^{237}Np(n,γ) E=th:secondary γ's 1990Ho02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 127, 191 (2015)	1-Jun-2014

Secondary γ-rays following thermal neutron capture in ^{237}Np were measured with the curved-crystal spectrometers **GAMS1** and **GAMS2/3** at the **ILL**. The conversion electrons following thermal neutron capture in ^{237}Np have been studied with the **BILL** β-spectrometer at the **ILL**.

E(n)=thermal.

^{238}Np Levels

E(level)†	J$^\pi$‡	T$_{1/2}$	Comments
0.0	2$^+$	2.117 d *2*	T$_{1/2}$: from Adopted Levels.
26.427 *2*	3$^+$		
62.330 *3*	4$^+$		
86.674 *3*	3$^+$		
106.164 *14*	5$^+$		
121.645 *16*	4$^+$		
136.044 *5*	3$^-$		
165.59 *3*	5$^+$		
179.156 *6*	4$^-$		
182.878 *3*	2$^-$		
215.521 *4*	3$^-$		
217.949 *10*	0$^-$		
218.57? *8*	6$^+$		
232.823 *13*	5$^-$		
243.959 *4*	1$^+$		
250.385 *14*	2$^-$		
258.855 *8*	4$^-$		
275.515 *11*	5$^+$		
277.642 *17*	2$^+$		
298.368 *8*	3$^+$		
299.789 *19*	1$^-$		
312.707 *19*	5$^-$		
315.068 *7*	(4)$^+$		
324.314 *8*	4$^-$		
325.210 *9*	1$^-$		
342.396 *19*	5$^-$		
352.46 *4*	3$^-$		
367.26 *3*	2$^-$		
373.684 *14*	1$^-$		
380.600 *9*	3$^-$		
395.198 *16*	5$^+$		
417.639 *13*	2$^+$,3$^+$		
433.719 *12*	3$^+$,4$^+$		
442.24 *3*	4$^-$		
473.3 *4*	(3$^-$,4$^-$)		
497.20 *3*	2$^-$,3$^-$		
523.87 *3*	5$^+$,4$^+$		
529.857 *9*	3$^-$		
543.23 *3*	4$^-$		
567.021 *15*	3$^-$		
646.76 *3*	2$^+$,3$^+$		

† From 1990Ho02.
‡ From Adopted Levels.

γ(^{238}Np)

In analyzing their ce data, 1990Ho02 used theoretical values directly from 1968Ha53. The ce(L2) subshell binding energy used by 1968Ha53 is incorrect, and consequently the values of α(L2) for Z=93 in that tabulation are also incorrect. The internal conversion program BRICC used by the NSDD network, and available from BNL, contains corrected values. Using this program, the evaluators have reanalyzed the ce data of 1990Ho02. None of the multipolarity assignments are changed as a result of this reanalysis, but several of the mixing ratios are revised from values given in 1990Ho02.

@B@0@0@@@@ @B@0@1@@@@@1 multipolarity assignments is changed as a result of this reanalysis,

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
24.37[e] *2*	0.0064[e] *10*	86.674	3+	62.330	4+	M1(+E2)	≤0.03[†]	326 *8*	α(L)=244 *6*; α(M)=60.3 *15* α(N)=16.3 *4*; α(O)=4.02 *10*; α(P)=0.779 *17*; α(Q)=0.0598 *9* δ: From M2/M1=0.13 *2*.
[x]25.93[e] *2*	2.50[e] *25*					E1		4.41	M1:M2:M3=100:126 *11*:233 *20* α(L)=3.27 *5*; α(M)=0.856 *13* α(N)=0.226 *4*; α(O)=0.0499 *7*; α(P)=0.00712 *10*; α(Q)=0.000190 *3*
26.43[e] *2*	0.104[e] *15*	26.427	3+	0.0	2+	M1+E2	0.097[†] *6*	333 *12*	α(L)=248 *9*; α(M)=62.7 *23* α(N)=17.0 *6*; α(O)=4.13 *15*; α(P)=0.767 *24*; α(Q)=0.0469 *7* δ: From M1:M2:M3=100:34 *2*:20 *1*$.
[x]27.58[e] *4*	0.038[e] *6*					M1+E2	0.096[†] *4*	286 *7*	α(L)=214 *5*; α(M)=53.8 *14* α(N)=14.6 *4*; α(O)=3.55 *9*; α(P)=0.662 *15*; α(Q)=0.0413 *6* δ: From M2/M1=0.31 *1*$.
32.67[e] *3*	0.026[e] *4*	215.521	3−	182.878	2−	M1(+E2)	≤0.025[†]	136.4 *22*	α(L)=102.6 *17*; α(M)=25.0 *4* α(N)=6.77 *11*; α(O)=1.67 *3*; α(P)=0.324 *5*; α(Q)=0.0251 *4* δ: From M2/M1=0.13 *1*.
34.97[e] *3*	0.082[e] *11*	121.645	4+	86.674	3+	M1+E2	0.097[†] *3*	130.7 *23*	α(L)=97.8 *17*; α(M)=24.3 *5* α(N)=6.60 *12*; α(O)=1.61 *3*; α(P)=0.304 *5*; α(Q)=0.0204 *3* δ: From M2/M1=0.25 *1*.
35.07[e] *3*	0.0071[e] *10*	217.949	0−	182.878	2−	E2		2.21×10^3	M3/M2=1.10 *3* α(L)=1611 *24*; α(M)=446 *7* α(N)=121.7 *18*; α(O)=28.3 *5*; α(P)=4.58 *7*; α(Q)=0.00987 *15*
35.90[e] *2*	0.0109[e] *15*	62.330	4+	26.427	3+	M1+E2	0.130[†] *3*	133.6 *24*	α(L)=99.8 *18*; α(M)=25.1 *5* α(N)=6.81 *13*; α(O)=1.65 *3*; α(P)=0.307 *6*; α(Q)=0.0188 *3* δ: From M1:M2:M3=100:35 *1*:19 *1*.
[x]37.371[e] *2*	0.26[e] *3*					M1+E2	0.094[†] *4*	104.5 *19*	α(L)=78.3 *14*; α(M)=19.4 *4* α(N)=5.26 *10*; α(O)=1.285 *24*; α(P)=0.244 *5*; α(Q)=0.01676 *24* α(M1)exp=5.9 *7* Evaluators believe EMC1=15.9 *7* (typographical error). δ: From M1:M2:M3=100:28 *1*:6.1 *4*$.

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
43.11[e] *3*	0.044[e] *7*	179.156	4^-	136.044	3^-	M1+E2	0.08[†] *2*	65 *3*	α(L)=48.5 *21*; α(M)=11.9 *6* α(N)=3.23 *16*; α(O)=0.79 *4*; α(P)=0.152 *6*; α(Q)=0.01100 *16* δ: From L2/L1=0.17 *2*; M1/L1=0.25 *1*.
43.32[e] *3*	0.0046[e] *7*	258.855	4^-	215.521	3^-	M1+E2	0.391 *20*	156 *9*	L1:L2:L3=100:123 *17*:91 *11*; M1/L1=0.59 *7*; M1:M2:M3=37 *11*:100:19 *3* α(L)=115 *7*; α(M)=30.5 *19* α(N)=8.3 *5*; α(O)=1.97 *12*; α(P)=0.339 *19*; α(Q)=0.00996 *17* Mult.: from L-subshell ratios. The M-subshell values give inconsistent results. M1/M2 yields δ=0.60, M3/M2 yields δ=0.056, and M1/L1 requires an E4 component.
43.84[e] *3*	0.075[e] *11*	106.164	5^+	62.330	4^+	M1+E2	0.111[†] *5*	65.3 *12*	α(L)=48.9 *9*; α(M)=12.12 *24* α(N)=3.29 *7*; α(O)=0.803 *15*; α(P)=0.152 *3*; α(Q)=0.01043 *15* δ: From L1:L2:L3=100:21 *1*:9.0 *5*; M1/L1=0.31 *2*; M1:M2:M3=100:23.6 *12*:8 *1*. Mult.: authors' entry of I(α(M1))=236 *12* relative to I(α(M1))=100 in table ii is a misprint. The evaluators assume this should be 23.6 *12*.
43.98[e] *4*	0.058[e] *8*	165.59	5^+	121.645	4^+	M1+E2	0.13[†] *4*	68 *8*	α(L)=51 *6*; α(M)=12.6 *16* α(N)=3.4 *5*; α(O)=0.83 *10*; α(P)=0.157 *17*; α(Q)=0.01030 *17* δ: From L1:L2:L3=100:20 *1*:11 *1*; M1/L1=0.35 *2*; M1:M2:M3=100:64 *16*:13 *2*. δ: M2/M1 yields an inconsistent value of 0.26 *5* and is not used in arriving at the adopted value.
[x]45.197 *4*	0.13 *3*								
46.84[e] *3*	0.111[e] *17*	182.878	2^-	136.044	3^-	M1+E2	0.14[†] *4*	56 *6*	α(L)=42 *5*; α(M)=10.5 *13* α(N)=2.9 *4*; α(O)=0.69 *8*; α(P)=0.131 *13*; α(Q)=0.00854 *14* δ: From L2/L1=0.17 *1*; M1/L1=0.20 *1*; M1:M2:M3=100:17 *1*:18 *1*. Additional information 2.
[x]46.97[e] *3*	0.0016[eg] *2*					E2		533	L3/L2=0.37 *4*; M2/L2=0.44 *6*; M3/M2=0.49 *5* α(L)=388 *6*; α(M)=107.6 *16* α(N)=29.4 *5*; α(O)=6.83 *10*; α(P)=1.111 *16*; α(Q)=0.00273 *4* Mult.: authors' entry of I(ce(M1))=100 in table ii is probably a misprint. This entry should be blank.
48.50[&] *3*	0.0111[&] *17*	373.684	1^-	325.210	1^-	[M1]		42.3	α(L)=31.8 *5*; α(M)=7.74 *11* α(N)=2.10 *3*; α(O)=0.517 *8*; α(P)=0.1003 *15*; α(Q)=0.00781 *11*
49.372 *2*	8.57 *14*	136.044	3^-	86.674	3^+	E1		0.820	α(L1)exp=0.19 *1* α(L)=0.615 *9*; α(M)=0.1536 *22* α(N)=0.0408 *6*; α(O)=0.00939 *14*; α(P)=0.001508 *22*; α(Q)=5.32×10^{-5} *8*
52.60[e] *5*	0.0035[eg] *6*	352.46	3^-	299.789	1^-				L1:L2:L3=13 *1*:100:64 *3*; M2/L2=0.32 *2*; M1:M2:M3=24 *3*:100:76 *11* Mult.: the authors assign mult=E2 and place the transition from a 3^-

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
									to a 1$^-$ level; however, the data are not consistent with pure E2. All the ce ratios except M3/M2 require an M1 admixture; however, the deduced δ values are not self consistent. One gets δ>0.25 from M3/M2, and 1.44 *8*, 0.27 *3*, and 0.93 *7* from L1/L2, L3/L2, and M1/M2, respectively.
52.98[em] *7*	0.029[e] *4*	218.57?	6$^+$	165.59	5$^+$	M1+E2	0.17[†] *2*	40.1 *19*	α(L)=29.9 *14*; α(M)=7.5 *4* α(N)=2.03 *11*; α(O)=0.494 *25*; α(P)=0.093 *4*; α(Q)=0.00589 *9* δ: From L2/L1= 0.18 *2*; M1/L1=0.20 *1*; M2/M1=1.17 *7*. E_γ: unplaced by authors. Added by evaluators on the basis of E(level)=218.7 *6* for the 6$^+$ member of the band whose 5$^+$ member is at 165.59.
[x]53.562 *9*	0.15 *5*					E1+M2	0.022[†] *7*	1.27 *45*	α(L)=0.93 *33*; α(M)=0.249 *93* α(N)=0.068 *26*; α(O)=0.0161 *63*; α(P)=0.0028 *12*; α(Q)=1.44×10^{-4} *73* δ: From α(L1)exp=0.46 *16*. Mult.: 1990Ho02 assign (E1).
53.70[e] *7*	0.038[e] *6*	232.823	5$^-$	179.156	4$^-$	M1+E2	0.271 *4*	48.3 *9*	L1:L2:L3=100:50 *2*:29 *1*; M1/L1=0.30 *2*; M2/M1=0.56 *6* α(L)=35.9 *7*; α(M)=9.20 *17* α(N)=2.50 *5*; α(O)=0.601 *11*; α(P)=0.1092 *19*; α(Q)=0.00549 *8* α(L)exp=35.9 *7* δ: from α(M)exp=9.20 *17* and α(N+...)exp=3.22 *6*.
53.88[e] *4*	0.017[e] *3*	312.707	5$^-$	258.855	4$^-$	M1+E2	0.22[†] *4*	42 *5*	α(L)=32 *3*; α(M)=8.0 *9* α(N)=2.17 *24*; α(O)=0.52 *6*; α(P)=0.097 *9*; α(Q)=0.00553 *11* Mult.: From L1:L2:L3=100:37 *4*:7 *2*; M1/L1=0.28 *4*$M2/M1=0.71 *15*. δ: weighted average of 0.23 *2*, 0.13 *2*, and 0.33 *5* from L2/L1, L3/L1, and M2/M1, respectively.
[x]54.13[e] *4*	0.075[e] *11*					M1+E2	0.06[†] *1*	31.5 *6*	α(L)=23.7 *4*; α(M)=5.78 *11* α(N)=1.57 *3*; α(O)=0.385 *7*; α(P)=0.0744 *13*; α(Q)=0.00563 *8* δ: From L1:L2:L3=100:19 *1*:1.8 *2*; M1/L1=0.27 *1*$ M2/M1=0.051 *14*.
54.40[e] *4*	0.0040[eg] *6*	298.368	3$^+$	243.959	1$^+$	E2		262	L3/L2=0.96 *3*; M2/L2= 0.20 *2*; M3/M2=0.89 *11* α(L)=190 *3*; α(M)=52.9 *8* α(N)=14.45 *21*; α(O)=3.36 *5*; α(P)=0.548 *8*; α(Q)=0.001445 *21*
[x]59.211 *25*	0.147 *21*					M1+E2	≤0.10[†]	24.3 *9*	α(L)=18.3 *6*; α(M)=4.46 *17* α(N)=1.21 *5*; α(O)=0.297 *11*; α(P)=0.0574 *18*; α(Q)=0.00432 *7* δ: From M3/L3=0.31 *5*; M3/M2=0.49 *10*; α(M2)exp=0.62 *11*.
59.31[&] *4*	0.0082[&] *13*	121.645	4$^+$	62.330	4$^+$	[M1]		23.4	α(L)=17.64 *25*; α(M)=4.29 *6* α(N)=1.161 *17*; α(O)=0.286 *4*; α(P)=0.0556 *8*; α(Q)=0.00432 *7*
60.243 *4*	0.68 *5*	86.674	3$^+$	26.427	3$^+$	M1+E2	0.089[†] *23*	23.5 *7*	α(L)=17.6 *6*; α(M)=4.32 *15* α(N)=1.17 *4*; α(O)=0.287 *9*; α(P)=0.0553 *15*; α(Q)=0.00410 *6* δ: From L1:L2:L3=100:17 *1*:2.5 *1*; M1/L1=0.25 *2*; M1:M2:M3=100:14 *1*:3.7 *4* ; α(L1)exp=11.8 *8*.

$^{238}_{93}$Np$_{145}$-4

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
^{x}62.18[&] 5	0.07[&] 3					[M1]		20.4	α(L)=15.36 22; α(M)=3.73 6 α(N)=1.011 15; α(O)=0.249 4; α(P)=0.0484 7; α(Q)=0.00376 6
62.33[e] 3	0.0132[eg] 20	62.330	4^+	0.0	2^+	E2		136.0	L1:L2:L3=3.1 4:100:86 10; M2/L2=0.31 2; M3/M2=0.80 6 α(L)=98.9 14; α(M)=27.5 4 α(N)=7.52 11; α(O)=1.749 25; α(P)=0.285 4; α(Q)=0.000809 12
^{x}65.10[e] 4	0.017[e] 3					M1+E2	0.28[†] 1	24.6 6	α(L)=18.3 5; α(M)=4.65 12 α(N)=1.26 4; α(O)=0.305 8; α(P)=0.0561 13; α(Q)=0.00310 5 δ: From L1:L2:L3=100:37 4:23 2.
66.919 5	0.23 3	342.396	5^-	275.515	5^+	E1		0.368	α(L2)exp<1.2 α(L)=0.277 4; α(M)=0.0684 10 α(N)=0.0182 3; α(O)=0.00425 6; α(P)=0.000709 10; α(Q)=2.82×10^{-5} 4 Mult.: the authors show mult=(E1,E2); however, α(L2)exp is consistent only with E1(+M2) with δ<0.24.
^{x}67.17[&] 4	0.028[&] 14					[M1]		16.28	α(L)=12.26 18; α(M)=2.98 5 α(N)=0.807 12; α(O)=0.199 3; α(P)=0.0386 6; α(Q)=0.00300 5
^{x}70.15[e] 2	0.0027[eg] 4					E2		77.3	L3/L2=0.76 10 α(L)=56.2 8; α(M)=15.65 22 α(N)=4.27 6; α(O)=0.995 14; α(P)=0.1627 23; α(Q)=0.000494 7
^{x}72.873 10	0.66 7					E1		0.294	α(L1)exp=0.09 2 α(L)=0.221 3; α(M)=0.0546 8 α(N)=0.01455 21; α(O)=0.00340 5; α(P)=0.000573 8; α(Q)=2.35×10^{-5} 4
^{x}73.01 8									L1:L2:L3=100:84 8:78 7; M1/L1= 0.25 2; M1:M2:M3=100:43 10:40 9 Mult.,I_γ: there is an inconsistency in the authors' Iγ, ce, and mult. In the authors' table I, Iγ is given as 0.019 7 based on mult=M1 and α(L1)(M1)=9.1, implying I(ce(L1))=0.172. In table ii, however, the mult is given as E1+M2 with δ=0.022, based on L- and M-subshell ratios, and thus α(L1)(E1/M2) would be 0.172. If the above deduced I(ce(L1)) is correct, then for mult=E1+M2 one would get Iγ=1.0, a value large enough that it would have been seen in the photon spectrum. Note that the ce data are reasonably consistent with M1+E2. The L2/L1, L3/L1, M2/M1, and M3/M1 values giving δ=0.51 3, 0.61 3, 0.31 6, and 0.40 5, respectively. With mult=M1+E2 and δ=0.4, I(ce(L1))=0.172 gives Iγ=0.021. In view of these discrepancies, the evaluators have not given Iγ or mult for this unplaced transition.
73.715 4	0.49 15	136.044	3^-	62.330	4^+	E1		0.285	L1:L2:L3=100:86 10:61 8 α(L1)exp=0.08 2 α(L)=0.215 3; α(M)=0.0529 8 α(N)=0.01411 20; α(O)=0.00330 5; α(P)=0.000557 8; α(Q)=2.30×10^{-5} 4

γ(^{238}Np) (continued)

E_γ [#]	I_γ [#j]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [@]	δ [i]	α [‡h]	Comments
									Mult.: 1990Ho02 assign mult=E1+M2 with δ=0.022; however, the evaluators′ reanalysis indicates that no M2 admixture is required.
[x]74.679 *2*	0.38 *11*					E1		0.276	α(L1)exp<0.18 α(L)=0.207 *3*; α(M)=0.0511 *8* α(N)=0.01364 *19*; α(O)=0.00319 *5*; α(P)=0.000539 *8*; α(Q)=2.23×10^{-5} *4*
74.975 *2*	0.27 *7*	442.24	4$^-$	367.26	2$^-$				
75.97[e] *7*	0.0064[eg] *10*	258.855	4$^-$	182.878	2$^-$	E2		52.9	L3/L2=0.61 *7* α(L)=38.4 *6*; α(M)=10.71 *16* α(N)=2.93 *5*; α(O)=0.681 *10*; α(P)=0.1115 *17*; α(Q)=0.000357 *6* Mult.: the experimental L3/L2 value of 0.61 *7* is slightly smaller than the E2 theory value of 0.73, suggesting E2+M1 with δ=0.45 *+27−11*; however, the placement of this transition requires ΔL=2.
[x]76.646 *10*	0.46 *10*					E1		0.258	L2/L1=0.72 *22*; α(L1)exp=0.09 *3* α(L)=0.194 *3*; α(M)=0.0477 *7* α(N)=0.01273 *18*; α(O)=0.00298 *5*; α(P)=0.000505 *7*; α(Q)=2.11×10^{-5} *3*
79.483 *17*	0.17 *3*	215.521	3$^-$	136.044	3$^-$	E2(+M1)	5.8 *2*	41.7	α(L)=30.3 *5*; α(M)=8.45 *12* α(N)=2.31 *4*; α(O)=0.538 *8*; α(P)=0.0882 *13*; α(Q)=0.000342 *6* δ: From α(L1)exp=0.91 *20*.
79.74[e] *3*	0.024[eg] *4*	106.164	5$^+$	26.427	3$^+$	E2		42.0	L3/L2=0.61 *3* α(L)=30.6 *5*; α(M)=8.51 *12* α(N)=2.33 *4*; α(O)=0.542 *8*; α(P)=0.0888 *13*; α(Q)=0.000294 *5* Mult.: the experimental L3/L2 value of 0.61 *3* is slightly smaller than the E2 theory value of 0.72, suggesting E2+M1 with δ=0.49 *+10−7*; however, the placement of this transition requires ΔL=2.
82.232 *4*	0.57 *8*	315.068	(4)$^+$	232.823	5$^-$	E1+M2	0.025 *+6−7*	0.33 *7*	α(L1)exp=0.13 *3* α(L)=0.25 *5*; α(M)=0.063 *13* α(N)=0.017 *4*; α(O)=0.0041 *9*; α(P)=0.00072 *16*; α(Q)=3.8×10^{-5} *11*
[x]86.219 *4*	0.34 *11*					M1+E2	0.22[†] *12*	8.8 *13*	α(L)=6.6 *9*; α(M)=1.6 *3* α(N)=0.45 *7*; α(O)=0.109 *16*; α(P)=0.0206 *25*; α(Q)=0.00139 *8* δ: From L1:L2:L3=100:18 *5*:1.5 *7*; M1/L1=0.39 *19*;M1:M2:M3=100:45 *22*:8 *4*; α(L1)exp=6.7 *24*. Mult.: the subshell ratios do not give a unique solution for δ, one gets δ=0.08 *+3−4*, 0.16 *+7−11*, 0.06 *+3−6*, 0.20 *+5−6* from L3/L1, L2/L1, M3/M2, and M2/M1, respectively. Elic gives δ≤5.9. The authors assign mult=M1(+E2).
86.676 *2*	2.3 *4*	86.674	3$^+$	0.0	2$^+$	M1+E2	0.10[†] *3*	7.95 *18*	α(L)=5.98 *13*; α(M)=1.46 *4*

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
									α(N)=0.395 10; α(O)=0.0972 23; α(P)=0.0188 4; α(Q)=0.001413 22 δ: From L1:L2:L3=100:16 4:1.9 5; M1/L1=0.28 7; M1:M2:M3=100:22 5:2.5 6; α(L1)exp=6.2 13.
92.486 7	0.19 4	179.156	4^-	86.674	3^+	E1		0.1574	α(L2)exp<0.07 α(L)=0.1184 17; α(M)=0.0291 4 α(N)=0.00777 11; α(O)=0.00183 3; α(P)=0.000316 5; α(Q)=1.410×10^{-5} 20 Mult.: δ<0.075.
93.67 5	0.19 4	352.46	3^-	258.855	4^-				
95.22[&] 2	0.046[&] 6	121.645	4^+	26.427	3^+	[M1]		5.90	α(L)=4.44 7; α(M)=1.078 16 α(N)=0.292 4; α(O)=0.0719 10; α(P)=0.01397 20; α(Q)=0.001084 16
96.82[e] 5	0.033[eg] 5	232.823	5^-	136.044	3^-	E2		16.87	L3/L2=0.77 12 α(L)=12.26 18; α(M)=3.42 5 α(N)=0.934 14; α(O)=0.218 3; α(P)=0.0358 5; α(Q)=0.0001386 20 Mult.: the L3/L2 ratio gives mult=E2(+M1) with δ>1.4. Placement in the level scheme requires ΔL=2.
97.22[e] 5	0.055[eg] 7	312.707	5^-	215.521	3^-	E2		16.54	M2/L2=0.25 4; M3/M2=0.80 18 α(L)=12.03 17; α(M)=3.35 5 α(N)=0.916 13; α(O)=0.213 3; α(P)=0.0351 5; α(Q)=0.0001365 20 Mult.: the M3/M2 ratio gives mult=E2(+M1) with δ>0.66. Placement in the level scheme requires ΔL=2.
[x]97.798 10	0.31 8								
[x]106.137 6	0.135 24					M1(+E2)	≤0.23	4.48 18	α(L)=3.36 13; α(M)=0.82 4 α(N)=0.223 11; α(O)=0.0548 24; α(P)=0.0105 4; α(Q)=0.000774 21 δ: From α(L1)exp=3.5 6.
107.263 6	0.65 12	325.210	1^-	217.949	0^-	M1		4.18	L2/L1=0.12 4; M1/L1=0.28 1; M1:M2:M3=100:15 1:5.7 7 α(L1)exp=3.0 5 α(L)=3.15 5; α(M)=0.763 11 α(N)=0.207 3; α(O)=0.0509 8; α(P)=0.00990 14; α(Q)=0.000767 11 Mult.,δ: δ=0.09 +3−4 from M2/M1. α(L1)exp gives δ<0.46, L2/L1 gives δ<0.16, and M3/M1 gives an anomalously high value of 0.210 15.
108.792 7	0.45 22	324.314	4^-	215.521	3^-				
109.614[la]	0.9[la] 3	136.044	3^-	26.427	3^+	E1+M2	0.028 6	0.144 21	α(L1)exp=0.06 1 α(L)=0.107 15; α(M)=0.027 4 α(N)=0.0074 12; α(O)=0.0018 3; α(P)=0.00032 6; α(Q)=1.7×10^{-5} 4

From ENSDF

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
109.614[la]	≤0.32[la]	342.396	5⁻	232.823	5⁻				
[x]111.104 *11*	0.25 *4*								
111.197 *15*	0.19 *4*	232.823	5⁻	121.645	4⁺				
116.90[&] *2*	0.095[&] *14*	299.789	1⁻	182.878	2⁻	[M1]		3.26	α(L)=2.45 *4*; α(M)=0.596 *9* α(N)=0.1613 *23*; α(O)=0.0397 *6*; α(P)=0.00772 *11*; α(Q)=0.000598 *9* Mult.: 1990Ho02 show mult=M1+E2 in table I; however, Iγ was deduced from I(ce(L1)) using the α(L1) value for mult=M1.
[x]117.359 *5*	0.62 *13*					E1		0.0847	α(L1)exp=0.041 *7* α(L)=0.0637 *9*; α(M)=0.01559 *22* α(N)=0.00417 *6*; α(O)=0.000990 *14*; α(P)=0.0001741 *25*; α(Q)=8.40×10⁻⁶ *12*
[x]118.532 *21*	0.41 *6*					M1+E2	0.72 *8*	4.32 *19*	α(L)=3.19 *14*; α(M)=0.83 *4* α(N)=0.227 *12*; α(O)=0.054 *3*; α(P)=0.0097 *4*; α(Q)=0.00040 *3* δ: From L2/L1=0.72 *8*$ M1/L1=0.38 *5*; M1:M2:M3=100:60 *12*:22 *5*; α(L1)exp=0.92 *12*.
121.69[e] *4*	0.088[eg] *13*	121.645	4⁺	0.0	2⁺	E2		6.04	α(K)=0.179 *3*; α(L)=4.26 *6*; α(M)=1.186 *17* α(N)=0.324 *5*; α(O)=0.0756 *11*; α(P)=0.01251 *18*; α(Q)=6.14×10⁻⁵ *9* Mult.: L3/L2(E2 theory)=0.60, slightly inconsistent with the experimental value of 0.53 4. The placement requires ΔL=2.
122.76 *7*	0.019 *8*	258.855	4⁻	136.044	3⁻	[M1]		13.43	α(K)=10.60 *15*; α(L)=2.13 *3*; α(M)=0.517 *8* α(N)=0.1401 *20*; α(O)=0.0345 *5*; α(P)=0.00670 *10*; α(Q)=0.000519 *8* Mult.: 1990Ho02 show mult=M1+E2 in table I; however, Iγ was deduced from I(ce(L1)) using the α(L1) value for mult=M1.
[x]124.29 *5*	0.054 *21*					M1+E2	1.2 *4*	8.6 *15*	α(K)=4.3 *21*; α(L)=3.1 *4*; α(M)=0.84 *12* α(N)=0.23 *4*; α(O)=0.054 *8*; α(P)=0.0094 *10*; α(Q)=2.39×10⁻⁴ *89* δ: ELC1=0.82 *31*.
[x]125.241 *9*	0.26 *4*								
[x]126.21 *3*	0.191 *17*								
[x]126.355 *3*	0.48 *8*								
130.215 *12*	0.25 *4*	380.600	3⁻	250.385	2⁻	E2(+M1)	5.7×10³ *1*	4.50	α(K)=0.203 *3*; α(L)=3.13 *5*; α(M)=0.871 *13* α(N)=0.238 *4*; α(O)=0.0555 *8*; α(P)=0.00921 *13*; α(Q)=4.90×10⁻⁵ *7* δ: ELC1=0.13 *3*.
[x]133.662 *15*	0.21 *3*					M1+E2	2.8 *1*	4.77 *9*	α(K)=1.13 *7*; α(L)=2.65 *4*; α(M)=0.732 *11* α(N)=0.200 *3*; α(O)=0.0468 *7*; α(P)=0.00785 *12*; α(Q)=8.6×10⁻⁵ *3* δ: ELC1=0.28 *4*.

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
135.918 *7*	0.20 *3*	315.068	(4)$^+$	179.156	4$^-$				E_γ: authors′ value of 135.198 in table I is a misprint.
136.045 *10*	0.68 *11*	136.044	3$^-$	0.0	2$^+$	E1		0.247	α(K)exp=0.20 *3* α(K)=0.190 *3*; α(L)=0.0436 *6*; α(M)=0.01064 *15* α(N)=0.00285 *4*; α(O)=0.000679 *10*; α(P)=0.0001206 *17*; α(Q)=6.09×10^{-6} *9*
^{x}138.47 *3*	0.21 *6*								
142.328 *10*	0.44 *10*	325.210	1$^-$	182.878	2$^-$				
^{x}144.260 *21*	0.14 *3*					M1(+E2)	<0.7	7.6 *10*	α(K)=5.7 *11*; α(L)=1.45 *11*; α(M)=0.36 *4* α(N)=0.098 *11*; α(O)=0.0239 *22*; α(P)=0.0045 *3*; α(Q)=0.00028 *5* δ: α(K)exp=7.0 *22*.
152.69[kc]	≤0.33[kc]	179.156	4$^-$	26.427	3$^+$				
152.69[kc]	≤0.33[kc]	258.855	4$^-$	106.164	5$^+$				
153.192 *12*	0.43 *5*	215.521	3$^-$	62.330	4$^+$	(E1)		0.187	α(K)=0.1447 *21*; α(L)=0.0322 *5*; α(M)=0.00785 *11* α(N)=0.00210 *3*; α(O)=0.000503 *7*; α(P)=9.00×10^{-5} *13*; α(Q)=4.70×10^{-6} *7* Mult.: α(K)exp is consistent with E1 or E2(+M1). Placement in the level scheme requires Δπ=yes.
^{x}153.731 *11*	0.46 *4*					M1+E2	2.8 *3*	2.80 *13*	α(K)=0.82 *14*; α(L)=1.441 *23*; α(M)=0.396 *7* α(N)=0.1082 *18*; α(O)=0.0254 *4*; α(P)=0.00429 *7*; α(Q)=5.6×10^{-5} *6*
153.870 *9*	0.45 *10*	275.515	5$^+$	121.645	4$^+$				L1/K=0.054 *2*; L1:L2:L3=100:15 *1*:8.9 *15*; M1/L1=0.25 *1* α(K)exp=1.8 *4* Mult.: 1990Ho02 assign mult=M1+E2; however, the conversion data are not consistent. α(K)exp gives δ=1.7 *3*, L2/L1 gives δ=0.18 *4*, L3/L1 gives δ=0.42 *4*, and L1/K is not consistent with any multipolarity. Placement in the decay scheme involves ΔJ=1, Δπ=no.
155.731 *11*	0.22 *3*	373.684	1$^-$	217.949	0$^-$				
156.452 *2*	4.23 *22*	182.878	2$^-$	26.427	3$^+$	E1		0.1784	α(K)exp=0.14 *1* α(K)=0.1379 *20*; α(L)=0.0305 *5*; α(M)=0.00744 *11* α(N)=0.00199 *3*; α(O)=0.000477 *7*; α(P)=8.54×10^{-5} *12*; α(Q)=4.49×10^{-6} *7*
^{x}159.585 *21*	0.28 *5*					M1+E2	5.6 *+24−11*	2.07 *8*	α(K)=0.35 *8*; α(L)=1.248 *18*; α(M)=0.346 *6* α(N)=0.0944 *14*; α(O)=0.0221 *4*; α(P)=0.00370 *6*; α(Q)=3.3×10^{-5} *4*
^{x}160.642 *14*	0.37 *5*								
^{x}161.521 *4*	0.37 *5*								
163.29 *5*	0.28 *4*	342.396	5$^-$	179.156	4$^-$	M1+E2	6.26[†] *7*	1.86	α(K)=0.310 *5*; α(L)=1.130 *16*; α(M)=0.313 *5* α(N)=0.0855 *12*; α(O)=0.0200 *3*; α(P)=0.00335 *5*; α(Q)=2.93×10^{-5} *5* δ: From α(K)exp=0.31 *5*.
174.88 *3*	0.15 *11*	433.719	3$^+$,4$^+$	258.855	4$^-$	E1		0.1375	α(K)=0.1069 *15*; α(L)=0.0231 *4*; α(M)=0.00561 *8*

γ(^{238}Np) (continued)

E_γ [#]	I_γ [#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [@]	δ [i]	α [‡h]	Comments
									α(N)=0.001506 *21*; α(O)=0.000361 *5*; α(P)=6.51×10^{-5} *10*; α(Q)=3.52×10^{-6} *5*
176.62 *5*	0.17 *3*	312.707	5⁻	136.044	3⁻				
179.00 *3*	0.19 *4*	315.068	(4)⁺	136.044	3⁻				
182.876 *2*	13.9 *16*	182.878	2⁻	0.0	2⁺	E1		0.1239	M1/L1=0.17 *2*; α(K)exp=0.097 *13* α(K)=0.0965 *14*; α(L)=0.0206 *3*; α(M)=0.00502 *7* α(N)=0.001346 *19*; α(O)=0.000323 *5*; α(P)=5.84×10^{-5} *9*; α(Q)=3.20×10^{-6} *5*
184.38 *3*	0.24 *4*	367.26	2⁻	182.878	2⁻				
^{x}185.24 *3*	0.23 *5*								
^{x}188.05 *9*	0.34 *4*								
189.099 *6*	0.44 *4*	215.521	3⁻	26.427	3⁺	E1		0.1146	α(K)=0.0894 *13*; α(L)=0.0190 *3*; α(M)=0.00462 *7* α(N)=0.001238 *18*; α(O)=0.000297 *5*; α(P)=5.38×10^{-5} *8*; α(Q)=2.98×10^{-6} *5*
^{x}197.315 *14*	0.40 *15*					E1		0.1038	α(K)=0.0811 *12*; α(L)=0.01708 *24*; α(M)=0.00415 *6* α(N)=0.001114 *16*; α(O)=0.000268 *4*; α(P)=4.86×10^{-5} *7*; α(Q)=2.72×10^{-6} *4* Mult.: α(K)exp=0.09 *3*.
^{x}198.52 *3*	0.29 *4*								
215.517 *5*	0.81 *4*	215.521	3⁻	0.0	2⁺	E1		0.0847	α(K)=0.0664 *10*; α(L)=0.01376 *20*; α(M)=0.00334 *5* α(N)=0.000897 *13*; α(O)=0.000216 *3*; α(P)=3.94×10^{-5} *6*; α(Q)=2.25×10^{-6} *4* Mult.: α(K)exp=0.067 *7*.
217.26 *7*	0.30 *3*	529.857	3⁻	312.707	5⁻	E2		0.589	α(K)=0.1340 *19*; α(L)=0.332 *5*; α(M)=0.0915 *13* α(N)=0.0250 *4*; α(O)=0.00586 *9*; α(P)=0.000991 *14*; α(Q)=1.090×10^{-5} *16* Mult.: α(K)exp=0.12 *3*.
217.966[e] *20*	0.20[e] *3*	217.949	0⁻	0.0	2⁺	M2		10.57	α(K)=7.09 *10*; α(L)=2.56 *4*; α(M)=0.674 *10* α(N)=0.186 *3*; α(O)=0.0456 *7*; α(P)=0.00865 *13*; α(Q)=0.000607 *9* Mult.: L1/L2/L3 (exp)=100/15 *1*/13 *1*; L1/K(exp)=0.31 *3*.
218.17 *3*	0.28 *5*	433.719	3⁺,4⁺	215.521	3⁻				
^{x}218.56 *6*	0.29 *5*					M1+E2	1.41 *14*	1.27 *10*	α(K)=0.79 *10*; α(L)=0.353 *7*; α(M)=0.0928 *14* α(N)=0.0253 *4*; α(O)=0.00604 *10*; α(P)=0.001077 *22*; α(Q)=4.1×10^{-5} *5* δ: α(K)exp=0.79 *13*.
223.89 *10*	0.29 *4*	250.385	2⁻	26.427	3⁺	(E1)		0.0776	α(K)=0.0609 *9*; α(L)=0.01254 *18*; α(M)=0.00304 *5* α(N)=0.000817 *12*; α(O)=0.000197 *3*; α(P)=3.60×10^{-5} *5*; α(Q)=2.07×10^{-6} *3* Mult.: α(K)exp=0.10 *3*. Mult.: α(K)exp is consistent with mult=E1 or E2. Placement in the level scheme requires Δπ=yes.
232.433 *8*	0.29 *5*	258.855	4⁻	26.427	3⁺	E1		0.0712	α(K)exp=0.05 *2*

$^{238}_{93}Np_{145}$-10

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
									α(K)=0.0560 *8*; α(L)=0.01145 *16*; α(M)=0.00278 *4* α(N)=0.000746 *11*; α(O)=0.000180 *3*; α(P)=3.29×10^{-5} *5*; α(Q)=1.92×10^{-6} *3*
[x]233.650 *6*	0.243 *22*					M1+E2	1.50 *25*	0.99 *15*	α(K)=0.62 *14*; α(L)=0.275 *9*; α(M)=0.0722 *17* α(N)=0.0197 *5*; α(O)=0.00469 *12*; α(P)=0.00084 *3*; α(Q)=3.2×10^{-5} *7* δ: α(K)exp=0.67 *11*.
236.025 *11*	0.61 *5*	298.368	3$^+$	62.330	4$^+$	M1		2.13	α(K)=1.691 *24*; α(L)=0.332 *5*; α(M)=0.0806 *12* α(N)=0.0218 *3*; α(O)=0.00537 *8*; α(P)=0.001043 *15*; α(Q)=8.06×10^{-5} *12*
243.959 *4*	3.6 *4*	243.959	1$^+$	0.0	2$^+$	M1+E2	0.2 *9*	1.88 *79*	α(K)exp=1.5 *2* α(K)=1.49 *73*; α(L)=0.30 *5*; α(M)=0.073 *9* α(N)=0.0197 *23*; α(O)=0.0048 *7*; α(P)=0.00094 *18*; α(Q)=7.1×10^{-5} *34*
250.40[kb] *4*	≤0.41[kb]	250.385	2$^-$	0.0	2$^+$	(E1)[b]		0.0602	α(K)=0.0475 *7*; α(L)=0.00958 *14*; α(M)=0.00232 *4* α(N)=0.000624 *9*; α(O)=0.0001504 *21*; α(P)=2.76×10^{-5} *4*; α(Q)=1.637×10^{-6} *23* Mult.: α(K)exp is consistent with mult=E1 or E2. Placement in the level scheme requires $\Delta\pi$=yes.
250.40[kb]	≤0.41[kb]	312.707	5$^-$	62.330	4$^+$	[b]			
251.25 *4*	0.152 *21*	277.642	2$^+$	26.427	3$^+$	E2		0.354	α(K)=0.1047 *15*; α(L)=0.182 *3*; α(M)=0.0500 *7* α(N)=0.01365 *20*; α(O)=0.00321 *5*; α(P)=0.000546 *8*; α(Q)=7.50×10^{-6} *11* Mult.: α(K)exp=0.14 *3*.
[x]262.80 *8*	0.49 *4*								α(K)exp=0.076 *8* Mult.: 1990Ho02 assign mult=E2; however, α(K)=0.098 for E2 theory. The α(K)exp value is consistent with E1+M2 with δ=0.091 *12*.
[x]264.68 *3*	0.13 *3*					M1+E2	1.0 *2*	0.92 *14*	α(K)=0.66 *13*; α(L)=0.194 *11*; α(M)=0.0494 *21* α(N)=0.0134 *6*; α(O)=0.00325 *15*; α(P)=0.00060 *4*; α(Q)=3.3×10^{-5} *6* δ: α(K)exp=0.65 *13*.
271.953 *11*	0.44 *3*	298.368	3$^+$	26.427	3$^+$	M1		1.437	α(K)=1.140 *16*; α(L)=0.224 *4*; α(M)=0.0542 *8* α(N)=0.01467 *21*; α(O)=0.00361 *5*; α(P)=0.000702 *10*; α(Q)=5.42×10^{-5} *8* Mult.: α(K)exp=1.3 *2*.
277.633 *19*	0.25 *5*	277.642	2$^+$	0.0	2$^+$				
281.79 *10*	0.15 *4*	497.20	2$^-$,3$^-$	215.521	3$^-$	M1+E2	1.0 *+5−3*	0.77 *21*	α(K)=0.56 *19*; α(L)=0.159 *17*; α(M)=0.040 *4* α(N)=0.0109 *10*; α(O)=0.00265 *25*; α(P)=0.00049 *6*; α(Q)=2.74×10^{-5} *84* δ: α(K)exp=0.57 *18*.
289.04 *8*	0.16 *3*	395.198	5$^+$	106.164	5$^+$	M1+E2	0.9 *3*	0.77 *19*	α(K)=0.57 *17*; α(L)=0.151 *16*; α(M)=0.038 *4* α(N)=0.0103 *9*; α(O)=0.00250 *23*; α(P)=0.00047 *6*; α(Q)=2.76×10^{-5} *74* δ: α(K)exp==0.64 *16*.

$^{238}_{93}Np_{145}$-11

^{237}Np(n,γ) E=th:secondary γ's 1990Ho02 (continued)

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[i]	α[‡h]	Comments
294.178[m] *20*	0.21 *3*	473.3	(3⁻,4⁻)	179.156	4⁻	M1		1.156	α(K)=0.917 *13*; α(L)=0.180 *3*; α(M)=0.0435 *6* α(N)=0.01178 *17*; α(O)=0.00290 *4*; α(P)=0.000564 *8*; α(Q)=4.35×10^{-5} *6* Mult.: α(K)exp=1.1 *2*. Transition is unplaced by 1990Ho02. Placement is suggested by the evaluators as deexcitation of the 473.3 level reported by these authors in their arc work.
295.984 *15*	0.63 *5*	417.639	2⁺,3⁺	121.645	4⁺	E2		0.208	α(K)=0.0780 *11*; α(L)=0.0950 *14*; α(M)=0.0259 *4* α(N)=0.00707 *10*; α(O)=0.001665 *24*; α(P)=0.000286 *4*; α(Q)=5.03×10^{-6} *7* Mult.: α(K)exp=0.07 1S. Mult.: the authors assign mult=E1,E2, but α(K)exp is consistent only with E2, unless one invokes an M2 admixture with δ=0.114 *17*.
297.672 *15*	0.66 *8*	433.719	3⁺,4⁺	136.044	3⁻	E1		0.0410	α(K)=0.0325 *5*; α(L)=0.00638 *9*; α(M)=0.001544 *22* α(N)=0.000415 *6*; α(O)=0.0001003 *14*; α(P)=1.86×10^{-5} *3*; α(Q)=1.144×10^{-6} *16* Mult.: α(K)exp=0.03 *1*.
298.38 *4*	0.056 *6*	298.368	3⁺	0.0	2⁺	M1		1.111	α(K)=0.882 *13*; α(L)=0.1727 *25*; α(M)=0.0418 *6* α(N)=0.01133 *16*; α(O)=0.00279 *4*; α(P)=0.000542 *8*; α(Q)=4.18×10^{-5} *6* Mult.: α(K)exp=1.0 *3*.
ˣ302.65 *7*	0.19 *3*					E2+M1	4.4 *16*	0.24 *6*	α(K)=0.113 *50*; α(L)=0.091 *6*; α(M)=0.0245 *12* α(N)=0.0067 *3*; α(O)=0.00158 *8*; α(P)=0.000276 *17*; α(Q)=6.5×10^{-6} *23* δ: α(K)exp=0.13 *3*.
310.40[&] *8*	0.008[&] *3*	543.23	4⁻	232.823	5⁻	[M1]		0.997	α(K)=0.791 *11*; α(L)=0.1548 *22*; α(M)=0.0375 *6* α(N)=0.01015 *15*; α(O)=0.00250 *4*; α(P)=0.000485 *7*; α(Q)=3.75×10^{-5} *6*
ˣ314.168 *14*	0.23 *4*								
314.31[kf] *3*	≤0.209[kf]	497.20	2⁻,3⁻	182.878	2⁻	[f]			
314.31[kf] *3*	≤0.209[kf]	529.857	3⁻	215.521	3⁻	[f]			
ˣ328.89 *3*	0.13 *3*								
ˣ329.24 *10*	0.024 *6*					[M1]		0.847	α(K)=0.673 *10*; α(L)=0.1315 *19*; α(M)=0.0318 *5* α(N)=0.00862 *12*; α(O)=0.00212 *3*; α(P)=0.000412 *6*; α(Q)=3.18×10^{-5} *5* I_γ: 1990Ho02 show mult=M1+E2 in table I; however, the α(K) value used to get Iγ is that corresponding to mult=M1.
330.966 *19*	0.29 *8*	417.639	2⁺,3⁺	86.674	3⁺				
ˣ332.257 *13*	0.75 *5*					M1+E2	0.38[†] *10*	0.74 *5*	α(K)=0.58 *4*; α(L)=0.120 *5*; α(M)=0.0292 *10* α(N)=0.0079 *3*; α(O)=0.00194 *7*; α(P)=0.000375 *15*; α(Q)=2.76×10^{-5} *17* δ: From α(K)exp=0.58 *3*.

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[i]	α[‡h]	Comments
332.868 *16*	0.24 *3*	395.198	5^+	62.330	4^+	E2(+M1)	9.0 *2*	0.1540	α(K)=0.0701 *11*; α(L)=0.0615 *9*; α(M)=0.01662 *24* α(N)=0.00453 *7*; α(O)=0.001072 *15*; α(P)=0.000186 *3*; α(Q)=4.15×10^{-6} *6* δ: α(K)exp=0.07 *1*.
334.205 *13*	0.27 *8*	567.021	3^-	232.823	5^-	E2		0.1441	α(K)exp=0.05 *1* α(K)=0.0624 *9*; α(L)=0.0598 *9*; α(M)=0.01620 *23* α(N)=0.00442 *7*; α(O)=0.001044 *15*; α(P)=0.000181 *3*; α(Q)=3.78×10^{-6} *6*
^{x}341.760 *12*	0.36 *4*								
346.98 *1*	0.11 *3*	529.857	3^-	182.878	2^-	M1+E2	0.7[†] *4*	0.53 *15*	α(K)=0.41 *13*; α(L)=0.093 *16*; α(M)=0.023 *4* α(N)=0.0063 *9*; α(O)=0.00153 *23*; α(P)=0.00029 *5*; α(Q)=1.96×10^{-5} *60* δ: α(K)exp=0.4 *1*. δ: From α(K)exp=0.4 *1*.
351.37 *8*	0.34 *5*	567.021	3^-	215.521	3^-	E2		0.1247	α(K)exp=0.06 *1* α(K)=0.0569 *8*; α(L)=0.0497 *7*; α(M)=0.01342 *19* α(N)=0.00366 *6*; α(O)=0.000865 *13*; α(P)=0.0001505 *22*; α(Q)=3.38×10^{-6} *5*
358.25 *4*	0.34 *3*	523.87	5^+,4^+	165.59	5^+				Mult.: 1990Ho02 show mult=E2 for this transition; however, no ce data are available. The basis for this assignment is not given.
364.09 *4*	0.09 *3*	543.23	4^-	179.156	4^-				
^{x}368.41 *5*	0.32 *3*					M1+E2	0.97 *14*	0.37 *4*	α(K)=0.28 *4*; α(L)=0.070 *5*; α(M)=0.0175 *10* α(N)=0.0047 *3*; α(O)=0.00115 *7*; α(P)=0.000217 *14*; α(Q)=1.35×10^{-5} *16* δ: α(K)exp=0.28 *3*.
^{x}369.875 *15*	0.271 *24*								
^{x}373.03 *5*	0.85 *3*								
^{x}374.59[&] *7*	0.031[&] *6*					[M1]		0.595	α(K)=0.473 *7*; α(L)=0.0921 *13*; α(M)=0.0223 *4* α(N)=0.00604 *9*; α(O)=0.001487 *21*; α(P)=0.000289 *4*; α(Q)=2.23×10^{-5} *4*
^{x}380.302 *25*	0.014 *4*					[M1]		0.571	α(K)=0.453 *7*; α(L)=0.0884 *13*; α(M)=0.0214 *3* α(N)=0.00579 *9*; α(O)=0.001426 *20*; α(P)=0.000277 *4*; α(Q)=2.14×10^{-5} *3*
^{x}381.995 *19*	0.241 *25*								
384.12 *4*	0.191 *19*	567.021	3^-	182.878	2^-	M1+E2	0.93[†] *16*	0.34 *5*	α(K)=0.26 *4*; α(L)=0.063 *5*; α(M)=0.0156 *11* α(N)=0.0042 *3*; α(O)=0.00103 *8*; α(P)=0.000195 *15*; α(Q)=1.24×10^{-5} *17* δ: 0.26 *3*. δ: From α(K)exp=0.26 *3*.
391.27 *3*	0.37 *3*	417.639	2^+,3^+	26.427	3^+	M1+E2	1.3 *2*	0.25 *4*	α(K)=0.19 *3*; α(L)=0.052 *4*; α(M)=0.0130 *9* α(N)=0.00354 *24*; α(O)=0.00086 *6*; α(P)=0.000160 *13*; α(Q)=9.0×10^{-6} *14*

γ(^{238}Np) (continued)

$E_γ$[#]	$I_γ$[#j]	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.[@]	δ[i]	α[‡h]	Comments
									δ: α(K)exp=0.19 *3*. Mult.: the authors assign mult=M1; however, α(K)exp requires an E2 admixture.
^{x}405.213 *11*	0.27 *3*					M1		0.480	α(K)=0.382 *6*; α(L)=0.0743 *11*; α(M)=0.0180 *3* α(N)=0.00487 *7*; α(O)=0.001198 *17*; α(P)=0.000233 *4*; α(Q)=1.80×10^{-5} *3* Mult.: α(K)exp=0.26 *3*.
^{x}409.96 *3*	0.188 *22*								
417.60[kd]	≤0.031[kd]	417.639	$2^+,3^+$	0.0	2^+				
417.60[kd] *6*	≤0.031[kd]	523.87	$5^+,4^+$	106.164	5^+				
430.96 *3*	0.65 *8*	567.021	3^-	136.044	3^-	M1+E2	0.87[†] *22*	0.26 *5*	α(K)=0.20 *4*; α(L)=0.046 *6*; α(M)=0.0114 *12* α(N)=0.0031 *4*; α(O)=0.00076 *8*; α(P)=0.000144 *17*; α(Q)=9.6×10^{-6} *18* δ: 0.20 *3*. δ: From α(K)exp=0.20 *3*.
^{x}432.05 *1*	0.021 *6*					[M1]		0.403	α(K)=0.321 *5*; α(L)=0.0623 *9*; α(M)=0.01508 *22* α(N)=0.00408 *6*; α(O)=0.001005 *14*; α(P)=0.000195 *3*; α(Q)=1.506×10^{-5} *21*
^{x}442.74 *3*	0.026 *6*					[M1]		0.377	α(K)=0.300 *5*; α(L)=0.0583 *9*; α(M)=0.01410 *20* α(N)=0.00382 *6*; α(O)=0.000940 *14*; α(P)=0.000183 *3*; α(Q)=1.409×10^{-5} *20*
^{x}456.040 *13*	0.51 *3*								
461.59 *9*	0.36 *6*	523.87	$5^+,4^+$	62.330	4^+	M1+E2	0.93 *+25−20*	0.21 *4*	α(K)=0.16 *3*; α(L)=0.037 *4*; α(M)=0.0091 *9* α(N)=0.00247 *25*; α(O)=0.00060 *6*; α(P)=0.000114 *13*; α(Q)=7.6×10^{-6} *13* δ: α(K)exp=0.17 *3*.
^{x}469.17 *4*	0.15 *3*								
^{x}476.99 *3*	0.13 *4*					M1+E2	0.7 *5*	0.225 *74*	α(K)=0.175 *62*; α(L)=0.038 *9*; α(M)=0.0092 *21* α(N)=0.0025 *6*; α(O)=0.00061 *14*; α(P)=0.00012 *3*; α(Q)=8.3×10^{-6} *29* δ: α(K)exp=0.17 *5*.
^{x}478.79 *4*	0.38 *4*					M1+E2	0.4 *3*	0.27 *5*	α(K)=0.21 *4*; α(L)=0.043 *6*; α(M)=0.0104 *14* α(N)=0.0028 *4*; α(O)=0.00069 *9*; α(P)=0.000134 *19*; α(Q)=1.00×10^{-5} *19* δ: α(K)exp=0.21 *2*.
^{x}481.605 *19*	0.50 *4*					M1+E2	0.56 *25*	0.24 *4*	α(K)=0.19 *4*; α(L)=0.039 *5*; α(M)=0.0096 *11* α(N)=0.0026 *3*; α(O)=0.00064 *8*; α(P)=0.000123 *15*; α(Q)=8.9×10^{-6} *15* δ: α(K)exp=0.19 *2*.
^{x}482.60 *4*	0.45 *7*					M1+E2	0.5 *4*	0.25 *6*	α(K)=0.197 *51*; α(L)=0.040 *8*; α(M)=0.0098 *17* α(N)=0.0027 *5*; α(O)=0.00065 *12*; α(P)=0.000126 *24*; α(Q)=9.2×10^{-6} *24* δ: α(K)exp=0.19 *3*.

γ(^{238}Np) (continued)

$E_γ$[#]	$I_γ$[#j]	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.[@]	δ[i]	α[‡h]	Comments
^{x}483.75 *5*	0.44 *8*								
^{x}496.53 *4*	0.55 *9*					M1+E2	1.2 *2*	0.143 *21*	α(K)=0.108 *18*; α(L)=0.026 *3*; α(M)=0.0066 *6* α(N)=0.00178 *16*; α(O)=0.00043 *4*; α(P)=8.2×10^{-5} *8*; α(Q)=5.2×10^{-6} *8* δ: α(K)exp=0.11 *2*.
497.49 *5*	0.43 *4*	523.87	5$^+$,4$^+$	26.427	3$^+$				
^{x}530.61 *10*	0.34 *7*								
^{x}538.39 *5*	0.32 *3*					M1(+E2)	≤0.5	0.204 *19*	α(K)=0.162 *16*; α(L)=0.0320 *23*; α(M)=0.0078 *6* α(N)=0.00210 *15*; α(O)=0.00052 *4*; α(P)=0.000100 *8*; α(Q)=7.6×10^{-6} *7* δ: α(K)exp=0.17 *2*.
^{x}541.28 *4*	0.37 *7*					M1+E2	0.9 *3*	0.14 *4*	α(K)=0.108 *28*; α(L)=0.024 *4*; α(M)=0.0059 *10* α(N)=0.0016 *3*; α(O)=0.00039 *7*; α(P)=7.4×10^{-5} *13*; α(Q)=5.1×10^{-6} *13* δ: α(K)exp=0.11 *2*.
^{x}551.64 *5*	0.29 *3*								
^{x}554.62 *7*	0.33 *4*								
^{x}555.16 *6*	0.39 *8*					M1+E2	0.9 *3*	0.13 *3*	α(K)=0.101 *26*; α(L)=0.022 *4*; α(M)=0.0055 *9* α(N)=0.00148 *24*; α(O)=0.00036 *6*; α(P)=6.9×10^{-5} *13*; α(Q)=4.8×10^{-6} *12* δ: α(K)exp=0.10 *2*.
^{x}555.50 *6*	0.394 *25*								
^{x}557.45 *7*	0.37 *3*					M1+E2	1.7 *2*	0.081 *9*	α(K)=0.060 *7*; α(L)=0.0158 *11*; α(M)=0.00398 *25* α(N)=0.00108 *7*; α(O)=0.000262 *17*; α(P)=4.9×10^{-5} *4*; α(Q)=2.9×10^{-6} *4* δ: α(K)exp=0.06 *1*.
^{x}565.31 *5*	0.40 *4*					M1+E2	0.7 *2*	0.143 *21*	α(K)exp=0.11 *1* α(K)=0.112 *17*; α(L)=0.023 *3*; α(M)=0.0057 *6* α(N)=0.00155 *17*; α(O)=0.00038 *4*; α(P)=7.3×10^{-5} *9*; α(Q)=5.3×10^{-6} *8*
^{x}571.25 *3*	0.36 *5*								
^{x}582.53 *6*	0.20 *3*								
584.47 *5*	0.4 *1*	646.76	2$^+$,3$^+$	62.330	4$^+$				
^{x}588.92 *5*	0.95 *15*								
^{x}592.92 *6*	0.19 *4*								
^{x}602.50 *3*	0.61 *7*								
^{x}603.23 *5*	0.41 *4*					M1+E2	1.7 *2*	0.066 *7*	α(K)exp=0.05 *1* α(K)=0.049 *6*; α(L)=0.0126 *9*; α(M)=0.00317 *21* α(N)=0.00086 *6*; α(O)=0.000209 *14*; α(P)=3.9×10^{-5} *3*; α(Q)=2.4×10^{-6} *3*
^{x}606.73 *4*	0.44 *5*								
^{x}609.07 *8*	0.15 *4*								
^{x}612.86 *5*	0.32 *5*					M1+E2	1.06[†] *20*	0.091 *14*	α(K)=0.070 *11*; α(L)=0.0156 *17*; α(M)=0.0038 *4*

γ(^{238}Np) (continued)

E_γ[#]	I_γ[#j]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[i]	α[‡h]	Comments
									α(N)=0.00104 *11*; α(O)=0.00025 *3*; α(P)=4.8×10^{-5} *6*; α(Q)=3.3×10^{-6} *5* δ: From α(K)exp=0.07 *1*.
^{x}614.09 *6*	0.16 *3*								
620.28 *6*	0.63 *8*	646.76	2$^+$,3$^+$	26.427	3$^+$	M1+E2	0.97 *21*	0.093 *15*	α(K)=0.072 *12*; α(L)=0.0157 *19*; α(M)=0.0039 *5* α(N)=0.00105 *12*; α(O)=0.00026 *3*; α(P)=4.9×10^{-5} *6*; α(Q)=3.4×10^{-6} *6*
^{x}625.73 *5*	0.184 *22*								
^{x}630.54 *7*	0.20 *3*								
^{x}633.56 *9*	0.14 *3*								
646.75 *7*	0.55 *5*	646.76	2$^+$,3$^+$	0.0	2$^+$	E2(+M1)	≥1.9	0.040 *12*	α(K)exp=0.03 *1* α(K)=0.0285 *98*; α(L)=0.0083 *16*; α(M)=0.0021 *4* α(N)=0.00057 *10*; α(O)=0.000139 *25*; α(P)=2.6×10^{-5} *5*; α(Q)=1.37×10^{-6} *45*
^{x}648.27 *8*	0.50 *7*								

† Deduced by evaluators using conversion-electron in 1990Ho02 data and a minimization procedure (Program BRICCMixing), except as noted.

‡ Theoretical values listed here are from 2002Ba85, and have been interpolated using the computer code bricc (Band Raman Internal Conversion Coefficients) (2005KiZT).

From 1990Ho02. The Iγ are in units of photons per 100 neutron captures.

@ From experimental conversion coefficient and subshell ratio data of 1990Ho02.

& No photon is observed, and only an L1 subshell or K ce peak is seen. 1990Ho02 assume mult=M1 to deduce Eγ and Iγ. In such cases mult=E0, E3 or higher or M2 or higher would be possible but much less likely.

a 1990Ho02 report E=109.614 *4* with Iγ=1.09 *24* and α(L1)exp=0.06 *1* for this doubly placed transition. Placement from the 136 level requires mult=E1(+M2), and placement from the 342 level requires mult=M1 or E2. Comparison of α(L1)exp with the theory values of 0.038 (E1), 0.233 (E2), and 2.80 (M1) suggests that most of the intensity of this transition belongs with the 136 level. From Iγ(109γ)/Iγ(67γ)≤1.23 *10* from the 342 level in α decay, one obtains Iγ(109γ)≤0.32 for placement from the 342 level in (n,γ), leaving Iγ(109γ)=0.9 *3* for placement from the 136 level in (n,γ).

b 1990Ho02 report E=250.40 *4* with Iγ=0.35 *6* and α(K)exp=0.13 *3* for this doubly placed transition. Both placements require mult=E1(+M2); however, the α(K)exp gives δ=0.13 *+2−3*, an unusually large value. The authors observe a 250.33 transition in α decay, with a placement requiring mult=M1 or E2. A 5% contribution to the 250.44 peak from the 250.33 transition would yield the observed K-shell conversion coefficient.

c 1990Ho02 report E=152.69 *3* with Iγ=0.29 *4* for this doubly placed transition. The authors assign a tentative mult of E1, probably based on the absence of any ce lines. Both placements of this transition involve ΔJ=1, Δπ=yes.

d 1990Ho02 report E=417.60 *6* with Iγ=0.025 *6* for this doubly placed transition. No photon has been seen, and this intensity has been deduced by the authors from I(ce(K)) with the assumption of mult=M1. Both placements involve ΔL=0,1 and Δπ=no.

e No photon has been detected. Eγ and Iγ are obtained from the ce data and the deduced multipolarity.

f 1990Ho02 report E=314.31 *3* with Iγ=0.185 *24* and α(K)exp=0.46 *7* for this doubly placed transition. α(K)exp is consistent with mult=M1,E2 required for both placements.

$^{238}_{93}$Np$_{145}$-16

γ(^{238}Np) (continued)

[g] Authors′ value, deduced from I(ce(L2)) and α(L2), is reevaluated by the evaluators to correspond to the corrected theoretical α(L2). See the general comment at the head of the γ listing.
[h] Additional information 3.
[i] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.
[j] Intensity per 100 neutron captures.
[k] Multiply placed with undivided intensity.
[l] Multiply placed with intensity suitably divided.
[m] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

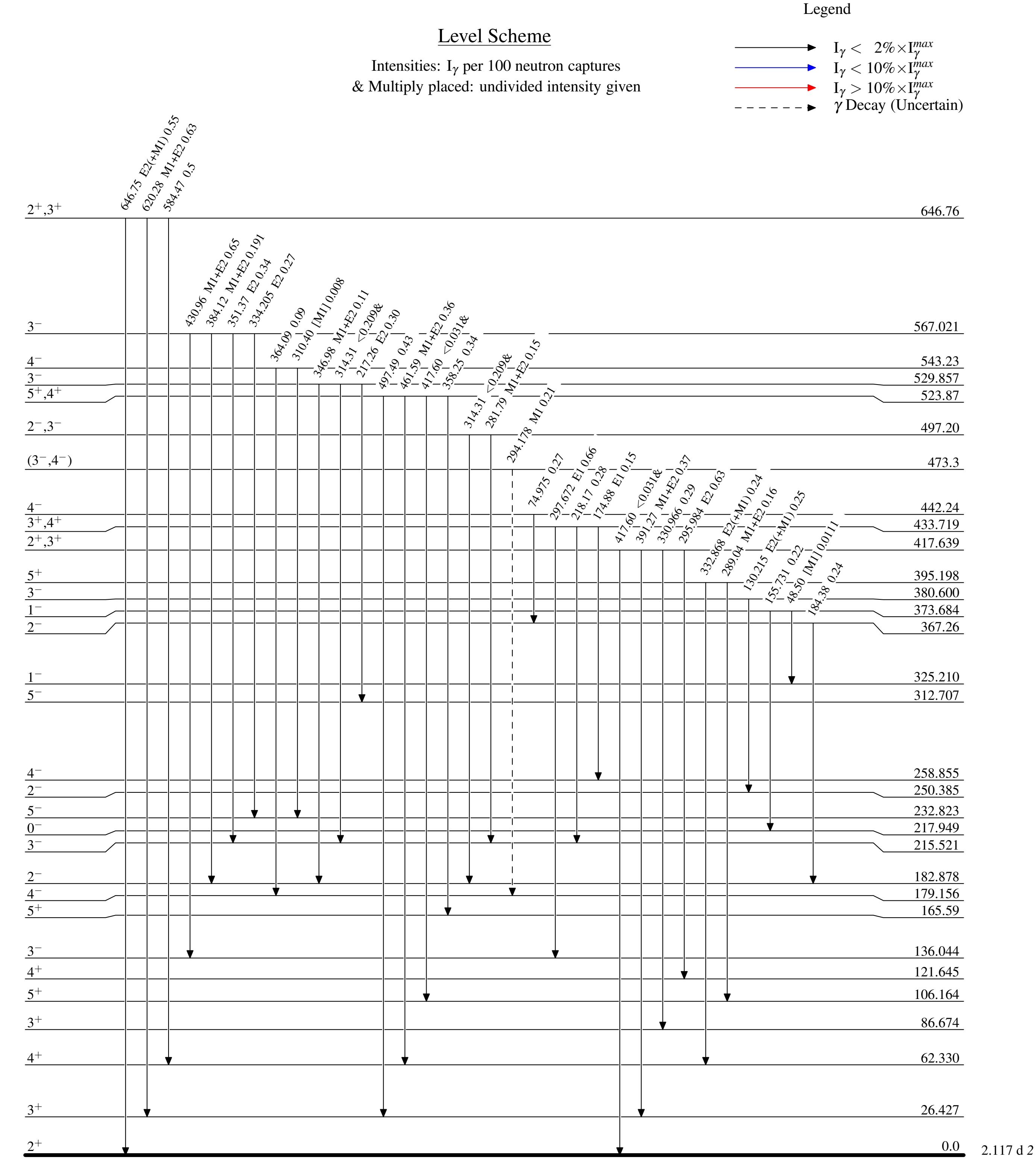
$^{238}_{93}Np_{145}$-17

$^{237}Np(n,\gamma)$ E=th:secondary γ's 1990Ho02

Level Scheme

Intensities: I_γ per 100 neutron captures

& Multiply placed: undivided intensity given



$^{238}_{93}Np_{145}$

^{237}Np(n,γ) E=th:secondary γ's 1990Ho02

Level Scheme (continued)

Intensities: I_γ per 100 neutron captures

& Multiply placed: undivided intensity given

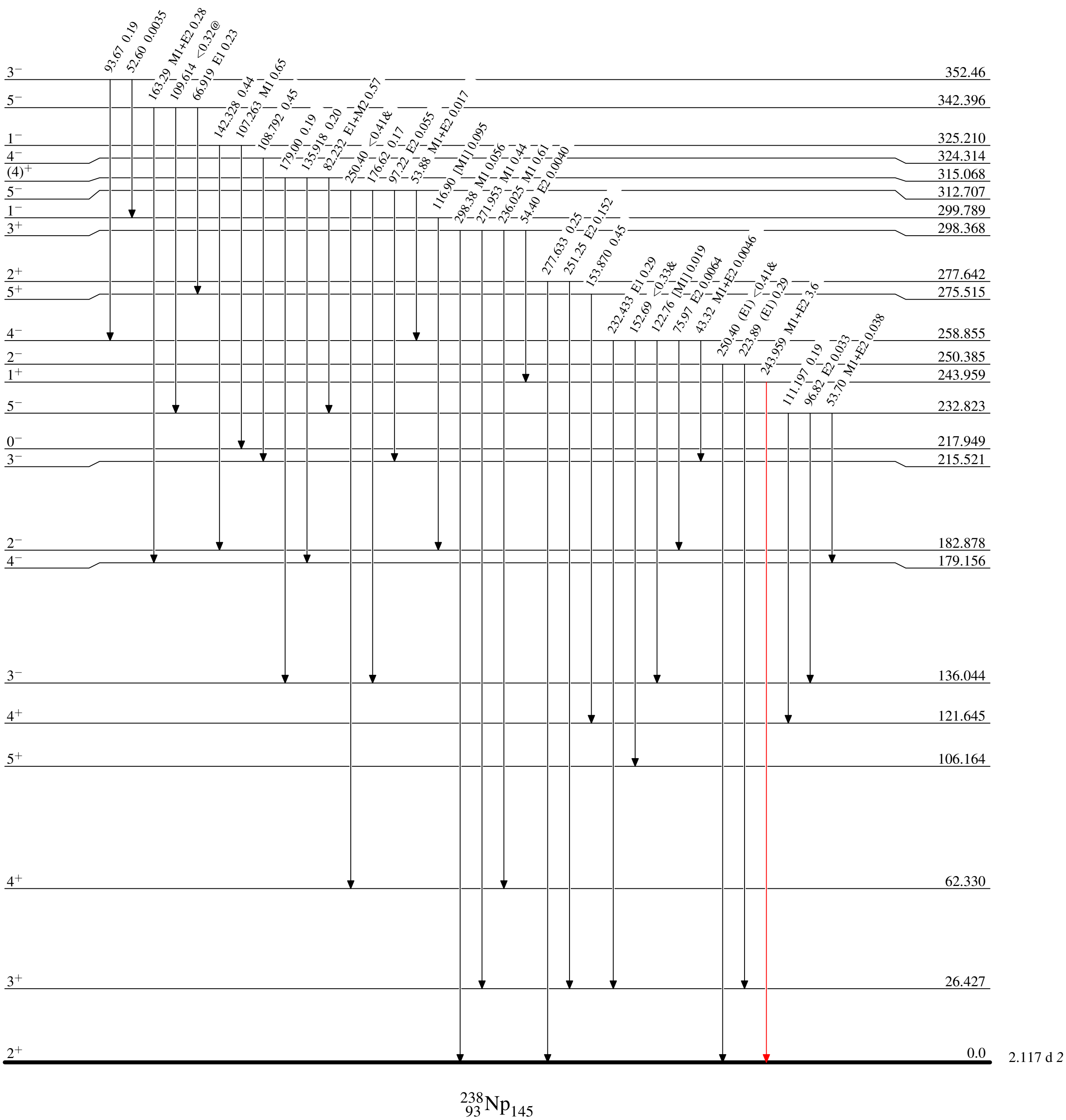
@ Multiply placed: intensity suitably divided

Legend

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

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

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



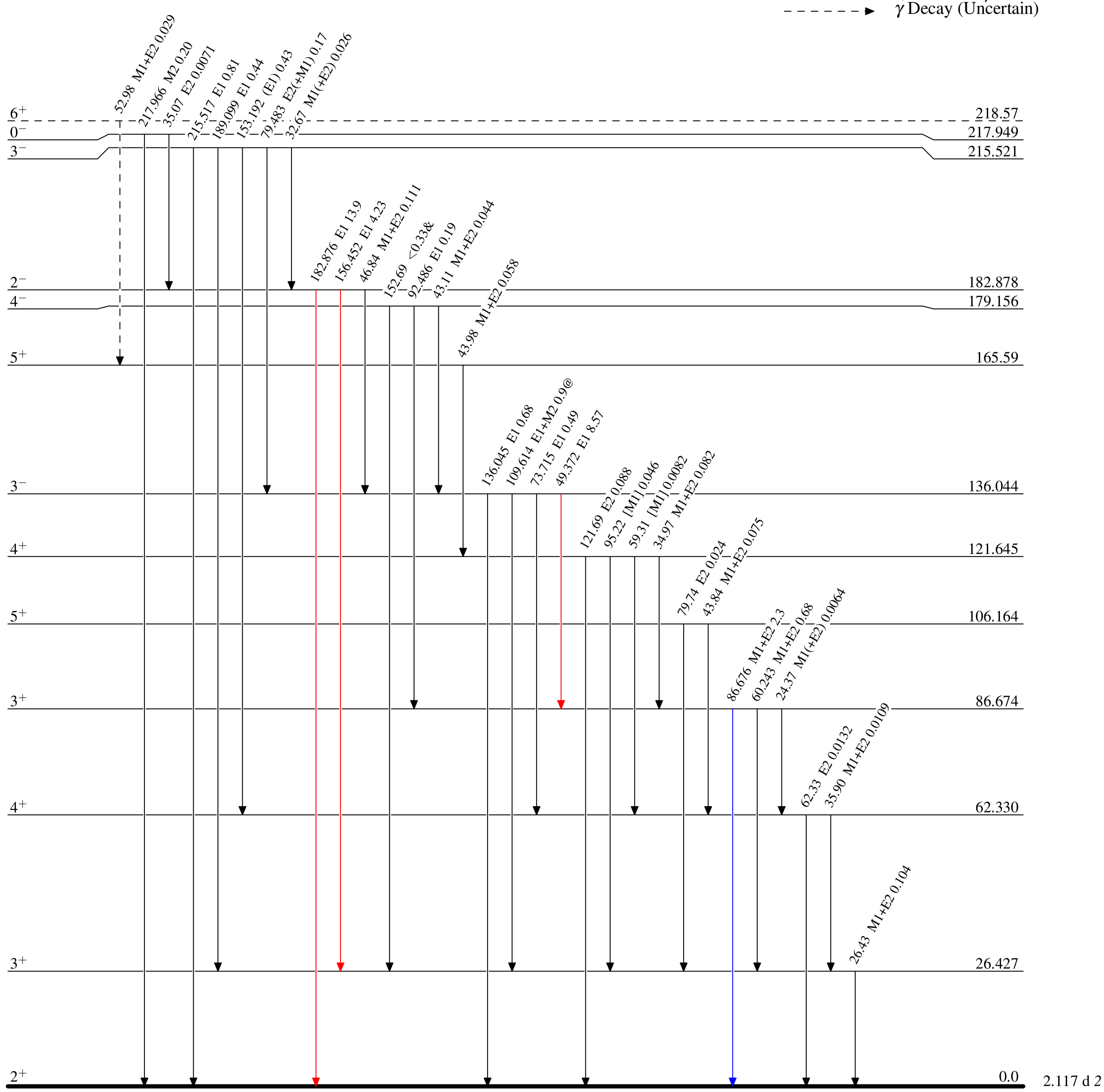
^{237}Np(n,γ) E=th:secondary γ's 1990Ho02

Level Scheme (continued)

Intensities: I_γ per 100 neutron captures
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

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



$^{238}_{93}Np_{145}$