Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	P. K. Joshi, B. Singh, S. Singh, A. K. Jain	NDS 138, 1 (2016)	15-Oct-2016

Q(β^-)=−2129.1 *30*; S(n)=7453 *12*; S(p)=7717 *7*; Q(α)=−1524 *7* 2012Wa38
S(2n)=17174 *7*, S(2p)=13807 *7* (2012Wa38).

^{139}Ce Levels

Cross Reference (XREF) Flags

A	^{139}Ce IT decay (57.58 s)	F	^{137}Ba(α,2nγ),^{138}Ba(α,3nγ)
B	^{139}Pr ε decay (4.41 h)	G	^{138}Ce(n,γ) E=thermal
C	^{130}Te(^{12}C,3nγ):E=65 MeV	H	^{139}La(p,nγ)
D	^{130}Te(^{12}C,3nγ):E=50.5 MeV	I	^{140}Ce(d,t),(^{3}He,α),(p,d),
E	^{130}Te(^{14}C,5nγ)		

E(level)†	Jπ‡	$T_{1/2}$#	XREF	Comments
0.0	3/2$^+$	137.63 d *3*	ABCDEFGHI	%ε=100 μ=1.06 *4* (1991Mu06,2014StZZ) J$^\pi$: spin from ABMR (1973In04), and $\gamma(\theta)$ in oriented nuclei (1963Ha07, 1962Gr17,1961Kn02); π from L=2 and analyzing powers in (p,d). $T_{1/2}$: weighted average (internal) of 137.5 d *3* (1965An07), 137.2 d *4* (1972Em01), 137.66 d *4* (1976Va30), 137.59 d *4* (1978La21; $\Delta T_{1/2}$=0.12 at 3σ level), 137.65 d *3* (1982RuZY), 137.8 d *2* (1982RyZX), and 137.73 d *20* (2014Un01). The value of 137.73 d *90* from 1992Un01 is superseded by 137.73 d *20* from 2014Un01. 1982RuZV replaced earlier measurements by 1973MeYE, 1976MeZK, and 1980RuZY and 1982HoZJ. Others: 1987ChZD, 1988DaZS. See also 1982HoZF and 1999BeZS evaluations. μ: NMR on oriented nuclei (1991Mu06). Others: 1.0 *2* (nuclear orientation with γ detection, 1963Ha07); 0.85 *15* (1962Gr17, same method as in 1963Ha07).
255.075 *16*	1/2$^+$	110 ps *20*	B HI	$T_{1/2}$: from ε decay. J$^\pi$: L=0 and analyzing powers in pickup reactions.
754.24& *8*	11/2$^-$	57.58 s *32*	ABCDEF HI	%IT=100 J$^\pi$: L=5 and analyzing powers in pickup reactions. $T_{1/2}$: from time variation of 754-keV γ from ^{139}Ce IT decay (2012To09). Others: 54.8 s *10* (1967Ge09), 56.44 s *48* (1967Yu01), 56.54 s *13* (quoted in 2012Au07 from S. Itoh et al (1994), Conf. Proc.).
1320.248 *20*	5/2$^+$	<1.0 ps	B HI	J$^\pi$: L=2 in pickup reactions and A(θ) in (pol p,d). 1988Ch23 note that slope of excit in (p,nγ) not consistent with 5/2$^+$.
1347.338 *10*	7/2$^+$		B HI	J$^\pi$: L=4 in pickup reactions. E2 γ to 3/2$^+$.
1578.24 *22*	7/2$^-$		B H	J$^\pi$: E2 γ to 11/2$^-$; log $f^{1u}t$=8.3 from 5/2$^+$.
1579.11 *19*	(7/2$^-$)		H	J$^\pi$: γs to 5/2$^+$ and 11/2$^-$.
1596.592 *20*	(3/2)$^+$	<0.9 ps	B HI	J$^\pi$: 3/2$^+$,5/2$^+$ from L=2 in pickup reactions. J$^\pi$=3/2 from excit in (p,nγ).
1630.674 *18*	3/2$^+$	<3.8 ps	B HI	J$^\pi$: from L=2 in pickup reactions; M1(+E2) γ to 1/2$^+$. 5/2 from excit in (p,nγ) discrepant.
1790	(1/2$^+$)		I	J$^\pi$: from energy systematics of second 1/2$^+$ level in N=81 nuclei (1971Jo05).
1818.434 *22*	5/2$^+$	0.45 ps *+11−8*	B HI	J$^\pi$: L=2 in pickup reactions; E2 γ to 1/2$^+$.
1842.94? *13*	(7/2$^-$)		B	J$^\pi$: γ to 11/2$^-$ and log $f^{1u}t$=7.7 from 5/2$^+$ parent.
1889	1/2$^+$		I	
1907.657 *23*	(3/2)$^+$	1.2 ps *6*	B HI	J$^\pi$: L=2 and analyzing powers in pickup reactions; excit in (p,nγ).

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Adopted Levels, Gammas (continued)

^{139}Ce Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
1965.36 *24*	(3/2,5/2+)		B g	Jπ: γ to 1/2+ and log $f^{1u}t$=6.8 from 5/2+.
1984.83 *7*	(3/2,5/2+)		B gH	Jπ: γ to 1/2+ and log $f^{1u}t$=5.5 from 5/2+.
2016.26 *4*	(3/2+)	≤4.3 ps	B Hi	Jπ: 3/2,5/2,7/2+ from γ to 3/2+ and log $f^{1u}t$=5.3 from 5/2+. 3/2+ from excit in (p,nγ). "Non-standard" angular distribution in pickup reactions.
2017.6 *5*			Hi	
2028.6 *5*	(11/2−,13/2)		F	Jπ: γ to 11/2− and possible γ from (15/2−).
2063.84 *20*	11/2(−)		CDE	Jπ: ΔJ=0, dipole γ to 11/2−.
2069.7 *4*			H	
2088.6 *3*	3/2+,5/2+	>0.8 ps	HI	Jπ: L=2 in pickup reactions.
2096.0 *4*			H	
2105.1 *3*			H	
2138.7 *4*	3/2+,5/2+		HI	Jπ: L=2 in pickup reactions.
2164.1 *5*	(13/2−)		E	
2183.4 *3*			H	
2195.7 *4*			H	
2208.7 *4*			H	
2219.5 *5*			H	
2220.8 *3*			H	
2228.0 *4*			H	
2245.9 *3*	(7/2)+		HI	Jπ: L=4 in pickup reaction; γ to (3/2)+.
2279.8 *3*	(5/2+)		H	Jπ: gammas to 1/2+, 7/2− and 7/2+.
2286	11/2−		I	Jπ: L=5 and analyzing power in pickup reaction.
2287.7 *3*	(3/2+,5/2,7/2+)		H	Jπ: γ rays to (3/2)+ and 7/2+.
2354.5 *4*			H	
2361.23[&] *20*	(15/2−)		CDEF	Jπ: stretched Q γ to 11/2−; stretched (E2) to 11/2(−).
2363[@]	(7/2+,9/2+)[@]		I	Jπ: L=4 in pickup reactions.
2364.0 *3*	(3/2+,5/2+)		H	Jπ: gammas to 3/2+ and 7/2+; possible γ to 1/2+.
2392.0 *5*			H	
2400.4 *3*			H	
2421.0 *4*	3/2+,5/2+	0.43 ps *+37−15*	HI	Jπ: L=2 in pickup reactions.
2441.5 *3*			H	
2455	7/2+,9/2+		I	Jπ: L=4 in pickup reactions.
2484.9 *6*			H	
2489.5 *5*			HI	
2499.83 *23*			H	
2541.2 *5*			H	
2551.4 *5*			H	
2553.5 *3*	(3/2+,5/2,7/2+)	0.50 ps *+37−15*	H	Jπ: γs to (3/2)+ and 7/2+.
2556[@]	(9/2)+[@]		I	Jπ: L=4 in pickup reactions; 9/2+ preferred from A(θ) in (pol p,d).
2568.84 *21*			H	
2598.2 *5*			H	
2606.4 *5*			HI	XREF: I(?).
2631.9[&] *3*	(19/2−)	70 ns *5*	CDEF H	μ=+3.99 *6* (1980Ba68,2014StZZ) Jπ: J(2632)>J(2362) from excit; $T_{1/2}$≤ ≈100 ns suggests mult(269γ)=Q (1977Lu04). π=− from comparison of g(exp)=+0.405 *8* to g(theory)=+0.40 *3* assuming Configuration= $\nu 1h^{-1}_{11/2}$⊗(4+ in ^{140}Ce) (1984Vo12). $T_{1/2}$: from γ(t) in (α,3nγ). μ: TDPAD method in (α,3nγ) (1980Ba68). Other: +3.85 *8* (TDPAD,1984Vo12).
2634.3 *3*			H	
2700.8 *3*			HI	
2752.69 *23*			H	

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Adopted Levels, Gammas (continued)

^{139}Ce Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
2776.8 *4*			H	
2797.4 *4*	7/2+		HI	Jπ: L=4 and analyzing powers in pickup reactions.
2819.3 *4*	11/2−		HI	Jπ: L=5 and analyzing powers in pickup reactions.
2819.6[&] *3*	(21/2−)	≤3.0 ns	CDEF	Jπ: from γ(θ) in (α,3nγ) and γ-deexcitation pattern. $T_{1/2}$: from γ(t) in (α,3nγ).
2822.5	9/2−,11/2−		I	Jπ: L=5 in pickup reactions.
2831.9 *3*			H	
2849.2 *3*		0.63 ps *+21−13*	H	
2900.4 *4*			H	
2908.6 *4*	(9/2)+,3/2+,5/2+		HI	E(level),Jπ: L=2+4 in pickup reactions for a possible doublet; 9/2+ preferred for L=4 from A(θ) in (pol p,d).
2951.6 *4*			H	
2964	3/2+,5/2+		I	Jπ: L=2 in pickup reactions.
3052.1 *4*			H	
3082[@]	(7/2+,9/2+)[@]		I	Jπ: L=(4) in pickup reactions.
3114.0 *5*		0.79 ps *+42−21*	H	
3144	1/2+		I	
3172	3/2+,5/2+		I	Jπ: L=2 in pickup reactions.
3187.1 *3*	(23/2−)		CDEF	Jπ: from γ(θ) in (α,3nγ) and γ-deexcitation pattern.
3189.2 *4*	(7/2+,9/2+)		HI	Jπ: L=(4) in pickup reactions.
3212.5 *6*			H	
3268.8 *5*			H	
3282	7/2+,9/2+		I	Jπ: L=4 in pickup reactions.
3302	1/2+		I	
3327	5/2+,7/2+		I	Jπ: L=2+(4) in pickup reactions.
3352	5/2+,7/2+		I	Jπ: L=2+4 in pickup reactions.
3405	(1/2+)		I	
3459.4 *6*			H	
3483.7 *6*	(25/2)		F	Jπ: from γ-deexcitation pattern.
3523.5 *4*			H	
3535[@]	3/2+,5/2+ [@]		I	Jπ: L=2 in pickup reactions.
3592	3/2+,5/2+		I	Jπ: L=2 in pickup reactions.
3655	3/2+,5/2+		I	Jπ: L=2 in pickup reactions.
3703.9 *6*	(27/2)		F	Jπ: from γ-deexcitation pattern.
3852	3/2+,5/2+		I	Jπ: L=2 in pickup reactions.
3877.0[b] *4*	(23/2−)		CDE	
4013.7[a] *4*	(23/2+)		CDE	Jπ: 23/2− in (^{12}C,3nγ).
4083.8[a] *4*	(25/2+)		CDE	Jπ: 25/2− in (^{12}C,3nγ).
4098.9[b] *4*	(25/2−)		CDE	
4262.5	(3/2+,5/2+)		I	Jπ: L=(2) in pickup reactions.
4276.8[a] *4*	(27/2+)		CDE	Jπ: 27/2− in (^{12}C,3nγ).
4404.6[b] *4*	(27/2−)		CDE	
4431.5 *11*			E	
4570.8 *6*	(29/2−)		C	
4756.6[a] *4*	(29/2+)		CDE	
4808.4[b] *4*	(31/2−)		CDE	Jπ: 29/2− in (^{12}C,3nγ):E=65 MeV.
5211.8 *8*	(31/2−)		C	
5297.9 *5*	(29/2+)		C E	Jπ: 29/2− in (^{12}C,3nγ).
5532.6[a] *4*	(31/2+)		CDE	Jπ: 31/2− in (^{12}C,3nγ).
5697.6[c] *6*	(31/2−)		E	
5737.1 *6*	(31/2+)		E	
5822.7 *5*	(33/2−)		E	
5884.4[b] *5*	(35/2−)		CDE	Jπ: 31/2− in (^{12}C,3nγ).

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Adopted Levels, Gammas (continued)

^{139}Ce Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
5916.1[c] 4	(33/2⁻)	CDE	Jπ,E(level): two levels, one with 31/2⁻ and the other with 33/2⁻ are proposed in (^{12}C,3nγ):E=65 MeV.
6030.8 7	(33/2⁺)	E	
6077.2 5	(35/2⁻)	E	
6142.1[c] 5	(35/2⁻)	E	
6155.1[d] 4	(35/2⁻)	C E	
6331.8[d] 5	(37/2⁻)	E	
6487.9[c] 5	(37/2⁻)	E	
6797.6[d] 6	(39/2⁻)	E	
6844.5[c] 7	(39/2⁻)	E	
6967.1 7		E	
7165.3 7		E	
7308.5[d] 8	(41/2⁻)	E	
7332.8[c] 8	(41/2⁻)	E	
7449.8 11		E	
7571.8 11		E	
7856.0[d] 9	(43/2⁻)	E	
7987.1[c] 9	(43/2⁻)	E	
8001.2 9		E	

† From least-squares fit to Eγ data, assuming 0.5 keV uncertainty for Eγ, when not stated.

‡ From angular momentum transfer in pickup reactions. For high-spins (J>13/2 or so), assignments are based on multipolarities from DCO and angular asymmetry ratios, γ cascades and yrast type of population. No separate arguments are given for these states.

\# From DSA method in (p,nγ) (2006Bu04), except as noted.

@ Possible doublet in (d,t). Small L=0 component for second member of doublet.

& Band(A): γ cascade based on 11/2⁻.

a Band(B): γ cascade based on (23/2⁺). Parity reversed in (^{12}C,3nγ) data (2009Ch26,2006Bu04). Evaluators adopt positive parity for this band as discussed in detail by 2015Ka06 in their (^{14}C,5nγ) study, based on comparison with shell-model calculations, and expected configuration=$\nu h^{-1}_{11/2}$ coupled to negative-parity states from $\pi h^{1}_{11/2} \otimes \pi(d_{5/2}/g_{7/2})^{1}$ in the ^{140}Ce core.

b Band(C): γ cascade based on (23/2⁻), 3876.7.

c Band(D): Magnetic-dipole rotational band based on (31/2⁻).

d Band(E): Band based on (35/2⁻).

Adopted Levels, Gammas (continued)

$\gamma(^{139}Ce)$

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[&]	Comments
255.075	1/2+	255.11 2	100	0.0	3/2+	M1+E2	1.5 5	0.0840 18	α(K)=0.0680 24; α(L)=0.0126 7; α(M)=0.00270 17; α(N)=0.00059 4; α(O)=9.0×10^{-5} 5 α(P)=4.7×10^{-6} 4 B(M1)(W.u.)=0.0034 17; B(E2)(W.u.)=71 20
754.24	11/2−	754.24 8	100	0.0	3/2+	M4		0.0800	α(K)=0.0652 10; α(L)=0.01161 17; α(M)=0.00251 4; α(N)=0.000557 8; α(O)=8.86×10^{-5} 13 α(P)=5.96×10^{-6} 9 B(M4)(W.u.)=2.231 13
1320.248	5/2+	1065.32 20	6.1 10	255.075	1/2+				
		1320.24 2	100.0 14	0.0	3/2+	M1,E2			
1347.338	7/2+	1347.33 1	100	0.0	3/2+	E2			
1578.24	7/2−	824.0[a] 2	100	754.24	11/2−	E2			
1579.11	(7/2−)	231.4	4.4 26	1347.338	7/2+				
		258.4	16.6 9	1320.248	5/2+				
		824.9	100 5	754.24	11/2−				
1596.592	(3/2)+	249.3	<0.29	1347.338	7/2+				
		276.1	14.5 5	1320.248	5/2+				
		1341.50 9	14 7	255.075	1/2+				
		1596.58 2	100 8	0.0	3/2+				
1630.674	3/2+	283.7	1.5 5	1347.338	7/2+				
		310.7	<2.7	1320.248	5/2+				
		1375.56 3	43.9[#] 17	255.075	1/2+	(M1+E2)	<1.2		B(M1)(W.u.)>0.00027
		1630.67 2	100.0[#] 25	0.0	3/2+	E2			B(E2)(W.u.)>0.21
1818.434	5/2+	1563.38 2	100 6	255.075	1/2+	E2			B(E2)(W.u.)=1.8 +4−3
		1818.30 4	74 5	0.0	3/2+				E_γ: slightly poor fit, level-energy difference=1818.42.
1842.94?	(7/2−)	1088.70[a] 10	100	754.24	11/2−				
1907.657	(3/2)+	587.37[a] 15	18[#] 6	1320.248	5/2+				E_γ: γ from ε decay only, not seen in (p,nγ), treated as uncertain by evaluators.
		1652.58 2	100[#] 6	255.075	1/2+				
		1907.61 5	55.2 22	0.0	3/2+				
1965.36	(3/2,5/2+)	1710.27 24	100 25	255.075	1/2+				
		1965.66[a] 44	≤42	0.0	3/2+				
1984.83	(3/2,5/2+)	354.00 10	100 20	1630.674	3/2+				
		664.60[a] 15	≤24	1320.248	5/2+				
		1729.89 9	76 12	255.075	1/2+				
		1985.04[a] 29	≤6	0.0	3/2+				
2016.26	(3/2+)	696.01[a] 10	≤24[#]	1320.248	5/2+				
		2016.25 4	100[#] 12	0.0	3/2+				
2017.6		670.3	100	1347.338	7/2+				
2028.6	(11/2−,13/2)	1274.4	100	754.24	11/2−				

From ENSDF

$^{139}_{58}Ce_{81}$-5

γ(^{139}Ce) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	Comments
2063.84	11/2$^{(-)}$	1309.7 *2*	100	754.24	11/2$^-$	D	Mult.: ΔJ=0 transition from DCO data in (^{12}C,3nγ):E=50.5 MeV.
2069.7		722.4	100	1347.338	7/2$^+$		
		1814.5		255.075	1/2$^+$		
2088.6	3/2$^+$,5/2$^+$	768.8		1320.248	5/2$^+$		
		1833.2	9 *6*	255.075	1/2$^+$		
		2088.4	100 *10*	0.0	3/2$^+$		
2096.0		775.7		1320.248	5/2$^+$		
		1840.9		255.075	1/2$^+$		
2105.1		758.0		1347.338	7/2$^+$		
		785.3	21 *5*	1320.248	5/2$^+$		
		2104.9	100 *8*	0.0	3/2$^+$		
2138.7	3/2$^+$,5/2$^+$	508.0		1630.674	3/2$^+$		
		1883.6		255.075	1/2$^+$		
2164.1	(13/2$^-$)	1409.4 *10*	100	754.24	11/2$^-$	(D+Q)	
2183.4		835.5	<10	1347.338	7/2$^+$		
		863.5	100 *11*	1320.248	5/2$^+$		
		1928.6	<10	255.075	1/2$^+$		
2195.7		600.2	100 *13*	1596.592	(3/2)$^+$		
		847.3		1347.338	7/2$^+$		
2208.7		612.3	100 *6*	1596.592	(3/2)$^+$		
		861.1	16 *3*	1347.338	7/2$^+$		
2219.5		899.2		1320.248	5/2$^+$		
2220.8		589.9	100 *8*	1630.674	3/2$^+$		
		624.2	7 *4*	1596.592	(3/2)$^+$		
		873.6	<1	1347.338	7/2$^+$		
2228.0		907.5		1320.248	5/2$^+$		
		1973.2	100 *19*	255.075	1/2$^+$		
2245.9	(7/2)$^+$	650.0	29 *5*	1596.592	(3/2)$^+$		
		898.1		1347.338	7/2$^+$		
		925.4	100 *17*	1320.248	5/2$^+$		
2279.8	(5/2$^+$)	699.2	100 *8*	1579.11	(7/2$^-$)		
		932.1	28 *4*	1347.338	7/2$^+$		
		960.8	<1	1320.248	5/2$^+$		
		2025.3	6 *3*	255.075	1/2$^+$		
2287.7	(3/2$^+$,5/2,7/2$^+$)	379.9	50 *18*	1907.657	(3/2)$^+$		
		690.3	35 *22*	1596.592	(3/2)$^+$		
		941.2	100 *10*	1347.338	7/2$^+$		
		967.4	<220	1320.248	5/2$^+$		
2354.5		757.8		1596.592	(3/2)$^+$		
		1034.3	100 *40*	1320.248	5/2$^+$		
2361.23	(15/2$^-$)	197.0 *5*	4.7 *9*	2164.1	(13/2$^-$)		
		297.8 *4*	6.4 *3*	2063.84	11/2$^{(-)}$	(E2)	E_γ: unweighted average.
		1606.9 *2*	100 *4*	754.24	11/2$^-$	Q@	

γ(^{139}Ce) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[&]	Comments
2364.0	(3/2$^+$,5/2$^+$)	1016.7	41 *6*	1347.338	7/2$^+$			
		1043.7	37 *5*	1320.248	5/2$^+$			
		2109.0		255.075	1/2$^+$			
		2363.8	100 *13*	0.0	3/2$^+$			
2392.0		2136.9		255.075	1/2$^+$			
2400.4		769.8		1630.674	3/2$^+$			
		804.0	43 *4*	1596.592	(3/2)$^+$			
		1052.9	52 *12*	1347.338	7/2$^+$			
		1080.2	100 *12*	1320.248	5/2$^+$			
2421.0	3/2$^+$,5/2$^+$	824.2		1596.592	(3/2)$^+$			
		1073.8	100 *15*	1347.338	7/2$^+$			
2441.5		336.9	42 *13*	2105.1				
		1093.5	59 *12*	1347.338	7/2$^+$			
		1121.4	100 *11*	1320.248	5/2$^+$			
2484.9		888.1[a]	53 *4*	1596.592	(3/2)$^+$			
		905.8	100 *4*	1579.11	(7/2$^-$)			
2489.5		1142.2	100	1347.338	7/2$^+$			
2499.83		483.5	3.7 *4*	2016.26	(3/2$^+$)			
		902.5		1596.592	(3/2)$^+$			
		1152.7	7 *3*	1347.338	7/2$^+$			
		1180.0	<0.5	1320.248	5/2$^+$			
		2244.9	100 *7*	255.075	1/2$^+$			
2541.2		1193.9	100	1347.338	7/2$^+$			
2551.4		2296.3	100	255.075	1/2$^+$			
2553.5	(3/2$^+$,5/2,7/2$^+$)	956.8	40 *10*	1596.592	(3/2)$^+$	[E2]		B(E2)(W.u.)=7 *3*
		1206.3	100 *13*	1347.338	7/2$^+$			
		1233.2	50 *10*	1320.248	5/2$^+$			
2568.84		553.4	14 *1*	2016.26	(3/2$^+$)			
		938.3	48 *6*	1630.674	3/2$^+$			
		971.0	<91	1596.592	(3/2)$^+$			
		990.1	100 *10*	1579.11	(7/2$^-$)			
		1221.4	48 *5*	1347.338	7/2$^+$			
		1248.6	9 *3*	1320.248	5/2$^+$			
2598.2		1250.9	100	1347.338	7/2$^+$			
2606.4		1259.1		1347.338	7/2$^+$			
2631.9	(19/2$^-$)	270.7 *2*	100	2361.23	(15/2$^-$)	E2	0.0688	α(K)=0.0546 *8*; α(L)=0.01120 *16*; α(M)=0.00242 *4*; α(N)=0.000526 *8*; α(O)=7.94$\times10^{-5}$ *12* α(P)=3.54$\times10^{-6}$ *5* B(E2)(W.u.)=0.122 *9*
2634.3		727.7	6 *1*	1907.657	(3/2)$^+$			
		1037.2	69 *4*	1596.592	(3/2)$^+$			
		1313.6	100 *14*	1320.248	5/2$^+$			
2700.8		793.7	29 *3*	1907.657	(3/2)$^+$			

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Adopted Levels, Gammas (continued)

γ(^{139}Ce) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[&]
2700.8		1104.1	100 6	1596.592	(3/2)$^+$		
		1353.3	46 11	1347.338	7/2$^+$		
		1380.4	55 9	1320.248	5/2$^+$		
2752.69		768.4		1984.83	(3/2,5/2$^+$)		
		845.7		1907.657	(3/2)$^+$		
		1155.5		1596.592	(3/2)$^+$		
		1173.5	100 17	1579.11	(7/2$^-$)		
		1431.9		1320.248	5/2$^+$		
2776.8		1429.7	100 14	1347.338	7/2$^+$		
		1456.3	71 19	1320.248	5/2$^+$		
2797.4	7/2$^+$	781.2	<9	2016.26	(3/2$^+$)		
		1449.9	100 27	1347.338	7/2$^+$		
2819.3	11/2$^-$	1240.1	100 6	1579.11	(7/2$^-$)		
		1472.5[a]		1347.338	7/2$^+$	[M2]	
		2065.1	14 3	754.24	11/2$^-$		
2819.6	(21/2$^-$)	187.7 1	100	2631.9	(19/2$^-$)	(M1+E2)	0.215 13
2831.9		1236.0		1596.592	(3/2)$^+$		
		1484.1	<11	1347.338	7/2$^+$		
		1511.5	100 44	1320.248	5/2$^+$		
2849.2		1270.6	16.4 21	1579.11	(7/2$^-$)		
		1502.2		1347.338	7/2$^+$		
		1528.0	100 5	1320.248	5/2$^+$		
2908.6	(9/2)$^+$,3/2$^+$,5/2$^+$	1561.8		1347.338	7/2$^+$		
		1587.8		1320.248	5/2$^+$		
2951.6		1604.2		1347.338	7/2$^+$		
		1631.4		1320.248	5/2$^+$		
3052.1		1704.5		1347.338	7/2$^+$		
		1732.0		1320.248	5/2$^+$		
3114.0		1793.7	100	1320.248	5/2$^+$		
3187.1	(23/2$^-$)	367.4 1	100	2819.6	(21/2$^-$)	D+Q	
3189.2	(7/2$^+$,9/2$^+$)	1610.0	100 12	1579.11	(7/2$^-$)		
		1841.9		1347.338	7/2$^+$		
3212.5		1633.4	100	1579.11	(7/2$^-$)		
3268.8		1948.5	100	1320.248	5/2$^+$		
3459.4		1880.3	100	1579.11	(7/2$^-$)		
3483.7	(25/2)	296.5	100 10	3187.1	(23/2$^-$)		
		659.0[a]		2819.6	(21/2$^-$)		
3523.5		2175.5	100 12	1347.338	7/2$^+$		
		2203.9	44 7	1320.248	5/2$^+$		
3703.9	(27/2)	220.1	86 10	3483.7	(25/2)		
		517.0	100 34	3187.1	(23/2$^-$)		
3877.0	(23/2$^-$)	1057.3 2	100	2819.6	(21/2$^-$)	D+Q	
4013.7	(23/2$^+$)	1194.1 2	100	2819.6	(21/2$^-$)	D+Q	

From ENSDF

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$\gamma(^{139}Ce)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[&]	Comments
4083.8	(25/2+)	70.1 *2*	13.2 *17*	4013.7	(23/2+)	[M1]	3.29 *9*	α(K)=2.80 *7*; α(L)=0.385 *10*; α(M)=0.0807 *21*; α(N)=0.0179 *5*; α(O)=0.00289 *8* α(P)=0.000217 *6*
		206.7 *2*	13.0 *13*	3877.0	(23/2−)			
		896.7 *1*	100 *5*	3187.1	(23/2−)	D		
4098.9	(25/2−)	221.8 *2*	26 *3*	3877.0	(23/2−)	D		
		911.8 *2*	54 *10*	3187.1	(23/2−)	D+Q		I_γ: unweighted average.
		1279.4 *2*	100 *10*	2819.6	(21/2−)	Q		
4276.8	(27/2+)	193.0 *1*	100 *3*	4083.8	(25/2+)	D+Q		
		263.0[a] *5*	1.3 *3*	4013.7	(23/2+)			E_γ: from (^{12}C,3nγ) only.
4404.6	(27/2−)	305.7 *1*	100 *5*	4098.9	(25/2−)	D+Q		
		527.6[a] *5*	11 *1*	3877.0	(23/2−)			E_γ: from (^{12}C,3nγ):E=65 MeV only.
		1217.5 *2*	54 *5*	3187.1	(23/2−)	Q		
4431.5		1244.4 *10*	100	3187.1	(23/2−)			
4570.8	(29/2−)	294.0[a] *5*	100 *9*	4276.8	(27/2+)	D+Q		
4756.6	(29/2+)	479.8 *1*	100 *10*	4276.8	(27/2+)	D+Q		
		672.7[a] *5*	14.7 *12*	4083.8	(25/2+)			E_γ: from (^{12}C,3nγ):E=65 MeV only.
4808.4	(31/2−)	403.9 *1*	100 *11*	4404.6	(27/2−)	Q		
		709.3[a] *5*	8.1 *8*	4098.9	(25/2−)	[M3]		E_γ: from (^{12}C,3nγ):E=65 MeV only, and unlikely as it requires mult=M3.
5211.8	(31/2−)	641.0[a] *5*	100	4570.8	(29/2−)			
5297.9	(29/2+)	1021.3 *5*	100 *11*	4276.8	(27/2+)	D+Q		
		1213.9 *5*	59 *9*	4083.8	(25/2+)			
5532.6	(31/2+)	234.7 *5*	57 *5*	5297.9	(29/2+)	D+Q		
		776.0 *1*	109 *13*	4756.6	(29/2+)	D+Q		I_γ: 41 *9* from (^{12}C,3nγ):E=50.5 MeV seems discrepant.
		1255.6 *2*	100 *11*	4276.8	(27/2+)	Q		
5697.6	(31/2−)	166.0[a] *5*	176 *53*	5532.6	(31/2+)			
		1293.3 *10*	100 *10*	4404.6	(27/2−)			
5737.1	(31/2+)	439.1 *5*	100 *9*	5297.9	(29/2+)	D+Q		
		1460.6 *10*	100 *14*	4276.8	(27/2+)	Q		
5822.7	(33/2−)	1013.6 *5*	100	4808.4	(31/2−)			
5884.4	(35/2−)	61.0 *5*	8 *4*	5822.7	(33/2−)			
		1076.3 *3*	100 *10*	4808.4	(31/2−)	Q		
5916.1	(33/2−)	218.6 *5*	31 *2*	5697.6	(31/2−)	D+Q		
		383.4 *2*	93 *19*	5532.6	(31/2+)	D		I_γ: unweighted average.
		1108.1 *5*	100 *10*	4808.4	(31/2−)	D+Q		
		1160.8[a] *5*	19 *3*	4756.6	(29/2+)			
6030.8	(33/2+)	293.7 *2*	100	5737.1	(31/2+)	D+Q		
6077.2	(35/2−)	192.8 *2*	100	5884.4	(35/2−)			
6142.1	(35/2−)	226.0 *2*	100	5916.1	(33/2−)	D+Q		
6155.1	(35/2−)	239.0 *2*	100	5916.1	(33/2−)	D+Q		
6331.8	(37/2−)	176.4 *5*	49 *5*	6155.1	(35/2−)	D+Q		
		253.0[a] *10*	15 *4*	6077.2	(35/2−)			
		447.4 *2*	100 *7*	5884.4	(35/2−)	(D+Q)		

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Adopted Levels, Gammas (continued)

$\gamma(^{139}Ce)$ (continued)

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.‡
6487.9	(37/2⁻)	345.8 *2*	100	6142.1	(35/2⁻)	D+Q
6797.6	(39/2⁻)	465.5 *5*	40 *7*	6331.8	(37/2⁻)	D+Q
		642.7 *5*	100 *13*	6155.1	(35/2⁻)	
6844.5	(39/2⁻)	356.6 *5*	100	6487.9	(37/2⁻)	(D+Q)
6967.1		889.8 *5*	100	6077.2	(35/2⁻)	
7165.3		1088.0 *5*	100	6077.2	(35/2⁻)	
7308.5	(41/2⁻)	510.9 *5*	100	6797.6	(39/2⁻)	
7332.8	(41/2⁻)	488.3 *2*	100	6844.5	(39/2⁻)	D+Q
7449.8		1118.0 *10*	100	6331.8	(37/2⁻)	
7571.8		1240.0 *10*	100	6331.8	(37/2⁻)	
7856.0	(43/2⁻)	547.5 *5*	100	7308.5	(41/2⁻)	
7987.1	(43/2⁻)	654.3 *5*	100	7332.8	(41/2⁻)	(D+Q)
8001.2		835.9 *5*	100	7165.3		

† From ε decay for γ rays from levels below 2.02 MeV and from high-spin reactions from levels above 2.02 MeV, except as noted. The values, when considered from different reactions, are either weighted averages when not discrepant or unweighted averages when discrepant.

‡ From α(K)exp and conversion electron ratios in ε decay for γ rays below 2.02 MeV, from $\gamma(\theta)$ in (α,3nγ) for γ rays from levels above 2.02 MeV and from DCO ratios in (^{12}C,3nγ) and (^{14}C,5nγ) for transitions deexciting levels above 3.8 MeV or so, except as noted.

Branching ratios from ε decay and (p,nγ) are discrepant.

@ Stretched.

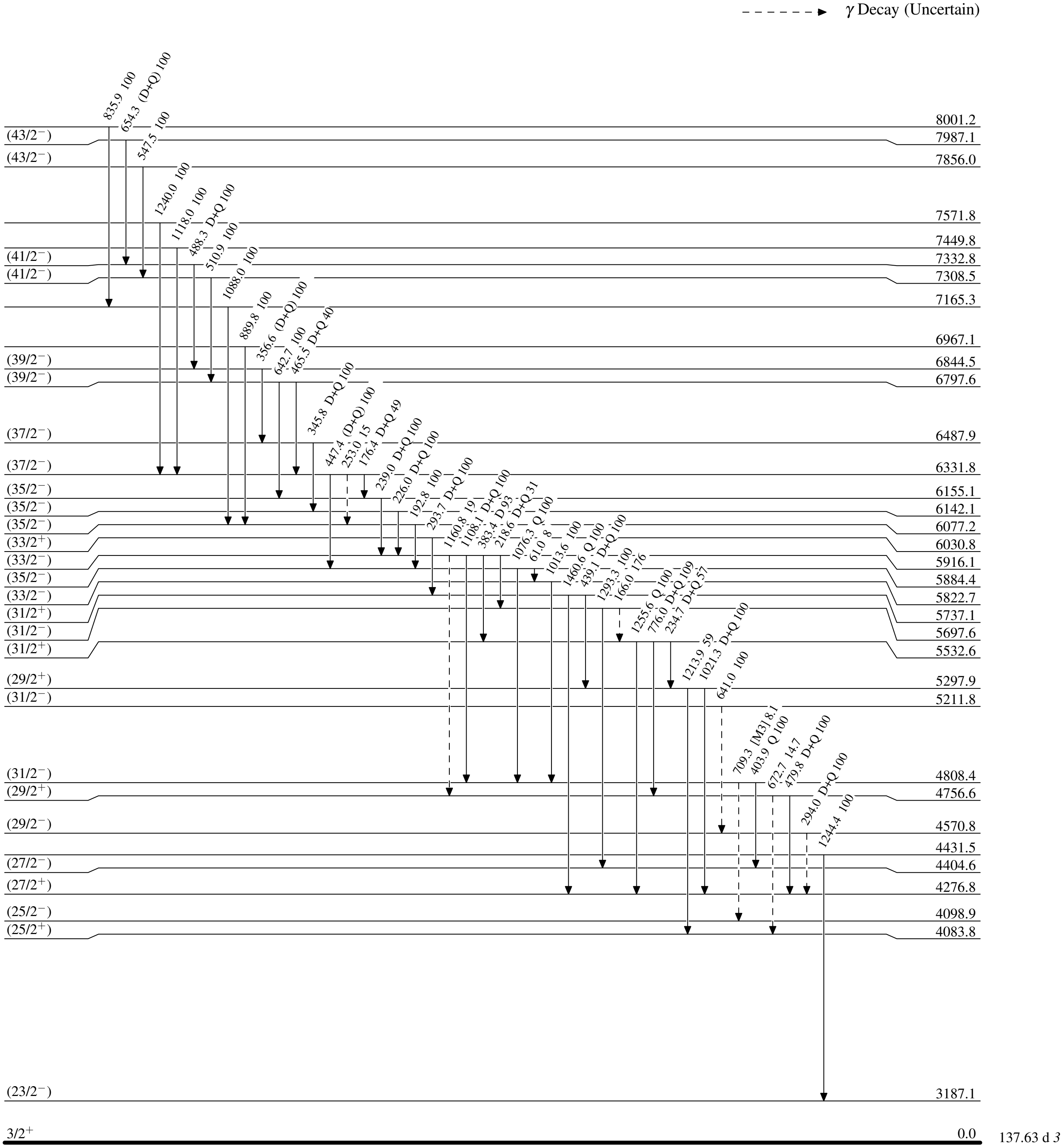
& Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

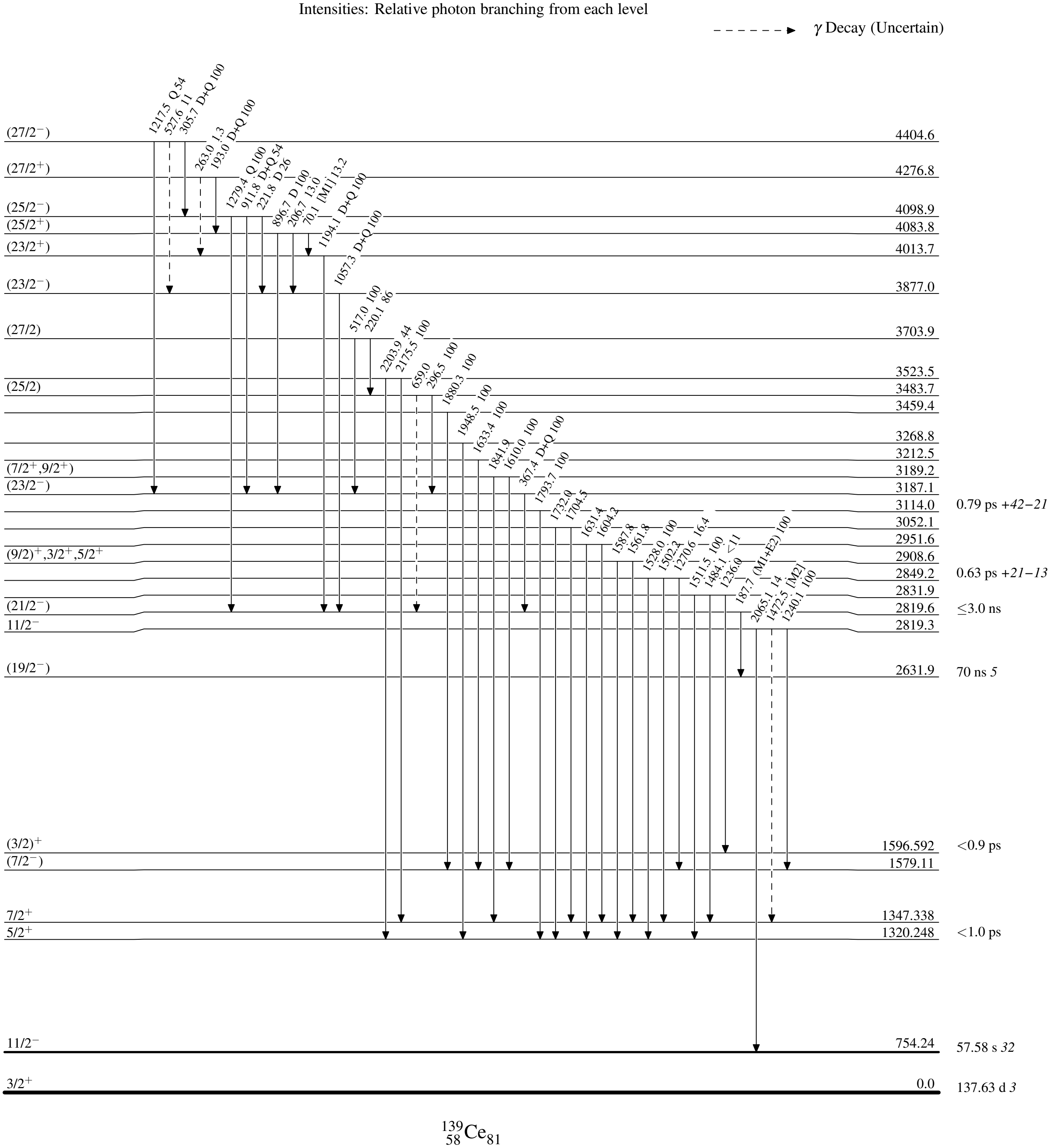


$^{139}_{58}Ce_{81}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



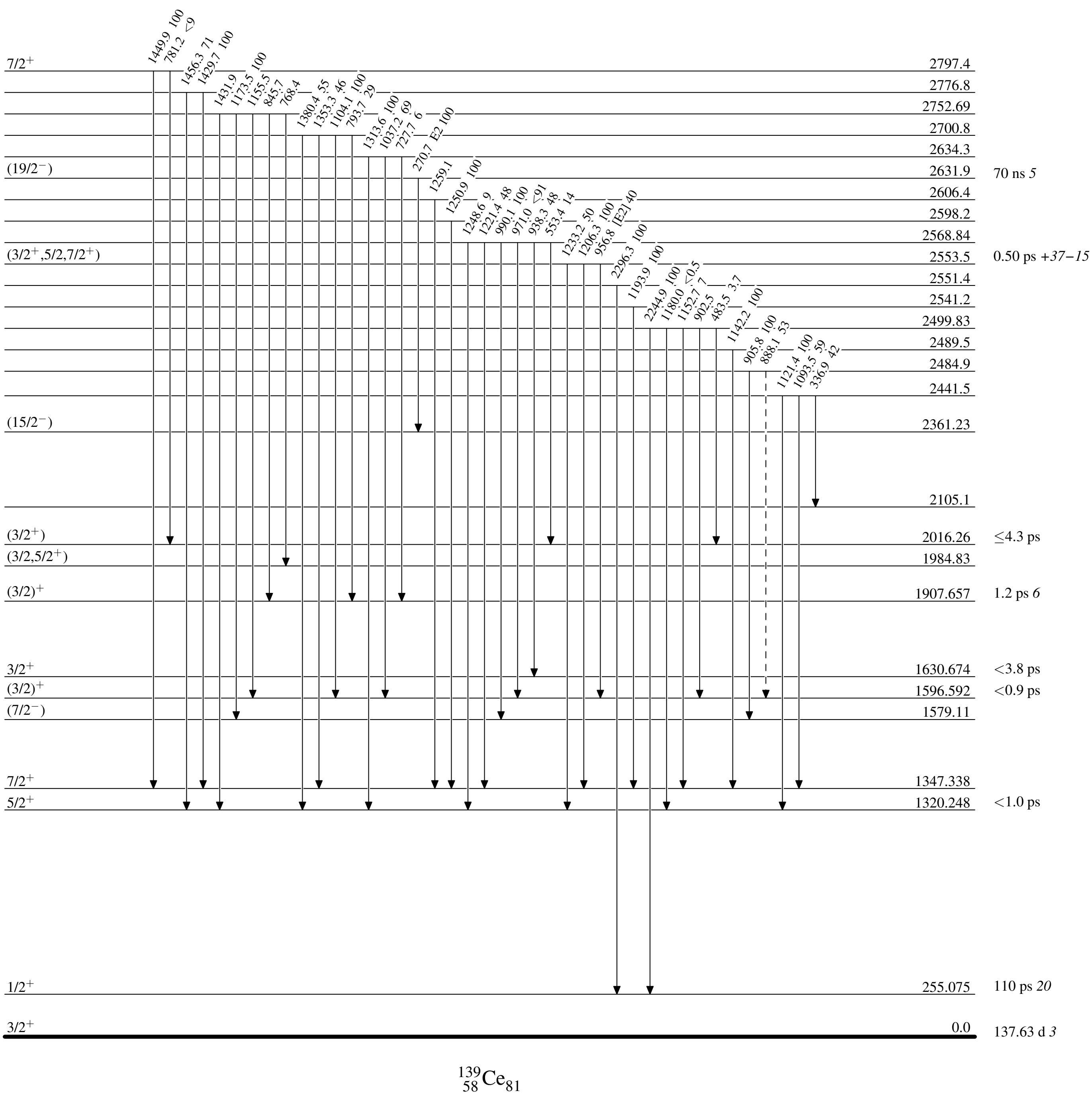
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

Legend

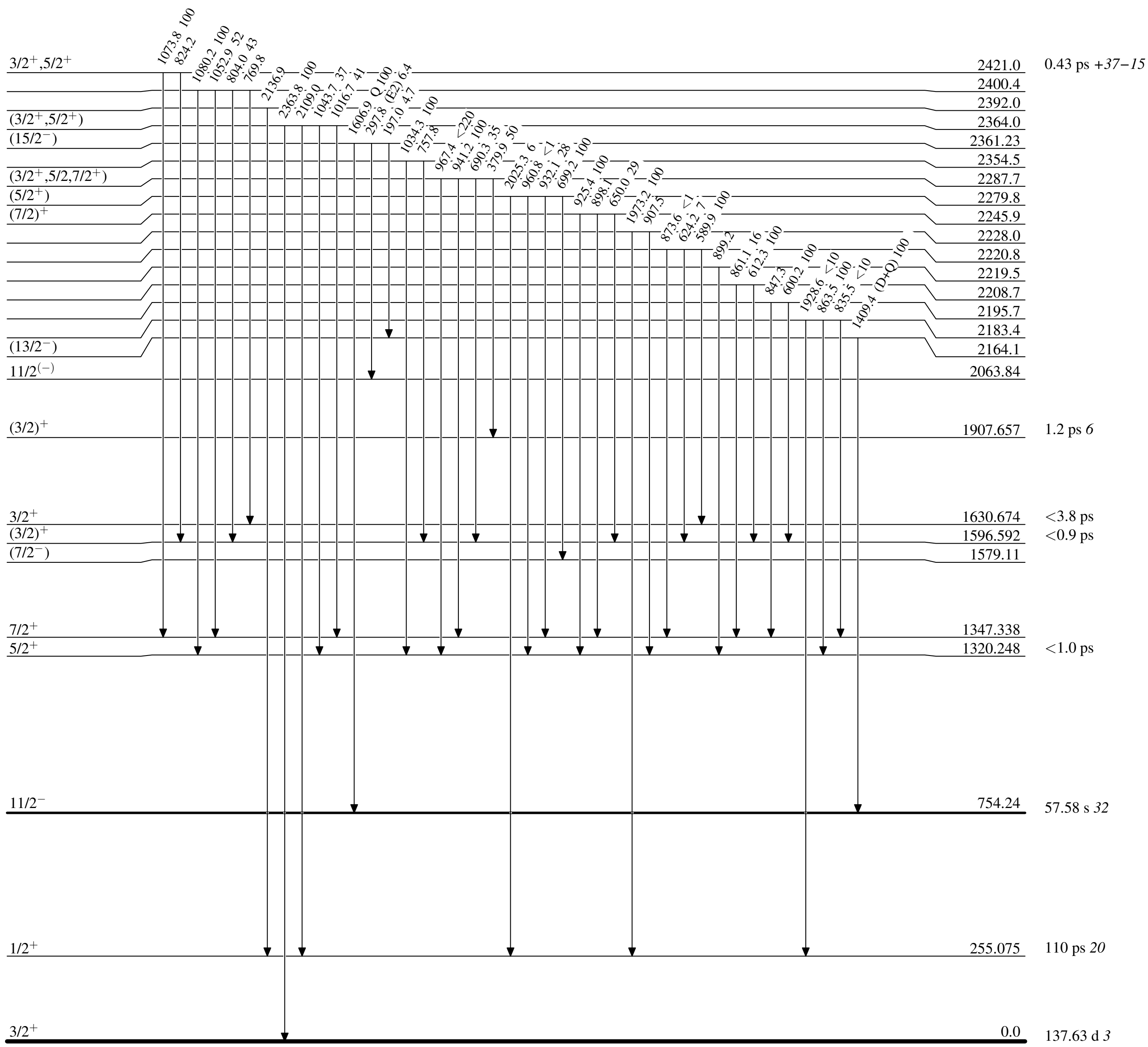
- - - - - -► γ Decay (Uncertain)



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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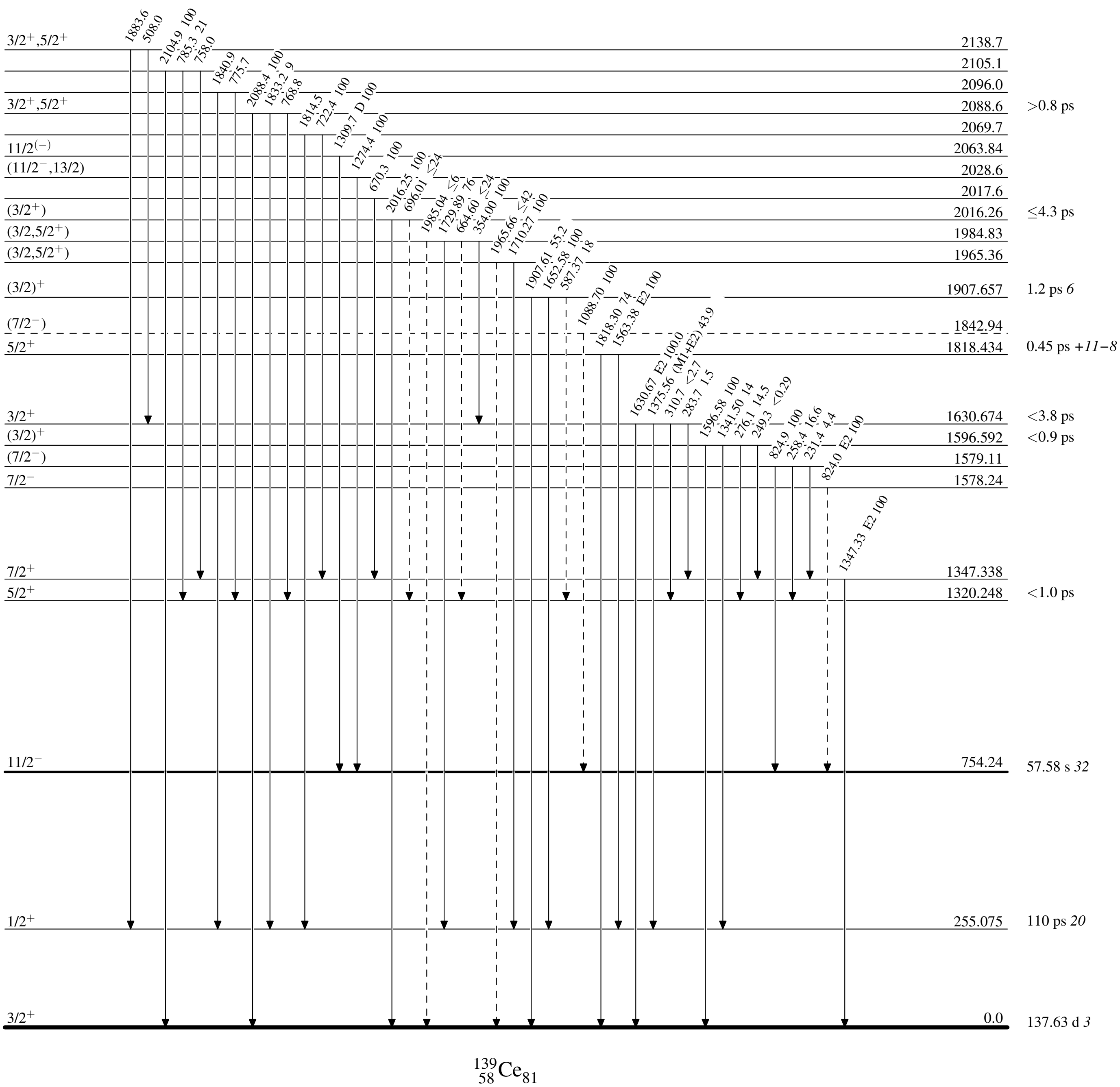
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

Legend

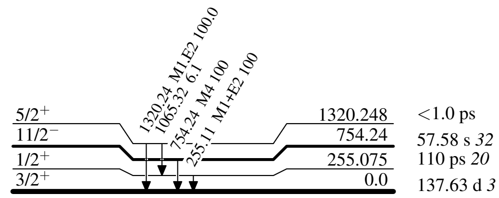
- - - - - - ► γ Decay (Uncertain)



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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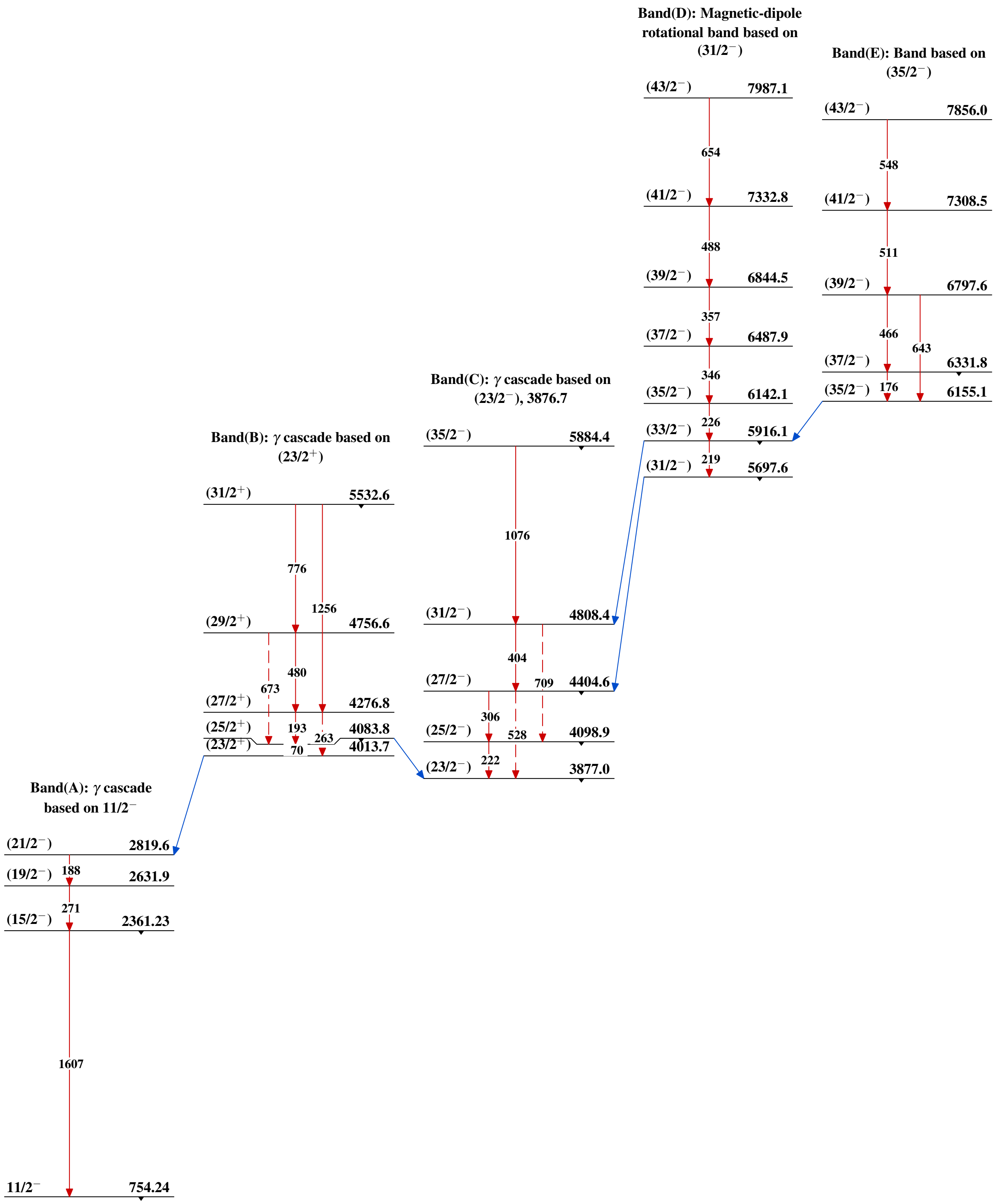
Adopted Levels, Gammas



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