

$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  1995Ju02

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Yu. Khazov and A. Rodionov, F. G. Kondev		NDS 112, 855 (2011)	31-Oct-2010

1995Ju02:  $^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  E=48.4, 65.5 MeV; measured  $E\gamma$ ,  $I\gamma$ ,  $\gamma\gamma$ ,  $\gamma\gamma(\theta)$ coin, DCO values;  $^{133}\text{Ba}$ ; deduced levels,  $J^\pi$ , rotational bands, B(M1)/B(E2). Tandem, NORDBALL array, cranked shell model.

 $^{133}\text{Ba}$  Levels

E(level) <sup>†</sup>	$J^\pi$ <sup>‡</sup>	$T_{1/2}$ <sup>#</sup>	Comments
0.0 <sup>@</sup>	1/2 <sup>+</sup>	10.551 y 11	
12.327 <sup>&amp;</sup> 6	3/2 <sup>+</sup>	7.0 ns 3	
288.252 <sup>f</sup> 10	11/2 <sup>-</sup>	38.93 h 10	
291.33 <sup>@</sup> 6	5/2 <sup>+</sup>		
577.77 <sup>&amp;</sup> 7	7/2 <sup>+</sup>		
883.64 <sup>@</sup> 8	9/2 <sup>+</sup>		
901.83 <sup>g</sup> 8	13/2 <sup>-</sup>		
969.01 <sup>f</sup> 8	15/2 <sup>-</sup>		
1375.87 <sup>&amp;</sup> 9	11/2 <sup>+</sup>		
1529.03 <sup>i</sup> 9	15/2 <sup>-</sup>		
1633.29 <sup>@</sup> 10	13/2 <sup>+</sup>		
1712.80 <sup>g</sup> 9	17/2 <sup>-</sup>		
1859.15 <sup>f</sup> 9	19/2 <sup>-</sup>		
1942.13 <sup>c</sup> 10	19/2 <sup>+</sup>	3.5 ns 15	
2036.23 11	17/2 <sup>-</sup>		
2170.79 <sup>i</sup> 9	19/2 <sup>-</sup>		
2211.18 <sup>&amp;</sup> 11	15/2 <sup>+</sup>		
2366.10 <sup>c</sup> 11	23/2 <sup>+</sup>		
2382.03 <sup>d</sup> 14	(21/2 <sup>+</sup> )		
2447.36 <sup>@</sup> 11	17/2 <sup>+</sup>		
2496.05 12	21/2 <sup>+</sup>		
2509.31 <sup>i</sup> 9	21/2 <sup>-</sup>		
2526.51 11	19/2 <sup>-</sup>		
2671.22 <sup>g</sup> 11	21/2 <sup>-</sup>		
2830.49 <sup>i</sup> 10	23/2 <sup>-</sup>		
2831.14 <sup>k</sup> 12	19/2 <sup>(+)</sup>		
2862.21 11	21/2 <sup>+</sup>		
2890.43 <sup>f</sup> 10	23/2 <sup>-</sup>		
2966.4 4	21/2 <sup>-</sup>		
2978.2 5	19/2		Populated by 137-keV D $\gamma$ from 3115.24-keV level (J=21/2 <sup>+</sup> ).
3062.99 <sup>k</sup> 11	21/2 <sup>(+)</sup>		
3103.86 <sup>d</sup> 12	25/2 <sup>+</sup>		
3115.24 <sup>a</sup> 10	21/2 <sup>+</sup>		
3246.58 <sup>b</sup> 10	23/2 <sup>+</sup>		
3255.97 <sup>i</sup> 10	25/2 <sup>-</sup>		
3346.00 <sup>c</sup> 12	27/2 <sup>+</sup>		
3373.65 <sup>k</sup> 12	23/2 <sup>(+)</sup>		
3433.77 <sup>a</sup> 12	25/2 <sup>+</sup>		
3545.97 <sup>i</sup> 11	27/2 <sup>-</sup>		
3582.74 <sup>h</sup> 11	27/2 <sup>-</sup>		
3646.47 13	25/2 <sup>+</sup>		

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$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  1995Ju02 (continued) $^{133}\text{Ba}$  Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	Comments
3688.46 <sup>g</sup> 14	(25/2 <sup>-</sup> )	
3700.65 <sup>k</sup> 16	25/2 <sup>(+)</sup>	
3709.95 16	25/2	
3710.73 <sup>b</sup> 12	27/2 <sup>+</sup>	
3838.98 <sup>d</sup> 14	29/2 <sup>+</sup>	
3967.91 15		E(level): remains uncertain: populating (690.9γ I) and depopulating (1601.8γ I) transitions of the level fit poorly to corresponding level energy differences (normalized $\chi^2=6.26$ for each transition).
3988.03 <sup>f</sup> 15	27/2 <sup>-</sup>	
4084.7 <sup>k</sup> 4	27/2 <sup>(+)</sup>	
4145.64 14	29/2 <sup>(+)</sup>	
4179.08 <sup>a</sup> 13	29/2 <sup>+</sup>	
4194.47 <sup>i</sup> 13	29/2 <sup>-</sup>	
4203.27 <sup>c</sup> 14	31/2 <sup>+</sup>	
4223.88 13	29/2 <sup>+</sup>	
4242.91 <sup>h</sup> 12	31/2 <sup>-</sup>	
4255.88 13	29/2 <sup>+</sup>	
4402.47 16	(27/2)	J <sup>π</sup> : stretched D γ from 4657.87-keV, J=29/2 <sup>-</sup> level.
4421.96 <sup>i</sup> 12	31/2 <sup>-</sup>	
4425.14 13	27/2	
4485.41 13	31/2 <sup>+</sup>	
4500.7 <sup>k</sup> 7	29/2	
4502.49 <sup>b</sup> 13	31/2 <sup>+</sup>	
4633.67 18	29/2	J <sup>π</sup> : stretched D γ from 4824.57-keV, J=31/2 <sup>-</sup> level.
4657.87 <sup>e</sup> 12	29/2 <sup>-</sup>	
4824.57 <sup>e</sup> 16	31/2 <sup>-</sup>	
4830.64 <sup>d</sup> 14	33/2 <sup>+</sup>	
5001.48 <sup>a</sup> 15	33/2 <sup>+</sup>	
5058.17 <sup>e</sup> 19	33/2 <sup>-</sup>	
5174.22 15	33/2 <sup>+</sup>	
5242.32 <sup>c</sup> 15	35/2 <sup>+</sup>	
5263.5 <sup>i</sup> 6	(33/2 <sup>-</sup> )	
5350.47 <sup>e</sup> 21	35/2 <sup>-</sup>	
5391.77 <sup>i</sup> 13	35/2 <sup>-</sup>	
5417.86 <sup>b</sup> 14	35/2 <sup>+</sup>	
5430.16 <sup>j</sup> 14	33/2 <sup>-</sup>	
5465.24 18	35/2 <sup>+</sup>	
5520.61 <sup>h</sup> 15	35/2 <sup>-</sup>	
5661.92 <sup>j</sup> 14	35/2 <sup>-</sup>	
5735.67 <sup>e</sup> 23	37/2 <sup>-</sup>	
5858.23 <sup>d</sup> 16	37/2 <sup>+</sup>	
5936.30 <sup>a</sup> 16	37/2 <sup>+</sup>	
5983.77 <sup>j</sup> 14	37/2 <sup>-</sup>	
6237.1 <sup>e</sup> 3	39/2 <sup>-</sup>	
6277.42 <sup>c</sup> 17	39/2 <sup>+</sup>	
6307.97 <sup>j</sup> 15	39/2 <sup>-</sup>	
6366.95 <sup>i</sup> 14	39/2 <sup>-</sup>	
6425.83 <sup>b</sup> 16	39/2 <sup>+</sup>	
6546.23 19		
6749.56 <sup>j</sup> 16	41/2 <sup>-</sup>	
6818.1 <sup>e</sup> 3	41/2 <sup>-</sup>	

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<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02 (continued)

<sup>133</sup>Ba Levels (continued)

E(level) <sup>†</sup>	J $\pi$ <sup>‡</sup>	E(level) <sup>†</sup>	J $\pi$ <sup>‡</sup>	E(level) <sup>†</sup>	J $\pi$ <sup>‡</sup>
6955.14 <sup>a</sup> 18	(41/2 <sup>+</sup> )	7217.76 <sup>j</sup> 19	43/2 <sup>-</sup>	7431.44 <sup>b</sup> 18	(43/2 <sup>+</sup> )
6980.63 <sup>d</sup> 19	41/2 <sup>+</sup>	7421.1 <sup>e</sup> 4	43/2 <sup>-</sup>	7585.93 <sup>c</sup> 19	(43/2 <sup>+</sup> )
				8052.1 <sup>e</sup> 5	45/2 <sup>-</sup>

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

<sup>‡</sup> From deduced transition multipolarities and band assignment.

# From 'Adopted Levels'.

@ Band(A): based on 1/2<sup>+</sup> state,  $\alpha=+1/2$ ; Dominant  $\nu(s_{1/2})^{-1}$  configuration.

& Band(B): based on 3/2<sup>+</sup> state,  $\alpha=-1/2$ ; Dominant  $\nu(d_{3/2})^{-1}$  configuration.

<sup>a</sup> Band(C): Based on 21/2<sup>+</sup> state,  $\alpha=+1/2$ ; probable configuration= $\nu(h_{11/2})^{-1} \otimes \pi(h_{11/2}^{-1}, g_{7/2}^{-1})$ .

<sup>b</sup> Band(D): Based on 23/2<sup>+</sup> state,  $\alpha=-1/2$ ; probable configuration= $\nu(h_{11/2})^{-1} \otimes \pi(h_{11/2}^{-1}, g_{7/2}^{-1})$ .

<sup>c</sup> Band(E): Based on 19/2<sup>+</sup> state,  $\alpha=-1/2$ ; probable a mixture of  $\nu(s_{1/2}^{-1}, h_{11/2}^{-2})$  and  $\nu(d_{3/2}^{-1}, h_{11/2}^{-2})$  configurations.

<sup>d</sup> Band(F): Based on 21/2<sup>+</sup> state,  $\alpha=+1/2$ ; probable a mixture of  $\nu(s_{1/2}^{-1}, h_{11/2}^{-2})$  and  $\nu(d_{3/2}^{-1}, h_{11/2}^{-2})$  configurations.

<sup>e</sup> Band(G): based on 29/2<sup>-</sup> state.

<sup>f</sup> Band(H): Based on 11/2<sup>-</sup> state,  $\alpha=-1/2$ ; configuration= $\nu(h_{11/2})^{-1}$ .

<sup>g</sup> Band(I): Based on 13/2<sup>-</sup> state,  $\alpha=+1/2$ ; configuration= $\nu(h_{11/2})^{-1}$ .

<sup>h</sup> Band(J): based on 27/2<sup>-</sup> state.

<sup>i</sup> Band(K): based on 15/2<sup>-</sup> state.

<sup>j</sup> Band(L): band L based on 33/2<sup>-</sup> state.

<sup>k</sup> Band(M): Based on 19/2<sup>(+)</sup> state; probable configuration= $\nu(h_{11/2})^{-1} \otimes \pi(h_{11/2}^{-1}, d_{5/2}^{-1})$ .

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

E $\gamma$ <sup>†</sup>	I $\gamma$ <sup>†</sup>	E <sub>i</sub> (level)	J $\pi$ <sub>i</sub>	E <sub>f</sub>	J $\pi$ <sub>f</sub>	Mult. <sup>‡</sup>	Comments
12.327 6		12.327	3/2 <sup>+</sup>	0.0	1/2 <sup>+</sup>	M1+E2	E $\gamma$ , Mult.: not observed in 1995Ju02; from 'Adopted Levels and gammas'.
83.1 1	48 5	1942.13	19/2 <sup>+</sup>	1859.15	19/2 <sup>-</sup>	D	R=1.0 1.
131.4 1	3.0 2	3246.58	23/2 <sup>+</sup>	3115.24	21/2 <sup>+</sup>	D	R=0.78 3.
137.0 5	0.23 4	3115.24	21/2 <sup>+</sup>	2978.2	19/2	D	R=0.88 7.
146.4 1	0.64 4	1859.15	19/2 <sup>-</sup>	1712.80	17/2 <sup>-</sup>	D	R=0.87 7.
166.7 1	9.20 8	4824.57	31/2 <sup>-</sup>	4657.87	29/2 <sup>-</sup>	D	R=0.82 2.
187.2 1	7.9 3	3433.77	25/2 <sup>+</sup>	3246.58	23/2 <sup>+</sup>	D	R=0.80 2.
190.9 1	0.6 1	4824.57	31/2 <sup>-</sup>	4633.67	29/2	D	R=0.82 8.
219.2 1	0.24 4	2890.43	23/2 <sup>-</sup>	2671.22	21/2 <sup>-</sup>	M1+E2	R=0.47 7.
227.4 1	1.31 8	4421.96	31/2 <sup>-</sup>	4194.47	29/2 <sup>-</sup>	D	R=0.9314.
229.2 1	5.26 9	1942.13	19/2 <sup>+</sup>	1712.80	17/2 <sup>-</sup>	D	R=0.93 3.
231.7 1	0.6 2	5661.92	35/2 <sup>-</sup>	5430.16	33/2 <sup>-</sup>		
231.9 1	0.30 4	3062.99	21/2 <sup>(+)</sup>	2831.14	19/2 <sup>(+)</sup>	D	R=0.78 5.
232.7 1	0.9 2	4657.87	29/2 <sup>-</sup>	4425.14	27/2		
233.6 1	13.3 5	5058.17	33/2 <sup>-</sup>	4824.57	31/2 <sup>-</sup>	D	R=0.83 2.
243.7 1	0.44 4	5417.86	35/2 <sup>+</sup>	5174.22	33/2 <sup>+</sup>	D	R=0.79 9.
246.6 1	1.00 5	4502.49	31/2 <sup>+</sup>	4255.88	29/2 <sup>+</sup>	D	R=0.79 7.
252.9 1	0.41 6	3115.24	21/2 <sup>+</sup>	2862.21	21/2 <sup>+</sup>	D	R=1.76 13, $\Delta J=0$ .
255.4 1	1.07 6	4657.87	29/2 <sup>-</sup>	4402.47	(27/2)	D	R=0.81 6.
257.5 1	<0.2	1633.29	13/2 <sup>+</sup>	1375.87	11/2 <sup>+</sup>	M1+E2	R=0.52 8.
261.4 1	0.8 1	4485.41	31/2 <sup>+</sup>	4223.88	29/2 <sup>+</sup>	D	R=0.63 7.
275.925 7		288.252	11/2 <sup>-</sup>	12.327	3/2 <sup>+</sup>	M4	E $\gamma$ , Mult.: from 'Adopted Levels and gammas'.
276.9 1	6.1 2	3710.73	27/2 <sup>+</sup>	3433.77	25/2 <sup>+</sup>	D	R=0.80 2.

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$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  1995Ju02 (continued) $\gamma(^{133}\text{Ba})$  (continued)

$E_\gamma$ †	$I_\gamma$ †	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	Comments
279.1 1	1.9 3	291.33	5/2 <sup>+</sup>	12.327	3/2 <sup>+</sup>	M1(+E2)	Mult.: from 'Adopted Levels and gammas'. R=0.71 3.
282.2 1	0.9 1	4485.41	31/2 <sup>+</sup>	4203.27	31/2 <sup>+</sup>	D	R=1.34 10, $\Delta J=0$ .
286.4 1	<0.1	577.77	7/2 <sup>+</sup>	291.33	5/2 <sup>+</sup>	M1,E2	Mult.: from 'Adopted Levels and gammas'. R=1.2 2.
290.0 1	7.6 2	3545.97	27/2 <sup>-</sup>	3255.97	25/2 <sup>-</sup>	D	R=0.76 2.
291.3 1	0.4 1	291.33	5/2 <sup>+</sup>	0.0	1/2 <sup>+</sup>	E2	Mult.: in $^{133}\text{La}$ $\varepsilon$ decay mult.=(E2). R=1.43 7.
292.3 1	10.8 4	5350.47	35/2 <sup>-</sup>	5058.17	33/2 <sup>-</sup>	D	R=0.77 2.
305.9 1	0.22 5	883.64	9/2 <sup>+</sup>	577.77	7/2 <sup>+</sup>	D	R=0.68 4.
306.4 1	0.3 1	4485.41	31/2 <sup>+</sup>	4179.08	29/2 <sup>+</sup>		
310.8 1	1.9 3	3373.65	23/2 <sup>(+)</sup>	3062.99	21/2 <sup>(+)</sup>		
311.4 1	0.7 2	2170.79	19/2 <sup>-</sup>	1859.15	19/2 <sup>-</sup>		
321.3 1	11.1 5	2830.49	23/2 <sup>-</sup>	2509.31	21/2 <sup>-</sup>	D	R=0.74 3.
321.8 1	1.9 3	5983.77	37/2 <sup>-</sup>	5661.92	35/2 <sup>-</sup>		
323.5 1	0.9 1	4502.49	31/2 <sup>+</sup>	4179.08	29/2 <sup>+</sup>	D	R=0.78 4.
324.3 1	1.3 2	6307.97	39/2 <sup>-</sup>	5983.77	37/2 <sup>-</sup>	D	R=0.56 5.
326.8 1	8.6 4	3582.74	27/2 <sup>-</sup>	3255.97	25/2 <sup>-</sup>	D	R=0.74 2.
327.0 1	1.0 2	3700.65	25/2 <sup>(+)</sup>	3373.65	23/2 <sup>(+)</sup>	D	R=0.89 4.
336.3 1	0.20 5	3709.95	25/2	3373.65	23/2 <sup>(+)</sup>	D	R=0.75 10.
338.6 1	16.7 6	2509.31	21/2 <sup>-</sup>	2170.79	19/2 <sup>-</sup>	D	R=0.70 2.
345.3 1	0.5 2	4830.64	33/2 <sup>+</sup>	4485.41	31/2 <sup>+</sup>	D	R=0.86 9.
365.5 1	5.3 3	3255.97	25/2 <sup>-</sup>	2890.43	23/2 <sup>-</sup>	D	R=0.71 3.
381.0 5	1.6 2	2890.43	23/2 <sup>-</sup>	2509.31	21/2 <sup>-</sup>		
382.5 1	1.2 3	6749.56	41/2 <sup>-</sup>	6366.95	39/2 <sup>-</sup>	D	R=0.65 7.
383.1 1	0.8 2	6366.95	39/2 <sup>-</sup>	5983.77	37/2 <sup>-</sup>		
384.0 5	0.35 7	4084.7	27/2 <sup>(+)</sup>	3700.65	25/2 <sup>(+)</sup>	D	R=0.81 11.
384.5 1	<0.3	3246.58	23/2 <sup>+</sup>	2862.21	21/2 <sup>+</sup>	D	R=0.77 7.
385.2 1	7.0 3	5735.67	37/2 <sup>-</sup>	5350.47	35/2 <sup>-</sup>	D	R=0.75 2.
411.6 1	0.7 1	5242.32	35/2 <sup>+</sup>	4830.64	33/2 <sup>+</sup>	D	R=0.80 9.
415.9 @ 1	0.5 1	5417.86	35/2 <sup>+</sup>	5001.48	33/2 <sup>+</sup>	D	$E_\gamma$ : poor fit; level energy difference is equal to 416.38 10. R=0.75 6.
416.0 5	<0.2	3246.58	23/2 <sup>+</sup>	2830.49	23/2 <sup>-</sup>		
416.0 5	<0.3	4500.7	29/2	4084.7	27/2 <sup>(+)</sup>		
419.2 1	0.67 5	6277.42	39/2 <sup>+</sup>	5858.23	37/2 <sup>+</sup>	D	R=0.62 8.
423.9 1	35.2 10	2366.10	23/2 <sup>+</sup>	1942.13	19/2 <sup>+</sup>	E2	R=1.49 3.
425.5 1	5.8 2	3255.97	25/2 <sup>-</sup>	2830.49	23/2 <sup>-</sup>	M1+E2	R=0.50 6.
439.9 1	0.40 10	2382.03	(21/2 <sup>+</sup> )	1942.13	19/2 <sup>+</sup>		
440.0 5	<0.2	2966.4	21/2 <sup>-</sup>	2526.51	19/2 <sup>-</sup>		
441.7 1	1.7 2	6749.56	41/2 <sup>-</sup>	6307.97	39/2 <sup>-</sup>	D	R=0.63 7.
458.0 1	10.5 4	2170.79	19/2 <sup>-</sup>	1712.80	17/2 <sup>-</sup>	D	R=0.60 2.
463.1 1	1.2 1	5983.77	37/2 <sup>-</sup>	5520.61	35/2 <sup>-</sup>	D	R=0.67 12.
468.2 1	1.9 3	7217.76	43/2 <sup>-</sup>	6749.56	41/2 <sup>-</sup>	D	R=0.61 7.
468.4 1	2.6 2	4179.08	29/2 <sup>+</sup>	3710.73	27/2 <sup>+</sup>	D	R=0.85 9.
476.3 1	0.6 2	7431.44	(43/2 <sup>+</sup> )	6955.14	(41/2 <sup>+</sup> )		
489.4 1	0.4 1	6425.83	39/2 <sup>+</sup>	5936.30	37/2 <sup>+</sup>		
490.0 5	0.3 1	2526.51	19/2 <sup>-</sup>	2036.23	17/2 <sup>-</sup>		
492.4 1	0.15 5	1375.87	11/2 <sup>+</sup>	883.64	9/2 <sup>+</sup>	D	R=0.82 13.
493.1 1	0.9 1	3838.98	29/2 <sup>+</sup>	3346.00	27/2 <sup>+</sup>	D	R=0.85 9.
496.0 5	<0.4	2862.21	21/2 <sup>+</sup>	2366.10	23/2 <sup>+</sup>		
499.1 1	2.2 2	5001.48	33/2 <sup>+</sup>	4502.49	31/2 <sup>+</sup>	D	R=0.76 9.
501.4 1	4.2 2	6237.1	39/2 <sup>-</sup>	5735.67	37/2 <sup>-</sup>	D	R=0.65 3.
507.2 1	0.5 1	2036.23	17/2 <sup>-</sup>	1529.03	15/2 <sup>-</sup>	M1+E2	R=0.53 5.
513.1 1	1.0 1	4223.88	29/2 <sup>+</sup>	3710.73	27/2 <sup>+</sup>	D	R=0.72 10.

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<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02 (continued)

$\gamma$ (<sup>133</sup>Ba) (continued)

$E_\gamma$ <sup>†</sup>	$I_\gamma$ <sup>†</sup>	$E_i$ (level)	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	Comments
518.3 <i>I</i>	1.3 <i>I</i>	5936.30	37/2 <sup>+</sup>	5417.86	35/2 <sup>+</sup>	D	R=0.82 10.
529.3 <i>I</i>	0.7 <i>I</i>	6955.14	(41/2 <sup>+</sup> )	6425.83	39/2 <sup>+</sup>		
545.1 <i>I</i>	1.9 <i>I</i>	4255.88	29/2 <sup>+</sup>	3710.73	27/2 <sup>+</sup>	D	R=0.72 5.
554.0 <i>I</i>	2.9 2	2496.05	21/2 <sup>+</sup>	1942.13	19/2 <sup>+</sup>	M1+E2	R=0.46 5.
560.0 <i>I</i>	2.6 <i>I</i>	1529.03	15/2 <sup>-</sup>	969.01	15/2 <sup>-</sup>	D	R=1.02 7.
565.4 <i>I</i>	0.9 <i>I</i>	577.77	7/2 <sup>+</sup>	12.327	3/2 <sup>+</sup>	E2	Mult.: from 'Adopted Levels and gammas'. R=1.34 4.
577.9 <i>I</i>	<0.2	2211.18	15/2 <sup>+</sup>	1633.29	13/2 <sup>+</sup>	D	R=0.9 2.
581.0 <i>I</i>	2.2 <i>I</i>	6818.1	41/2 <sup>-</sup>	6237.1	39/2 <sup>-</sup>	D	R=0.62 5.
586.0 5	0.3 <i>I</i>	5417.86	35/2 <sup>+</sup>	4830.64	33/2 <sup>+</sup>		$E_\gamma$ : poor fit; level energy difference is equal to 587.22 10.
592.1 <i>I</i>	1.3 <i>I</i>	5983.77	37/2 <sup>-</sup>	5391.77	35/2 <sup>-</sup>	D	R=0.65 9.
592.4 <i>I</i>	2.0 <i>I</i>	883.64	9/2 <sup>+</sup>	291.33	5/2 <sup>+</sup>	E2	R=1.27 8.
603.0 5	1.0 <i>I</i>	7421.1	43/2 <sup>-</sup>	6818.1	41/2 <sup>-</sup>	D	R=0.6 2.
613.6 <i>I</i>	19.0 9	901.83	13/2 <sup>-</sup>	288.252	11/2 <sup>-</sup>	M1+E2	R=0.44 2.
615.8 <i>I</i>	1.3 2	5858.23	37/2 <sup>+</sup>	5242.32	35/2 <sup>+</sup>	D	R=0.68 10.
627.3 <sup>#</sup> <i>I</i>	11.3 <sup>#</sup> 5	1529.03	15/2 <sup>-</sup>	901.83	13/2 <sup>-</sup>	M1+E2	R=0.39 1.
627.3 <sup>#</sup> <i>I</i>	3.6 <sup>#</sup> 2	4830.64	33/2 <sup>+</sup>	4203.27	31/2 <sup>+</sup>	D	R=0.51 4.
631.0 5	0.7 <i>I</i>	8052.1	45/2 <sup>-</sup>	7421.1	43/2 <sup>-</sup>	D	R=0.6 1.
634.6 <i>I</i>	1.4 <i>I</i>	5465.24	35/2 <sup>+</sup>	4830.64	33/2 <sup>+</sup>	M1+E2	R=0.55 6.
641.9 <i>I</i>	10.2 5	2170.79	19/2 <sup>-</sup>	1529.03	15/2 <sup>-</sup>	E2	R=1.51 3.
650.2 <i>I</i>	4.4 2	2509.31	21/2 <sup>-</sup>	1859.15	19/2 <sup>-</sup>	M1+E2	R=0.49 3.
655.4 <i>I</i>	0.7 2	3545.97	27/2 <sup>-</sup>	2890.43	23/2 <sup>-</sup>		
659.6 <i>I</i>	<1	2830.49	23/2 <sup>-</sup>	2170.79	19/2 <sup>-</sup>	E2	R=1.36 8.
660.1 <i>I</i>	9.0 6	4242.91	31/2 <sup>-</sup>	3582.74	27/2 <sup>-</sup>	E2	R=1.31 12.
667.9 <i>I</i>	0.9 <i>I</i>	3115.24	21/2 <sup>+</sup>	2447.36	17/2 <sup>+</sup>	E2	R=1.44 8.
680.7 <i>I</i>	100	969.01	15/2 <sup>-</sup>	288.252	11/2 <sup>-</sup>	E2	R=1.36 2.
688.0 <i>I</i>	0.6 <i>I</i>	6546.23		5858.23	37/2 <sup>+</sup>		
690.6 <sup>@</sup> <i>I</i>	0.5 2	4657.87	29/2 <sup>-</sup>	3967.91			$E_\gamma$ : see comment for 3967.91-keV level.
693.0 5	1.0 3	3582.74	27/2 <sup>-</sup>	2890.43	23/2 <sup>-</sup>		
697.0 <i>I</i>	6.4 5	4242.91	31/2 <sup>-</sup>	3545.97	27/2 <sup>-</sup>	E2	R=1.35 7.
702.3 <i>I</i>	0.5 <i>I</i>	3373.65	23/2 <sup>(+)</sup>	2671.22	21/2 <sup>-</sup>	D	R=0.9 1.
703.2 <i>I</i>	0.7 2	6980.63	41/2 <sup>+</sup>	6277.42	39/2 <sup>+</sup>		
711.0 5	<0.2	4084.7	27/2 <sup>(+)</sup>	3373.65	23/2 <sup>(+)</sup>		
715.6 <i>I</i>	7.6 3	3545.97	27/2 <sup>-</sup>	2830.49	23/2 <sup>-</sup>	E2	R=1.42 8.
735.0 <i>I</i>	0.4 <i>I</i>	3838.98	29/2 <sup>+</sup>	3103.86	25/2 <sup>+</sup>		
737.3 <i>I</i>	1.8 <i>I</i>	3246.58	23/2 <sup>+</sup>	2509.31	21/2 <sup>-</sup>	D	R=0.74 5.
737.8 <i>I</i>	4.0 2	3103.86	25/2 <sup>+</sup>	2366.10	23/2 <sup>+</sup>	M1+E2	R=0.36 2.
743.8 <i>I</i>	14.9 5	1712.80	17/2 <sup>-</sup>	969.01	15/2 <sup>-</sup>	M1+E2	R=0.48 2.
746.6 <i>I</i>	12.4 4	3255.97	25/2 <sup>-</sup>	2509.31	21/2 <sup>-</sup>	E2	R=1.45 4.
749.6 <i>I</i>	2.1 2	1633.29	13/2 <sup>+</sup>	883.64	9/2 <sup>+</sup>	E2	R=1.31 5.
750.6 <i>I</i>	0.8 2	3246.58	23/2 <sup>+</sup>	2496.05	21/2 <sup>+</sup>		
752.3 <i>I</i>	10.5 3	3582.74	27/2 <sup>-</sup>	2830.49	23/2 <sup>-</sup>	E2	R=1.45 4.
756.0 5	<0.3	4402.47	(27/2)	3646.47	25/2 <sup>+</sup>		
774.7 <i>I</i>	0.5 <i>I</i>	4485.41	31/2 <sup>+</sup>	3710.73	27/2 <sup>+</sup>	E2	R=1.22 11.
778.6 <i>I</i>	0.5 <i>I</i>	4425.14	27/2	3646.47	25/2 <sup>+</sup>	D	R=0.74 7.
791.7 <i>I</i>	1.4 <i>I</i>	4502.49	31/2 <sup>+</sup>	3710.73	27/2 <sup>+</sup>	E2	R=1.39 8.
796.5 <i>I</i>	1.5 <i>I</i>	2509.31	21/2 <sup>-</sup>	1712.80	17/2 <sup>-</sup>	E2	R=1.4 2.
798.0 <i>I</i>	0.8 <i>I</i>	1375.87	11/2 <sup>+</sup>	577.77	7/2 <sup>+</sup>	E2	R=1.26 8.
798.0 5	<0.3	3688.46	(25/2 <sup>-</sup> )	2890.43	23/2 <sup>-</sup>		
799.6 <i>I</i>	0.5 2	4145.64	29/2 <sup>(+)</sup>	3346.00	27/2 <sup>+</sup>		
810.9 <i>I</i>	6.5 2	1712.80	17/2 <sup>-</sup>	901.83	13/2 <sup>-</sup>	E2	R=1.33 7.
812.0 5	1.6 3	2671.22	21/2 <sup>-</sup>	1859.15	19/2 <sup>-</sup>	(M1+E2)	R=0.58 6.
813.8 <i>I</i>	0.5 <i>I</i>	2526.51	19/2 <sup>-</sup>	1712.80	17/2 <sup>-</sup>	M1+E2	R=0.48 5.
814.1 <i>I</i>	1.9 <i>I</i>	2447.36	17/2 <sup>+</sup>	1633.29	13/2 <sup>+</sup>	E2	R=1.32 8.

Continued on next page (footnotes at end of table)

<sup>124</sup>Sn(<sup>13</sup>C,4nγ) 1995Ju02 (continued)

γ(<sup>133</sup>Ba) (continued)

$E_\gamma$ †	$I_\gamma$ †	$E_i$ (level)	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	Comments
822.3	1	0.4	1	5001.48	33/2 <sup>+</sup>	4179.08 29/2 <sup>+</sup>	E2 R=1.5 3.
835.3	1	0.35	6	2211.18	15/2 <sup>+</sup>	1375.87 11/2 <sup>+</sup>	E2 R=1.26 7.
839.4	1	5.4	2	4421.96	31/2 <sup>-</sup>	3582.74 27/2 <sup>-</sup>	E2 R=1.5 2.
846.4	1	1.2	3	6366.95	39/2 <sup>-</sup>	5520.61 35/2 <sup>-</sup>	E2 R=1.36 10.
857.2	1	14.3	4	4203.27	31/2 <sup>+</sup>	3346.00 27/2 <sup>+</sup>	E2 R=1.43 2.
875.9	1	3.0	2	4421.96	31/2 <sup>-</sup>	3545.97 27/2 <sup>-</sup>	E2 R=1.45 12.
877.8	1	0.9	2	4223.88	29/2 <sup>+</sup>	3346.00 27/2 <sup>+</sup>	E2 R=1.22 10.
880.4	1	1.6	2	3246.58	23/2 <sup>+</sup>	2366.10 23/2 <sup>+</sup>	D R=1.29 8, ΔJ=0.
890.1	1	78	2	1859.15	19/2 <sup>-</sup>	969.01 15/2 <sup>-</sup>	E2 R=1.36 4.
915.5	1	2.0	1	5417.86	35/2 <sup>+</sup>	4502.49 31/2 <sup>+</sup>	E2 R=1.46 9.
916.2	1	2.6	2	6307.97	39/2 <sup>-</sup>	5391.77 35/2 <sup>-</sup>	E2 R=1.32 14.
918.4	1	0.8	1	5174.22	33/2 <sup>+</sup>	4255.88 29/2 <sup>+</sup>	E2 R=1.4 2.
920.1	1	0.5	1	2862.21	21/2 <sup>+</sup>	1942.13 19/2 <sup>+</sup>	(M1+E2) R=0.59 13.
930.0	5	<0.3	5	2966.4	21/2 <sup>-</sup>	2036.23 17/2 <sup>-</sup>	E2 R=1.41 4.
932.3	1	0.8	1	5417.86	35/2 <sup>+</sup>	4485.41 31/2 <sup>+</sup>	E2 R=1.4 2.
935.0	5	0.6	1	5936.30	37/2 <sup>+</sup>	5001.48 33/2 <sup>+</sup>	[E2]
938.4	1	3.0	2	4194.47	29/2 <sup>-</sup>	3255.97 25/2 <sup>-</sup>	E2 R=1.42 10.
944.4	1	0.9	1	3115.24	21/2 <sup>+</sup>	2170.79 19/2 <sup>-</sup>	D R=0.81 7.
958.3	1	1.6	1	2671.22	21/2 <sup>-</sup>	1712.80 17/2 <sup>-</sup>	E2 R=1.4 2.
969.8	1	5.4	4	5391.77	35/2 <sup>-</sup>	4421.96 31/2 <sup>-</sup>	E2 R=1.30 10.
971.5	1	14.7	5	2830.49	23/2 <sup>-</sup>	1859.15 19/2 <sup>-</sup>	E2 R=1.23 6.
975.1	1	0.5	1	6366.95	39/2 <sup>-</sup>	5391.77 35/2 <sup>-</sup>	[E2]
980.0	1	21.1	8	3346.00	27/2 <sup>+</sup>	2366.10 23/2 <sup>+</sup>	E2 R=1.44 3.
995.0	5	0.2	1	5174.22	33/2 <sup>+</sup>	4179.08 29/2 <sup>+</sup>	
997.4	1	0.2	1	2526.51	19/2 <sup>-</sup>	1529.03 15/2 <sup>-</sup>	E2 R=1.3 2.
1005.6	1	0.6	1	7431.44	(43/2 <sup>+</sup> )	6425.83 39/2 <sup>+</sup>	
1008.1	1	2.1	2	6425.83	39/2 <sup>+</sup>	5417.86 35/2 <sup>+</sup>	E2 R=1.42 9.
1018.0	5	0.3	1	3688.46	(25/2 <sup>-</sup> )	2671.22 21/2 <sup>-</sup>	
1027.7	1	0.6	1	5858.23	37/2 <sup>+</sup>	4830.64 33/2 <sup>+</sup>	E2 R=1.2 2.
1031.1	1	8.8	6	2890.43	23/2 <sup>-</sup>	1859.15 19/2 <sup>-</sup>	E2 R=1.41 4.
1035.1	1	2.2	1	6277.42	39/2 <sup>+</sup>	5242.32 35/2 <sup>+</sup>	E2 R=1.36 7.
1039.0	1	6.0	3	5242.32	35/2 <sup>+</sup>	4203.27 31/2 <sup>+</sup>	E2 R=1.29 6.
1041.8	1	0.9	1	4145.64	29/2 <sup>(+)</sup>	3103.86 25/2 <sup>+</sup>	E2 R=1.26 10.
1051.0	5	0.7	2	4633.67	29/2 <sup>-</sup>	3582.74 27/2 <sup>-</sup>	
1067.2	1	<1	1	2036.23	17/2 <sup>-</sup>	969.01 15/2 <sup>-</sup>	M1+E2 R=0.45 5.
1067.6	1	1.3	1	3433.77	25/2 <sup>+</sup>	2366.10 23/2 <sup>+</sup>	D R=0.65 6.
1069.0	5	0.9	2	5263.5	(33/2 <sup>-</sup> )	4194.47 29/2 <sup>-</sup>	
1075.1	1	6.0	3	4657.87	29/2 <sup>-</sup>	3582.74 27/2 <sup>-</sup>	M1+E2 R=0.45 2.
1081.5 @	1	0.3	1	6818.1	41/2 <sup>-</sup>	5735.67 37/2 <sup>-</sup>	E2 R=1.5 3. E <sub>γ</sub> : poor fit; level energy difference is equal to 1082.40 14.
1097.6	1	1.2	1	3988.03	27/2 <sup>-</sup>	2890.43 23/2 <sup>-</sup>	E2 R=1.8 2.
1118.4	1	0.5	1	2831.14	19/2 <sup>(+)</sup>	1712.80 17/2 <sup>-</sup>	D R=0.80 6.
1139.3	1	1.4	1	4485.41	31/2 <sup>+</sup>	3346.00 27/2 <sup>+</sup>	E2 R=1.58 14.
1148.9	1	0.9	1	5391.77	35/2 <sup>-</sup>	4242.91 31/2 <sup>-</sup>	E2 R=1.7 10.
1152.1	1	0.4	1	4255.88	29/2 <sup>+</sup>	3103.86 25/2 <sup>+</sup>	
1156.7	1	0.9	1	4502.49	31/2 <sup>+</sup>	3346.00 27/2 <sup>+</sup>	
1173.3	1	2.4	1	3115.24	21/2 <sup>+</sup>	1942.13 19/2 <sup>+</sup>	D R=0.67 6.
1184.0	5	0.3	1	7421.1	43/2 <sup>-</sup>	6237.1 39/2 <sup>-</sup>	[E2]
1187.2	1	1.8	1	5430.16	33/2 <sup>-</sup>	4242.91 31/2 <sup>-</sup>	M1+E2 R=0.51 7.
1201.8	1	4.3	2	2170.79	19/2 <sup>-</sup>	969.01 15/2 <sup>-</sup>	E2 R=1.56 13.
1203.9	1	1.6	1	3062.99	21/2 <sup>(+)</sup>	1859.15 19/2 <sup>-</sup>	D R=0.87 7.
1234.0	5	0.6	1	8052.1	45/2 <sup>-</sup>	6818.1 41/2 <sup>-</sup>	[E2]
1278.0	5	4.4	2	5520.61	35/2 <sup>-</sup>	4242.91 31/2 <sup>-</sup>	E2 R=1.38 10.
1280.3	1	1.2	1	3646.47	25/2 <sup>+</sup>	2366.10 23/2 <sup>+</sup>	M1+E2 R=0.59 6.
1304.2	1	0.9	2	3246.58	23/2 <sup>+</sup>	1942.13 19/2 <sup>+</sup>	E2 R=1.29 5.

Continued on next page (footnotes at end of table)

$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  **1995Ju02** (continued) $\gamma(^{133}\text{Ba})$  (continued)

$E_\gamma$ <sup>†</sup>	$I_\gamma$ <sup>†</sup>	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	Comments
1308.5	1	7585.93	(43/2 <sup>+</sup> )	6277.42	39/2 <sup>+</sup>		$E_\gamma$ : poor fit, level energy difference is equal to 1304.45 5.
1311.9	1	4657.87	29/2 <sup>-</sup>	3346.00	27/2 <sup>+</sup>	D	R=0.80 9.
1321.3	1	4425.14	27/2	3103.86	25/2 <sup>+</sup>	D	R=0.94 11.
1419.0	1	5661.92	35/2 <sup>-</sup>	4242.91	31/2 <sup>-</sup>	E2	R=1.35 14.
1601.8	1	3967.91		2366.10	23/2 <sup>+</sup>		

<sup>†</sup> From **1995Ju02**, except as noted.

<sup>‡</sup> From **1995Ju02**.  $R=I_\gamma(37^\circ \text{ or } 143^\circ)/I_\gamma(79^\circ \text{ or } 101^\circ)$  ratio is 1.4 – 1.5 for known  $\Delta J=0$  dipole and  $\Delta J=2$  quadrupole (E2) transitions, while for known stretched dipole transitions it is about 0.8; for many cases, when R is small ( $\approx 0.4$ ), transitions connect levels with  $\Delta J=1$  and have D+Q (M1+E2) multipolarities.

# Multiply placed with intensity suitably divided.

@ Placement of transition in the level scheme is uncertain.

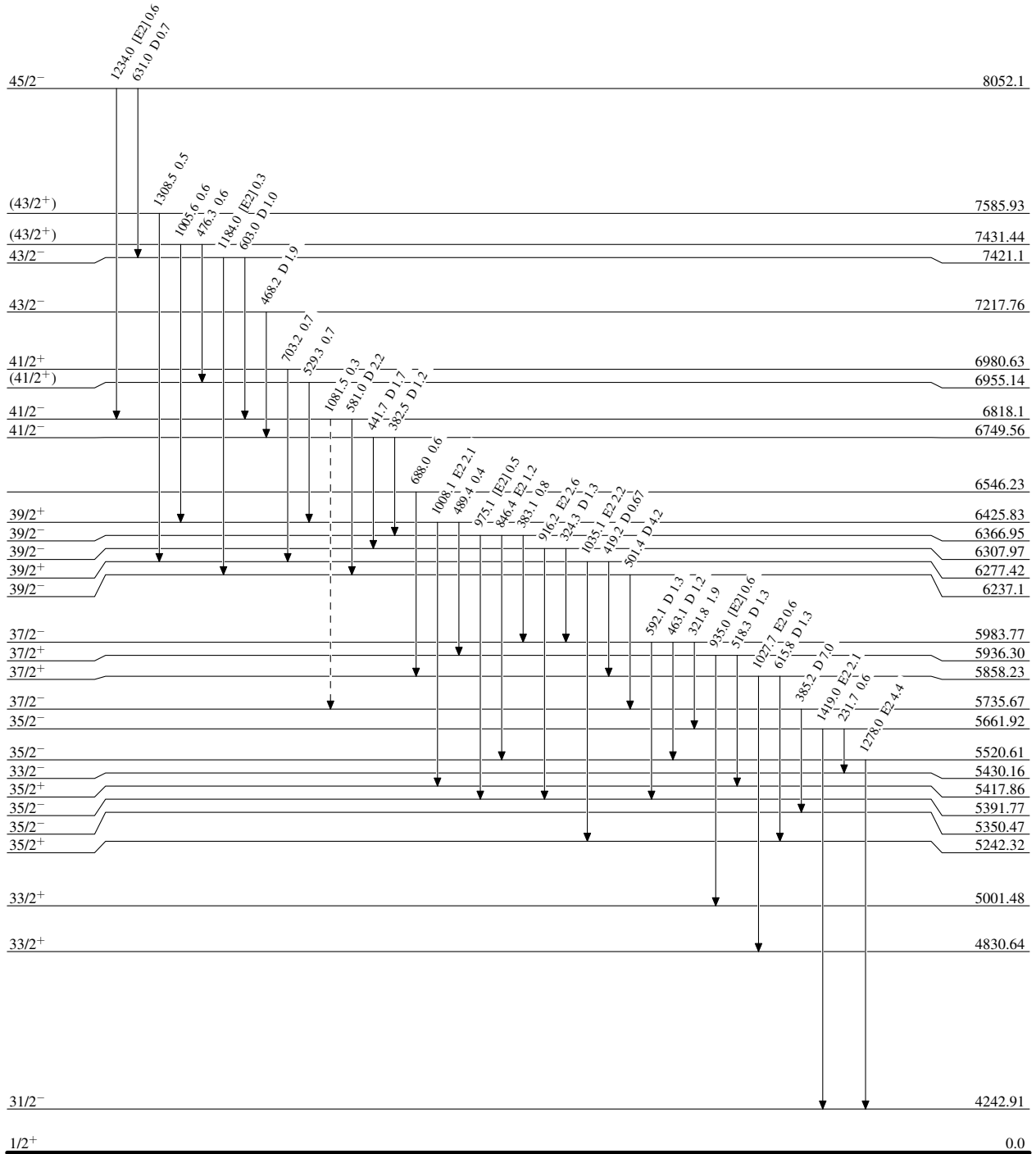
<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02

Legend

Level Scheme

Intensities: Relative I $\gamma$

- I $\gamma$  < 2% × I $\gamma^{max}$
- I $\gamma$  < 10% × I $\gamma^{max}$
- I $\gamma$  > 10% × I $\gamma^{max}$
- - - - -  $\gamma$  Decay (Uncertain)






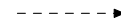


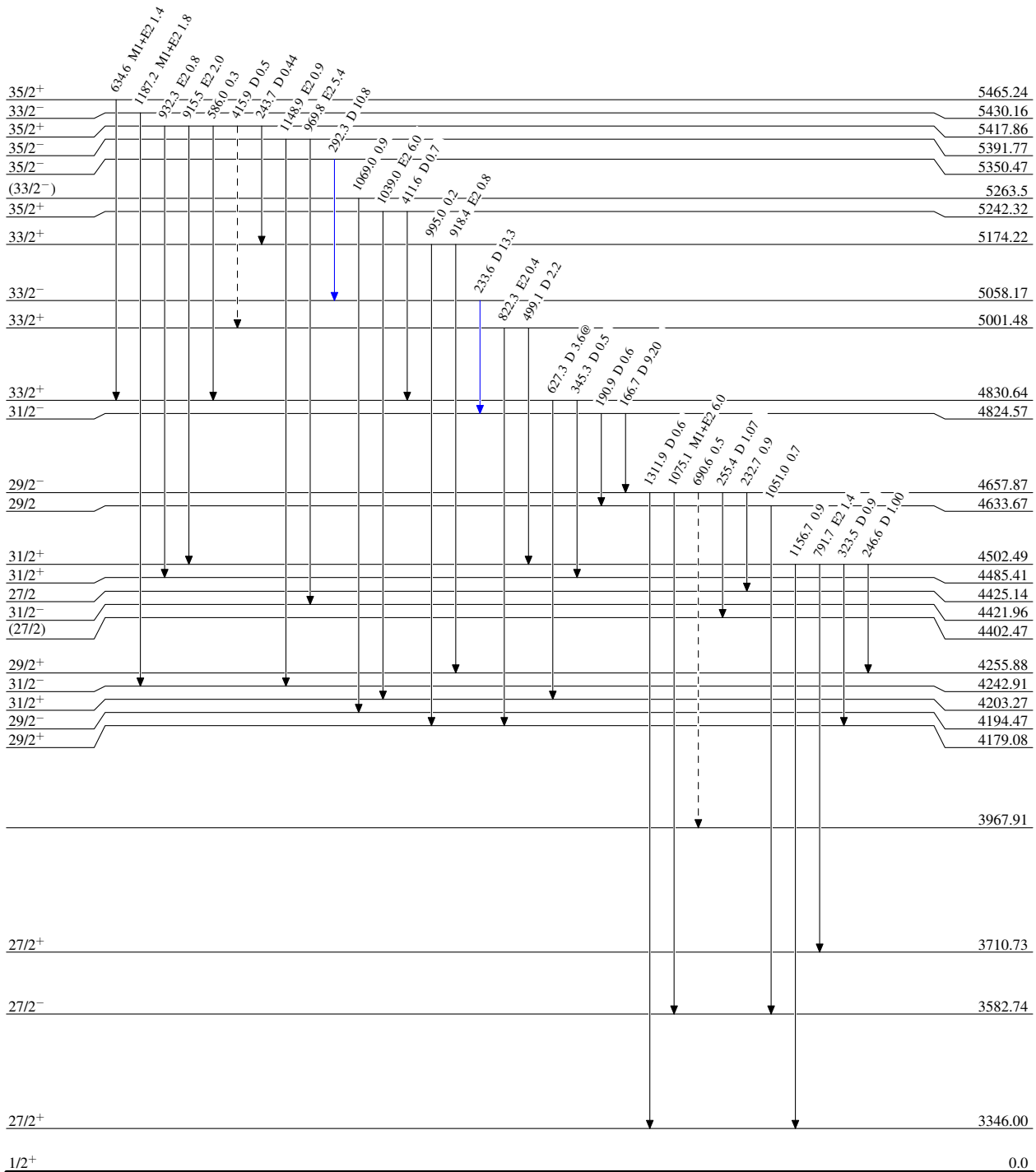
<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02

Level Scheme (continued)

Intensities: Relative I $\gamma$   
@ Multiply placed: intensity suitably divided

Legend

-  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>
-   $\gamma$  Decay (Uncertain)



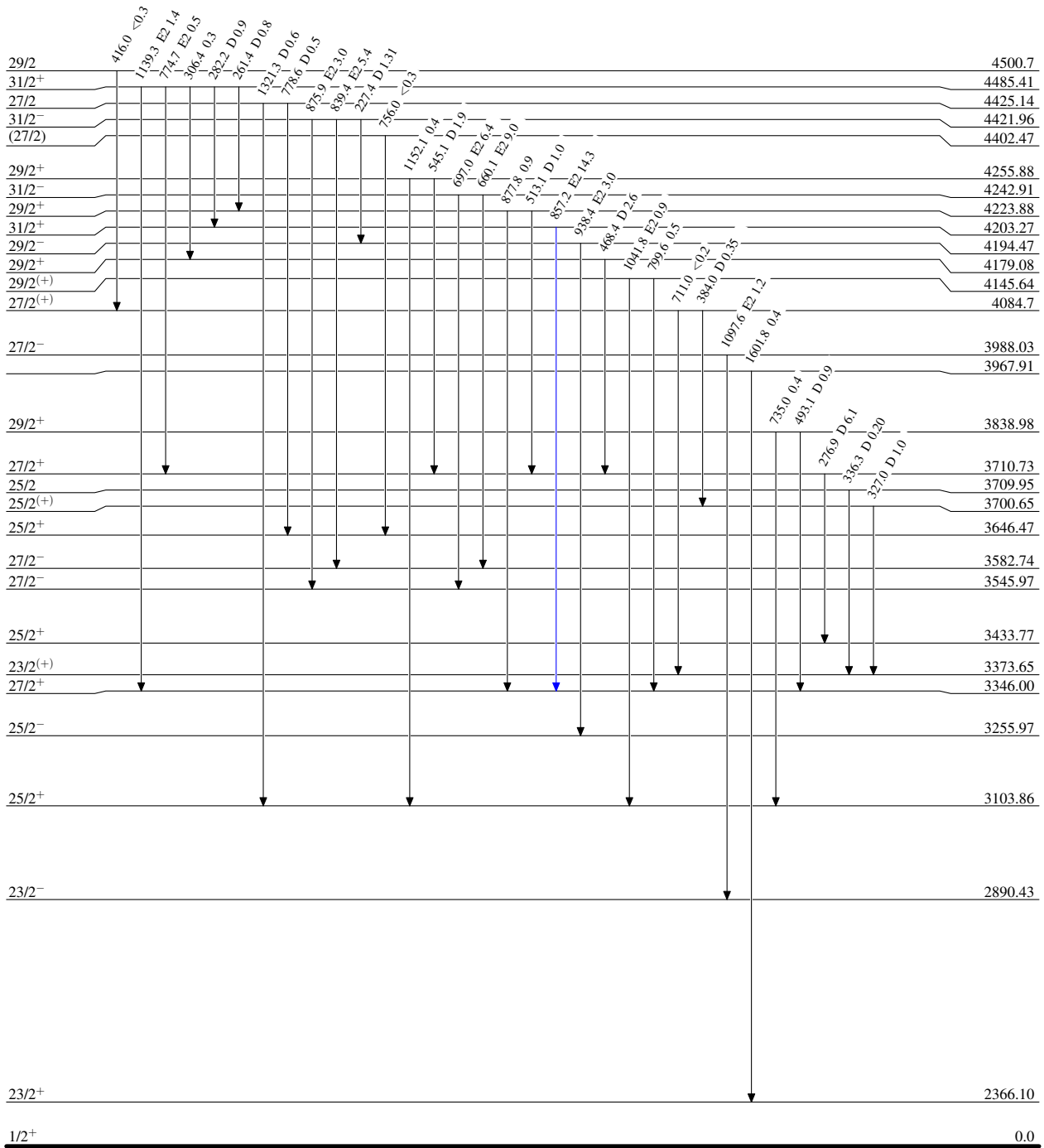
<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02

Level Scheme (continued)

Legend

Intensities: Relative I $\gamma$   
@ Multiply placed: intensity suitably divided

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



<sup>133</sup>Ba<sub>77</sub>

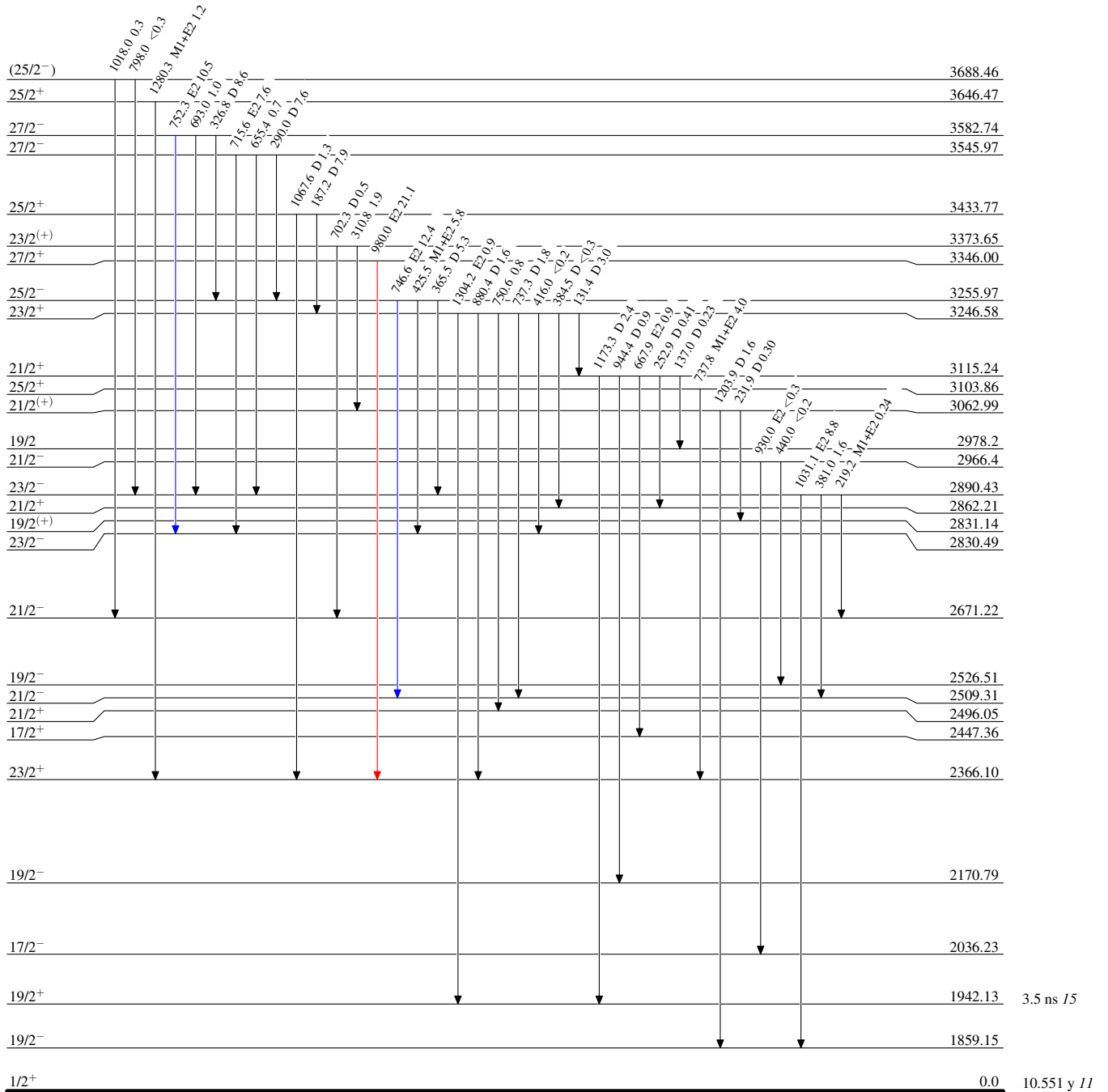
<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02

Level Scheme (continued)

Legend

Intensities: Relative I $\gamma$   
@ Multiply placed: intensity suitably divided

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



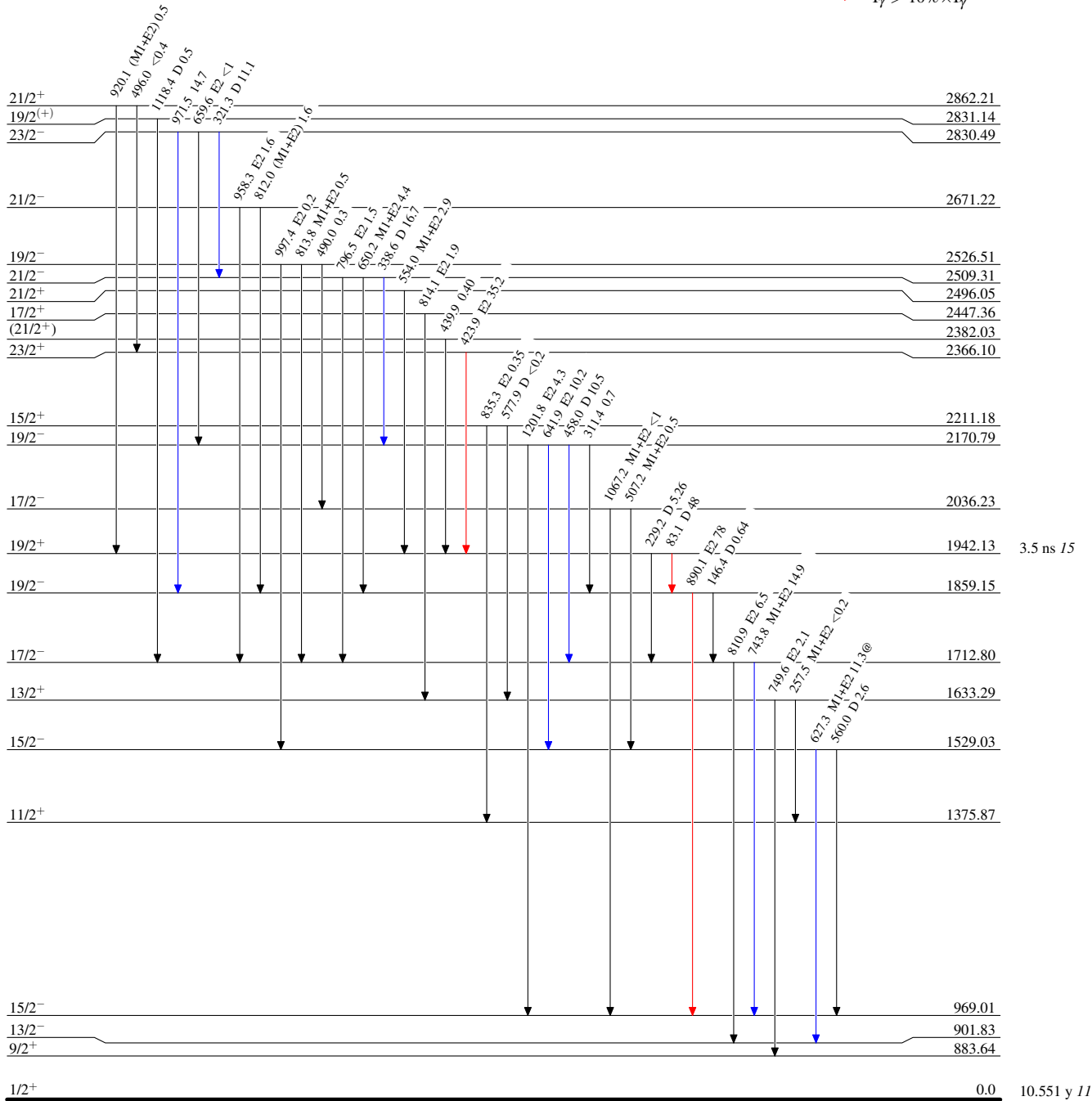
<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02

Level Scheme (continued)

Intensities: Relative I $\gamma$   
@ Multiplied: intensity suitably divided

Legend

- 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>



<sup>133</sup>Ba<sub>77</sub>

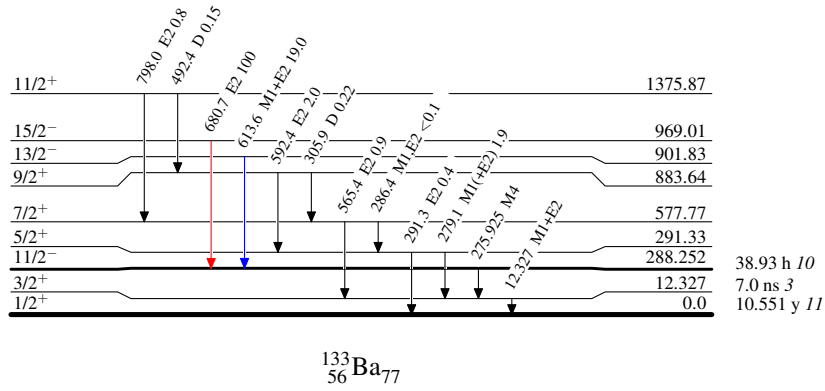
<sup>124</sup>Sn(<sup>13</sup>C,4n $\gamma$ ) 1995Ju02

Level Scheme (continued)

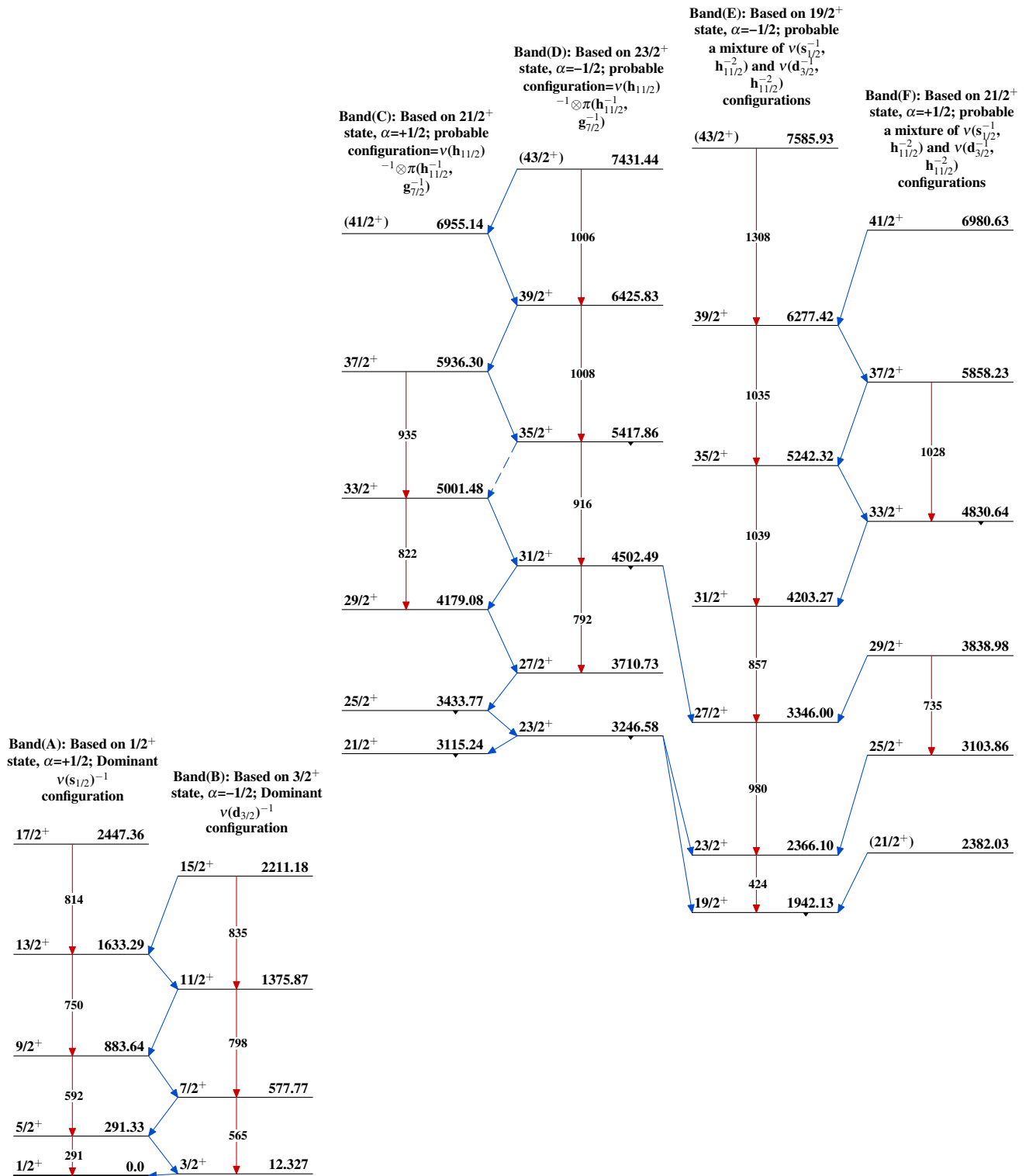
Intensities: Relative I $\gamma$   
 @ Multiply placed: intensity suitably divided

Legend

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

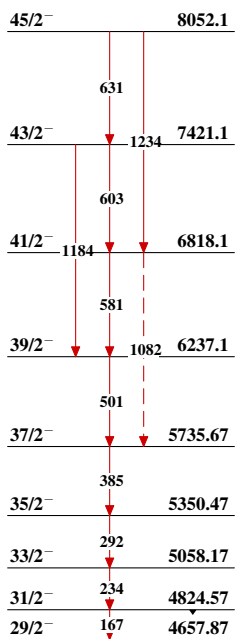


$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  1995Ju02

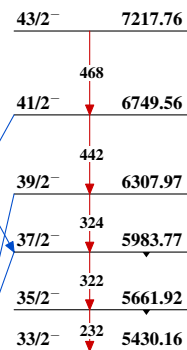


$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  1995Ju02 (continued)

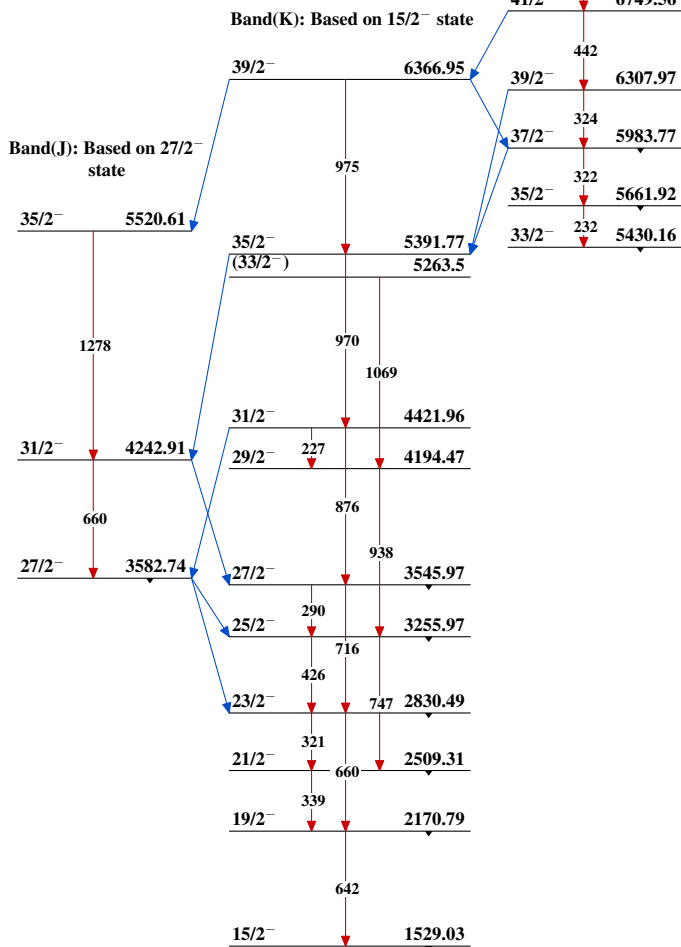
Band(G): Based on 29/2<sup>-</sup> state



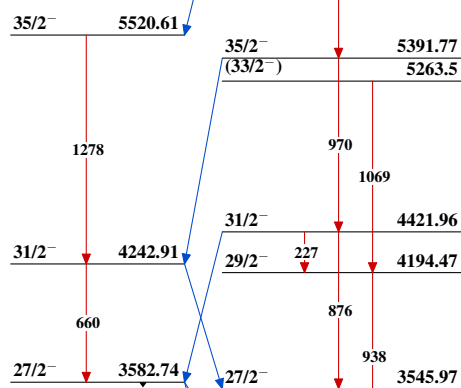
Band(L): Band L based on 33/2<sup>-</sup> state



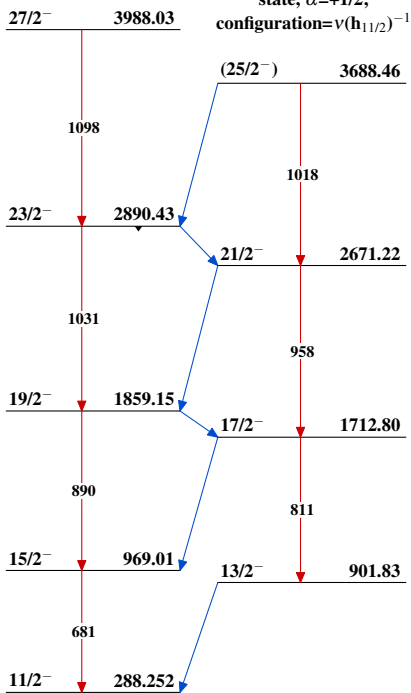
Band(K): Based on 15/2<sup>-</sup> state



Band(J): Based on 27/2<sup>-</sup> state



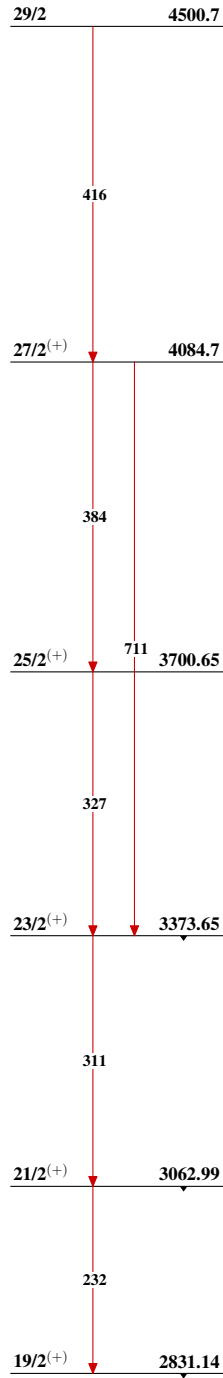
Band(H): Based on 11/2<sup>-</sup> state,  $\alpha=-1/2$ ;  
configuration= $\nu(h_{11/2})^{-1}$



Band(I): Based on 13/2<sup>-</sup> state,  $\alpha=+1/2$ ;  
configuration= $\nu(h_{11/2})^{-1}$

$^{124}\text{Sn}(^{13}\text{C},4n\gamma)$  1995Ju02 (continued)

Band(M): Based on  $19/2^{(+)}$   
state; probable  
configuration= $\nu(\text{h}_{11/2})$   
 $^{-1} \otimes \pi(\text{h}_{11/2}^{-1},$   
 $\text{d}_{5/2}^{-1})$



$^{133}_{56}\text{Ba}_{77}$