^{96}Zr(^{18}O,p4nγ) 1996Po07,2007TiZZ

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. Kumar(a), J. Chen(b) and F. G. Kondev	NDS 137, 1 (2016)	31-May-2016

1996Po07: Experiments were carried out at both the University of Pennsylvania Tandem Van de Graaff Accelerator and the Tandem Accelerator Superconducting Cyclotron "TASCC" Facility at Chalk River. At both facilities, the nuclides of interest were populated via fusion-evaporation reactions with 56-80 MeV ^{18}O beams incident on thin ^{96}Zr targets (1 mg/cm^2 at Penn, 600 mg/cm^2 at Chalk River), enriched to 85% ^{96}Zr, with ^{90}Zr comprising the bulk of the remainder. At Penn, γ rays were detected by two Compton compressed 25% efficient Ge detectors at 45° and 90° and charged particles were detected and identified by the Penn 4π array; at Chalk River, γ rays were detected by the 8π spectrometer and charged particles by an array of 24 CsI(Tl) detectors. Measured Eγ, Iγ, γγ-coin, charged particles-γγ coin, γγ(θ), substate alignment. Deduced levels, J^π, band structures, γ-ray branching ratios, multipolarities, mixing ratios. Comparisons with cranked shell model and total Routhian surface calculations.

2007TiZZ: ^{18}O beam was produced at iThemba LABS and incident on ^{96}Zr target. γ rays were detected by the AFRODITE array of 8 clover detectors and identified by detecting charged particles with the DIAMANT charged-particle detector array. Measured Eγ, Iγ, particle-γγ-coin. Deduced level scheme.

^{109}Ag Levels

E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]
0.0	1/2− [@]	2479.9[b] *11*	17/2−	3203.6[a] *11*	(23/2−)	4375.9[&] *11*	31/2+
88.0 *10*	7/2+ [@]	2567.4[&] *11*	19/2+	3276.4[&] *11*	25/2+	4475.7?[‡a] *17*	(29/2−)[‡]
132.8[&] *10*	9/2+	2568.5[b] *11*	19/2−	3316.8[b] *11*	25/2−	4880.8?[‡b] *16*	(31/2−)[‡]
773.5[&] *11*	11/2+	2660.6[a] *11*	19/2−	3558.6?[‡a] *14*	(25/2−)[‡]	4886.5[&] *11*	33/2+
930.8[&] *10*	13/2+	2740.7[b] *11*	21/2−	3575.3[&] *11*	27/2+	5414.7[&] *11*	(35/2+)
1703.0[&] *11*	15/2+	2840.8[&] *11*	21/2+	3757.8?[‡b] *14*	27/2−[‡]	5485.8?[‡b] *16*	(33/2−)[‡]
1894.3[&] *11*	17/2+	2940.3[a] *11*	(21/2−)	3968.8[&] *11*	29/2+	5999.6?[‡&] *13*	(37/2+)[‡]
2206.5[a] *11*	15/2−	2988.8[b] *11*	23/2−	4015.7?[‡a] *14*	(27/2−)[‡]	6091.8?[‡b] *19*	(35/2−)[‡]
2420.0[a] *11*	17/2−	3090.2[&] *11*	23/2+	4283.8?[‡b] *14*	(29/2−)[‡]	6640.6?[‡&] *17*	(39/2+)[‡]

[†] From a least-squares fit to Eγ. For Eγ without uncertainties, ΔEγ=1 keV was assumed in the fit.
[‡] From 2007TiZZ.
[#] From 1996Po07 based on γ-ray transition multipolarities, band structure and systematics, unless otherwise noted.
[@] From Adopted Levels.
[&] Band(A): Band 1, $\pi g_{9/2}$ band. Above J^π=21/2+, it changes to $\pi g_{9/2}\otimes\nu(h_{11/2})^2$.
[a] Band(B): Band 2.
[b] Band(C): Band 3.

γ(^{109}Ag)

Eγ[†]	Iγ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[a]	δ[a]	Comments
44.8 *1*		132.8	9/2+	88.0	7/2+	M1+E2	0.35 *15*	
88.0		88.0	7/2+	0.0	1/2−			
88.5		2568.5	19/2−	2479.9	17/2−			
148.4 *1*	9[&] *1*	2568.5	19/2−	2420.0	17/2−	M1(+E2)	+0.05 *11*	anisotropy α=−0.16 *19*.
157.3 *1*	8[&] *1*	930.8	13/2+	773.5	11/2+			
172.2 *1*	18 *3*	2740.7	21/2−	2568.5	19/2−	M1(+E2)	+0.01 *8*	anisotropy α=−0.23 *14*.
186.2 *1*	34[&] *1*	3276.4	25/2+	3090.2	23/2+	M1(+E2)	−0.05 *5*	anisotropy α=−0.31 *10*.
192.0[‡b]		1894.3	17/2+	1703.0	15/2+			
213.5 *1*	17 *2*	2420.0	17/2−	2206.5	15/2−	M1+E2	−0.09 *8*	anisotropy α=−0.36 *12*.

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^{96}Zr(^{18}O,p4nγ) 1996Po07,2007TiZZ (continued)

γ(^{109}Ag) (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[a]	δ[a]	Comments
240.5 *2*	8 *2*	2660.6	19/2⁻	2420.0	17/2⁻	M1(+E2)	−0.05 *9*	anisotropy α=−0.31 *16*.
248.1 *1*	18 *4*	2988.8	23/2⁻	2740.7	21/2⁻	M1(+E2)	+0.02 *8*	anisotropy α=−0.20 *12*.
249.4 *1*	49 *5*	3090.2	23/2⁺	2840.8	21/2⁺	M1+E2	+0.05 *4*	anisotropy α=−0.16 *7*.
263.3[#] *2*	8 *3*	3203.6	(23/2⁻)	2940.3	(21/2⁻)	M1+E2	−0.14 *9*	anisotropy α=−0.46 *16*.
273.4 *3*	9 *3*	2479.9	17/2⁻	2206.5	15/2⁻			
273.5 *1*	15 *2*	2840.8	21/2⁺	2567.4	19/2⁺	M1(+E2)	+0.03 *8*	anisotropy α=−0.18 *13*.
279.7[#] *2*	9 *2*	2940.3	(21/2⁻)	2660.6	19/2⁻	M1+E2	+0.13 *9*	anisotropy α=−0.02 *15*.
298.8 *1*	33[&] *1*	3575.3	27/2⁺	3276.4	25/2⁺	M1+E2	−0.07 *5*	anisotropy α=−0.35 *9*.
328.0 *1*	11 *3*	3316.8	25/2⁻	2988.8	23/2⁻	M1+E2	+0.06 *4*	anisotropy α=−0.13 *13*.
355.0[‡b]		3558.6?	(25/2⁻)	3203.6	(23/2⁻)			
393.5 *1*	29[&] *1*	3968.8	29/2⁺	3575.3	27/2⁺	M1+E2	+0.06 *4*	anisotropy α=−0.13 *10*.
407.1 *1*	21 *2*	4375.9	31/2⁺	3968.8	29/2⁺	M1(+E2)	0.00 *6*	anisotropy α=−0.22 *11*.
441.0[‡b]		3757.8?	27/2⁻	3316.8	25/2⁻			
455.0[‡b]		2660.6	19/2⁻	2206.5	15/2⁻			
457.0[‡b]		4015.7?	(27/2⁻)	3558.6?	(25/2⁻)			
460.0[‡b]		4475.7?	(29/2⁻)	4015.7?	(27/2⁻)			
486.0[‡b]		3575.3	27/2⁺	3090.2	23/2⁺			
510.6 *2*	15 *2*	4886.5	33/2⁺	4375.9	31/2⁺	M1+E2	−0.14 *8*	anisotropy α=−0.46 *15*.
526.0[‡b]		4283.8?	(29/2⁻)	3757.8?	27/2⁻			
528.1 *3*	11 *2*	5414.7	(35/2⁺)	4886.5	33/2⁺	M1+E2	+0.20 *14*	anisotropy α=0.10 *19*.
585.0[‡b]		5999.6?	(37/2⁺)	5414.7	(35/2⁺)			
597.0[‡b]		4880.8?	(31/2⁻)	4283.8?	(29/2⁻)			
605.0[‡b]		5485.8?	(33/2⁻)	4880.8?	(31/2⁻)			
606.0[‡b]		6091.8?	(35/2⁻)	5485.8?	(33/2⁻)			
640.6 *2*	24[&] *1*	773.5	11/2⁺	132.8	9/2⁺	M1+E2	>+0.3	anisotropy α=0.30 *9*.
641.0[‡b]		6640.6?	(39/2⁺)	5999.6?	(37/2⁺)			
673.4 *2*	12 *3*	2567.4	19/2⁺	1894.3	17/2⁺	M1+E2	+0.31 *20*	anisotropy α=0.20 *19*.
675.0[‡b]		2568.5	19/2⁻	1894.3	17/2⁺			
693.0[‡b]		3968.8	29/2⁺	3276.4	25/2⁺			
699.0[‡b]		4015.7?	(27/2⁻)	3316.8	25/2⁻			
772.3 *3*	32 *5*	1703.0	15/2⁺	930.8	13/2⁺	M1+E2	+1.0 *+10−5*	anisotropy α=0.50 *21*.
798.0 *1*	100[&] *1*	930.8	13/2⁺	132.8	9/2⁺	E2		anisotropy α=0.22 *6*.
801.0[‡b]		4375.9	31/2⁺	3575.3	27/2⁺			
864.9 *4*	13 *4*	2567.4	19/2⁺	1703.0	15/2⁺	E2		anisotropy α=0.61 *29*.
919.0[‡b]		4886.5	33/2⁺	3968.8	29/2⁺			
930.6 *8*	8 *3*	1703.0	15/2⁺	773.5	11/2⁺			
946.4 *1*	35[&] *1*	2840.8	21/2⁺	1894.3	17/2⁺	E2		anisotropy α=0.34 *11*.
963.5 *1*	60[&] *1*	1894.3	17/2⁺	930.8	13/2⁺	E2		anisotropy α=0.43 *9*.
967.0[‡b]		4283.8?	(29/2⁻)	3316.8	25/2⁻			
1039.0[‡b]		5414.7	(35/2⁺)	4375.9	31/2⁺			
1113.0[‡b]		5999.6?	(37/2⁺)	4886.5	33/2⁺			
1202.0[‡b]		5485.8?	(33/2⁻)	4283.8?	(29/2⁻)			
1275.7 *2*	29[&] *1*	2206.5	15/2⁻	930.8	13/2⁺	E1(+M2)	+0.02 *8*	anisotropy α=−0.21 *12*. Mult.: assigned as E1 by 1996Po07.

† From 1996Po07, unless otherwise noted.

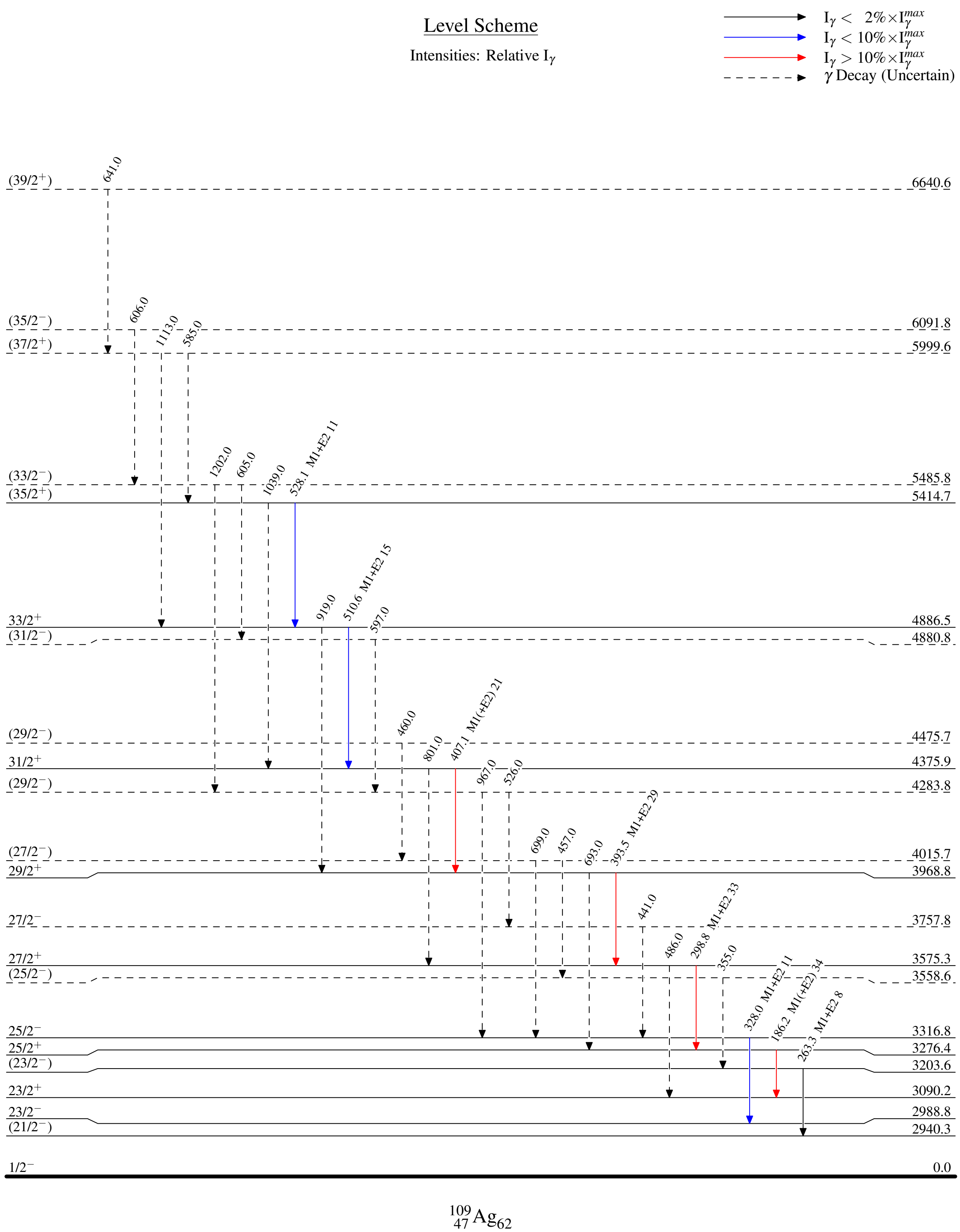
Continued on next page (footnotes at end of table)

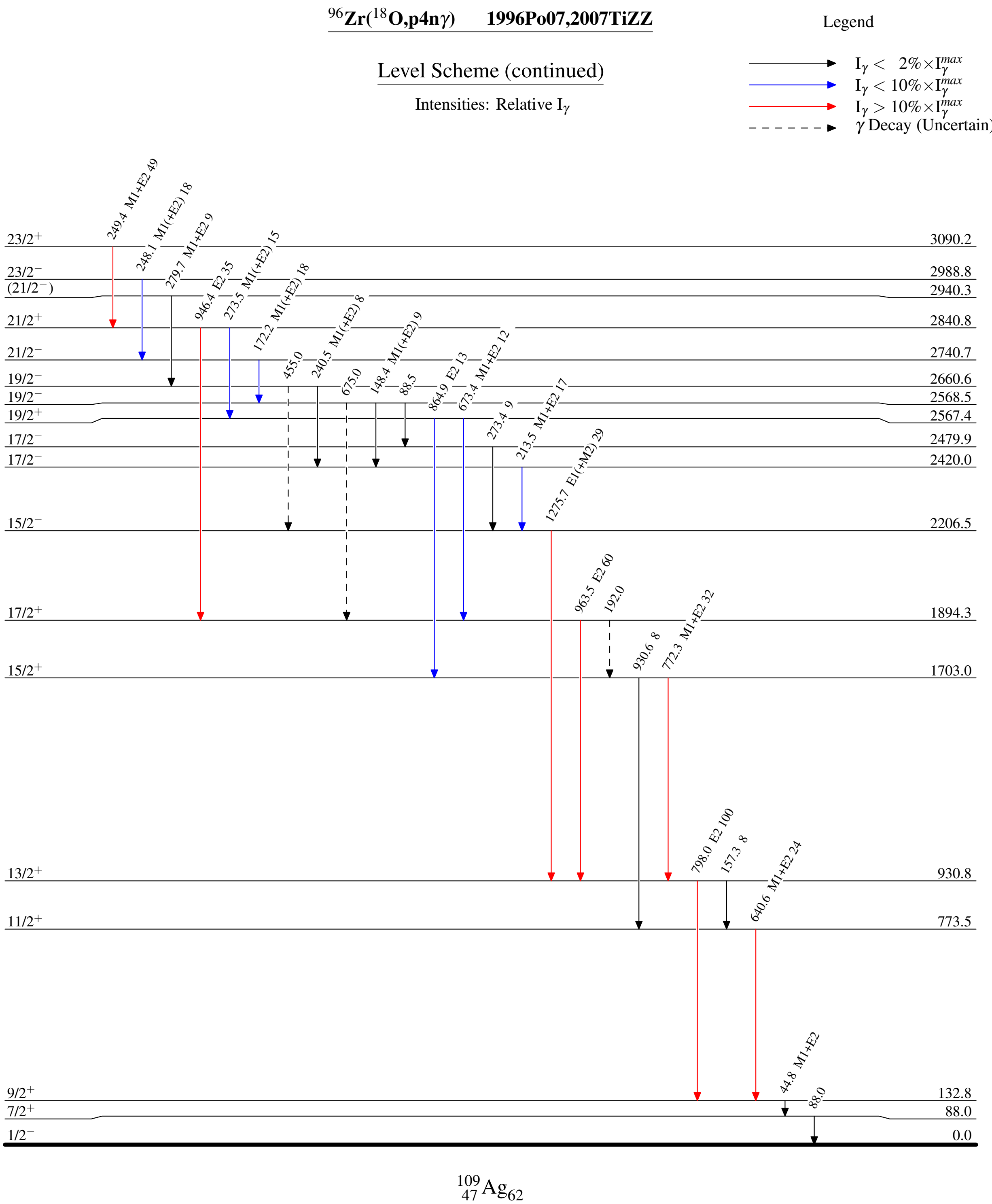
^{96}Zr(^{18}O,p4nγ) 1996Po07,2007TiZZ (continued)

γ(^{109}Ag) (continued)

‡ From 2007TiZZ.
\# 2007TiZZ placed these two transitions as 280-264 cascade from E=3204 level, making a level at E=2925.
@ From coincidence data in 1996Po07, unless otherwise noted.
& From singles data in 1996Po07.
[a] From measured anisotropies in 1996Po07, which is defined as $A=2[(I\gamma_{37^\circ}-I\gamma_{79^\circ})/(I\gamma_{37^\circ}+I\gamma_{79^\circ})]$. Typical anisotropies in this measurement were A≈0.3 for ΔI=−2 quadrupoles, A≈−0.3 for ΔI=−1 dipoles, −1<A<1 for mixed ΔI=−1 transitions. Values of anisotropies are given in comments.
[b] Placement of transition in the level scheme is uncertain.

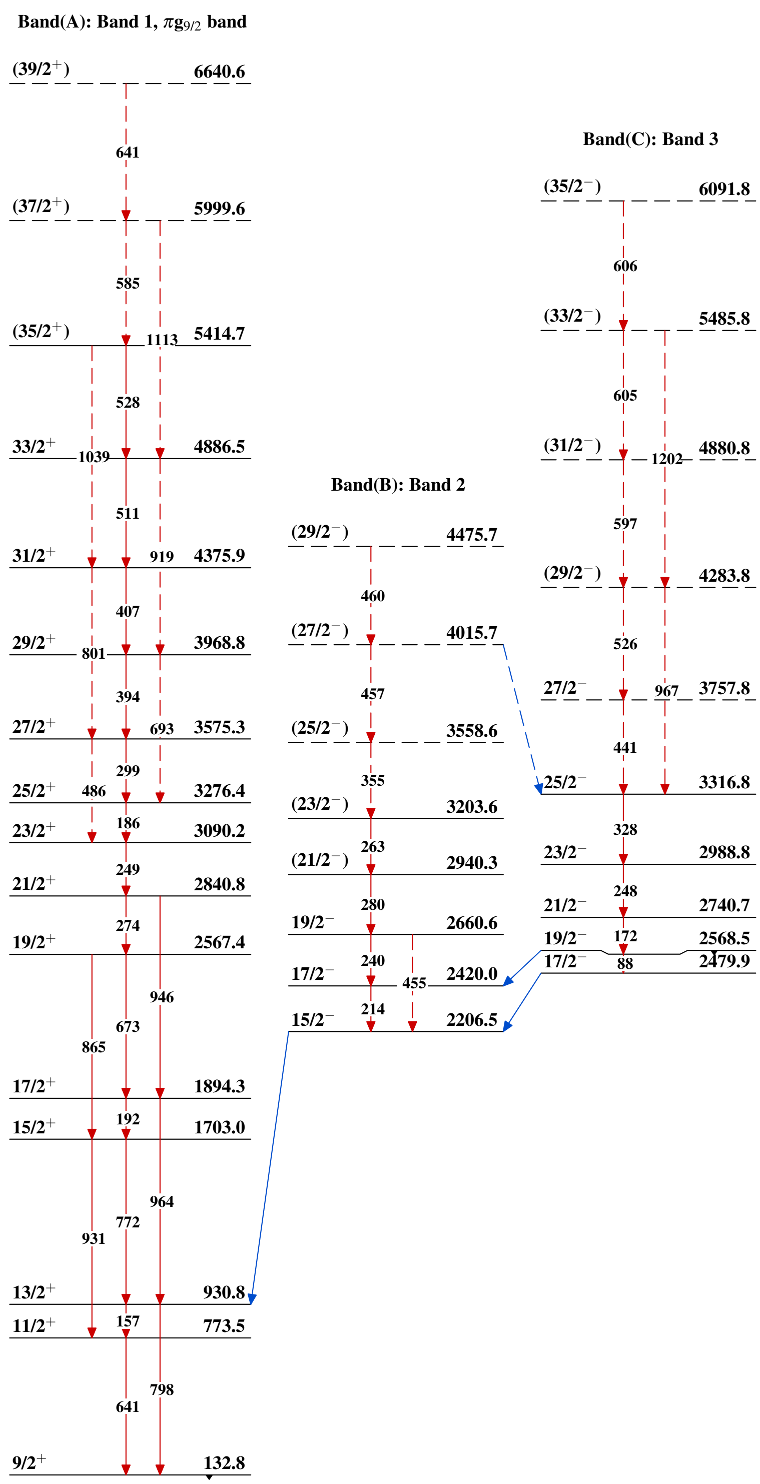
$^{96}Zr(^{18}O,p4n\gamma)$ 1996Po07,2007TiZZ





96Zr(18O,p4nγ) 1996Po07,2007TiZZ
Level Scheme (continued)
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
γ Decay (Uncertain)
23/2+ 3090.2
23/2− 2988.8
(21/2−) 2940.3
21/2+ 2840.8
21/2− 2740.7
19/2− 2660.6
19/2− 2568.5
19/2+ 2567.4
17/2− 2479.9
17/2− 2420.0
15/2− 2206.5
17/2+ 1894.3
15/2+ 1703.0
13/2+ 930.8
11/2+ 773.5
9/2+ 132.8
7/2+ 88.0
1/2− 0.0
249.4 M1+E2 49
248.1 M1(+E2) 18
279.7 M1+E2 9
946.4 E2 35
273.5 M1(+E2) 15
172.2 M1(+E2) 18
455.0
240.5 M1(+E2) 8
675.0
148.4 M1(+E2) 9
88.5
864.9 E2 13
673.4 M1+E2 12
273.4 9
213.5 M1+E2 17
1275.7 E1(+M2) 29
963.5 E2 60
192.0
930.6 8
772.3 M1+E2 32
798.0 E2 100
157.3 8
640.6 M1+E2 24
44.8 M1+E2
88.0
109 47 Ag 62

$^{96}Zr(^{18}O,p4n\gamma)$ 1996Po07,2007TiZZ



$^{109}_{47}Ag_{62}$