^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Includes ^{152}Sm(^{19}F,4nγ) from 1998Ya04.

1990Yu01: ^{123}Sb(^{48}Ca,4nγ),E=206 MeV; ESSA30 detector array of 29 escape-suppressed Ge detectors at Daresbury Laboratory, placed at θ=37°, 63°, 79°, 101°, 117°, and 143°. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$(DCO) (at 37° and 79°).

Other:

1998Ya04, 1997Wu03: ^{152}Sm(^{19}F,4nγ),E=85,87 MeV; 98.4% ^{152}Sm targets. Measured Eγ, $\gamma\gamma$-coin using six Compton-suppressed HPGe-BGO detectors, and an HPGe planar detector. Authors reported 15 new transitions associated with previously-known 1/2[411] and 5/2[402] bands, and established a new band, interpreted as a possible triaxial SD band. Only level schemes are given in 1998Ya04 and 1997Wu03, with no data for gamma-ray intensities. Note that there are several differences in the level schemes in 1998Ya04 and 1997Wu03. In cases, evaluators take data from 1998Ya04 with the assumption that these supersede data presented by the same experimental group, and likely the same experiment reported in 1997Wu03.

^{167}Lu Levels

The level scheme is a combination of data from 1990Yu01 and 1998Ya04. The conclusions of 1998Ya04 are presumed by evaluators to supersede those of 1997Wu03 (same authors and same experimental conditions); as 1997Wu03 propose a very different interconnection between the possible SD-band and normal-deformation levels, leading to different J^π for levels of the former band, and several gammas present in 1997Wu03 but absent in 1998Ya04, and vice versa.

Experimental B(M1)/B(E2) ratios are from Table 1 in 1990Yu01, with the assumption of pure M1 for J→J-1 transitions.

Band assignments are from 1990Yu01, unless otherwise indicated.

E(level)[†]	J$^\pi$[‡]	Comments
0.0[&]	7/2$^+$	
14.9+x[f] *5*	(3/2$^+$)	Additional information 1. E(level): taken by the evaluators from (^{3}He,5nγ), with x=33.7 keV according to level energies in the Adopted Levels, that are based on data in 2015Ro27.
35.1+x[g] *16*	(5/2$^+$)	Additional information 2.
122.2+x[d] *5*	5/2$^-$	Additional information 3.
140.03[@] *12*	9/2$^+$	
151.7+x[h] *7*	(7/2$^+$)	
185.1+x[f] *7*	(7/2$^+$)	
233.9+x[d] *5*	9/2$^-$	
296.3+x[g] *6*	(9/2$^+$)	
305.29[&] *10*	11/2$^+$	B(M1)/B(E2)=0.35 *2*.
332.0[b] *3*	9/2$^-$	
433.6[c] *4*	11/2$^-$	
446.7+x[d] *5*	13/2$^-$	
465.9+x[h] *7*	(11/2$^+$)	
474.5+x[f] *7*	(11/2$^+$)	J$^\pi$: misprinted as 13/2$^+$ in 1998Ya04 and 1997Wu03.
494.17[@] *12*	13/2$^+$	B(M1)/B(E2)=0.22 *2*.
577.1[b] *4*	13/2$^-$	B(M1)/B(E2)=0.65 *8*.
659.4+x[g] *8*	(13/2$^+$)	
704.27[&] *12*	15/2$^+$	B(M1)/B(E2)=0.22 *2*.
744.3[c] *4*	15/2$^-$	B(M1)/B(E2)=0.86 *5*.
761.6+x[d] *5*	17/2$^-$	
854.2+x[f] *7*	(15/2$^+$)	

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^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

^{167}Lu Levels (continued)

E(level)[†]	Jπ[‡]	Comments
881.8+x[h] 9	(15/2$^+$)	
934.11[@] 13	17/2$^+$	B(M1)/B(E2)=0.21 2.
947.9[b] 4	17/2$^-$	B(M1)/B(E2)=0.85 5.
1107.6+x[g] 9	(17/2$^+$)	
1159.6[c] 4	19/2$^-$	B(M1)/B(E2)=0.87 6.
1172.8+x[d] 5	21/2$^-$	
1181.20[&] 15	19/2$^+$	B(M1)/B(E2)<0.36.
1313.7+x[f] 7	(19/2$^+$)	
1372.1+x[h] 10	19/2$^+$[#]	
1411.7[b] 4	21/2$^-$	B(M1)/B(E2)=0.8 1.
1444.36[@] 16	21/2$^+$	B(M1)/B(E2)=0.21 1.
1615.5+x[g] 11	21/2$^+$[#]	
1656.0[c] 4	23/2$^-$	B(M1)/B(E2)=0.87 6.
1671.0+x[d] 5	25/2$^-$	
1720.16[&] 17	23/2$^+$	B(M1)/B(E2)=0.24 3.
1823.9+x[f] 12	(23/2$^+$)	
1920.7+x[h] 12	23/2$^+$[#]	
1947.6[b] 4	25/2$^-$	B(M1)/B(E2)=0.77 3.
2007.99[@] 18	25/2$^+$	B(M1)/B(E2)=0.28 4.
2152.5+x[g] 12	25/2$^+$[#]	
2214.9[c] 4	27/2$^-$	B(M1)/B(E2)=0.6 1.
2246.0+x[d] 6	29/2$^-$	
2299.35[&] 19	27/2$^+$	B(M1)/B(E2)=0.23 2.
2366.1+x[f] 13	(27/2$^+$)	
2532.1[b] 4	29/2$^-$	B(M1)/B(E2)=1.0 2.
2580.60[@] 20	29/2$^+$	B(M1)/B(E2)=0.36 6.
2689.3+x 13		E(level): level proposed by 1998Ya04 based on placements of 323γ and 537γ either not seen or placed differently in other studies; level not adopted in Adopted Levels.
2699.4+x[i] 14	(29/2)$^+$[#]	
2800.7[c] 4	31/2$^-$	B(M1)/B(E2)=1.8 3.
2823.13[&] 21	31/2$^+$	B(M1)/B(E2)=0.59 4.
2886.9+x[d] 6	33/2$^-$	
2985.1+x[f] 17	31/2$^+$[#]	
3043.9[@] 3	33/2$^+$	B(M1)/B(E2)=0.43 5.
3070.3[b] 4	33/2$^-$	B(M1)/B(E2)=2.3 4.
3250.4+x[i] 15	(33/2)$^+$[#]	
3285.44[&] 23	35/2$^+$	B(M1)/B(E2)=0.62 7.
3289.0[c] 4	35/2$^-$	B(M1)/B(E2)=2.0 2.
3523.4[b] 4	37/2$^-$	B(M1)/B(E2)=1.54 9.
3532.3[@] 3	37/2$^+$	B(M1)/B(E2)<0.76.
3582.3+x[d] 6	37/2$^-$	
3774.3[c] 4	39/2$^-$	B(M1)/B(E2)=1.26 9.
3813.0[&] 3	39/2$^+$	B(M1)/B(E2)=0.29 5.
3851.4+x[i] 18	(37/2)$^+$[#]	
4046.0[b] 4	41/2$^-$	B(M1)/B(E2)=1.46 13.
4096.2[@] 3	41/2$^+$	B(M1)/B(E2)=0.41 5.

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^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

^{167}Lu Levels (continued)

E(level)[†]	Jπ[‡]	Comments
4273.9+x[d] 8	41/2⁻	
4339.7[c] 5	43/2⁻	B(M1)/B(E2)=1.4 *1*.
4347.3+x[e] 12	(41/2⁻)	E(level): could correspond to the 4373.5,(41/2⁻) level in Adopted Level.
4417.5[&] 3	43/2⁺	B(M1)/B(E2)<0.21.
4504.4+x[i] 20	(41/2)⁺[#]	
4656.2[b] 4	45/2⁻	B(M1)/B(E2)=1.2 *1*.
4735.3[@] 3	45/2⁺	B(M1)/B(E2)<0.4.
4910.2+x[d] 9	45/2⁻	
4986.2[c] 4	47/2⁻	B(M1)/B(E2)=1.5 *2*.
5093.6[&] 5	47/2⁺	
5107.3+x[e] 15	(45/2⁻)	E(level): could correspond to the 5142.3,(45/2⁻) level in Adopted Levels.
5209.4+x[i] 23	(45/2)⁺[#]	
5349.1[b] 5	49/2⁻	B(M1)/B(E2)=1.0 *1*.
5442.9[@] 3	49/2⁺	
5606.4+x[d] 10	49/2⁻	
5705.5[c] 5	51/2⁻	B(M1)/B(E2)=1.30 *14*.
5833.9[&] 7	(51/2⁺)	
5872.3+x[e] 18	(49/2⁻)	
5962.4+x[i] 25	(49/2)⁺[#]	
6116.8[b] 6	53/2⁻	B(M1)/B(E2)=0.79 *23*.
6213.1[@] 6	(53/2⁺)	
6365.6+x[d] 12	53/2⁻	
6490.3[c] 6	55/2⁻	B(M1)/B(E2)=1.3 *2*.
6631.6[&] 9	(55/2⁺)	
6689.3+x[e] 21	(53/2⁻)	E(level): no corresponding level in Adopted Levels.
6766+x[i] 3	(53/2)⁺[#]	
6952.3[b] 7	57/2⁻	B(M1)/B(E2)=0.90 *25*.
7036.1[@] 8	(57/2⁺)	
7183.1+x[d] 13	57/2⁻	
7333.6[c] 7	59/2⁻	B(M1)/B(E2)=1.7 *3*.
7471.1[&] 10	(59/2⁺)	
7523.3+x[e] 23	(57/2⁻)	E(level): no corresponding level in Adopted Levels.
7620+x[i] 3	(57/2⁺)[#]	
7854.2[b] 8	(61/2⁻)	
7875.9[@] 9	(61/2⁺)	
8056.7+x[d] 14	61/2⁻	
8232.9[c] 9	63/2⁻	
8341.7[&] 11	(63/2⁺)	
8382.6[a] 11	(63/2⁺)	E(level): could correspond to the 8455.8,(63/2⁺) level in Adopted Levels.
8524+x?[i] 3	(61/2)⁺[#]	
8746.9[@] 14	(65/2⁺)	
8982.7+x[d] 17	65/2⁻	
9188.0?[c] 10	(67/2⁻)	
9266.3[&] 12	(67/2⁺)	E(level): probably corresponds to the 9269.9 level in Adopted Levels.
9374.3[a] 12	(67/2⁺)	E(level): could correspond to the 9442.9,(67/2⁺) level in Adopted Levels.

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^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

^{167}Lu Levels (continued)

E(level)[†]	J$^\pi$[‡]	Comments
10196.0?[c] *14*	(71/2$^-$)	
10245.3?[&] *13*	(71/2$^+$)	E(level): probably corresponds to the 10551.3,(71/2$^+$) level in Adopted Levels.

[†] From a least-squares adjustment of Eγ values, with ΔEγ=1 keV, assigned by evaluators, when Eγ listed to nearest keV. For level energies listed as number+x, levels corresponding to those in the Adopted Levels (based on data in 2015Ro27) can be obtained using x=33.7 keV.

[‡] From 1990Yu01, except as noted; based on measured DCO ratios, deduced band structure, γ branching and comparison with structure for lighter Lu isotopes.

[#] As given by 1998Ya04.

[@] Band(A): π7/2[404],α=+1/2.

[&] Band(a): π7/2[404],α=−1/2. Above (59/2$^+$), a side band is reported with (63/2$^+$) and (67/2$^+$) levels.

[a] Band(B): Side band. Side band of band based on π7/2[404],α=−1/2.

[b] Band(C): π9/2[514],α=+1/2.

[c] Band(c): π9/2[514],α=−1/2.

[d] Band(D): π1/2[541],α=+1/2.

[e] Band(E): Side band based on (41/2$^+$),α=+1/2. Spins are from Fig. 4 of 1990Yu01, showing that this band connects to 1/2[541] band at 37/2$^-$. Table 1 gives values which are two units higher, which will require connection to the 41/2$^-$ member of 1/2[541] band, instead.

[f] Band(F): π1/2[411],α=−1/2. Band assignment from 1990Yu01 and 1998Ya04. Signature partner band not observed, consistent with knowledge of 1/2[411] bands in neighboring odd-A Lu isotopes. In 1990Yu01, band is shown up to (27/2$^+$).

[g] Band(G): π5/2[402],α=+1/2. Band assignment from 1990Yu01 and 1998Ya04. In 1990Yu01, band is shown up to (17/2$^+$).

[h] Band(g): π5/2[402],α=−1/2. Band assignment from 1990Yu01 and 1998Ya04. In 1990Yu01, band is shown up to (15/2$^+$).

[i] Band(H): TSD (triaxial) band (?). Band assignment from 1998Ya04. Transition energies in the upper part of this band and dynamic moment of inertia values are similar to those for possible 1/2[660] TSD bands in ^{163}Lu and ^{165}Lu (1998Ya04), and ^{164}Lu (1999To08). This band and levels in it are proposed by 1998Ya04 based on the cascade of the transition energies, however, those transitions are placed differently by 2015Ro27 in (^{48}Ca,4nγ) E=203 MeV as also adopted in Adopted Levels, Gammas. Adopted placement of each transition is given under comment.

γ(^{167}Lu)

DCO ratio in 1990Yu01 measured at θ=37° and 79°. DCO(D)=DCO ratio for gate on ΔJ=1, dipole transition, and DCO(Q) for gate on ΔJ=2, quadrupole transition. Expected DCO ratios are: 0.5 for stretched quadrupole and 1.0 for stretched dipole transitions, when gated with stretched dipoles. For gates on stretched quadrupole transitions, expected DCO is 1.0 for stretched quadrupoles.

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[@]	Comments
101.5 *5*		433.6	11/2$^-$	332.0	9/2$^-$		
(107.3 *2*)		122.2+x	5/2$^-$	14.9+x	(3/2$^+$)		E$_\gamma$: from the Adopted Gammas.
111.7 *5*		233.9+x	9/2$^-$	122.2+x	5/2$^-$		
117[‡] *1*		151.7+x	(7/2$^+$)	35.1+x	(5/2$^+$)		
139.9 *5*		140.03	9/2$^+$	0.0	7/2$^+$		
143.4 *1*	74.6 *47*	577.1	13/2$^-$	433.6	11/2$^-$		DCO(D)=0.84 *5*
144.8[‡] *5*		296.3+x	(9/2$^+$)	151.7+x	(7/2$^+$)	(Q)	DCO(Q)=1.0 *4*
165.3 *1*	62.5 *60*	305.29	11/2$^+$	140.03	9/2$^+$		
167.3 *1*	105 *9*	744.3	15/2$^-$	577.1	13/2$^-$		DCO(D)=0.75 *5*
170[‡] *1*		185.1+x	(7/2$^+$)	14.9+x	(3/2$^+$)		DCO(Q)=1.0 *3*
170[‡] *1*		465.9+x	(11/2$^+$)	296.3+x	(9/2$^+$)	(Q)	DCO(Q)=1.0 *3*
178.2[‡] *5*		474.5+x	(11/2$^+$)	296.3+x	(9/2$^+$)	(Q)	DCO(Q)=1.5 *9*

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^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

$\gamma(^{167}Lu)$ (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult. @	Comments
185#		659.4+x	(13/2$^+$)	474.5+x	(11/2$^+$)		
188.9 *1*	42.1 *46*	494.17	13/2$^+$	305.29	11/2$^+$		
191.7 *5*		332.0	9/2$^-$	140.03	9/2$^+$	D	DCO(D)=0.99 *9*
193 *1*		659.4+x	(13/2$^+$)	465.9+x	(11/2$^+$)		
194#		854.2+x	(15/2$^+$)	659.4+x	(13/2$^+$)		
203.6 *1*	82.3 *49*	947.9	17/2$^-$	744.3	15/2$^-$	D	DCO(D)=0.90 *5*
205#		1313.7+x	(19/2$^+$)	1107.6+x	(17/2$^+$)		
210.3 *1*	40.0 *37*	704.27	15/2$^+$	494.17	13/2$^+$		
211.7 *1*	77.1 *56*	1159.6	19/2$^-$	947.9	17/2$^-$		DCO(D)=0.77 *4*
212.8 *1*	113.7 *56*	446.7+x	13/2$^-$	233.9+x	9/2$^-$	Q	DCO(Q)=1.1 *1*
218.8 *1*	40.7 *25*	3289.0	35/2$^-$	3070.3	33/2$^-$	D	DCO(D)=0.95 *5*
221.1 *5*	18.4 *15*	3043.9	33/2$^+$	2823.13	31/2$^+$		
223 *1*		881.8+x	(15/2$^+$)	659.4+x	(13/2$^+$)		
225 *1*		1107.6+x	(17/2$^+$)	881.8+x	(15/2$^+$)		
230.0 *1*	36.0 *51*	934.11	17/2$^+$	704.27	15/2$^+$		
232#		2152.5+x	25/2$^+$	1920.7+x	23/2$^+$		
234.4 *1*	41.5 *25*	3523.4	37/2$^-$	3289.0	35/2$^-$	D	DCO(D)=0.97 *5*
241.2 *5*	18.2 *20*	3285.44	35/2$^+$	3043.9	33/2$^+$		
242.1 *5*	13.5 *12*	2823.13	31/2$^+$	2580.60	29/2$^+$		
243#		1615.5+x	21/2$^+$	1372.1+x	19/2$^+$		
244.4 *1*	53.3 *50*	1656.0	23/2$^-$	1411.7	21/2$^-$		
244.8 *5*	24.0 *40*	577.1	13/2$^-$	332.0	9/2$^-$		Iγ(244.8)/Iγ(143.4)=0.32 *4*.
246.6 *5*	<36.0	1181.20	19/2$^+$	934.11	17/2$^+$		
246.6 *5*	<23.0	3532.3	37/2$^+$	3285.44	35/2$^+$		
251.0 *5*	28.6 *29*	3774.3	39/2$^-$	3523.4	37/2$^-$		DCO(D)=0.86 *4* DCO for 251.0γ+252.1γ doublet.
252.1 *1*	66.0 *53*	1411.7	21/2$^-$	1159.6	19/2$^-$		DCO(D)=0.86 *4* DCO for 251.0γ+252.1γ doublet.
254#		1107.6+x	(17/2$^+$)	854.2+x	(15/2$^+$)		
261‡ *1*		296.3+x	(9/2$^+$)	35.1+x	(5/2$^+$)		
263.6 *5*	21.4 *17*	1444.36	21/2$^+$	1181.20	19/2$^+$		
265#		1372.1+x	19/2$^+$	1107.6+x	(17/2$^+$)		
267.6 *5*	23.7 *41*	2214.9	27/2$^-$	1947.6	25/2$^-$		
268.5 *1*	58 *10*	2800.7	31/2$^-$	2532.1	29/2$^-$		DCO(D)=0.83 *4* DCO for 268.5γ+269.6γ doublet. The 269γ is self-coincident.
269.6 *1*	63 *10*	3070.3	33/2$^-$	2800.7	31/2$^-$		DCO(D)=0.83 *4* DCO for 268.5γ+269.6γ doublet. The 269γ is self-coincident.
271.7 *1*	34.9 *22*	4046.0	41/2$^-$	3774.3	39/2$^-$	D	DCO(D)=0.89 *5*
275.8 *5*	16.7 *14*	1720.16	23/2$^+$	1444.36	21/2$^+$		
280.7 *5*	8.0 *14*	3813.0	39/2$^+$	3532.3	37/2$^+$		
281.0 *5*	12.6 *20*	2580.60	29/2$^+$	2299.35	27/2$^+$		
283.6 *5*	8.7 *9*	4096.2	41/2$^+$	3813.0	39/2$^+$		
288.3 *5*	18.4 *15*	2007.99	25/2$^+$	1720.16	23/2$^+$		
289.4‡ *5*		474.5+x	(11/2$^+$)	185.1+x	(7/2$^+$)		
291.2 *5*	11.3 *11*	2299.35	27/2$^+$	2007.99	25/2$^+$		
291.6 *1*	42.0 *26*	1947.6	25/2$^-$	1656.0	23/2$^-$		DCO(D)=0.80 *6* DCO for 291.6γ+293.9γ doublet, dominated by the 291.6γ.
293.9 *5*	24.2 *26*	4339.7	43/2$^-$	4046.0	41/2$^-$		DCO(D)=0.88 *6* DCO for 291.6γ+293.9γ doublet, dominated by 291.6γ.

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^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

$\gamma(^{167}Lu)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
294.0 *5*		433.6	11/2$^-$	140.03	9/2$^+$		
305[#]		1920.7+x	23/2$^+$	1615.5+x	21/2$^+$		
305.3 *1*	73.8 *55*	305.29	11/2$^+$	0.0	7/2$^+$		Iγ(305.3)/Iγ(165.3)=1.18 *7*.
310.7 *1*	54.7 *40*	744.3	15/2$^-$	433.6	11/2$^-$		DCO(D)=0.78 *5* Iγ(310.7)/Iγ(167.3)=0.50 *3*.
314[‡] *1*		465.9+x	(11/2$^+$)	151.7+x	(7/2$^+$)		
314.9 *1*	104.3 *51*	761.6+x	17/2$^-$	446.7+x	13/2$^-$	Q	DCO(Q)=1.3 *2*
316 *1*	33.4 *48*	2532.1	29/2$^-$	2214.9	27/2$^-$		
316.9 *5*	22.4 *35*	4656.2	45/2$^-$	4339.7	43/2$^-$	D	DCO(D)=0.89 *5*
317[b] *1*	<8.0	4735.3	45/2$^+$	4417.5	43/2$^+$		
321.5[b] *5*	<5.0	4417.5	43/2$^+$	4096.2	41/2$^+$		
323[#b]		2689.3+x		2366.1+x	(27/2$^+$)		E_γ: a 324γ unplaced in (^{3}He,5nγ) (1977Ba40); not seen in (^{48}Ca,4nγ) (2015Ro27). The evaluators consider this placement questionable.
330.0 *1*	23.0 *20*	4986.2	47/2$^-$	4656.2	45/2$^-$		DCO(D)=0.68 *9*
331.9 *5*		332.0	9/2$^-$	0.0	7/2$^+$		DCO(D)=1.24 *9*
354.1 *1*	110 *10*	494.17	13/2$^+$	140.03	9/2$^+$		Iγ(354.1)/Iγ(188.9)=2.6 *2*.
356.5 *5*	14.5 *11*	5705.5	51/2$^-$	5349.1	49/2$^-$		DCO(D)=0.8 *1*
359[b] *1*	<4.0	5093.6	47/2$^+$	4735.3	45/2$^+$		
363 *1*		659.4+x	(13/2$^+$)	296.3+x	(9/2$^+$)		
363.0 *5*	15.0 *30*	5349.1	49/2$^-$	4986.2	47/2$^-$		
370.8 *1*	56.0 *48*	947.9	17/2$^-$	577.1	13/2$^-$	(Q)	DCO(D)=0.70 *7* Iγ(370.8)/Iγ(203.6)=0.68 *4*.
373.8 *5*	5.5 *7*	6490.3	55/2$^-$	6116.8	53/2$^-$		
379.6 *5*	24.5 *36*	854.2+x	(15/2$^+$)	474.5+x	(11/2$^+$)	Q	DCO(Q)=0.89 *15*
381.3 *5*	4.6 *5*	7333.6	59/2$^-$	6952.3	57/2$^-$		
388.3 *1*	30.9 *42*	854.2+x	(15/2$^+$)	465.9+x	(11/2$^+$)	Q	DCO(Q)=0.95 *15*
399.0 *1*	138 *11*	704.27	15/2$^+$	305.29	11/2$^+$		Iγ(399.0)/Iγ(210.3)=3.4 *3*.
411.2 *1*	100.0 *49*	1172.8+x	21/2$^-$	761.6+x	17/2$^-$	Q	DCO(Q)=1.1 *1*
411.8 *5*	6.3 *9*	6116.8	53/2$^-$	5705.5	51/2$^-$		
414 *1*		881.8+x	(15/2$^+$)	465.9+x	(11/2$^+$)		
415.2 *1*	80.2 *49*	1159.6	19/2$^-$	744.3	15/2$^-$		DCO(D)=0.76 *6* Iγ(415.2)/Iγ(211.7)=1.04 *7*.
439.7 *1*	160 *20*	934.11	17/2$^+$	494.17	13/2$^+$		Iγ(439.7)/Iγ(230.0)=4.3 *3*.
448 *1*		1107.6+x	(17/2$^+$)	659.4+x	(13/2$^+$)		
453.1 *1*	29.1 *19*	3523.4	37/2$^-$	3070.3	33/2$^-$		DCO(D)=0.77 *7* Iγ(453.1)/Iγ(234.4)=0.67 *4*.
459.5 *1*	34.0 *46*	1313.7+x	(19/2$^+$)	854.2+x	(15/2$^+$)	Q	DCO(Q)=1.14 *10*
462 *1*	5.5 *6*	6952.3	57/2$^-$	6490.3	55/2$^-$		
462.3 *1*	30.9 *63*	3285.44	35/2$^+$	2823.13	31/2$^+$		Iγ(462.3)/Iγ(241.2)=1.7 *2*.
463 *1*	59.3 *84*	3043.9	33/2$^+$	2580.60	29/2$^+$		Iγ(463)/Iγ(221.1)=3.2 *4*.
463.8 *1*	71.0 *44*	1411.7	21/2$^-$	947.9	17/2$^-$		DCO(D)=0.77 *6* Iγ(463.8)/Iγ(252.1)=1.1 *1*.
477.0 *1*	116.8 *87*	1181.20	19/2$^+$	704.27	15/2$^+$		Iγ(477.0)/Iγ(246.6)>3.2.
485.3 *5*	26.9 *20*	3774.3	39/2$^-$	3289.0	35/2$^-$	Q	DCO(D)=0.60 *8* Iγ(485.3)/Iγ(251.0)=0.94 *7*.
488.3 *1*	36.9 *24*	3289.0	35/2$^-$	2800.7	31/2$^-$		DCO(D)=0.80 *7* Iγ(488.3)/Iγ(218.8)=0.93 *8*.
488.4 *1*	38.5 *30*	3532.3	37/2$^+$	3043.9	33/2$^+$		Iγ(488.4)/Iγ(246.6)>1.70.
490[#]		1372.1+x	19/2$^+$	881.8+x	(15/2$^+$)		
496.5 *1*	80.4 *49*	1656.0	23/2$^-$	1159.6	19/2$^-$		DCO(D)=0.71 *11* Iγ(496.5)/Iγ(244.4)=1.65 *12*.
498.2 *1*	90.5 *77*	1671.0+x	25/2$^-$	1172.8+x	21/2$^-$	Q	DCO(Q)=1.0 *1*

Continued on next page (footnotes at end of table)

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

$\gamma(^{167}Lu)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
508[#]		1615.5+x	$21/2^+$	1107.6+x	$(17/2^+)$		
510 *1*	<50.0	1823.9+x	$(23/2^+)$	1313.7+x	$(19/2^+)$	Q	DCO(Q)=0.9 *1*
510.2 *1*	149 *11*	1444.36	$21/2^+$	934.11	$17/2^+$		Iγ(510.2)/Iγ(263.6)=6.3 *4*.
522.6 *1*	34.9 *23*	4046.0	$41/2^-$	3523.4	$37/2^-$	Q	DCO(D)=0.45 *4* Iγ(522.6)/Iγ(271.7)=0.93 *8*.
523.8 *1*	44.7 *35*	2823.13	$31/2^+$	2299.35	$27/2^+$		Iγ(523.8)/Iγ(242.1)=3.3 *2*.
527.5 *1*	35.1 *28*	3813.0	$39/2^+$	3285.44	$35/2^+$		Iγ(527.5)/Iγ(280.7)=4.4 *7*.
535.9 *1*	70.8 *45*	1947.6	$25/2^-$	1411.7	$21/2^-$	Q	DCO(D)=0.57 *5* Iγ(535.9)/Iγ(291.6)=1.62 *5*.
537[&#]		2152.5+x	$25/2^+$	1615.5+x	$21/2^+$		
537[&#b]		2689.3+x		2152.5+x	$25/2^+$		E_γ: doublet with 537γ from 2152.5+x level; this placement not seen other studies and not adopted in Adopted Gammas.
538.2 *1*	42.9 *30*	3070.3	$33/2^-$	2532.1	$29/2^-$	Q	DCO(D)=0.47 *8* Iγ(538.2)/Iγ(269.6)=1.7 *1*.
539.0 *1*	106.2 *79*	1720.16	$23/2^+$	1181.20	$19/2^+$		Iγ(539.0)/Iγ(275.8)=6.4 *7*.
542 *1*	<50.0	2366.1+x	$(27/2^+)$	1823.9+x	$(23/2^+)$	(Q)	DCO(Q)=0.8 *1* E_γ: γγ-coin indicates that this γ is a doublet, but placement of other component could not be determined.
547[#]		2699.4+x	$(29/2)^+$	2152.5+x	$25/2^+$		E_γ: in Adopted Gammas, this 551γ-547γ cascade feeds $(19/2^+)$ level at E=1406.6.
549[#]		1920.7+x	$23/2^+$	1372.1+x	$19/2^+$		
551[#]		3250.4+x	$(33/2)^+$	2699.4+x	$(29/2)^+$		E_γ: placed from 2506.6,$(27/2^+)$ in Adopted Gammas.
558.9 *1*	77.8 *49*	2214.9	$27/2^-$	1656.0	$23/2^-$	Q	DCO(D)=0.64 *4* Iγ(558.9)/Iγ(267.6)=3.3 *5*.
561[#]		3250.4+x	$(33/2)^+$	2689.3+x			E_γ: could correspond to the 560.6γ from 3814.8,$(37/2^+)$ and the 559.8γ from 3254.3,$(33/2^+)$ level in Adopted Gamma.
563.6 *1*	108 *10*	2007.99	$25/2^+$	1444.36	$21/2^+$		Iγ(563.6)/Iγ(288.3)=5.9 *7*.
563.9 *1*	36.8 *60*	4096.2	$41/2^+$	3532.3	$37/2^+$		Iγ(563.9)/Iγ(283.6)=4.2 *5*.
565.2 *5*	27.7 *20*	4339.7	$43/2^-$	3774.3	$39/2^-$	Q	DCO(D)=0.51 *5* Iγ(565.2)/Iγ(293.9)=1.15 *9*.
572.6 *1*	66.9 *51*	2580.60	$29/2^+$	2007.99	$25/2^+$		Iγ(572.6)/Iγ(281.0)=5.3 *8*.
575.0 *1*	61.5 *53*	2246.0+x	$29/2^-$	1671.0+x	$25/2^-$	Q	DCO(Q)=1.1 *2*
579.2 *1*	87.5 *66*	2299.35	$27/2^+$	1720.16	$23/2^+$		Iγ(579.2)/Iγ(291.2)=8.0 *5*.
584.4 *1*	50.1 *63*	2532.1	$29/2^-$	1947.6	$25/2^-$		DCO(D)=0.63 *3* DCO for 584.4γ+585.9γ doublet. Iγ(584.4)/Iγ(316)=1.5 *2*.
585.9 *1*	79.6 *85*	2800.7	$31/2^-$	2214.9	$27/2^-$		DCO(D)=0.63 *3* DCO for 584.4γ+585.9γ doublet. Iγ(585.9)/Iγ(268.5)=1.4 *2*.
601[#]		3851.4+x	$(37/2)^+$	3250.4+x	$(33/2)^+$		E_γ: probably corresponds to the 604.4γ from 5125.6,$(43/2^+)$ in Adopted Gammas.
604.5 *1*	37.4 *33*	4417.5	$43/2^+$	3813.0	$39/2^+$		Iγ(604.5)/Iγ(321.5)>8.
610.2 *1*	33.6 *23*	4656.2	$45/2^-$	4046.0	$41/2^-$		DCO(D)=0.70 *7* Iγ(610.2)/Iγ(316.9)=1.50 *15*.
619[#]		2985.1+x	$31/2^+$	2366.1+x	$(27/2^+)$		
636.3 *5*	17.0 *16*	4910.2+x	$45/2^-$	4273.9+x	$41/2^-$	Q	DCO(Q)=1.2 *2*
639.1 *1*	43.5 *36*	4735.3	$45/2^+$	4096.2	$41/2^+$		Iγ(639.1)/Iγ(317)>5.9.
640.9 *1*	49.3 *43*	2886.9+x	$33/2^-$	2246.0+x	$29/2^-$	(Q)	DCO(Q)=0.8 *1*
646.5 *1*	30.1 *25*	4986.2	$47/2^-$	4339.7	$43/2^-$		DCO(D)=0.78 *7* Iγ(646.5)/Iγ(330.0)=1.5 *2*.

Continued on next page (footnotes at end of table)

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

$\gamma(^{167}Lu)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
653[#]		4504.4+x	$(41/2)^+$	3851.4+x	$(37/2)^+$		E_γ: probably corresponds to the 654.6γ from 5076.2,$(45/2^+)$ level in Adopted Gammas.
676.0 *5*	28.5 *25*	5093.6	$47/2^+$	4417.5	$43/2^+$		Iγ(676.0)/Iγ(359)>8.
691.6 *5*	19.1 *31*	4273.9+x	$41/2^-$	3582.3+x	$37/2^-$	(Q)	DCO(Q)=0.9 *2*
692.8 *5*	29.0 *40*	5349.1	$49/2^-$	4656.2	$45/2^-$	(Q)	DCO(D)=0.70 *10* Iγ(692.8)/Iγ(363.0)=2.3 *2*.
695.4 *1*	32.4 *69*	3582.3+x	$37/2^-$	2886.9+x	$33/2^-$	(Q)	DCO(Q)=0.81 *9*
696.2 *5*	15.0 *33*	5606.4+x	$49/2^-$	4910.2+x	$45/2^-$	Q	DCO(Q)=1.1 *2*
705[#]		5209.4+x	$(45/2)^+$	4504.4+x	$(41/2)^+$		E_γ: could correspond to the 701.8γ from 5778.0,$(49/2^+)$, 704.2γ from 5125.6,$(43/2^+)$, or 706.1γ from 4521.2,$(39/2^+)$ level from two neighboring bands in Adopted Gammas.
707.6 *1*	35.6 *31*	5442.9	$49/2^+$	4735.3	$45/2^+$		
719.3 *1*	31.1 *42*	5705.5	$51/2^-$	4986.2	$47/2^-$		DCO(D)=0.73 *8* Iγ(719.3)/Iγ(356.5)=2.31 *25*.
740.3 *5*	24.5 *28*	5833.9	$(51/2^+)$	5093.6	$47/2^+$		
753[#]		5962.4+x	$(49/2)^+$	5209.4+x	$(45/2)^+$		E_γ: probably corresponds to the 751.6γ from 6529.6,$(53/2^+)$ level in Adopted Gammas.
759.2 *5*	12.1 *29*	6365.6+x	$53/2^-$	5606.4+x	$49/2^-$	(Q)	DCO(Q)=0.9 *2*
760 *1*	<10.0	5107.3+x	$(45/2^-)$	4347.3+x	$(41/2^-)$		E_γ: probably corresponds to 760.0γ from 4373.5,$(41/2^-)$ level.
765[a] *1*	<10.0[a]	4347.3+x	$(41/2^-)$	3582.3+x	$37/2^-$	(Q)	DCO(Q)=0.7 *2* E_γ: probably corresponds to 760.0γ from 4373.5,$(41/2^-)$ level or the 765.1γ from 5907.4,$(49/2^-)$ level in Adopted Gammas. DCO for doublet, 765γ being self-coincident.
765[a] *1*	<10.0[a]	5872.3+x	$(49/2^-)$	5107.3+x	$(45/2^-)$		DCO(Q)=0.7 *2*
767.5 *5*	19.5 *16*	6116.8	$53/2^-$	5349.1	$49/2^-$	(Q)	DCO(D)=0.68 *9* Iγ(767.5)/Iγ(411.8)=3.4 *10*.
770.2 *5*	26.8 *24*	6213.1	$(53/2^+)$	5442.9	$49/2^+$		
784.5 *5*	17.0 *15*	6490.3	$55/2^-$	5705.5	$51/2^-$	(Q)	DCO(D)=0.7 *1* Iγ(784.5)/Iγ(373.8)=3.0 *4*.
797.7 *5*	16.9 *18*	6631.6	$(55/2^+)$	5833.9	$(51/2^+)$		
804[#]		6766+x	$(53/2)^+$	5962.4+x	$(49/2)^+$		E_γ: could correspond to the 798.7γ from 7328.3,$(57/2^+)$ level, or 801.8γ from 6388.3,$(53/2^+)$ level in Adopted Gammas.
817 *1*	<9.0	6689.3+x	$(53/2^-)$	5872.3+x	$(49/2^-)$		E_γ: no corresponding transition found in Adopted Gammas.
817.5 *5*	10.7 *27*	7183.1+x	$57/2^-$	6365.6+x	$53/2^-$		
823.0 *5*	18.6 *66*	7036.1	$(57/2^+)$	6213.1	$(53/2^+)$		
834 *1*	<7.0	7523.3+x	$(57/2^-)$	6689.3+x	$(53/2^-)$		E_γ: could correspond to the 836.2γ from 5142.3,$(45/2^-)$ level in Adopted Levels.
835.4 *5*	16.8 *16*	6952.3	$57/2^-$	6116.8	$53/2^-$	(Q)	DCO(D)=0.71 *9* Iγ(835.4)/Iγ(462)=3.2 *9*.
839.5 *5*	10.2 *13*	7471.1	$(59/2^+)$	6631.6	$(55/2^+)$		
839.8 *5*	<9.0	7875.9	$(61/2^+)$	7036.1	$(57/2^+)$		
843.4 *5*	14.0 *20*	7333.6	$59/2^-$	6490.3	$55/2^-$	Q	DCO(D)=0.61 *9* Iγ(843.4)/Iγ(381.3)=3.1 *6*.
854[#]		7620+x	$(57/2^+)$	6766+x	$(53/2)^+$		E_γ: could corresponds to the 853.5γ from 7241.7,$(57/2^+)$ level, or 854.5γ from 8182.9,$(61/2^+)$ level in Adopted Gammas.
870.6 *5*	<7.0	8341.7	$(63/2^+)$	7471.1	$(59/2^+)$		
871 *1*	<6.0	8746.9	$(65/2^+)$	7875.9	$(61/2^+)$		
873.6 *5*	8.4 *21*	8056.7+x	$61/2^-$	7183.1+x	$57/2^-$		

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^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)

$\gamma(^{167}Lu)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
899.3 *5*	<18.0	8232.9	63/2$^-$	7333.6	59/2$^-$	(Q)	DCO(D)=0.6 *1* DCO for 901.9γ+899.3γ doublet.
901.9 *5*	<15.0	7854.2	(61/2$^-$)	6952.3	57/2$^-$	(Q)	DCO(D)=0.62 *11* DCO for 901.9γ+899.3γ doublet.
904[#b]		8524+x?	(61/2)$^+$	7620+x	(57/2$^+$)		E_γ: probably corresponds to the 901.9γ from 8143.6,(61/2$^+$) level in Adopted Gammas.
911.5 *5*	<4.0	8382.6	(63/2$^+$)	7471.1	(59/2$^+$)		E_γ: probably corresponds to the 912.6γ from 8455.8,(63/2$^+$) level in Adopted Gammas.
924.5 *5*	<4.0	9266.3	(67/2$^+$)	8341.7	(63/2$^+$)		E_γ: probably corresponds to the 924.7γ from 9571.4,(67/2$^+$) level in Adopted Gammas.
926 *1*	<6.0	8982.7+x	65/2$^-$	8056.7+x	61/2$^-$		
955.0[b] *5*		9188.0?	(67/2$^-$)	8232.9	63/2$^-$		
979.0[b] *5*	<4.0	10245.3?	(71/2$^+$)	9266.3	(67/2$^+$)		E_γ: probably corresponds to the 979.9γ from 10551.3,(71/2$^+$) level in Adopted Gammas.
991.6 *5*	<4.0	9374.3	(67/2$^+$)	8382.6	(63/2$^+$)		E_γ: could correspond to 987.1γ from 9442.9,(67/2$^+$) level.
1008[b] *1*		10196.0?	(71/2$^-$)	9188.0?	(67/2$^-$)		

[†] From 1990Yu01, except as noted. Intensities are for E(^{48}Ca)=206 MeV. ΔE_γ=0.1 keV for most transitions, 0.5 or 1 keV for weak (Iγ<30) or contaminated transitions. The γ-branching ratios defined as Iγ(J→J-2)/Iγ(J→j-1) are given by 1990Yu01 are given under comments. Authors mention that these values were obtained from $\gamma\gamma$-coin data with gates above spin J, whereas for higher spin states, gates were set on low-spin transitions, with averages taken from the two methods. Evaluators find that most of these branching ratios are ratios of corresponding relative Iγ values listed in column 3 of Table 1 in 1990Yu01.

[‡] From Fig. 5 and/or Table 2 of 1990Yu01.

[#] From 1998Ya04; uncertainty not given by authors.

[@] Based on measured DCO ratios (1990Yu01).

[&] Multiply placed.

[a] Multiply placed with intensity suitably divided.

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

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01

Level Scheme

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

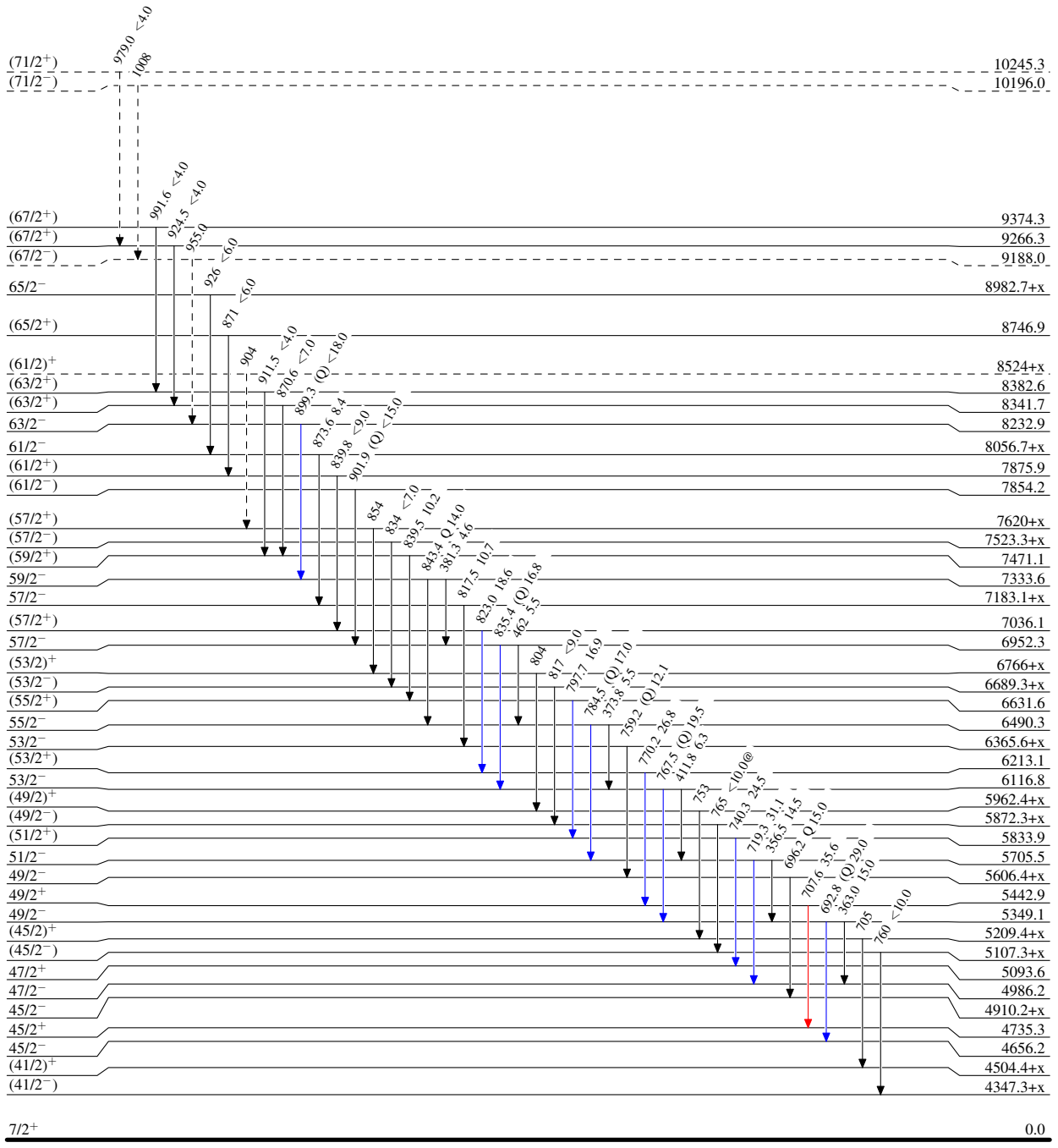
Legend

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

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

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

γ Decay (Uncertain)



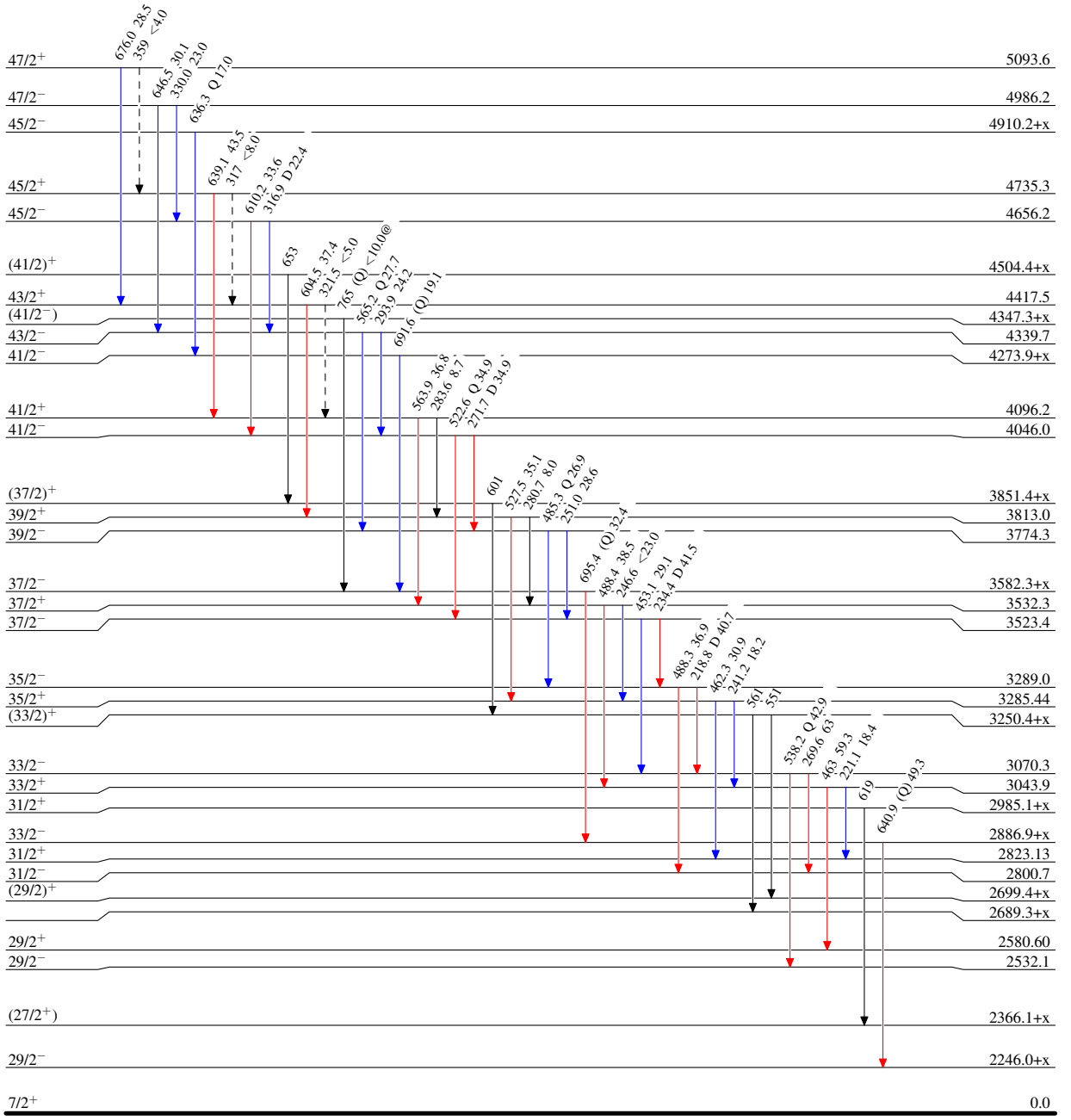
$^{167}_{71}Lu_{96}$

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01

Level Scheme (continued)

Intensities: Relative I_γ
@ 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)



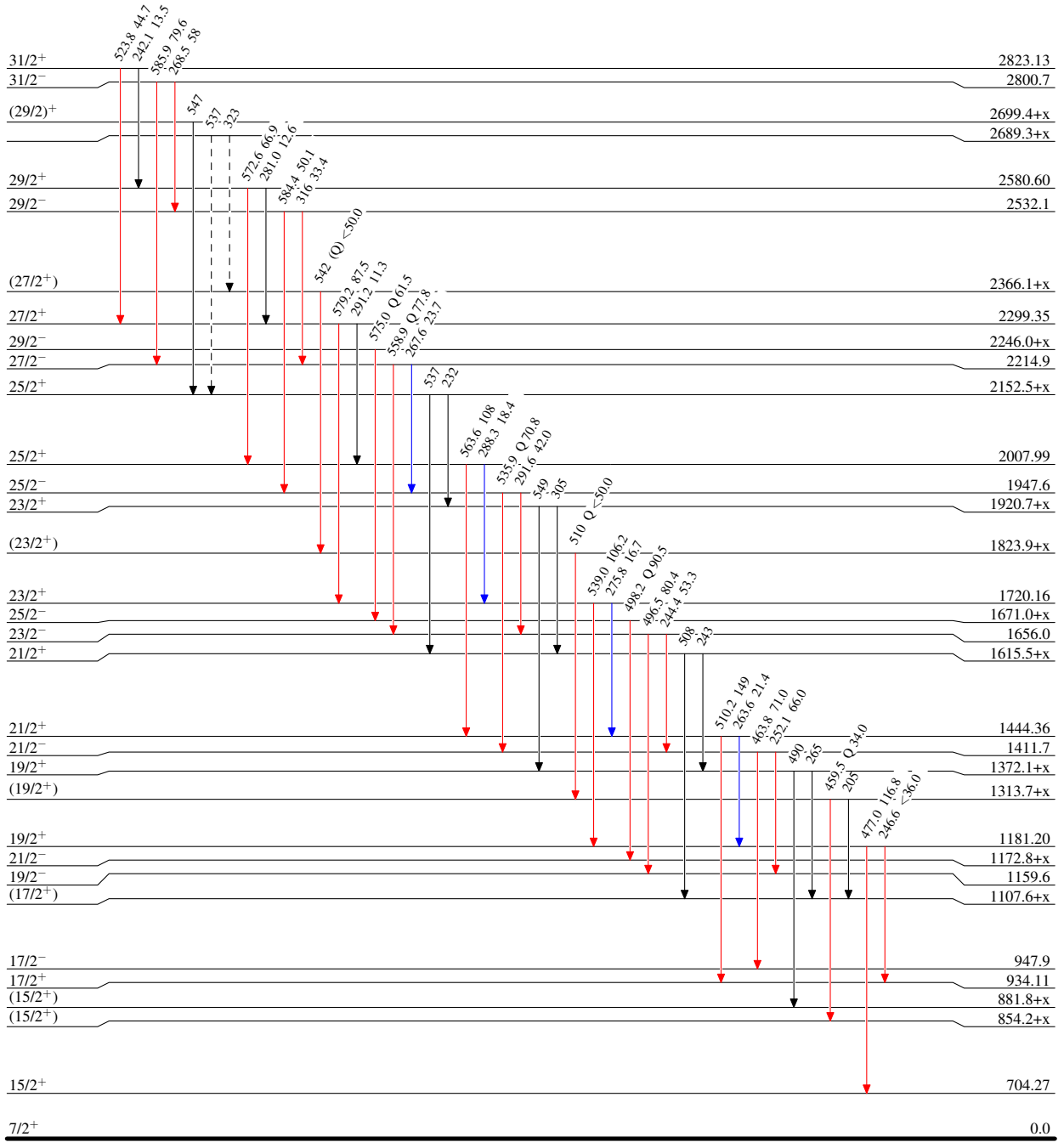
$^{167}_{71}Lu_{96}$

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01

Level Scheme (continued)

Intensities: Relative I_γ
@ 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)



$^{167}_{71}Lu_{96}$

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01

Level Scheme (continued)

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

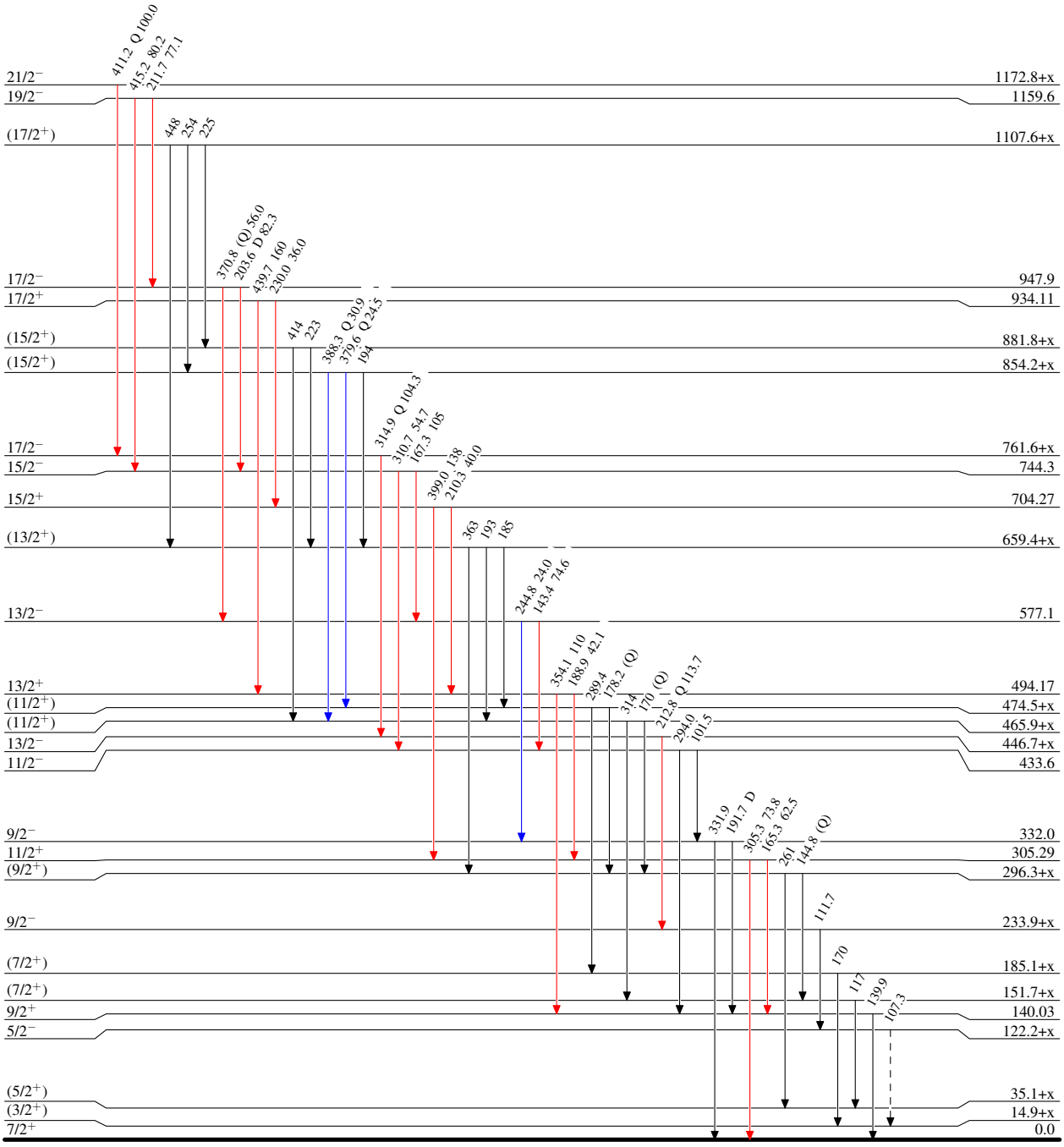
Legend

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

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

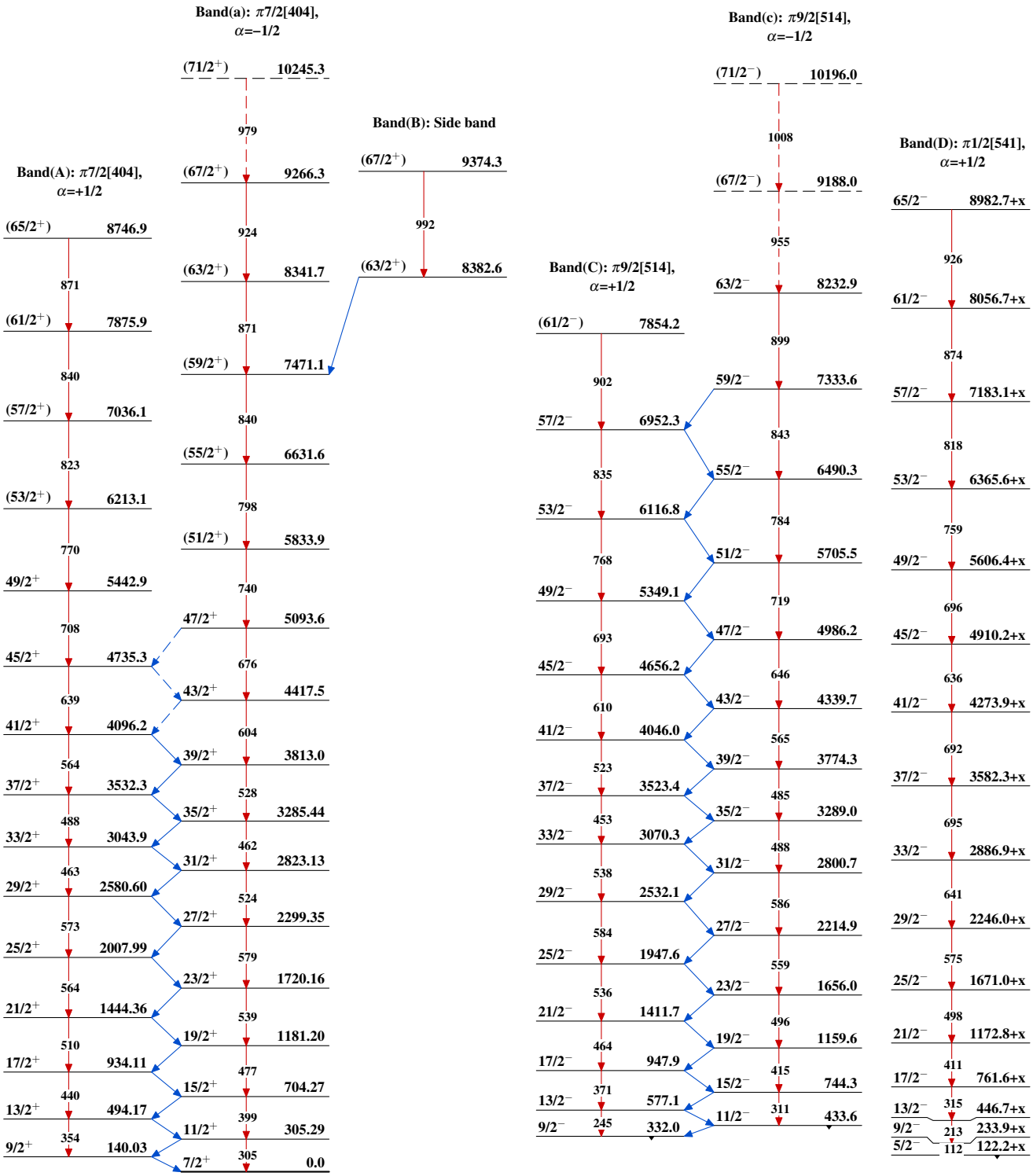
$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



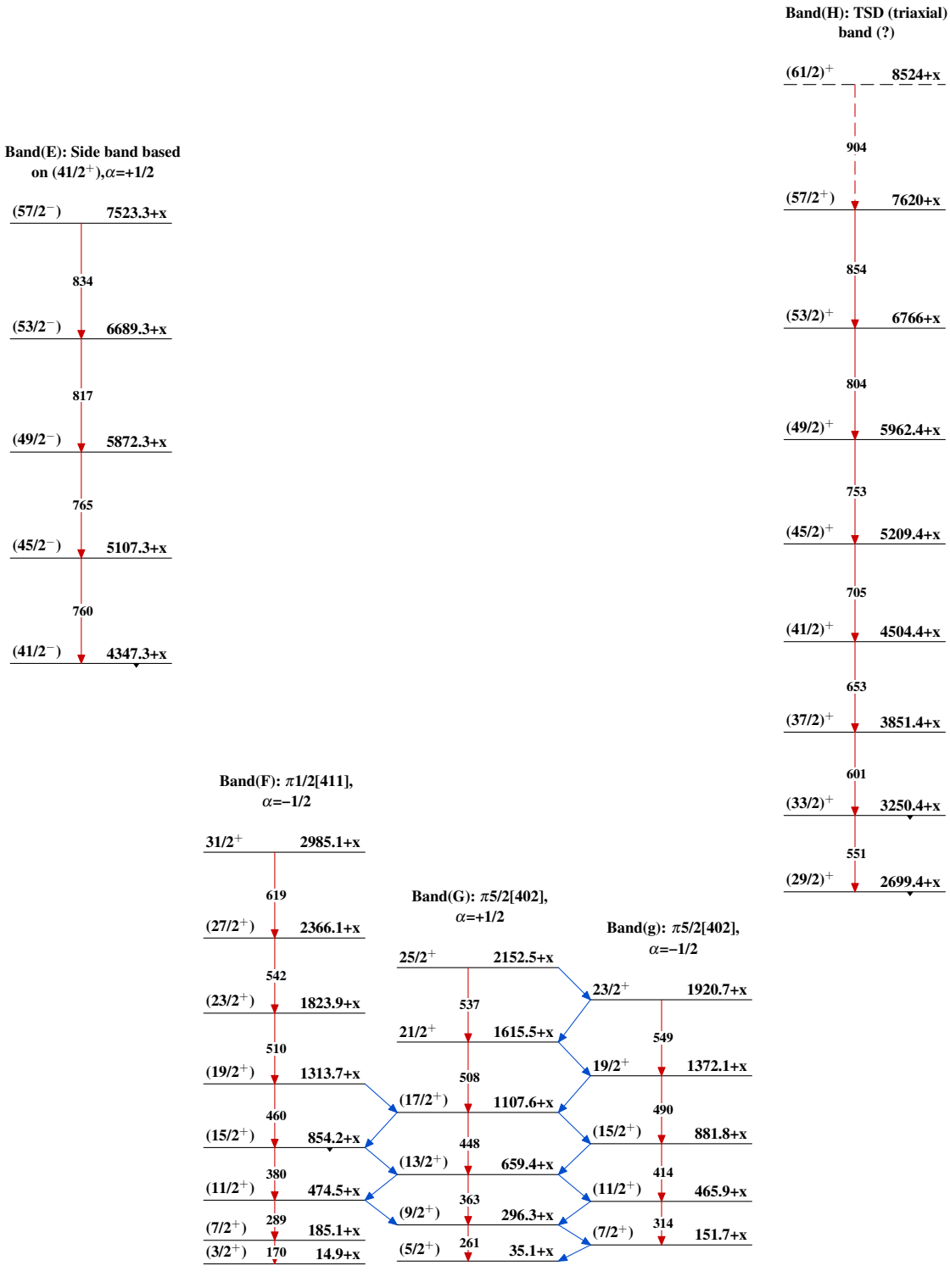
$^{167}_{71}Lu_{96}$

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01



$^{167}_{71}Lu_{96}$

^{123}Sb(^{48}Ca,4nγ) E=206 MeV 1990Yu01 (continued)



$^{167}_{71}Lu_{96}$