^{139}La(^{28}Si,4nγ) 1992Sc03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich, Balraj Singh	NDS 111, 1211 (2010)	12-Apr-2010

Includes reactions ^{122}Sn(^{45}Sc,4nγ); ^{147}Sm(^{19}F,3nγ); ^{148}Sm(^{19}F,4nγ).

1992Sc03, 1992ScZL: ^{139}La(^{28}Si,4nγ) E=150 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO) with an array of 12-Compton suppressed Ge detectors and 48 BGO detectors. Cranked shell-model and total-Routhian surface calculations. See 1995Sc39 for theoretical analysis of π1/2[660], large deformation (triaxial superdeformed) band.

1993Sc13, 1992ScZL: ^{147}Sm(^{19}F,3nγ) E=85 MeV. Measured lifetimes by DSAM (Doppler-shift attenuation) and RDDS (recoil-distance Doppler shift) methods. The detector array for the DSAM experiment consisted of 12 Compton-suppressed Ge detectors and 10 BaF_2 detectors. For the RDDS method, the detector array contained 19 Ge detectors and 30 BaF_2 detectors.

Others:

1992Li13: ^{148}Sm(^{19}F,4nγ) E=92 MeV. Measured γ, $\gamma\gamma$ with three Compton-suppressed Ge detectors and two other Ge detectors. Two bands, each with a signature partner, were reported. No γ-ray intensities reported.

1994Ch77, 1990Gr18: ^{122}Sn(^{45}Sc,4nγ) E=192 MeV. Description of a computer code for analysis of 2-dimensional $\gamma\gamma$ data.

Earlier measurements:

1986HoZD: ^{122}Sn(^{45}Sc,4nγ) E=192 MeV. Measured γ, $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO at 24° and 63°) with an array of five Compton-suppressed Ge detectors and three additional Ge detectors. The inner ball consisted of 72 NaI detectors. γ-ray intensities were not reported. Three bands, two with signature partners, were reported.

1983RoZW: ^{148}Sm(^{19}F,4nγ) E=80-105 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$, excitation functions. One band with a signature partner reported.

1983WaZO: ^{148}Sm(^{19}F,4nγ). Measured γ, $\gamma\gamma$ with an array of five Ge detectors and a multiplicity filter of NaI detectors. Evidence for $h_{11/2}$ band (to 47/2$^-$) and $g_{7/2}$ band found. Details of this study are not available.

^{163}Lu Levels

The present level scheme is from 1992Sc03 with modifications as suggested by 2002Je05 (also 1999Do34). See also 1992Li13 and 1993Sc13. The detailed results from 2002Je05 and 1999Do34 are given in a separate ^{139}La(^{29}Si,5nγ) data set.

E(level)[†]	J$^\pi$[#]	T$_{1/2}$[‡]	Comments
0.0[j]	1/2$^+$[c]		
16.8[dk] 3	3/2$^+$[c]		Additional information 1.
62.19 8	5/2$^+$		
124.32[g] 10	7/2$^+$		
190.7[j] 8	5/2$^+$[c]		
195.29[i] 11	7/2$^-$		
210.2[h] 3	9/2$^-$		
223.8 6	7/2$^+$		
249.4[k] 5	7/2$^+$[c]		
294.8[i] 4	11/2$^-$		
310.51[f] 25	9/2$^+$		
491.3[h] 4	13/2$^-$		
520.3[j] 9	9/2$^+$[c]		
520.41[g] 25	11/2$^+$		
620.0[k] 6	11/2$^+$[c]		
643.8[i] 4	15/2$^-$	5.6[&] ps +6−11	
754.5[f] 3	13/2$^+$		
936.3[h] 5	17/2$^-$	1.4[&] ps +8−7	
967.3[j] 10	13/2$^+$[c]		
1007.7[g] 3	15/2$^+$		

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^{139}La(^{28}Si,4nγ) 1992Sc03 (continued)

^{163}Lu Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[‡]
1105.7[k] 8	15/2+[c]	
1114.4[i] 5	19/2−	1.9[&] ps +2−4
1281.9[f] 4	17/2+	
1484.6[h] 5	21/2−	0.9[&] ps 3
1501.2[j] 11	17/2+[c]	
1561.1[g] 4	19/2+	
1668.5[k] 9	19/2+[c]	
1676.0[i] 4	23/2−	1.0[&] ps +2−3
1738.3[l] 13	(13/2+)	
1866.7[f] 4	21/2+	
1935.0[l] 13	(17/2+)	
2102.6[h] 5	25/2−	
2138.6[g] 4	23/2+	
2199.0[el] 12	(21/2+)	
2275.4[j] 11	23/2+[c]	
2305.9[i] 5	27/2−	1.2[&] ps +3−5
2399.1[f] 4	25/2+	
2513.7[l] 12	(25/2+)	3.3[a] ps +7−5
2613.3[g] 5	27/2+	
2746.2[h] 5	29/2−	
2802.3[f] 5	29/2+	
2853.5 9	(29/2−)	
2899.7[l] 12	(29/2+)	2.3[a] ps +5−4
2923.2[i] 6	31/2−	
3002.7[g] 5	31/2+	
3020.0 8	(31/2−)	
3121.6[h] 6	33/2−	
3243.8[f] 5	33/2+	
3318.7[i] 6	35/2−	4.2[&] ps +5−6
3349.7[l] 13	(33/2+)	0.9[a] ps +5−3
3482.4[g] 5	35/2+	
3549.6[h] 6	37/2−	
3788.2[f] 6	37/2+	
3820.3[i] 7	39/2−	
3864.6[l] 13	(37/2+)	0.31 ps +14−11
4066.6[g] 6	39/2+	
4101.4[h] 7	41/2−	
4403.9[f] 6	41/2+	
4428.8[i] 7	43/2−	
4442.7[l] 13	(41/2+)	0.15 ps +6−5
4717.4[g] 7	43/2+	
4757.8[h] 7	45/2−	
5055.0[f] 7	45/2+	
5081.4[l] 14	(45/2+)	0.10 ps +4−3
5129.0[i] 7	47/2−	0.15[@] ps 5
5385.6[g] 7	47/2+	
5502.0[h] 7	49/2−	0.11[@] ps +5−3
5717.1[f] 7	49/2+	
5778.4[l] 14	(49/2+)	0.08 ps +4−3
5913.4[i] 8	51/2−	0.12[@] ps +3−6
6062.4[g] 7	51/2+	
6330.3[h] 8	53/2−	0.09[@] ps +6−4
6412.3[f] 7	53/2+	
6530.4[l] 14	(53/2+)	0.055 ps +21−28
6785.7[i] 8	55/2−	
6785.9[g] 8	55/2+	
7171.5[f] 8	57/2+	
7243.4[h] 8	57/2−	
7335.6[l] 15	(57/2+)	0.04 ps 3
7581.5[g] 8	59/2+	
7725.3[i] 9	59/2−	
8008.8[f] 8	61/2+	
8193.3[l] 15	(61/2+)	0.034[@] ps +35−33
8219.1[h] 9	61/2−	
8457.0[g] 8	63/2+	
8924.4[f] 9	65/2+	
9101.7[l] 16	(65/2+)	
9405.6[g] 9	67/2+	
9914.7[f] 9	69/2+	
10063.6[l] 17	(69/2+)	
10423.8[g] 9	71/2+	
10976.8[f] 10	73/2+	
11500.7[g] 10	75/2+	
12094.2[f] 14	77/2+	
12621.6[g] 14	79/2+	
13254.6?[bf] 17	81/2+	
14480.0?[bf] 20	85/2+	

[†] From least-squares fit to Eγ′s. Note that the lowest state in 1992Sc03 is now placed at 17.0 keV by 2002Je05. The level scheme given by 1992Sc03 is modified in accordance with results from 2002Je05. This results in shifting the energies of the low-lying levels upwards by ≈17 keV, moving lower by ≈54 keV the positions of the π7/2[404] and π7/2[523] band members, and the lowest γ at 264 in SD band from 1484, (17/2+) to 1220, (13/2+) (1992Sc03) is now placed from a 2200, 21/2+ to 1936, 17/2+ level (2002Je05,1999Do34). Thus all the higher members of the SD band as shown by 1992Sc03 are pushed up in energy by ≈715 keV and in spin by two units.

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^{139}La(^{28}Si,4nγ) 1992Sc03 (continued)

^{163}Lu Levels (continued)

‡ From DSAM (1993Sc13,1992ScZL), unless otherwise stated.
# The assignments are as proposed by 1992Sc03, based on $\gamma\gamma(\theta)$ (DCO) data and associated band structures. It is assumed that multipolarities are M1(+E2) for $\Delta J=1$ and E2 for $\Delta J=2$ transitions.
@ From DSAM (1992ScZL).
& From RDDS (1992ScZL).
a From RDDS (1993Sc13,1992ScZL).
b Level proposed by 1992Sc03 in the $\pi 7/2[404]$ band is considered as uncertain since it is not given in the high-statistics experiment of 2002Je05 and 2004Je03. The level is not included in the 'Adopted Levels'.
c From 2002Je05.
d From ^{139}La(^{29}Si,5nγ).
e A 533.9γ from this level proposed by 1992Sc03 is now placed from 1500 level (2002Je05).
f Band(A): $\pi 7/2[404]$ band, $\alpha=+1/2$. Strongly coupled proton band (1992Sc03).
g Band(B): $\pi 7/2[404]$ band, $\alpha=-1/2$. Strongly coupled proton band (1992Sc03).
h Band(C): $\pi 7/2[523]$ band, $\alpha=+1/2$. Strongly coupled proton band (1993Sc13). Of the two possible choices (1992Sc03) of $\pi 7/2[523]$ and $\pi 9/2[514]$, $\pi 7/2[523]$ is preferred (1993Sc13,1999Do34), based on the experimental Q_t pattern with K=7/2 or 9/2 and a comparison of experimental and calculated B(M1) values.
i Band(D): $\pi 7/2[523]$ band, $\alpha=-1/2$. Strongly coupled proton band (1993Sc13). See comments on signature partner of this band.
j Band(E): $\pi 1/2[411]$ band, $\alpha=+1/2$. Band adopted from 2002Je05, 1999Do34.
k Band(e): $\pi 1/2[411]$ band, $\alpha=-1/2$.
l Band(F): Triaxial SD-1 band (1995Sc39,1992Sc03). The lowest γ at 264 in SD-1 band from 1484, $(17/2^+)$ to 1220, $(13/2^+)$ (1992Sc03) is now placed from a 2200, $21/2^+$ to 1936, $17/2^+$ level (2002Je05,1999Do34). Thus all the higher members of the SD-1 band as shown by 1992Sc03 are pushed up in energy by ≈715 keV and in spin by two units. Configuration=$\pi i_{13/2}$, 1/2[660], $\alpha=+1/2$. $\beta_2\approx 0.42$ (1993Sc13,1992Sc03); $Q_t=10.7$ *7* (1993Sc13, lifetime data). This value is about twice as large as that for other deformed bands for ^{163}Lu and in this mass region. See 1995Sc39 for discussion of this band and for a detailed comparison with population of a similar 1/2[660] large deformation (triaxial superdeformed) band in ^{165}Lu.

$\gamma(^{163}Lu)$

DCO ratios (1992Sc03) refer to Iγ(30°)/Iγ (90°), where Iγ(30°) is intensity along the 30° axis (in 30° x 90° $\gamma\gamma$ matrix) when gates are set on stretched $\Delta J=2$ transitions on the 90° axis. Iγ(90°) is the intensity on the 90° axis while the gates are set on stretched $\Delta J=2$ transitions on the 30° axis. DCO ratio is ≈1.0 for stretched $\Delta J=2$ (E2) and ≈0.7 for $\Delta J=1$, dipole transitions.

Intensities in ^{148}Sm(^{19}F,4nγ) (1983RoZW)

Eγ	Iγ		Eγ	Iγ	
132.90 *15*	35 *4*		349.3 *1*	105 *5*	
152.70 *15*	74 *8*		370.6 *1*	71 *7*	
177.00 *15*			396.10 *15*	71 *7*	
177.80 *15*	61 *6*		426.90 *15*	32 *3*	
180.00 *15*	13 *2*		440.90 *15*	21 *2*	
191.50 *15*	28 *3*		445.10 *15*	99 *5*	
196.80 *15*	242 *12*	b	470.8 *1*	168 *8*	
198.80 *15*	69 *7*	b	501.90 *15*	15 *2*	
203.00 *15*	47 *5*	a	548.20 *15*	44 *5*	
231.0 *1*	47 *5*		562.1 *1*	180 *9*	
270.9 *1*	37 *4*		609.10 *15*	26 *3*	
281.50 *15*	53 *6*		617.8 *1*	131 *7*	
292.8 *1*	81 *4*		618.00 *15*	14 *2*	
327.70 *15*	18 *2*		630.2 *1*	146 *10*	a
329.10 *15*	12 *1*		644.10 *15*	39 *4*	

a: possible contamination from ^{163}Yb
b: intensity is uncertain due to ^{19}F line

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
45.39[#] *8*		62.19	$5/2^+$	16.8	$3/2^+$		Placement based on the proposed 16.8 level as the first excited state (1999Do34,2002Je05).
62.14[#] *5*		124.32	$7/2^+$	62.19	$5/2^+$		
70.98[#] *8*		195.29	$7/2^-$	124.32	$7/2^+$		
84.5 *5*	17 *8*	294.8	$11/2^-$	210.2	$9/2^-$		
85.9[b]		210.2	$9/2^-$	124.32	$7/2^+$		
101.6 *10*	<4	3121.6	$33/2^-$	3020.0	$(31/2^-)$		
133.08[#] *10*		195.29	$7/2^-$	62.19	$5/2^+$		
152.5 *3*	38 *3*	643.8	$15/2^-$	491.3	$13/2^-$	(D)[&]	R(DCO)=0.80 *18*. δ(Q/D)=+0.22 *1* (1983RoZW).
161.9 *10*	<2.0	223.8	$7/2^+$	62.19	$5/2^+$		
173.8 *10*	<1.0	190.7	$5/2^+$	16.8	$3/2^+$		
177.0 *3*	13.5 *20*	2923.2	$31/2^-$	2746.2	$29/2^-$	(D)[&]	R(DCO)=0.74 *20*.
178.1 *3*	23 *4*	1114.4	$19/2^-$	936.3	$17/2^-$	D[&]	R(DCO)=0.74 *20*. δ(Q/D)=+0.15 *2* (1983RoZW).
186.2 *3*	42.0 *25*	310.51	$9/2^+$	124.32	$7/2^+$		
189.0 *3*	17.4 *11*	2802.3	$29/2^+$	2613.3	$27/2^+$		
191.4 *3*	14.0 *15*	1676.0	$23/2^-$	1484.6	$21/2^-$	(D+Q)[&]	R(DCO)=0.86 *18*. δ(Q/D)=+0.18 *9* (1983RoZW).
196.5 *3*	36.2 *20*	491.3	$13/2^-$	294.8	$11/2^-$	(D)[&]	R(DCO)=0.76 *20*. δ(Q/D)=+0.03 *2* (1983RoZW).
196.7[b]		1935.0	$(17/2^+)$	1738.3	$(13/2^+)$		
197.1 *5*	61 *22*	3318.7	$35/2^-$	3121.6	$33/2^-$	(D)[&]	R(DCO)=0.76 *20*.
198.4 *5*	42 *15*	3121.6	$33/2^-$	2923.2	$31/2^-$	(D)[&]	R(DCO)=0.76 *20*.
200.4 *3*	15.6 *8*	3002.7	$31/2^+$	2802.3	$29/2^+$		
203.3 *3*	8.0 *10*	2305.9	$27/2^-$	2102.6	$25/2^-$	(D+Q)	Mult.: $\Delta J=1$, D+Q transition from $\gamma(\theta)$ (1983RoZW). δ(Q/D)=+0.30 *8* (1983RoZW).
209.9 *3*	13.3 *10*	520.41	$11/2^+$	310.51	$9/2^+$		
214.1 *3*	17.2 *9*	2613.3	$27/2^+$	2399.1	$25/2^+$		
230.9 *3*	48.4 *20*	3549.6	$37/2^-$	3318.7	$35/2^-$	(D)[&]	R(DCO)=0.71 *18*. δ(Q/D)=+0.25 *5* (1983RoZW).
232.6 *5*	5 *3*	249.4	$7/2^+$	16.8	$3/2^+$		
234.1 *3*	6.4 *12*	754.5	$13/2^+$	520.41	$11/2^+$		
238.6 *3*	10.8 *7*	3482.4	$35/2^+$	3243.8	$33/2^+$		
241.1 *3*	11.3 *10*	3243.8	$33/2^+$	3002.7	$31/2^+$		
253.2 *3*	8.0 *13*	1007.7	$15/2^+$	754.5	$13/2^+$		
260.6 *3*	15.4 *15*	2399.1	$25/2^+$	2138.6	$23/2^+$		
264.0 *5*	3.0 *10*	2199.0	$(21/2^+)$	1935.0	$(17/2^+)$		
268.1 *10*	<4	3121.6	$33/2^-$	2853.5	$(29/2^-)$		
270.7 *3*	34.5 *15*	3820.3	$39/2^-$	3549.6	$37/2^-$	(D)[&]	R(DCO)=0.80 *15*. δ(Q/D)=+0.22 *3* (1983RoZW).
271.9 *3*	3.7 *5*	2138.6	$23/2^+$	1866.7	$21/2^+$		
274.2 *3*	4.6 *9*	1281.9	$17/2^+$	1007.7	$15/2^+$		
278.3 *5*	<12	4066.6	$39/2^+$	3788.2	$37/2^+$		
279.2 *5*	3.0 *6*	1561.1	$19/2^+$	1281.9	$17/2^+$		
281.0 *5*	10.5 *15*	491.3	$13/2^-$	210.2	$9/2^-$	(Q)[@]	R(DCO)=0.92 *13*.
281.1 *5*	33 *4*	4101.4	$41/2^-$	3820.3	$39/2^-$	(D)[&]	R(DCO)=0.92 *13*.
292.5 *3*	43.0 *15*	936.3	$17/2^-$	643.8	$15/2^-$	D[&]	R(DCO)=0.99 *24*. δ(Q/D)=+0.03 *1* (1983RoZW).
296.5 *10*	<2.0	520.3	$9/2^+$	223.8	$7/2^+$		
298.7 *10*	<4	3318.7	$35/2^-$	3020.0	$(31/2^-)$		
305.6 *5*	7.7 *15*	1866.7	$21/2^+$	1561.1	$19/2^+$		

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^{139}La(^{28}Si,4nγ) 1992Sc03 (continued)

$\gamma(^{163}Lu)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
305.9 *5*	8.0 *20*	3788.2	37/2$^+$	3482.4	35/2$^+$		
313.7 *3*	6.9 *8*	4717.4	43/2$^+$	4403.9	41/2$^+$		
314.7 *3*	8.1 *9*	2513.7	(25/2$^+$)	2199.0	(21/2$^+$)		
327.4 *5*	12 *4*	4428.8	43/2$^-$	4101.4	41/2$^-$	(D)[&]	R(DCO)=0.80 *18*.
329.0 *5*	11.5 *12*	4757.8	45/2$^-$	4428.8	43/2$^-$	[&]	R(DCO)=0.80 *18*.
329.6 *5*	2.5 *15*	520.3	9/2$^+$	190.7	5/2$^+$		
330.5 *5*	6.0 *20*	5385.6	47/2$^+$	5055.0	45/2$^+$		
331.5 *5*	5.5 *20*	5717.1	49/2$^+$	5385.6	47/2$^+$		
337.4 *5*	7.9 *10*	4403.9	41/2$^+$	4066.6	39/2$^+$		
337.7 *5*	7.0 *10*	5055.0	45/2$^+$	4717.4	43/2$^+$		
345.3 *3*	6.1 *5*	6062.4	51/2$^+$	5717.1	49/2$^+$		
349.0 *3*	60.0 *20*	643.8	15/2$^-$	294.8	11/2$^-$	(E2)[@]	R(DCO)=0.82 *17*.
349.9 *3*	3.8 *7*	6412.3	53/2$^+$	6062.4	51/2$^+$		
370.2 *3*	24.2 *25*	1484.6	21/2$^-$	1114.4	19/2$^-$	(D)[&]	R(DCO)=0.82 *18*. δ(Q/D)=+0.05 *3* (1983RoZW).
370.5 *5*	5 *3*	620.0	11/2$^+$	249.4	7/2$^+$		
371.2 *3*	10.9 *25*	5129.0	47/2$^-$	4757.8	45/2$^-$		
373.0 *3*	9.0 *20*	5502.0	49/2$^-$	5129.0	47/2$^-$		
373.6 *3*	6.3 *5*	6785.9	55/2$^+$	6412.3	53/2$^+$		
375.4 *5*	8 *3*	3121.6	33/2$^-$	2746.2	29/2$^-$		
385.6 *3*	3.5 *3*	7171.5	57/2$^+$	6785.9	55/2$^+$		
386.0 *3*	9.5 *10*	2899.7	(29/2$^+$)	2513.7	(25/2$^+$)		
389.4 *3*	8.6 *5*	3002.7	31/2$^+$	2613.3	27/2$^+$		
395.5 *5*	12 *4*	3318.7	35/2$^-$	2923.2	31/2$^-$		
396.1 *3*	22.1 *20*	520.41	11/2$^+$	124.32	7/2$^+$	(Q)	Mult.: ΔJ=2, Q from $\gamma(\theta)$ (1983RoZW).
396.2 *5*	<2	620.0	11/2$^+$	223.8	7/2$^+$		
403.1 *3*	14.0 *12*	2802.3	29/2$^+$	2399.1	25/2$^+$		
410.1 *3*	7.1 *10*	7581.5	59/2$^+$	7171.5	57/2$^+$		
411.4 *3*	10.4 *12*	5913.4	51/2$^-$	5502.0	49/2$^-$		
416.9 *3*	9.5 *12*	6330.3	53/2$^-$	5913.4	51/2$^-$		
426.6 *3*	19 *3*	2102.6	25/2$^-$	1676.0	23/2$^-$	(D)	Mult.: ΔJ=1, D(+Q) transition from $\gamma(\theta)$ (1983RoZW). δ(Q/D)=+0.07 *5* (1983RoZW).
427.3 *3*	4.8 *5*	8008.8	61/2$^+$	7581.5	59/2$^+$		
428.0 *3*	18.0 *22*	3549.6	37/2$^-$	3121.6	33/2$^-$		
440.3 *3*	14 *4*	2746.2	29/2$^-$	2305.9	27/2$^-$	(D)	Mult.: ΔJ=1, D(+Q) transition from $\gamma(\theta)$ (1983RoZW). δ(Q/D)=−0.01 *13* (1983RoZW).
441.5 *3*	13.0 *20*	3243.8	33/2$^+$	2802.3	29/2$^+$		
444.0 *3*	23.7 *20*	754.5	13/2$^+$	310.51	9/2$^+$		
445.0 *3*	39.0 *16*	936.3	17/2$^-$	491.3	13/2$^-$		
447.0 *5*	3.5 *10*	967.3	13/2$^+$	520.3	9/2$^+$		
448.2 *5*	2.0 *10*	8457.0	63/2$^+$	8008.8	61/2$^+$		
450.0 *3*	9.5 *12*	3349.7	(33/2$^+$)	2899.7	(29/2$^+$)		
470.6 *3*	100.0 *20*	1114.4	19/2$^-$	643.8	15/2$^-$	E2[@]	R(DCO)=1.16 *12*.
474.7 *3*	10.3 *8*	2613.3	27/2$^+$	2138.6	23/2$^+$		
479.7 *3*	12.3 *6*	3482.4	35/2$^+$	3002.7	31/2$^+$		
485.7 *5*	6.0 *25*	1105.7	15/2$^+$	620.0	11/2$^+$		
487.3 *3*	23 *3*	1007.7	15/2$^+$	520.41	11/2$^+$		
x492[a]							
501.6 *3*	24.2 *20*	3820.3	39/2$^-$	3318.7	35/2$^-$	(Q)[@]	R(DCO)=0.94 *11*.
514.9 *3*	10.0 *10*	3864.6	(37/2$^+$)	3349.7	(33/2$^+$)		
527.4 *3*	18.8 *19*	1281.9	17/2$^+$	754.5	13/2$^+$		
532.5 *3*	6.5 *6*	2399.1	25/2$^+$	1866.7	21/2$^+$		
533.9 *5*	5.0 *15*	1501.2	17/2$^+$	967.3	13/2$^+$		Placement from 2002Je05.
544.5 *3*	11.4 *10*	3788.2	37/2$^+$	3243.8	33/2$^+$		

Continued on next page (footnotes at end of table)

^{139}La(^{28}Si,4nγ) 1992Sc03 (continued)

$\gamma(^{163}Lu)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
548.3 *3*	26 *3*	1484.6	21/2$^-$	936.3	17/2$^-$	(E2)	Mult.: ΔJ=2, Q from $\gamma(\theta)$ (1983RoZW).
551.8 *3*	30.0 *25*	4101.4	41/2$^-$	3549.6	37/2$^-$	(Q)[@]	R(DCO)=0.82 *21*.
553.4 *3*	23.2 *15*	1561.1	19/2$^+$	1007.7	15/2$^+$		
561.6 *3*	105.9 *22*	1676.0	23/2$^-$	1114.4	19/2$^-$	E2[@]	R(DCO)=1.01 *11*.
562.8 *5*	4.0 *20*	1668.5	19/2$^+$	1105.7	15/2$^+$		
577.5 *3*	20.1 *18*	2138.6	23/2$^+$	1561.1	19/2$^+$		
x578[a]							
578.1 *3*	10.5 *10*	4442.7	(41/2$^+$)	3864.6	(37/2$^+$)		
584.2 *5*	<15	4066.6	39/2$^+$	3482.4	35/2$^+$		
584.8 *5*	25 *3*	1866.7	21/2$^+$	1281.9	17/2$^+$		
606.9 *5*	3.5 *23*	2275.4	23/2$^+$	1668.5	19/2$^+$		
608.5 *5*	17 *4*	4428.8	43/2$^-$	3820.3	39/2$^-$	Q[@]	R(DCO)=1.16 *14*.
615.7 *3*	11.0 *15*	4403.9	41/2$^+$	3788.2	37/2$^+$		
617.3 *5*	90 *15*	2923.2	31/2$^-$	2305.9	27/2$^-$	Q[@]	R(DCO)=0.95 *10*.
618.0 *5*	24 *4*	2102.6	25/2$^-$	1484.6	21/2$^-$	Q[@]	R(DCO)=0.95 *10*.
629.9 *3*	86.3 *22*	2305.9	27/2$^-$	1676.0	23/2$^-$	E2[@]	R(DCO)=1.21 *10*.
638.7 *3*	9.5 *10*	5081.4	(45/2$^+$)	4442.7	(41/2$^+$)		
643.6 *3*	23.9 *12*	2746.2	29/2$^-$	2102.6	25/2$^-$	(Q)[@]	R(DCO)=1.0 *3*.
650.6 *5*	15 *4*	4717.4	43/2$^+$	4066.6	39/2$^+$		
650.9 *5*	15 *4*	5055.0	45/2$^+$	4403.9	41/2$^+$		
656.4 *3*	17.6 *15*	4757.8	45/2$^-$	4101.4	41/2$^-$	[@]	R(DCO)=1.0 *3*.
662.0 *3*	10.8 *11*	5717.1	49/2$^+$	5055.0	45/2$^+$		
668.2 *3*	11.1 *12*	5385.6	47/2$^+$	4717.4	43/2$^+$		
676.8 *3*	10.3 *6*	6062.4	51/2$^+$	5385.6	47/2$^+$		
695.2 *3*	10.2 *9*	6412.3	53/2$^+$	5717.1	49/2$^+$		
697.0 *3*	9.0 *10*	5778.4	(49/2$^+$)	5081.4	(45/2$^+$)		
697.8[b]		2199.0	(21/2$^+$)	1501.2	17/2$^+$		
700.2 *3*	15.2 *20*	5129.0	47/2$^-$	4428.8	43/2$^-$		
714.1 *10*	<4	3020.0	(31/2$^-$)	2305.9	27/2$^-$		
723.1 *3*	9.0 *10*	2399.1	25/2$^+$	1676.0	23/2$^-$	D[&]	R(DCO)=0.58 *22*.
723.5 *5*	5.5 *20*	6785.9	55/2$^+$	6062.4	51/2$^+$		
744.2 *3*	22 *3*	5502.0	49/2$^-$	4757.8	45/2$^-$		
750.9 *10*	<4	2853.5	(29/2$^-$)	2102.6	25/2$^-$		
752.0 *3*	7.0 *8*	6530.4	(53/2$^+$)	5778.4	(49/2$^+$)		
759.2 *3*	8.6 *6*	7171.5	57/2$^+$	6412.3	53/2$^+$		
784.5 *3*	14.3 *15*	5913.4	51/2$^-$	5129.0	47/2$^-$		
795.7 *3*	7.0 *6*	7581.5	59/2$^+$	6785.9	55/2$^+$		
805.2 *3*	5.2 *6*	7335.6	(57/2$^+$)	6530.4	(53/2$^+$)		
828.3 *3*	16.0 *18*	6330.3	53/2$^-$	5502.0	49/2$^-$		
837.3 *3*	8.5 *8*	8008.8	61/2$^+$	7171.5	57/2$^+$		
857.7 *3*	3.3 *5*	8193.3	(61/2$^+$)	7335.6	(57/2$^+$)		
872.2 *3*	11.9 *10*	6785.7	55/2$^-$	5913.4	51/2$^-$		
875.5 *3*	8.6 *10*	8457.0	63/2$^+$	7581.5	59/2$^+$		
908.4 *5*	1.4 *8*	9101.7	(65/2$^+$)	8193.3	(61/2$^+$)		
913.1 *3*	9.8 *10*	7243.4	57/2$^-$	6330.3	53/2$^-$		
915.6 *3*	4.0 *5*	8924.4	65/2$^+$	8008.8	61/2$^+$		
939.6 *3*	10.0 *17*	7725.3	59/2$^-$	6785.7	55/2$^-$		
948.6 *3*	5.0 *5*	9405.6	67/2$^+$	8457.0	63/2$^+$		
961.9 *5*	2.6 *10*	10063.6	(69/2$^+$)	9101.7	(65/2$^+$)		
975.7 *3*	7.0 *8*	8219.1	61/2$^-$	7243.4	57/2$^-$		
990.3 *3*	4.1 *4*	9914.7	69/2$^+$	8924.4	65/2$^+$		
1018.2 *3*	2.7 *5*	10423.8	71/2$^+$	9405.6	67/2$^+$		
1062.1 *3*	3.3 *4*	10976.8	73/2$^+$	9914.7	69/2$^+$		

Continued on next page (footnotes at end of table)

^{139}La(^{28}Si,4nγ) 1992Sc03 (continued)

$\gamma(^{163}Lu)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π
1076.9 *3*	4.1 *7*	11500.7	$75/2^+$	10423.8	$71/2^+$
1117.4 *10*	1.5 *15*	12094.2	$77/2^+$	10976.8	$73/2^+$
1120.8 *10*	1.5 *15*	12621.6	$79/2^+$	11500.7	$75/2^+$
1160.4 *10*	2.0 *15*	13254.6?	$81/2^+$	12094.2	$77/2^+$
1225.4 *10*		14480.0?	$85/2^+$	13254.6?	$81/2^+$

[†] Uncertainties are 0.3 for strong and well resolved lines, 0.5 for doublets and when intensity uncertainty is ≥25%, and 1.0 for weak or uncertain lines.
[‡] Uncertainties are 5-10%, but a few intense Iγ′s (230.9γ, 292.5γ, 349.0γ, 445.0γ, 470.6γ, 561.6γ, 629.9γ) are quoted (1992Sc03) with 2-4% uncertainty.
[#] From Adopted Gammas.
[@] DCO ratio is consistent with ΔJ=2 (E2).
[&] DCO ratio is consistent with ΔJ=1 (dipole), but ΔJ=2 does not seem to be ruled out by the quoted R(DCO).
[a] A possible 492-578 cascade proposed by 1992Sc03 above the 486-563-607 cascade is given in the level scheme of 2002Je05 also, but higher up in the 1/2[411] band.
[b] From 2002Je05.
[x] γ ray not placed in level scheme.

^{139}La(^{28}Si,4nγ) 1992Sc03

Level Scheme

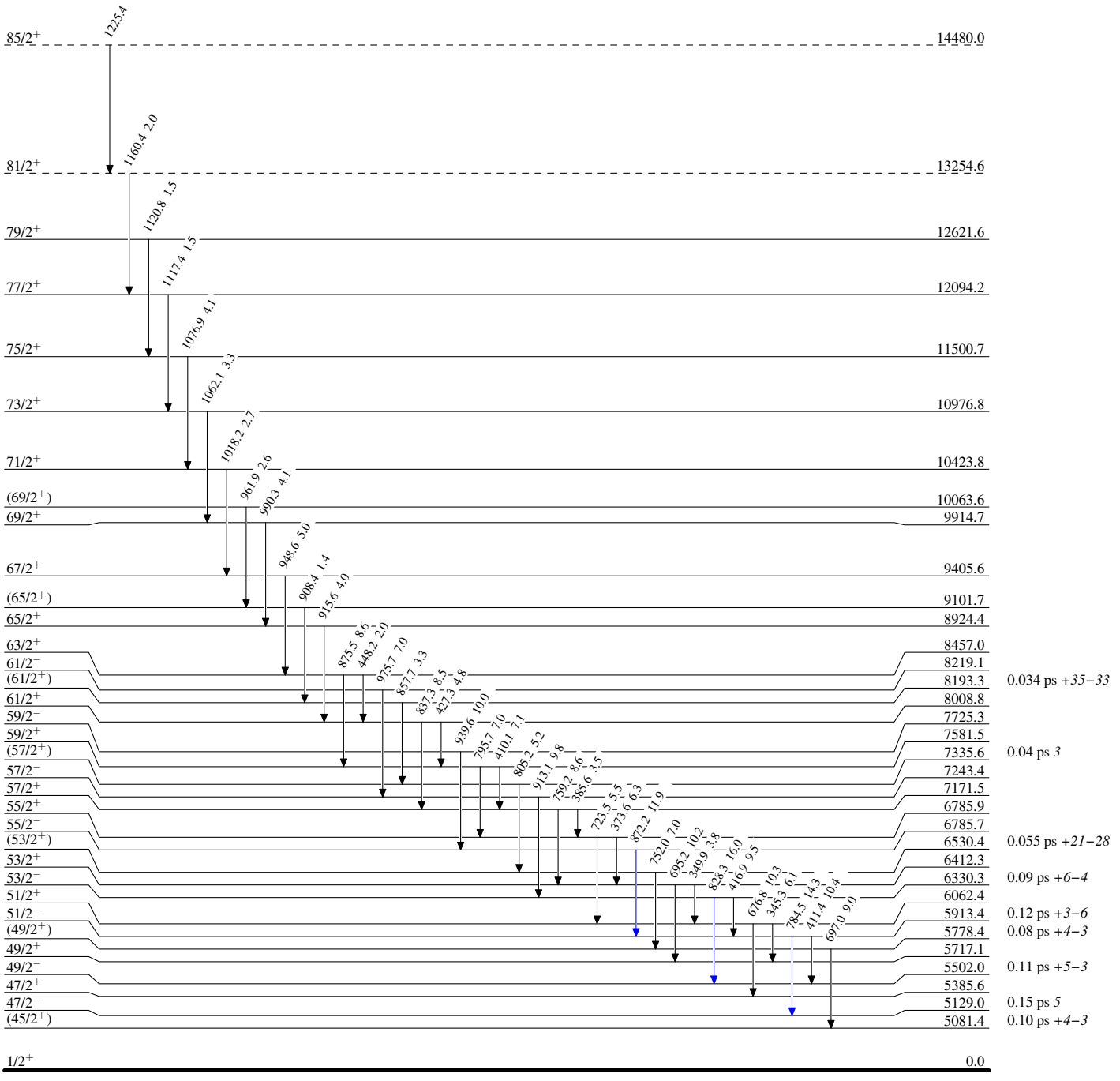
Intensities: Relative I_γ

Legend

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

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

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



$^{163}_{71}Lu_{92}$

^{139}La(^{28}Si,4nγ) 1992Sc03

Level Scheme (continued)

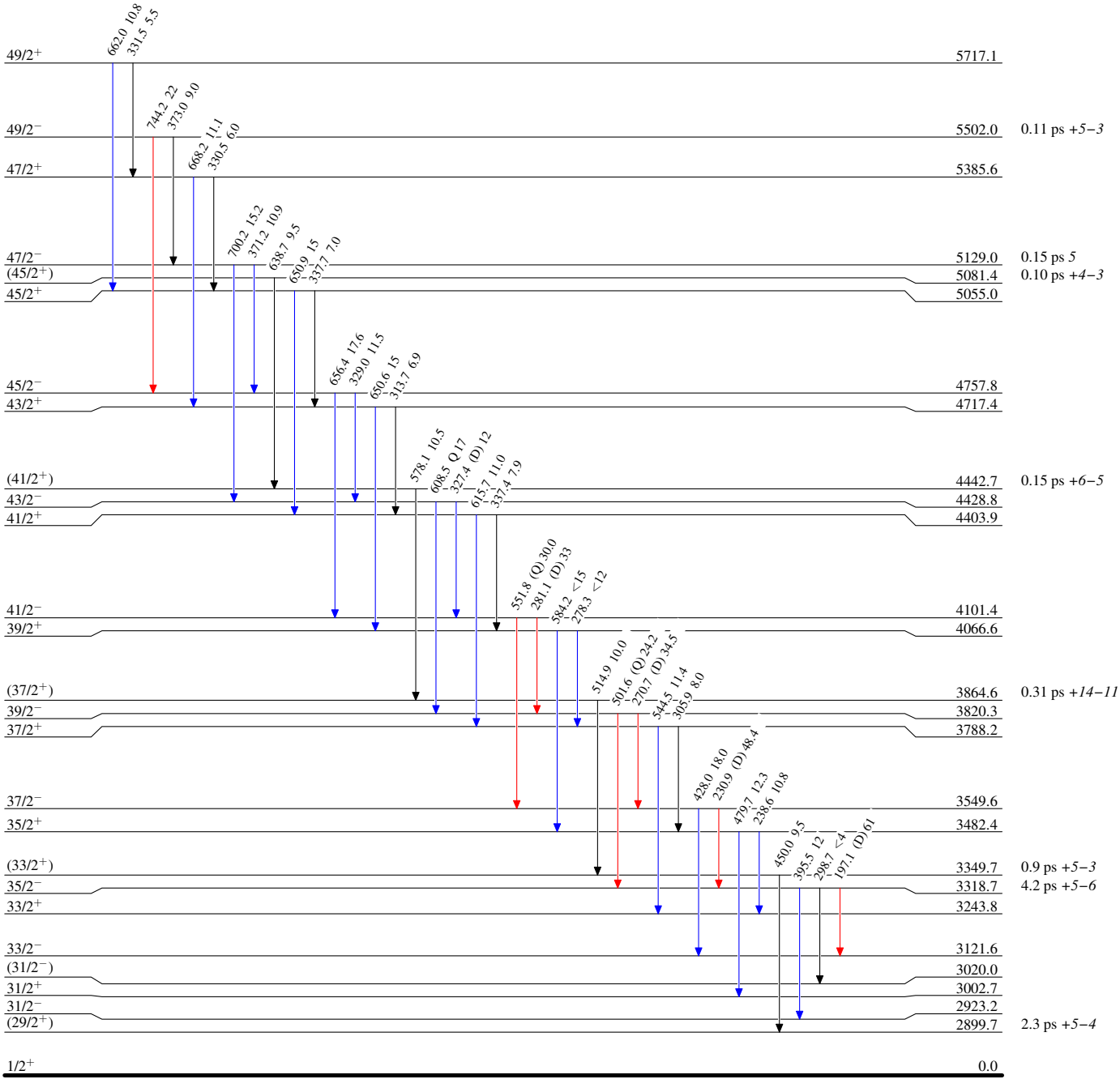
Intensities: Relative I_γ

Legend

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

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

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



$^{163}_{71}Lu_{92}$

^{139}La(^{28}Si,4nγ) 1992Sc03

Level Scheme (continued)

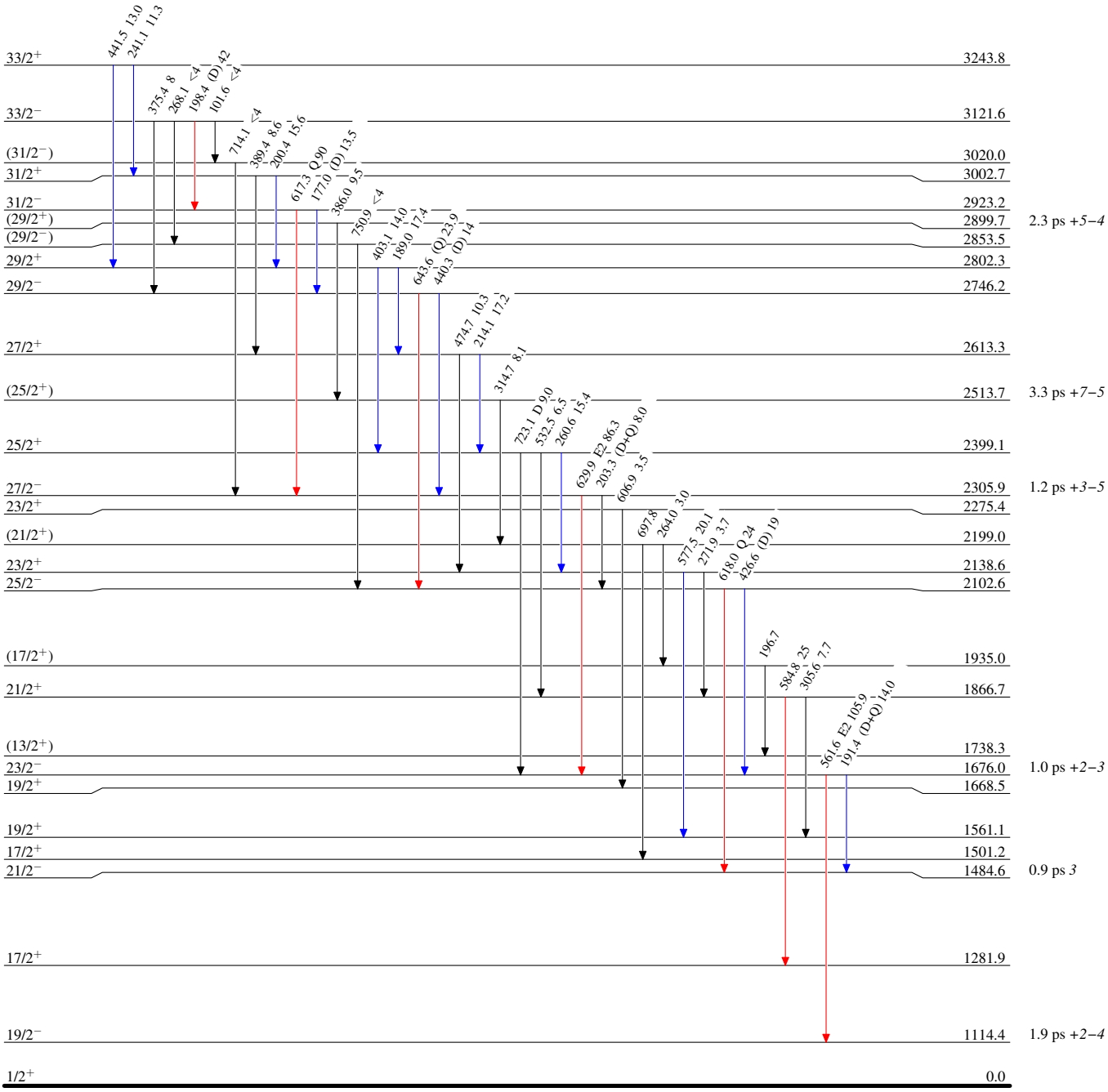
Intensities: Relative I_γ

Legend

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

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

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

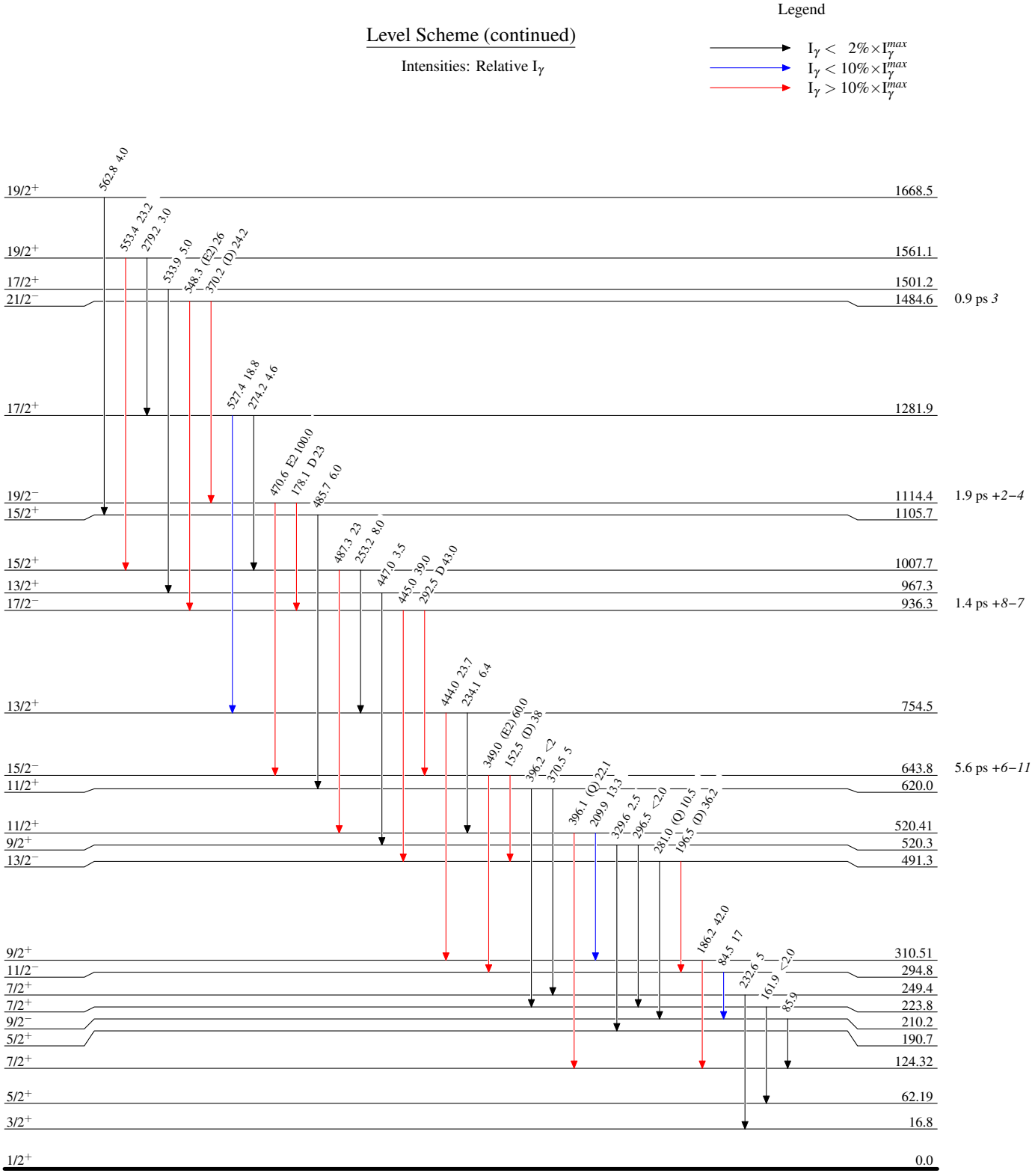


$^{163}_{71}Lu_{92}$

^{139}La(^{28}Si,4nγ) 1992Sc03

Level Scheme (continued)

Intensities: Relative I_γ

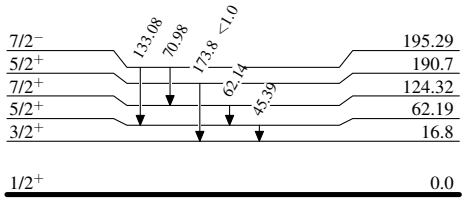


$^{163}_{71}Lu_{92}$

^{139}La(^{28}Si,4nγ) 1992Sc03

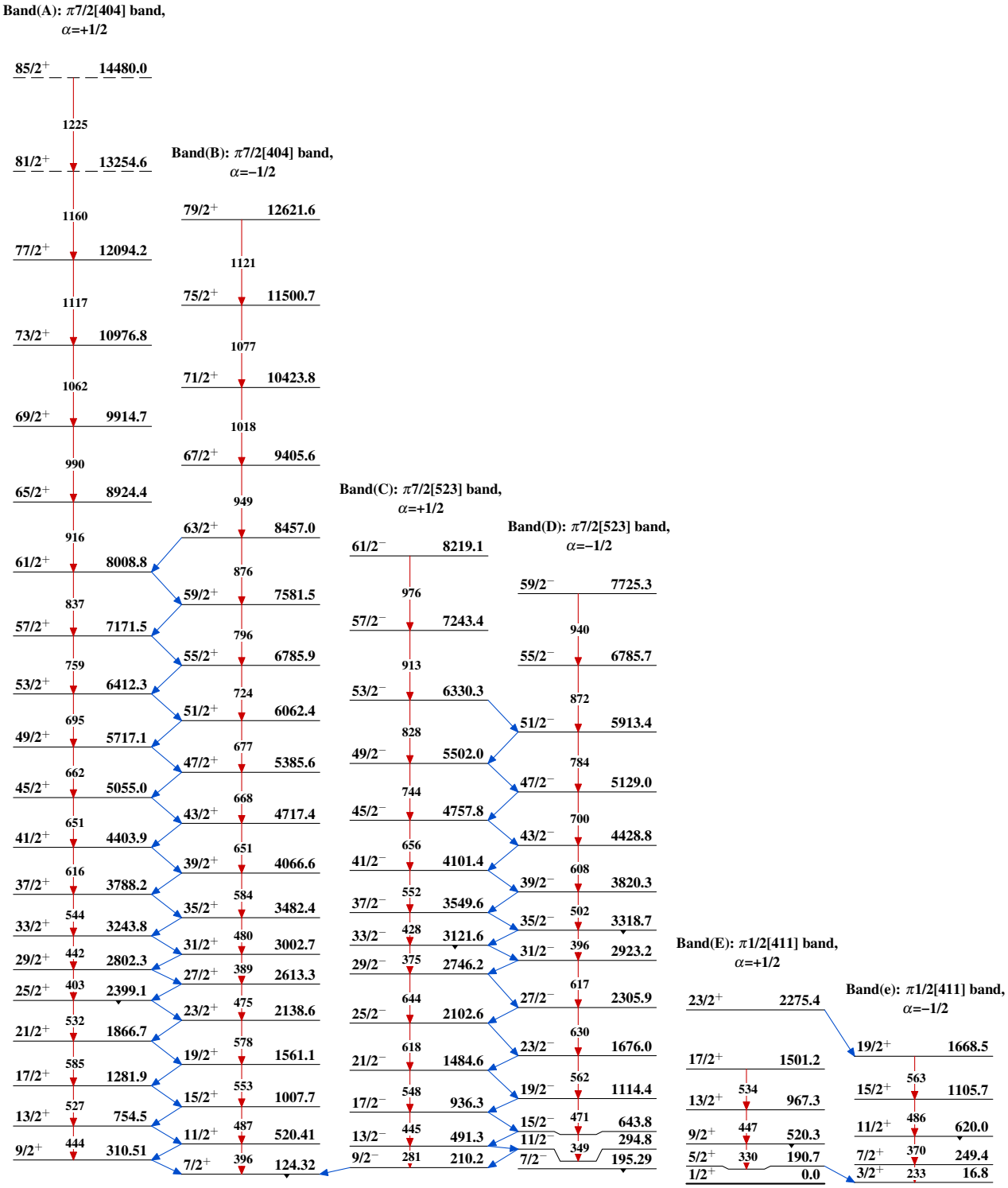
Level Scheme (continued)

Intensities: Relative I_γ



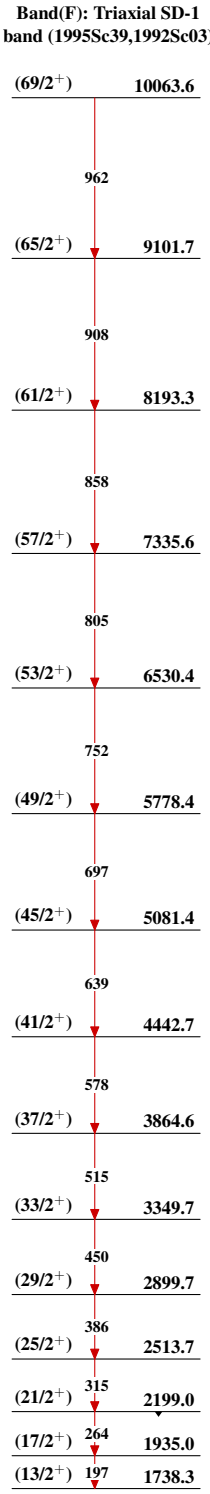
$^{163}_{71}Lu_{92}$

^{139}La(^{28}Si,4nγ) 1992Sc03



$^{163}_{71}Lu_{92}$

^{139}La(^{28}Si,4nγ) 1992Sc03 (continued)



$^{163}_{71}Lu_{92}$