Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

Q(β^-)=−4437 *10*; S(n)=9724 *5*; S(p)=7719 *50*; Q(α)=−1046 *5* 2017Wa10
S(2n)=17205 *5*, S(2p)=13262 *5* (2017Wa10).
First identification of ^{138}Ce nuclide by A.J. Dempster: Phys Rev 49, 947 (1936).
Other measurement:
^{138}Ba(π^+,π^-): GDR built on IAS state (1992Od01).
Theoretical calculations:
2016Du04: calculated charge densities, rms charge radii.
2016Pr01: calculated B(E2).
2015El05: calculated two-neutron separation energies.
2015Hu05,2013Bo24,2010Pa12,2009Si32,2008Lo05,2007Ji05,2007Tu03, 2004Yo04: calculated energy levels, J, π, B(E2).

^{138}Ce Levels

Cross Reference (XREF) Flags

A	^{138}La β^- decay	E	^{124}Sn(^{18}O,4nγ)	I	^{139}La(p,2nγ)
B	^{138}Pr ε decay (1.45 min)	F	^{130}Te(^{12}C,4nγ)	J	^{140}Ce(p,t)
C	^{138}Pr ε decay (2.03 h)	G	^{136}Ba(α,2nγ)	K	Coulomb excitation
D	^{138}Ce IT decay (8.73 ms)	H	^{138}Ba(α,4nγ)		

E(level)†	J$^\pi$	T$_{1/2}$‡	XREF	Comments
0.0@	0$^+$	>4.4×10^{16} y	ABCDEFGHIJK	%2ε=100 T$_{1/2}$: From 2014Be37 for the 2ν2K decay mode for the decay branch of g.s. to g.s. at 90% confidence level. Limits of T$_{1/2}$ values for other 0ν decay modes to g.s. were also derived in 2014Be37 and are: ≥5.5×10^{17} y for 0ν2K mode; ≥4.6×10^{17} y for 0νKL mode; and ≥4.0×10^{17} for 0ν2L mode. Others: 2011Be02, 2009Be20, 2001Da22. Δ<r^2>(^{138}Ce,^{140}Ce)=0.056 *16* (1989Ga24), isotope shift $\delta\nu$(^{138}Ce,^{140}Ce)=26.0 *42* MHz (1999Is02). Evaluated nuclear charge radius <r^2>$^{1/2}$=4.8737 fm *18* (2013An02).
788.744@ *8*	2$^+$	1.98 ps *4*	ABCDEFGHIJK	μ=0.52 *16* (2014Na15) β_2=0.126 *8*; B(E2)↑=0.45 *3* J$^\pi$: 788.742γ E2 to 0$^+$, L(p,t)=2. T$_{1/2}$: weighted average of 2.06 ps *14* from B(E2)↑ in Coulomb Excitation and 1.97 ps *4* from RDDS in Coulomb Excitation. μ: from g-factor=0.26 *8* measured using the Time-Dependent Recoil Into Vacuum (TDRIM) technique (2014Na15). β_2 and B(E2) from Coulomb Excitation.
1476.93 *9*	0$^+$		B G I K	J$^\pi$: 1476.9γ E0 to 0$^+$.
1510.80 *15*	2$^+$	0.834 ps *20*	B G IJK	J$^\pi$: 722.2γ M1 to 2$^+$, 1510.5γ E2 to 0$^+$; systematics of N=80 nuclides. T$_{1/2}$: from Coulomb excitation by DSAM.
1826.51@ *10*	4$^+$	<40 ps	CDEFGHIJK	J$^\pi$: 1037.8γ E2 to 2$^+$. See J$^\pi$ comment for 2137 level. T$_{1/2}$: from $\gamma\gamma$(t) in ^{130}Te(^{12}C,4nγ).
2129.28@ *12*	7$^-$	8.73 ms *20*	CDEFGHIJ	%IT=100 J$^\pi$: 302.8γ E3 to 4$^+$; L(p,t)=7. T$_{1/2}$: from γ(t) in ^{138}Ce IT decay (1977Go15 and 1960Mo19). Configuration=$\nu d_{3/2}^{-1} h_{11/2}^{-1}$ (1976Lu05).
2137.00 *13*	4$^+$		BC EFGHI	J$^\pi$: L(p,t)=5,6 for 2217 level; 80.4γ from 2217 to 2137 level, 1348.1γ E2 from 2137 level to 2$^+$; and 390.9γ E1 from 2217 level to 1826

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Adopted Levels, Gammas (continued)

^{138}Ce Levels (continued)

E(level)†	Jπ	T1/2‡	XREF	Comments
				level, 1037.8γ E2 from 1826 level to 2+, establish Jπ(1826)=4+, Jπ(2137)=4+ and Jπ(2217)=5−.
2142.9 *7*	(2+)	123 fs *7*	K	Jπ: 1354γ (M1+E2) to 2+, 2143γ to 0+. T1/2: from Coulomb excitation by DSAM.
2177.37 *16*	(3−)		G I K	B(E3)↑=0.163 *9* (2006Ra08) Jπ: suggested by 2006Ra08 in Coulomb excitation based on γ(θ). Jπ=(3+) suggested by 1987Lo12 in (α,2nγ) but no experimental evidence. B(E3)↑ from Coulomb excitation (2006Ra08).
2217.41 *12*	5−	450 ps *30*	C EFGHIJ	Jπ: L(p,t)=5,6; 390.9γ E1 to 4+. See Jπ comment for 2137 level. T1/2: from γγ(t) in ^{130}Te(^{12}C,4nγ). Other: <0.3 ns from γγ(t) in ^{138}Pr ε decay (2.03 h).
2236.54 *15*	2+	56.8 fs *35*	B K	Jπ: 2236.5γ E2 to 0+, 1447.8γ M1+E2 to 2+. T1/2: from Coulomb excitation by DSAM.
2293.97@ *12*	6+	880 ps *19*	FGHI	Jπ: 467.5γ E2 to 4+, 157.0γ E2 to 4+, 164.7γ (E1) to 7−. T1/2: from γγ(t) in ^{130}Te(^{12}C,4nγ).
2339.85 *10*	0+		B J	Jπ: L(p,t)=0; log *ft*=5.7 from 1+ parent in ^{138}Pr ε decay (1.45 m).
2393.91 *23*	(3−)		G IJ	Jπ: L(p,t)=(2,3); 176.5γ to 5−.
2396.11 *22*	6+		G I	Jπ: 569.6γ E2 to 4+, no γ to J<4.
2443.90 *25*	4+		G IJ	Jπ: 933.1γ Q to 2+, L(p,t)=4 or 5.
2470.99 *15*	(1,2+)	109 fs *6*	B K	Jπ: 1682.1γ to 2+, 2471.1γ to 0+.
2471.68 *18*	(4+,5+)		G I	Jπ: 334.6γ (M1+E2) to 4+, 177.8γ to 6+.
2642.4 *3*	2+	66 fs *32*	B JK	Jπ: L(p,t)=2 or 3, 2642.0γ to 0+. T1/2: from Coulomb excitation by DSAM.
2719 *15*	(4+,5−)		J	Jπ: L(p,t)=4,5.
2733.09 *18*	6+		FG I	Jπ: 906.6γ E2 to 4+, 439.1γ M1+E2 to 6+.
2748.78 *18*	5+		G I	Jπ: 611.7γ M1 to 4+ and 454.9γ M1+E2 to 6+.
2764.94 *13*	6−		C FGHI	Jπ: 547.5γ M1 to 5−, 635.7γ M1 to 7−.
2885 *16*	(2+,3−)		J	Jπ: L(p,t)=2,3.
2899.25 *18*	6−		C G I	Jπ: 770.1γ M1 to 7−, 681.7γ ΔJ=1 to 5−.
2903.21 *20*	(1,2+)		B	Jπ: 1426.9γ to 0+, 2114.4γ to 2+.
2907.22 *22*	(3,4,5)		G I	Jπ: 1080.7γ D+Q to 4+.
2942 *16*	(4+,5−)		J	Jπ: L(p,t)=4,5.
2950.5 *3*	(2−,3−,4−)		G I	Jπ: 556.6γ M1 to (3−).
2995.72 *22*	6+		G I	Jπ: 1169.2γ E2, ΔJ=2 to 4+.
3005 *16*	(4+,5−)		J	Jπ: L(p,t)=4,5.
3082 *19*	(4+,5−)		J	Jπ: L(p,t)=4,5.
3109.02@ *13*	8+		FGHI	Jπ: 979.7γ E1 to 7−, 815.1γ E2 to 6+.
3176.27 *23*			G I	
3177.4? *7*			B	
3214.17 *23*	(5,6,7)		G I	Jπ: 920.2γ to 6+, ΔJ<2 from γ(θ) in (α,2nγ).
3220 *16*	(2+,3−)		J	Jπ: L(p,t)=2,3.
3229.8 *3*			G I	
3277 *16*	(3−)		J	Jπ: L(p,t)=(3).
3331.59 *20*	8−		F	Jπ: 1202.3γ M1 to 7−.
3356 *18*	(2+,3−)		J	Jπ: L(p,t)=2,3.
3367.8 *4*			C	
3429 *16*	(4+,5−)		J	Jπ: L=4,5 in (p,t) dataset.
3430.2 *3*	(7)+		FG I	Jπ: 697.1γ M1(+E2) to 6+; no γ to J<6. 2009Bh04 in (^{12}C,4nγ) assigned (8+) assuming 697.1γ (E2) to 6+ but no experimental support is presented.
3507.30b *17*	9−		F	Jπ: 1378.0γ E2 to 7−, 175.7γ to 8−, 398.3γ to 8+.
3531 *16*			J	
3539.21@ *15*	10+	82 ns *2*	EFGHI	%IT=100

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Adopted Levels, Gammas (continued)

^{138}Ce Levels (continued)

E(level)†	Jπ	$T_{1/2}$‡	XREF	Comments
				μ=−1.70 *3* (1980Ba68,2014StZZ); Q=0.77 (1983Da29,2016St14)
				Jπ: 430.2γ E2 to 8+, band structure.
				$T_{1/2}$: weighted average of 81 ns *2* from (^{12}C,4nγ), 81 ns *5* from (α,4nγ), 82 ns *2* from (^{18}O,4nγ).
				μ: from g-factor=−0.170 *3* in 1980Ba68 in (^{18}O,4nγ). Other: g-factor=−0.176 *10* from 1980Me11 in (^{12}C,4nγ).
				MOMM2: estimated by 1983Da29 using an effective charge of 1.87.
				Configuration=$\nu h^{-2}_{11/2}$ (1976Lu05).
3545.79 *23*	(9−)		F	E(level): this level is constructed by 2009Bh04 in (^{12}C,4nγ) from the placement of the 396.7γ-1416.5γ cascade from the 3942, 11+ level to the 2129, 7− level. 1999Zh28 in (^{18}O,4nγ) placed the cascade in opposite order, making a level at E=2526 level instead. A 1416.5γ is also observed but unplaced in ^{138}Pr ε decay (2.03 h) from 7− parent decay and it could indicate that the placement of this γ from the 3942, 11+ level in (^{18}O,4nγ) is less likely and its placement from the 3546, (9−) level is favored.
				Jπ: 1416.5γ (E2) to 7−.
3646 *16*	(7−)		J	Jπ: L(p,t)=(7).
3670.6 *3*	(6,7−)		C	Jπ: 1453.3γ to 5−, 1540.9γ to 7−, log *ft*=7.1 from 7− parent.
3800.6 *4*	(6,7−)		C	Jπ: 1671.2γ to 7−, 1583.2γ to 5−, log *ft*=7.2 from 7− parent.
3926.7 *5*	(6,7−)		C	Jπ: 1797.5γ to 7−, 1709.2γ to 5−, log *ft*=7.2 from 7− parent.
3942.42@ *18*	11+	140 ps *11*	EFGHI	Jπ: 403.2γ M1+E2 to 10+, 396.7γ (M2) to (9−), band structure.
				$T_{1/2}$: from γγ(t) in (^{12}C,4nγ). Other: <1.5 ns from 1976Lu07.
4050.0? *3*			G I	
4139.3 *3*	(10−)		F	Jπ: 632.0γ (M1) to 9−.
4157.0 *5*	6,7,8		C	Jπ: 2026.6γ to 7−, 1392.6γ to 6−, log *ft*=6.7 from 7− parent.
4204.0 *3*	(10−)		F	Jπ: proposed in (^{12}C,4nγ).
4248.1 *7*	(6,7−)		C	Jπ: 2119.3γ to 7−, 2030.2γ to 5−, log *ft*=7.1 from 7− parent.
4359.93@ *23*	12+		EFGHI	Jπ: 417.5γ M1 to 11+, band structure.
4401.9b *3*	10−		F	Jπ: 894.6γ M1 to 9−, band structure.
4781.51 *25*	(12+)		F	Jπ: 839.1γ (M1+E2) to 11+.
4843.0 *3*	13−		F	Jπ: 483.0γ E1 to 12+.
4974.64 *25*	13+		EF H	Jπ: 614.7γ M1 to 12+; no γ to J<12.
5071.3 *4*	(11−)		F	Jπ: 932.0γ (M1) to (10−).
5089.32 *24*	12−		EF H	Jπ: 1146.9γ E1 to 11+, 729.3γ to 12+.
5214.30@ *24*	13−		EFGHI	Jπ: 854.4γ E1 to 12+, 124.8γ M1+E2 to 12−, band structure.
5312.39@ *25*	14+	80 ps *9*	EF H	Jπ: 337.7γ M1 to 13+, band structure.
				$T_{1/2}$: from γγ(t) in (^{12}C,4nγ).
5387.7b *4*	11−		F	Jπ: 985.8γ M1 to 10−, band structure.
5411.5& *3*	14−		F H	Jπ: 197.9γ M1 to 13−, 568.5γ M1 to 13−, 99.1γ to 14+, band structure.
5566.4@ *3*	15+		F H	Jπ: 254.0γ M1+E2 to 14+, band structure.
5714.4 *3*	(14−)		F	Jπ: 500.1γ (M1) to 13−.
5726.6a *3*	14+		F	Jπ: 1366.7γ E2 to 12+, band structure.
5731.0& *3*	15−		F H	Jπ: 319.5γ M1 to 14−, band structure.
5871.2a *3*	15+		F	Jπ: 896.6γ E2 to 13+, 144.6γ to 14+, band structure.
5955.3 *4*			F	
6014.4@ *3*	16+		EF H	Jπ: 448.0γ M1 to 15+, band structure.
6134.7 *3*	(14+)		F	Jπ: 1291.7γ (E1) to 13−.
6328.7b *4*	(12−)		F	Jπ: 941.0γ (M1) to 11−, band structure.
6363.4& *4*	16−		F	Jπ: 632.4γ M1 to 15−, band structure.
6408.6 *4*	(15−)		F	Jπ: proposed in (^{12}C,4nγ) assuming 997.1γ (M1) to 14−.
6451.0 *4*			F	
6451.2a *4*	16+		F	Jπ: 580.0γ M1 to 15+, band structure.
6536.4# *3*	15(−)		F	Jπ: 1224.0γ (E1+M2), ΔJ=1 to 14+, 970.0γ to 15+, 149.1γ ΔJ=1 from 16−.

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Adopted Levels, Gammas (continued)

^{138}Ce Levels (continued)

E(level)[†]	Jπ	XREF	Comments
6597.6 *5*		F	
6606.3[a] *4*	17^+	F	Jπ: 155.1γ M1 to 16^+, band structure.
6685.5[#] *3*	16^-	EF	Jπ: 1119.1γ E1 to 15^+, band structure. $J^\pi=16^+$ assigned by 1999Zh28 in (^{18}O,4nγ) is inconsistent with γ(DCO) and γ(pol) data in (^{12}C,4nγ) and not adopted.
6738.3 *4*	(16^-)	F	Jπ: proposed in (^{12}C,4nγ) assuming 1007.3γ (M1) to 15^-.
6841.7[@] *3*	17^+	EF	Jπ: 827.3γ M1 to 16^+, 1275.3γ ΔJ=2 to 15^+, band structure.
6859.7 *5*		F	
6889.0[#] *3*	17^-	EF	Jπ: 874.6γ E1 to 16^+, 203.5γ M1 to 16^-, band structure.
7074.0[&] *4*	(17^-)	F	Jπ: proposed in (^{12}C,4nγ) assuming 710.6γ (M1) to 16^- and 1343.0γ (E2) to 15^-.
7104.7[@] *3*	18^+	EF	Jπ: 1090.3γ E2 to 16^+, 263.0γ M1 to 17^+, band structure.
7185.3 *4*	(16^-)	F	Jπ: proposed in (^{12}C,4nγ).
7211.3[#] *3*	18^-	EF	Jπ: 322.3γ M1 to 17^-, band structure.
7225.2 *3*	(16^-)	F	Jπ: proposed in (^{12}C,4nγ).
7392.3[a] *5*	(18^+)	F	Jπ: proposed in (^{12}C,4nγ) assuming 786.0γ (M1) to 17^+.
7427.6 *4*		F	
7532.4 *3*	(17^-)	F	Jπ: 347.1γ (M1) to (16^-), 1518.0γ (E1) to 16^+.
7682.9 *4*	19^+	EF	Jπ: 578.2γ M1 to 18^+.
7685.8[#] *4*	19^-	EF	Jπ: 474.5γ M1 to 18^-, band structure.
7744.2 *4*	(18^-)	F	Jπ: 211.8γ (M1+E2) to (17^-).
7803.2[@] *4*	20^+	EF	Jπ: 120.3γ M1+E2 to 19^+, 698.5γ to 18^+, band structure.
8322.3 *4*	(20^+)	F	Jπ: 211.8γ (M1) to 19^+.
8350.3[#] *4*	20^-	EF	Jπ: 664.5γ M1 to 19^-, 1139.0γ to 18^-, band structure.
8709.6[#] *4*	21^-	F	Jπ: 359.3γ M1 to 20^-, band structure.
8873.5[@] *4*	22^+	EF	Jπ: 1070.3γ E2 to 20^+, band structure.
8921.1 *4*		F	
8957.9[#] *5*	$22^{(-)}$	F	Jπ: 248.3γ (M1), ΔJ=1 to 21^-, band structure.
8978.3 *4*		F	
9430.9[@] *5*	(23^+)	F	Jπ: 557.4γ (M1) to 22^+, band structure.
9511.4 *4*		F	

[†] From least-squares fit to Eγ, assuming ΔEγ=1 keV when unknown.
[‡] From Coulomb excitation by DSAM and (^{12}C,4nγ) by γγ(t), unless otherwise noted.
[#] Band(A): Band based on 15^-. Possible magnetic-rotational band with proposed configuration= $\pi g_{7/2}\otimes\pi h_{11/2}\otimes\nu h^{-2}_{11/2}$.
[@] Seq.(E): Yrast sequence. Configurations: $[\pi(g^6_{7/2}d^2_{5/2})\otimes\nu h^{-2}_{11/2} + \pi(g^5_{7/2}d^3_{5/2})\otimes\nu h^{-2}_{11/2}]$ for positive-parity states and $[\pi(g^6_{7/2}d^1_{5/2}h^1_{11/2})\otimes\nu h^{-2}_{11/2}] + [\pi(g^5_{7/2}d^2_{5/2}h^1_{11/2})\otimes\nu h^{-2}_{11/2}] + [\pi(g^5_{7/2}d^3_{5/2})\otimes\nu(s^{-1}_{1/2}h^{-1}_{11/2}]$ for negative-parity states. Above 6 MeV excitation, configuration= $\pi h^2_{11/2}\otimes\nu h^{-2}_{11/2}$.
[&] Band(B): Band based on 14^-. Possible configuration=$\pi(g_{7/2}d_{5/2})\otimes\ \nu(h^{-1}_{11/2}d^{-1}_{3/2})$.
[a] Band(C): Band based on 14^+.
[b] Band(D): Band based on 9^-. Possible configuration=$\nu h_{11/2}\otimes\nu d_{3/2}$ or $\nu h_{11/2}\otimes\nu s_{1/2}$.

Adopted Levels, Gammas (continued)

γ(^{138}Ce)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	α[†]	$I_{(\gamma+ce)}$	Comments
788.744	2^+	788.742 *8*	100	0.0	0^+	E2[@]	0.00342		α(K)=0.00291 *4*; α(L)=0.000406 *6*; α(M)=8.52×10^{-5} *12* α(N)=1.88×10^{-5} *3*; α(O)=3.01×10^{-6} *5*; α(P)=2.10×10^{-7} *3* B(E2)(W.u.)=21.2 *+16−14* E_γ: from ^{138}La β^- decay.
1476.93	0^+	688.2 *1*	100	788.744	2^+	E2[&]	0.00473		α(K)=0.00400 *6*; α(L)=0.000576 *8*; α(M)=0.0001211 *17* α(N)=2.67×10^{-5} *4*; α(O)=4.24×10^{-6} *6*; α(P)=2.87×10^{-7} *4* E_γ: from ^{138}Pr ε decay (1.45 m).
		1476.9 *2*		0.0	0^+	E0[&]		3.1 *3*	E_γ,$I_{(\gamma+ce)}$: from ^{138}Pr ε decay (1.45 m).
1510.80	2^+	722.2 *2*	75.9 *9*	788.744	2^+	M1[#]	0.00630		α(K)=0.00541 *8*; α(L)=0.000700 *10*; α(M)=0.0001458 *21* α(N)=3.24×10^{-5} *5*; α(O)=5.27×10^{-6} *8*; α(P)=4.09×10^{-7} *6* B(M1)(W.u.)=0.0301 *11* E_γ: weighted average of 722.3 *3* from ^{138}Pr ε decay (1.45 m), 722.1 *2* from ^{136}Ba(α,2nγ), and 722 *1* from Coulomb excitation. I_γ: weighted average of 89 *11* from ^{138}Pr ε decay (1.45 m), 81 *3* from ^{139}La(p,2nγ), and 75.7 *6* Coulomb Excitation. Other: 90 *3* from ^{136}Ba(α,2nγ). Mult.: Other: M1+E2 from Coulomb Excitation with δ=−1.97 *+32−25* based on γ(θ).
		1510.5 *3*	100.0 *6*	0.0	0^+	E2	9.54×10^{-4}		α(K)=0.000751 *11*; α(L)=9.63×10^{-5} *14*; α(M)=2.00×10^{-5} *3* α(N)=4.44×10^{-6} *7*; α(O)=7.19×10^{-7} *10*; α(P)=5.47×10^{-8} *8*; α(IPF)=8.10×10^{-5} *12* B(E2)(W.u.)=1.15 *4* E_γ: weighted average of 1510.2 *2* from ^{138}Pr ε decay (1.45 m), 1510.9 *2* from ^{136}Ba(α,2nγ), and 1510 *1* from Coulomb excitation. I_γ: from Coulomb excitation. Mult.: Q from γ(θ) in ^{136}Ba(α,2nγ) and Coulomb excitation; M2 is ruled out by RUL.
1826.51	4^+	1037.8 *1*	100	788.744	2^+	E2	0.00186		α(K)=0.001594 *23*; α(L)=0.000213 *3*; α(M)=4.44×10^{-5} *7* α(N)=9.83×10^{-6} *14*; α(O)=1.583×10^{-6} *23*; α(P)=1.157×10^{-7} *17* B(E2)(W.u.)>0.28 E_γ: weighted average of 1038.0 *1* from ^{138}Pr ε decay (2.03 h), 1037.6 *9* from ^{138}Ce IT decay, 1037.6 *1* from ^{130}Te(^{12}C,4nγ), 1037.7 *2* from ^{136}Ba(α,2nγ), 1037.6 *3* from ^{138}Ba(α,4nγ), and 1038 *1* from Coulomb excitation. Mult.: based on ce data in ^{138}Pr ε decay (2.03 h), γ(θ) in ^{136}Ba(α,2nγ), ^{138}Ba(α,4nγ) and Coulomb excitation, and γ(DCO) and γ(pol) in ^{130}Te(^{12}C,4nγ).
2129.28	7^-	302.8 *1*	100	1826.51	4^+	E3	0.183		α(K)=0.1236 *18*; α(L)=0.0462 *7*; α(M)=0.01033 *15* α(N)=0.00223 *4*; α(O)=0.000324 *5*; α(P)=8.31×10^{-6} *12* B(E3)(W.u.)=0.450 *12*

$^{138}_{58}Ce_{80}$-5

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	δ	α[†]	Comments
									E_γ: weighted average of 302.7 *1* from ^{138}Pr ε decay, 302.9 *8* from ^{138}Ce IT decay, 302.9 *1* from ^{130}Te(^{12}C,4nγ), 302.7 *2* from ^{136}Ba(α,2nγ), and 302.7 *3* from ^{138}Ba(α,4nγ). Mult.: based on ce data in ^{138}Pr ε decay (2.03 h) and ^{138}Ce IT decay.
2137.00	4$^+$	1348.1 *2*	100	788.744	2$^+$	E2		1.12×10^{-3}	α(K)=0.000937 *14*; α(L)=0.0001213 *17*; α(M)=2.52×10^{-5} *4* α(N)=5.59×10^{-6} *8*; α(O)=9.05×10^{-7} *13*; α(P)=6.81×10^{-8} *10*; α(IPF)=3.17×10^{-5} *5* E_γ: weighted average of 1347.8 *10* from ^{138}Pr ε decay (1.45 m), 1348.0 *3* from ^{138}Pr ε decay (2.03 h), 1348.1 *2* from ^{130}Te(^{12}C,4nγ), 1348.1 *2* from ^{136}Ba(α,2nγ). Mult.: based on ce data in (p,2nγ) and (α,2nγ), γ(θ) in ^{136}Ba(α,2nγ), γ(DCO) and γ(pol) in ^{130}Te(^{12}C,4nγ).
2142.9	(2$^+$)	1354 *1*	100 *1*	788.744	2$^+$	(M1+E2)	−0.83 *+6−8*	0.00133 *3*	α(K)=0.001120 *22*; α(L)=0.000143 *3*; α(M)=2.97×10^{-5} *6* α(N)=6.60×10^{-6} *13*; α(O)=1.073×10^{-6} *21*; α(P)=8.29×10^{-8} *17*; α(IPF)=3.33×10^{-5} *6* B(M1)(W.u.)=0.032 *+6−4*; B(E2)(W.u.)=7.4 *+12−13* E_γ,I_γ: from Coulomb excitation. Mult.,δ: from Coulomb excitation based on γ(θ); bracket is added by evaluator.
		2143 *1*	32.2 *7*	0.0	0$^+$	[E2]		8.16×10^{-4}	α(K)=0.000392 *6*; α(L)=4.91×10^{-5} *7*; α(M)=1.018×10^{-5} *15* α(N)=2.26×10^{-6} *4*; α(O)=3.67×10^{-7} *6*; α(P)=2.85×10^{-8} *4*; α(IPF)=0.000362 *5* B(E2)(W.u.)=0.58 *+6−5* E_γ,I_γ: from Coulomb excitation.
2177.37	(3$^-$)	666.6 *2*	48.1 *7*	1510.80	2$^+$				E_γ: from (α,2nγ). I_γ: from Coulomb excitation. Other: 30 *2* from (p,2nγ).
		1388.6 *2*	100.0 *7*	788.744	2$^+$	(E1+M2)	−0.025 *+12−19*	0.00063 *3*	α(K)=0.000427 *24*; α(L)=5.3×10^{-5} *3*; α(M)=1.10×10^{-5} *7* α(N)=2.43×10^{-6} *15*; α(O)=3.95×10^{-7} *24*; α(P)=3.06×10^{-8} *19*; α(IPF)=0.0001339 *23* E_γ: from (α,2nγ). I_γ: from Coulomb excitation. Mult.,δ: from Coulomb excitation based on γ(θ), bracket added by evaluator. Other: δ=−2.2 *2* for Mult=M1+E2 in (α,2nγ).

$^{138}_{58}Ce_{80}$-6

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	δ	α †	Comments
2217.41	5⁻	80.4 *2*	2.4 *10*	2137.00	4⁺	[E1]		0.442	α(K)=0.375 *6*; α(L)=0.0536 *9*; α(M)=0.01117 *18* α(N)=0.00243 *4*; α(O)=0.000375 *6*; α(P)=2.19×10^{-5} *4* B(E1)(W.u.)=2.0×10^{-5} *+13−10* E_γ: weighted average of 79.4 *6* from ^{138}Pr ε decay (2.03 h), 80.4 *2* from ^{130}Te(^{12}C,4nγ), and 80.4 *2* from ^{136}Ba(α,2nγ). I_γ: from ^{138}Pr ε decay (2.03 h). Other: ≤5 from (α,4nγ).
		88.0	5.6 *14*	2129.28	7⁻	[E2]		3.25	α(K)=1.756 *25*; α(L)=1.167 *17*; α(M)=0.261 *4* α(N)=0.0559 *8*; α(O)=0.00784 *11*; α(P)=9.11×10^{-5} *13* B(E2)(W.u.)=2.5×10^{2} *7* E_γ,I_γ: from (α,4nγ) only.
		390.9 *1*	100 *4*	1826.51	4⁺	E1		0.00642	α(K)=0.00552 *8*; α(L)=0.000713 *10*; α(M)=0.0001482 *21* α(N)=3.27×10^{-5} *5*; α(O)=5.25×10^{-6} *8*; α(P)=3.81×10^{-7} *6* B(E1)(W.u.)=7.4×10^{-6} *+11−9* E_γ: weighted average of 390.9 *1* from ^{130}Te(^{12}C,4nγ), 390.8 *2* from ^{136}Ba(α,2nγ), 390.7 *3* from ^{138}Ba(α,4nγ), and 390.9 *1* from ^{138}Pr ε decay (2.03 h). I_γ: from (α,2nγ). Mult.: based on ce data in (α,2nγ) and ^{138}Pr ε decay (2.03 h), γ(θ) in (α,2nγ) and (α,4nγ), γ(DCO) and γ(pol) in (^{12}C,4nγ).
2236.54	2⁺	1447.8 *2*	100.0 *7*	788.744	2⁺	M1+E2	0.18 *+5−4*	1.30×10^{-3}	α(K)=0.001069 *16*; α(L)=0.0001354 *20*; α(M)=2.81×10^{-5} *5* α(N)=6.25×10^{-6} *10*; α(O)=1.018×10^{-6} *15*; α(P)=7.98×10^{-8} *12*; α(IPF)=6.11×10^{-5} *9* B(M1)(W.u.)=0.069 *+7−6*; B(E2)(W.u.)=0.6 *+5−3* E_γ: from ^{138}Pr ε decay (1.45 m). I_γ: from Coulomb excitation. Mult.: from Coulomb excitation based on γ(θ) and RUL.
		2236.5 *2*	80.0 *11*	0.0	0⁺	E2		8.27×10^{-4}	α(K)=0.000363 *5*; α(L)=4.54×10^{-5} *7*; α(M)=9.41×10^{-6} *14* α(N)=2.09×10^{-6} *3*; α(O)=3.39×10^{-7} *5*; α(P)=2.64×10^{-8} *4*; α(IPF)=0.000407 *6* B(E2)(W.u.)=1.87 *+15−13* E_γ: from ^{138}Pr ε decay (1.45 m). I_γ: from Coulomb excitation. Other: 61 *9* from ^{138}Pr ε decay (1.45 m). Mult.: Q from γ(θ) in Coulomb excitation; M2 is ruled out by RUL.
2293.97	6⁺	76.6 *1*	41 *5*	2217.41	5⁻	(E1)		0.505	α(K)=0.427 *7*; α(L)=0.0616 *9*; α(M)=0.01282 *19* α(N)=0.00279 *4*; α(O)=0.000429 *7*; α(P)=2.48×10^{-5} *4* B(E1)(W.u.)=0.000123 *18* E_γ: weighted average of 76.7 *1* from ^{130}Te(^{12}C,4nγ), 76.4 *2*

$^{138}_{58}Ce_{80}$-7

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	α[†]	Comments
								from ^{136}Ba(α,2nγ), and 76.5 *3* from ^{138}Ba(α,4nγ).
								I_γ: weighted average of 43 *5* from ^{130}Te(^{12}C,4nγ), 34 *9* from ^{136}Ba(α,2nγ).
								Mult.: based on γ(θ) in (α,2nγ) and (α,4nγ).
2293.97	6^+	157.0 *2*	8.2 *4*	2137.00	4^+	E2	0.420	α(K)=0.302 *5*; α(L)=0.0932 *14*; α(M)=0.0205 *3* α(N)=0.00442 *7*; α(O)=0.000642 *10*; α(P)=1.76×10^{-5} *3* B(E2)(W.u.)=6.1 *+9−8* E_γ: weighted average of 157.1 *2* from ^{130}Te(^{12}C,4nγ), 156.8 *2* from ^{136}Ba(α,2nγ). I_γ: weighted average of 9.2 *10* from ^{136}Ba(α,2nγ) and 8.0 *4* from ^{139}La(p,2nγ). Other: 27.2 *27* from ^{130}Te(^{12}C,4nγ). Mult.: from Coulomb excitation based on γ(DCO) and RUL.
		164.7 *1*	100 *4*	2129.28	7^-	(E1)	0.0616	α(K)=0.0527 *8*; α(L)=0.00707 *10*; α(M)=0.001470 *21* α(N)=0.000323 *5*; α(O)=5.09×10^{-5} *8*; α(P)=3.38×10^{-6} *5* B(E1)(W.u.)=3.0×10^{-5} *+4−3* E_γ: weighted average of 164.7 *1* from ^{130}Te(^{12}C,4nγ), 164.6 *2* from ^{136}Ba(α,2nγ) and 164.6 *3* from ^{138}Ba(α,4nγ). I_γ: from (p,2nγ). Mult.: based on γ(θ) in (α,4nγ) and (α,2nγ); also suggested in Coulomb excitation.
		467.5 *2*	33 *3*	1826.51	4^+	E2	0.01298	α(K)=0.01079 *16*; α(L)=0.001729 *25*; α(M)=0.000367 *6* α(N)=8.06×10^{-5} *12*; α(O)=1.258×10^{-5} *18*; α(P)=7.53×10^{-7} *11* B(E2)(W.u.)=0.105 *+18−16* E_γ: weighted average of 467.6 *1* from ^{130}Te(^{12}C,4nγ), 467.2 *2* from ^{136}Ba(α,2nγ), and 467.0 *3* from ^{138}Ba(α,4nγ). I_γ: unweighted average of 29.6 *10* from (α,2nγ) and 36 *2* from (p,2nγ). Other: 56.9 *30* from (^{12}C,4nγ). Mult.: based on ce data in (α,2nγ) and (p,2nγ), γ(θ) in (α,2nγ) and (α,4nγ), γ(DCO) and γ(pol) in ^{130}Te(^{12}C,4nγ).
2339.85	0^+	1551.1 *1*	100	788.744	2^+	E2	9.25×10^{-4}	α(K)=0.000714 *10*; α(L)=9.13×10^{-5} *13*; α(M)=1.90×10^{-5} *3* α(N)=4.21×10^{-6} *6*; α(O)=6.82×10^{-7} *10*; α(P)=5.20×10^{-8} *8*; α(IPF)=9.56×10^{-5} *14* E_γ: from ^{138}Pr ε decay (1.45 m). Mult.: M1,E2 from ce data in ^{138}Pr ε decay (1.45 m); M1 is ruled out by level-spin difference.
2393.91	(3^-)	176.5 *2*	100	2217.41	5^-			E_γ: from (α,2nγ).
2396.11	6^+	569.6 *2*	100	1826.51	4^+	E2	0.00762	α(K)=0.00640 *9*; α(L)=0.000965 *14*; α(M)=0.000204 *3* α(N)=4.48×10^{-5} *7*; α(O)=7.07×10^{-6} *10*; α(P)=4.54×10^{-7} *7* E_γ: from (α,2nγ). Mult.: based on γ(θ) in (α,2nγ) and ce data in (p,2nγ).
2443.90	4^+	933.1 *2*	100	1510.80	2^+	E2	0.00234	α(K)=0.00200 *3*; α(L)=0.000271 *4*; α(M)=5.67×10^{-5} *8*

$^{138}_{58}Ce_{80}$-8

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	δ	α[†]	Comments
									α(N)=1.254×10^{-5} *18*; α(O)=2.01×10^{-6} *3*; α(P)=1.449×10^{-7} *21* E_γ: from (α,2nγ). Mult.: Q from γ(θ) in (α,2nγ) and M2 is ruled out by no level-parity change.
2470.99	(1,2$^+$)	1682.1 *2*	80.8 *10*	788.744	2$^+$				E_γ: from ^{138}Pr ε decay (1.45 m). I_γ: weighted average of 68 *14* from ^{138}Pr ε decay (1.45 m) and 80.9 *10* from Coulomb excitation.
		2471.1 *2*	100 *3*	0.0	0$^+$				E_γ: from ^{138}Pr ε decay (1.45 m). I_γ: from Coulomb excitation.
2471.68	(4$^+$,5$^+$)	177.8 *2*	57.3 *24*	2293.97	6$^+$				E_γ: from (α,2nγ). I_γ: weighted average of 68 *16* from ^{136}Ba(α,2nγ) and 57.1 *24* from ^{139}La(p,2nγ).
		334.6 *2*	100 *5*	2137.00	4$^+$	(M1+E2)	−0.16 *4*	0.039 *5*	α(K)=0.033 *5*; α(L)=0.00504 *14*; α(M)=0.00107 *4* α(N)=0.000235 *8*; α(O)=3.70×10^{-5} *6*; α(P)=2.4×10^{-6} *5* E_γ,I_γ: from (α,2nγ). Mult.,δ: from γ(θ) in (α,2nγ). Other: (M1,E2) from ce data in (p,2nγ).
2642.4	2$^+$	1853.7 *3*	100 *4*	788.744	2$^+$				E_γ: from ^{138}Pr ε decay (1.45 m). I_γ: from Coulomb excitation.
		2642.0 *7*	35 *14*	0.0	0$^+$	[E2]		9.10×10^{-4}	α(K)=0.000270 *4*; α(L)=3.35×10^{-5} *5*; α(M)=6.94×10^{-6} *10* α(N)=1.541×10^{-6} *22*; α(O)=2.51×10^{-7} *4*; α(P)=1.96×10^{-8} *3*; α(IPF)=0.000598 *9* B(E2)(W.u.)=0.41 *+63−23* E_γ: from ^{138}Pr ε decay (1.45 m). I_γ: from Coulomb excitation.
2733.09	6$^+$	439.1 *2*	16.9 *12*	2293.97	6$^+$	M1+E2[#]	1.6 *3*	0.0172 *6*	α(K)=0.0144 *6*; α(L)=0.00219 *5*; α(M)=0.000464 *9* α(N)=0.0001021 *20*; α(O)=1.61×10^{-5} *4*; α(P)=1.03×10^{-6} *5* E_γ: weighted average of 438.7 *2* from ^{130}Te(^{12}C,4nγ) and 439.5 *2* from ^{136}Ba(α,2nγ). I_γ: weighted average of 52 *8* from ^{130}Te(^{12}C,4nγ), 19 *3* from ^{136}Ba(α,2nγ), and 16.5 *12* from ^{139}La(p,2nγ). δ: from (α,2nγ).
		906.6 *2*	100 *3*	1826.51	4$^+$	E2[#]		0.00250	α(K)=0.00213 *3*; α(L)=0.000290 *4*; α(M)=6.07×10^{-5} *9* α(N)=1.342×10^{-5} *19*; α(O)=2.15×10^{-6} *3*; α(P)=1.542×10^{-7} *22* E_γ: weighted average of 906.3 *2* from ^{130}Te(^{12}C,4nγ) and 906.9 *2* from ^{136}Ba(α,2nγ). I_γ: from (α,2nγ).
2748.78	5$^+$	454.9 *2*	70 *5*	2293.97	6$^+$	M1+E2[#]	2.5 *15*	0.017 *3*	α(K)=0.014 *3*; α(L)=0.00205 *18*; α(M)=0.00043 *4*

$^{138}_{58}Ce_{80}$-9

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	δ	α[†]	Comments
									α(N)=9.5×10^{-5} *8*; α(O)=1.52×10^{-5} *16*; α(P)=1.05×10^{-6} *24* E_γ,δ: from (α,2nγ). I_γ: from (p,2nγ).
2748.78	5$^+$	611.7 *2*	100 *6*	2137.00	4$^+$	M1[#]		0.00943	α(K)=0.00810 *12*; α(L)=0.001054 *15*; α(M)=0.000220 *3* α(N)=4.87×10^{-5} *7*; α(O)=7.93×10^{-6} *12*; α(P)=6.13×10^{-7} *9* E_γ: from (α,2nγ). I_γ: from (p,2nγ).
2764.94	6$^-$	547.5 *1*	100 *5*	2217.41	5$^-$	M1[#a]		0.01239	α(K)=0.01064 *15*; α(L)=0.001389 *20*; α(M)=0.000290 *4* α(N)=6.43×10^{-5} *9*; α(O)=1.045×10^{-5} *15*; α(P)=8.07×10^{-7} *12* E_γ: weighted average of 547.5 *1* from ^{138}Pr ε decay (2.03 h), 547.3 *2* from ^{130}Te(^{12}C,4nγ), and 547.7 *2* from ^{136}Ba(α,2nγ). I_γ: from ^{138}Pr ε decay (2.03 h).
		635.7 *1*	35 *3*	2129.28	7$^-$	M1[a]		0.00858	α(K)=0.00737 *11*; α(L)=0.000958 *14*; α(M)=0.000200 *3* α(N)=4.43×10^{-5} *7*; α(O)=7.21×10^{-6} *10*; α(P)=5.58×10^{-7} *8* E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
2899.25	6$^-$	681.7 *2*	43 *3*	2217.41	5$^-$	M1+E2	−2.5 *3*	0.00517 *11*	α(K)=0.00439 *10*; α(L)=0.000620 *12*; α(M)=0.0001302 *24* α(N)=2.87×10^{-5} *6*; α(O)=4.59×10^{-6} *9*; α(P)=3.18×10^{-7} *8* E_γ: weighted average of 680.8 *5* from ^{138}Pr ε decay (2.03 h) and 681.8 *2* from ^{136}Ba(α,2nγ). I_γ: weighted average of 35 *7* from ^{138}Pr ε decay (2.03 h), 50 *7* from ^{136}Ba(α,2nγ), and 43.5 *27* from ^{139}La(p,2nγ). Mult.,δ: D+Q from γ(θ) in (α,2nγ), ΔJ=1; polarity from level-parity change.
		770.1 *2*	100 *5*	2129.28	7$^-$	M1[#]		0.00539	α(K)=0.00464 *7*; α(L)=0.000599 *9*; α(M)=0.0001247 *18* α(N)=2.77×10^{-5} *4*; α(O)=4.51×10^{-6} *7*; α(P)=3.50×10^{-7} *5* E_γ: weighted average of 770.4 *4* from ^{138}Pr ε decay (2.03 h) and 770.0 *2* from ^{136}Ba(α,2nγ). I_γ: from (p,2nγ). Mult.: ΔJ=1 from γ(θ) in (α,2nγ).
2903.21	(1,2$^+$)	1426.9 *7*	31 *16*	1476.93	0$^+$				E_γ,I_γ: from ^{138}Pr ε decay (1.45 m).
		2114.4 *2*	100 *19*	788.744	2$^+$				E_γ,I_γ: from ^{138}Pr ε decay (1.45 m).
2907.22	(3,4,5)	1080.7 *2*	100	1826.51	4$^+$	D+Q			E_γ: from (α,2nγ). Mult.: deduced by evaluator based on γ(θ) in (α,2nγ).
2950.5	(2$^-$,3$^-$,4$^-$)	556.6 *2*	100	2393.91	(3$^-$)	M1[#]		0.01189	α(K)=0.01021 *15*; α(L)=0.001333 *19*; α(M)=0.000278 *4* α(N)=6.17×10^{-5} *9*; α(O)=1.003×10^{-5} *14*; α(P)=7.74×10^{-7} *11* E_γ: from (α,2nγ).
2995.72	6$^+$	1169.2 *2*	100	1826.51	4$^+$	E2[#]		1.46×10^{-3}	α(K)=0.001246 *18*; α(L)=0.0001638 *23*; α(M)=3.41×10^{-5} *5*

$^{138}_{58}Ce_{80}$-10

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	δ	α[†]	Comments
									α(N)=7.56×10^{-6} *11*; α(O)=1.220×10^{-6} *17*; α(P)=9.05×10^{-8} *13*; α(IPF)=3.17×10^{-6} *5* Mult.: ΔJ=2 from γ(θ) in (α,2nγ).
3109.02	8$^+$	815.1 *1*	100 *3*	2293.97	6$^+$	E2		0.00317	α(K)=0.00270 *4*; α(L)=0.000375 *6*; α(M)=7.85×10^{-5} *11* α(N)=1.735×10^{-5} *25*; α(O)=2.77×10^{-6} *4*; α(P)=1.95×10^{-7} *3* E_γ: weighted average of 815.0 *1* from ^{130}Te(^{12}C,4nγ), 815.3 *2* from ^{136}Ba(α,2nγ), and 815.0 *3* from ^{138}Ba(α,4nγ). I_γ: from (α,2nγ). Mult.: based on ce data in (α,2nγ) and (p,2nγ), γ(θ) in (α,2nγ) and (α,4nγ), γ(DCO) and γ(pol) in (^{12}C,4nγ).
		979.7 *1*	47.2 *21*	2129.28	7$^-$	E1[#]		8.78×10^{-4}	α(K)=0.000759 *11*; α(L)=9.46×10^{-5} *14*; α(M)=1.96×10^{-5} *3* α(N)=4.34×10^{-6} *6*; α(O)=7.04×10^{-7} *10*; α(P)=5.39×10^{-8} *8* E_γ: weighted average of 979.7 *1* from ^{130}Te(^{12}C,4nγ), 979.8 *2* from ^{136}Ba(α,2nγ), and 979.3 *3* from ^{138}Ba(α,4nγ). I_γ: weighted average of 45.7 *21* from ^{136}Ba(α,2nγ) and 49.6 *26* from ^{139}La(p,2nγ). Others: 36.9 *19* from ^{130}Te(^{12}C,4nγ), 24 *4* from ^{138}Ba(α,4nγ). Mult.: based on ce data in (α,2nγ) and (p,2nγ), γ(θ) in (α,2nγ) and (α,4nγ), γ(DCO) and γ(pol) in (^{12}C,4nγ).
3176.27		882.3 *2*	100	2293.97	6$^+$				E_γ: from (α,2nγ).
3177.4?		3177.4 *7*	100	0.0	0$^+$				E_γ: from ^{138}Pr ε decay (1.45 m) only.
3214.17	(5,6,7)	920.2 *2*	100	2293.97	6$^+$				E_γ: from (α,2nγ).
3229.8		758.1 *2*	100	2471.68	(4$^+$,5$^+$)				E_γ: from (α,2nγ).
3331.59	8$^-$	1202.3 *2*	100	2129.28	7$^-$	M1		0.00191	Mult.: ΔJ=1 from γ(θ) in (α,2nγ). α(K)=0.001638 *23*; α(L)=0.000209 *3*; α(M)=4.34×10^{-5} *6* α(N)=9.63×10^{-6} *14*; α(O)=1.569×10^{-6} *22*; α(P)=1.227×10^{-7} *18*; α(IPF)=6.32×10^{-6} *10* E_γ: from (^{12}C,4nγ). A 1202.4γ is observed but unplaced in ^{138}Pr ε decay (2.03 h) from 7$^-$ parent. Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
3367.8		1239.0 *6*	100 *6*	2129.28	7$^-$				E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
		1540.9[b] *5*	<16[b]	1826.51	4$^+$				E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
3430.2	(7)$^+$	697.1 *2*	100	2733.09	6$^+$	M1(+E2)	≤1.1	0.0062 *7*	α(K)=0.0053 *6*; α(L)=0.00071 *6*; α(M)=0.000148 *12* α(N)=3.3×10^{-5} *3*; α(O)=5.3×10^{-6} *5*; α(P)=4.0×10^{-7} *5* E_γ: from (α,2nγ). Mult.,δ: based on ce data in (α,2nγ) and (p,2nγ) and γ(θ) in (α,2nγ). Mult=(E2) suggested by 2009Bh04 in (^{12}C,4nγ) is inconsistent. Mixing ratio is deduced by evaluator from ce data using the BrIccMixing program; M1 is given in (α,2nγ) and (p,2nγ).

$^{138}_{58}Ce_{80}$-11

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	α[†]	Comments
3507.30	9$^-$	175.7 *2*	61 *9*	3331.59	8$^-$	M1	0.243	α(K)=0.208 *3*; α(L)=0.0281 *4*; α(M)=0.00588 *9* α(N)=0.001305 *19*; α(O)=0.000211 *3*; α(P)=1.602×10^{-5} *23* E_γ,I_γ: from (^{12}C,4nγ). Mult.: D from γ(DCO) in (^{12}C,4nγ); polarity from no level-parity change.
		398.3 *2*	17.3 *27*	3109.02	8$^+$	[E1]	0.00613	α(K)=0.00528 *8*; α(L)=0.000681 *10*; α(M)=0.0001415 *20* α(N)=3.12×10^{-5} *5*; α(O)=5.02×10^{-6} *7*; α(P)=3.64×10^{-7} *6* E_γ,I_γ: from (^{12}C,4nγ).
		1378.0 *2*	100 *15*	2129.28	7$^-$	E2	1.08×10^{-3}	α(K)=0.000897 *13*; α(L)=0.0001159 *17*; α(M)=2.41×10^{-5} *4* α(N)=5.34×10^{-6} *8*; α(O)=8.65×10^{-7} *13*; α(P)=6.53×10^{-8} *10*; α(IPF)=3.95×10^{-5} *6* E_γ,I_γ: from (^{12}C,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
3539.21	10$^+$	31.9[c] *2*	0.081 *16*	3507.30	9$^-$	(E1)	0.934 *22*	α(L)=0.741 *17*; α(M)=0.155 *4* α(N)=0.0331 *8*; α(O)=0.00481 *11*; α(P)=0.000214 *5* B(E1)(W.u.)=7.5×10^{-8} *+20−18* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only.
		109.0[c] *2*	0.081 *16*	3430.2	(7)$^+$		1.510 *24*	α(K)=0.940 *15*; α(L)=0.446 *8*; α(M)=0.0994 *17* α(N)=0.0213 *4*; α(O)=0.00302 *5*; α(P)=5.07×10^{-5} *8* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. Mult.: (E2) from (^{12}C,4nγ) given J^π(3430.2)=(8)$^+$ suggested by 2009Bh04.
		430.2 *1*	100 *4*	3109.02	8$^+$	E2	0.01642	α(K)=0.01358 *19*; α(L)=0.00224 *4*; α(M)=0.000477 *7* α(N)=0.0001045 *15*; α(O)=1.625×10^{-5} *23*; α(P)=9.40×10^{-7} *14* B(E2)(W.u.)=0.0108 *3* E_γ: weighted average of 430.2 *1* from ^{130}Te(^{12}C,4nγ), 430.1 *2* from ^{136}Ba(α,2nγ), and 430.0 *3* from ^{138}Ba(α,4nγ). I_γ: from (α,2nγ). Other: 100 *5* from (^{12}C,4nγ). Mult.: based on ce data in (α,2nγ) and (p,2nγ), γ(θ) in (α,2nγ) and (α,4nγ), γ(DCO) and γ(pol) in (^{12}C,4nγ).
		1409.9 *2*	0.73 *8*	2129.28	7$^-$	(E3)	0.00193	α(K)=0.001628 *23*; α(L)=0.000226 *4*; α(M)=4.74×10^{-5} *7* α(N)=1.050×10^{-5} *15*; α(O)=1.688×10^{-6} *24*; α(P)=1.218×10^{-7} *17*; α(IPF)=1.80×10^{-5} *3* B(E3)(W.u.)=0.0084 *+16−14* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Also observed in (^{18}O,4nγ).
3545.79	(9$^-$)	1416.5 *2*	100	2129.28	7$^-$	(E2)	1.04×10^{-3}	α(K)=0.000851 *12*; α(L)=0.0001096 *16*; α(M)=2.28×10^{-5} *4* α(N)=5.05×10^{-6} *7*; α(O)=8.18×10^{-7} *12*; α(P)=6.19×10^{-8} *9*; α(IPF)=5.05×10^{-5} *7* E_γ: placed by 2009Bh04 in (^{12}C,4nγ). 1999Zh28 in (^{18}O,4nγ) placed this transition from the 3942 level, making a level at E=2526. See also the comment for 3546 level. Mult.: from (^{12}C,4nγ) based on γ(DCO).

$^{138}_{58}Ce_{80}$-12

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
3670.6	(6,7$^-$)	1453.3 *3*	100 *7*	2217.41	5$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
		1540.9[b] *5*	<63[b]	2129.28	7$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
3800.6	(6,7$^-$)	1583.2 *5*	100 *10*	2217.41	5$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
		1671.2 *5*	85 *8*	2129.28	7$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
3926.7	(6,7$^-$)	1709.2 *7*	92 *12*	2217.41	5$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
		1797.5 *7*	100 *11*	2129.28	7$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
3942.42	11$^+$	396.7[c] *2*	3.0 *5*	3545.79	(9$^-$)	(M2)	0.1020	α(K)=0.0854 *12*; α(L)=0.01309 *19*; α(M)=0.00278 *4* α(N)=0.000618 *9*; α(O)=9.95×10^{-5} *14*; α(P)=7.27×10^{-6} *11* B(M2)(W.u.)=24 *+8−6* E_γ,I_γ: placed by 2009Bh04 in (^{12}C,4nγ). But this placement is still considered questionable since it wrould require an unreasonable large B(M2) value. 1999Zh28 in (^{18}O,4nγ) has placed this transition from a level at E=2526 to the 2129 level which is however unfavored. See also the comment for 3546 level. Mult.: from (^{12}C,4nγ) based on γ(DCO).
		403.2 *1*	100 *6*	3539.21	10$^+$	M1+E2	0.023 *4*	α(K)=0.020 *4*; α(L)=0.00289 *14*; α(M)=0.000610 *24* α(N)=0.000135 *6*; α(O)=2.14×10^{-5} *15*; α(P)=1.4×10^{-6} *4* E_γ: weighted average of 403.3 *1* from ^{130}Te(^{12}C,4nγ), 403.1 *2* from ^{136}Ba(α,2nγ), and 403.0 *3* from ^{138}Ba(α,4nγ). I_γ: from (^{12}C,4nγ). Mult.: from ^{130}Te(^{12}C,4nγ) based on γ(DCO) and γ(pol).
4050.0?		941.0[c] *2*	100	3109.02	8$^+$			E_γ: from (α,2nγ).
4139.3	(10$^-$)	632.0 *2*	100	3507.30	9$^-$	(M1)	0.00870	α(K)=0.00748 *11*; α(L)=0.000972 *14*; α(M)=0.000202 *3* α(N)=4.49×10^{-5} *7*; α(O)=7.31×10^{-6} *11*; α(P)=5.66×10^{-7} *8* E_γ,Mult.: from (^{12}C,4nγ). Mult is based on γ(DCO) and γ(pol).
4157.0	6,7,8	1392.6 *5*	68 *8*	2764.94	6$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
		2026.6 *7*	100 *8*	2129.28	7$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
4204.0	(10$^-$)	658.2 *2*	100	3545.79	(9$^-$)	(M1)	0.00788	α(K)=0.00677 *10*; α(L)=0.000879 *13*; α(M)=0.000183 *3* α(N)=4.07×10^{-5} *6*; α(O)=6.61×10^{-6} *10*; α(P)=5.12×10^{-7} *8* E_γ,Mult.: from (^{12}C,4nγ). No γ(DCO) and γ(pols) data to support mult.
4248.1	(6,7$^-$)	2030.2 *9*	100 *67*	2217.41	5$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
		2119.3 *9*	66 *12*	2129.28	7$^-$			E_γ,I_γ: from ^{138}Pr ε decay (2.03 h).
4359.93	12$^+$	417.5 *2*	100	3942.42	11$^+$	M1	0.0245	α(K)=0.0210 *3*; α(L)=0.00277 *4*; α(M)=0.000578 *9* α(N)=0.0001282 *18*; α(O)=2.08×10^{-5} *3*; α(P)=1.600×10^{-6} *23* E_γ: weighted average of 417.6 *1* from ^{130}Te(^{12}C,4nγ), 417.5 *2* from ^{136}Ba(α,2nγ), and 417.4 *3* from ^{138}Ba(α,4nγ). Mult.: based on ce data in (α,2nγ), γ(θ) in (α,2nγ) and (α,4nγ), γ(DCO) and γ(pol) in (^{12}C,4nγ).
4401.9	10$^-$	894.6 *2*	100	3507.30	9$^-$	M1	0.00378	α(K)=0.00325 *5*; α(L)=0.000418 *6*; α(M)=8.69×10^{-5} *13* α(N)=1.93×10^{-5} *3*; α(O)=3.14×10^{-6} *5*; α(P)=2.45×10^{-7} *4* E_γ,Mult.: from (^{12}C,4nγ); mult is based on γ(DCO) and γ(pol).
4781.51	(12$^+$)	839.1 *2*	100	3942.42	11$^+$	(M1+E2)	0.0037 *8*	α(K)=0.0032 *7*; α(L)=0.00042 *7*; α(M)=8.7×10^{-5} *15*

$^{138}_{58}Ce_{80}$-13

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
								α(N)=1.9×10^{-5} *4*; α(O)=3.1×10^{-6} *6*; α(P)=2.3×10^{-7} *6* E_γ,Mult.: from (^{12}C,4nγ); mult is based on γ(DCO).
4843.0	13$^-$	483.0 *2*	100	4359.93	12$^+$	E1	0.00388	α(K)=0.00334 *5*; α(L)=0.000428 *6*; α(M)=8.89×10^{-5} *13* α(N)=1.97×10^{-5} *3*; α(O)=3.17×10^{-6} *5*; α(P)=2.33×10^{-7} *4* E_γ,Mult.: from (^{12}C,4nγ); mult is based on γ(DCO) and γ(pol).
4974.64	13$^+$	614.7 *1*	100	4359.93	12$^+$	M1	0.00931	α(K)=0.00800 *12*; α(L)=0.001041 *15*; α(M)=0.000217 *3* α(N)=4.81×10^{-5} *7*; α(O)=7.83×10^{-6} *11*; α(P)=6.06×10^{-7} *9* E_γ: from (^{12}C,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ) and γ(θ) in (α,4nγ).
5071.3	(11$^-$)	932.0 *2*	100	4139.3	(10$^-$)	(M1)	0.00343	α(K)=0.00295 *5*; α(L)=0.000379 *6*; α(M)=7.88×10^{-5} *11* α(N)=1.751×10^{-5} *25*; α(O)=2.85×10^{-6} *4*; α(P)=2.22×10^{-7} *4* E_γ,I_γ: from (^{12}C,4nγ); mult is based on γ(DCO).
5089.32	12$^-$	729.3 *2*	1.53 *23*	4359.93	12$^+$	E1	1.58×10^{-3}	α(K)=0.001359 *19*; α(L)=0.0001713 *24*; α(M)=3.55×10^{-5} *5* α(N)=7.86×10^{-6} *11*; α(O)=1.272×10^{-6} *18*; α(P)=9.60×10^{-8} *14* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: D from (^{12}C,4nγ) based on γ(DCO); polarity from level-parity change.
		1146.9 *2*	100 *10*	3942.42	11$^+$	E1	6.66×10^{-4}	α(K)=0.000567 *8*; α(L)=7.03×10^{-5} *10*; α(M)=1.456×10^{-5} *21* α(N)=3.23×10^{-6} *5*; α(O)=5.24×10^{-7} *8*; α(P)=4.04×10^{-8} *6*; α(IPF)=9.86×10^{-6} *15* E_γ,I_γ: from (^{12}C,4nγ). Other: Eγ=1146.9 *3* from (α,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ). Mult=(M1+E2) deduced by 1978Mu09 in (α,4nγ) based on γ(θ) is inconsistent and not adopted.
5214.30	13$^-$	124.8 *3*	11.4 *18*	5089.32	12$^-$	M1+E2	0.78 *16*	α(K)=0.58 *5*; α(L)=0.16 *9*; α(M)=0.035 *20* α(N)=0.008 *5*; α(O)=0.0011 *6*; α(P)=3.8×10^{-5} *4* E_γ: weighted average of 125.0 *2* from ^{130}Te(^{12}C,4nγ) and 124.4 *3* from ^{138}Ba(α,4nγ). I_γ: weighted average of 10.8 *16* from ^{130}Te(^{12}C,4nγ) and 17 *5* from ^{138}Ba(α,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ) and γ(θ) in (α,4nγ).
		432.8 *2*	4.6 *7*	4781.51	(12$^+$)	(E1)	0.00502	α(K)=0.00432 *6*; α(L)=0.000556 *8*; α(M)=0.0001155 *17* α(N)=2.55×10^{-5} *4*; α(O)=4.10×10^{-6} *6*; α(P)=3.00×10^{-7} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only.
		854.4 *1*	100 *5*	4359.93	12$^+$	E1	1.14×10^{-3}	α(K)=0.000988 *14*; α(L)=0.0001238 *18*; α(M)=2.57×10^{-5} *4* α(N)=5.68×10^{-6} *8*; α(O)=9.21×10^{-7} *13*; α(P)=7.01×10^{-8} *10* E_γ: weighted average of 854.3 *1* from ^{130}Te(^{12}C,4nγ), 854.6 *2* from ^{136}Ba(α,2nγ), and 854.2 *3* from ^{138}Ba(α,4nγ). I_γ: from (^{12}C,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ). Mult=(M1+E2) deduced by 1978Mu09 in (α,4nγ) based on γ(θ) is inconsistent and not adopted.

$^{138}_{58}Ce_{80}$-14

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.	α[†]	Comments
5312.39	14^+	98.1 *1*	100 *10*	5214.30	13^-	(E1)	0.256	α(K)=0.218 *4*; α(L)=0.0304 *5*; α(M)=0.00634 *9* α(N)=0.001384 *20*; α(O)=0.000215 *3*; α(P)=1.310×10^{-5} *19* B(E1)(W.u.)=0.0014 *+4−3* E_γ,I_γ: from (^{12}C,4nγ). Other: Eγ=98.3 *3* from (α,4nγ). Mult.: from (^{12}C,4nγ) with bracket added by evaluator since no γ(DCO) and γ(pol) data. This assignment is consistent with γ(θ) in (α,4nγ).
		337.7 *2*	91 *9*	4974.64	13^+	M1	0.0423	α(K)=0.0362 *5*; α(L)=0.00481 *7*; α(M)=0.001004 *15* α(N)=0.000223 *4*; α(O)=3.62×10^{-5} *5*; α(P)=2.77×10^{-6} *4* B(M1)(W.u.)=0.0028 *+8−6* E_γ,I_γ: from (^{12}C,4nγ). Other: Eγ=337.7 *3* from (α,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ) and γ(θ) in (α,4nγ).
		469.4 *2*	11.3 *19*	4843.0	13^-	(E1)	0.00415	α(K)=0.00357 *5*; α(L)=0.000458 *7*; α(M)=9.51×10^{-5} *14* α(N)=2.10×10^{-5} *3*; α(O)=3.38×10^{-6} *5*; α(P)=2.49×10^{-7} *4* B(E1)(W.u.)=1.5×10^{-6} *+7−5* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from (^{12}C,4nγ) with bracket added by evaluator since no γ(DCO) and γ(pol) data.
5387.7	11^-	985.8 *2*	100	4401.9	10^-	M1	0.00301	α(K)=0.00259 *4*; α(L)=0.000332 *5*; α(M)=6.90×10^{-5} *10* α(N)=1.532×10^{-5} *22*; α(O)=2.50×10^{-6} *4*; α(P)=1.95×10^{-7} *3* E_γ,Mult.: from (^{12}C,4nγ); mult is based on γ(DCO) and γ(pol).
5411.5	14^-	99.1 *2*	2.5 *4*	5312.39	14^+	(E1)	0.249	α(K)=0.212 *4*; α(L)=0.0296 *5*; α(M)=0.00616 *10* α(N)=0.001345 *21*; α(O)=0.000209 *4*; α(P)=1.276×10^{-5} *19* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from (^{12}C,4nγ) with bracket added by evaluator since no γ(DCO) and γ(pol) data.
		197.9 *7*	100 *10*	5214.30	13^-	M1	0.176 *3*	α(K)=0.150 *3*; α(L)=0.0202 *4*; α(M)=0.00423 *8* α(N)=0.000939 *16*; α(O)=0.000152 *3*; α(P)=1.156×10^{-5} *20* E_γ: unweighted average of 197.2 *2* from ^{130}Te(^{12}C,4nγ) and 198.6 *3* from ^{138}Ba(α,4nγ). I_γ: from (^{12}C,4nγ). Mult.: from (^{12}C,4nγ) based on γ(DCO) and γ(pol).
		568.5 *2*	5.1 *9*	4843.0	13^-	M1	0.01129	α(K)=0.00969 *14*; α(L)=0.001264 *18*; α(M)=0.000264 *4* α(N)=5.85×10^{-5} *9*; α(O)=9.51×10^{-6} *14*; α(P)=7.35×10^{-7} *11* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from (^{12}C,4nγ) based on γ(DCO) and γ(pol).
5566.4	15^+	254.0 *1*	100	5312.39	14^+	M1+E2	0.086 *4*	α(K)=0.071 *6*; α(L)=0.0121 *19*; α(M)=0.0026 *5* α(N)=0.00056 *9*; α(O)=8.8×10^{-5} *11*; α(P)=5.0×10^{-6} *9* E_γ: from (^{12}C,4nγ). Other: 254.1 *3* from (α,4nγ). Mult.: from (^{12}C,4nγ) based on γ(DCO) and γ(pol).
5714.4	(14^-)	500.1 *2*	100	5214.30	13^-	(M1)	0.01553	α(K)=0.01332 *19*; α(L)=0.001745 *25*; α(M)=0.000364 *6* α(N)=8.08×10^{-5} *12*; α(O)=1.313×10^{-5} *19*; α(P)=1.012×10^{-6} *15* E_γ,Mult.: from (^{12}C,4nγ); mult is based on γ(DCO).

$^{138}_{58}Ce_{80}$-15

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
5726.6	14^+	1366.7 *2*	100	4359.93	12^+	E2	1.10×10^{-3}	α(K)=0.000912 *13*; α(L)=0.0001179 *17*; α(M)=2.45×10^{-5} *4* α(N)=5.44×10^{-6} *8*; α(O)=8.80×10^{-7} *13*; α(P)=6.63×10^{-8} *10*; α(IPF)=3.64×10^{-5} *6* E_γ: from (^{12}C,4nγ) only. E_γ,Mult.: from (^{12}C,4nγ); mult is based on γ(DCO).
5731.0	15^-	319.5 *2*	100	5411.5	14^-	M1	0.0488	α(K)=0.0418 *6*; α(L)=0.00556 *8*; α(M)=0.001162 *17* α(N)=0.000258 *4*; α(O)=4.19×10^{-5} *6*; α(P)=3.20×10^{-6} *5* E_γ: weighted average of 319.6 *2* from ^{130}Te(^{12}C,4nγ) and 319.3 *3* from ^{138}Ba(α,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ) and γ(θ) in (α,4nγ).
5871.2	15^+	144.6 *2*	6.2 *8*	5726.6	14^+	M1	0.417	α(K)=0.356 *6*; α(L)=0.0484 *7*; α(M)=0.01014 *15* α(N)=0.00225 *4*; α(O)=0.000364 *6*; α(P)=2.75×10^{-5} *4* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: D from γ(DCO) in (^{12}C,4nγ); polarity from no level-parity change.
		896.6 *2*	100 *10*	4974.64	13^+	E2	0.00256	α(K)=0.00218 *3*; α(L)=0.000298 *5*; α(M)=6.23×10^{-5} *9* α(N)=1.378×10^{-5} *20*; α(O)=2.21×10^{-6} *3*; α(P)=1.580×10^{-7} *23* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from (^{12}C,4nγ) based on γ(DCO) and γ(DCO).
5955.3		388.9 *2*	100	5566.4	15^+			E_γ: from (^{12}C,4nγ) only.
6014.4	16^+	448.0 *1*	100	5566.4	15^+	M1	0.0205	α(K)=0.01756 *25*; α(L)=0.00231 *4*; α(M)=0.000482 *7* α(N)=0.0001069 *15*; α(O)=1.737×10^{-5} *25*; α(P)=1.336×10^{-6} *19* E_γ: from (^{12}C,4nγ). Other: 447.5 *3* from (α,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ) and γ(θ) in (α,4nγ).
6134.7	(14^+)	1291.7 *2*	100	4843.0	13^-	(E1)	6.05×10^{-4}	α(K)=0.000459 *7*; α(L)=5.67×10^{-5} *8*; α(M)=1.173×10^{-5} *17* α(N)=2.60×10^{-6} *4*; α(O)=4.23×10^{-7} *6*; α(P)=3.27×10^{-8} *5*; α(IPF)=7.43×10^{-5} *11* E_γ: from (^{12}C,4nγ) only. Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
6328.7	(12^-)	941.0 *2*	100	5387.7	11^-	(M1)	0.00335	α(K)=0.00289 *4*; α(L)=0.000370 *6*; α(M)=7.71×10^{-5} *11* α(N)=1.711×10^{-5} *24*; α(O)=2.79×10^{-6} *4*; α(P)=2.17×10^{-7} *3* E_γ: from (^{12}C,4nγ) only. Mult.: based on γ(DCO) and in (^{12}C,4nγ).
6363.4	16^-	632.4 *2*	100	5731.0	15^-	M1	0.00869	α(K)=0.00746 *11*; α(L)=0.000970 *14*; α(M)=0.000202 *3* α(N)=4.49×10^{-5} *7*; α(O)=7.30×10^{-6} *11*; α(P)=5.65×10^{-7} *8* E_γ: from (^{12}C,4nγ) only. Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
6408.6	(15^-)	997.1 *2*	100	5411.5	14^-	(M1)	0.00293	α(K)=0.00252 *4*; α(L)=0.000323 *5*; α(M)=6.72×10^{-5} *10* α(N)=1.492×10^{-5} *21*; α(O)=2.43×10^{-6} *4*; α(P)=1.89×10^{-7} *3* E_γ,Mult.: from (^{12}C,4nγ). No γ(DCO) or γ(pol) data for mult.
6451.0		495.7 *2*	100	5955.3				E_γ: from (^{12}C,4nγ) only.
6451.2	16^+	580.0 *2*	100	5871.2	15^+	M1	0.01074	α(K)=0.00923 *13*; α(L)=0.001203 *17*; α(M)=0.000251 *4*

$^{138}_{58}Ce_{80}$-16

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
								α(N)=5.56×10^{-5} *8*; α(O)=9.05×10^{-6} *13*; α(P)=6.99×10^{-7} *10* E_γ: from (^{12}C,4nγ) only. Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
6536.4	15$^{(-)}$	970.0 *2*	40 *6*	5566.4	15$^+$	(E1)	8.95×10^{-4}	α(K)=0.000774 *11*; α(L)=9.65×10^{-5} *14*; α(M)=2.00×10^{-5} *3* α(N)=4.43×10^{-6} *7*; α(O)=7.18×10^{-7} *10*; α(P)=5.49×10^{-8} *8* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from (^{12}C,4nγ) with bracket added by evaluator since no γ(DCO) or γ(pol) data.
		1224.0 *2*	100 *20*	5312.39	14$^+$	(E1+M2)	0.00066 *4*	α(K)=0.00054 *4*; α(L)=6.7×10^{-5} *5*; α(M)=1.38×10^{-5} *9* α(N)=3.06×10^{-6} *21*; α(O)=5.0×10^{-7} *4*; α(P)=3.8×10^{-8} *3*; α(IPF)=3.95×10^{-5} *7* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from (^{12}C,4nγ) based on γ(DCO), with bracket added by evaluator since no γ(pol) data.
6597.6		146.6 *2*	100	6451.0				E_γ: from (^{12}C,4nγ) only.
6606.3	17$^+$	155.1 *2*	100	6451.2	16$^+$	M1	0.343	α(K)=0.293 *5*; α(L)=0.0398 *6*; α(M)=0.00833 *12* α(N)=0.00185 *3*; α(O)=0.000299 *5*; α(P)=2.26×10^{-5} *4* E_γ: from (^{12}C,4nγ) only. Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
6685.5	16$^-$	149.1 *2*	12.9 *22*	6536.4	15$^{(-)}$	(M1)	0.383	α(K)=0.327 *5*; α(L)=0.0444 *7*; α(M)=0.00930 *14* α(N)=0.00206 *3*; α(O)=0.000334 *5*; α(P)=2.53×10^{-5} *4* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: D from γ(DCO) in (^{12}C,4nγ); polarity from no level-parity change.
		550.8 *2*	6.5 *11*	6134.7	(14$^+$)	(M2)	0.0379	α(K)=0.0320 *5*; α(L)=0.00465 *7*; α(M)=0.000982 *14* α(N)=0.000218 *3*; α(O)=3.53×10^{-5} *5*; α(P)=2.63×10^{-6} *4* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
		671.1 *2*	4.3 *7*	6014.4	16$^+$	E1+M2	0.00207 *20*	α(K)=0.00178 *17*; α(L)=0.000228 *24*; α(M)=4.7×10^{-5} *5* α(N)=1.05×10^{-5} *11*; α(O)=1.69×10^{-6} *18*; α(P)=1.27×10^{-7} *14* E_γ,I_γ: from (^{12}C,4nγ) only. Mult.: from γ(DCO) in (^{12}C,4nγ); polarity from no level-parity change.
		1119.1 *2*	100 *15*	5566.4	15$^+$	E1	6.90×10^{-4}	α(K)=0.000593 *9*; α(L)=7.36×10^{-5} *11*; α(M)=1.524×10^{-5} *22* α(N)=3.38×10^{-6} *5*; α(O)=5.48×10^{-7} *8*; α(P)=4.22×10^{-8} *6*; α(IPF)=4.61×10^{-6} *7* E_γ,I_γ: from (^{12}C,4nγ). Mult.: based on γ(DCO) and γ(pol) in (^{12}C,4nγ).
6738.3	(16$^-$)	1007.3 *2*	100	5731.0	15$^-$	(M1)	0.00286	α(K)=0.00246 *4*; α(L)=0.000315 *5*; α(M)=6.56×10^{-5} *10* α(N)=1.456×10^{-5} *21*; α(O)=2.37×10^{-6} *4*; α(P)=1.85×10^{-7} *3* E_γ,Mult.: from (^{12}C,4nγ). No γ(DCO) or γ(pol) data for mult.

$^{138}_{58}Ce_{80}$-17

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
6841.7	17^+	827.3 *2*	100 *11*	6014.4	16^+	M1	0.00455	α(K)=0.00391 *6*; α(L)=0.000504 *7*; α(M)=0.0001049 *15* α(N)=2.33×10^{-5} *4*; α(O)=3.79×10^{-6} *6*; α(P)=2.95×10^{-7} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		1275.3 *2*	32 *5*	5566.4	15^+	E2	1.23×10^{-3}	α(K)=0.001046 *15*; α(L)=0.0001362 *19*; α(M)=2.84×10^{-5} *4* α(N)=6.28×10^{-6} *9*; α(O)=1.015×10^{-6} *15*; α(P)=7.60×10^{-8} *11*; α(IPF)=1.688×10^{-5} *24* E_γ,I_γ: from (^{12}C,4nγ). Mult.: Q from γ(DCO) in (^{12}C,4nγ); polarity from no level-parity change.
6859.7		262.1 *2*	100	6597.6				E_γ: from (^{12}C,4nγ) only.
6889.0	17^-	203.5 *2*	81 *12*	6685.5	16^-	M1	0.1627	α(K)=0.1390 *20*; α(L)=0.0187 *3*; α(M)=0.00392 *6* α(N)=0.000870 *13*; α(O)=0.0001410 *21*; α(P)=1.071×10^{-5} *16* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		874.6 *2*	100 *15*	6014.4	16^+	E1	1.09×10^{-3}	α(K)=0.000944 *14*; α(L)=0.0001182 *17*; α(M)=2.45×10^{-5} *4* α(N)=5.42×10^{-6} *8*; α(O)=8.79×10^{-7} *13*; α(P)=6.70×10^{-8} *10* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
7074.0	(17^-)	710.6 *2*	54 *8*	6363.4	16^-	(M1)	0.00655	α(K)=0.00563 *8*; α(L)=0.000729 *11*; α(M)=0.0001517 *22* α(N)=3.37×10^{-5} *5*; α(O)=5.48×10^{-6} *8*; α(P)=4.25×10^{-7} *6* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
		1343.0 *2*	100 *15*	5731.0	15^-	(E2)	1.13×10^{-3}	α(K)=0.000944 *14*; α(L)=0.0001222 *18*; α(M)=2.54×10^{-5} *4* α(N)=5.64×10^{-6} *8*; α(O)=9.12×10^{-7} *13*; α(P)=6.86×10^{-8} *10*; α(IPF)=3.05×10^{-5} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
7104.7	18^+	263.0 *2*	100 *10*	6841.7	17^+	M1	0.0816	α(K)=0.0698 *10*; α(L)=0.00934 *14*; α(M)=0.00195 *3* α(N)=0.000433 *7*; α(O)=7.03×10^{-5} *10*; α(P)=5.36×10^{-6} *8* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		1090.3 *2*	29 *4*	6014.4	16^+	E2	1.68×10^{-3}	α(K)=0.001438 *21*; α(L)=0.000191 *3*; α(M)=3.98×10^{-5} *6* α(N)=8.81×10^{-6} *13*; α(O)=1.419×10^{-6} *20*; α(P)=1.044×10^{-7} *15* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
7185.3	(16^-)	1170.9 *2*	100	6014.4	16^+	(E1)	6.49×10^{-4}	α(K)=0.000546 *8*; α(L)=6.77×10^{-5} *10*; α(M)=1.402×10^{-5} *20* α(N)=3.11×10^{-6} *5*; α(O)=5.04×10^{-7} *7*; α(P)=3.89×10^{-8} *6*; α(IPF)=1.696×10^{-5} *25* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
7211.3	18^-	322.3 *1*	100 *10*	6889.0	17^-	M1	0.0477	α(K)=0.0409 *6*; α(L)=0.00544 *8*; α(M)=0.001135 *16* α(N)=0.000252 *4*; α(O)=4.09×10^{-5} *6*; α(P)=3.13×10^{-6} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		369.6 *2*	6.2 *11*	6841.7	17^+	(E1)	0.00737	α(K)=0.00633 *9*; α(L)=0.000820 *12*; α(M)=0.0001703 *24* α(N)=3.76×10^{-5} *6*; α(O)=6.03×10^{-6} *9*; α(P)=4.35×10^{-7} *7* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
7225.2	(16^-)	1210.8 *2*	100 *14*	6014.4	16^+	(E1)	6.28×10^{-4}	α(K)=0.000514 *8*; α(L)=6.37×10^{-5} *9*; α(M)=1.318×10^{-5} *19* α(N)=2.92×10^{-6} *4*; α(O)=4.75×10^{-7} *7*; α(P)=3.66×10^{-8} *6*; α(IPF)=3.36×10^{-5} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO).

$^{138}_{58}Ce_{80}$-18

Adopted Levels, Gammas (continued)

γ(^{138}Ce) (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
7225.2	(16$^-$)	1494.1 *2*	86 *14*	5731.0	15$^-$	(M1)	1.24×10^{-3}	α(K)=0.001004 *14*; α(L)=0.0001271 *18*; α(M)=2.64×10^{-5} *4* α(N)=5.86×10^{-6} *9*; α(O)=9.55×10^{-7} *14*; α(P)=7.50×10^{-8} *11*; α(IPF)=7.69×10^{-5} *11* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
7392.3	(18$^+$)	786.0 *2*	100	6606.3	17$^+$	(M1)	0.00514	α(K)=0.00442 *7*; α(L)=0.000570 *8*; α(M)=0.0001187 *17* α(N)=2.64×10^{-5} *4*; α(O)=4.29×10^{-6} *6*; α(P)=3.33×10^{-7} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
7427.6		585.9 *2*	100	6841.7	17$^+$			E_γ: from (^{12}C,4nγ) only.
7532.4	(17$^-$)	307.2 *2*	40 *6*	7225.2	(16$^-$)	(M1)	0.0541	α(K)=0.0463 *7*; α(L)=0.00617 *9*; α(M)=0.001289 *19* α(N)=0.000286 *4*; α(O)=4.64×10^{-5} *7*; α(P)=3.55×10^{-6} *5* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult.
		347.1 *2*	100 *20*	7185.3	(16$^-$)	(M1)	0.0394	α(K)=0.0337 *5*; α(L)=0.00447 *7*; α(M)=0.000934 *14* α(N)=0.000207 *3*; α(O)=3.37×10^{-5} *5*; α(P)=2.58×10^{-6} *4* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO).
		1518.0 *2*	80 *12*	6014.4	16$^+$	(E1)	6.31×10^{-4}	α(K)=0.000348 *5*; α(L)=4.28×10^{-5} *6*; α(M)=8.85×10^{-6} *13* α(N)=1.96×10^{-6} *3*; α(O)=3.19×10^{-7} *5*; α(P)=2.48×10^{-8} *4*; α(IPF)=0.000229 *4* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO).
7682.9	19$^+$	578.2 *2*	100	7104.7	18$^+$	M1	0.01083	α(K)=0.00930 *13*; α(L)=0.001212 *17*; α(M)=0.000253 *4* α(N)=5.61×10^{-5} *8*; α(O)=9.12×10^{-6} *13*; α(P)=7.04×10^{-7} *10* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
7685.8	19$^-$	474.5 *2*	100	7211.3	18$^-$	M1	0.01771	α(K)=0.01519 *22*; α(L)=0.00199 *3*; α(M)=0.000416 *6* α(N)=9.23×10^{-5} *13*; α(O)=1.500×10^{-5} *21*; α(P)=1.155×10^{-6} *17* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
7744.2	(18$^-$)	211.8 *2*	100	7532.4	(17$^-$)	(M1+E2)	0.149 *4*	α(K)=0.120 *5*; α(L)=0.022 *6*; α(M)=0.0048 *13* α(N)=0.0010 *3*; α(O)=0.00016 *4*; α(P)=8.4×10^{-6} *12* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO).
7803.2	20$^+$	120.3 *2*	100 *17*	7682.9	19$^+$	M1+E2	0.88 *19*	α(K)=0.65 *5*; α(L)=0.19 *11*; α(M)=0.041 *24* α(N)=0.009 *5*; α(O)=0.0013 *7*; α(P)=4.2×10^{-5} *4* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		698.5 *2*	96 *13*	7104.7	18$^+$	(E2)	0.00457	α(K)=0.00387 *6*; α(L)=0.000554 *8*; α(M)=0.0001164 *17* α(N)=2.57×10^{-5} *4*; α(O)=4.08×10^{-6} *6*; α(P)=2.77×10^{-7} *4* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult. Bracket is added by evaluator.
8322.3	(20$^+$)	639.4 *2*	100	7682.9	19$^+$	(M1)	0.00846	α(K)=0.00727 *11*; α(L)=0.000944 *14*; α(M)=0.000197 *3* α(N)=4.37×10^{-5} *7*; α(O)=7.10×10^{-6} *10*; α(P)=5.50×10^{-7} *8* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO).
8350.3	20$^-$	664.5 *2*	100 *15*	7685.8	19$^-$	M1	0.00770	α(K)=0.00662 *10*; α(L)=0.000859 *12*; α(M)=0.000179 *3* α(N)=3.97×10^{-5} *6*; α(O)=6.46×10^{-6} *9*; α(P)=5.00×10^{-7} *7* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		1139.0 *2*	12.2 *24*	7211.3	18$^-$	(E2)	1.53×10^{-3}	α(K)=0.001314 *19*; α(L)=0.0001733 *25*; α(M)=3.61×10^{-5} *5*

$^{138}_{58}Ce_{80}$-19

Adopted Levels, Gammas (continued)

$\gamma(^{138}Ce)$ (continued)

E_i(level)	J_i^π	E_γ ‡	I_γ ‡	E_f	J_f^π	Mult.	α †	Comments
								α(N)=8.00×10^{-6} *12*; α(O)=1.290×10^{-6} *18*; α(P)=9.55×10^{-8} *14*; α(IPF)=1.394×10^{-6} *22* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult. Bracket is added by evaluator.
8709.6	21$^-$	359.3 *2*	100 *14*	8350.3	20$^-$	M1	0.0360	α(K)=0.0308 *5*; α(L)=0.00409 *6*; α(M)=0.000853 *12* α(N)=0.000189 *3*; α(O)=3.07×10^{-5} *5*; α(P)=2.36×10^{-6} *4* E_γ,I_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
		1023.8 *2*	4.5 *9*	7685.8	19$^-$	(E2)	0.00192	α(K)=0.001641 *23*; α(L)=0.000219 *3*; α(M)=4.58×10^{-5} *7* α(N)=1.014×10^{-5} *15*; α(O)=1.631×10^{-6} *23*; α(P)=1.190×10^{-7} *17* E_γ,I_γ,Mult.: from (^{12}C,4nγ) only. No γ(DCO) or γ(pol) data for mult. Bracket is added by evaluator.
8873.5	22$^+$	1070.3 *2*	100	7803.2	20$^+$	E2	1.75×10^{-3}	α(K)=0.001495 *21*; α(L)=0.000199 *3*; α(M)=4.15×10^{-5} *6* α(N)=9.18×10^{-6} *13*; α(O)=1.478×10^{-6} *21*; α(P)=1.085×10^{-7} *16* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) and γ(pol).
8921.1		570.8 *2*	100	8350.3	20$^-$			E_γ: from (^{12}C,4nγ) only.
8957.9	22$^{(-)}$	248.3 *2*	100	8709.6	21$^-$	(M1)	0.0951	α(K)=0.0813 *12*; α(L)=0.01091 *16*; α(M)=0.00228 *4* α(N)=0.000506 *8*; α(O)=8.21×10^{-5} *12*; α(P)=6.25×10^{-6} *9* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO) with bracket added by evaluator.
8978.3		628.0 *2*	100	8350.3	20$^-$			E_γ: from (^{12}C,4nγ) only.
9430.9	(23$^+$)	557.4 *2*	100	8873.5	22$^+$	(M1)	0.01185	α(K)=0.01017 *15*; α(L)=0.001328 *19*; α(M)=0.000277 *4* α(N)=6.15×10^{-5} *9*; α(O)=9.99×10^{-6} *14*; α(P)=7.72×10^{-7} *11* E_γ,Mult.: from (^{12}C,4nγ). Mult is based γ(DCO).
9511.4		1161.1 *2*	100	8350.3	20$^-$			E_γ: from (^{12}C,4nγ) only.

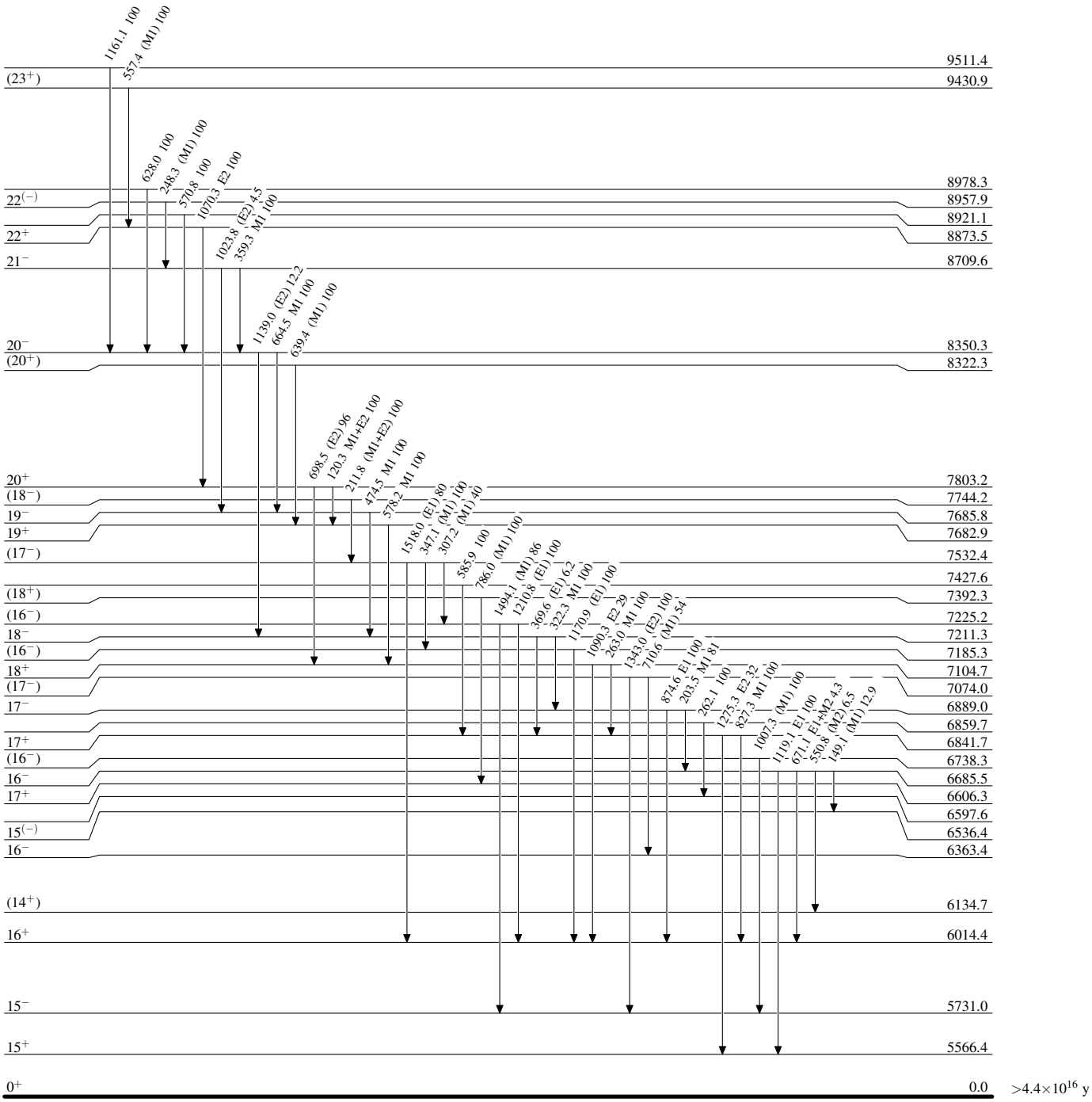
† Additional information 1.
‡ Primarily from (^{12}C,4nγ), ^{138}Pr ε decay and (α,2nγ). Weighted average is taken when available.
# From (p,2nγ) and (α,2nγ) (1987Lo12) based on ce data.
@ From (α,4nγ) based on $\gamma(\theta)$.
& From ^{138}Pr ε decay (1.45 min) based on ce data.
a From ^{138}Pr ε decay (2.1 h) based on ce data.
b Multiply placed with undivided intensity.
c Placement of transition in the level scheme is uncertain.

$^{138}_{58}Ce_{80}$-20

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

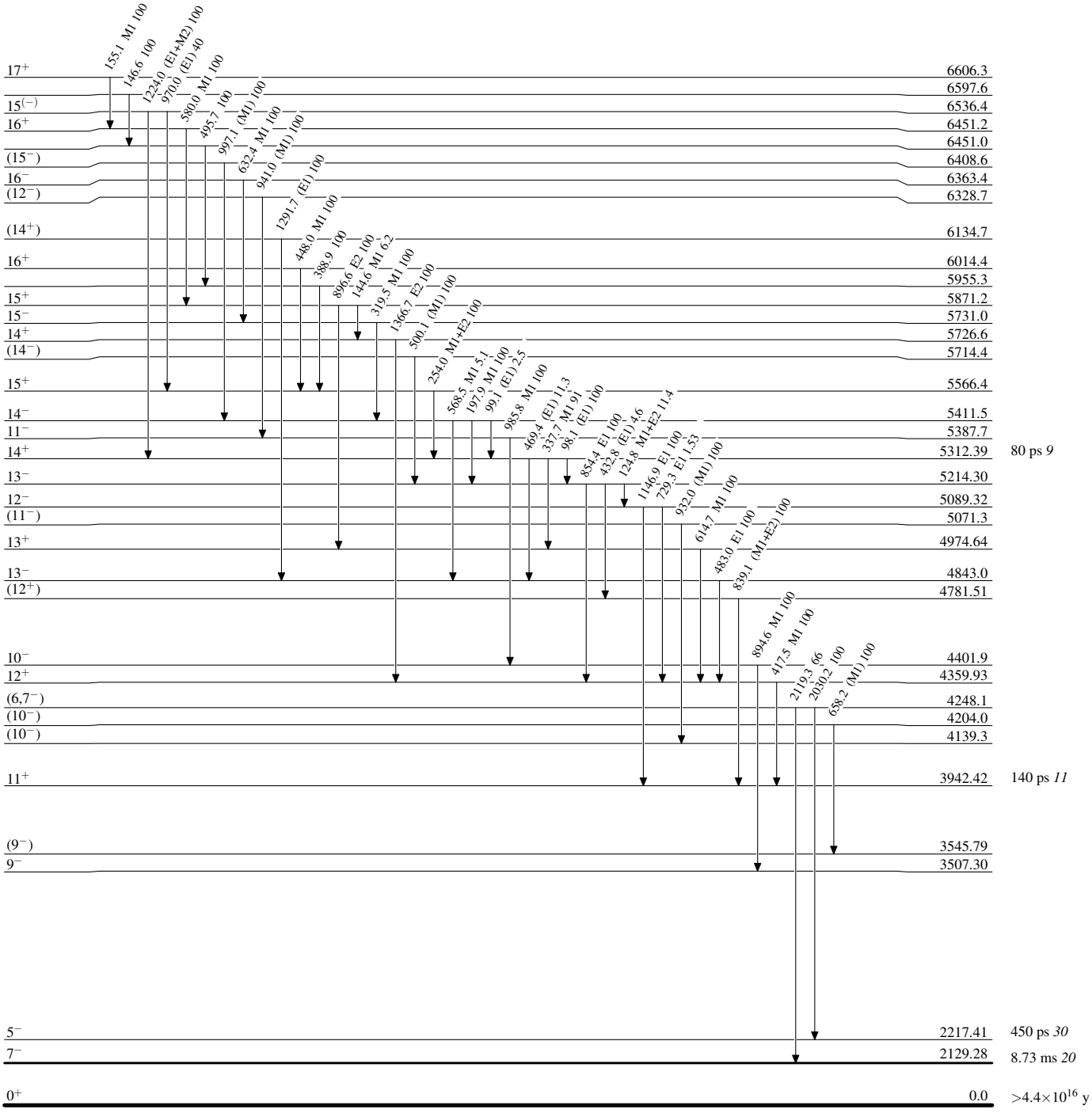


$^{138}_{58}Ce_{80}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{138}_{58}Ce_{80}$

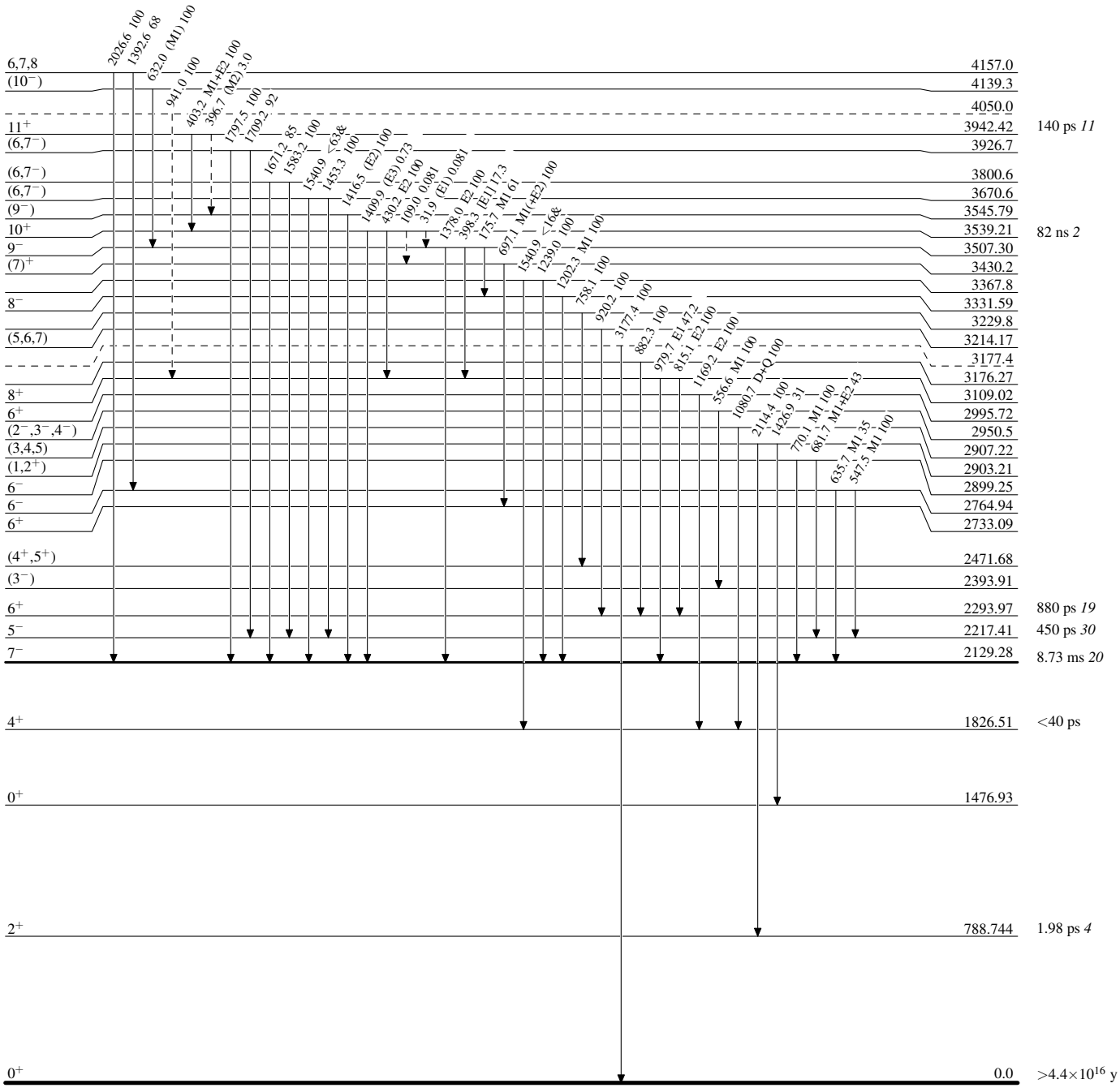
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

γ Decay (Uncertain)

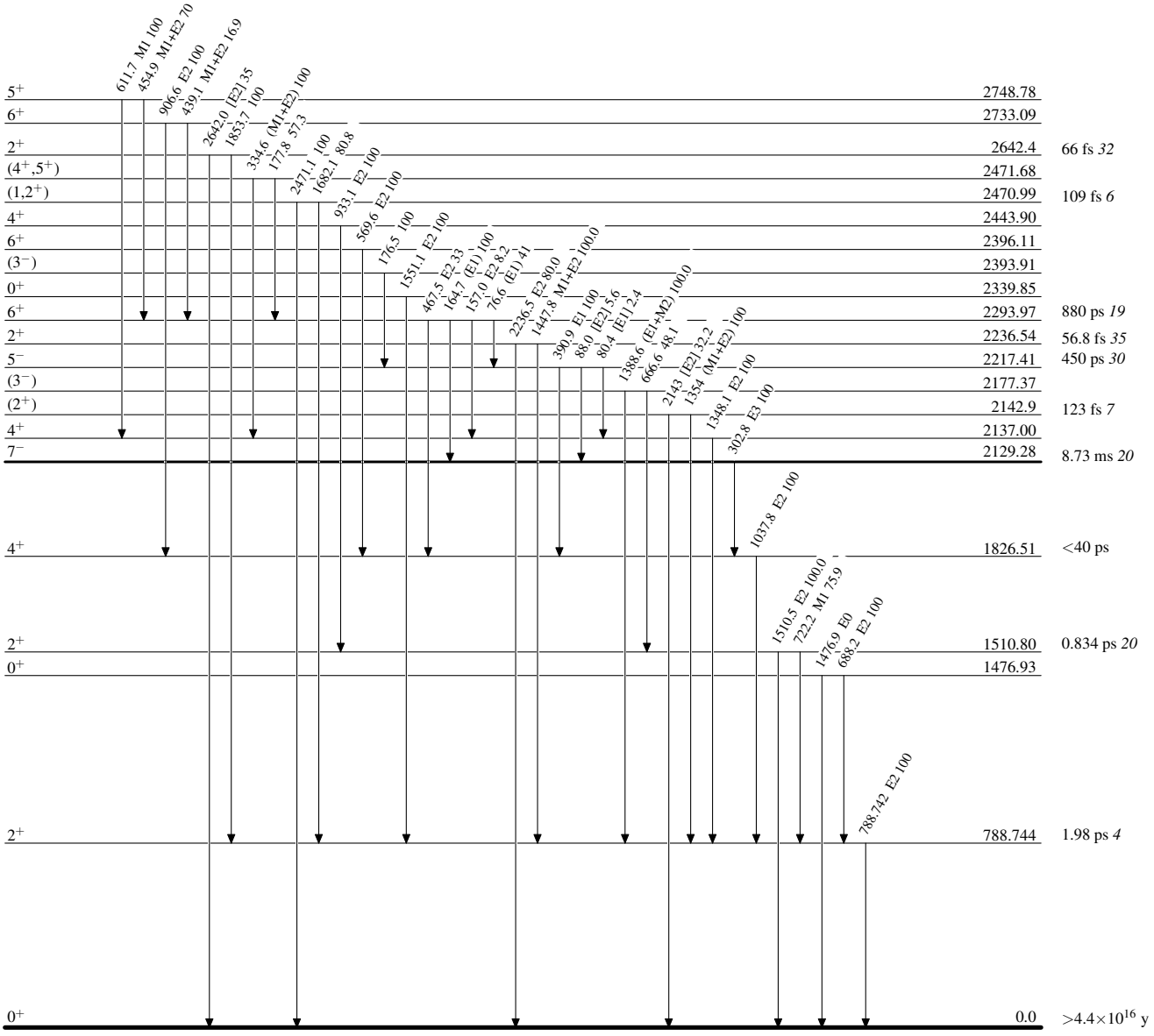


$^{138}_{58}Ce_{80}$

Adopted Levels, Gammas

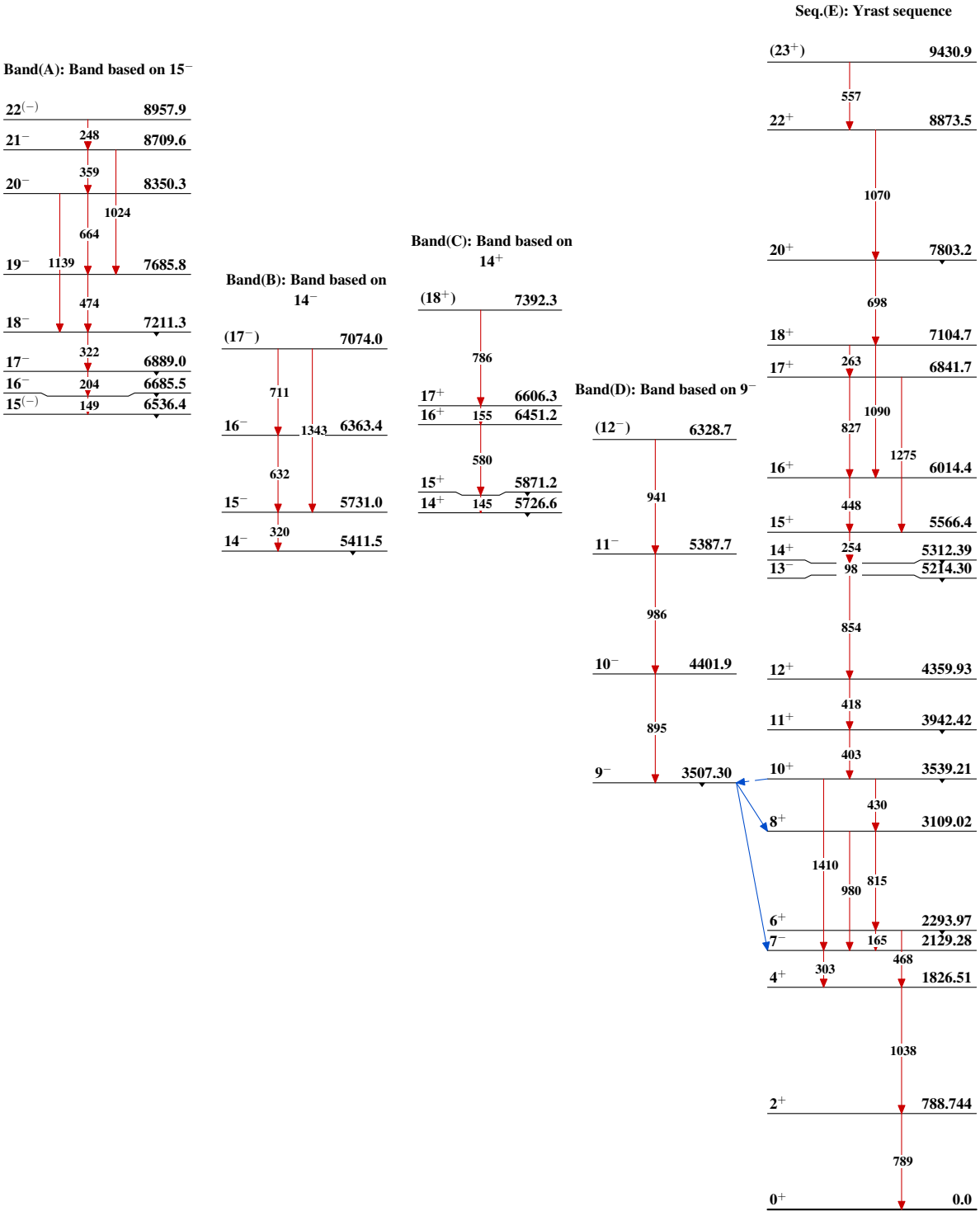
Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



$^{138}_{58}Ce_{80}$

Adopted Levels, Gammas



$^{138}_{58}Ce_{80}$