^{100}Mo(^{34}S,5nγ) 2009Pa40

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Janos Timar and Zoltan Elekes, Balraj Singh	NDS 121, 143 (2014)	31-May-2014

2009Pa40: E=155 MeV; measured Eγ, Iγ, $\gamma\gamma$-coin using the EUROGAM 2 spectrometer at CRN, Strasbourg. The EUROGAM 2 array consisted of 30 tapered coaxial, 24 four-element clover escape suppressed HPGe detectors. Comparison with cranked Woods-Saxon calculations and systematics of other light odd-N cerium isotopes.

Configuration assignments in 2009Pa40 were made through comparison with Woods-Saxon cranking calculations.

2009Li67: ^{96}Mo(^{37}Cl,p3nγ) E=155 MeV. Measured lifetimes by Doppler-shift attenuation method (DSAM) using 15 Compton-suppressed HPGe detectors at CIAE, Beijing. Also there is a short report by the same group as 2009Li67 in Chin. Phys. C 32, s2-141 (2008).

^{129}Ce Levels

Quasiparticle labels with main components:
a: ν5/2[402],α=+1/2.
b: ν5/2[402],α=−1/2.
e: ν7/2[523],α=−1/2.
f: ν7/2[523],α=+1/2.
A: π5/2[413],α=+1/2.
B: π5/2[413],α=−1/2.
E: π1/2[550],α=−1/2.
F: π1/2[550],α=+1/2.

E(level)[†]	J$^\pi$	T$_{1/2}$[‡]	Comments
0.0[b]	5/2$^+$		
0+y?[f]	(9/2$^-$)		J$^\pi$: (13/2$^+$) implied from data on ^{104}Pd(^{28}Si,2pnγ) (1996Ga13).
107.8[e] *3*	7/2$^-$	60[#] ns *2*	
144.73[c] *24*	7/2$^+$		
190.3[d] *4*	9/2$^-$		
335.8[e] *4*	11/2$^-$		
348.57[b] *24*	9/2$^+$		
419.9+y[@f] *10*	(13/2$^-$)		
590.5[c] *3*	11/2$^+$		
596.3[d] *5*	13/2$^-$		
806.5[e] *5*	15/2$^-$		
869.1[b] *3*	13/2$^+$		
967.2+y[@f] *11*	(17/2$^-$)		
1178.3[c] *4*	15/2$^+$		
1187.5[d] *5*	17/2$^-$		
1423.3[e] *5*	19/2$^-$		
1515.3[b] *4*	17/2$^+$		
1568.1+y[@f] *11*	(21/2$^-$)		
1870.8[c] *4*	19/2$^+$		
1909.8[d] *5*	21/2$^-$	0.20 ps *6*	Q(transition)=6.50 *9* (2009Li67).
2151.2[e] *5*	23/2$^-$	0.61 ps *34*	Q(transition)=4.0 *14* (2009Li67).
2202.0+y[f] *12*	(25/2$^-$)		
2233.8[b] *4*	21/2$^+$		
2537.0[a] *5*	23/2$^+$		
2622.8[c] *6*	23/2$^+$		

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^{100}Mo(^{34}S,5nγ) 2009Pa40 (continued)

^{129}Ce Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$[‡]	Comments
2666.4[d] 6	25/2⁻	0.334 ps 22	Q(transition)=3.57 11 (2009Li67).
2776.7[&] 5	25/2⁺		
2867.8[b] 6	25/2⁺		
2890.6[e] 6	27/2⁻	0.89 ps 29	Q(transition)=2.9 6 (2009Li67).
2901.2+y[f] 12	(29/2⁻)		
3011.9[a] 5	27/2⁺		
3146.2[c] 6	27/2⁺		
3209.1[d] 6	29/2⁻	1.14 ps 26	Q(transition)=5.1 5 (2009Li67).
3292.6[&] 6	29/2⁺		
3447.9[b] 7	29/2⁺		
3462.0[e] 6	31/2⁻	0.78 ps 27	Q(transition)=4.6 9 (2009Li67).
3586.9[a] 6	31/2⁺		
3675.4+y[f] 12	(33/2⁻)		
3789.1[d] 6	33/2⁻	0.30 ps 24	Q(transition)=6.3 19 (2009Li67).
3804.4[c] 8	31/2⁺		
3935.1[&] 6	33/2⁺		
4118.3[e] 6	35/2⁻	0.33 ps 25	Q(transition)=4.7 15 (2009Li67).
4179.8[b] 8	33/2⁺		
4295.8[a] 6	35/2⁺		
4508.2[d] 7	37/2⁻	<0.33 ps	Q(transition)>3.5 (2009Li67).
4526.4+y[f] 13	(37/2⁻)		
4597.6[c] 10	35/2⁺		
4712.7[&] 6	37/2⁺		
4911.5[e] 7	39/2⁻	<0.28 ps	Q(transition)>3.2 (2009Li67).
5049.6[b] 10	37/2⁺		
5136.5[a] 6	39/2⁺		
5367.8[d] 7	41/2⁻		
5449.8+y[f] 13	(41/2⁻)		
5468.7[c] 12	39/2⁺		
5620.1[&] 7	41/2⁺		
5837.7[e] 7	43/2⁻		
6010.6[b] 12	41/2⁺		
6106.1[a] 8	43/2⁺		
6362.1[d] 8	45/2⁻		
6448.4+y[f] 14	(45/2⁻)		
6649.9[&] 9	45/2⁺		
6885.8[e] 9	47/2⁻		
6971.6[b] 13	45/2⁺		
7193.9[a] 10	47/2⁺		
7480.5[d] 10	49/2⁻		
7520.8+y[f] 17	(49/2⁻)		
7790.7[&] 11	49/2⁺		
8039.5[e] 11	51/2⁻		
8385.7[a] 12	51/2⁺		
8667.8+y[f] 20	(53/2⁻)		
8712.7[d] 12	53/2⁻		
9034.4[&] 13	(53/2⁺)		

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^{100}Mo(^{34}S,5nγ) 2009Pa40 (continued)

^{129}Ce Levels (continued)

E(level)†	Jπ	E(level)†	Jπ	E(level)†	Jπ
9283.5[e] 13	55/2−	11189.4+y[f] 24	(61/2−)	15554+y[f] 3	(73/2−)
9672.7[a] 13	(55/2+)	11471.1[d] 15	61/2−	17178+y[f] 4	(77/2−)
9890.3+y[f] 22	(57/2−)	11980.4[e] 15	63/2−	18905+y[f] 4	(81/2−)
10046.1[d] 13	57/2−	12565+y[f] 3	(65/2−)		
10602.4[e] 14	59/2−	14021+y[f] 3	(69/2−)		

† From least-squares fit to the Eγ data.
‡ From DSAM (2009Li67), unless otherwise stated.
# From Adopted Levels.
@ Possibly feeds lowest members of positive-parity band. No linking transitions were found.
& Band(A): $\nu h_{11/2}\otimes\pi(h_{11/2},g_{7/2})$,$\alpha$=+1/2. Quasiparticle configuration=fEB. Band crossing at $\hbar\omega$=0.294 MeV.
[a] Band(a): $\nu h_{11/2}\otimes\pi(h_{11/2},g_{7/2})$,$\alpha$=−1/2. Quasiparticle configuration=eEB. Band crossing at $\hbar\omega$=0.301 MeV.
[b] Band(B): $\nu d_{5/2}$, α=+1/2. Quasiparticle configuration=a below, aEF above the band crossing. Band crossing at $\hbar\omega$=0.318 MeV. Second band crossing at $\hbar\omega$=0.48 MeV due to pair of $\pi h_{11/2}$ neutrons.
[c] Band(b): $\nu d_{5/2}$, α=−1/2. Quasiparticle configuration=b below, bEF above the band crossing. Band crossing at $\hbar\omega$=0.318 MeV.
[d] Band(C): $\nu h_{11/2}$,α=+1/2. Quasiparticle configuration=f below, fEF above the band crossing. Band crossing at $\hbar\omega$=0.312 MeV.
[e] Band(c): $\nu h_{11/2}$,α=−1/2. Quasiparticle configuration=e below, eEF above the band crossing. Band crossing at $\hbar\omega$=0.325 MeV.
[f] Band(D): ν1/2[541], α=+1/2. Decoupled enhanced deformation band. Interpreted as SD band in 1996Ga13 on the basis of Q(intrinsic) measurement. Possible transitions to band based on 5/2+ and its signature partner.

γ(^{129}Ce)

Multipolarities are assumed in 2009Pa40 as stretched quadrupoles (E2) for in-band transitions and dipoles (M1(+E2)) for interband transitions.

Eγ†	Iγ	Ei(level)	J_i^π	E_f	J_f^π	Mult.	α‡	Comments
82.3 3	>110	190.3	9/2−	107.8	7/2−			
107.8 3	30 3	107.8	7/2−	0.0	5/2+	[E1]	0.198 4	α(K)=0.168 3; α(L)=0.0233 4; α(M)=0.00485 8 α(N)=0.001060 17; α(O)=0.000165 3; α(P)=1.025×10−5 17 Additional information 1.
144.6 3	>120	144.73	7/2+	0.0	5/2+			
145.7 3	89 3	335.8	11/2−	190.3	9/2−			
203.6 3	91 3	348.57	9/2+	144.73	7/2+			
210.2 3	47.4 20	806.5	15/2−	596.3	13/2−			
224.3 3	17.2 11	2890.6	27/2−	2666.4	25/2−			
228.2 3	53.8 12	335.8	11/2−	107.8	7/2−			
235.2 3	38.0 16	3011.9	27/2+	2776.7	25/2+			
236.0 3	18.0 14	1423.3	19/2−	1187.5	17/2−			
239.8 3	36.5 16	2776.7	25/2+	2537.0	23/2+			
241.4 3	10.8 12	2151.2	23/2−	1909.8	21/2−			
241.8 3	53.5 24	590.5	11/2+	348.57	9/2+			
245.0 3	19.3 15	2867.8	25/2+	2622.8	23/2+			
253.1 3	92 4	3462.0	31/2−	3209.1	29/2−			
260.7 3	74 3	596.3	13/2−	335.8	11/2−			
278.4 3	21.5 15	3146.2	27/2+	2867.8	25/2+			
278.7 3	41.1 15	869.1	13/2+	590.5	11/2+			

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^{100}Mo(^{34}S,5nγ) 2009Pa40 (continued)

$\gamma(^{129}Ce)$ (continued)

E_γ †	I_γ	E_i(level)	J_i^π	E_f	J_f^π
280.7 *3*	33.6 *16*	3292.6	$29/2^+$	3011.9	$27/2^+$
294.2 *3*	29.9 *14*	3586.9	$31/2^+$	3292.6	$29/2^+$
301.8 *6*	9.1 *8*	3447.9	$29/2^+$	3146.2	$27/2^+$
303.2 *3*	24.7 *14*	2537.0	$23/2^+$	2233.8	$21/2^+$
309.5 *3*	25.1 *14*	1178.3	$15/2^+$	869.1	$13/2^+$
318.5 *3*	56.0 *21*	3209.1	$29/2^-$	2890.6	$27/2^-$
327.1 *3*	48.6 *20*	3789.1	$33/2^-$	3462.0	$31/2^-$
329.2 *3*	41.3 *18*	4118.3	$35/2^-$	3789.1	$33/2^-$
337.1 *3*	26.0 *16*	1515.3	$17/2^+$	1178.3	$15/2^+$
348.2 *3*	13.8 *13*	3935.1	$33/2^+$	3586.9	$31/2^+$
348.7 *3*	28.4 *22*	348.57	$9/2^+$	0.0	$5/2^+$
355.5 *3*	16.9 *13*	1870.8	$19/2^+$	1515.3	$17/2^+$
356.6 *6*	7.1 *12*	3804.4	$31/2^+$	3447.9	$29/2^+$
360.7 *3*	16.8 *14*	4295.8	$35/2^+$	3935.1	$33/2^+$
363.1 *3*	17.6 *15*	2233.8	$21/2^+$	1870.8	$19/2^+$
375.4 *6*	5.3 *13*	4179.8	$33/2^+$	3804.4	$31/2^+$
381.2 *3*	21.3 *17*	1187.5	$17/2^-$	806.5	$15/2^-$
389.0 *6*	<5.0	2622.8	$23/2^+$	2233.8	$21/2^+$
390.0 *3*	25.0 *13*	4508.2	$37/2^-$	4118.3	$35/2^-$
403.4 *3*	21.4 *14*	4911.5	$39/2^-$	4508.2	$37/2^-$
405.8 *3*	19.1 *12*	596.3	$13/2^-$	190.3	$9/2^-$
417.0 *3*	11.7 *12*	4712.7	$37/2^+$	4295.8	$35/2^+$
419.9@ *10*	<2.0	419.9+y	$(13/2^-)$	0+y?	$(9/2^-)$
423.9 *3*	10.2 *11*	5136.5	$39/2^+$	4712.7	$37/2^+$
445.9 *3*	30.9 *19*	590.5	$11/2^+$	144.73	$7/2^+$
456.3 *3*	18 *3*	5367.8	$41/2^-$	4911.5	$39/2^-$
469.9 *3*	16.2 *14*	5837.7	$43/2^-$	5367.8	$41/2^-$
470.7 *3*	79 *3*	806.5	$15/2^-$	335.8	$11/2^-$
474.9 *3*	32.4 *19*	3011.9	$27/2^+$	2537.0	$23/2^+$
483.6 *6*	9.1 *12*	5620.1	$41/2^+$	5136.5	$39/2^+$
486.0 *6*	5.0 *12*	6106.1	$43/2^+$	5620.1	$41/2^+$
486.6 *3*	14.9 *17*	1909.8	$21/2^-$	1423.3	$19/2^-$
515.2 *3*	16.9 *18*	2666.4	$25/2^-$	2151.2	$23/2^-$
516.0 *6*	9.6 *12*	3292.6	$29/2^+$	2776.7	$25/2^+$
520.6 *3*	36.0 *21*	869.1	$13/2^+$	348.57	$9/2^+$
523.5 *6*	9.6 *17*	3146.2	$27/2^+$	2622.8	$23/2^+$
524.5 *6*	7.2 *12*	6362.1	$45/2^-$	5837.7	$43/2^-$
542.7 *3*	26.3 *16*	3209.1	$29/2^-$	2666.4	$25/2^-$
542.9 *3*	15.3 *15*	2776.7	$25/2^+$	2233.8	$21/2^+$
547.3 *3*	5.3 *5*	967.2+y	$(17/2^-)$	419.9+y	$(13/2^-)$
571.4 *3*	28.5 *19*	3462.0	$31/2^-$	2890.6	$27/2^-$
574.9 *3*	26.5 *19*	3586.9	$31/2^+$	3011.9	$27/2^+$
579.9 *6*	8.6 *17*	3447.9	$29/2^+$	2867.8	$25/2^+$
579.9 *3*	19.2 *16*	3789.1	$33/2^-$	3209.1	$29/2^-$
587.5 *3*	52 *3*	1178.3	$15/2^+$	590.5	$11/2^+$
591.2 *3*	46 *3*	1187.5	$17/2^-$	596.3	$13/2^-$
600.9 *3*	9.9 *9*	1568.1+y	$(21/2^-)$	967.2+y	$(17/2^-)$
616.5 *3*	100	1423.3	$19/2^-$	806.5	$15/2^-$
633.9 *3*	9.3 *9*	2202.0+y	$(25/2^-)$	1568.1+y	$(21/2^-)$
633.9 *6*	<5.0	2867.8	$25/2^+$	2233.8	$21/2^+$
642.6 *3*	22.3 *19*	3935.1	$33/2^+$	3292.6	$29/2^+$
646.1 *3*	49 *3*	1515.3	$17/2^+$	869.1	$13/2^+$
656.3 *3*	25.4 *17*	4118.3	$35/2^-$	3462.0	$31/2^-$
658.2 *6*	7.7 *15*	3804.4	$31/2^+$	3146.2	$27/2^+$
666.1 *3*	36.7 *19*	2537.0	$23/2^+$	1870.8	$19/2^+$

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^{100}Mo(^{34}S,5nγ) 2009Pa40 (continued)

γ(^{129}Ce) (continued)

E_γ †	I_γ	E_i(level)	J_i^π	E_f	J_f^π
692.7 *3*	38 *3*	1870.8	$19/2^+$	1178.3	$15/2^+$
699.2 *3*	8.2 *8*	2901.2+y	$(29/2^-)$	2202.0+y	$(25/2^-)$
708.9 *3*	16.8 *16*	4295.8	$35/2^+$	3586.9	$31/2^+$
718.4 *3*	39.0 *23*	2233.8	$21/2^+$	1515.3	$17/2^+$
719.1 *3*	16.0 *16*	4508.2	$37/2^-$	3789.1	$33/2^-$
722.3 *3*	31.3 *21*	1909.8	$21/2^-$	1187.5	$17/2^-$
727.9 *3*	92 *5*	2151.2	$23/2^-$	1423.3	$19/2^-$
731.8 *6*	8.6 *22*	4179.8	$33/2^+$	3447.9	$29/2^+$
739.3 *3*	63 *3*	2890.6	$27/2^-$	2151.2	$23/2^-$
752.1 *6*	7.1 *19*	2622.8	$23/2^+$	1870.8	$19/2^+$
756.6 *3*	25 *3*	2666.4	$25/2^-$	1909.8	$21/2^-$
774.2 *3*	7.5 *8*	3675.4+y	$(33/2^-)$	2901.2+y	$(29/2^-)$
777.4 *3*	16.1 *16*	4712.7	$37/2^+$	3935.1	$33/2^+$
793.2 *6*	<5.0	4597.6	$35/2^+$	3804.4	$31/2^+$
793.2 *3*	20.5 *16*	4911.5	$39/2^-$	4118.3	$35/2^-$
840.8 *3*	13.3 *18*	5136.5	$39/2^+$	4295.8	$35/2^+$
851.0 *3*	6.2 *7*	4526.4+y	$(37/2^-)$	3675.4+y	$(33/2^-)$
859.6 *3*	19.0 *17*	5367.8	$41/2^-$	4508.2	$37/2^-$
869.8 *6*	<5.0	5049.6	$37/2^+$	4179.8	$33/2^+$
871.1 *6*	<5.0	5468.7	$39/2^+$	4597.6	$35/2^+$
907.4 *3*	14.3 *15*	5620.1	$41/2^+$	4712.7	$37/2^+$
923.4 *3*	4.8 *7*	5449.8+y	$(41/2^-)$	4526.4+y	$(37/2^-)$
926.1 *3*	10.7 *16*	5837.7	$43/2^-$	4911.5	$39/2^-$
961.0# *6*	<5.0	6010.6	$41/2^+$	5049.6	$37/2^+$
961.0#@ *6*	<5.0	6971.6	$45/2^+$	6010.6	$41/2^+$
969.6 *6*	6.4 *14*	6106.1	$43/2^+$	5136.5	$39/2^+$
994.3 *6*	9.7 *16*	6362.1	$45/2^-$	5367.8	$41/2^-$
998.6 *3*	4.4 *7*	6448.4+y	$(45/2^-)$	5449.8+y	$(41/2^-)$
1029.8 *6*	7.1 *14*	6649.9	$45/2^+$	5620.1	$41/2^+$
1048.1 *6*	8.8 *14*	6885.8	$47/2^-$	5837.7	$43/2^-$
1072.4 *10*	3.3 *6*	7520.8+y	$(49/2^-)$	6448.4+y	$(45/2^-)$
1087.8 *6*	5.6 *13*	7193.9	$47/2^+$	6106.1	$43/2^+$
1118.3 *6*	5.3 *15*	7480.5	$49/2^-$	6362.1	$45/2^-$
1140.8 *6*	<5.0	7790.7	$49/2^+$	6649.9	$45/2^+$
1147.0 *10*	2.1 *6*	8667.8+y	$(53/2^-)$	7520.8+y	$(49/2^-)$
1153.7 *6*	<5.0	8039.5	$51/2^-$	6885.8	$47/2^-$
1191.8 *6*	<5.0	8385.7	$51/2^+$	7193.9	$47/2^+$
1222.5 *10*	1.6 *5*	9890.3+y	$(57/2^-)$	8667.8+y	$(53/2^-)$
1232.2 *6*	<5.0	8712.7	$53/2^-$	7480.5	$49/2^-$
1243.7 *6*	<5.0	9034.4	$(53/2^+)$	7790.7	$49/2^+$
1244.0 *6*	<5.0	9283.5	$55/2^-$	8039.5	$51/2^-$
1287.0@ *6*	<5.0	9672.7	$(55/2^+)$	8385.7	$51/2^+$
1299.1 *10*	<1.0	11189.4+y	$(61/2^-)$	9890.3+y	$(57/2^-)$
1318.9 *6*	<5.0	10602.4	$59/2^-$	9283.5	$55/2^-$
1333.4 *6*	<5.0	10046.1	$57/2^-$	8712.7	$53/2^-$
1375.6 *10*	<1.0	12565+y	$(65/2^-)$	11189.4+y	$(61/2^-)$
1378.0 *6*	<5.0	11980.4	$63/2^-$	10602.4	$59/2^-$
1425.0 *6*	<5.0	11471.1	$61/2^-$	10046.1	$57/2^-$
1456.4 *10*	<1.0	14021+y	$(69/2^-)$	12565+y	$(65/2^-)$
1533.0 *10*	<1.0	15554+y	$(73/2^-)$	14021+y	$(69/2^-)$
1623.5 *10*	<1.0	17178+y	$(77/2^-)$	15554+y	$(73/2^-)$
1727.0 *10*	<1.0	18905+y	$(81/2^-)$	17178+y	$(77/2^-)$

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^{100}Mo(^{34}S,5nγ) 2009Pa40 (continued)

γ(^{129}Ce) (continued)

† General uncertainty stated for bands 1,2 and 3 in 2009Pa40 is 0.3 keV for Iγ>10, rising to 0.6 keV for weaker transitions. The evaluators assign 0.6 keV for transitions with I$\gamma\leq$10. For band 4, stated uncertainty is 0.3 keV for Iγ>4 rising to 1 keV for weaker transitions. The evaluators assign 1 keV for transitions with I$\gamma\leq$4.

‡ 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.

Multiply placed.

@ Placement of transition in the level scheme is uncertain.

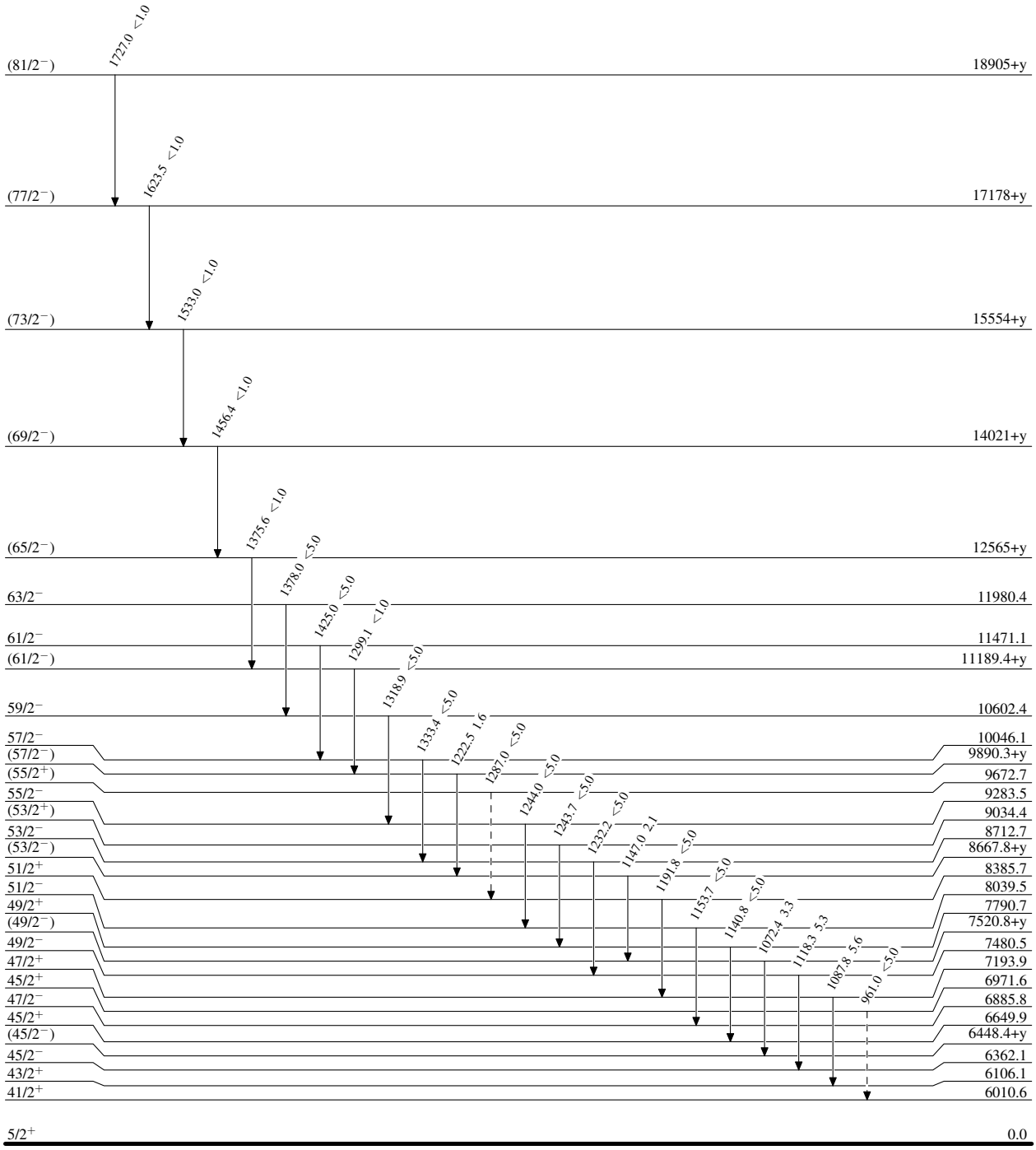
^{100}Mo(^{34}S,5nγ) 2009Pa40

Level Scheme

Intensities: Relative I_γ

Legend

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

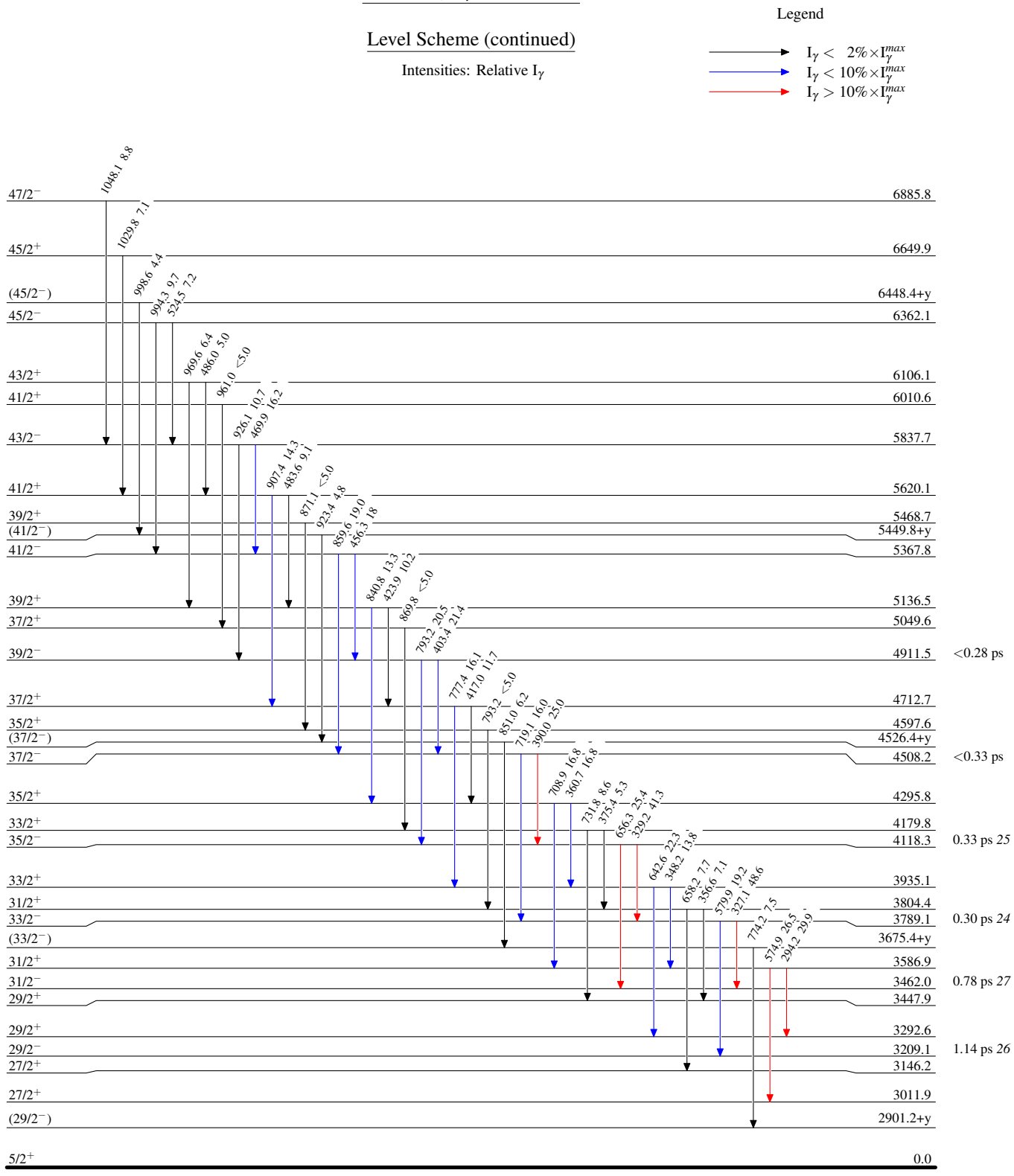


$^{129}_{58}Ce_{71}$

^{100}Mo(^{34}S,5nγ) 2009Pa40

Level Scheme (continued)

Intensities: Relative I_γ

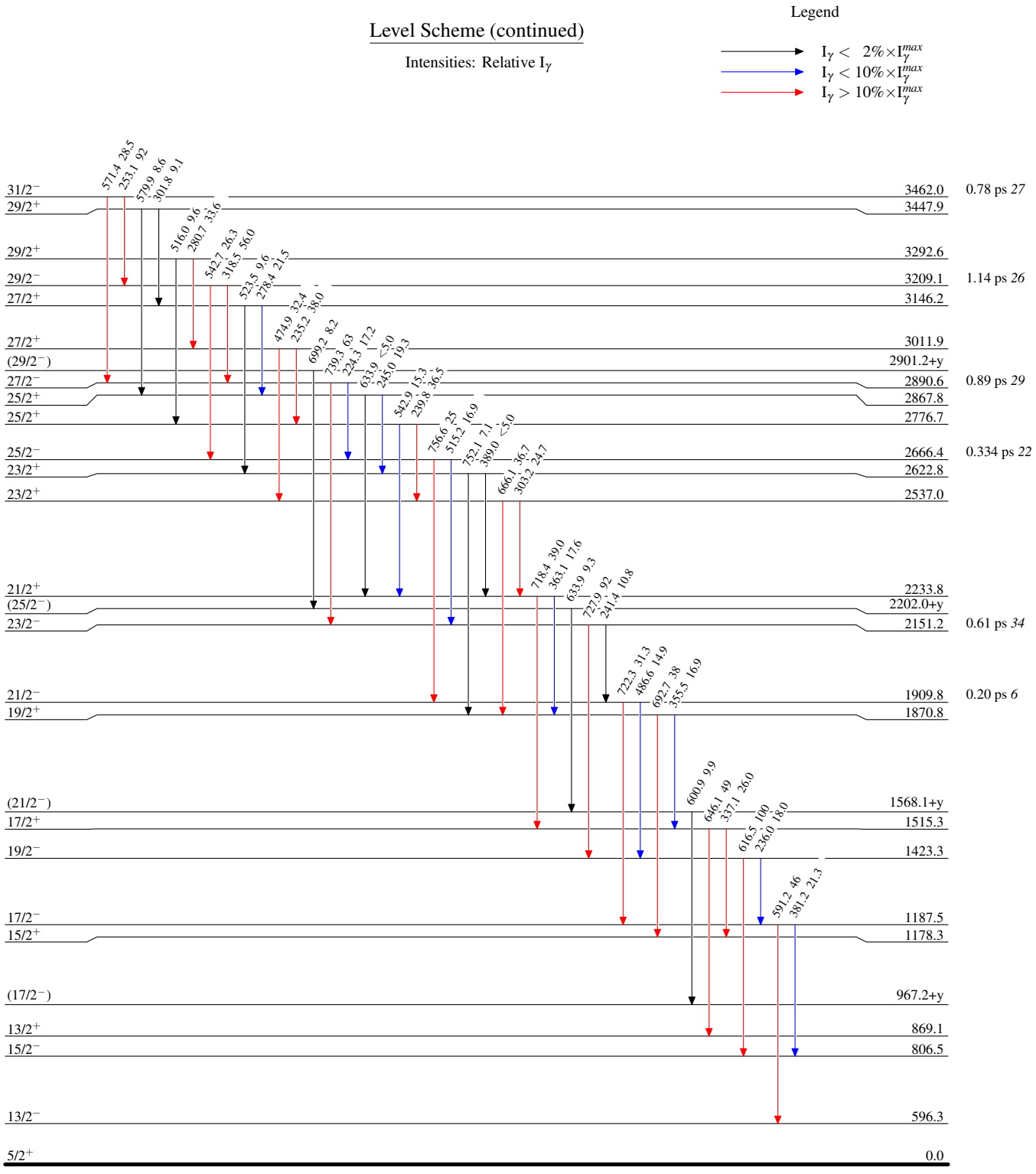


$^{129}_{58}Ce_{71}$

^{100}Mo(^{34}S,5nγ) 2009Pa40

Level Scheme (continued)

Intensities: Relative I_γ



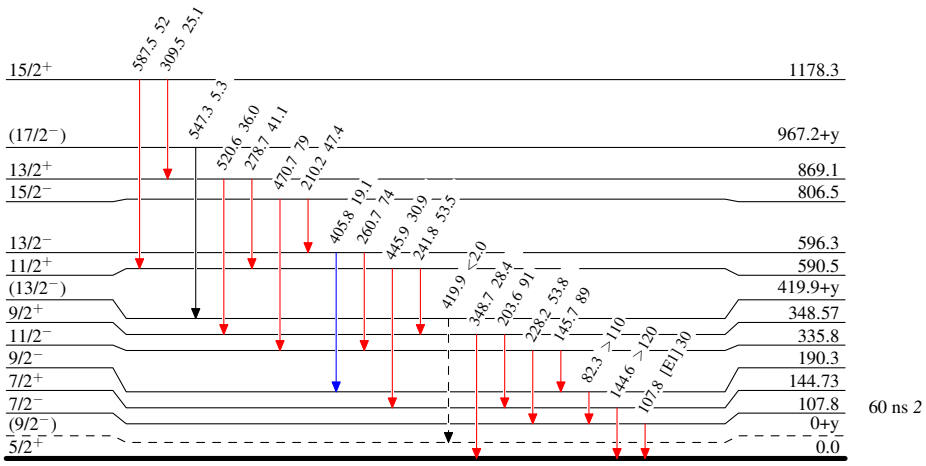
$^{129}_{58}Ce_{71}$

^{100}Mo(^{34}S,5nγ) 2009Pa40

Level Scheme (continued)

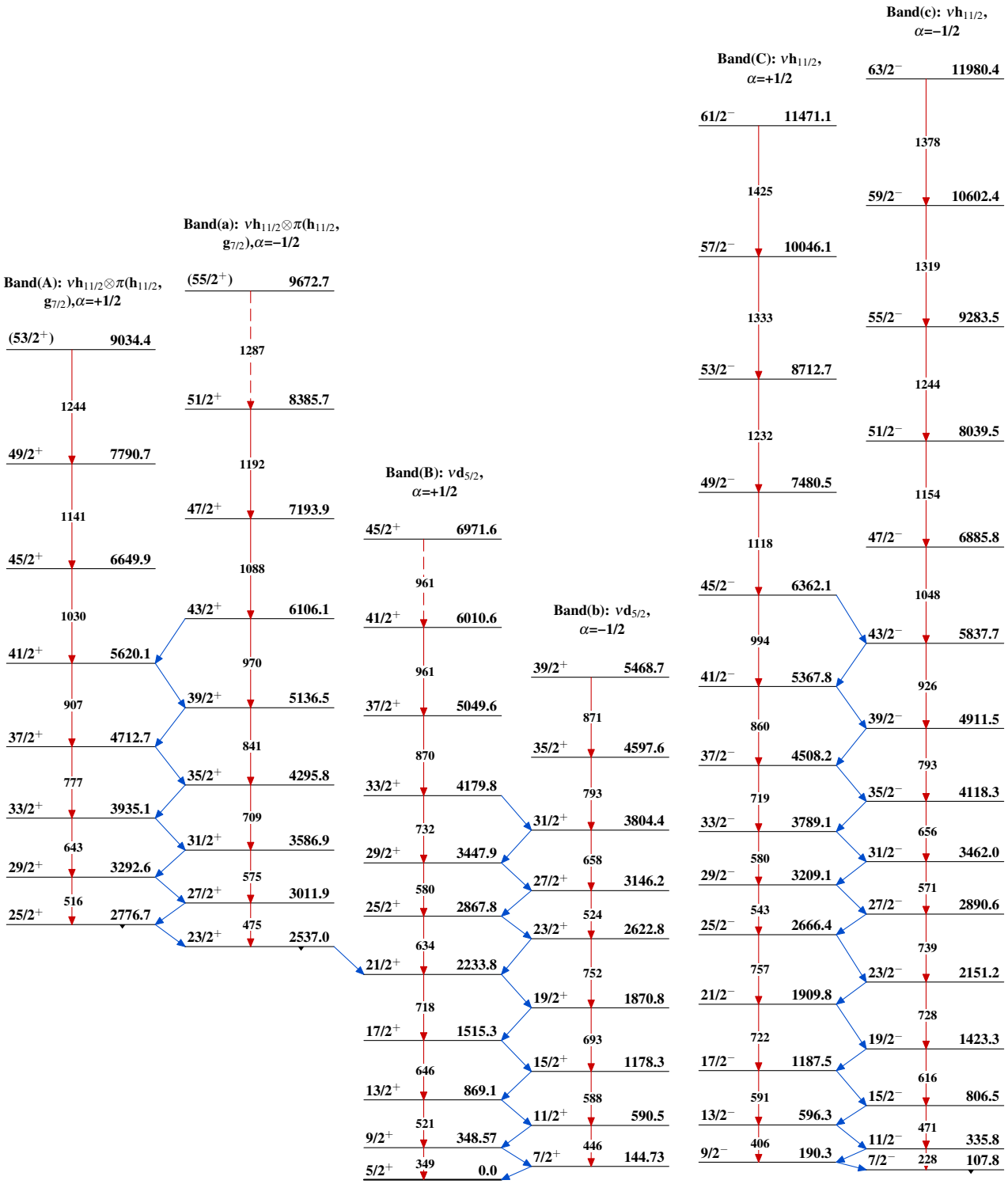
Intensities: Relative I_γ

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)



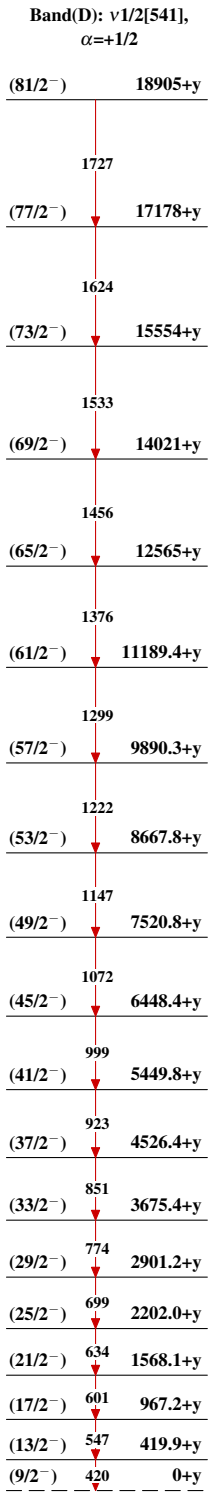
$^{129}_{58}Ce_{71}$

^{100}Mo(^{34}S,5nγ) 2009Pa40



$^{129}_{58}Ce_{71}$

^{100}Mo(^{34}S,5nγ) 2009Pa40 (continued)



$^{129}_{58}Ce_{71}$