(HI,xnγ) 1977An04,1985Ba48,1991Ku12

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	V. S. Shirley	NDS 75,377 (1995)	1-Oct-1993

1977An04: ^{165}Ho(^{12}C,4nγ), E(^{12}C)=60-76 MeV; ^{175}Lu(α,6nγ), E(α)=73 MeV. Measured Eγ, Iγ (Ge(Li)), prompt and delayed γγ coin, αγ(θ).

1985Ba48: ^{159}Tb(^{18}O,4nγ), E(^{18}O)=84 MeV; ^{124}Sn(^{51}V,2nγ), E(^{51}V)=230 MeV. Measured Eγ, Iγ (Ge(Li), Compton suppressed Ge(Li)), γγ coin, γ-ray angular distributions.

1991Ku12: ^{165}Ho(^{12}C,4nγ), E(^{12}C)=64 MeV, θ=125°. Metallic holmium targets. Measured Eγ, Iγ (high-purity germanium (FWHM=2.0 keV at 1.3 MeV), Si(Li) (FWHM=250 eV at 5.9 keV), NaI), prompt and delayed γγ coin.

The level scheme is from 1985Ba48, except for modifications necessitated by the inversion of the 130.2γ-35.7γ cascade (1991Ku12,1991KuZN), and for additions from 1977An04.

^{173}Ta Levels

E(level)	Jπ†	$T_{1/2}$	Comments
0.0‡	5/2−		
0.0+x#	5/2+		
83.50‡ *10*	9/2−		
109.51+x#	7/2+		
130.27+x@	7/2+	≤5 ns	$T_{1/2}$: γγ(t) (1991Ku12).
166.00+x&	9/2−	225 ns *15*	$T_{1/2}$: γγ(t) (1991Ku12). Other: 1977An04.
245.86+x#	9/2+		
260.43+x@	9/2+		
270.01‡ *14*	13/2−		
305.97+x&	11/2−		
408.27+x#	11/2+		
414.59+x@	11/2+		
471.95+x&	13/2−		
560.8‡ *4*	17/2−		
590.32+x@	13/2+		
593.40+x#	13/2+		
634?ab *2*	9/2−c		
661.46+x&	15/2−		
785.64+x@	15/2+		
801.28+x#	15/2+		
874.3+x&	17/2−		
877?ab *2*	11/2−c		
887.2‡b *4*	15/2−		
950.8‡ *6*	21/2−		
997.7+x@	17/2+		
1026.2+x#	17/2+		
1105.3+x& *3*	19/2−		
1224.8+x@	19/2+		
1271.0+x#	19/2+		
1294?‡b *2*	19/2−		
1304?ab *2*	15/2−c		
1358.0+x&	21/2−		

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(HI,xnγ) 1977An04,1985Ba48,1991Ku12 (continued)

^{173}Ta Levels (continued)

E(level)	J^{π}[†]	$T_{1/2}$	Comments
1431.9[‡] *6*	$25/2^-$		
1464.9+x[@]	$21/2^+$		
1526.8+x[#]	$21/2^+$		
1622.0+x[&]	$23/2^-$		
1713.6+x[b] *4*	$(21/2^-)$	≈100 ns	J^{π}: from timing and coincidence data (1977An04). A three quasiparticle state with $J^{\pi}=21/2^-$, as in ^{175}Ta and ^{177}Ta, is predicted to be at 1700 keV. $T_{1/2}$: γγ(t) (1977An04).
1717.0+x[@]	$23/2^+$		
1800.9+x[#]	$23/2^+$		
1824?[‡b] *2*	$23/2^-$		
1875?[ab] *2*	$21/2^-$[c]		
1906.1+x[&]	$25/2^-$		
1980.8+x[@]	$25/2^+$		
1995.3[‡] *8*	$29/2^-$		
2068.3+x[#]	$25/2^+$		
2194.3+x[&]	$27/2^-$		
2255.4+x[@]	$27/2^+$		
2354.4+x[#]	$27/2^+$		
2499.6+x[&]	$29/2^-$		
2541.3+x[@]	$29/2^+$		
2631.5[‡] *9*	$33/2^-$		
2801.5+x[&]	$(31/2^-)$		
2839.4+x[@]	$31/2^+$		
3107.5+x[&] *6*	$(33/2^-)$		
3148.4+x[@]	$33/2^+$		
3324.4[‡] *10*	$37/2^-$		
3381.6+x[&]	$(35/2^-)$		
3468.4+x[@]	$35/2^+$		
3640.5+x[&]	$(37/2^-)$		
3798.0+x[@]	$(37/2^+)$		
4029.7[‡] *10*	$(41/2^-)$		
4131.4+x[@]	$(39/2^+)$		
4727.2[‡] *11*	$(45/2^-)$		

[†] From transition multipolarities and fits of γ-ray cascades into rotational bands built on the 1/2[541], 9/2[514], 5/2[402], and 7/2[404] Nilsson orbitals (1985Ba48). The interpretation is based largely on analogies with the heavier odd-mass Ta isotopes.
[‡] 1/2[541] band.
[#] 5/2[402] band. x<10 keV (1991KuZN).
[@] 7/2[404] band. x<10 keV (1991KuZN).
[&] 9/2[514] band. x<10 keV (1991KuZN).
[a] 3/2[532] band.
[b] Added from 1977An04.
[c] Assigned to 3/2[532] band on basis of level spacings deduced from feedings to 1/2[541] band (1977An04).

(HI,xnγ) 1977An04,1985Ba48,1991Ku12 (continued)

γ(^{173}Ta)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	Comments
0.0+x	5/2$^+$	(≤10)		0.0	5/2$^-$			
83.50	9/2$^-$	83.50 *5*	28.9 *20*	0.0	5/2$^-$	E2		
109.51+x	7/2$^+$	109.55 *5*	61 *3*	0.0+x	5/2$^+$	M1+E2	0.35 *5*	
130.27+x	7/2$^+$	130.19 *5*	49.5 *20*	0.0+x	5/2$^+$	M1[c]		
166.00+x	9/2$^-$	35.65 *5*	116 *8*	130.27+x	7/2$^+$	E1+M2[c]	≈0.045[c]	
		166.08 *5*	7.2 *3*	0.0+x	5/2$^+$	(M2)[c]		
245.86+x	9/2$^+$	136.32 *5*	51.9 *20*	109.51+x	7/2$^+$	M1+E2	0.25 *5*	
		245.82 *5*	9.4 *5*	0.0+x	5/2$^+$	(E2)		
260.43+x	9/2$^+$	130.24 *5*	50.5 *21*	130.27+x	7/2$^+$			
270.01	13/2$^-$	186.51 *5*	179 *8*	83.50	9/2$^-$	E2		
305.97+x	11/2$^-$	139.96 *5*	74 *3*	166.00+x	9/2$^-$	M1+E2	0.35 *5*	
408.27+x	11/2$^+$	162.38 *5*	51.6 *21*	245.86+x	9/2$^+$	M1+E2	0.25 *5*	
		298.86 *5*	46.7 *24*	109.51+x	7/2$^+$	E2		
414.59+x	11/2$^+$	154.10 *5*	60 *3*	260.43+x	9/2$^+$	M1+E2	0.66 *10*	
		284.24 *5*	57 *3*	130.27+x	7/2$^+$	(E2)		
471.95+x	13/2$^-$	165.90 *5*	74 *3*	305.97+x	11/2$^-$	M1+E2	0.35 *5*	
		305.96 *5*	16.4 *9*	166.00+x	9/2$^-$	(E2)		
560.8	17/2$^-$	290.8[@] *2*	90.2[a]	270.01	13/2$^-$	E2		
590.32+x	13/2$^+$	175.68 *5*	33.5 *14*	414.59+x	11/2$^+$	(M1+E2)		
		330.01 *5*	58 *3*	260.43+x	9/2$^+$	E2		
593.40+x	13/2$^+$	185.11 *5*	60 *3*	408.27+x	11/2$^+$	(M1+E2)		
		347.24 *5*	28.5 *15*	245.86+x	9/2$^+$	E2		
634?	9/2$^-$	364[&f] *1*		270.01	13/2$^-$			
661.46+x	15/2$^-$	189.45 *5*	44.8 *19*	471.95+x	13/2$^-$	M1+E2	0.20 *5*	
		355.56[e] *5*	21.8[e] *12*	305.97+x	11/2$^-$	E2		
785.64+x	15/2$^+$	195.40 *5*	15.7 *7*	590.32+x	13/2$^+$	M1+E2	0.30 *10*	
		370.99 *5*	59 *4*	414.59+x	11/2$^+$	E2		
801.28+x	15/2$^+$	207.76 *5*	36.9 *23*	593.40+x	13/2$^+$	M1+E2	0.20 *5*	
		393.17 *5*	37.9 *22*	408.27+x	11/2$^+$	E2		
874.3+x	17/2$^-$	213.0[@] *2*	24.3[ab]	661.46+x	15/2$^-$	(M1+E2)	0.25 *5*	Iγ(213.0γ)/Iγ(402.3γ)=2.2 (1977An04).
		402.3[@] *2*	14.6[a]	471.95+x	13/2$^-$	E2		I_γ: see comment with 213.0γ.
877?	11/2$^-$	607[&f] *1*		270.01	13/2$^-$			
887.2	15/2$^-$	617.2[&] *2*		270.01	13/2$^-$			
950.8	21/2$^-$	390.0[@] *2*	62.9[a]	560.8	17/2$^-$	E2		
997.7+x	17/2$^+$	212.7[@] *2*	6.8[ab]	785.64+x	15/2$^+$	(M1+E2)		Iγ(212.7γ)/Iγ(407.2γ)=0.57 (1977An04).
		407.2[@] *2*	30.0[a]	590.32+x	13/2$^+$	E2		I_γ: see comment with 212.7γ.
1026.2+x	17/2$^+$	225.0[@] *2*	9.4[a]	801.28+x	15/2$^+$	M1+E2	0.05 *10*	
		432.6[@] *2*	12.8[a]	593.40+x	13/2$^+$	E2		
1105.3+x	19/2$^-$	231.1[@] *2*	24.2[a]	874.3+x	17/2$^-$	M1+E2	0.25 *5*	Iγ(231.1γ)/Iγ(443.8γ)=1.0 (1977An04).
		443.8[@] *2*	16.5[a]	661.46+x	15/2$^-$	E2		I_γ: see comment with 231.1γ.
1224.8+x	19/2$^+$	227.1[@] *2*	3.9[a]	997.7+x	17/2$^+$	M1+E2	0.25 *20*	
		438.8[@] *3*	23.6[a]	785.64+x	15/2$^+$	E2		
1271.0+x	19/2$^+$	244.9[@] *2*	7.1[ab]	1026.2+x	17/2$^+$	(M1+E2)	0.15 *10*	Iγ(244.9γ)/Iγ(469.7γ)=0.91 (1977An04).
		469.7[@] *2*	12.9[a]	801.28+x	15/2$^+$	E2		I_γ: see comment with 244.9γ.
1294?	19/2$^-$	407[&f] *1*		887.2	15/2$^-$			
		733[&f] *1*		560.8	17/2$^-$			

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(HI,xnγ) 1977An04,1985Ba48,1991Ku12 (continued)

γ(^{173}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	Comments
1304?	15/2⁻	743[&f] *1*		560.8	17/2⁻			
1358.0+x	21/2⁻	252.6[@] *2*	13.5[ab]	1105.3+x	19/2⁻	(M1+E2)	0.15 *5*	
		483.6[@] *2*	11.5[a]	874.3+x	17/2⁻	E2		
1431.9	25/2⁻	481.1[@] *2*	40.7[a]	950.8	21/2⁻	E2		
1464.9+x	21/2⁺	240.0[@] *2*	1.5[a]	1224.8+x	19/2⁺	M1+E2	0.35 *10*	
		467.2[@] *2*	14.7[a]	997.7+x	17/2⁺	E2		
1526.8+x	21/2⁺	255.9[@] *2*	4.6[a]	1271.0+x	19/2⁺	M1+E2	0.12 *7*	Iγ(255.9γ)/Iγ(500.5γ)=0.59 (1977An04).
		500.5[@] *2*	11.8[a]	1026.2+x	17/2⁺	E2		I_γ: see comment with 255.9γ.
1622.0+x	23/2⁻	264.0[@] *2*	18.1[a]	1358.0+x	21/2⁻	M1+E2	0.15 *5*	
		516.3[@] *4*	20.8[a]	1105.3+x	19/2⁻	E2		
1713.6+x	(21/2⁻)	355.56[e] *5*	11.7[ea]	1358.0+x	21/2⁻	E2		
		608.6[&] *2*		1105.3+x	19/2⁻			
		840[&] *1*		874.3+x	17/2⁻			
1717.0+x	23/2⁺	251.6[@] *6*	<1[ab]	1464.9+x	21/2⁺	(M1+E2)		Iγ(251.6γ)/Iγ(492.3γ)=0.42 (1977An04).
		492.3[@] *2*	15.0[a]	1224.8+x	19/2⁺	E2		I_γ: see comment with 251.6γ.
1800.9+x	23/2⁺	274.0[@] *4*	2.1[ab]	1526.8+x	21/2⁺	(M1+E2)	0.15 *5*	Iγ(274.0γ)/Iγ(530.0γ)=1.5 (1977An04).
		530.0[@] *6*	7.8[a]	1271.0+x	19/2⁺	E2		I_γ: see comment with 274.0γ.
1824?	23/2⁻	873[&f] *1*		950.8	21/2⁻			
1875?	21/2⁻	924[&f] *1*		950.8	21/2⁻			
1906.1+x	25/2⁻	284.1[@] *2*	15.0[ab]	1622.0+x	23/2⁻	(M1+E2)		
		548.1[@] *2*	15.2[a]	1358.0+x	21/2⁻	E2		
1980.8+x	25/2⁺	515.9[@] *2*	20.8[a]	1464.9+x	21/2⁺	E2		
1995.3	29/2⁻	563.4[@] *2*	27.1[a]	1431.9	25/2⁻	E2		
2068.3+x	25/2⁺	267.3[@] *4*	<1[ab]	1800.9+x	23/2⁺	(M1+E2)		
		542.0[@] *9*	7.8[a]	1526.8+x	21/2⁺	E2		
2194.3+x	27/2⁻	288.3[@] *3*	12.3[a]	1906.1+x	25/2⁻	(M1+E2)		
		572.2[@] *2*	12.1[a]	1622.0+x	23/2⁻	E2		
2255.4+x	27/2⁺	538.4[@] *2*	10.5[a]	1717.0+x	23/2⁺	E2		
2354.4+x	27/2⁺	286.1[@] *2*	<1[ab]	2068.3+x	25/2⁺	(M1+E2)		
		553.5[@] *2*	3.5[a]	1800.9+x	23/2⁺	E2		
2499.6+x	29/2⁻	302.0[d@] *2*	8.3[da]	2194.3+x	27/2⁻	(M1+E2)		
		593.5[@] *2*	4.5[a]	1906.1+x	25/2⁻	E2		
2541.3+x	29/2⁺	560.5[@] *2*	17.0[a]	1980.8+x	25/2⁺	E2		
2631.5	33/2⁻	636.2[@] *2*	10.8[a]	1995.3	29/2⁻	E2		
2801.5+x	(31/2⁻)	302.0[d@] *2*	8.3[da]	2499.6+x	29/2⁻	M1+E2	0.15 *5*	
		607.9[d@] *2*	9.3[da]	2194.3+x	27/2⁻	(E2)		I_γ: see comment with 607.1γ.
2839.4+x	31/2⁺	584.0[@] *2*	7.0[a]	2255.4+x	27/2⁺	E2		
3107.5+x	(33/2⁻)	305.96[d] *5*	11.9[da]	2801.5+x	(31/2⁻)	(M1+E2)		
		607.9[d@] *2*	9.3[da]	2499.6+x	29/2⁻	(E2)		
3148.4+x	33/2⁺	607.1[@] *2*	9.3[a]	2541.3+x	29/2⁺	(E2)		I_γ: combined intensity for 607.1γ and 607.9γ (two placements).
3324.4	37/2⁻	692.9[@] *2*	6.0[a]	2631.5	33/2⁻	E2		

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(HI,xnγ) 1977An04,1985Ba48,1991Ku12 (continued)

γ(^{173}Ta) (continued)

E_i(level)	J_i^π	E_γ [†]	I_γ [‡]	E_f	J_f^π	Mult.[#]	δ[#]
3381.6+x	(35/2⁻)	274.1[@] *2*	2.9[ab]	3107.5+x	(33/2⁻)	(M1+E2)	0.15 *5*
		580.6[@] *2*	4.8[ab]	2801.5+x	(31/2⁻)	(E2)	
3468.4+x	35/2⁺	629.0[@] *2*	5.4[ab]	2839.4+x	31/2⁺	(E2)	
3640.5+x	(37/2⁻)	259.3[@] *2*	3.0[ab]	3381.6+x	(35/2⁻)	(M1+E2)	
		532.5[@] *2*	5.2[ab]	3107.5+x	(33/2⁻)	(E2)	
3798.0+x	(37/2⁺)	649.6[@] *2*	2.5[ab]	3148.4+x	33/2⁺	(E2)	
4029.7	(41/2⁻)	705.3[@] *2*	3.9[ab]	3324.4	37/2⁻	(E2)	
4131.4+x	(39/2⁺)	663.0[@] *2*	1.7[ab]	3468.4+x	35/2⁺	(E2)	
4727.2	(45/2⁻)	697.5[@] *2*	2.3[ab]	4029.7	(41/2⁻)	(E2)	

† From 1991Ku12 except where noted. ΔE (all authors) estimated by evaluator from precision of authors′ energies.
‡ Arbitrary units (1991Ku12), except where noted. Differing experimental conditions make Iγ meaningless when considering the entire γ-ray spectrum. However, relative branchings from each level are mutually consistent and totally valid.
# From γ-ray angular distributions except where noted (1985Ba48). Quadrupole transitions based on positive A_2 are assumed to be stretched E2; dipole transitions based on negative A_2 and placement relative to cascading E2 γ′s are assumed to be M1+E2.
@ Average from 1977An04 and 1985Ba48.
& From 1977An04.
a From 1985Ba48.
b From coincidence spectra (1977An04,1985Ba48).
c From ^{173}W ε decay.
d Multiply placed with undivided intensity.
e Multiply placed with intensity suitably divided.
f Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

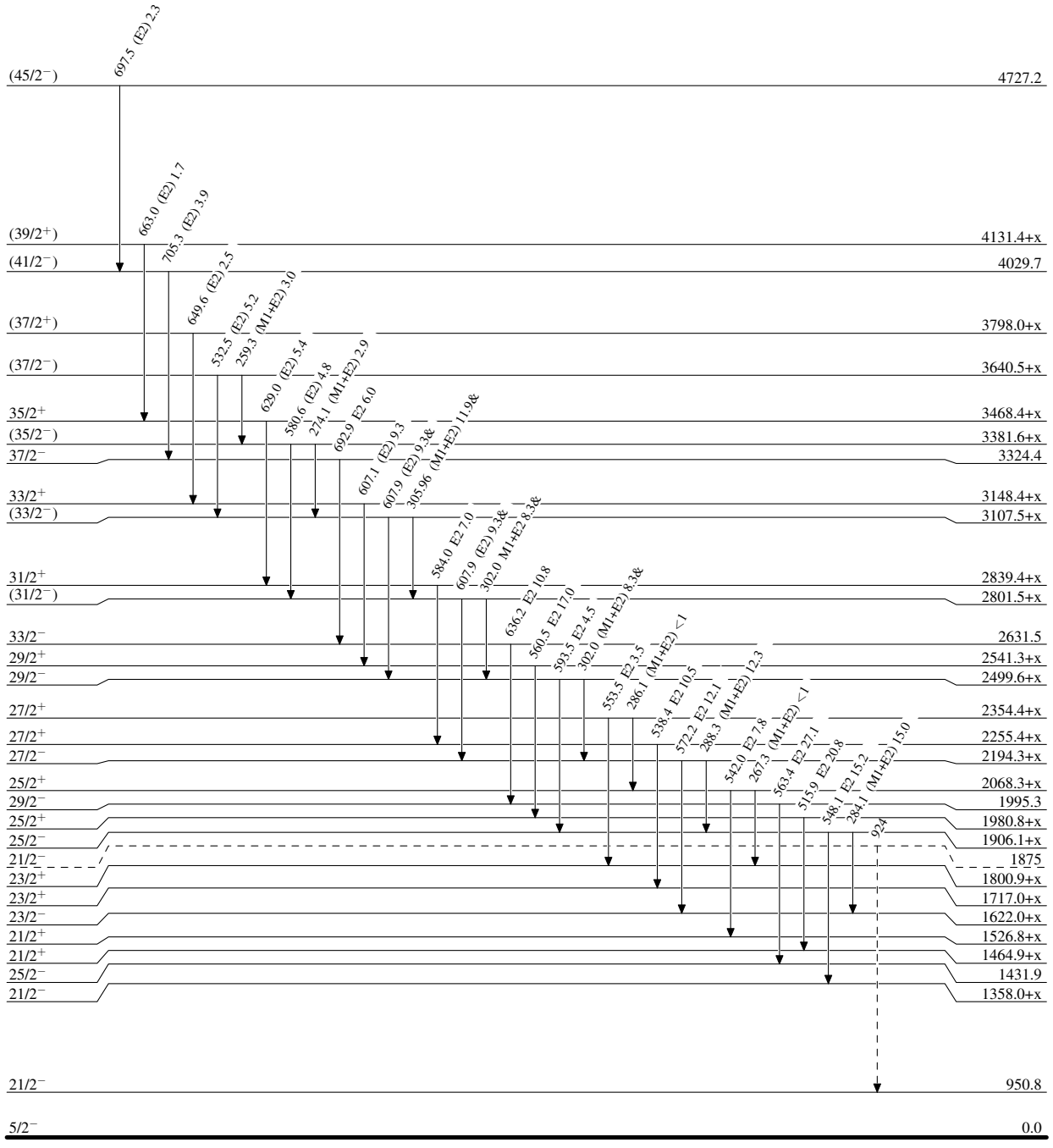
(HI,xnγ) 1977An04,1985Ba48,1991Ku12

Legend

Level Scheme

Intensities: Relative photon branching from each level (not normalized).
& Multiply placed: undivided intensity given

γ Decay (Uncertain)



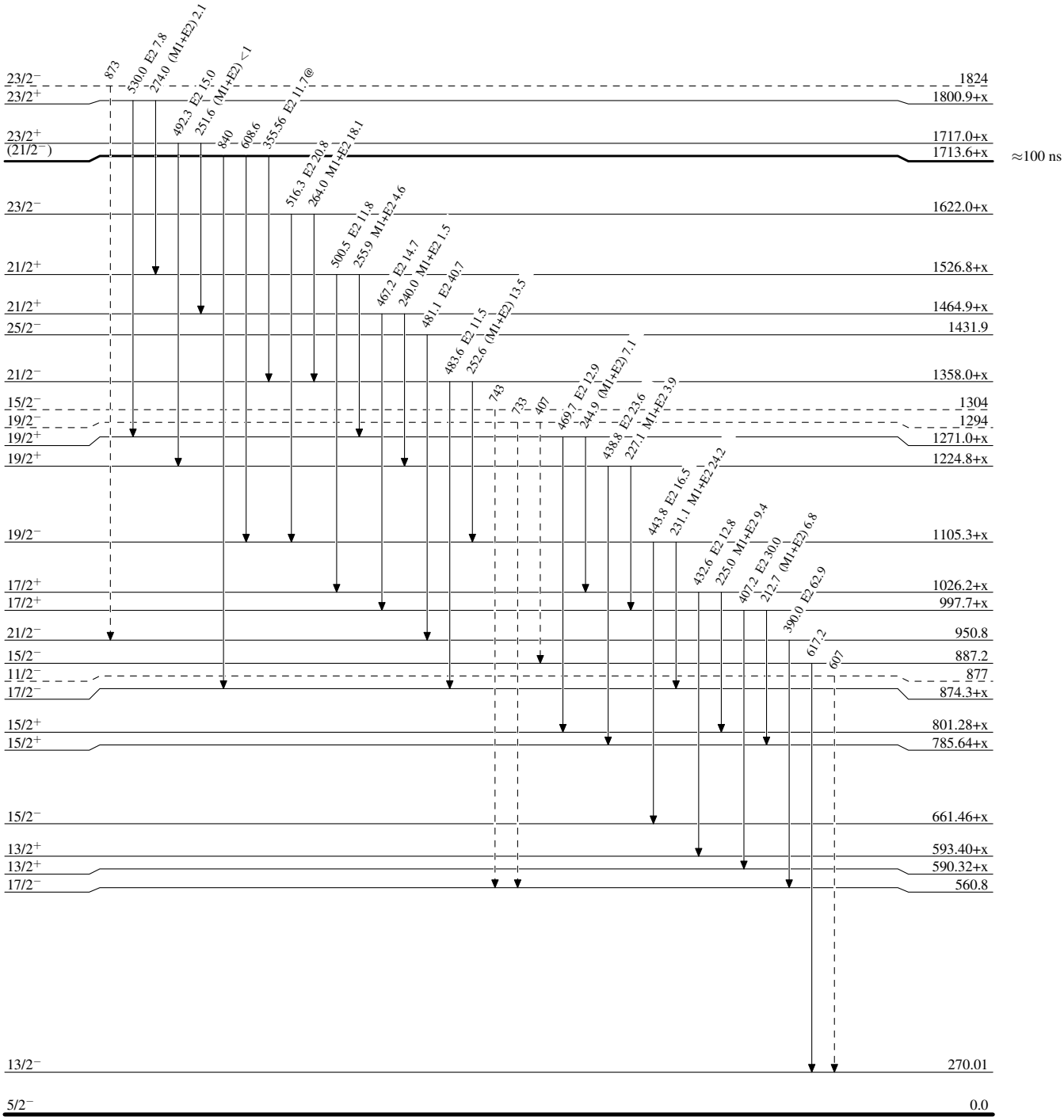
$^{173}_{73}Ta_{100}$

(HI,xnγ) 1977An04,1985Ba48,1991Ku12

Level Scheme (continued)

Intensities: Relative photon branching from each level (not normalized).
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend
γ Decay (Uncertain)



$^{173}_{73}Ta_{100}$

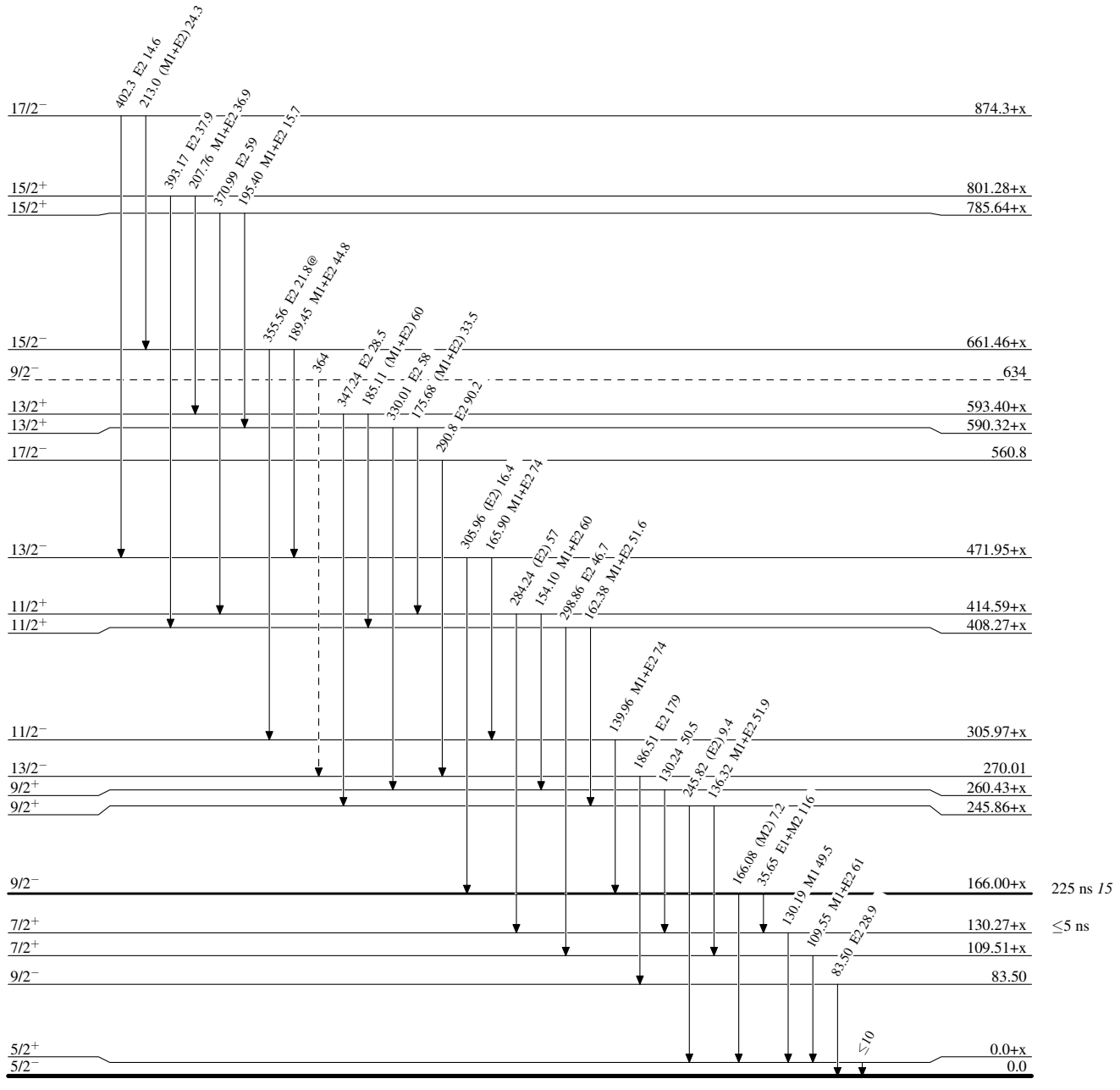
(HI,xnγ) 1977An04,1985Ba48,1991Ku12

Level Scheme (continued)

Legend

Intensities: Relative photon branching from each level (not normalized).
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

- - - - - - ► γ Decay (Uncertain)



$^{173}_{73}Ta_{100}$