^{222}Pa α decay (4.1 ms) 1970Bo13,1979Sc09,2019Mi08

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, M. S. Basunia, Murray Martin et al. ,	NDS 160,405 (2019)	30-Oct-2019

Parent: ^{222}Pa: E=0.0; $T_{1/2}$=4.1 ms *6*; Q(α)=8890 *syst*; %α decay=100

^{222}Pa-$T_{1/2}$: Unweighted average of 4.5 ms *3* (2019Mi08, time correlations between ^{222}Pa fragments and subsequent α decays); 3.3 ms *3* (1995AnZY); 2.9 ms *+6−4* (1979Sc09); 5.7 ms *5* (1970Bo13). In ^{222}Pa Adopted Levels in the ENSDF database (March 2011 update), value is adopted from 1979Sc09.

^{222}Pa-Q(α): 8890 *50* (syst, 2017Wa10).

^{222}Pa-%α decay: Only α decay has been observed for the decay of ^{222}Pa. Theoretical partial $T_{1/2}$=21.3 s for ^{222}Pa ε decay (2019Mo01) gives %ε+%β^+=0.02.

1970Bo13: measured Eα, Iα, hindrance factors, half-life of decay of ^{222}Pa.

1979Sc09: measured Eα, half-life of decay of ^{222}Pa.

2019Mi08: ^{222}Pa activities obtained from the α-decay chains starting from ^{226}Np or in ^{181}Ta(^{48}Ca,X),E=212, 217, 226 MeV at the UNILAC accelerator of GSI facility. Evaporation residues (ERs) were separated by the SHIP velocity filter and implanted into the COMPAct Spectroscopy Set-up (COMPASS), consisting of silicon detectors. Measured energy and time spectra of correlations between ERs and α particles from subsequent decays; deduced Eα and half-lives of decays of ^{222}Pa and ^{218}Ac.

Additional information 1.

^{218}Ac Levels

E(level)[†]
(0.0)
≈193
≈407
≈529
≈560
≈580

[†] Level energies are deduced from Q(α)=8890 *50* (syst, 2017Wa10) and Eα values given here.

α radiations

Eα[†]	E(level)	Iα[‡&]	HF[#]	Comments
8160[@]	≈580	≈17[@]	≈16[@]	
8180[@]	≈560	≈17[@]	≈18[@]	
8210[@]	≈529	≈17[@]	≈22[@]	Iα(8210α+ 8180α+ 8160α)≈50 (1970Bo13). Other: 8.31 MeV *4* (2019Mi08), emitted from the decay of ^{222}Pa, only when the activity of ^{222}Pa is produced directly in a reaction, not from the ^{226}Np α-decay chain, which may suggest an isomer in ^{222}Pa.
8330	≈407	≈20	≈40	Eα: α peak is strongly mixed somewhat with 8.36 MeV-α line emitted by ^{214}Fr activity. Other: 8.47 MeV *4* (2019Mi08).
8540	≈193	≈30	≈105	Eα: α peak is mixed somewhat with α lines emitted by ^{214m}Fr activity. Other: 8.63 MeV *4* (2019Mi08).

[†] From 1970Bo13. Uncertainty is not given by the authors, but expected to be ≈20 keV, based on data for other isotopes in the paper. Only one α of 8210 keV was observed by 1979Sc09. In 2019Mi08, two main peaks were reported at 8.63 and 8.47 MeV, and a third one at 8.31 MeV. It appears that α energies are about 100 keV higher in 2019Mi08, as compared to those in 1970Bo13. Note that statistics are much weaker in 2019Mi08 as compared to those in 1970Bo13.

[‡] From 1970Bo13.

[#] $r_0(^{218}Ac)$=1.5515 *79*, obtained using $r_0(^{218}Ra)$=1.5571 *17*, $r_0(^{216}Ra)$=1.5664 *65*, $r_0(^{220}Th)$=1.5514 *30*, and $r_0(^{218}Th)$=1.529 *15*.

Continued on next page (footnotes at end of table)

^{222}Pa α decay (4.1 ms) 1970Bo13,1979Sc09,2019Mi08 (continued)

α radiations (continued)

[@] Complex peak in 1970Bo13, too broad to be a single peak. Authors divide the peak in the three components. Total multiplet intensity ≈50 divided equally by the evaluators between the three α groups.
[&] Absolute intensity per 100 decays.