^{90}Zr(n,γ) E=thermal 1982LoZT,1978LoZX

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 114, 1293 (2013)	1-Sep-2013

Other: 2007ChZX.

2007ChZX: this evaluation includes new elemental cross section measurements for two primary and two secondary transitions.

1982LoZT: thermal neutron capture; natural Zr and ^{90}Zr-enriched targets; Ge(Li); measured Eγ, Iγ, capture cross sections. data probably supersede those of 1978LoZX.

1978LoZX: thermal neutron capture; enriched target;Ge(Li); measured Eγ, Iγ, γγ coin.

See separate dataset for (n,γ) E=res data.

% abundance (^{90}Zr)=51.5 *4*. σ_n=0.077 *16* (2006MuZX).

1978LoZX give a partial level scheme. the evaluator has removed from this the transitions which were not confirmed In the data of 1982LoZT. Since 1982LoZT give No level scheme and do not differentiate between primary and secondary transitions, the evaluator has added many transitions to the level scheme based on Eγ, on the likelihood that all low-spin levels below about 3000 keV are already known from other studies, and on the energies of established levels of appropriate J$^\pi$. Levels to which there appears to be primary feeding are shown As tentative if No deexcitation γ is reported. The possible placements of a number of unplaced transitions are indicated In comments. the γ intensities are not normalized since the level scheme is clearly incomplete; the total primary γ intensity is roughly 40% of the summed Iγ feeding to the g.s. In the present level scheme.

^{91}Zr Levels

E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]
0	5/2$^+$	2640.5 *8*	(3/2)$^-$	3984.3 *8*	3/2$^+$,5/2$^+$
1204.8 *8*	1/2$^+$	2694.4? *10*	(3/2)$^-$	4025.6? *11*	(3/2$^+$,5/2$^+$)
1466.4 *8*	5/2$^+$	2774.9? *10*	(5/2)$^-$	4162.5 *8*	3/2$^+$,5/2$^+$
1881.8? *10*	7/2$^+$	2871.6 *8*	3/2$^+$	4180.0 *7*	1/2$^{(+)}$,3/2,5/2$^+$
2042.0 *8*	3/2$^+$	3083.7 *8*	3/2$^+$	4319.9 *8*	3/2$^-$
2366.3? *11*		3234.7? *11*	(3/2)$^-$	4532.7? *11*	3/2$^+$,5/2$^+$
2558.3 *8*	1/2$^+$	3288.5? *11*	3/2$^+$	7194.9[#] *4*	1/2$^+$[@]
2577.9 *8*	(3/2)$^-$	3476.7 *8*	1/2$^-$,3/2,5/2$^+$[&]		

† From least-squares fit to Eγ, assigning an uncertainty of 1 keV to all gammas. This leads to E=7194.9 *4* for the capture state cf. 7193 *3* deduced by 1978LoZX, and the adopted value of S(n)=7193.9 *4* (2012Wa38).

‡ From Adopted Levels, except as noted.

\# From least-squares fit to Eγ (cf. S(n)=7193.9 *4* (2012Wa38).

@ Thermal n capture from 0$^+$ state.

& It is not known whether this level is the 1/2$^-$,3/2- 3476.1-keV or the 3/2$^+$,5/2$^+$ 3476.3-keV state (see Adopted Levels).

γ(^{91}Zr)

Eγ[†]	Iγ[†a]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Comments
^{x}1153[‡]						placed by 1978LoZX from a 2358 level fed by an uncertain 4834-keV primary γ; the latter γ is not confirmed by 1982LoZT.
1204.74	38.7	1204.8	1/2$^+$	0	5/2$^+$	other: Eγ=1206.89 *8*, elemental σ=0.0417 *25* (2007ChZX; Budapest data).
^{x}1407[‡]						placed by 1978LoZX from the 2874 level, but γ not confirmed by 1982LoZT and γ is otherwise unknown.
^{x}1433[‡]						placed by 1978LoZX from the 2641 level, but γ not confirmed by 1982LoZT and γ is otherwise unknown.
1466.32	33.4	1466.4	5/2$^+$	0	5/2$^+$	
1881.74[@b]	4.2	1881.8?	7/2$^+$	0	5/2$^+$	
2041.70	17.2	2042.0	3/2$^+$	0	5/2$^+$	

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^{90}Zr(n,γ) E=thermal 1982LoZT,1978LoZX (continued)

γ(^{91}Zr) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
x2533[‡]						Eγ is consistent with that for a γ known from Adopted Levels to deexcite the (3/2$^+$,5/2$^+$), 2535 state, but No corresponding primary γ has been identified.
2558.54	8.3	2558.3	1/2$^+$	0	5/2$^+$	
2578.07	9.8	2577.9	(3/2)$^-$	0	5/2$^+$	
2640.13	5.3	2640.5	(3/2)$^-$	0	5/2$^+$	
2662.12[&b]	2.8	7194.9	1/2$^+$	4532.7?	3/2$^+$,5/2$^+$	
2694.33[b]	3.5	2694.4?	(3/2)$^-$	0	5/2$^+$	other data: Eγ=2694.24 *16*, elemental σ=0.0057 *5* (2007ChZX; Budapest data).
2713.55	9.3	4180.0	1/2$^{(+)}$,3/2,5/2$^+$	1466.4	5/2$^+$	
2774.82[b]	2.8	2774.9?	(5/2)$^-$	0	5/2$^+$	
2870.70	3.0	2871.6	3/2$^+$	0	5/2$^+$	
2875.00	4.3	7194.9	1/2$^+$	4319.9	3/2$^-$	
x2896.67	1.3					E$_\gamma$: consistent with that expected for a primary γ feeding the adopted E=4296 *4*, 1/2$^-$,3/2$^-$ level, but No accompanying secondary γ has been identified.
3015.12	12.4	7194.9	1/2$^+$	4180.0	1/2$^{(+)}$,3/2,5/2$^+$	
3032.53	3.5	7194.9	1/2$^+$	4162.5	3/2$^+$,5/2$^+$	
3083.99	5.3	3083.7	3/2$^+$	0	5/2$^+$	
3169.20[&b]	1.3	7194.9	1/2$^+$	4025.6?	(3/2$^+$,5/2$^+$)	
3210.85	4.3	7194.9	1/2$^+$	3984.3	3/2$^+$,5/2$^+$	
3476.74	8.3	3476.7	1/2$^-$,3/2,5/2$^+$	0	5/2$^+$	
3718.15	6.1	7194.9	1/2$^+$	3476.7	1/2$^-$,3/2,5/2$^+$	
x3898.90	1.0					
3906.30[&b]	1.3	7194.9	1/2$^+$	3288.5?	3/2$^+$	
3960.14[&b]	3.5	7194.9	1/2$^+$	3234.7?	(3/2)$^-$	
x3977.16	2.2					
3984.45	2.8	3984.3	3/2$^+$,5/2$^+$	0	5/2$^+$	
x4097.2	1.3					
4111.5	1.4	7194.9	1/2$^+$	3083.7	3/2$^+$	
4162.6	2.2	4162.5	3/2$^+$,5/2$^+$	0	5/2$^+$	
4180.2	1.4	4180.0	1/2$^{(+)}$,3/2,5/2$^+$	0	5/2$^+$	
4319.8	2.5	4319.9	3/2$^-$	0	5/2$^+$	
4322.4	4.3	7194.9	1/2$^+$	2871.6	3/2$^+$	
4553.9	1.9	7194.9	1/2$^+$	2640.5	(3/2)$^-$	
x4572.3	0.4					
4617.0	5.3	7194.9	1/2$^+$	2577.9	(3/2)$^-$	
4636.8	2.8	7194.9	1/2$^+$	2558.3	1/2$^+$	
4828.5[&b]	2.4	7194.9	1/2$^+$	2366.3?		
x4889.5	0.8					
x4927.6[#]	0.8					
x5057.1	0.8					
5152.4	2.3	7194.9	1/2$^+$	2042.0	3/2$^+$	other data: Eγ=5154.3 *4*, elemental σ=0.0017 *5* (2007ChZX; Budapest data).
x5309.0[#]	1.0					
x5314.5[#]	2.8					
x5360.5[#]	2.8					
x5409.0	0.8					
x5436.5	1.0					
x5474.5[#]	1.4					
x5501.5[#]	0.9					

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^{90}Zr(n,γ) E=thermal 1982LoZT,1978LoZX (continued)

γ(^{91}Zr) (continued)

Eγ[†]	Iγ[†a]	Ei(level)	J^{π}_i	E_f	J^{π}_f	Comments
[x]5671.7[#]	0.8					
[x]5782.0[#]	0.5					
[x]5842.0[#]	0.8					
[x]5893.6[#]	0.8					
5989.8	1.6	7194.9	1/2+	1204.8	1/2+	other data: Eγ=5990.2 *3*, elemental σ=0.00111 *22* (2007ChZX; Budapest data).
[x]6026.6[#]	1.0					
[x]6355.1[#]	1.7					
[x]6386.5[#]	0.5					
[x]6627.9[#]	1.1					
7194.4	0.3	7194.9	1/2+	0	5/2+	

[†] From 1982LoZT, except As noted. authors do not state uncertainties. Eγ data, quoted by authors to two decimal places, agree with adopted values to better than 0.7 keV; evaluator has rounded Eγ to one decimal place for Eγ>4000. The summed relative intensities are 61.8 for placed primary transitions, 25.2 for unplaced transitions and 158.0 for placed secondary transitions (tentative placements included), with 149.0 feeding the g.s.

[‡] Reported by 1978LoZX only. since the more extensive data of 1982LoZT do not include this transition, the evaluator questions its assignment to ^{91}Zr.

[#] Probably a secondary γ feeding g.s.; there is an adopted level, known to ±10 keV from (d,p), near this energy, and there is No known low-lying state that a primary γ of this energy should populate.

[@] Designated As a secondary γ In 1978LoZX. however, if the 5314.5γ of 1982LoZT were a secondary γ to g.s., an Eγ=1880.4 primary transition would be expected and could not have been resolved from a secondary γ to g.s. from the known 7/2+, 1882.2 level. note that the latter level cannot be fed directly by a primary γ from the 1/2+ capture state.

[&] Placement shown As uncertain because No secondary γ could be identified with a level fed by a primary γ with this Eγ.

[a] For intensity per 100 neutron captures, multiply by ≈1.6.

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

[x] γ ray not placed in level scheme.

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Level Scheme

Intensities: Relative I_γ