

Adopted Levels, Gammas

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia		NDS 199,271 (2025)	1-Sep-2024

$Q(\beta^-)=8664$ 4; $S(n)=6476$ 4; $S(p)=13268$ 4; $Q(\alpha)=-11190$ 3 [2021Wa16](#)
 $S(2n)=11222$ 3, $S(2p)=29800$ 110, $Q(\beta^-n)=3836$ 4 ([2021Wa16](#)).

 ^{81}Ga LevelsCross Reference (XREF) Flags

- A** ^{81}Zn β^- decay (300 ms)
B ^{82}Zn β^-n decay (166 ms)
C $^9\text{Be}(^{238}\text{U}, \text{F}\gamma)$
D $^{238}\text{U}(^{82}\text{Se}, \text{X}\gamma), ^{192}\text{Os}(^{82}\text{Se}, \text{X}\gamma)$

E(level) [†]	J ^π [‡]	T _{1/2} [@]	XREF	Comments
0	5/2 ⁽⁻⁾	1.219 s 5	ABCD	$\% \beta^- = 100$; $\% \beta^-n = 11.8$ 8 $\mu = +1.747$ 5 $Q = -0.048$ 8 $\delta \langle r^2 \rangle (^{71}\text{Ga}, ^{81}\text{Ga}) = +0.242$ fm ² 4(stat) 99(syst) (2012Pr11). Isotope shift $\delta \nu(^{71}\text{Ga}, ^{81}\text{Ga}) = -271.8$ MHz 15(stat) 170(syst) (2012Pr11). J ^π : 5/2 from collinear laser spectroscopy measurements reported in 2010Ch16 . Parity from shell-model configuration. Anomalous g.s. spins of ^{81}Ga and change in sign of Q_2 suggest a changing shell structure from N=42 onwards and strong influence of $\pi f_{5/2}$ orbital in the g.s. wave function (2010Ch16). T _{1/2} : weighted average of 1.221 s 5 (delayed-n activity, 1991Kr15) and 1.211 s 6 (1993Ru01), 1.23 s 1 (1976Ru01), 1.23 s 10 (1982FoZZ), 1.22 s 1 (1986Wa17), 1.2 s 2 (quoted value in 1976Ru01 from Ref. 14), 1.25 s 3 (2020Pa26). Weighted average: 1.219 s 34 Uncertainty from 1991Kr15 – the lowest from the input values. Others: 0.959 s +37–29 (2010Ho12) is a discrepant value, 2.2 s (1975Al11). All from decay curve fitting including β^- , n, and coincidence growth measurements. $\% \beta^-n$ is from simultaneous measurement of n-emission rate and β^- decay rate. Average of: 10.6% 8 (1986Wa17 – 4% statistical and 7% systematic uncertainty); 12.2% 10 (revised/recommended value (1984Ma39) based on 12.0% 9 (1980Lu04) and overall consistency of data from different laboratories); 12.9% 8 (1993Ru01), and 11.2% 26 (2019To09). Other: 12.7% 12 (deduced by evaluator using $I_\gamma(216)/I_p = 2.9$ 2 (1981Ho07) and $\% I_\gamma(216)$ in ^{81}Ga β^- decay) = 36.7 24). μ : From 2010Ch16 , 2019StZV – Collinear Laser Spectroscopy. Other: +1.747 8 (2017Fa09). Q: From 2010Ch16 , 2021StZZ – Collinear Laser Spectroscopy. Other: -0.033 13 (2017Fa09).
350.91 7	(3/2 ⁻)	60 ps 10	ABC	
802.47 8	(3/2 ⁻)	23 ps 16	AB	
1236.0 9			D	E(level), J ^π : level not reported in ($^{238}\text{U}, \text{f}\gamma$). Spin parity 9/2 ⁻ from shell model calculations in ($^{82}\text{Se}, \text{x}\gamma$). In ($^{238}\text{U}, \text{f}\gamma$) 9/2 ⁻ has been reported at 1340.7 keV.
1266.6 4			A	
1341.00 10	(9/2 ⁻)		A C	J ^π : if beta feeding to this level from (1/2 ⁺ , 3/2 ⁺) in ^{81}Zn β^- decay is true, then it might be a different level or spin parity should be considered with caution.
1400.77 24	(7/2 ⁻) [#]		A C	J ^π : if beta feeding to this level from (1/2 ⁺ , 3/2 ⁺) in ^{81}Zn β^- decay is true, then it might be a different level or spin parity should be considered with caution.
1435.40 12			A	
1458.32 15	(5/2 ⁻ , 3/2 ⁻)		A	
1464.0? 9			D	XREF: D(1464?).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{81}Ga Levels (continued)

E(level) [†]	J $\pi^{\ddagger}$	T _{1/2} [@]	XREF	Comments
1506.32 9			A	
1636.22 12			A	
1936.42 10	(5/2 ⁻ , 3/2 ⁻)	≤21 ps	A	
1952.39 13	(11/2 ⁻) [#]		A C	J π : if beta feeding to this level from (1/2 ⁺ , 3/2 ⁺) in ^{81}Zn β - decay is true, then it might be a different level or spin parity should be considered with caution.
1998.0? 12			D	XREF: D(1998?).
2198.1 4			A	
2285.61 13			A	
2363.0? 12			D	XREF: D(2363?).
2416.4 3			A	
2686.38 21			A	
2766.0 8	(13/2 ⁻) [#]		C	
2788.5 3			A	
2830.8 3			A	
3093.0 9	(15/2 ⁻) [#]		C	
3158.0 3			A	
3189.2 7			A	
3725.7 6			A	
3753.7 4			A	
3909.6 5			A	
3949.2 5			A	
4114.6 7			A	
4209.2 4			A	
4294.92 15	(3/2 ⁺ , 5/2 ⁺ , 7/2 ⁺)		A	
4301.5 4			A	
4369.1 4			A	
4601.5 5			A	
4814.2 6			A	
4880.6 4	(3/2 ⁺ , 5/2 ⁺ , 7/2 ⁺)		A	
4921.0 4			A	
5113.6 6			A	
5131.5 6			A	
5178.0 3			A	
5190.9 7			A	
5375.1 5			A	
5422.06 25			A	
5475.7 5			A	
5485.3 5			A	
5658.4 4			A	
5695.0 7			A	
5727.1 4			A	
5831.2 5			A	
5863.7 3			A	
5904.1 8			A	
5936.3 6			A	
5969.4 7			A	
6150.8 7			A	
6213.1 4			A	
6236.4 5			A	
6295.6 5			A	
6405.5 5			A	
6434.9 4			A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

 ^{81}Ga Levels (continued)

[†] From a least-squares fit to the E_γ .

[‡] From shell model calculations except otherwise noted, including $1f_{5/2}$, $2p_{3/2}$, $2p_{1/2}$ and $1g_{9/2}$ active proton orbitals and an inert ^{78}Ni core (2007VeZZ – ^{81}Zn β^- decay) predict a $5/2^-$ g.s., $3/2^-$ levels at 299 keV and 730 keV, and a $9/2^-$ level at 1374 keV; the latter is tentatively associated with the observed level at 1236 keV (2007De37) and the second $3/2^-$ level with the observed 803-keV level (2007VeZZ). A more extensive series of calculations (2007Ve08) employing different sets of single-particle energies and two-body matrix elements predict somewhat different level energies but lead the authors to conclude that the π $1f_{5/2}$ single-particle state lies below the π $2p_{3/2}$ state for very neutron-rich nuclei such as ^{81}Ga ; the reverse is true for ^{83}Ga .

[#] As proposed by 2019Du18 (^{238}U , f γ), based on the assumption of preferred population of yrast states in fission reactions and comparison to shell model calculations.

[@] From ^{81}Zn β^- decay, using the Advanced Time-Delayed $\beta\gamma\gamma(t)$ fast-timing method, except where otherwise noted.

Adopted Levels, Gammas (continued)

$\gamma(^{81}\text{Ga})$

Additional information 1.

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.	$a^@$	Comments
350.91	(3/2 ⁻)	350.9 1	100	0	5/2 ⁽⁻⁾	[M1,E2]	0.0049 20	$\alpha(\text{K})=0.0043$ 18; $\alpha(\text{L})=4.5\times 10^{-4}$ 19; $\alpha(\text{M})=6.6\times 10^{-5}$ 28 $\alpha(\text{N})=3.5\times 10^{-6}$ 14 E_γ : weighted average of 351.1 1 from ⁸¹ Zn β^- decay, 350.8 1 from ⁸² Zn β^- -n decay, and 350.6 3 from (²³⁸ U,F γ). B(M1)(W.u.)=0.0085 +17-12 if M1, B(E2)(W.u.)=85 +17-12 if E2. $\alpha(\text{K})=0.0020$ 6; $\alpha(\text{L})=2.1\times 10^{-4}$ 7; $\alpha(\text{M})=3.1\times 10^{-5}$ 10 $\alpha(\text{N})=1.6\times 10^{-6}$ 5 E_γ : from ⁸¹ Zn β^- decay. Other: 451.5 3 from ⁸² Zn β^- -n decay. B(M1)(W.u.)=0.008 +9-4 if M1, B(E2)(W.u.)=5 $\times 10^1$ +6-2 if E2.
802.47	(3/2 ⁻)	451.6 1	100.0 35	350.91	(3/2 ⁻)	[M1,E2]	0.0023 7	E_γ : from ²³⁸ U(⁸² Se,X γ), ¹⁹² Os(⁸² Se,X γ).
1236.0		802.4 1	24.4 10	0	5/2 ⁽⁻⁾			
1266.6		1236 1	100	0	5/2 ⁽⁻⁾			
		915.6 4	100 7	350.91	(3/2 ⁻)			
		1266.9 6	26 3	0	5/2 ⁽⁻⁾			
1341.00	(9/2 ⁻)	1341.0 1	100	0	5/2 ⁽⁻⁾			E_γ : from ⁸¹ Zn β^- decay. Other: 1340.7 4 from (²³⁸ U,F γ).
1400.77	(7/2 ⁻)	1399.6 11	100	0	5/2 ⁽⁻⁾			E_γ : unweighted average of 1400.7 1 from ⁸¹ Zn β^- decay and 1398.5 7 from (²³⁸ U,F γ).
1435.40		632.9 1	30.0 23	802.47	(3/2 ⁻)			
		1084.7 5	100 7	350.91	(3/2 ⁻)			
1458.32	(5/2 ⁻ ,3/2 ⁻)	655.8 & 2	10.4 11	802.47	(3/2 ⁻)			
		1107.4 2	100 5	350.91	(3/2 ⁻)			
		1458.3 2	88 5	0	5/2 ⁽⁻⁾			
1464.0?		228 $\ddagger$ 1	100 $\ddagger$ 25	1236.0				
		1464 $\ddagger$ 1	83 $\ddagger$ 30	0	5/2 ⁽⁻⁾			
1506.32		1155.0 2	8 1	350.91	(3/2 ⁻)			
		1506.4 1	100 6	0	5/2 ⁽⁻⁾			
1636.22		1285.3 1	100	350.91	(3/2 ⁻)			
1936.42	(5/2 ⁻ ,3/2 ⁻)	478.2 & 2	4.3 4	1458.32	(5/2 ⁻ ,3/2 ⁻)			
		1585.5 1	86 5	350.91	(3/2 ⁻)			
		1936.3 2	100 6	0	5/2 ⁽⁻⁾			
1952.39	(11/2 ⁻)	611.4 1	100	1341.00	(9/2 ⁻)			E_γ : from ⁸¹ Zn β^- decay. Other: 611.5 5 from (²³⁸ U,F γ).
1998.0?		534 $\ddagger$ 1	100	1464.0?				
2198.1		1847.2 4	100	350.91	(3/2 ⁻)			
2285.61		333.3 2	21.6 11	1952.39	(11/2 ⁻)			
		884.8 2	25.7 22	1400.77	(7/2 ⁻)			
		944.4 4	36.0 22	1341.00	(9/2 ⁻)			

Adopted Levels, Gammas (continued)

$\gamma(^{81}\text{Ga})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π
2285.61		2285.5 2	100 6	0	5/2 ⁽⁻⁾	4921.0		4570.0 4	100	350.91	(3/2 ⁻)
2363.0?		365 [‡] 1	100 [‡] 29	1998.0?		5113.6		4761.9 10	100 16	350.91	(3/2 ⁻)
		899 [‡] 1	100 [‡] 37	1464.0?				5113.6 6	68 16	0	5/2 ⁽⁻⁾
2416.4		2065.5 3	100	350.91	(3/2 ⁻)	5131.5		4328.9 6	100	802.47	(3/2 ⁻)
2686.38		1250.9 2	32 4	1435.40		5178.0		4374.6 7	29 7	802.47	(3/2 ⁻)
		2686.6 4	100 11	0	5/2 ⁽⁻⁾			4826.9 4	53 7	350.91	(3/2 ⁻)
2766.0	(13/2 ⁻)	813.6 [#] 8	100	1952.39	(11/2 ⁻)			5178.2 5	100 13	0	5/2 ⁽⁻⁾
2788.5		2788.4 3	100	0	5/2 ⁽⁻⁾	5190.9		4839.8 7	100	350.91	(3/2 ⁻)
2830.8		894.1 ^{&} 1	56 5	1936.42	(5/2 ⁻ , 3/2 ⁻)	5375.1		5024.0 5	100	350.91	(3/2 ⁻)
		2830.7 3	100 13	0	5/2 ⁽⁻⁾	5422.06		4618.9 7	100 18	802.47	(3/2 ⁻)
3093.0	(15/2 ⁻)	327.0 [#] 2	100	2766.0	(13/2 ⁻)			5072.0 5	65 12	350.91	(3/2 ⁻)
3158.0		2807.0 3	100	350.91	(3/2 ⁻)			5421.6 3	47 12	0	5/2 ⁽⁻⁾
3189.2		2838.2 7	100	350.91	(3/2 ⁻)	5475.7		5475.5 5	100	0	5/2 ⁽⁻⁾
3725.7		3374.7 6	100	350.91	(3/2 ⁻)	5485.3		1185.2 ^{&} 2	17.4 22	4301.5	
3753.7		3402.7 4	100	350.91	(3/2 ⁻)			5485.1 5	100 13	0	5/2 ⁽⁻⁾
3909.6		3558.5 5	100 13	350.91	(3/2 ⁻)	5658.4		4856.6 5	100 11	802.47	(3/2 ⁻)
		3909.7 8	67 20	0	5/2 ⁽⁻⁾			5657.4 5	26 8	0	5/2 ⁽⁻⁾
3949.2		3598.2 5	100	350.91	(3/2 ⁻)	5695.0		5694.8 7	100	0	5/2 ⁽⁻⁾
4114.6		3763.6 7	100	350.91	(3/2 ⁻)	5727.1		5726.9 4	100	0	5/2 ⁽⁻⁾
4209.2		3858.5 4	100 15	350.91	(3/2 ⁻)	5831.2		5831.0 5	100	0	5/2 ⁽⁻⁾
		4208.5 6	27 5	0	5/2 ⁽⁻⁾	5863.7		5863.5 3	100	0	5/2 ⁽⁻⁾
4294.92	(3/2 ⁺ , 5/2 ⁺ , 7/2 ⁺)	2009.2 2	44.0 28	2285.61		5904.1		5903.9 8	100	0	5/2 ⁽⁻⁾
		2358.4 2	100 7	1936.42	(5/2 ⁻ , 3/2 ⁻)	5936.3		5936.1 6	100	0	5/2 ⁽⁻⁾
		3943.9 5	20 4	350.91	(3/2 ⁻)	5969.4		5969.2 7	100	0	5/2 ⁽⁻⁾
		4295.4 4	42 6	0	5/2 ⁽⁻⁾	6150.8		6150.5 7	100	0	5/2 ⁽⁻⁾
4301.5		3950.5 4	100	350.91	(3/2 ⁻)	6213.1		6212.8 4	100	0	5/2 ⁽⁻⁾
4369.1		4017.8 5	100 14	350.91	(3/2 ⁻)	6236.4		6236.1 5	100	0	5/2 ⁽⁻⁾
		4369.2 4	69 14	0	5/2 ⁽⁻⁾	6295.6		6295.3 5	100	0	5/2 ⁽⁻⁾
4601.5		4250.5 5	100	350.91	(3/2 ⁻)	6405.5		6405.2 5	100	0	5/2 ⁽⁻⁾
4814.2		4463.2 6	100	350.91	(3/2 ⁻)	6434.9		6434.6 4	100	0	5/2 ⁽⁻⁾
4880.6	(3/2 ⁺ , 5/2 ⁺ , 7/2 ⁺)	4880.4 4	100	0	5/2 ⁽⁻⁾						

[†] From ^{81}Zn β^- decay, except where otherwise noted.

[‡] From ($^{82}\text{Se}, x\gamma$).

[#] From ($^{238}\text{U}, \text{F}\gamma$).

@ [Additional information 2.](#)

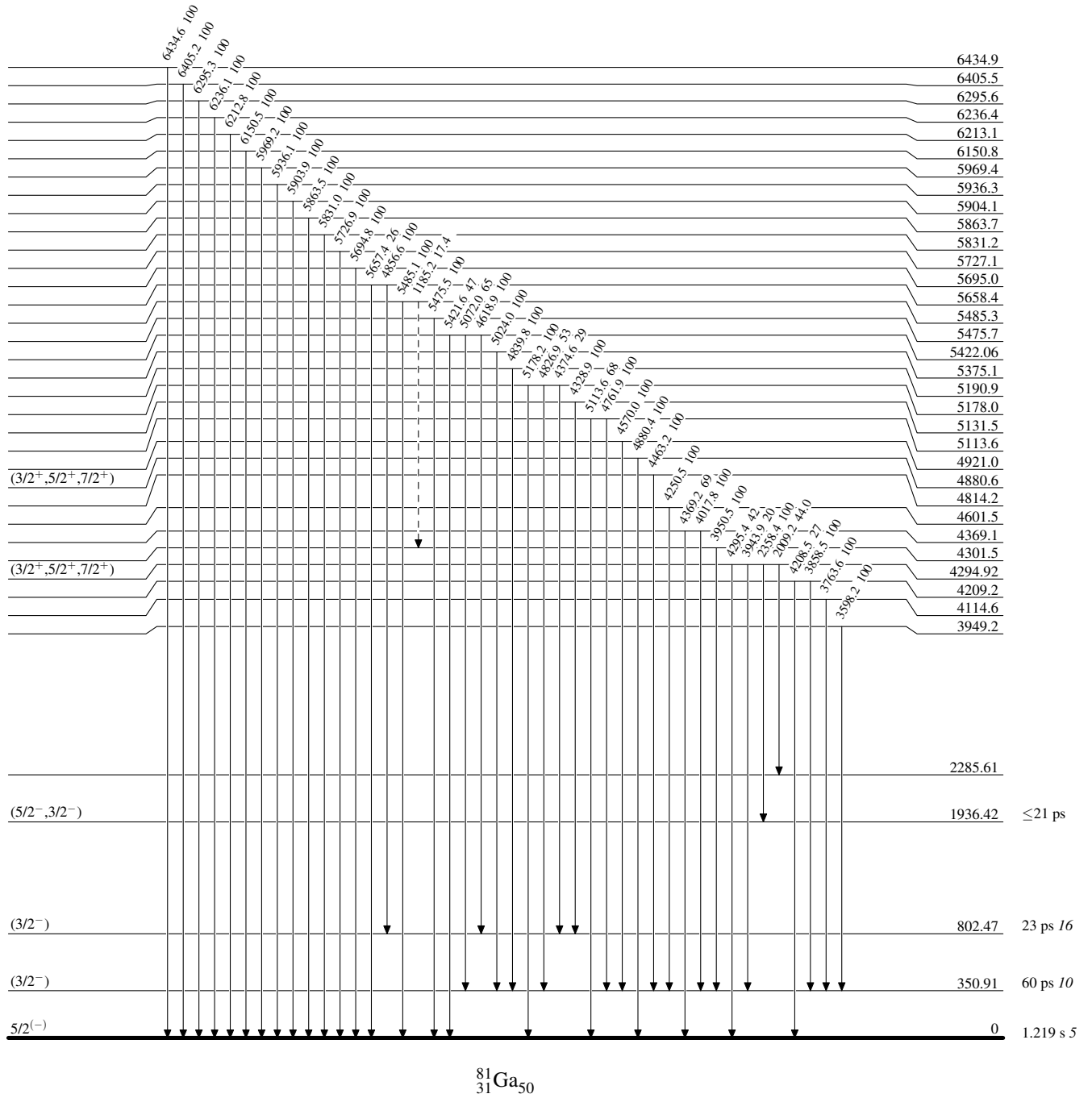
& Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

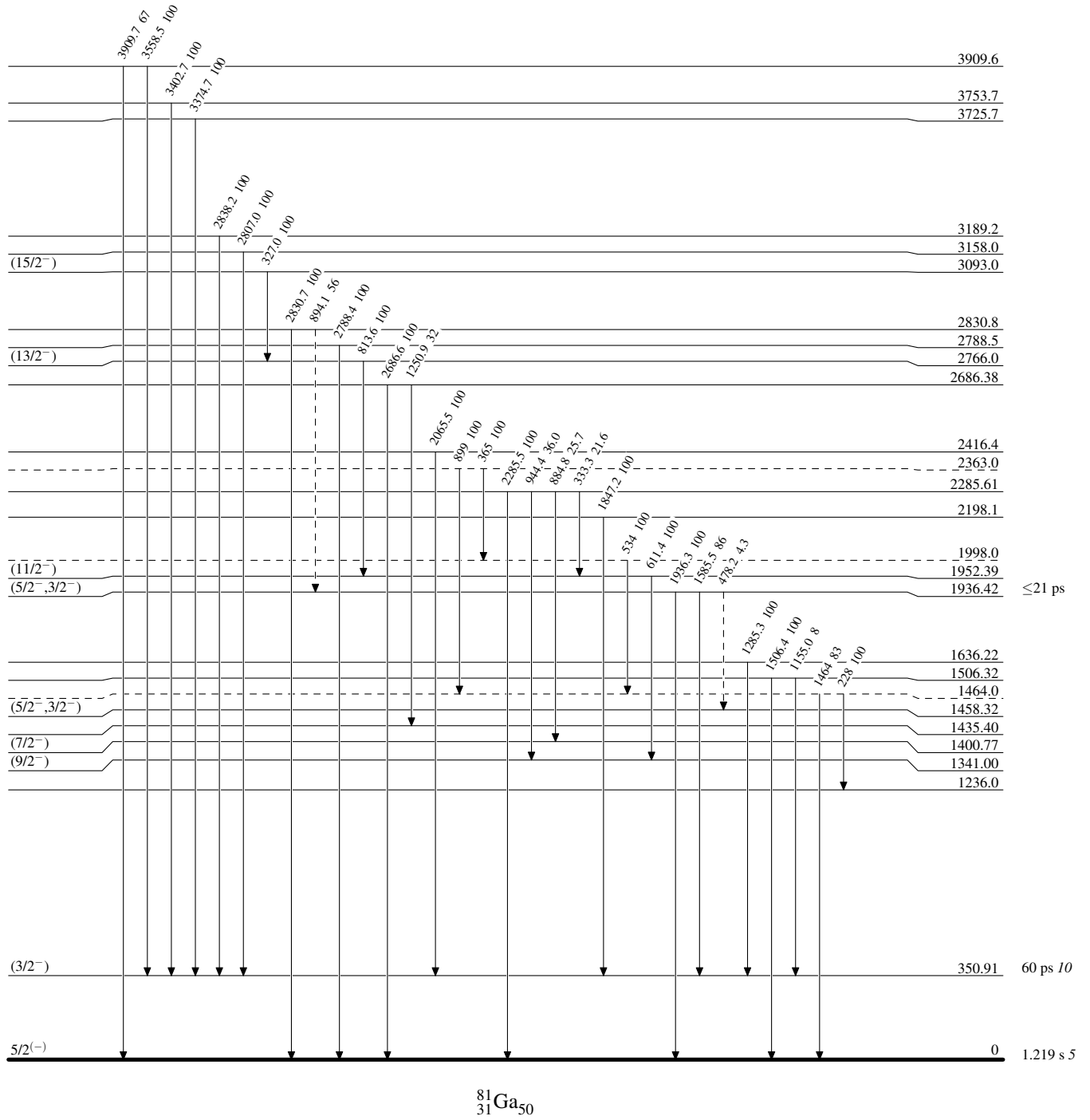
-----► γ Decay (Uncertain)

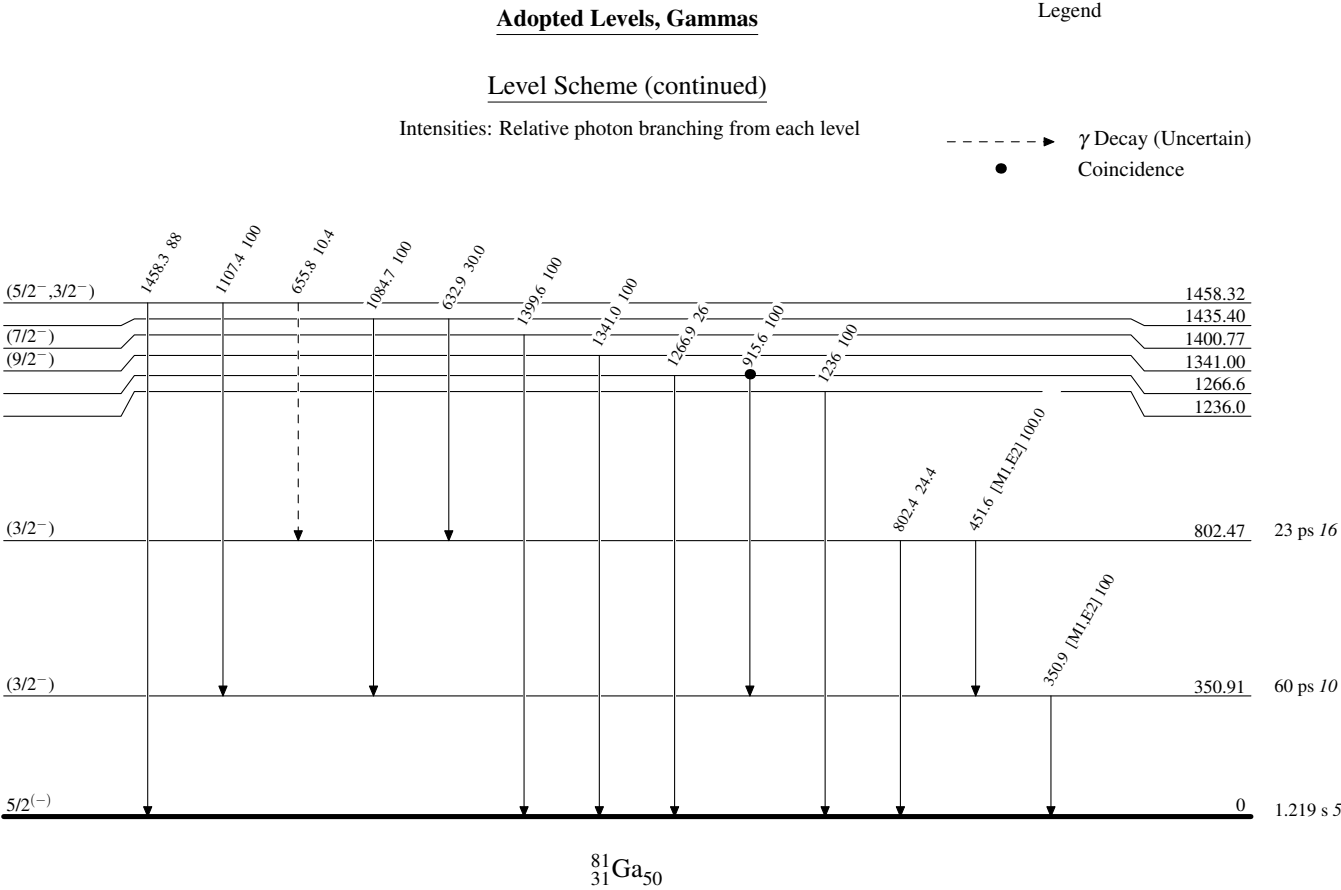
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



⁸¹Ga₅₀