(HI,xnγ)

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	D. De Frenne	NDS 110, 2081 (2009)	1-Mar-2009

1999Ny01: ^{70}Zn(^{36}S,3nγ): E=130 MeV. Measured Eγ,$\gamma\gamma$, $\gamma\gamma(\theta)$(DCO) and lifetimes using EUROGAM-2 spectrometer array of Compton-suppressed HPGe detectors. 1999Ny01 data supersede the 1993Je02 data.

1974Gr07: ^{100}Ru(α,nγ) E=16-24 MeV; ^{94}Zr(^{12}C,3nγ) E=44-54 MeV. Measured: σ(Eα,Eγ), σ(E(^{12}C),Eγ), σ(Eγ,θ), $\gamma\gamma$ coin, γ linear polarization. Deduced: ^{103}Pd levels, J^π, $T_{1/2}$, mult.

1975Ki13: ^{94}Zr(^{12}C,3n); E=48-56 MeV. Measured: γ linear polarization. Deduced: ^{103}Pd levels, π, δ of γ transitions.

Others: 1993Je02, 1993Re13, 1973Ri10.

Unless noted otherwise, levels are taken from 1999Ny01, as those experimental data are more recent and more complete than those of 1993Je02.

^{103}Pd Levels

E(level)[†]	J^π[‡]	$T_{1/2}$	Comments
0.0[#]	5/2$^+$	16.991 d *19*	
118.60 *9*	3/2$^+$		Not observed by 1999Ny01.
243.79[@]	7/2$^+$		
266.70 *9*	5/2$^+$		Not observed by 1999Ny01. Branching: Iγ(267γ)/Iγ(148γ)=0.77 *10* (^{12}C,3nγ) disagrees with 0.47 *2* (^{103}Ag decay), 0.49 *4* (p,nγ).
531.77[&] *4*	7/2$^+$		
717.71[#] *5*	9/2$^+$		
784.79[a] *10*	11/2$^-$	25 ns *2*	$T_{1/2}$: from Adopted Levels.
899.77 *13*	9/2$^+$		E(level): not observed by 1999Ny01.
903.92[@] *7*	11/2$^+$		
1261.50[a] *11*	15/2$^-$		
1329.12[&] *16*	(11/2)$^+$		
1527.04[#] *7*	13/2$^+$		
1776.98[@] *9*	15/2$^+$		
1975.50[a] *12*	19/2$^-$		
2109.18? *13*	(17/2$^+$)		E(level): observed only by 1974Gr07.
2178[&]	15/2$^+$		
2346.58? *17*	(15/2$^+$)		E(level): observed only by 1974Gr07.
2468[#]	17/2$^+$		
2601[c]	15/2$^+$		
2657.18 *20*	(17/2$^+$)		E(level): observed only by 1974Gr07.
2764.18[@] *13*	19/2$^+$		
2822.60[a] *16*	23/2$^-$		
2834[b]	17/2$^+$		
2924			
3020.38 *17*	(21/2)$^+$		
3071[c]	19/2$^+$		
3102.98? *22*	(19/2$^+$)		E(level): observed only by 1974Gr07.
3382[b]	21/2$^+$		
3530.38? *24*	21/2$^+$		E(level): observed only by 1974Gr07.
3714[c]	23/2$^+$		
3792.70[a] *17*	27/2$^-$		
4056	25/2$^+$		
4160[b]	25/2$^+$		
4587[c]	27/2$^+$		

Continued on next page (footnotes at end of table)

(HI,xnγ) (continued)

^{103}Pd Levels (continued)

E(level)[†]	Jπ[‡]	Comments
4887.0[a] 3	31/2−	
5025[b]	29/2+	
5458[c]	31/2+	
5983[b]	33/2+	
6048.9[a] 4	35/2−	
6452[c]	35/2+	
7056[b]	37/2+	
7316[a]	39/2−	
7593[c]	39/2+	
8212[b]	41/2+	
8668[a]	43/2−	
8831[c]	43/2+	
9442[b]	45/2+	
10119[a]	47/2−	
10190[c]	47/2+	
10741[b]	49/2+	
11638[a]	51/2−	
11643[c]	51/2+	
12208[b]	53/2+	
13240[c]	55/2+	
13798[b]	57/2+	
14932[c]	59/2+	
15487[b]	61/2+	
17357[b]	65/2+	E(level): band terminating state (1999Ny01).
0+x		
453+x[d]	(53/2)	
1912+x[d]	(57/2)	
2045+x		
3439+x[d]	(61/2)	
5003+x[d]	(65/2)	
6662+x[d]	(69/2)	
8449+x[d]	(73/2)	
10359+x[d]	(77/2)	
12377+x[d]	(81/2)	
14636+x[d]	(85/2)	E(level): possible band terminating state (1999Ny01).

† Level energies with uncertainties calculated with a least-squares fit from gammas with uncertainties (1974Gr07), others from 1999Ny01.

‡ Based on A_{22},A_{44} (1975Ki13) and γ-linear pol (1974Gr07) and observed band structure.

\# Band(A): ΔJ=2 band on 5/2+ g.s. (1999Ny01).

@ Band(B): ΔJ=2 band on 243 keV, 7/2+ level (1999Ny01).

& Band(C): ΔJ=2 band on 531 keV, 7/2+ level (1999Ny01).

a Band(D): ΔJ=2 band on 785 keV, 11/2− level (1999Ny01).

b Band(E): ΔJ=2 band on 2834 keV, 17/2+ level (1999Ny01).

c Band(F): ΔJ=2 band on 2601 keV, 15/2+ level (1999Ny01).

d Band(G): ΔJ=2 band on (53/2) level (1999Ny01).

(HI,xnγ) (continued)

γ(^{103}Pd)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[@]	Comments
67.1 2	78 20	784.79	11/2$^-$	717.71	9/2$^+$				
96		3020.38	(21/2)$^+$	2924					
118.6 1	12 1	118.60	3/2$^+$	0.0	5/2$^+$	M1+E2	+0.11 3	0.242 6	A_{22}=−0.099 10, A_{44}=0.013 11.
147		3071	19/2$^+$	2924					
148.1 1	13 1	266.70	5/2$^+$	118.60	3/2$^+$	M1		0.1277 18	A_{22}=−0.212 17, A_{44}=0.003 17. δ=0.00 5 from 148γ(θ) (1974Gr07). Pol=−0.01 10 (1974Gr07).
185.94 5	30 3	717.71	9/2$^+$	531.77	7/2$^+$	M1+E2	0.12 6	0.071 2	Pol=−0.01 10 (1974Gr07).
186		903.92	11/2$^+$	717.71	9/2$^+$				A_{22}=−0.241 9, A_{44}=0.027 10. Pol=−0.01 10 (1974Gr07).
198.0 3	5.5 CA	1527.04	13/2$^+$	1329.12	(11/2)$^+$				Eγ from (α,nγ); Iγ from experimental branching ratio via (α,nγ) (1974Gr07).
233		2834	17/2$^+$	2601	15/2$^+$				
237		3071	19/2$^+$	2834	17/2$^+$	M1			
237.4 1	15 2	2346.58?	(15/2$^+$)	2109.18?	(17/2$^+$)	M1+E2	+0.03 2		Pol=−0.11 9 (1974Gr07). A_{22}=−0.170 12, A_{44}=0.043 15. δ: from 237γ(θ) 1975Ki13; others: +0.01 2 (1974Gr07) γ(θ), +0.17 20 (1975Ki13) 237γ linear pol.
243.79 5	100	243.79	7/2$^+$	0.0	5/2$^+$	M1+E2	−0.085 15	0.0340 5	A_{22}=−0.271 8, A_{44}=0.019 6. Pol=−0.18 6 (1974Gr07). δ: from linear pol (1975Ki13); other: −0.10 5 (1974Gr07) via γ(θ).
256.2 1	9 1	3020.38	(21/2)$^+$	2764.18	19/2$^+$	M1+E2	−0.03 2		δ: other: −0.12 13 from 256γ linear pol (1975Ki13). A_{22}=0.272 26, A_{44}=0.012 35. Pol=−0.21 15 (1974Gr07).
265.1 3	4 1	531.77	7/2$^+$	266.70	5/2$^+$	M1		0.0272 4	δ=0.00 10 from 265γ(θ) (1974Gr07). A_{22}=−0.209 26, A_{44}=0.107 60.
266.7 3	10 1	266.70	5/2$^+$	0.0	5/2$^+$	M1+E2	−0.11 10	0.0270 7	A_{22}=0.175 14, A_{44}=0.013 25.
288.0 1	3 1	531.77	7/2$^+$	243.79	7/2$^+$	M1+E2	−0.17 10	0.0223 6	A_{22}=0.161 37, A_{44}=−0.030 47.
310.6 1	13 2	2657.18	(17/2$^+$)	2346.58?	(15/2$^+$)	M1+E2	+0.09 3		Pol=−0.55 11 (1974Gr07). A_{22}=−0.094 20, A_{44}=0.004 29. δ: other: +0.10 3 (1975Ki13) 311γ linear pol.
311		3382	21/2$^+$	3071	19/2$^+$	M1			
323		2924		2601	15/2$^+$				
332		3714	23/2$^+$	3382	21/2$^+$	M1			
332.2 1	14 2	2109.18?	(17/2$^+$)	1776.98	15/2$^+$	M1+E2	+0.055 15		Pol=−0.39 10 (1974Gr07). A_{22}=−0.154 20, A_{44}=0.019 29. δ: from 332γ linear pol (1975Ki13); other: +0.05 3 γ(θ) (1974Gr07).
362		3382	21/2$^+$	3020.38	(21/2)$^+$				
366		2834	17/2$^+$	2468	17/2$^+$				
367.9 3	2.5 CA	899.77	9/2$^+$	531.77	7/2$^+$				Eγ from (α,nγ), Iγ from experimental branching ratio via (α,nγ) (1974Gr07) 0.0118 17. Pol=0.41 34 (1974Gr07).

γ(^{103}Pd) (continued)

E_γ †	I_γ ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	δ#	α@	Comments
427		4587	27/2+	4160	25/2+	M1			
427.4 *1*	8 *2*	3530.38?	21/2+	3102.98?	(19/2+)	M1+E2	+0.05 *5*		A_{22}=−0.150 *34*, A_{44}=0.005 *41*. Pol=−0.11 *15* (1974Gr07).
429.4 *3*	3 *CA*	1329.12	(11/2)+	899.77	9/2+				Eγ from (α,nγ), Iγ from experimental branching ratio via (α,nγ) (1974Gr07).
433		5458	31/2+	5025	29/2+	M1			
438		5025	29/2+	4587	27/2+	M1			
445.8 *1*	9 *2*	3102.98?	(19/2+)	2657.18	(17/2+)	M1+E2	+0.10 *5*		δ: other: +0.07 *5* from 446γ linear pol (1975Ki13). A_{22}=−0.075 *43*, A_{44}=0.027 *71*. Pol=−0.40 *16* (1974Gr07).
446		4160	25/2+	3714	23/2+	M1			
451.0 *1*	10 *2*	717.71	9/2+	266.70	5/2+	E2			Pol=0.46 *19* (1974Gr07). A_{22}=0.240 *23*, A_{44}=−0.115 *32*.
456		2924		2468	17/2+				
458		3382	21/2+	2924					
470		3071	19/2+	2601	15/2+	E2			
473.9 *1*	29 *3*	717.71	9/2+	243.79	7/2+	M1+E2			Pol=0.18 *6* (1974Gr07). A_{22}=−0.452 *26*, A_{44}=0.078 *32*. δ: −1.4 *2* or −0.50 *20* (1974Gr07).
476.70 *5*	156 *10*	1261.50	15/2−	784.79	11/2−	E2			Pol=0.52 *2* (1974Gr07). A_{22}=0.318 *8*, A_{44}=−0.107 *9*.
531		4587	27/2+	4056	25/2+				
531.77 *5*	30 *3*	531.77	7/2+	0.0	5/2+	M1+E2	−0.7 *2*		A_{22}=−0.577 *18*, A_{44}=0.054 *12*. Pol=0.06 *6* (1974Gr07). δ: from 532γ linear pol (1975Ki13); other: −0.7 *3* γ(θ) (1974Gr07).
541.0 *1*	21 *4*	784.79	11/2−	243.79	7/2+	M2		0.01450 *21*	Pol=−0.23 *13* (1974Gr07). A_{22}=0.165 *30*, A_{44}=−0.090 *35*. Mult.: from 541γ linear pol (1975Ki13) and α(K)exp=0.0135 (1975Di09) (p,nγ).
548		3382	21/2+	2834	17/2+	E2			
552		3020.38	(21/2)+	2468	17/2+				
611.4 *3*	3 *CA*	1329.12	(11/2)+	717.71	9/2+				Eγ from (α,nγ), Iγ from experimental branching ratio via (α,nγ) (1974Gr07).
623		1527.04	13/2+	903.92	11/2+				
643		3714	23/2+	3071	19/2+	E2			
656.0 *2*	6 *1*	899.77	9/2+	243.79	7/2+	M1+E2	−1.8 *2*		A_{22}=−0.714 *50*, A_{44}=0.006 *53*. Branching: Iγ(900γ)/Iγ(656γ)=0.5 *2* (^{12}C,3nγ), 0.46 (α,nγ); exp branching ratios via (p,nγ) and ^{103}Ag ε decay are different.
656		2834	17/2+	2178	15/2+	M1			
660.13 *5*	45 *4*	903.92	11/2+	243.79	7/2+	E2			Pol=0.56 *5* (1974Gr07).
694		3714	23/2+	3020.38	(21/2)+				

$^{103}_{46}$Pd$_{57}$-4

(HI,xnγ) (continued)

γ(^{103}Pd) (continued)

E_γ †	I_γ ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	Comments
714.00 5	137 5	1975.50	19/2⁻	1261.50	15/2⁻	E2	A_{22}=0.307 8, A_{44}=−0.114 6. Pol=0.48 3 (1974Gr07).
717.7 1	159 10	717.71	9/2⁺	0.0	5/2⁺	E2	Pol=0.36 2 (1974Gr07). A_{22}=0.201 9, A_{44}=−0.056 10.
778		4160	25/2⁺	3382	21/2⁺	E2	
791		3714	23/2⁺	2924			
797.4 3	6 1	1329.12	(11/2)⁺	531.77	7/2⁺	E2	A_{22}=0.172 33, A_{44}=−0.120 49.
809.33 5	22 3	1527.04	13/2⁺	717.71	9/2⁺	E2	Pol=0.69 11 (1974Gr07). A_{22}=0.237 19, A_{44}=−0.076 21.
847.1 1	102 5	2822.60	23/2⁻	1975.50	19/2⁻	E2	Pol=−0.57 5 (1974Gr07). A_{22}=0.312 12, A_{44}=−0.143 16.
849		2178	15/2⁺	1329.12	(11/2)⁺		
865		5025	29/2⁺	4160	25/2⁺	E2	
871		5458	31/2⁺	4587	27/2⁺	(E2)	
873&		3530.38?	21/2⁺	2657.18	(17/2⁺)		
873		4587	27/2⁺	3714	23/2⁺	(E2)	
873.05 5	43 4	1776.98	15/2⁺	903.92	11/2⁺	E2	Pol=0.43 6 (1974Gr07). A_{22}=0.298 17, A_{44}=0.084 20.
899.8 2	3 1	899.77	9/2⁺	0.0	5/2⁺	E2	A_{22}=0.359 67, A_{44}=−0.0130 82.
941		2468	17/2⁺	1527.04	13/2⁺		
959		5983	33/2⁺	5025	29/2⁺	E2	
968		5025	29/2⁺	4056	25/2⁺		
970.09 5	52 4	3792.70	27/2⁻	2822.60	23/2⁻	E2	A_{22}=0.277 16, A_{44}=−0.086 19.
987.2 1	18 2	2764.18	19/2⁺	1776.98	15/2⁺	E2	Pol=0.54 16 (1974Gr07). A_{22}=0.309 19, A_{44}=0.153 31.
994		6452	35/2⁺	5458	31/2⁺		
1007		7056	37/2⁺	6048.9	35/2⁻	E1	
1036		4056	25/2⁺	3020.38	(21/2)⁺		
1057		2834	17/2⁺	1776.98	15/2⁺	M1	
1072		7056	37/2⁺	5983	33/2⁺	E2	
1074		2601	15/2⁺	1527.04	13/2⁺		
1094.3 2	22 2	4887.0	31/2⁻	3792.70	27/2⁻	E2	A_{22}=0.191 17, A_{44}=−0.128 24.
1097		5983	33/2⁺	4887.0	31/2⁻	E1	
1141		7593	39/2⁺	6452	35/2⁺		
1147		2924		1776.98	15/2⁺		
1156		8212	41/2⁺	7056	37/2⁺	E2	
1161.9 2	6 2	6048.9	35/2⁻	4887.0	31/2⁻	E2	A_{22}=0.212 60, A_{44}=−0.103 56.
1230		9442	45/2⁺	8212	41/2⁺	E2	
1232		5025	29/2⁺	3792.70	27/2⁻	E1	
1238		8831	43/2⁺	7593	39/2⁺		
1267		7316	39/2⁻	6048.9	35/2⁻		
1299		10741	49/2⁺	9442	45/2⁺	E2	
1307		2834	17/2⁺	1527.04	13/2⁺		

(HI,xnγ) (continued)

γ(^{103}Pd) (continued)

E_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	E_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]
1338	4160	25/2$^+$	2822.60	23/2$^-$	E1	1573	2834	17/2$^+$	1261.50	15/2$^-$	
1352	8668	43/2$^-$	7316	39/2$^-$		1590	13798	57/2$^+$	12208	53/2$^+$	E2
1359	10190	47/2$^+$	8831	43/2$^+$		1597	13240	55/2$^+$	11643	51/2$^+$	
1394	3439+x	(61/2)	2045+x			1659	6662+x	(69/2)	5003+x	(65/2)	E2
1407	3382	21/2$^+$	1975.50	19/2$^-$	E1	1689	15487	61/2$^+$	13798	57/2$^+$	E2
1451	10119	47/2$^-$	8668	43/2$^-$		1692	14932	59/2$^+$	13240	55/2$^+$	E2
1453	11643	51/2$^+$	10190	47/2$^+$		1787	8449+x	(73/2)	6662+x	(69/2)	E2
1459	1912+x	(57/2)	453+x	(53/2)		1870	17357	65/2$^+$	15487	61/2$^+$	
1467	12208	53/2$^+$	10741	49/2$^+$	E2	1910	10359+x	(77/2)	8449+x	(73/2)	E2
1519	11638	51/2$^-$	10119	47/2$^-$		1912	1912+x	(57/2)	0+x		
1527	3439+x	(61/2)	1912+x	(57/2)	E2	2018	12377+x	(81/2)	10359+x	(77/2)	E2
1564	5003+x	(65/2)	3439+x	(61/2)	E2	2259	14636+x	(85/2)	12377+x	(81/2)	E2

[†] $E\gamma$'s with uncertainties from 1974Gr07, others from 1999Ny01.

[‡] As no $I\gamma$ are given by 1999Ny01, $I\gamma$'s taken from 1974Gr07 at E(^{12}C)=49 MeV; for rel $I\gamma$ via (α,nγ) $E\alpha$=18 MeV see 1974Gr07.

[#] From 1974Gr07, unless noted otherwise. Based on γ linear pol and/or A_2,A_4 coef in $\gamma(\theta)$ with adopted J values E(^{12}C)=49 MeV; for rel $I\gamma$ via (α,nγ) $E\alpha$=18 MeV see 1974Gr07 Linear polarization coefficients are defined by 1974Gr07 as P=[I(90°)−I(0°)]/[I(90°)+I(0°)] where I(0°) and I(90°) are the intensities of the γ radiation with the electric vector parallel and perpendicular respectively to the beam direction. No details are given which values of P correspond to an electric or magnetic transition.

[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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

$^{103}_{46}\mathrm{Pd}_{57}$-6

(HI,xnγ)

Level Scheme

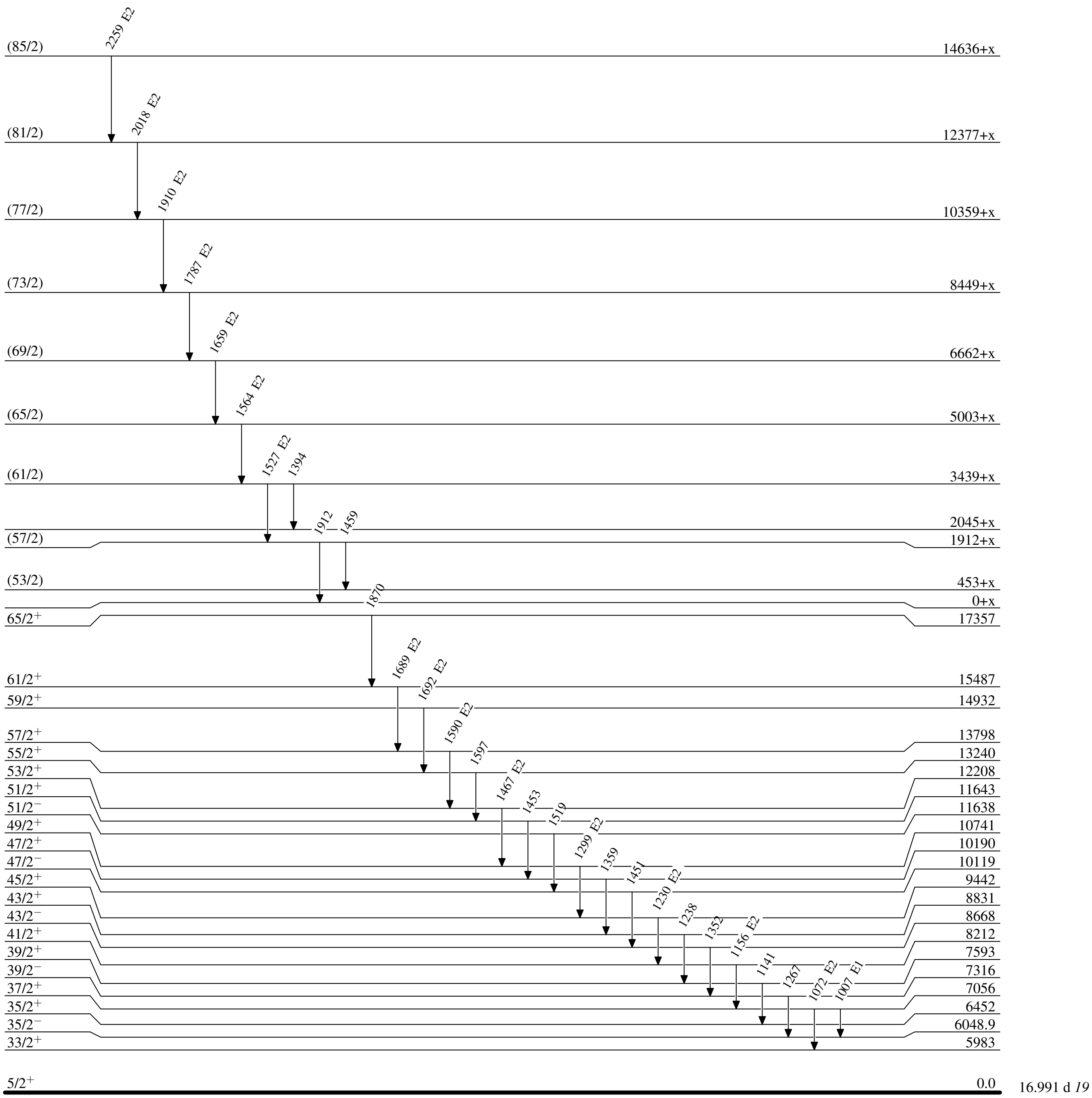
Intensities: Type not specified

Legend

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

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

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

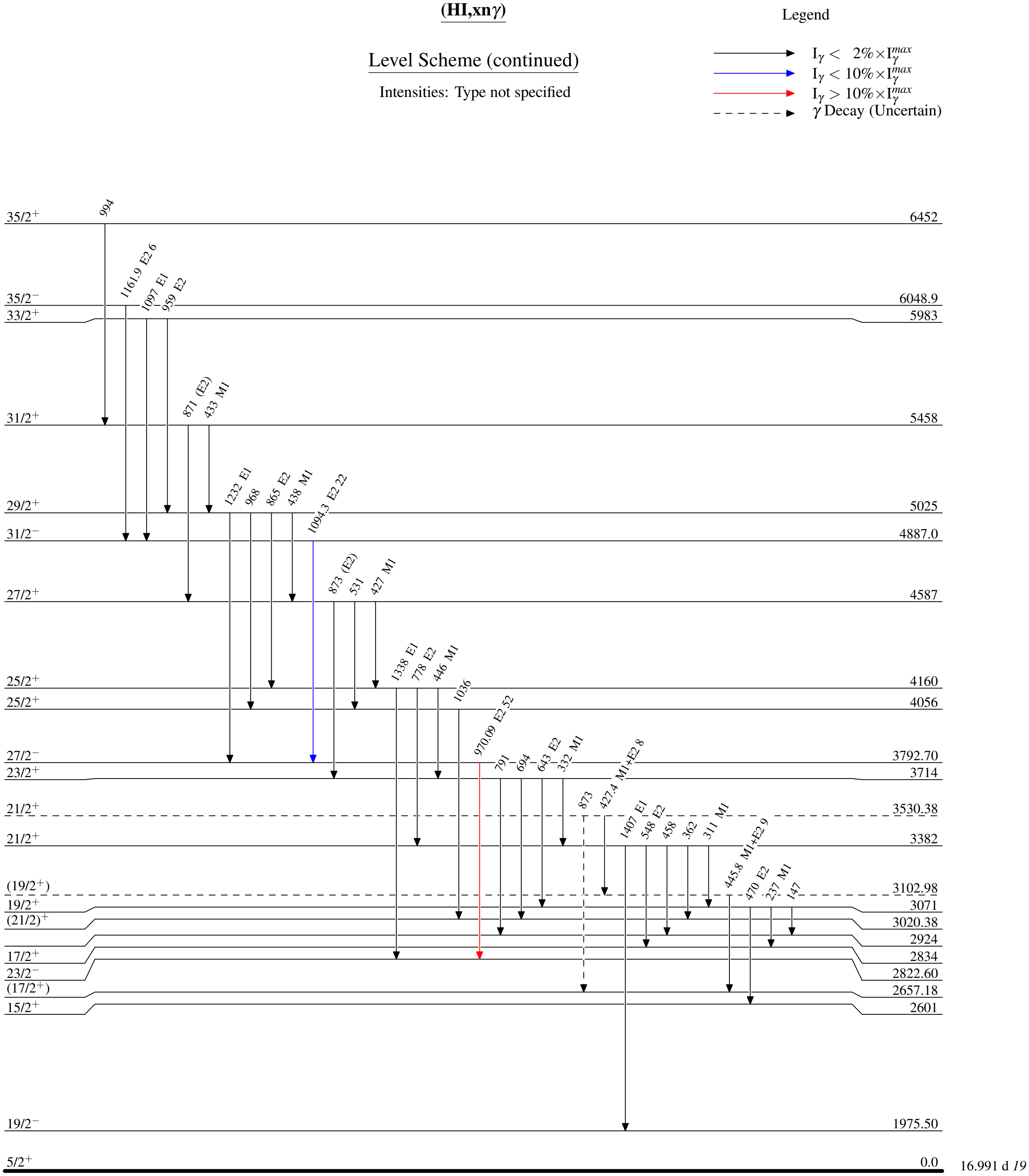


$^{103}_{46}Pd_{57}$

(HI,xnγ)

Level Scheme (continued)

Intensities: Type not specified

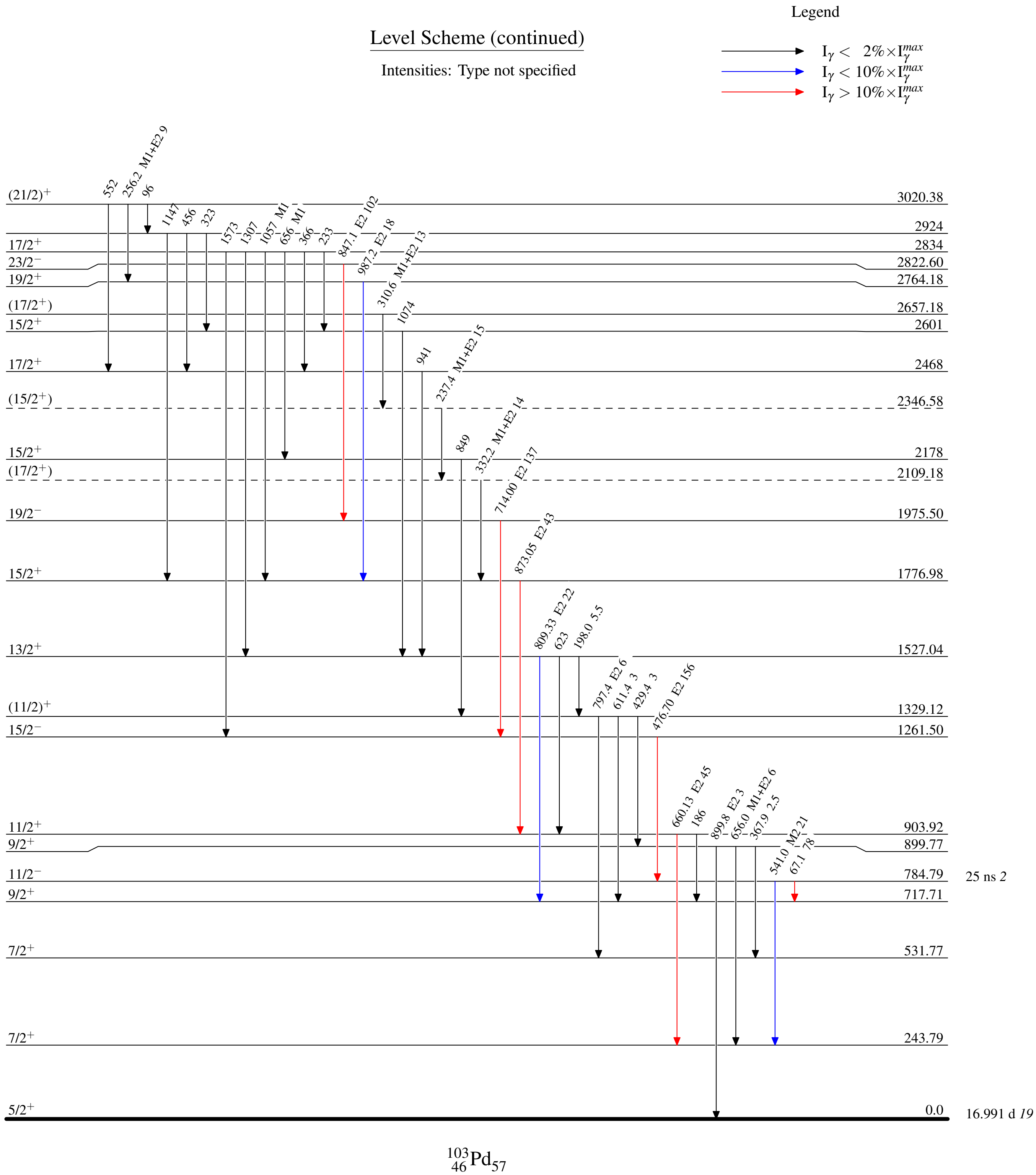


$^{103}_{46}Pd_{57}$

(HI,xnγ)

Level Scheme (continued)

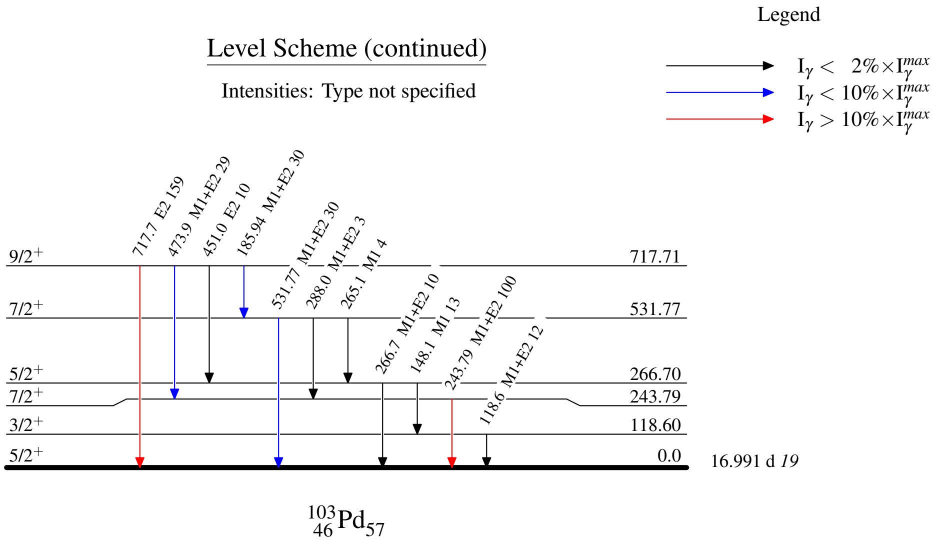
Intensities: Type not specified



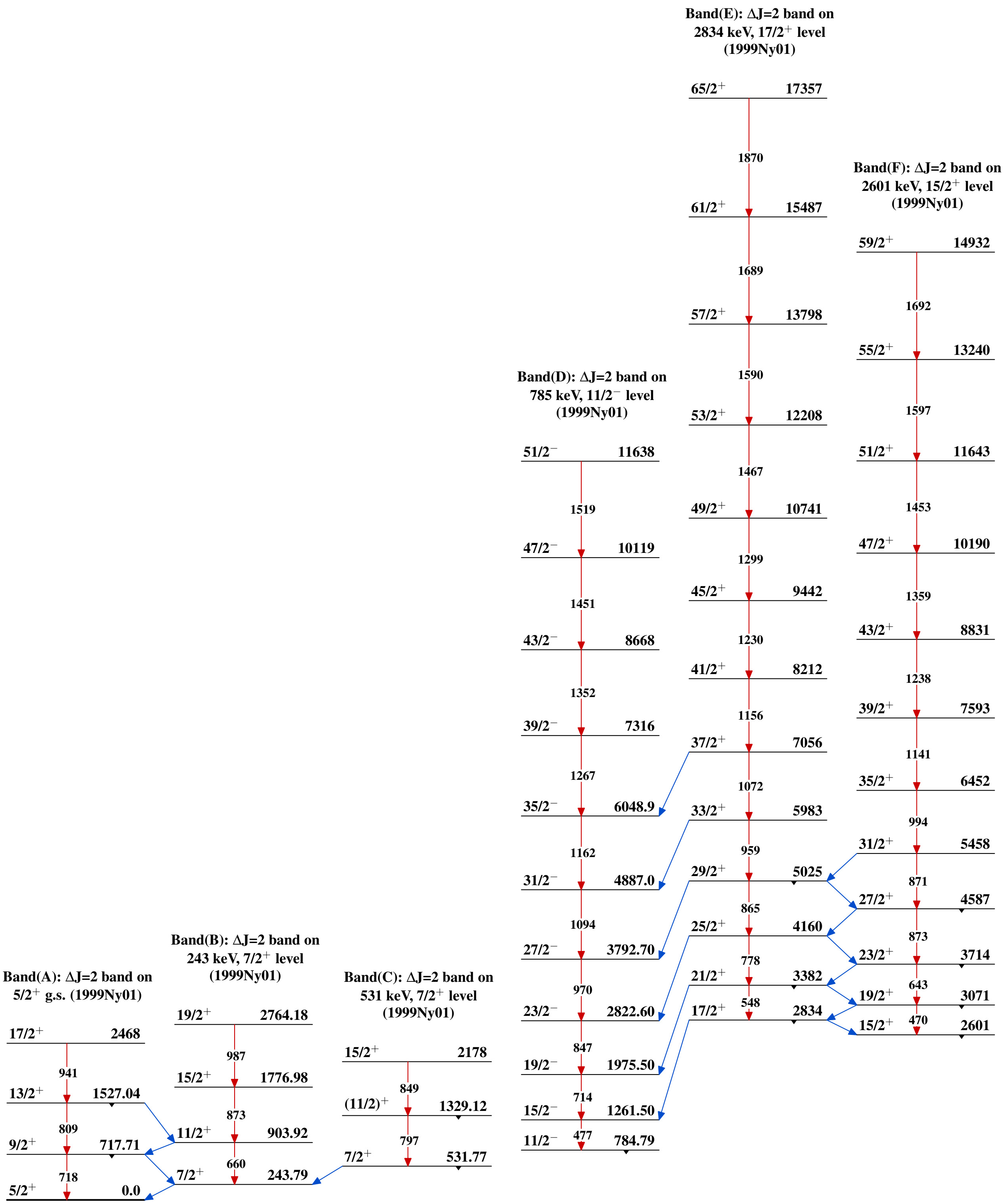
(HI,xnγ)

Level Scheme (continued)

Intensities: Type not specified

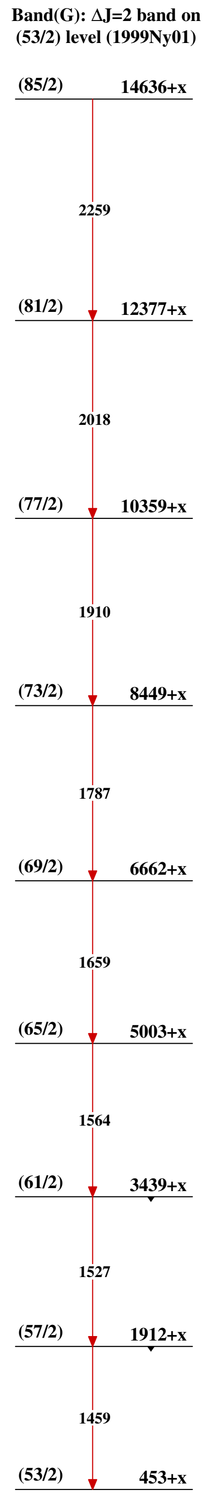


(HI,xnγ)



$^{103}_{46}Pd_{57}$

(HI,xnγ) (continued)



$^{103}_{46}Pd_{57}$