$^{186}W(^{13}C,5n\gamma)$ **1986Hu02**

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 177, 1 (2021)	3-Sep-2021

Includes $^{186}W(^{12}C,4n\gamma)$ from 2018Es04.

1986Hu02(also 1984Hu10): E=84-87 MeV ^{13}C beams were produced from ANU 14 UN Pelletron. Target was 97% enriched ^{186}W power with a thickness of about 4 mg/cm^2. γ rays were detected by Ge detectors with NaI(Tl) anti-Compton shields. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$. Deduced levels, J, π, γ-ray multipolarities. Comparisons with Total-routhian surface and cranking-model calculations.

2018Es04: E=64 MeV ^{12}C beam was produced from the Cologne 10 MV FN-Tandem accelerator. Target was 65 mg/cm^2 ^{186}W with 99.79% enrichment with 102 mg/cm^2 Bi and 108 mg/cm^2 Cu backing. γ rays were detected using eight HPGe detectors and nine $LaBr_3$(Ce) scintillation detectors (six with BGO suppression shields). Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma$(t). Deduced lifetime of first 2^+, 4^+ and 9^- levels using fast technique and the generalized centroid difference (GCD) method. Comparison to interacting boson approximation model with configuration mixing model with both phenomenological and microscopic basis.

2001Gu31: measured half-lives of 7^- and 8^- levels by recoil-shadow asymmetry method (RSAM). Reaction for population of the states not specified by the authors.

See also (α,xnγ) dataset for several in-beam γ-ray studies between 1974 and 1985.

^{194}Hg Levels

Quasiparticle labeling scheme (1986Hu02):

A: ν1/2[660], α=+1/2.
B: ν1/2[660], α=−1/2.
C: ν3/2[651], α=+1/2.
D: ν3/2[651], α=−1/2.
E: ν1/2[521], α=+1/2.
F: ν1/2[521], α=−1/2.
A_p: π/2[550], α=−1/2.
B_p: π/2[550], α=+1/2.

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0.0[#]	0^+		
427.9[#] *2*	2^+	14.6 ps *28*	$T_{1/2}$: from (636.6γ)(427.9γ)(t) and generalized centroid difference (GCD) method (2018Es04).
1064.5[#] *3*	4^+	4.9 ps *28*	$T_{1/2}$: from (748.9γ)(636.3γ)(t) and (734.8γ)(636.3γ)(t), and using GCD method (2018Es04).
1799.3[#] *4*	6^+		
1813.3[&] *4*	5^-		
1910.4[&] *4*	7^-	4.0 ns *6*	$T_{1/2}$: from 2001Gu31, recoil-shadow asymmetry method.
2138.0[a] *4*	8^-	1.1 ns *5*	$T_{1/2}$: from 2001Gu31, recoil-shadow asymmetry method.
2143.3[&] *4*	9^-	302 ps *9*	$T_{1/2}$: from (280.2γ)(232.9γ)(t) and GCD method (2018Es04). Other measured values in 2018Es04: 284 ps *28* from slope method, and 270 ps *14* from convolution method; none of these adopted by the authors as time-correlated background contributions were not taken into account.
2364.2[@] *4*	8^+		
2423.6[@] *4*	10^+		
2475.7[@] *5*	12^+		
2561.8[a] *4*	10^-		
2687.9[&] *5*	11^-		
2888.6[@] *5*	14^+		
3173.0[a] *5*	12^-		
3394.1[&] *5*	13^-		

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$^{186}W(^{13}C,5n\gamma)$ 1986Hu02 (continued)

^{194}Hg Levels (continued)

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
3531.6[@] 5	16^+	4317.6[f] 6	16^+	5522.7[f] 7	20^+	6676.3[e] 10	(22^+)
3747.7[d] 5	14^-	4491.2 7	$17^{(-)}$	5578.4[b] 7	22^+	6815.3[g] 9	(24,25)
3819.9 6	(15^-)	4498.0[c] 6	19^-	5610.0[g] 8	(20,21)	6834.3[e] 10	(24^+)
3879.3[c] 6	15^-	4520.9[g] 6	(16,17)	5700.3[d] 8	22^-	6941.3[c] 9	(25^-)
3984.0[d] 6	16^-	4797.5[f] 6	18^+	6049.6[c] 8	(23^-)	6989.4[e] 9	(26^+)
4004.6?[g] 8	(14,15)	4896.7[d] 7	20^-	6120.3[g] 9	(22,23)	7304.1[e] 10	(28^+)
4015.1[f] 5	14^+	4985.6[b] 6	20^+	6256.6 8		7767.9?[c] 10	(27^-)
4114.8[c] 6	17^-	5103.3[g] 7	(18,19)	6349.3?[f] 9	(22^+)	7784.4[e] 10	(30^+)
4275.2[@] 6	18^+	5163.8[c] 7	21^-	6411.0[b] 8	24^+		
4289.9[d] 6	18^-	5265.9[@] 7	20^+	6645.6[d] 9	24^-		

† From a least-squares fit to γ-ray energies.

‡ As proposed by 1986Hu02, based on γ(θ) data, previously known assignments for levels up to 16^+ or so, and band assignments. When considered in the Adopted Levels, assignments are placed under parentheses by evaluators, where no other firm experimental arguments are available. See the Adopted Levels.

[#] Band(A): g.s. band.

[@] Band(B): AB band, α=0. Crossing frequency from g.s. band to AB band=0.206 MeV (1986Hu02).

[&] Band(C): AE band, α=1.

[a] Band(D): AF band, α=0.

[b] Band(E): ABCD band, α=0. Average g factor=0.25 2 (1998We23,1999We04,2014StZZ, transient field method). Crossing frequency from AB band to ABCD band=0.348 MeV (1986Hu02).

[c] Band(F): ABCE band, α=1. Average g factor=0.26 3 (1998We23,1999We04,2014StZZ, transient field method). Crossing frequency from AE band to ABCE band=0.239 MeV (1986Hu02).

[d] Band(G): ABCF band, α=0. Average g factor=0.27 2 (1998We23,1999We04,2014StZZ, transient field method). Crossing frequency from AF band to ABCF band=0.221 MeV (1986Hu02).

[e] Band(H): $ABCDA_pB_p$ band, α=0. Crossing frequency from ABCD band to $ABCDA_pB_p$ band<0.36 MeV (1986Hu02).

[f] Band(I): ABEF band, α=0. Crossing frequency from AB band to ABEF band ≈0.52 MeV (1986Hu02).

[g] Band(J): $\nu i^2_{13/2}\otimes\pi h^2_{11/2}$. Tentative assignment.

$\gamma(^{194}Hg)$

A_2 and A_4 values under comments are from γ(θ) in 1986Hu02, unless otherwise stated.

E_γ†	I_γ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	Comments
52.0 2	0.38	2475.7	12^+	2423.6	10^+	[E2]	E_γ: from ce data in (α,4nγ) (1983Gu05). I_γ: deduced from intensity balance at 2476 level, assuming no side feeding to this level.
59.5	0.34	2423.6	10^+	2364.2	8^+	[E2]	E_γ: from ce data in (α,4nγ) (1983Gu05). I_γ: deduced from I(γ+ce) balance at 2424 level that, I(γ+ce)(52.0γ)=I(γ+ce)(59.5γ+280.2γ).
97.0 2	11 1	1910.4	7^-	1813.3	5^-		A_2=+0.20 6
111.0 3	8.6 9	1910.4	7^-	1799.3	6^+	(E1)	A_2=−0.17 10
130.8[a] 4		4114.8	17^-	3984.0	16^-		
[x]145.9 4	1.7 7						A_2=+0.02 10
155.1 4	1.2 5	6989.4	(26^+)	6834.3	(24^+)		A_2=+0.34 10
158.0 4	0.4 2	6834.3	(24^+)	6676.3	(22^+)		A_2=+0.22 20

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$^{186}W(^{13}C,5n\gamma)$ 1986Hu02 (continued)

$\gamma(^{194}Hg)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
208.0 *4*	2.5 *5*	4498.0	19^-	4289.9	18^-		A_2=+0.08 *10*
227.6 *2*	12 *1*	2138.0	8^-	1910.4	7^-		A_2=−0.75 *4*; A_4=+0.03 *6*
232.9 *2*	40 *2*	2143.3	9^-	1910.4	7^-		A_2=+0.26 *3*; A_4=−0.09 *4*
235.5 *4*	<21	4114.8	17^-	3879.3	15^-	(Q)	A_2=+0.39 *5*; A_4=−0.11 *7* 235.5γ and 236.3γ are unresolved, combined Iγ=21 *2*; γ(θ) for the doublet.
236.3 *4*	<21	3984.0	16^-	3747.7	14^-		
[x]253.3 *3*	4.4 *9*						A_2=−0.16 *25*
[x]265.6 *4*	0.5 *2*						A_2=−0.23 *19*
267.3 *4*	0.6 *3*	4015.1	14^+	3747.7	14^-		A_2=+0.23 *15*
280.2 *2*	22 *1*	2423.6	10^+	2143.3	9^-	[E1]	A_2=−0.14 *3*; A_4=−0.07 *4*
302.5[a] *4*		4317.6	16^+	4015.1	14^+		
305.9 *2*	11 *1*	4289.9	18^-	3984.0	16^-	Q[@]	A_2=+0.41 *3*; A_4=−0.18 *5*
314.7 *4*		7304.1	(28^+)	6989.4	(26^+)		A_2=−0.40 *5*; A_4=−0.09 *7* Complex line with total Iγ=4.5 *9*. γ(θ) for unresolved line, as negative A_2 is inconsistent ΔJ=2, Q transition as suggested by ΔJ^π.
[x]328.2 *4*	1.0[&] *4*						A_2=+0.27 *10*
333.6[d] *4*	1.0 *4*	4317.6	16^+	3984.0	16^-		
[x]335.1[b] *4*	1.2 *5*						
[x]345.3[b] *4*	1.7[&] *7*						A_2=+0.24 *12*
353.6 *4*	0.6 *3*	3747.7	14^-	3394.1	13^-		A_2=−0.12 *12*
[x]359.7[b] *4*	0.7 *3*						A_2=−0.20 *15*
[x]366.0 *4*	0.4 *2*						A_2=−0.5 *4*
[x]377.9[b] *4*	0.6 *3*						A_2=−0.5 *7*
383.2 *4*	8[&] *3*	4498.0	19^-	4114.8	17^-	(Q)	A_2=+0.37 *4*; A_4=−0.12 *6* Iγ and γ(θ) for a complex line.
412.9 *2*	41 *2*	2888.6	14^+	2475.7	12^+	Q[@]	A_2=+0.36 *3*; A_4=−0.13 *4*
418.5 *3*	4.8 *10*	2561.8	10^-	2143.3	9^-		A_2=+0.42 *8*; A_4=+0.25 *10*
423.8 *2*	17 *1*	2561.8	10^-	2138.0	8^-	Q[@]	A_2=+0.42 *7*; A_4=−0.15 *10*
427.9 *2*	100	427.9	2^+	0.0	0^+	Q[@]	A_2=+0.30 *2*; A_4=−0.09 *3*
[x]440.0 *4*	1.1[&] *5*						
[x]442.4[b] *4*	0.3 *1*						A_2=+0.8 *4*
[x]454.3[b] *4*	0.4 *2*						A_2=+0.5 *4*
[x]460.4 *4*	1.9 *8*						A_2=−0.21 *10*; A_4=+0.01 *13*
[x]472.6[b] *4*	0.8 *3*						A_2=−0.5 *4*
480.0 *4*	3.3[&] *13*	4797.5	18^+	4317.6	16^+	(Q)	A_2=+0.46 *10*; A_4=−0.16 *12* Iγ and γ(θ) for a complex line.
480.3 *4*	1.0[&] *4*	7784.4	(30^+)	7304.1	(28^+)		A_2=+0.46 *10*; A_4=−0.16 *12* γ(θ) for a doublet.
485.0[c] *4*	10[c] *1*	3173.0	12^-	2687.9	11^-		A_2=+0.44 *3*; A_4=−0.07 *4* γ(θ) for unresolved doublet.
485.2[c] *4*	10[c] *1*	3879.3	15^-	3394.1	13^-		
506.7 *3*	5.0 *10*	5610.0	(20,21)	5103.3	(18,19)	(Q)[@]	A_2=+0.22 *10*; A_4=−0.10 *12*
507.5[ad] *4*		4797.5	18^+	4289.9	18^-		
510.3[a] *4*		6120.3	(22,23)	5610.0	(20,21)		
516.2[ad] *4*		4520.9	(16,17)	4004.6?	(14,15)		
[x]532.1 *4*	1.5[&] *6*						A_2=0.0 *3*
[x]533.0 *4*	1.3 *5*						A_2=+0.1 *4*

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$^{186}W(^{13}C,5n\gamma)$ 1986Hu02 (continued)

$\gamma(^{194}Hg)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
541.6[d] 4	0.9 4	6120.3	(22,23)	5578.4	22+		A2=+1.0 5
544.6 2	18 1	2687.9	11−	2143.3	9−	Q[@]	A2=+0.39 3; A4=−0.13 4
[x]548.8 4	1.6 7						A2=+0.39 10
[x]554.3 4	1.3[&] 5						A2=+0.28 8; A4=0.00 10
565.0 2	31 2	2364.2	8+	1799.3	6+	Q[@]	A2=+0.31 2; A4=−0.10 3
574.7 2	23 2	3747.7	14−	3173.0	12−	Q[@]	A2=+0.33 3; A4=−0.13 4
578.4 4	1.7 7	6989.4	(26+)	6411.0	24+		A2=+0.20 10
582.4 4	<3.9	5103.3	(18,19)	4520.9	(16,17)		A2=−0.05 15 582.4γ and 583.1γ are unresolved with combined Iγ=3.9 8. γ(θ) for 582.4γ+583.1γ.
583.1 4	<3.9	4114.8	17−	3531.6	16+		
592.8 3	7.8 8	5578.4	22+	4985.6	20+	Q[@]	A2=+0.43 5; A4=−0.18 7
606.8 4	5.8[&] 23	4896.7	20−	4289.9	18−		
611.2 4	<33	3173.0	12−	2561.8	10−	(Q)	A2=+0.37 4; A4=−0.13 5 611.2γ and 612.1γ are unresolved with combined Iγ=33 2. γ(θ) for 611.2γ+612.1γ.
612.1 4	<33	5103.3	(18,19)	4491.2	17(−)		
621.3[a] 4		4015.1	14+	3394.1	13−		
624.4[ad] 4		5610.0	(20,21)	4985.6	20+		
636.6 2	97 5	1064.5	4+	427.9	2+	Q[@]	A2=+0.29 2; A4=−0.10 3
643.0 2	28 2	3531.6	16+	2888.6	14+	Q[@]	A2=+0.39 4; A4=−0.17 6
665.8 3	7.0 7	5163.8	21−	4498.0	19−	Q[@]	A2=+0.41 5; A4=−0.18 6
671.3 4	1.9 8	4491.2	17(−)	3819.9	(15−)		A2=+0.39 20
678.2 4	1.2 5	6256.6		5578.4	22+		A2=+0.06 20
[x]687.5 3	3.8 8						A2=+0.03 6; A4=−0.24 9
695.0 3	2.6 5	6815.3	(24,25)	6120.3	(22,23)		A2=+0.23 20
701.0 4	0.8 3	4520.9	(16,17)	3819.9	(15−)		
706.2 2	10 1	3394.1	13−	2687.9	11−	Q[@]	A2=+0.39 4; A4=−0.16 6
710.4 2	16 1	4985.6	20+	4275.2	18+	Q[@]	A2=+0.43 4; A4=−0.19 6
713.9 4	0.7 3	6834.3	(24+)	6120.3	(22,23)		
[x]721.4[b] 4	1.1 5						A2=+0.53 20
725.2 4	2.0 8	5522.7	20+	4797.5	18+	Q	A2=+0.44 10
734.8 2	44 3	1799.3	6+	1064.5	4+	Q[@]	A2=+0.36 3; A4=−0.13 4
743.6 2	44 3	4275.2	18+	3531.6	16+	Q[@]	A2=+0.41 5; A4=−0.14 6
748.8 2	58 3	1813.3	5−	1064.5	4+	(E1)	A2=−0.19 3; A4=−0.04 4
[x]757.3[b] 4	1.8[&] 7						A2=+0.42 10; A4=+0.03 15
[x]766.0[b] 4	1.6 7						A2=+0.42 15
[x]774.6 4	0.9 4						A2=+0.43 15
[x]776.5 4	0.9 4						A2=−0.40 20
[x]786.4[b] 4	1.5 6						A2=−0.21 10
[x]791.2[b] 4	1.5 6						A2=+0.49 12
803.6 3	3.1 6	5700.3	22−	4896.7	20−	(Q)	A2=+0.33 10; A4=−0.02 15
826.6[cd] 4	1.2[c] 5	6349.3?	(22+)	5522.7	20+		A2=+0.20 15
826.6[cd] 4	1.2[c] 5	7767.9?	(27−)	6941.3	(25−)		
828.3[d] 4	0.6 3	5103.3	(18,19)	4275.2	18+		
832.6 3	3.6 7	6411.0	24+	5578.4	22+		A2=+0.15 15
[x]868.8[b] 4	1.7[&] 7						A2=+21 10; A4=−0.14 12

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^{186}W(^{13}C,5nγ) 1986Hu02 (continued)

γ(^{194}Hg) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
885.8 *4*	4.0[&] *16*	6049.6	(23⁻)	5163.8	21⁻		
891.7 *4*	1.9 *8*	6941.3	(25⁻)	6049.6	(23⁻)	(Q)[@]	A_2=+0.40 *10*; A_4=−0.09 *12*
[x]897.0 *4*	0.9 *4*						A_2=+0.3 *6*
[x]920.0 *4*	1.4 *6*						A_2=−0.14 *20*
931.4 *4*	3.0[&] *12*	3819.9	(15⁻)	2888.6	14⁺	D+Q	A_2=−0.76 *10* A_2 is consistent with ΔJ=1, D+Q. 1986Hu02 suggest pure dipole, but expected A_2≈−0.3 for ΔJ=1, dipole.
[x]933.0 *4*	1.5[&] *6*						A_2=−0.05 *20*
945.2 *4*	1.0 *4*	6645.6	24⁻	5700.3	22⁻		A_2=+0.7 *3*
[x]953.2 *4*	0.6 *3*						A_2=+0.8 *4*
989.2 *4*	2.0[&] *8*	4520.9	(16,17)	3531.6	16⁺		
990.7 *4*	3.1[&] *12*	5265.9	20⁺	4275.2	18⁺	(Q)	A_2=+0.18 *12*
[x]995.3[b] *4*	0.9 *4*						A_2=−0.15 *15*
[x]1005.7[b] *4*	1.2 *5*						A_2=+0.25 *12*
[x]1014.7[a] *4*							
[x]1027.4[b] *4*	1.9 *8*						A_2=+0.05 *15*
[x]1096.5 *4*	1.6 *7*						A_2=−0.56 *10*
1116.0[d] *4*	1.9 *8*	4004.6?	(14,15)	2888.6	14⁺		Complex line. Intensity not corrected.
[x]1120.5 *4*	0.7 *3*						A_2=−0.5 *3*
1126.5 *4*	0.4 *2*	4015.1	14⁺	2888.6	14⁺		
1152.0[d] *4*	0.4 *2*	6676.3	(22⁺)	5522.7	20⁺		
[x]1184.0 *4*	0.8 *3*						A_2=+0.09 *25*

[†] From 1986Hu02, unless otherwise noted. Uncertainty assigned by evaluators as 0.2 for Iγ≥10, 0.3 for Iγ=2 to 10, and 0.4 for Iγ<2, based on a comment by 1986Hu02 that it varies from 0.2 to 0.4 keV.

[‡] From 1986Hu02, unless otherwise noted. Uncertainty assigned by evaluators as 5% for Iγ≥10, 10% for Iγ=5-10, 20% for Iγ=2 to 5, and 40% for Iγ<2, based on a comment by 1986Hu02 that uncertainties are 5% to 40%.

[#] From γ(θ) data in 1986Hu02.

[@] The γ(θ) data in 1986Hu02 suggest ΔJ=2, stretched quadrupole (E2) transition.

[&] Complex line; Iγ deduced from γγ-coin (1986Hu02).

[a] Complex line; Iγ not available (1986Hu02).

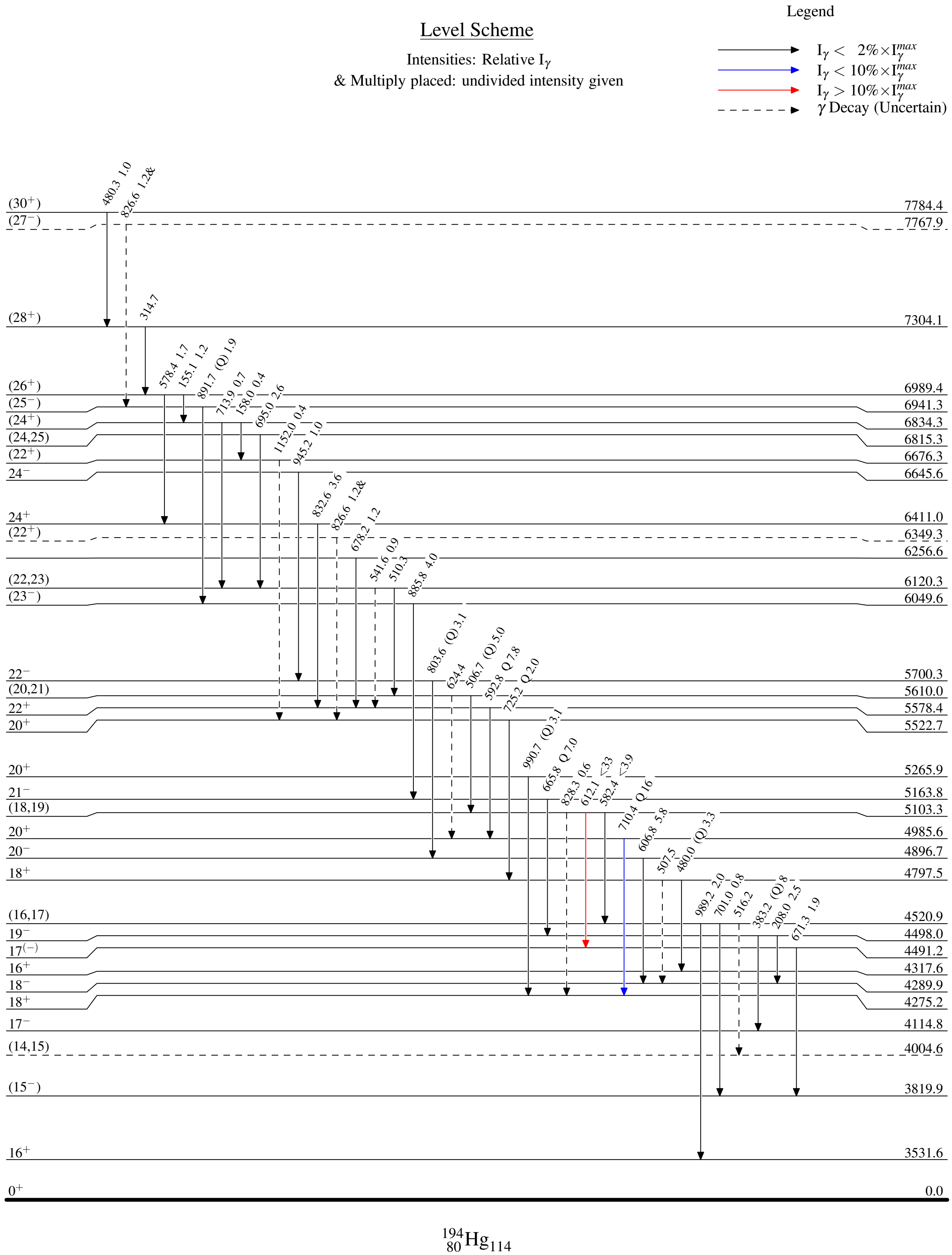
[b] A transition similar in energy is reported in (^{48}Ca,4nγ) (1996Fo01). See ^{150}Nd(^{48}Ca,4nγ) for placement.

[c] Multiply placed with undivided intensity.

[d] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

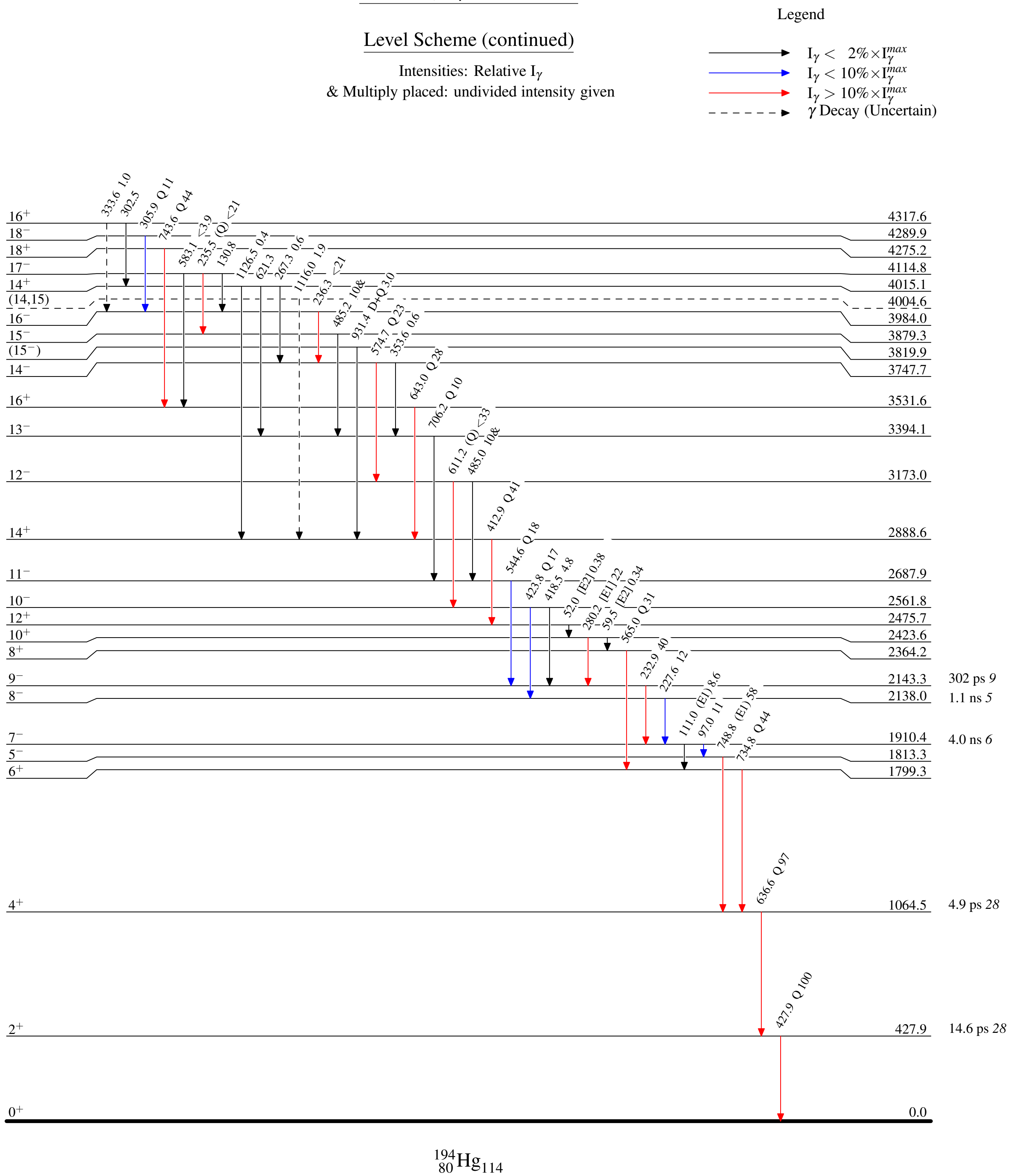
$^{186}W(^{13}C,5n\gamma)$ 1986Hu02



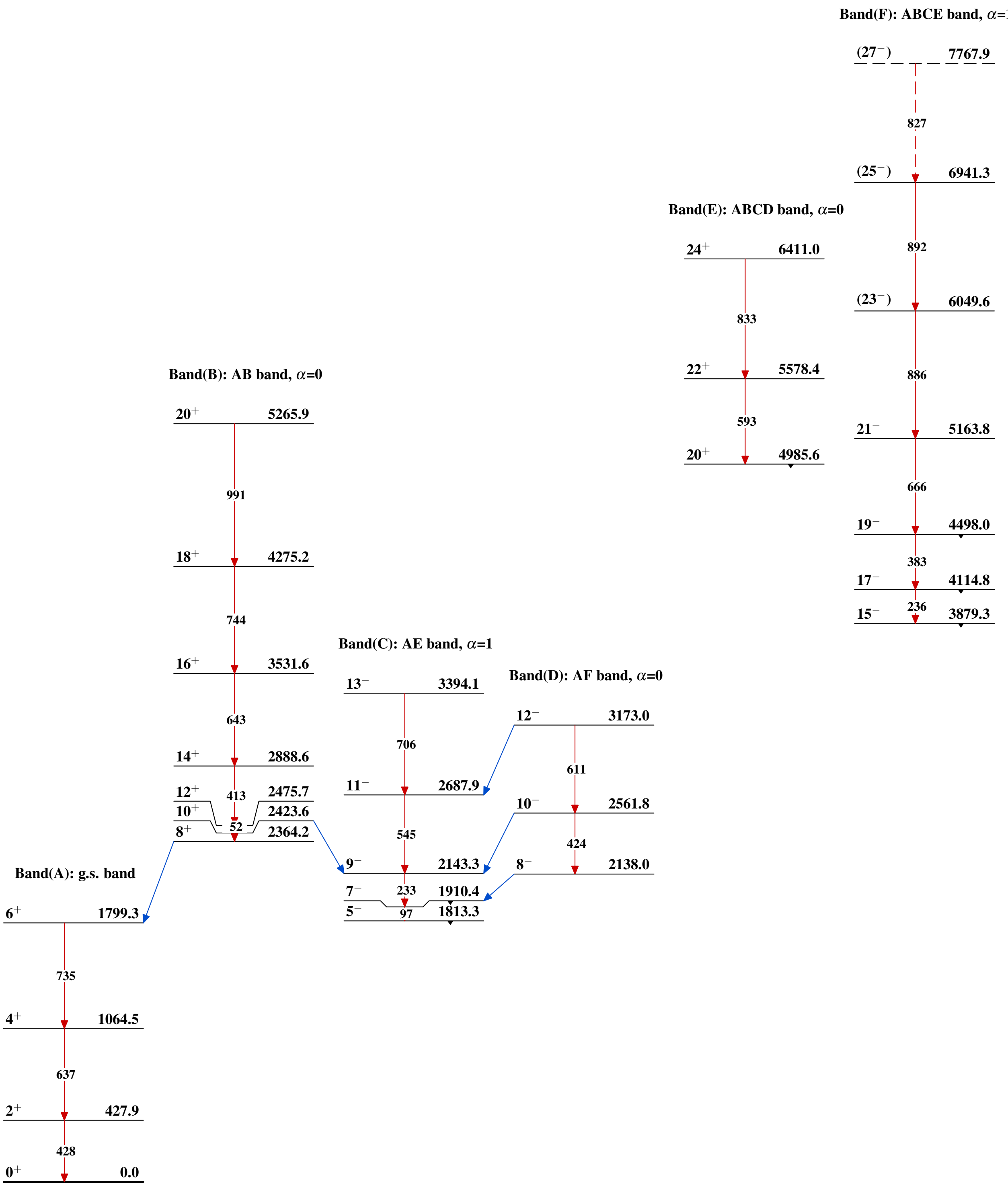
$^{186}W(^{13}C,5n\gamma)$ 1986Hu02

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

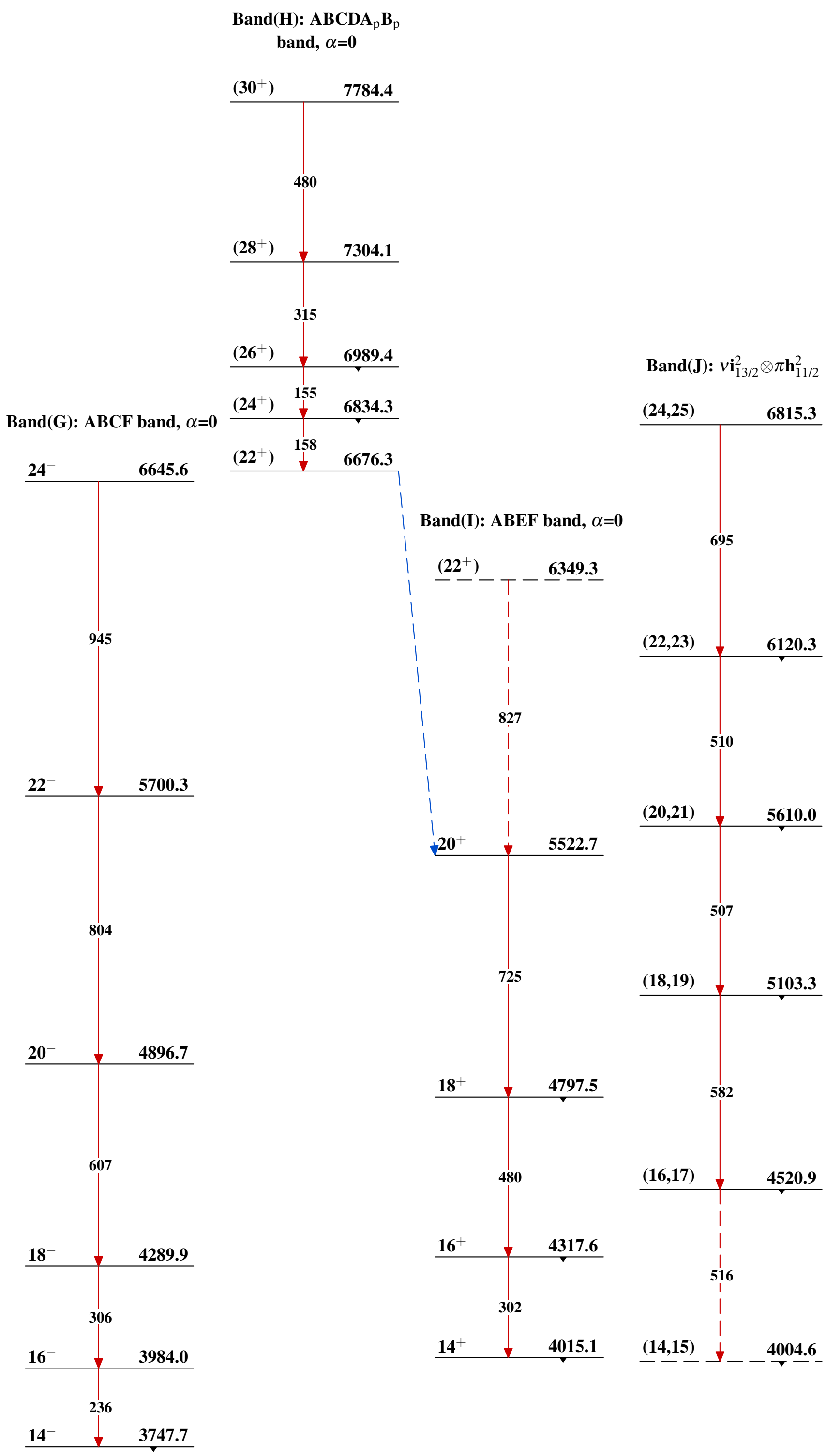


$^{186}W(^{13}C,5n\gamma)$ 1986Hu02



$^{194}_{80}Hg_{114}$

$^{186}W(^{13}C,5n\gamma)$ 1986Hu02 (continued)



$^{194}_{80}Hg_{114}$