^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	30-Sep-2020

1997Ha08, 1996Ha16: E(^{40}Ca)=128 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin, recoil γ coin, $\gamma\gamma(\theta)$(DCO) using EUROGAM array with 45 Compton-suppressed Ge detectors. Lifetimes were measured by Doppler-shift attenuation (DSA) method using NORDBALL array with 19 Compton-suppressed Ge detectors. Cranked shell-model calculations.

1986Lu08 (also thesis by Luhmann, Gottingen (1985)): E=122, 132 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin (at 122 MeV), $T_{1/2}$ by Doppler-shift attenuation method (at E=132 MeV).

1983Li11: E(^{40}Ca)=117 MeV. Measured Eγ, Iγ, pγ, $\gamma\gamma$-coin.

Calculation of continuum feeding times in ^{40}Ca(^{40}Ca,3p),E=122 MeV: 1988Cr03.

^{77}Rb Levels

Band assignments are primarily from 1997Ha08.

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0.0[d]	3/2$^-$		
144.83[e] *3*	5/2$^-$	0.54[#] ns *3*	
146.94[a] *2*	5/2$^{(+)}$	5.1 ns *4*	$T_{1/2}$: from RDDS (quoted by 1997Ha08 from thesis by Luhmann).
307.03[b] *4*	(7/2$^+$)	0.39[#] ns *3*	
331.63[a] *10*	9/2$^{(+)}$	0.687[#] ns *25*	
368.17[d] *6*	7/2$^-$	29.1[#] ps *21*	
614.74[e] *8*	9/2$^-$	8.0[#] ps *6*	
804.33[b] *11*	(11/2$^+$)	3.6[#] ps *7*	
833.46[a] *13*	(13/2$^+$)	6.4[#] ps *4*	
943.92[d] *13*	11/2$^-$	2.9[#] ps *3*	
1153.75[c] *18*	(9/2$^+$)		
1280.39[e] *15*	(13/2$^-$)	0.96 ps *12*	$T_{1/2}$: weighted average of 0.89 ps *6* (DSA, 1997Ha08), 1.41 ps *17* (DSA) 1.09 ps *26* (RDDS). The last two values are quoted by 1997Ha08 from thesis by Luhmann. 1986Lu08 give 1.28 ps *21* from DSA.
1575.96[a] *17*	(17/2$^+$)	0.65 ps *3*	$T_{1/2}$: weighted average of 0.64 ps *3* (DSA, 1997Ha08), 0.78 ps *15* (DSA), 0.88 ps *18* (RDDS). The last two values are quoted by 1997Ha08 from thesis by Luhmann. 1986Lu08 give 0.83 ps *10* from DSA.
1590.39[b] *16*	(15/2$^+$)	0.62[@] ps *4*	$T_{1/2}$: other: 0.61 ps *24* (DSA,1986Lu08).
1717.37[d] *17*	(15/2$^-$)	0.46 ps *3*	$T_{1/2}$: weighted average of 0.451 ps *21* (DSA, 1997Ha08) and 0.67 ps *14* (DSA, 1986Lu08).
1882.55[c] *14*	(13/2$^+$)		
2124.94[e] *20*	(17/2$^-$)	0.32 ps *3*	$T_{1/2}$: weighted average of 0.31 ps *3* (DSA, 1997Ha08) and 0.33 ps *4* (DSA, 1986Lu08).
2149.5[h] *3*	(11/2$^-$)		
2388.1[h] *3*	(13/2$^-$)		
2390.6[i] *8*			
2529.36[a] *22*	(21/2$^+$)	0.252 ps *14*	$T_{1/2}$: weighted average of 0.256 ps *14* (DSA, 1997Ha08) and 0.22 ps *4* (DSA, 1986Lu08).
2596.78[c] *17*	(17/2$^+$)		
2630.58[b] *20*	(19/2$^+$)	0.132[@] ps *21*	$T_{1/2}$: other: 0.69 ps *35* (RDDS, effective $T_{1/2}$ quoted by 1997Ha08 from thesis by Luhmann).
2668.0[h] *3*	(15/2$^-$)		
2680.5[d] *3*	(19/2$^-$)	0.23 ps *3*	$T_{1/2}$: weighted average of 0.243 ps *21* (DSA, 1997Ha08) and 0.15 ps *6* (DSA, 1986Lu08).

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^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

^{77}Rb Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
2991.4[h] 3	(17/2$^-$)		
3134.0[e] 3	(21/2$^-$)	0.17 ps 3	$T_{1/2}$: weighted average of 0.180 ps 21 (DSA, 1997Ha08) and 0.12 ps 4 (DSA, 1986Lu08).
3229.8[f] 5	(19/2$^-$)		
3343.0[h] 3	(19/2$^-$)		
3353.7[i] 7			
3411.30[c] 23	(21/2$^+$)	0.64[@] ps 3	
3674.39[a] 25	(25/2$^+$)	0.096 ps 17	$T_{1/2}$: weighted average of 0.104 ps 14 (DSA, 1997Ha08) and 0.06 ps 3 (DSA, 1986Lu08).
3701.2 6	(21/2$^-$)		
3776.2[h] 4	(21/2$^-$)		
3823.4[d] 4	(23/2$^-$)	0.118[@] ps 21	
3894.57[b] 24	(23/2$^+$)	0.069[@] ps 14	
4122.9[f] 6	(23/2$^-$)		
4216.7[h] 4	(23/2$^-$)		
4303.5[e] 4	(25/2$^-$)	0.111[@] ps 7	$T_{1/2}$: other: 0.14 ps 3 (DSA, effective $T_{1/2}$ quoted by 1997Ha08 from thesis by Luhmann).
4329.7[c] 3	(25/2$^+$)	0.374[@] ps 21	
4417.5[i] 8			
4711.6 4	(25/2$^-$)		
4758.6[h] 7	(25/2$^-$)		
5006.1[a] 3	(29/2$^+$)	0.049[@] ps 7	$T_{1/2}$: other: 0.13 ps 3 (DSA, effective $T_{1/2}$ quoted by 1997Ha08 from thesis by Luhmann).
5103.9[f] 4	(27/2$^-$)	0.146[@] ps 14	
5176.4[d] 4	(27/2$^-$)		
5317.6[h] 8	(27/2$^-$)		
5345.4[b] 5	(27/2$^+$)	≤0.21[&] ps	
5441.3[c] 3	(29/2$^+$)	0.201[@] ps 14	
5478.5[i] 10			
5639.1[e] 4	(29/2$^-$)	≤0.17[&] ps	
5681.5[i] 10			
5851.6 9	(29/2$^-$)		
5956.4[h] 11	(29/2$^-$)		
6299.5[f] 4	(31/2$^-$)	≤0.24[&] ps	
6525.5[a] 4	(33/2$^+$)	0.028[@] ps 7	
6615.6[h] 13	(31/2$^-$)		
6642.5[d] 6	(31/2$^-$)		
6752.3[c] 4	(33/2$^+$)	0.118[@] ps 14	
6806.5[i] 12			
6927.5[b] 7	(31/2$^+$)		
7087.1[g] 6	(33/2$^-$)		
7198.1[e] 11	(33/2$^-$)		
7358.4[h] 15	(33/2$^-$)		
7506 3			
7635.0[f] 6	(35/2$^-$)		
8079.7[h] 24	(35/2$^-$)		
8168.4[c] 4	(37/2$^+$)	≤0.13[&] ps	
8263.5[i] 15			

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^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

^{77}Rb Levels (continued)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	E(level)[†]	J$^\pi$[‡]
8300.5[d] *12*	(35/2$^-$)		10774.1[e] *25*	(41/2$^-$)
8316.7[a] *4*	(37/2$^+$)	0.042[@] ps *14*	10860.0[f] *16*	(43/2$^-$)
8519.8[g] *8*	(37/2$^-$)		11476[i] *4*	
8627.5[b] *13*	(35/2$^+$)		11582.3[c] *14*	(45/2$^+$)
8832.1 *15*	(37/2$^-$)		11869.8[g] *16*	(45/2$^-$)
8892.1[e] *15*	(37/2$^-$)		12264.7[a] *10*	(45/2$^+$)
8954.4[h] *25*	(37/2$^-$)		12558.6 *11*	
9146.0[f] *12*	(39/2$^-$)		12807.0[f] *19*	(47/2$^-$)
9794[i] *3*			13551.3[c] *18*	(49/2$^+$)
9817.3[c] *10*	(41/2$^+$)		13888[g] *3*	(49/2$^-$)
10096.8[g] *13*	(41/2$^-$)		15013[f] *3*	(51/2$^-$)
10103.5[d] *24*	(39/2$^-$)		15797[c] *3*	(53/2$^+$)
10209.6[a] *5*	(41/2$^+$)	≤0.076[&] ps	17485[f] *4*	(55/2$^-$)
10365.1 *18*	(41/2$^-$)		18376[c] *4*	(57/2$^+$)

[†] From least-squares fit to Eγ data.
[‡] From 1997Ha08 based on $\gamma(\theta)$, $\gamma\gamma(\theta)$, γ-ray asymmetry ratio, probable band associations and cranked shell-model calculations. Many J^π values have been given under parentheses (by evaluator) due to lack of strong arguments for such assignments, while 1997Ha08 gave J^π values for only few levels at the top of each band under parentheses.
[#] Recoil-distance Doppler shift (RDDS) method (1986Lu08).
[@] Doppler-shift attenuation (DSA) method (1997Ha08).
[&] Effective half-life from DSA (1997Ha08).
[a] Band(A): $\pi 3/2[431]^{-1}\nu 5/2[422]^2$,$\alpha$=+1/2.
[b] Band(a): $\pi 3/2[431]^{-1}\nu 5/2[422]^2$,$\alpha$=−1/2.
[c] Band(B): $\pi 3/2[431]^{-1}\nu 3/2[301]^2$,$\alpha$=+1/2.
[d] Band(C): $\pi 3/2[312]^{-1}\nu 5/2[422]^2$,$\alpha$=−1/2.
[e] Band(c): $\pi 3/2[312]^{-1}\nu 5/2[422]^2$,$\alpha$=+1/2.
[f] Band(D): Band #1,α=−1/2. Configuration=$\pi 3/2[312]^{-1}\nu 3/2[301]^2$ or $\pi 3/2[312]^{-1}\pi 1/2[310]^{-2}$.
[g] Band(d): Band #2,α=+1/2. Configuration=$\pi 3/2[312]^{-1}\nu 3/2[301]^2$ or $\pi 3/2[312]^{-1}\pi 1/2[310]^{-2}$.
[h] Band(E): $\pi 3/2[431]^{-1}\nu 5/2[422]\nu 3/2[301]$, ΔJ=1.
[i] Seq.(F): γ cascade.

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

$\gamma(^{77}Rb)$

In addition to all the γ rays reported by 1983Li11, 1986Lu08 reported Eγ=786.1, 844.4, 963.4, 1009.4, 1049, 1139.0, 1144.8, 1169.1, 1278.5, 1332.6, 1334.3, 1446.4, 1519.5, 1560.0, 1644.5. No intensities were given by 1986Lu08.

A_2 and A_4 coefficients are from 1983Li11. DCO ratios (for one γ ray at 158° and the other at 86° or 94°) and γ-intensity asymmetry ratios (R(θ)) from $\gamma\gamma$(particle) coin projection spectra ((Iγ(37°)+Iγ(143°))/(Iγ(79°)+Iγ(101°))) are from 1997Ha08.

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[@]	α[b]	$I_{(\gamma+ce)}$	Comments
(24.60)		331.63	9/2$^{(+)}$	307.03	(7/2$^+$)				≈78	E_γ: from level energy difference. Presence of this transition is inferred (1983Li11,1997Ha08) from (502γ)(160γ). Other: 24.78 (1983Li11). $I_{(\gamma+ce)}$: from intensity balance at 332 level (1983Li11) assuming no side feeding.
144.82[a] *3*	40[&] *6*	144.83	5/2$^-$	0.0	3/2$^-$	E2+M1	−1.8 *5*	0.20 *3*		A_2=−0.40 *3*; A_4=+0.10 *3*; DCO=0.49 *1* Eγ=144.7 *2* (1997Ha08). Iγ=33.8 (1983Li11, at 117 MeV). R(θ)=0.37 *2*.
146.94[a] *2*	26[&] *6*	146.94	5/2$^{(+)}$	0.0	3/2$^-$	D				A_2=−0.22 *2*; A_4=0.0 *2* Eγ=146.5 *2* (1997Ha08). Iγ=56.5 (1983Li11, at 117 MeV). From $\gamma(\theta)$, δ<0.03 for D+Q. R(θ)=0.60 *3*.
160.10[a] *3*	20.8[&] *9*	307.03	(7/2$^+$)	146.94	5/2$^{(+)}$	M1+E2	+0.39 *6*	0.058 *5*		A_2=+0.23 *1*; A_4=+0.02 *1* Eγ=159.9 *5* (1997Ha08). Iγ=22.3 (1983Li11, at 117 MeV). R(θ)=0.88 *4*.
162.11[a] *13*	4.2[&] *2*	307.03	(7/2$^+$)	144.83	5/2$^-$	D				A_2=−0.24 *2*; A_4=0.00 *2* Eγ=162.0 *5* (1997Ha08). Iγ=4.4 (1983Li11, at 117 MeV). From $\gamma(\theta)$, δ<0.03. R(θ)=0.60 *3*.
184.81 *12*	35.1[&] *11*	331.63	9/2$^{(+)}$	146.94	5/2$^{(+)}$	E2		0.1017		A_2=+0.33 *2*; A_4=−0.12 *2*; DCO=0.79 *1* E_γ: weighted average of 184.86 *8* (1983Li11), 184.5 *2* (1997Ha08). Iγ=26.5 (1983Li11, at 117 MeV). $R($\theta$)=1.10 *5*.
220.8 *3*	0.2 *1*	3894.57	(23/2$^+$)	3674.39	(25/2$^+$)	D+Q				R(θ)=0.64 *4*.
223.31[a] *9*	8.4 *4*	368.17	7/2$^-$	144.83	5/2$^-$	E2+M1	−1.8 *7*	0.043 *8*		A_2=−0.40 *3*; A_4=+0.10 *3*; DCO=0.57 *1* Eγ=223.2 *2* (1997Ha08). Iγ=3.6 (1983Li11, at 117 MeV). Iγ(223)/Iγ(368)=0.21 (1997Ha08), 0.37 (1983Li11). R(θ)=0.35 *2*.
238.6 *2*	1.7 *2*	2388.1	(13/2$^-$)	2149.5	(11/2$^-$)	D+Q				R(θ)=0.48 *3*.

$^{77}_{37}Rb_{40}$-4

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

$\gamma(^{77}Rb)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[@]	α[b]	Comments
246.51[a] *9*	4.4 *2*	614.74	9/2$^-$	368.17	7/2$^-$	E2+M1	−1.0 *1*	0.0246 *13*	A_2=−0.50 *5*; A_4=+0.05 *5*; DCO=0.39 *2* Eγ=246.7 *2* (1997Ha08). Iγ=1.6 (1983Li11, at 117 MeV). Iγ(246)/Iγ(470)=0.076 (1997Ha08), 0.123 (1983Li11). R(θ)=0.31 *2*.
280.0 *2*	2.0 *3*	2668.0	(15/2$^-$)	2388.1	(13/2$^-$)	D+Q			R(θ)=0.41 *3*.
307.8 *2*	1.9 *1*	614.74	9/2$^-$	307.03	(7/2$^+$)	D			R(θ)=0.69 *5*.
323.3 *2*	2.3 *2*	2991.4	(17/2$^-$)	2668.0	(15/2$^-$)	D+Q			R(θ)=0.42 *3*.
329.3 *3*	2.0 *1*	943.92	11/2$^-$	614.74	9/2$^-$	D+Q			DCO<1 R(θ)=0.31 *2*. Eγ=328.0 *5*, Iγ=0.4 (1983Li11).
336.6 *2*	1.8 *1*	1280.39	(13/2$^-$)	943.92	11/2$^-$	D+Q			DCO=0.35 *4* R(θ)=0.26 *2*.
350.4 *7*	0.4 *1*	1153.75	(9/2$^+$)	804.33	(11/2$^+$)	D+Q			R(θ)=0.47 *8*.
351.7 *2*	2.4 *3*	3343.0	(19/2$^-$)	2991.4	(17/2$^-$)	D+Q			R(θ)=0.44 *3*.
368.14[a] *9*	39.9 *12*	368.17	7/2$^-$	0.0	3/2$^-$	E2		0.00907	A_2=+0.37 *2*; A_4=−0.16 *2*; DCO=0.80 *1* Eγ=368.2 *2* (1997Ha08). Iγ=9.8 (1983Li11, at 117 MeV). R(θ)=1.11 *5*.
407.6 *3*	0.9 *1*	2124.94	(17/2$^-$)	1717.37	(15/2$^-$)	D+Q			R(θ)=0.47 *6*.
433.4 *3*	2.4 *3*	3776.2	(21/2$^-$)	3343.0	(19/2$^-$)	D+Q			R(θ)=0.37 *2*.
440.6 *2*	1.7 *2*	4216.7	(23/2$^-$)	3776.2	(21/2$^-$)	D+Q			R(θ)=0.33 *3*.
469.92[a] *13*	57.8 *17*	614.74	9/2$^-$	144.83	5/2$^-$	E2			A_2=+0.31 *2*; A_4=−0.12 *2*; DCO=0.82 *1* Eγ: weighted average of 469.88 *13* (1983Li11), 470.0 *2* (1997Ha08). Iγ=13.0 (1983Li11, at 117 MeV). R(θ)=1.14 *4*.
472.9 *2*	11.1 *4*	804.33	(11/2$^+$)	331.63	9/2$^{(+)}$	M1+E2	+0.4 *1*		A_2=+0.32 *1*; A_4=+0.06 *2*; DCO=0.80 *3* Eγ=472.23 *13*, Iγ=3.8 (1983Li11).
476.4 *5*	1.1 *1*	1280.39	(13/2$^-$)	804.33	(11/2$^+$)	D			R(θ)=0.68 *4*.
494.9 *2*	1.4 *3*	4711.6	(25/2$^-$)	4216.7	(23/2$^-$)	D+Q			R(θ)<1.
497.23[a] *15*	11.3 *4*	804.33	(11/2$^+$)	307.03	(7/2$^+$)	E2			A_2=+0.33 *5*; A_4=−0.31 *5*; DCO=0.84 *3* Eγ=497.2 3 (1997Ha08). Iγ=4.0 (1983Li11, at 117 MeV). R(θ)=0.95 *4*.
501.88 *15*	100 *3*	833.46	(13/2$^+$)	331.63	9/2$^{(+)}$	E2			A_2=+0.37 *2*; A_4=−0.15 *2*; DCO=0.79 *1* Eγ: weighted average of 501.81 *15* (1983Li11), 502.0 *2* (1997Ha08). Iγ=26.6 (1983Li11, at 117 MeV). R(θ)=1.11 *5*.
515.4 *5*	0.9 *1*	4216.7	(23/2$^-$)	3701.2	(21/2$^-$)				
518 *1*	<1	2668.0	(15/2$^-$)	2149.5	(11/2$^-$)				
534 *1*	0.7 *1*	5851.6	(29/2$^-$)	5317.6	(27/2$^-$)				
534.7 *5*	1.0 *1*	2124.94	(17/2$^-$)	1590.39	(15/2$^+$)				
542 *1*	0.6 *2*	4758.6	(25/2$^-$)	4216.7	(23/2$^-$)				
575.7 *2*	45.8 *14*	943.92	11/2$^-$	368.17	7/2$^-$	E2			A_2=+0.35 *5*; A_4=−0.10 *5*; DCO=0.85 *1*

$^{77}_{37}Rb_{40}$-5

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

$\gamma(^{77}Rb)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
							Eγ=574.50 *18*, Iγ=7.0 (1983Li11). R(θ)=1.13 *5*.
603 *1*	0.8 *3*	2991.4	(17/2$^-$)	2388.1	(13/2$^-$)		
606 *1*	1.0 *3*	5317.6	(27/2$^-$)	4711.6	(25/2$^-$)		
611.9 *5*	1.1 *2*	943.92	11/2$^-$	331.63	9/2$^{(+)}$		
665.4 *2*	57.6 *18*	1280.39	(13/2$^-$)	614.74	9/2$^-$	(E2)	DCO=0.88 *1* Eγ=665 *1*, Iγ=5.0 (1983Li11, at 117 MeV). R(θ)=1.10 *5*.
675.2 *5*	1.9 *2*	3343.0	(19/2$^-$)	2668.0	(15/2$^-$)	Q	R(θ)=1.00 *10*.
714.1 *2*	19.2 *6*	2596.78	(17/2$^+$)	1882.55	(13/2$^+$)	(E2)	DCO=0.99 *2* R(θ)=1.09 *5*.
729.0 *2*	4.9 *3*	1882.55	(13/2$^+$)	1153.75	(9/2$^+$)	Q	DCO=0.93 *5* R(θ)=1.28 *8*.
742.6 *2*	89 *3*	1575.96	(17/2$^+$)	833.46	(13/2$^+$)	(E2)	DCO=0.87 *1* Eγ=742 *2*, Iγ=11.5 (1983Li11, at 117 MeV). R(θ)=1.03 *4*.
757.0 *2*	5.0 *2*	1590.39	(15/2$^+$)	833.46	(13/2$^+$)	D+Q	DCO=0.47 *8* R(θ)=0.63 *3*.
773.4 *2*	36.9 *19*	1717.37	(15/2$^-$)	943.92	11/2$^-$	(E2)	DCO=1.03 *2* Eγ=772 *3*, Iγ=5.0 (1983Li11, at 117 MeV). R(θ)=1.12 *5*.
784.4 *5*	1.9 *2*	3776.2	(21/2$^-$)	2991.4	(17/2$^-$)		
786.1 *2*	15.8 *5*	1590.39	(15/2$^+$)	804.33	(11/2$^+$)	(E2)	DCO=0.84 *5* R(θ)=0.96 *5*.
813.7 *5*	0.2 *1*	3343.0	(19/2$^-$)	2529.36	(21/2$^+$)		
814.5 *2*	24.6 *9*	3411.30	(21/2$^+$)	2596.78	(17/2$^+$)	Q	DCO=0.96 *3* R(θ)=0.94 *4*.
822.3 *3*	3.8 *1*	1153.75	(9/2$^+$)	331.63	9/2$^{(+)}$	D	DCO=0.80 *5* R(θ)=1.01 *9* consistent with ΔJ=0, dipole.
844.5 *2*	50.1 *15*	2124.94	(17/2$^-$)	1280.39	(13/2$^-$)	(E2)	DCO=1.00 *2*
847.0 *4*	0.8 *2*	1153.75	(9/2$^+$)	307.03	(7/2$^+$)		
866 *1*	0.6 *2*	2991.4	(17/2$^-$)	2124.94	(17/2$^-$)		
873.2 *5*	2.2 *3*	4216.7	(23/2$^-$)	3343.0	(19/2$^-$)		
879.4 *3*	3.0 *2*	2596.78	(17/2$^+$)	1717.37	(15/2$^-$)	D	DCO=0.52 *4*
881.9[c] *4*	1.2 *4*	3411.30	(21/2$^+$)	2529.36	(21/2$^+$)		
884.0 *3*		1717.37	(15/2$^-$)	833.46	(13/2$^+$)		E_γ: doublet.
893.4 *7*	2.7 *2*	4122.9	(23/2$^-$)	3229.8	(19/2$^-$)		
918.4 *2*	21.6 *21*	4329.7	(25/2$^+$)	3411.30	(21/2$^+$)	(E2)	DCO=0.95 *3*
935.4 *5*	1.4 *3*	4711.6	(25/2$^-$)	3776.2	(21/2$^-$)		
938.5 *2*	3.7 *2*	1882.55	(13/2$^+$)	943.92	11/2$^-$	D	DCO=0.58 *4*
953.4 *2*	70.6 *21*	2529.36	(21/2$^+$)	1575.96	(17/2$^+$)	(E2)	DCO=0.98 *2* Eγ=946 *5*, Iγ=5.0 (1983Li11, at 117 MeV).
963 *1*	2.2 *2*	3353.7		2390.6			

$^{77}_{37}Rb_{40}$-6

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

$\gamma(^{77}Rb)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
963.1 *2*	31.0 *16*	2680.5	(19/2$^-$)	1717.37	(15/2$^-$)	(E2)	DCO=1.01 *2*
980 *1*	1.9 *3*	5103.9	(27/2$^-$)	4122.9	(23/2$^-$)		
982 *1*	1.7 *4*	4758.6	(25/2$^-$)	3776.2	(21/2$^-$)		
1006[c] *1*	0.3 *1*	1153.75	(9/2$^+$)	146.94	5/2$^{(+)}$		
1006.9 *6*	3.7 *4*	2596.78	(17/2$^+$)	1590.39	(15/2$^+$)	D+Q	DCO=0.36 *4*
1009.1 *2*	40.6 *21*	3134.0	(21/2$^-$)	2124.94	(17/2$^-$)	(E2)	DCO=1.06 *3*
1020.9 *2*	4.6 *3*	2596.78	(17/2$^+$)	1575.96	(17/2$^+$)	D	R(θ)=1.11 *8* consistent with ΔJ=0, dipole.
1021 *1*	2.6 *3*	3701.2	(21/2$^-$)	2680.5	(19/2$^-$)	D+Q	DCO=0.38 *4*
1040.2 *2*	15.6 *5*	2630.58	(19/2$^+$)	1590.39	(15/2$^+$)	(E2)	DCO=0.96 *5*
1049.0 *2*	7.8 *9*	1882.55	(13/2$^+$)	833.46	(13/2$^+$)	D	DCO=0.86 *5* R(θ)=1.16 *9* consistent with ΔJ=0, dipole.
1054.6 *2*	3.7 *4*	2630.58	(19/2$^+$)	1575.96	(17/2$^+$)		
1055 *1*	1.3 *2*	5176.4	(27/2$^-$)	4122.9	(23/2$^-$)		
1058 *1*	1.1 *1*	4758.6	(25/2$^-$)	3701.2	(21/2$^-$)		
1061 *1*	1.2 *2*	5478.5		4417.5			
1063 *1*	1.9 *9*	4417.5		3353.7			
1078.1 *2*	4.4 *5*	1882.55	(13/2$^+$)	804.33	(11/2$^+$)	D+Q	R(θ)=0.82 *5*.
1092.1 *5*	0.5 *1*	2668.0	(15/2$^-$)	1575.96	(17/2$^+$)		
1101 *1*	2.2 *5*	5317.6	(27/2$^-$)	4216.7	(23/2$^-$)		
1104.9 *4*	4.6 *2*	3229.8	(19/2$^-$)	2124.94	(17/2$^-$)	D+Q	DCO=0.58 *5*
1107.5 *5*	0.9 *4*	2388.1	(13/2$^-$)	1280.39	(13/2$^-$)		
1111.6 *2*	14.0 *6*	5441.3	(29/2$^+$)	4329.7	(25/2$^+$)	(E2)	DCO=0.85 *4*
1123.0 *2*	3.4 *2*	6299.5	(31/2$^-$)	5176.4	(27/2$^-$)	(E2)	DCO=0.88 *5*
1125 *1*	0.6 *1*	6806.5		5681.5			
1140 *1*	0.8 *2*	5851.6	(29/2$^-$)	4711.6	(25/2$^-$)		
1142.9 *2*	26.8 *14*	3823.4	(23/2$^-$)	2680.5	(19/2$^-$)	(E2)	DCO=1.04 *2*
1145.2 *2*	52.7 *22*	3674.39	(25/2$^+$)	2529.36	(21/2$^+$)	(E2)	DCO=1.04 *2*
1169.4 *2*	27.6 *14*	4303.5	(25/2$^-$)	3134.0	(21/2$^-$)	(E2)	DCO=0.98 *3*
1195.6 *2*	10.7 *6*	6299.5	(31/2$^-$)	5103.9	(27/2$^-$)	(E2)	DCO=1.15 *5*
1198 *1*	2.3 *4*	5956.4	(29/2$^-$)	4758.6	(25/2$^-$)		
1205 *2*		2149.5	(11/2$^-$)	943.92	11/2$^-$		
1244 *2*	0.5 *2*	5956.4	(29/2$^-$)	4711.6	(25/2$^-$)		
1264.0 *2*	15.8 *5*	3894.57	(23/2$^+$)	2630.58	(19/2$^+$)	(E2)	DCO=0.95 *5*
1264 *1*	0.9 *2*	5681.5		4417.5			
1280.5 *2*	13.8 *7*	5103.9	(27/2$^-$)	3823.4	(23/2$^-$)	(E2)	DCO=1.06 *4*
1298 *1*	1.3 *3*	6615.6	(31/2$^-$)	5317.6	(27/2$^-$)		
1311.0 *2*	9.2 *6*	6752.3	(33/2$^+$)	5441.3	(29/2$^+$)	(E2)	DCO=0.92 *5*
1316.1 *5*	2.5 *2*	2149.5	(11/2$^-$)	833.46	(13/2$^+$)		
1328 *1*	0.4 *1*	6806.5		5478.5			
1331.7 *2*	41.6 *18*	5006.1	(29/2$^+$)	3674.39	(25/2$^+$)	(E2)	DCO=0.94 *2*
1335.5 *4*	7.8 *7*	7635.0	(35/2$^-$)	6299.5	(31/2$^-$)	Q	DCO=0.96 *6*
1335.6 *2*	21.8 *12*	5639.1	(29/2$^-$)	4303.5	(25/2$^-$)	(E2)	DCO=0.94 *4*
1346 *1*	1.3 *3*	2149.5	(11/2$^-$)	804.33	(11/2$^+$)		

$^{77}_{37}Rb_{40}$-7

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

$\gamma(^{77}Rb)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
1352.5 *5*	7.6 *4*	5176.4	(27/2$^-$)	3823.4	(23/2$^-$)	Q	DCO=1.04 *6*
1364.7 *3*	3.3 *2*	3894.57	(23/2$^+$)	2529.36	(21/2$^+$)		
1402 *1*	1.4 *4*	7358.4	(33/2$^-$)	5956.4	(29/2$^-$)		
1416.1 *3*	5.1 *2*	8168.4	(37/2$^+$)	6752.3	(33/2$^+$)	(E2)	DCO=1.08 *9*
1432.7 *5*	7.1 *4*	8519.8	(37/2$^-$)	7087.1	(33/2$^-$)	Q	DCO=0.84 *7*
1448.0 *4*	10.2 *5*	7087.1	(33/2$^-$)	5639.1	(29/2$^-$)	Q	DCO=0.98 *6*
1451.3 *5*	10.1 *6*	5345.4	(27/2$^+$)	3894.57	(23/2$^+$)	(E2)	DCO=0.77 *6*
1457 *1*	1.0 *2*	8263.5		6806.5			
1464 *2*	0.8 *2*	8079.7	(35/2$^-$)	6615.6	(31/2$^-$)		
1465.9 *5*	4.7 *2*	6642.5	(31/2$^-$)	5176.4	(27/2$^-$)	Q	DCO=1.17 *10*
1511 *1*	6.7 *4*	9146.0	(39/2$^-$)	7635.0	(35/2$^-$)	Q	DCO=1.00 *6*
1519.4 *2*	26.1 *8*	6525.5	(33/2$^+$)	5006.1	(29/2$^+$)	(E2)	DCO=0.97 *3*
1530 *2*	0.4 *1*	9794		8263.5			
1533 *1*	1.6 *3*	10365.1	(41/2$^-$)	8832.1	(37/2$^-$)		
1539 *1*	1.5 *1*	6642.5	(31/2$^-$)	5103.9	(27/2$^-$)		
1557 *1*	1.9 *5*	2390.6		833.46	(13/2$^+$)		
1559 *1*	6.5 *3*	7198.1	(33/2$^-$)	5639.1	(29/2$^-$)	Q	DCO=0.80 *7* E_γ: placement is from 1997Ha08. Other tentative placement, from 8643 level (in 1986Lu08), is rejected.
1563 *1*	0.7 *1*	8316.7	(37/2$^+$)	6752.3	(33/2$^+$)		
1577 *1*	5.4 *3*	10096.8	(41/2$^-$)	8519.8	(37/2$^-$)	Q	DCO=0.76 *9*
1582.1 *5*	5.6 *4*	6927.5	(31/2$^+$)	5345.4	(27/2$^+$)	Q	DCO=0.72 *7*
1596 *2*	0.5 *2*	8954.4	(37/2$^-$)	7358.4	(33/2$^-$)		
1634 *1*	2.3 *3*	8832.1	(37/2$^-$)	7198.1	(33/2$^-$)		
1643 *1*	9.1 *16*	8168.4	(37/2$^+$)	6525.5	(33/2$^+$)	(E2)	DCO=0.94 *4* DCO for 1643+1649.
1649 *1*	7.7 *9*	9817.3	(41/2$^+$)	8168.4	(37/2$^+$)	(Q)	DCO=0.94 *4* DCO for 1643+1649.
1651 *1*	2.1 *3*	3776.2	(21/2$^-$)	2124.94	(17/2$^-$)		
1658 *1*	2.2 *1*	8300.5	(35/2$^-$)	6642.5	(31/2$^-$)	Q	DCO=1.35 *21*
1669 *1*	1.0 *1*	5345.4	(27/2$^+$)	3674.39	(25/2$^+$)		
1682 *2*	0.2 *1*	11476		9794			
1694 *1*	3.9 *2*	8892.1	(37/2$^-$)	7198.1	(33/2$^-$)	Q	DCO=0.92 *16*
1700 *1*	2.0 *5*	8627.5	(35/2$^+$)	6927.5	(31/2$^+$)		
1714 *1*	2.6 *1*	10860.0	(43/2$^-$)	9146.0	(39/2$^-$)	Q	DCO=0.90 *9*
1745.8 *4*	4.0 *4*	6752.3	(33/2$^+$)	5006.1	(29/2$^+$)	(E2)	DCO=0.81 *17*
1762[c] *1*	0.6 *2*	2596.78	(17/2$^+$)	833.46	(13/2$^+$)		
1765 *1*	5.6 *2*	11582.3	(45/2$^+$)	9817.3	(41/2$^+$)	Q	DCO=1.03 *14*
1766.9 *5*	1.3 *2*	5441.3	(29/2$^+$)	3674.39	(25/2$^+$)		
1773 *1*	2.7 *3*	11869.8	(45/2$^-$)	10096.8	(41/2$^-$)	Q	DCO=0.99 *21*
1777 *1*	2.2 *2*	3353.7		1575.96	(17/2$^+$)		
1791.3 *2*	6.2 *3*	8316.7	(37/2$^+$)	6525.5	(33/2$^+$)	(E2)	DCO=1.05 *6*
1801 *2*	1.0 *1*	4329.7	(25/2$^+$)	2529.36	(21/2$^+$)		

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)

$\gamma(^{77}Rb)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
1803 *2*	1.4 *1*	10103.5	(39/2$^-$)	8300.5	(35/2$^-$)		
1804[c] *2*	<0.5	5478.5		3674.39	(25/2$^+$)		
1817.9 *5*	0.8 *1*	2149.5	(11/2$^-$)	331.63	9/2$^{(+)}$		
1838 *2*	1.1 *1*	3411.30	(21/2$^+$)	1575.96	(17/2$^+$)		
1882 *2*	1.7 *3*	10774.1	(41/2$^-$)	8892.1	(37/2$^-$)		
1889 *1*	0.8 *4*	4417.5		2529.36	(21/2$^+$)		
1892.8 *3*	4.0 *2*	10209.6	(41/2$^+$)	8316.7	(37/2$^+$)	(E2)	DCO=0.90 *10*
1947 *1*	1.2 *1*	12807.0	(47/2$^-$)	10860.0	(43/2$^-$)		
1969 *1*	1.4 *1*	13551.3	(49/2$^+$)	11582.3	(45/2$^+$)		
2007 *2*	<1	5681.5		3674.39	(25/2$^+$)		
2018 *2*	1.4 *3*	13888	(49/2$^-$)	11869.8	(45/2$^-$)		
2041 *1*	1.4 *1*	10209.6	(41/2$^+$)	8168.4	(37/2$^+$)		
2055 *1*	0.6 *1*	12264.7	(45/2$^+$)	10209.6	(41/2$^+$)		
2206 *2*	0.6 *1*	15013	(51/2$^-$)	12807.0	(47/2$^-$)		
2246 *2*	0.9 *1*	15797	(53/2$^+$)	13551.3	(49/2$^+$)		
2349 *1*	0.7 *1*	12558.6		10209.6	(41/2$^+$)		
2448 *2*	0.4 *1*	12264.7	(45/2$^+$)	9817.3	(41/2$^+$)		
2472 *3*	0.2 *1*	17485	(55/2$^-$)	15013	(51/2$^-$)		
2500 *3*	1.4 *3*	7506		5006.1	(29/2$^+$)		
2579 *3*	0.2 *1*	18376	(57/2$^+$)	15797	(53/2$^+$)		

[†] From 1997Ha08, except as noted.
[‡] From 1997Ha08 at E=128 MeV and θ=64°. The Iγ values from 1983Li11 at 117 MeV are given under comments.
[#] From $\gamma(\theta)$ (1983Li11), $\gamma\gamma(\theta)$ (DCO) and asymmetry ratios (1997Ha08). R(DCO) or R(Iγ)=1.0 indicates ΔJ=2, quadrupole (E2 from RUL when $T_{1/2}$ is known); this value is also consistent with (less likely choice of) ΔJ=0, dipole as for 822.3γ, 1020.9γ and 1049.0γ. R(DCO) or R(Iγ)=0.5 indicates ΔJ=1, dipole or dipole with some quadrupole admixture.
[@] From $\gamma(\theta)$ (1983Li11).
[&] Intensity is underestimated due to long half-life of the deexciting level.
[a] From 1983Li11. Value from 1997Ha08 is in agreement but is less precise.
[b] 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.
[c] Placement of transition in the level scheme is uncertain.

$^{77}_{37}Rb_{40}$-9

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08

Level Scheme

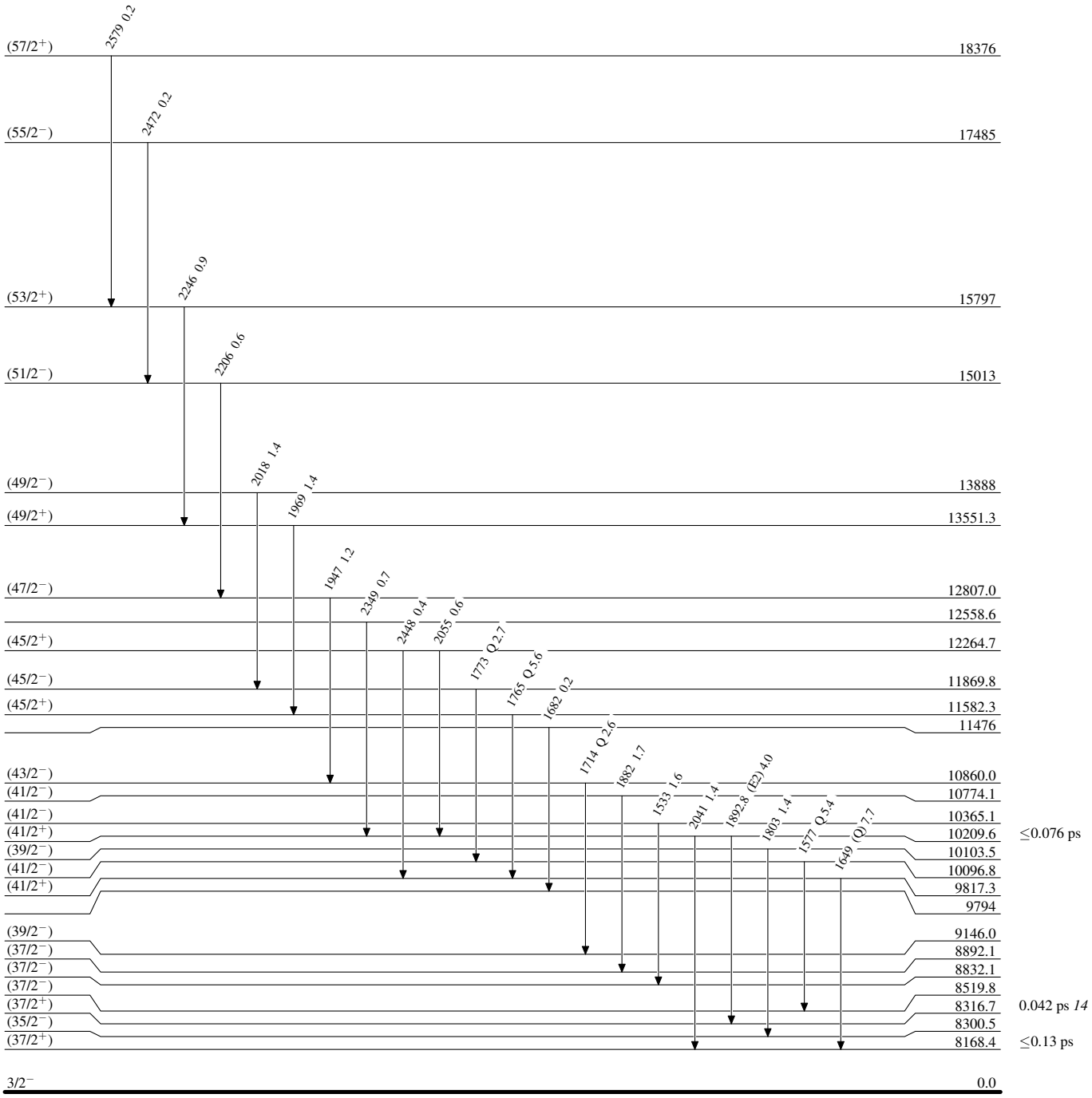
Intensities: Relative I_γ

Legend

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

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

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



$^{77}_{37}Rb_{40}$

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08

Level Scheme (continued)

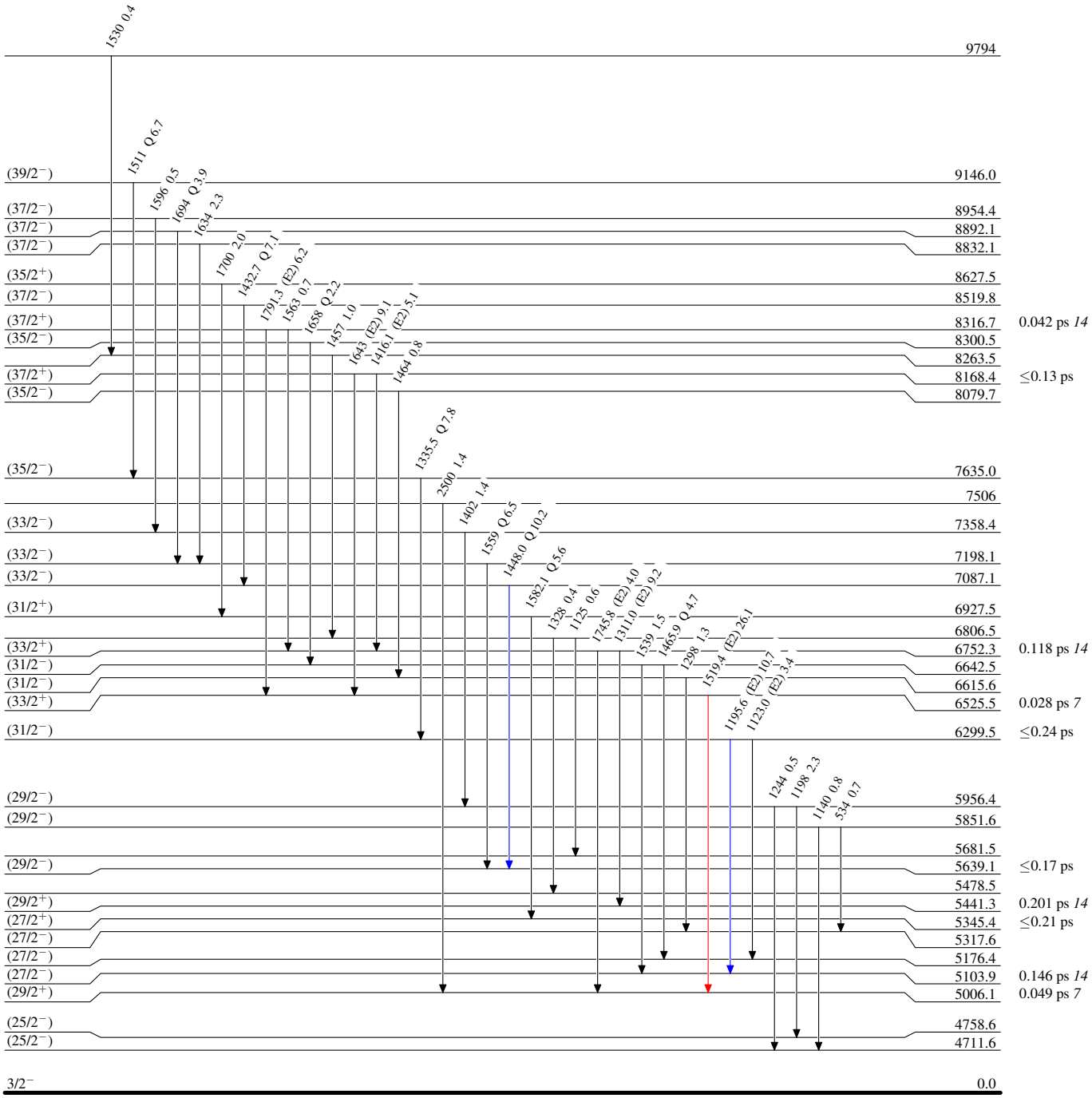
Intensities: Relative I_γ

Legend

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

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

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



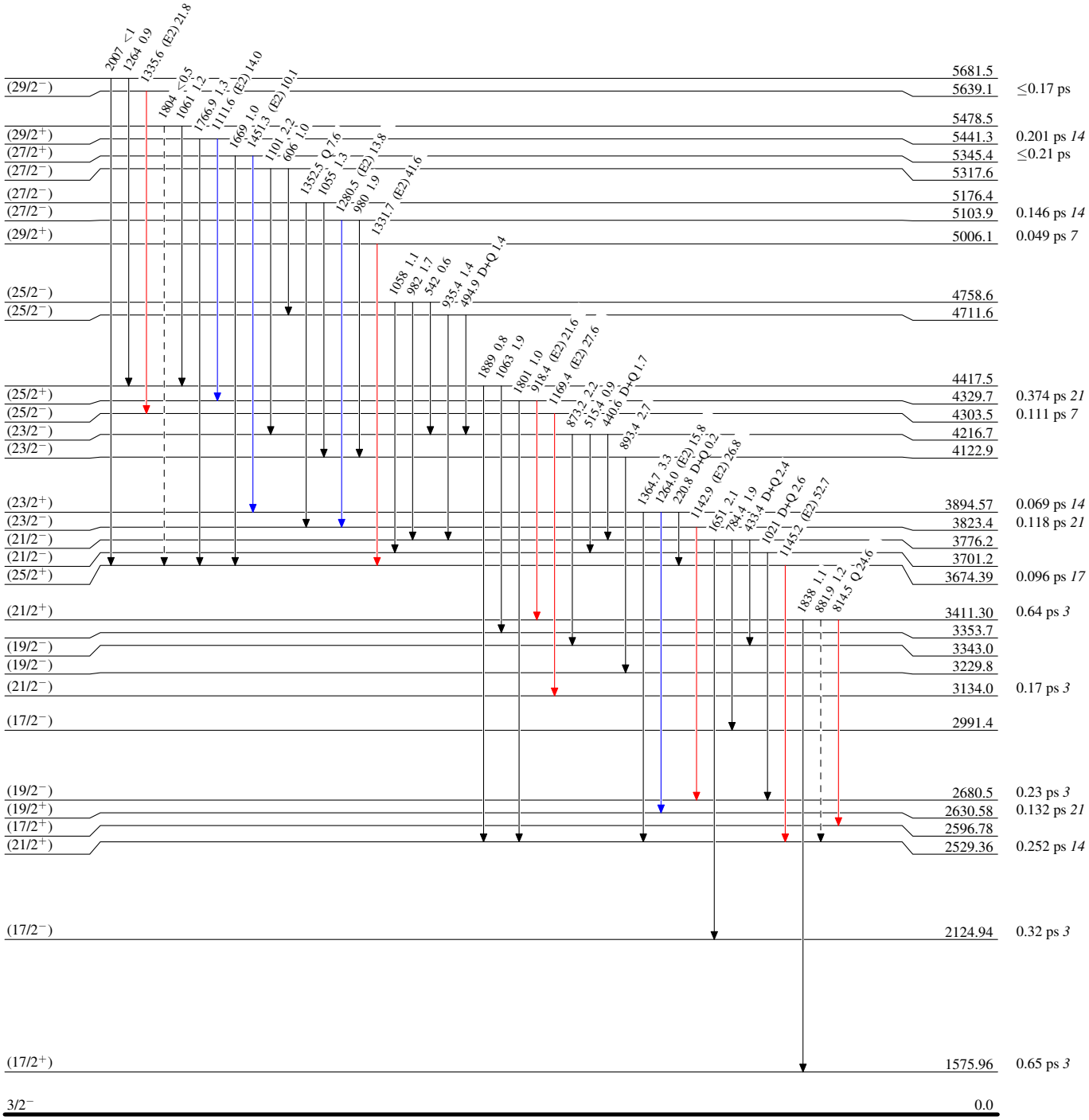
$^{77}_{37}Rb_{40}$

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08

Level Scheme (continued)

Intensities: Relative I_γ

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)

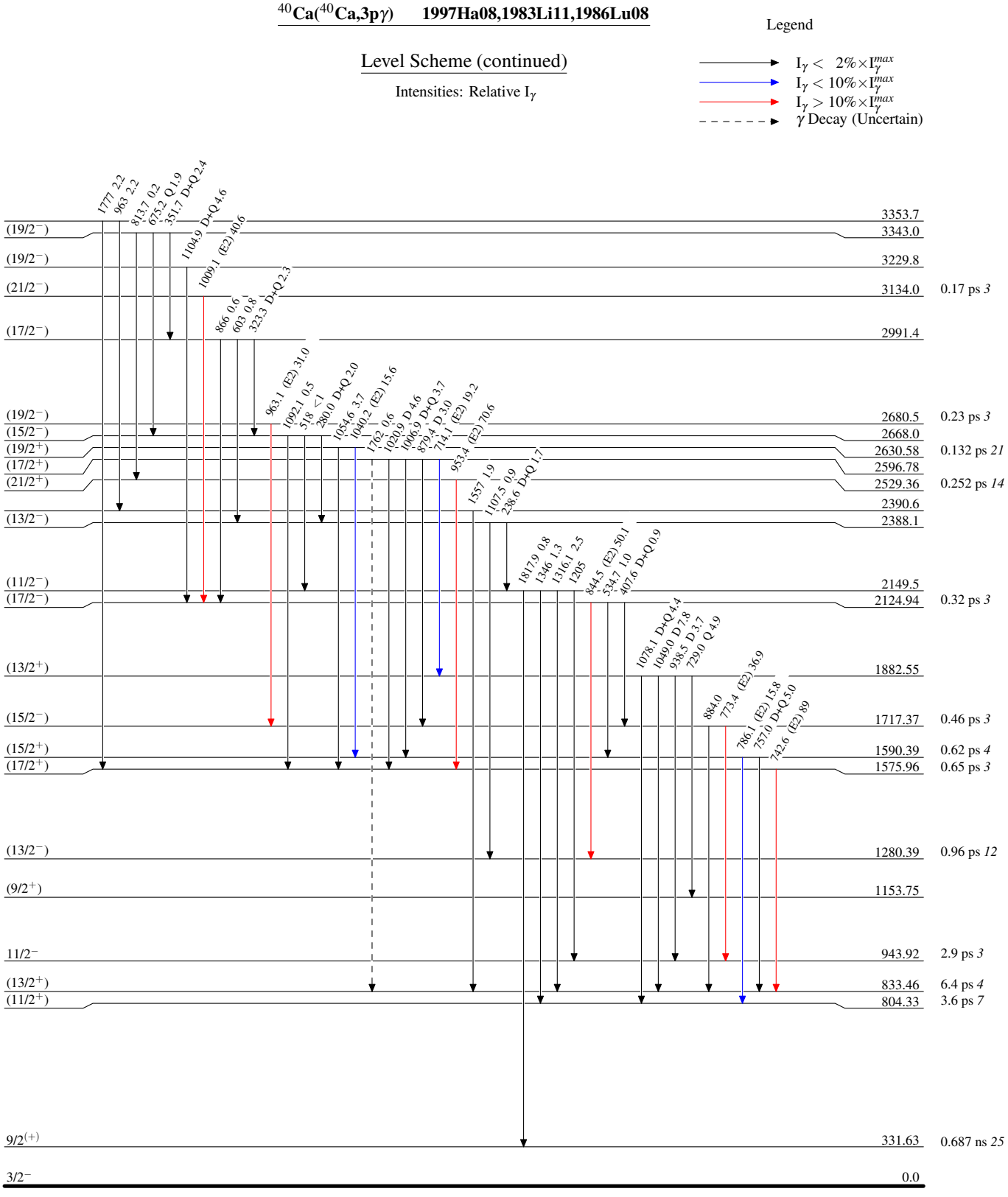


$^{77}_{37}Rb_{40}$

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08

Level Scheme (continued)

Intensities: Relative I_γ



$^{77}_{37}Rb_{40}$

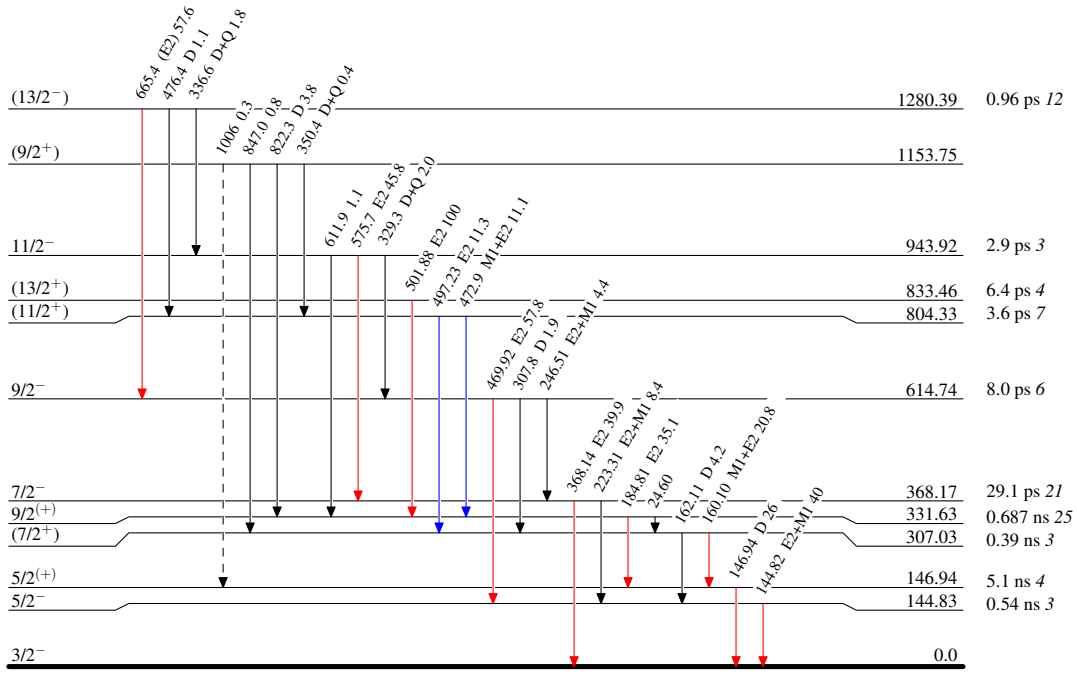
^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08

Level Scheme (continued)

Intensities: Relative I_γ

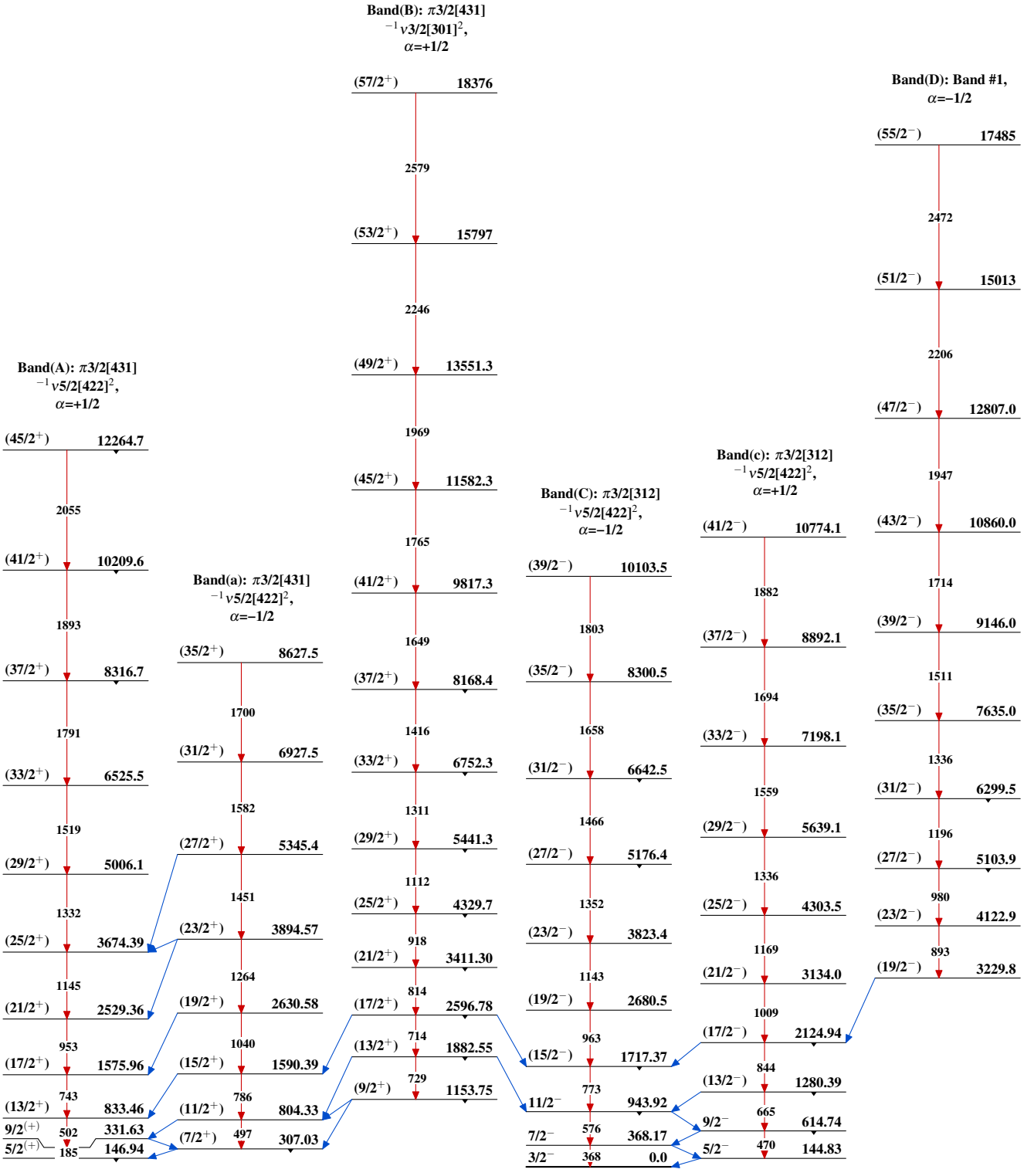
Legend

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



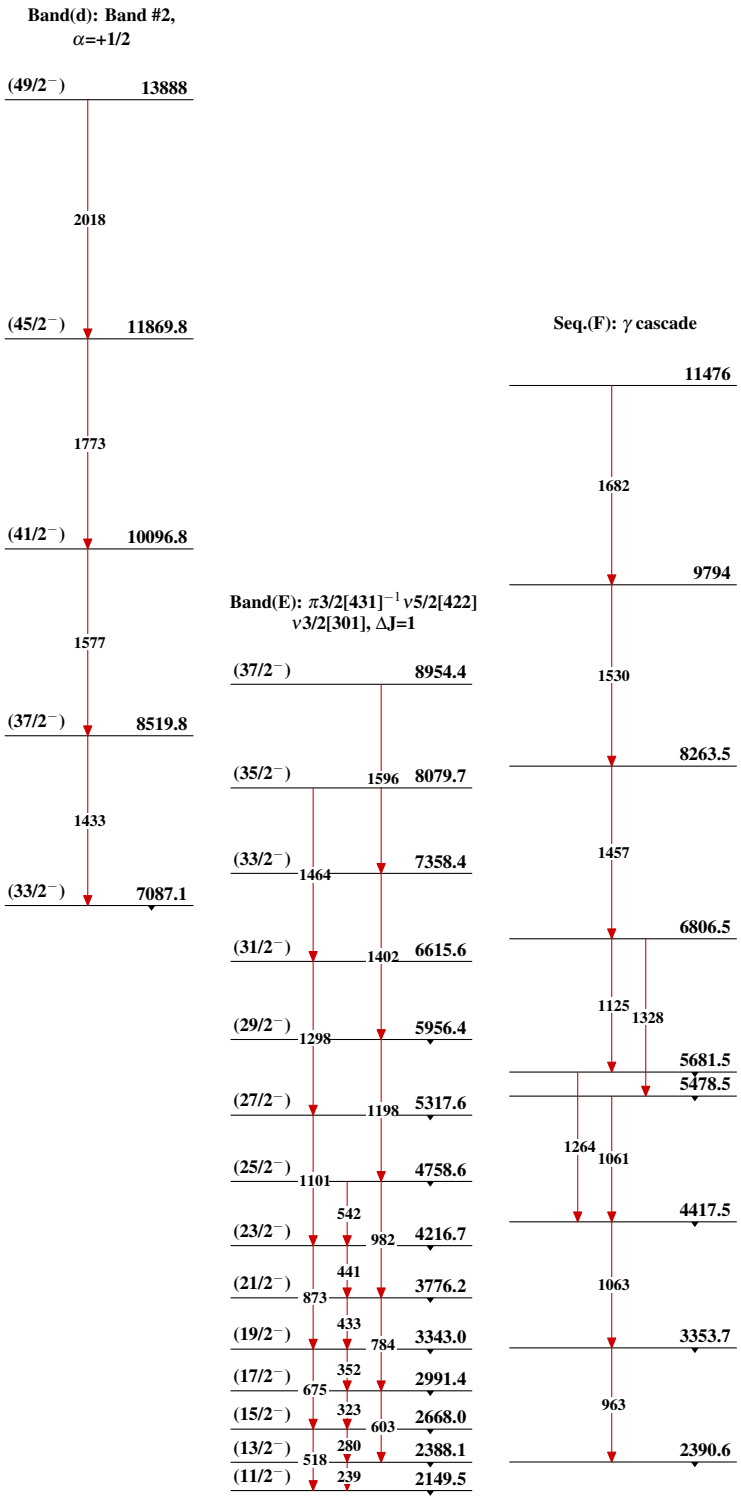
$^{77}_{37}Rb_{40}$

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08



$^{77}_{37}Rb_{40}$

^{40}Ca(^{40}Ca,3pγ) 1997Ha08,1983Li11,1986Lu08 (continued)



$^{77}_{37}Rb_{40}$