^{226}Th α decay

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Sukhjeet Singh, A. K. Jain, Jagdish K. Tuli	NDS 112,2851 (2011)	31-Mar-2011

Parent: ^{226}Th: E=0.0; $J^\pi=0^+$; $T_{1/2}$=30.57 min *10*; Q(α)=6450.9 *22*; %α decay=100.0

^{222}Ra Levels

$\alpha\gamma$(t):

(6234α)(ce 111γ)(t)	$T_{1/2}$(111 level)=0.52 ns *4*	5
(α)(240γ)(t)	$T_{1/2}$(242 level)<1.2 ns	
(α)(190γ)(t)	$T_{1/2}$(301 level)<1.4 ns	

E(level)	J^π	$T_{1/2}$
0.0	0^+	38.0 s *5*
111.12 *2*	2^+	0.52 ns *4*
242.11 *2*	1^-	<1.2 ns
301.39 *4*	4^+	<1.4 ns
317.29 *5*	3^-	
473.76 *8*	(5^-)	
914.0 *3*	(0^+)	
1024.9 *2*	2^+	

α radiations

See 1986Ch36, 1980Ka41, 1979Po23 for theoretical calculations of α-decay probabilities.
See 2010Wa31, 2009Wa01, 2009De32, 2009Ni06 and 2006Xu08 for calculation of branching ratio and half-lives. 2007Pe30, 2006Xu04, 2005Sh42, 2003Ba64, 2002Ba60, 2002Du16 for calculations of half-lives See 2005Bu38,199de51, 1996De19 for calculation of alpha decay width.

Eα[†]	E(level)	Iα[‡&]	HF[#]	Comments
(5333[@] *6*)	1024.9	0.00017 *4*	4.0 *10*	
(5442[@] *6*)	914.0	0.00034 *4*	8.2 *10*	
(5874[@] *6*)	473.76	0.00023 *2*	2.2×10^3 *2*	
6028 *5*	317.29	0.206 *9*	13.9 *7*	Iα: 0.22% was measured by 1975VaZD.
6040 *5*	301.39	0.187 *11*	18.1 *11*	Iα: 0.2% was measured by 1975VaZD.
6099 *5*	242.11	1.26 *5*	5.0 *2*	Iα: the measured values are 1.7% (1956As38), 1.2% (1963Le17), 1.3% *2* (1975VaZD).
6234 *5*	111.12	22.8 *2*	1.08 *2*	Iα: measurement of 1969Pe17. Other measured values: 19.0% *15* (1956As38), 20% (1961Ru06), 23.0% *23* (1975VaZD). 23.1% *16* from level scheme.
6336.8 *10*	0.0	75.5 *3*	1.0	Iα: from sum of Iα's. Iα=75.3% *3* is recommended by 1991Ry01. The measured intensities are 79% (1956As38), 78% (1961Ru06), 75% *8* (1975VaZD). Iα=75.2 *16* from Iγ's.

[†] The energies of α's to the g.s. and to the 111-keV level are given as recommended by 1991Ry01 from Eα measurements of 1956As38 and 1975VaZD. The energies measured by 1956As38 are increased 4.6 keV, the Eα(0) and Eα(111 level) measured by 1975VaZD are decreased 0.4 keV and 6.1 keV, respectively, by 1991Ry01 because of changes in calibration energies. All other Eα's are calculated by the evaluator from Eα(g.s.) and E(level).
[‡] Deduced from level scheme, except for Iα(to g.s.) and Iα(to 111 level), as indicated.

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^{226}Th α decay (continued)

α radiations (continued)

[#] HF(α to g.s.)=1.0 gives $r_0(^{222}Ra)$=1.5382 *5*. $T_{1/2}(^{226}Th)$=30.57 min *10*, measured by 1987Mi10, and Q(α)(^{226}Th)=6450.9 *22* of 1993Au05, 2011AuZZ are used in calculations. See 1990Bu30 for a semiclassical calculation of nuclear radius and for systematics of $T_{1/2}(\alpha)$ and r_0 values. See also 1977Ba70.
[@] α has not been observed.
[&] Absolute intensity per 100 decays.

$\gamma(^{222}Ra)$

$\gamma\gamma$: see 1976Ku08, 1956As38.
$\alpha\gamma$: see 1963Le17, 1969Pe17, 1969Br10.
$\alpha\gamma(\theta)$: see 1971He19, 1954St02.

E_γ [†]	I_γ [‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[b]	Comments
(75.13[#] *2*)	3.2×10^{-5}[@] *8*	317.29	3$^-$	242.11	1$^-$	[E2]	37.5	α(L)=27.4; α(M)=7.44; α(N+..)=2.67
111.12 *3*	3.29 *20*	111.12	2$^+$	0.0	0$^+$	E2	6.26	α(K)=0.298; α(L)=4.35; α(M)=1.18; α(N+..)=0.429 I_γ: 3.3% *2* was measured by 1969Pe17. Mult.: Ice measurements: L12:L3:M23:N= 17.0 *22*:11.6 *19*:9.5 *17*:3.2 *7* (1967LoZZ); α(L2)=2.4 *4*, α(L)=4.1 *5* (1974Va28). Ice′s given here were normalized to Ice(K)(230γ of ^{226}Ac decay)=5.45. For absolute Ice′s per 100 α decays, they should be multiplied by 0.269 *18*. α: 6.24 *25* was deduced by 1969Pe17 from $\alpha\gamma$ data.
131.02 *5*	0.278 *13*	242.11	1$^-$	111.12	2$^+$	(E1)	0.254	α(K)=0.199; α(L)=0.0416; α(M)=0.0100; α(N+..)=0.00345 Mult.: no ce lines were observed (1969Br10).
172.3 *3*	0.00020 *2*	473.76	(5$^-$)	301.39	4$^+$	[E1]	0.130	α(K)=0.103; α(L)=0.0205; α(M)=0.00489; α(N+..)=0.00169 Transition was observed only in $\gamma\gamma$-coincidence spectra.
190.30 *5*	0.109 *6*	301.39	4$^+$	111.12	2$^+$	E2	0.716	α(K)=0.180; α(L)=0.392; α(M)=0.106; α(N+..)=0.0380 Mult.: from ce data of 1976Ku08 (measured ce intensities were not given). Only E2 multipolarity yields an intensity balance at the 301.42-keV level.
206.23 *5*	0.189 *8*	317.29	3$^-$	111.12	2$^+$	E1	0.0847	α(K)=0.0675; α(L)=0.01299; α(M)=0.00310; α(N+..)=0.00107 Mult.: from ce data of 1976Ku08 (measured ce intensities were not given). Only E1 multipolarity is consisted with the intensity balance at the 317.35 level.
242.12 *5*	0.866 *40*	242.11	1$^-$	0.0	0$^+$	E1	0.0580	α(K)=0.0464; α(L)=0.00873; α(M)=0.00208; α(N+..)=0.00072 Mult.: α(K)exp≈0.06 (estimated by the evaluator from the (α)(ce) spectrum shown by 1969Br10).
671.9 *3*	0.00028 *3*	914.0	(0$^+$)	242.11	1$^-$			
707.5 *5*	0.00006[&] *2*	1024.9	2$^+$	317.29	3$^-$			
723.4[#] *4*	0.000002[@] *1*	1024.9	2$^+$	301.39	4$^+$			

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^{226}Th α decay (continued)

$\gamma(^{222}Ra)$ (continued)

E_γ [†]	I_γ [‡ a]	E_i(level)	J_i^π	E_f	J_f^π
783.0 *5*	0.00009[&] *3*	1024.9	2^+	242.11	1^-
802.7 *5*	0.00006 *2*	914.0	(0^+)	111.12	2^+
913.7[#] *4*	0.000010[@] *4*	1024.9	2^+	111.12	2^+
1025.0[#] *4*	0.000004[@] *2*	1024.9	2^+	0.0	0^+

[†] From 1976Ku08. Other measurements: 1974Va28, 1969Br10, 1956Sm88, 1956As38.
[‡] From 1976Ku08. Relative photon intensities were normalized by 1976Ku08 to I(324γ of ^{222}Ra α decay)=2.77% (taken from 1969Pe17) to obtain intensities per 100 α decays.
[#] This γ was not observed in ^{226}Th α decay; its energy is the adopted value from ^{222}Fr β^- decay.
[@] From relative branching deexciting the level, as measured in ^{222}Fr β^- decay.
[&] Iγ(783γ)/Iγ(707γ)=0.98 *9* was measured in ^{222}Fr β^- decay.
[a] Absolute intensity per 100 decays.
[b] 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.

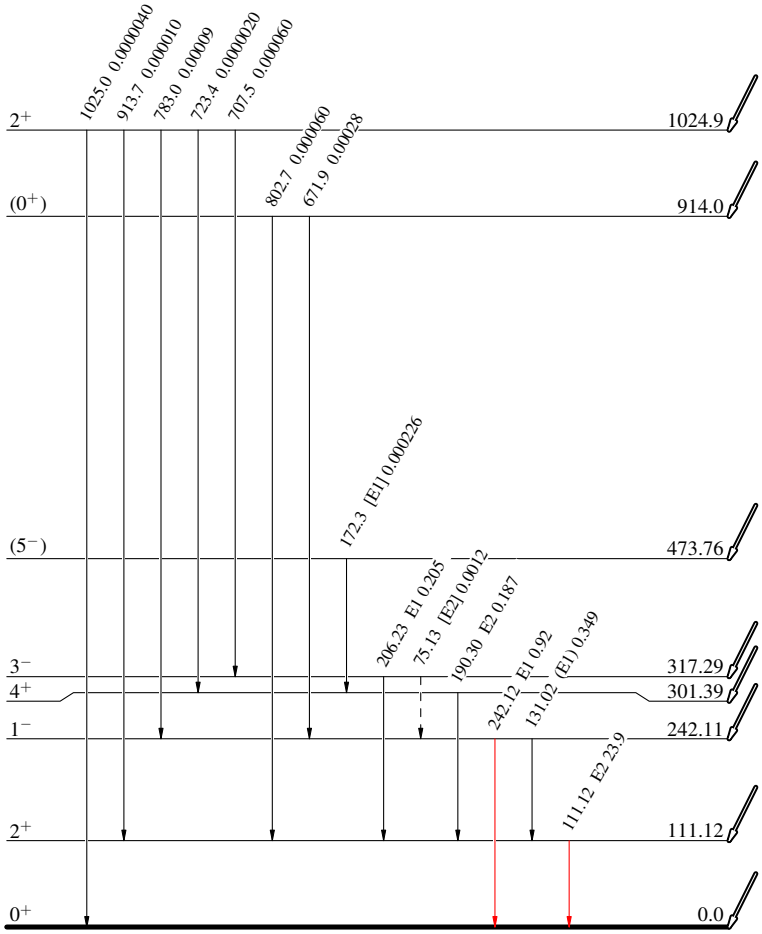
^{226}Th α decay

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 decays through this branch

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)

0^+ 0.0 30.57 min *10*
Q_α=6450.9 *22* $\%\alpha$=100
$^{226}_{90}Th_{136}$



		Eα	Iα	HF
1024.9		5333	0.00017	4.0
914.0		5442	0.00034	8.2
473.76		5874	0.00023	2200
317.29		6028	0.206	13.9
301.39	<1.4 ns	6040	0.187	18.1
242.11	<1.2 ns	6099	1.26	5.0
111.12	0.52 ns *4*	6234	22.8	1.08
0.0	38.0 s *5*	6336.8	75.5	1.0

$^{222}_{88}Ra_{134}$