^{249}Md α decay 2005He27,2008Ga25,2009He20

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 189,1 (2023)	14-Feb-2023

Parent: ^{249}Md: E=0.0; J^π=(7/2$^-$); $T_{1/2}$=24.8 s *10*; Q(α)=8441 *syst*; %α decay=75 *5*

^{249}Md-J^π: From Adopted Levels for ^{249}Md in 2011Ab07.

^{249}Md-$T_{1/2}$: From weighted average of 26 s *1* (2019Br06), 23 s *3* (2009He20), 23.8 s *+38−29* (2008Ga25), 19 s *+3−2* (2001He35), 25 s *+14−7* (1985He22), and 24 s *4* (1973Es01). The current Adopted Levels in the ENDSF database for ^{249}Md (2011Ab07) gives $T_{1/2}$(^{249}Md)= 21.7 s *20* based on references available at the time of the evaluation.

^{249}Md-Q(α): 8441 *18* (2021Wa16).

^{249}Md-%α decay: %α from 2019Br06. The current Adopted Levels of ^{249}Md (2011Ab07) gives %α>60 based on references available at the time of the evaluation.

2019Br06: ^{249}Md source was produced via ^{203}Tl(^{48}Ca,2n) reaction at the Accelerator Laboratory of the University of Jyvaskyla (JYFL). Fusion-evaporation residues were separated and selected using the recoil ion transport unit (RITU) gas-filled separator. Separated residues were first detected in a position-sensitive multiwire proportional counter (MWPC) and then implanted into two adjacent double-sided strip detector (DSSDs). Measured energy spectra of subsequent α decays of residue recoils, recoil-α-correlations, recoil-α(t). Deduced α-decay $T_{1/2}$, and branching ratio.

2009He20: Improved decay data from previous experiments by this group. ^{249}Md produced in the α decay chain: ^{257}Db → ^{253}Lr → ^{249}Md. ^{257}Db was produced by the ^{209}Bi(^{50}Ti,2n) reaction at the UNILAC accelerator, GSI, Darmstadt. Evaporation residues from the heavy-ion fusion reaction were separated from the projectile beam by the velocity filter SHIP and implanted into a position-sensitive 16 strip Si PIPS detector surrounded six Si-wafers. Measured Eα, Iα, $T_{1/2}$, and excitation functions.

2008Ga25: ^{249}Md produced in the α decay chain: ^{257}Db → ^{253}Lr → ^{249}Md. The ^{257}Db activity was produced by the ^{209}Bi(^{50}Ti,2n) and ^{208}Pb(^{51}V,2n) reactions at 4.7 − 5.1 MeV/nucleon beams of ^{51}V and ^{50}Ti provided by the 88-Inch Cyclotron at the Lawrence Berkeley National Laboratory. Evaporation residues were separated from the beam and other unwanted reaction products in the Berkeley Gas-filled Separator. The Db recoils were implanted at the focal plane detector consisting of silicon cards that were able to detect the alphas.

2005He27: ^{249}Md was produced in two reactions:

i) ^{209}Bi(^{50}Ti,2n)^{257m,g}Db →α decay → ^{253m,g}Lr → α decay → ^{249}Md.

ii)^{209}Bi(^{48}Ca,4n) ^{253m,g}Lr →α decay → ^{249}Md.

The experiment was performed at the UNILAC accelerator, GSI, Darmstadt. Evaporation residues from the heavy-ion fusion reaction were separated from the projectile beam by the velocity filter SHIP and implanted into a position-sensitive 16 strip Si PIPS detector. Measured (fragments)α coin, $\alpha\gamma$ coin, prompt and delayed γ rays, K-x rays. A 'Clover' detector was used for γ rays.

1985He22: ^{249}Md produced in the α decay chain: ^{257}Db → ^{253}Lr → ^{249}Md. ^{257}Db was produced by the ^{209}Bi(^{50}Ti,2n) reaction at the UNILAC accelerator, GSI, Darmstadt. Evaporation residues from the heavy-ion fusion reaction were separated from the projectile beam by the velocity filter SHIP and identified after implantation into an array of position-sensitive surface-barrier detectors by analyzing their α-decay chains. Measured Eα, Iα, $T_{1/2}$, branching ratio and excitation functions.

1973Es01: ^{249}Md was populated in the ^{241}Am(^{12}C,α4n) reaction at the Berkeley heavy-ion linear accelerator. Alpha spectrum was measured with a series of Si-Au surface barrier detectors. Measured excitation function, $T_{1/2}$, Eα, Iα.

^{245}Es Levels

E(level)‡	J^π†	$T_{1/2}$†	Comments
0.0	(3/2$^-$)	66.6 s *60*	J^π: Systematics of Nilsson orbitals suggests either the 3/2[521] or the 7/2[633] state. 3/2[521] and 7/2[633] orbitals are close in energy and either could be the g.s. However, 2005He27 estimate that 7/2$^+$ bandhead of 7/2[633] band lies ≈30 keV above the 3/2$^-$ bandhead of 3/2[521] band, hence the g.s is assigned (3/2$^-$).
0.0+x	(7/2$^+$)		E(level): x ≈30 keV *15* (2005He27). x=30 keV *21* deduced by evaluator (see comments at Ex=253.2+x. Configuration=7/2[633].
52.8+x	(9/2$^+$)		
253.2+x *3*	(7/2$^-$)		E(level): x=30 keV *21* deduced by evaluator using Qα (g.s.)=8441 keV *18* and Eα=8026 keV *10*. Configuration=7/2[514].

Continued on next page (footnotes at end of table)

^{249}Md α decay 2005He27,2008Ga25,2009He20 (continued)

^{245}Es Levels (continued)

† From Adopted Levels.
‡ From level scheme in 2005He27.

α radiations

Eα†	E(level)	Iα#	HF‡	Comments
8026 *10*	253.2+x	100	≈1.10	Eα: From 2009He20. Others: 8030 keV *20* (1973Es01), 8026 keV *20* (1985He22). Iα: From 2009He20. Intensity per 100 alpha decays.

† Two additional α lines may ne attributed to the α decay of ^{249}Md. 8087 keV 7956 keV (2009He20). From α-γ coincidence, 2009He20 suggests that the former 8087-keV could be interpreted as a result of summing with conversion electroms from the transition of $9/2^+ \rightarrow 7/2^+$.
‡ The nuclear radius parameter $r_0(^{245}Es)$=1.4945 *65* as specified by the user. The nuclear radius parameter $r_0(^{245}Es)$ is the unweighted average of adjacent even-even nuclides $r_0(^{244}Cf)$ and $r_0(^{246}Fm)$ The $r_0(^{244}Cf)$=1.4945 *65* (2020Si16) but evaluator is unable to estimate the $r_0(^{246}Fm)$. Hence $r_0(^{245}Cf)$=1.4945 *65* is used in the estimation of HF.
# For absolute intensity per 100 decays, multiply by 0.75 *5*.

γ(^{245}Es)

Eγ†	Iγ†	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α‡	Comments
200.4 *7*	20 *8*	253.2+x	(7/2⁻)	52.8+x	(9/2⁺)			Eγ: Transition into the $9/2^+$ level assigned by 2005He27.
x223.2 *5*	10 *5*							Eγ: Was seen in coincidence with Eα=8029 keV *10* by 2009He20. Due to low statistics of events, the evaluator considers this gamma unplaced.
253.2 *5*	100	253.2+x	(7/2⁻)	0.0+x	(7/2⁺)	E1	0.0673 *10*	α(K)=0.0518 *8*; α(L)=0.01155 *17*; α(M)=0.00285 *4* α(N)=0.000786 *12*; α(O)=0.0002014 *30*; α(P)=3.62×10^{-5} *5*; α(Q)=1.544×10^{-6} *22* Mult.: From α(K)exp≤0.09; α(L)exp≤0.034 deduced from ratio of K x ray, L x ray and Iγ (2005He27).

† From 2005He27. Iγ have been normalized to I(253.2γ)=100.
‡ Additional information 1.
x γ ray not placed in level scheme.

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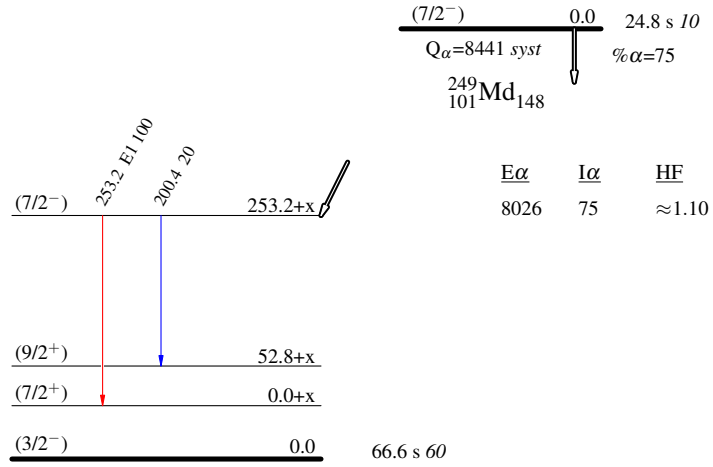
Decay Scheme

Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



Eα	Iα	HF
8026	75	≈1.10