^{40}Ca(^{29}Si,2α2pγ) 2002Yu01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 151, 1 (2018)	1-Apr-2018

Enriched ^{40}Ca target; ^{29}Si beam, E=130 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO), lifetimes by centroid-shift Doppler-shift attenuation method using the Gammasphere array for γ rays and 95-element CsI detector array Microball for charged particles. Deduced transition quadrupole moments.

^{59}Ni Levels

E(level)†	J$^\pi$‡	Comments
0.0#	3/2$^-$	
339.3& *7*	5/2$^-$	
1337.8# *8*	7/2$^-$	
1767.4& *10*	9/2$^-$	
1948.0 *8*	7/2$^-$	
2705.0# *10*	11/2$^-$	
3054.7@ *9*	9/2$^+$	
3376.9& *11*	11/2$^-$	
3559.1a *11*	11/2$^-$	
4140.8a *12*	13/2$^-$	
4455.4@ *11*	13/2$^+$	
4946.3a *13*	15/2$^-$	
5251.4@ *15*	17/2$^+$	
5943.3a *17*		
8129.5@ *18*	21/2$^+$	
8129.5+xb	(21/2$^+$)	Additional information 1. E(level): This level is likely the same as 8129.5. However, 2002Yu01 note that there is a small possibility that unobserved weak and multipath connecting transitions from this level to the normal bands may exist.
9896.6+xb *9*	(25/2$^+$)	
10417.5+xc *9*	(23/2)	
11641.9+xc *10*	(27/2)	
11906.9+xb *12*	(29/2$^+$)	
13225.1+xc *12*	(31/2)	
14279.0+xb *14*	(33/2$^+$)	
15176.1+xc *14*	(35/2)	
16464.1+x *17*		
17582.1+xb *17*	(37/2$^+$)	
17682.2+xc *17*	(39/2)	
21100.3+xc *20*	(43/2)	
ye		Additional information 2.
1771.0+ye *10*		
2704.1+y *18*		
3652.1+ye *15*		
5802.1+ye *18*		
8379.2+ye *20*		
11439.3+ye *23*		
z		Additional information 3.
579.0+zd *15*		
1873.0+zd *10*		

Continued on next page (footnotes at end of table)

^{40}Ca(^{29}Si,2α2pγ) 2002Yu01 (continued)

^{59}Ni Levels (continued)

E(level)[†]
3608.1+z[d] *15*
5660.1+z[d] *18*
8020.2+z *20*
8185.2+z[d] *20*
11355.3+z[d] *23*

[†] From least-squares fit to γ-ray energies.
[‡] From 2002Yu01, based on γ-ray multipolarity, placement in the level scheme, and band assignment.
[#] Seq.(E): $3/2^-$ band.
[@] Seq.(F): $9/2^+$ band.
[&] Seq.(G): $5/2^-$ band.
[a] Seq.(H): Based on $11/2^-$.
[b] Band(A): Highly-deformed band-1, based on $(21/2^+)$. Proposed configuration=$\pi[(f_{7/2})^{-2}_6(p_{3/2}f_{5/2})\ ^2_4]\otimes\nu[(p_{3/2}f_{5/2})^2_4(g_{9/2})]$. Q(transition)=1.5 to 1.1.
[c] Band(B): Highly-deformed band-2, based on (23/2). Proposed configuration=$\pi[(f_{7/2})^{-2}_6(p_{3/2}$ or $f_{5/2})(g_{9/2})]\otimes\nu[(p_{3/2}f_{5/2})^2_4g_{9/2}]$. Q(transition)=2.0 to 1.1.
[d] Band(C): Highly-deformed band-3.
[e] Band(D): Highly-deformed band-4.

γ(^{59}Ni)

DCO's are averaged triple directional correlation ratios. DCO=Iγ(30°)/Iγ(30°)(γ_1) gated on γ_2,γ_3 at any θ. Expected DCO value of about 2 for quadrupole and 1 for dipole transitions.

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
339 *1*	100 *6*	339.3	$5/2^-$	0.0	$3/2^-$	D	DCO=1.16 *5*.
582 *1*	22 *4*	4140.8	$13/2^-$	3559.1	$11/2^-$		
672 *1*	14.8 *14*	3376.9	$11/2^-$	2705.0	$11/2^-$		
764 *1*	23 *4*	4140.8	$13/2^-$	3376.9	$11/2^-$		
796 *1*	48 *3*	5251.4	$17/2^+$	4455.4	$13/2^+$	Q	DCO=1.93 *9*.
806 *1*	38 *5*	4946.3	$15/2^-$	4140.8	$13/2^-$		
854 *1*	9.1 *34*	3559.1	$11/2^-$	2705.0	$11/2^-$		
897[&] *1*		15176.1+x	(35/2)	14279.0+x	$(33/2^+)$		
948 *1*	1.1 *1*	3652.1+y		2704.1+y			
997 *1*	9 *5*	5943.3		4946.3	$15/2^-$		
998 *1*	73 *5*	1337.8	$7/2^-$	339.3	$5/2^-$		
1107 *1*	23.2 *16*	3054.7	$9/2^+$	1948.0	$7/2^-$	D	DCO=1.11 *10*.
1224 *1*	6.3 *7*	11641.9+x	(27/2)	10417.5+x	(23/2)	Q	DCO=2.15 *10*.
1294 *1*	3.5 *4*	1873.0+z		579.0+z		Q	DCO=1.87 *11*.
1318 *1*		13225.1+x	(31/2)	11906.9+x	$(29/2^+)$		
1338 *1*	22.0 *16*	1337.8	$7/2^-$	0.0	$3/2^-$	Q	DCO=1.95 *7*.
1367 *1*	62 *4*	2705.0	$11/2^-$	1337.8	$7/2^-$	Q	DCO=1.94 *3*.
1401 *1*	30.0 *20*	4455.4	$13/2^+$	3054.7	$9/2^+$	Q	DCO=2.01 *16*.
1428 *1*	57 *4*	1767.4	$9/2^-$	339.3	$5/2^-$	Q	DCO=2.35 *7*.
1569 *1*	2.3 *23*	4946.3	$15/2^-$	3376.9	$11/2^-$		
1584 *1*	9.1 *11*	13225.1+x	(31/2)	11641.9+x	(27/2)	Q	DCO=2.11 *10*.
1609[@] *1*	19.3[@] *24*	1948.0	$7/2^-$	339.3	$5/2^-$		I_γ: from level scheme figure 1 of 2002Yu01, only

Continued on next page (footnotes at end of table)

^{40}Ca(^{29}Si,2α2pγ) 2002Yu01 (continued)

γ(^{59}Ni) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
							a small fraction of the total intensity of 1609γ belongs at this location. Adopted Iγ(1609)/Iγ(1948)=0.64 *8*.
1609[@] *1*	19.3[@] *24*	3376.9	11/2$^-$	1767.4	9/2$^-$		I_γ: from adopted Iγ(1609)/Iγ(672)=2.0.
1717 *1*	13.6 *13*	3054.7	9/2$^+$	1337.8	7/2$^-$	D	DCO=1.03 *7*.
1735 *1*	5.8 *6*	3608.1+z		1873.0+z		Q	DCO=1.92 *10*.
1745 *1*	8.3 *13*	11641.9+x	(27/2)	9896.6+x	(25/2$^+$)	D	DCO=0.94 *4*.
1750 *1*	22 *4*	4455.4	13/2$^+$	2705.0	11/2$^-$	D	DCO=0.96 *4*.
1767 *1*	16.6 *10*	9896.6+x	(25/2$^+$)	8129.5+x	(21/2$^+$)	Q	DCO=2.10 *5*.
1771[&] *1*	0.3 *1*	1771.0+y		y			
1792 *1*	14 *4*	3559.1	11/2$^-$	1767.4	9/2$^-$		
1873[&] *1*	1.7 *2*	1873.0+z		z			
1881 *1*	1.5 *1*	3652.1+y		1771.0+y		Q	DCO=2.19 *40*.
1948 *1*	13.6 *25*	1948.0	7/2$^-$	0.0	3/2$^-$		
1951 *1*	10.1 *11*	15176.1+x	(35/2)	13225.1+x	(31/2)	Q	DCO=2.19 *15*.
2010 *1*	10.7 *1*	11906.9+x	(29/2$^+$)	9896.6+x	(25/2$^+$)	Q	Additional information 4. DCO=1.97 *12*.
2052 *1*	5.1 *6*	5660.1+z		3608.1+z		Q	DCO=1.97 *10*.
2150 *1*	2.5 *1*	5802.1+y		3652.1+y		Q	DCO=1.86 *30*.
2185 *1*	1.7 *6*	16464.1+x		14279.0+x	(33/2$^+$)		
2288 *1*	6.1 *7*	10417.5+x	(23/2)	8129.5+x	(21/2$^+$)	D	DCO=1.07 *5*.
2360 *1*	1.5 *3*	8020.2+z		5660.1+z		Q	DCO=2.61 *50*.
2372 *1*	10.0 *8*	14279.0+x	(33/2$^+$)	11906.9+x	(29/2$^+$)	Q	DCO=1.91 *11*.
2506 *1*	5.9 *1*	17682.2+x	(39/2)	15176.1+x	(35/2)	Q	Additional information 5. DCO=1.93 *6*.
2525 *1*	2.5 *3*	8185.2+z		5660.1+z		Q	DCO=1.93 *20*.
2577 *1*	1.4 *1*	8379.2+y		5802.1+y		Q	DCO=2.07 *50*.
2878 *1*	18.0 *20*	8129.5	21/2$^+$	5251.4	17/2$^+$	Q	I_γ: 6.3 *10* is also given for band #1 in figure 1 of 2002Yu01. DCO=2.12 *11*.
3060 *1*	0.2 *1*	11439.3+y		8379.2+y			
3170 *1*	0.4 *2*	11355.3+z		8185.2+z			
3303 *1*	2.3 *8*	17582.1+x	(37/2$^+$)	14279.0+x	(33/2$^+$)	Q	DCO=1.86 *44*.
3418 *1*	1.7 *7*	21100.3+x	(43/2)	17682.2+x	(39/2)	Q	DCO=1.93 *25*.

[†] Uncertainty of 1 keV is suggested by the first author (C.H. Yu) (private communications).

[‡] Obtained from first author (C.H. Yu) (private communications). The gamma ray is expected to be weak when no intensity is listed.

[#] From averaged triple directional correlation ratios plotted in figure 3a of 2002Yu01; and numerical values obtained from C.H. Yu. MULT=Q corresponds to ΔJ=2, and most likely E2 from measured lifetimes which are indicative of fast transitions.

[@] Multiply placed with undivided intensity.

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

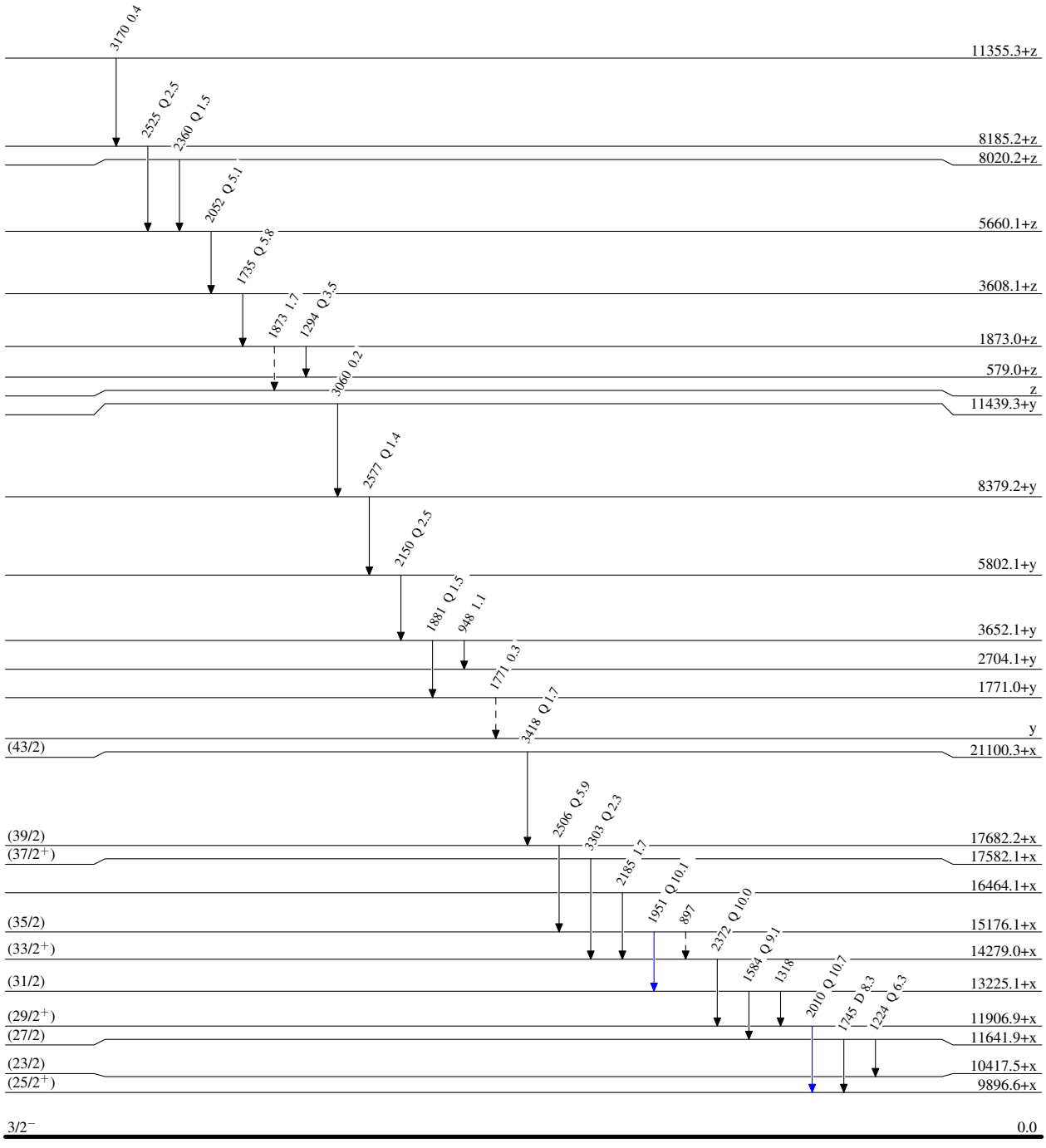
^{40}Ca(^{29}Si,2α2pγ) 2002Yu01

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)



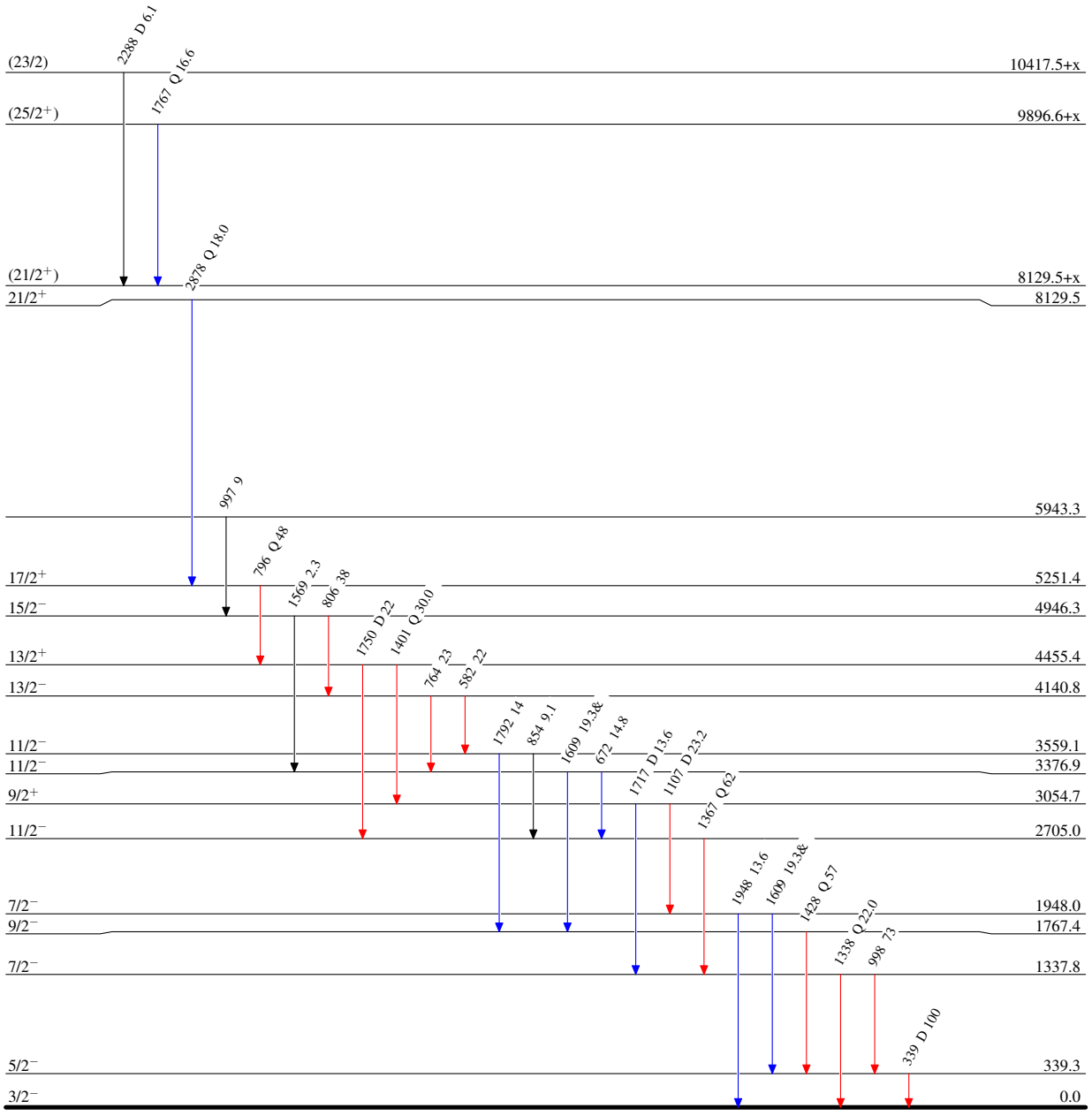
$^{59}_{28}Ni_{31}$

^{40}Ca(^{29}Si,2α2pγ) 2002Yu01

Level Scheme (continued)

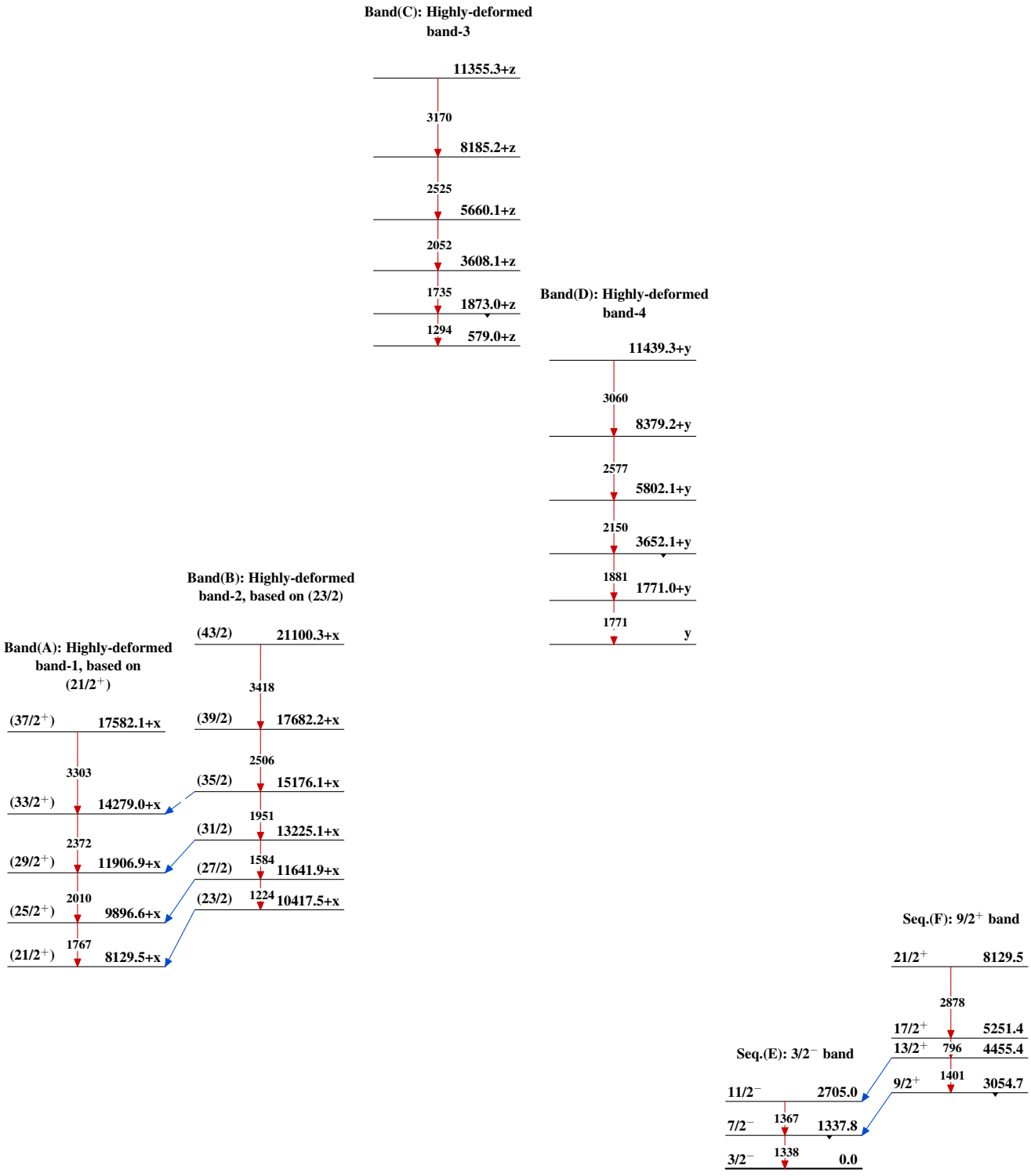
Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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



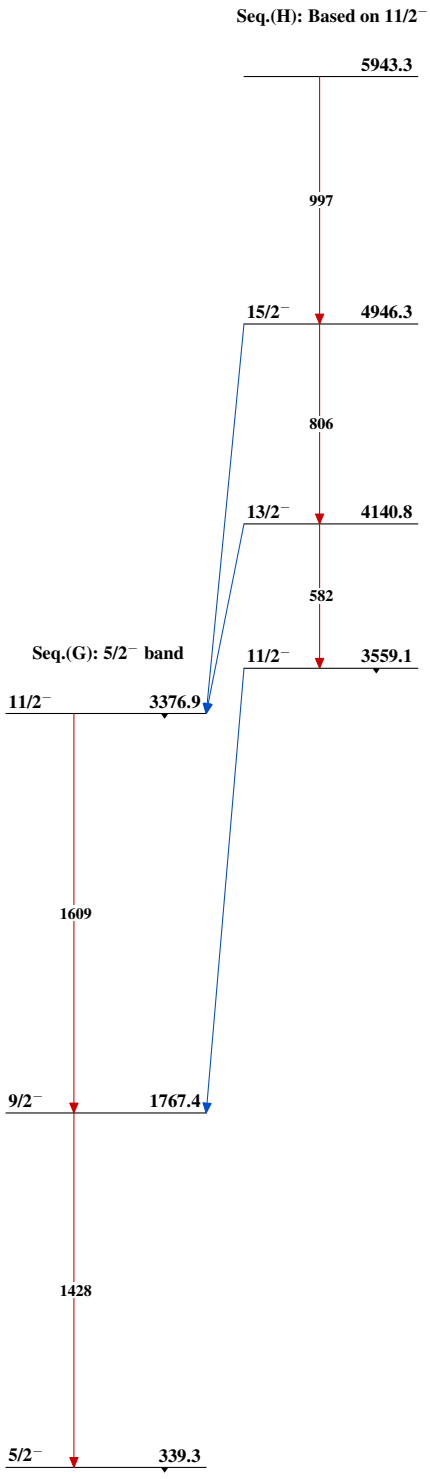
$^{59}_{28}Ni_{31}$

^{40}Ca(^{29}Si,2α2pγ) 2002Yu01



$^{59}_{28}Ni_{31}$

^{40}Ca(^{29}Si,2α2pγ) 2002Yu01 (continued)



$^{59}_{28}Ni_{31}$