Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 178, 41 (2021).	12-Nov-2021

Q(β^-)=−7171.2 *15*; S(n)=11861.9 *15*; S(p)=7713.1 *6*; Q(α)=−3955.7 *7* 2021Wa16
Q(2ε)=1095.0 *7*, S(2n)=20978.6 *8*, S(2p)=13835.5 *6* (2021Wa16).
Mass excess measurements: 2018Ki21, 2008Go23, 2007Ke09, 2005Ch60, 1977De20, 1976De21.
Other reactions:
^{59}Co(^{6}Li,n) E=39.7, 90 MeV: 1984Bo45: Measured $\sigma(\theta)$, reaction mechanism.
^{60}Ni(α,p):IAR E=7.260-7.450 MeV: 1976Fo06: Measured resonance strengths. Other: 1961No04.
^{60}Ni(α,α'):IAR E=14.6-20.9 MeV: 1975Lu06: Si telescope, $\sigma(\theta)$, deduced isospin mixing for ^{64}Zn at excitations of 17.6-23.5 MeV.
^{61}Ni(α,n) E=53 MeV: 1984Bo45, 1979Bo45: $\sigma(\theta)$, reaction mechanism.
Additional information 1.
^{64}Zn(t,t) E=12 MeV: 1972Hu06: measured $\sigma(\theta)$. Deduced optical model-parameters.
^{64}Zn(^{6}Li,^{6}Li), (^{7}Li,^{7}Li): 1991Bo48.
^{27}Al(^{37}Cl,X) and ^{48}Ti(^{16}O,X): 1984Mi09 (scission mechanism for excited ^{64}Zn nucleus).
^{63}Cu(^{16}O,^{15}N): 1975We20 E=38-51 MeV. Reaction mechanism.
^{60}Ni(^{18}O,^{14}C): 1973RoYT, 1972HeYV.
^{64}Zn(π^+,π^-): 1993Be02: E=293.4 MeV, measured $\sigma(\theta)$.
^{64}Zn(π^+,π^-): 1997Fo03: E=140-230 MeV, measured $\sigma(\theta)$.
^{64}Zn(K$^-$,X): 1980De11, calculated atomic level shifts.
^{64}Zn(^{7}Li,tα) E=42 MeV: 2001To07 (also 1999Ut03): measured triton and α spectra, $\sigma(\theta)$, deduced astrophysical S factors.
^{64}Zn(^{10}Be,^{10}Be),((^{11}Be,^{11}Be),E(c.m.)=24.5 MeV: 2014DiZV: measured $\sigma(\theta)$ for elastic scattering at REX-ISOLDE facility of CERN, and analyzed using CDCC with optical model calculations.
Giant-dipole resonances: 1981Do12 (^{64}Zn(e,p)); 1977TaYW (^{64}Zn(γ,α)); 1973Ya04 (^{64}Zn(γ,n), (γ,np)); 1972ClZK (^{64}Zn(γ,p)); 1970Co25 (^{64}Zn(γ,n), (γ,2n), (γ,np)).
Isotope shifts: 1970Le23. Theory: 1982Fo09.
There are several high-spin studies: ^{12}C(^{54}Fe,2pγ) from 1994Cr05; ^{40}Ca(^{28}Si,4pγ) E=115 MeV from 1998Ga11; ^{40}Ca(^{28}Si,4pγ) E=120 MeV from 1997Fu08; ^{40}Ca(^{28}Si,4pγ) E=122 MeV from 2004Ka18; ^{51}V(^{16}O,p2nγ),^{59}Co(^{7}Li,2nγ) from 1977We10, 1978We15, and 1977Al14; ^{61}Ni(α,nγ),^{56}Fe(^{11}B,2npγ) from 1980Si02 and 1978Si02; ^{61}Ni(α,nγ),(HI,xnγ) from 1978Ne02 and 1976Ch11. While there is general agreement between all these studies below about 5 MeV excitation, above this energy, there are major differences even when the same reaction is used as in 2004Ka18, 1998Ga11 and 1997Fu08. Since the statistics in $\gamma\gamma$ coincidences is the highest in 2004Ka18, where Gammasphere array has been used, evaluators have adopted the high-spin level scheme from 2004Ka18 with the exception of few cases where results of 2004Ka18 are in clear disagreement with other experiments, the results of which are considered by evaluators as more definitive. Such cases are noted in comments. It should also be mentioned that complete details of data are not available from 2004Ka18. Requests by evaluators for obtaining such details from the authors of 2004Ka18 were unsuccessful. Full details of data are also missing in 1998Ga11 and 1997Fu08, although, some were obtained as priv. comm. (1996GaZZ) from authors of 1998Ga11. Several levels proposed by 1998Ga11, 1997Fu08 and 1994Cr05, but not reported by 2004Ka18 have been omitted here. See individual datasets for details.
In the opinion of the evaluators, there are several incomplete or discrepant aspects of the high-spin portion of the level scheme which need to be resolved in further experiments.

^{64}Zn Levels

Cross Reference (XREF) Flags

A	^{64}Cu β^- decay (12.7006 h)	N	^{62}Ni(^{3}He,n)	Others:	
B	^{64}Ga ε decay (2.627 min)	O	^{63}Cu(p,γ) E=1.3-3.2 MeV	AA	^{64}Zn(μ^-,X)
C	^{12}C(^{54}Fe,2pγ)	P	^{63}Cu(p,γ) E=2050 keV	AB	^{64}Zn(n,n′)
D	^{40}Ca(^{28}Si,4pγ) E=115 MeV	Q	^{63}Cu(p,γ) E=2.1-3.1 MeV	AC	^{64}Zn(n,n′γ)
E	^{40}Ca(^{28}Si,4pγ) E=120 MeV	R	^{63}Cu(p,γ) E=2098 keV	AD	^{64}Zn(p,p′),(pol p,p′)
F	^{40}Ca(^{28}Si,4pγ) E=122 MeV	S	^{63}Cu(p,γ) E=3217,3251 keV	AE	^{64}Zn(p,p′γ)
G	^{51}V(^{16}O,p2nγ),^{59}Co(^{7}Li,2nγ)	T	^{63}Cu(p,γ) E=3.46 MeV	AF	^{64}Zn(d,d′),(pol d,d)
H	^{60}Ni(^{6}Li,d)	U	^{63}Cu(p,n):resonances	AG	^{64}Zn(^{3}He,^{3}He′)
I	^{60}Ni(^{7}Li,t)	V	^{63}Cu(d,n),(pol d,n)	AH	^{64}Zn(α,α')

J	^{60}Ni(^{16}O,^{12}C)	W	^{63}Cu(^{3}He,d)	AI	^{64}Zn(^{16}O,^{16}O′),(^{12}C,^{12}C′)
K	^{61}Ni(α,nγ),^{56}Fe(^{11}B,2npγ)	X	^{63}Cu(α,t)	AJ	Coulomb excitation
L	^{61}Ni(α,nγ),(HI,xnγ)	Y	^{64}Zn(γ,γ′)	AK	^{66}Zn(p,t)
M	^{62}Ni(^{12}C,^{10}Be),(^{16}O,^{14}C)	Z	^{64}Zn(e,e′)		

E(level)†	Jπ‡	$T_{1/2}$#	XREF	Comments
0.0&	0^+	stable@	ABCDEFGHIJKLMNOPQRST VWXYZ	XREF: Others: AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK Evaluated rms charge radius $<r^2>^{1/2}$=3.9283 fm *15* (2013An02). Evaluated $\delta<r^2>$(^{66}Zn,^{64}Zn)=−0.162 fm^2 *2* (2013An02). Measured change in isotope shift δν(^{68}Zn,^{64}Zn)=−141.2 MHz *12*(stat) *66*(syst) (2019Xi07, collinear laser spectroscopy at ISOLDE, CERN), with laser wavelength of 480.7254 nm to match the Doppler shifted transition. Measured change in charge radius $\delta<r^2>$(^{68}Zn,^{64}Zn)=−0.279 fm^2 *4*(stat) *34*(syst) (2019Xi07, collinear laser spectroscopy at ISOLDE, CERN), with laser wavelength of 480.7254 nm to match the Doppler shifted transition. Jπ: hyperfine structure measurements: 1929Sc01, 1931Mu02. $T_{1/2}$: see footnote for lower limits for double β decay. Additional information 2.
991.54& *5*	2^+	1.94 ps *5*	BCDEFGHIJKLMNOPQRST VWXYZ	XREF: Others: AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK β_2=0.260 *18* (1987Ja04) μ=+0.89 *14* (2005Le12,2010Mo14,2020StZV) Q=−0.143 *21* (1976Ne06,1977Ne05,1981Ko06,2016St14, 2021StZZ) XREF: J(960)N(1024)AB(920). Additional information 3. E(level): level energy held fixed in least-squares adjustment. Jπ: E2 γ to 0^+. β_2: from (p,p′). Others: see (e,e′); (n,n′); (p,p′); (d,d′); (^{3}He,^{3}He′) and (α,α′). β_2(pol p,p′)=0.26, 0.25 (1993Mo15). Negative sign is indicated by 1991Ku30 from an analysis of σ(θ)(α,α′) data. μ: from transient fields in Coul. ex. (2005Le12,2010Mo14). Others: +0.89 *9* (2002Ke02), +0.92 *20* (1979Fa06), +0.84 *18*, +1.04 *24* (1978BeZJ,1979BrZP). 2010Mo14 reanalyzed their previously measured g factor of +0.45 *3* in 2005Le12 using a different procedure for precession effect, and obtained the same value. Uncertainty of 0.06 in 2010Mo14 increased to 0.14 in 2020StZV evaluation. Q: from electron scattering (1976Ne06,1977Ne05, value of −0.124 *11* reanalyzed by 1981Ko06 to −0.143 *21*. Others: −0.32 *6* or −0.26 *6* (1988Sa32, reorientation method in Coulomb excitation; −0.135 *14* ((e,e′), 1972Li12); −0.01 *+9−5* (Coul. ex., 2003KoZQ). $T_{1/2}$: weighted average of 1.97 ps *6* (DSA in Coul. Ex.,2005Le12); 1.87 ps *6* (DSA in Coul. Ex.,2002Ke02); 2.06 ps *17* ((γ,γ′),1981Ca10); 2.8 ps *7* (RDDS in (^{16}O,p2nγ),1977Al14); 1.71 ps *21* (line shape in Coul. ex., 1973Fi15) and 2.16 ps *15* ((γ,γ′),1971ImZY). Values deduced from B(E2) values in Coul. Ex. and (e,e′) are somewhat lower: 1.76 ps *4* (from B(E2)=0.168 *4*,1988Sa32); 1.82 ps *10* (from B(E2)=0.162 *9* and 1.83 ps *13* from B(E2)=0.161 *12*,1975Th01); 1.73 ps *15* (from B(E2)=0.170 *15*, 1962St02). Weighted average of all the values is 1.84 ps 4. 2001Ra27 evaluation quotes 1.86 ps 17 from weighted average of 15 values (B(E2) in Coul. Ex.: 1988Sa32,1975Th01,1962St02,1960An07, 1956Te26; Doppler-shift method in Coul. Ex.: 1973Fi15; Doppler-shift

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$[#]	XREF	Comments
				in (^{16}O,p2nγ): 1977Al14; (γ,γ′): 1981Ca10,1977Ca14,1972ArZD,1965Ta13; (e,e′): 1977Ne05,1976Ne06,1970Af04.
1799.41[a] *4*	2$^+$	2.0 ps *2*	BCDEFGH JKLM OPQRST VW Z	XREF: Others: AC, AD, AE, AF, AH, AJ, AK XREF: J(1750). J$^{\pi}$: E2 γ to 0$^+$. T$_{1/2}$: from B(E2)(↑)=0.00170 *12* ((e,e′), 1977Ne05). Others (from (α,nγ), (^{11}B,2npγ)): 1.4 ps *7* (1977Al14), 2.1 ps *14* (1977We10), 1.8 ps *+6−3* (1976Ch11), >1.0 ps (1978Si02).
1910.26 *4*	0$^+$	0.95 ns *5*	B H KL OPQR T W	XREF: Others: AC, AD, AE, AF, AH, AK XREF: AF(1960)AK(1940). J$^{\pi}$: E0 transition to 0$^+$. T$_{1/2}$: γce(t) in (p,p′γ) (1985Pa07). Others (from (α,nγ),(^{11}B,2npγ)): 2.4 ps *+10−6* (1976Ch11), >1.0 ps (1978Si02).
2306.72[&] *5*	4$^+$	0.776 ps *28*	CDEFGH JKLM OPQRST VW Z	XREF: Others: AC, AD, AE, AF, AH, AJ, AK μ=+2.0 *6* (2005Le12,2010Mo14,2020StZV) XREF: M(2400)V(2230). μ: from transient fields in Coul. ex. (2005Le12, 2010Mo14 reanalyzed previously measured g factor in 2005Le12 of +0.53 *16* using a different procedure for precession effect, and obtained g factor=+0.49 *15*. J$^{\pi}$: γ(θ) and γ(lin pol) in (α,nγ),(^{11}B,2npγ). B(E4)=0.00034 *10* from (e,e′). T$_{1/2}$: from DSA method in Coul. ex. (2005Le12). Others: 0.21 ps *+11−8* ((n,n′γ),1985Ko27); 0.29 ps *8* (α,nγ),((^{11}B,2npγ),1978Si02); 1.0 ps *6* (1977We10) and 0.8 ps *3* (1976Le31) in (^{16}O,p2nγ),(^{7}Li,2nγ); 0.44 ps *9* (1976Ch11) in (α,nγ).
2609.52 *7*	0$^+$	0.20 ps *8*	B H KL OPQR T W	XREF: Others: AC, AD, AE, AK J$^{\pi}$: E0 transition to 0$^+$. T$_{1/2}$: weighted average of 0.15 ps *+6−3* ((n,n′γ), 1985Ko27); 0.36 ps *10* (α,nγ),((^{11}B,2npγ), 1978Si02); 1.0 ps *+6−4* ((α,nγ), 1976Ch11).
2736.57[a] *6*	4$^+$	1.5 ps *3*	CDEFGh KL OPQRST w	XREF: Others: AC, AD, AE, AH, AJ, AK XREF: AH(2780). J$^{\pi}$: 937γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). T$_{1/2}$: from (α,nγ),(^{11}B,2npγ). Weighted average of 1.2 ps *3* (1980Si02); 3.5 ps *21*, 1.7 ps *7* (1977We10); 3.5 ps *14* (1977Al14); 2.1 ps *7* (1976Ch11).
2793.5 *4*	2$^+$	0.049 ps *14*	h KL OPQRST w	XREF: Others: AC, AD, AE, AK J$^{\pi}$: L(p,t)=2 from 0$^+$. T$_{1/2}$: from (α,nγ),(^{11}B,2npγ) (1978Si02). Other: <0.009 ps (1976Ch11).
2979.94 *15*	3$^+$	0.30 ps *+39−11*	jKL nOPQRST	XREF: Others: AC, AD, AE XREF: j(2960)n(2930). J$^{\pi}$: γ(θ, lin pol) in (α,nγ),(^{11}B,2npγ). T$_{1/2}$: from (n,n′γ) (1985Ko27). Others: >2.6 ps (1976Ch11), >1.0 ps (1978Si02) in (α,nγ),(^{11}B,2npγ).
2998.54[b] *17*	3$^-$	0.152 ps *4*	CDEFGH jKL nOP rST wX Z	XREF: Others: AB, AC, AD, AE, AF, AG, AH, AJ, AK μ=+1.5 *9* (2005Le12,2020StZV) B(E3)↑=0.040 *7* (1976Ne06)

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				β_3=0.235 *16* (1987Ja04) XREF: H(2980)j(2960)n(2930)X(3040)AB(3300)AK(3020). μ: from transient fields in Coul. ex. (2005Le12). B(E3)↑: from (e,e′). Others: see (e,e′) and (α,α′). 2002Ki06 quote 0.034 *5* from average of 0.040 *7* (1976Ne06) and 0.0307 *23* (1970Af04). β_3: from (p,p′). Others: see (e,e′); (n,n′); (p,p′); (d,d′); (^{3}He,^{3}He′); (α,α′). β_3(pol p,p′)=0.22, 0.21 (1993Mo15). J^{π}: L(e,e′)=3. Strong population in (p,p′) and other inelastic scattering experiments identifies this as an octupole state. $T_{1/2}$: from DSA method in Coul. ex. (2005Le12). Others: 0.097 ps *21* ((n,n′γ),1985Ko27); 0.080 ps *21* (α,nγ),((^{11}B,2npγ),1978Si02); >1.0 ps (1976Ch11).
3005.73 *14*	2^+	0.057 ps *8*	KL OP r T w	XREF: Others: AC, AD, AE J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). $T_{1/2}$: weighted average of 0.069 ps *+21−14* ((n,n′γ), 1985Ko27); 0.080 ps *21* (α,nγ),((^{11}B,2npγ), 1978Si02); 0.056 ps *15*, 0.045 ps *12* ((α,nγ), 1976Ch11).
3071.4 *7*	(1,2^+)		O	XREF: Others: AE J^{π}: prominent γ to 0^+; 1^+ proposed in (p,γ) E=1.3-3.2 MeV.
3077.77 *13*	4^+	0.55 ps *6*	CDEFG KLM OPQ ST w	XREF: Others: AC, AD, AH, AJ, AK XREF: AK(3110). J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). Also L(p,p′)=L(α,α′)=4. $T_{1/2}$: from DSA in Coul. ex. (2005Le12). Others: 0.42 ps *+28−10* ((n,n′γ), 1985Ko27); 0.42 ps *11* (α,nγ),((^{11}B,2npγ),1978Si02); 1.0 ps *3* ((^{7}Li,2nγ),1977We10); 1.4 ps *+10−6* ((α,nγ), 1976Ch11).
3094.64 *9*	$(3)^+$	0.090 ps *11*	KL OPQR T Vw	XREF: Others: AC, AD, AE XREF: V(3120). J^{π}: γ(θ, lin pol) in (α,nγ),(^{11}B,2npγ). J=3 is favored over J=2. $T_{1/2}$: weighted average of 0.083 ps *+21−7* ((n,n′γ), 1985Ko27); 0.087 ps *21* (α,nγ),((^{11}B,2npγ), 1978Si02); 0.13 ps *3* ((α,nγ), 1976Ch11).
3186.84 *6*	1^+	0.042 ps *10*	B KL P R T	XREF: Others: AC, AD, AE J^{π}: log *ft*=5.14 from 0^+. $T_{1/2}$: from DSA in (n,n′γ) (1985Ko27). Others: from (α,nγ), (^{11}B,2npγ): 0.26 ps *13* (1980Si02), 0.40 ps *+21−12* (1976Ch11). Noting a large discrepancy in $T_{1/2}$ results, 1985Ko27 repeated their measurement and obtained a consistent $T_{1/2}$=0.042 ps.
3196.9 *4*	(2,3)		K P ST	XREF: Others: AD, AE J^{π}: γ(θ) in (α,nγ),(^{11}B,2npγ) for 2205γ.
3205.98 *9*	$(3)^+$	0.18 ps *5*	KL P R T	XREF: Others: AC, AD J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ) gives 3^+ (poor fit for 2^+), but a 1295γ to 0^+ (reported in (p,γ) and (n,n′γ), not in (α,nγ), (^{11}B,2npγ)) is inconsistent with J=3. $T_{1/2}$: weighted average of 0.16 ps *+15−6* ((n,n′γ), 1985Ko27); 0.15 ps *5* (α,nγ),((^{11}B,2npγ), 1980Si02); 0.33 ps *+14−8* ((α,nγ), 1976Ch11).
3240 *20*	(0^+)			XREF: Others: AK

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				J^{π}: L(p,t)=0.
3261.94 *9*	1	0.4 ps +*7*−*2*	B H KL P R T W	XREF: Others: AC, AD, AE J^{π}: log *ft*=6.1 from 0^+; γ to 0^+. $T_{1/2}$: from (n,n′γ) (1985Ko27). Others (from (α,nγ),(^{11}B,2npγ)): 0.042 ps *14* (1980Si02); 0.014 ps *8* (1976Ch11). Noting a large discrepancy in $T_{1/2}$ results, 1985Ko27 repeated their measurement and obtained a consistent $T_{1/2}$=0.4 ps.
3285 *3*	(1^- to 5^-)		S	J^{π}: 1^-,2,3,4,5^- from primary γ from (3^-).
3297.17 *14*	$(2)^+$	0.27 ps *5*	KL P R T	XREF: Others: AC, AD, AK J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ) and L(p,p′)=2. $T_{1/2}$: from (α,nγ),(^{11}B,2npγ). Weighted average of 0.23 ps *7* (1980Si02), 0.31 ps *7* ((α,nγ) (1976Ch11)).
3306.85 *15*	(4^+)	0.26 ps *8*	F K P	XREF: Others: AD, AK XREF: AD(3305). J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). $T_{1/2}$: from (^{11}B,2npγ) 1980Si02.
3321.8? *12*	(1)		B	XREF: B(?). J^{π}: weak ε branch (log *ft*=7.1) from 0^+; γ to 0^+.
3365.99 *6*	1^+	0.023 ps *8*	B KL P RST vw Y	XREF: Others: AC, AD, AE XREF: L(?)AC(?). J^{π}: log *ft*=5.04 from 0^+. $T_{1/2}$: from (α,nγ),(^{11}B,2npγ) (1980Si02). Others: 0.026 ps +*19*−*15* (1976Ch11), 0.028 ps *5* (in (γ,γ′)).
3369.86 *13*	3^+	0.35 ps +*14*−*10*	K P T vw	XREF: Others: AC, AD, AK XREF: AK(3340). J^{π}: γ(θ,lin pol) in (^{11}B,2npγ); but L(p,p′)=(1)+2 for a 3367 doublet and L(p,t)=2 for a 3340 group suggest 2^+. E(level): there may be an additional 2^+ level near this energy as suggested by L(p,t) and L(p,p′). $T_{1/2}$: from (α,nγ),(^{11}B,2npγ) (1980Si02).
3414 *3*	(1^- to 5^-)		S v	XREF: Others: AK XREF: AK(3410). J^{π}: 1^-,2,3,4,5^- from primary γ from (3^-).
3425.13 *10*	1^+	0.031 ps *7*	B KL PQR T v Y	XREF: Others: AC, AD, AE XREF: L(?)AC(?). J^{π}: log *ft*=5.63 from 0^+. $T_{1/2}$: from (α,nγ),(^{11}B,2npγ) (1980Si02). Others: <0.010 ps (1976Ch11), 0.044 ps *11* (in (γ,γ′)).
3452.0 *10*	(1,2^+)		T	XREF: Others: AE XREF: T(3454). J^{π}: γ to 0^+.
3458.66 *17*	(2,3)	0.24 ps *6*	K P R T	XREF: Others: AC J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). $T_{1/2}$: from (α,nγ),(^{11}B,2npγ) (1980Si02). Other: 0.17 ps +*42*−*8* (1985Ko27) in (n,n′γ).
3465 *5*	$(5,4,6)^-$			XREF: Others: AD J^{π}: L(p,p′)=5.
3500 *10*			W	XREF: Others: AK
3538.7? *10*	(2^+ to 6^+)			XREF: Others: AE

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#	XREF	Comments
				Jπ: 2^+,3,4,5,6^+ from γ to 4^+.
3545.9? *9*	(0 to 3^+)		P T	XREF: Others: AD, AE Jπ: 0,1,2,3^+ from γ to 1^+.
3552.3 *3*	4^+	>1.0 ps	K R T	XREF: Others: AD Jπ: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ) and γ to 2^+; but J=4 inconsistent with a tentative 3551γ to 0^+ (in (p,γ)). There may be two different levels near 3552. $T_{1/2}$: from 1980Si02.
3586.9 *21*				XREF: Others: AD, AE XREF: AD(3576).
3597.24 *20*	(2^+,3,4^+)		K PQ T	XREF: Others: AC, AD, AE, AK Jπ: γs to 4^+, 2^+. Excitation function in (p,γ) suggests 4^+, whereas, L(p,t)=(2) suggests 2^+.
3601.9 *10*	(1,2^+)		R	XREF: Others: AK Jπ: γ to 0^+.
3606.5 *5*	(0^+ to 4^+)		jK	Jπ: 0^+,1,2,3,4^+ from γ to 2^+.
3620.7 *10*	(2^+ to 6^+)		jK	Jπ: 2^+,3,4,5,6^+ from γ to 4^+.
3628.4 *5*	$(4)^+$	0.16 ps *5*	jK T	XREF: Others: AD Jπ: L(p,p′)=4; γ to 2^+. $T_{1/2}$: from 1980Si02.
3630? *3*	(0^+,6^-)		j PQ	E(level): in (p,γ) E=2050 keV, 1980Er05 adopted this energy from (p,p′) (1967Br10,1974Au04). This level is most likely different from that in (p,p′) (E=3633 *5* in 1987Ja04) due to different *Jπ* values for the two levels. Jπ: comparison of measured yield in (p,γ),E=2050 keV with Hauser-Feshbach calculations.
3680 *3*	(1^- to 5^-)		n S w	Jπ: 1^-,2,3,4,5^- from primary γ from (3^-).
3698.9 *7*			n w	XREF: Others: AD, AE, AH XREF: ah(3720). Jπ: L(α,α′)=3 for a 3720 group suggests 3^- for 3699 or 3718.
3701.4 *4*	1^-	0.025 ps *4*	H n P w Y	XREF: Others: AC XREF: H(3680)Y(3704). Jπ: from γ(θ) in (γ,γ′); L(^{6}Li,d)=1. $T_{1/2}$: from (γ,γ′).
3710.0 *7*	(2^+)		n T w	XREF: Others: AD, AE XREF: T(3707). Jπ: γs to 0^+, 4^+.
3718.4 *3*	(0^+ to 4^+)	0.031 ps *10*	K n P T w	XREF: Others: AD, AE, AH XREF: ah(3720). Jπ: 0^+,1,2,3,4^+ from γ to 2^+; L(α,α′)=3 for a 3720 group suggests 3^- for 3699 or 3718. $T_{1/2}$: from 1980Si02.
3759 *3*	(1^- to 5^-)		n S	XREF: Others: AD Jπ: 1^-,2,3,4,5^- from primary γ from (3^-).
3780 *10*	2^+		n	XREF: Others: AK Jπ: L(p,t)=2.
3795.03 *10*	1^+		B PQR T	XREF: Others: AD, AE Jπ: log *ft*=5.58 from 0^+.
3815.4 *5*	(0^+ to 4^+)		h K w	XREF: Others: AD Jπ: 0^+,1,2,3,4^+ from γ to 2^+.
3819.65 *21*	(0^+ to 4^+)		h PQ T w	XREF: Others: AD Jπ: 0^+,1,2,3,4^+ from γ to 2^+.
3850.5 *4*	$(\leq3)^{(+)}$	<0.7 ps	Kl sT Vw	XREF: Others: AC, AD

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				J^{π}: γ to 2^+. L(d,n)=1 from $3/2^-$ for a 3850 *50* group suggests 0^+ to 3^+. $T_{1/2}$: from 1980Si02.
3853.27 *21*	5^+	>2 ps	Kl P sT w	XREF: Others: AD J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). $T_{1/2}$: from 1980Si02.
3863.7 *10*	(2^+ to 6^+)		K w	XREF: Others: AD J^{π}: γ to 4^+.
3880 *3*	(0^+ to 4^+)		h R	J^{π}: 0^+,1,2,3,4^+ from primary γ from (2^+).
3898.5 *3*	(2^+,3,4^+)	0.038 ps *10*	h K PQR T	XREF: Others: AC, AD J^{π}: γs to 2^+, 4^+. $T_{1/2}$: from 1980Si02.
3924.69[b] *16*	5^-	<1.4 ps	CDEFG KL PQ	XREF: Others: AD J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). Also L(p,p′)=5. $T_{1/2}$: from 1977Al14. Others: <1.7 ps (1977We10), >0.35 ps (1980Si02). $T_{1/2}$(3924.7 level) not lower than ≈0.7 ps from RUL=1 for B(M2)(W.u.).
3932.0 *4*	(4,5)		K	XREF: Others: AD, AK XREF: AK(3920). J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). L(p,t)=(2) is inconsistent. There may be an additional 2^+ level near this energy.
3951.9 *6*	(4^+,3^+)		K T	XREF: Others: AC, AD, AH, AK XREF: AC(?)AK(3920). J^{π}: L(p,p′)=4; γ to 2^+.
3993.36[&] *8*	6^+	0.12 ps *3*	CDEFG KL	XREF: Others: AD J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). Also L(p,p′)=6. $T_{1/2}$: from 1980Si02. Others: 0.15 ps *3* (1977We10), <0.14 ps (1976Le31).
4020.4 *4*	$(2)^+$		K P T	XREF: Others: AD, AK XREF: AK(4010). J^{π}: L(p,p′)=2 and γ to 4^+. L(p,t)=(0) is inconsistent. There may be an additional 0^+ level near this energy.
4039.7 *4*	(0^+ to 4^+)		K P T	XREF: Others: AD J^{π}: 0^+,1,2,3,4^+ from γ to 2^+.
4076.55 *20*	$(5)^+$	0.49 ps *+24−17*	CDEF KL T	XREF: Others: AD J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ); L(p,p′)=4. Assignment of 6^+ by 2004Ka18 in (^{28}Si,4pγ) on the basis of ΔJ=2 deduced from γγ(θ) of 1340γ is inconsistent with γ(θ,pol) data for 1340γ in 1980Si02 from (α,nγ),(^{11}B,2n2pγ). $T_{1/2}$: from 1980Si02.
4110 *3*	$(2)^+$		T	XREF: Others: AD, AK XREF: AD(4107)AK(4120). E(level): from ^{63}Cu(p,γ) E=3.46 MeV. J^{π}: L(p,p′)=2.
4140 *3*	$(2,1)^+$		n T	XREF: Others: AD, AE XREF: AD(4132). E(level): from ^{63}Cu(p,γ) E=3.46 MeV. J^{π}: L(p,p′)=2; possible γ to 0^+.

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
4153.1? *22*			n P	XREF: Others: AD
4156.53 *19*	5⁻	0.11 ps *3*	CDEF KLmn ST w	XREF: Others: AD, AH XREF: AD(4164)AH(4190). J^{π}: ΔJ=2, E2 γ from 7⁻; ΔJ=1 γ to (4⁺); analyzing power in (pol p,p′) for a group at 4164 *10*. $T_{1/2}$: from 1980Si02.
4159.5 *18*	1	7.7 fs *25*	n P w y	XREF: Others: AD XREF: AD(4159). J^{π}: from γ(θ) in (γ,γ′). $T_{1/2}$: from (γ,γ′).
4181.7 *5*			jK n w	XREF: Others: AC, AD XREF: AC(?).
4205.2 *4*	(4,3)⁺		n PQ T w	XREF: Others: AC, AD, AK XREF: AC(?)ak(4230). J^{π}: L(p,p′)=4; γ to 2⁺.
4219 *10*	(4)⁺		n	XREF: Others: AD, AK XREF: ak(4230). J^{π}: L(p,p′)=4.
4236.71[a] *10*	6⁺	0.13 ps *4*	CDEFG KL n	XREF: Others: AD J^{π}: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ). Also L(p,p′)=6. $T_{1/2}$: from 1980Si02. Others: 1.3 ps *2* (1977We10), 42 ps *21* (1977Al14).
4260 *3*			T	
4288.6 *4*	(4)⁺		K Z	XREF: Others: AD, AK J^{π}: L(p,p′)=4. Also L(e,e′)=2+4.
4304.1 *22*	(1⁻ to 5⁻)		S	XREF: Others: AK J^{π}: 1⁻,2,3,4,5⁻ from primary γ from (3⁻).
4310 *3*			T	
4319.1 *22*	(4,3)⁺		T w	XREF: Others: AC, AD, AK XREF: AC(?)AK(4340). J^{π}: L(p,p′)=4; γ to 2⁺.
4362.1 *22*	(2,1,3)⁺		ST w	XREF: Others: AD, AK XREF: AD(4351). E(level): from ^{63}Cu(p,γ) E=3.46 MeV. J^{π}: L(p,p′)=2.
4370 *3*	3⁻		T w	XREF: Others: AD, AH, AK XREF: AD(4385)AH(4370)AK(4410). E(level): from ^{63}Cu(p,γ) E=3.46 MeV. J^{π}: L(α,α′)=3; L(p,t)=(3). L(p,p′)=(1).
4380 *3*			T	
4420 *3*	(4,3)⁺		T vw	XREF: Others: AD E(level): from ^{63}Cu(p,γ) E=3.46 MeV. J^{π}: L(p,p′)=4. L(d,n)=1 from 3/2⁻ for 4420 *50* gives 0⁺ to 3⁺.
4454.68 *15*	1⁺	3.2 fs *6*	B vw Y	XREF: Others: AC, AD J^{π}: log *ft*=5.44 from 0⁺; but L(p,p′)=1 for a 4453 *10* group gives negative parity, unless an unnatural parity state is populated in (p,p′). $T_{1/2}$: from (γ,γ′).
4470 *3*	(0⁺)		T vw	XREF: Others: AD, AK XREF: AK(4480). J^{π}: L(p,t)=(0).
4488 *10*	(4,3,5)⁺		w	XREF: Others: AD J^{π}: L(p,p′)=4.
4504 *10*				XREF: Others: AD
4522 *10*				XREF: Others: AD

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#	XREF	Comments
4538 *10*	(4,3,5)$^+$			XREF: Others: AD Jπ: L(p,p′)=4.
4560 *3*			T	XREF: Others: AC, AD XREF: AC(?). E(level): from ^{63}Cu(p,γ) E=3.46 MeV.
4573 *10*	(1$^-$,0$^-$,2$^-$)		J	XREF: Others: AD, AK Jπ: L(p,p′)=(1).
4608.75 *20*	(1)		B	XREF: Others: AD XREF: AD(4593). Jπ: log *ft*≈6.3 from 0$^+$.
4615 *10*	(4,3,5)$^+$			XREF: Others: AD Jπ: L(p,p′)=4.
4626 *10*				XREF: Others: AD
4634.87 *9*	7$^-$	94 ps *6*	CDEFG KLM	XREF: Others: AD, AH μ=1.6 *3* (1983Ba69,2020StZV) XREF: M(4650)AD(4648). Jπ: γ(θ,lin pol) in (α,nγ),(^{11}B,2npγ) and L(p,p′)=7. $T_{1/2}$: weighted average of 105 ps *13*, 99 ps *10* (1977We10); 90 ps *10*, 80 ps *14* (1977Al14). μ: integral PAC method, recoil into gas and vacuum (1983Ba69).
4638.2 *5*				XREF: Others: AD
4664 *3*	(1)	41 fs *12*	Y	XREF: Others: AD, AK XREF: Y(?). Jπ: from γ(θ) in (γ,γ′). $T_{1/2}$: from (γ,γ′) for %Iγ(to g.s.)=100.
4668.93 *19*	(6$^-$)		CDEF L	XREF: Others: AD, AK Jπ: ΔJ=1 γs to 5$^-$ and (5)$^+$. Negative parity proposed in (^{28}Si,4pγ) (2004Ka18), (1998Ga11), but positive parity proposed by 1998Ga11.
4684 *3*	(1$^-$ to 5$^-$)		S	XREF: Others: AD, AK XREF: AD(4702). Jπ: 1$^-$,2,3,4,5$^-$ from primary γ from (3$^-$).
4713.15 *21*	(1)		B	XREF: Others: AD Jπ: weak ε branch (log *ft*≈6.0) from 0$^+$.
4729 *10*				XREF: Others: AD
4751 *10*	(4$^+$,3$^+$,5$^+$)		w	XREF: Others: AD, AK Jπ: L(p,p′)=4.
4761 *10*			w	XREF: Others: AD, AH, AK
4786 *10*	(4$^+$,3$^+$,5$^+$)		w	XREF: Others: AD, AK Jπ: L(p,p′)=4.
4797 *10*			w	XREF: Others: AD
4816 *10*	(2$^+$,1$^+$,3$^+$)		w	XREF: Others: AD, AK Jπ: L(p,p′)=2.
4823.5 *6*	(5,6,7)		L	XREF: Others: AD, AK XREF: AD(4831). Jπ: γ to (5$^+$) and heavy-ion excitation.
4851 *10*	(4$^+$,3$^+$,5$^+$)			XREF: Others: AD, AK Jπ: L(p,p′)=4.
4902 *10*	(4$^+$,3$^+$,5$^+$)			XREF: Others: AD, AK Jπ: L(p,p′)=4.
4935 *10*	(3$^-$,2$^-$,4$^-$)			XREF: Others: AD, AK Jπ: L(p,p′)=3.
4947 *10*	(2$^+$)			XREF: Others: AD, AK XREF: ak(4980). Jπ: L(p,t)=2 for a 4980 *30* group.

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
4980.87[b] *17*	7^-	1.3 ps *4*	CDEFG KL	XREF: Others: AD XREF: AD(4970). J^{π}: ΔJ=2, E2 γ to 5^-; L(p,p′)=7. $T_{1/2}$: from 1977We10. Other: 3.1 ps *7* (1977Al14).
5005 *10*	2^+		w	XREF: Others: AD, AK XREF: AK(4980). J^{π}: L(p,p′)=2; L(p,t)=2 for a 4980 *30* group.
5038 *10*			w	XREF: Others: AD, AK
5050 *10*	(0 to 3)$^{(+)}$		vw	XREF: Others: AD, AH, AK J^{π}: L(d,n)=1 from $3/2^-$ for a 5050 *50* group.
5066.8 *20*			vw	XREF: Others: AC, AD, AK XREF: AC(?).
5081 *10*			w	XREF: Others: AD, AK
5110 *10*			n w	XREF: Others: AD, AK
5121 *10*	$(2,1,3)^+$		n w	XREF: Others: AD J^{π}: L(p,p′)=2.
5138 *10*			n w	XREF: Others: AD
5151.71 *12*	(7^-)		C F L n w	XREF: Others: AD, AK J^{π}: ΔJ=2 γ to 5^-.
5160 *10*			n w	XREF: Others: AD, AK
5171 *10*			w	XREF: Others: AD, AK
5191 *10*	$(3,2,4)^-$		n w	XREF: Others: AD, AK J^{π}: L(p,p′)=3.
5197 *10*			n	XREF: Others: AD
5211 *10*			n	XREF: Others: AD, AK
5224 *10*			n	XREF: Others: AD, AK
5234 *10*			n	XREF: Others: AD, AK
5256 *10*			n	XREF: Others: AD
5267 *10*			n	XREF: Others: AD
5292 *10*			n w	XREF: Others: AD
5307 *10*			M w	XREF: Others: AD XREF: M(5300).
5319 *10*			w	XREF: Others: AD
5329 *10*			w	XREF: Others: AD
5337 *10*				XREF: Others: AD
5351 *10*				XREF: Others: AD
5361 *10*				XREF: Others: AD
5375 *10*	(3^-)			XREF: Others: AD, AH J^{π}: L(α,α′)=3 for 5370 *45* group.
5384 *10*				XREF: Others: AD
5398 *10*				XREF: Others: AD
5413 *10*				XREF: Others: AD
5425 *10*				XREF: Others: AD
5443 *10*				XREF: Others: AD
5457 *10*				XREF: Others: AD
5474 *10*				XREF: Others: AD
5485 *10*	(0 to 3)$^{(+)}$		V	XREF: Others: AD J^{π}: L(d,n)=(1) from $3/2^-$ for 5480 *50* group.
5495 *10*	(4^+)		Z	XREF: Others: AD XREF: Z(5500). J^{π}: L=4, E4 excitation in (e,e′).
5517 *10*				XREF: Others: AD
5530 *10*				XREF: Others: AD
5545 *10*				XREF: Others: AD
5553 *10*				XREF: Others: AD
5564 *10*				XREF: Others: AD

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
5576 *10*				XREF: Others: AD
5588 *10*				XREF: Others: AD
5601 *10*				XREF: Others: AD
5613 *10*				XREF: Others: AD
5623.75 *21*	(8⁻)		CDEF L	XREF: Others: AD J^{π}: ΔJ=2 γ to (6⁻).
5642 *10*				XREF: Others: AD
5652 *10*				XREF: Others: AD
5665 *10*				XREF: Others: AD
5676 *10*				XREF: Others: AD
5689 *10*				XREF: Others: AD
5699.38 *18*	(8⁻)		C F LM	XREF: Others: AD XREF: M(5700). J^{π}: ΔJ=1 γ to (7⁻); ΔJ=2 γ to (6⁻).
5719 *10*				XREF: Others: AD
5729 *10*				XREF: Others: AD
5737 *10*				XREF: Others: AD
5760 *10*				XREF: Others: AD
5770 *10*				XREF: Others: AD
5780 *10*				XREF: Others: AD
5792 *10*				XREF: Others: AD
5812 *10*				XREF: Others: AD, AH J^{π}: L(α,α′)=5 for a 5800 *45* group suggests 5⁻ for one of the levels.
5822 *10*				XREF: Others: AD
5833 *10*				XREF: Others: AD
5844 *10*				XREF: Others: AD
5860 *10*				XREF: Others: AD
5872 *10*				XREF: Others: AD
5882 *10*				XREF: Others: AD
5893 *10*				XREF: Others: AD
5909 *10*				XREF: Others: AD
5920 *10*				XREF: Others: AD
5933 *10*				XREF: Others: AD
5936.0 *7*	(8⁺)		CDEF	J^{π}: ΔJ=(2) γ to 6⁺.
5951.7 *5*	(9⁻)		EF L	XREF: Others: AD J^{π}: ΔJ=2 γ to 7⁻; γ to (8⁻).
6031.5[a] *4*	(8⁺)		CDEF	J^{π}: ΔJ=2 γ to 6⁺; γ to 7⁻.
6124.0 *4*	(8⁺)		CDEF	E(level): see comment for 6126 level. J^{π}: ΔJ=2 γ to 6⁺; ΔJ=1 γ to 7⁻.
6124.7[b] *4*	(9⁻)		CDE L	E(level),J^{π}: only one level proposed by 2004Ka18 in (^{28}Si,4pγ) E=122 MeV. 1998Ga11, 1997Fu08 and 1994Cr05 proposed two levels near this energy with J^{π}=8⁺ and 9⁻, respectively, with the placement of 1144γ from 9⁻. This placement also proposed by 1978Ne02 in (α,nγ) and ^{56}Fe(^{14}N,αpnγ) based on 1144γ(θ) result consistent with ΔJ=2, Q γ to 7⁻ level.
6262.1 *6*	(7,8,9⁻)		C	J^{π}: γ to 7⁻.
6300 *50*			M	
6377.0 *22*	(7,8,9⁻)		F J	XREF: J(6390). J^{π}: γ to 7⁻; yrast pattern of population.
6700 *50*			M	
6830			J	
6963.0 *4*	(9)		C	J^{π}: ΔJ=1 γ to (8⁻); γ to (9⁻).
6998.1 *5*	(11⁻)	0.97 ps *21*	CDEFG KL	E(level): in (α,nγ),(^{11}B,2npγ); (^{28}Si,4pγ) E=115 MeV; and (^{54}Fe,2pγ), this level corresponds to 5681, 9⁻ where

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
			the placement of 1046γ was differently ordered. Jπ: ΔJ=2, E2 γ to (9⁻). $T_{1/2}$: from 1977We10. Other: 4.0 ps *5* (1977Al14). This half-life was assigned (1977We10,1977Al14) to 5681, 9⁻ level; but with the reassignment of the 1314-1046 cascade, evaluators assign the half-life to 6998 level.
7000	(4⁺)	Z	Jπ: L=4, E4 excitation in (e,e′).
7062.4 *4*	(10⁻)	F	Jπ: ΔJ=2 γ to (8⁻).
7118.9 *4*	(10⁺)	CDEF	Jπ: ΔJ=2 γ to (8⁺); γ to (9⁻).
7212.4 *7*	(11⁻)	F	Jπ: ΔJ=2 γ to (9⁻).
7334.7 *5*	(10⁺)	C	Jπ: ΔJ=2 γ to (8⁺).
7380		M Y	XREF: M(7400).
7556.2 *22*	(10⁻)	F	Jπ: γ to (9⁻).
7579.1[b] *4*	(11⁻)	C	Jπ: ΔJ=2 γ to (9⁻).
7806.0 *10*	(10⁺)	C	Jπ: ΔJ=2 γ to (8⁺).
7900 *50*		M	
7902 *3*	(9,10,11⁻)	C	Jπ: γ to (9⁻).
7946.5 *21*	(10⁺)	C	Jπ: ΔJ=2 γ to (8⁺).
8157.1 *21*	(10⁺)	C	Jπ: ΔJ=(2) γ to (8⁺).
8181.1 *11*	(10⁻)	F	Jπ: γ to (9⁻).
8302.8 *6*	(12⁻)	F	Jπ: γ to (11⁻).
8322.1 *22*	(11)	F	Jπ: γ to (10⁺).
8426.1 *4*	(11⁻)	DEF	Jπ: γs to (9⁻) and (11⁻).
8580.4 *5*	(12⁺)	CDEF	Jπ: ΔJ=2 γ to (10⁺); γ to (11⁻).
8995.4 *10*	(12⁺)	C	Jπ: ΔJ=2 γ to (10⁺).
9363.7 *8*	(11⁻)	F	Jπ: γs to (9⁻) and (10⁻).
9440.3 *6*	(11⁻)	F	Jπ: γ to (10⁺).
9666 *3*	(14)	EF	Jπ: γ to (12).
9772 *2*	(2⁺)	R	Additional information 4. E(level): proton capture state, E(p)(lab)=2098 keV. Jπ: γs to 0⁺ and 4⁺.
9803.5 *7*	(11⁻)	F	Jπ: γ to (10⁻); ΔJ=2 γ from (13⁻).
9948.4[d] *6*	(12⁻)	F	Jπ: ΔJ=1 γ to (11⁻); ΔJ=2 γ to (10⁻).
10.31×10^3 *50*		Q	Additional information 5. E(level): average proton-resonance, E(p)=2.1-3.1 MeV range in the c.m. system.
10460.2[c] *6*	(13⁻)	D F	Jπ: ΔJ=2 γ to (11⁻); γ to (12⁻).
10872	(3⁻)	S	Additional information 6. E(level),Jπ: proton resonance state, E(p)=3217 resonance, identified as $g_{9/2}$ IAR of 1546 level in ^{64}Cu, with γ decay similar to the decay of 3251 keV resonance (1976Fo06).
10906	(3⁻)	S	Additional information 7. E(level),Jπ: proton resonance state, E(p)=3251 resonance, identified as $g_{9/2}$ IAR of 1589 level in ^{64}Cu; spin from Iγ(90°)/Iγ(0°) of primary transitions. Parity from decay modes and lack of 3⁺ in the parent nucleus ^{64}Cu.
11023.4[d] *6*	(14⁻)	D F	Jπ: ΔJ=1 γ to (13⁻); γ to (12⁻).
11120	(2⁺)	T	Additional information 8. E(level): proton-resonance state from E(p)(lab)=3.46 MeV and S(p)(^{64}Zn)=7713.1 keV *6* (2021Wa16). Jπ: γ rays to 0⁺ and 4⁺.
11464[e] *4*	(15)	F	Jπ: γ to (14).
11626.4[c] *7*	(15⁻)	D F	Jπ: ΔJ=1 γ to (14⁻); ΔJ=2 γ to (13⁻).
12335.7[d] *7*	(16⁻)	D F	Jπ: γs to (14⁻) and (15⁻).

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Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$[#]	XREF	Comments
12468[f] 4	(16)		F	J$^{\pi}$: γ to (15).
13082.1[c] 7	(17$^-$)		D F	J$^{\pi}$: ΔJ=1 γ to (16$^-$); γ to (15$^-$).
13324[e] 4	(17)		F	J$^{\pi}$: γs to (15) and (16).
13948.1[d] 8	(18$^-$)		D F	J$^{\pi}$: ΔJ=1 γ to (17$^-$); ΔJ=2 γ to (16$^-$).
14391[f] 3	(18)		F	J$^{\pi}$: γs to (16) and (17).
14857 6			F	J$^{\pi}$: γ from (19).
14862.5[c] 8	(19$^-$)		D F	J$^{\pi}$: ΔJ=1 γ to (18$^-$); ΔJ=2 γ to (17$^-$).
15.42×10^3 94	1$^-$	4.6 MeV +16−15		XREF: Others: AH %EWSR=19 for E1 isoscalar giant dipole resonance (ISGDR) strength.
15423.6[e] 25	(19)		F	J$^{\pi}$: γs to (17) and (18).
15.7×10^3 5	2$^+$	6.43 MeV 65		XREF: Others: AH %EWSR=113 for E2 isoscalar giant quadrupole resonance (ISGQR) strength.
15939 7			F	J$^{\pi}$: γ from (20).
15945.0[d] 9	(20$^-$)		D F	J$^{\pi}$: ΔJ=2 γ to (18$^-$); γ to (19$^-$).
16686.8[f] 25	(20)		F	J$^{\pi}$: γs to (18) and (19).
17084 5			F	J$^{\pi}$: γ from (21).
17087.2[c] 10	(21$^-$)		D F	J$^{\pi}$: ΔJ=2 γ to (19$^-$); γ to (20$^-$).
17853[e] 4	(21)		F	J$^{\pi}$: γs to (19) and (20).
18.34×10^3 70	0$^+$	9.21 MeV 114		XREF: Others: AH %EWSR=64 for E0 isoscalar giant monopole resonance (ISGMR) strength.
18483.3[d] 11	(22$^-$)		D F	J$^{\pi}$: ΔJ=2 γ to (20$^-$); γ to (21$^-$).
19365[f] 4	(22)		F	J$^{\pi}$: γ to (20).
19775.6[c] 13	(23$^-$)		D F	J$^{\pi}$: ΔJ=2 γ to (21$^-$); γ to (22$^-$).
20657[e] 5	(23)		F	J$^{\pi}$: γ to (21).
21297.5[d] 15	(24$^-$)		F	J$^{\pi}$: γs to (22$^-$) and (23$^-$).
22892.7[c] 17	(25$^-$)		F	J$^{\pi}$: γ to (23$^-$).
24868.6[d] 18	(26$^-$)		F	J$^{\pi}$: γ to (24$^-$).
25.6×10^3 12	1$^-$	12.6 MeV 32		XREF: Others: AH %EWSR=68 for E1 isoscalar giant dipole resonance (ISGDR) strength.

† From a least-squares fit to Eγ data for levels populated in γ-ray studies, assuming ΔEγ=3 keV for high-energy γ rays from proton capture and resonance states. Normalized χ^2=0.92. Energies of levels populated only in particle-transfer reactions are primarily from (p,p′). Due to high level density and limited resolution, correspondence of levels, above ≈3.5 MeV excitation, from different reactions is somewhat ambiguous.

‡ In cases where L(p,p′) is used, parity is $(-1)^L$ and spin is L for levels up to 3.2 MeV, with the possibility of L-1, L, L+1 for higher levels, although J=L is the most likely choice, which is listed first, followed by less likely J=L−1 and J=L−2. For levels above ≈5 MeV populated in in-beam high-spin studies, J^{π} values are based on $\gamma(\theta)$, $\gamma\gamma(\theta)$ (DCO), band associations, and assumption of ascending spins with excitation energy.

\# Mainly from DSA method in (α,nγ),(^{11}B,2npγ) (also (α,nγ) and (n,n′γ)). Values quoted from 1977Al14 are from recoil distance method (RDDS) in (^{11}B,2npγ). Above 3458 values are available from (^{11}B,2npγ) only. For some of the levels, values from different studies are in disagreement and are noted under comments.

@ Double β decay to ^{64}Ni is possible with Q value=1095.7 7. From measurements of double β decay, lower limits of half-life for decay to ^{64}Ni g.s. have been determined (generally at 90% confidence level): $T_{1/2}(2\nu 2K)$: ≥1.1×10^{19} y (2011Be39, also 2010Be41, 2009Be27, 2008Be02); $T_{1/2}(\varepsilon\beta^+)$: ≥1.1×10^{18} y (2009Da16), ≥1.3×10^{20} y (2007Ki13); $T_{1/2}(2\varepsilon)$: ≥3.3×10^{17} y

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{64}Zn Levels (continued)

(2009Da16); $T_{1/2}(2\beta^+)$: >10×10^{17} y (1952Fr23); $T_{1/2}(0\nu 2\varepsilon)$: ≥3.2×10^{20} y (2011Be39), ≥1.19×10^{17} y (2007Bl15), ≥9.52×10^{16} y (2006Zu02,2006Wi12), ≥1.0×10^{18} y (2005Da47); $T_{1/2}(0\nu\varepsilon\beta^+)$: >1.2×10^{22} y (2020Az05), ≥8.5×10^{20} y (2011Be39), ≥5.07×10^{18} y (2006Zu02,2006Wi12), ≥3.6×10^{18} y (2005Da47), >2.8×10^{16} y (2003Ki08), 1.1×10^{19} y *9* (1995Bi24, from observed 511 keV peak, but systematic effects were not estimated); $T_{1/2}(2\nu\varepsilon\varepsilon)$: >6.0×10^{16} y (2003Ki08, also 2005Zu01,2001Zu03); $T_{1/2}(2\nu\varepsilon\beta^+)$: ≥9.4×10^{20} y (2011Be39), ≥8.9×10^{18} y (2005Da47); $T_{1/2}(0\nu+2\nu,\beta^+\varepsilon)$>2.3×10^{18} y (1985No03); $T_{1/2}(0\nu+2\nu,2\varepsilon)$>8×10^{15} y (1953Be33). Others $T_{1/2}$: 1999TsZZ, 2002Tr04 (evaluation).

[&] Band(A): g.s. band.

[a] Band(B): Band based on 2^+.

[b] Band(C): Band based on 3^-.

[c] Band(D): Collective (strongly coupled) band,α=1. Configuration=$\pi[(f^{-1}_{7/2})(p_{3/2}f^2_{5/2}(g^1_{9/2}] \otimes \nu[(p_{3/2}f_{5/2})^4(g^2_{9/2})]$; also [11,02] in the notation used by 2004Ka18, implying one proton hole in $f_{7/2}$ and one proton in $g_{9/2}$ orbitals, no neutron hole in $f_{7/2}$ orbital and 2 neutrons in $g_{9/2}$ orbital.

[d] Band(d): Collective (strongly coupled) band based,α=0. See configuration listed above for its signature partner.

[e] Band(E): Strongly coupled band,α=1.

[f] Band(e): Strongly coupled band,α=0.

$\gamma(^{64}Zn)$

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[@]	$I_{(\gamma+ce)}$	Comments
991.54	2^+	991.53 *5*	100	0.0	0^+	E2				B(E2)(W.u.)=20.0 *5* E_γ: NRM weighted average of 10 values from different datasets where uncertainties are given. This procedure increases the uncertainty in one of the discrepant values (991.16 *4* in (^{28}Si,4pγ) E=115 MeV) from 0.04 keV to 0.15 keV. Regular weighted average is 991.37 *7*, but with reduced χ^2=6.9, while unweighted average is 991.41 *8*. Removal of the 991.16 *4* value gives weighted average of 991.56 *5*.
1799.41	2^+	807.85 *6*	100.0 *16*	991.54	2^+	E2+M1	−3.9 *7*			B(M1)(W.u.)=0.00099 *+47−27*; B(E2)(W.u.)=39 *4* E_γ: NRM weighted average of ten values. δ: from weighted average of −4.6 *10* in (n,n′γ) (1985Ko42); −3.3 *7* in (α,nγ),(^{11}B,2npγ) (1978Si02); −5.5 *40* in ^{51}V(^{16}O,p2nγ),^{59}Co(^{7}Li,2nγ) (1977We10); and −4.5 *15* (1964Se02) in (p,p′γ). Others: −1.3 *3* (1978We15), −0.08 *3* (1977We10), −0.45 *5* (1977Al14) in ^{51}V(^{16}O,p2nγ), ^{59}Co(^{7}Li,2nγ); −0.57 *+13−27* (1976Br12) in (α,nγ),(HI,xnγ). Evaluators prefer high value of δ(E2/M1) (dominant E2) for transition from the second 2^+ to first 2^+ from a trend in other even-even nuclei.
		1799.34 *11*	29.6 *7*	0.0	0^+	E2				B(E2)(W.u.)=0.225 *+25−22* E_γ: weighted average of ten values. I_γ: NRM weighted average of ten values. Weighted average is 30.3 *16*, but with reduced χ^2=15.
1910.26	0^+	110.7 *1*	3.4 *11*	1799.41	2^+	[E2]		0.447		B(E2)(W.u.)=76 *24* E_γ,I_γ: from ^{64}Ga ε decay.
		918.77 *5*	100.0 *34*	991.54	2^+	E2				B(E2)(W.u.)=0.057 *3* E_γ: weighted average of five values. I_γ: from ^{64}Ga ε decay. Mult.: from ce data in (p,p′γ).
		1910		0.0	0^+	E0			0.64 *13*	Mult.: transition seen only in ce data from (p,p′γ). $I_{(\gamma+ce)}$: I(ce+pair). q^2_K(E0/E2)=6.0 *5*, X(E0/E2)=2.25 *19*, ρ^2(E0)=0.0038 *4* (1985Pa07,1986Pa23,2005Ki02).
2306.72	4^+	1315.15 *5*	100	991.54	2^+	E2				B(E2)(W.u.)=12.2 *+5−4* E_γ: weighted average of seven values.
2609.52	0^+	809[a]	<0.5	1799.41	2^+	[E2]				B(E2)(W.u.)<4.5 E_γ,I_γ: from (α,nγ),(^{11}B,2npγ). Iγ<2.0 in (p,p′γ) (1985Pa07).
		1617.93 *19*	100	991.54	2^+	E2				B(E2)(W.u.)=17 *+11−5* E_γ: NRM weighted average of five values. Mult.: from ce data in (p,p′γ).
		2610		0.0	0^+	E0			0.0030 *6*	Mult.: transition seen only in ce data from (p,p′γ).

$^{64}_{30}Zn_{34}$-15

Adopted Levels, Gammas (continued)

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[@]	Comments
									$I_{(\gamma+ce)}$: I(pair+ce). q_K^2(E0/E2)=0.027 *6*, X(E0/E2)=0.031 *7*, ρ^2(E0)=0.015 *7* (1985Pa07,1986Pa23,2005Ki02).
2736.57	4^+	429.77 *13*	9.3 *6*	2306.72	4^+	M1+E2	−0.25 *9*		B(M1)(W.u.)=0.014 *+4−3*; B(E2)(W.u.)=8 *+7−5* E_γ: NRM weighted average of eight values. I_γ: weighted average of eight values. δ: Other: +1.7 *5* or −0.2 *3* (1977We10) in $^{51}V(^{16}O,p2n\gamma)$.
		937.17 *6*	100.0 *19*	1799.41	2^+	E2			B(E2)(W.u.)=30 *+8−5* E_γ: weighted average of nine values.
		1745.4 *5*	4.8 *8*	991.54	2^+	(E2)			B(E2)(W.u.)=0.064 *+20−15* E_γ: weighted average of three values with consistent Iγ values. I_γ: NRM weighted average of three values. Others: 23 *6* (n,n′γ); 33 (p,p′γ); 42 *4* in (p,γ) E=2050 keV; 154 *13* in (p,γ) E=2098 keV are too high and in severe disagreement.
2793.5	2^+	1802.1 *4*	100	991.54	2^+	M1+E2	+0.7 *5*		B(M1)(W.u.)=0.052 *+26−23*; B(E2)(W.u.)=13 *+13−10*
		2793.0[a] *15*		0.0	0^+				γ reported in (p,p′γ) only.
2979.94	3^+	1180.58 *15*	100 *4*	1799.41	2^+	M1+E2	−0.05 *3*		B(M1)(W.u.)=0.028 *+17−14*; B(E2)(W.u.)=0.08 *+16−7* E_γ: weighted average of three values.
		1987.0 *7*	61 *14*	991.54	2^+	M1+E2	+0.26 *3*		B(M1)(W.u.)=0.0033 *+20−17*; B(E2)(W.u.)=0.10 *+6−5* E_γ,I_γ: unweighted average of three values.
2998.54	3^-	1197 *1*	≈4	1799.41	2^+	[E1]			B(E1)(W.u.)≈0.000062 E_γ,I_γ: from (n,n′γ).
		2007.03 *18*	100 *3*	991.54	2^+	(E1)			B(E1)(W.u.)=3.29×10^{-4} *11* E_γ: NRM weighted average of eight values.
		2997	0.5 *3*	0.0	0^+	[E3]			B(E3)(W.u.)=72 *+44−35* γ from $^{61}Ni(\alpha,n\gamma)$,$^{56}Fe(^{11}B,2np\gamma)$ only. B(E3)(W.u.) from B(E3)=0.040 *7* ((e,e′),1976Ne06). Other: 70 *50* from $T_{1/2}$ and E3 γ branching.
3005.73	2^+	1092[a] *1*	7.5	1910.26	0^+	[E2]			B(E2)(W.u.)≈12.6 γ reported in (p,p′γ) only. Considered as uncertain by evaluators.
		1206.2 *2*	77 *5*	1799.41	2^+	M1+E2	+0.6 *5*		B(M1)(W.u.)=0.050 *+15−21*; B(E2)(W.u.)=21 *+24−16* E_γ,I_γ: weighted average of three values.
		2014.3 *2*	100 *7*	991.54	2^+	M1(+E2)	−0.06 *10*		B(M1)(W.u.)=0.019 *+5−4*; B(E2)(W.u.)<0.25 E_γ: weighted average of three values.
		3005.5 *4*	65 *7*	0.0	0^+	E2			B(E2)(W.u.)=0.69 *+13−11* E_γ: weighted average of three values. I_γ: weighted average of two values.
3071.4	(1,2$^+$)	1272 *1*	100	1799.41	2^+				
		3071 *1*	39	0.0	0^+				
3077.77	4^+	341.2 *3*	11 *1*	2736.57	4^+	M1(+E2)	<0.5	0.0036 *9*	B(M1)(W.u.)=0.055 *+24−20*; B(E2)(W.u.)<230 E_γ: weighted average of three values.

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
								I_γ: from ^{54}Fe,2pγ). Others: 120 *13* (α,nγ),(^{11}B,2npγ); 38 *10* (α,nγ),(HI,xnγ); 24 *6* (p,γ) E=2050 keV. δ: from RUL(E2)<300. In (α,nγ),(^{11}B,2npγ) reaction, 1980Si02 quote δ=−1.2 *2* but in a footnote also state that δ for this transition is not determined from experiment.
3077.77	4+	770.95 *15*	100 *10*	2306.72	4+	M1+E2	−0.19 *8*	B(M1)(W.u.)=0.045 *6*; B(E2)(W.u.)=4.6 *+45−30* E_γ: weighted average of seven values. δ: others: −0.4 *1* (1978Ne02) in (α,nγ),(HI,xnγ), −0.54 *12* (1978We15) in ^{51}V(^{16}O,p2nγ).
		2086.8 *3*	78 *9*	991.54	2+	E2		B(E2)(W.u.)=0.71 *+11−9* E_γ: weighted average of seven values. Level-energy difference=2086.2. I_γ: weighted average of four values. Others: 190 *8* in (^{28}Si,4pγ) E=122 MeV; 113 *9* in (α,nγ),(^{11}B,2npγ); 141 *9* (p,γ) E=2025 keV are in disagreement.
3094.64	(3)+	1295.1 *2*	19 *9*	1799.41	2+	[M1+E2]		B(M1)(W.u.)=0.018 *+8−7*; B(E2)(W.u.)=18 *8* E_γ: weighted average of two values. I_γ: unweighted average of three values. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		2103.1 *1*	100 *7*	991.54	2+	M1+E2		B(M1)(W.u.)=0.022 *+4−3*; B(E2)(W.u.)=8.4 *+14−11* E_γ: weighted average of two values. δ: +9.4 *15* or +0.40 *5* (for J=3); +0.6 *4* (for J=2). B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
3186.84	1+	577.3 *1*	0.76 *15*	2609.52	0+	[M1]		B(M1)(W.u.)=0.0090 *+35−24* E_γ,I_γ: from ^{64}Ga ε only.
		1276.52 *16*	47.6 *11*	1910.26	0+	(M1)		B(M1)(W.u.)=0.052 *+16−10* E_γ: weighted average of five values. I_γ: from ^{64}Ga ε decay. Other three available values are either imprecise or in disagreement.
		1387.34 *10*	100.0 *26*	1799.41	2+	[M1+E2]		B(M1)(W.u.)=0.085 *+26−16*; B(E2)(W.u.)=75 *+24−15* E_γ: weighted average of four values. I_γ: in (α,nγ),(^{11}B,2npγ) value is low by a factor of ≈9. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		2195.34 *10*	80.4 *18*	991.54	2+	[M1+E2]		B(M1)(W.u.)=0.017 *+5−3*; B(E2)(W.u.)=6.1 *+19−12* E_γ: weighted average of five values. I_γ: from ^{64}Ga ε decay. Other three available values are either imprecise or in disagreement. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		3186.8 *2*	1.5 *3*	0.0	0+	[M1]		B(M1)(W.u.)=1.1×10^{-4} *+4−3* E_γ,I_γ: from ^{64}Ga ε decay. Other Iγ: 41 *8* (p,γ) 2098 keV; 18 in (p,′γ) are in disagreement.
3196.9	(2,3)	1397.4 *4*	52 *5*	1799.41	2+			
		2205.3 *8*	100 *5*	991.54	2+			
		3200[a] *3*	18	0.0	0+			γ reported in (p,p′γ) only.

From ENSDF

$^{64}_{30}Zn_{34}$-17

γ(^{64}Zn) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
3205.98	(3)$^+$	898.8 *5*	13 *2*	2306.72	4$^+$	[M1+E2]		B(M1)(W.u.)=0.017 *+7−4*; B(E2)(W.u.)=36 *+15−8* B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		1295.1[a] *7*	10 *5*	1910.26	0$^+$			γ not reported in (α,nγ),(^{11}B,2npγ). It is considered (by evaluators) as highly questionable since it involves M3 transition, with unrealistically large B(M3)(W.u.)=1.9×10^7 *+7−4*.
		1406.57 *8*	100.0 *10*	1799.41	2$^+$	M1+E2	−0.25 *9*	B(M1)(W.u.)=0.033 *+13−8*; B(E2)(W.u.)=1.8 *+16−10*
		2214.0 *5*	3.1 *10*	991.54	2$^+$	[M1+E2]		B(M1)(W.u.)=0.00028 *+11−6*; B(E2)(W.u.)=0.096 *+36−21* γ reported in (α,nγ),(^{11}B,2npγ) only. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		3205[a] *3*		0.0	0$^+$			γ reported in (p,γ) E=2098 keV only, highly questionable as required mult=[M3].
3261.94	1	1352[a] *1*	<6	1910.26	0$^+$			I_γ: from ^{64}Ga ε decay.
		1461.3[a] *1*	<4.5	1799.41	2$^+$			E_γ,I_γ: from ^{64}Ga ε decay. This γ was reported in (p,γ) E=2050 keV; and in (p,p′γ), with Iγ=24 in the latter work. It fits poorly in the decay scheme.
		2270.40 *10*	100 *5*	991.54	2$^+$			E_γ: weighted average of four values.
		3261.7 *2*	6.2 *4*	0.0	0$^+$			E_γ,I_γ: from ^{64}Ga ε decay. Other Iγ=90 *10* (p,γ) 2098 keV; ≈67 (n,n′γ) are in disagreement.
3297.17	(2)$^+$	1498 *1*	29 *11*	1799.41	2$^+$	[M1+E2]		B(M1)(W.u.)=0.0041 *+17−15*; B(E2)(W.u.)=3.1 *+14−12* γ reported only in (p,γ) E=2098 keV. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		2305.54 *14*	100 *14*	991.54	2$^+$	[M1+E2]		B(M1)(W.u.)=0.0039 *+11−8*; B(E2)(W.u.)=1.24 *+35−25* B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		3299 *1*	42 *19*	0.0	0$^+$	[E2]		B(E2)(W.u.)=0.087 *+37−34* γ reported only in (p,γ) E=2098 keV.
3306.85	(4$^+$)	512[a]	0.5 *5*	2793.5	2$^+$	[E2]		B(E2)(W.u.)<59 γ from (α,nγ),(^{11}B,2npγ) only.
		1000.15 *15*	100	2306.72	4$^+$	M1(+E2)	+0.07 *20*	B(M1)(W.u.)=0.084 *+39−24*; B(E2)(W.u.)<14 E_γ: from (p,γ) E=2050 keV. In several in-beam studies (1998Ga11,1994Cr05, 1978Ne02), a 1000γ deexcited a level at 4078, but in (α,nγ),(^{11}B,2npγ), 1980Si02 reported the placement from 4078 level as incorrect and placed it from 3307 level, as also proposed in (p,γ). In (^{28}Si,4pγ) study of 2004Ka18, a 999.9γ is placed from both the 3307 and 4078 levels. δ: from 1980Si02. Other: −0.1 *2* (1978Ne02).
3321.8?	(1)	1411.3 *15*	100 *29*	1910.26	0$^+$			
		3322 *2*	58 *16*	0.0	0$^+$			
3365.99	1$^+$	756.58 *10*	9.0 *5*	2609.52	0$^+$	[M1]		B(M1)(W.u.)=0.11 *+6−3* γ reported in ^{64}Ga ε decay only. Eγ and Iγ data for four higher energy γ rays from the 3366 level have been taken from ^{64}Ga ε decay. These are reported in other datasets, but with imprecise energies and intensities, as compared to the data in ε decay.
		1455.84 *12*	13.9 *7*	1910.26	0$^+$	[M1]		B(M1)(W.u.)=0.023 *+12−6* E_γ,I_γ: from ^{64}Ga ε decay. This γ reported in (p,γ) E=2050 keV; and (p,p′γ) but with imprecise energies and intensities.

$^{64}_{30}$Zn$_{34}$-18

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
3365.99	1^+	1566.50 *18*	15.7 *9*	1799.41	2^+	[M1+E2]		B(M1)(W.u.)=0.021 +*11*−*6*; B(E2)(W.u.)=14 +*8*−*4* E_γ,I_γ: from ^{64}Ga ε decay. This γ reported in (p,γ) E=2050 keV; (p,p′γ); and (α,nγ),(HI,xnγ), but with imprecise energies and intensities. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		2374.30 *10*	50.5 *13*	991.54	2^+	[M1+E2]		B(M1)(W.u.)=0.019 +*10*−*5*; B(E2)(W.u.)=5.7 +*30*−*15* E_γ,I_γ: from ^{64}Ga ε decay. This γ reported in (p,γ) E=2050 keV; (p,γ) E=2098 keV; (p,p′γ); (α,nγ),(^{11}B,2npγ) and (α,nγ),(HI,xnγ), but with imprecise energies and intensities. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		3365.80 *10*	100 *3*	0.0	0^+	[M1]		B(M1)(W.u.)=0.013 +*7*−*4* E_γ,I_γ: from ^{64}Ga ε decay. This γ reported in (p,γ) E=2050 keV; (p,γ) E=2098 keV; (p,p′γ); (α,nγ),(^{11}B,2npγ) and (α,nγ),(HI,xnγ), but with imprecise energies and intensities.
3369.86	3^+	633.40 *15*	25 *6*	2736.57	4^+	[M1+E2]		B(M1)(W.u.)=0.034 +*16*−*12*; B(E2)(W.u.)=1.4×10^2 +*7*−*5* γ reported in (p,γ) E=2.05 MeV only. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		1570.3 *2*	100 *5*	1799.41	2^+	M1+E2	−0.40 *6*	B(M1)(W.u.)=0.0077 +*31*−*22*; B(E2)(W.u.)=0.84 +*42*−*31*
		2377.8 *6*	57 *5*	991.54	2^+	[M1+E2]		B(M1)(W.u.)=0.0015 +*6*−*4*; B(E2)(W.u.)=0.44 +*18*−*13* I_γ: weighted average of values from (α,nγ),(^{11}B,2npγ); (p,γ) E=2050 keV; and (n,n′γ). B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
3425.13	1^+	419.5[a] *4*	0.5 *5*	3005.73	2^+	[M1+E2]		B(M1)(W.u.)<0.092; B(E2)(W.u.)<890 γ reported in (α,nγ),(^{11}B,2npγ) only. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		1514.7 *2*	4.8 *8*	1910.26	0^+	[M1]		B(M1)(W.u.)=0.0068 +*23*−*16* E_γ,I_γ: from ^{64}Ga ε decay. γ reported in (p,p′γ).
		1625.87 *20*	24.9 *17*	1799.41	2^+	[M1+E2]		B(M1)(W.u.)=0.029 +*9*−*6*; B(E2)(W.u.)=18 +*6*−*4* E_γ,I_γ: from ^{64}Ga ε decay. Other: Iγ: 71 *5* in (p,γ) E=2.05 MeV. Tentative γ also reported in (n,n′γ). B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		2433.6 *2*	13.2 *12*	991.54	2^+	[M1+E2]		B(M1)(W.u.)=0.0045 +*14*−*9*; B(E2)(W.u.)=1.3 +*4*−*3* E_γ,I_γ: from ^{64}Ga ε decay. γ reported in (p,γ) E=2098 keV. B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		3424.97 *15*	100 *5*	0.0	0^+	[M1]		B(M1)(W.u.)=0.0123 +*37*−*23* E_γ,I_γ: from ^{64}Ga ε decay. γ reported in (p,γ) E=2050 keV; (p,γ) E=2098 keV; (p,p′γ); (α,nγ),(^{11}B,2npγ) and (α,nγ),(HI,xnγ), but with imprecise energies.
3452.0	(1,2$^+$)	1542 *1*	100	1910.26	0^+			
3458.66	(2,3)	1659.2 *2*	100 *7*	1799.41	2^+			
		2467.1 *3*	82 *9*	991.54	2^+			I_γ: from (α,nγ),(^{11}B,2npγ). Other: 144 *11* in (p,γ) E=2.05 MeV.

Adopted Levels, Gammas (continued)

γ(^{64}Zn) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
3458.66	(2,3)	3455[a] *1*		0.0	0$^+$			γ reported only in (p,γ) E=2.098 keV as the strongest transition from a 3458 level. The placement is considered tentative by evaluators.
3538.7?	(2$^+$ to 6$^+$)	1232 *1*	100	2306.72	4$^+$			
3545.9?	(0 to 3$^+$)	284 *1*	52	3261.94	1			
		359 *2*	100	3186.84	1$^+$			
		1747.65[a] *15*		1799.41	2$^+$			γ reported only in (p,γ) E=2.05 MeV.
3552.3	4$^+$	1246.7 *4*	100 *6*	2306.72	4$^+$	M1+E2	−0.16 *10*	B(M1)(W.u.)<0.0057; B(E2)(W.u.)<0.39 γ reported in (^{11}B,2npγ). This γ may correspond to a 1245γ (unplaced) in (p,p$'\gamma$) and a 1247.2 *2* (unplaced) in (p,γ) E=2050 keV.
		2559.7 *4*	85 *6*	991.54	2$^+$	[E2]		B(E2)(W.u.)<0.15 This γ may correspond to a 2560γ (unplaced) in (p,p$'\gamma$).
		3551[a] *1*	42 *15*	0.0	0$^+$			γ reported in (p,γ) E=2.098 keV. Evaluators treat this γ as highly questionable as ΔJ^π requires mult=E4 and an unrealistic large B(E4)(W.u.)<2.1×10^6.
3586.9		390 *2*	100	3196.9	(2,3)			
3597.24	(2$^+$,3,4$^+$)	860.5 *3*	57 *14*	2736.57	4$^+$			γ reported only in (p,γ) E=2.05 MeV.
		1290.5 *3*	100 *9*	2306.72	4$^+$			
		2606.0 *5*	82 *9*	991.54	2$^+$			
3601.9	(1,2$^+$)	3602 *1*	100	0.0	0$^+$			
3606.5	(0$^+$ to 4$^+$)	2614.9 *5*	100	991.54	2$^+$			
3620.7	(2$^+$ to 6$^+$)	1314.0 *10*	100	2306.72	4$^+$			
3628.4	(4)$^+$	2636.8 *5*	100	991.54	2$^+$	[E2]		B(E2)(W.u.)=1.8 *+8−5*
3698.9		502.0 *5*	100	3196.9	(2,3)			
3701.4	1$^-$	3701.3 *4*	100	0.0	0$^+$	[E1]		B(E1)(W.u.)=3.3×10^{-4} *+6−5*
3710.0	(2$^+$)	1099 *1*	7	2609.52	0$^+$			
		1406 *1*	100	2306.72	4$^+$			E_γ: fits poorly. Eγ=1403 from level-energy difference.
		≈3710		0.0	0$^+$			
3718.4	(0$^+$ to 4$^+$)	2726.8 *3*	100	991.54	2$^+$			
3795.03	1$^+$	1185.4 *1*	4.4 *24*	2609.52	0$^+$			γ reported in ^{64}Ga ε decay only.
		1995.9 *2*	100 *6*	1799.41	2$^+$			E_γ,I_γ: from ^{64}Ga ε decay. γ reported in (p,γ) E=2050 keV.
		2803.3 *3*	39 *4*	991.54	2$^+$			E_γ,I_γ: from ^{64}Ga ε decay. γ reported in (p,γ) E=2098 keV.
		3795.1 *3*	74 *5*	0.0	0$^+$			E_γ,I_γ: from ^{64}Ga ε decay. γ reported in (p,γ) E=2050 keV and (p,γ) E=2098 keV.
3815.4	(0$^+$ to 4$^+$)	2016.0 *5*	100	1799.41	2$^+$			
3819.65	(0$^+$ to 4$^+$)	2020.2 *2*	100	1799.41	2$^+$			
3850.5	(≤3)$^{(+)}$	1116[a]		2736.57	4$^+$			γ reported in (α,nγ),(^{11}B,2npγ).
		2051.0 *4*	22.0 *25*	1799.41	2$^+$			γ reported in (α,nγ),(^{11}B,2npγ).
		2859.2 *6*	100 *4*	991.54	2$^+$			
3853.27	5$^+$	1116.7 *2*	100.0 *5*	2736.57	4$^+$	M1+E2	−1.00 *15*	B(M1)(W.u.)<0.0046; B(E2)(W.u.)<6.1
		1547[a]	0.5 *5*	2306.72	4$^+$	[M1+E2]		B(M1)(W.u.)<3.0×10^{-5}; B(E2)(W.u.)<0.021 γ reported in (α,nγ),(^{11}B,2npγ). B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.‡	δ‡	Comments
3863.7	(2+ to 6+)	1557.0 *10*	100	2306.72	4+			
3898.5	(2+,3,4+)	1162.5 *5*	20 *7*	2736.57	4+			γ reported in (p,γ) E=2.09 MeV.
		2906.5 *4*	100 *13*	991.54	2+			
3924.69	5−	617.9 *5*	8.3 *5*	3306.85	(4+)	[E1]		B(E1)(W.u.)>6.7×10−5
		848		3077.77	4+	[E1]		
		926.2 *5*	19 *4*	2998.54	3−	E2		B(E2)(W.u.)>4.1
		1187.4 *10*	16 *1*	2736.57	4+	[E1]		B(E1)(W.u.)>1.8×10−5
		1618.4 *5*	100 *1*	2306.72	4+	E1+M2	+0.12 *4*	B(E1)(W.u.)>4.6×10−5; B(M2)(W.u.)>0.53
								Mult.,δ: from 1978We15 in ^{51}V(^{16}O,p2nγ).
								RUL(M2)=1 for B(M2)(W.u.) suggests $T_{1/2}$(3924.7 level) not lower than ≈0.7 ps.
3932.0	(4,5)	935[a]		2998.54	3−			
		1625.3 *4*	100	2306.72	4+			
3951.9	(4+,3+)	2960.4 *6*	100	991.54	2+			
3993.36	6+	1686.60 *6*	100	2306.72	4+	E2		B(E2)(W.u.)=23 *+8−5*
4020.4	(2)+	1283.4 *7*	100 *20*	2736.57	4+			γ reported in (p,γ) E=2.05 MeV.
		3029.0 *5*	100 *20*	991.54	2+			
4039.7	(0+ to 4+)	3048.1 *4*	100	991.54	2+			
4076.55	(5)+	999.7[a] *6*		3077.77	4+			I_γ: <39 from 2004Ka18 in (^{28}Si,4pγ). Others: 33 *5* (1994Cr05), 77 *19* (1998Ga11), 127 *21* (1978Ne02) in (α,nγ),(HI,xnγ) where a 999.7 *3* γ was assigned from only the 4077 level. But 1980Si02 in (α,nγ),(^{11}B,2npγ) do not support the placement of this γ from 4077 level, based on the absence of (1000γ)(771γ) coincidences.
		1340.2 *4*	100.0 *16*	2736.57	4+	M1+E2	−0.49 *11*	B(M1)(W.u.)=0.015 *+8−5*; B(E2)(W.u.)=3.4 *+22−16*
								E_γ: unweighted average of all available values.
		1771.5[a] *2*		2306.72	4+			I_γ: 26 *4* (1994Cr05,2004Ka18), 100 *19* (1998Ga11). But this γ was not detected by 1980Si02 in (α,nγ) and (^{11}B,2npγ), the authors gave an upper limit of 0.1 for branching ratio. Placement or existence of 1773.2 *10* γ in 2004Ka18 is considered uncertain.
								If M1, B(M1)(W.u.)=0.0014 *4*. If E2, B(E2)(W.u.)=0.8 *3*.
4140	(2,1)+	≈4140		0.0	0+			
4156.53	5−	851		3306.85	(4+)			
		1079.2 *4*	43 *11*	3077.77	4+	(E1)		B(E1)(W.u.)=0.00070 *+30−20*
								I_γ: unweighted average of two available intensities.
		1159.0[a] *4*	46 *10*	2998.54	3−	[E2]		B(E2)(W.u.)=39 *+16−11*
								E_γ: reported in (α,nγ),(^{11}B,2np) (1980Si02) only, considered as uncertain (evaluators).
		1850.4 *8*	100 *10*	2306.72	4+	[E1]		B(E1)(W.u.)=0.00032 *+13−7*
								E_γ: unweighted average of available values.
4159.5	1	3168	85	991.54	2+			E_γ,I_γ: from (γ,γ′).
		4159	100	0.0	0+			If E1, B(E1)(W.u.)=0.00041 *12*. If M1, B(M1)(W.u.)=0.021 *6*.
								E_γ,I_γ: from (γ,γ′).
4181.7		1875.0 *5*		2306.72	4+			γ reported in (α,nγ),(^{11}B,2npγ).

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	Comments
4181.7		2381[a] *2*		1799.41	2^+		γ reported in (n,n′γ).
4205.2	$(4,3)^+$	3213.6 *4*	100	991.54	2^+		
4236.71	6^+	1500.1 *3*	100.0 *22*	2736.57	4^+	E2	B(E2)(W.u.)=26 +*12*−*6*
		1935.3[a] *7*	45 *3*	2306.72	4^+	(E2)	B(E2)(W.u.)=3.3 +*15*−*8* E_γ: γ from (^{28}Si,4pγ) study of 2004Ka18 only. It is treated as uncertain due to poor fit in level scheme (level-energy difference gives 1930.0) and non-observation in other γ-ray studies.
4288.6	$(4)^+$	1552.0 *4*	100	2736.57	4^+		
4319.1	$(4,3)^+$	3327 *3*		991.54	2^+		E_γ: from (n,n′γ).
4454.68	1^+	2544.4 *2*	20 *4*	1910.26	0^+	[M1]	B(M1)(W.u.)=0.052 +*16*−*12*
		2655.2 *2*	34 *6*	1799.41	2^+	[M1+E2]	B(M1)(W.u.)=0.078 +*22*−*17*; B(E2)(W.u.)=19 +*5*−*4* B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		3462.4 *10*	5.8 *12*	991.54	2^+	[M1+E2]	B(M1)(W.u.)=0.0060 +*19*−*15*; B(E2)(W.u.)=0.85 +*27*−*21* B(M1)(W.u.) for pure M1; B(E2)(W.u.) for pure E2.
		4454.3 *10*	100 *6*	0.0	0^+	[M1]	B(M1)(W.u.)=0.049 +*12*−*8* B(M1)(W.u.)=0.049 +*12*−*8*
4560		3564[a] *3*		991.54	2^+		
4608.75	(1)	3617.1 *2*	100 *18*	991.54	2^+		
		4609 *2*	≈32	0.0	0^+		
4634.87	7^-	398.17 *6*	20.7 *9*	4236.71	6^+	E1	B(E1)(W.u.)=1.23×10^{-5} *9*
		641.48 *5*	100.0 *6*	3993.36	6^+	E1	B(E1)(W.u.)=1.42×10^{-5} *9*
4664	(1)	4664		0.0	0^+		If E1, B(E1)(W.u.)=0.00010 *3*. If M1, B(M1)(W.u.)=0.0053 *13*.
4668.93	(6^-)	512.2 *2*	19 *4*	4156.53	5^-	D	I_γ: from (^{28}Si,4pγ) E=115 MeV. Other: 102 *15* in (^{54}Fe,2pγ).
		592.4 *1*	67 *11*	4076.55	$(5)^+$	D(+Q)	I_γ: unweighted average of two values.
		744.8 *6*	100 *8*	3924.69	5^-	D(+Q)	E_γ: unweighted average of available values.
4713.15	(1)	2103.6 *2*	100 *23*	2609.52	0^+		
		2913[a] *2*	6	1799.41	2^+		
		4712 *2*	≈11	0.0	0^+		
4823.5	(5,6,7)	746.9 *5*		4076.55	$(5)^+$		
4980.87	7^-	743.5 *10*	7.0 *9*	4236.71	6^+	[E1]	B(E1)(W.u.)=4.3×10^{-5} +*21*−*11*
		824.7 *2*	21.0 *11*	4156.53	5^-	E2	B(E2)(W.u.)=12 +*6*−*3* I_γ: other: 100 *10* in (^{54}Fe,2pγ).
		1056.1 *1*	100.0 *17*	3924.69	5^-	E2	B(E2)(W.u.)=17 +*8*−*4*
5066.8		2760[a] *2*		2306.72	4^+		
5151.71	(7^-)	516.8 *1*	57 *7*	4634.87	7^-		I_γ: from (^{54}Fe,2pγ).
		1227.3 *2*	100 *14*	3924.69	5^-	Q	
5623.75	(8^-)	954.8 *1*	100 *3*	4668.93	(6^-)	Q	
		990 *1*		4634.87	7^-		
5699.38	(8^-)	547.8 *2*	7 *2*	5151.71	(7^-)	D	I_γ: from (^{54}Fe,2pγ). Other: 46 *2* in (^{28}Si,4pγ) E=122 MeV.
		1030.4 *2*	88 *11*	4668.93	(6^-)	Q	I_γ: unweighted average of two values.
		1064.0 *4*	100 *5*	4634.87	7^-		
5936.0	(8^+)	1698.5 *10*	33 *7*	4236.71	6^+		
		1942.8 *10*	100 *6*	3993.36	6^+	(Q)	

$^{64}_{30}Zn_{34}$-22

γ(^{64}Zn) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	Comments
5951.7	(9⁻)	328		5623.75	(8⁻)		
		971.1 *5*	≈12	4980.87	7⁻	Q	
		1313.50# *16*	100	4638.2			E_γ: from 1996GaZZ. Other: 1315 (2004Ka18).
6031.5	(8⁺)	1395.6 *10*	22 *3*	4634.87	7⁻		I_γ: from (^{28}Si,4pγ) E=115 MeV. Other: 74 *3* in (^{28}Si,4pγ) E=122 MeV.
		1794.5 *17*	67 *6*	4236.71	6⁺		I_γ: from (^{54}Fe,2pγ). Other: 112 *6* in (^{28}Si,4pγ) E=115 MeV.
		2038.9 *5*	100 *6*	3993.36	6⁺	Q	
6124.0	(8⁺)	502		5623.75	(8⁻)		
		1488.5 *10*	47 *3*	4634.87	7⁻		
		1887.0 *4*	19 *4*	4236.71	6⁺	Q	I_γ: from (^{54}Fe,2pγ). Other: 51 *3* in (^{28}Si,4pγ) E=115 MeV.
		2130.6 *6*	100 *4*	3993.36	6⁺	Q	
6124.7	(9⁻)	1143.8 *4*	100	4980.87	7⁻	Q	Mult.: ΔJ=2 γ from $\gamma(\theta)$ in (α,nγ),(HI,xnγ) (1978Ne02) and DCO ratio (1994Cr05) in (^{54}Fe,2pγ). 2004Ka18, in (p,γ) E=122 MeV, propose ΔJ=1 from $\gamma\gamma(\theta)$(DCO) and γ(anisotropy) ratio, but their results seem consistent with ΔJ=2 also.
6262.1	(7,8,9⁻)	1627.2 *6*	100	4634.87	7⁻		
6377.0	(7,8,9⁻)	1741		4634.87	7⁻		
6963.0	(9)	838.3 *3*	100 *11*	6124.7	(9⁻)		
		1263.4 *5*	36 *7*	5699.38	(8⁻)	D	Mult.: from DCO ratio.
6998.1	(11⁻)	1046.45# *10*	100	5951.7	(9⁻)	E2	B(E2)(W.u.)=31 *+9−6*
7062.4	(10⁻)	1363.0 *4*	100	5699.38	(8⁻)	Q	
7118.9	(10⁺)	993.0& *10*	134& *6*	6124.0	(8⁺)		I_γ: from (^{28}Si,4pγ) E=115 MeV. Iγ<25 for 997.6γ in (^{54}Fe,2pγ).
		993.0& *10*	101& *5*	6124.7	(9⁻)		I_γ: from (^{28}Si,4pγ) E=115 MeV. Iγ<25 for 997.6γ in (^{54}Fe,2pγ).
		1088.0 *5*	100 *5*	6031.5	(8⁺)	Q	E_γ: unweighted average of two values.
		1166		5951.7	(9⁻)		
		1181.8 *13*	29 *1*	5936.0	(8⁺)	Q	E_γ: unweighted average of two values. I_γ: from (^{54}Fe,2pγ). Other: 55 *3* in (^{28}Si,4pγ) E=115 MeV.
7212.4	(11⁻)	1260.3 *7*	100	5951.7	(9⁻)	Q	
7334.7	(10⁺)	1210.7 *3*	100	6124.0	(8⁺)	Q	
7556.2	(10⁻)	1605		5951.7	(9⁻)		
7579.1	(11⁻)	1454.3 *2*	100	6124.7	(9⁻)	Q	
7806.0	(10⁺)	1869.9 *7*	100	5936.0	(8⁺)	Q	
7902	(9,10,11⁻)	1776.9		6124.7	(9⁻)		
7946.5	(10⁺)	1915 *2*	100	6031.5	(8⁺)	Q	
8157.1	(10⁺)	2221 *2*	100	5936.0	(8⁺)	(Q)	
8181.1	(10⁻)	2229.8		5951.7	(9⁻)		
8302.8	(12⁻)	1304.9 *5*	100	6998.1	(11⁻)		
8322.1	(11)	1204		7118.9	(10⁺)		
8426.1	(11⁻)	1307.15 *9*	100 *3*	7118.9	(10⁺)		
		1429.1 *10*	16.7 *18*	6998.1	(11⁻)		E_γ: γ not reported in (^{28}Si,4pγ) E=122 MeV.
		2048		6377.0	(7,8,9⁻)		
8580.4	(12⁺)	154.30 *5*	2.5 *3*	8426.1	(11⁻)		
		259		8322.1	(11)		

$^{64}_{30}$Zn$_{34}$-23

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	Comments
8580.4	(12$^+$)	1462.5 *10*	100 *4*	7118.9	(10$^+$)	Q	E_γ: unweighted average of available values.
		1583.3# *10*	87 *3*	6998.1	(11$^-$)		
8995.4	(12$^+$)	1189.4 *3*	100	7806.0	(10$^+$)	Q	
9363.7	(11$^-$)	1808		7556.2	(10$^-$)		
		3414		5951.7	(9$^-$)		
9440.3	(11$^-$)	2321.9 *9*	100	7118.9	(10$^+$)		
9666	(14)	1086		8580.4	(12$^+$)		
9772	(2$^+$)	5873	7.4 *16*	3898.5	(2$^+$,3,4$^+$)		
		5892	10 *4*	3880	(0$^+$ to 4$^+$)		
		5975	11 *3*	3795.03	1$^+$		
		6172	11 *4*	3601.9	(1,2$^+$)		
		6224	17.4 *23*	3552.3	4$^+$		
		6313	11 *4*	3458.66	(2,3)		
		6344	12.3 *23*	3425.13	1$^+$		
		6407	11 *3*	3365.99	1$^+$		
		6469	16 *4*	3297.17	(2)$^+$		
		6514	8.0 *28*	3261.94	1		
		6569	19.6 *22*	3205.98	(3)$^+$		
		6585	12.4 *13*	3186.84	1$^+$		
		6681	21 *6*	3094.64	(3)$^+$		
		6768	20.7 *14*	3005.73	2$^+$		
		6795	20.9 *26*	2979.94	3$^+$		
		6977	17.1 *14*	2793.5	2$^+$		
		7040	9.7 *26*	2736.57	4$^+$		
		7162	7.9 *29*	2609.52	0$^+$		
		7464	16 *6*	2306.72	4$^+$		
		7861	10.0 *7*	1910.26	0$^+$		
		7972	93 *29*	1799.41	2$^+$		
		8782	100 *9*	991.54	2$^+$		
		9772	36 *7*	0.0	0$^+$		
9803.5	(11$^-$)	1622.5 *8*	100 *62*	8181.1	(10$^-$)		
		2743		7062.4	(10$^-$)		
9948.4	(12$^-$)	508.1 *5*		9440.3	(11$^-$)		
		584.8 *5*	86 *5*	9363.7	(11$^-$)	D	
		2886 *1*	25 *2*	7062.4	(10$^-$)	Q	
		2950 *1*	100 *5*	6998.1	(11$^-$)	D	
10.31×10^3		6110	6.9 *12*	4205.2	(4,3)$^+$		
		6390	3.4 *11*	3924.69	5$^-$		
		6410	8.6 *14*	3898.5	(2$^+$,3,4$^+$)		
		6490	12.2 *16*	3819.65	(0$^+$ to 4$^+$)		
		6510	9.5 *19*	3795.03	1$^+$		
		6680	2.3 *9*	3630?	(0$^+$,6$^-$)		
		6710	11.2 *17*	3597.24	(2$^+$,3,4$^+$)		

$^{64}_{30}Zn_{34}$-24

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	Comments
10.31×10^3		6890	12.4 *19*	3425.13	1^+		
		7220	22 *4*	3094.64	$(3)^+$		
		7230	14 *4*	3077.77	4^+		
		7330	25 *4*	2979.94	3^+		
		7520	25 *3*	2793.5	2^+		
		7570	20 *3*	2736.57	4^+		
		7700	6.9 *12*	2609.52	0^+		
		8000	26 *3*	2306.72	4^+		
		8400	11.0 *17*	1910.26	0^+		
		8510	60 *7*	1799.41	2^+		
		9320	100 *12*	991.54	2^+		
		10310	45 *6*	0.0	0^+		
10460.2	(13^-)	512.0 *5*		9948.4	(12^-)		
		656.7 *5*	50.0 *17*	9803.5	(11^-)	Q	
		1020.0 *5*	100 *3*	9440.3	(11^-)		
		2158.3 *9*	72 *3*	8302.8	(12^-)		
		3247 *1*	48.3 *17*	7212.4	(11^-)	Q	
		3461 *1*	92 *3*	6998.1	(11^-)	Q	
10872	(3^-)	6568	26	4304.1	$(1^-$ to $5^-)$		
		6719	16	4156.53	5^-		
		7113	11	3759	$(1^-$ to $5^-)$		
		7192	16	3680	$(1^-$ to $5^-)$		
		7458	21	3414	$(1^-$ to $5^-)$		
		7513	11	3365.99	1^+		E_γ: 7506 from level-energy difference.
		7588[a]		3285	$(1^-$ to $5^-)$		
		7674	26	3196.9	(2,3)		
		7799	32	3077.77	4^+		
		7871	74	2998.54	3^-		
		7891	26	2979.94	3^+		
		8080	47	2793.5	2^+		
		8134	42	2736.57	4^+		
		8568	26	2306.72	4^+		
		9073	47	1799.41	2^+		
		9881	100	991.54	2^+		
		10872[a]	5.3	0.0	0^+		
10906	(3^-)	6222	7.7	4684	$(1^-$ to $5^-)$		
		6541	12	4362.1	$(2,1,3)^+$		
		6601	15	4304.1	$(1^-$ to $5^-)$		
		6752	19	4156.53	5^-		
		7051	12	3853.27	5^+		
		7061	12	3850.5	$(\leq3)^{(+)}$		
		7621	12	3285	$(1^-$ to $5^-)$		
		7707	15	3196.9	(2,3)		

$^{64}_{30}Zn_{34}$-25

γ(^{64}Zn) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	Comments
10906	(3$^-$)	7832	19	3077.77	4$^+$		
		7904	58	2998.54	3$^-$		
		7924	12	2979.94	3$^+$		
		8113	19	2793.5	2$^+$		
		8167	12	2736.57	4$^+$		
		8601	15	2306.72	4$^+$		
		9106	38	1799.41	2$^+$		
		9914	100	991.54	2$^+$		
		10906[a]	3.9	0.0	0$^+$		
11023.4	(14$^-$)	563.3 *3*	100.0 *5*	10460.2	(13$^-$)	D	
		1074.7 *5*	24.3 *6*	9948.4	(12$^-$)		
		2720 *1*	1.68 *15*	8302.8	(12$^-$)		
11120	(2$^+$)	6560	≥6.1	4560			
		6650	≥5.3	4470	(0$^+$)		
		6700	≥3.4	4420	(4,3)$^+$		
		6740	≥2.6	4380			
		6750	≥5.3	4370	3$^-$		
		6760	≥2.5	4362.1	(2,1,3)$^+$		
		6800	3.4 *2*	4319.1	(4,3)$^+$		
		6810	≥1.9	4310			
		6860	≥6.7	4260			
		6910	9.9 *3*	4205.2	(4,3)$^+$		
		6960	6 *4*	4156.53	5$^-$		
		6980	≥2.3	4140	(2,1)$^+$		
		7010	≥1.1	4110	(2)$^+$		
		7040	1.5 *3*	4076.55	(5)$^+$		
		7080	11.5 *24*	4039.7	(0$^+$ to 4$^+$)		
		7100	4 *4*	4020.4	(2)$^+$		
		7170	1.29 *14*	3951.9	(4$^+$,3$^+$)		
		7220	10.6 *10*	3898.5	(2$^+$,3,4$^+$)		
		7268	≥2.5	3853.27	5$^+$		
		7270	9 *8*	3850.5	(≤3)$^{(+)}$		
		7300	11.0 *24*	3819.65	(0$^+$ to 4$^+$)		
		7320	6.2 *24*	3795.03	1$^+$		
		7400	≥6.7	3718.4	(0$^+$ to 4$^+$)		
		7420	9.5 *4*	3710.0	(2$^+$)		E_γ: 7410 from level-energy difference.
		7490	3.2 *13*	3628.4	(4)$^+$		
		7520	7 *5*	3597.24	(2$^+$,3,4$^+$)		
		7570	7 *5*	3552.3	4$^+$		
		7575	8 *6*	3545.9?	(0 to 3$^+$)		
		7660	13 *4*	3458.66	(2,3)		
		7670	≥1.8	3452.0	(1,2$^+$)		
		7690	8.6 *24*	3425.13	1$^+$		

$^{64}_{30}$Zn$_{34}$-26

$\gamma(^{64}Zn)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	Comments
11120	(2$^+$)	7750	29 *11*	3369.86	3$^+$		
		7755	16 *3*	3365.99	1$^+$		
		7820	37 *3*	3297.17	(2)$^+$		
		7860	15.3 *24*	3261.94	1		
		7910	32 *7*	3205.98	(3)$^+$		
		7920	3.5 *3*	3196.9	(2,3)		
		7930	13.4 *19*	3186.84	1$^+$		
		8020	25 *11*	3094.64	(3)$^+$		
		8040	20 *8*	3077.77	4$^+$		
		8110	25 *3*	3005.73	2$^+$		
		8120	35 *16*	2998.54	3$^-$		
		8140	36.4 *24*	2979.94	3$^+$		
		8330	37.0 *6*	2793.5	2$^+$		
		8380	19.6 *15*	2736.57	4$^+$		
		8510	6.5 *13*	2609.52	0$^+$		
		8810	36.8 *15*	2306.72	4$^+$		
		9210	27 *4*	1910.26	0$^+$		
		9320	57 *9*	1799.41	2$^+$		
		10130	100 *4*	991.54	2$^+$		
		11120	48 *3*	0.0	0$^+$		
11464	(15)	1792[a]		9666	(14)		
11626.4	(15$^-$)	603.0 *3*	100.0 *4*	11023.4	(14$^-$)	D	
		1166 *1*	51.0 *4*	10460.2	(13$^-$)	Q	
12335.7	(16$^-$)	709.5 *3*	100 *6*	11626.4	(15$^-$)		
		1312.5 *9*	88 *6*	11023.4	(14$^-$)		
12468	(16)	1003		11464	(15)		
13082.1	(17$^-$)	746.4 *3*	100.0 *5*	12335.7	(16$^-$)	D	
		1455.2 *5*	100 *6*	11626.4	(15$^-$)		
13324	(17)	856		12468	(16)		
		1860		11464	(15)		
13948.1	(18$^-$)	865.8 *5*	45.0 *5*	13082.1	(17$^-$)	D	I_γ: other: 122 *10* in (^{28}Si,4pγ) E=115 MeV.
		1613.3 *6*	100.0 *19*	12335.7	(16$^-$)	Q	
14391	(18)	1067		13324	(17)		
		1924		12468	(16)		
14862.5	(19$^-$)	914.5 *5*	97.1 *10*	13948.1	(18$^-$)	D	
		1779.6 *6*	100.0 *10*	13082.1	(17$^-$)	Q	
15423.6	(19)	561		14862.5	(19$^-$)		
		1032		14391	(18)		
		2099		13324	(17)		
15945.0	(20$^-$)	1082.1 *5*	45.8 *10*	14862.5	(19$^-$)		
		1997.4 *6*	100.0 *13*	13948.1	(18$^-$)	Q	
16686.8	(20)	742		15945.0	(20$^-$)		
		1263		15423.6	(19)		

$^{64}_{30}Zn_{34}$-27

Adopted Levels, Gammas (continued)

γ(^{64}Zn) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	Comments
16686.8	(20)	2296		14391	(18)		
17087.2	(21⁻)	1142.0 *5*	19 *4*	15945.0	(20⁻)		I_γ: other: 68 *16* in (^{28}Si,4pγ) E=115 MeV.
		2225.1 *10*	100.0 *18*	14862.5	(19⁻)	Q	
17853	(21)	769		17087.2	(21⁻)		
		1167		16686.8	(20)		
		2429		15423.6	(19)		
18483.3	(22⁻)	1395.6 *9*	28.4 *14*	17087.2	(21⁻)		
		2538.6 *10*	100.0 *20*	15945.0	(20⁻)	Q	
19365	(22)	2678		16686.8	(20)		
19775.6	(23⁻)	1292		18483.3	(22⁻)		
		2688.5 *10*	100 *5*	17087.2	(21⁻)	Q	
20657	(23)	2804		17853	(21)		
21297.5	(24⁻)	1523		19775.6	(23⁻)		
		2814 *1*	100 *4*	18483.3	(22⁻)		
22892.7	(25⁻)	3117 *1*	100	19775.6	(23⁻)		
24868.6	(26⁻)	3571 *1*		21297.5	(24⁻)		

† When a level is populated in two or more datasets, averages of values are taken where uncertainties are given. Additional comments are also provided for certain individual γ rays.

‡ From γ(θ) and/or γ(lin pol) in (α,nγ),(^{11}B,2npγ). (1980Si02,1978Si02). RUL (for E2 and M2) also used when $T_{1/2}$ known. Mult=Q (most likely E2) from ΔJ=2, quadrupole transition; mult=D or D+Q for ΔJ=1 (or in rare cases ΔJ=0), dipole or dipole+quadrupole transition. For some of the transitions, especially, for high-spin (J≥4) levels, multipolarities are also established in ^{51}V(^{16}O,p2nγ),^{59}Co(^{7}Li,2nγ) from γ(θ), γ(pol) and level lifetimes.

Ordering of 1314-1046-1583 cascade above the 4636, 7⁻ level is from (^{28}Si,4pγ) (2004Ka18 and 1997Fu08). Others: 1046-1314-1583 cascade in 1998Ga11, 1047-1582 cascade in 1994Cr05 with no 1314γ reported, only the 1046γ (placed above 4636, 7⁻ level) reported in (α,nγ),(^{11}B,2npγ) (1980Si02,1978Ne02).

@ 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.

& Multiply placed with intensity suitably divided.

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

$^{64}_{30}Zn_{34}$-28

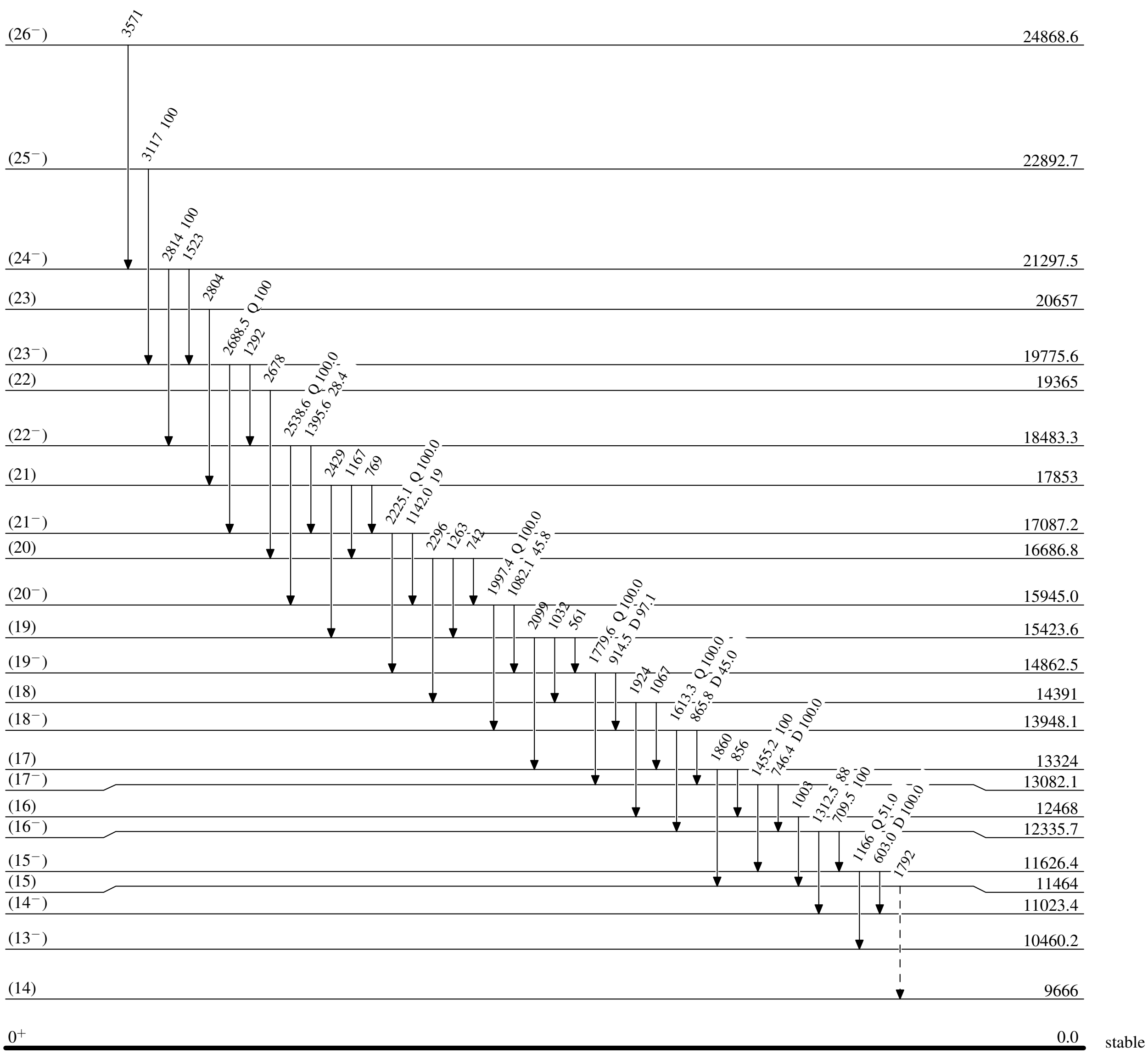
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

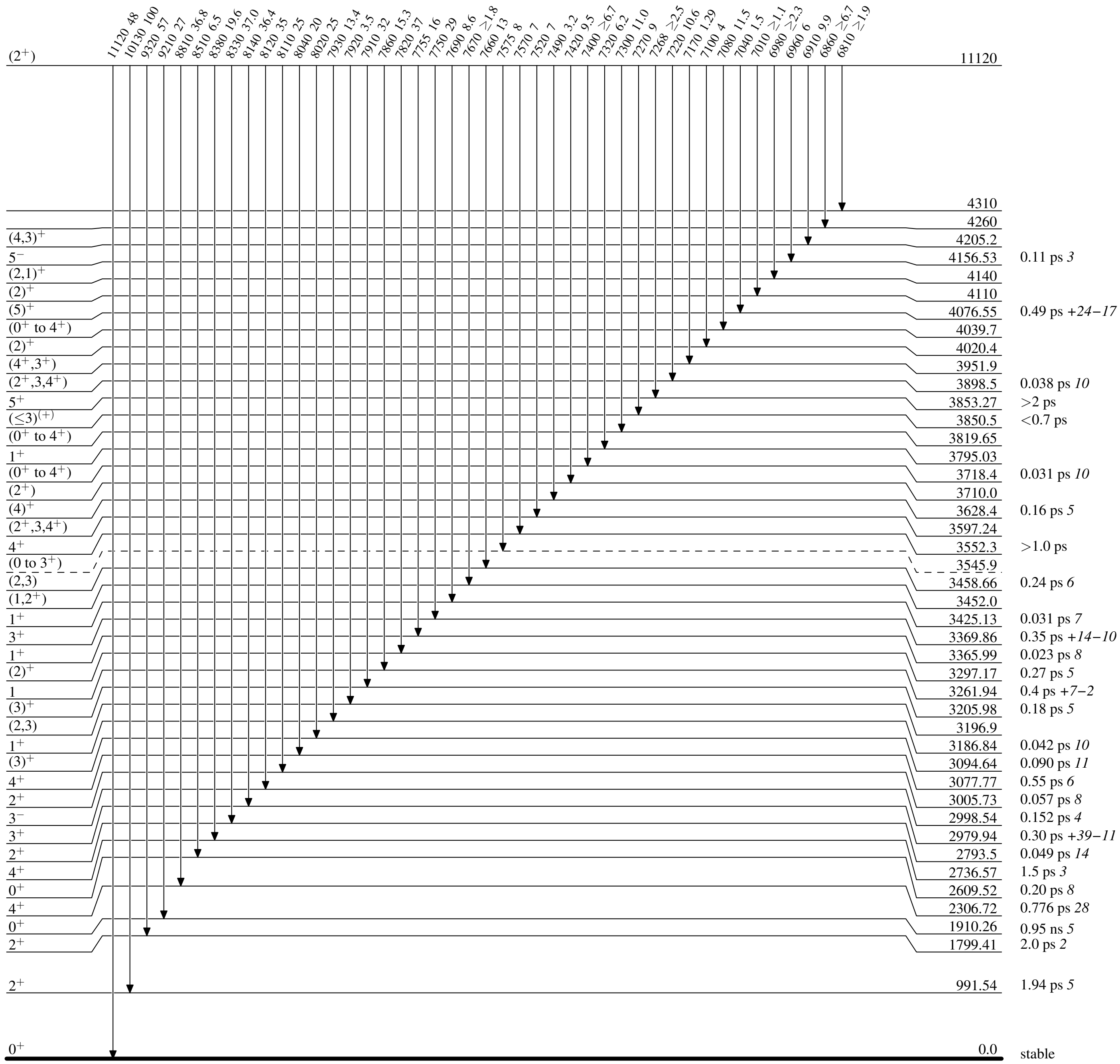


$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{64}_{30}Zn_{34}$

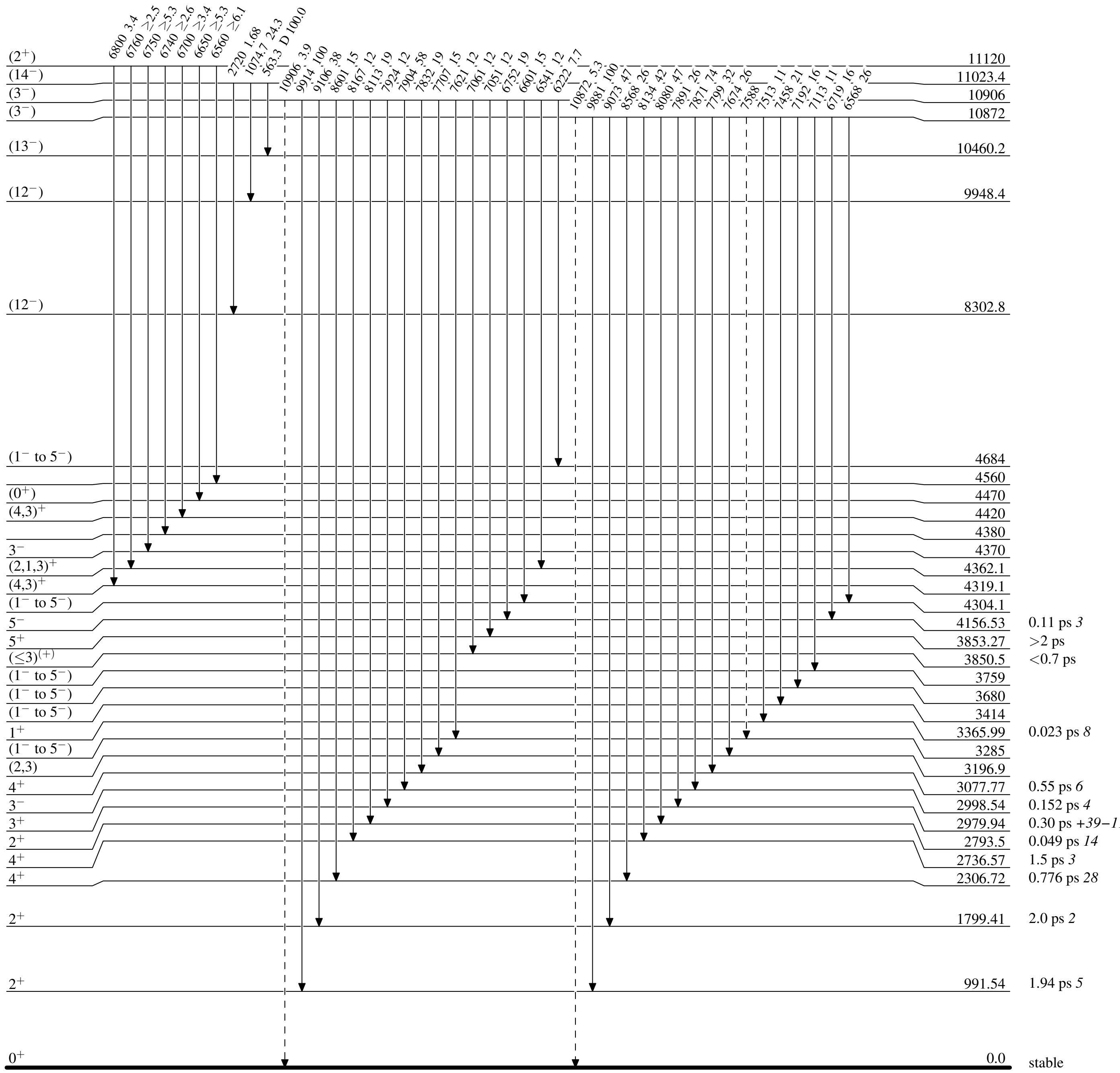
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

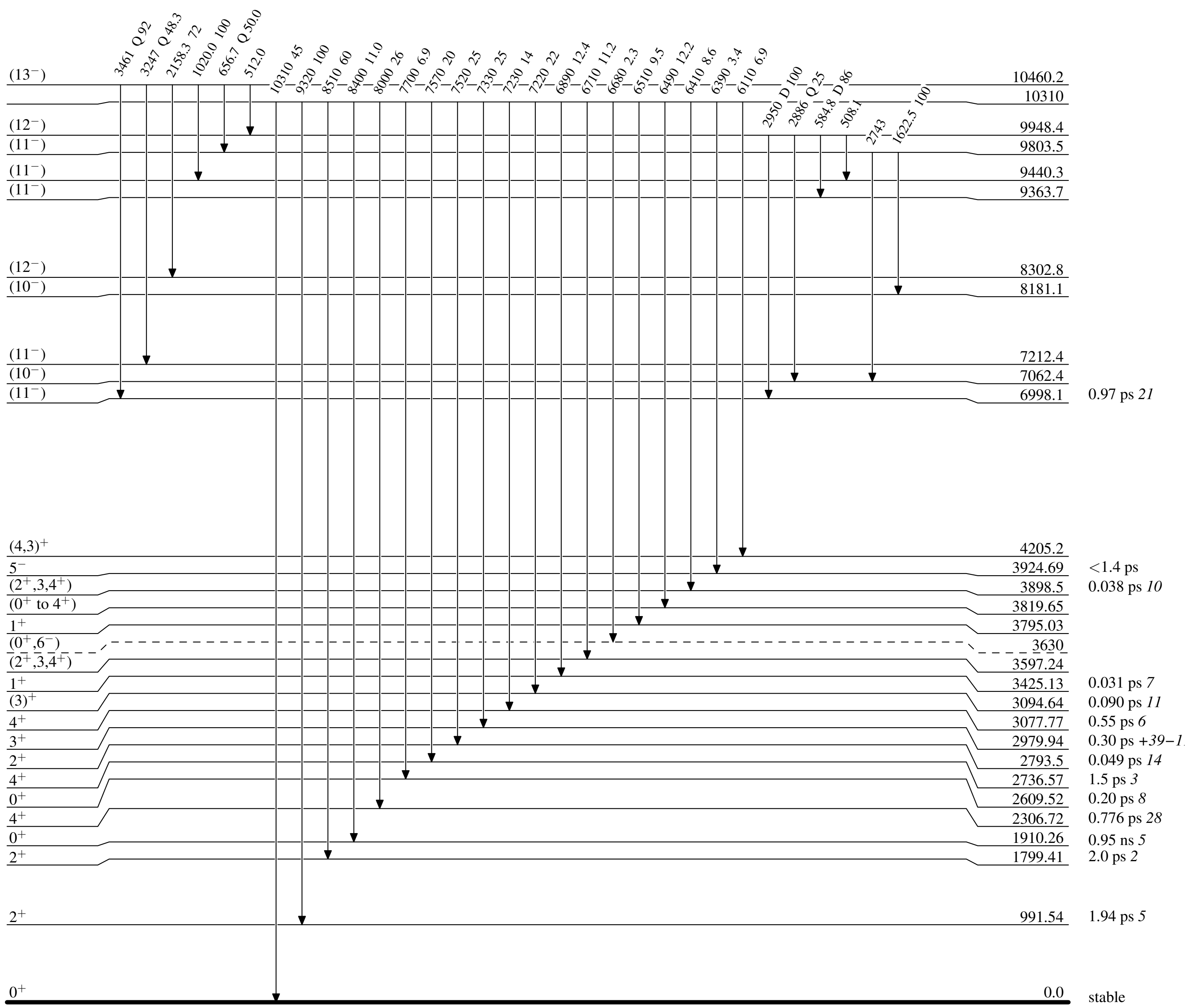


$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

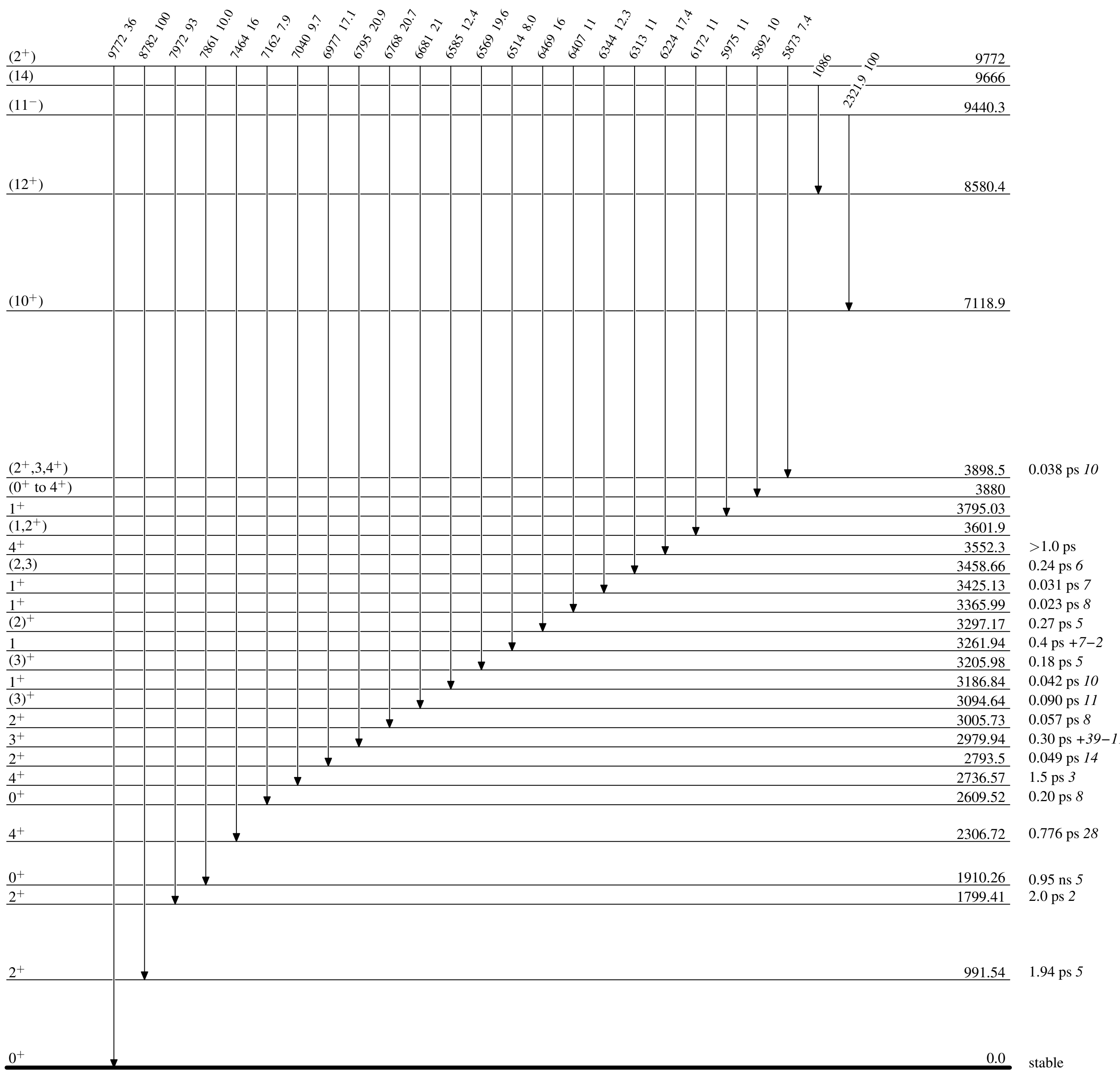


$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

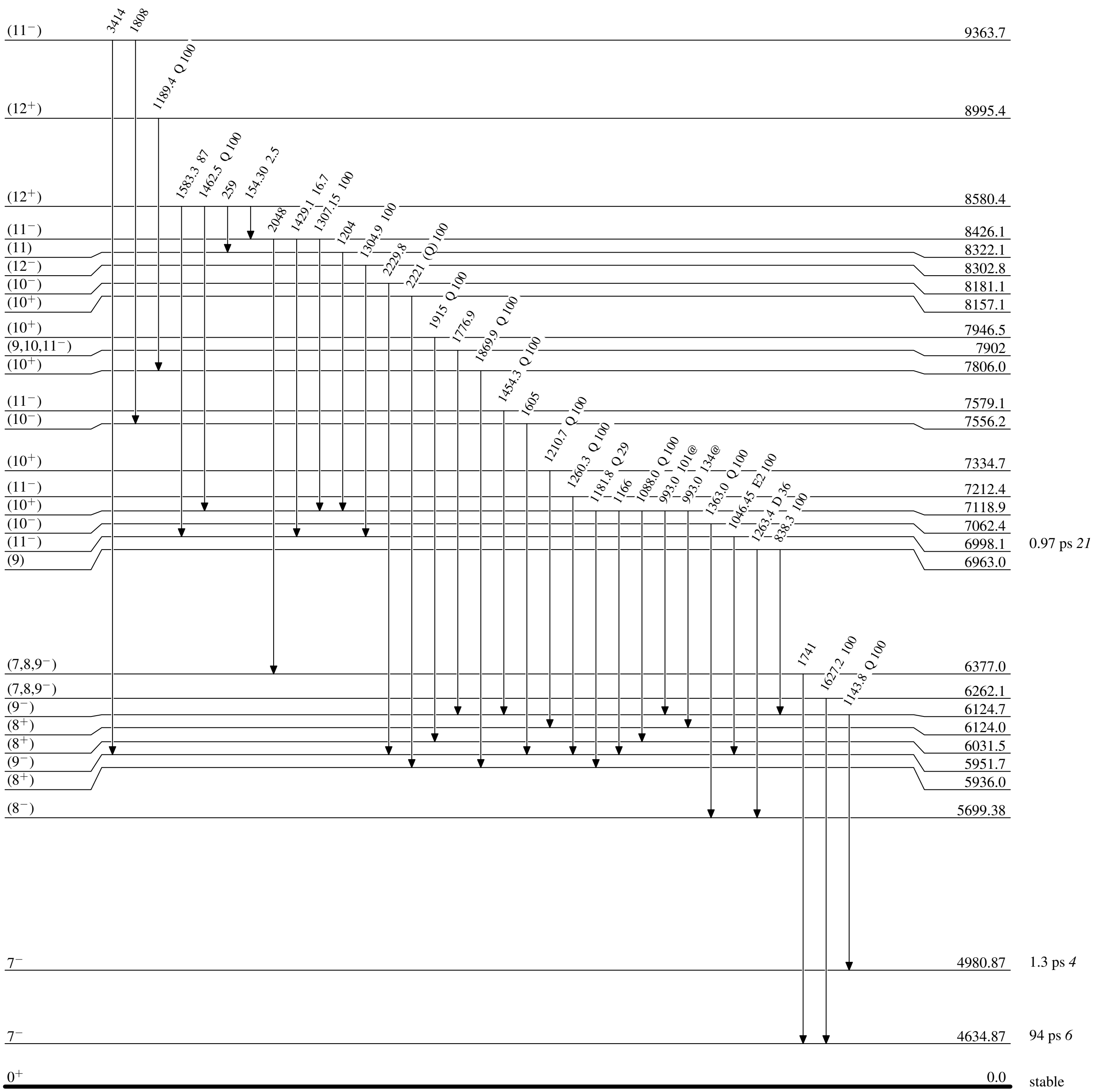


$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



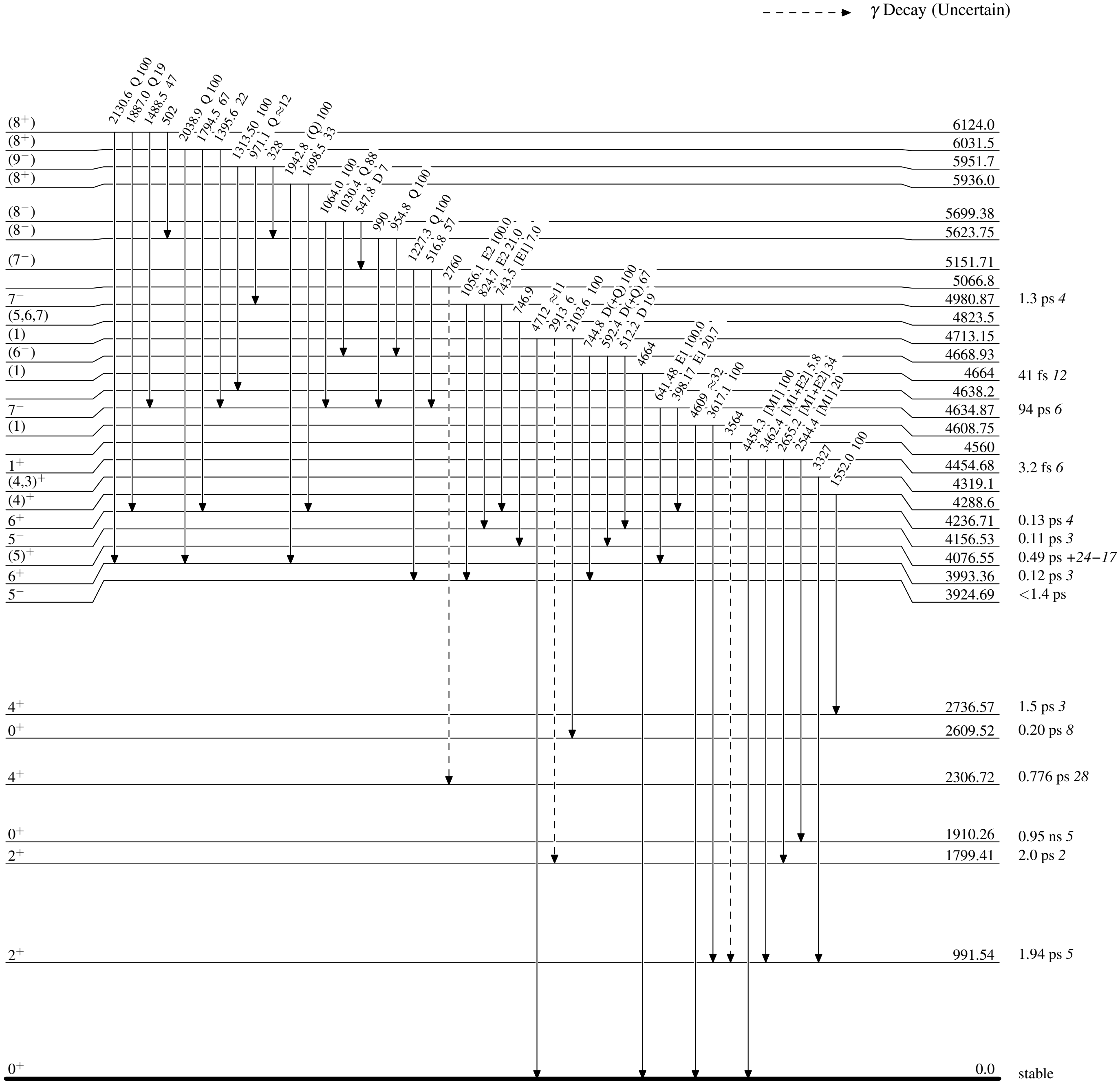
$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas

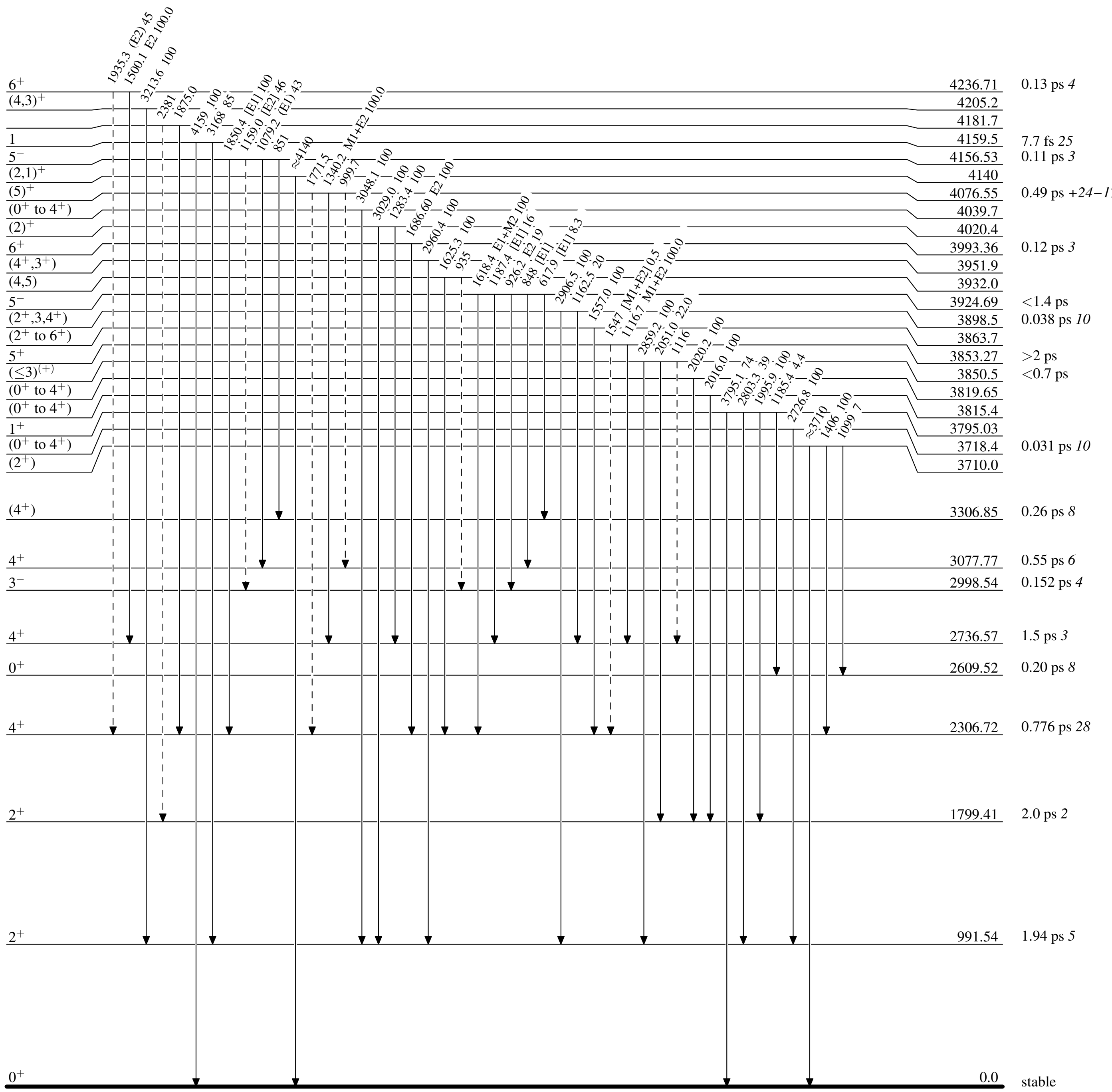
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

@ Multiply placed: intensity suitably divided

γ Decay (Uncertain)



$^{64}_{30}Zn_{34}$

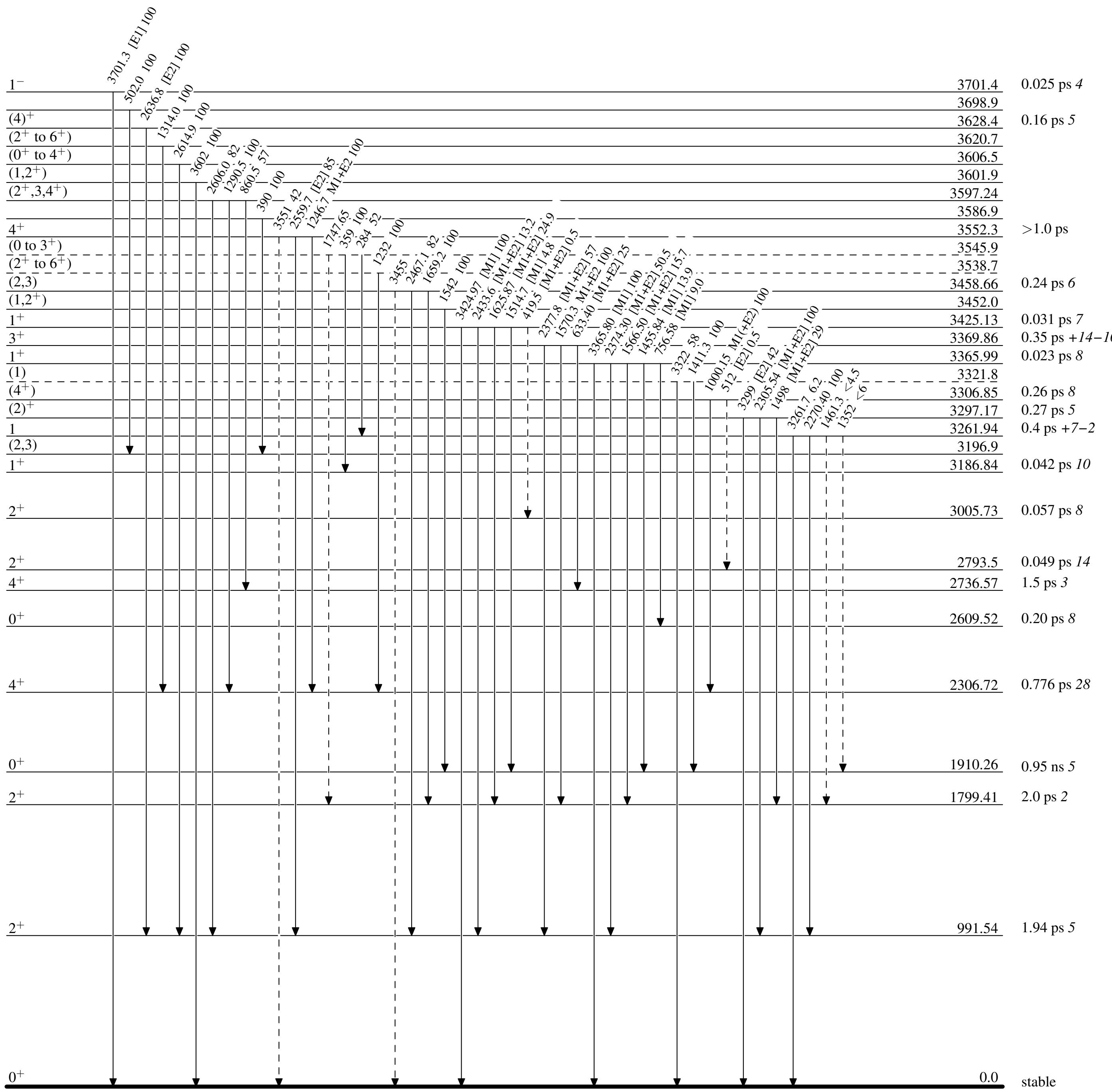
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

Legend

γ Decay (Uncertain)



$^{64}_{30}Zn_{34}$

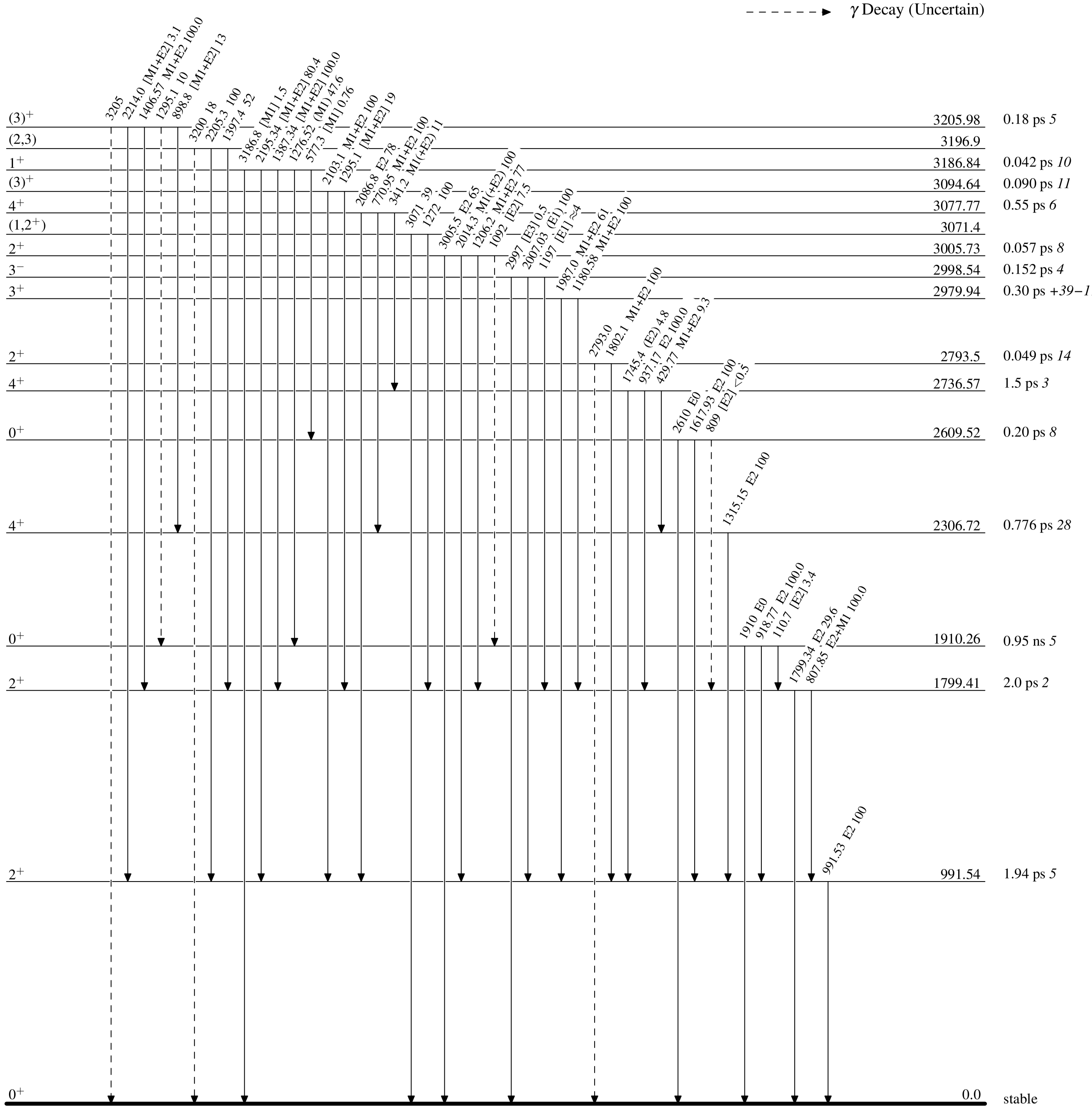
Adopted Levels, Gammas

Legend

Level Scheme (continued)

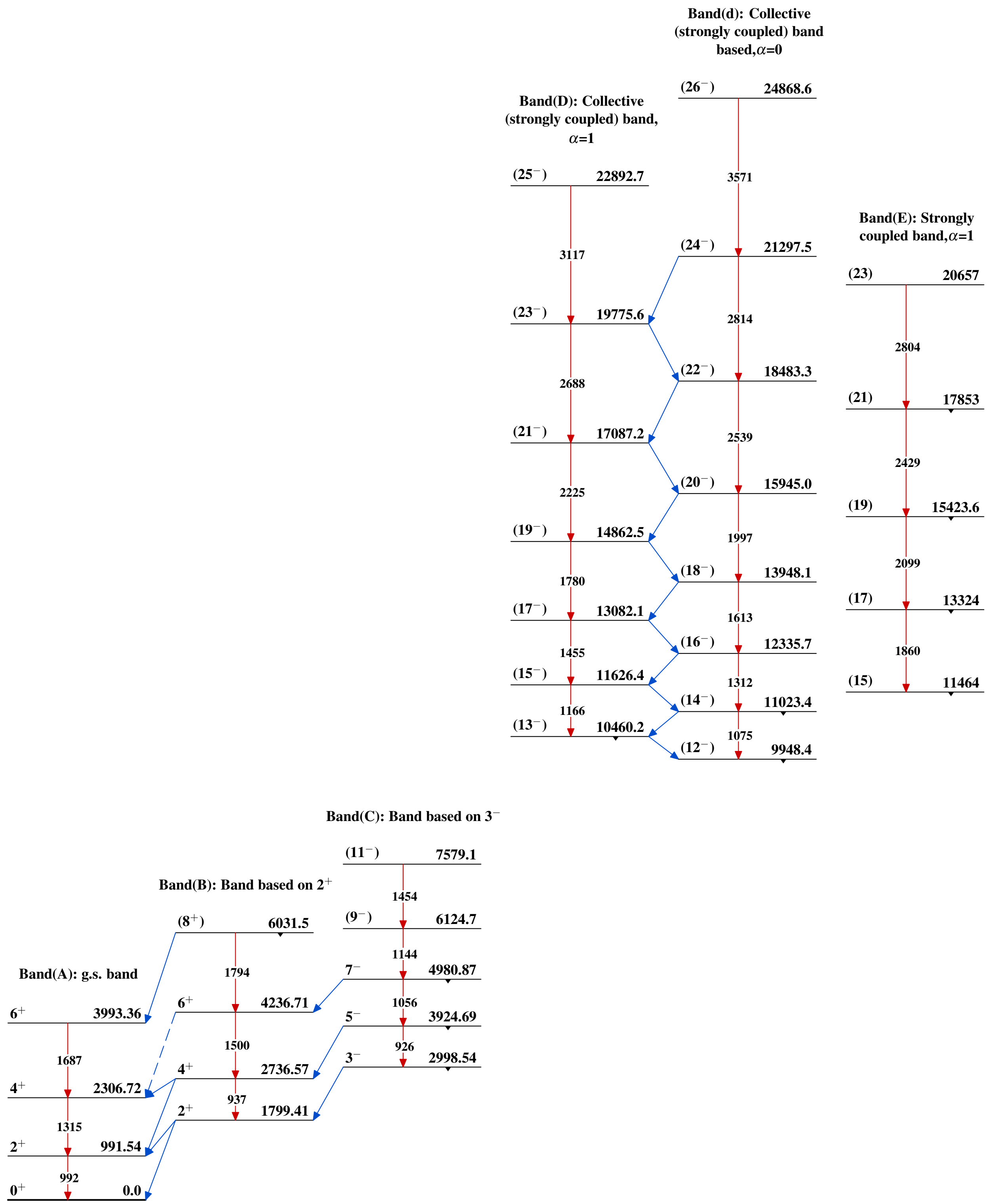
Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

- - - - - -▸ γ Decay (Uncertain)



$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas



$^{64}_{30}Zn_{34}$

Adopted Levels, Gammas (continued)