^{253}Md α decay (6 min) 2012He09,2005He27

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 195,718 (2024)	12-Oct-2023

Parent: ^{253}Md: E=0.0; J^π=(7/2$^-$); $T_{1/2}$=6 min *+12−3*; Q(α)=7573 *8*; %α decay≈0.7

^{253}Md-$T_{1/2}$,J^π: From Adopted Levels in ENSDF database (2013Br09).

^{253}Md-Q(α): From 2021Wa16.

^{253}Md-%α decay: %α≈0.7 (2005He27).

2012He09: ^{253}Md produced as daughter of ε decay of ^{253}No produced in reaction: ^{207}Pb(^{48}Ca,2n) with beam energy 218.4 MeV. Evaporation residues were separated from the primary beam by velocity filter SHIP at GSI facility and implanted at focal plane into a position-sensitive 16-strip PIPS detector. The PIPS detector was used to measure α decay energy of the implanted nuclei and their daughter products. It was surrounded in backward hemisphere by a box of silicon detectors to stop α particles. Gamma rays were detected using a four crystal Ge-clover detector shielded with Cu, Cd, Pb with FWHM=1.7 keV (Expt.1), and VEGA-type detector without shielding with FWHM=2.5 keV (Expt.2). Both FWHM values are for the 279.5-keV γ ray. Measured Eγ, Iγ, E_α, I_α, $\alpha\gamma$ coin ($\Delta t \leq \pm 0.4$ μs). Deduced level scheme.

2011Lo06: ^{253}Md produced as daughter of ε decay of ^{253}No that was produced in ^{207}Pb(^{48}Ca,2n) reaction. The residues were separated by VASSILISSA recoil separator and implanted into the GABRIELA detection system at focal plane. The detectors consisted of 48x48 strip Double-Sided-Silicon strip Detector (DSSD), 32-strip silicon detector upstream and a Ge detector. The efficiency for γ ray detection was 16.4% for 100-keV photon and 3.4% at 1332 keV. Measured α, γ, $\gamma\gamma$ coin, $\alpha\gamma$ coin, and conversion electrons.

2005He27: ^{253}Md produced as daughter of ε decay of ^{253}No produced in reaction: ^{207}Pb(^{48}Ca,2n) with beam energy E=4.58, 4.60 MeV/nucleon. Evaporation residues were separated from the primary beam by velocity filter SHIP at GSI facility and implanted at focal plane into a position-sensitive 16-strip PIPS detector. The PIPS detector was used to measure the alphas and a clover detector was used for γ rays. Measured (fragments)α coin, $\alpha\gamma$ coin, prompt and delayed γ rays.

All data from 2012He09, except as noted.

^{249}Es Levels

E(level)	J^π[†]	$T_{1/2}$[†]	Comments
0.0	7/2$^+$	102.2 min *6*	Configuration=π7/2[633].
49.0 *6*	(9/2$^+$)		J^π: Proposed in 2012He09 based on 304.2γ from 353, 7/2$^-$ level feeding this level.
353.2 *4*	(7/2$^-$)		E(level): from Eγ=353.2 *4*. Configuration=π7/2[514].

[†] From Adopted Levels.

α radiations

Eα	E(level)	Comments
7123[†] *15*		Eα: See comment for 390.8γ.
7103 *15*	353.2	Eα: Alpha hindrance factor≈1 was deduced by 2012He09, based on a single 7103α branch with theoretical half-life from 1980Po10 and 1983Ru11. Other: 7065 (2011Lo06 who reported that the Eα is rather low).

[†] Existence of this branch is questionable.

γ(^{249}Es)

Iγ normalization: From I(γ+ce) of 353.3γ and 304.2γ=100.

Continued on next page (footnotes at end of table)

^{253}Md α decay (6 min) 2012He09,2005He27 (continued)

γ(^{249}Es) (continued)

E_γ	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[†]	Comments
304.2 *4*	17	353.2	(7/2⁻)	49.0	(9/2⁺)	[E1]	0.0455 *6*	α(K)=0.0354 *5*; α(L)=0.00760 *11*; α(M)=0.001867 *27* α(N)=0.000516 *7*; α(O)=0.0001326 *19*; α(P)=2.411×10^{-5} *34*; α(Q)=1.075×10^{-6} *15* E_γ: 19 events observed by 2012He09, 1 event observed by 2011Lo06.
353.2 *4*	83	353.2	(7/2⁻)	0.0	7/2⁺	(E1)	0.0334 *5*	α(K)=0.0261 *4*; α(L)=0.00547 *8*; α(M)=0.001340 *19* α(N)=0.000370 *5*; α(O)=9.54×10^{-5} *14*; α(P)=1.748×10^{-5} *25*; α(Q)=8.06×10^{-7} *11* E_γ: 68 events observed by 2012He09, 15 event observed by 2011Lo06. Mult.: from α(K)exp≤0.06 (2005He27).
[x]390.8 *4*								E_γ: Observed 3 events. 2012He09 describe a possible scenario of assignment of the (7123α, 390.8γ) pair to the g.s. decay of ^{253}Md that would suggest ^{249}Es g.s. to be 3/2[521], such as for ^{251}Es, then placement of 390.8γ from 353, 7/2⁻ state (see Fig. 5 in 2012He09) could feed a 5/2⁻ state at ≈30 keV built on the 3/2[521] orbital, comparable to states in ^{247,249}Bk. In this scenario 7/2⁺ state with 7/2[633] configuration will lie at ≈68 keV. Better quality data are required to support this tentative scenario, thus 2012He09 omit placement of 390.8γ in the decay scheme.

† Additional information 1.
‡ For absolute intensity per 100 decays, multiply by ≈0.00679.
[x] γ ray not placed in level scheme.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays