(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 143, 1 (2017)	31-Mar-2017

Other: 1996SaZU.

2016NdZZ: ^{160}Gd(^{37}Cl,4nγ): Two experiments were performed with thin (1.0 mg/cm^2) and thick (10 mg/cm^2) ^{160}Gd targets with beam energies of 167 MeV and 162 MeV, respectively, at iThamba accelarator facility. γ rays were measured using 9 clover detectors (afrodite array). Four clover detectors were place (average location) at 135° and five clovers at 90° with respect to beam ditection, but the crystals are arranged in rings at 85° and 95°, 130° and 140°. Both thin and thick target data were used to build the level scheme, while the data from the thin target were used for γ-ray angular distribution and linear polarization measurements. Measured Eγ, Iγ, $\gamma\gamma$ coin, γ-ray angular distribution, linear polarization anisotropy, and lifetime measurement by Doppler Shift Attenuation Method. Also studied by ^{181}Ta(^{18}O,6nγ), E=105 MeV, reaction.

1992Re08: ^{160}Gd(^{37}Cl,4nγ); E=167 MeV; 12 Compton suppressed Ge(Li) detectors, 4π BGO array (ATLAS array), >97% ^{160}Gd target; measured Eγ, Iγ, $\gamma\gamma$ coin, DCO ratio (I(γ1(146°),γ2(34°))/I(γ1(90°), γ2(34°))).

1974Ne16: ^{181}Ta(^{16}O,4nγ), E(^{16}O)=79, 84, 89, 98 MeV; ^{184}W(^{14}N,5nγ), E(^{14}N)=82, 86, 89 MeV; also includes ^{197}Au(α,8nγ), E(α)=93, 104, 116 MeV; measured Eγ, Iγ (Ge(Li)), $\gamma\gamma$ coin, γ-ray angular distributions, E(ce), Ice (mag spect, Si(Li)).

1996SaZU: ^{181}Ta(^{16}O,4nγ), E(^{16}O)=84 MeV; measured $\gamma\gamma(\theta)$, γ(ce)(θ).

Level scheme from 2016NdZZ. Level scheme of 1992Re08 was revised and and new transitions added by 2016NdZZ.

^{193}Tl Levels

E(level)[a]	J$^\pi$[b]	T$_{1/2}$	Comments
0.0			
365.3 *5*			E(level): from Adopted Levels.
365.3+x[†]	9/2$^-$		Additional information 1.
757.8+x[†] *4*	11/2$^-$		
1081.7+x[†] *4*	13/2$^-$		
1493.8+x *4*	13/2$^{(-)}$		J$^\pi$: 13/2$^+$ in 1992Re08. 1128.4γ (2016NdZZ) to 9/2$^-$.
1512.8+x[†] *4*	15/2$^-$		
1833.8+x[†] *5*	17/2$^-$		
1900.2+x *5*	15/2$^-$		
1929.7+x *5*	17/2$^-$		
1960.6+x *5*	15/2$^{(-)}$		J$^\pi$: 1466.9γ M1 to 13/2$^{(-)}$. 15/2$^+$ in 1992Re08.
2008.1+x[@] *5*	17/2$^+$	0.6 ns	J$^\pi$: 15/2$^+$ in 1992Re03. T$_{1/2}$: 2016NdZZ estimate the value using Recoil Shadow Attenuation Method (RSAM) and list t$_{1/2}$=0.6 ns, however, used the term “lifetime”. The evaluator assumes half-life.
2105.4+x[@] *6*	19/2$^+$		
2231.5+x[@] *7*	21/2$^+$		
2303.8+x[†] *5*	19/2$^-$		
2393.4+x[@] *8*	23/2$^+$		
2393.7+x *5*	19/2$^-$		
2452.0+x *8*	23/2		
2506.3+x[‡] *5*	21/2$^-$		
2576.2+x[†] *6*	21/2$^-$		
2591.3+x[‡] *6*	23/2$^-$		
2672.5+x *8*	25/2		
2687.3+x[‡] *7*	25/2$^-$		
2710.2+x[@] *6*	25/2$^+$		

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(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16 (continued)

^{193}Tl Levels (continued)

E(level)[a]	Jπ[b]	E(level)[a]	Jπ[b]	E(level)[a]	Jπ[b]	E(level)[a]	Jπ[b]
2798.3+x *9*	27/2	3630.5+x *12*	33/2	4306.8+x[‡] *9*	35/2⁻	5039.5+x *14*	41/2
2931.5+x *9*	27/2	3747.1+x[@] *8*	31/2⁺	4307.6+x *10*	35/2	5124.4+x[‡] *10*	39/2⁻
2956.3+x[‡] *8*	27/2⁻	3767.2+x[#] *9*	29/2⁻	4319.3+x[@] *11*	37/2⁺	5125.0+x[@] *12*	43/2⁺
3026.9+x[@] *7*	27/2⁺	3767.3+x[&] *9*	31/2⁻	4335.2+x[#] *11*	33/2⁻	5264.2+x[&]	41/2⁻
3030.3+x *10*	29/2	3849.8+x[‡] *9*	33/2⁻	4525.7+x[@] *12*	39/2⁺	5312.2+x[#] *13*	39/2⁻
3087.5+x *11*	29/2	3966.2+x[#] *10*	31/2⁻	4532.6+x *11*	37/2	5469.8+x[‡] *10*	41/2⁻
3164.3+x[‡] *8*	29/2⁻	3988.9+x[&] *10*	33/2⁻	4553.4+x[&] *11*	37/2⁻	5490.6+x[@] *12*	45/2⁺
3407.0+x[@] *7*	29/2⁺	4008.0+x[@] *8*	33/2⁺	4587.2+x[#] *11*	35/2⁻	5853.8+x[‡] *11*	43/2⁻
3428.5+x *12*	31/2	4114.6+x *8*	33/2	4646.4+x[‡] *9*	37/2⁻	5888.6+x[@] *13*	47/2⁺
3457.3+x[&] *7*	27/2⁻	4157.5+x[@] *10*	35/2⁺	4804.9+x[@] *12*	41/2⁺	6271.2+x[‡] *12*	45/2⁻
3556.8+x[‡] *9*	31/2⁻	4227.4+x[&] *10*	35/2⁻	4890.4+x[&] *11*	39/2⁻		
3616.3+x[&] *8*	29/2⁻	4262.5+x *13*	37/2	4956.2+x[#] *12*	37/2⁻		

[†] Band(A): Band 1.
[‡] Band(B): Band 2.
[#] Band(C): Band 3.
[@] Band(D): Band 4.
[&] Band(E): Band 5.
[a] From least-squares fitting to γ-ray energies, assuming $\Delta E\gamma$=0.5 keV.
[b] From 2016NdZZ based on γ-ray angular distribution ratio and polarization measurement. Also coincidence relationships, intensity balances, and increasing J with increasing E(level).

γ(^{193}Tl)

E_γ[@]	I_γ[@b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[c]	Comments
(15.1)		2591.3+x	23/2⁻	2576.2+x	21/2⁻		
47.5	19.82 *5*	2008.1+x	17/2⁺	1960.6+x	15/2$^{(-)}$	D[d]	Mult.: R_{ad}=0.86 *20* (2016NdZZ).
(60.3)		1960.6+x	15/2$^{(-)}$	1900.2+x	15/2⁻		E_γ: Unobserved transition that lies at the shoulder of the x-ray peak tentatively placed based on observed coincidence relations. Placement from level scheme (Fig 4.1). In Table 4.1 – from 2226 keV level.
85.0		2591.3+x	23/2⁻	2506.3+x	21/2⁻		E_γ: Placement from level scheme (Fig. 4.1). In Table 4.1 – from 1643 keV level – a misprint. Based on intensity balance at 2226.1 keV level, 2016NdZZ propose as an M1 transition.
96.0[a]	5.150 *8*	2687.3+x	25/2⁻	2591.3+x	23/2⁻	D	Mult.: R_{ad}=0.87 *17* (2016NdZZ); DCO=1.24 *5* (1992Re08).
97.0	5.150 *4*	2105.4+x	19/2⁺	2008.1+x	17/2⁺	D	E_γ: Confirmed coincidence relation with 735.9γ from 1128.4 keV level, however, changed placement based on coincidences with both 406.6γ and 466.9γ from 1535- and 1595-keV level, respectively. In 1992Re08, 96.4 keV *3*, from 2056.4+x, level not present in 2016NdZZ. Mult.: R_{ad}=0.8 *3* (2016NdZZ); DCO=1.24 *5* (1992Re08).
107.8[&]	6.460 *5*	2008.1+x	17/2⁺	1900.2+x	15/2⁻	D[d]	Mult.: R_{ad}=0.87 *19* (2016NdZZ); DCO=1.42 *3* (1992Re08).

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(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16 (continued)

γ(^{193}Tl) (continued)

E_γ[@]	I_γ[@b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[c]	Comments
111.0	0.9200 *21*	2798.3+x	27/2	2687.3+x	25/2⁻	D	Mult.: R_{ad}=0.78 *12* (2016NdZZ).
112.5	0.9400 *18*	2506.3+x	21/2⁻	2393.7+x	19/2⁻	[d]	
125.9[a]	9.260 *7*	2231.5+x	21/2⁺	2105.4+x	19/2⁺	D	Mult.: R_{ad}=0.81 *21* (2016NdZZ); DCO=0.660 *19* (1992Re08).
149.5[a]	9.020 *4*	4157.5+x	35/2⁺	4008.0+x	33/2⁺	D	Mult.: R_{ad}=0.74 *13* (2016NdZZ); DCO=0.664 *16* (1992Re08).
151.0	1.1100 *21*	3767.3+x	31/2⁻	3616.3+x	29/2⁻	D	Mult.: R_{ad}=0.76 *19* (2016NdZZ).
156.0[‡a]	2.150 *3*	3087.5+x	29/2	2931.5+x	27/2	D	Mult.: R_{ad}=0.8 *3* (2016NdZZ); DCO=0.69 *3* (1992Re08).
159.0	0.7400 *15*	3616.3+x	29/2⁻	3457.3+x	27/2⁻	D	Mult.: R_{ad}=0.74 *21* (2016NdZZ)Expected to be a magnetic dipole transition (2016NdZZ) from 159.0γ and 929.0γ intensity comparisons of this level.
161.8	10.260 *14*	2393.4+x	23/2⁺	2231.5+x	21/2⁺		
161.8[a]	5.780 *5*	4319.3+x	37/2⁺	4157.5+x	35/2⁺	D	Mult.: R_{ad}=0.87 *21* (2016NdZZ).
193.0[#]	1.370 *2*	4307.6+x	35/2	4114.6+x	33/2	D	Mult.: R_{ad}=0.73 *18* (2016NdZZ).
199.0[a]	3.110 *3*	3966.2+x	31/2⁻	3767.2+x	29/2⁻	(M1)	Mult.: R_{ad}=0.79 *11*. Sign from intensity balance (2016NdZZ). DCO=0.69 *3* (1992Re08).
202.5[&]	4.060 *7*	2506.3+x	21/2⁻	2303.8+x	19/2⁻	D	Mult.: R_{ad}=0.90 *14* (2016NdZZ); DCO=0.90 *5* (1992Re08).
206.4[a]	5.860 *6*	4525.7+x	39/2⁺	4319.3+x	37/2⁺	D	Mult.: R_{ad}=0.85 *14* (2016NdZZ); DCO=0.816 *16* (1992Re08).
208.0[a]	9.030 *18*	3164.3+x	29/2⁻	2956.3+x	27/2⁻	D	Mult.: R_{ad}=0.82 *12* (2016NdZZ); DCO=0.72 *4* (1992Re08).
210.4	1.500 *25*	3767.2+x	29/2⁻	3556.8+x	31/2⁻	D	Mult.: R_{ad}=0.7 *3* (2016NdZZ).
220.5[ea]	3.90[e] *9*	2452.0+x	23/2	2231.5+x	21/2⁺	D	Mult.: R_{ad}=0.8 *3* (2016NdZZ); DCO=0.696 *20* for doublet (1992Re08).
220.5[ea‡]	3.90[e] *9*	2672.5+x	25/2	2452.0+x	23/2	D	Mult.: R_{ad}=0.8 *3* (2016NdZZ); DCO=0.696 *20* for doublet (1992Re08).
221.6	2.510 *5*	3988.9+x	33/2⁻	3767.3+x	31/2⁻	M1	Mult.: R_{ad}=0.83 *8*, A_{pol}=−0.17 *4* (2016NdZZ).
225.0[#]	1.3200 *15*	4532.6+x	37/2	4307.6+x	35/2	D	Mult.: R_{ad}=0.87 *8* (2016NdZZ).
232.0[†a]	1.390 *4*	3030.3+x	29/2	2798.3+x	27/2	D	Mult.: R_{ad}=0.9 *3* (2016NdZZ); DCO=0.95 *3* (1992Re08).
238.5[a]	2.510 *3*	4227.4+x	35/2⁻	3988.9+x	33/2⁻	M1	Mult.: R_{ad}=0.77 *12*, A_{pol}=−0.06 *4* (2016NdZZ); DCO=0.69 *3* (1992Re08).
252.0[a]	0.890 *3*	4587.2+x	35/2⁻	4335.2+x	33/2⁻	D	Mult.: R_{ad}=0.85 *24* (2016NdZZ); DCO=0.54 *6* (1992Re08).
259.0[‡a]	9.480 *8*	2931.5+x	27/2	2672.5+x	25/2	D	Mult.: R_{ad}=0.70 *16* (2016NdZZ); DCO=0.75 *3* (1992Re08).
260.9[a]	9.10 *12*	4008.0+x	33/2⁺	3747.1+x	31/2⁺	M1	Mult.: R_{ad}=0.72 *20*, A_{pol}=−0.10 *4* (2016NdZZ); DCO=0.862 *20* (1992Re08).
269.0[a]	17.870 *12*	2956.3+x	27/2⁻	2687.3+x	25/2⁻	M1	Mult.: R_{ad}=0.78 *9*, A_{pol}=−0.04 *3* (2016NdZZ); DCO=0.884 *24* (1992Re08); A_2=−0.49 *15*, A_4=−0.02 *15* (1974Ne16).
272.4[&]	3.150 *5*	2576.2+x	21/2⁻	2303.8+x	19/2⁻	D	Mult.: R_{ad}=0.81 *21* (2016NdZZ); DCO=0.95 *3* (1992Re08).
279.2[a]	5.190 *8*	4804.9+x	41/2⁺	4525.7+x	39/2⁺	M1	Mult.: R_{ad}=0.77 *7*, A_{pol}=−0.06 *3* (2016NdZZ); DCO=0.789 *16* (1992Re08).
287.5	8.820 *15*	2591.3+x	23/2⁻	2303.8+x	19/2⁻	(Q)	Mult.: R_{ad}=1.12 *8* (2016NdZZ).
293.0[a]	5.490 *7*	3849.8+x	33/2⁻	3556.8+x	31/2⁻	D	Mult.: R_{ad}=0.81 *10* (2016NdZZ); DCO=0.67 *5* (1992Re08).
316.7[ea]	8.240[e] *7*	2710.2+x	25/2⁺	2393.4+x	23/2⁺	D	Mult.: R_{ad}=0.73 *8* (2016NdZZ); DCO=0.435 *12* (1992Re08).

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(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16 (continued)

γ(^{193}Tl) (continued)

E_γ[@]	I_γ[@b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[c]	δ	Comments
316.7[ea]	3.670[e] *4*	3026.9+x	27/2+	2710.2+x	25/2+	D		Mult.: R_{ad}=0.7 *4* (2016NdZZ); DCO=0.669 *12* (1992Re08).
320.1	5.160 *7*	5125.0+x	43/2+	4804.9+x	41/2+	D		E_γ: Placement from level scheme (Fig. 4.1). In table 4.1 − placement from 2661 keV level. Mult.: R_{ad}=0.76 *9* (2016NdZZ).
321.0[&]	13.040 *7*	1833.8+x	17/2−	1512.8+x	15/2−	D		Mult.: R_{ad}=0.85 *12* (2016NdZZ); DCO=0.84 *4* (1992Re08).
323.9[&]	31.28 *6*	1081.7+x	13/2−	757.8+x	11/2−	M1+E2	0.6 *+4−5*	Mult.,δ: From α(K)exp=0.21 *5* (1974Ne16); R_{ad}=0.86 *9* (2016NdZZ); DCO=0.791 *11* (1992Re08); A_2=−0.74 *2*, A_4=+0.02 *2* (1974Ne16) for unresolved 323.8γ+320.9γ.
326.0[a]	3.280 *6*	4553.4+x	37/2−	4227.4+x	35/2−	D		Mult.: R_{ad}=0.74 *9* (2016NdZZ); DCO=0.71 *3* (1992Re08).
337.0[a]	1.440 *3*	4890.4+x	39/2−	4553.4+x	37/2−	D		E_γ: Placement from level scheme (Fig. 4.1). In Table 4.1 − from 4749 keV level. Mult.: R_{ad}=0.68 *19* (2016NdZZ); DCO=0.60 *3* (1992Re08).
339.6[a]	2.270 *5*	4646.4+x	37/2−	4306.8+x	35/2−	M1		Mult.: R_{ad}=0.74 *10*, A_{pol}=−0.06 *4* (2016NdZZ); DCO=0.70 *6* (1992Re08). E_γ: From level scheme (Fig 4.1). In Table 4.1 − from 4182 keV level, which appears to be a misprint of 4281.
340.1[a]	7.40 *6*	3747.1+x	31/2+	3407.0+x	29/2+	M1		Mult.: R_{ad}=0.72 *13*, A_{pol}=−0.05 *3* (2016NdZZ); DCO=0.70 *6* (1992Re08).
341.0[‡]	5.710 *5*	3428.5+x	31/2	3087.5+x	29/2	D		Mult.: R_{ad}=0.75 *21* (2016NdZZ).
345.4[a]	1.300 *22*	5469.8+x	41/2−	5124.4+x	39/2−	M1		Mult.: R_{ad}=0.76 *25*, A_{pol}=−0.10 *4* (2016NdZZ); DCO=0.60 *4* (1992Re08).
356.0[a]	1.1200 *13*	5312.2+x	39/2−	4956.2+x	37/2−	D		Mult.: R_{ad}=0.77 *23* (2016NdZZ); DCO=0.65 *5* (1992Re08).
365.3		365.3		0.0				E_γ: from 1974Ne16. I_γ: found to be duty cycle dependent.
365.6[a]	1.90 *4*	5490.6+x	45/2+	5125.0+x	43/2+	D		Mult.: R_{ad}=0.74 *24* (2016NdZZ); DCO=1.254 *24* (1992Re08) not consistent with D.
367.5	1.840 *4*	4114.6+x	33/2	3747.1+x	31/2+	D		Mult.: R_{ad}=0.77 *21* (2016NdZZ).
369.0[fa]	2.370[f] *4*	4335.2+x	33/2−	3966.2+x	31/2−	D		Mult.: R_{ad}=0.70 *12* (2016NdZZ).
369.0[fa]	2.0400[f] *21*	4956.2+x	37/2−	4587.2+x	35/2−	D		Mult.: R_{ad}=0.70 *12* (2016NdZZ); DCO=0.61 *4* (1992Re08).
374.0[g]	0.2600 *5*	5264.2+x	41/2−	4890.4+x	39/2−	D		Mult.: R_{ad}=0.75 *23* (2016NdZZ).
380.1[a]	8.69 *1*	3407.0+x	29/2+	3026.9+x	27/2+	M1		Mult.: R_{ad}=0.69 *12*, A_{pol}=−0.05 *3* (2016NdZZ); DCO=0.721 *24* (1992Re08).
384.0[a]	1.430 *4*	5853.8+x	43/2−	5469.8+x	41/2−	D		Mult.: R_{ad}=0.8 *3* (2016NdZZ); DCO=0.70 *8* (1992Re08).
392.5[e&]	100[e] *1*	757.8+x	11/2−	365.3+x	9/2−	M1+E2	−0.59 *14*	Mult.: α(K)exp=0.110 *25* (1974Ne16);

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(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16 (continued)

γ(^{193}Tl) (continued)

E_γ[@]	I_γ[@b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[c]	Comments
							DCO=0.791 *11* (1992Re08); A_2=−0.74 *2*, A_4=+0.02 *2* (1974Ne16); R_{ad}=0.91 *8*, A_{pol}=−0.019 *29* (2016NdZZ). δ: from γγ(θ) and γ(ce)(θ) (1996SaZU).
392.5[ea]	13.820[e] *17*	3556.8+x	31/2⁻	3164.3+x	29/2⁻	M1	Mult.: R_{ad}=0.78 *12*, A_{pol}=−0.08 *4* (2016NdZZ).
398.0	2.540 *4*	5888.6+x	47/2⁺	5490.6+x	45/2⁺	D	Mult.: R_{ad}=0.64 *11* (2016NdZZ).
406.2[&]	29.70 *15*	1900.2+x	15/2⁻	1493.8+x	13/2$^{(-)}$	M1	Mult.: R_{ad}=0.83 *14*, A_{pol}=−0.07 *3* (2016NdZZ); α(K)exp=0.12 *3*, K/L=4.6 *8* (1974Ne16); DCO=0.710 *16* (1992Re08); A_2=−0.68 *3*, A_4=+0.02 *3* (1974Ne16).
412.0[&]	6.150 *6*	1493.8+x	13/2$^{(-)}$	1081.7+x	13/2⁻	D+Q	Mult.: R_{ad}=1.12 *8* (2016NdZZ), DCO=1.37 *3* indicates dominant Q (1992Re08).
416.9[f&]	2.480[f] *8*	1929.7+x	17/2⁻	1512.8+x	15/2⁻	D	E_γ,I_γ: 416.9 is a doublet of 416.9γ and 417.4γ from 6271.2+x keV level. Undivided γ-ray intensity listed. Mult.: DCO=0.53 *4* (1992Re08).
417.4[fa]	2.480[f] *8*	6271.2+x	45/2⁻	5853.8+x	43/2⁻	D	E_γ,I_γ: Doublet of 417.4γ and 416.9γ from 1929.7+x keV level. Undivided γ-ray intensity listed. Q. Mult.: DCO=0.53 *4* (1992Re08).
431.2[&]	17.910 *13*	1512.8+x	15/2⁻	1081.7+x	13/2⁻	M1	Mult.: R_{ad}=0.79 *8*, A_{pol}=−0.04 *3* (2016NdZZ); α(K)exp=0.12 *3*, K/L=4.3 *8* (1974Ne16); DCO=0.81 *3* (1992Re08); A_2=−0.51 *8*, A_4=−0.16 *8* (1974Ne16).
441.0	1.3100 *15*	2672.5+x	25/2	2231.5+x	21/2⁺	(Q)	Mult.: R_{ad}=1.16 *20* (2016NdZZ). E_γ: Placement from level scheme (Fig. 4.1). In Table 4.1 – from 1128 keV level – is a misprint.
457.0[a]	2.980 *7*	4306.8+x	35/2⁻	3849.8+x	33/2⁻	M1	Mult.: R_{ad}=0.7 *3*, A_{pol}=−0.028 *13* (2016NdZZ); DCO=0.81 *4* (1992Re08).
460.1	1.790 *5*	4227.4+x	35/2⁻	3767.3+x	31/2⁻	Q	Mult.: R_{ad}=1.2 *4* (2016NdZZ).
464.1[&]	6.10 *12*	2393.7+x	19/2⁻	1929.7+x	17/2⁻	D	Mult.: R_{ad}=0.73 *17* (2016NdZZ); DCO=0.90 *4* (1992Re08).
466.9[&]	14.410 *12*	1960.6+x	15/2$^{(-)}$	1493.8+x	13/2$^{(-)}$	M1	Mult.: R_{ad}=0.73 *16*, A_{pol}=−0.05 *3* (2016NdZZ); α(K)exp=0.090 *25* (1974Ne16); DCO=0.729 *14* (1992Re08).
470.0[&]	6.670 *7*	2303.8+x	19/2⁻	1833.8+x	17/2⁻	D	Mult.: R_{ad}=0.82 *17* (2016NdZZ); DCO=0.79 *3* (1992Re08).
477.0[a]	4.450 *6*	3164.3+x	29/2⁻	2687.3+x	25/2⁻	Q	Mult.: R_{ad}=1.3 *3* (2016NdZZ); DCO=1.346 *22* (1992Re08).
478.0[a]	2.220 *4*	5124.4+x	39/2⁻	4646.4+x	37/2⁻	D	Mult.: R_{ad}=0.83 *8* (2016NdZZ); DCO=0.89 *3* (1992Re08).
478.5	2.670 *7*	2710.2+x	25/2⁺	2231.5+x	21/2⁺	Q	Mult.: R_{ad}=1.2 *3* (2016NdZZ).
485.6[a]	0.700 *18*	4804.9+x	41/2⁺	4319.3+x	37/2⁺	Q	Mult.: R_{ad}=1.25 *13* (2016NdZZ); DCO=1.33 *4* (1992Re08).
495.2[&]	6.01 *1*	2008.1+x	17/2⁺	1512.8+x	15/2⁻	E1	Mult.: R_{ad}=0.78 *17*, A_{pol}=0.03 *3* (2016NdZZ); DCO=1.51 *3* (1992Re08).
543.0[†a]	1.790 *5*	3630.5+x	33/2	3087.5+x	29/2	Q	Mult.: R_{ad}=1.17 *6* (2016NdZZ); DCO=1.462 *20* (1992Re08).
599.3[a]	6.080 *14*	5125.0+x	43/2⁺	4525.7+x	39/2⁺	Q	E_γ,I_γ: Doublet of 599.3γ and 601.0γ from 3642 keV level. Undivided γ-ray intensity listed. Mult.: DCO=1.29 *4* (1992Re08).
600.5	2.980 *11*	3556.8+x	31/2⁻	2956.3+x	27/2⁻		E_γ: From level scheme (Fig 4.1). In Table 4.1 – from 3191 keV level, which appears to be the same with this level.
601.0[a]	6.080 *14*	4008.0+x	33/2⁺	3407.0+x	29/2⁺	Q	E_γ,I_γ: Doublet of 601.0γ and 599.3γ from 4759

Continued on next page (footnotes at end of table)

(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16 (continued)

γ(^{193}Tl) (continued)

E_γ[@]	I_γ[@b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[c]	Comments
							keV level. Undivided γ-ray intensity listed. Mult.: DCO=1.40 *3* (1992Re08).
621.0[a]	0.9100 *24*	4587.2+x	35/2⁻	3966.2+x	31/2⁻	Q	Mult.: R_{ad}=1.41 *11* (2016NdZZ); DCO=1.40 *3* (1992Re08).
632.0[a]	1.760 *3*	4262.5+x	37/2	3630.5+x	33/2	Q	Mult.: R_{ad}=1.2 *3* (2016NdZZ); DCO=1.599 *22* (1992Re08).
633.4[a]	10.460 *11*	3026.9+x	27/2⁺	2393.4+x	23/2⁺	E2	Mult.: R_{ad}=1.33 *11*, A_{pol}=0.04 *4*; DCO=1.599 *22* (1992Re08).
663.0[a]	0.730 *2*	4890.4+x	39/2⁻	4227.4+x	35/2⁻	Q	Mult.: R_{ad}=1.31 *20* (2016NdZZ); DCO=1.36 *5* (1992Re08).
672.5[&]	39.19 *4*	2506.3+x	21/2⁻	1833.8+x	17/2⁻	E2	Mult.: R_{ad}=1.21 *15*, A_{pol}=0.04 *3* (2016NdZZ); DCO=1.347 *15* (1992Re08).
685.5[a]	4.67 *1*	3849.8+x	33/2⁻	3164.3+x	29/2⁻	E2	Mult.: R_{ad}=1.25 *11*, A_{pol}=0.07 *4* (2016NdZZ); DCO=1.353 *21* (1992Re08).
685.7	0.4900 *8*	5490.6+x	45/2⁺	4804.9+x	41/2⁺	Q	Mult.: R_{ad}=1.25 *21* (2016NdZZ).
696.8[a]	7.680 *5*	3407.0+x	29/2⁺	2710.2+x	25/2⁺	(E2)	Mult.: R_{ad}=1.15 *8*, A_{pol}=0.039 *25* (2016NdZZ); DCO=1.278 *24* (1992Re08).
707.7	4.150 *9*	4114.6+x	33/2	3407.0+x	29/2⁺	Q	Mult.: R_{ad}=1.33 *18* (2016NdZZ).
716.4[&]	34.88 *6*	1081.7+x	13/2⁻	365.3+x	9/2⁻	E2	Mult.: R_{ad}=1.29 *23*, A_{pol}=0.06 *3* (2016NdZZ); α(K)exp=0.0075 *2* (1974Ne16); DCO=1.291 *16* (1992Re08); A_2=+0.32 *5*, A_4=−0.02 *5* (1974Ne16).
720.2[a]	10.570 *8*	3747.1+x	31/2⁺	3026.9+x	27/2⁺	E2	Mult.: R_{ad}=1.33 *5*, A_{pol}=0.06 *4* (2016NdZZ); DCO=1.406 *18* (1992Re08).
729.4[ag]	0.3100 *11*	5853.8+x	43/2⁻	5124.4+x	39/2⁻	Q	Mult.: DCO=1.30 *3* (1992Re08).
735.9[&]	52.34 *6*	1493.8+x	13/2$^{(-)}$	757.8+x	11/2⁻	D	Mult.: R_{ad}=0.72 *13*, A_{pol}=0.001 *34* (2016NdZZ); α(K)exp=0.0060 *15* (1974Ne16), theory: α(K)(E1)=0.00354, α(K)(M1)=0.0299; DCO=0.704 *23* (1992Re08); A_2=−0.19 *4*, A_4=0.04 *4* (1974Ne16).
742.4[&]	12.920 *13*	2576.2+x	21/2⁻	1833.8+x	17/2⁻	Q	Mult.: R_{ad}=1.29 *25* (2016NdZZ); α(K)exp=0.030 *15* (1974Ne16); theory: α(K)(E2)=0.00349, α(K)(M1)=0.0292; DCO=1.191 *19* (1992Re08); A_2=+0.24 *17*, A_4=−0.05 *17* (1974Ne16). In band transition.
750.0	1.770 *6*	4306.8+x	35/2⁻	3556.8+x	31/2⁻	Q	Mult.: R_{ad}=1.21 *14* (2016NdZZ).
752.2[&]	41.65 *7*	1833.8+x	17/2⁻	1081.7+x	13/2⁻	E2	Mult.: α(K)exp=0.013 *4* (1974Ne16); DCO=1.640 *15* (1992Re08); R_{ad}=1.2 *3* (2016NdZZ).
755.1[&]	24.37 *5*	1512.8+x	15/2⁻	757.8+x	11/2⁻	E2	Mult.: R_{ad}=1.25 *12* (2016NdZZ); α(K)exp=0.011 *4* (1974Ne16); DCO=1.219 *18* (1992Re08). theory: α(K)(E2)=0.00867.
770.0	1.460 *3*	3457.3+x	27/2⁻	2687.3+x	25/2⁻	M1	Mult.: R_{ad}=0.8 *4*, A_{pol}=−0.05 *4* (2016NdZZ).
777.0[†a]	1.950 *3*	5039.5+x	41/2	4262.5+x	37/2	Q	Mult.: R_{ad}=1.3 *3* (2016NdZZ); DCO=1.39 *3* (1992Re08).
791.0[&]	10.750 *8*	2303.8+x	19/2⁻	1512.8+x	15/2⁻	(E2)	Mult.: R_{ad}=1.13 *11*, A_{pol}=0.038 *25* (2016NdZZ); DCO=1.488 *18* (1992Re08).
796.6[a]	3.330 *6*	4646.4+x	37/2⁻	3849.8+x	33/2⁻	(E2)	Mult.: R_{ad}=1.15 *8*, A_{pol}=0.13 *5* (2016NdZZ); DCO=1.382 *21* (1992Re08).
801.4[ag]	0.7200 *17*	6271.2+x	45/2⁻	5469.8+x	41/2⁻		Mult.: DCO=1.30 *7* (1992Re08).
810.9	2.280 *5*	3767.2+x	29/2⁻	2956.3+x	27/2⁻	M1	Mult.: R_{ad}=0.53 *13*, A_{pol}=−0.014 *4* (2016NdZZ).
817.6[a]	1.2100 *18*	5124.4+x	39/2⁻	4306.8+x	35/2⁻	Q	Mult.: R_{ad}=1.30 *11* (2016NdZZ); DCO=1.90 *8* (1992Re08).
818.6	1.810 *4*	1900.2+x	15/2⁻	1081.7+x	13/2⁻	D	Mult.: R_{ad}=0.78 *8* (2016NdZZ).
823.4[a]	1.00 *3*	5469.8+x	41/2⁻	4646.4+x	37/2⁻	Q	Mult.: R_{ad}=1.32 *20* (2016NdZZ); DCO=1.699 *23* (1992Re08).

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(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16 (continued)

γ(^{193}Tl) (continued)

E_γ [@]	I_γ [@b]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [c]	Comments
848.1 [&]	7.170 *14*	1929.7+x	17/2⁻	1081.7+x	13/2⁻	Q	Mult.: R_{ad}=1.131 *21* (2016NdZZ); DCO=1.201 *23* (1992Re08).
866.0	0.9100 *23*	3457.3+x	27/2⁻	2591.3+x	23/2⁻	(E2)	Mult.: R_{ad}=1.16 *25*, A_{pol}=0.09 *5* (2016NdZZ).
878.9	1.4300 *24*	1960.6+x	15/2$^{(-)}$	1081.7+x	13/2⁻	D	Mult.: R_{ad}=0.86 *15* (2016NdZZ).
881.0	0.8800 *12*	2393.7+x	19/2⁻	1512.8+x	15/2⁻	Q	Mult.: R_{ad}=1.23 *22* (2016NdZZ).
929.0	1.0400 *24*	3616.3+x	29/2⁻	2687.3+x	25/2⁻	Q	Mult.: R_{ad}=1.2 *3* (2016NdZZ).
1128.4	1.600 *21*	1493.8+x	13/2$^{(-)}$	365.3+x	9/2⁻	Q	Mult.: R_{ad}=1.34 *8* (2016NdZZ).

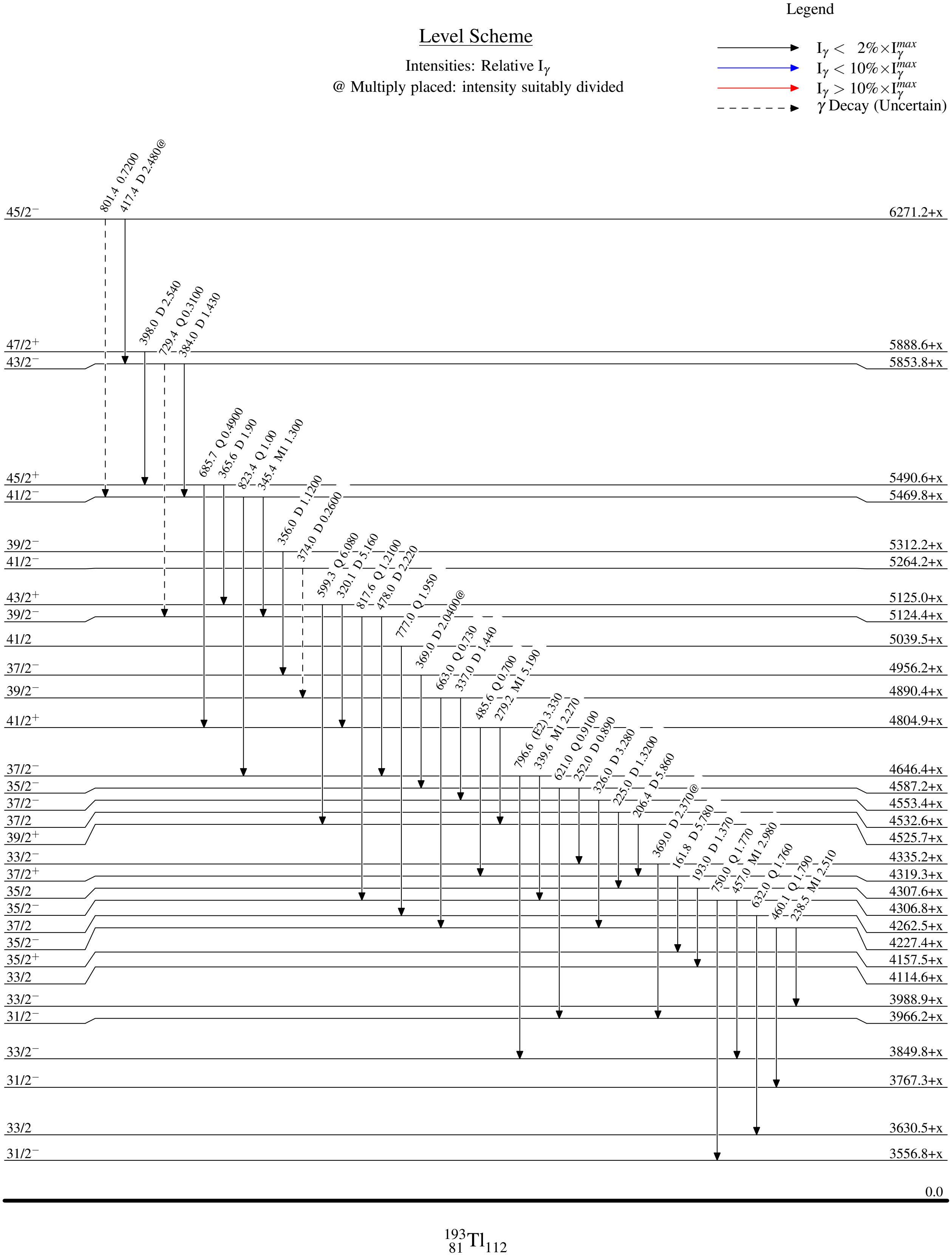
[†] Member of a sequence.
[‡] Member of a sequence.
[#] Member of a sequence.
[@] From 2016NdZZ, except otherwise noted. 2016NdZZ did not report uncertainty of γ-ray energy. Assuming a 0.5 keV uncertainty, the values are in good agreement with those of 1992Re08.
[&] A comparable γ ray from the same level also reported in 1992Re08.
[a] A comparable γ-ray reported in 1992Re08, but level not present in 2016NdZZ.
[b] From 2016NdZZ, except otherwise noted.
[c] Based on α(K)exp, K/L, γ(θ) results (1974Ne16), DCO (1992Re08), and γ-ray angular distribution ratio, polarization measurement (2016NdZZ). The levels up to 13/2⁺ and 15/2⁻ were considered established by 1974Ne16. To obtain the α(K)exp, the photon and ce-spectra of 1974Ne16 were calibrated through α(K) (E3 theory) for 382.8γ in ^{199}Tl. The DCO ratio is defined as I(γ_1(146°),γ_2(34°))/I(γ_1(90°),γ_2(34°)) which results in DCO=1.4 for ΔJ=2 Q and ΔJ=0 D, and DCO=0.7 for ΔJ=1, D. 2016NdZZ measured γ-ray angular distribution ratio R_{ad}=Iγ(135°)/Iγ(90°) and linear polarization anisotropy measurements. Expected R_{ad}=0.85 for pure stretched dipole and R_{ad}=1.35 for pure stretched quadrupole. For parity − a positive sign of polarization anisotropy A_{pol} for stretched electric transitions and a negative sign for stretched magnetic transitions was expected.
[d] 2016NdZZ argue the transition expected to be electric dipole based on intensity comparison with following transitons of 406.6γ, 818.6γ, 466.9γ, 878.9γ and without any additional feeding to 15/2⁻ state at 1535.0 keV level.
[e] Multiply placed with undivided intensity.
[f] Multiply placed with intensity suitably divided.
[g] Placement of transition in the level scheme is uncertain.

(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16

Level Scheme

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided



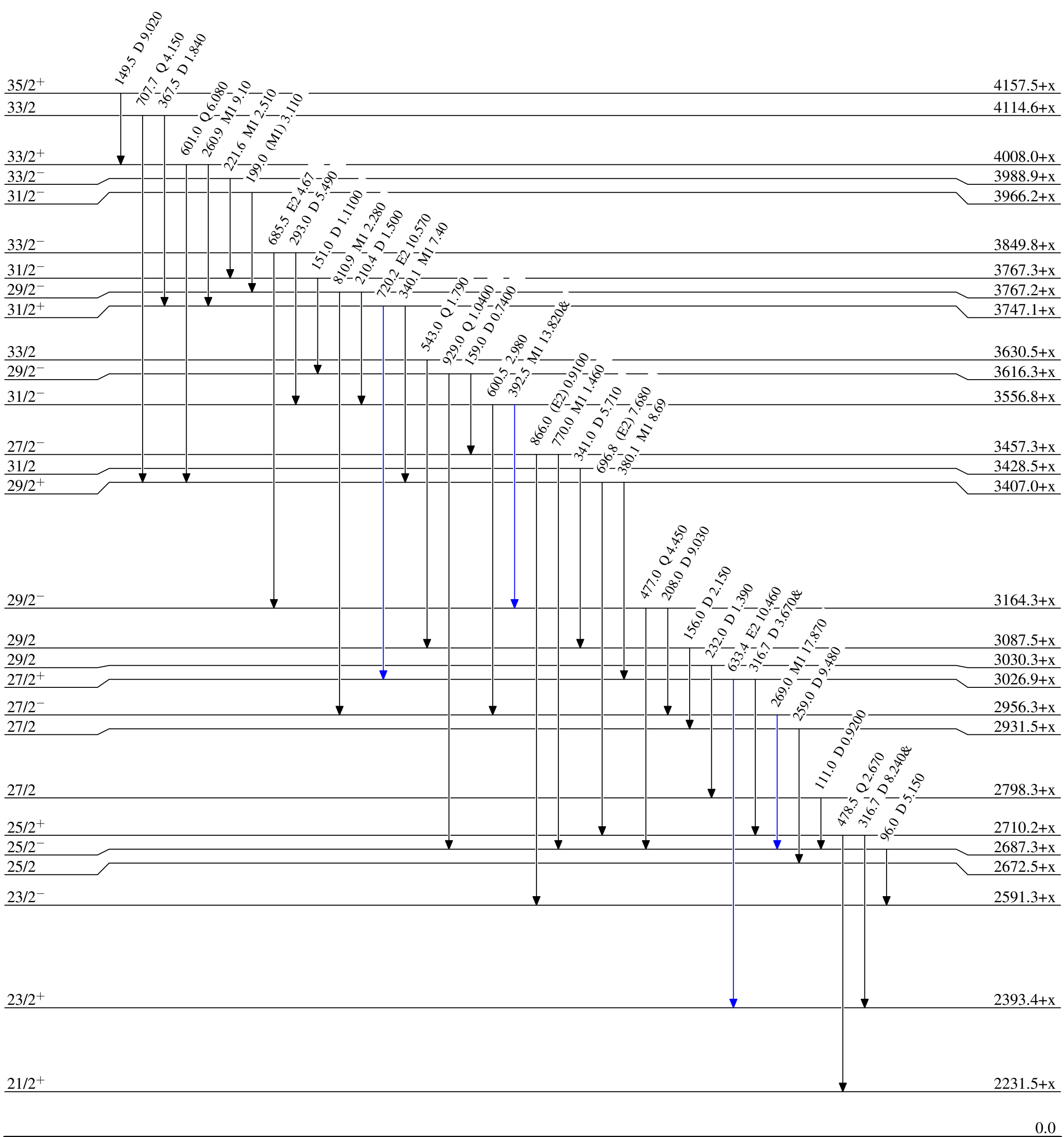
(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

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



$^{193}_{81}Tl_{112}$

(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16

Level Scheme (continued)

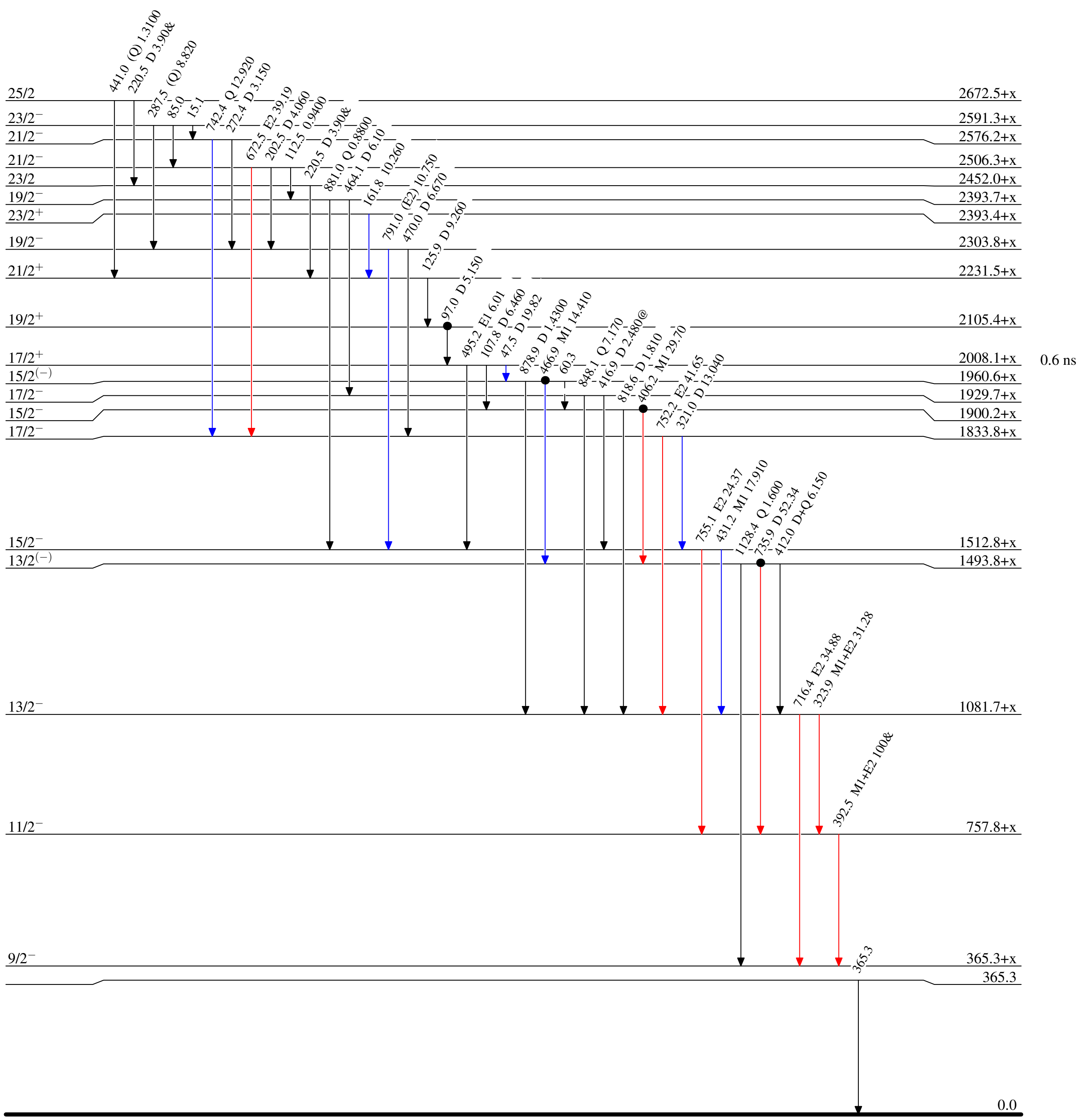
Intensities: Relative I_γ

& Multiply placed: undivided intensity given

@ Multiply placed: intensity suitably divided

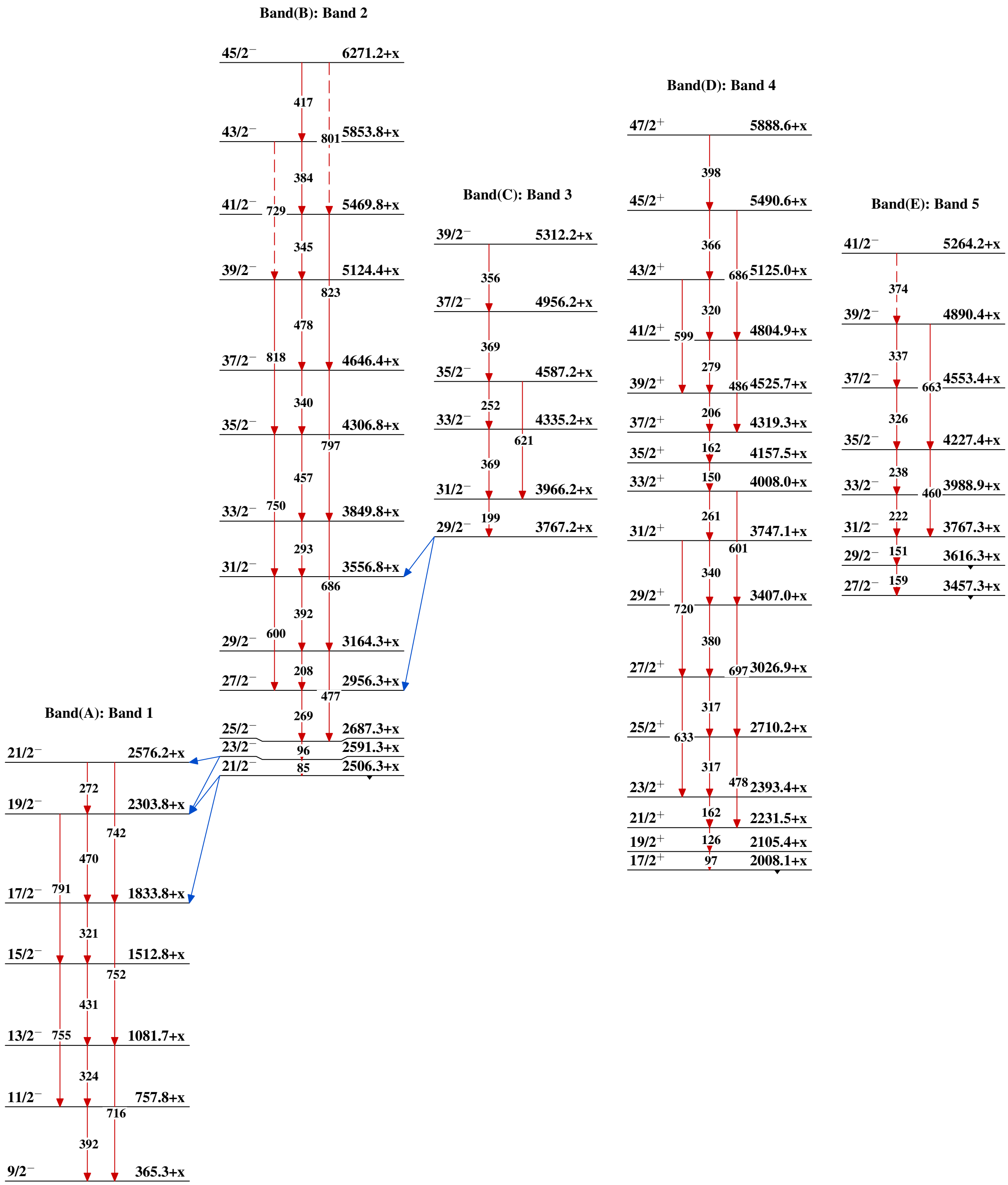
Legend

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



$^{193}_{81}Tl_{112}$

(HI,xnγ) 2016NdZZ,1992Re08,1974Ne16



$^{193}_{81}Tl_{112}$