

**(HL,xnγ) 1991Hi03**

Type	Author	History	Citation	Literature Cutoff Date
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**1991Hi03:** <sup>122</sup>Sb(<sup>15</sup>N,4nγ) E=65 MeV; measured E<sub>γ</sub>, I<sub>γ</sub>, γγ, γ(θ) at six angles between 0° and 145°. <sup>133</sup>La; deduced levels, J<sup>π</sup>, bands. Tandem, Ge detectors, surrounded by BGO anti-Compton shields; total routhian surface model.

**1982Mo26:** <sup>133</sup>Cs(α,4nγ) E=50-70 MeV; measured E<sub>γ</sub>, γγ, γγ(t), αγ(t), γ(θ) at six angles between 90° and 165° with respect to α beam. <sup>133</sup>La; deduced levels, J<sup>π</sup>, δ, bands. Isochronous cyclotron, Ge(Li) detectors.

**1973Le09:** <sup>124</sup>Sb(<sup>14</sup>N,5nγ) E=68.5 MeV, <sup>126</sup>Te(<sup>11</sup>B,4nγ) E=52.5 MeV; measured E<sub>γ</sub>, γγ, γγ(t). <sup>133</sup>La; deduced levels, J<sup>π</sup>, T<sub>1/2</sub>. Ge(Li) detectors.

Others: **1977Ch23**, **1973Na08**.

Band assignments are according to **1991Hi03**. In figure 1 (part 2) of **1991Hi03**, two states 2219.8 and 2289.0 keV are shown below the 2368.17, 17/2<sup>+</sup> state which is the first level of band A. Evaluators have calculated the parameters of band A (11 levels, beginning with J=17/2) assuming K=13/2. Calculated energies of additional levels E(J=13/2<sup>+</sup>)=2197.2 and E(J=15/2<sup>+</sup>)=2268.5 keV agree well with those for the two states above mentioned and this gives grounds to assign them to band A.

<sup>133</sup>La Levels

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	T <sub>1/2</sub> <sup>@</sup>	Comments
0.0 <sup>e</sup>	5/2 <sup>+</sup>	3.912 h 8	T <sub>1/2</sub> : from 'Adopted Levels'.
87.8 <sup>c</sup> 3	5/2 <sup>+</sup>		
130.70 <sup>d</sup> 14	7/2 <sup>+</sup>		
476.99 <sup>e</sup> 17	9/2 <sup>+</sup>		
535.40 <sup>f</sup> 21	11/2 <sup>-</sup>	60 ns 5	T <sub>1/2</sub> : from γγ(t) of <b>1973Le09</b> .
540.3 <sup>b</sup> 4	7/2 <sup>+</sup>		
563.11 <sup>c</sup> 21	9/2 <sup>+</sup>		
654.22 <sup>d</sup> 24	11/2 <sup>+</sup>		
949.8 7	9/2 <sup>+</sup>		
980.0 <sup>f</sup> 3	15/2 <sup>-</sup>		
1153.0 <sup>g</sup> 3	13/2 <sup>-</sup>		
1188.41 <sup>e</sup> 21	13/2 <sup>+</sup>		
1219.5 <sup>b</sup> 3	(11/2 <sup>+</sup> )		
1260.33 <sup>c</sup> 23	13/2 <sup>+</sup>		
1310.6 4			
1377.67 <sup>d</sup> 23	15/2 <sup>+</sup>		
1495.6 4	11/2 <sup>+</sup>		
1561.0 5	(11/2 <sup>-</sup> )		
1656.9 7			
1661.3 <sup>f</sup> 4	19/2 <sup>-</sup>		
1663.6 5			
1737.8 <sup>g</sup> 4	17/2 <sup>-</sup>		
1806.6 9	9/2 <sup>-</sup> , 11/2 <sup>-</sup>		
1815.4 4	(15/2 <sup>-</sup> )		
1953.7 <sup>b</sup> 3	(15/2 <sup>+</sup> )		
2039.49 <sup>e</sup> 25	17/2 <sup>+</sup>		
2075.27 <sup>c</sup> 23	17/2 <sup>+</sup>		
2174.8 6			
2201.3 4	(19/2 <sup>-</sup> )		
2219.8 <sup>&amp;</sup> 4	(13/2 <sup>+</sup> )		
2261.4 4	(13/2 <sup>-</sup> , 15/2, 17/2)		
2262.2 <sup>d</sup> 3	19/2 <sup>+</sup>		
2289.0 <sup>&amp;</sup> 3	(15/2 <sup>+</sup> )		

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**(HI,xn $\gamma$ ) 1991Hi03 (continued)** $^{133}\text{La}$  Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>
2368.17 <sup>&amp;</sup> 22	17/2 <sup>+</sup>	3104.3 4	(25/2)	3778.3 <sup>a</sup> 5	(27/2 <sup>+</sup> )	4871.5 6	
2423.9 7		3111.1 <sup>a</sup> 4	(23/2 <sup>+</sup> )	3948.9 5	(29/2 <sup>-</sup> )	4926.4 6	(33/2)
2450.0 <sup>f</sup> 4	23/2 <sup>-</sup>	3258.8 <sup>&amp;</sup> 4	25/2 <sup>+</sup>	4012.0 5	(29/2)	4938.4 <sup>&amp;</sup> 6	33/2 <sup>+</sup>
2503.40 <sup>&amp;</sup> 25	19/2 <sup>+</sup>	3270.0 7		4030.8 <sup>&amp;</sup> 5	29/2 <sup>+</sup>	5004.7 6	
2535.1 <sup>g</sup> 4	21/2 <sup>-</sup>	3276.7 <sup>d</sup> 9	23/2 <sup>+</sup>	4055.2 5		5039.0 6	
2581.2 4	(21/2 <sup>-</sup> )	3278.2 4	25/2 <sup>+</sup>	4072.5 6		5198.7 <sup>f</sup> 6	35/2 <sup>-</sup>
2682.1 <sup>&amp;</sup> 4	21/2 <sup>+</sup>	3292.8 <sup>f</sup> 5	27/2 <sup>-</sup>	4134.1 <sup>a</sup> 5	(29/2 <sup>+</sup> )	5220.2 13	
2716.2 5		3382.3 <sup>a</sup> 4	(25/2 <sup>+</sup> )	4227.2 <sup>f</sup> 5	31/2 <sup>-</sup>	5221.3 7	(35/2 <sup>-</sup> )
2727.2 <sup>a</sup> 7	(19/2 <sup>+</sup> )	3431.6 <sup>g</sup> 4	25/2 <sup>-</sup>	4359.8 <sup>g</sup> 9	(29/2)	5319.7 8	
2884.6 <sup>e</sup> 7	(21/2 <sup>+</sup> )	3448.7 4	25/2 <sup>-</sup>	4397.1 5	(31/2 <sup>-</sup> )	5351.9 <sup>&amp;</sup> 6	35/2 <sup>+</sup>
2891.1 4	23/2 <sup>+</sup>	3552.0 9		4475.3 <sup>&amp;</sup> 5	31/2 <sup>+</sup>	6144.9 <sup>f</sup> 7	(39/2 <sup>-</sup> )
2894.1 <sup>a</sup> 4	(21/2 <sup>+</sup> )	3600.3 4	(27/2 <sup>-</sup> )	4510.8 5	(31/2)	6283.2 <sup>&amp;</sup> 7	(39/2 <sup>+</sup> )
2916.0 4	(23/2 <sup>-</sup> )	3614.5 <sup>&amp;</sup> 4	27/2 <sup>+</sup>	4513.0 6			
2927.7 <sup>&amp;</sup> 4	23/2 <sup>+</sup>	3646.9 5	(27/2)	4569.3 10			
3003.8 5	(23/2 <sup>-</sup> )	3762.6 5	(27/2 <sup>-</sup> ) <sup>#</sup>	4831.6 6	(33/2 <sup>-</sup> )		

<sup>†</sup> From a least-squares fit to E $\gamma$ 's.

<sup>‡</sup> From Adopted Levels.

<sup>#</sup> D  $\gamma$  from (29/2<sup>-</sup>) level,  $\gamma$  to 23/2<sup>-</sup>.

@ T<sub>1/2</sub> ≤ 3 ns for excited states above the 11/2<sup>-</sup> isomer (1982Mo26).

<sup>&</sup> Band(A): based on 17/2<sup>+</sup> 2368-keV state,  $\Delta J=1$ .

<sup>a</sup> Band(B): based on (19/2<sup>+</sup>) 2727-keV state,  $\Delta J=1$ .

<sup>b</sup> Band(C): based on 7/2<sup>+</sup> 541-keV state.

<sup>c</sup> Band(D): based on 5/2<sup>+</sup> 88-keV state.

<sup>d</sup> Band(E): based on 7/2<sup>+</sup> 131-keV state.

<sup>e</sup> Band(F): based on 5/2<sup>+</sup> ground state.

<sup>f</sup> Band(G): based on 11/2<sup>-</sup> 536-keV isomer,  $\alpha=-1/2$ .

<sup>g</sup> Band(H): based on 13/2<sup>-</sup> 1153-keV state,  $\alpha=+1/2$ .

(HI,xn $\gamma$ ) **1991Hi03** (continued)

$\gamma(^{133}\text{La})$

$E_\gamma$ †	$I_\gamma$ †	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	$\delta^\#$	Comments
58.3 <sup>a</sup> 8		535.40	11/2 <sup>-</sup>	476.99	9/2 <sup>+</sup>	E1 &		
79.6 8		2368.17	17/2 <sup>+</sup>	2289.0	(15/2 <sup>+</sup> )			
87.8 3	41 20	87.8	5/2 <sup>+</sup>	0.0	5/2 <sup>+</sup>	M1+E2 &		$A_2=+0.96$ 9, $A_4\approx 0.0$ .
130.70 @ 15	27 14	130.70	7/2 <sup>+</sup>	0.0	5/2 <sup>+</sup>	M1+E2 &		$A_2=-0.05$ 3, $A_4\approx 0.0$ .
135.1 @ 3	26 13	2503.40	19/2 <sup>+</sup>	2368.17	17/2 <sup>+</sup>	D		$A_2=-0.09$ 3, $A_4\approx 0.0$ .
147.8 <sup>a</sup> 8		2368.17	17/2 <sup>+</sup>	2219.8	(13/2 <sup>+</sup> )			
151.4 @ 3	6 3	3600.3	(27/2 <sup>-</sup> )	3448.7	25/2 <sup>-</sup>	D+Q		$A_2=-0.14$ 7, $A_4=+0.09$ 8.
167.1 8		2894.1	(21/2 <sup>+</sup> )	2727.2	(19/2 <sup>+</sup> )			
168.5 @ 3	11 6	3600.3	(27/2 <sup>-</sup> )	3431.6	25/2 <sup>-</sup>	D		$A_2=-0.32$ 3, $A_4\approx 0.0$ .
178.0 8	24 12	3104.3	(25/2)	2927.7	23/2 <sup>+</sup>	D+Q		$I_\gamma$ : for the 178.0+178.7 $\gamma$ 's. $A_2=-0.55$ 4, $A_4=+0.14$ 5.
178.7 3	24 12	2682.1	21/2 <sup>+</sup>	2503.40	19/2 <sup>+</sup>	M1+E2	-0.10 3	$I_\gamma$ : for the 178.0+178.7 $\gamma$ 's. $A_2=-0.55$ 4, $A_4=+0.14$ 5. $A_2=-0.43$ 3, $A_4\approx 0.0$ .
187.3 <sup>a</sup> 8	7 3	3948.9	(29/2 <sup>-</sup> )	3762.6	(27/2 <sup>-</sup> )	D		
209.03 @ 17	13 7	2891.1	23/2 <sup>+</sup>	2682.1	21/2 <sup>+</sup>	M1+E2		Mult.: from $A_2=-0.48$ 4, $A_4=+0.19$ 4 and RUL.
213.13 @ 17	6 3	3104.3	(25/2)	2891.1	23/2 <sup>+</sup>	D+Q		$A_2=-0.61$ 4, $A_4=+0.23$ 5.
217.0 3	1.4 7	3111.1	(23/2 <sup>+</sup> )	2894.1	(21/2 <sup>+</sup> )	D+Q		$A_2=-0.50$ 11, $A_4=+0.20$ 12.
226.4 8		3111.1	(23/2 <sup>+</sup> )	2884.6	(21/2 <sup>+</sup> )			
245.6 3	10.8 11	2927.7	23/2 <sup>+</sup>	2682.1	21/2 <sup>+</sup>	M1+E2	-0.13 4	$A_2=-0.51$ 5, $A_4=+0.11$ 6.
249.1 3		2423.9		2174.8				
271.0 8	2.0 2	3382.3	(25/2 <sup>+</sup> )	3111.1	(23/2 <sup>+</sup> )	D+Q		$A_2=-0.37$ 10, $A_4=+0.14$ 11.
280.3 8		5319.7		5039.0				
286.1 8	1.8 2	4513.0		4227.2	31/2 <sup>-</sup>	D+Q		$A_2=-0.11$ 13, $A_4=+0.05$ 13.
307.3 @ <sup>a</sup> 4	6 3	3600.3	(27/2 <sup>-</sup> )	3292.8	27/2 <sup>-</sup>	D+Q		$A_2=-0.43$ 3, $A_4=+0.08$ 32.
313.8 <sup>a</sup> 8	1.1 6	2682.1	21/2 <sup>+</sup>	2368.17	17/2 <sup>+</sup>			$A_2=-0.21$ 11, $A_4\approx 0.0$ .
328.2 3	0.4 2	2368.17	17/2 <sup>+</sup>	2039.49	17/2 <sup>+</sup>			
331.03 @ 17	3.4 3	3258.8	25/2 <sup>+</sup>	2927.7	23/2 <sup>+</sup>	M1+E2		$\delta$ : -0.16 6 or -3.7 6. $A_2=-0.55$ 5, $A_4=+0.04$ 6.
336.1 @ 3	7.1 7	3614.5	27/2 <sup>+</sup>	3278.2	25/2 <sup>+</sup>	M1+E2	-4.4 13	$A_2=-0.06$ 4, $A_4=-0.02$ 5.
<sup>x</sup> 338	1.1 3							$E_\gamma$ : from 1982Mo26, $I_\gamma$ is reduced to 1991Hi03.
346.26 @ 17	8.1 8	476.99	9/2 <sup>+</sup>	130.70	7/2 <sup>+</sup>	M1(+E2) &		$A_2=-0.04$ 2, $A_4\approx 0.0$ .
348.4 @ 3	10.8 11	3948.9	(29/2 <sup>-</sup> )	3600.3	(27/2 <sup>-</sup> )	D		$A_2=-0.44$ 2, $A_4\approx 0.0$ .
350.50 @ 17	5.1 5	3278.2	25/2 <sup>+</sup>	2927.7	23/2 <sup>+</sup>	M1+E2	-3.7 10	$A_2=-0.26$ 5, $A_4=+0.12$ 6.
355.5 8	4.4 4	4134.1	(29/2 <sup>+</sup> )	3778.3	(27/2 <sup>+</sup> )	D		$I_\gamma$ : for the 355.5+355.7 $\gamma$ 's. $A_2=-0.33$ 3, $A_4\approx 0.0$ .
355.70 @ 19	4.4 4	3614.5	27/2 <sup>+</sup>	3258.8	25/2 <sup>+</sup>	D		$I_\gamma$ : for the 355.5+355.7 $\gamma$ 's. $A_2=-0.33$ 3, $A_4\approx 0.0$ .
359.3 8	1.8 9	2174.8		1815.4	(15/2 <sup>-</sup> )			

(HL,xn $\gamma$ ) **1991Hi03** (continued) $\gamma(^{133}\text{La})$  (continued)

$E_\gamma$ †	$I_\gamma$ †	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	$\delta^\#$	Comments
364.7 3	2.2 2	4012.0	(29/2)	3646.9	(27/2)	D+Q		$I_\gamma$ : for the 364.7+367.5 $\gamma$ 's. $A_2=-0.31$ 6, $A_4=0.17$ 8.
367.78 @ 18	2.2 2	3258.8	25/2 <sup>+</sup>	2891.1	23/2 <sup>+</sup>	D+Q		$I_\gamma$ : for the 364.7+367.5 $\gamma$ 's. $A_2=-0.31$ 6, $A_4=0.17$ 8.
386.96 @ 17	2.8 3	3278.2	25/2 <sup>+</sup>	2891.1	23/2 <sup>+</sup>	M1+E2	-0.08 5	$A_2=-0.62$ 8, $A_4=+0.21$ 7.
389.0 8	2.2 2	476.99	9/2 <sup>+</sup>	87.8	5/2 <sup>+</sup>	E2&		Mult.: $A_2=-0.13$ 8, $A_4\approx 0.0$ . Mult.=D+Q from $\gamma(\theta)$ measurement; D ruled out from placement in level scheme.
389.7 3		5221.3	(35/2 <sup>-</sup> )	4831.6	(33/2 <sup>-</sup> )			
391.3 8		2894.1	(21/2 <sup>+</sup> )	2503.40	19/2 <sup>+</sup>			
396.0 3	2.1 2	3778.3	(27/2 <sup>+</sup> )	3382.3	(25/2 <sup>+</sup> )	D		$A_2=-0.21$ 7, $A_4\approx 0.0$ .
404.73 @ a 17	3.7 4	535.40	11/2 <sup>-</sup>	130.70	7/2 <sup>+</sup>	M2&		$A_2=+0.32$ 6, $A_4=+0.12$ 8.
414.4 3	3.4 3	2368.17	17/2 <sup>+</sup>	1953.7	(15/2 <sup>+</sup> )			$A_2=+0.09$ 6, $A_4\approx 0.0$ .
415.9 3	3.7 4	4030.8	29/2 <sup>+</sup>	3614.5	27/2 <sup>+</sup>	(M1)		Mult.: level scheme; $A_2=-0.06$ 9, $A_4\approx 0.0$ .
419.6 8	3.7 18	2682.1	21/2 <sup>+</sup>	2262.2	19/2 <sup>+</sup>			
428.3 @ a 3	10 5	2503.40	19/2 <sup>+</sup>	2075.27	17/2 <sup>+</sup>			$I_\gamma$ : for the 428.4+428.7 $\gamma$ 's; $A_2=-0.54$ 5, $A_4=+0.19$ 6
428.7 a 8	10 5	3111.1	(23/2 <sup>+</sup> )	2682.1	21/2 <sup>+</sup>	D+Q		$I_\gamma$ : for the 428.4+428.7 $\gamma$ 's. $A_2=-0.54$ 5, $A_4=+0.19$ 6.
432.38 @ 19	6.3 6	563.11	9/2 <sup>+</sup>	130.70	7/2 <sup>+</sup>	M1+E2	+0.07 4	$A_2=-0.25$ 4, $A_4\approx 0.0$ .
434.5 a 3	3.7 18	4831.6	(33/2 <sup>-</sup> )	4397.1	(31/2 <sup>-</sup> )	(D)		$A_2=-0.60$ 4, $A_4\approx 0.0$ .
440.7 3	2.9 15	4055.2		3614.5	27/2 <sup>+</sup>			
444.5 3	69 7	4475.3	31/2 <sup>+</sup>	4030.8	29/2 <sup>+</sup>	E2		$I_\gamma$ : for the 444.5+444.6 $\gamma$ 's. Mult.: stretched E2, band structure; $A_2=+0.20$ 2, $A_4=-0.00$ 3.
444.6 3	69 7	980.0	15/2 <sup>-</sup>	535.40	11/2 <sup>-</sup>	E2&		$I_\gamma$ : for the 444.5+444.6 $\gamma$ 's. Mult.: stretched E2 in 1991He03 $A_2=+0.20$ 2, $A_4=-0.00$ 3.
448.26 @ 17	10 5	4397.1	(31/2 <sup>-</sup> )	3948.9	(29/2 <sup>-</sup> )			
454.3 3	3.4 3	3382.3	(25/2 <sup>+</sup> )	2927.7	23/2 <sup>+</sup>	(D+Q)		$A_2=-0.08$ 12, $A_4\approx 0.0$ .
463.1 a 3	16 8	4938.4	33/2 <sup>+</sup>	4475.3	31/2 <sup>+</sup>	(M1+E2)		Mult.: from $A_2=-0.10$ 5, $A_4=+0.06$ 4 and RUL.
474.4 3	10.2 10	4871.5		4397.1	(31/2 <sup>-</sup> )			$I_\gamma$ : for the 474.4+475.3 $\gamma$ 's. $A_2=-0.21$ 5, $A_4\approx 0.0$ .
475.3 8	10.2 10	563.11	9/2 <sup>+</sup>	87.8	5/2 <sup>+</sup>	E2&		$I_\gamma$ : for the 474.4+475.3 $\gamma$ 's. $A_2=-0.21$ 5, $A_4\approx 0.0$ .
476.9 @ 3	100	476.99	9/2 <sup>+</sup>	0.0	5/2 <sup>+</sup>	E2&		$A_2=+0.18$ 3, $A_4=+0.02$ 4.
491.7 3	4.0 20	5004.7		4513.0				
496.8 8	1.9 9	4569.3		4072.5				
498.9 3	3.3 16	4510.8	(31/2)	4012.0	(29/2)			
510.5 8		1663.6		1153.0	13/2 <sup>-</sup>			$E_\gamma$ : contaminated by the 511 annihilation line.
511.0 8		2174.8		1663.6				$E_\gamma$ : contaminated by the 511 annihilation line.
523.2 8	23 11	2261.4	(13/2 <sup>-</sup> ,15/2,17/2)	1737.8	17/2 <sup>-</sup>			$I_\gamma$ : for the 523.2+523.6 $\gamma$ 's. $A_2=+0.07$ 4, $A_4=+0.09$ 4.
523.6 3	23 12	654.22	11/2 <sup>+</sup>	130.70	7/2 <sup>+</sup>	E2&		$I_\gamma$ : for the 523.2+523.6 $\gamma$ 's. Mult.: stretched E2, band structure; $A_2=+0.07$ 4, $A_4=+0.09$ 4.

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(HI,xn $\gamma$ ) 1991Hi03 (continued) $\gamma(^{133}\text{La})$  (continued)

$E_\gamma$ †	$I_\gamma$ †	$E_i$ (level)	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	$\delta^\#$	Comments
534.3 <sup>a</sup> 8	6 3	1188.41	13/2 <sup>+</sup>	654.22	11/2 <sup>+</sup>	D+Q		$A_2=-0.04$ 6, $A_4=0.10$ 7.
540.3 3		2201.3	(19/2 <sup>-</sup> )	1661.3	19/2 <sup>-</sup>			
541.2 8	4.7 5	540.3	7/2 <sup>+</sup>	0.0	5/2 <sup>+</sup>	M1&		$A_2=-0.00$ 4, $A_4\approx 0.0$ .
542.44 <sup>@</sup> 17	4.9 5	3646.9	(27/2)	3104.3	(25/2)	M1+E2	-0.13 7	$A_2=-0.57$ 5, $A_4=+0.11$ 7.
553.1 8	1.8 2	2368.17	17/2 <sup>+</sup>	1815.4	(15/2 <sup>-</sup> )	(D)		$A_2=-0.13$ 30, $A_4\approx 0.0$ .
564.1 3		4513.0		3948.9	(29/2 <sup>-</sup> )			
576.0 8		1953.7	(15/2 <sup>+</sup> )	1377.67	15/2 <sup>+</sup>			
576.8 8		3258.8	25/2 <sup>+</sup>	2682.1	21/2 <sup>+</sup>			
581.0 3	1.6 8	1561.0	(11/2 <sup>-</sup> )	980.0	15/2 <sup>-</sup>			
584.8 <sup>a</sup> 3	6 3	1737.8	17/2 <sup>-</sup>	1153.0	13/2 <sup>-</sup>	E2		Mult.: stretched quadrupole; $A_2=+0.45$ 8, $A_4\approx 0.0$ .
598.0 8		2261.4	(13/2 <sup>-</sup> ,15/2,17/2)	1663.6				
606.3 8	1.9 10	1260.33	13/2 <sup>+</sup>	654.22	11/2 <sup>+</sup>			$I_\gamma$ : for the 606.3+607.4 $\gamma$ 's; $A_2=+0.42$ 16, $A_4\approx 0.0$ .
607.4 8	1.9 10	3111.1	(23/2 <sup>+</sup> )	2503.40	19/2 <sup>+</sup>			$I_\gamma$ : for the 606.3+607.4 $\gamma$ 's. $A_2=+0.42$ 16, $A_4\approx 0.0$ .
617.63 <sup>@</sup> 17	12.1 12	1153.0	13/2 <sup>-</sup>	535.40	11/2 <sup>-</sup>	M1+E2		$A_2=-0.71$ 5, $A_4=+0.11$ 6. $\delta$ : -0.32 10 or -1.8 4.
641.8 3		5039.0		4397.1	(31/2 <sup>-</sup> )			
650.9 8	1.4 7	5220.2		4569.3				
656.0 8	1.4 7	1310.6		654.22	11/2 <sup>+</sup>			
662.5 <sup>@a</sup> 4	6 3	1815.4	(15/2 <sup>-</sup> )	1153.0	13/2 <sup>-</sup>	(M1+E2)		Mult.: from $A_2=-0.13$ 6, $A_4=-0.08$ 6 and RUL.
667.3 <sup>a</sup> 8	1.3 6	3778.3	(27/2 <sup>+</sup> )	3111.1	(23/2 <sup>+</sup> )			
679.3 3	9 4	1219.5	(11/2 <sup>+</sup> )	540.3	7/2 <sup>+</sup>			
681.27 <sup>@</sup> 17	65 6	1661.3	19/2 <sup>-</sup>	980.0	15/2 <sup>-</sup>	E2		Mult.: stretched E2; $A_2=+0.25$ 3, $A_4=-0.03$ 4.
686.8 <sup>@</sup> 3	4.1 4	3614.5	27/2 <sup>+</sup>	2927.7	23/2 <sup>+</sup>	(E2)		Mult.: from band structure; $A_2=-0.03$ 16, $A_4\approx 0.0$ .
689.0 8		3270.0		2581.2	(21/2 <sup>-</sup> )			
693.5 8		1953.7	(15/2 <sup>+</sup> )	1260.33	13/2 <sup>+</sup>			
697.1 3	8.5 9	1260.33	13/2 <sup>+</sup>	563.11	9/2 <sup>+</sup>	E2		$I_\gamma$ : for the 697.1+698.1 $\gamma$ 's. Mult.: stretched E2, band structure; $A_2=+0.01$ 8, $A_4=-0.09$ 10.
698.1 8	8.5 9	2075.27	17/2 <sup>+</sup>	1377.67	15/2 <sup>+</sup>			$I_\gamma$ : for the 697.1+698.1 $\gamma$ 's; $A_2=+0.01$ 8, $A_4=-0.09$ 10.
700.5 3	0.9 4	3382.3	(25/2 <sup>+</sup> )	2682.1	21/2 <sup>+</sup>			
706.8 8		1656.9		949.8	9/2 <sup>+</sup>			
711.43 <sup>@</sup> 17	19.4 19	1188.41	13/2 <sup>+</sup>	476.99	9/2 <sup>+</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.13$ 3, $A_4\approx 0.0$ .
714.6 <sup>a</sup> 3	20 10	2916.0	(23/2 <sup>-</sup> )	2201.3	(19/2 <sup>-</sup> )	E2		$A_2=+0.10$ 5, $A_4\approx 0.0$ .
723.46 <sup>@</sup> 17	17.1 17	1377.67	15/2 <sup>+</sup>	654.22	11/2 <sup>+</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.16$ 4.
734.1 3	4.9 25	1953.7	(15/2 <sup>+</sup> )	1219.5	(11/2 <sup>+</sup> )			
742.3 3	2.7 14	1219.5	(11/2 <sup>+</sup> )	476.99	9/2 <sup>+</sup>	(M1)		Mult.: perhaps, stretched (M1), $A_2=-0.01$ 10, $A_4\approx 0.0$ .
742.5 <sup>b</sup> 8	2.7 <sup>b</sup> 13	3003.8	(23/2 <sup>-</sup> )	2261.4	(13/2 <sup>-</sup> ,15/2,17/2)			$I_\gamma$ : for the 742.3+742.5 $\gamma$ 's. $A_2=-0.01$ 10, $A_4\approx 0.0$ .

(HI,xn $\gamma$ ) **1991Hi03** (continued) $\gamma(^{133}\text{La})$  (continued)

$E_\gamma$ †	$I_\gamma$ †	$E_i$ (level)	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	$\delta^\#$	Comments
747.5 3		1310.6		563.11	9/2 <sup>+</sup>			
751.9 3	1.6 8	4134.1	(29/2 <sup>+</sup> )	3382.3	(25/2 <sup>+</sup> )			
757.89 @ 17	7.6 7	1737.8	17/2 <sup>-</sup>	980.0	15/2 <sup>-</sup>	M1+E2	-1.5 12	$A_2=-1.07$ 6, $A_4\approx 0.0$ .
772.3 3		4030.8	29/2 <sup>+</sup>	3258.8	25/2 <sup>+</sup>			
777.0 <sup>a</sup> 8		4055.2		3278.2	25/2 <sup>+</sup>			
779.7 <sup>ba</sup> 8	3.3 <sup>b</sup> 16	2039.49	17/2 <sup>+</sup>	1260.33	13/2 <sup>+</sup>			
779.7 <sup>b</sup> 3	3.3 <sup>b</sup> 16	4072.5		3292.8	27/2 <sup>-</sup>			
788.69 @ 17	43 4	2450.0	23/2 <sup>-</sup>	1661.3	19/2 <sup>-</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.29$ 4, $A_4=0.04$ 5.
797.7 @ 4	5.0 5	2535.1	21/2 <sup>-</sup>	1737.8	17/2 <sup>-</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.47$ 2, $A_4\approx 0.0$ .
802.4 3	8.7 9	3003.8	(23/2 <sup>-</sup> )	2201.3	(19/2 <sup>-</sup> )	E2		$A_2=+0.55$ 6, $A_4\approx 0.0$ .
814.85 @ 23	2.8 3	2075.27	17/2 <sup>+</sup>	1260.33	13/2 <sup>+</sup>	E2		Mult.: band structure ( <b>1991Hi03</b> ); $A_2=+0.23$ 8, $A_4=-0.05$ 14.
818.7 8	2.1 2	2894.1	(21/2 <sup>+</sup> )	2075.27	17/2 <sup>+</sup>			$I_\gamma$ : for the 818.7+818.8 $\gamma$ 's. $A_2=-0.44$ 7, $A_4\approx 0.0$ .
818.8 8	2.1 2	949.8	9/2 <sup>+</sup>	130.70	7/2 <sup>+</sup>			$I_\gamma$ : for the 818.7+818.8 $\gamma$ 's. $A_2=-0.44$ 7, $A_4\approx 0.0$ .
842.1 3	27 3	2219.8	(13/2 <sup>+</sup> )	1377.67	15/2 <sup>+</sup>			$I_\gamma$ : for the 842.1+842.6 $\gamma$ 's. $A_2=+0.16$ 4, $A_4=0.22$ 4.
842.7 @ 3	27 3	3292.8	27/2 <sup>-</sup>	2450.0	23/2 <sup>-</sup>	E2		$I_\gamma$ : for the 842.1+842.6 $\gamma$ 's. Mult.: stretched E2, band structure; $A_2=+0.16$ 4, $A_4=0.22$ 4.
845.1 8		2884.6	(21/2 <sup>+</sup> )	2039.49	17/2 <sup>+</sup>			
846.4 3		3762.6	(27/2 <sup>-</sup> )	2916.0	(23/2 <sup>-</sup> )			$E_\gamma$ : in <b>1982Mo16</b> , this single $\gamma$ transition introduces the doubtful 1382-keV level.
850.84 @ 19	3.7 4	2039.49	17/2 <sup>+</sup>	1188.41	13/2 <sup>+</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.81$ 15, $A_4=-0.05$ 18.
854.3 8	2.3 12	2894.1	(21/2 <sup>+</sup> )	2039.49	17/2 <sup>+</sup>			
860.7 8	2.2 11	4475.3	31/2 <sup>+</sup>	3614.5	27/2 <sup>+</sup>			
863.6 8	1.3 6	4510.8	(31/2)	3646.9	(27/2)			
867.7 3		3448.7	25/2 <sup>-</sup>	2581.2	(21/2 <sup>-</sup> )			
873.72 @ 19	4.7 5	2535.1	21/2 <sup>-</sup>	1661.3	19/2 <sup>-</sup>	M1+E2	-1.5 12	$A_2=-1.16$ 11, $A_4\approx 0.0$ .
876.6 3	6 3	5351.9	35/2 <sup>+</sup>	4475.3	31/2 <sup>+</sup>			
884.51 @ 19	4.3 4	2262.2	19/2 <sup>+</sup>	1377.67	15/2 <sup>+</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.40$ 33, $A_4=0.56$ 16.
886.93 @ 17	5.2 5	2075.27	17/2 <sup>+</sup>	1188.41	13/2 <sup>+</sup>	(Q)		$A_2=+0.45$ 8, $A_4\approx 0.0$ .
896.5 3	11.1 11	3431.6	25/2 <sup>-</sup>	2535.1	21/2 <sup>-</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.52$ 6, $A_4\approx 0.0$ .
907.76 @ 17	8.5 9	4012.0	(29/2)	3104.3	(25/2)	(E2)		$A_2=+0.14$ 5, $A_4\approx 0.0$ .
913.56 @ 17	6.0 6	3448.7	25/2 <sup>-</sup>	2535.1	21/2 <sup>-</sup>	(Q)		$I_\gamma$ : for the 913.7+914.4 $\gamma$ 's. $A_2=+0.24$ 7, $A_4\approx 0.0$ .
914.4 3	6.0 6	4926.4	(33/2)	4012.0	(29/2)	(Q)		$E_\gamma$ : in <b>1982Mo26</b> , 913.5 2 $\gamma$ -ray from E=3363, J=(27/2) level. $I_\gamma$ : for the 913.7+914.4 $\gamma$ 's. $A_2=+0.24$ 7, $A_4\approx 0.0$ .
920.05 @ 23	4.2 21	2581.2	(21/2 <sup>-</sup> )	1661.3	19/2 <sup>-</sup>	M1+E2	-1.7 15	$A_2=-0.69$ 10, $A_4=0.09$ 12 from <b>1982Mo26</b> .
923.0 8		5319.7		4397.1	(31/2 <sup>-</sup> )			

(HL,xn $\gamma$ ) **1991Hi03** (continued)

$\gamma(^{133}\text{La})$  (continued)

$E_\gamma$ <sup>†</sup>	$I_\gamma$ <sup>†</sup>	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta$ <sup>#</sup>	Comments
931.3 3	2.6 13	6283.2	(39/2 <sup>+</sup> )	5351.9	35/2 <sup>+</sup>			
934.5 <sup>@</sup> 3	9.2 9	4227.2	31/2 <sup>-</sup>	3292.8	27/2 <sup>-</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.11$ 10, $A_4=0.08$ 10.
946.2 3	1.5 8	6144.9	(39/2 <sup>-</sup> )	5198.7	35/2 <sup>-</sup>			
971.5 3	3.8 4	5198.7	35/2 <sup>-</sup>	4227.2	31/2 <sup>-</sup>	E2		Mult.: stretched E2, band structure; $A_2=+0.09$ 11, $A_4=-0.21$ 10.
981.2 <sup>@</sup> 4	5.9 6	3431.6	25/2 <sup>-</sup>	2450.0	23/2 <sup>-</sup>	M1+E2	-1.3 10	$A_2=-1.00$ 5, $A_4=0.18$ 4.
990.50 <sup>@</sup> 17	10.6 11	2368.17	17/2 <sup>+</sup>	1377.67	15/2 <sup>+</sup>	M1+E2	-0.33 10	$A_2=-0.8$ 3, $A_4=0.06$ 5.
998.62 <sup>@</sup> 19	5.3 5	3448.7	25/2 <sup>-</sup>	2450.0	23/2 <sup>-</sup>	M1+E2	-1.5 13	$A_2=-0.75$ 6, $A_4=-0.02$ 7.
1003.0 8	4.1 20	1656.9		654.22	11/2 <sup>+</sup>			
1014.5 8		3276.7	23/2 <sup>+</sup>	2262.2	19/2 <sup>+</sup>			
1018.6 3	2.6 3	1495.6	11/2 <sup>+</sup>	476.99	9/2 <sup>+</sup>	D+Q		$A_2=-0.67$ 8, $A_4\approx 0.0$ .
1022.1 8	3.7 4	2174.8		1153.0	13/2 <sup>-</sup>	(D)		$A_2=-0.24$ 5, $A_4\approx 0.0$ .
1028.7 3	2.9 15	2289.0	(15/2 <sup>+</sup> )	1260.33	13/2 <sup>+</sup>			
1054.9 3	0.7 4	2716.2		1661.3	19/2 <sup>-</sup>			
1066.2 8	2.6 13	2727.2	(19/2 <sup>+</sup> )	1661.3	19/2 <sup>-</sup>			$I_\gamma$ : for the 1066.2+1067.0 $\gamma$ 's; $A_2=+0.60$ 27, $A_4\approx 0.0$ .
1067.0 8	2.6 13	4359.8	(29/2)	3292.8	27/2 <sup>-</sup>			$I_\gamma$ : for the 1066.2+1067.0 $\gamma$ 's. $A_2=+0.60$ 27, $A_4\approx 0.0$ .
1100.7 3	3.3 17	2289.0	(15/2 <sup>+</sup> )	1188.41	13/2 <sup>+</sup>			$I_\gamma$ : for the 1100.7+1102.0 $\gamma$ 's.
1102.0 8	$\leq 4.9$	3552.0		2450.0	23/2 <sup>-</sup>			$I_\gamma$ : for the 1100.7+1102.0 $\gamma$ 's.
1107.8 <sup>@</sup> 3	2.7 3	2368.17	17/2 <sup>+</sup>	1260.33	13/2 <sup>+</sup>	E2		Mult.: stretched E2; $A_2=+0.12$ 19, $A_4\approx 0.0$ .
1125.73 <sup>@</sup> 17	6.1 6	2503.40	19/2 <sup>+</sup>	1377.67	15/2 <sup>+</sup>			$A_2=-0.07$ 6, $A_4\approx 0.0$ .
1128.2 8		1663.6		535.40	11/2 <sup>-</sup>			
1150.6 3	6.1 6	3600.3	(27/2 <sup>-</sup> )	2450.0	23/2 <sup>-</sup>			$A_2=-0.07$ 6, $A_4\approx 0.0$ .
1152.4 8	4.3 21	1806.6	9/2 <sup>-</sup> , 11/2 <sup>-</sup>	654.22	11/2 <sup>+</sup>			
1179.86 <sup>@</sup> 17	5.1 5	2368.17	17/2 <sup>+</sup>	1188.41	13/2 <sup>+</sup>	E2		Mult.: stretched E2; $A_2=+0.22$ 6, $A_4\approx 0.0$ .
1221.1 3	2.0 10	2201.3	(19/2 <sup>-</sup> )	980.0	15/2 <sup>-</sup>			
1254.6 3		2916.0	(23/2 <sup>-</sup> )	1661.3	19/2 <sup>-</sup>			
1281.5 3	2.7 3	2261.4	(13/2 <sup>-</sup> , 15/2, 17/2)	980.0	15/2 <sup>-</sup>	D		$A_2=-0.25$ 11, $A_4\approx 0.0$ .
1312.9 3		3762.6	(27/2 <sup>-</sup> )	2450.0	23/2 <sup>-</sup>			
1608.6 8		3270.0		1661.3	19/2 <sup>-</sup>			

<sup>†</sup> From 1991Hi03, except as noted.

<sup>‡</sup> From  $\gamma(\theta)$  in 1991Hi03, unless stated otherwise.  $A_2$ ,  $A_4$  from 1991Hi03, except as noted.

<sup>#</sup> From  $\gamma(\theta)$  in 1982Mo26.

<sup>@</sup> Weighted average of 1991Hi03 and 1982Mo26 data.

<sup>&</sup> From  $\alpha(\text{exp})$  in  $^{133}\text{Ce}$   $\varepsilon$  decay (5.1 h).

<sup>a</sup>  $\gamma$  rays contaminated.

<sup>b</sup> Multiply placed with undivided intensity.

<sup>x</sup>  $\gamma$  ray not placed in level scheme.

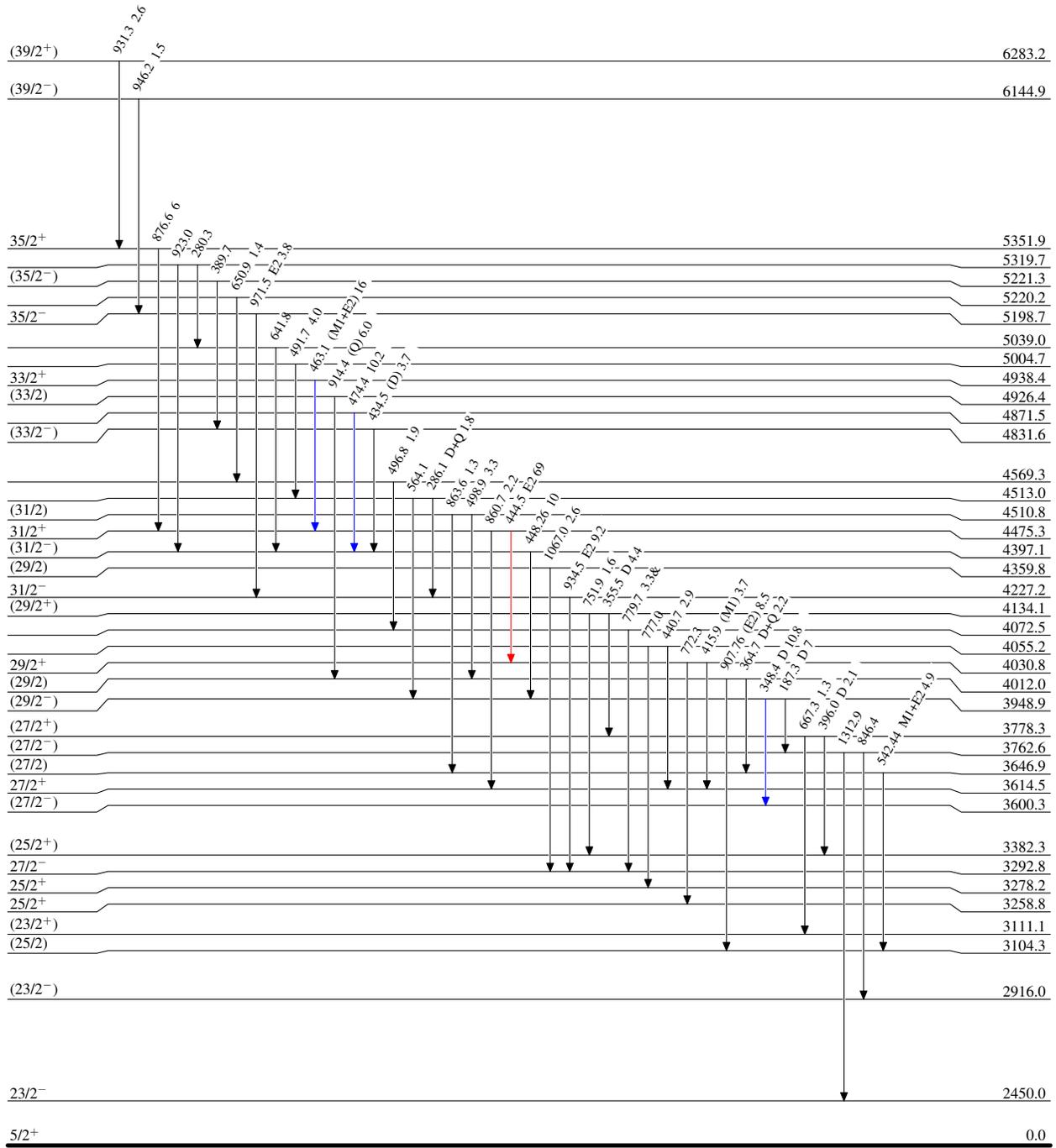
(HI,xn $\gamma$ ) 1991Hi03

Level Scheme

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

Legend

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



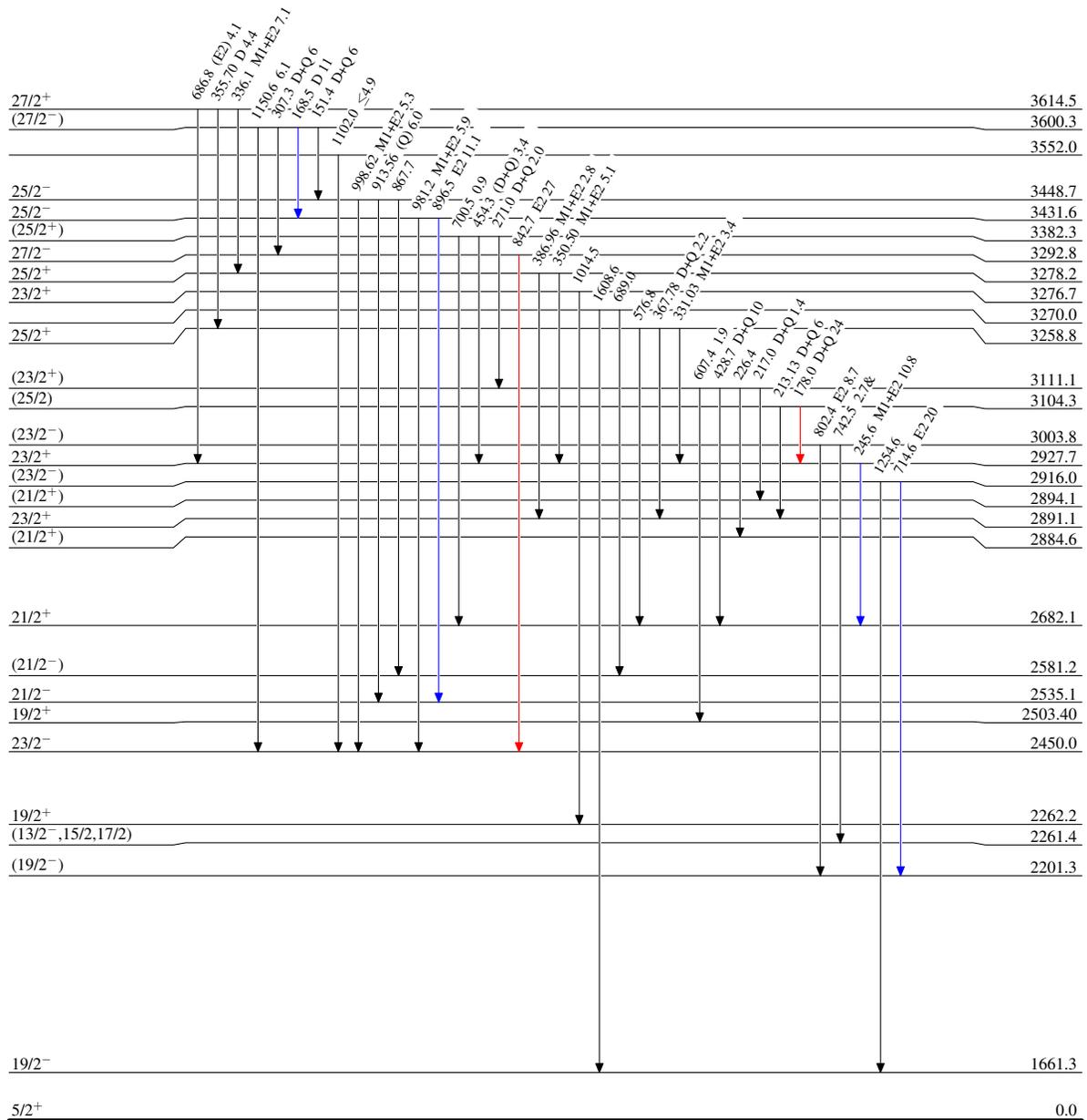
(HI,xn $\gamma$ ) 1991Hi03

Level Scheme (continued)

Legend

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

- I $\gamma$  < 2%  $\times$  I $\gamma$ <sup>max</sup>
- I $\gamma$  < 10%  $\times$  I $\gamma$ <sup>max</sup>
- I $\gamma$  > 10%  $\times$  I $\gamma$ <sup>max</sup>



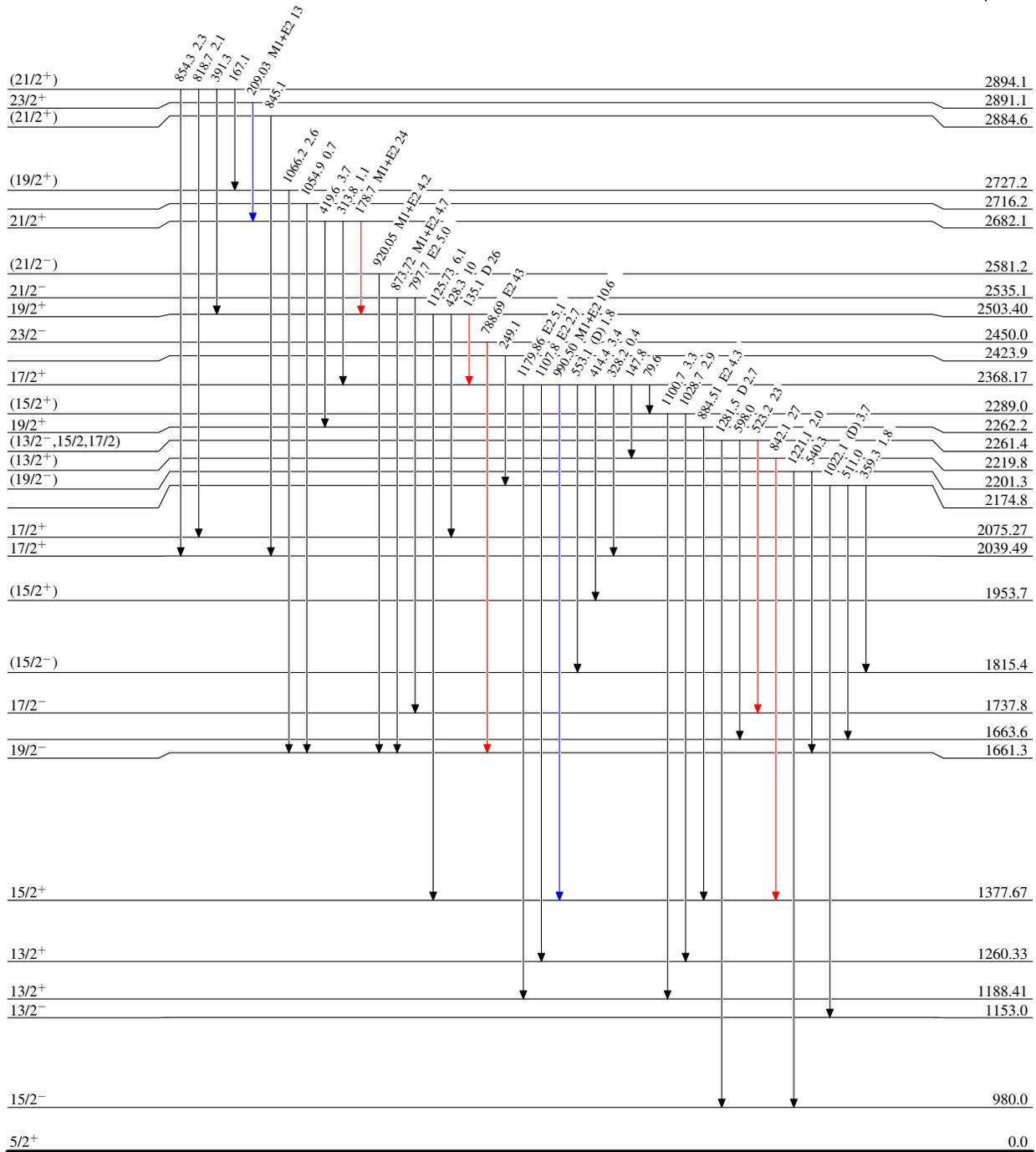
(HI,xn $\gamma$ ) 1991Hi03

Level Scheme (continued)

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

Legend

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



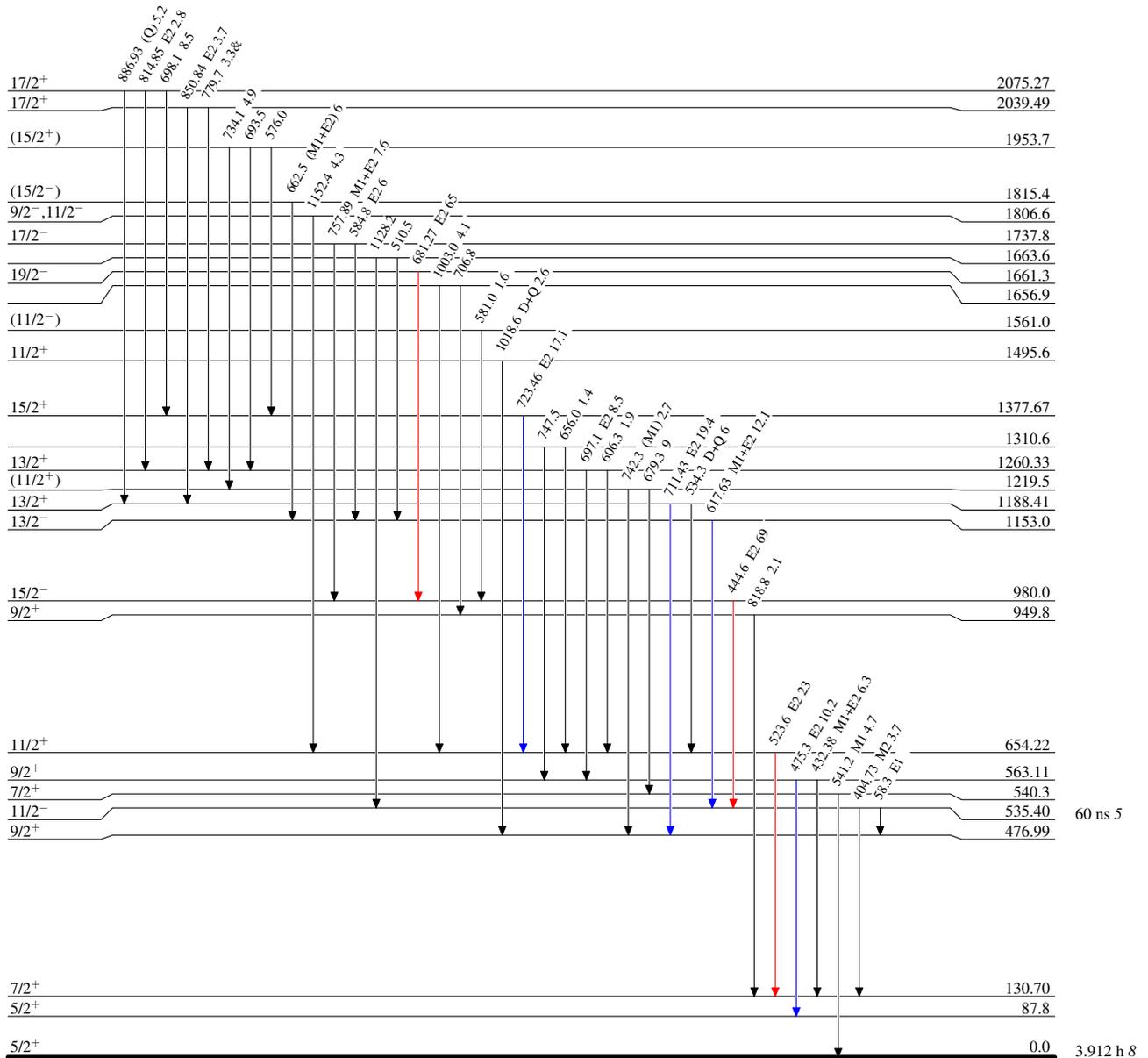
(HI,xn $\gamma$ ) 1991Hi03

Level Scheme (continued)

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

Legend

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



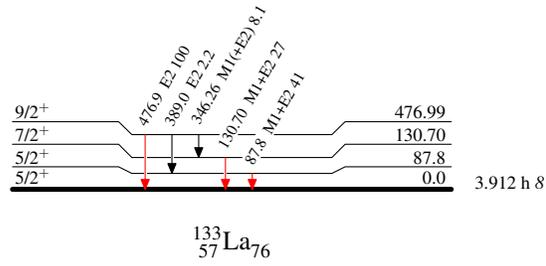
<sup>133</sup>La<sub>76</sub>

**(HI,xn $\gamma$ ) 1991Hi03**Level Scheme (continued)

Intensities: Relative  $I_\gamma$   
& Multiply placed: undivided intensity given

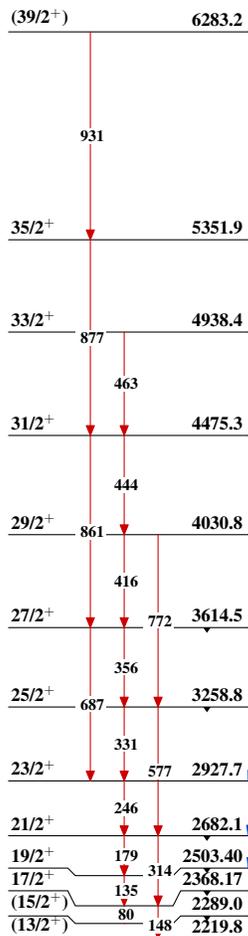
## Legend

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

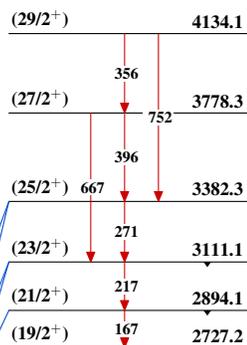


**(HI,xn $\gamma$ ) 1991Hi03**

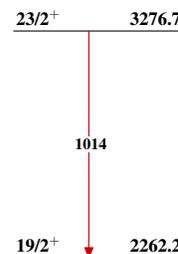
**Band(A): Based on 17/2<sup>+</sup> 2368-keV state,  $\Delta J=1$**



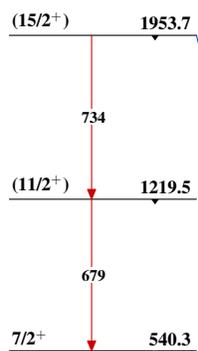
**Band(B): Based on (19/2<sup>+</sup>) 2727-keV state,  $\Delta J=1$**



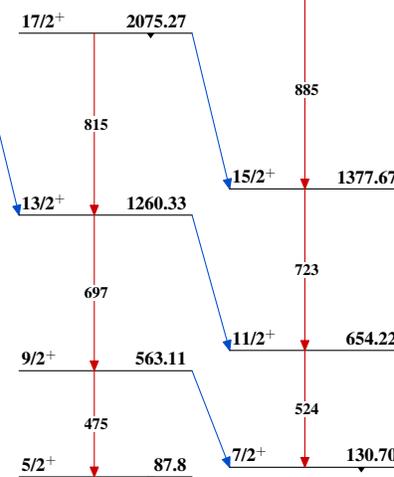
**Band(E): Based on 7/2<sup>+</sup> 131-keV state**

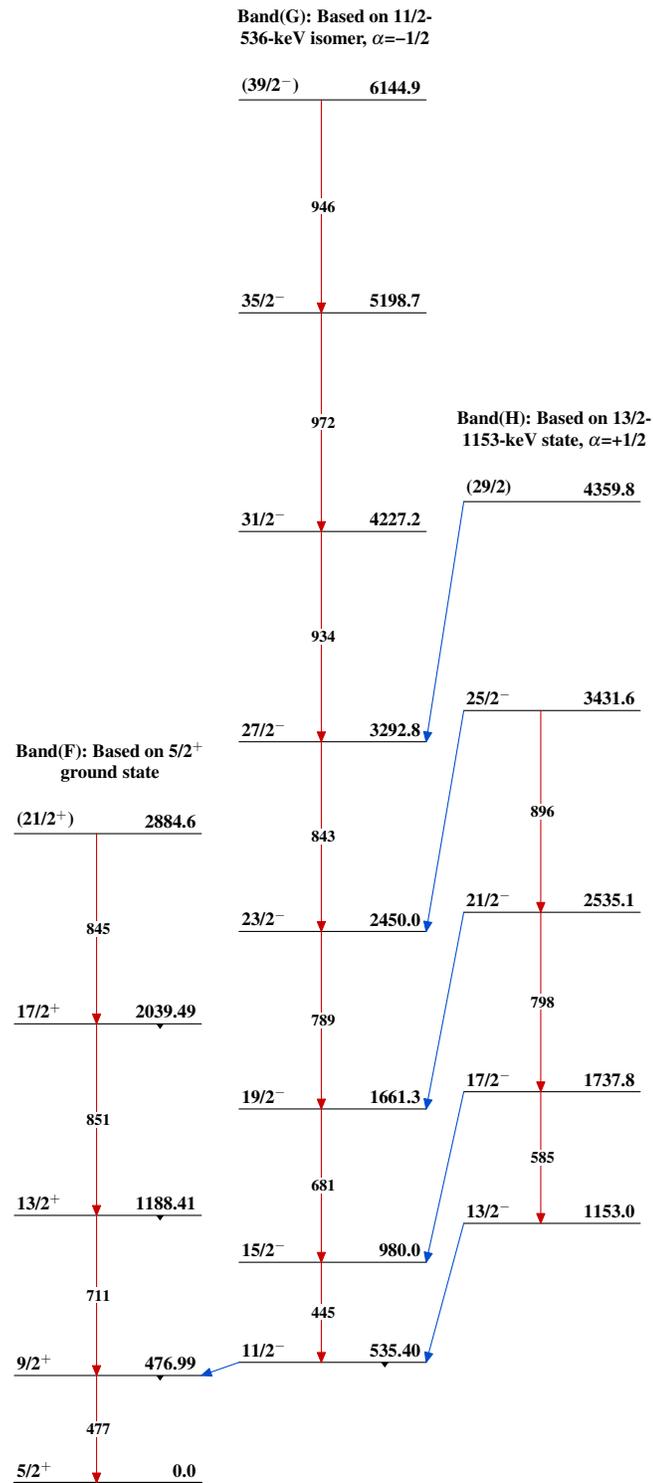


**Band(C): Based on 7/2<sup>+</sup> 541-keV state**



**Band(D): Based on 5/2<sup>+</sup> 88-keV state**



**(HI,xn $\gamma$ ) 1991Hi03 (continued)** $^{133}_{57}\text{La}_{76}$