^{96}Zr(^{13}C,α3nγ) 2005So09

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	D. De Frenne	NDS 110, 1745 (2009)	31-Dec-2008

E=51, 58 MeV. Measured Eγ, Iγ, $\gamma\gamma$, charged particle-γ coin, $\gamma\gamma(\theta)$(DCO), $\gamma\gamma$(lin pol) with the EUROBALL IV array which consisted of 15 'cluster' and 26 'clover' composite Ge detectors and the DIAMANT array which was composed of 88 CsI detector elements. The four-element clover detectors placed close to 90° relative to the beam direction were used as Compton polarimeters.

^{102}Ru Levels

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
0.0#	0^+	3457.9a 6	9^-	5679.3c 8	14^+	8054.4d 9	18^+
475.7# 3	2^+	3539.2& 6	10^-	5725.5# 8	16^+	8128.6@ 10	19^-
1107.9# 4	4^+	3820.8@ 6	11^-	5758.8@ 8	15^-	8248.2a 10	19^-
1875.7# 5	6^+	3859.9c 7	10^+	5767.9b 12	(14^-)	9038.5& 12	(20^-)
2046.1@ 5	3^-	4014.3b 8	10^-	6059.5a 9	15^-	9249.5d 9	20^+
2374.1@ 5	5^-	4056.4# 7	12^+	6081.6d 8	(14^+)	9305.4# 10	22^+
2651.0& 5	6^-	4184.9a 6	11^-	6508.4& 8	16^-	9373.2@ 10	21^-
2707.1# 6	8^+	4366.3& 6	12^-	6726.7b 13	(16^-)	9511.0a 12	(21^-)
2707.7@ 5	7^-	4712.1@ 7	13^-	6791.2# 8	18^+	10683.8@ 12	(23^-)
2937.8a 6	7^-	4721.0c 7	12^+	6919.2@ 9	17^-	10709.2# 11	24^+
2943.2& 5	8^-	4809.2# 8	14^+	7001.4d 8	16^+	12221.6?# 13	(26^+)
3139.8@ 6	9^-	4841.1b 10	(12^-)	7119.5a 10	17^-		
3329.5b 7	8^-	5071.1a 8	13^-	7751.6& 9	18^-		
3435.2# 6	10^+	5371.6& 7	14^-	7999.2# 9	20^+		

† From least-squares fit to Eγ's (by evaluator).

‡ Based on $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO), $\gamma\gamma$(lin pol) band structure and systematics. Numerical values the same as the adopted ones but here no parentheses used.

Band(A): Yrast band. Predominantly $\nu h^2_{11/2}$ above the first crossing at $\hbar\omega\approx0.4$ MeV.

@ Band(B): $\nu(h_{11/2}(d_{5/2},g_{7/2}))$; α=1 Vibration structure below 9^-, rotational above this spin. Bandhead at 2046 keV.

& Band(b): $\nu(h_{11/2}(d_{5/2},g_{7/2}))$; α=0.

a Band(C): $\nu(h_{11/2}(d_{5/2},g_{7/2}))$; α=1 Bandhead at 2937 keV.

b Band(c): $\nu(h_{11/2}(d_{5/2},g_{7/2}))$; α=0.

c Band(D): Band based on 10^+. γ-vibration $\otimes$ $\nu h^2_{11/2}$ (?).

d Band(E): Band based on (14^+). β-vibration $\otimes$ $\nu h^2_{11/2}$ (?).

$\gamma(^{102}Ru)$

$R_{DCO}=I_{\gamma\gamma}(156°,90°[gate])$ / $I_{\gamma\gamma}(90°,156°[gate])$; ratios were extracted by applying corrections for different efficiencies of clover and cluster detector rings. When gated by a stretched E2 γ ray, R_{DCO}=1.0 for stretched ΔJ=2 transition and ≈0.6 for a stretched ΔJ=1 γ ray. R_{DCO} for a pure nonstretched ΔJ=1 transition with $\delta\approx0$ is roughly the same as for a stretched ΔJ=2 γ ray. For mixed M1+E2 transitions, R_{DCO} varies between 0.5 and 1.0 depending on the value of δ.

POL=1/Q[$n_{perpendicular}-n_{parallel}$ / $n_{perpendicular}+n_{parallel}$]; where Q is the polarization sensitivity. POL>0 for stretched E1, E2 and unstretched M1 transitions, whereas POL<0 for stretched M1 and unstretched E1 transitions.

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^{96}Zr(^{13}C,α3nγ) 2005So09 (continued)

γ(^{102}Ru) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
196.6 *5*	0.2 *1*	3139.8	9^-	2943.2	8^-		
235.4 *3*	4.6 *3*	2943.2	8^-	2707.7	7^-	D	DCO=0.33 *6*.
276.8 *3*	2.6 *2*	2651.0	6^-	2374.1	5^-	D	DCO=0.41 *5*.
292.3 *3*	7.2 *4*	2943.2	8^-	2651.0	6^-	E2	DCO=1.05 *6*. POL=+0.51 *18*.
328.1 *4*	0.3 *1*	2374.1	5^-	2046.1	3^-	Q	DCO=1.09 *25*.
333.6 *5*	5.9 *4*	2707.7	7^-	2374.1	5^-	E2	DCO=0.99 *6*. POL=+0.64 *20*.
386.3 *4*	0.8 *1*	3329.5	8^-	2943.2	8^-	M1+E2[‡#]	No δ given. DCO=0.98 *11*. POL=+0.7 *5*.
399.4 *4*	1.6 *2*	3539.2	10^-	3139.8	9^-	M1+E2	No δ given. DCO=0.24 *6*. POL=−0.31 *18*.
424.6 *4*	1.3 *2*	3859.9	10^+	3435.2	10^+	M1+E2[‡]	DCO=1.00 *9*. POL=+0.9 *5*. No δ given.
432.0 *3*	21.6 *12*	3139.8	9^-	2707.7	7^-	E2	DCO=1.09 *5*. POL=+0.60 *9*.
475.7 *3*	100 *5*	475.7	2^+	0.0	0^+	E2	DCO=1.01 *5*. POL=+0.43 *8*.
498.4 *4*	0.4 *1*	2374.1	5^-	1875.7	6^+		
514.6 *4*	1.6 *2*	3457.9	9^-	2943.2	8^-		
520.4 *4*	0.7 *1*	3457.9	9^-	2937.8	7^-	Q	DCO=1.08 *21*.
545.4 *4*	0.6 *1*	4366.3	12^-	3820.8	11^-		
563.9 *4*	1.2 *2*	2937.8	7^-	2374.1	5^-	Q	DCO=1.10 *24*.
595.9 *3*	10.3 *6*	3539.2	10^-	2943.2	8^-	E2	DCO=0.98 *5*. POL=+0.42 *10*.
621.2 *3*	28.0 *16*	4056.4	12^+	3435.2	10^+	E2	DCO=0.99 *5*. POL=+0.53 *9*.
621.4 *9*	0.3 *1*	3329.5	8^-	2707.7	7^-		
632.2 *3*	98 *5*	1107.9	4^+	475.7	2^+	E2	DCO=1.00 *5*. POL=+0.50 *8*.
645.6 *5*	0.8 *1*	4184.9	11^-	3539.2	10^-	M1+E2	No δ given. DCO=0.53 *9*. POL=−0.42 *18*.
664.6 *4*	0.6 *1*	4721.0	12^+	4056.4	12^+	M1+E2[‡]	No δ given. DCO=1.10 *19*. POL=+1.0 *5*.
680.9 *3*	13.9 *8*	3820.8	11^-	3139.8	9^-	E2	DCO=0.96 *5*. POL=+0.35 *10*.
684.8 *5*	0.8 *1*	4014.3	10^-	3329.5	8^-	Q	DCO=0.95 *14*.
727.1 *4*	2.3 *2*	4184.9	11^-	3457.9	9^-	Q	DCO=0.99 *8*.
728.1 *3*	35.6 *20*	3435.2	10^+	2707.1	8^+	E2	DCO=1.04 *5*. POL=+0.56 *9*.
750.2 *8*	0.4 *1*	3457.9	9^-	2707.7	7^-		
752.8 *3*	20.6 *14*	4809.2	14^+	4056.4	12^+	E2	DCO=1.03 *5*. POL=+0.55 *9*.
767.7 *3*	86 *5*	1875.7	6^+	1107.9	4^+	E2	DCO=1.00 *5*. POL=+0.43 *8*.
775.4 *3*	7.8 *5*	2651.0	6^-	1875.7	6^+	E1[‡]	DCO=1.07 *6*. POL=−0.75 *22*.
826.8 *5*	0.5 *1*	4841.1	(12^-)	4014.3	10^-		
827.2 *3*	7.7 *5*	4366.3	12^-	3539.2	10^-	E2	DCO=1.01 *6*. POL=+0.31 *12*.

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^{96}Zr(^{13}C,α3nγ) 2005So09 (continued)

γ(^{102}Ru) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
831.4 *3*	40 *3*	2707.1	8^+	1875.7	6^+	E2	DCO=1.00 *5*. POL=+0.57 *9*.
831.9 *3*	32.3 *20*	2707.7	7^-	1875.7	6^+	E1	DCO=0.55 *5*. POL=+0.36 *9*.
860.8 *5*	0.6 *1*	4721.0	12^+	3859.9	10^+	Q	DCO=1.03 *5*.
886.2 *4*	1.9 *2*	5071.1	13^-	4184.9	11^-	Q	DCO=1.08 *10*.
891.3 *3*	8.7 *6*	4712.1	13^-	3820.8	11^-	E2	DCO=0.92 *5*. POL=+0.84 *18*.
916.3 *3*	12.9 *8*	5725.5	16^+	4809.2	14^+	E2	DCO=0.94 *6*. POL=+0.73 *15*.
919.6 *5*	0.2 *1*	7001.4	16^+	6081.6	(14^+)		
926.8 *7*	0.4 *1*	5767.9	(14^-)	4841.1	(12^-)		
958.4 *5*	0.9 *1*	5679.3	14^+	4721.0	12^+	Q	DCO=1.04 *14*.
958.8 *5*	0.3 *1*	6726.7	(16^-)	5767.9	(14^-)		
988.4 *4*	1.3 *2*	6059.5	15^-	5071.1	13^-	E2	DCO=1.11 *14*. POL=+1.0 *3*.
1005.3 *3*	4.0 *3*	5371.6	14^-	4366.3	12^-	E2	DCO=0.95 *7*. POL=+0.6 *3*.
1046.7 *3*	4.9 *3*	5758.8	15^-	4712.1	13^-	E2	DCO=1.00 *7*. POL=+0.53 *17*.
1053.0 *4*	0.3 *1*	8054.4	18^+	7001.4	16^+	Q	DCO=1.08 *19*.
1060.0 *4*	0.7 *1*	7119.5	17^-	6059.5	15^-	Q	DCO=0.94 *10*.
1061.9 *9*	0.4 *1*	2937.8	7^-	1875.7	6^+		
1065.8 *3*	6.2 *4*	6791.2	18^+	5725.5	16^+	E2	DCO=0.99 *6*. POL=+0.72 *17*.
1128.7 *4*	0.4 *1*	8248.2	19^-	7119.5	17^-	Q	DCO=0.92 20.
1136.8 *4*	2.1 *2*	6508.4	16^-	5371.6	14^-	E2	DCO=0.91 *7*. POL=+0.9 *4*.
1152.7 *4*	2.0 *2*	3859.9	10^+	2707.1	8^+	E2	DCO=0.96 *11*. POL=+0.8 *4*.
1160.4 *4*	2.0 *2*	6919.2	17^-	5758.8	15^-	E2	DCO=1.04 *9*. POL=+0.8 *3*.
1195.1 *4*	0.2 *1*	9249.5	20^+	8054.4	18^+	Q	DCO=0.94 *12*.
1207.9 *4*	2.7 *3*	7999.2	20^+	6791.2	18^+	E2	DCO=0.99 *6*. POL=+0.60 *17*.
1209.4 *4*	0.5 *1*	8128.6	19^-	6919.2	17^-	E2	DCO=1.02 *10*. POL=+1.2 *6*.
1243.2 *4*	0.6 *1*	7751.6	18^-	6508.4	16^-	Q	DCO=1.10 *20*.
1244.6 *4*	0.2 *1*	9373.2	21^-	8128.6	19^-	Q	DCO=1.07 *14*.
1250.3 *5*	0.2 *1*	9249.5	20^+	7999.2	20^+		
1262.7 *6*	0.2 *1*	9511.0	(21^-)	8248.2	19^-		
1263.2 *4*	0.4 *1*	8054.4	18^+	6791.2	18^+		
1266.2 *4*	12.4 *8*	2374.1	5^-	1107.9	4^+	E1	DCO=0.50 6. POL=+0.40 *15*.
1272.3 *4*	0.6 *1*	6081.6	(14^+)	4809.2	14^+		
1276.0 *4*	0.9 *2*	7001.4	16^+	5725.5	16^+	M1+E2[‡#]	DCO=1.00 *7*. No δ given. POL=+1.0 *5*.
1286.1 *4*	1.1 *1*	4721.0	12^+	3435.2	10^+	Q	DCO=1.02 *17*.
1286.9 *8*	0.2 *1*	9038.5	(20^-)	7751.6	18^-		
1306.2 *4*	1.2 *2*	9305.4	22^+	7999.2	20^+	E2	DCO=1.01 *12*. POL=+0.7 *4*.
1310.6 *6*	0.1 *1*	10683.8	(23^-)	9373.2	21^-		
1403.8 *4*	0.3 *1*	10709.2	24^+	9305.4	22^+	Q	DCO=0.93 *15*.
1512.4[@] *7*	0.1 *1*	12221.6?	(26^+)	10709.2	24^+		

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^{96}Zr(^{13}C,α3nγ) 2005So09 (continued)

$\gamma(^{102}Ru)$ (continued)

E_γ †	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
1570.4 *4*	0.4 *1*	2046.1	3^-	475.7	2^+	E1	DCO=0.59 *9*. POL=+1.1 *9*.
1622.7 *5*	0.2 *1*	5679.3	14^+	4056.4	12^+		

† Systematic errors attributed to energy and efficiency calibrations were estimated to be ≈0.2-0.3 keV and ≈55%, respectively.
‡ Unstretched ΔJ=0 dipole or D+Q transition; E1 or M1+E2 from γ(lin pol).
# ΔJ=2, E2 or ΔJ=0, M1+E2 From R_{DCO} and POL values; ΔJ=0, M1+E2 assignment is preferred by 2005So09 as the ΔJ=2, E2 would imply transition in the yrast band, which is in contradiction with the low observed intensities of this transition.
@ Placement of transition in the level scheme is uncertain.

^{96}Zr(^{13}C,α3nγ) 2005So09

Level Scheme

Intensities: Relative I_γ

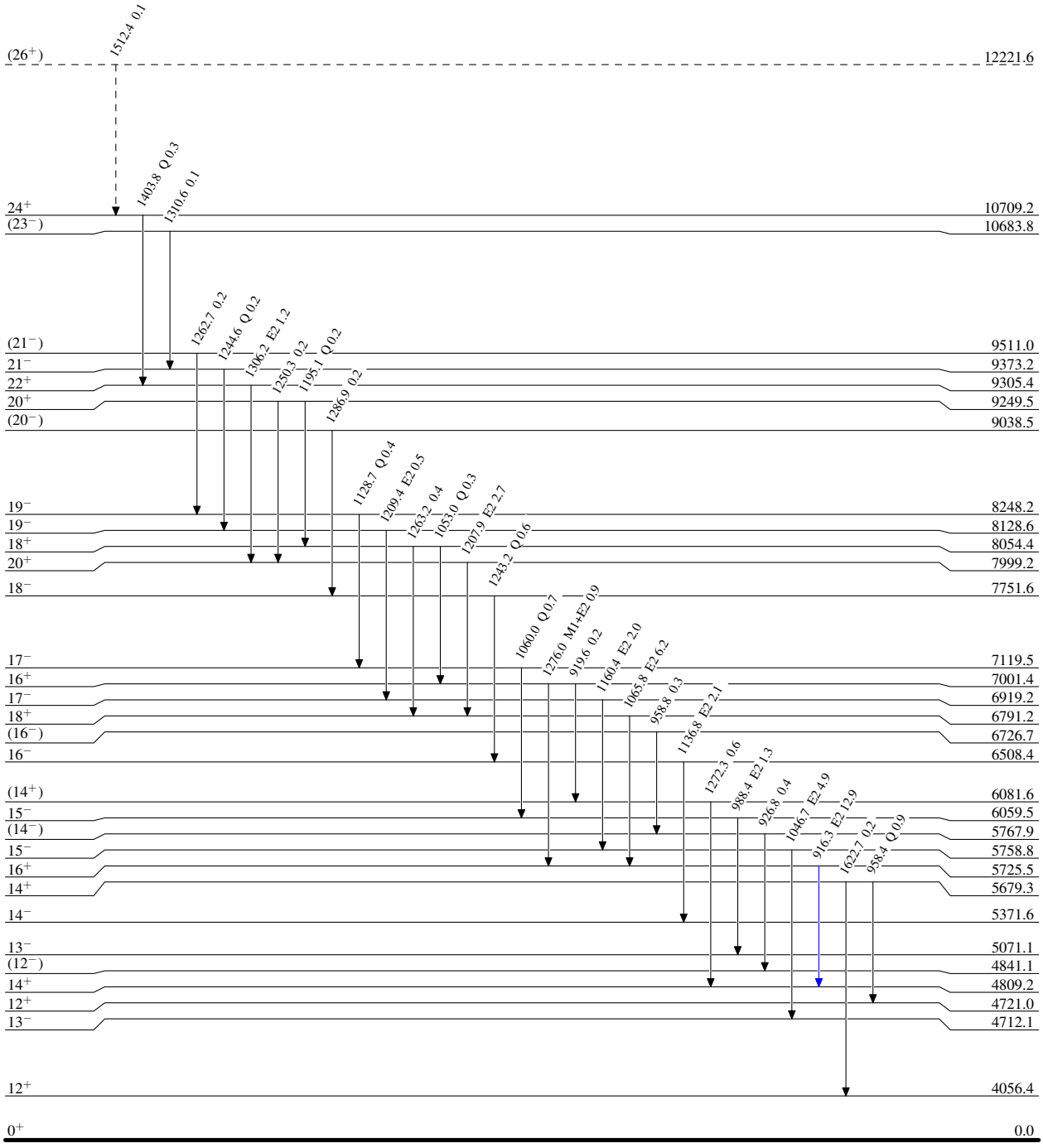
Legend

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

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

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

γ Decay (Uncertain)



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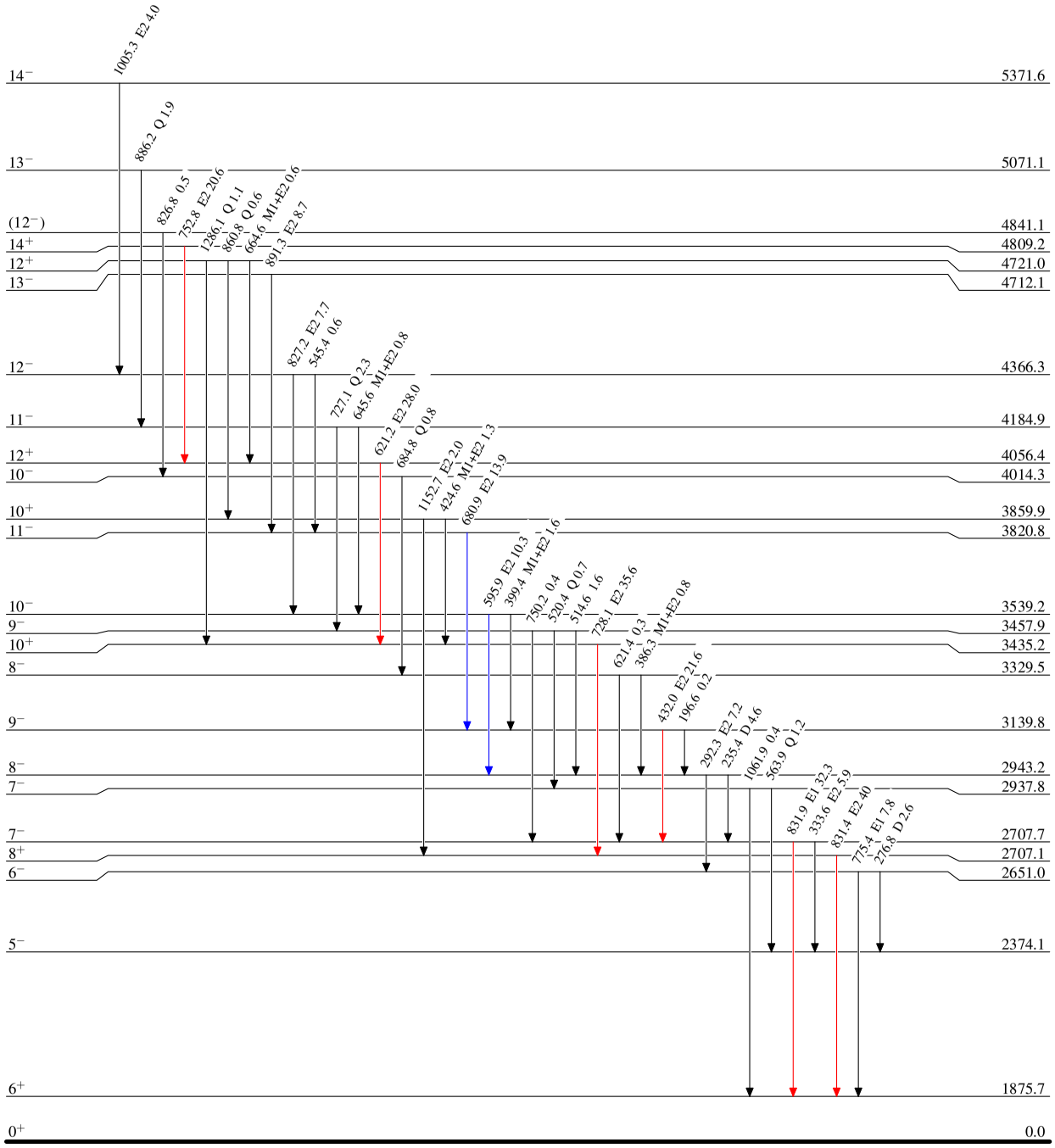
^{96}Zr(^{13}C,α3nγ) 2005So09

Level Scheme (continued)

Intensities: Relative I_γ

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

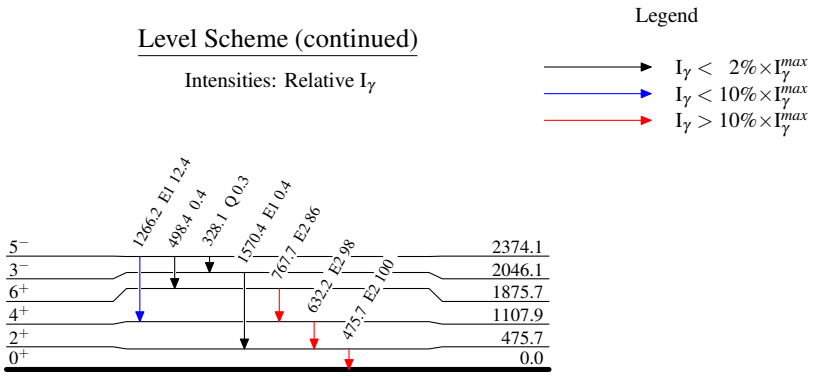


$^{102}_{44}Ru_{58}$

^{96}Zr(^{13}C,α3nγ) 2005So09

Level Scheme (continued)

Intensities: Relative I_γ



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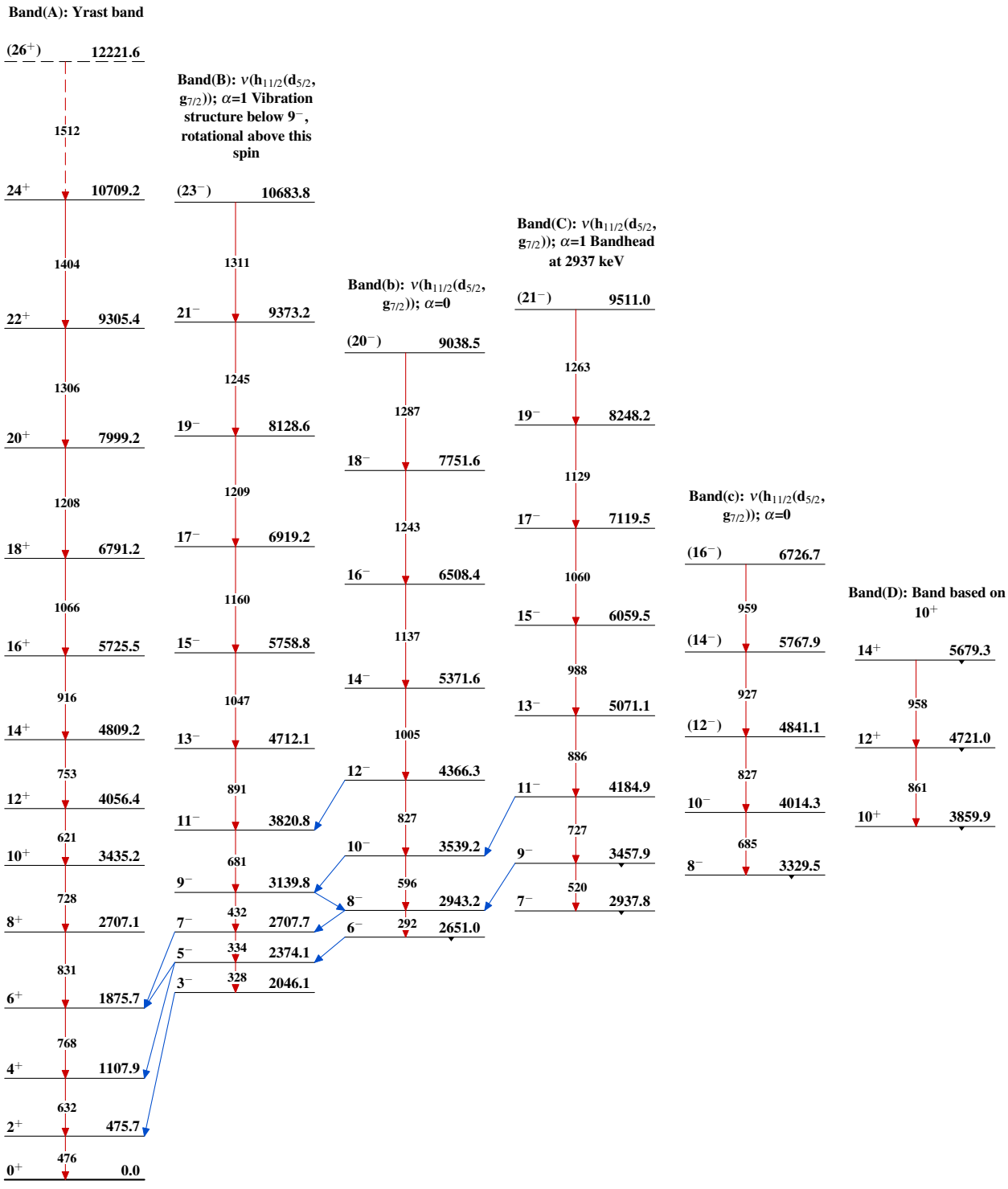
$^{96}Zr(^{13}C,\alpha 3n\gamma)$ 2005So09



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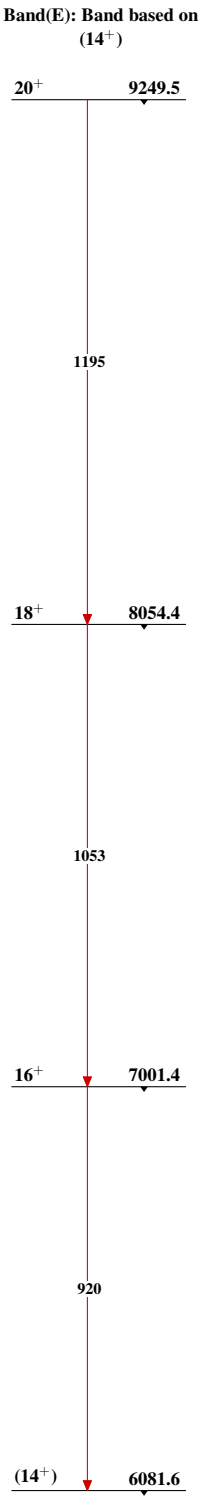
^{96}Zr(^{13}C,α3nγ) 2005So09 (continued)



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