^{96}Zr(n,n′γ) 1989Mo15,1989Be29

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	D. Abriola(a), A. A. Sonzogni	NDS 109, 2501 (2008)	1-Apr-2008

1989Mo15,1988MoZS: E=reactor fast neutrons, E=2.0-4.7 MeV; measured Eγ, Iγ, γ(θ), σ(Eγ,E), excitation functions, Hauser-Feshbach analysis.
1989Be29,1988BeYD: E=3.8,4.3 MeV; measured Eγ(θ), Iγ(θ), $T_{1/2\ 1/2}$ by DSAM.
Others: 1991Be46,1986Mo07,1986MoZJ.

^{96}Zr Levels

E(level)†	Jπ‡	$T_{1/2}$#	E(level)†	Jπ‡	$T_{1/2}$#
0.0	0^+		3363.30 *5*		
1581.66& *7*	0^+		3448.73 *8*	(2^+)	>0.66 ps
1750.494 *16*	2^+		3472.14 *7*	2^+	0.146 ps *+35−21*
1897.164 *19*	3^-		3483.45 *9*	6^+	
2225.839& *18*	2^+		3509.21 *8*	2^+	0.104 ps *21*
2438.744 *19*	3^+	0.38[a] ps *+19−10*	3556.18 *8*	2^+	0.16 ps *4*
2668.82 *4*	(2^+)	0.24[a] ps *+32−10*	3577.62 *6*		
2695.17 *4*	0^+		3602.17 *20*	$(1,2^+)$	0.19@ ps *+19−7*
2857.393& *25*	4^+	0.60 ps *+46−18*	3620.73 *7*	$(1,2^+)$	0.005 ps *3*
2925.53 *4*	0^+	>1.4 ps	3700.68 *10*	$(1,2^+)$	0.006 ps *3*
3082.36 *4*	4^+	>1.4 ps	3749.38 *11*	4^+	>0.26 ps
3119.87 *4*	5^-	0.58 ps *+68−21*	3857.48 *20*	2^+	0.055 ps *+21−14*
3150.28 *4*	3^-	>0.54 ps	3865.16 *11*		
3176.44 *3*	4^+	0.39 ps *+59−28*	3947.19 *10*	$(1,2^+)$	0.010 ps *+6−4*
3211.84 *4*	2^+	0.090 ps *+21−14*	4013.9 *10*	5^-	
3243.61 *7*		>0.097 ps	4037.89 *20*	$(1,2^+)$	0.007 ps *+6−5*
3248.63 *6*	2^+	0.19 ps *+5−4*	4132.4 *3*	$(1,2^+)$	<0.017 ps
3309.18 *9*	$(4^+,5^+,6^+)$				

† From a least-squares fit to Eγ data.
‡ From Adopted Levels.
# From DSAM (1989Be29).
@ $T_{1/2}$=0.31 ps *+19−7* given in author's table 3 is a misprint (priv comm from authors).
& Band(A): 4p-4h intruder band (1986Mo07).
[a] May be about 20% lower than indicated because cascade feeding effect was not considered.

γ(^{96}Zr)

E_γ[‡]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[@]	α[b]	Comments
146.65 *2*	263 *10*	1897.164	3⁻	1750.494	2⁺	[E1]		0.0371	α=0.0371 I_γ: from I(γ+ce)=273 *10* and α.
226.82 *8*	6 *1*	3309.18	(4⁺,5⁺,6⁺)	3082.36	4⁺				
328.75 *3*	14 *1*	2225.839	2⁺	1897.164	3⁻	(E1(+M2))[&]	−0.02 *5*		Mult.: A_2=−0.04 *3*, A_4=+0.02 *5*.
363.58 *8*	<2	3483.45	6⁺	3119.87	5⁻				
442.9 *3*	4 *1*	2668.82	(2⁺)	2225.839	2⁺				
469.33 *3*	21 *1*	2695.17	0⁺	2225.839	2⁺				
475.33 *1*	57 *1*	2225.839	2⁺	1750.494	2⁺	(M1+E2)[&]	−0.09 *+1−2*		Mult.,δ: A_2=+0.159 *7*, A_4=−0.027 *10*.
574.74 *6*	8 *2*	3243.61		2668.82	(2⁺)				
631.63 *9*	10 *2*	2857.393	4⁺	2225.839	2⁺	E2(+M3)	−0.02 *8*		Mult.: Q+O from γ(θ), E2(+M3) from RUL. A_2=+0.37 *7*, A_4=−0.15 *12*.
644.18 *6*	28 *2*	2225.839	2⁺	1581.66	0⁺	(E2)[&]			Mult.: A_2=+0.33 *3*, A_4=−0.06 *4*.
688.25 *1*	135 *4*	2438.744	3⁺	1750.494	2⁺	M1+E2	+0.02 *+2−1*		Mult.: D+Q from γ(θ); M1+E2 from RUL. A_2=−0.253 *13*, A_4=−0.03 *2*.
699.6 *1*	<7	2925.53	0⁺	2225.839	2⁺				
711.56 *3*	25 *2*	3150.28	3⁻	2438.744	3⁺	(E1+M2)[&]	−0.07 *4*		Mult.: A_2=+0.32 *4*, A_4=−0.02 *6*. δ: −0.07 *4* for a 3⁻ to 3⁺ transition.
[x]763.0 *5*	10 *3*								
771.60 *4*	22 *3*	2668.82	(2⁺)	1897.164	3⁻	(E1+M2)[&]	+0.08 *+6−7*		Mult.: A_2=−0.16 *5*, A_4=−0.06 *7*.
780.2 *2*	16 *3*	3448.73	(2⁺)	2668.82	(2⁺)				I_γ: includes an impurity contaminant.
857 *1*	<3	3082.36	4⁺	2225.839	2⁺				
894[#] *1*		4013.9	5⁻	3119.87	5⁻				
918.6 *1*	63 *3*	2668.82	(2⁺)	1750.494	2⁺				
924.55 *4*	21 *2*	3363.30		2438.744	3⁺				I_γ: doublet observed with E(n)=3.4 MeV and 3.8 MeV thresholds.
960.9 *2*	7 *2*	2857.393	4⁺	1897.164	3⁻				E_γ: from reactor fast neutrons.
1018.3 *2*	8 *2*	3243.61		2225.839	2⁺				
1022.8 *1*	8 *2*	3248.63	2⁺	2225.839	2⁺				
1106.88 *2*	47 *3*	2857.393	4⁺	1750.494	2⁺	E2(+M3)	−0.03 *3*		Mult.: Q+O from γ(θ), E2(+M3) from RUL. A_2=+0.37 *3*, A_4=−0.18 *4*.
1138.87 *5*	<30	3577.62		2438.744	3⁺				I_γ: includes an impurity contaminant.
1175.04 *3*	13 *2*	2925.53	0⁺	1750.494	2⁺				
1185.19 *3*	41 *2*	3082.36	4⁺	1897.164	3⁻	(E1(+M2))	+0.02 *3*		Mult.: A_2=−0.27 *4*, A_4=−0.08 *6*.
1222.70 *3*	36 *3*	3119.87	5⁻	1897.164	3⁻	(E2+M3)[&]	−0.05 *3*		Mult.: A_2=+0.36 *3*, A_4=−0.22 *5*.
1252.98 *7*	18 *6*	3150.28	3⁻	1897.164	3⁻	M1+E2[&]	+1.7 *3*		Mult.: A_2=+0.29 *5*, A_4=−0.20 *8*. D+Q from γ(θ); M1+E2 from RUL.
1279.27 *2*	45 *4*	3176.44	4⁺	1897.164	3⁻	(E1(+M2))[&]	−0.03 *3*		Mult.: A_2=−0.36 *4*, A_4=−0.10 *6*.
1283.3 *1*	9 *2*	3509.21	2⁺	2225.839	2⁺				
1314.64 *4*	28 *3*	3211.84	2⁺	1897.164	3⁻				
1332 *1*	<3	3082.36	4⁺	1750.494	2⁺				
[x]1352.5 *1*	10 *2*								

$^{96}_{40}Zr_{56}$-2

^{96}Zr(n,n′γ) 1989Mo15,1989Be29 (continued)

γ(^{96}Zr) (continued)

E_γ‡	I_γ†	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
x1399.1 *5*	7 *2*						
1426.4# *1*	<4	3865.16		2438.744	3^+		
1461.5 *1*	15 *3*	3211.84	2^+	1750.494	2^+		I_γ: includes an impurity contaminant.
1551.50 *8*	12 *3*	3448.73	(2^+)	1897.164	3^-		
x1559.47 *6*	18 *3*						
x1595.50 *6*							
1612.1 *1*	35 *4*	3509.21	2^+	1897.164	3^-		
x1688.4 *1*	15 *3*						
x1705.4 *5*	9 *3*						
x1731.16 *7*	13 *2*						
1750.42 *2*	1000 *10*	1750.494	2^+	0.0	0^+		
x1806.2 *1*	7 *2*						
x1824.7 *1*	6 *1*						
1852.2# *1*	10 *3*	3749.38	4^+	1897.164	3^-		
1897.21 *3*	49 *3*	1897.164	3^-	0.0	0^+		
x1935.6 *1*							
x1951.24 *6*	11 *2*						
x1968.1 *1*							
x1982.48 *7*	14 *2*						
2225.93 *4*	100 *5*	2225.839	2^+	0.0	0^+	(E2)&	Mult.: A_2=+0.31 *4*, A_4=−0.12 *5*.
x2273.8 *1*							
3211.8 *1*	18 *5*	3211.84	2^+	0.0	0^+		
3248.56 *6*	37 *4*	3248.63	2^+	0.0	0^+		
3472.07 *7*	30 *4*	3472.14	2^+	0.0	0^+	[E2][a]	I_γ: includes an impurity contaminant.
3556.11 *8*		3556.18	2^+	0.0	0^+	[E2][a]	
3602.1# *2*		3602.17	$(1,2^+)$	0.0	0^+		
3620.66 *7*	34 *3*	3620.73	$(1,2^+)$	0.0	0^+		
3700.6# *1*		3700.68	$(1,2^+)$	0.0	0^+		
3857.4# *2*		3857.48	2^+	0.0	0^+	[E2][a]	
3947.1# *1*		3947.19	$(1,2^+)$	0.0	0^+		
4037.8# *2*		4037.89	$(1,2^+)$	0.0	0^+		
4132.3# *3*		4132.4	$(1,2^+)$	0.0	0^+		

† At E(n)=4 MeV; authors also give values resulting from reactor fast neutrons (1989Mo15).
‡ E(n)=fast or 4 MeV; more precise of the two sets of values are given (1989Mo15).
# Observed only at E(n)=4.3 and 4.7 MeV (1989Mo15).
@ Adopted values from γ(θ) (1989Mo15).
& From γ(θ) (1989Mo15) and ΔJ^π.

$^{96}_{40}Zr_{56}$-3

^{96}Zr(n,n′γ) 1989Mo15,1989Be29 (continued)

γ(^{96}Zr) (continued)

[a] Expected from ΔJ^{π}.
[b] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[x] γ ray not placed in level scheme.

$^{96}_{40}Zr_{56}$-4

^{96}Zr(n,n′γ) 1989Mo15,1989Be29

Level Scheme

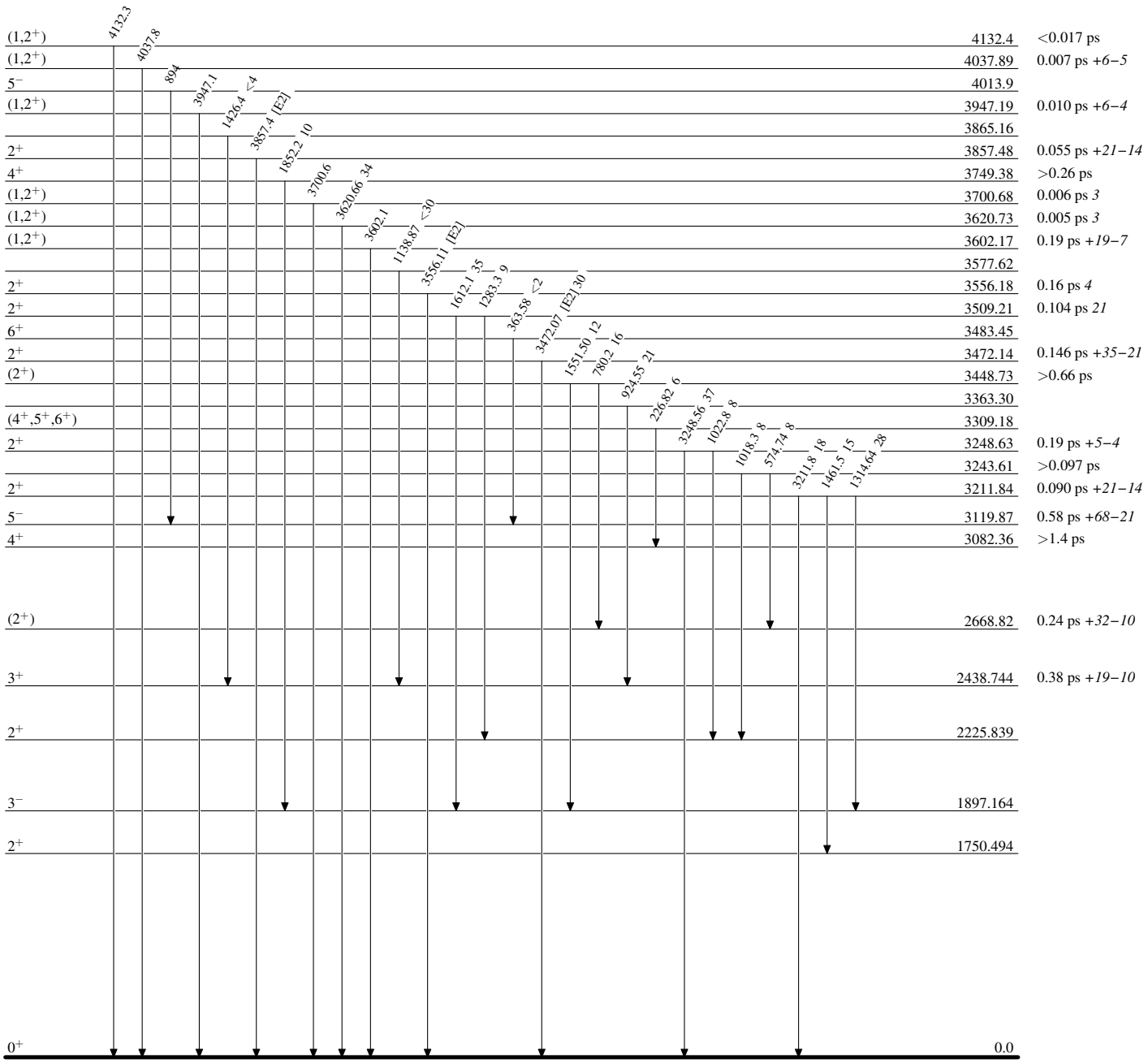
Intensities: Relative I_γ

Legend

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

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

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



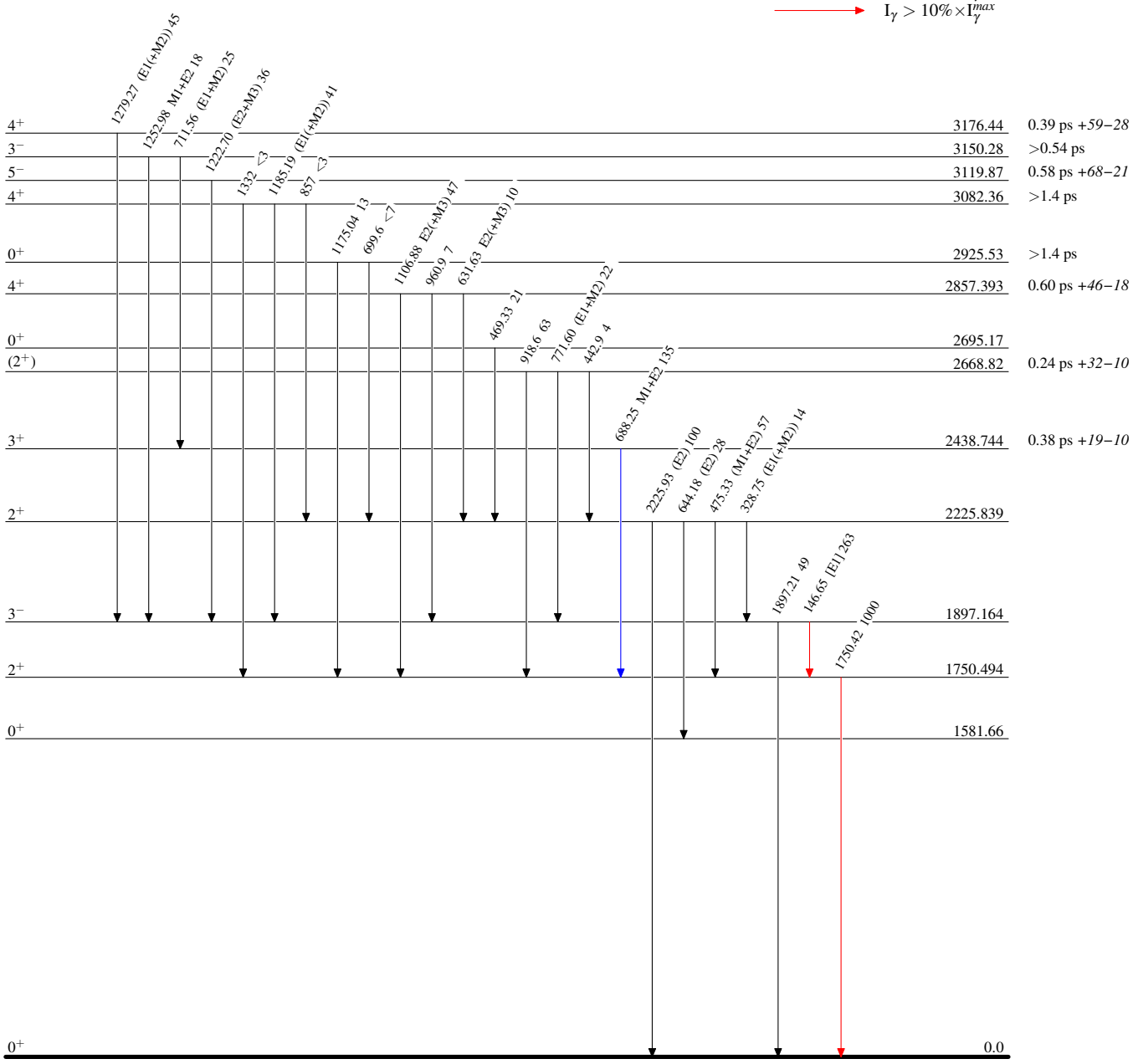
$^{96}_{40}Zr_{56}$

^{96}Zr(n,n′γ) 1989Mo15,1989Be29

Level Scheme (continued)

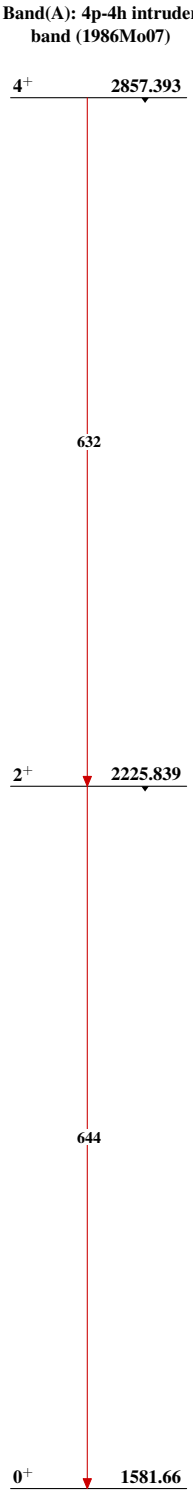
Intensities: Relative I_γ

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



$^{96}_{40}Zr_{56}$

^{96}Zr(n,n′γ) 1989Mo15,1989Be29



$^{96}_{40}Zr_{56}$