

[233U  \$\alpha\$  decay](#)    [2003Ba78,2007Be16](#)

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli		NDS 109,2657 (2008)	1-Jun-2008

Parent:  $^{233}\text{U}$ : E=0.0;  $J^\pi=5/2^+$ ;  $T_{1/2}=159.2 \times 10^3$  y 2;  $Q(\alpha)=4908.5$  12; % $\alpha$  decay=100

$^{233}\text{U}-T_{1/2}$ : From [2003Au02](#).

$^{233}\text{U}-Q(\alpha)$ : From [2003Au02](#).

$^{233}\text{U}-\% \alpha$  decay: %SF<6×10<sup>-9</sup>.

#### Additional information 1.

[2003Ba78](#): Isotopes of  $^{233}\text{U}$  were obtained by successive  $\beta^-$  decays of  $^{233}\text{Th}$  formed in the  $^{232}\text{Th}(n,\gamma)$  reaction. Other uranium isotopes, and their respective daughter nuclei were present despite fast separation methods employed.

Measured  $E\gamma$ ,  $I\gamma$ ,  $\gamma\gamma$  coin. Singles  $\gamma$ -ray measurements were made using a planar LEPS and three coaxial HP germanium detectors. All counting sessions were performed with detectors shielded by a 5-10 cm thick lead wall. Coincidence  $\gamma$ -ray measurements were performed with four HP germanium detectors, three coaxial and one planar.

[2007Be16](#): a 105-micro Curie  $^{233}\text{U}$  source was obtained from  $\beta^-$  decay of  $^{233}\text{Pa}$  which was chemically separated from products formed in the  $^{232}\text{Th}(n,\gamma)$  reaction. The source was free of potentially interfering contaminants such as  $^{232}\text{U}$ . This source was electro-deposited onto five aluminum planchets. Gamma rays were counted using nasa's x-ray spectrometer xrs, a system of 36 microcalorimeters. Resolution (FWHM)=6 eV at 60 mK and 0.1-10 keV bandpass. Photon energies up to 60 keV were measured at 90 mK with FWHM=26 eV.

[1994He08](#): Measured singles spectra from a  $^{233}\text{U}$  source. Determined precise  $\gamma$ -ray energies. Detectors; High-purity germanium coaxial, germanium planar, Si(Li) detector.

[1992El01](#): Uranium was chemically separated and immediately measured  $\gamma$ -ray spectra using germanium high-purity detectors.

[1996Ko29](#): Uranium was continuously separated chemically on a column of anion-exchange resin. Measured  $E\gamma$ ,  $I\gamma$ . High-purity germanium detectors.

Calculated total average radiation energy of 4893 keV 2 agrees with  $Q(\alpha)=4908.5$  keV 12 from the mass adjustment ([2003Au03](#)), which suggest consistency and completeness of the decay scheme.

[229Th Levels](#)

E(level) <sup>†</sup>	$J^\pi$	$T_{1/2}^{\ddagger}$	Comments
0.0 <sup>#</sup>	$5/2^+$	7340 y 160	% $\alpha$ =100
0.0076 <sup>@</sup> 5	( $3/2^+$ )		<a href="#">Additional information 2.</a>
20.2? 8	( $7/2^-$ )		E(level): From precise energy measurement of low-energy $\gamma$ rays from $^{233}\text{U} \alpha$ decay ( <a href="#">2007Be16</a> ). Other value: 0.0035 keV 10 ( <a href="#">1994He08</a> ).
29.1927 <sup>@</sup> 5	( $5/2^+$ )		<a href="#">Additional information 3.</a>
42.4349 <sup>#</sup> 2	$7/2^+$	0.172 ns 6	<a href="#">Additional information 4.</a> E(level): From 42.4349 keV 2 $\gamma$ ray to ground state ( <a href="#">2007Be16</a> ).
67.8? 7			<a href="#">Additional information 5.</a>
71.8260 <sup>@</sup> 5	( $7/2^+$ )		E(level): From 29.3911 keV 4 $\gamma$ ray to 42.4349-keV level, and 42.6333 keV 2 $\gamma$ ray to 29.1927-keV level ( <a href="#">2007Be16</a> ).
75.1? 10	( $9/2^-$ )		
97.13595 <sup>#</sup> 24	$9/2^+$	0.147 ns 12	
125.4385 <sup>@</sup> 10	( $9/2^+$ )		
140.9? 8	( $11/2^-$ )		
146.3569 <sup>a</sup> 14	( $5/2^-$ )		
148.1730 <sup>a</sup> 22	( $7/2^-$ )		
163.2542 <sup>#</sup> 7	$11/2^+$		
164.5317 <sup>&amp;</sup> 4	( $3/2^-$ )		
173.4837 <sup>a</sup> 22	( $9/2^-$ )		
189.99? 3			

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$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued) $^{229}\text{Th}$  Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup>	E(level) <sup>†</sup>	J <sup>π</sup>	E(level) <sup>†</sup>	J <sup>π</sup>
195.7194 <sup>@</sup> 16	(11/2 <sup>+</sup> )	317.1731 <sup>c</sup> 7	(5/2 <sup>+</sup> )	478.649 8	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )
212.382 20	(5/2 <sup>+</sup> )	320.5483 <sup>b</sup> 7	(5/2 <sup>+</sup> )	513.479 10	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )
217.1597 <sup>&amp;</sup> 3	(5/2 <sup>-</sup> )	327.8 <sup>#</sup> 3	(15/2 <sup>+</sup> )	526.516 9	(5/2,7/2)
235.1266 11	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )	347.800 20	(5/2 <sup>+</sup> )	536.08 <sup>d</sup> 8	(1/2 <sup>-</sup> )
237.366 <sup>&amp;</sup> 5	(7/2 <sup>-</sup> )	359.6044 20	(7/2 <sup>+</sup> )	569.2721 <sup>e</sup> 12	(3/2,5/2 <sup>+</sup> )
241.546 <sup>#</sup> 19	13/2 <sup>+</sup>	365.8136 <sup>b</sup> 15	(7/2 <sup>+</sup> )	585.237? 10	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )
255.957 15	(3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> )	374.815 4	(7/2 <sup>+</sup> )	605.165 <sup>e</sup> 10	(5/2,7/2) <sup>+</sup>
261.964 <sup>c</sup> 4	(1/2 <sup>+</sup> )	382.54? 5	(7/2 <sup>-</sup> ,9/2,11/2 <sup>+</sup> )	620.837 16	(5/2 <sup>+</sup> ,7/2)
272.84? <sup>@</sup> 3	(13/2 <sup>+</sup> )	425.877 <sup>b</sup> 10	(9/2 <sup>+</sup> )	637.384 18	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )
287.895 4	(7/2 <sup>-</sup> )	428.04 8	(5/2 <sup>+</sup> )	656.89 4	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )
288.491 <sup>c</sup> 14	(3/2 <sup>+</sup> )	436.951 15	(7/2 <sup>-</sup> )	664.98? 7	(1/2,3/2,5/2)
302.989 4	(7/2 <sup>+</sup> )	465.426 9	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	749.849 20	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )

<sup>†</sup> Deduced by evaluators from least-squares fit to  $\gamma$ -ray energies.<sup>‡</sup> From Adopted Levels, Gammas.

# Band(A): 5/2[633].

@ Band(B): 3/2[631].

&amp; Band(C): 3/2[761].

<sup>a</sup> Band(D): 5/2[752].<sup>b</sup> Band(E): 5/2[622].<sup>c</sup> Band(F): 1/2[631].<sup>d</sup> Band(G): 1/2[501].<sup>e</sup> Band(H): 3/2[642]? $\alpha$  radiations

Others: 1984Ah06, 1984Gl03, 1967Ga15, 1966Ah02, 1961Ru06, 1960Dz07, 1959Tr31, 1956Go43, 1955g057, 1953As40, 1948Cr12.  $\alpha\gamma(t)$  1970To12, 1967Tr07, 1967Hu03.  $\alpha\gamma(\theta)$  1968Ma42, 1967Hu03, 1958Ro64.

E $\alpha$ <sup>†</sup>	E(level)	I $\alpha$ <sup>‡#</sup>	HF <sup>‡</sup>	Comments
4074	749.849	1.44×10 <sup>-5</sup> 21	13.2 20	I $\alpha$ =1.44×10 <sup>-5</sup> % 21, from $\gamma$ -ray transition intensity balance. I $\alpha$ =9.3×10 <sup>-7</sup> % 23, from $\gamma$ -ray transition intensity balance.
4159	664.98?			I $\alpha$ =1.0×10 <sup>-5</sup> % 4, from $\gamma$ -ray transition intensity balance.
4167	656.89			I $\alpha$ =1.03×10 <sup>-5</sup> % 15, from $\gamma$ -ray transition intensity balance.
4187	637.384			I $\alpha$ =7.3×10 <sup>-6</sup> % 13, from $\gamma$ -ray transition intensity balance.
4203	620.837			I $\alpha$ =1.0×10 <sup>-5</sup> % 4, from $\gamma$ -ray transition intensity balance.
4219	605.165			I $\alpha$ =8.3×10 <sup>-6</sup> % 12, from $\gamma$ -ray transition intensity balance.
4239	585.237?			I $\alpha$ =2.0×10 <sup>-5</sup> % 2, from $\gamma$ -ray transition intensity balance.
4255	569.2721			I $\alpha$ =3.0×10 <sup>-6</sup> % 16, from $\gamma$ -ray transition intensity balance.
4288	536.08			I $\alpha$ =0.0007% 3, from $\gamma$ -ray transition intensity balance.
4309 2	526.516	0.0009	16	I $\alpha$ =5.0×10 <sup>-5</sup> % 5, from $\gamma$ -ray transition intensity balance.
4311	513.479			I $\alpha$ =5.0×10 <sup>-5</sup> % 4, from $\gamma$ -ray transition intensity balance.
4345	478.649			I $\alpha$ =0.00085% 6, from $\gamma$ -ray transition intensity balance.
4359	465.426			I $\alpha$ =0.00085% 6, from $\gamma$ -ray transition intensity balance.
4387	436.951			I $\alpha$ =0.00029% 4, from $\gamma$ -ray transition intensity balance.
4404 2	428.04	0.0003	279	I $\alpha$ =0.0054% 7, from $\gamma$ -ray transition intensity balance.
4411 2	425.877	0.0004	218	I $\alpha$ =5.7×10 <sup>-5</sup> % 5, from $\gamma$ -ray transition intensity balance.
4441	382.54?			I $\alpha$ =0.0023% 6, from $\gamma$ -ray transition intensity balance.
4457 2	374.815	0.0028	77	

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$^{233}\text{U}$   $\alpha$  decay    **2003Ba78,2007Be16 (continued)** $\alpha$  radiations (continued)

E $\alpha$ <sup>†</sup>	E(level)	I $\alpha$ <sup>‡#</sup>	HF <sup>‡</sup>	Comments
4465 2	365.8136	0.003	84	I $\alpha$ =0.0046 1 from $\gamma$ -ray transition intensity balance.
4483 2	347.800	0.0014	246	I $\alpha$ =0.0013 4 from $\gamma$ -ray transition intensity balance.
4503 2	327.8	0.001	488	I $\alpha$ =0.00100 4 from $\gamma$ -ray transition intensity balance.
4507 2	320.5483	0.012	46	I $\alpha$ =0.0199 7 from $\gamma$ -ray transition intensity balance.
4513 2	317.1731	0.018	33	I $\alpha$ =0.0194 8 from $\gamma$ -ray transition intensity balance.
4538 2	287.895	0.004	242	I $\alpha$ =0.005% 5, from $\gamma$ -ray transition intensity balance.
4565 2	261.964	0.0023	654	I $\alpha$ (255)+I $\alpha$ (262)=0.0027% 7, from $\gamma$ -ray transition intensity balance.
4572 2	255.957			
4582	241.546			I $\alpha$ =0.00166% 17, from $\gamma$ -ray transition intensity balance.
4590 2	237.366	0.007	325	I $\alpha$ =0.004% 5, from $\gamma$ -ray transition intensity balance.
4589	235.1266			I $\alpha$ =0.0007% 3, from $\gamma$ -ray transition intensity balance.
4611 2	217.1597	0.006	532	I $\alpha$ =0.0113% 10, from $\gamma$ -ray transition intensity balance.
4615 2	212.382	0.004	864	I $\alpha$ =0.0006% 9, from $\gamma$ -ray transition intensity balance.
4634 2	195.7194	0.01	456	I $\alpha$ =0.0131% 7, from $\gamma$ -ray transition intensity balance.
4641 2	189.99?	0.003	1669	
4656 2	173.4837	$\approx$ 0.005	$\approx$ 1315	I $\alpha$ =0.003% 3, from $\gamma$ -ray transition intensity balance.
4659	164.5317			I $\alpha$ =0.0036% 12, from $\gamma$ -ray transition intensity balance.
4664 2	163.2542	0.042	185	I $\alpha$ =0.062% 10, from $\gamma$ -ray transition intensity balance.
4676	148.1730			I $\alpha$ =0.0014% 5, from $\gamma$ -ray transition intensity balance.
4681	146.3569	0.01	1024	I $\alpha$ (146)+I $\alpha$ (148)=0.004% 4, from $\gamma$ -ray transition intensity balance.
4687 2	140.9?	0.0028	3998	
4701 2	125.4385	0.06	240	I $\alpha$ =0.091% 6, from $\gamma$ -ray transition intensity balance.
4729 2	97.13595	1.61	14	I $\alpha$ =1.63% 9, from $\gamma$ -ray transition intensity balance.
4751 2	75.1?	0.01	3225	
4754 2	71.8260	0.163	210	I $\alpha$ =0.29% 5, from $\gamma$ -ray transition intensity balance.
4758 2	67.8?	0.016	2264	
4783.5 12	42.4349	13.2	4.2	E $\alpha$ : From <a href="#">1968Ba25</a> . I $\alpha$ =9% 3, from $\gamma$ -ray transition intensity balance. I $\alpha$ =0.6% 4, from $\gamma$ -ray transition intensity balance.
4796 2	29.1927	0.28	240	
4804	20.2?			
4824.2 12	0.0	84.3 6	1.24	

E $\alpha$ ,I $\alpha$ ,HF: for ground state + 7.6-eV level.E $\alpha$ : From [1968Ba25](#).I $\alpha$ =88% 3, from  $\gamma$ -ray transition intensity balance.<sup>†</sup> From [1967Ba43](#), unless otherwise specified.<sup>‡</sup> Using  $r_0=1.5252$ , average of  $r_0(^{232}\text{U})=1.5289$  and  $r_0(^{234}\text{U})=1.5216$  ([1998Ak04](#)).<sup>#</sup> Absolute intensity per 100 decays.

$^{233}\text{U } \alpha \text{ decay} \quad 2003\text{Ba78}, 2007\text{Be16} \text{ (continued)}$ 
 $\gamma(^{229}\text{Th})$ 

$I\gamma$  normalization: From  $I\gamma(208\gamma)=0.00229\%$  3, measured and reported in 1984Re05.

Others: 1996Ko29, 1990Re03, 1984Re05, 1976Kr03, 1977Ca04, 1966Ah02, 1967Mo28, 1964Ba42, 1961Ru06, 1961An08, 1956Al30, 1952We27.

X rays(Th):							
	E $\gamma$ (x ray)	I $\gamma$ (%)					
1976Kr03	1979Ce04	1966Ah02					
11.12	0.13 4		L $\alpha_1$	x ray			
12.97	2.4 4		L $\alpha_1$	x ray+L $\alpha_2$	x ray		
14.97			L $\beta_6$	x ray			
15.64			L $\beta_2$	x ray+L $\beta_4$	x ray		
16.20	3.3 5		L $\beta_1$	x ray			
17.08			L $\beta_9$	x ray+L $\beta_{10}$	x ray		
18.37			L $\gamma_5$	x ray			
18.98	0.90 15		L $\gamma_1$	x ray			
19.50			L $\gamma_2$	x ray+L $\gamma_3$	x ray+L $\gamma_6$	x ray	
20.27			L $\gamma_4$	x ray			
89.94	89.96	0.0096 10	K $\alpha_2$	x ray			
93.34	93.35	0.0140 14	K $\alpha_1$	x ray			
104.83			K $\beta_3$	x ray			
105.59	105.5	0.0058 6	K $\beta_1$	x ray			
106.16			K $\beta_5$	x ray			
108.49			K $\beta_4$	x ray			
108.67	108.69	0.0015 3	K $\beta_2$	x ray			
E $\gamma$ <sup>†</sup>	I $\gamma$ <i>eh</i>	E $i$ (level)	J $^\pi_i$	E $f$	J $^\pi_f$	Mult. <sup>‡</sup>	$\alpha^j$
(0.0076)		0.0076	(3/2 $^+$ )	0.0	5/2 $^+$	[M1]	
(13.244)	2.4 <sup>f</sup> 7	42.4349	7/2 $^+$	29.1927	(5/2 $^+$ )	[M1]	358
20.25 <sup>m</sup>		20.2?	(7/2 $^-$ )	0.0	5/2 $^+$	[E1]	
25.02 <sup>m</sup> 5	0.10 4	237.366	(7/2 $^-$ )	212.382	(5/2 $^+$ )	[E1]	4.57
25.3106 <sup>l#</sup> 8	2.11 <sup>l</sup> 12	97.13595	9/2 $^+$	71.8260	(7/2 $^+$ )	[M1]	213
25.3106 <sup>l#</sup> 8	<0.004 <sup>l</sup>	173.4837	(9/2 $^-$ )	148.1730	(7/2 $^-$ )	[M1]	213
25.311 <sup>m</sup> 4		67.8?		42.4349	7/2 $^+$	[M1+E2]	$4 \times 10^3$ 5
							Comments
							E $\gamma$ : From decay scheme (2003Ba78).
							$\alpha(M)=266$ 4; $\alpha(N+..)=91.6$ 13
							$\alpha(N)=71.2$ 10; $\alpha(O)=16.86$ 24; $\alpha(P)=3.27$ 5; $\alpha(Q)=0.313$ 5
							$\alpha(L)=3.41$ 5; $\alpha(M)=0.879$ 14; $\alpha(N+..)=0.283$ 5
							$\alpha(N)=0.227$ 4; $\alpha(O)=0.0480$ 8; $\alpha(P)=0.00710$ 11; $\alpha(Q)=0.000235$ 4
							$\alpha(L)=160.7$ 23; $\alpha(M)=38.9$ 6; $\alpha(N+..)=13.36$ 19
							$\alpha(N)=10.38$ 15; $\alpha(O)=2.46$ 4; $\alpha(P)=0.477$ 7; $\alpha(Q)=0.0456$ 7
							$\alpha(L)=160.7$ 23; $\alpha(M)=38.9$ 6; $\alpha(N+..)=13.36$ 19
							$\alpha(N)=10.38$ 15; $\alpha(O)=2.46$ 4; $\alpha(P)=0.477$ 7; $\alpha(Q)=0.0456$ 7
							$\alpha(L)=3.E3$ 3; $\alpha(M)=9.E2$ 9; $\alpha(N+..)=3.E2$ 3
							$\alpha(N)=2.3 \times 10^2$ 23; $\alpha(O)=5.E1$ 5; $\alpha(P)=9$ 9; $\alpha(Q)=0.040$ 6

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^\dagger$	$I_\gamma^{\text{eh}}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^\ddagger$	$\alpha^j$	Comments
(27.119)	<0.002	173.4837	(9/2 <sup>-</sup> )	146.3569	(5/2 <sup>-</sup> )	[E2]		$6.13 \times 10^3$	$\alpha(L)=4.50 \times 10^3$ 7; $\alpha(M)=1225$ 18; $\alpha(N+..)=412$ 6 $\alpha(N)=327$ 5; $\alpha(O)=72.6$ 11; $\alpha(P)=11.93$ 17; $\alpha(Q)=0.0250$ 4
(28.288)	0.036 <sup>f</sup> 9	125.4385	(9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	[M1]		153.4	$\alpha(L)=115.8$ 17; $\alpha(M)=28.0$ 4; $\alpha(N+..)=9.61$ 14 $\alpha(N)=7.47$ 11; $\alpha(O)=1.769$ 25; $\alpha(P)=0.343$ 5; $\alpha(Q)=0.0328$ 5
29.1851 <sup>&amp;</sup> 4	7.8 10	29.1927	(5/2 <sup>+</sup> )	0.0076	(3/2 <sup>+</sup> )	M1 [+E2] <sup>b</sup>	0.145 <sup>b</sup>	225	$\alpha(L)=168.0$ 24; $\alpha(M)=42.6$ 6; $\alpha(N+..)=14.49$ 21 $\alpha(N)=11.36$ 16; $\alpha(O)=2.62$ 4; $\alpha(P)=0.478$ 7; $\alpha(Q)=0.0296$ 5 E <sub>γ</sub> : Measured value of 29.1856 keV 5 corrected for expected 29.19 <sub>γ</sub> to ground state (2007Be16).
(29.190)	2.7 <sup>f</sup> 5	29.1927	(5/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	M1		139.8	$\alpha(L)=105.6$ 15; $\alpha(M)=25.5$ 4; $\alpha(N+..)=8.76$ 13 $\alpha(N)=6.80$ 10; $\alpha(O)=1.612$ 23; $\alpha(P)=0.313$ 5; $\alpha(Q)=0.0299$ 5
29.3911 <sup>&amp;</sup> 4	0.80 <sup>f</sup> 14	71.8260	(7/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	[M1]		137.0	$\alpha(L)=103.5$ 15; $\alpha(M)=25.0$ 4; $\alpha(N+..)=8.58$ 12 $\alpha(N)=6.67$ 10; $\alpha(O)=1.579$ 23; $\alpha(P)=0.306$ 5; $\alpha(Q)=0.0293$ 4
<sup>x</sup> 31.41 3	0.24 4								
(32.453)	0.016 <sup>f</sup> 3	195.7194	(11/2 <sup>+</sup> )	163.2542	11/2 <sup>+</sup>	[M1]		102.3	$\alpha(L)=77.3$ 11; $\alpha(M)=18.6$ 3; $\alpha(N+..)=6.40$ 9 $\alpha(N)=4.97$ 7; $\alpha(O)=1.178$ 17; $\alpha(P)=0.229$ 4; $\alpha(Q)=0.0218$ 3
32.52 2	0.018 <sup>g</sup> 6	288.491	(3/2 <sup>+</sup> )	255.957	(3/2 <sup>+</sup> , 5/2 <sup>+</sup> , 7/2 <sup>+</sup> )	[M1]		101.7	$\alpha(L)=76.8$ 11; $\alpha(M)=18.5$ 3; $\alpha(N+..)=6.36$ 9 $\alpha(N)=4.94$ 7; $\alpha(O)=1.171$ 17; $\alpha(P)=0.227$ 4; $\alpha(Q)=0.0217$ 3
32.73 5	0.97 12	320.5483	(5/2 <sup>+</sup> )	287.895	(7/2 <sup>-</sup> )	[E1]		2.26	$\alpha(L)=1.697$ 25; $\alpha(M)=0.427$ 7; $\alpha(N+..)=0.1388$ 21 $\alpha(N)=0.1110$ 17; $\alpha(O)=0.0239$ 4; $\alpha(P)=0.00372$ 6; $\alpha(Q)=0.0001390$ 20
<sup>x</sup> 36.516 23	0.14 3								
<sup>x</sup> 36.95 3	0.12 3								
37.80 3	0.25 4	163.2542	11/2 <sup>+</sup>	125.4385	(9/2 <sup>+</sup> )	[M1]		65.2	$\alpha(L)=49.3$ 7; $\alpha(M)=11.87$ 17; $\alpha(N+..)=4.08$ 6 $\alpha(N)=3.17$ 5; $\alpha(O)=0.750$ 11; $\alpha(P)=0.1457$ 21; $\alpha(Q)=0.01390$ 20
<sup>x</sup> 41.98 2	0.34 4								
(42.431)	0.18 <sup>f</sup> 5	42.4349	7/2 <sup>+</sup>	0.0076	(3/2 <sup>+</sup> )	[E2]		683	$\alpha(L)=500$ 7; $\alpha(M)=136.7$ 20; $\alpha(N+..)=46.0$ 7

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^\ddagger$	$\alpha^j$	Comments
42.4349 <sup>&amp;</sup> 2	72.4	42.4349	7/2 <sup>+</sup>	0.0	5/2 <sup>+</sup>	M1+E2 <sup>b</sup>	0.40 <sup>b</sup> 10	1.3×10 <sup>2</sup> 4	$\alpha(N)=36.5\ 6; \alpha(O)=8.12\ 12;$ $\alpha(P)=1.337\ 19; \alpha(Q)=0.00336\ 5$ $\alpha(L)=1.0\times10^2\ 3; \alpha(M)=26\ 8;$ $\alpha(N+..)=9\ 3$ $\alpha(N)=7.0\ 22; \alpha(O)=1.6\ 5; \alpha(P)=0.27\ 8; \alpha(Q)=0.0090\ 5$ Mult., $\delta$ : From conversion electron data in 1959Tr31.
42.6333 <sup>&amp;</sup> 2	13.2 7	71.8260	(7/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	(M1) <sup>b</sup>	<sup>b</sup>	45.8	$\alpha(L)=34.6\ 5; \alpha(M)=8.33\ 12;$ $\alpha(N+..)=2.86\ 4$ $\alpha(N)=2.22\ 4; \alpha(O)=0.526\ 8;$ $\alpha(P)=0.1021\ 15; \alpha(Q)=0.00974\ 14$
43.69 <sup>km</sup> 3		140.9?	(11/2 <sup>-</sup> )	97.13595	9/2 <sup>+</sup>				
43.69 <sup>k</sup> 3	0.042 14	255.957	(3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> )	212.382	(5/2 <sup>+</sup> )	[M1]		42.6	$\alpha(L)=32.2\ 5; \alpha(M)=7.75\ 11;$ $\alpha(N+..)=2.66\ 4$ $\alpha(N)=2.07\ 3; \alpha(O)=0.490\ 7;$ $\alpha(P)=0.0950\ 14; \alpha(Q)=0.00907\ 13$
44.80 2	0.028 <sup>g</sup> 9	347.800	(5/2 <sup>+</sup> )	302.989	(7/2 <sup>+</sup> )	[M1]		39.5	$\alpha(L)=29.9\ 5; \alpha(M)=7.20\ 11;$ $\alpha(N+..)=2.47\ 4$ $\alpha(N)=1.92\ 3; \alpha(O)=0.455\ 7;$ $\alpha(P)=0.0883\ 13; \alpha(Q)=0.00842\ 12$
(45.855)	0.0091 <sup>f</sup> 16	241.546	13/2 <sup>+</sup>	195.7194	(11/2 <sup>+</sup> )	[M1]		36.9	$\alpha(L)=27.9\ 4; \alpha(M)=6.72\ 10;$ $\alpha(N+..)=2.31\ 4$ $\alpha(N)=1.79\ 3; \alpha(O)=0.425\ 6;$ $\alpha(P)=0.0824\ 12; \alpha(Q)=0.00786\ 11$
51.0 3	0.03 1	287.895	(7/2 <sup>-</sup> )	237.366	(7/2 <sup>-</sup> )	[M1+E2]		1.5×10 <sup>2</sup> 13	$\alpha(L)=1.1\times10^2\ 10; \alpha(M)=3.E1\ 3;$ $\alpha(N+..)=10\ 9$ $\alpha(N)=8\ 7; \alpha(O)=1.8\ 16; \alpha(P)=0.30\ 25; \alpha(Q)=0.0036\ 22$
52.60 3	0.10 3	217.1597	(5/2 <sup>-</sup> )	164.5317	(3/2 <sup>-</sup> )	[M1]		24.7	$\alpha(L)=18.6\ 3; \alpha(M)=4.49\ 7;$ $\alpha(N+..)=1.542\ 22$ $\alpha(N)=1.198\ 17; \alpha(O)=0.284\ 4;$ $\alpha(P)=0.0550\ 8; \alpha(Q)=0.00525\ 8$
<sup>x</sup> 53.18 <sup>@</sup> 1	0.32								
53.6106 <sup>#</sup> 11	3.47 18	125.4385	(9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	(M1) <sup>b</sup>	<sup>b</sup>	23.3	$\alpha(L)=17.63\ 25; \alpha(M)=4.24\ 6;$ $\alpha(N+..)=1.458\ 21$ $\alpha(N)=1.133\ 16; \alpha(O)=0.268\ 4;$ $\alpha(P)=0.0521\ 8; \alpha(Q)=0.00496\ 7$
54.7039 <sup>k#m</sup> 11		75.1?	(9/2 <sup>-</sup> )	20.2?	(7/2 <sup>-</sup> )				
54.7039 <sup>k#</sup> 11	16.8 8	97.13595	9/2 <sup>+</sup>	42.4349	7/2 <sup>+</sup>	M1+E2 <sup>b</sup>	0.46 <sup>b</sup> 3	53 4	$\alpha(L)=39\ 3; \alpha(M)=10.3\ 7;$

$^{233}\text{U } \alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma^{(229)\text{Th}}$ (continued)									
$E_\gamma^\dagger$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. $^{\ddagger}$	$\delta^{\ddagger}$	$\alpha^j$	Comments
<sup>x</sup> 57.72 <sup>@</sup> 1 63.79 6	1.5 0.029 11	237.366	(7/2 <sup>-</sup> )	173.4837	(9/2 <sup>-</sup> )	[M1]		14.02	$\alpha(N+..)=3.48\ 24$ $\alpha(N)=2.75\ 19$ ; $\alpha(O)=0.62\ 5$ ; $\alpha(P)=0.109\ 7$ ; $\alpha(Q)=0.00405\ 9$ Mult., $\delta$ : From conversion electron data in 1959Tr31.
65.62 <sup>km</sup> 5 65.62 <sup>k</sup> 5	140.9? 0.05 1	302.989	(11/2 <sup>-</sup> ) (7/2 <sup>+</sup> )	75.1? 237.366	(9/2 <sup>-</sup> ) (7/2 <sup>-</sup> )	[E1]		0.358	$\alpha(L)=0.270\ 4$ ; $\alpha(M)=0.0661\ 10$ ; $\alpha(N+..)=0.0219\ 3$ $\alpha(N)=0.01731\ 25$ ; $\alpha(O)=0.00388\ 6$ ; $\alpha(P)=0.000659\ 10$ ; $\alpha(Q)=3.28\times 10^{-5}\ 5$
66.1183 <sup>#</sup> 6	1.06 6	163.2542	11/2 <sup>+</sup>	97.13595	9/2 <sup>+</sup>	(M1+E2) <sup>b</sup>	0.56 <sup>b</sup> 20	29 9	$\alpha(L)=21\ 7$ ; $\alpha(M)=5.6\ 18$ ; $\alpha(N+..)=1.9\ 6$ $\alpha(N)=1.5\ 5$ ; $\alpha(O)=0.34\ 11$ ; $\alpha(P)=0.059\ 17$ ; $\alpha(Q)=0.0022\ 3$
67.943 <sup>m</sup> 7	67.8?			0.0	5/2 <sup>+</sup>	[M1+E2]		$4\times 10^1\ 3$	$\alpha(L)=30\ 22$ ; $\alpha(M)=8\ 6$ ; $\alpha(N+..)=2.7\ 21$ $\alpha(N)=2.2\ 16$ ; $\alpha(O)=0.5\ 4$ ; $\alpha(P)=0.08\ 6$ ; $\alpha(Q)=0.0015\ 11$
67.9460 <sup>#</sup> 5	0.320 23	97.13595	9/2 <sup>+</sup>	29.1927	(5/2 <sup>+</sup> )	E2		70.2	$\alpha(L)=51.3\ 8$ ; $\alpha(M)=14.08\ 20$ ; $\alpha(N+..)=4.75\ 7$ $\alpha(N)=3.77\ 6$ ; $\alpha(O)=0.839\ 12$ ; $\alpha(P)=0.1387\ 20$ ; $\alpha(Q)=0.000438\ 7$
68.81 3	0.100 23	217.1597	(5/2 <sup>-</sup> )	148.1730	(7/2 <sup>-</sup> )	[M1]		11.23	$\alpha(L)=8.49\ 12$ ; $\alpha(M)=2.04\ 3$ ; $\alpha(N+..)=0.702\ 10$ $\alpha(N)=0.545\ 8$ ; $\alpha(O)=0.1291\ 19$ ; $\alpha(P)=0.0251\ 4$ ; $\alpha(Q)=0.00239\ 4$
70.2813 13	0.58 4	195.7194	(11/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )	[M1+E2] <sup>b</sup>	0.157 <sup>b</sup> 3	11.74	$\alpha(L)=8.84\ 13$ ; $\alpha(M)=2.16\ 4$ ; $\alpha(N+..)=0.741\ 11$ $\alpha(N)=0.577\ 9$ ; $\alpha(O)=0.1356\ 20$ ; $\alpha(P)=0.0258\ 4$ ; $\alpha(Q)=0.00220\ 3$
71.812 <sup>k</sup> 8	1.81 14	71.8260	(7/2 <sup>+</sup> )	0.0076	(3/2 <sup>+</sup> )	E2 <sup>a</sup>		53.9	$\alpha(L)=39.4\ 6$ ; $\alpha(M)=10.81\ 16$ ; $\alpha(N+..)=3.65\ 6$ $\alpha(N)=2.90\ 4$ ; $\alpha(O)=0.644\ 9$ ; $\alpha(P)=0.1066\ 15$ ; $\alpha(Q)=0.000350\ 5$
71.812 <sup>m</sup> 8 71.8159 20	374.815 1.16 <sup>f</sup> 12	71.8260	(7/2 <sup>+</sup> )	302.989 0.0	(7/2 <sup>+</sup> ) 5/2 <sup>+</sup>	[M1+E2] <sup>b</sup>	0.25 <sup>b</sup>	12.50	$\alpha(L)=9.37\ 14$ ; $\alpha(M)=2.33\ 4$ ; $\alpha(N+..)=0.798\ 12$ $\alpha(N)=0.623\ 9$ ; $\alpha(O)=0.1452\ 21$ ; $\alpha(P)=0.0271\ 4$ ; $\alpha(Q)=0.00200\ 3$
<sup>x</sup> 72.74 <sup>@</sup> 1 (72.825)	0.76 <0.03	237.366	(7/2 <sup>-</sup> )	164.5317	(3/2 <sup>-</sup> )	[E2]		50.4	$\alpha(L)=36.8\ 6$ ; $\alpha(M)=10.12\ 15$ ; $\alpha(N+..)=3.41\ 5$ $\alpha(N)=2.71\ 4$ ; $\alpha(O)=0.603\ 9$ ; $\alpha(P)=0.0997\ 14$ ; $\alpha(Q)=0.000330\ 5$
74.542 <sup>#</sup> 5	1.49 8	146.3569	(5/2 <sup>-</sup> )	71.8260	(7/2 <sup>+</sup> )	[E1]		0.255	$\alpha(L)=0.193\ 3$ ; $\alpha(M)=0.0470\ 7$ ; $\alpha(N+..)=0.01561\ 22$

$^{233}\text{U } \alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma^{(229)\text{Th}}$ (continued)									
$E_\gamma^\dagger$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^\ddagger$	$\alpha^j$	Comments
76.350 <sup><i>l</i></sup> 4	0.30 <sup><i>l</i></sup> 3	148.1730	(7/2 <sup>-</sup> )	71.8260	(7/2 <sup>+</sup> )	[E1]		0.240	$\alpha(N)=0.01233\ 18; \alpha(O)=0.00277\ 4;$ $\alpha(P)=0.000478\ 7; \alpha(Q)=2.49\times 10^{-5}\ 4$
76.350 <sup><i>l</i></sup> 4	<0.02 <sup><i>l</i></sup>	173.4837	(9/2 <sup>-</sup> )	97.13595	9/2 <sup>+</sup>	[E1]		0.240	$\alpha(L)=0.181\ 3; \alpha(M)=0.0441\ 7; \alpha(N+..)=0.01465\ 21$ $\alpha(N)=0.01157\ 17; \alpha(O)=0.00260\ 4;$ $\alpha(P)=0.000450\ 7; \alpha(Q)=2.36\times 10^{-5}\ 4$
77.12 3		272.84?	(13/2 <sup>+</sup> )	195.7194	(11/2 <sup>+</sup> )	[M1+E2]		23 16	$\alpha(L)=0.181\ 3; \alpha(M)=0.0441\ 7; \alpha(N+..)=0.01465\ 21$ $\alpha(N)=0.01157\ 17; \alpha(O)=0.00260\ 4;$ $\alpha(P)=0.000450\ 7; \alpha(Q)=2.36\times 10^{-5}\ 4$
77.12 3	0.43 4	436.951	(7/2 <sup>-</sup> )	359.6044	(7/2 <sup>+</sup> )	[E1]		0.233	$\alpha(L)=0.1761\ 25; \alpha(M)=0.0429\ 6; \alpha(N+..)=0.01426\ 20$ $\alpha(N)=0.01127\ 16; \alpha(O)=0.00254\ 4;$ $\alpha(P)=0.000438\ 7; \alpha(Q)=2.31\times 10^{-5}\ 4$
78.21 5	0.044 7	241.546	13/2 <sup>+</sup>	163.2542	11/2 <sup>+</sup>	[M1+E2] <sup><i>b</i></sup>	0.56 <sup><i>b</i></sup>	14.45	$E_\gamma: 77.142$ and 77.198 form a doublet structure. $\alpha(L)=10.71\ 16; \alpha(M)=2.79\ 4; \alpha(N+..)=0.948\ 14$ $\alpha(N)=0.746\ 11; \alpha(O)=0.1702\ 25; \alpha(P)=0.0301\ 5;$ $\alpha(Q)=0.001309\ 19$
83.0125 20	0.197 22	125.4385	(9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	M1+E2 <sup><i>b</i></sup>	0.62 <sup><i>b</i></sup>	12 1	$I_\gamma: 0.038\ 7$ listed in table VI of 2003Ba78. $\alpha(L)=9.0\ 1; \alpha(M)=2.4\ 1; \alpha(N+..)=0.6\ 1$ $\alpha(N)=0.9\ 6; \alpha(O)=0.20\ 13; \alpha(P)=0.034\ 20;$ $\alpha(Q)=0.0008\ 6$
<sup>x</sup> 84.29 <sup>@</sup> 4	0.082								
85.4221 9	0.12 4	320.5483	(5/2 <sup>+</sup> )	235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )	[E1]		0.1779	$\alpha(L)=0.1343\ 19; \alpha(M)=0.0327\ 5; \alpha(N+..)=0.01089\ 16$ $\alpha(N)=0.00859\ 12; \alpha(O)=0.00194\ 3;$ $\alpha(P)=0.000338\ 5; \alpha(Q)=1.85\times 10^{-5}\ 3$
86.3 <sup><i>km</i></sup> 3		235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )	148.1730	(7/2 <sup>-</sup> )	[M1] <sup><i>b</i></sup>	<sup><i>b</i></sup>	5.81 10	$\alpha(L)=4.39\ 8; \alpha(M)=1.056\ 19; \alpha(N+..)=0.363\ 7$ $\alpha(N)=0.282\ 5; \alpha(O)=0.0667\ 12; \alpha(P)=0.01295\ 23;$ $\alpha(Q)=0.001232\ 22$
86.3 <sup><i>l</i></sup> 3	0.038 <sup><i>lf</i></sup> 3	327.8	(15/2 <sup>+</sup> )	241.546	13/2 <sup>+</sup>	[M1+E2] <sup><i>b</i></sup>	0.44 <sup><i>b</i></sup>	8.52 17	$\alpha(L)=6.35\ 12; \alpha(M)=1.62\ 3; \alpha(N+..)=0.551\ 11$ $\alpha(N)=0.433\ 9; \alpha(O)=0.0997\ 19; \alpha(P)=0.0181\ 4;$ $\alpha(Q)=0.001060\ 19$
86.3 <sup><i>l</i></sup> 3	0.099 <sup><i>l</i></sup> 23	374.815	(7/2 <sup>+</sup> )	288.491	(3/2 <sup>+</sup> )	[E2]		22.5 5	$\alpha(L)=16.5\ 4; \alpha(M)=4.52\ 10; \alpha(N+..)=1.53\ 4$ $\alpha(N)=1.21\ 3; \alpha(O)=0.270\ 6; \alpha(P)=0.0447\ 10;$ $\alpha(Q)=0.000170\ 4$
87.25 4	0.088 22	212.382	(5/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )	[E2]		21.4	$\alpha(L)=15.63\ 23; \alpha(M)=4.29\ 6; \alpha(N+..)=1.449\ 21$ $\alpha(N)=1.150\ 17; \alpha(O)=0.256\ 4; \alpha(P)=0.0425\ 6;$ $\alpha(Q)=0.0001629\ 23$

$^{233}\text{U } \alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^{\ddagger}$	$\alpha^j$	Comments
89.39 7	0.26 3	237.366	(7/2 <sup>-</sup> )	148.1730	(7/2 <sup>-</sup> )	[M1]	5.24		$\alpha(L)=3.96$ 6; $\alpha(M)=0.954$ 14; $\alpha(N+..)=0.327$ 5 $\alpha(N)=0.254$ 4; $\alpha(O)=0.0603$ 9; $\alpha(P)=0.01169$ 17; $\alpha(Q)=0.001113$ 16
89.9568 <sup>c</sup> 24	0.229 23	235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )	146.3569	(5/2 <sup>-</sup> )	[M1]	5.40		$\alpha(L)=4.08$ 6; $\alpha(M)=0.983$ 14; $\alpha(N+..)=0.337$ 5 $\alpha(N)=0.262$ 4; $\alpha(O)=0.0621$ 9; $\alpha(P)=0.01205$ 17; $\alpha(Q)=0.001146$ 16
90.99 1	0.31 4	237.366	(7/2 <sup>-</sup> )	146.3569	(5/2 <sup>-</sup> )	[M1]	4.98		$\alpha(L)=3.76$ 6; $\alpha(M)=0.906$ 13; $\alpha(N+..)=0.311$ 5 $\alpha(N)=0.242$ 4; $\alpha(O)=0.0572$ 8; $\alpha(P)=0.01110$ 16; $\alpha(Q)=0.001057$ 15
(91.433)	0.041 <sup>f</sup> 7	163.2542	11/2 <sup>+</sup>	71.8260	(7/2 <sup>+</sup> )	[E2]	17.14		$\alpha(L)=12.54$ 18; $\alpha(M)=3.44$ 5; $\alpha(N+..)=1.163$ 17 $\alpha(N)=0.923$ 13; $\alpha(O)=0.206$ 3; $\alpha(P)=0.0341$ 5; $\alpha(Q)=0.0001368$ 20
92.23 12	0.033 12	347.800	(5/2 <sup>+</sup> )	255.957	(3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> )	[M1]	4.79		$\alpha(L)=3.62$ 6; $\alpha(M)=0.871$ 13; $\alpha(N+..)=0.299$ 5 $\alpha(N)=0.232$ 4; $\alpha(O)=0.0550$ 8; $\alpha(P)=0.01068$ 16; $\alpha(Q)=0.001016$ 15
92.85 <sup>m</sup> 3	0.26 3	189.99?		97.13595	9/2 <sup>+</sup>				
96.69 7	0.190 25								
97.1346 3	20.3 10	97.13595	9/2 <sup>+</sup>	0.0	5/2 <sup>+</sup>	E2 <sup>a</sup>	12.91		$\alpha(L)=9.44$ 14; $\alpha(M)=2.59$ 4; $\alpha(N+..)=0.876$ 13 $\alpha(N)=0.695$ 10; $\alpha(O)=0.1549$ 22; $\alpha(P)=0.0257$ 4; $\alpha(Q)=0.0001097$ 16
97.37 4	2.0 6	261.964	(1/2 <sup>+</sup> )	164.5317	(3/2 <sup>-</sup> )	[E1]	0.1259		$\alpha(L)=0.0951$ 14; $\alpha(M)=0.0231$ 4; $\alpha(N+..)=0.00771$ 11 $\alpha(N)=0.00608$ 9; $\alpha(O)=0.001379$ 20; $\alpha(P)=0.000243$ 4; $\alpha(Q)=1.387\times 10^{-5}$ 20
x98.37@ 2	0.13								
(98.565)	0.097 <sup>f</sup> 16	195.7194	(11/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	[M1+E2] <sup>b</sup>	0.27 <sup>b</sup>	4.50	$\alpha(L)=3.38$ 5; $\alpha(M)=0.834$ 12; $\alpha(N+..)=0.285$ 4 $\alpha(N)=0.223$ 4; $\alpha(O)=0.0521$ 8; $\alpha(P)=0.00984$ 14; $\alpha(Q)=0.000788$ 11
99.95 15	0.019 6	317.1731	(5/2 <sup>+</sup> )	217.1597	(5/2 <sup>-</sup> )	[E1]	0.1176		$\alpha(L)=0.0888$ 13; $\alpha(M)=0.0216$ 4; $\alpha(N+..)=0.00720$ 11

$^{233}\text{U } \alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)								
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\alpha^j$	Comments
101.70 5	0.069 15	173.4837	(9/2 <sup>-</sup> )	71.8260 (7/2 <sup>+</sup> )	[E1]	0.1123		$\alpha(N)=0.00567\ 9; \alpha(O)=0.001288\ 19; \alpha(P)=0.000227\ 4;$ $\alpha(Q)=1.309\times10^{-5}\ 19$ $\alpha(L)=0.0848\ 12; \alpha(M)=0.0206\ 3; \alpha(N+..)=0.00688\ 10$ $\alpha(N)=0.00542\ 8; \alpha(O)=0.001231\ 18; \alpha(P)=0.000217\ 3;$ $\alpha(Q)=1.260\times10^{-5}\ 18$
103.73 10	0.063 19	320.5483	(5/2 <sup>+</sup> )	217.1597 (5/2 <sup>-</sup> )	[E1]	0.1066		$\alpha(L)=0.0805\ 12; \alpha(M)=0.0196\ 3; \alpha(N+..)=0.00653\ 10$ $\alpha(N)=0.00514\ 8; \alpha(O)=0.001169\ 17; \alpha(P)=0.000207\ 3;$ $\alpha(Q)=1.206\times10^{-5}\ 17$
<sup>x</sup> 109.41 <sup>④</sup> 5	0.25							
111.93 1	0.40 3	237.366	(7/2 <sup>-</sup> )	125.4385 (9/2 <sup>+</sup> )	[E1]	0.372		$\alpha(K)=0.284\ 4; \alpha(L)=0.0660\ 10; \alpha(M)=0.01600\ 23; \alpha(N+..)=0.00535\ 8$ $\alpha(N)=0.00421\ 6; \alpha(O)=0.000959\ 14; \alpha(P)=0.0001705\ 24;$ $\alpha(Q)=1.019\times10^{-5}\ 15$
114.2 2	0.183 23	287.895	(7/2 <sup>-</sup> )	173.4837 (9/2 <sup>-</sup> )	[M1]	12.68		$\alpha(K)=10.10\ 15; \alpha(L)=1.95\ 3; \alpha(M)=0.469\ 7; \alpha(N+..)=0.1612\ 24$ $\alpha(N)=0.1252\ 19; \alpha(O)=0.0297\ 5; \alpha(P)=0.00575\ 9; \alpha(Q)=0.000547\ 9$
116.3 <sup>l</sup> 2	0.0047 <sup>lf</sup> 9	241.546	13/2 <sup>+</sup>	125.4385 (9/2 <sup>+</sup> )	[E2]	5.84 10		$\alpha(K)=0.245\ 4; \alpha(L)=4.09\ 7; \alpha(M)=1.124\ 19; \alpha(N+..)=0.380\ 7$ $\alpha(N)=0.301\ 5; \alpha(O)=0.0672\ 11; \alpha(P)=0.01118\ 18; \alpha(Q)=5.91\times10^{-5}\ 9$
116.3 <sup>l</sup> 2	0.121 <sup>l</sup> 23	436.951	(7/2 <sup>-</sup> )	320.5483 (5/2 <sup>+</sup> )	[E1]	0.342		$\alpha(K)=0.263\ 4; \alpha(L)=0.0597\ 9; \alpha(M)=0.01447\ 22; \alpha(N+..)=0.00484\ 8$ $\alpha(N)=0.00381\ 6; \alpha(O)=0.000869\ 13; \alpha(P)=0.0001548\ 23;$ $\alpha(Q)=9.36\times10^{-6}\ 14$
117.162 <sup>#</sup> 2	2.87 14	146.3569	(5/2 <sup>-</sup> )	29.1927 (5/2 <sup>+</sup> )	E1	0.336		$\alpha(K)=0.259\ 4; \alpha(L)=0.0586\ 9; \alpha(M)=0.01419\ 20; \alpha(N+..)=0.00475\ 7$ $\alpha(N)=0.00374\ 6; \alpha(O)=0.000852\ 12; \alpha(P)=0.0001519\ 22;$ $\alpha(Q)=9.21\times10^{-6}\ 13$
118.968 <sup>#</sup> 5	3.63 18	148.1730	(7/2 <sup>-</sup> )	29.1927 (5/2 <sup>+</sup> )	(E1)	0.325		$\alpha(K)=0.250\ 4; \alpha(L)=0.0563\ 8; \alpha(M)=0.01363\ 19; \alpha(N+..)=0.00456\ 7$ $\alpha(N)=0.00359\ 5; \alpha(O)=0.000819\ 12; \alpha(P)=0.0001462\ 21;$ $\alpha(Q)=8.90\times10^{-6}\ 13$
120.819 <sup>km</sup> 2	140.9?	(11/2 <sup>-</sup> )	20.2? (7/2 <sup>-</sup> )					
120.819 <sup>k#</sup> 2	2.82 15	163.2542	11/2 <sup>+</sup>	42.4349 7/2 <sup>+</sup>	E2 <sup>a</sup>	4.95		$\alpha(K)=0.257\ 4; \alpha(L)=3.43\ 5; \alpha(M)=0.943\ 14; \alpha(N+..)=0.319\ 5$ $\alpha(N)=0.253\ 4; \alpha(O)=0.0564\ 8; \alpha(P)=0.00939\ 14; \alpha(Q)=5.22\times10^{-5}\ 8$
123.886 <sup>#</sup> 7	0.72 5	195.7194	(11/2 <sup>+</sup> )	71.8260 (7/2 <sup>+</sup> )	[E2]	4.45		$\alpha(K)=0.261\ 4; \alpha(L)=3.06\ 5; \alpha(M)=0.841\ 12; \alpha(N+..)=0.284\ 4$ $\alpha(N)=0.225\ 4; \alpha(O)=0.0503\ 7; \alpha(P)=0.00838\ 12; \alpha(Q)=4.81\times10^{-5}\ 7$
125.04 23	0.010 3	428.04	(5/2 <sup>+</sup> )	302.989 (7/2 <sup>+</sup> )	[M1]	9.83		$\alpha(K)=7.84\ 12; \alpha(L)=1.503\ 23; \alpha(M)=0.362\ 6; \alpha(N+..)=0.1242\ 19$ $\alpha(N)=0.0965\ 15; \alpha(O)=0.0228\ 4; \alpha(P)=0.00443\ 7; \alpha(Q)=0.000421\ 7$
125.43 4	0.051 10	125.4385	(9/2 <sup>+</sup> )	0.0 5/2 <sup>+</sup>	E2	4.22		$\alpha(K)=0.262\ 4; \alpha(L)=2.89\ 4; \alpha(M)=0.794\ 12; \alpha(N+..)=0.268\ 4$ $\alpha(N)=0.213\ 3; \alpha(O)=0.0475\ 7; \alpha(P)=0.00792\ 12; \alpha(Q)=4.63\times10^{-5}\ 7$
<sup>x</sup> 129.13 <sup>④</sup> 1 (129.514)	0.18 ≈0.06	302.989	(7/2 <sup>+</sup> )	173.4837 (9/2 <sup>-</sup> )	[E1]	0.266		$\alpha(K)=0.206\ 3; \alpha(L)=0.0451\ 7; \alpha(M)=0.01092\ 16; \alpha(N+..)=0.00366\ 6$ $\alpha(N)=0.00288\ 4; \alpha(O)=0.000658\ 10; \alpha(P)=0.0001180\ 17;$ $\alpha(Q)=7.37\times10^{-6}\ 11$

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^{\ddagger}$	$\alpha^j$	Comments
131.22 8	0.0174 22	173.4837	(9/2 <sup>-</sup> )	42.4349	7/2 <sup>+</sup>	[E1]	0.257		$\alpha(K)=0.200\ 3; \alpha(L)=0.0436\ 7; \alpha(M)=0.01055\ 15;$ $\alpha(N+..)=0.00354\ 5$ $\alpha(N)=0.00278\ 4; \alpha(O)=0.000636\ 9; \alpha(P)=0.0001142\ 16;$ $\alpha(Q)=7.16\times10^{-6}\ 10$
(132.1)	0.0035 <sup>f</sup> 7	327.8	(15/2 <sup>+</sup> )	195.7194	(11/2 <sup>+</sup> )	[E2]	3.39		$\alpha(K)=0.263\ 4; \alpha(L)=2.28\ 4; \alpha(M)=0.627\ 9; \alpha(N+..)=0.212\ 3$ $\alpha(N)=0.1681\ 24; \alpha(O)=0.0375\ 6; \alpha(P)=0.00626\ 9;$ $\alpha(Q)=3.94\times10^{-5}\ 6$
135.3390 <sup>#</sup> 5	1.97 10	164.5317	(3/2 <sup>-</sup> )	29.1927	(5/2 <sup>+</sup> )	E1	0.239		$\alpha(K)=0.186\ 3; \alpha(L)=0.0403\ 6; \alpha(M)=0.00974\ 14;$ $\alpha(N+..)=0.00327\ 5$ $\alpha(N)=0.00257\ 4; \alpha(O)=0.000587\ 9; \alpha(P)=0.0001057\ 15;$ $\alpha(Q)=6.68\times10^{-6}\ 10$
139.3 <sup>k</sup> 3		374.815	(7/2 <sup>+</sup> )	235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )	[E1]	0.223		$\alpha(K)=0.174\ 3; \alpha(L)=0.0374\ 6; \alpha(M)=0.00903\ 14;$ $\alpha(N+..)=0.00303\ 5$ $\alpha(N)=0.00238\ 4; \alpha(O)=0.000546\ 9; \alpha(P)=9.83\times10^{-5}\ 15;$ $\alpha(Q)=6.27\times10^{-6}\ 10$
139.3 <sup>k</sup> 3	0.0206 23	428.04	(5/2 <sup>+</sup> )	288.491	(3/2 <sup>+</sup> )	[M1]	7.24		$\alpha(K)=5.78\ 9; \alpha(L)=1.103\ 17; \alpha(M)=0.265\ 4; \alpha(N+..)=0.0911\ 14$ $\alpha(N)=0.0708\ 11; \alpha(O)=0.0168\ 3; \alpha(P)=0.00325\ 5;$ $\alpha(Q)=0.000309\ 5$
139.722 <sup>#</sup> 3	0.090 18	287.895	(7/2 <sup>-</sup> )	148.1730	(7/2 <sup>-</sup> )	[M1]	7.17		$\alpha(K)=5.73\ 8; \alpha(L)=1.093\ 16; \alpha(M)=0.263\ 4; \alpha(N+..)=0.0903\ 13$ $\alpha(N)=0.0701\ 10; \alpha(O)=0.01661\ 24; \alpha(P)=0.00322\ 5;$ $\alpha(Q)=0.000306\ 5$
141.95 10	0.0090 15	288.491	(3/2 <sup>+</sup> )	146.3569	(5/2 <sup>-</sup> )	[E1]	0.213		$\alpha(K)=0.1663\ 24; \alpha(L)=0.0356\ 5; \alpha(M)=0.00860\ 13;$ $\alpha(N+..)=0.00289\ 4$ $\alpha(N)=0.00227\ 4; \alpha(O)=0.000520\ 8; \alpha(P)=9.38\times10^{-5}\ 14;$ $\alpha(Q)=6.01\times10^{-6}\ 9$
142.69 <sup>c</sup> 1	0.034 5	359.6044	(7/2 <sup>+</sup> )	217.1597	(5/2 <sup>-</sup> )	[E1]	0.211		$\alpha(K)=0.1643\ 23; \alpha(L)=0.0351\ 5; \alpha(M)=0.00849\ 12;$ $\alpha(N+..)=0.00285\ 4$ $\alpha(N)=0.00224\ 4; \alpha(O)=0.000513\ 8; \alpha(P)=9.25\times10^{-5}\ 13;$ $\alpha(Q)=5.94\times10^{-6}\ 9$
144.42 2	0.30 3	241.546	13/2 <sup>+</sup>	97.13595	9/2 <sup>+</sup>	[E2]	2.34		$\alpha(K)=0.250\ 4; \alpha(L)=1.527\ 22; \alpha(M)=0.419\ 6; \alpha(N+..)=0.1416\ 20$ $\alpha(N)=0.1123\ 16; \alpha(O)=0.0251\ 4; \alpha(P)=0.00419\ 6;$ $\alpha(Q)=3.01\times10^{-5}\ 5$
145.35 2	1.73 7	217.1597	(5/2 <sup>-</sup> )	71.8260	(7/2 <sup>+</sup> )	[E1]	0.202		$\alpha(K)=0.1574\ 22; \alpha(L)=0.0335\ 5; \alpha(M)=0.00809\ 12;$ $\alpha(N+..)=0.00272\ 4$ $\alpha(N)=0.00213\ 3; \alpha(O)=0.000489\ 7; \alpha(P)=8.84\times10^{-5}\ 13;$ $\alpha(Q)=5.70\times10^{-6}\ 8$
146.3462 <sup>#c</sup> 6	6.5 3	146.3569	(5/2 <sup>-</sup> )	0.0076	(3/2 <sup>+</sup> )	(E1)	0.198		$\alpha(K)=0.1549\ 22; \alpha(L)=0.0329\ 5; \alpha(M)=0.00795\ 12;$

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$a_j$	$I_{(\gamma+ce)} i$	Comments
146.9 <sup>m</sup> 5	0.116 10	272.84?	(13/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )			0.00035	$\alpha(N..)=0.00267$ 4
148.20 2	0.397 20	148.1730	(7/2 <sup>-</sup> )	0.0	5/2 <sup>+</sup>	[E1]	0.193		$\alpha(N)=0.00210$ 3; $\alpha(O)=0.000481$ 7; $\alpha(P)=8.69\times10^{-5}$ 13; $\alpha(Q)=5.62\times10^{-6}$ 8
<sup>x</sup> 149.69 2	0.095 6								$I_\gamma$ : 0.119 in table VI of 2003Ba78.
152.62 10	0.011 3	317.1731	(5/2 <sup>+</sup> )	164.5317	(3/2 <sup>-</sup> )	[E1]	0.179		$\alpha(K)=0.1504$ 21; $\alpha(L)=0.0319$ 5; $\alpha(M)=0.00770$ 11; $\alpha(N..)=0.00259$ 4
									$\alpha(N)=0.00203$ 3; $\alpha(O)=0.000466$ 7; $\alpha(P)=8.42\times10^{-5}$ 12; $\alpha(Q)=5.46\times10^{-6}$ 8
153.17 <sup>km</sup> 4		173.4837	(9/2 <sup>-</sup> )	20.2?	(7/2 <sup>-</sup> )				$\alpha(K)=0.1404$ 20; $\alpha(L)=0.0295$ 5; $\alpha(M)=0.00714$ 10; $\alpha(N..)=0.00240$ 4
153.17 <sup>k</sup> 4	0.037 3	195.7194	(11/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	[E2]	1.84		$\alpha(N)=0.00188$ 3; $\alpha(O)=0.000432$ 6; $\alpha(P)=7.82\times10^{-5}$ 11; $\alpha(Q)=5.12\times10^{-6}$ 8
153.17 <sup>km</sup> 4									$\alpha(K)=0.236$ 4; $\alpha(L)=1.174$ 17; $\alpha(M)=0.322$ 5;
154.90 3	0.143 8	302.989	(7/2 <sup>+</sup> )	212.382	(5/2 <sup>+</sup> )				$\alpha(N..)=0.1088$ 16
				148.1730	(7/2 <sup>-</sup> )	[E1]	0.1732		$\alpha(N)=0.0862$ 13; $\alpha(O)=0.0193$ 3; $\alpha(P)=0.00323$ 5; $\alpha(Q)=2.53\times10^{-5}$ 4
156.19 5	0.036 3	320.5483	(5/2 <sup>+</sup> )	164.5317	(3/2 <sup>-</sup> )	[E1]	0.1698		$\alpha(K)=0.1356$ 19; $\alpha(L)=0.0284$ 4; $\alpha(M)=0.00687$ 10; $\alpha(N..)=0.00231$ 4
									$\alpha(N)=0.00181$ 3; $\alpha(O)=0.000416$ 6; $\alpha(P)=7.54\times10^{-5}$ 11; $\alpha(Q)=4.95\times10^{-6}$ 7
162.45 <sup>k</sup> 4	0.054 5	287.895	(7/2 <sup>-</sup> )	125.4385	(9/2 <sup>+</sup> )	[E1]	0.1546		$\alpha(K)=0.1330$ 19; $\alpha(L)=0.0278$ 4; $\alpha(M)=0.00672$ 10; $\alpha(N..)=0.00226$ 4
									$\alpha(N)=0.001774$ 25; $\alpha(O)=0.000407$ 6; $\alpha(P)=7.39\times10^{-5}$ 11; $\alpha(Q)=4.86\times10^{-6}$ 7
162.45 <sup>k</sup> 4		465.426	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	302.989	(7/2 <sup>+</sup> )				$\alpha(K)=0.1213$ 17; $\alpha(L)=0.0252$ 4; $\alpha(M)=0.00608$ 9; $\alpha(N..)=0.00204$ 3
<sup>x</sup> 163.72 3	0.117 6								$\alpha(N)=0.001604$ 23; $\alpha(O)=0.000369$ 6; $\alpha(P)=6.70\times10^{-5}$ 10; $\alpha(Q)=4.46\times10^{-6}$ 7
(164.5) <sup>l</sup>	0.261 <sup>l</sup> 5	327.8	(15/2 <sup>+</sup> )	163.2542	11/2 <sup>+</sup>	[E2]	1.385		$\alpha(K)=0.216$ 3; $\alpha(L)=0.856$ 12; $\alpha(M)=0.234$ 4; $\alpha(N..)=0.0792$ 11
									$\alpha(N)=0.0628$ 9; $\alpha(O)=0.01405$ 20; $\alpha(P)=0.00236$ 4; $\alpha(Q)=2.07\times10^{-5}$ 3
164.5240 <sup>l#</sup> 5	6.0 <sup>l</sup> 3	164.5317	(3/2 <sup>-</sup> )	0.0076	(3/2 <sup>+</sup> )	(E1) <sup>a</sup>	0.1500		$\alpha(K)=0.1177$ 17; $\alpha(L)=0.0244$ 4; $\alpha(M)=0.00588$ 9; $\alpha(N..)=0.00198$ 3

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)								
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\alpha^j$	Comments
165.61 3	0.407 23	237.366	(7/2 <sup>-</sup> )	71.8260	(7/2 <sup>+</sup> )	[E1]	0.1476	$\alpha(N)=0.001553$ 22; $\alpha(O)=0.000357$ 5; $\alpha(P)=6.49\times10^{-5}$ 9; $\alpha(Q)=4.33\times10^{-6}$ 6 $\alpha(K)=0.1159$ 17; $\alpha(L)=0.0240$ 4; $\alpha(M)=0.00579$ 9; $\alpha(N+..)=0.00195$ 3
167.10 7	0.0165 14	526.516	(5/2,7/2)	359.6044	(7/2 <sup>+</sup> )			$\alpha(N)=0.001527$ 22; $\alpha(O)=0.000351$ 5; $\alpha(P)=6.39\times10^{-5}$ 9; $\alpha(Q)=4.27\times10^{-6}$ 6
169.002 <sup>#</sup> 5	0.041 6	317.1731	(5/2 <sup>+</sup> )	148.1730	(7/2 <sup>-</sup> )	[E1]	0.1407	$\alpha(K)=0.1106$ 16; $\alpha(L)=0.0228$ 4; $\alpha(M)=0.00549$ 8; $\alpha(N+..)=0.00185$ 3 $\alpha(N)=0.001450$ 21; $\alpha(O)=0.000334$ 5; $\alpha(P)=6.07\times10^{-5}$ 9; $\alpha(Q)=4.08\times10^{-6}$ 6
170.809 <sup>#</sup> 24	0.100 6	317.1731	(5/2 <sup>+</sup> )	146.3569	(5/2 <sup>-</sup> )	[E1]	0.1372	$\alpha(K)=0.1078$ 16; $\alpha(L)=0.0222$ 4; $\alpha(M)=0.00535$ 8; $\alpha(N+..)=0.00180$ 3 $\alpha(N)=0.001412$ 20; $\alpha(O)=0.000325$ 5; $\alpha(P)=5.92\times10^{-5}$ 9; $\alpha(Q)=3.99\times10^{-6}$ 6
172.39 10	0.0228 22	320.5483	(5/2 <sup>+</sup> )	148.1730	(7/2 <sup>-</sup> )	[E1]	0.1342	$\alpha(K)=0.1055$ 15; $\alpha(L)=0.0217$ 3; $\alpha(M)=0.00522$ 8; $\alpha(N+..)=0.001758$ 25 $\alpha(N)=0.001379$ 20; $\alpha(O)=0.000317$ 5; $\alpha(P)=5.78\times10^{-5}$ 9; $\alpha(Q)=3.91\times10^{-6}$ 6
174.192 <sup>#</sup> 2	0.170 9	320.5483	(5/2 <sup>+</sup> )	146.3569	(5/2 <sup>-</sup> )	[E1]	0.1309	$\alpha(K)=0.1030$ 15; $\alpha(L)=0.0211$ 3; $\alpha(M)=0.00509$ 8; $\alpha(N+..)=0.001712$ 24 $\alpha(N)=0.001343$ 19; $\alpha(O)=0.000309$ 5; $\alpha(P)=5.64\times10^{-5}$ 8; $\alpha(Q)=3.82\times10^{-6}$ 6
<sup>x</sup> 176.10 5	0.016 5							
177.91 <sup>k</sup> 16	0.0066 13	302.989	(7/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )	[M1]	3.62	$\alpha(K)=2.89$ 5; $\alpha(L)=0.549$ 8; $\alpha(M)=0.1320$ 19; $\alpha(N+..)=0.0453$ 7 $\alpha(N)=0.0352$ 5; $\alpha(O)=0.00834$ 12; $\alpha(P)=0.001618$ 23; $\alpha(Q)=0.0001536$ 22
177.91 <sup>k</sup> 16	0.022 5	656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )			
184.1 3	0.022 5	425.877	(9/2 <sup>+</sup> )	241.546	13/2 <sup>+</sup>	[E2]	0.897	$\alpha(K)=0.182$ 3; $\alpha(L)=0.523$ 9; $\alpha(M)=0.1429$ 23; $\alpha(N+..)=0.0484$ 8 $\alpha(N)=0.0383$ 6; $\alpha(O)=0.00858$ 14; $\alpha(P)=0.001445$ 23; $\alpha(Q)=1.523\times10^{-5}$ 23
185.76 <sup>m</sup> 9	0.0078 21	359.6044	(7/2 <sup>+</sup> )	173.4837	(9/2 <sup>-</sup> )	[E1]	0.1124	$\alpha(K)=0.0886$ 13; $\alpha(L)=0.0179$ 3; $\alpha(M)=0.00432$ 6; $\alpha(N+..)=0.001456$ 21 $\alpha(N)=0.001142$ 16; $\alpha(O)=0.000263$ 4; $\alpha(P)=4.81\times10^{-5}$ 7; $\alpha(Q)=3.32\times10^{-6}$ 5
<sup>x</sup> 187.12 3	0.032 4							
187.9670 <sup>#</sup> 3	1.87 9	217.1597	(5/2 <sup>-</sup> )	29.1927	(5/2 <sup>+</sup> )	[E1]	0.1093	$\alpha(K)=0.0862$ 12; $\alpha(L)=0.01741$ 25; $\alpha(M)=0.00420$ 6;

**$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)**

$\gamma(^{229}\text{Th})$ (continued)								
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\alpha^j$	Comments
188.65 6	0.025 4	425.877	(9/2 <sup>+</sup> )	237.366	(7/2 <sup>-</sup> )	[E1]	0.1083	$\alpha(N+..)=0.001414\ 20$ $\alpha(N)=0.001108\ 16$ ; $\alpha(O)=0.000256\ 4$ ; $\alpha(P)=4.68\times10^{-5}\ 7$ ; $\alpha(Q)=3.23\times10^{-6}\ 5$
192.26 4	0.036 4	365.8136	(7/2 <sup>+</sup> )	173.4837	(9/2 <sup>-</sup> )	[E1]	0.1036	$\alpha(K)=0.0855\ 12$ ; $\alpha(L)=0.01725\ 25$ ; $\alpha(M)=0.00416\ 6$ ; $\alpha(N+..)=0.001401\ 20$ $\alpha(N)=0.001098\ 16$ ; $\alpha(O)=0.000253\ 4$ ; $\alpha(P)=4.63\times10^{-5}\ 7$ ; $\alpha(Q)=3.20\times10^{-6}\ 5$
<sup>x</sup> 198.60 12	0.0038 13							
205.75 <sup>k</sup> 6	0.0228 24	302.989	(7/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	[M1]	2.40	$\alpha(K)=1.92\ 3$ ; $\alpha(L)=0.364\ 6$ ; $\alpha(M)=0.0875\ 13$ ; $\alpha(N+..)=0.0300\ 5$ $\alpha(N)=0.0233\ 4$ ; $\alpha(O)=0.00553\ 8$ ; $\alpha(P)=0.001072\ 15$ ; $\alpha(Q)=0.0001018\ 15$
205.75 <sup>k</sup> 6	526.516	(5/2,7/2)		320.5483	(5/2 <sup>+</sup> )			
<sup>x</sup> 207.25 9	0.032 5							
208.179 <sup>#</sup> 7	2.29 11	237.366	(7/2 <sup>-</sup> )	29.1927	(5/2 <sup>+</sup> )	[E1]	0.0859	$\alpha(K)=0.0680\ 10$ ; $\alpha(L)=0.01350\ 19$ ; $\alpha(M)=0.00325\ 5$ ; $\alpha(N+..)=0.001096\ 16$ $\alpha(N)=0.000858\ 12$ ; $\alpha(O)=0.000198\ 3$ ; $\alpha(P)=3.65\times10^{-5}\ 6$ ; $\alpha(Q)=2.58\times10^{-6}\ 4$
209.08 8	0.019 3	382.54?	(7/2 <sup>-</sup> ,9/2,11/2 <sup>+</sup> )	173.4837	(9/2 <sup>-</sup> )			
210.90 8	0.0137 24	428.04	(5/2 <sup>+</sup> )	217.1597	(5/2 <sup>-</sup> )	[E1]	0.0833	$\alpha(K)=0.0660\ 10$ ; $\alpha(L)=0.01307\ 19$ ; $\alpha(M)=0.00315\ 5$ ; $\alpha(N+..)=0.001061\ 15$ $\alpha(N)=0.000831\ 12$ ; $\alpha(O)=0.000192\ 3$ ; $\alpha(P)=3.53\times10^{-5}\ 5$ ; $\alpha(Q)=2.51\times10^{-6}\ 4$
212.36 3	0.130 7	212.382	(5/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]	2.20	$\alpha(K)=1.759\ 25$ ; $\alpha(L)=0.333\ 5$ ; $\alpha(M)=0.0801\ 12$ ; $\alpha(N+..)=0.0275\ 4$ $\alpha(N)=0.0214\ 3$ ; $\alpha(O)=0.00506\ 7$ ; $\alpha(P)=0.000981\ 14$ ; $\alpha(Q)=9.31\times10^{-5}\ 13$
<sup>x</sup> 214.98 11	0.0058 16							
216.07 1	0.62 3	287.895	(7/2 <sup>-</sup> )	71.8260	(7/2 <sup>+</sup> )	[E1]	0.0787	$\alpha(K)=0.0624\ 9$ ; $\alpha(L)=0.01231\ 18$ ; $\alpha(M)=0.00296\ 5$ ; $\alpha(N+..)=0.001000\ 14$ $\alpha(N)=0.000783\ 11$ ; $\alpha(O)=0.000181\ 3$ ; $\alpha(P)=3.33\times10^{-5}\ 5$ ; $\alpha(Q)=2.38\times10^{-6}\ 4$
217.151 <sup>#</sup> 4	3.28 16	217.1597	(5/2 <sup>-</sup> )	0.0076	(3/2 <sup>+</sup> )	[E1]	0.0778	$\alpha(K)=0.0617\ 9$ ; $\alpha(L)=0.01216\ 17$ ; $\alpha(M)=0.00293\ 4$ ; $\alpha(N+..)=0.000987\ 14$ $\alpha(N)=0.000773\ 11$ ; $\alpha(O)=0.000179\ 3$ ; $\alpha(P)=3.29\times10^{-5}\ 5$ ; $\alpha(Q)=2.36\times10^{-6}\ 4$

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{\text{eh}}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^{\ddagger}$	$\alpha^j$	Comments
217.8 <sup>m</sup> 2	<0.003	365.8136	(7/2 <sup>+</sup> )	148.1730	(7/2 <sup>-</sup> )	[E1]	0.0773		$\alpha(\text{K})=0.0617~9; \alpha(\text{L})=0.01216~17; \alpha(\text{M})=0.00293~4;$ $\alpha(\text{N+..})=0.000987~14$ $\alpha(\text{N})=0.000773~11; \alpha(\text{O})=0.000179~3;$ $\alpha(\text{P})=3.29\times 10^{-5}~5; \alpha(\text{Q})=2.36\times 10^{-6}~4$
219.43 2	0.118 6	365.8136	(7/2 <sup>+</sup> )	146.3569	(5/2 <sup>-</sup> )	[E1]	0.0759		$\alpha(\text{K})=0.0613~9; \alpha(\text{L})=0.01207~18; \alpha(\text{M})=0.00290~5;$ $\alpha(\text{N+..})=0.000980~14$ $\alpha(\text{N})=0.000768~11; \alpha(\text{O})=0.000177~3;$ $\alpha(\text{P})=3.27\times 10^{-5}~5; \alpha(\text{Q})=2.34\times 10^{-6}~4$
223.37 3	0.024 3	320.5483	(5/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	[E2]	0.443		$\alpha(\text{K})=0.0603~9; \alpha(\text{L})=0.01185~17; \alpha(\text{M})=0.00285~4;$ $\alpha(\text{N+..})=0.000962~14$ $\alpha(\text{N})=0.000754~11; \alpha(\text{O})=0.0001743~25;$ $\alpha(\text{P})=3.21\times 10^{-5}~5; \alpha(\text{Q})=2.30\times 10^{-6}~4$
224.33 19	0.0013 4	436.951	(7/2 <sup>-</sup> )	212.382	(5/2 <sup>+</sup> )	[E1]	0.0721		$\alpha(\text{K})=0.1295~19; \alpha(\text{L})=0.230~4; \alpha(\text{M})=0.0625~9;$ $\alpha(\text{N+..})=0.0212~3$ $\alpha(\text{N})=0.01676~24; \alpha(\text{O})=0.00376~6; \alpha(\text{P})=0.000639~9; \alpha(\text{Q})=9.24\times 10^{-6}~13$
226.2 2	0.070 23	255.957	(3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	[M1]	1.84		$\alpha(\text{K})=1.475~21; \alpha(\text{L})=0.279~4; \alpha(\text{M})=0.0670~10;$ $\alpha(\text{N+..})=0.0230~4$ $\alpha(\text{N})=0.0179~3; \alpha(\text{O})=0.00423~6; \alpha(\text{P})=0.000821~12; \alpha(\text{Q})=7.79\times 10^{-5}~11$
230.17 2	0.071 5	425.877	(9/2 <sup>+</sup> )	195.7194	(11/2 <sup>+</sup> )	[M1+E2]	1.1 7		$\alpha(\text{K})=0.8~7; \alpha(\text{L})=0.23~4; \alpha(\text{M})=0.059~5;$ $\alpha(\text{N+..})=0.0203~17$ $\alpha(\text{N})=0.0159~12; \alpha(\text{O})=0.0037~4; \alpha(\text{P})=0.00067~11; \alpha(\text{Q})=4.E-5~4$
<sup>x</sup> 230.97 9	0.0086 22								
<sup>x</sup> 237.49 10	0.0051 17								
240.373 <sup>#</sup> 3	0.413 22	365.8136	(7/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )	M1+E2	0.79 7	1.09 6	$\alpha(\text{K})=0.81~5; \alpha(\text{L})=0.210~4; \alpha(\text{M})=0.0525~9;$ $\alpha(\text{N+..})=0.0179~3$ $\alpha(\text{N})=0.01402~23; \alpha(\text{O})=0.00326~6; \alpha(\text{P})=0.000608~13; \alpha(\text{Q})=4.3\times 10^{-5}~3$
240.90 <sup>m</sup> 4		382.54?	(7/2 <sup>-</sup> ,9/2,11/2 <sup>+</sup> )	140.9?	(11/2 <sup>-</sup> )				
<sup>x</sup> 244.50 6	0.038 5								
245.350 <sup>#</sup> 1	3.57 18	317.1731	(5/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	M1+E2	0.76 5	1.05 4	$\alpha(\text{K})=0.79~4; \alpha(\text{L})=0.198~4; \alpha(\text{M})=0.0493~8;$ $\alpha(\text{N+..})=0.0169~3$ $\alpha(\text{N})=0.01318~21; \alpha(\text{O})=0.00307~5; \alpha(\text{P})=0.000574~11; \alpha(\text{Q})=4.20\times 10^{-5}~18$

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^{\ddagger}$	$\alpha^j$	Comments
248.724 <sup>k#</sup> 1	1.40 7	320.5483	(5/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	[M1]		1.415	$\alpha(K)=1.132\ 16; \alpha(L)=0.214\ 3; \alpha(M)=0.0514\ 8;$ $\alpha(N+..)=0.01763\ 25$ $\alpha(N)=0.01370\ 20; \alpha(O)=0.00324\ 5; \alpha(P)=0.000629\ 9; \alpha(Q)=5.97\times10^{-5}\ 9$
248.724 <sup>k#</sup> 1		569.2721	(3/2,5/2 <sup>+</sup> )	320.5483	(5/2 <sup>+</sup> )	M1+E2	0.87 7	0.94 5	$\alpha(K)=0.69\ 5; \alpha(L)=0.185\ 4; \alpha(M)=0.0465\ 8;$ $\alpha(N+..)=0.0159\ 3$ $\alpha(N)=0.01242\ 22; \alpha(O)=0.00289\ 6; \alpha(P)=0.000536\ 12; \alpha(Q)=3.70\times10^{-5}\ 22$
x252.05 <sup>@</sup> 8 255.91 2	0.009 0.0393 25	255.957	(3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]		1.307	$\alpha(K)=1.046\ 15; \alpha(L)=0.197\ 3; \alpha(M)=0.0474\ 7;$ $\alpha(N+..)=0.01628\ 23$ $\alpha(N)=0.01265\ 18; \alpha(O)=0.00300\ 5; \alpha(P)=0.000581\ 9; \alpha(Q)=5.51\times10^{-5}\ 8$
259.31 2	0.155 8	288.491	(3/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	[M1]		1.260	$\alpha(K)=1.009\ 15; \alpha(L)=0.190\ 3; \alpha(M)=0.0457\ 7;$ $\alpha(N+..)=0.01569\ 22$ $\alpha(N)=0.01219\ 17; \alpha(O)=0.00289\ 4; \alpha(P)=0.000560\ 8; \alpha(Q)=5.31\times10^{-5}\ 8$
260.53 2	0.102 6	302.989	(7/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	[M1]		1.244	$\alpha(K)=0.996\ 14; \alpha(L)=0.188\ 3; \alpha(M)=0.0451\ 7;$ $\alpha(N+..)=0.01549\ 22$ $\alpha(N)=0.01203\ 17; \alpha(O)=0.00285\ 4; \alpha(P)=0.000553\ 8; \alpha(Q)=5.25\times10^{-5}\ 8$
261.957 <sup>#</sup> 4	0.278 14	261.964	(1/2 <sup>+</sup> )	0.0076	(3/2 <sup>+</sup> )	M1+E2	0.93 7	0.78 4	$\alpha(K)=0.57\ 4; \alpha(L)=0.155\ 4; \alpha(M)=0.0389\ 8;$ $\alpha(N+..)=0.01327\ 25$ $\alpha(N)=0.01038\ 19; \alpha(O)=0.00241\ 5; \alpha(P)=0.000447\ 11; \alpha(Q)=3.06\times10^{-5}\ 18$
268.675 <sup>#</sup> 2	0.246 12	365.8136	(7/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	M1+E2	0.75 7	0.82 5	$\alpha(K)=0.62\ 4; \alpha(L)=0.149\ 4; \alpha(M)=0.0370\ 8;$ $\alpha(N+..)=0.0127\ 3$ $\alpha(N)=0.00989\ 20; \alpha(O)=0.00231\ 5; \alpha(P)=0.000434\ 11; \alpha(Q)=3.29\times10^{-5}\ 19$
272.39 2	0.071 4	436.951	(7/2 <sup>-</sup> )	164.5317	(3/2 <sup>-</sup> )	[E2]		0.228	$\alpha(K)=0.0882\ 13; \alpha(L)=0.1027\ 15; \alpha(M)=0.0277\ 4;$ $\alpha(N+..)=0.00938\ 14$ $\alpha(N)=0.00742\ 11; \alpha(O)=0.001672\ 24; \alpha(P)=0.000287\ 4; \alpha(Q)=5.70\times10^{-6}\ 8$
273.74 5	0.0155 17	302.989	(7/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	[M1]		1.085	$\alpha(K)=0.868\ 13; \alpha(L)=0.1636\ 23; \alpha(M)=0.0393\ 6;$ $\alpha(N+..)=0.01349\ 19$ $\alpha(N)=0.01048\ 15; \alpha(O)=0.00248\ 4; \alpha(P)=0.000482\ 7; \alpha(Q)=4.57\times10^{-5}\ 7$
274.735 <sup>#</sup> 1	0.420 22	317.1731	(5/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	M1+E2	1.07 10	0.62 5	$\alpha(K)=0.45\ 4; \alpha(L)=0.129\ 4; \alpha(M)=0.0324\ 8;$ $\alpha(N+..)=0.0111\ 3$

**$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)**

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^\dagger$	$I_\gamma^{\textcolor{blue}{eh}}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. $^\ddagger$	$\delta^\ddagger$	$\alpha^{\textcolor{blue}{j}}$	Comments
278.108 <sup>#</sup> 2	1.13 6	320.5483	(5/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	M1+E2	1.14 10	0.57 4	$\alpha(N)=0.00866$ 20; $\alpha(O)=0.00201$ 5; $\alpha(P)=0.000370$ 11; $\alpha(Q)=2.41\times 10^{-5}$ 20
284.29 <sup>m</sup> 11	0.0089 16	359.6044	(7/2 <sup>+</sup> )	75.1?	(9/2 <sup>-</sup> )	[E1]		0.0419	$\alpha(K)=0.41$ 4; $\alpha(L)=0.122$ 4; $\alpha(M)=0.0308$ 7; $\alpha(N+..)=0.01050$ 25 $\alpha(N)=0.00822$ 19; $\alpha(O)=0.00190$ 5; $\alpha(P)=0.000350$ 11; $\alpha(Q)=2.21\times 10^{-5}$ 18
<sup>x</sup> 287.32 14	0.015 7								
288.0290 <sup>k#m</sup> 9	0.91 5	317.1731	(5/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	[M1+E2]	0.6 4		$\alpha(K)=0.4$ 4; $\alpha(L)=0.11$ 3; $\alpha(M)=0.028$ 6; $\alpha(N+..)=0.0096$ 21
288.0290 <sup>k#m</sup> 9	0.015 7								$\alpha(N)=0.0075$ 16; $\alpha(O)=0.0017$ 4; $\alpha(P)=0.00032$ 10; $\alpha(Q)=2.2\times 10^{-5}$ 18
288.50 3	0.117 14	605.165	(5/2,7/2) <sup>+</sup>	317.1731	(5/2 <sup>+</sup> )				
		288.491	(3/2 <sup>+</sup> )	0.0076	(3/2 <sup>+</sup> )	[M1]	0.938		$\alpha(K)=0.751$ 11; $\alpha(L)=0.1414$ 20; $\alpha(M)=0.0340$ 5; $\alpha(N+..)=0.01166$ 17
									$\alpha(N)=0.00906$ 13; $\alpha(O)=0.00215$ 3; $\alpha(P)=0.000416$ 6; $\alpha(Q)=3.95\times 10^{-5}$ 6
<sup>x</sup> 290.62 3	0.109 7								
291.355 <sup>l#</sup> 9	4.63 <sup>l</sup> 25	320.5483	(5/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	M1+E2	0.80 6	0.63 3	$\alpha(K)=0.476$ 25; $\alpha(L)=0.115$ 3; $\alpha(M)=0.0284$ 6; $\alpha(N+..)=0.00972$ 21
									$\alpha(N)=0.00759$ 16; $\alpha(O)=0.00177$ 4; $\alpha(P)=0.000333$ 9; $\alpha(Q)=2.53\times 10^{-5}$ 13
291.355 <sup>l#</sup> 9	0.62 <sup>lg</sup> 25	526.516	(5/2,7/2)	235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )				
291.93 4	0.102 15	465.426	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	173.4837	(9/2 <sup>-</sup> )				
293.996 <sup>#</sup> 9	0.122 7	365.8136	(7/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	M1	0.890		$\alpha(K)=0.713$ 10; $\alpha(L)=0.1342$ 19; $\alpha(M)=0.0322$ 5; $\alpha(N+..)=0.01106$ 16
									$\alpha(N)=0.00860$ 12; $\alpha(O)=0.00204$ 3; $\alpha(P)=0.000395$ 6; $\alpha(Q)=3.75\times 10^{-5}$ 6
302.989 <sup>k#d</sup> 4	0.078 4	302.989	(7/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]	0.820		$\alpha(K)=0.656$ 10; $\alpha(L)=0.1235$ 18; $\alpha(M)=0.0296$ 5; $\alpha(N+..)=0.01018$ 15
									$\alpha(N)=0.00791$ 11; $\alpha(O)=0.00187$ 3; $\alpha(P)=0.000363$ 5; $\alpha(Q)=3.45\times 10^{-5}$ 5
302.989 <sup>k#</sup> 4		374.815	(7/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	[M1]	0.820		$\alpha(K)=0.656$ 10; $\alpha(L)=0.1235$ 18; $\alpha(M)=0.0296$ 5; $\alpha(N+..)=0.01018$ 15
									$\alpha(N)=0.00791$ 11; $\alpha(O)=0.00187$ 3; $\alpha(P)=0.000363$ 5; $\alpha(Q)=3.45\times 10^{-5}$ 5

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

 $\gamma(^{229}\text{Th})$  (continued)

$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. $^{\ddagger}$	$\delta^{\ddagger}$	$\alpha^j$	$I_{(\gamma+ce)}^i$	Comments
307.45 19	0.0050 14	569.2721	(3/2,5/2 <sup>+</sup> )	261.964	(1/2 <sup>+</sup> )	[M1,E2]		0.5 4		$\alpha(K)=0.3 3; \alpha(L)=0.09 3;$ $\alpha(M)=0.023 6;$ $\alpha(N+..)=0.0078 20$ $\alpha(N)=0.0061 15;$ $\alpha(O)=0.0014 4;$ $\alpha(P)=0.00026 9;$ $\alpha(Q)=1.9\times10^{-5} 15$
309.49 3	0.083 5	526.516	(5/2,7/2)	217.1597	(5/2 <sup>-</sup> )					
310.71 5	0.038 3	382.54?	(7/2 <sup>-</sup> ,9/2,11/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )					
311.76 3	0.063 4	436.951	(7/2 <sup>-</sup> )	125.4385	(9/2 <sup>+</sup> )	[E1]		0.0341		$\alpha(K)=0.0274 4;$ $\alpha(L)=0.00512 8;$ $\alpha(M)=0.001225 18;$ $\alpha(N+..)=0.000415 6$ $\alpha(N)=0.000324 5;$ $\alpha(O)=7.54\times10^{-5} 11;$ $\alpha(P)=1.409\times10^{-5} 20;$ $\alpha(Q)=1.091\times10^{-6} 16$
313.45 18	0.0056 11	569.2721	(3/2,5/2 <sup>+</sup> )	255.957	(3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> )					
315.39 13	0.0100 15	478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )	163.2542	11/2 <sup>+</sup>	[M1]		0.734		$\alpha(K)=0.588 9; \alpha(L)=0.1105$ $16; \alpha(M)=0.0265 4;$ $\alpha(N+..)=0.00911 13$ $\alpha(N)=0.00707 10;$ $\alpha(O)=0.001675 24;$ $\alpha(P)=0.000325 5;$ $\alpha(Q)=3.08\times10^{-5} 5$
<sup>x</sup> 316.30 4	0.094 7									
317.169 <sup>#cd</sup> 2	7.1 <sup>l</sup> 4	317.1731	(5/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	M1+E2	1.24 9	0.371 22		$\alpha(K)=0.268 20;$ $\alpha(L)=0.0774 22;$ $\alpha(M)=0.0195 5;$ $\alpha(N+..)=0.00666 17$ $\alpha(N)=0.00522 13;$ $\alpha(O)=0.00121 4;$ $\alpha(P)=0.000223 7;$ $\alpha(Q)=1.44\times10^{-5} 10$
317.169 <sup>l#</sup> 2	0.27 <sup>l</sup> 11	359.6044	(7/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	[M1]		0.723		$\alpha(K)=0.579 9; \alpha(L)=0.1088$ $16; \alpha(M)=0.0261 4;$ $\alpha(N+..)=0.00897 13$ $\alpha(N)=0.00697 10;$ $\alpha(O)=0.001649 23;$ $\alpha(P)=0.000320 5;$ $\alpha(Q)=3.04\times10^{-5} 5$
320.547 <sup>#d</sup> 1	2.78 14	320.5483	(5/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	M1+E2	1.37 12	0.334 25		$\alpha(K)=0.237 22;$

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^\dagger$	$I_\gamma^{\textcolor{blue}{eh}}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. $^\ddagger$	$\delta^\ddagger$	$\alpha^{\textcolor{blue}{j}}$	Comments
323.381 <sup>#</sup> 14	0.77 4	365.8136	(7/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	M1+E2	1.67 12	0.280 17	$\alpha(L)=0.0724$ 24; $\alpha(M)=0.0184$ 6; $\alpha(N+..)=0.00626$ 19 $\alpha(N)=0.00491$ 14; $\alpha(O)=0.00114$ 4; $\alpha(P)=0.000208$ 8; $\alpha(Q)=1.28\times 10^{-5}$ 11
328.758 19	0.080 4	425.877	(9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	[M1+E2]		0.4 3	$\alpha(K)=0.191$ 15; $\alpha(L)=0.0662$ 18; $\alpha(M)=0.0169$ 4; $\alpha(N+..)=0.00577$ 14 $\alpha(N)=0.00453$ 11; $\alpha(O)=0.00104$ 3; $\alpha(P)=0.000189$ 6; $\alpha(Q)=1.04\times 10^{-5}$ 8
<sup>x</sup> 335.68 8	0.0081 19								
336.63 1	0.58 3	365.8136	(7/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	M1+E2	1.59 24	0.26 4	$\alpha(K)=0.18$ 3; $\alpha(L)=0.059$ 4; $\alpha(M)=0.0150$ 8; $\alpha(N+..)=0.0051$ 3 $\alpha(N)=0.00401$ 20; $\alpha(O)=0.00092$ 5; $\alpha(P)=0.000169$ 11; $\alpha(Q)=9.8\times 10^{-6}$ 16
340.19 8	0.0025 16	436.951	(7/2 <sup>-</sup> )	97.13595	9/2 <sup>+</sup>	[E1]		0.0282	$\alpha(K)=0.0227$ 4; $\alpha(L)=0.00419$ 6; $\alpha(M)=0.001001$ 14; $\alpha(N+..)=0.000339$ 5 $\alpha(N)=0.000265$ 4; $\alpha(O)=6.18\times 10^{-5}$ 9; $\alpha(P)=1.157\times 10^{-5}$ 17; $\alpha(Q)=9.11\times 10^{-7}$ 13
<sup>x</sup> 340.20 <sup>@</sup> 5	0.09 2								
<sup>x</sup> 352.06 <sup>@</sup> 5	0.007								
354.04 2	0.060 4	425.877	(9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	[M1+E2]		0.32 22	$\alpha(K)=0.24$ 19; $\alpha(L)=0.059$ 22; $\alpha(M)=0.015$ 5; $\alpha(N+..)=0.0050$ 16 $\alpha(N)=0.0039$ 13; $\alpha(O)=0.0009$ 3; $\alpha(P)=0.00017$ 7; $\alpha(Q)=1.3\times 10^{-5}$ 10
359.38 <sup>d</sup> 4	0.0049 15	359.6044	(7/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]		0.513	$\alpha(K)=0.411$ 6; $\alpha(L)=0.0771$ 11; $\alpha(M)=0.0185$ 3; $\alpha(N+..)=0.00635$ 9 $\alpha(N)=0.00494$ 7; $\alpha(O)=0.001169$ 17; $\alpha(P)=0.000227$ 4; $\alpha(Q)=2.15\times 10^{-5}$ 3
364.01 <sup>m</sup> 12	0.0064 16	605.165	(5/2,7/2) <sup>+</sup>	241.546	13/2 <sup>+</sup>				
365.820 <sup>#d</sup> 3	0.77 4	365.8136	(7/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]		0.489	$\alpha(K)=0.392$ 6; $\alpha(L)=0.0734$ 11; $\alpha(M)=0.01763$ 25; $\alpha(N+..)=0.00605$ 9 $\alpha(N)=0.00470$ 7; $\alpha(O)=0.001113$ 16; $\alpha(P)=0.000216$ 3; $\alpha(Q)=2.05\times 10^{-5}$ 3
<sup>x</sup> 367.795 8									From 1994He08.
371.34 9	0.0014 7	536.08	(1/2 <sup>-</sup> )	164.5317	(3/2 <sup>-</sup> )	[M1]		0.469	$\alpha(K)=0.376$ 6; $\alpha(L)=0.0705$ 10; $\alpha(M)=0.01692$ 24; $\alpha(N+..)=0.00581$ 9 $\alpha(N)=0.00451$ 7; $\alpha(O)=0.001068$ 15; $\alpha(P)=0.000207$ 3; $\alpha(Q)=1.97\times 10^{-5}$ 3

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

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$\gamma(^{229}\text{Th})$ (continued)								Comments
$E_\gamma^\dagger$	$I_\gamma^{\text{eh}}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\alpha^j$	
374.71 <sup>d</sup> 20	0.0038 20	374.815	(7/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]	0.458	$\alpha(\text{K})=0.367$ 6; $\alpha(\text{L})=0.0688$ 10; $\alpha(\text{M})=0.01650$ 24; $\alpha(\text{N}..)=0.00566$ 8 $\alpha(\text{N})=0.00440$ 7; $\alpha(\text{O})=0.001042$ 15; $\alpha(\text{P})=0.000202$ 3; $\alpha(\text{Q})=1.92\times 10^{-5}$ 3
381.35 8	0.0039 13	478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>	[M1]	0.437	$\alpha(\text{K})=0.350$ 5; $\alpha(\text{L})=0.0655$ 10; $\alpha(\text{M})=0.01573$ 22; $\alpha(\text{N}..)=0.00540$ 8 $\alpha(\text{N})=0.00419$ 6; $\alpha(\text{O})=0.000993$ 14; $\alpha(\text{P})=0.000193$ 3; $\alpha(\text{Q})=1.83\times 10^{-5}$ 3
383.43 3	0.096 5	425.877	(9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	[M1+E2]	0.26 18	$\alpha(\text{K})=0.19$ 15; $\alpha(\text{L})=0.046$ 18; $\alpha(\text{M})=0.012$ 4; $\alpha(\text{N}..)=0.0039$ 14 $\alpha(\text{N})=0.0031$ 11; $\alpha(\text{O})=0.0007$ 3; $\alpha(\text{P})=0.00013$ 6; $\alpha(\text{Q})=1.0\times 10^{-5}$ 8
387.86 12	0.0012 3	513.479	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )			
393.60 1	0.0130 12	465.426	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )			
396.62 3	0.0044 10	425.877	(9/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	[E2]	0.0762	$\alpha(\text{K})=0.0421$ 6; $\alpha(\text{L})=0.0252$ 4; $\alpha(\text{M})=0.00666$ 10; $\alpha(\text{N}..)=0.00226$ 4 $\alpha(\text{N})=0.001783$ 25; $\alpha(\text{O})=0.000406$ 6; $\alpha(\text{P})=7.12\times 10^{-5}$ 10; $\alpha(\text{Q})=2.43\times 10^{-6}$ 4
<sup>x</sup> 398.26@ 11	0.004							
402.22 2	0.0072 14	637.384	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )			
404.39 5	0.0013 4	569.2721	(3/2,5/2 <sup>+</sup> )	164.5317	(3/2 <sup>-</sup> )	[E1]	0.0195	$\alpha(\text{K})=0.01574$ 22; $\alpha(\text{L})=0.00284$ 4; $\alpha(\text{M})=0.000679$ 10; $\alpha(\text{N}..)=0.000230$ 4 $\alpha(\text{N})=0.000180$ 3; $\alpha(\text{O})=4.20\times 10^{-5}$ 6; $\alpha(\text{P})=7.91\times 10^{-6}$ 11; $\alpha(\text{Q})=6.43\times 10^{-7}$ 9
406.58 5	0.0015 4	478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )	[M1]	0.367	$\alpha(\text{K})=0.294$ 5; $\alpha(\text{L})=0.0550$ 8; $\alpha(\text{M})=0.01320$ 19; $\alpha(\text{N}..)=0.00453$ 7 $\alpha(\text{N})=0.00352$ 5; $\alpha(\text{O})=0.000833$ 12; $\alpha(\text{P})=0.0001617$ 23; $\alpha(\text{Q})=1.534\times 10^{-5}$ 22
416.31 3	0.0120 10	513.479	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>			
423.09 <sup>k</sup> 14	0.00052 14	465.426	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>			
423.09 <sup>k</sup> 14		569.2721	(3/2,5/2 <sup>+</sup> )	146.3569	(5/2 <sup>-</sup> )	[E1]	0.01774	$\alpha(\text{K})=0.01434$ 20; $\alpha(\text{L})=0.00258$ 4; $\alpha(\text{M})=0.000614$ 9; $\alpha(\text{N}..)=0.000209$ 3 $\alpha(\text{N})=0.0001628$ 23; $\alpha(\text{O})=3.80\times 10^{-5}$ 6; $\alpha(\text{P})=7.18\times 10^{-6}$ 10; $\alpha(\text{Q})=5.88\times 10^{-7}$ 9
425.46 10	0.00080 14	637.384	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	212.382	(5/2 <sup>+</sup> )			
436.23 <sup>k</sup> 2	0.00351 9	465.426	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )			
436.23 <sup>k</sup> 2		478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>	[M1]	0.303	$\alpha(\text{K})=0.243$ 4; $\alpha(\text{L})=0.0454$ 7; $\alpha(\text{M})=0.01089$ 16; $\alpha(\text{N}..)=0.00374$ 6 $\alpha(\text{N})=0.00290$ 4; $\alpha(\text{O})=0.000687$ 10; $\alpha(\text{P})=0.0001334$ 19; $\alpha(\text{Q})=1.266\times 10^{-5}$ 18

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. $^{\ddagger}$	$\delta^{\ddagger}$	$\alpha^j$	Comments
<sup>x</sup> 440.42 @ 3	0.006								
441.53 17	0.00073 22	513.479	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )				
449.52 2	0.0064 8	478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )	[M1]		0.280	$\alpha(K)=0.224$ 4; $\alpha(L)=0.0418$ 6; $\alpha(M)=0.01004$ 14; $\alpha(N+..)=0.00344$ 5 $\alpha(N)=0.00268$ 4; $\alpha(O)=0.000634$ 9; $\alpha(P)=0.0001229$ 18; $\alpha(Q)=1.167\times10^{-5}$ 17
455.48 25	0.00117 21	526.516	(5/2,7/2)	71.8260	(7/2 <sup>+</sup> )				
456.87 16	0.00044 21	605.165	(5/2,7/2) <sup>+</sup>	148.1730	(7/2 <sup>-</sup> )				
459.81 1	0.0076 11	585.237?	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )				
465.37 <sup>d</sup> 12	0.00047 23	465.426	(5/2 <sup>-</sup> ,7/2,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>				
471.06 1	0.0185 18	513.479	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>				
<sup>x</sup> 473.51 18	0.0030 15								
474.41 8	0.00077 11	620.837	(5/2 <sup>+</sup> ,7/2)	146.3569	(5/2 <sup>-</sup> )				
478.64 1	0.0148 12	478.649	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	[M1]		0.236	$\alpha(K)=0.189$ 3; $\alpha(L)=0.0353$ 5; $\alpha(M)=0.00846$ 12; $\alpha(N+..)=0.00290$ 4 $\alpha(N)=0.00226$ 4; $\alpha(O)=0.000534$ 8; $\alpha(P)=0.0001037$ 15; $\alpha(Q)=9.84\times10^{-6}$ 14
484.34 3	0.0023 10	526.516	(5/2,7/2)	42.4349	7/2 <sup>+</sup>				
500.40 9	0.00070 23	664.98?	(1/2,3/2,5/2)	164.5317	(3/2 <sup>-</sup> )				
513.20 <sup>kd</sup> 5	0.0165 21	513.479	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>				
513.20 <sup>k</sup> 5		585.237?	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )				
514.81 11	0.0112 18	749.849	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	235.1266	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )				
523.68 6	0.00094 24	620.837	(5/2 <sup>+</sup> ,7/2)	97.13595	9/2 <sup>+</sup>				
531.54 8	0.00070 23	656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	125.4385	(9/2 <sup>+</sup> )				
533.53 5	0.00117 23	605.165	(5/2,7/2) <sup>+</sup>	71.8260	(7/2 <sup>+</sup> )	M1+E2	1.13 20	0.098 14	$\alpha(K)=0.076$ 12; $\alpha(L)=0.0169$ 17; $\alpha(M)=0.0042$ 4; $\alpha(N+..)=0.00142$ 13 $\alpha(N)=0.00111$ 10; $\alpha(O)=0.000259$ 25; $\alpha(P)=4.9\times10^{-5}$ 5; $\alpha(Q)=4.0\times10^{-6}$ 6
536.44 12	0.00047 23	536.08	(1/2 <sup>-</sup> )	0.0076	(3/2 <sup>+</sup> )	[E1]		0.01098	$\alpha(K)=0.00892$ 13; $\alpha(L)=0.001558$ 22; $\alpha(M)=0.000370$ 6; $\alpha(N+..)=0.0001260$ 18 $\alpha(N)=9.82\times10^{-5}$ 14; $\alpha(O)=2.30\times10^{-5}$ 4; $\alpha(P)=4.37\times10^{-6}$ 7; $\alpha(Q)=3.72\times10^{-7}$ 6
540.52 6	0.00164 23	637.384	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>				
542.41 13	0.00047 23	585.237?	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>				
<sup>x</sup> 549.79 @ 8	0.0007								
559.87 18	$\approx$ 0.00023	656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>				
562.61 6	0.0014 7	605.165	(5/2,7/2) <sup>+</sup>	42.4349	7/2 <sup>+</sup>	M1+E2	1.36 16	0.075 8	$\alpha(K)=0.057$ 6; $\alpha(L)=0.0133$ 9; $\alpha(M)=0.00327$ 21; $\alpha(N+..)=0.00112$ 7 $\alpha(N)=0.00087$ 6; $\alpha(O)=0.000204$ 13; $\alpha(P)=3.8\times10^{-5}$ 3; $\alpha(Q)=3.0\times10^{-6}$ 3

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

$\gamma(^{229}\text{Th})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{eh}$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. $^{\ddagger}$	$\delta^{\ddagger}$	$\alpha^j$	Comments
569.19 <sup>d</sup> 2	0.0039 15	569.2721	(3/2,5/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>	M1+E2	1.66 12	0.063 4	$\alpha(K)=0.047$ 3; $\alpha(L)=0.0116$ 5; $\alpha(M)=0.00289$ 11; $\alpha(N+..)=0.00099$ 4 $\alpha(N)=0.00077$ 3; $\alpha(O)=0.000180$ 7; $\alpha(P)=3.37 \times 10^{-5}$ 14; $\alpha(Q)=2.48 \times 10^{-6}$ 16
576.00 7	0.0009 4	605.165	(5/2,7/2) <sup>+</sup>	29.1927	(5/2 <sup>+</sup> )	M1+E2	1.55 22	0.064 8	$\alpha(K)=0.049$ 7; $\alpha(L)=0.0116$ 10; $\alpha(M)=0.00288$ 22; $\alpha(N+..)=0.00098$ 8 $\alpha(N)=0.00077$ 6; $\alpha(O)=0.000179$ 14; $\alpha(P)=3.4 \times 10^{-5}$ 3; $\alpha(Q)=2.5 \times 10^{-6}$ 4
578.42 2	0.0034 11	620.837	(5/2 <sup>+</sup> ,7/2)	42.4349	7/2 <sup>+</sup>				
584.94 <sup>kd</sup> 16	$\approx 0.00023$	585.237?	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>				
584.94 <sup>k</sup> 16		656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	71.8260	(7/2 <sup>+</sup> )				
591.64 7	0.00070 23	620.837	(5/2 <sup>+</sup> ,7/2)	29.1927	(5/2 <sup>+</sup> )				
605.16 <sup>d</sup> 1	0.0048 9	605.165	(5/2,7/2) <sup>+</sup>	0.0	5/2 <sup>+</sup>	M1+E2	1.10 13	0.072 7	$\alpha(K)=0.056$ 6; $\alpha(L)=0.0121$ 8; $\alpha(M)=0.00295$ 19; $\alpha(N+..)=0.00101$ 7 $\alpha(N)=0.00079$ 5; $\alpha(O)=0.000185$ 12; $\alpha(P)=3.51 \times 10^{-5}$ 24; $\alpha(Q)=2.9 \times 10^{-6}$ 3
608.15 5	0.00047 23	637.384	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )				
614.45 7	0.00070 23	656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>				
620.81 <sup>d</sup> 3	0.0015 6	620.837	(5/2 <sup>+</sup> ,7/2)	0.0	5/2 <sup>+</sup>				
627.70 8	0.00047 23	656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )				
x633.51 12	0.00069 23								
637.25 <sup>d</sup> 10	$\approx 0.00023$	637.384	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>				
652.79 19	$\approx 0.00023$	749.849	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	97.13595	9/2 <sup>+</sup>				
656.89 <sup>d</sup> 5	0.0040 10	656.89	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>				
665.03 <sup>d</sup> 10	$\approx 0.00023$	664.98?	(1/2,3/2,5/2)	0.0	5/2 <sup>+</sup>				
x703.3 3	0.0011 5								
707.41 2	0.0020 9	749.849	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	42.4349	7/2 <sup>+</sup>				
x714.28 6	0.00047 23								
x720.62 11	0.0040 11								
720.62 11	0.00047 23	749.849	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	29.1927	(5/2 <sup>+</sup> )				
749.8 <sup>d</sup> 9	0.00047 23	749.849	(5/2 <sup>+</sup> ,7/2,9/2 <sup>+</sup> )	0.0	5/2 <sup>+</sup>				
x765.82 20	0.00014 7								
x843.35 10	0.00016 5								
x927.1 3	0.0014 7								
x932.6 3	0.0014 7								
x1109.8 5	0.0008 3								

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued) $\gamma(^{229}\text{Th})$  (continued)

<sup>†</sup> Weighted average of values given in 2003Ba78 and 1992El01, unless otherwise specified.

<sup>‡</sup> From  $^{229}\text{Ac}$   $\beta^-$  decay, unless otherwise specified.

<sup>#</sup> Weighted average of values given in 2003Ba78 and 1994He08.

<sup>@</sup> Reported only in 1992El01 and 1996Ko29.

<sup>&</sup> From 2007Be16. Very precise measurement. Energy resolution FWHM=25 eV. Detector: micro calorimeter.

<sup>a</sup> From conversion electron data in 1959Tr31.

<sup>b</sup> From rotational model (2003Ba78).

<sup>c</sup>  $\gamma$  ray energy does not fit well the decay scheme suggesting a possible systematic error. The evaluators did not used this transition for the levels least-squares fit.

<sup>d</sup> The final level of the transition was assumed to be the ground state.

<sup>e</sup> From 2003Ba78 normalized to 2.29 3 per 100000  $\alpha$ -particles, as measured for the 208-keV  $\gamma$  ray in 1984Re05, unless otherwise specified.

<sup>f</sup> Calculated by 2003Ba78 from strong coupling rotational model.

<sup>g</sup> Deduced by 2003Ba78 from intensity balance.

<sup>h</sup> For absolute intensity per 100 decays, multiply by 0.001.

<sup>i</sup> Absolute intensity per 100 decays.

<sup>j</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

<sup>k</sup> Multiply placed.

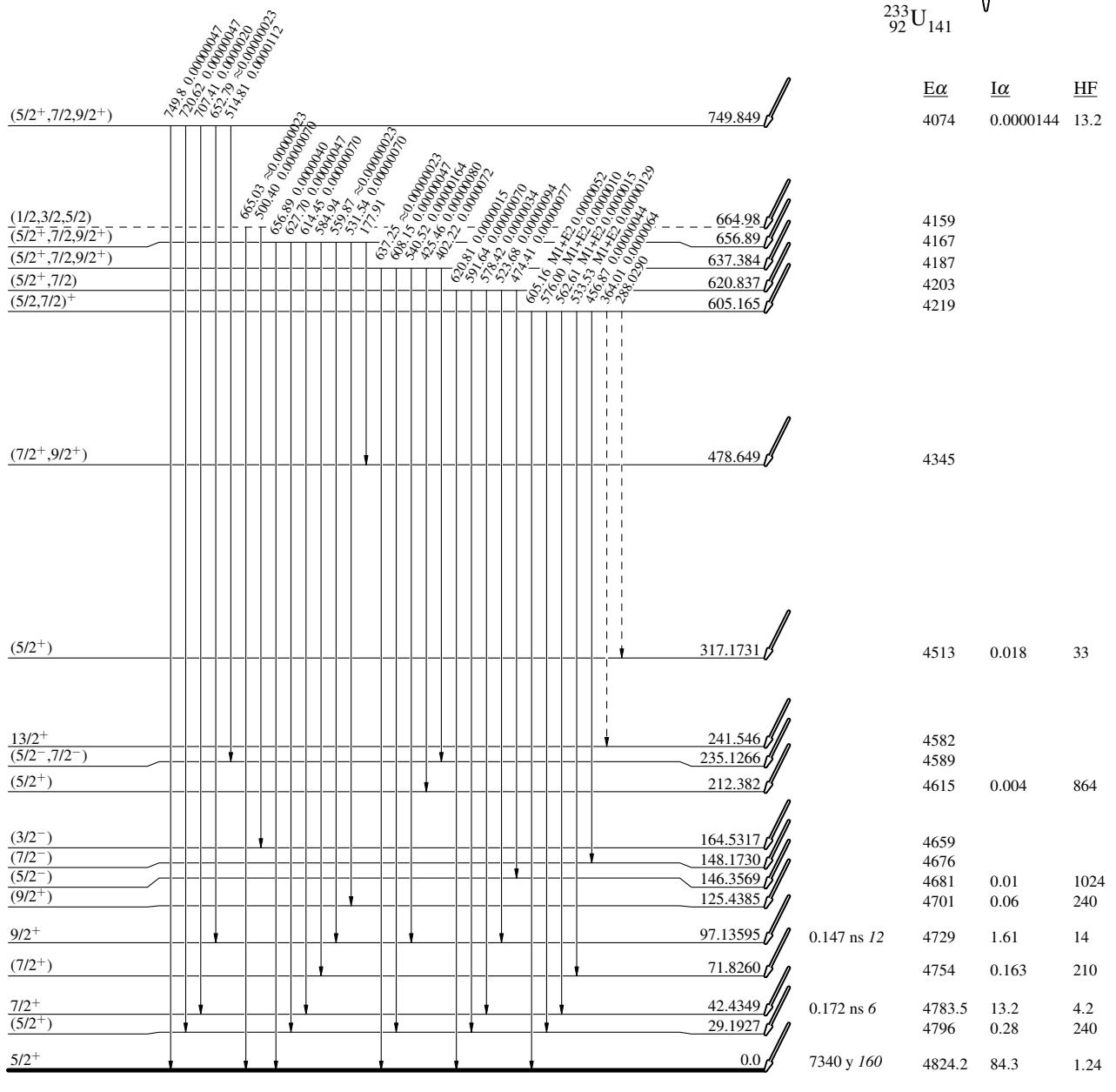
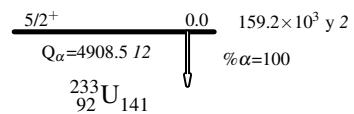
<sup>l</sup> Multiply placed with intensity suitably divided.

<sup>m</sup> Placement of transition in the level scheme is uncertain.

<sup>x</sup>  $\gamma$  ray not placed in level scheme.

**$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16****Legend**

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

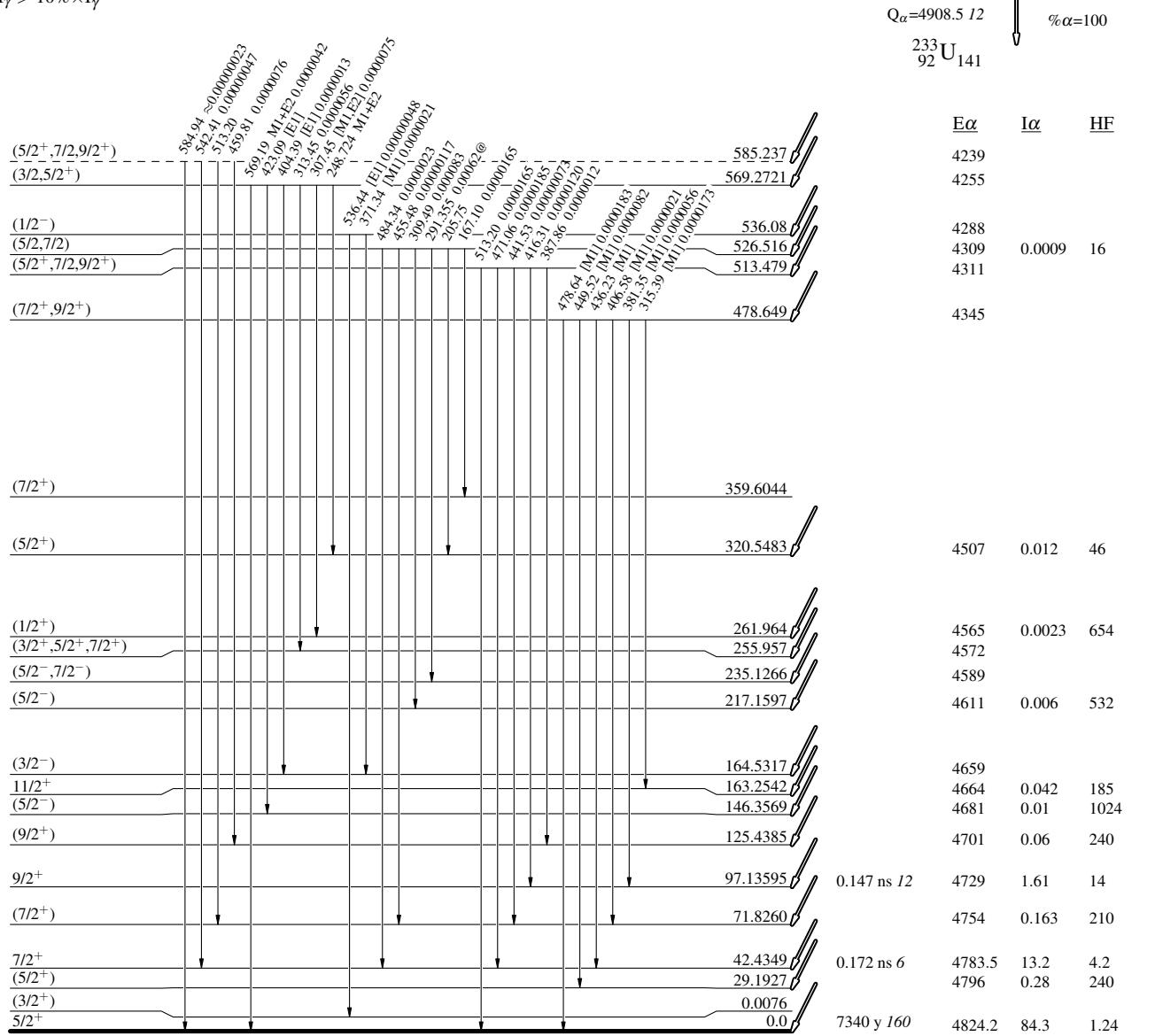
**Decay Scheme**Intensities:  $I_{(\gamma+ce)}$  per 100 parent decays

$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16Decay Scheme (continued)Intensities:  $I_{(\gamma+ce)}$  per 100 parent decays

@ Multiply placed: intensity suitably divided

## Legend

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



$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16

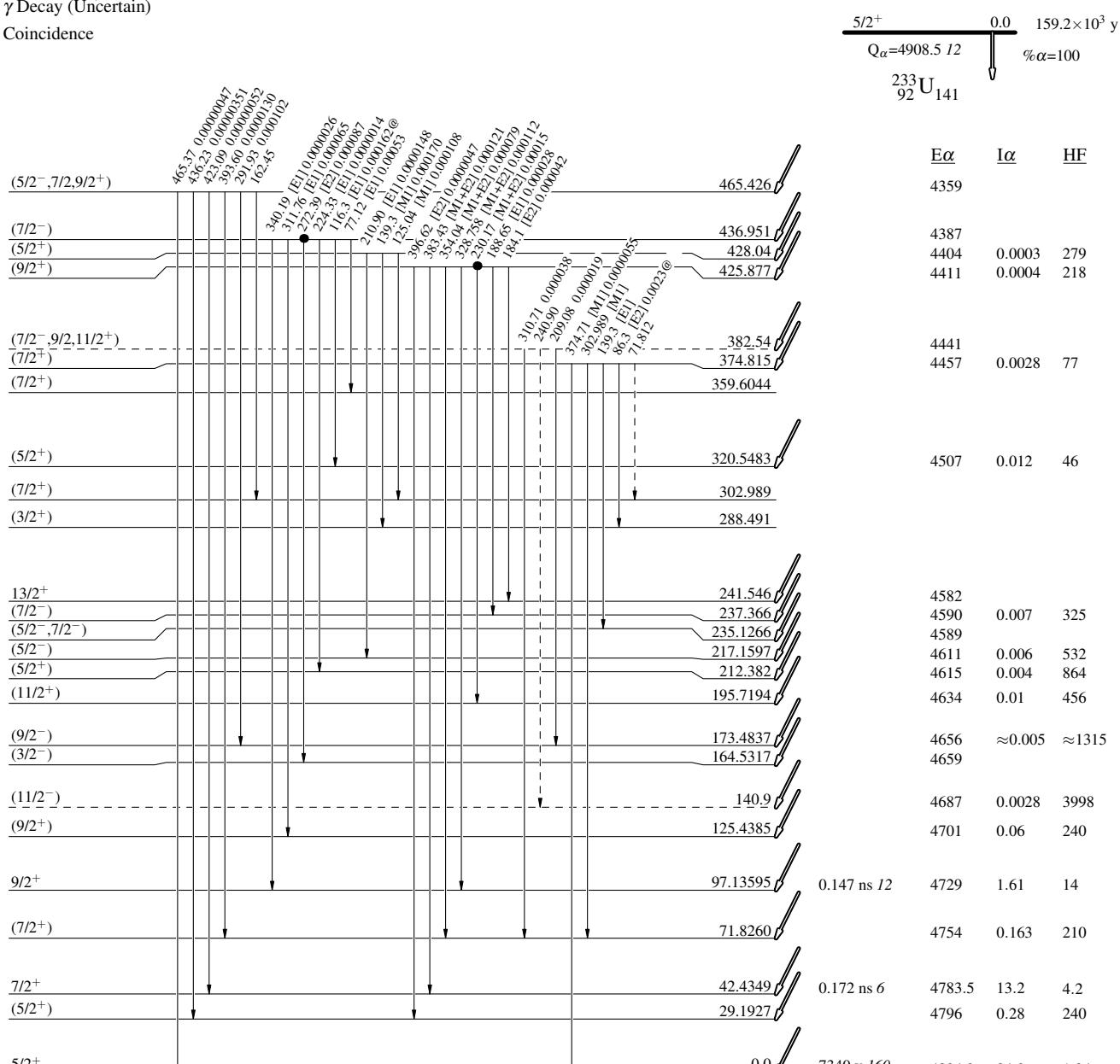
## Legend

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

## Decay Scheme (continued)

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

@ Multiply placed: intensity suitably divided



$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16

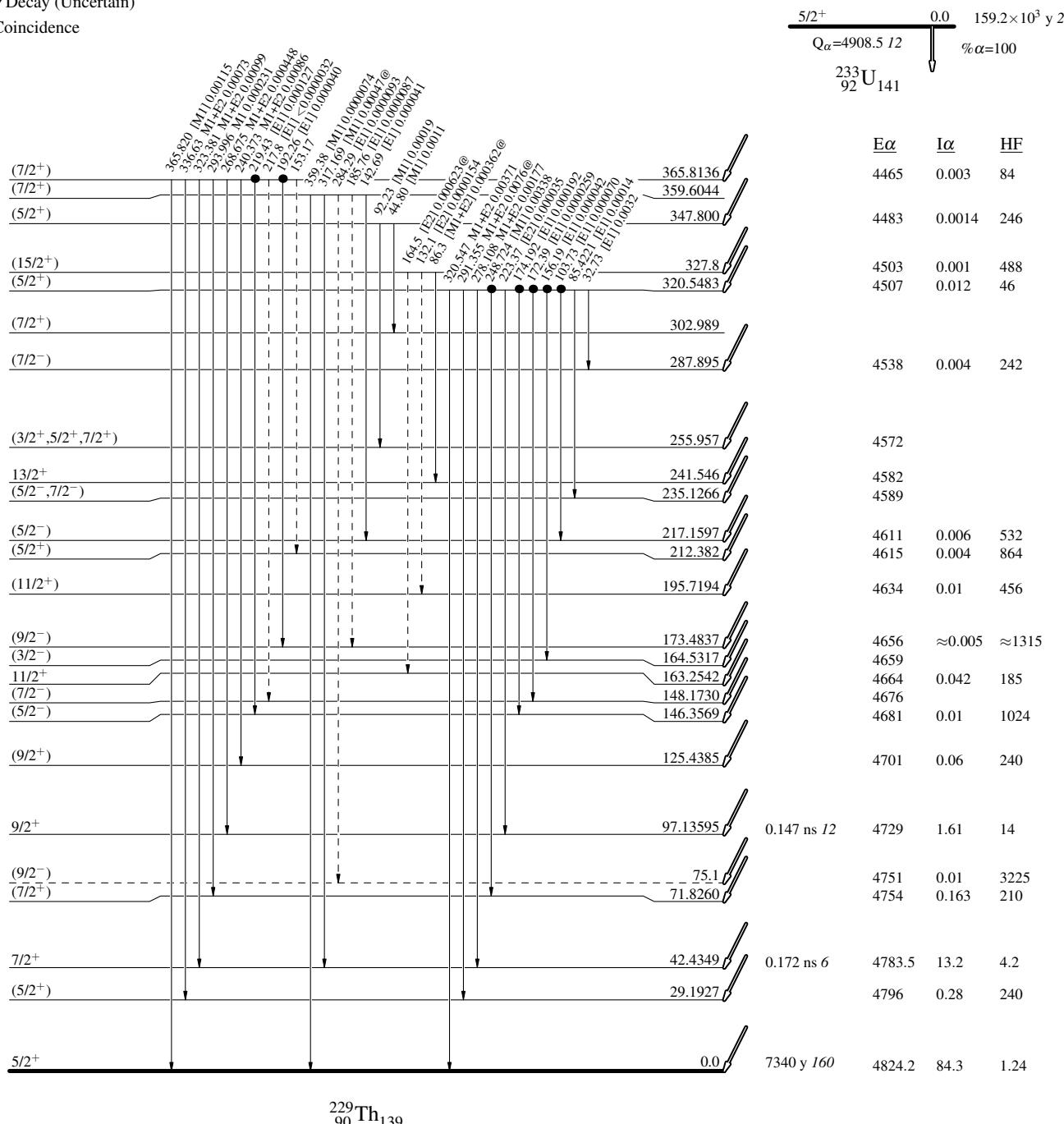
## Legend

Decay Scheme (continued)

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

@ Multiply placed: intensity suitably divided

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



$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16

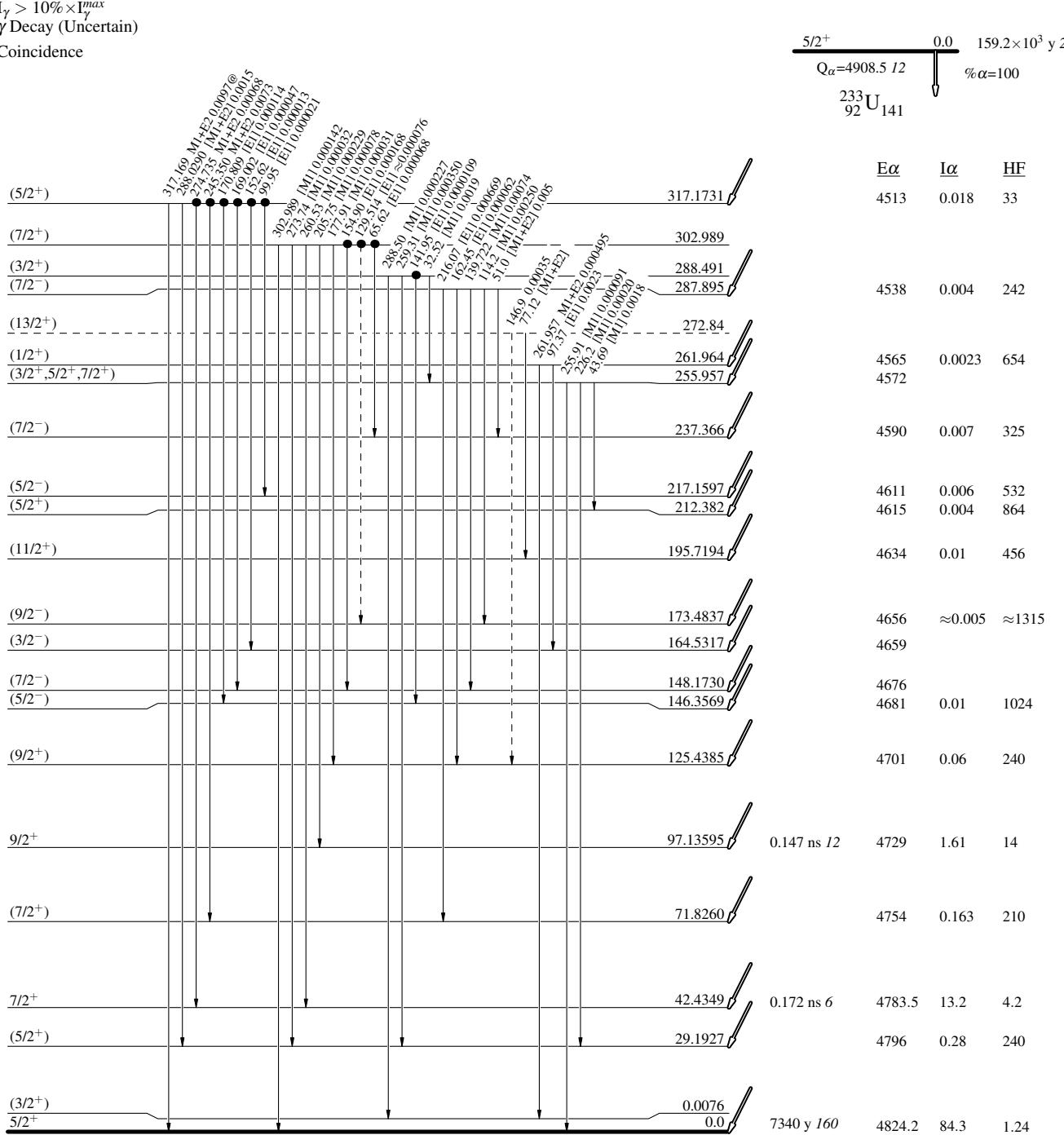
## Legend

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

## Decay Scheme (continued)

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

@ Multiply placed: intensity suitably divided



$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16

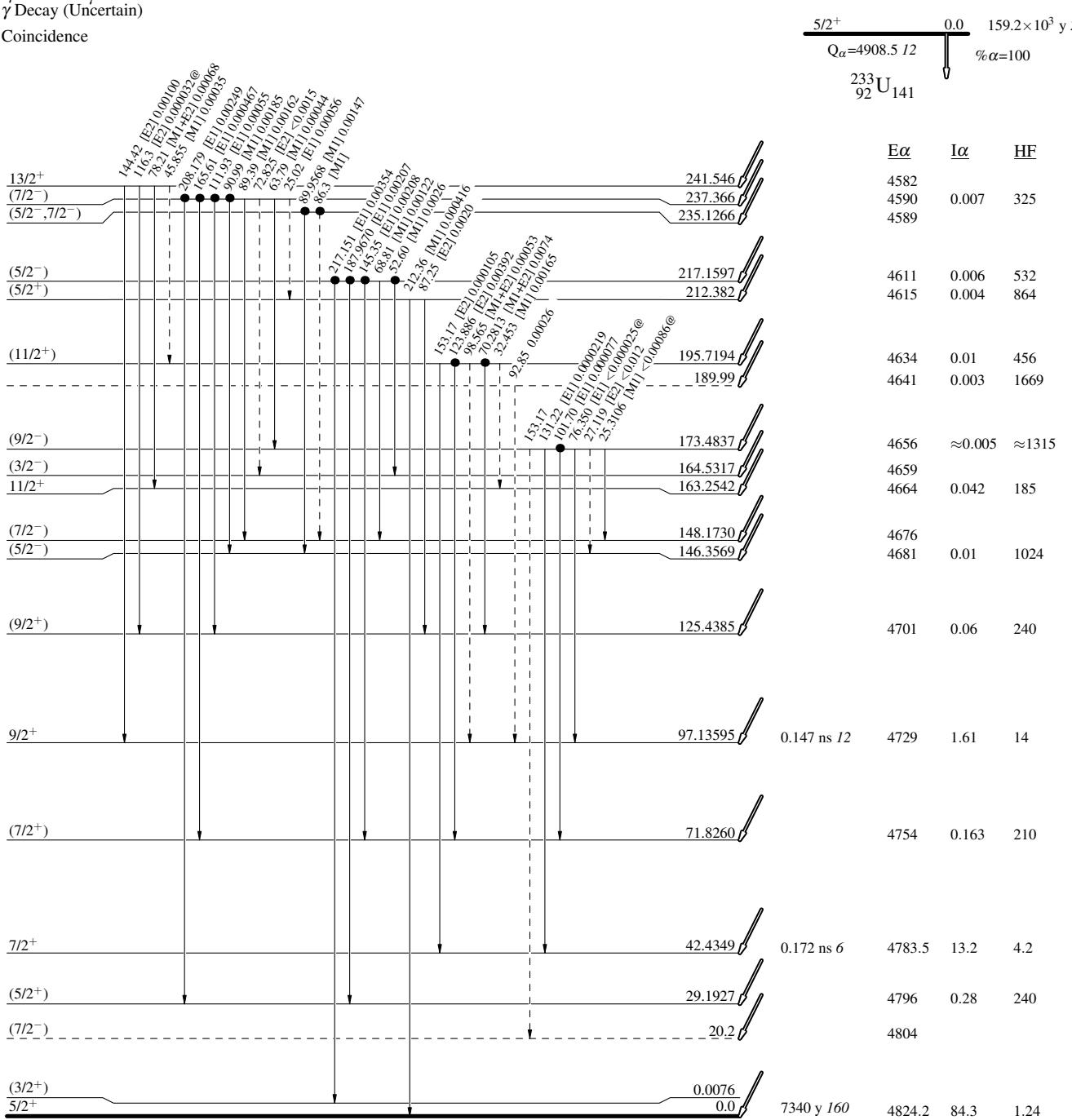
## Legend

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

## Decay Scheme (continued)

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

@ Multiply placed: intensity suitably divided



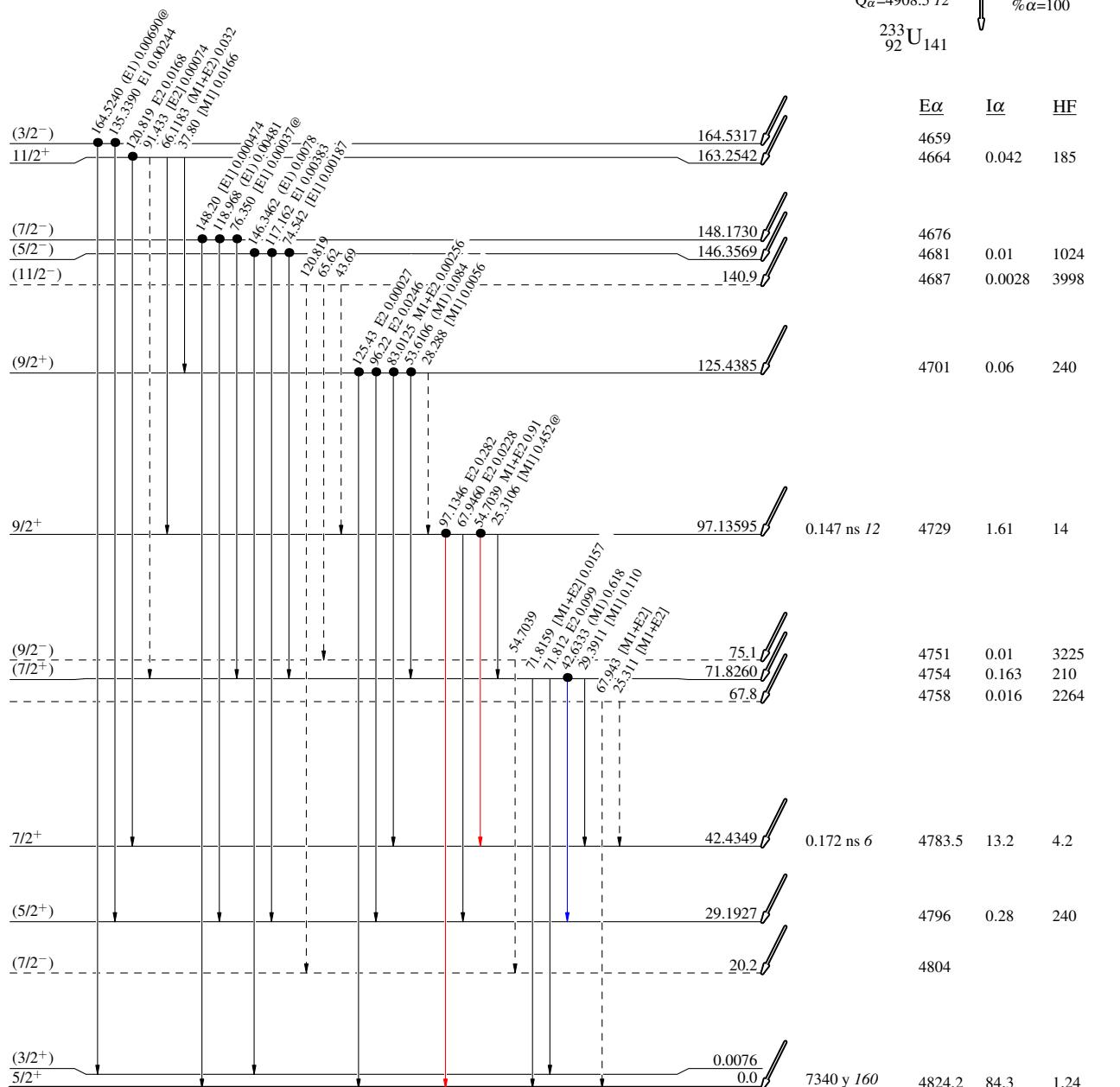
$^{233}\text{U} \alpha$  decay    2003Ba78,2007Be16

## Decay Scheme (continued)

## Legend

- I $_{\gamma}$  < 2%  $\times$  I $_{\gamma}^{\max}$
- I $_{\gamma}$  < 10%  $\times$  I $_{\gamma}^{\max}$
- I $_{\gamma}$  > 10%  $\times$  I $_{\gamma}^{\max}$
- - - - -  $\gamma$  Decay (Uncertain)
- Coincidence

Intensities: I $_{(\gamma+ce)}$  per 100 parent decays  
 @ Multiply placed: intensity suitably divided



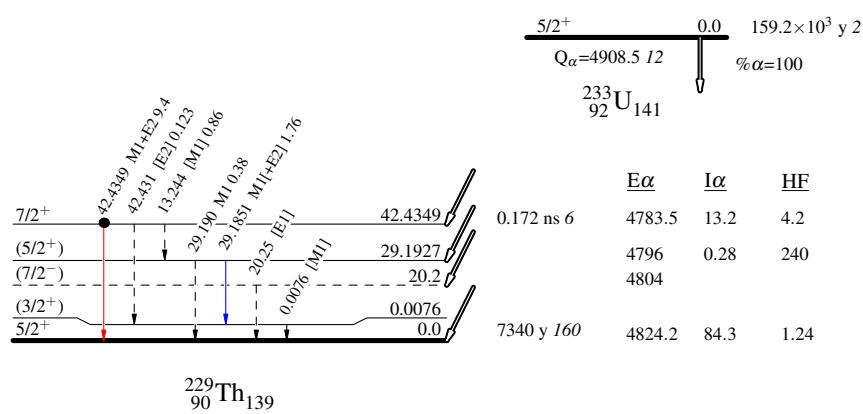
$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16

## Legend

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

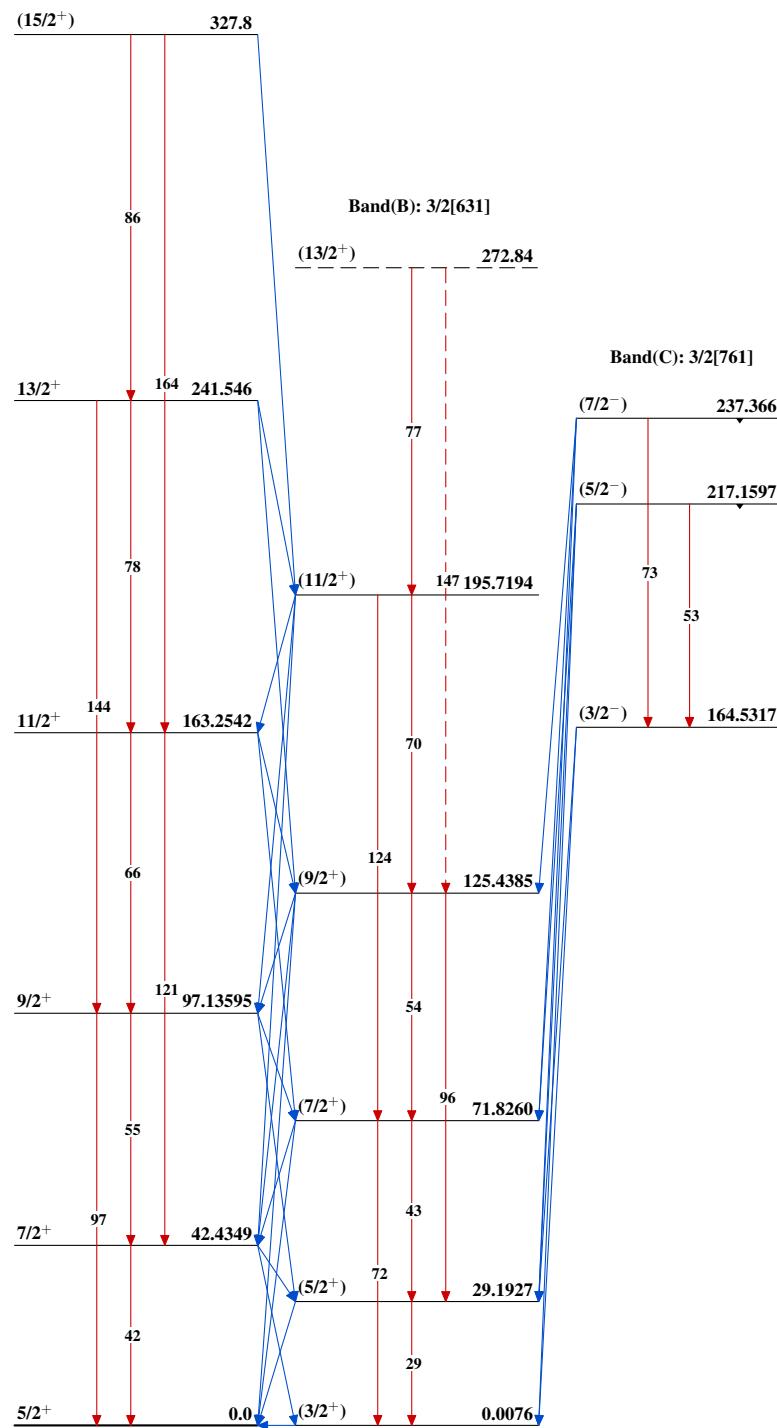
## Decay Scheme (continued)

Intensities:  $I_{(\gamma+ce)}$  per 100 parent decays  
 @ Multiply placed: intensity suitably divided



$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16

Band(A): 5/2[633]



$^{233}\text{U}$   $\alpha$  decay    2003Ba78,2007Be16 (continued)

Band(H): 3/2[642]?

 $(5/2, 7/2)^+$       605.165
 $(3/2, 5/2)^+$       569.2721

Band(G): 1/2[501]

 $(1/2^-)$       536.08

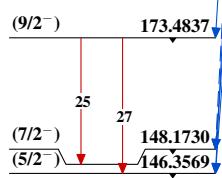
Band(E): 5/2[622]

 $(9/2^+)$       425.877
 $(7/2^+)$       365.8136

Band(F): 1/2[631]

 $(5/2^+)$       320.5483
 $(5/2^+)$       317.1731
 $(3/2^+)$       288.491
 $(1/2^+)$       261.964

Band(D): 5/2[752]

 $^{229}_{90}\text{Th}_{139}$