^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen[#]	NDS 147, 1 (2018)	30-Nov-2017

1997Ca29 (also 1996Ca03): E(^{30}Si)=157 MeV, E(^{29}Si)=145 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO) with GASP array of 35 Compton-suppressed Ge detectors and two planar detectors.

^{164}Lu Levels

E(level)[†]	J$^{\pi}$[‡]	Comments
0+x[b]	(8$^+$)	Additional information 1.
104.12+x[c] 22	(9$^+$)	According to Adopted Levels, this level should be at 130 keV, with 104.1γ and 119.5γ to lower levels, the latter γ is shown to deexcite this level in figure 7 of 1997Ca29. See details in Adopted Levels.
173.2+x[#] 5	(10$^-$)	
245.05+x[b] 22	(10$^+$)	
266.4+x[@] 5	(11$^-$)	
413.28+x[c] 23	(11$^+$)	
431.8+x[#] 5	(12$^-$)	
594.0+x[@] 5	(13$^-$)	
623.65+x[b] 23	(12$^+$)	
830.9+x[#] 5	(14$^-$)	
848.41+x[c] 24	(13$^+$)	
1057.2+x[@] 5	(15$^-$)	
1115.37+x[b] 25	(14$^+$)	
1341.8+x[#] 5	(16$^-$)	
1382.40+x[c] 25	(15$^+$)	
1625.8+x[@] 5	(17$^-$)	
1690.0+x[b] 3	(16$^+$)	
1938.5+x[#] 5	(18$^-$)	
1987.9+x[c] 3	(17$^+$)	
2021.8+x[&] 4	(16$^+$)	
2206.8+x[a] 4	(17$^+$)	
2270.3+x[@] 5	(19$^-$)	
2314.2+x[b] 3	(18$^+$)	
2413.2+x[&] 4	(18$^+$)	
2595.0+x[#] 5	(20$^-$)	
2621.1+x[c] 3	(19$^+$)	
2635.6+x[a] 4	(19$^+$)	
2873.3+x[&] 4	(20$^+$)	
2919.1+x[b] 4	(20$^+$)	
2958.7+x[@] 5	(21$^-$)	
3140.5+x[a] 4	(21$^+$)	
3208.3+x[c] 4	(21$^+$)	
3281.9+x[#] 5	(22$^-$)	
3424.3+x[&] 4	(22$^+$)	
3519.0+x[b] 4	(22$^+$)	
3659.1+x[@] 5	(23$^-$)	
3746.3+x[a] 4	(23$^+$)	
3836.7+x[c] 4	(23$^+$)	

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^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29 (continued)

^{164}Lu Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	Comments
3979.1+x[#] 5	(24$^-$)	
4084.1+x[&] 5	(24$^+$)	
4182.7+x[b] 4	(24$^+$)	
4367.5+x[@] 5	(25$^-$)	
4452.6+x[a] 5	(25$^+$)	
4537.2+x[c] 4	(25$^+$)	
4701.9+x[#] 5	(26$^-$)	
4844.9+x[&] 5	(26$^+$)	
4920.4+x[b] 5	(26$^+$)	
5115.2+x[@] 5	(27$^-$)	
5243.5+x[a] 5	(27$^+$)	
5316.2+x[c] 5	(27$^+$)	
5476.6+x[#] 5	(28$^-$)	
5663.0+x[&] 6	(28$^+$)	
5734.4+x?[b] 11	(28$^+$)	
5925.7+x[@] 6	(29$^-$)	
6196.2+x?[c] 11	(29$^+$)	
6317.6+x?[#] 12	(30$^-$)	
0+y		Additional information 2.
152.1+y[d] 3		
553.3+y[d] 4		
1058.9+y[d] 5		
1644.7+y[d] 5		
2277.8+y[d] 6		
2926.5+y[d] 7		
3599.2+y[d] 7		

[†] From least-squares fit to Eγ data. The 0+x, (8$^+$) level corresponds to 25.9+x, (8$^+$) in Adopted Levels. The 152+y level corresponds to 297.4+x, (10$^+$) in Adopted Levels and 152γ is not confirmed. Also 672.7γ from 3599.2+y level is not confirmed in 2007Br09.

[‡] As suggested by 1997Ca29. The assignments are based on $\gamma\gamma(\theta)$(DCO) data and band associations from $\gamma\gamma$ coin data.

[#] Band(A): π(9/2[514] or 7/2[523])$\otimes\nu i_{13/2}$,α=0.

[@] Band(a): π(9/2[514] or 7/2[523])$\otimes\nu i_{13/2}$,α=1.

[&] Band(B): π7/2[404]$\otimes\nu i_{13/2}\otimes\nu i^2_{13/2}$,$\alpha$=0.

[a] Band(b): π7/2[404]$\otimes\nu i_{13/2}\otimes\nu i^2_{13/2}$,$\alpha$=1.

[b] Band(C): $\pi h_{11/2}\otimes\nu$(3/2[521] or 5/2[523]),α=0.

[c] Band(c): $\pi h_{11/2}\otimes\nu$(3/2[521] or 5/2[523]),α=1.

[d] Band(D): π1/2[541]$\otimes\nu i_{13/2}$ (?). Uncertain band assignment.

^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29 (continued)

γ(^{164}Lu)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
93.1 *1*	21.9	266.4+x	(11$^-$)	173.2+x	(10$^-$)	D	DCO=0.74 *12*
104.1 *3*	8.7	104.12+x	(9$^+$)	0+x	(8$^+$)	D	DCO=0.62 *15*
140.9 *1*	22.9	245.05+x	(10$^+$)	104.12+x	(9$^+$)	D	DCO=0.60 *12*
152.1[@] *3*		152.1+y		0+y			E_γ: this γ ray is not confirmed in later studies.
162.1 *1*	110.0	594.0+x	(13$^-$)	431.8+x	(12$^-$)	D	DCO=0.74 *6*
165.5 *1*	100.0	431.8+x	(12$^-$)	266.4+x	(11$^-$)	D	DCO=0.71 *6*
168.2 *1*	29.5	413.28+x	(11$^+$)	245.05+x	(10$^+$)	D	DCO=0.62 *12*
184.9 *3*	3.3	2206.8+x	(17$^+$)	2021.8+x	(16$^+$)		
206.4 *3*	9.8	2413.2+x	(18$^+$)	2206.8+x	(17$^+$)		
210.3 *1*	33.8	623.65+x	(12$^+$)	413.28+x	(11$^+$)	D	DCO=0.72 *14*
222.5 *3*	7.8	2635.6+x	(19$^+$)	2413.2+x	(18$^+$)	(D)	DCO=0.81 *21*
224.7 *1*	21.9	848.41+x	(13$^+$)	623.65+x	(12$^+$)		
226.3 *1*	82.1	1057.2+x	(15$^-$)	830.9+x	(14$^-$)	D	DCO=0.65 *5*
237.0 *1*	104.3	830.9+x	(14$^-$)	594.0+x	(13$^-$)		
237.9 *3*	8.0	2873.3+x	(20$^+$)	2635.6+x	(19$^+$)		
245.1 *3*	4.3	245.05+x	(10$^+$)	0+x	(8$^+$)		Iγ(245)/Iγ(141)=0.21 *5*.
252.0 *3*	3.0	2873.3+x	(20$^+$)	2621.1+x	(19$^+$)		
258.6 *2*	14.4	431.8+x	(12$^-$)	173.2+x	(10$^-$)		Iγ(259)/Iγ(165)=0.16 *2*.
267.0 *2*	13.5	1115.37+x	(14$^+$)	848.41+x	(13$^+$)	D	DCO=0.56 *20*
267.0 *2*	14.0	1382.40+x	(15$^+$)	1115.37+x	(14$^+$)	(D)	DCO=0.76 *23*
267.2 *3*	6.6	3140.5+x	(21$^+$)	2873.3+x	(20$^+$)		
283.9 *1*	52.8	1625.8+x	(17$^-$)	1341.8+x	(16$^-$)	D	DCO=0.74 *10*
283.9 *3*	9.0	3424.3+x	(22$^+$)	3140.5+x	(21$^+$)		
284.6 *1*	74.4	1341.8+x	(16$^-$)	1057.2+x	(15$^-$)	D	DCO=0.78 *15*
289.2 *3*	5.6	3208.3+x	(21$^+$)	2919.1+x	(20$^+$)		
297.8 *3*	9.1	2919.1+x	(20$^+$)	2621.1+x	(19$^+$)		
298.0 *3*	8.0	1987.9+x	(17$^+$)	1690.0+x	(16$^+$)		
307.1 *3*	7.2	2621.1+x	(19$^+$)	2314.2+x	(18$^+$)		
307.8 *2*	10.3	1690.0+x	(16$^+$)	1382.40+x	(15$^+$)		
309.3 *2*	16.0	413.28+x	(11$^+$)	104.12+x	(9$^+$)		Iγ(309)/Iγ(168)=0.56 *7*.
310.6 *3*	6.0	3519.0+x	(22$^+$)	3208.3+x	(21$^+$)		
312.7 *1*	49.2	1938.5+x	(18$^-$)	1625.8+x	(17$^-$)	D	DCO=0.68 *10*
317.7 *3*	3.3	3836.7+x	(23$^+$)	3519.0+x	(22$^+$)		
320.1 *1*	21.2	3979.1+x	(24$^-$)	3659.1+x	(23$^-$)	D	DCO=0.60 *12*
322.0 *3*	5.5	3746.3+x	(23$^+$)	3424.3+x	(22$^+$)	(D)	DCO=0.84 *25*
323.0 *1*	30.6	3281.9+x	(22$^-$)	2958.7+x	(21$^-$)		
324.8 *1*	32.6	2595.0+x	(20$^-$)	2270.3+x	(19$^-$)		
326.3 *3*	7.6	2314.2+x	(18$^+$)	1987.9+x	(17$^+$)		
327.6 *1*	33.0	594.0+x	(13$^-$)	266.4+x	(11$^-$)	Q	DCO=1.2 *2* Iγ(328)/Iγ(162)=0.33 *7*.
331.8 *1*	36.4	2270.3+x	(19$^-$)	1938.5+x	(18$^-$)		
334.3 *2*	11.0	4701.9+x	(26$^-$)	4367.5+x	(25$^-$)	(D)	DCO=0.79 *25*
337.9 *3*	4.4	4084.1+x	(24$^+$)	3746.3+x	(23$^+$)		
346.1 *3*	3.3	4182.7+x	(24$^+$)	3836.7+x	(23$^+$)		
354.7 *3*	2.3	4537.2+x	(25$^+$)	4182.7+x	(24$^+$)		
361.5 *3*	7.0	5476.6+x	(28$^-$)	5115.2+x	(27$^-$)		
363.7 *1*	28.8	2958.7+x	(21$^-$)	2595.0+x	(20$^-$)	D	DCO=0.69 *17*
368.5 *3*	2.7	4452.6+x	(25$^+$)	4084.1+x	(24$^+$)		
377.3 *2*	15.9	3659.1+x	(23$^-$)	3281.9+x	(22$^-$)	(D)	DCO=0.67 *20*
378.6 *1*	26.8	623.65+x	(12$^+$)	245.05+x	(10$^+$)	Q	DCO=1.1 *2* Iγ(379)/Iγ(210)=0.83 *13*.
383.3 *3*	2.1	4920.4+x	(26$^+$)	4537.2+x	(25$^+$)		
388.3 *2*	15.4	4367.5+x	(25$^-$)	3979.1+x	(24$^-$)	(D)	DCO=0.75 *21*
391.6 *3*	8.3	2413.2+x	(18$^+$)	2021.8+x	(16$^+$)		Iγ(392)/Iγ(206)=0.45 *8*.
392.3 *3*	2.2	4844.9+x	(26$^+$)	4452.6+x	(25$^+$)		

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^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29 (continued)

γ(^{164}Lu) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
398.8 *3*	1.4	5243.5+x	(27^+)	4844.9+x	(26^+)		
399.1 *1*	50.0	830.9+x	(14^-)	431.8+x	(12^-)	Q	DCO=1.10 *20* Iγ(399)/Iγ(237)=0.50 *8*.
401.2 *2*	16.0	553.3+y		152.1+y		Q	DCO=1.2 *2*
413.2 *3*	9.4	5115.2+x	(27^-)	4701.9+x	(26^-)		
419.3 *3*	0.5	5663.0+x	(28^+)	5243.5+x	(27^+)		
428.6 *3*	4.5	2635.6+x	(19^+)	2206.8+x	(17^+)		Iγ(429)/Iγ(222)=0.59 *9*.
435.2 *1*	29.8	848.41+x	(13^+)	413.28+x	(11^+)	Q	DCO=1.19 *15* Iγ(435)/Iγ(225)=1.6 *2*.
449.0 *3*	4.0	5925.7+x	(29^-)	5476.6+x	(28^-)		
460.1 *3*	6.4	2873.3+x	(20^+)	2413.2+x	(18^+)	(Q)	DCO=0.94 *26* Iγ(460)/Iγ(238)=0.77 *15*.
463.2 *1*	89.4	1057.2+x	(15^-)	594.0+x	(13^-)	Q	DCO=1.19 *13* Iγ(226)/Iγ(463)=1.0 *1*.
491.7 *1*	29.2	1115.37+x	(14^+)	623.65+x	(12^+)	(Q)	DCO=0.96 *19* Iγ(492)/Iγ(267)=1.9 *3*.
505.0 *3*	6.4	3140.5+x	(21^+)	2635.6+x	(19^+)		Iγ(505)/Iγ(267)=0.94 *15*.
505.6 *2*	14.5	1058.9+y		553.3+y			
510.9 *1*	79.0	1341.8+x	(16^-)	830.9+x	(14^-)	(Q)	DCO=0.93 *12* Iγ(511)/Iγ(285)=0.91 *11*.
534.0 *1*	37.1	1382.40+x	(15^+)	848.41+x	(13^+)	(Q)	DCO=0.97 *16* Iγ(534)/Iγ(267)=2.4 *7*.
550.9 *3*	6.7	3424.3+x	(22^+)	2873.3+x	(20^+)		Iγ(551)/Iγ(284)=0.67 *10*.
568.6 *1*	78.5	1625.8+x	(17^-)	1057.2+x	(15^-)	(Q)	DCO=0.97 *15* Iγ(569)/Iγ(284)=1.6 *3*.
574.6 *1*	32.5	1690.0+x	(16^+)	1115.37+x	(14^+)		DCO=0.8 *3* Iγ(575)/Iγ(308)=2.9 *8*.
585.8 *2*	11.6	1644.7+y		1058.9+y			
587.2 *3*	7.6	3208.3+x	(21^+)	2621.1+x	(19^+)		Iγ(587)/Iγ(289)=1.1 *3*.
596.7 *1*	77.0	1938.5+x	(18^-)	1341.8+x	(16^-)	(Q)	DCO=1.0 *2* Iγ(597)/Iγ(312)=1.5 *2*.
600.0 *3*	7.8	3519.0+x	(22^+)	2919.1+x	(20^+)		Iγ(600)/Iγ(311)=1.5 *3*.
605.0 *3*	8.0	2919.1+x	(20^+)	2314.2+x	(18^+)		Iγ(605)/Iγ(298)=0.9 *3*.
605.4 *1*	53.0	1987.9+x	(17^+)	1382.40+x	(15^+)		Iγ(605)/Iγ(298)=6.3 *18*.
605.9 *3*	8.2	3746.3+x	(23^+)	3140.5+x	(21^+)		Iγ(606)/Iγ(322)=1.4 *3*.
624.3 *1*	28.5	2314.2+x	(18^+)	1690.0+x	(16^+)	Q	DCO=1.3 *3* Iγ(624)/Iγ(1326)=7.1 *17*.
628.3 *3*	9.9	3836.7+x	(23^+)	3208.3+x	(21^+)		Iγ(628)/Iγ(318)=2.9 *7*.
633.1 *3*	7.6	2277.8+y		1644.7+y			
633.2 *1*	24.2	2621.1+x	(19^+)	1987.9+x	(17^+)	(Q)	DCO=1.2 *3* Iγ(633)/Iγ(307)=3.1 *7*.
644.5 *1*	72.7	2270.3+x	(19^-)	1625.8+x	(17^-)	Q	DCO=1.08 *15* Iγ(644)/Iγ(332)=2.5 *4*.
647.8 *2*	11.8	2635.6+x	(19^+)	1987.9+x	(17^+)	Q	DCO=1.1 *2*
648.7 *3*	5.4	2926.5+y		2277.8+y			
656.5 *1*	56.6	2595.0+x	(20^-)	1938.5+x	(18^-)	Q	DCO=1.2 *2* Iγ(656)/Iγ(325)=1.7 *3*.
659.7 *3*	5.2	4084.1+x	(24^+)	3424.3+x	(22^+)		Iγ(660)/Iγ(338)=1.7 *3*.
663.8 *2*	16.3	4182.7+x	(24^+)	3519.0+x	(22^+)		Iγ(664)/Iγ(346)=5.0 *12*.
672.7 *3*	1.5	3599.2+y		2926.5+y			
687.0 *1*	59.7	3281.9+x	(22^-)	2595.0+x	(20^-)	Q	DCO=1.3 *2* Iγ(687)/Iγ(323)=2.4 *6*.
688.4 *1*	56.8	2958.7+x	(21^-)	2270.3+x	(19^-)	Q	DCO=1.10 *18* Iγ(688)/Iγ(364)=2.0 *4*.
697.0 *1*	39.4	3979.1+x	(24^-)	3281.9+x	(22^-)		Iγ(697)/Iγ(320)=1.9 *3*.
700.5 *1*	36.1	3659.1+x	(23^-)	2958.7+x	(21^-)		Iγ(700)/Iγ(377)=2.2 *4*.

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^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29 (continued)

γ(^{164}Lu) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
700.5 *2*	11.9	4537.2+x	(25^+)	3836.7+x	(23^+)		Iγ(700)/Iγ(355)=4.4 *8*.
706.1 *3*	6.3	4452.6+x	(25^+)	3746.3+x	(23^+)		Iγ(706)/Iγ(368)=2.5 *6*.
708.4 *1*	22.2	4367.5+x	(25^-)	3659.1+x	(23^-)		Iγ(708)/Iγ(388)=1.5 *3*.
722.9 *2*	19.9	4701.9+x	(26^-)	3979.1+x	(24^-)	Q	DCO=1.2 *2* Iγ(723)/Iγ(334)=1.6 *4*.
737.6 *2*	10.2	4920.4+x	(26^+)	4182.7+x	(24^+)		Iγ(738)/Iγ(383)=3.5 *6*.
747.8 *2*	10.7	5115.2+x	(27^-)	4367.5+x	(25^-)		Iγ(748)/Iγ(413)=1.1 *3*.
761.1 *3*	4.0	4844.9+x	(26^+)	4084.1+x	(24^+)		Iγ(761)/Iγ(392)=2.0 *4*.
774.6 *2*	14.4	5476.6+x	(28^-)	4701.9+x	(26^-)		Iγ(775)/Iγ(361)=1.7 *6*.
779.0 *2*	10.7	5316.2+x	(27^+)	4537.2+x	(25^+)		
790.6 *3*	4.0	5243.5+x	(27^+)	4452.6+x	(25^+)		Iγ(791)/Iγ(399)=3.2 *8*.
810.6 *3*	5.4	5925.7+x	(29^-)	5115.2+x	(27^-)		Iγ(811)/Iγ(449)=1.4 *5*.
814 [@] *1*	1.4	5734.4+x?	(28^+)	4920.4+x	(26^+)		E_γ: probably erroneous. Eγ=833.1 (1996Wa25).
818.3 *3*	1.7	5663.0+x	(28^+)	4844.9+x	(26^+)		Iγ(818)/Iγ(419)=2.8 *6*.
841 [@] *1*		6317.6+x?	(30^-)	5476.6+x	(28^-)		
864.9 *3*	6.1	2206.8+x	(17^+)	1341.8+x	(16^-)	D	DCO≤0.6
880 [@] *1*	2.3	6196.2+x?	(29^+)	5316.2+x	(27^+)		
964.6 *2*	10.1	2021.8+x	(16^+)	1057.2+x	(15^-)	D	DCO≤0.7

[†] Based on a general statement by 1997Ca29, the following the following uncertainties are assigned by evaluators: 0.1 keV for Iγ>20, 0.2 keV for Iγ=10-20 and 0.3 keV for Iγ<10.

[‡] From (^{29}Si,4nγ) at E=145 MeV. Uncertainty is 5 to 30%. Independent branching ratios determined from $\gamma\gamma$ coin data are given under comments. In most cases these ratios agree with those deduced from Iγ values.

[#] Assignments are by the evaluators, based on DCO data for 90° for one γ ray and 32°, 36°, 144°, 148° for the other γ ray, where with gates on ΔJ=2, quadrupole transitions, expected DCO ratios are ≈1.0 for ΔJ=2, quadrupole and ≈0.5 for ΔJ=1, dipole transitions. Assignment of mult=Q indicates ΔJ=2, quadrupole (most likely E2) and mult=D indicates ΔJ=1, dipole or dipole+quadrupole. It should be noted that DCO ratios here for ΔJ=1 transitions are generally larger than expected for pure dipole, indicating quadrupole (most likely E2) admixture in these transitions.

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

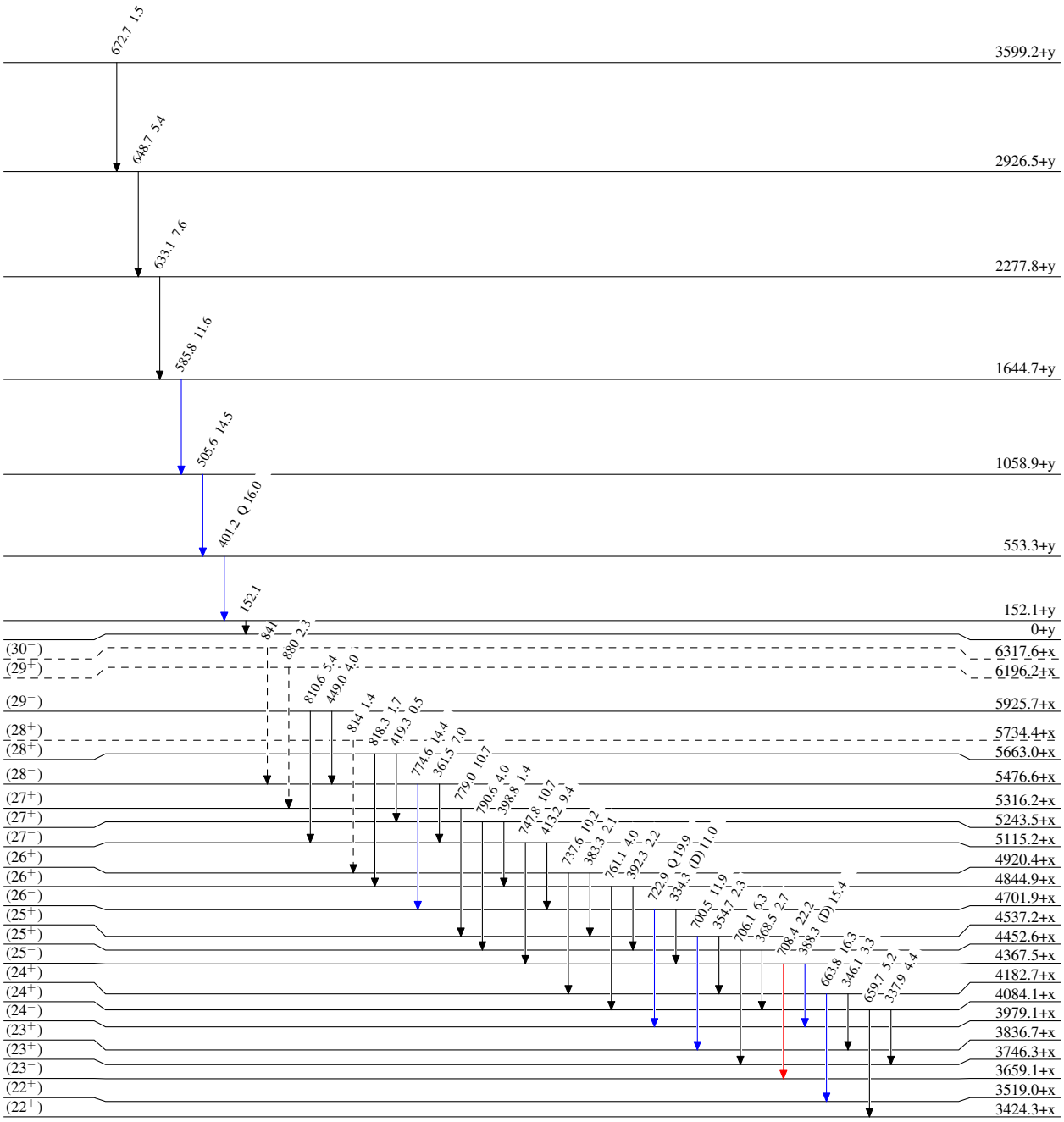
^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29

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)



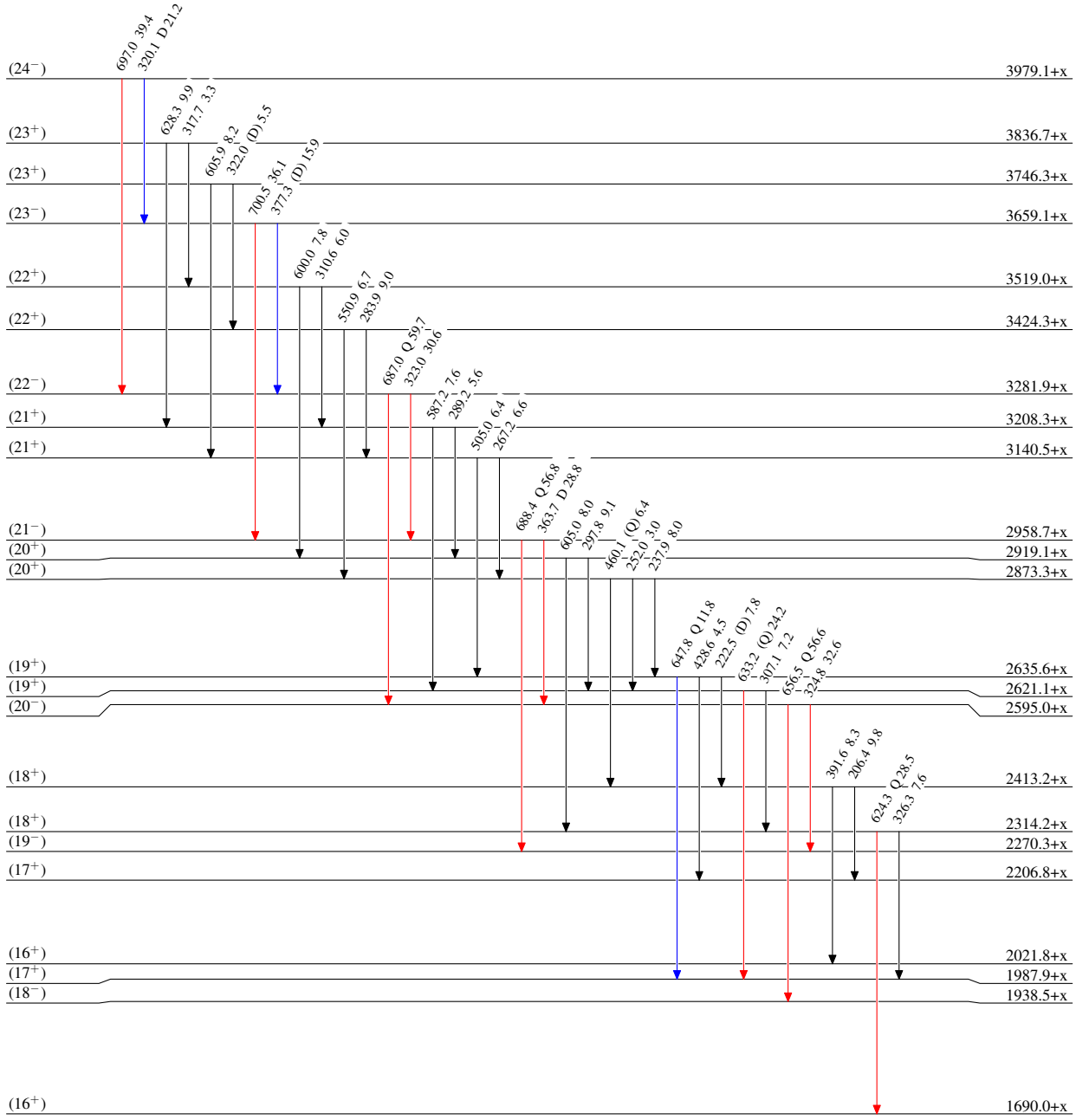
$^{164}_{71}Lu_{93}$

^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29

Level Scheme (continued)

Intensities: Relative I_γ

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



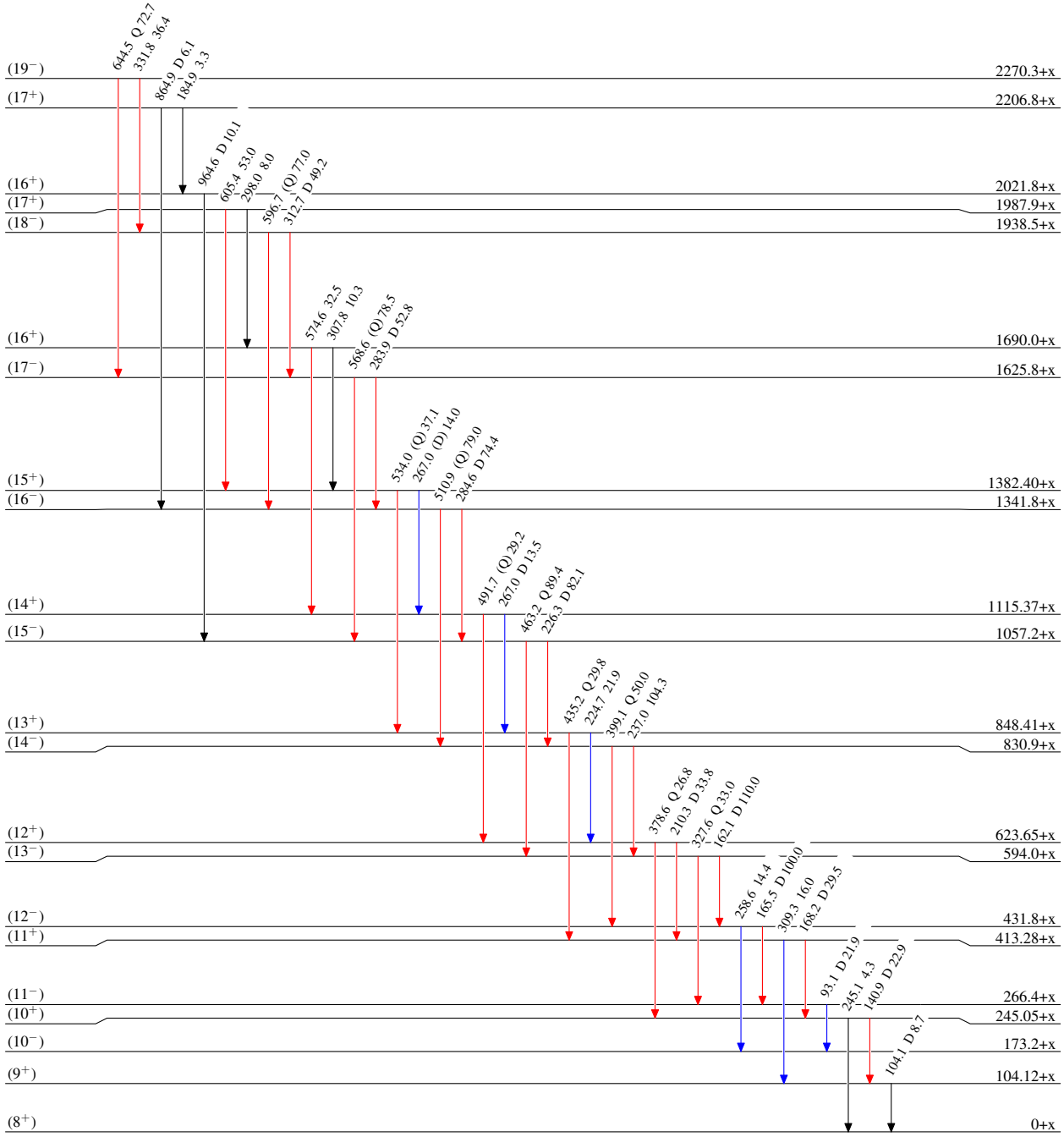
$^{164}_{71}Lu_{93}$

^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29

Level Scheme (continued)

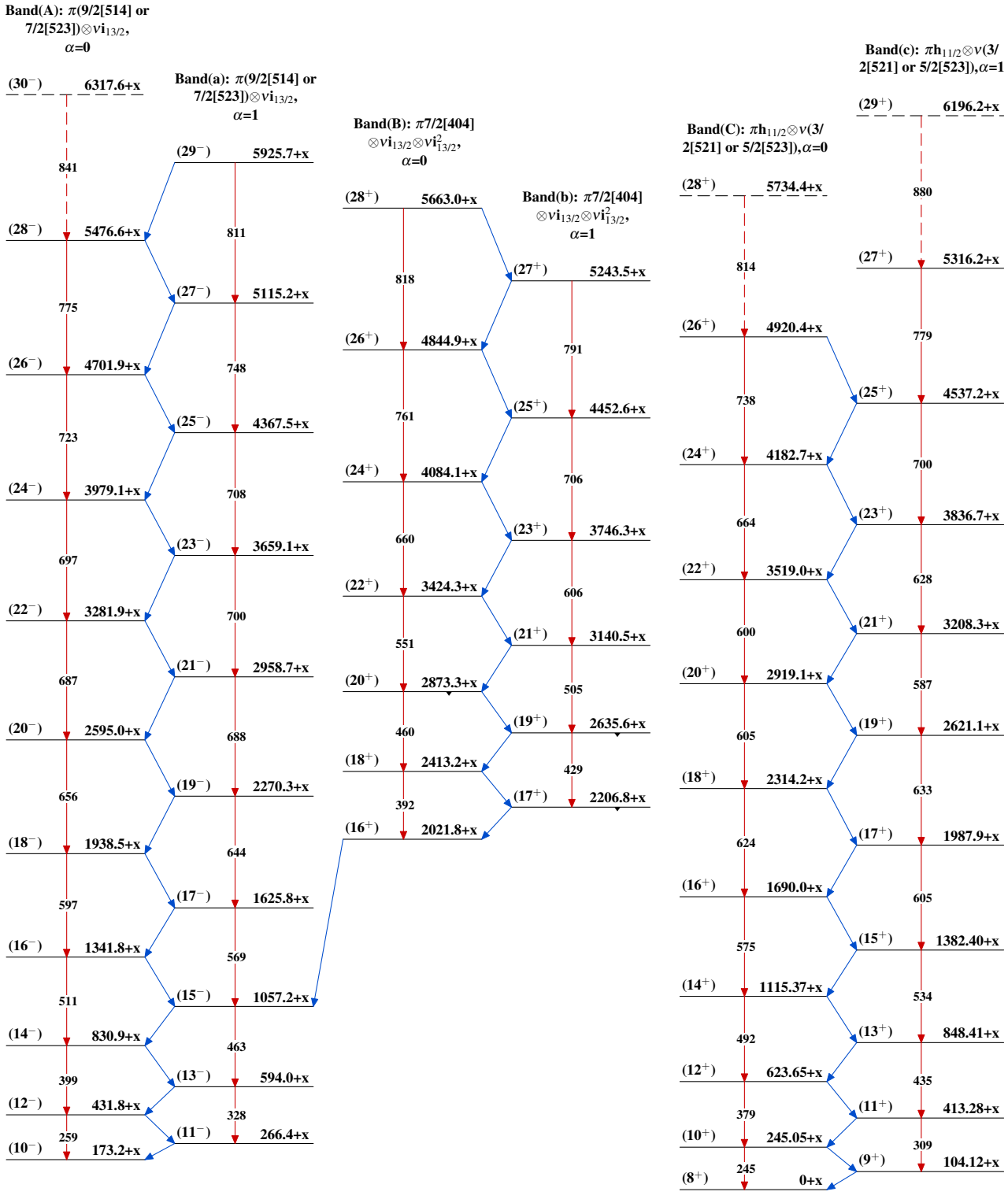
Intensities: Relative I_γ

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



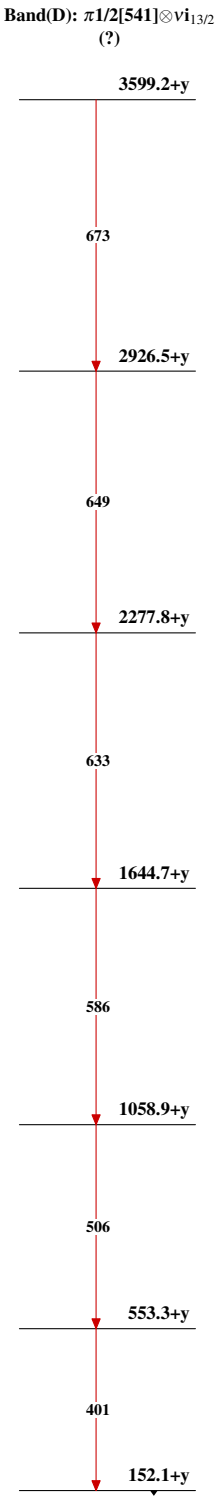
$^{164}_{71}Lu_{93}$

^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29



$^{164}_{71}Lu_{93}$

^{139}La(^{30}Si,5nγ),(^{29}Si,4nγ) 1997Ca29 (continued)



$^{164}_{71}Lu_{93}$