Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 115, 1 (2014)	31-Jul-2013

Q(β^-)=−2227.1 *5*; S(n)=10313.4 *19*; S(p)=6609.9 *15*; Q(α)=−4489.3 *14* 2012Wa38

^{69}Ga Levels

Cross Reference (XREF) Flags

A	^{69}Zn β^- decay (56.4 min)	G	^{71}Ga(p,t)	M	^{68}Zn(p,p′), (p,p), (p,n), IAR
B	^{69}Zn β^- decay (13.756 h)	H	^{68}Zn(^{3}He,d)	N	^{68}Zn(d,n)
C	^{69}Ge ε decay	I	^{69}Ga(γ,γ')	O	^{70}Ge(d,^{3}He), (pol d,^{3}He)
D	^{66}Zn(α,pγ), (α,p)	J	^{69}Ga(n,n′γ)	P	^{69}Ga(α,$\alpha'\gamma$)
E	^{68}Zn(p,γ)	K	Coulomb excitation		
F	^{64}Ni(^{7}Li,2nγ)	L	^{69}Ga(p,p′γ)		

E(level)[†]	J$^\pi$	T$_{1/2}$[c]	XREF	Comments
0.0	3/2$^-$	stable	ABCDEFGHIJKLMNOP	μ=+2.01659 *5* (1954Wa37) Q=+0.171 *11* (2010Ch16) J$^\pi$: from collinear laser spectroscopy (2010Ch16) and optical spectroscopy (1976Fu06), π from L(p,t)=0. μ,Q: from resonance cell laser spectroscopy. Others compiled by 2011StZZ.
318.706 *21*	1/2$^-$	<70 ps	A CDE GHIJKL NO	B(E2)↑=0.0068 *4* J$^\pi$: from $\gamma(\theta)$ in ^{69}Ga(n,n′γ), π from L(p,t)=2. B(E2): from Coul. ex. T$_{1/2}$: by pulsed beam delayed coincidences in Coul. ex. Others:<97 ps from ^{69}Ga(p,p′γ);<330 ps from B(E2) and δ<0.6.
574.220 *22*	5/2$^-$	1.7 ps *7*	BCDEFGHIJKL NOP	B(E2)↑=0.00072 *12* XREF: G(?). B(E2): from Coul. ex. J$^\pi$: from $\gamma(\theta)$ in ^{69}Ga(p,p′γ), π from L(d,n)=3. T$_{1/2}$: from DSA in ^{69}Ga(α,$\alpha'\gamma$). Others: 12.8 ps *+17−13* from ^{69}Ga(γ,γ'); 6.8 ps *+44−31* from B(E2).
872.147 *22*	3/2$^-$	0.250[&] ps *21*	A CDE GHIJKL NO	B(E2)↑=0.0068 *17* B(E2): from Coul. ex. J$^\pi$: from $\gamma(\theta)$ in ^{69}Ga(n,n′γ), π from L(p,t)=0. T$_{1/2}$: Others: 0.22 ps *5* from Coul. ex.; 0.28 ps *5* from ^{69}Ga(γ,γ'); 0.27 ps *+32−17* from B(E2).
1028.59 *4*	1/2$^-$	1.2[&] ps *10*	DE GHIJKL NOP	B(E2)↑=0.0029 *8* B(E2): from Coul. ex. J$^\pi$: from $\gamma(\theta)$ and γ yields in ^{69}Ga(p,p′γ) and yield in (n,n′γ), π from L(p,t)=2. T$_{1/2}$: Inconsistent with <0.11 ps from (α,pγ) but consistent with > 0.53 ps from (γ,γ').
1107.04 *4*	5/2$^-$	0.222[&] ps *21*	CDEFG IJKL OP	B(E2)↑=0.031 *3* J$^\pi$: from $\gamma(\theta)$ in ^{69}Ga(p,p′γ), π from L(p,t)=2. B(E2): from Coul. ex. T$_{1/2}$: Others: 0.24 ps *7* from ^{69}Ga(α,$\alpha'\gamma$); 0.23 ps *3* from ^{69}Ga(p,p′γ), 0.22 ps *3* from ^{64}Ni(^{7}Li,2nγ); 0.240 ps *+19−18* from (γ,γ'); 0.15 ps *4* from DSA in Coulomb ex.; 0.15 ps *3* from B(E2).
1134 *15*			N	
1336.69 *3*	7/2$^-$	1.18[a] ps *6*	CDEFGHIJKL NOP	B(E2)↑=0.033 *5*

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Adopted Levels, Gammas (continued)

^{69}Ga Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[c]	XREF	Comments
				J^π: from $\gamma(\theta)$ in ^{69}Ga(p,p′γ), π from L(p,t)=2 1.4 *7*. B(E2): from Coul. ex. $T_{1/2}$: Others: 1.4 ps *7* from ^{69}Ga(p,p′γ); 1.04 ps *+14−35* from ^{64}Ni(^{7}Li,2nγ) ; 0.76 ps *13* from DSA in Coul. ex.; 0.76 ps *+14−10* from B(E2).
1488.07 *4*	7/2$^-$	1.9[a] ps *+10−5*	CDEFG IJ L NO	J^π: from $\gamma(\theta)$ in ^{69}Ga(p,p′γ), and π from L(p,t)=2. E(level): possible doublet in ^{68}Zn(d,n).
1525.76 *4*	3/2$^-$	≥0.55[#] ps	C E GHIJ L	J^π: from $\gamma(\theta)$ and γ yields in ^{69}Ga(n,n′γ), π from L(p,t)=0.
1723.71 *4*	5/2$^-$	0.15[b] ps *+12−6*	C E GHIJ NO	J^π: from $\gamma(\theta)$ in ^{69}Ga(n,n′γ), and π from L(d,n)=3. $T_{1/2}$: others: 0.40 ps *+18−10* from ^{69}Ga(γ,γ'),≥0.97 ps from DSAM in ^{68}Zn(p,γ).
1764.78 *4*	9/2$^-$	0.83[@] ps *14*	DEFG J	J^π: from $\gamma(\theta)$ and γ yields in ^{69}Ga(n,n′γ) and ^{66}Zn(α,pγ); γ to 5/2$^-$. $T_{1/2}$: other: 0.38 ps *+69−19* from DSAM in ^{69}Ga(n,n′γ).
1891.64 *6*	3/2$^-$	22 fs *3*	C E GHIJ O	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), and π from L(p,t)=2. $T_{1/2}$: weighted average of 20 fs *3* from ^{69}Ga(γ,γ'), 20 fs *10* from DSAM in ^{69}Ga(n,n′γ), and 29 fs *6* from DSAM in ^{68}Zn(p,γ).
1924.25 *4*	7/2$^-$	≥0.62[#] ps	C E G IJ O	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), and π from L(d,^{3}He)=3.
1972.37 *5*	9/2$^{(+)}$	≥2.8[@] ps	DEF H J NO	J^π: from $\gamma(\theta)$ in ^{69}Ga(n,n′γ), and π from L(d,^{3}He)=4+1 at 1970 *7* (doublet).
1973.08 *6*	(1/2)$^-$	97[#] fs *28*	E GHIJ	XREF: I(?). J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), π from L(p,t)=2 at 1976 *2*. E(level): unresolved doublet at 1971 *15* in ^{68}Zn(^{3}He,d).
2007.66 *5*	3/2$^{(-)}$,5/2$^{(-)}$	0.35[#] ps *+21−10*	E H J	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), L(^{3}He,d)=(1) gives π=(−1) and prefers J=3/2. $T_{1/2}$: others: 0.20 ps *+11−6* from ^{69}Ga(n,n′γ).
2023.91 *9*	5/2$^-$	0.175[a] ps *19*	C E GHIJ	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), π from L(p,t)=2. $T_{1/2}$: Others: 0.19 ps *+8−5* from DSAM in ^{68}Zn(p,γ) and 0.173 ps *+13−11* in ^{69}Ga(γ,γ').
2045.24 *8*	5/2$^-$	111[#] fs *14*	C E GHIJ	XREF: H(?). J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), π from L(p,t)=2. $T_{1/2}$: other: 29 fs *12* from DSAM in ^{69}Ga(n,n′γ), 40 fs *7* in ^{69}Ga(γ,γ').
2197 *4*	[f]		hI	
2219.29 *19*	[f]	≥0.21[#] ps	E h	
2250.99 *10*	(1/2,3/2)$^-$	0.10[#] ps *+5−3*	E G J O	J^π: 1/2 preferentially from $\gamma(\theta)$ in ^{69}Ga(n,n′γ); (3/2) from $\gamma(\theta)$ in ^{68}Zn(p,γ); π from L(p,t)=2 If 3/2$^-$, one would expect and L=0 component, however the isotropic $\gamma(\theta)$ rules out 3/2. $T_{1/2}$: other: 0.033 ps *15* from DSAM in ^{69}Ga(n,n′γ).
2319.55 *20*	(5/2$^+$,7/2$^+$)	1.04[@] ps *21*	EFG	J^π: from $\gamma(\theta)$ and yield ratio in ^{64}Ni(^{7}Li,2nγ); π from L(p,t)=(3). $T_{1/2}$: other:≥0.21 ps from DSAM in ^{68}Zn(p,γ).
2353.30 *24*	5/2	≥0.17[#] ps	E G I	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ).
2423.29 *7*			iJ	
2428.68 *21*	5/2$^-$,7/2$^-$	≥1.7[@] ps	FG i O	J^π: from $\gamma(\theta)$ and yield ratio in ^{64}Ni(^{7}Li,2nγ); π from L(p,t)=4.
2458.84 *11*	7/2$^{(-)}$	0.15 ps *+19−6*	E G I O	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), π from L(d,^{3}He)=(3). $T_{1/2}$: from DSAM in ^{68}Zn(p,γ).

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Adopted Levels, Gammas (continued)

^{69}Ga Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[c]	XREF	Comments
2485.70 *10*	$5/2^+$	70[#] fs *+50−30*	E GHI	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), π from L(^{3}He,d)=2.
2529.81 *9*	$(3/2)^-$	76[#] fs *21*	E GH	J^π: from $\gamma(\theta)$ in ^{68}Zn(p,γ), π from L(^{3}He,d)=1.
2560 *3*	$(7/2)^-$		O	J^π: from L(pol d,^{3}He)=3.
2564.3 *8*			E hI NO	E(level): possible doublet. J=(1/2,3/2) favored by γ decay modes in ^{69}Ga(γ,γ') for possible level at 2565 *4*; J^π=7/2$^+$,9/2$^+$ from L(^{3}He,d)=4 for level at 2564 *30*. J^π=5/2$^-$,7/2$^-$ from L(d,^{3}He)=3 for level at 2560 *3*.
2572.54 *21*	$9/2^+$		EF H n	J^π: 5/2,9/2 from $\gamma(\theta)$ and yield ratio in ^{64}Ni(^{7}Li,2nγ); J^π=7/2$^+$,9/2$^+$ from L(^{3}He,d)=4 for level at 2564 *30*.
2573 *5*	$3/2^-$		G I n	J^π: from L(p,t)=0.
2600 *5*	$^-$		G	J^π: L(p,t)=4.
2614 *5*	$^-$		G	J^π: L(p,t)=2.
2660.3 *18*	$3/2^-$		D GHI N	J^π: from $\gamma(\theta)$ in ^{69}Ga(γ,γ'), π from L(p,t)=2.
2668.28 *6*	11/2	≥1.7[@] ps	F	J^π: J=9/2,11/2 from $\gamma(\theta)$ and yield ratio in ^{64}Ni(^{7}Li,2nγ); γ from (15/2) makes J=9/2 unlikely.
2680 *3*	$5/2^-,7/2^-$		O	J^π: L(d,^{3}He)=3.
2717.99 *5*	$13/2^{(+)}$	≥1.4[@] ps	D FG J	J^π: from $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ); π from probable E2 to $9/2^{(+)}$.
2749 *5*	$1/2^-,3/2^-$		GH	J^π: L(p,t)=2, L(^{3}He,d)=1.
2766 *3*			G I	XREF: G(?).
2789 *30*	$1/2^-$		H	J^π: L(^{3}He,d)=1.
2795.0 *5*	$(7/2)^-$		FGHI	J^π: L(p,t)=2; γ to $9/2^{(+)}$.
2847 *3*	$^+$		G I	J^π: L(p,t)=3.
2860 *5*			I	
2932 *15*	$3/2^+,5/2^+$		H N	J^π: L(d,n)=2, L(^{3}He,d)=2.
2965 *3*	$^-$		G I	J^π: L(p,t)=4.
2978.8 *22*	$^-$		G I	J^π: L(p,t)=2.
2995 *5*			G	
3052 *3*	3/2,7/2		G I	J^π: from $\gamma(\theta)$ in ^{69}Ga(γ,γ').
3077 *4*	$5/2^+$		HI N	J^π: from $\gamma(\theta)$ in ^{69}Ga(γ,γ'); π from L(^{3}He,d)=2 at 3089 *30*.
3098 *5*	$^-$		G	J^π: L(p,t)=4.
3118.39 *17*	$11/2^-$	0.24[@] ps *5*	FG	J^π: from $\gamma(\theta)$ and yield ratio in ^{64}Ni(^{7}Li,2nγ); π from M1+E2 to $9/2^-$.
3135 *5*			G	
3192 *5*	$(^-)$		G	J^π: L(p,t)=(2).
3203 *4*	$(3/2^-)$		G I	J^π: L(p,t)=(0).
3211 *5*			GHI	
3240 *5*	$^-$		G	J^π: L(p,t)=4.
3242.44 *7*	$13/2^-$	0.5[@] ps *3*	F	J^π: $\gamma(\theta)$ give J=9/2 or 13/2 and γ yields give 11/2 or 13/2 in ^{64}Ni(^{7}Li,2nγ); π from E2 to $9/2^-$.
3283 *6*	$3/2^-$		G I	J^π: L(p,t)=0(+2).
3299 *5*	$^-$		G	J^π: L(p,t)=2.
3319 *6*	7/2		GHI	J^π: from $\gamma(\theta)$ in ^{69}Ga(γ,γ'); π=− from L(p,t)=2 disagrees with π=+ from L(^{3}He,d)=2.
3328 *5*	$^-$		G	J^π: L(p,t)=2.
3358 *30*	$3/2^+,5/2^+$		H	J^π: L(^{3}He,d)=2.
3371 *5*	$3/2^-$		G	J^π: L(p,t)=0(+2).
3389.33 *10*	$(15/2^+)$	1.9[@] ps *10*	F	J^π: $\gamma(\theta)$ consistent with J=11/2,13/2 or 15/2 and yields suggest J=15/2 or 17/2 in ^{64}Ni(^{7}Li,2nγ); M1+E2 transition to 13/2 rules out 17/2.
3490 *5*	$^-$		G N	J^π: L(p,t)=4.
3542.76 *10*	$11/2^{(+)}$	0.42[@] ps *7*	F	J^π: $\gamma(\theta)$ gives J=11/2 or 15/2 and yields give J<13/2 in ^{64}Ni(^{7}Li,2nγ); π from M1+E2 to $13/2^{(+)}$.

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Adopted Levels, Gammas (continued)

^{69}Ga Levels (continued)

E(level)[†]	J^{π}	$T_{1/2}$[c]	XREF	Comments
3578 *5*	−		G	J^{π}: L(p,t)=2.
3633.95 *7*	17/2$^{(+)}$	1.4[@] ps *7*	F	J^{π}: $\gamma(\theta)$ gives J=17/2 or 13/2 and yields give J≥17/2 in ^{64}Ni(^{7}Li,2nγ); π from E2 to 13/2$^{(+)}$.
3655 *5*	−		G	J^{π}: L(p,t)=2.
3693 *5*			G	
3722.30 *8*	(11/2,13/2)	1.6[@] ps *3*	F	J^{π}: $\gamma(\theta)$ consistent with J=11/2, 13/2 and 15/2; yields consistent with J=9/2,11/2 or 13/2 in ^{64}Ni(^{7}Li,2nγ).
3757 *5*	3/2^{-}		GH	J^{π}: L(p,t)=0.
3786.07 *12*	(15/2)	1.04[@] ps *21*	F	J^{π}: from $\gamma(\theta)$ and yield in ^{64}Ni(^{7}Li,2nγ).
3795 *5*	($^{-}$)		G	J^{π}: L(p,t)=(2).
3803 *30*	1/2^{+}		H	J^{π}: from L(^{3}He,d)=0.
3881 *5*	−		G	J^{π}: L(p,t)=2.
3928 *5*	($^{-}$)		G	J^{π}: L(p,t)=(2).
3950 *5*			G	
3966 *5*			G	
3993 *5*	[g]		GH	XREF: H(?).
4032 *5*	−[g]		GH	XREF: H(?). J^{π}: L(p,t)=2.
4078.20 *10*	(15/2)$^{-}$	0.55[@] ps *10*	F	J^{π}: $\gamma(\theta)$ consistent with J=11/2, 13/2 or 15/2; yield ratios favor J=15/2 or 17/2 in ^{64}Ni(^{7}Li,2nγ); π from M1+E2 to 13/2^{-}.
4106 *5*			G	
4115 *30*	1/2^{+}		H	J^{π}: L(^{3}He,d)=0.
4152 *30*	1/2^{+}		H	J^{π}: L(^{3}He,d)=0.
4160 *5*			G	
4190 *30*	1/2^{+}		H	J^{π}: L(^{3}He,d)=0.
4191 *5*			G	
4251 *5*	3/2^{-}		G	J^{π}: L(p,t)=0.
4253 *30*	(1/2^{+})		H	J^{π}: L(^{3}He,d)=(0).
4291 *5*			G	
4321 *30*	(1/2^{+})		H	J^{π}: L(^{3}He,d)=(0).
4430 *30*			H	
4528.10 *14*	(17/2,19/2)	≥2.8[@] ps	F	J^{π}: $\gamma(\theta)$ give J=11/2 to 19/2; yield ratios give J≥17/2 in ^{64}Ni(^{7}Li,2nγ).
4533 *30*	(1/2^{+})		H	J^{π}: L(^{3}He,d)=(0).
4830 *30*	1/2^{+}		H	J^{π}: L(^{3}He,d)=0.
6874.2 *16*	1/2	<10 fs	I	J^{π}: from $\gamma(\theta)$ in ^{69}Ga(γ,γ'). $T_{1/2}$: from Γ in ^{69}Ga(γ,γ') with the assumption J=1/2.
7306.9 *7*	5/2^{+}	4.3 fs *+11−7*	I	J^{π}: from $\gamma(\theta)$ and π from linear polarization measurement in (γ,γ'). $T_{1/2}$: from Γ in ^{69}Ga(γ,γ') with J=5/2.
9813.6[‡] *6*		1.5×10^{-2} as *5*	E M	
10247.8[‡] *7*			E	
10251.7[‡] *8*			E	
10256.8[‡] *7*			E	
10586	(3/2^{-})[e]	9.1×10^{-1} as	M	
10597		1.8×10^{-1} as	M	
10621	3/2^{-}[d]	1.5×10^{-2} as	M	
10655	(5/2^{+})[d]	1.5×10^{-2} as	M	
10686	(5/2^{+})[e]	1.8×10^{-1} as	M	
10698	(5/2^{+})[e]	1.8×10^{-1} as	M	
10717	(5/2^{+})[e]	1.8×10^{-1} as	M	

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Adopted Levels, Gammas (continued)

^{69}Ga Levels (continued)

E(level)[†]	J^{π}	$T_{1/2}$[c]	XREF
11404	5/2+[d]	1.5×10^{-2} as	M
11483	1/2+[d]	7.6×10^{-3} as	M
11601	(1/2−)[d]	1.5×10^{-2} as	M
12028	1/2+[d]	1.1×10^{-2} as	M
12178	5/2+[d]	1.5×10^{-2} as	M
12331	5/2+[d]	1.5×10^{-2} as	M
12434	1/2+[d]	9.1×10^{-2} as	M

† From least squares fit to Eγ data and from reaction data.
‡ From E(level) difference.
\# From DSAM in ^{68}Zn(p,γ).
@ From DSAM in ^{64}Ni(^{7}Li,2nγ).
& From DSAM in ^{69}Ga(p,p′γ).
a From ^{69}Ga(γ,γ′).
b From DSAM in ^{69}Ga(n,n′γ).
c From total Γ in ^{68}Zn(p,p′) for E>9800 or as indicated otherwise.
d From σ(E) and pγγ(θ) in ^{68}Zn(p,p′).
e From Breit-Wigner analysis of data in ^{68}Zn(p,p′).
f Possible J^{π}=1/2+ level from L(^{3}He,d)=0 at 2220 *30*. J^{π}(2219)=(1/2,3/2) from γ(θ) in (p,γ).
g L(^{3}He,d)=1 at 4021 *30*.

$\gamma(^{69}$Ga)

E_i(level)	J^π_i	E_γ	I_γ[†]	E_f	J^π_f	Mult.	δ	α[jn]	Comments
318.706	1/2⁻	318.71 *3*	100	0.0	3/2⁻	M1+E2[g]	<0.24	0.00374 *18*	α(K)=0.00334 *16*; α(L)=0.000344 *17*; α(M)=5.03×10^{-5} *24* α(N)=2.70×10^{-6} *12* B(M1)(W.u.)>0.0092 δ: from B(E2) in Coulomb excitation and $T_{1/2}$; 0.53 *10* from α(exp) in ^{69}Ge ε decay. B(E2)(W.u.)=8.1 *5* from B(E2) in Coulomb excitation.
574.220	5/2⁻	255.4 *5*	0.19 *6*	318.706	1/2⁻				
		574.20 *3*	100 *8*	0.0	3/2⁻	M1+E2[#]	−0.06[@] *1*	9.13×10^{-4}	B(M1)(W.u.)=0.07 *3*; B(E2)(W.u.)=1.1 *7* α(K)=0.000817 *12*; α(L)=8.30×10^{-5} *12*; α(M)=1.215×10^{-5} *17* α(N)=6.58×10^{-7} *10* δ: 0.030 *9* from B(E2) in Coulomb excitation and $T_{1/2}$. B(E2)(W.u.)=0.29 *5* from B(E2) in Coulomb excitation.
872.147	3/2⁻	298.3 *5*	0.21 *6*	574.220	5/2⁻				
		553.43 *4*	5.8 *4*	318.706	1/2⁻	(M1(+E2))	+0.00[c] *3*	9.90×10^{-4}	α(K)=0.000886 *13*; α(L)=9.00×10^{-5} *13*; α(M)=1.317×10^{-5} *19* α(N)=7.13×10^{-7} *10* B(M1)(W.u.)=(0.027 *4*)
		872.14 *3*	100 *8*	0.0	3/2⁻	M1+E2[e]	−0.13[f] *4*	3.71×10^{-4}	B(M1)(W.u.)=0.118 *16*; B(E2)(W.u.)=4.0 *25* α(K)=0.000332 *5*; α(L)=3.35×10^{-5} *5*; α(M)=4.91×10^{-6} *7* α(N)=2.66×10^{-7} *4* δ: 0.13 *4* from B(E2) in Coulomb excitation and $T_{1/2}$. B(E2)(W.u.)=4.1 *10* from B(E2) in Coulomb excitation.
1028.59	1/2⁻	454.4 *10*	≤4.3	574.220	5/2⁻	[d]			
		709.84 *5*	100 *5*	318.706	1/2⁻	(M1)[d]		5.73×10^{-4}	B(M1)(W.u.)=0.030 *+158−15* α(K)=0.000513 *8*; α(L)=5.19×10^{-5} *8*; α(M)=7.59×10^{-6} *11* α(N)=4.12×10^{-7} *6*
		1028.63 *6*	61 *4*	0.0	3/2⁻	M1+E2	0.79	2.78×10^{-4}	α(K)=0.000249 *4*; α(L)=2.52×10^{-5} *4*; α(M)=3.68×10^{-6} *6* α(N)=1.99×10^{-7} *3* B(M1)(W.u.)=0.004 *4*; B(E2)(W.u.)=3 *3* Mult.: from $\gamma(\theta)$ in ^{69}Ga(p,p′γ) and RUL. δ: 0.79 from B(E2) in Coulomb excitation and $T_{1/2}$. B(E2)(W.u.)=3.4 *10* from B(E2) in Coulomb excitation.
1107.04	5/2⁻	234.90 *6*	1.02 *8*	872.147	3/2⁻	M1+E2[i]	−0.12 *6*	0.0078 *4*	α(K)=0.0070 *4*; α(L)=0.00073 *4*; α(M)=0.000106 *6* α(N)=5.7×10^{-6} *3* B(M1)(W.u.)=0.072 *9*; B(E2)(W.u.)=3.E+1 *3* δ: From $\gamma\gamma(\theta)$ (1975Pa22) with δ(872γ) taken as −0.11.
		532.66 *10*	0.75 *6*	574.220	5/2⁻	(M1+E2)[h]		0.0014 *4*	B(M1)(W.u.)=0.0023 *3*; B(E2)(W.u.)=12.5 *15*

$^{69}_{31}Ga_{38}$-6

γ(^{69}Ga) (continued)

E_i(level)	J^{π}_i	E_γ	I_γ[†]	E_f	J^{π}_f	Mult.	δ	α[jn]	Comments
									α(K)=0.0013 *4*; α(L)=0.00013 *4*; α(M)=1.9×10^{-5} *5* α(N)=1.02×10^{-6} *25* δ: +0.00 *5* or −1.65 *20*.
1107.04	5/2$^-$	788.16 *7*	0.95 *8*	318.706	1/2$^-$				I_γ: Iγ=2.0 *4* in (n,n′γ).
		1107.01 *6*	100	0.0	3/2$^-$	M1+E2[a]	+0.32[b] *2*	2.30×10^{-4}	B(M1)(W.u.)=0.062 *6*; B(E2)(W.u.)=8.0 *12* α(K)=0.000206 *3*; α(L)=2.07×10^{-5} *3*; α(M)=3.03×10^{-6} *5* α(N)=1.644×10^{-7} *24*; α(IPF)=7.24×10^{-7} *11* δ: 0.40 *5* from B(E2) in Coulomb excitation and $T_{1/2}$. B(E2)(W.u.)=12.3 *12* from B(E2) in Coulomb excitation.
1336.69	7/2$^-$	762.48 *2*	5.1 *5*	574.220	5/2$^-$	M1+E2[a]	−2.2 *2*	6.14×10^{-4} *10*	α(K)=0.000549 *9*; α(L)=5.60×10^{-5} *9*; α(M)=8.18×10^{-6} *13* α(N)=4.38×10^{-7} *7* B(M1)(W.u.)=0.00038 *22*; B(E2)(W.u.)=5 *3* δ: preferred value by authors in (p,γ); −0.22 *4* also possible. Others: −2.0 *+3-6* or −0.68 *+9-10* in ε decay; −1.5 *5* or −0.42 *+16-40* in (^{7}Li,2nγ).
		1336.72 *6*	100 *8*	0.0	3/2$^-$	E2(+M3)	+0.00[@] *2*	2.05×10^{-4}	α(K)=0.0001511 *22*; α(L)=1.522×10^{-5} *22*; α(M)=2.22×10^{-6} *4* α(N)=1.202×10^{-7} *17*; α(IPF)=3.69×10^{-5} *6* B(E2)(W.u.)=(7 *4*) Mult.: Q from $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ); from RUL. B(E2)(W.u.)=9.8 *15* from B(E2) in Coulomb excitation.
1488.07	7/2$^-$	381.16 *16*	26 *15*	1107.04	5/2$^-$	(M1(+E2))[&]	−0.03[b] *3*	0.00233	α(K)=0.00209 *3*; α(L)=0.000214 *3*; α(M)=3.13×10^{-5} *5* α(N)=1.687×10^{-6} *25* B(M1)(W.u.)=(0.026 *+18−26*); B(E2)(W.u.)=(0.2 *+6−2*)
		616.42 *9*	12 *2*	872.147	3/2$^-$				E_γ: This transition is not included in the least-squares fit for the excitation energies since the energy fit is poor. The least-squares fit gives Eγ=616.01 *4*.
		913.79 *9*	63 *15*	574.220	5/2$^-$	M1+E2[e]	−2.54[f] *10*	3.93×10^{-4}	α(K)=0.000352 *5*; α(L)=3.57×10^{-5} *5*; α(M)=5.22×10^{-6} *8* α(N)=2.80×10^{-7} *4* B(M1)(W.u.)=0.0006 *+3−6*; B(E2)(W.u.)=7 *+4−6*
		1488.02 *6*	100 *8*	0.0	3/2$^-$	E2(+M3)	+0.00[@] *3*	2.17×10^{-4}	α(K)=0.0001210 *18*; α(L)=1.217×10^{-5} *18*; α(M)=1.78×10^{-6} *3* α(N)=9.63×10^{-8} *14*; α(IPF)=8.18×10^{-5} *12* B(E2)(W.u.)=(1.1 *+5−10*) Mult.: Q from $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ); E2 from RUL.

$^{69}_{31}$Ga$_{38}$-7

$\gamma(^{69}Ga)$ (continued)

E_i(level)	J_i^π	E_γ	I_γ[†]	E_f	J_f^π	Mult.	δ	α[jn]	Comments
1525.76	3/2⁻	418.51 *6*	18.4 *18*	1107.04	5/2⁻	(M1(+E2))[&]	+0.05[b] *7*	0.00188 *4*	α(K)=0.00168 *4*; α(L)=0.000172 *4*; α(M)=2.51×10^{-5} *5* α(N)=1.356×10^{-6} *25* B(M1)(W.u.)<0.051?; B(E2)(W.u.)<4.2?
		951.54 *9*	10 *4*	574.220	5/2⁻	(M1(+E2))[&]	+0.3[b] *3*	3.13×10^{-4} *11*	α(K)=0.000281 *10*; α(L)=2.83×10^{-5} *11*; α(M)=4.14×10^{-6} *15* α(N)=2.25×10^{-7} *8* B(M1)(W.u.)<0.0025?; B(E2)(W.u.)<0.94?
		1207.21 *6*	100 *7*	318.706	1/2⁻	(M1+E2)[&]	+0.14[b] *2*	1.99×10^{-4}	α(K)=0.0001715 *24*; α(L)=1.724×10^{-5} *25*; α(M)=2.52×10^{-6} *4* α(N)=1.371×10^{-7} *20*; α(IPF)=7.09×10^{-6} *10* B(M1)(W.u.)<0.011?; B(E2)(W.u.)<0.30?
		1525.83 *7*	68 *6*	0.0	3/2⁻	(M1+E2)[&]	−0.38[b] *7*	2.00×10^{-4}	α(K)=0.0001097 *16*; α(L)=1.101×10^{-5} *16*; α(M)=1.609×10^{-6} *23* α(N)=8.75×10^{-8} *13*; α(IPF)=7.76×10^{-5} *14* B(M1)(W.u.)<0.0036?; B(E2)(W.u.)<0.43?
1723.71	5/2⁻	616.7 *2*	21	1107.04	5/2⁻	(M1(+E2))[&]	+0.05[b] *25*	0.00078 *4*	α(K)=0.00070 *3*; α(L)=7.1×10^{-5} *3*; α(M)=1.03×10^{-5} *5* α(N)=5.61×10^{-7} *23* B(M1)(W.u.)=(0.057 *+23−46*); B(E2)(W.u.)=(1 *+6−1*)
		851.31 *9*	9 *2*	872.147	3/2⁻				
		1149.46 *7*	66 *6*	574.220	5/2⁻	M1+E2[a]	−0.46[b] *10*	2.17×10^{-4} *4*	α(K)=0.000192 *3*; α(L)=1.94×10^{-5} *3*; α(M)=2.83×10^{-6} *5* α(N)=1.536×10^{-7} *24*; α(IPF)=2.37×10^{-6} *7* B(M1)(W.u.)=0.023 *+10−19*; B(E2)(W.u.)=6 *+3−5*
		1405.12 *8*	34 *6*	318.706	1/2⁻	E2(+M3)	−0.05[b] *7*	2.07×10^{-4} *5*	α(K)=0.000137 *5*; α(L)=1.38×10^{-5} *5*; α(M)=2.02×10^{-6} *7* α(N)=1.09×10^{-7} *4*; α(IPF)=5.47×10^{-5} *10* B(E2)(W.u.)=(6 *+3−5*); B(M3)(W.u.)=(5.E+4 *+16−5*) Mult.: Q from γ(θ) in ^{68}Zn(p,γ); E2 from RUL.
		1723.79 *8*	100 *6*	0.0	3/2⁻	M1+E2[a]	−0.75[b] *15*	2.57×10^{-4} *6*	α(K)=8.82×10^{-5} *13*; α(L)=8.84×10^{-6} *13*; α(M)=1.292×10^{-6} *19* α(N)=7.02×10^{-8} *11*; α(IPF)=0.000158 *4* B(M1)(W.u.)=0.008 *+4−7*; B(E2)(W.u.)=2.3 *+11−20*
1764.78	9/2⁻	1190.55 *3*	100	574.220	5/2⁻	E2(+M3)	−0.02[@] *3*	2.24×10^{-4}	α(K)=0.000194 *3*; α(L)=1.96×10^{-5} *3*; α(M)=2.87×10^{-6} *5* α(N)=1.546×10^{-7} *24*; α(IPF)=7.32×10^{-6} *11* B(E2)(W.u.)=(17 *3*); B(M3)(W.u.)=(3.E+4 *+10−3*) Mult.: Q from γ(θ) in ^{64}Ni(^{7}Li,2nγ); E2 from RUL.
1891.64	3/2⁻	1317.1 *10*	0.6 *3*	574.220	5/2⁻				
		1572.99 *8*	48 *4*	318.706	1/2⁻	(M1(+E2))[&]	−0.09[b] *9*	2.06×10^{-4}	α(K)=0.0001030 *15*; α(L)=1.032×10^{-5} *15*;

$^{69}_{31}Ga_{38}$-8

Adopted Levels, Gammas (continued)

γ(^{69}Ga) (continued)

E$_i$(level)	J$^\pi_i$	E$_\gamma$	I$_\gamma$[†]	E$_f$	J$^\pi_f$	Mult.	δ	α[jn]	Comments
									α(M)=1.509×10^{-6} 22 α(N)=8.21×10^{-8} 12; α(IPF)=9.08×10^{-5} 14 B(M1)(W.u.)=(0.086 13); B(E2)(W.u.)=(0.4 +9−4)
1891.64	3/2$^-$	1891.55 7	100 8	0.0	3/2$^-$	M1+E2[a]	−0.15[b] 6	2.95×10^{-4}	B(M1)(W.u.)=0.102 15; B(E2)(W.u.)=1.0 8 α(K)=7.34×10^{-5} 11; α(L)=7.34×10^{-6} 11; α(M)=1.073×10^{-6} 15 α(N)=5.85×10^{-8} 9; α(IPF)=0.000213 4
1924.25	7/2$^-$	587.64 8	69 7	1336.69	7/2$^-$	(M1(+E2))[&]	0.00 7	8.66×10^{-4}	α(K)=0.000775 11; α(L)=7.87×10^{-5} 12; α(M)=1.151×10^{-5} 17 α(N)=6.23×10^{-7} 9 B(M1)(W.u.)<0.042? δ: preferred value by authors in (p,γ); +1.1 1 also possible. Others: −1.0 +1-2 or −0.025 75 in ε decay.
		816.9 10	8.4 8	1107.04	5/2$^-$				
		1052.10 4	100 8	872.147	3/2$^-$	(E2)[&]		2.87×10^{-4}	B(E2)(W.u.)<15 α(K)=0.000257 4; α(L)=2.60×10^{-5} 4; α(M)=3.80×10^{-6} 6 α(N)=2.04×10^{-7} 3
		1349.99 5	76 8	574.220	5/2$^-$	(M1+E2)[&]	−2.6 4	2.02×10^{-4}	α(K)=0.0001466 21; α(L)=1.477×10^{-5} 22; α(M)=2.16×10^{-6} 3 α(N)=1.168×10^{-7} 17; α(IPF)=3.88×10^{-5} 7 B(M1)(W.u.)<0.00062?; B(E2)(W.u.)<2.9? δ: preferred value by authors in (p,γ); −0.15 5 also possible. Others: −6.5 +14-21 or −0.30 75 in ε decay.
		1923.8 2	35 3	0.0	3/2$^-$				
1972.37	9/2$^{(+)}$	484.29 7	24 3	1488.07	7/2$^-$	(E1(+M2))[‡]	+0.00[@] 2	6.98×10^{-4}	α(K)=0.000625 9; α(L)=6.31×10^{-5} 9; α(M)=9.21×10^{-6} 13 α(N)=4.93×10^{-7} 7 B(E1)(W.u.)<0.00023?
		635.71 5	100 7	1336.69	7/2$^-$	(E1(+M2))[‡]	−0.01[@] 2	3.63×10^{-4} 6	α(K)=0.000325 5; α(L)=3.28×10^{-5} 5; α(M)=4.79×10^{-6} 7 α(N)=2.57×10^{-7} 4 B(E1)(W.u.)<0.00043?; B(M2)(W.u.)<2.4?
		1397.94 14	7.1 17	574.220	5/2$^-$	(M2(+E3))[‡]	−0.06[@] 12	3.01×10^{-4}	α(K)=0.000258 4; α(L)=2.61×10^{-5} 4; α(M)=3.82×10^{-6} 6 α(N)=2.08×10^{-7} 3; α(IPF)=1.279×10^{-5} 23 B(M2)(W.u.)<6.8?; B(E3)(W.u.)<1.4×10^{2}?
1973.08	(1/2)$^-$	1654.18[m] 9	83[l] 10	318.706	1/2$^-$				
		1973.19[m] 8	100[l]	0.0	3/2$^-$				

From ENSDF

$\gamma(^{69}Ga)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ[†]	E_f	J^π_f	Mult.	δ	α[jn]	Comments
2007.66	$3/2^{(-)},5/2^{(-)}$	1135.58 7	23.5 25	872.147	$3/2^-$	M1+E2[a]		2.30×10^{-4} 14	B(M1)(W.u.)=0.0035 6; B(E2)(W.u.)=4.1 7 α(K)=0.000204 12; α(L)=2.06×10^{-5} 13; α(M)=3.01×10^{-6} 18 α(N)=1.63×10^{-7} 9; α(IPF)=1.9×10^{-6} 4 δ: −0.38 9 for a 3/2 to 3/2 transition; +0.15 4 for a 5/2 to 3/2 transition.
		2007.56 7	100 8	0.0	$3/2^-$	(M1+E2)[&]		0.00036 3	B(M1)(W.u.)=0.0027 4; B(E2)(W.u.)=1.02 15 α(K)=6.70×10^{-5} 15; α(L)=6.70×10^{-6} 15; α(M)=9.80×10^{-7} 22 α(N)=5.33×10^{-8} 11; α(IPF)=0.00029 3 δ: −1.3 +4−6 for a 3/2 to 3/2 transition; +0.01 2 for a 5/2 to 3/2 transition.
2023.91	$5/2^-$	1149.6 5	8.0 13	872.147	$3/2^-$				E_γ: This transition is not included in the least-squares fit for the excitation energies since the energy fit is poor. The least-squares fit gives Eγ=1151.71 9.
		1449.58 12	8.7 7	574.220	$5/2^-$				
		2023.99 13	100 7	0.0	$3/2^-$	M1+E2[a]	+0.16[b] 3	3.43×10^{-4}	α(K)=6.50×10^{-5} 9; α(L)=6.50×10^{-6} 9; α(M)=9.50×10^{-7} 14 α(N)=5.18×10^{-8} 8; α(IPF)=0.000271 4 B(M1)(W.u.)=0.0127 19; B(E2)(W.u.)=0.12 5
2045.24	$5/2^-$	1173.09 9	90 12	872.147	$3/2^-$	M1+E2[a]		2.17×10^{-4} 12	B(M1)(W.u.)=0.037 8; B(E2)(W.u.)=2.2 10 α(K)=0.000191 10; α(L)=1.92×10^{-5} 11; α(M)=2.81×10^{-6} 16 α(N)=1.52×10^{-7} 8; α(IPF)=4.5×10^{-6} 8 δ: −0.23 5 or −1.8 2 in (p,γ).
		1471.24 21	97 11	574.220	$5/2^-$	M1+E2[a]		2.01×10^{-4} 13	α(K)=0.000120 4; α(L)=1.21×10^{-5} 5; α(M)=1.77×10^{-6} 6 α(N)=9.6×10^{-8} 3; α(IPF)=6.7×10^{-5} 9 B(M1)(W.u.)=0.020 4; B(E2)(W.u.)=0.4 +7−4 δ: +0.17 14 or −1.15 25 in ←p,γ).
		2044.98 18	100 9	0.0	$3/2^-$	M1+E2[a]	+0.26[b] 12	3.53×10^{-4} 6	B(M1)(W.u.)=0.0076 14; B(E2)(W.u.)=0.19 17 α(K)=6.39×10^{-5} 9; α(L)=6.39×10^{-6} 9; α(M)=9.34×10^{-7} 14 α(N)=5.09×10^{-8} 8; α(IPF)=0.000282 6
2219.29		1900.59 20	100	318.706	$1/2^-$				
		2218.9 6	41	0.0	$3/2^-$				
2250.99	$(1/2,3/2)^-$	1932.33 17	62 7	318.706	$1/2^-$	(M1(+E2))[&]		0.00033 3	B(M1)(W.u.)=0.012 6 α(K)=7.18×10^{-5} 16; α(L)=7.19×10^{-6} 17; α(M)=1.050×10^{-6} 24 α(N)=5.71×10^{-8} 13; α(IPF)=0.000254 25 δ: +0.03 12 for 3/2 to 1/2 transition.

$^{69}_{31}Ga_{38}$-10

$\gamma(^{69}Ga)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ[†]	E_f	J^π_f	Mult.	δ	α[jn]	Comments
2250.99	$(1/2,3/2)^-$	2250.91 *12*	100 *8*	0.0	$3/2^-$	(M1+E2)[&]		0.00046 *4*	α(K)=5.46×10^{-5} *11*; α(L)=5.46×10^{-6} *12*; α(M)=7.98×10^{-7} *17* α(N)=4.34×10^{-8} *9*; α(IPF)=0.00040 *4* δ: −0.23 *8* for 3/2 to 3/2 transition.
2319.55	$(5/2^+,7/2^+)$	1212.50 *19*	100	1107.04	$5/2^-$	(E1+M2)[&]		1.57×10^{-4} *4*	α(K)=9.0×10^{-5} *3*; α(L)=9.1×10^{-6} *3*; α(M)=1.32×10^{-6} *5* α(N)=7.16×10^{-8} *24*; α(IPF)=5.62×10^{-5} *10* δ: −0.23 *8* for 7/2 to 5/2 transition; −1.2 *2* for 5/2 to 5/2 transition.
2353.30	5/2	1246.6 *4*	68	1107.04	$5/2^-$	D(+Q)[&]	+0.17[b] *30*		
		1481.4 *5*	87	872.147	$3/2^-$	D(+Q)[&]	−0.19[b] *20*		
		1778.5 *5*	68	574.220	$5/2^-$				
		2353.0 *5*	100	0.0	$3/2^-$	D(+Q)[&]	−0.04[b] *30*		
2423.29		897.64 *19*	39 *13*	1525.76	$3/2^-$				
		935.31 *10*	90 *14*	1488.07	$7/2^-$				
		1849.00 *11*	100 *11*	574.220	$5/2^-$				
		2422.9 *2*	61 *13*	0.0	$3/2^-$				
2428.68	$5/2^-,7/2^-$	1321.64 *20*	100	1107.04	$5/2^-$	(M1+E2)[‡]		1.95×10^{-4} *11*	B(M1)(W.u.)<0.0053; B(E2)(W.u.)<4.6 α(K)=0.000149 *6*; α(L)=1.50×10^{-5} *7*; α(M)=2.19×10^{-6} *10* α(N)=1.19×10^{-7} *5*; α(IPF)=2.9×10^{-5} *5* δ: +0.35 *20* for 7/2 to 5/2 transition; +0.0 *2* for 5/2 to 5/2 transition.
2458.84	$7/2^{(-)}$	1884.6 *1*	100	574.220	$5/2^-$	(M1+E2)[&]	−0.17[b] *3*	2.93×10^{-4}	α(K)=7.39×10^{-5} *11*; α(L)=7.39×10^{-6} *11*; α(M)=1.081×10^{-6} *16* α(N)=5.89×10^{-8} *9*; α(IPF)=0.000211 *3* B(M1)(W.u.)=(0.021 *+9−21*); B(E2)(W.u.)=(0.27 *+14−27*)
2485.70	$5/2^+$	2485.65 *10*	100	0.0	$3/2^-$	(E1(+M2))[&]	−0.04[b] *6*	9.81×10^{-4} *15*	α(K)=2.84×10^{-5} *6*; α(L)=2.83×10^{-6} *6*; α(M)=4.14×10^{-7} *9* α(N)=2.25×10^{-8} *5*; α(IPF)=0.000950 *15* B(E1)(W.u.)=(0.00037 *+16−27*); B(M2)(W.u.)=(0.4 *+14−4*)
2529.81	$(3/2)^-$	1657.63 *20*	32	872.147	$3/2^-$	(M1(+E2))[&]	−0.05[b] *25*	2.25×10^{-4} *5*	α(K)=9.33×10^{-5} *14*; α(L)=9.35×10^{-6} *14*; α(M)=1.367×10^{-6} *20* α(N)=7.44×10^{-8} *11*; α(IPF)=0.000121 *3* B(M1)(W.u.)=(0.015 *5*); B(E2)(W.u.)=(0.021 *+214−21*)
		2529.76 *10*	100	0.0	$3/2^-$	(M1(+E2))[&]	−0.03[b] *10*	5.42×10^{-4}	α(K)=4.41×10^{-5} *7*; α(L)=4.40×10^{-6} *7*; α(M)=6.43×10^{-7} *9*

$^{69}_{31}Ga_{38}$-11

Adopted Levels, Gammas (continued)

$\gamma(^{69}\mathrm{Ga})$ (continued)

E_i(level)	J^π_i	E_γ	I_γ†	E_f	J^π_f	Mult.	δ	α jn	Comments
									α(N)=3.51×10^{-8} *5*; α(IPF)=0.000492 *7* B(M1)(W.u.)=(0.014 *4*); B(E2)(W.u.)=(0.003 *+20−3*)
2572.54	9/2$^+$	1235.84 *20*	100	1336.69	7/2$^-$	(E1+M2)‡		1.69×10^{-4} *4*	α(K)=8.7×10^{-5} *3*; α(L)=8.7×10^{-6} *3*; α(M)=1.28×10^{-6} *5* α(N)=6.92×10^{-8} *23*; α(IPF)=7.15×10^{-5} *13* δ: +0.60 *25* for 5/2 to 7/2 transition; −0.50 *15* for 9/2 to 7/2 transition.
2660.3	3/2$^-$	2340 *4*	100	318.706	1/2$^-$				
2668.28	11/2	1180.04 *10*	46	1488.07	7/2$^-$				
		1331.63 *6*	100	1336.69	7/2$^-$				
2717.99	13/2$^{(+)}$	745.61 *2*	100	1972.37	9/2$^{(+)}$	(E2(+M3))#	−0.01@ *3*	6.79×10^{-4} *11*	α(K)=0.000607 *10*; α(L)=6.21×10^{-5} *10*; α(M)=9.06×10^{-6} *14* α(N)=4.83×10^{-7} *8* B(E2)(W.u.)<1.0×10^2?; B(M3)(W.u.)<9.2×10^5?
2795.0	(7/2)$^-$	822.5 *5*	100	1972.37	9/2$^{(+)}$				
3118.39	11/2$^-$	1146.1 *3*	70	1972.37	9/2$^{(+)}$	D(+Q)‡	+0.02@ *11*		
		1353.55 *20*	100	1764.78	9/2$^-$	M1+E2#	+0.31@ *17*	1.86×10^{-4} *4*	α(K)=0.0001378 *22*; α(L)=1.384×10^{-5} *23*; α(M)=2.02×10^{-6} *4* α(N)=1.100×10^{-7} *18*; α(IPF)=3.18×10^{-5} *11* B(M1)(W.u.)=0.020 *5*; B(E2)(W.u.)=1.6 *+17−16*
3242.44	13/2$^-$	1477.65 *6*	100	1764.78	9/2$^-$	E2(+M3)	+0.01@ *5*	2.15×10^{-4} *4*	α(K)=0.0001228 *20*; α(L)=1.235×10^{-5} *21*; α(M)=1.81×10^{-6} *3* α(N)=9.77×10^{-8} *16*; α(IPF)=7.81×10^{-5} *12* B(E2)(W.u.)=(10 *6*); B(M3)(W.u.)=(3.E+3 *+31−3*) Mult.: from $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ); E2 from RUL.
3389.33	(15/2$^+$)	671.34 *8*	100	2717.99	13/2$^{(+)}$	M1+E2#	+0.50@ *4*	6.98×10^{-4} *12*	α(K)=0.000625 *11*; α(L)=6.35×10^{-5} *11*; α(M)=9.28×10^{-6} *16* α(N)=5.00×10^{-7} *9* B(M1)(W.u.)=0.031 *17*; B(E2)(W.u.)=26 *14*
3542.76	11/2$^{(+)}$	824.77 *8*	100	2717.99	13/2$^{(+)}$	M1+E2#	+0.35@ *4*	4.27×10^{-4} *7*	α(K)=0.000383 *6*; α(L)=3.87×10^{-5} *6*; α(M)=5.66×10^{-6} *9* α(N)=3.06×10^{-7} *5* B(M1)(W.u.)=0.083 *14*; B(E2)(W.u.)=23 *6*
3633.95	17/2$^{(+)}$	915.95 *5*	100	2717.99	13/2$^{(+)}$	E2(+M3)	+0.00@ *2*	4.00×10^{-4}	α(K)=0.000358 *5*; α(L)=3.63×10^{-5} *6*; α(M)=5.31×10^{-6} *8* α(N)=2.85×10^{-7} *4* B(E2)(W.u.)=(37 *19*) Mult.: Q from $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ); E2 from RUL.
3722.30	(11/2,13/2)	333.0 *5*	12	3389.33	(15/2$^+$)				

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$\gamma(^{69}Ga)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ[†]	E_f	J^π_f	Mult.	δ	α[jn]	Comments
3722.30	(11/2,13/2)	1004.30 *6*	100	2717.99	$13/2^{(+)}$	D+Q[‡]			δ: +0.00 *4* if it is a 11/2 to 13/2 transition; −1.0 *2* if it is a 13/2 to 13/2 transition.
3786.07	(15/2)	1117.78 *10*	100	2668.28	11/2	(E2)[#]		2.51×10^{-4}	α(K)=0.000223 *4*; α(L)=2.26×10^{-5} *4*; α(M)=3.30×10^{-6} *5* α(N)=1.779×10^{-7} *25*; α(IPF)=1.361×10^{-6} *20* B(E2)(W.u.)=19 *4*
4078.20	$(15/2)^-$	444.0 *4*	15	3633.95	$17/2^{(+)}$	(D)[‡]			
		835.76 *7*	100	3242.44	$13/2^-$	M1+E2[#]	+0.52[@] *7*	4.25×10^{-4} *8*	α(K)=0.000381 *7*; α(L)=3.85×10^{-5} *7*; α(M)=5.63×10^{-6} *10* α(N)=3.05×10^{-7} *6* B(M1)(W.u.)=0.047 *9*; B(E2)(W.u.)=28 *8*
4528.10	(17/2,19/2)	449.9 *1*	100	4078.20	$(15/2)^-$				
6874.2	1/2	4214 *4*	7.3 *15*	2660.3	$3/2^-$				
		4309[o] *4*	4.9 *10*	2564.3					
		4417 *4*	7.3 *15*	2458.84	$7/2^{(-)}$				
		4896[o] *4*	12 *2*	1973.08	$(1/2)^-$				
		4980 *4*	4.9 *10*	1891.64	$3/2^-$				
		5349 *4*	9.8 *20*	1525.76	$3/2^-$				
		6002 *4*	39 *8*	872.147	$3/2^-$				
		6554 *4*	100 *20*	318.706	$1/2^-$				
		6874 *4*	49 *10*	0.0	$3/2^-$				
7306.9	$5/2^+$	3988 *6*	7.9 *12*	3319	7/2				
		4024 *6*	1.9 *3*	3283	$3/2^-$				
		4081 *6*	4.2 *6*	3211					E_γ: This transition is not included in the least-squares fit for the excitation energies since the energy fit is poor. It cannot be placed from a level within ±10 keV.
		4102 *4*	4.2 *6*	3203	$(3/2^-)$				
		4230 *4*	6.5 *10*	3077	$5/2^+$				
		4255 *3*	6.9 *10*	3052	3/2,7/2				
		4328 *2*	2.3 *3*	2978.8	$^-$				
		4342 *3*	0.77 *12*	2965	$^-$				
		4446 *4*	1.5 *2*	2860					
		4460 *3*	0.77 *12*	2847	$^+$				
		4509 *3*	3.8 *6*	2795.0	$(7/2)^-$				
		4541 *3*	1.15 *17*	2766					
		4646 *2*	8.1 *12*	2660.3	$3/2^-$				
		4822 *2*	3.8 *6*	2485.70	$5/2^+$				
		4849 *2*	3.7 *6*	2458.84	$7/2^{(-)}$				
		4880 *3*	1.9 *3*	2428.68	$5/2^-,7/2^-$				
		4954 *3*	2.5 *4*	2353.30	5/2				
		5109 *3*	0.96 *14*	2197					

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$\gamma(^{69}Ga)$ (continued)

E_i(level)	J^{π}_i	E_γ	I_γ[†]	E_f	J^{π}_f	Mult.	Comments
7306.9	5/2$^+$	5383 *3*	0.19 *3*	1924.25	7/2$^-$		
		5415 *3*	1.5 *2*	1891.64	3/2$^-$		
		5818 *2*	11.5 *17*	1488.07	7/2$^-$		
		6434 *2*	5.8 *9*	872.147	3/2$^-$		
		6732 *2*	6.9 *10*	574.220	5/2$^-$		
		7306 *2*	100 *15*	0.0	3/2$^-$	E1	α(IPF)=0.00258 *4* B(E1)(W.u.)=0.00013 *+3−4* Mult.: from $\gamma(\theta)$ of 7306γ in ^{69}Ga(γ,γ') and its linear polarization measurement assumed to be dipole.
9813.6		8287	56	1525.76	3/2$^-$	D[k]	
		8941	44	872.147	3/2$^-$	D[k]	
		9494		318.706	1/2$^-$	D[k]	Transition not seen in ^{68}Zn(p,γ).
		9813	100	0.0	3/2$^-$	D[k]	
10247.8		7683	34	2564.3		D[k]	
		8275	100	1972.37	9/2$^{(+)}$	D[k]	
		8759	20	1488.07	7/2$^-$	D[k]	
10251.7		7687	21	2564.3		D[k]	
		8279	100	1972.37	9/2$^{(+)}$	D[k]	
		8763	27	1488.07	7/2$^-$	D[k]	
10256.8		7692	47	2564.3		D[k]	
		8284	100	1972.37	9/2$^{(+)}$	D[k]	
		8768	26	1488.07	7/2$^-$	D[k]	

[†] Relative photon branching from each level.
[‡] From $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ) and J^π of initial and final levels.
[#] From $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ) and RUL.
[@] From $\gamma(\theta)$ in ^{64}Ni(^{7}Li,2nγ).
[&] From $\gamma(\theta)$ in ^{68}Zn(p,γ) and J^π of initial and final levels.
[a] From $\gamma(\theta)$ in ^{68}Zn(p,γ) and RUL.
[b] From $\gamma(\theta)$ in ^{68}Zn(p,γ) levels.
[c] From $\gamma(\theta)$ in ^{69}Ga(n,n'γ).
[d] From $\gamma(\theta)$ in ^{69}Ga(p,p'γ) and J^π of initial and final levels.
[e] From $\gamma(\theta)$ in ^{69}Ga(p,p'γ) and RUL.
[f] From $\gamma(\theta)$ in ^{69}Ga(p,p'γ).
[g] From α(exp) in ^{69}Ge ε decay.

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$\gamma(^{69}Ga)$ (continued)

[h] From $\gamma\gamma(\theta)$ in ^{69}Ge ε decay and J^π of initial and final levels.
[i] From $\gamma(\theta)$ in ^{69}Ge ε decay and RUL.
[j] α(exp) from ^{69}Ge ε decay.
[k] From $\gamma(\theta)$ in ^{68}Zn(p,γ).
[l] From (n,n′γ). Iγ(1654)=49 in (p,γ).
[m] Weighted average from (p,γ) and (n,n′γ).
[n] Additional information 1.
[o] Placement of transition in the level scheme is uncertain.

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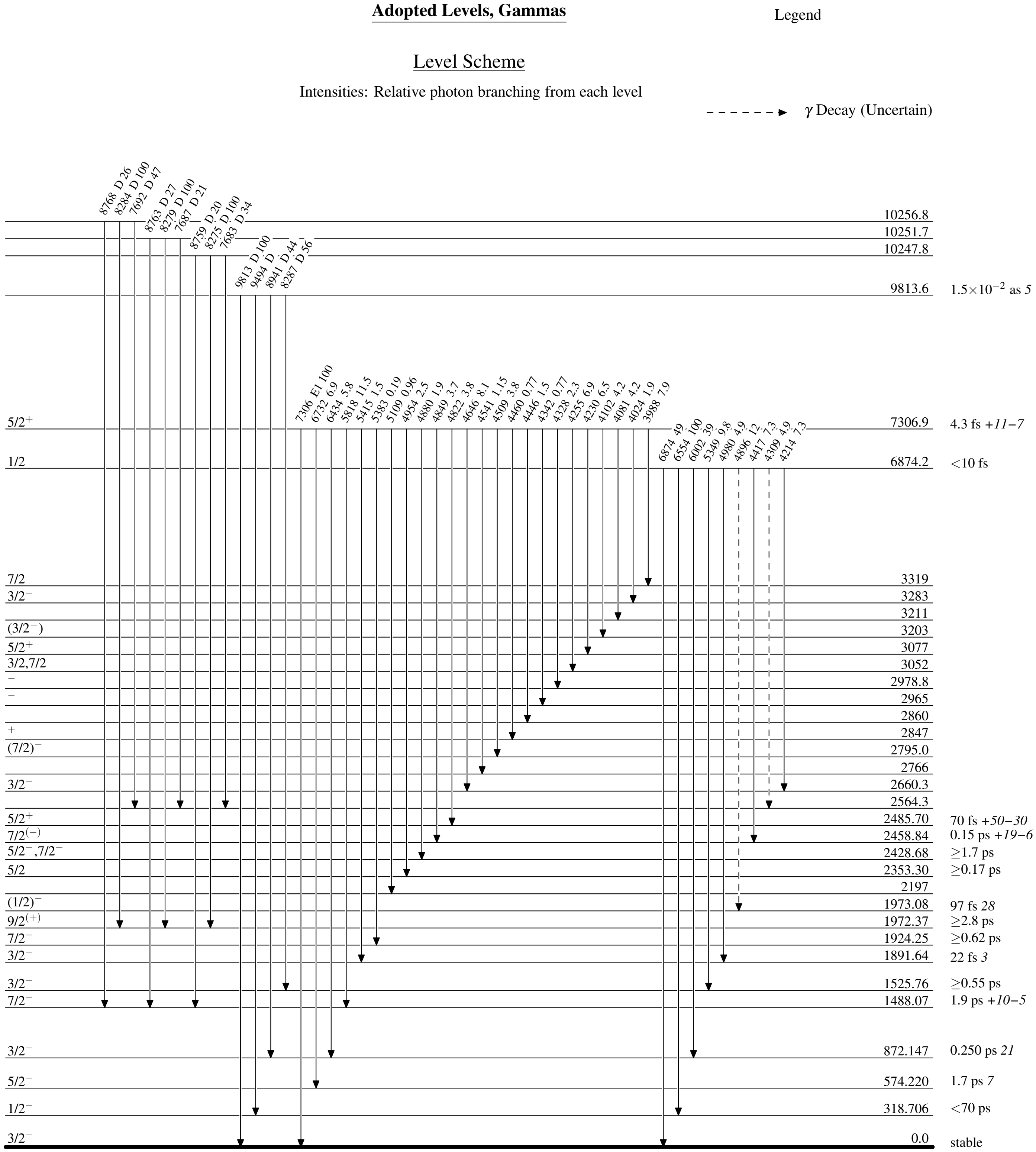
Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

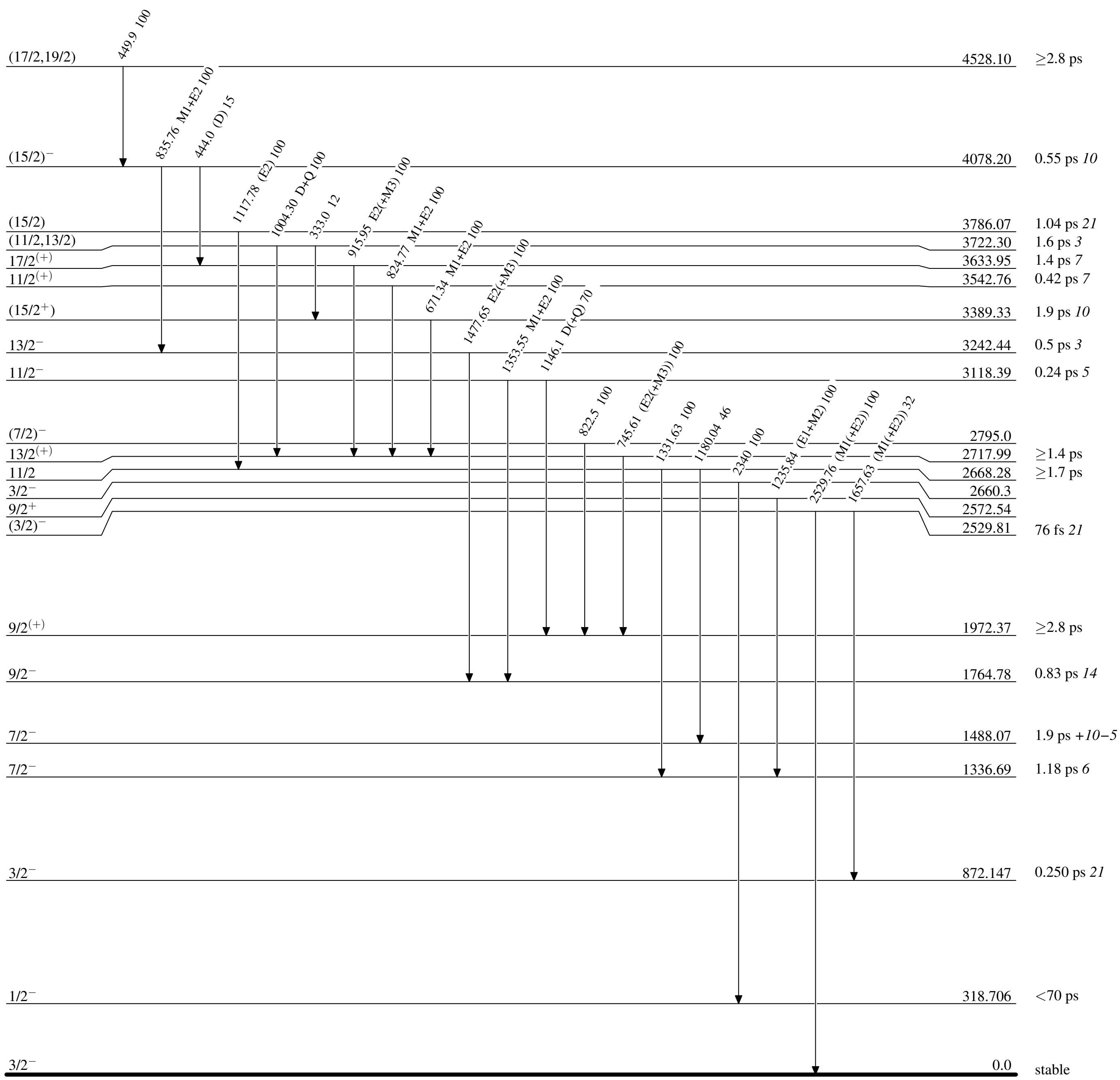


$^{69}_{31}Ga_{38}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

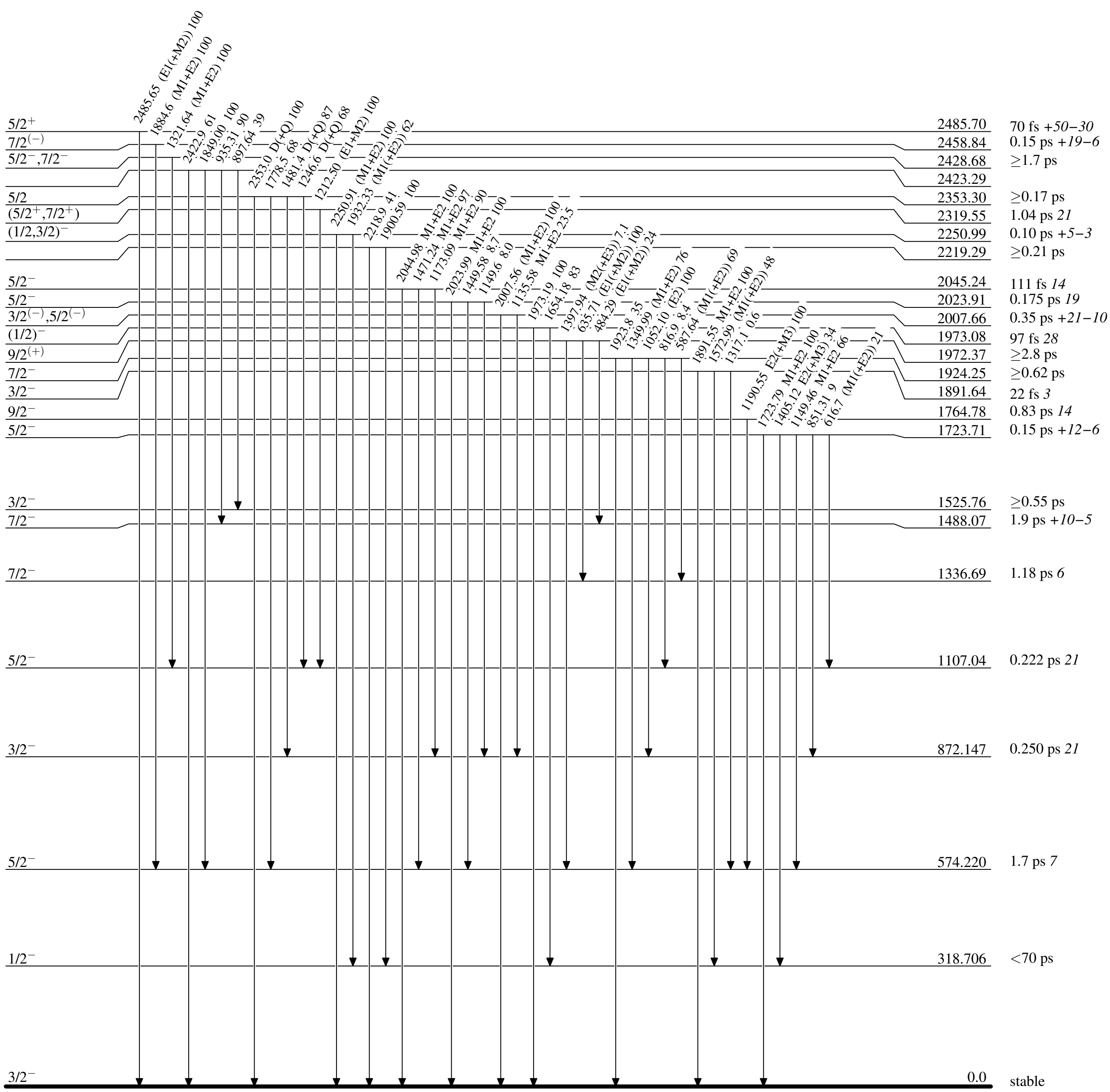


$^{69}_{31}Ga_{38}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

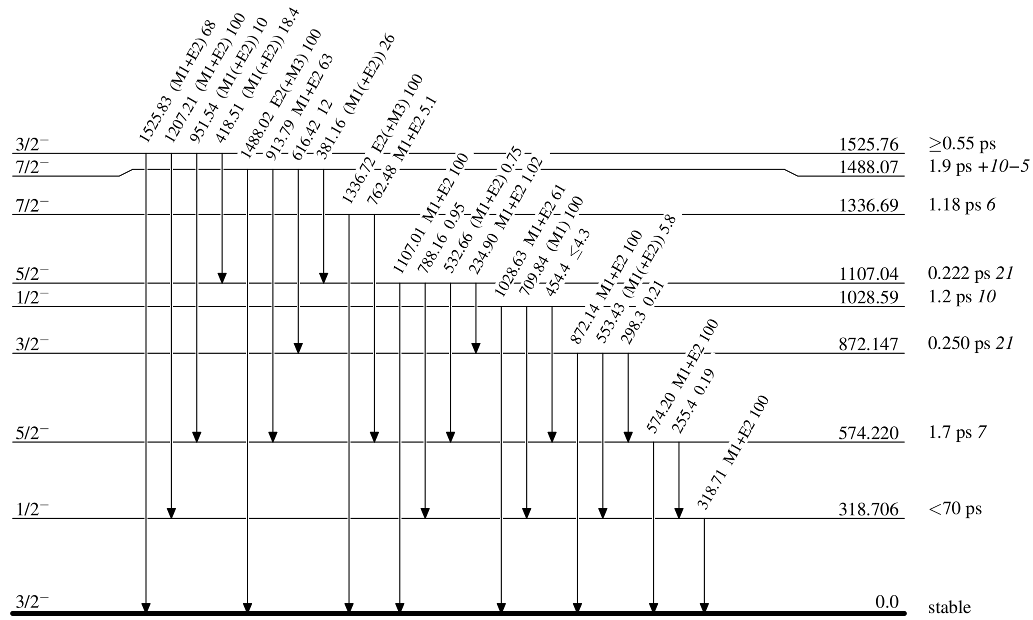


$^{69}_{31}Ga_{38}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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