GREAT spectrometer consisting of multiwire proportional gas counter (MWPC) and two double-sided silicon strip detectors (DSSD). Time-of-flight setup was used to separate evaporation residues (ERs) from scattered beam particles. The gas counter was used to separate α particles from low-energy recoils. A planar Ge and a larger Ge detectors were used for γ detection. A total of ten α - α correlated events were assigned to originate from ¹⁹⁸Fr parent.

Tentative decay schemes were reported in 2013Uu01 and 2013Ka16, but due to disagreements in E α values, no decay scheme is adopted by evaluators.

¹⁹⁴At Levels

E(level)	J ^{π}	Comments
0+x	(4 ⁻ ,5 ⁻)	J ^{π} : from the Adopted Levels. 2013Uu01 proposed 2 ⁻ for a level fed by E α =7613 keV, and 6 ⁺ ,7 ⁺ for a level, possibly fed by E α =7684 keV. Observed E α \approx 7710 keV and a broad range of E α =7470-7920 group from ¹⁹⁸ Fr decay (2013Ka16). In 2013Uu01, E α =7613 keV 15 and 7684 keV 15 from ¹⁹⁸ Fr decay. It is possible that 7684 α in 2013Uu01 corresponds to E α \approx 7710 keV α in 2013Ka16.