^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 113, 2187 (2012)	15-Sep-2012

Others: 1964Ba02, 1965Ko10, 1970Or05, 2007Eg02; natural Zr targets. 1972FaZW.

$J^\pi(^{91}Zr)=5/2^+$; abundance(^{91}Zr)=11.2%.

σ_n=1.24 b *25* (1981MuZQ,2007ChZX); consistent with lower and upper limits of 1.30 b *4* and 1.5 b *2* (2007Na05). 0.83 b *8* (2006MuZX) has been revised by author to 1.22 b for adoption In the ENDF/B-VII.1 database (2011Ch57).

1965Ko10: measured (pol n, pol γ).

1979HeZT, 1972FaZW: reports of same experiment; 70% enriched ^{91}Zr target. 1972FaZW present a level scheme based on coincidence data and energy sum relations. 1979HeZT report Eγ, Iγ for Eγ<2800; Eγ values for E$\gamma\geq$2800 (ΔE and Iγ unstated) are given in 1972FaZW. The 6295-keV primary γ is by far the most intense.

2007ChZX: evaluation of (n,γ) E=thermal data that includes new elemental cross section data; Ge detector; measured Eγ, Iγ (labelled here As 'Budapest Data').

2007Eg02: HPGe detector; Zr oxide target mixed with Al standard; measured absolute intensity of 934γ.

2007Na05: 18.6 *1* atomic % ^{91}Zr oxide target At center of graphite thermal column In 6 x 10^{11} n/cm^2 flux with 350° K maxwellian distribution; coaxial Ge(Li) detector inside NaI(Tl) annulus optically divided lengthwise to enable operation As pair spectrometer (for Eγ>1.02 MeV) and In Compton-suppression mode (for Eγ<2 MeV), all enclosed In cylindrical 10 cm thick shield of steel and Pb; FWHM=2.3 keV At 2 MeV, 5.7 keV At 11 MeV; calibrated using radioactive sources or ^{14}N(n,γ) E=thermal; measured Eγ, Iγ.

Data from 1970Or05 are not quoted here because their inferior spectrum resolution and the more complex spectrum resulting from a natural Zr target make it unproductive to compare those data with higher-resolution ones from isotopically-enriched targets.

^{92}Zr Levels

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
0.0	0^+	2485.95 *9*	5^-@	3124.56 *12*	$1^{(+)}$	3452.13 *7*	$(2)^+$
934.48 *4*	2^+	2743.49 *7*	4^-	3178.26 *11*	4^+	3462.98? *16*	$(4)^+$
1382.70 *7*	0^+	2819.53 *8*	2^+	3190.93 *21*		3472.01 *15*	1^+
1495.41 *6*	4^+	2864.60 *10*	4^+	3237.21? *21*		3500.16 *10*	2^+
1847.26 *5*	2^+	2903.39 *21*		3262.61 *4*	2^+	3628.28 *8*	(4^+)
2066.58 *6*	2^+&	2909.40 *7*	3^+	3275.71 *8*	$2^+,3^+$	3640.25 *11*	$(2)^+$
2339.58 *6*	3^-*a*	2957.2 *3*		3289.09 *8*	3^+	3649.17 *13*	3^+
2398.31 *7*	4^+	3039.65 *7*	3	3371.43 *8*	$1^{(-)}$	3830.26 *9*	$(1^-,2^+)$
2473.64 *20*		3057.3 *3*		3408.04 *18*		(8634.79*b* *9*)	2^+#

† From least-squares fit to Eγ excluding Eγ for transitions with uncertain placement and assigning 1 keV uncertainty to all data for which ΔE(γ) is unknown.

‡ From Adopted Levels, except As noted.

$J^\pi=2^+,3^+$ for thermal n capture on $5/2^+$ target. $J^\pi=2^+$ is adopted because $\gamma\gamma(\theta)$ data indicate very little, if any, mixing for 6295γ to 3^- state if J=2 but considerable mixing if J=3. Also, γ decay to both 0^+ and 4^+ levels is observed from the capture state. See also the comment on mult for 6295γ and 1405γ.

@ 1972FaZW suggest $J^\pi=2^+$ for 2486 level on the basis of 1103γ deexcitation to a 0^+ state (no coin information). 1103γ not observed by 2007Na05 or in (n,n'γ) or in (^{7}Li,2npγ) from the 5^- level adopted at this energy and deexcited by a 990γ. Either the 1103γ is misplaced or there exist two levels which possess almost identical excitation energy. The evaluator adopts the former explanation and shows the 1103γ placement as unknown here.

& From $\gamma\gamma(\theta)$; see comment on mult, δ for 1132γ.

a 1965Ko10 deduce $J^\pi=1^-$ from measured asymmetry=−1.8 *5* for 6295-keV primary γ ray feeding this state. The conflicting, adopted $J^\pi=3^-$ is well established from numerous scattering and transfer reaction L value determinations.

b E(level) from least-squares fit to Eγ (cf. S(n)=8634.79 *11* from 2011AuZZ).

^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr)

Iγ normalization: 0.079 *16* from measured absolute intensity (=79 *16*) for 934γ (2007Eg02). Consistent with value deduced from elemental σ(934γ)=0.125 b *5* (2007ChZX) assuming σ_n=1.24 *25* (1981MuZQ, 2007ChZX).

E_γ[†]	I_γ[‡k]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]122.27 *14*	0.56 *8*					
[x]124.96 *11*	1.60 *20*					
[x]134.8 *3*	0.32 *8*					
[x]143.7 *3*	0.16 *8*					
[x]147.85 *21*	0.28 *8*					
[x]167.38 *16*	0.36 *8*					
[x]172.40 *25*	0.24 *8*					
[x]181.87 *11*	1.60 *16*					
[x]192.6 *4*	0.16 *8*					
[x]203.18 *27*	0.24 *16*					
[x]206.12 *22*	0.32 *16*					
219.07 *15*	0.56 *16*	2066.58	2^+	1847.26	2^+	Eγ: weighted average of 219.16 *17* (1979HeZT) and 218.8 *3* (2007Na05). Iγ: from 1979HeZT. Other Iγ: 28.5 *17* (2007Na05).
224.7 *3*	0.24 *8*	3500.16	2^+	3275.71	2^+,3^+	other Eγ (Iγ): 224.4 *3* (3.2 *24*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
257.57 *10*	7.2 *7*	2743.49	4^-	2485.95	5^-	γ unobserved by 2007Na05.
[x]269.80 *18*	0.56 *8*					
272.85[l] *24*	0.40 *16*	2339.58	3^-	2066.58	2^+	other Eγ (Iγ): 273.08 *11* (23 *3*) (2007ChZX, Budapest Data), unobserved by 2007Na05, so shown As uncertain here and excluded from Adopted Gammas.
[x]278.08 *12*	1.12 *16*					
295.77 *19*	0.80 *16*	3039.65	3	2743.49	4^-	other Eγ (Iγ): 296.67 *18* (8.2 *18*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
[x]304.13 *17*	0.72 *16*					
[x]307.6 *3*	0.40 *16*					
[x]311.8 *3*	0.48 *16*					
[x]314.2 *3*	0.40 *16*					
[x]333.95[g] *9*						Eγ: weighted average of 334.2 *2* (2007Na05), 333.82 *25* (2007ChZX, Budapest Data) and 333.90 *11* (1979HeZT). Iγ: discrepant data: 2.08 *16* (1979HeZT), 8.4 *8* (2007Na05) and 7.3 *20* (2007ChZX, Budapest Data).
[x]336.5 *4*	0.24 *16*					
[x]341.80 *14*	1.04 *16*					
344.8 *3*	0.40 *16*	2743.49	4^-	2398.31	4^+	other Eγ (Iγ): 345.40 *15* (8.6 *19*) (2007ChZX, Budapest Data). Branch not observed by 2007Na05 or In (n,n′γ).
[x]349.4 *4*	0.32 *16*					
[x]352.33[c]	2.6[c] *3*					
[x]356.28 *20*	0.64 *16*					
366.62[l] *19*	0.80 *16*	3275.71	2^+,3^+	2909.40	3^+	γ unobserved by 2007Na05 2007ChZX.
378.21 *16*	1.76 *24*	3830.26	$(1^-,2^+)$	3452.13	$(2)^+$	γ unobserved by 2007Na05 or 2007ChZX.
379.60 *10*	4.1 *9*	3289.09	3^+	2909.40	3^+	Eγ: weighted average of 379.34 *12* (9.0 *15*) and 379.5 *2* (2007Na05). other: 379.34 *12* (2007ChZX, Budapest Data). Iγ: unweighted average of 5.0 *8* (2007Na05), 3.12 *24* (1979HeZT). Other: 9.0 *15* (2007ChZX, Budapest Data).379.5 2 (5.0 *8*) (2007Na05), .
403.83 *9*	5.7 *10*	2743.49	4^-	2339.58	3^-	Eγ: weighted average of 403.81 *10* (4.7 *4*) (1979HeZT) and 403.9 *2* (6.7 *8*) (2007Na05). other: 403.47 *15* (2007ChZX, Budapest Data). Iγ: unweighted average of 4.7 *4* (1979HeZT) and 6.7 *8* (2007Na05). Other: 11.0 *20* (2007ChZX, Budapest Data). Unweighted average of all data is 7.5 *19*.

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

$\gamma(^{92}Zr)$ (continued)

E_γ[†]	I_γ[‡k]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]411.7 *3*	0.40 *16*					
[x]420.57 *18*	0.96 *16*					
[x]424.4 *4*	0.40 *16*					
[x]436.2 *3*	0.56 *24*					
[x]439.58 *18*	1.04 *16*					
448.22 *5*	52.8 *13*	1382.70	0^+	934.48	2^+	E_γ: unweighted average of 448.3 *2* (2007Na05), 448.13 *7* (2007ChZX, Budapest data), 448.22 *10* (1979HeZT). I_γ: weighted average of 52.9 *17* (2007Na05), 53.6 *24* (2007ChZX, Budapest data), 48 *5* (1979HeZT).
[x]453.9 *4*	0.56 *32*					
465.94[e] *21*	1.1 *3*	2864.60	4^+	2398.31	4^+	γ unobserved by 2007Na05.
492.37 *10*	24.2 *20*	2339.58	3^-	1847.26	2^+	other Eγ (Iγ): 492.5 *2* (39.4 *17*) (2007Na05).
[x]498.3 *8*	0.32 *24*					
[x]517.01 *10*	4.4 *4*					
560.93 *5*	236 *10*	1495.41	4^+	934.48	2^+	E_γ: weighted average of 560.96 *10* (1979HeZT), 560.91 *6* (2007ChZX, Budapest data), 561.0 *2* (2007Na05). I_γ: unweighted average of 225 *16* (1979HeZT), 228 *4* (2007ChZX, Budapest data), 255 *8* (2007Na05).
569.47 *17*	0.56 *16*	2909.40	3^+	2339.58	3^-	E_γ: weighted average of 569.46 *21* (1979HeZT), 569.5 *3* (2007ChZX, Budapest Data). I_γ: 0.56 *16* (1979HeZT), 10.4 *24* (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
571.28 *15*	0.48 *16*	2066.58	2^+	1495.41	4^+	E_γ: weighted average of 571.37 *22* (1979HeZT) and 571.2 *2* (2007Na05). other Eγ: 572.05 *20* (2007ChZX, Budapest Data). I_γ: from 1979HeZT. others: 15.1 *8* (2007Na05), 17.6 *24* (2007ChZX, Budapest Data).
[x]575.08 *12*	1.12 *16*					
[x]580.4 *6*	0.24 *16*					
[x]583.7 *3*	0.48 *16*					
588.32 *24*	0.56 *16*	3628.28	(4^+)	3039.65	3	other Eγ (Iγ): 589.1 *6* (9 *3*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
590.67 *22*	0.72 *16*	3500.16	2^+	2909.40	3^+	γ unobserved by 2007Na05 or 2007ChZX.
[x]598.8[f] *3*	0.56 *16*					
601.1[l] *3*	0.40 *16*	3640.25	$(2)^+$	3039.65	3	γ unobserved by 2007Na05 or 2007ChZX.
[x]608.63 *20*	0.80 *16*					
[x]616.6 *4*	0.32 *16*					
[x]622.23 *16*	1.04 *16*					
632.12[l] *24*	0.64 *16*	3452.13	$(2)^+$	2819.53	2^+	γ unobserved by 2007Na05 or 2007ChZX.
[x]645.59 *13*	1.28 *16*					
[x]651.3 *4*	0.32 *16*					
[x]657.85 *10*	4.4 *4*					
[x]669.99 *24*	0.56 *16*					
[x]674.8 *4*	0.32 *16*					
677.59[l] *15*		2743.49	4^-	2066.58	2^+	E_γ: weighted average of 677.45 *23* (1979HeZT), 677.7 *2* (2007Na05). Fits placement poorly and placement requires M2 multipolarity, so shown As tentative here and branch omitted from Adopted Levels. Gammas. I_γ: data are discrepant: 0.64 *16* (1979HeZT), 8.4 *8* (2007Na05). Branch is absent In (n,n$'\gamma$).
680.65 *21*	0.64 *16*	3500.16	2^+	2819.53	2^+	other Eγ (Iγ): 682.5 *3* (8.0 *24*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
700.10 *9*	4.6 *4*	3039.65	3	2339.58	3^-	Eγ (Iγ): weighted average of 700.0 *2* (4.2 *8*) (2007Na05) and 700.13 *10* (4.8 *5*) (1979HeZT). other Eγ (Iγ): 700.0 *2* (4.2 *8*) (2007Na05).
[x]706.34 *21*	0.88 *16*					
717.7[j] *3*	3.4[j] *8*	3057.3		2339.58	3^-	

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ [†]	I_γ [‡ k]	E_i(level)	J_i^π	E_f	J_f^π	Comments
x737.86 *24*	0.80 *24*					
x763.97 *21*	1.4 *3*					
x770.17 *12*	2.56 *24*					
x775.86 *21*	0.80 *16*					
779.94 [d] *10*	7.5 *7*	3178.26	4^+	2398.31	4^+	other Eγ (Iγ): 780.0 *2* (9.2 *8*) (2007Na05).
x784.40 *16*	2.08 *24*					
x786.27 *15*	2.64 *24*					
x788.49 *12*	3.5 *3*					
790.70 *11*	3.5 *7*	3830.26	$(1^-,2^+)$	3039.65	3	E_γ: weighted average of 790.74 *13* (1979HeZT), 790.6 *2* (2007Na05). I_γ: unweighted average of 4.2 *8* (2007Na05) and 2.88 *24* (1979HeZT).
x792.99 *19*	1.28 *24*					
x798.09 *24*	0.56 *16*					
x806.2 *3*	0.48 *16*					
808.67 *22*	1.04 *16*	3628.28	(4^+)	2819.53	2^+	γ unobserved by 2007Na05 or 2007ChZX.
x810.76 *20*	1.12 *16*					
x818.39 *21*	0.88 *16*					
821.0 *3*	0.48 *16*	3640.25	$(2)^+$	2819.53	2^+	E_γ: weighted average of 821.1 *4* (1979HeZT), 820.9 *5* (2007Na05). other γ: 0.8 *8* (2007Na05).
x823.2 *3*	0.72 *16*					
x831.7 *3*	0.72 *24*					
x834.7 *3*	0.88 *24*					
836.8 [j] *2*	3.4 [j] *8*	2903.39		2066.58	2^+	
x837.51 [i] *13*	2.72 *24*					
842.69 *15*	4.7 *6*	2909.40	3^+	2066.58	2^+	γ unobserved by 2007Na05 or 2007ChZX.
844.12 *6*	71 *5*	2339.58	3^-	1495.41	4^+	E_γ: weighted average of 844.2 *2* (2007Na05), 844.08 *7* (2007ChZX, Budapest Data), 844.19 *10* (1979HeZT). I_γ: unweighted average of 75.5 *25* (2007Na05), 76 *3* (2007ChZX, Budapest Data), 61 *5* (1979HeZT) (the weighted average is 74 *3*).
x851.58 *11*	3.9 *3*					
x854.65 *13*	2.32 *24*					
x867.17 *15*	1.44 *16*					
x870.53 *23*	0.88 *16*					
x873.2 *4*	0.48 *16*					
877.45 *10*	2.8 *6*	3275.71	$2^+,3^+$	2398.31	4^+	E_γ: weighted average of 877.3 *2* (2007Na05) and 877.51 *12* (1979HeZT). I_γ: unweighted average of 2.24 *24* (1979HeZT) and 3.4 *8* (2007Na05). weighted average is 2.3 *3*.
884.74 *11*	6.3 *6*	3628.28	(4^+)	2743.49	4^-	γ unobserved by 2007Na05 or 2007ChZX.
891.0 *4*	0.40 *24*	3289.09	3^+	2398.31	4^+	γ unobserved by 2007Na05 or 2007ChZX.
x897.49 *17*	2.00 *24*					
902.92 *7*	34.7 *17*	2398.31	4^+	1495.41	4^+	Eγ (Iγ): weighted average of 902.8 *2* (34.4 *17*) (2007Na05), 903.05 *12* (38 *4*) (2007ChZX, Budapest Data), 902.86 *10* (34 *3*) (1979HeZT).
912.72 *6*	98 *5*	1847.26	2^+	934.48	2^+	E_γ: weighted average of 912.71 *7* (2007ChZX, Budapest data), 912.7 *2* (2007Na05), 912.76 *10* (1979HeZT). I_γ: unweighted average of 92 *8* (1979HeZT), 107 *3* (2007Na05), 94 *4* (2007ChZX, Budapest data). other Eγ (Iγ): 912.7 *2* (107 *3*) (2007Na05).
934.46 *5*	1000 *33*	934.48	2^+	0.0	0^+	I_γ: from 2007Na05. other Iγ: 1000 *80* (1979HeZT), 1000 *40* (2007ChZX, Budapest data). I_γ: 79 *16* per 100 neutron captures (2007Eg02). E_γ: weighted average of 934.47 *6* (2007ChZX, Budapest data), 934.46 *10* (1979HeZT), 934.4 *2* (2007Na05).

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ [†]	I_γ [‡k]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
[x]968.4 *4*	0.40 *16*						
972.30 *9*	19.0 *7*	2819.53	2^+	1847.26	2^+		Eγ (Iγ): weighted average of 972.2 *2* (19.3 *8*) (2007Na05) and 972.33 *10* (17.7 *16*) (1979HeZT).
990.52 *9*	225.9 *18*	2485.95	5^-	1495.41	4^+		Eγ (Iγ): weighted average of 990.54 *10* (27.0 *24*) (1979HeZT), 990.45 *17* (23 *4*) (2007ChZX, Budapest Data); γ unobserved by 2007Na05.
[x]995.42[f] *11*	4.7 *4*						
[x]1018.61[f] *27*	0.72 *16*						
1032.0 *3*	0.64 *16*	3371.43	$1^{(-)}$	2339.58	3^-		other Eγ (Iγ): 1030.83 *24* (10 *3*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
[x]1035.37 *28*	0.72 *16*						
[x]1044.7 *4*	0.40 *24*						
1057.97[e] *10*	3.00 *23*	3124.56	$1^{(+)}$	2066.58	2^+		Eγ (Iγ): weighted average of 1057.8 *2* (3.4 *8*) (2007Na05) and 1058.03 *12* (2.96 *24*) (1979HeZT).
[x]1061.71 *18*	1.44 *24*						
[x]1065.00 *24*	1.04 *24*						
[x]1068.18 *11*	5.2 *5*						May deexcite a 3408 level As In Adopted Levels, Gammas.
1068.3[j] *3*	4.2[j] *8*	3408.04		2339.58	3^-		
[x]1077.6 *5*	0.48 *24*						
[x]1103.39[b] *12*	3.9 *3*						placement by 1972FaZW from 2486 level not adopted. see comment on J(2486 level).
1112.65 *22*	1.9 *7*	3452.13	$(2)^+$	2339.58	3^-		I_γ: unweighted average of 1.20 *24* (1979HeZT), 2.5 *8* (2007Na05). other Eγ: 1111.9 *3* (2007Na05).
1132.11 *6*	79.4 *21*	2066.58	2^+	934.48	2^+	D+Q[&]	Eγ (Iγ): weighted average of 1132.1 *2* (79.7 *25*) (2007Na05), 1132.10 *7* (80 *6*) (2007ChZX, Budapest Data), 1132.13 *10* (76 *7*) (1979HeZT).
1159.54[l] *16*	2.00 *24*	3500.16	2^+	2339.58	3^-		E_γ: fits placement poorly; excluded from least-squares fit. γ unobserved by 2007Na05 so placement shown As uncertain.
1162.7 *3*	1.3 *3*	3649.17	3^+	2485.95	5^-		γ unobserved by 2007Na05 or 2007ChZX.
[x]1164.85 *12*	4.3 *5*						
[x]1182.8 *3*	0.80 *24*						
[x]1187.42 *16*	1.84 *24*						
1192.49 *27*	0.88 *24*	3039.65	3	1847.26	2^+		other Eγ (Iγ): 1193.5 *4* (0.8 *8*) (2007Na05).
[x]1198.49 *28*	1.2 *3*						
1209.22 *10*	9.6 *6*	3275.71	$2^+,3^+$	2066.58	2^+		Eγ (Iγ): weighted average 1209.3 *2* (10.1 *8*) (2007Na05) and 1209.19 *11* (9.0 *8*) (1979HeZT).
1222.47 *9*		3289.09	3^+	2066.58	2^+		E_γ: weighted average of 1222.43 *11* (1979HeZT), 1222.37 *19* (2007ChZX, Budapest Data), 1222.7 *2* (2007Na05). I_γ: 4.8 *5* (1979HeZT), 14 *3* (2007ChZX, Budapest Data), 22.7 *8* (2007Na05).
1229.81 *22*	1.28 *24*	3628.28	(4^+)	2398.31	4^+		E_γ: weighted average of 1230.05 *21* (1979HeZT), 1229.6 *2* (2007Na05). other Iγ: 3.4 *8* (2007Na05).
[x]1237.49 *24*	1.04 *24*						
1248.00 *11*		2743.49	4^-	1495.41	4^+		E_γ: weighted average of 1248.08 *11* (1979HeZT), 1247.76 *13* (2007ChZX, Budapest Data), 1248.1 *2* (2007Na05). I_γ: data are discrepant: 4.7 *4* (1979HeZT), 30 *3* (2007ChZX, Budapest Data), 16.8 *8* (2007Na05).
1251.16[e] *18*	2.08 *24*	3649.17	3^+	2398.31	4^+		γ unobserved by 2007Na05 or 2007ChZX.
1301.0 *5*	1.1 *4*	3640.25	$(2)^+$	2339.58	3^-		other Eγ (Iγ): 1300.1 *5* (12 *4*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ[†]	I_γ[‡k]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
[x]1327.4 *4*	0.56 *24*						
[x]1340.73 *25*	0.96 *24*						
[x]1358.49 *20*	1.68 *24*						
[x]1364.12 *18*	1.76 *24*						
1369.25 *10*	13.8 *7*	2864.60	4^+	1495.41	4^+		Eγ (Iγ): weighted average of 1369.2 *2* (13.4 *8*) (2007Na05) and 1369.27 *11* (14.9 *19*) (1979HeZT).
[x]1384.31 *16*	4.3 *4*						
[x]1386.3 *3*	2.1 *4*						
[x]1397.7 *4*	1.4 *5*						
[x]1399.6 *5*	1.3 *6*						
1405.06 *5*	228 *9*	2339.58	3^-	934.48	2^+	D(+Q)[@]	E_γ: weighted average of 1405.1 *2* (2007Na05), 1405.02 *6* (2007ChZX, Budapest Data), 1405.16 *10* (1979HeZT). I_γ: unweighted average of 211 *7* (2007Na05), 241 *8* (2007ChZX, Budapest Data), 232 *20* (1979HeZT) (the weighted average is 225 *10*).
1414.01 *11*	8.7 *6*	2909.40	3^+	1495.41	4^+		Eγ (Iγ): weighted average of 1413.9 *2* (8.4 *8*) (2007Na05), 1414.05 *13* (8.9 *8*) (1979HeZT).
1433.9[hh] *3*	3.4 *8*	3500.16	2^+	2066.58	2^+		I_γ: 7.3 *8* (1979HeZT) May include impurity.
1436.2[l] *6*	0.9 *4*	2819.53	2^+	1382.70	0^+		γ unconfirmed by 2007Na05 and 2007ChZX or In either β^- decay or (n,n′γ), so placement is shown As uncertain here.
1441.0[e] *4*	0.88 *24*	3289.09	3^+	1847.26	2^+		γ unobserved by 2007Na05 or 2007ChZX.
[x]1461.59 *20*	3.4 *4*						
1461.8[j] *3*	1.7[j] *8*	2957.2		1495.41	4^+		
1463.81 *10*	9.2 *25*	2398.31	4^+	934.48	2^+		E_γ: weighted average of 1463.8 *2* (2007Na05), 1463.82 *12* (1979HeZT). I_γ: unweighted average of 6.7 *8* (2007Na05), 11.7 *10* (1979HeZT).
[x]1466.23 *21*	2.8 *4*						
[x]1471.89 *23*	1.52 *24*						
[x]1476.5 *3*	1.1 *3*						
[x]1484.93 *22*	1.6 *3*						
1490.7 *3*	4.3 *9*	3830.26	$(1^-,2^+)$	2339.58	3^-		Eγ (Iγ): unweighted average of 1490.46 *12* (5.1 *5*) (1979HeZT), 1491.0 *3* (3.4 *8*) (2007Na05).
[x]1498.7 *3*	1.28 *24*						
[x]1505.01 *13*	3.9 *3*						
[x]1519.1 *5*	0.6 *3*						
[x]1531.97 *26*	1.5 *3*						
[x]1554.4 *6*	0.6 *3*						
[x]1588.0 *5*	0.72 *24*						
[x]1598.7 *3*	1.04 *24*						
1604.86 *10*	7.1 *5*	3452.13	$(2)^+$	1847.26	2^+		Eγ (Iγ): weighted average of 1604.9 *2* (6.7 *8*) (2007Na05) and 1604.85 *11* (7.4 *7*) (1979HeZT).
[x]1622.3 *5*	0.72 *24*						
[x]1643.55 *27*	1.6 *3*						
1652.79 *13*	4.6 *4*	3500.16	2^+	1847.26	2^+		
[x]1685.6 *3*	1.5 *4*						
[x]1695.30 *12*	8.2 *8*						May deexcite a 3191 level As In Adopted Levels, Gammas.
1695.5[j] *2*	7.6[j] *8*	3190.93		1495.41	4^+		
[x]1708.54 *24*	2.6 *4*						May deexcite a 3774 level As In Adopted Levels, Gammas.
[x]1723.6 *7*	1.3 *7*						
1741.8[l] *2*	6.1 *8*	3237.21?		1495.41	4^+		placement from 2007Na05; placed from 2124 level by

Continued on next page (footnotes at end of table)

^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ [†]	I_γ [‡ k]	E_i(level)	J_i^π	E_f	J_f^π	Comments
						1979HeZT and also In (n,n′γ), so placement shown As uncertain here. Eγ (Iγ): weighted average of 1741.8 *2* (5.0 *8*) (2007Na05) and 1741.66 *12* (6.7 *6*) (1979HeZT).
x1753.5 *3*	1.2 *3*					
1763.39 *18*	2.7 *3*	3830.26	(1⁻,2⁺)	2066.58	2⁺	γ unobserved by 2007Na05 or 2007ChZX.
x1784.7 *3*	1.4 *3*					
1793.87 *23*	2.2 *3*	3289.09	3⁺	1495.41	4⁺	other Eγ (Iγ): 1793.4 *2* (10.9 *8*) (2007Na05).
1800.74[l] *27*	1.6 *4*	3649.17	3⁺	1847.26	2⁺	γ unobserved by 2007Na05 or 2007ChZX and Eγ somewhat low for this placement, so shown As tentative.
x1811.0 *3*	1.5 *3*					
x1831.0 *4*	1.4 *4*					
1847.27 *9*	51 *8*	1847.26	2⁺	0.0	0⁺	E_γ: weighted average of 1847.26 *10* (1979HeZT), 1847.3 *2* (2007Na05). I_γ: unweighted average of 46 *4* (1979HeZT), 67 *6* (2007ChZX, Budapest Data), 41.1 *17* (2007Na05). other Eγ (Iγ): 1847.78 *15* (67 *6*) (2007ChZX, Budapest Data).
x1867.27 *18*	3.6 *4*					
1885.00 *12*	7.8 *7*	2819.53	2⁺	934.48	2⁺	E_γ: weighted average of 1885.07 *12* (1979HeZT) and 1774.8 *2* (2007Na05). I_γ: from 1979HeZT, consistent with branching In (n,n′γ) and β^- decay. other: 39.4 *17* (2007Na05); source of discrepancy unknown.
x1926.5 *5*	1.4 *4*					May deexcite a 3774 level As In Adopted Levels, Gammas.
1930.13[e] *18*	4.7 *4*	2864.60	4⁺	934.48	2⁺	γ unobserved by 2007Na05.
x1942.2 *3*	2.2 *5*					
x1951.06 *14*	6.7 *6*					
1956.60 *12*	5.6 *5*	3452.13	(2)⁺	1495.41	4⁺	Eγ (Iγ): weighted average of 1956.6 *2* (5.0 *8*) (2007Na05) and 1956.60 *15* (6.0 *6*) (1979HeZT). other Eγ (Iγ): 1957.35 *23* (28 *4*) (2007ChZX, Budapest Data).
x1959.60 *26*	3.8 *6*					
1967.53[e] *15*	5.8 *6*	3462.98?	(4)⁺	1495.41	4⁺	γ unobserved by 2007Na05 or 2007ChZX.
1974.93 *10*	14.5 *24*	2909.40	3⁺	934.48	2⁺	E_γ: weighted average of 1974.90 *12*)1979HeZT), 1975.2 *3* (2007ChZX, Budapest Data), 1974.9 *2* (2007Na05). I_γ: unweighted average of 13.5 *12* (1979HeZT), 19 *4* (2007ChZX, Budapest Data), 10.9 *8* (2007Na05). weighted average is 11.9 *12*.
x1986.4 *4*	4.2 *10*					
1988.71 *10*	23 *3*	3371.43	1⁽⁻⁾	1382.70	0⁺	E_γ: weighted average of 1988.75 *12* (1979HeZT) and 1988.6 *2* (2007Na05). I_γ: unweighted average of 26.3 *24* (1979HeZT), 20.1 *8* (2007Na05). other Eγ (Iγ): 1988.14 *18* (39 *4*) (2007ChZX, Budapest Data). 1988.6 *2* (20.1 *8*) (2007Na05).
x2034.7 *4*	1.8 *5*					
x2050.8 *4*	1.6 *4*					
2069.5 *4*	1.3 *4*	3452.13	(2)⁺	1382.70	0⁺	γ unobserved by 2007Na05 or 2007ChZX.
2089.6[e] *6*	1.8 *6*	3472.01	1⁺	1382.70	0⁺	γ unobserved by 2007Na05 or 2007ChZX.
x2092.3 *4*	2.5 *6*					
2105.18 *8*	19.3 *13*	3039.65	3	934.48	2⁺	E_γ: weighted average of 2105.13 *10* (1979HeZT), 2105.26 *23* (2007ChZX, Budapest Data), 2105.3 *2* (2007Na05). I_γ: unweighted average of 16.8 *8* (2007Na05), 20 *4* (2007ChZX, Budapest Data), 21.1 *20* (1979HeZT). Weighted average is 17.5 *11*.
x2122.9 *4*	2.2 *5*					May deexcite a 3057 level As In Adopted Levels, Gammas.
2132.90 *11*	9.3 *9*	3628.28	(4⁺)	1495.41	4⁺	E_γ: weighted average of 2132.90 *13* (1979HeZT), 2132.9 *2* (2007Na05). I_γ: unweighted average of 8.4 *8* (2007Na05) and 10.1 *5* (1979HeZT).

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ [†]	I_γ [‡ k]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]2149.5 *4*	1.4 *4*					
2153.68 *18*	3.7 *4*	3649.17	3^+	1495.41	4^+	γ unobserved by 2007Na05 or 2007ChZX.
[x]2163.7 *3*	1.8 *3*					
[x]2176.1 *3*	2.3 *5*					
2243.80[d] *26*	2.0 *3*	3178.26	4^+	934.48	2^+	other Eγ (Iγ): 2244.2 *3* (1.7 *8*) (2007Na05).
[x]2255.4 *4*	1.3 *3*					May deexcite a 3638 level As In Adopted Levels, Gammas.
[x]2264.5 *5*	0.9 *3*					
[x]2276.6 *5*	1.0 *4*					
[x]2290.40 *26*	2.0 *3*					
[x]2296.10 *15*	4.2 *4*					
[x]2304.70 *14*	4.6 *4*					
[x]2310.9 *4*	1.1 *4*					
2328.17 *13*	13.9 *7*	3262.61	2^+	934.48	2^+	Eγ (Iγ): weighted average of 2328.4 *2* (14.3 *8*) (2007Na05) and 2328.10 *11* (13.0 *12*) (1979HeZT).
[x]2333.00 *20*	3.3 *3*					
2339.4[jl] *22*	0.8[j] *16*	2339.58	3^-	0.0	0^+	
2340.90 *16*	4.3 *4*	3275.71	$2^+,3^+$	934.48	2^+	γ unobserved by 2007Na05 or 2007ChZX.
[x]2351.0 *4*	1.7 *3*					
2354.80 *13*	7.5 *7*	3289.09	3^+	934.48	2^+	γ unobserved by 2007Na05 or 2007ChZX.
[x]2360.6 *5*	1.0 *4*					
[x]2378.1 *5*	0.9 *3*					
[x]2391.10 *26*	1.2 *3*					
[x]2415.90 *27*	1.5 *3*					
[x]2424.20 *21*	2.1 *3*					
2436.92 *10*	10.8 *6*	3371.43	$1^{(-)}$	934.48	2^+	Eγ (Iγ): weighted average of 2437.0 *2* (10.9 *8*) (2007Na05) and 2436.90 *11* (10.6 *10*) (1979HeZT).
[x]2442.5 *3*	1.36 *24*					
2447.3 *3*	1.60 *24*	3830.26	$(1^-,2^+)$	1382.70	0^+	other Eγ (Iγ): 2448.0 *3* (1.7 *8*) (2007Na05).
[x]2462.0 *3*	1.52 *24*					
2473.6[j] *2*	6.7[j] *8*	2473.64		0.0	0^+	
2473.6[j] *2*	6.7[j] *8*	3408.04		934.48	2^+	
[x]2488.4 *5*	1.0 *3*					
[x]2495.2 *6*	1.0 *3*					
[x]2509.50 *22*	3.3 *4*					
2517.73 *11*	8.3 *3*	3452.13	$(2)^+$	934.48	2^+	Eγ (Iγ): weighted average of 2517.8 *2* (7.6 *8*) (2007Na05) and 2517.70 *14* (8.4 *3*) (1979HeZT).
2528.7[e] *5*	1.4 *3*	3462.98?	$(4)^+$	934.48	2^+	γ unobserved by 2007Na05 or 2007ChZX.
2537.1 *2*	4.0 *3*	3472.01	1^+	934.48	2^+	other Eγ (Iγ): 2538.5 *8* (11 *4*) (2007ChZX, Budapest Data). γ unobserved by 2007Na05.
[x]2542.1 *4*	1.6 *3*					
[x]2562.6 *2*	3.1 *3*					
[x]2576.9 *5*	1.2 *3*					
[x]2583.3 *3*	2.4 *3*					
[x]2589.6 *3*	2.0 *3*					
[x]2605.9 *4*	1.5 *4*					
[x]2611.3 *2*	5.4 *5*					
[x]2621.7 *5*	1.1 *3*					
[x]2634.9 *2*	5.1 *5*					
[x]2638.9 *4*	1.8 *3*					
[x]2654.7 *4*	1.5 *3*					
[x]2676.4 *2*	2.9 *3*					
2693.86 *12*	36 *4*	3628.28	(4^+)	934.48	2^+	E_γ: weighted average of 2693.8 *1* (1979HeZT), 2694.1 *2* (2007Na05). I_γ: unweighted average of 31.9 *17* (2007Na05) and 40 *4* (1979HeZT).
[x]2699.6 *5*	1.8 *5*					

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ[†]	I_γ[‡k]	E_i(level)	J_i^π	E_f	J_f^π	Comments
2705.76 *12*	12.0 *19*	3640.25	$(2)^+$	934.48	2^+	E_γ: weighted average of 2705.7 *1* (1979HeZT), 2706.0 *2* (2007Na05). I_γ: unweighted average of 10.1 *8* (2007Na05) and 13.8 *12* (1979HeZT).
[x]2711.0 *5*	3.2 *6*					
2714.1 *4*	3.6 *6*	3649.17	3^+	934.48	2^+	γ unobserved by 2007Na05 or 2007ChZX.
[x]2732.5 *4*	1.4 *3*					
[x]2740.5 *2*	3.4 *3*					
[x]2749.5 *5*	1.3 *3*					
[x]2762.1 *3*	2.3 *3*					May deexcite a 3697 level As In Adopted Levels, Gammas.
[x]2774.6 *4*	1.4 *3*					
2819.07[l]		2819.53	2^+	0.0	0^+	γ unobserved by 2007Na05 but branch expected from β^- decay and (n,n′γ).
2894.9		3830.26	$(1^-,2^+)$	934.48	2^+	from 1972FaZW; γ unobserved by 2007Na05 or 2007ChZX.
[x]3178.176[a] *22*						placed by 2007ChZX from 3178 level, but placement rejected by evaluator because it would imply E4 multipolarity.
3262.54 *4*		3262.61	2^+	0.0	0^+	E_γ: from 2007ChZX. 3263.2 from 1972FaZW; γ unobserved by 2007Na05.
[x]3275.72[a] *4*						placed by 2007ChZX from 3276 level, but placement rejected by evaluator because other transitions known to deexcite that level were not reported by 2007ChZX. γ absent In 2007Na05.
3371.2[j] *3*	13.8[j] *16*	3371.43	$1^{(-)}$	0.0	0^+	Eγ (Iγ): weighted average of 3371.5 *3* (13.4 *17*) (2007Na05) and 3370.8 *4* (16 *4*) (2007ChZX). other Eγ: 3371.2 (1979HeZT).
3472.6[j] *3*	10.9[j] *17*	3472.01	1^+	0.0	0^+	E_γ: 3472.5 from 1972FaZW; γ unobserved by 2007ChZX.
3500.8[j] *6*	6.7[j] *17*	3500.16	2^+	0.0	0^+	E_γ: 3500.0 from 1972FaZW.
[x]3648.92[a] *13*						placed by 2007ChZX from 3649 level, but placement rejected by evaluator because it implies ΔJ=3,4. γ is absent In 2007Na05.
[x]3833.0[a] *4*	14 *4*					placed by 2007ChZX from 3830 level; however, this is only branch from that level observed by these authors and Eγ fits placement poorly, so evaluator rejects it. γ not observed by 2007Na05.
4804.7		(8634.79)	2^+	3830.26	$(1^-,2^+)$	γ unobserved by 2007Na05 and 2007ChZX.
4985.1[j] *7*	5.9[j] *17*	(8634.79)	2^+	3649.17	3^+	E_γ: 4986.1 from 1972FaZW.
4995.0[j] *3*	14.3[j] *17*	(8634.79)	2^+	3640.25	$(2)^+$	E_γ: other Eγ (Iγ): 4995.2 *5* (22 *4*) from 2007ChZX.
5006.1[j] *3*	25.2[j] *17*	(8634.79)	2^+	3628.28	(4^+)	E_γ: other Eγ (Iγ): 5006.4 *3* (39 *6*) from 2007ChZX.
5134.6[j] *3*	7.6[j] *8*	(8634.79)	2^+	3500.16	2^+	E_γ: 5135.1 from 1972FaZW.
5162.5[j] *3*	7.6[j] *8*	(8634.79)	2^+	3472.01	1^+	E_γ: 5163.1 from 1972FaZW.
5183.0[a] *5*	15 *3*	(8634.79)	2^+	3452.13	$(2)^+$	γ observed by 2007ChZX alone.
5263.2 *5*	46 *5*	(8634.79)	2^+	3371.43	$1^{(-)}$	E_γ: Eγ (Iγ): unweighted average of 5262.7 *4* (51 *6*) (2007ChZX, Budapest Data) and 5263.6 *2* (41.4 *17*) (2007Na05).
5347.1		(8634.79)	2^+	3289.09	3^+	γ unobserved by 2007Na05 or 2007ChZX.
5359.5		(8634.79)	2^+	3275.71	$2^+,3^+$	γ unobserved by 2007Na05 or 2007ChZX.
5371.2[a] *5*	13 *3*	(8634.79)	2^+	3262.61	2^+	γ observed by 2007ChZX alone.
5594.7[j] *4*	3.4[j] *8*	(8634.79)	2^+	3039.65	3	E_γ: 5594.9 from 1972FaZW.
5815.0[j] *3*	2.5[j] *8*	(8634.79)	2^+	2819.53	2^+	E_γ: 5815.7 from 1972FaZW.
6237.2[j] *6*	2.5[j] *8*	(8634.79)	2^+	2398.31	4^+	E_γ: 6236.3 from 1972FaZW.

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^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT (continued)

γ(^{92}Zr) (continued)

E_γ [†]	I_γ [‡ k]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
6294.88 *12*	213 *7*	(8634.79)	2^+	2339.58	3^-	@	E_γ: Eγ (Iγ): weighted average of 6294.86 *18* (223 *16*) (2007ChZX, Budapest Data) and 6294.9 *2* (211 *8*) (2007Na05).
6568.2		(8634.79)	2^+	2066.58	2^+		from 1972FaZW; γ unobserved by 2007Na05 or 2007ChZX.
7139.5		(8634.79)	2^+	1495.41	4^+		from 1972FaZW; γ unobserved by 2007Na05 or 2007ChZX.
7251.8 [j] *9*	0.8 [j] *8*	(8634.79)	2^+	1382.70	0^+		other Eγ: 7252.9 (1972FaZW).
7701.2		(8634.79)	2^+	934.48	2^+		from 1972FaZW; γ unobserved by 2007Na05 or 2007ChZX.
8634.4 [j] *2*	10.9 [j] *8*	(8634.79)	2^+	0.0	0^+		other Eγ: 8634.9 (1972FaZW).

† From 1979HeZT, except As noted. the quoted ΔE is the reported statistical uncertainty combined in quadrature with a 100-eV systematic uncertainty.

‡ Relative to I(934γ)=1000; from 1979HeZT, except As noted. the 'Budapest Data' from 2007ChZX are inconsistent In disturbingly many cases, sometimes by an order of magnitude, and these inconsistencies are noted In comments on the relevant transitions.

From γγ(θ).

@ 1964Ba02 measured A_2=+0.14 *2* for the 6295γ-1405γ cascade, −0.10 *2* for 6295γ-(1405γ)−934γ cascade and +0.06 *11* for the 1405γ-934γ cascade, based on W(180°)/W(90°). δ(6296γ)=−0.070 *16*, δ(6295γ)=−0.072 *22* and δ(1405γ)=+0.18 *+20−15*, respectively, for these three cascades. The latter disagrees with δ(1405γ)=−0.02 *2* obtained for the same cascade in ^{92}Y β^- decay. These correlations permit $J^\pi=2^+$ but not 3^+ for the capture state if the 6295γ is presumed to be predominantly E1.

& From A_2=+0.20 *9*, A_4=+0.34 *14* for 1132γ-934γ(θ) (1972FaZW); this allows J(2067 level)=2 with δ(1132γ)=−2.7 *+8−15*, and rules out J=1,3,4.

a From 2007ChZX, 'Budapest Data'.

b See comment on J for 2486 level.

c Eγ=352.33 *3* for a doublet for which Iγ=2.56 *32* after correction for nearby Eγ=352.83, Iγ=1.04 background line (1979HeZT); transition reported in this study only. Authors′ association of one component with deexcitation of the 1847 level is considered by the evaluator to be highly questionable, given that its energy is ≈5σ too high; neither that placement nor one from the 3628 level is included here or in Adopted Levels.

d Tentatively placed by evaluator by analogy with level scheme deduced from (n,n′γ) reaction data.

e Placed by evaluator In accord with Adopted Levels, Gammas.

f The 2nd digit of 995.42γ and the 4th digit of 1018.61γ energy may be incorrectly transcribed; text almost illegible in original copy. The 3rd digit of E(598.8γ) is also in doubt.

g 1972FaZW, 2007ChZX, 2007Na05 propose a 2^+ to 5^- placement from 2819 level for this γ, but Eγ is far too high for that placement; also, no such γ is observed to deexcite the 2818 level in ^{92}Y β^-decay or (n,n′γ), whereas both the 972γ and 1885γ are observed to do so in the latter reactions and the relatively weak 2820γ (not seen by 2007Na05) is also present in ^{92}Y β^- decay. Also, the implied E3 multipolarity would result In B(E3)(W.u.) that vastly exceeded RUL. Consequently, the evaluator rejects placement of the 334γ from the 2820 level.

h Eγ a little high for this placement, possibly due to interference from a 1434.21 keV, Iγ=1.8 impurity line In 1979HeZT.

i See (n,n′γ) for placement of γ with similar energy.

j From 2007Na09.

k For intensity per 100 neutron captures, multiply by 0.079 *16*.

l Placement of transition in the level scheme is uncertain.

x γ ray not placed in level scheme.

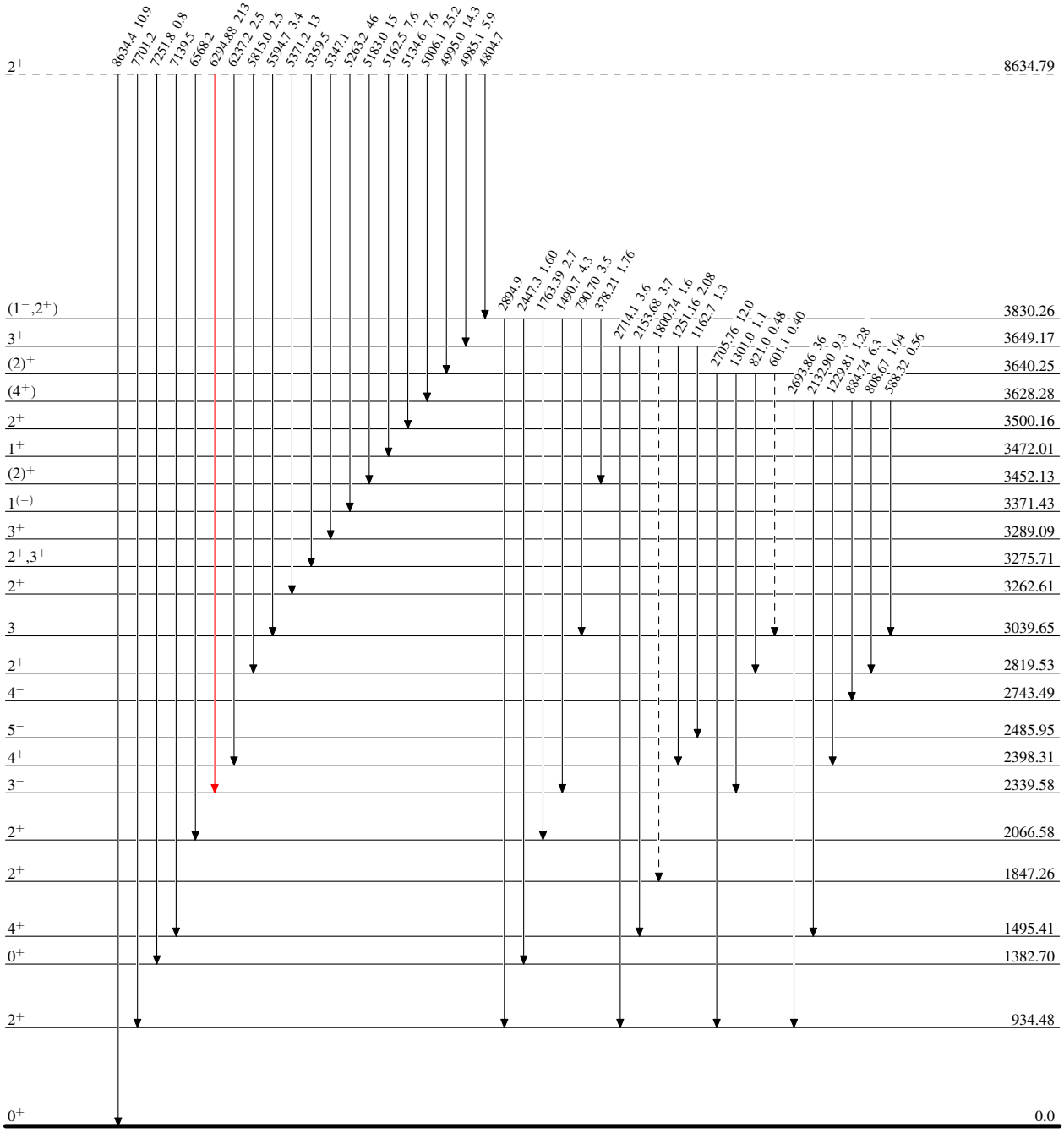
^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT

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)

Level Scheme

Intensities: Relative I_γ



$^{92}_{40}Zr_{52}$

^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT

Level Scheme (continued)

Intensities: Relative I_γ

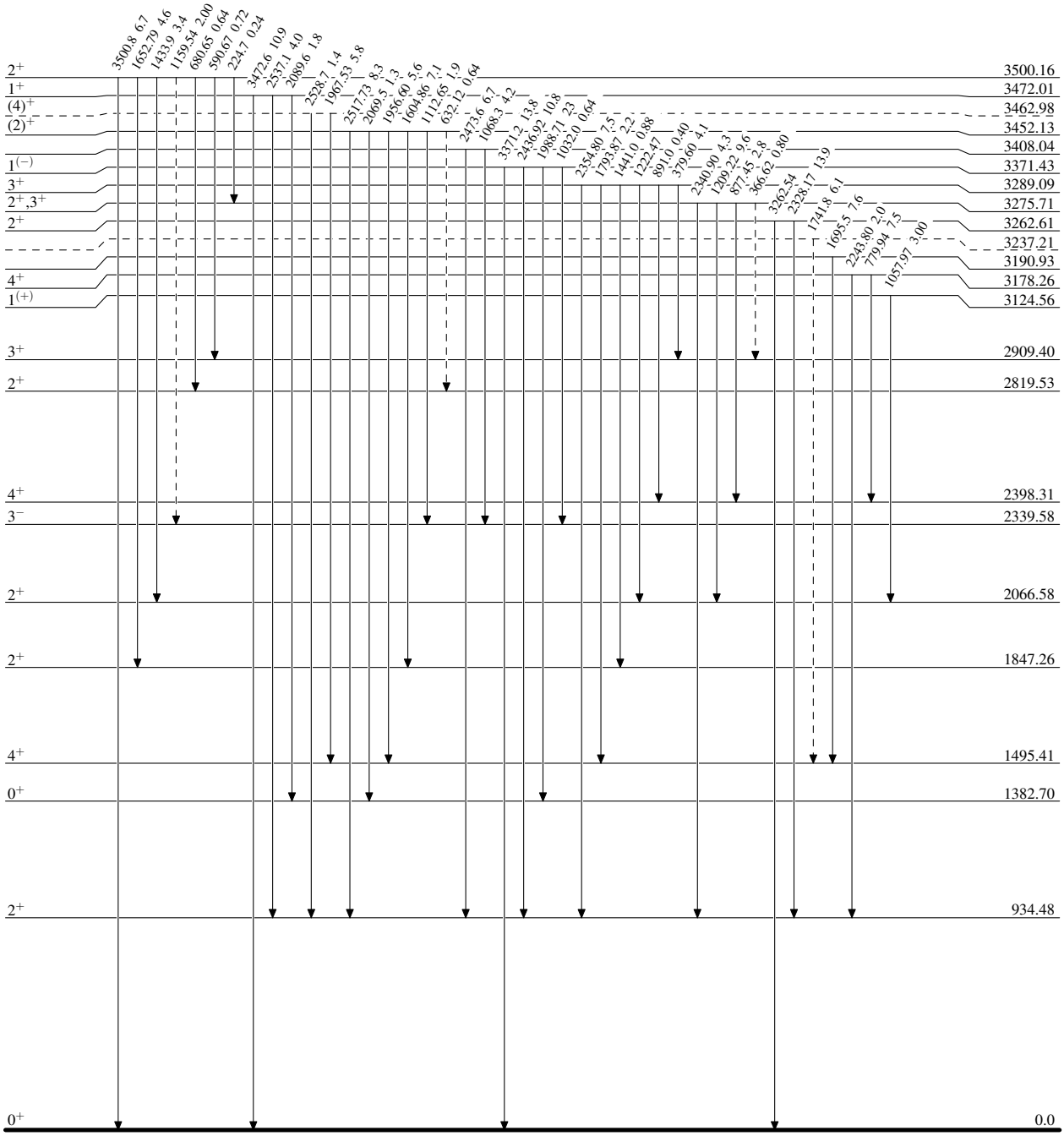
Legend

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

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

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

γ Decay (Uncertain)

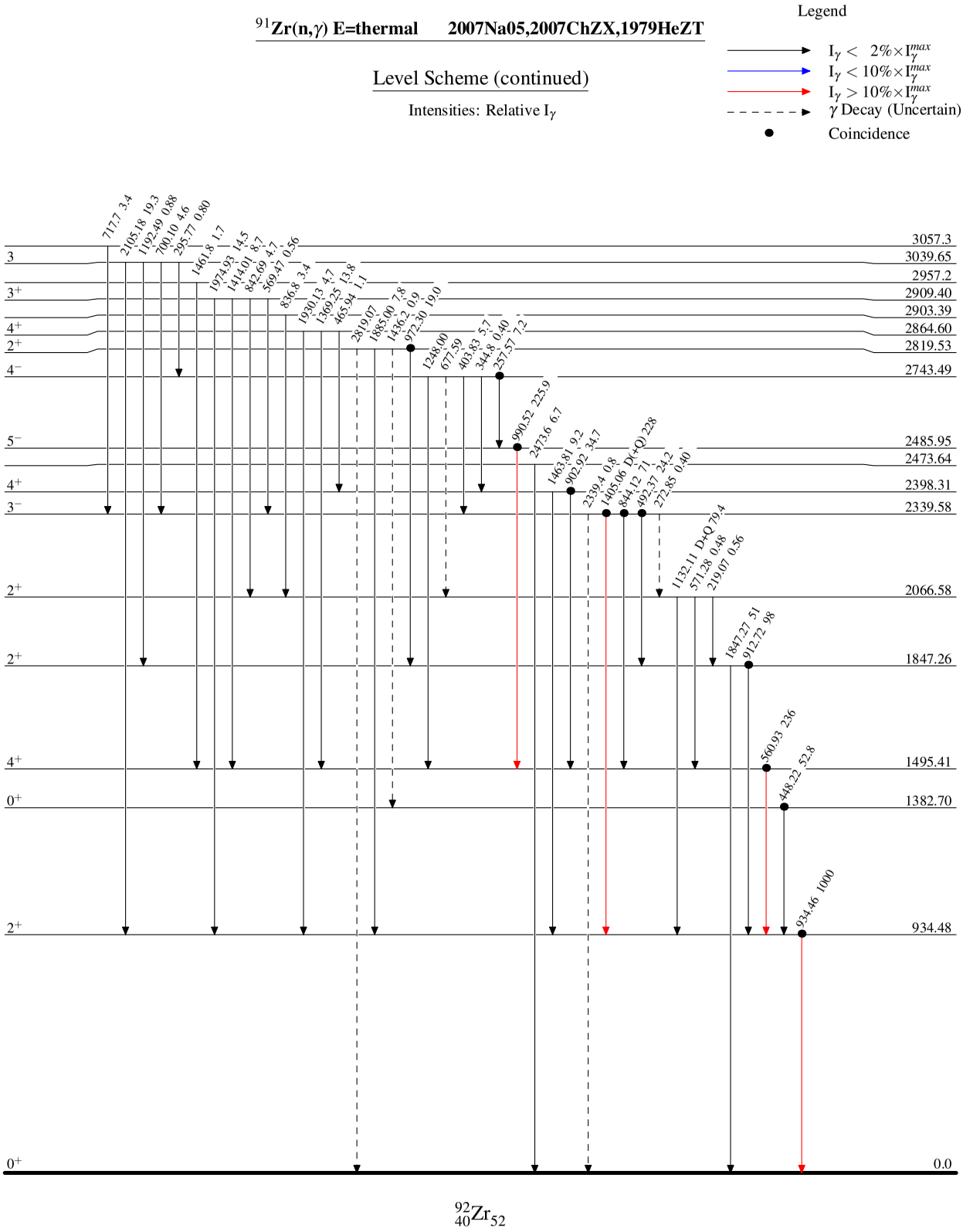


$^{92}_{40}Zr_{52}$

^{91}Zr(n,γ) E=thermal 2007Na05,2007ChZX,1979HeZT

Level Scheme (continued)

Intensities: Relative I_γ



$^{92}_{40}Zr_{52}$