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^{276}Mt α decay (0.69 s)   2015Ga24,2013Ru11,2013Og01

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	Type	Author	History Citation	Literature Cutoff Date
	Full Evaluation	Balraj Singh	NDS 156, 148 (2019)	31-Jan-2019

Parent: ^{276}Mt: E=0; $T_{1/2}$=0.69 s *+9−7*; $Q(\alpha)$=10100 *9*; %α decay≈100.0

^{276}Mt-$T_{1/2}$: From ^{276}Mt Adopted Levels.

^{276}Mt-$Q(\alpha)$: From 2017Wa10.

See ^{276}Mt Adopted Levels for production and half-life. In all the ^{272}Bh produced from α decay chain ^{288}Mc -> ^{284}Nh -> ^{280}Rg -> ^{276}Mt -> ^{272}Bh; ^{288}Mc was produced in the bombardment of ^{243}Am target with ^{48}Ca beam.

2015Ga24: measured Eα and $\alpha\gamma$-coin at Berkeley using the corner cube clover (C3) focal plane detector consisting of silicon-strip detectors surrounded by HPGe clover-type detectors. GEANT4 simulations. No K x-rays were definitively identified in this work, and Z identification was not possible.

2013Ru11: charged particles were detected with the TASISpec comprising a 32×32-strip DSSSD and four additional 16×16-strip DSSSD forming a cube-like detector, and the γ rays were detected with Ge detectors at GSI facility. Measured Eα, recoil-α-α, recoil-α-fission, Eγ, $\alpha\gamma$-coin, α-decay curves.

2013Og01, 2012Og02: measured α spectrum in the range of 9.6 to 11.0 MeV. Two activities assigned to the α decay of ^{276}Mt: 0.54 s *+14−9* and 6 s *+8−2*, but according to 2013Ru11, the 6-s activity is not certain, and if present, it could be assigned also to ^{280}Rg or ^{272}Bh.

The decay scheme here is from 2015Ga24, as the authors provide more in-depth analysis of $\alpha\gamma$-coin data, while combining the data from their experiment and the 2013Ru11 GSI experiment. Note that many authors are the same in the two papers. In this respect, a 232-keV level proposed in 2013Ru11 is not included here, neither a 130-keV γ from 362 level, and a 202-keV γ from 434 level.

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^{272}Bh Levels

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E(level)[†]	$T_{1/2}$	Comments
0.0	10.5 s *+15−11*	$T_{1/2}$: from Adopted Levels.
60.2? *10*		
196.2? *10*		E(level): 226.2 keV if the ordering of 136γ-166γ cascade is reversed. Ordering of the two γ rays is not established.
362.2 *5*		A tentative 130-keV γ was shown to a 232-keV level in 2013Ru11.
434? *1*		A tentative 202-keV, M1 γ was shown to a 232-keV level in 2013Ru11.
479.6? *23*		

[†] From Eγ data.

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α radiations

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HF=$T^{exp}_{1/2}$/$T^{sys}_{1/2}$, using $T_{1/2}$=0.63 s *+9−7* (based on data from 2013Ru11 and 2013Og01) for ^{276}Mt, and the systematic half-lives calculated according to 2009Qi07.

Eα	E(level)	Iα[†]	Comments
9.48×10^3	479.6?	5	HF=62 *+9−8* (2015Ga24).
			Eα: also 9.50 MeV *2* in the text in 2015Ga24.
9.53×10^3	434?	5	HF=87 *+13−11* (2015Ga24).
9600 *10*	362.2	80	HF=8.9 *+13−11* (2015Ga24); 12 *+3−2* (2013Ru11).
			Eα: average energy. Also noted as 9.60 MeV *2* in text of 2015Ga24.
9.90×10^3	60.2?	10	HF=490 *+70−60* (2015Ga24).
9.95×10^3 *1*	0.0		Eα: 8.52 to 10.01 MeV; $Q(\alpha)$=10.10 MeV *1* (2017Og01 review); 9.17-10.01 MeV (2015Og05 review); 9.17 to 9.95 MeV (2013Ru11); 9.53 MeV and 9.60 MeV (2015Ru11), 9.71 MeV *6* (2004Og03,2011Og07). Assumed as g.s. to g.s. α transition.

[†] For absolute intensity per 100 decays, multiply by ≈1.0.

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$\gamma(^{272}$Bh$)$

Coincidences between 135.7 26- and 147.0 20-keV photons seen by 2015Ga24 was explained by the authors that 147-keV photon is consistent with energy expected from Compton scattering of a 166-keV photon in the material between the DSSD and the Ge detectors.

E_i(level)	$E_\gamma{}^\dagger$	$I_\gamma{}^\dagger$	E_f	Mult.$^{\#}$	$\alpha{}^{\&}$	Comments
196.2?	136‡ 1		60.2?	(E1)$^{@}$	0.0878	136γ and 166γ seen in $\gamma\gamma$ coincidence (2015Ga24). I_γ: number of counts: 2 (2015Ga24).
362.2	166‡ 1	10	196.2?	(E1)$^{@}$	0.0543	I_γ: number of counts=3 (2015Ga24). Two more photons of 164.4 26 and 165.7 22 keV were observed by 2015Ga24, in coincidence with 9.58 MeV 2 and 9.55 MeV 5 particles. The photon energies are close to K$_{\beta2}$ x-rays of 167.12 keV, but from intensity arguments, the 166-keV photons could only be assigned as discrete γ ray.
	302^a 1	5	60.2?	[E1]	0.0554	E_γ: from 2013Ru11. I_γ: number of counts=1 (2015Ga24).
	362.2 5	100	0.0	[E1]	0.0390	I_γ: number of counts=7 (2015Ga24). Eγ=362 1, mult=E2 in 2013Ru11. A pair of photons with energies of 126.6 12 and 227.0 25 keV seen in $\gamma\gamma$-coin (2015Ga24), which the authors interpret as the two summing to about 362 keV, and arising from the detection of two Compton scattered photons between two of the unshielded Ge detectors.
434?	434^a 1		0.0	[E1]	0.0278	I_γ: number of counts=1 (2015Ga24). In coincidence with 9530α. However, no α peak was observed in the α spectrum in coin with 434γ (2015Ga24), thus the placement of 434γ is tentative. Eγ=434 1, mult=E2 in 2013Ru11.
479.6?	479.6^a 23		0.0	[E1]	0.0232	I_γ: number of counts=1 (2015Ga24). In coincidence with 9480α. However, no α peak was observed in the α spectrum in coin with 479.6γ (2015Ga24), thus the placement of 479.6γ is tentative.

† From 2015Ga24, where the analysis combined their experimental data and those from 2013Ru11 experiment at GSI. Number of observed photons for a certain γ-ray is from text on p5 in 2015Ga24.

‡ Reversed ordering of the 166-136 γ cascade is also possible.

$^{\#}$ Multipolarity in square bracket assumed by 2015Ga24 for GEANT simulations.

$^{@}$ Determined by 2015Ga24 from their experimental data and GEANT simulations, based on the expected counts of 166γ and 136γ as well as the observation of $\gamma\gamma$-coincidences. The assignment is treated as tentative by the evaluator.

$^{\&}$ 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.

^{a} Placement of transition in the level scheme is uncertain.

^{x} γ ray not placed in level scheme.

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Legend   <u>Decay Scheme</u>

Intensities: Relative photon branching from each level

- - - - - ► γ Decay (Uncertain)
●   Coincidence

Q_α=10100 9

$^{276}_{109}Mt_{167}$ 0   0.69 s +9−7 %α≈100

479.6 [E1]
434 [E1]
362.2 [E1] 100
302 [E1] 5
166 (E1) 10
136 (E1)

Level		$E\alpha$	$I\alpha$
479.6		9480	5.0
434		9530	5.0
362.2		9600	80
196.2			
60.2		9900	10.0
0.0	10.5 s +15−11	9950	

$^{272}_{107}Bh_{165}$