

$^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$ 2001Sh36

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	S. -c. Wu	NDS 106, 367 (2005)	31-Aug-2005

2001Sh36,2001Ch89,2001Ch10: E(^{238}U)=1585 MeV, pulsed beam. Measured γ , $\gamma\gamma$, $T_{1/2}$ using GAMMASPHERE array of 98 Compton-suppressed Ge detectors and three LEPS detectors. Yrast 3-quasiparticle K-isomers identified.

1999Da09,1999Ch48: E(^{238}U)=1.6 GeV, pulsed beam. Measured γ , $\gamma\gamma$, $T_{1/2}$ using Argonne-Notre Dame BGO array of 12 Compton-suppressed Ge detectors. 1999Da09 includes $^{180}\text{Hf}(^{208}\text{Pb}, ^{207}\text{Pb}\gamma)$ E=1.3 GeV. GAMMASPHERE array.

 ^{181}Hf Levels

Band structure and configuration assignment are from 2001Sh36 based on $\gamma\gamma$ and $\gamma\gamma\gamma$ coin.

E(level) [†]	J π [‡]	T _{1/2}	Comments
0.0 [#]	1/2 ⁻		
46.0 [#] 7	3/2 ⁻		
99.0 [#] 7	5/2 ⁻		
205.0 [#] 8	7/2 ⁻		
252.0 7	3/2 ⁻		$\nu 3/2[512]$ state.
304.0 [#] 9	9/2 ⁻		
441.0 8	7/2 ⁻		$\nu 7/2[503]$ state, tentative assignment (2001Sh36).
466.0 [#] 10	11/2 ⁻		
595.0 10	9/2 ⁺	80 μs 5	%IT=100 $\nu 9/2[624]$ state. $T_{1/2}$: from coincidence time spectrum (1999Da09).
617.1 [@] 10	(11/2 ⁺)		
755.6 [@] 10	(13/2 ⁺)		
925.2 [@] 10	(15/2 ⁺)		
1040.5 10	(17/2 ⁺)	$\approx 100 \mu\text{s}$	%IT=100 $\pi 9/2[514]\pi 7/2[404]\nu 1/2[510]$ state, tentative assignment (2001Sh36). $T_{1/2}$: estimated from the observed intensities of γ rays in the double-gated spectrum from the delayed γ - γ - γ cube.
1122.3? [@] 12	(17/2 ⁺)		
1239.7 11	(19/2 ⁺)		
1347.2? [@] 13	(19/2 ⁺)		
1381.9 11	(19/2 ⁺)		$\pi 9/2[514]\pi 7/2[404]\nu 3/2[512]$ state.
1738.9 11	(25/2 ⁻)	1.5 ms 5	%IT=100 $\pi 9/2[514]\pi 7/2[404]\nu 9/2[624]$ state, tentative assignment (2001Sh36). $T_{1/2}$: from $\gamma\gamma$ intensity for different time slices (2001Sh36).

[†] From least-squares fit to $E\gamma$'s, assuming 0.3 keV uncertainty when $E\gamma$ quoted to nearest tenth of a keV, 1 keV otherwise.

[‡] From 2001Sh36, assigned according to the band structures, γ -multipolarities, intensity balances, single-particle half-life estimates, and comparisons with expected quasiparticle excitation energies.

[#] Band(A): $\nu 1/2[510]$ band.

[@] Band(B): $\nu 11/2[615]$ band.

$^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$ **2001Sh36 (continued)** $\gamma(^{181}\text{Hf})$

$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\alpha^\&$	
22.1	4.6 [@]	15	617.1	(11/2 ⁺)	595.0	9/2 ⁺	M1	59.0
46			46.0	3/2 ⁻	0.0	1/2 ⁻		
53			99.0	5/2 ⁻	46.0	3/2 ⁻		
99			99.0	5/2 ⁻	0.0	1/2 ⁻		
99			304.0	9/2 ⁻	205.0	7/2 ⁻		
106			205.0	7/2 ⁻	99.0	5/2 ⁻		
115.3	61 [@]	3	1040.5	(17/2 ⁺)	925.2	(15/2 ⁺)	M1	2.74
129			595.0	9/2 ⁺	466.0	11/2 ⁻		
137			441.0	7/2 ⁻	304.0	9/2 ⁻		
138.4	83 [@]	5	755.6	(13/2 ⁺)	617.1	(11/2 ⁺)	M1	1.62
142.4	1.2 [#]	3	1381.9	(19/2 ⁺)	1239.7	(19/2 ⁺)	M1	1.50
153			252.0	3/2 ⁻	99.0	5/2 ⁻		
154			595.0	9/2 ⁺	441.0	7/2 ⁻		
159			205.0	7/2 ⁻	46.0	3/2 ⁻		
162			466.0	11/2 ⁻	304.0	9/2 ⁻		
169.5	100 [@]	3	925.2	(15/2 ⁺)	755.6	(13/2 ⁺)	M1	0.92
189			441.0	7/2 ⁻	252.0	3/2 ⁻		
197 ^a			1122.3?	(17/2 ⁺)	925.2	(15/2 ⁺)		
199.3	69 [#]	2	1239.7	(19/2 ⁺)	1040.5	(17/2 ⁺)	M1	0.584
205			304.0	9/2 ⁻	99.0	5/2 ⁻		
206			252.0	3/2 ⁻	46.0	3/2 ⁻		
225 ^a			1347.2?	(19/2 ⁺)	1122.3?	(17/2 ⁺)		
236			441.0	7/2 ⁻	205.0	7/2 ⁻		
252			252.0	3/2 ⁻	0.0	1/2 ⁻		
261			466.0	11/2 ⁻	205.0	7/2 ⁻		
284.9	37 [@]	2	1040.5	(17/2 ⁺)	755.6	(13/2 ⁺)	E2	0.093
291			595.0	9/2 ⁺	304.0	9/2 ⁻		
308.1	52 [@]	3	925.2	(15/2 ⁺)	617.1	(11/2 ⁺)	E2	0.0737
341.4	15 [#]	2	1381.9	(19/2 ⁺)	1040.5	(17/2 ⁺)	M1	0.135
342			441.0	7/2 ⁻	99.0	5/2 ⁻		
357.0	19 [#]	2	1738.9	(25/2 ⁻)	1381.9	(19/2 ⁺)	E3	0.185
367 ^a			1122.3?	(17/2 ⁺)	755.6	(13/2 ⁺)		
390			595.0	9/2 ⁺	205.0	7/2 ⁻		
422 ^a			1347.2?	(19/2 ⁺)	925.2	(15/2 ⁺)		
499.2	100 [#]	3	1738.9	(25/2 ⁻)	1239.7	(19/2 ⁺)	E3	0.0591

[†] From 2001Sh36.[‡] From γ intensity balance (2001Sh36).[#] Relative to 100 for 499.2 γ .[@] Relative to 100 for 169.5 γ .[&] 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.

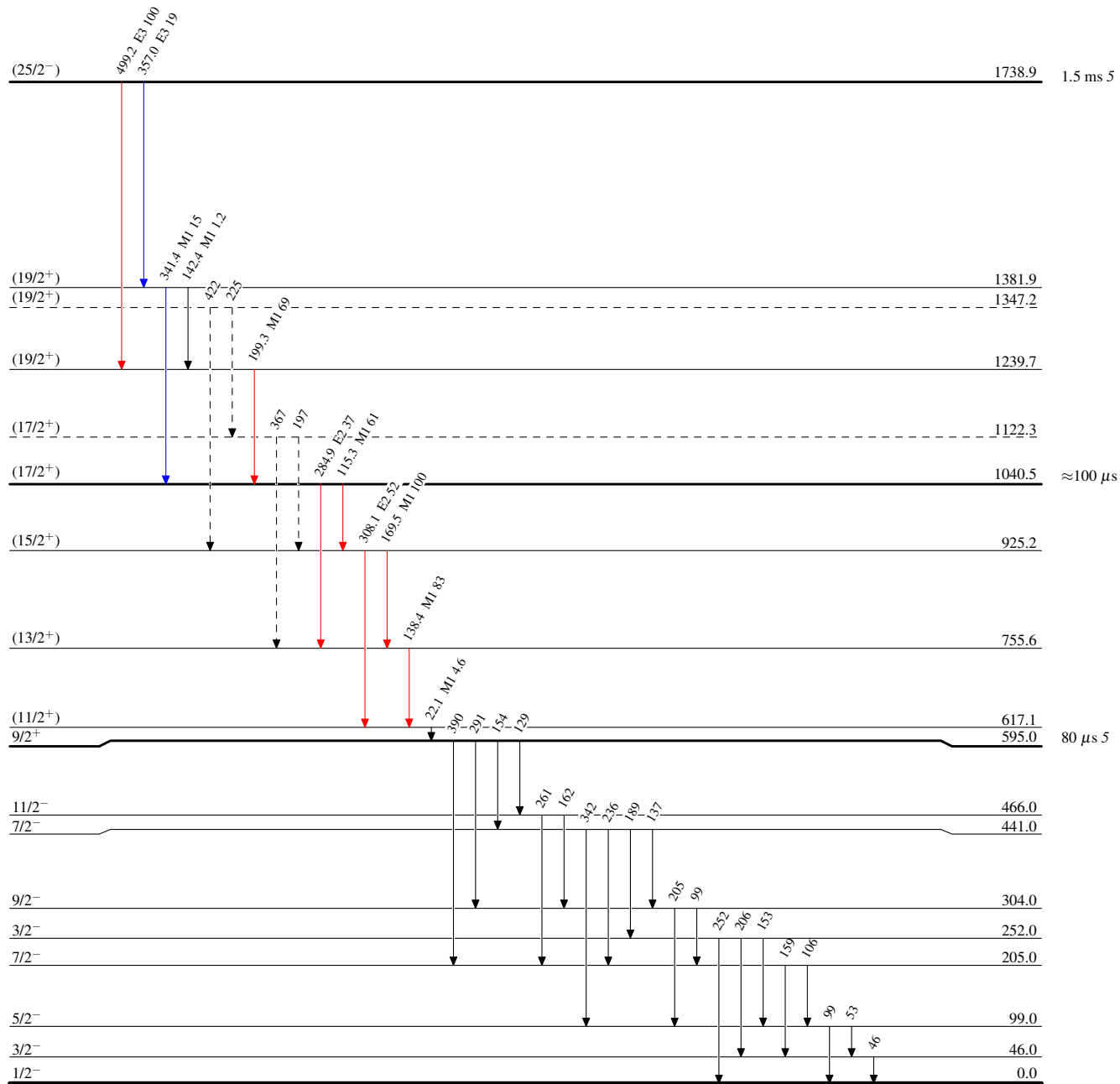
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Legend

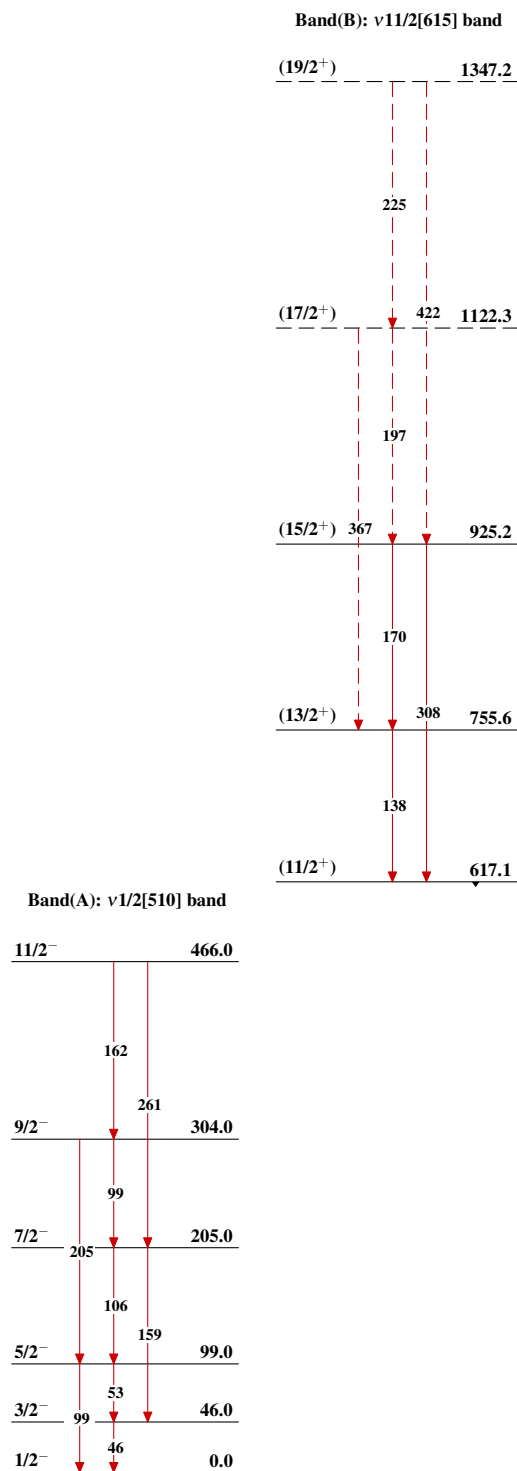
Level Scheme

Intensities: Relative I_γ

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

 $^{181}_{72}\text{Hf}_{109}$

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