Adopted Levels, Gammas

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

Q(β^-)=−2005.9 *18*; S(n)=8634.79 *11*; S(p)=9396.7 *19*; Q(α)=−2963.2 *21* 2012Wa38
Note: Current evaluation has used the following Q record −2005.9 18 *8634*.7911 *9396*.8 *19*−2964.3 *23* 2011AuZZ.
Q(β^-),S(n),S(p),Q(α): from 2011AuZZ; −2005.5 *18*, 8634.80 *11*, 9397.8 *18*, −2957.1 *25*, respectively, from 2003Au03.
See ^{91}Zr(n,γ) E=res for neutron resonance information; it has not been included in the present dataset.
Other Reactions:

^{9}Be(^{86}Kr,3nγ): 2007SuZN: E(^{86}Kr)=280 MeV; GEMINI-II γ detector array; measured $T_{1/2}$ using DSAM for high-spin states; data analysis not yet complete.
^{91}Zr(^{7}Li,^{6}Li): 1993Yo01: E(^{7}Li)=210 MeV, magnetic spectrograph, FWHM≈500 keV, 88.5% ^{91}Zr target; observed resonances at E=0.0 MeV (Γ=0.6 MeV), 1.3 MeV (Γ=0.9 MeV), 3.6 MeV (Γ=1.2 MeV), 4.7 MeV (Γ=0.9 MeV), 5.5 MeV (Γ=1.0 MeV), 6.8 MeV (Γ=1.6 MeV) and 15.8 MeV (Γ=6.0 MeV); interpreted these resonances as single-particle states.
^{92}Zr(^{6}Li,^{6}Li′): 1993Ho02: E(^{6}Li)=70 MeV, magnetic spectrometer, particle identification, 94.57% ^{92}Zr target, FWHM≈225 keV, θ(lab)≈4°−45°; measured $\sigma(\theta)$ for 934 and 2340 levels ($J^\pi=2^+$ and 3^-, respectively); deduced isospin character of transitions to the above two states (deformed optical model analysis). See also 1992Ho12.
For relativistic mean field calculation of g.s. properties of ^{92}Zr, see 2004He24.
For shell-model calculation of g factors and electromagnetic decay rates for lowest-energy 2^+ (934) and 3^- (2340) levels, see 2004St11.

^{92}Zr Levels

Above 3 MeV, the correspondence between levels from different reactions is sometimes ambiguous. This is due, in part, to particle reaction energy resolution being inadequate for the existing level density, but also results from particle reaction data for which the authors do not state ΔE (viz., (α,^{3}He), (p,t), (^{3}He,^{3}He′), (t,t′), (d,^{3}He)) and/or data for which the energy scale appears to include an unstated systematic uncertainty (viz.: (α,^{3}He), 10-30 keV low; (p,t), 5-10 keV low; (p,p′) from 1966St15, 10-20 keV low).
For theoretical work see, e.g., 1972Wa09, 1975Gl07, 1976Te02, 1976Pr07, 1993Ha37, 2000Ho15.

Cross Reference (XREF) Flags

A	^{92}Y β^- decay	N	^{94}Zr(p,t)	Others:	
B	^{92}Nb ε decay (10.15 d)	O	^{92}Zr(p,p′γ)	AA	^{89}Y(α,p)
C	^{48}Ca(^{48}Ca,4nγ)	P	^{92}Zr(^{3}He,^{3}He′)	AB	^{92}Zr(γ,xn), (γ,pn)
D	^{88}Sr(^{7}Li,2npγ)	Q	^{93}Nb(μ^-,nγ)	AC	^{94}Mo(^{14}C,^{16}O)
E	^{90}Zr(t,p)	R	^{93}Nb(d,^{3}He), (pol d,^{3}He)	AD	^{96}Mo(d,^{6}Li)
F	^{91}Zr(n,γ) E=thermal	S	^{94}Mo(^{6}Li,^{8}B)	AE	^{91}Zr(^{16}O,^{15}O)
G	^{91}Zr(d,p), (pol d,p)	T	^{92}Zr(^{16}O,^{16}O′), (^{18}O,^{18}O′)	AF	^{91}Zr(n,γ),(n,n) E=res
H	^{91}Zr(α,^{3}He)	U	^{92}Nb ε decay (3.47×10^{7} y)	AG	^{173}Yb(^{24}Mg,Fγ),^{176}Yb(^{28}Si,Xγ),
I	^{92}Zr(n,n′γ)	V	^{90}Zr(α,^{2}He)	AH	^{92}Zr(pol γ,γ′), (γ,γ′)
J	^{92}Zr(p,p′), (pol p,p′)	W	Coulomb excitation	AI	^{208}Pb(^{90}Zr,Xγ)
K	^{92}Zr(α,α′)	X	^{92}Zr(n,n′)	AJ	^{82}Se(^{13}C,3nγ)
L	^{92}Zr(d,d′), (pol d,d)	Y	^{95}Mo(n,α)	AK	^{92}Zr(α,α′γ)
M	^{92}Zr(t,t′)	Z	^{92}Zr(e,e′)	AL	^{91}Zr(n,γ) E=292 eV

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
0.0[b]	0^+	stable	ABCDEFGHIJKLMNOPQRSTUVWXYZ	XREF: Others: AA, AC, AD, AF, AG, AH, AI, AJ, AK, AL Δ<r^2>(92,90)=0.224 *26* (1999GaZX), 0.224 *25* (1988GaZS); Δ<r^2>(92,94)=0.170 *19* (1988GaZS). <r^2>$^{1/2}$(charge)=4.3057 fm *9* (2004An14).
934.51[b] *4*	2^+	5.0 ps *4*	ABCDEFGHIJKLMNOPQRSTU WXYZ	XREF: Others: AA, AC, AD, AF, AG, AI, AJ, AK, AL

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
				μ=−0.360 *20* (1999Ja13) J^π: L=2 in (t,p), (p,t) and p,d,t,^{3}He,α scattering. μ implies dominant role of $d_{5/2}$ neutrons in wavefunction of this state (1999Ja13). $T_{1/2}$: from B(E2)=0.080 *6* (Coulomb excitation). μ: from measured g-factor=−0.180 *10* from $\gamma(\theta$,H,t) in Coulomb excitation. Other μ: −0.06 *10* from transient field integral PAC (1989Ra17, from 1980Ha31), assuming $T_{1/2}$=4.85 ps; −0.36 *4* (2008We07; transient field).
1382.77 *7*	0^+	88 ps *3*	A EFG IJ L NO QRS WX	XREF: Others: AA, AC, AD, AH J^π: 448γ-934$\gamma(\theta)$ in ^{92}Y β^- decay indicates a 0-2-0 cascade; L=0 in (t,p) and (p,t). $T_{1/2}$: from ^{92}Y β^- decay. Other: 85 ps *15* from (p,p′γ).
1495.46[b] *5*	4^+	102 ps *3*	A CDEFGHIJKLMN PQ STUVWX	XREF: Others: AA, AC, AD, AF, AG, AH, AI, AJ, AK, AL μ=−2.0 *4* (1999Ja13) μ: from measured g-factor=−0.50 *11* from $\gamma(\theta$,H,t) in Coulomb excitation. J^π: L=4 in (t,p), (p,t), (p,p′), (t,t′), (α,α′). μ implies dominant role of $d_{5/2}$ neutrons in wavefunction of this state (1999Ja13). $T_{1/2}$: from $\gamma\gamma$(t), ^{92}Y β^- decay.
1847.27 *4*	2^+	96[&] fs *10*	AB EFGHIJKLMN P R T WX Z	XREF: Others: AA, AC, AD, AF, AH μ=+1.5 *10* (2008We07) J^π: L=2 in (p,t), (p,p′), (t,t′), (α,α′), (^{3}He,^{3}He′), (t,p). μ: From measured g-factor in Coulomb excitation (transient field). Level exhibits structure expected for a mixed symmetry one-phonon Q excitation (2002We15).
2066.65 *5*	2^+	>0.76[&] ps	AB EFGHIJKLM WX	XREF: Others: AC, AD, AF, AL J^π: L=2 in (t,p), (p,p′), (α,α′).
2182 *10*	(2^+)		K	J^π: L(α,α′)=(2). Probably same level as in (p,p′) at E=2180? 22.
2339.66 *4*	3^-	0.28[&] ps *3*	A EFGHIJKLMN P R T VWX	XREF: Others: AD, AL J^π: L=3 in (t,p), (p,t), (p,p′), (d,d′), (t,t′), (^{3}He,^{3}He′), (α,α′). For summary of B(E3)↑ data, see 1989Sp01; recommended value is 0.067 *22* based on b_3 from angular distribution in (p,p′). This corresponds to 4.4% *15* of energy-weighted E3 sum rule.
2398.36 *6*	4^+	149[&] fs *16*	EFGHI K N WX	XREF: Others: AB, AD, AF, AG XREF: X(2360). J^π: L=4 in (t,p) and (α,α′). Note: evaluator assumes J=1,3 from (n,n′) for 2360 *20* level to be in error; alternatively, an additional level may exist at that energy.
2473.4? *5*	(≤2)		A	J^π: γ ray to 0^+ state.
2486.01 *9*	5^-	≤3.5 ns	DEF IJKL N R WX	XREF: Others: AB, AC, AD, AE, AG XREF: R(2450). J^π: L=5 in (t,p), (p,p′), (α,α′) and analyzing power in (pol p,p′) (1979De11). See comment on J(2486 level) in (n,γ).

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
2666 *30*			J X	XREF: Others: AA, AB, AE, AF XREF: J(2651). Excitation of level in (p,p′) is not certain.
2743.55 *7*	4^-	>2.63[&] ps	F I R	J^π: D(+Q) 404γ and 258γ to 3^- 2340 and 5^- 2486, respectively; L(d,^{3}He)=1. If the 2486 and 2744 states are treated as members of the ($p_{1/2}$,$g_{9/2}$) doublet, they exhaust the $p_{1/2}$ pickup strength in (d,^{3}He).
2752?[†] *11*	3^-		KLM x	XREF: Others: AB, AG, AH XREF: x(2778). J^π: L(α,α')=3.
2819.54 *7*	2^+	64[&] fs *7*	A EFG IJK x	XREF: Others: AB, AG, AH XREF: x(2778). J^π: L=2 in (t,p), (α,α').
2864.66 *9*	4^+	0.24[&] ps *3*	E G IJKLM X	XREF: Others: AB, AD, AE, AF XREF: J(2650). J^π: L=4 in (t,p), (α,α'); however, if reported L(p,p′)=(2) is correct, a (2^+) level also must exist at approximately this energy.
2904.08 *18*	0^+	0.83[&] ps *+57−24*	EF I	J^π: L=0 in (t,p).
2909.43 *7*	3^+	216[&] fs *24*	FG I X	J^π: L=0 in (d,p) on $5/2^+$ target; D+Q 1414γ to 4^+ 1495.
2957.4[b] *3*	6^+	≤3.5 ns	CDE GH JK	XREF: Others: AB, AC, AG, AI, AJ XREF: H(2944). J^π: L(t,p)=6; supported by L(α,α')=(6) and (Q) 1462γ to 4^+ 1495.
3039.70 *6*	3	91[&] fs *10*	A EF I lm x	XREF: Others: AC, AD, AF, AL XREF: l(3040)m(3040)x(3063). J^π: D(+Q) 2105γ to 2^+ 934; D(+Q) 700γ to 3^- 2340; 296γ to 4^- 2744; J=3 from 700γ(θ) in (n,n′γ).
3057.40 *13*	2^+	98[&] fs *10*	E G IJKlm x	XREF: Others: AC, AD, AF XREF: J(3040)l(3040)m(3040)x(3063). J^π: L=2 in (t,p), (α,α').
3124.61 *11*	$1^{(+)}$	58[&] fs *6*	G I	XREF: Others: AA, AB, AD, AF XREF: G(3126). J^π: D 3125γ to 0^+ g.s.; L(d,p)=2 for $5/2^+$ target and uncertain state.
3178.31 *11*	4^+	54[&] fs *6*	F IjK M x	XREF: Others: AA, AC, AD, AG, AH XREF: j(3180)K(3187)M(3140)x(3187). J^π: L=4 in (t,t′), (α,α'). E(level): if (α,α'), (t,t′) and (n,n′γ) excite same level.
3190.99 *21*	(4^-)	153[&] fs *18*	GhIj x	XREF: Others: AA, AB, AD, AE, AG, AH XREF: h(3215)j(3180)x(3187). J^π: L(d,p)=(3+5) for $5/2^+$ target; D(+Q) 1696γ to 4^+ 1496, but J=5 requires δ(D,Q)=+0.36 *5* and J=3 requires δ=−0.41 to −1.92 to 4^+ level, violating RUL if π=−. E(level),J^π: if (d,p), (α,^{3}He) and (n,n′γ) excite same state.
3236.9 *6*	4^+		E Gh JKl	XREF: Others: AA, AB, AD, AE

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J$^\pi$	T$_{1/2}$[#]	XREF	Comments
				XREF: h(3215)l(3250). J$^\pi$: L=4 in (p,p′), (α,α′).
3262.62 *4*	2$^+$	12.5[&] fs *14*	A FGHI klM x	XREF: Others: AB, AC, AD, AE, AG, AH XREF: k(3273)l(3250)M(3240)x(3275). J$^\pi$: L=0+2 in (d,p); E2 3263γ to 0$^+$ g.s.
3275.76 *8*	2$^+$,3$^+$	53[&] fs *6*	F I k x	XREF: Others: AB, AD, AE, AG XREF: k(3273)x(3275). J$^\pi$: M1+E2 2341γ to 2$^+$ 934; D,Q 878γ to 4$^+$ 2398.
3289.13 *7*	3$^+$	174[&] fs *19*	FG I k x	XREF: Others: AB, AD, AE, AG XREF: k(3273)x(3275). J$^\pi$: L=0 in (d,p); M1+E2 2355γ to 2$^+$ 934; M1+E2 1794γ to 4$^+$ 1496.
3304 *10*	6$^+$		E m	XREF: Others: AB, AD XREF: m(3320). J$^\pi$: L=6 in (t,p).
3308.7[b] *4*	(8$^+$)	1.18 ns *7*	CD m r	XREF: Others: AA, AB, AD, AG, AI, AJ XREF: m(3320)r(3310). J$^\pi$: stretched Q transition to 6$^+$ 2958 in (^{7}Li,2npγ). T$_{1/2}$: from recoil-distance measurements in ^{48}Ca(^{48}Ca,4nγ).
3325? *8*	($^+$)		Gh j m r	XREF: Others: AA, AB, AD, AG XREF: h(3327)j(3320)m(3320)r(3310). J$^\pi$: L=(4) in (d,p). E(level): existence of level based on uncertain level in (d,p).
3345 *20*	5$^-$		h jK m	XREF: Others: AB, AD, AG XREF: h(3327)j(3320)m(3320). J$^\pi$: L=5 in (α,α′).
3371.48 *8*	1$^{(-)}$	27[&] fs *3*	A EFg I	XREF: Others: AC, AD, AG, AH XREF: g(3374). J$^\pi$: L=(1) in (t,p); D 3371γ to 0$^+$ g.s.
3379.8 *10*	(7$^-$)	≤3.5 ns	D	XREF: Others: AG J$^\pi$: γ to 5$^-$ in (^{7}Li,2npγ) and ^{173}Yb(^{24}Mg,Fγ).
3382 *20*	3$^-$		g K n	XREF: Others: AA, AC, AD, AG XREF: g(3374)n(3410). J$^\pi$: L=3 in (α,α′).
3407.83 *17*	2$^-$,3$^-$	0.30[&] ps *4*	I n	XREF: Others: AA, AC, AD XREF: n(3410). J$^\pi$: M1+E2 1068γ to 3$^-$ 2340; D(+Q) 2473γ to 2$^+$ 934; δ to 3$^-$ is ≥0.3 if J=2.
3446 *14*	3$^-$		jKLm	XREF: Others: AC, AD XREF: j(3440)m(3440). J$^\pi$: L=3 in (α,α′).
3452.17 *7*	(2)$^+$	58[&] fs *6*	F Ij	XREF: Others: AC, AD XREF: j(3440). J$^\pi$: M1+E2 2518γ to 2$^+$ 934; 1113γ to 3$^-$ 2340; 2070γ to 0$^+$ 1383.
3463.04 *15*	(4)$^+$	137[&] fs *+21−17*	E Ij m	XREF: Others: AA, AC, AD, AE XREF: E(3451)j(3440)m(3440). E(level): values from (p,p′) (1966St15) and E(t,p) are, respectively, 10-20 keV and 5-10 keV low. J$^\pi$: E2(+M3) 2529γ to 2$^+$ 934; L(t,p)=(4); 1968γ to 4$^+$ 1495.

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
3471.88 *16*	1^+	5.3[&] fs *6*	FGhI	XREF: Others: AC, AD, AF, AG, AH, AI XREF: G(3469)h(3479). J^π: L(d,p)=2 for $5/2^+$ target; M1 3471γ to 0^+ g.s.
3491 *20*	(3^-)		K v	XREF: Others: AC, AD, AE XREF: v(3540). J^π: L=(3) in (α,α').
3499.88 *10*	2^+	53[&] fs *5*	EF h v	XREF: Others: AC, AD, AE, AG, AH, AI XREF: h(3479)v(3540). L=2 in (t,p).
3589 *10*	0^+		E k v	XREF: Others: AC, AD, AE, AG, AH XREF: k(3587)v(3540). J^π: L(t,p)=0+(5) for 3589+3602 doublet.
3602 *9*	(5^-)		E Gh k M	XREF: Others: AB, AD, AE, AF, AG, AH, AI XREF: h(3597)k(3587)M(3620). J^π: L(t,p)=0+(5) for 3589+3602 doublet; L(d,p)=(3+5) for $5/2^+$ target; L=(5) in (t,t').
3609.5 *4*	(0^+)	151[&] fs *+26−23*	I	2675γ to 2^+ 934; J=(0) from excit in (n,n'γ).
3628.33 *7*	(4^+)	26[&] fs *3*	EF hIjk	XREF: Others: AC, AD, AE, AF, AG, AI XREF: h(3597)j(3640). 2694γ to 2^+ 934; 885γ to 4^- 2744; 2133γ to 4^+ 1495; L(t,p)=2+(4) for 3628+3640 doublet so this is presumed to be the L=(4) component.
3638.2 *3*	1^-	8.4[&] fs *11*	Ijk	XREF: Others: AB, AC, AD, AF, AH XREF: j(3620)k(3634). J^π: E1 3638γ to 0^+ g.s.
3640.28 *11*	$(2)^+$	128[&] fs *15*	EF hIjk	XREF: Others: AB, AC, AD, AE, AF, AG, AI XREF: h(3597)j(3620)k(3634). J^π: M1+E2 2706γ to 2^+ 934; 1301γ to 3^- 2340; L(t,p)=2+(4) for 3628+3640 doublet, with L=(4) component associated with 3628 level on basis of that level's γ decay.
3649.22 *12*	3^+	56[&] fs *7*	FGhI L X	XREF: Others: AD, AE, AG, AI XREF: h(3597). J^π: M1+E2 2714γ to 2^+ 934; M1+E2 2154γ to 4^+ 1495. and 5^- levels; L(d,p)=2+4 for $5/2^+$ target.
3667.1 *10*	1			XREF: Others: AH J^π,E(level): from (γ,γ').
3675.8 *4*	3^+,4^+,5^+	116[&] fs *+24−20*	I	J^π: M1+E2 2180γ to 4^+ 1495.
3696.8 *4*	$1^{(+)}$	17.3[&] fs *28*	I	XREF: Others: AH J^π: D 3697γ to 0^+ g.s.; D+Q, $\Delta\pi$=(no) 2762γ to 2^+ 934.
3704 *7*	$(4)^+$		E Gh k	XREF: Others: AA, AD, AF, AG, AH XREF: h(3683)k(3711). J^π: L(t,p)=(4); L(d,p)=2 for $5/2^+$ target.
3725 *9*	$^+$		Gh k	XREF: Others: AA, AD, AF, AG, AH XREF: h(3683)k(3711). J^π: L(d,p)=2 for $5/2^+$ target.
3760 *10*	2^+		E h	XREF: Others: AD, AF, AH XREF: h(3683). J^π: L(t,p)=2.
3767 *20*	5^-		K	J^π: L(α,α')=5.
3774.6 *3*	$(1,2^+)$	17[&] fs *5*	I	J^π: 3775γ not M2 to 0^+ g.s.; 2840γ to 2^+ 934.
3783 *7*	$(4)^+$		E Gh	XREF: Others: AD, AF, AH

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
				XREF: h(3683). J^π: L(d,p)=2 for $5/2^+$ target; L(t,p)=(4).
3804.7 *5*	(≤4)	9[&] fs *+6−5*	I	E(level),J^π: may be the same level as 3814 in (d,p) with J^π=(1,2,3,4)$^{(+)}$. 2870γ to 2^+ 934.
3814 *10*	(4)$^+$		Gh N	XREF: Others: AB, AD, AH XREF: h(3802). J^π: L(d,p)=2 for $5/2^+$ target; L(p,t)=(4).
3819.4 *12*	(8^-)	≤3.5 ns	D	XREF: Others: AG J^π: D ΔJ=1 440γ to (7^-) 3380 in (^{7}Li,2npγ).
3830.31 *9*	(1^-,2^+)		F hI K	XREF: Others: AB, AD, AH XREF: h(3802). J^π: 2447γ to 0^+ 1383; 1490γ to 3^- 2340.
3891 *10*			Gh Jkl	XREF: Others: AB, AD, AG, AH, AI XREF: h(3802)J(3870)k(3877)l(3900). J^π: L(α,α′)=4 for one or both of 3891 and 3902 levels.
3902 *10*			E G kl	XREF: Others: AD, AG, AH, AI XREF: k(3877)l(3900). J^π: L(α,α′)=4 for one or both of 3891 and 3902 levels.
3915 *1*	1			XREF: Others: AH J^π,E(level): from (γ,γ′); D 3915γ to 0^+ g.s.
3944 *20*	5^-		H jK r	XREF: Others: AC, AD, AI XREF: H(3909)j(3940)r(3940). J^π: L(α,α′)=5.
3971 *10*			G j n r	XREF: Others: AC, AD, AI XREF: j(3940)n(3990)r(3940). J^π: L(d,p)=2 on $5/2^+$ target for 3971+3983 doublet.
3983 *10*			G jk n	XREF: Others: AC, AD, AI XREF: j(3990)k(4003)n(3990). J^π: L(d,p)=2 on $5/2^+$ target for 3971+3983 doublet. E(level): doublet reported in (d,p).
3992 *10*	0^+		E jk	XREF: Others: AC, AD XREF: k(4003). J^π: L(t,p)=0+(2).
3998.7? *12*	(9^-)	≤3.5 ns	D	XREF: Others: AG J^π: crossover 619γ to (7^-) 3380 in (^{24}Mg,Fγ); D ΔJ=1 179γ to (8^-) 3819 in ^{88}Sr(^{7}Li,2npγ).
4012 *10*	$^+$		E Gh k	XREF: Others: AC, AD, AH, AI XREF: h(3998)k(4003). J^π: L(d,p)=2 for $5/2^+$ target.
4040 *7*	4^+		E Gh JKL	XREF: Others: AA, AB, AC, AD, AH, AI XREF: E(4031)h(3998)J(4020). E(level): (p,p′) datum excluded from weighted average. J^π: L=4 in (α,α′) and (t,p).
4082 *7*	4^+		E G K	XREF: Others: AA, AC, AD, AG, AI XREF: E(4071)G(4093). J^π: L=4 in (t,p), (α,α′).
4142 *10*	2^+,3^+		Gh	XREF: Others: AA, AC, AE, AI XREF: h(4159). J^π: L(d,p)=0+2 for $5/2^+$ target.
4161 *10*	4^+		E h J	XREF: Others: AA, AC, AE, AI XREF: h(4159)J(4150). E(level): from (t,p). J^π: L(t,p)=4.
4181 *20*	3^-		K	J^π: L(α,α′)=3.
4183 *10*	($^+$)		Gh	XREF: Others: AA, AC, AE, AI

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
				XREF: h(4159). J^π: L(d,p)=(2+4) for $5/2^+$ target.
4213 *11*	$2^+,3^+$		Gh	XREF: Others: AA, AC, AE, AI XREF: h(4159). J^π: L(d,p)=0+(2) for $5/2^+$ target.
4256 *10*	4^+		G K	J^π: L(α,α')=4.
4270	(5^-)		N r	XREF: Others: AB, AC, AH XREF: r(4280). J^π: L(p,t)=(5).
4283 *10*	0^+		E r	XREF: Others: AB, AC, AH XREF: r(4280). J^π: L(t,p)=0.
4296.6[b] *4*	(10^+)	≤3.5 ns	CD	XREF: Others: AG, AI, AJ J^π: stretched (Q) 988γ to (8^+) 3309 in (^{7}Li,2npγ).
4332 *10*	2^+		E JK	XREF: Others: AA, AB, AC, AD, AF XREF: E(4332)J(4300)K(4316). E(level): from (t,p); may be 5-10 keV low. J^π: L(t,p)=2.
4380	(4^+)		N	J^π: L(p,t)=(4).
4397 *20*	2^+		K	J^π: L=2 in (α,α').
4453 *11*	$(2)^+$		Gh jkl	XREF: Others: AC, AD, AF XREF: h(4430)j(4430)l(4460). E(level): from (d,p). J^π: L=(2) for (p,p$'$) doublet; L(d,p)=2 for doublet for $5/2^+$ target.
4465 *11*	4^+		Gh jkl	XREF: Others: AC, AD, AF XREF: h(4430)j(4430)l(4460). E(level): from (d,p). J^π: L(α,α')=4; L(d,p)=2 for doublet.
4494 *11*			G	J^π: L(d,p)=2 for 4494+4504 doublet.
4504 *11*			G	J^π: L(d,p)=2 for 4494+4504 doublet.
4539 *20*	3^-		K	J^π: L=3 in (α,α').
4604 *12*	$+$		GH	J^π: L(d,p)=2 for $5/2^+$ target.
4606 *20*	(5^-)		K	J^π: L=(5) in (α,α').
4640 *12*	$-$		G	J^π: L=3 in (d,p) for $5/2^+$ target.
4670 *12*	$+$		G	J^π: L(d,p)=2 for $5/2^+$ target.
4720 *10*	$(2^+,3^+)$		G JK	J^π: L(d,p)=(0+4) for $5/2^+$ target.
4785 *10*	$(2^+,3^+)$		Gh K	XREF: Others: AC, AG, AH XREF: h(4788). J^π: L(d,p)=(0+2+4) for $5/2^+$ target.
4807 *20*	(3^-)		h Kl	XREF: Others: AA, AC, AG, AH XREF: h(4788)l(4810). J^π: L=(3) in (α,α').
4813 *12*			Gh l	XREF: Others: AA, AC, AG, AH XREF: h(4788)l(4810). J^π: L(d,p)=(2+4) for 4813+4821 doublet.
4821 *12*			Gh kl	XREF: Others: AA, AC, AD, AG, AH XREF: h(4788)k(4837)l(4810). J^π: L(d,p)=(2+4) for 4813+4821 doublet.
4847 *12*	$(^-)$		G k	XREF: Others: AC, AD, AG, AH XREF: k(4837). J^π: L(d,p)=(3) for $5/2^+$ target.
4894 *12*	$(^+)$		G	J^π: L(d,p)=(2+4) for $5/2^+$ target.
4928 *10*	5^-		G K	J^π: L=5 in (α,α').
4947.2[b] *7*	(12^+)	≤3.5 ns	CD	XREF: Others: AG, AI, AJ

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
				J^π: stretched (Q) γ to (10^+).
4977 *12*			G	J^π: L(d,p)=2 for 4977+4982 doublet.
4982 *12*			G	J^π: L(d,p)=2 for 4977+4982 doublet.
5012 *11*	−		G K	J^π: L(d,p)=3 for $5/2^+$ target.
5040 *13*	(−)		G	J^π: L(d,p)=(3) for $5/2^+$ target.
5056 *20*	4^+		K	J^π: L=4 in (α,α').
5067 *13*	2^+,3^+		G	J^π: L(d,p)=0+2 for $5/2^+$ target.
5091 *13*	+		G	J^π: L(d,p)=2 for $5/2^+$ target.
5115 *11*	$(4)^+$		G K N	J^π: L(p,t)=(4); L(d,p)=2 for $5/2^+$ target.
5197 *13*			G	
5215 *13*			G	
5278 *13*			Gh	XREF: Others: AB, AE, AF, AI XREF: h(5269). J^π: L(d,p)=(2,3) for $5/2^+$ target.
5310 *13*	(2^+,3^+)		Gh	XREF: Others: AB, AE, AF, AI XREF: h(5269). J^π: L(d,p)=(0+2+4) for $5/2^+$ target.
5358 *13*	−		G	J^π: L(d,p)=3 for $5/2^+$ target.
5455 *20*			K	
5490	(0^+)		l N	XREF: Others: AA, AE XREF: l(5510). J^π: L(p,t)=(0).
5537 *20*			Kl	XREF: Others: AA, AE XREF: l(5510).
5581 *20*	(2^+)		K	J^π: L=(2) in (α,α').
5680	(4^+)		N	J^π: L(p,t)=(4).
5685 *20*	3^-		K	J^π: L=3 in (α,α').
5885 *20*	3^-		K V	J^π: L(α,α')=3.
6045.5[@b] *12*	(14^+)		C	XREF: Others: AG, AI, AJ J^π: γ to (12^+); suggested value from (^{48}Ca,4nγ).
6056	3^-		K	J^π: L(α,α')=3.
6125 *20*			K	
6187	3^-		K	J^π: L(α,α')=3.
6240	(4^+)		N	J^π: L(p,t)=(4).
6334	3^-		K	J^π: L(α,α')=3.
6436	3^-		K	J^π: L(α,α')=3.
6990 *90*			V	
7.0×10^3 *4*			P	Possible low energy octupole resonance (1981Ya02). Note: E(res)≈6.3 MeV from (α,α') (1980ToZS).
7.4×10^3 *1*			V	
7445.8[@b] *16*	(16^+)		C	XREF: Others: AG, AI, AJ J^π: 1400γ to (14^+) 6046 in (^{48}Ca,4nγ); band assignment.
8039.1?[@] *19*	(17,18^+)	42 ps *14*	C	XREF: Others: AJ J^π: D,E2 593γ feeds (16^+) 7446. (17^-) suggested in (^{48}Ca,4nγ), but (18^+) suggested in (^{13}C,3nγ). $T_{1/2}$: from recoil-distance data, ^{48}Ca(^{48}Ca,4nγ).
(8634.82 *8*)	2^+[a]		F	E(level): thermal neutron capture state(s); not a discrete level.
8.8×10^3 *2*	1^+	1.4 MeV *2*	J	M1 giant resonance.

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Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

E(level)[‡]	J^π	$T_{1/2}$[#]	XREF	Comments
9127.5[b] *19*	(18$^+$)			XREF: Others: AG J^π: 1681γ to (16$^+$) 7446.
9722.2 *22*	(≤20)			XREF: Others: AJ J^π: 1683γ feeds (17,18$^+$) 8039 level. (20$^+$) suggested in (^{13}C,3nγ);
13.2×10^3 *1*	2$^+$	3.8 MeV *2*	Z	J^π: E2 excitation in (e,e′). GQR. T=0.
13.7×10^3 *5*	2$^+$ & 4$^+$		J	J^π: L(p,p′)=2+4. GMR including 13200, 2$^+$ resonance seen in (e,e′).
15.7×10^3 *1*	0$^+$	4.0 MeV *2*	Z	J^π: E0 excitation in (e,e′). Isoscalar giant monopole resonance.
16.20×10^3 *5*	1$^-$	4.68 MeV	Z	XREF: Others: AB Γ: from (γ,xn)+(γ,np). J^π: E1 excitation in (γ,xn)+(γ,np). GDR. T=1.
17.5×10^3 *3*	0$^+$ & 4$^+$	3.3 MeV	J	Γ: from (p,p′). J^π: L(p,p′)=0+4 giant multipole resonances.
25.1×10^3 *3*	3$^-$	6.3 MeV *3*	P Z	J^π: E3 excitation in (e,e′). T=0. High energy isoscalar octupole giant resonance.
28.1×10^3 *3*	2$^+$	5.9 MeV *2*	Z	J^π: E2 excitation in (e,e′). Isovector GQR.

† State reported also in numerous ^{92}Zr inelastic scattering spectra. Evaluator believes these observations can be attributed largely, if not entirely, to a known 3$^-$ ^{90}Zr state contributing in these experiments via the typical ≈3% ^{90}Zr target impurity. It is unclear whether excitation of the 4$^-$ 2744 level via inelastic scattering is masked by the impurity or absent altogether.

‡ From least-squares fit to adopted Eγ for levels deexcited by gammas, ignoring tentatively-placed lines and allowing 1 keV uncertainty in Eγ whenever no transition from a given level has an author-assigned uncertainty; from weighted average of data from cross-referenced reactions otherwise.

Half-life from ^{88}Sr(^{7}Li,2npγ) for E(level)<8500, width from (e,e′) for E(level)≥8500, except as noted.

@ ΔE=3 keV if 1 keV is assumed for unknown ΔE(γ).

& From DSAM in (n,n′γ).

a J^π=2$^+$,3$^+$ for thermal n capture on 5/2$^+$ target. J^π=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.

b Band(A): π=+ ΔJ=2 sequence. Yrast sequence built on 0$^+$ g.s. (2002Fo03).

Adopted Levels, Gammas (continued)

$\gamma(^{92}Zr)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	$I_{(\gamma+ce)}$	Comments
934.51	2^+	934.47 *4*	100	0.0	0^+	E2			B(E2)(W.u.)=6.4 *6* E_γ: weighted average of 934.47 *7* from β^- decay, 934.44 *10* from ε decay (10.15 d), 934.46 *5* from (n,γ) E=thermal and 934.5 *1* from (n,n′γ). Mult.: Q to 0^+, from $\gamma(\theta)$ in (^{7}Li,2npγ); $\Delta\pi$=no from RUL. E2 confirmed by α(exp) in ^{92}Nb ε decay (10.15 d).
1382.77	0^+	448.26 *7*	100	934.51	2^+	E2			B(E2)(W.u.)=14.4 *5* E_γ: weighted average of 448.5 *1* (from β^- decay), 448.13 *7*, 448.22 *10*, 448.3 *2* (all from (n,γ) E=thermal) and 448.3 *1* (from (n,n′γ)). (the unweighted average is 448.29 *6*.). Mult.: mult=Q to 2^+, from $\gamma\gamma(\theta)$ in ^{92}Y β^- decay; not M2, from RUL.
		1383		0.0	0^+	E0		0.196 *19*	$I_{(\gamma+ce)}$: from (p,p′γ). E0 transition strength ρ^2(E0)=0.0081 *8* calculated by 1999Wo07.
1495.46	4^+	560.92 *15*	100	934.51	2^+	E2			B(E2)(W.u.)=4.05 *12* E_γ: weighted average of 561.1 *1* from β^- decay and (n,n′γ), 561.0 *2* from (^{7}Li,2npγ) and 560.93 *5* from (n,γ) E=thermal. Mult.: mult=Q from $\gamma(\theta)$ in (^{7}Li,2npγ); not M2 from RUL. δ(Q,O)=+0.04 *2* from (n,n′γ), +0.01 *+11−9* or +1.6 *+4−3* from $\gamma\gamma(\theta)$ in ^{92}Y β^- decay. B(M3)(W.u.) exceeds RUL, unless δ<0.00033.
1847.27	2^+	912.72 *6*	100.0 *23*	934.51	2^+	(M1(+E2))	−0.002 *25*		B(M1)(W.u.)=0.201 *22*; B(E2)(W.u.)=0.001 *+25−1* I_γ: from (n,n′γ). Mult.: mult=D(+Q) from ^{92}Nb(10.15 d) ε decay; $\Delta\pi$=no from level scheme. δ: unweighted average of −0.04 *2* in (n,n′γ), and −0.01 *3* and +0.044 *17* from ε decay (10.15 d).
		1847.27 *5*	51 *3*	0.0	0^+	E2			B(E2)(W.u.)=3.7 *5* E_γ: weighted average of 1847.3 *1*, 1847.5 *3*, 1847.27 *9* and 1847.2 *1* from β^- decay, ε decay (10.15 d), (n,γ) E=thermal and (n,n′γ), respectively. I_γ: unweighted average of 58 *4*, 47.8 *22*, 52 *8* and 44.6 *23* from β^- decay, ε decay (10.15 d), (n,γ) E=thermal and (n,n′γ), respectively (weighted average is 47.9 *25*).
2066.65	2^+	219.07[b] *15*	0.64 *10*	1847.27	2^+				I_γ: weighted average of 0.61 *12* from (n,n′γ), 0.71 *20* from (n,γ) E=thermal.
		571.28 *15*	0.60 *20*	1495.46	4^+				
		1132.12 *5*	100 *3*	934.51	2^+	(M1+E2)	−3.2 *+5−4*		B(M1)(W.u.)<0.0022; B(E2)(W.u.)<15 E_γ: weighted average of 1132.17 *14*, 1132.11 *6* and 1132.1 *1*

$^{92}_{40}Zr_{52}$-10

Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[a]	Comments
									from ε decay, (n,γ) E=thermal and (n,n$'\gamma$), respectively. Other Eγ: 1132.4 *1* from β^- decay. Mult.: D+Q from $\gamma\gamma(\theta)$ in (n,γ) and (n,n$'\gamma$); adopted $\Delta\pi$=no. δ: from δ=−3.2 *+5−4* or +0.85 *7* from 2005Fr17 in (n,n$'\gamma$) and −2.7 *+8−15* from (n,γ) E=thermal. Other δ: −2.4 *+3−4* or −1.04 *11* (1978Gl04) in (n,n$'\gamma$).
2066.65	2^+	2066.7[@] *4*	0.53[@] *7*	0.0	0^+	E2			B(E2)(W.u.)<0.0042 Mult.,δ: Q (δ=0) from $\gamma(\theta)$ in (n,n$'\gamma$); not M2 from RUL.
2339.66	3^-	272.85[b] *24*		2066.65	2^+				E_γ,I_γ: Eγ from (n,γ) E=thermal. Branch absent in β^- decay and (n,n$'\gamma$) and one (n,γ) E=thermal study, and Iγ data from the two (n,γ) E=thermal studies that report it are discrepant.
		492.37 *10*	10.8 *5*	1847.27	2^+	(E1(+M2))	≤0.009		B(E1)(W.u.)=0.00067; B(M2)(W.u.)≤1.3 I_γ: unweighted average of 11.7 *7* from (n,n$'\gamma$), 10.6 *9* from (n,γ) E=thermal and 10.1 *6* from β^- decay. Weighted average is 10.7 *5*. Mult.: D(+Q) from $\gamma(\theta)$ in (n,n$'\gamma$), $\Delta\pi$=yes from level scheme. δ: +0.01 *3* from (n,n$'\gamma$); however, B(M2)(W.u.) exceeds RUL, unless δ<0.009.
		844.12 *6*	29.9 *19*	1495.46	4^+	(E1+M2)	≤0.02		B(E1)(W.u.)≥0.00036; B(M2)(W.u.)≤1.2 Mult.: D+Q from $\gamma(\theta)$ in (n,n$'\gamma$), $\Delta\pi$=yes from level scheme. δ: +0.13 *4* (1978Gl04) from (n,n$'\gamma$); however, B(M2)(W.u.) exceeds RUL, unless δ<0.02. I_γ: unweighted average of 32.3 *18* from (n,n$'\gamma$), 31.1 *22* from (n,γ) E=thermal and 26.2 *17* from β^- decay. Weighted average is 29.6 *20*.
		1405.06 *5*	100 *4*	934.51	2^+	(E1)			B(E1)(W.u.)=0.00030 *4* I_γ: weighted average from (n,n$'\gamma$), (n,γ) E=thermal and β^- decay. Mult.: mult=D(+Q) from $\gamma\gamma(\theta)$ in (n,γ), ^{92}Y β^- decay, and from $\gamma(\theta)$ in (n,n$'\gamma$); adopted $\Delta\pi$=yes. δ: −0.019 *+21−20* from $\gamma\gamma(\theta)$ in ^{92}Y β^- decay. Others: +0.03 *2* from $\gamma(\theta)$ in (n,n$'\gamma$); evaluator rejects value of +0.18 *+20−15* from $\gamma\gamma(\theta)$ in (n,γ). B(M2)(W.u.) exceeds RUL, unless δ<0.04.
		2339.9 *1*	≈0.11	0.0	0^+	E3		0.00049	B(E3)(W.u.)=18.3 *11* E_γ,I_γ: from β^- decay. Other Eγ (Iγ): 2339.4 *22* (0.4 *7*) in (n,γ) E=thermal. Mult.: from form factor in (e,e$'$). B(E3)(W.u.): from (e,e$'$). However, B(E3)(W.u.)=48 *13* from adopted $T_{1/2}$ and branching=0.30 *7* from β^- decay; a branch of 0.11 would Be required to reduce this B(E3)(W.u.) to the value obtained in (e,e$'$), suggesting branching may be overestimated in β^- decay.

$^{92}_{40}\mathrm{Zr}_{52}$-11

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

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[a]	Comments
2398.36	4^+	902.92 *7*	100.0 *21*	1495.46	4^+	M1+E2	−0.11 *+3−2*		B(M1)(W.u.)=0.147 *17*; B(E2)(W.u.)=2.3 *13* I_γ: weighted average from (n,n′γ) and (n,γ) E=thermal. Other δ: +1.30 *+13−30* or −0.13 *9* from (n,n′γ).
		1463.81 *10*	35 *3*	934.51	2^+	E2(+M3)			B(E2)(W.u.)=5.9 *7* B(E2)(W.u.): if δ=0; see comment on δ. I_γ: weighted average of 35.9 *23* from (n,n′γ) and 27 *7* from (n,γ) E=thermal. δ: −0.13 *+5−6* (2005Fr17) in (n,n′γ). However, B(M3)(W.u.) violates RUL, unless δ<0.0007. Other δ: −0.13 *+9−5* (1978Gl04) from (n,n′γ).
2473.4?	(≤2)	2473.6[b] *2*	100	0.0	0^+				
2486.01	5^-	990.52 *9*	100	1495.46	4^+	(E1)			B(E1)(W.u.)≥9.8×10^{-8} May also deexcite the 3057 level. Mult.: mult=D or D(+Q) to 4^+, from γ(θ) in (^{7}Li,2npγ) and (n,n′γ), respectively; Δπ=yes from level scheme. δ: +0.04 (1978Gl04) in (n,n′γ).
2743.55	4^-	257.57 *10*	90 *5*	2486.01	5^-	(M1(+E2))	−0.01 *+2−3*	0.01624	B(M1)(W.u.)<0.30 B(M1)(W.u.): if δ=0. I_γ: from (n,n′γ). 72 *7* from (n,γ) E=thermal if I(404γ)=57. Mult.: D(+Q) from (n,n′γ); Δπ=no from level scheme. Other δ(D,Q)=+0.09 *+8−5* or ≥11.4 or ≤−22.9 from (n,n′γ).
		344.8 *3*	4.0 *16*	2398.36	4^+				I_γ: from (n,γ) E=thermal branching renormalized so I(404γ)=57.
		403.83 *9*	57 *3*	2339.66	3^-	(M1(+E2))	+0.04 *2*		B(M1)(W.u.)<0.028; B(E2)(W.u.)<0.57 I_γ: from (n,n′γ). Mult.: D(+Q) from (n,n′γ); Δπ=no from level scheme. Other δ: 0.00 *4* or −7 *+2−16* from 1978Gl04 in (n,n′γ).
		1248.00 *11*	100 *5*	1495.46	4^+	(E1(+M2))	+0.02 *+6−4*		B(E1)(W.u.)<2.5×10^{-5}; B(M2)(W.u.)<0.20 I_γ: from (n,n′γ). Mult.: D(+Q) from (n,n′γ); Δπ=yes from level scheme. Other δ: −0.13 *4* from 1978Gl04 in (n,n′γ).
2819.54	2^+	972.30 *9*	100 *4*	1847.27	2^+	(M1(+E2))	+0.01 *2*		B(M1)(W.u.)=0.196 *24*; B(E2)(W.u.)=0.022 *+87−22* I_γ: weighted average from β^- decay, (n,n′γ) and (n,γ) E=thermal. Mult.: from γ(θ) in (n,n′γ), assuming Δπ from level scheme. δ: +2.3 *+2−1* also possible, but less likely (2005Fr17 in (n,n′γ)). Other δ: −0.18 *4* or +4.5 *+12−8* from 1978Gl04 in (n,n′γ).
		1436.2[b] *6*	4.7 *21*	1382.77	0^+				
		1885.00 *12*	38.7 *23*	934.51	2^+	(M1+E2)			I_γ: unweighted average of 34.2 *19* from (n,n′γ), 41 *4* from from (n,γ) E=thermal and 41 *5* from β^- decay. Weighted average is 36.0 *21*. Mult.: D+Q from γ(θ) in (n,n′γ), Δπ=no from level scheme. δ: −0.14 *4* or +3.7 *+7−5* from (n,n′γ).

$^{92}_{40}Zr_{52}$-12

Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
2819.54	2^+	2819.8 *3*	4.6 *4*	0.0	0^+	E2		B(E2)(W.u.)=0.048 *7* E_γ: from β^- decay. Other: 2819.3 *7* from (n,n′γ). I_γ: weighted average of 4.5 *4* from (n,n′γ) and 6.1 *18* from β^- decay.
2864.66	4^+	465.94 *21*	10.6 *17*	2398.36	4^+	(M1(+E2))	−0.01 *+15−13*	B(M1)(W.u.)=0.068 *15*; B(E2)(W.u.)=0.03 *+99−3* I_γ: weighted average of 11.1 *10* from (n,n′γ) and 8.0 *22* from (n,γ) E=thermal. Mult.: D(+Q) from (n,n′γ); $\Delta\pi$=no from level scheme.
		1369.25 *10*	100 *4*	1495.46	4^+	M1+E2	−0.49 *5*	B(M1)(W.u.)=0.021 *3*; B(E2)(W.u.)=2.7 *6* I_γ: weighted average of 100 *5* from (n,n′γ) and 100 *5* from (n,γ) E=thermal.
		1930.13 *18*	30 *4*	934.51	2^+	E2(+M3)	−0.02 *4*	B(E2)(W.u.)=0.76 *15* I_γ: unweighted average of 26.7 *17* from (n,n′γ) and 34 *3* from (n,γ) E=thermal. Other δ(Q,O)=+0.32 *+19−28* or ≥+3.73 (1978Gl04) for 1928.7γ in (n,n′γ).
2904.08	0^+	837.4@ *2*	100@ *5*	2066.65	2^+			Other Eγ: 836.8 *2* from (n,γ) E=thermal.
		1969.6@ *3*	44@ *5*	934.51	2^+	E2		B(E2)(W.u.)=0.28 *+9−20*
2909.43	3^+	569.47 *17*	3.9 *11*	2339.66	3^-			E_γ,I_γ: From (n,γ); alternative placement in (n,n′γ) not adopted.
		842.69 *15*	32 *4*	2066.65	2^+	M1+E2	−0.25 *+7−9*	B(M1)(W.u.)=0.026 *5*; B(E2)(W.u.)=2.4 *14*
		1414.01 *11*	60 *4*	1495.46	4^+	M1+E2		δ: −0.50 *+6−7* or −1.49 *+16−14* from (n,n′γ).
		1974.93 *10*	100 *17*	934.51	2^+	M1+E2	+0.13 *+0−4*	B(M1)(W.u.)=0.0066 *15*; B(E2)(W.u.)=0.030 *7*
2957.4	6^+	471.3&b		2486.01	5^-			
		559.6&b		2398.36	4^+			
		1461.93 *26*	100	1495.46	4^+	(E2)		B(E2)(W.u.)≥0.00098 E_γ: weighted average of 1461.8 *3* in (n,γ) E=thermal and 1462.3 *5* from (^{7}Li,2npγ). Mult.: mult=(Q) from $\gamma(\theta)$ in (^{7}Li,2npγ); $(6)^+$ to 4^+ transition.
3039.70	3	295.77 *19*	4.2 *8*	2743.55	4^-			
		700.10 *9*	23.8 *21*	2339.66	3^-	D(+Q)	+0.08 *10*	
		1192.49 *27*	4.6 *12*	1847.27	2^+	D(+Q)	+0.02 *+3−2*	
		2105.18 *8*	100 *7*	934.51	2^+	D(+Q)	−0.04 *+4−9*	δ: if J=3. Other δ: −1.6 *+5−8* if J(3039 level)=2 from (n,n′γ).
3057.40	2^+	717.9@ *2*	31.5@ *19*	2339.66	3^-	D(+Q)	−0.03 *7*	Other Eγ: 717.7 *3* from (n,γ) E=thermal. Mult.: D(+Q) from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=no from level scheme. δ: from 2005Fr17; other δ: +0.41 *+17−14* or +4.5 *+31−18* (1978Gl04); all δ from (n,n′γ).
		990.5@ *2*	≈100@	2066.65	2^+			Doubly placed in (n,n′γ); also deexcites 2486 level.
		1674.9@ *5*	6.7@ *5*	1382.77	0^+	E2		B(E2)(W.u.)=0.64 *20*
		2123.0@ *3*	39.1@ *21*	934.51	2^+	M1+E2	+0.69 *16*	B(M1)(W.u.)=0.0034 *11*; B(E2)(W.u.)=0.37 *16*
		3057.2@ *5*	8.2@ *7*	0.0	0^+	E2		B(E2)(W.u.)=0.039 *12*

$^{92}_{40}Zr_{52}$-13

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

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
3124.61	$1^{(+)}$	1057.97 *10*	49 *3*	2066.65	2^+	D(+Q)		E_γ: from (n,γ) E=thermal. Other $E\gamma$: 1058.0 *3* from (n,n′γ). I_γ: from (n,n′γ). δ: −3.1 *+15−59* or −0.02 *20* from (n,n′γ).
		1741.6[@] *3*	100[@] *5*	1382.77	0^+	D		$E\gamma$ matches that for γ placed from possible 3237 level in (n,γ) E=thermal. Additional information 1.
		2190.3[@] *5*	27.3[@] *17*	934.51	2^+			
		3124.5[@] *5*	31.4[@] *18*	0.0	0^+	D		
3178.31	4^+	779.94 *10*	100.0 *15*	2398.36	4^+	M1(+E2)	−0.04 *4*	B(M1)(W.u.)=0.68 *8*; B(E2)(W.u.)=1.9 *+38−19* I_γ: from (n,n′γ). Mult.: D+Q from (n,n′γ); $\Delta\pi$=no from level scheme.
		2243.80 *26*	25.8 *15*	934.51	2^+	E2(+M3)	+0.06 *+10−9*	B(E2)(W.u.)=1.53 *20* I_γ: from (n,n′γ); 27 *4* from (n,γ) E=thermal.
3190.99	(4^-)	1695.5 *2*	100	1495.46	4^+	D(+Q)	−0.02 *+4−3*	Other δ: −0.09 *13* (1978Gl04), also from (n,n′γ).
3236.9	4^+	1741.8[b] *2*	100	1495.46	4^+	D+Q	−1.09 *+9−10*	Placement may Be questionable; see comment on 1742γ from 3125 level.
3262.62	2^+	2328.17 *13*	100.0 *17*	934.51	2^+	(M1+E2)	−0.06 *3*	B(M1)(W.u.)=0.108 *13*; B(E2)(W.u.)=0.07 *+8−7* I_γ: from (n,n′γ). Mult.: D+Q from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=no from level scheme. δ: from (2005Fr17); other δ: −0.27 *+9−5* (1978Gl04); both from (n,n′γ).
		3262.54 *4*	29.3 *17*	0.0	0^+	E2		B(E2)(W.u.)=1.13 *15* I_γ: from (n,n′γ). Mult.: Q from (γ,γ'); not M2 from RUL.
3275.76	$2^+,3^+$	366.62[b] *19*	8.3 *17*	2909.43	3^+			Uncertain γ in (n,γ), absent in (n,n′γ) so may be misplaced.
		877.45 *10*	23.1 *15*	2398.36	4^+	D,Q		I_γ: from (n,n′γ). Other: 29 *6* from (n,γ) E=thermal. δ: >+10 or +0.08 *+4−5* from (n,n′γ).
		1209.22 *10*	100 *6*	2066.65	2^+	Q(+D)		δ: +0.13 *+0−4* if J=3, ∞ or −0.52 *+11−∞* if J=2 from (n,n′γ).
		1428.7[@] *5*	4.2[@] *5*	1847.27	2^+			Branch is absent in (n,γ) E=thermal.
		2340.90 *16*	45 *4*	934.51	2^+	M1+E2	+4.4 *+8−5*	B(M1)(W.u.)=0.00040 *15*; B(E2)(W.u.)=1.46 *22*
3289.13	3^+	379.60 *10*	78 *4*	2909.43	3^+	D(+Q)		I_γ: from (n,n′γ). Other $I\gamma$: 55 *12* in (n,γ) E=thermal. δ: +0.02 *6* or +1.5 *2* from (n,n′γ).
		891.0 *4*	5 *3*	2398.36	4^+			
		1222.47 *9*	93 *5*	2066.65	2^+	M1+E2		I_γ: from (n,n′γ). Data from (n,γ) E=thermal are discrepant. δ: +0.68 *+9−7* or +2.3 *4* from (n,n′γ).
		1441.2 *3*	26.4 *18*	1847.27	2^+	M1+E2	+0.24 *5*	B(M1)(W.u.)=0.0031 *5*; B(E2)(W.u.)=0.09 *4* E_γ: weighted average of 1441.6 *5* from (n,n′γ) and 1441.0 *4* from (n,γ) E=thermal. I_γ: from (n,n′γ). Other: 12 *3* from (n,γ) E=thermal.
		1793.87 *23*	33.8 *26*	1495.46	4^+	M1+E2	+0.22 *5*	B(M1)(W.u.)=0.0021 *3*; B(E2)(W.u.)=0.033 *15* I_γ: weighted average of 35.2 *22* from (n,n′γ) and 29 *4* from (n,γ) E=thermal.

$^{92}_{40}Zr_{52}$-14

Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[a]	Comments
3289.13	3^+	2354.80 *13*	100 *9*	934.51	2^+	M1+E2	+0.29 *3*		B(M1)(W.u.)=0.0027 *4*; B(E2)(W.u.)=0.042 *10*
3308.7	(8^+)	351.3 *2*	100	2957.4	6^+	E2		0.01276	B(E2)(W.u.)=3.59 *22* Mult.: Q from $\gamma(\theta)$ in (^{7}Li,2npγ); not M2, from RUL.
3371.48	$1^{(-)}$	1032.0 *3*	2.8 *7*	2339.66	3^-				
		1988.71 *10*	100 *13*	1382.77	0^+	(E1)			B(E1)(W.u.)=0.00079 *15* Mult.: D from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$ from level scheme.
		2436.92 *10*	45.1 *20*	934.51	2^+	(E1(+M2))			I_γ: average of 43.1 *26* from (n,n′γ) and 47.0 *26* from (n,γ) E=thermal. Mult.: D(+Q)) from $\gamma(\theta)$ in (n,n′γ), $\Delta\pi$=yes from level scheme. δ: +0.11 *18* or −5 *+3−27* from (n,n′γ).
		3371.2 *3*	51 *5*	0.0	0^+	(E1)			B(E1)(W.u.)=8.2×10^{-5} *14* I_γ: unweighted average of 43 *3* from (n,n′γ), 60 *7* from (n,γ) E=thermal, 50 *7* from β^- decay. (weighted average is 46 *4*.). Mult.: D from (γ,γ'); $\Delta\pi$ from level scheme.
3379.8	(7^-)	893.8	100	2486.01	5^-				E_γ: from ^{173}Yb(^{24}Mg,Fγ)^{92}Zr.
3407.83	$2^-,3^-$	1068.2[@] *2*	100[@] *4*	2339.66	3^-	M1+E2			δ: +5.8 *21* or +0.36 *+6−5* if J=2 from (n,n′γ). Other δ: +1.2 *+7−5* if J=2, −1.7 *+7−28* if J=3, −0.13 *4* if J=4 from $\gamma(\theta)$ in (n,n′γ).
		2473.2[@] *3*	73[@] *4*	934.51	2^+	(E1(+M2))	+0.08 *6*		B(E1)(W.u.)=3.1×10^{-5} *5*; B(M2)(W.u.)=0.15 *+22−15* Other Eγ (Iγ): 2473.6 *2* (159 *19*) from (n,γ) E=thermal. Mult.: D(+Q) from (n,n′γ); $\Delta\pi$=yes from level scheme.
3452.17	$(2)^+$	632.12[b] *24*	7.7 *19*	2819.54	2^+				
		1112.65 *22*	21.7	2339.66	3^-				I_γ: from (n,n′γ). Other Iγ: 23 *8* from (n,γ) E=thermal.
		1604.86 *10*	90 *4*	1847.27	2^+	M1+E2[#]	−1.5 *+5−8*		B(M1)(W.u.)=0.008 *4*; B(E2)(W.u.)=7.4 *18* I_γ: weighted average of 86 *6* from (n,γ) E=thermal and 92 *5* from (n,n′γ).
		1956.60 *12*	67 *6*	1495.46	4^+				Other Iγ: 36 *3* from (n,n′γ).
		2069.5 *4*	16 *5*	1382.77	0^+				
		2517.73 *11*	100 *4*	934.51	2^+	M1+E2	+2.0 *12*		B(M1)(W.u.)=0.0016 *16*; B(E2)(W.u.)=1.0 *3*
3463.04	$(4)^+$	1967.53 *15*	100.0 *23*	1495.46	4^+				I_γ: from (n,n′γ).
		2528.7[@] *5*	33.8[@] *23*	934.51	2^+	E2(+M3)	≤+0.005		B(E2)(W.u.)=0.41 *+6−7* B(E2)(W.u.): if pure E2. δ: +0.11 *10* from (n,n′γ); B(M3)(W.u.) exceeds RUL, unless δ≤0.005. Other Iγ: 24 *5* from (n,γ) E=thermal.
3471.88	1^+	2089.6[@] *5*	17.9[@] *14*	1382.77	0^+	(M1)			B(M1)(W.u.)=0.052 *8* Mult.: D from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=no from level scheme.
		2537.1 *2*	39.2 *23*	934.51	2^+	M1			B(M1)(W.u.)=0.063 *9* I_γ: from (n,n′γ); 37 *3* from (n,γ) E=thermal. δ: 0.0 *3* or −3.4 *+17−280* from (n,n′γ); M1 from (pol γ,γ').

$^{92}_{40}Zr_{52}$-15

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

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
3471.88	1^+	3471.9[@] *5*	100[@] *5*	0.0	0^+	M1		B(M1)(W.u.)=0.063 *9* Other Eγ (Iγ): 3472.6 *3* (100 *16*) from (n,γ) E=thermal. Mult.: from (pol γ,γ′); confirmed by γ(θ) in (n,n′γ).
3499.88	2^+	224.7 *3*	3.6 *12*	3275.76	$2^+,3^+$			
		590.67 *22*	10.8 *24*	2909.43	3^+			
		680.65 *21*	9.6 *24*	2819.54	2^+			
		1159.54 *16*	22.4 *18*	2339.66	3^-	(E1(+M2))	−0.04 *15*	B(E1)(W.u.)=0.00038 *5*; B(M2)(W.u.)=2.1 *+155−21* I_γ: from (n,n′γ). Other: 30 *4* from (n,γ) E=thermal. Mult.: D(+Q) from γ(θ) in (n,n′γ); Δπ=yes from level scheme.
		1433.6[@] *4*	19.3[@] *14*	2066.65	2^+			Other Eγ (Iγ): 1433.9 *3* (51 *12*) from (n,γ) E=thermal.
		1652.8[@] *3*	56[@] *3*	1847.27	2^+	M1+E2		Other Eγ (Iγ): 1652.79 *13* (69 *6*) from (n,γ) E=thermal. δ: −0.11 *+3−5* or +3.3 *+6−4*.
		2565.6[@] *5*	15.8[@] *13*	934.51	2^+	M1+E2		Branch is absent in (n,γ) E=thermal. δ: −0.62 *+16−27* or −7 *+3−57*.
		3499.8[@] *5*	100[@] *5*	0.0	0^+	E2		B(E2)(W.u.)=0.35 *4* Other Eγ (Iγ): 3500.8 *6* (100 *25*) from (n,γ) E=thermal.
3609.5	(0^+)	1762.3[@] *5*	29[@] *4*	1847.27	2^+			
		2674.8[@] *5*	100[@] *4*	934.51	2^+			
3628.33	(4^+)	588.32 *24*	1.6 *4*	3039.70	3			
		808.67 *22*	2.9 *4*	2819.54	2^+			
		884.74 *11*	17.5 *17*	2743.55	4^-			
		1229.81 *22*	3.6 *7*	2398.36	4^+			
		2132.90 *11*	25.8 *25*	1495.46	4^+			
		2693.86 *12*	100 *11*	934.51	2^+			
3638.2	1^-	2255.4[@] *3*	14.1[@] *16*	1382.77	0^+	(E1)		B(E1)(W.u.)=0.00043 *8* Mult.: D from γ(θ) in (n,n′γ); Δπ=yes from level scheme.
		3638.0[@] *5*	100.0[@] *16*	0.0	0^+	E1		B(E1)(W.u.)=0.00072 *10* Mult.: from (pol γ,γ′).
3640.28	$(2)^+$	601.1[b] *3*	3.3 *13*	3039.70	3			
		821.0 *3*	4.0 *13*	2819.54	2^+			
		1301.0 *5*	9 *3*	2339.66	3^-			I_γ: from (n,n′γ).
		2705.76 *12*	100 *15*	934.51	2^+	M1+E2		I_γ: 100.0 *26* from (n,n′γ). δ: +3.5 *4* or −0.12 *+3−4* from (n,n′γ).
3649.22	3^+	1162.7 *3*	35 *8*	2486.01	5^-			
		1251.16 *18*	52 *4*	2398.36	4^+	M1+E2		I_γ: weighted average of 56 *6* from (n,γ) E=thermal and 50 *5* from (n,n′γ). δ(D,Q)=+12 *+52−6* or +0.22 *+7−8* from (n,n′γ).
		1800.74[b] *27*	26 *4*	1847.27	2^+	D(+Q)		I_γ: from (n,n′γ); 43 *11* from (n,γ) E=thermal. δ(D,Q)=−3.8 *+9−14* or −0.08 *8* from (n,n′γ).
		2153.68 *18*	100 *7*	1495.46	4^+	M1+E2		I_γ: from (n,n′γ); 100 *11* from (n,γ) E=thermal. δ(D,Q)=−3.9 *+7−9* or −0.12 *4* from (n,n′γ).

$^{92}_{40}Zr_{52}$-16

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

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
3649.22	3^+	2714.1 *4*	73 *5*	934.51	2^+	M1+E2	−0.73 *+12−18*	B(M1)(W.u.)=0.0038 *10*; B(E2)(W.u.)=0.28 *9* I_γ: from (n,n′γ); 97 *16* from (n,γ) E=thermal.
3667.1	1	3667	100	0.0	0^+	D		E_γ: from level-energy difference. Mult.: from (γ,γ′); if M1, B(M1)(W.u.)=0.0037 *6* (2002We15 in (γ,γ′)).
3675.8	$3^+,4^+,5^+$	2180.3[@] *4*	100[@]	1495.46	4^+	M1+E2	+3.6 *+6−5*	B(M1)(W.u.)=0.0013 *5*; B(E2)(W.u.)=3.7 *+7−8* Mult.: D+Q from γ(θ) in (n,n′γ); Δπ=no from RUL.
3696.8	$1^{(+)}$	2762.3[@] *4*	99[@] *7*	934.51	2^+	(M1+E2)	+1.3 *+28−8*	B(M1)(W.u.)=0.011 *+31−11*; B(E2)(W.u.)=3 *+5−3* Mult.: D+Q from γ(θ) in (n,n′γ); Δπ=(no) from RUL.
		3696.5[@] *7*	100[@] *7*	0.0	0^+	(M1)		B(M1)(W.u.)=0.0127 *24* Mult.: D from (γ,γ′); Δπ=no from level scheme.
3774.6	$(1,2^+)$	1708.1[@] *5*	49[@] *10*	2066.65	2^+			
		1927.1[@] *5*	35[@] *7*	1847.27	2^+			
		2839.9[@] *5*	100[@] *20*	934.51	2^+			
		3774.6[@] *8*	46[@] *9*	0.0	0^+			Mult.: not M2 from RUL.
3804.7	(≤4)	2870.1[@] *5*	100[@]	934.51	2^+			
3819.4	(8^-)	439.6 *5*	100	3379.8	(7^-)	D		Mult.: from γ(θ) in (^{7}Li,2npγ).
3830.31	$(1^-,2^+)$	378.21 *16*	38 *6*	3452.17	$(2)^+$			
		790.70 *11*	75 *15*	3039.70	3			
		1490.7 *3*	92 *18*	2339.66	3^-			I_γ: from (n,n′γ).
		1763.39 *18*	58 *6*	2066.65	2^+			
		2447.3 *3*	34 *6*	1382.77	0^+			
		2895.1[@] *10*	100[@] *18*	934.51	2^+			
3915	1	3915	100	0.0	0^+	D		E_γ: from level-energy difference. Mult.: from (γ,γ′); if M1, B(M1)(W.u.)=0.022 *3* (2002We15 in (γ,γ′)).
3998.7?	(9^-)	179.4[b] *5*	57 *6*	3819.4	(8^-)	D		Mult.: from γ(θ) in (^{7}Li,2npγ).
		618.8[b]	≈100	3379.8	(7^-)			E_γ: from ^{173}Yb(^{24}Mg,Fγ)^{92}Zr.
4296.6	(10^+)	987.9 *2*	100	3308.7	(8^+)	(Q)		Mult.: from γ(θ) in (^{7}Li,2npγ).
4947.2	(12^+)	650.6 *5*	100	4296.6	(10^+)	(E2)		B(E2)(W.u.)≥0.056 Mult.: (Q) from γ(θ) in (^{7}Li,2npγ); not M2, from RUL.
6045.5	(14^+)	1098.3	100	4947.2	(12^+)			E_γ: from ^{173}Yb(^{24}Mg,Fγ)^{92}Zr.
7445.8	(16^+)	1400.3	100	6045.5	(14^+)			E_γ: from ^{173}Yb(^{24}Mg,Fγ)^{92}Zr.
8039.1?	$(17,18^+)$	593[b]	100	7445.8	(16^+)	D,E2		Mult.: from RUL.
(8634.82)	2^+	4804.7		3830.31	$(1^-,2^+)$			
		4985.1 *7*	2.8 *8*	3649.22	3^+			
		4995.0 *3*	6.7 *8*	3640.28	$(2)^+$			
		5006.1 *3*	11.8 *8*	3628.33	(4^+)			

$^{92}_{40}Zr_{52}$-17

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

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Comments
(8634.82)	2^+	5134.6 *3*	3.6 *4*	3499.88	2^+	
		5162.5 *3*	3.6 *4*	3471.88	1^+	
		5183.0 *5*	7.0 *14*	3452.17	$(2)^+$	
		5263.2 *5*	21.6 *24*	3371.48	$1^{(-)}$	
		5347.1		3289.13	3^+	
		5359.5		3275.76	$2^+,3^+$	
		5371.2 *5*	6.1 *14*	3262.62	2^+	
		5594.7 *4*	1.6 *4*	3039.70	3	
		5815.0 *3*	1.2 *4*	2819.54	2^+	
		6237.2 *6*	1.2 *4*	2398.36	4^+	
		6294.88 *12*	100 *3*	2339.66	3^-	
		6568.2		2066.65	2^+	
		7139.5		1495.46	4^+	
		7251.8 *9*	0.4 *4*	1382.77	0^+	
		7701.2		934.51	2^+	
		8634.4 *2*	5.1 *4*	0.0	0^+	
9127.5	(18^+)	1681.3[&b]	100	7445.8	(16^+)	
9722.2	(≤20)	1683[b]		8039.1?	$(17,18^+)$	E_γ: from (^{13}C,3nγ) only.

† From (n,γ) E=thermal, except as noted. Uncertainty in Eγ from this source may include 100 eV systematic uncertainty combined in quadrature with experimental statistical uncertainty.

‡ From $\gamma(\theta)$ in (n,n$'\gamma$), except as noted, assigning $\Delta\pi$=no from RUL whenever relevant.

\# For additional mult and δ information, see $\gamma(\theta)$ from (n,n$'\gamma$).

@ From (n,n$'\gamma$).

& from ^{173}Yb(^{24}Mg,Fγ)^{92}Zr; unconfirmed in ^{176}Yb(^{28}Si,Xγ) or ^{176}Yb(^{31}P,Xγ) so placement shown as tentative here.

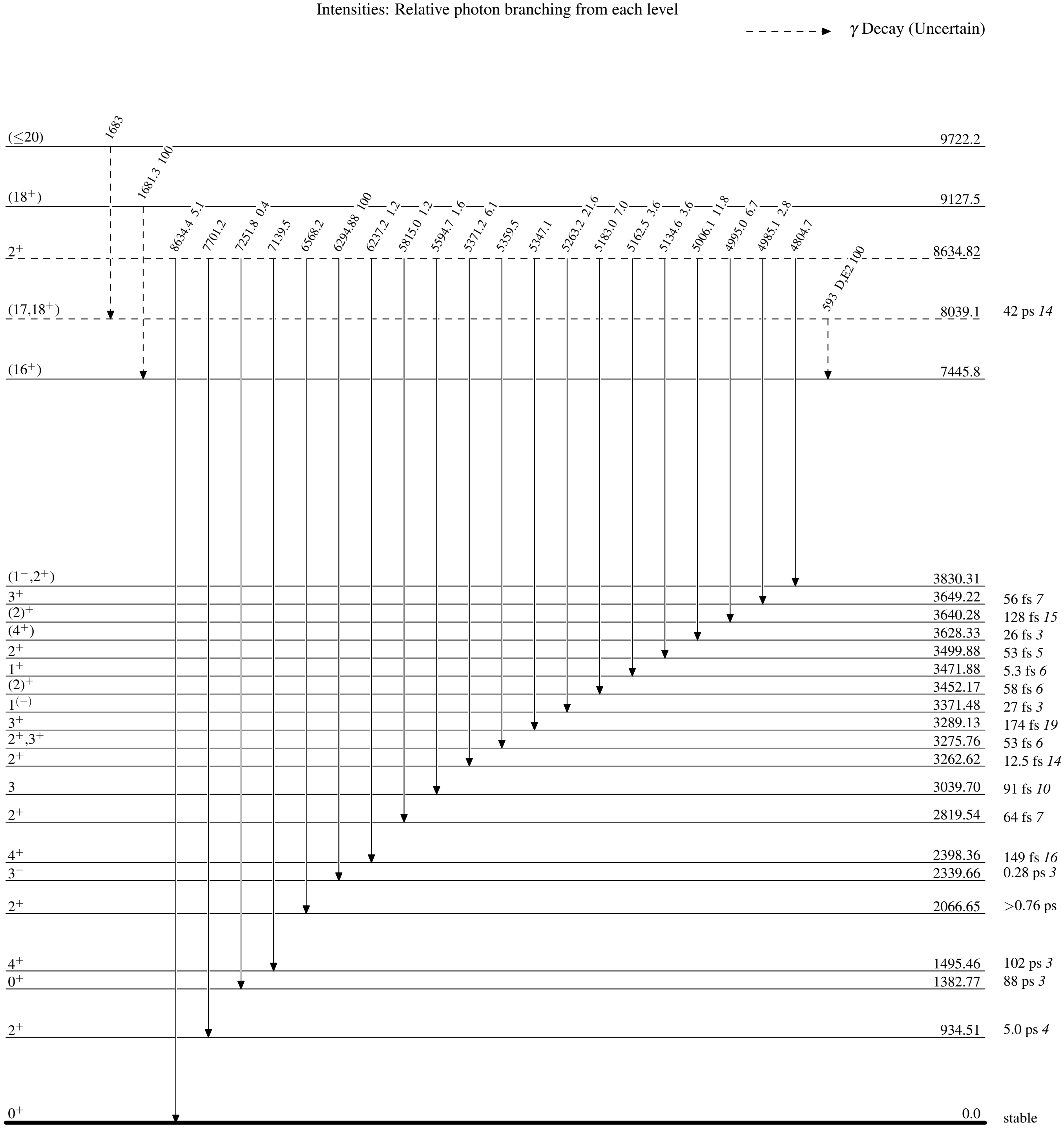
a Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

b Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

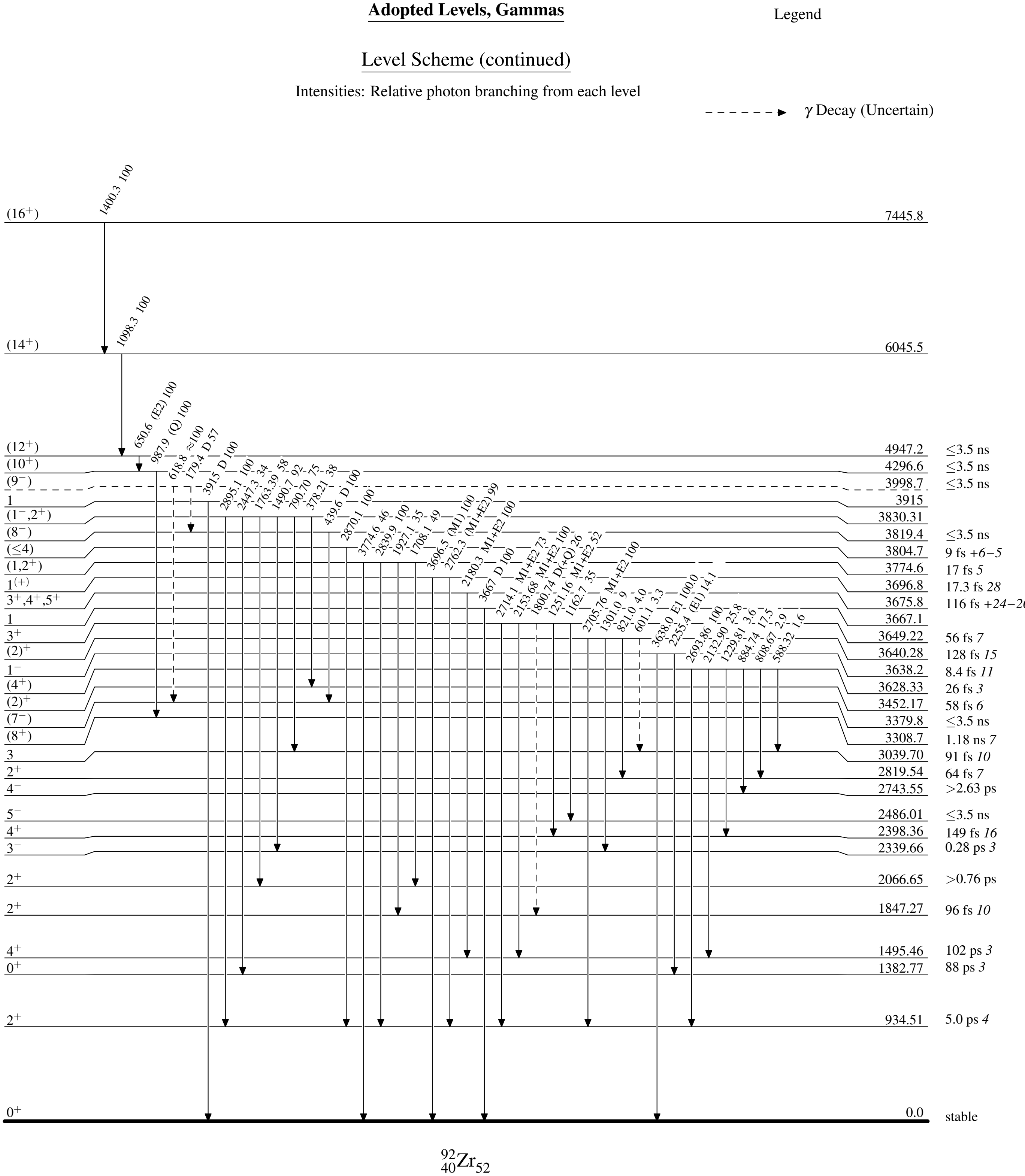


$^{92}_{40}Zr_{52}$

Adopted Levels, Gammas

Level Scheme (continued)

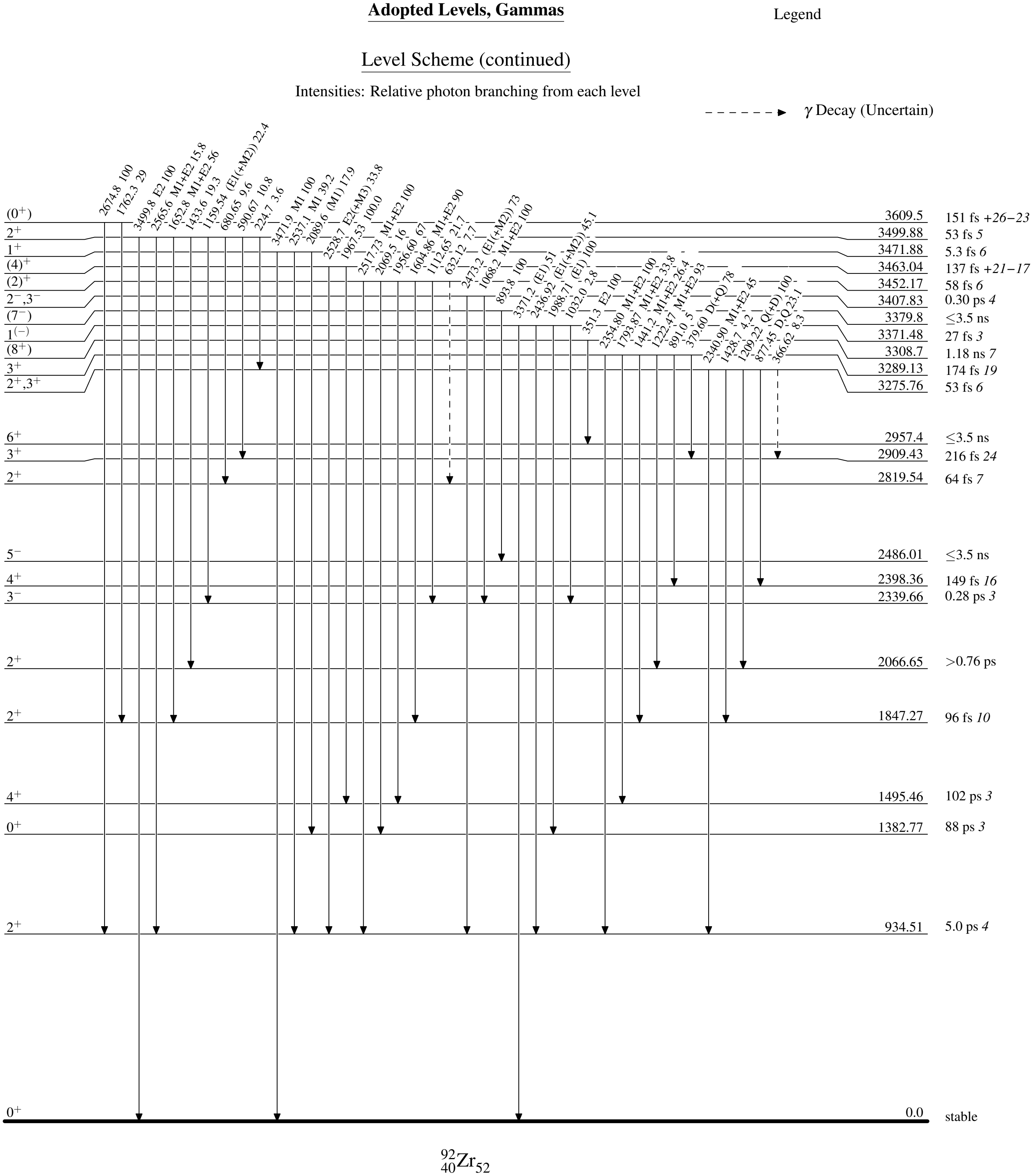
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

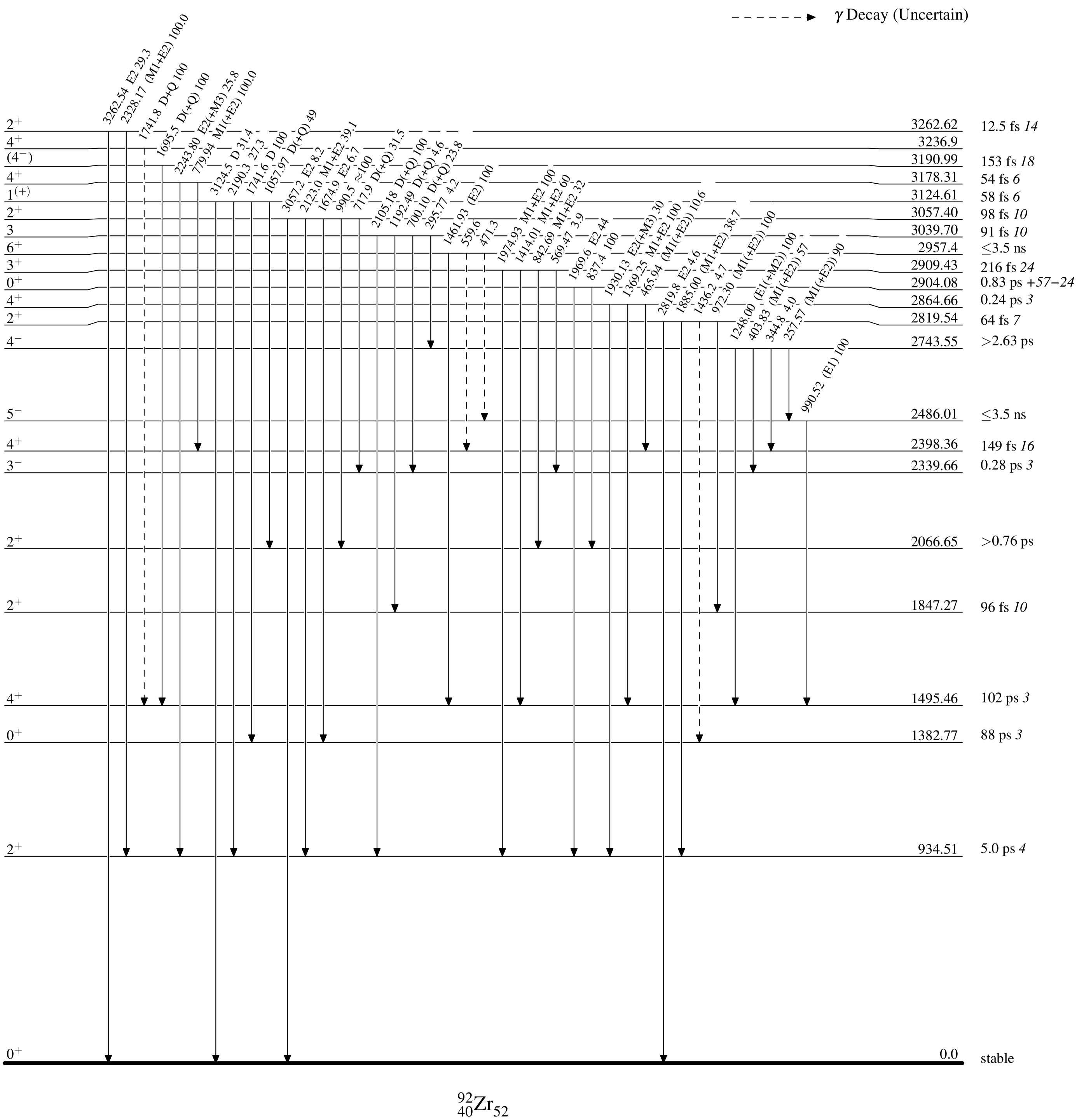
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

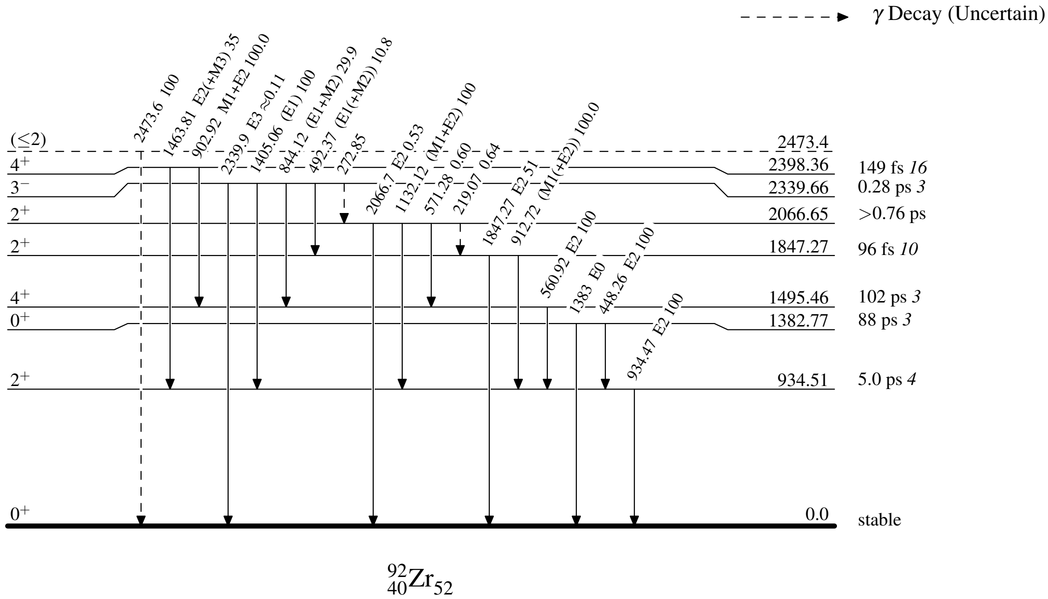


Adopted Levels, Gammas

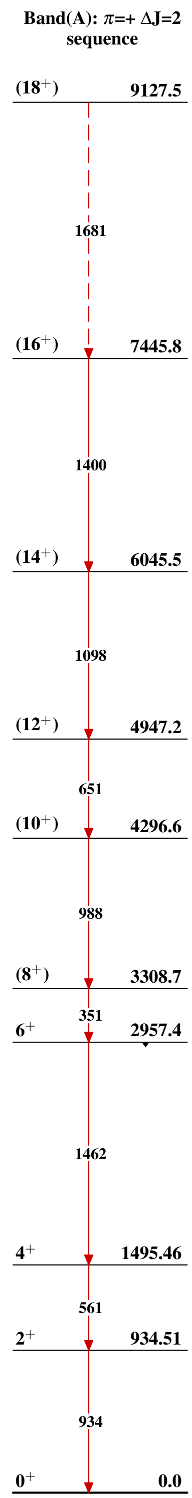
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level



Adopted Levels, Gammas



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