Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Alexander A. Rodionov And Yuri L. Khazov	NDS 109,517 (2008)	22-Jan-2008

Q(β^-)=−1207 *10*; S(n)=6971.97 *10*; S(p)=8248.5 *3*; Q(α)=−1862.0 *4* 2012Wa38

Note: Current evaluation has used the following Q record −1200 10 *6971*.9610 *8248*.3 *4* −1860.210 2003Au03.

Isotope shifts, hyperfine structure, moments, etc. measurements: 2000Tr07, 1995Va36, 1993Vi10, 1988Ya13, 1988We07, 1987Va16, 1986Si03, 1986Ca25, 1985Si24, 1985Va04, 1985Si24, 1985Ca40, 1985We15, 1984Va08, 1984Pe06, 1983Ri02, 1983Ho06, 1983Gr15, 1983El06, 1983El04, 1983Be12, 1982Sh05, 1982Ri07, 1982Ri03, 1982Ne13, 1982Ne12, 1982Ne11, 1982Gr14, 1982Gr15, 1981Wa19, 1980Si14, 1980Ji01, 1979Gu09, 1979Ba74, 1979Be25, 1978Lu07, 1977Kr12, 1976Ma28, 1970Vo08, 1970Ho31, 1969Su04, 1968Op01, 1968Be60, 1966Ol02, 1966Co32, 1966Co28, 1966Co26, 1966Co18, 1964Ja11, 1963Zu05, 1963Na11, 1963Ja15, 1962Wi10, 1962Ko22.

Additional information 1.

Nuclear structure calculations: 2004Yo04 (levels, transition rates), 2000Dm04 (anapole moments), 1999Dr18 (IBA model), 1990Lo16 (levels, IBFM model), 1987Mi15 (levels, transition rates, magnetic moment, Q), 1985Ha34 (levels), 1984Ab01 (yrast levels).

For 86 neutron resonances from 102 eV to 10.6 keV, see ^{134}Ba(n,γ):resonances dataset compiled from 1996Ko27. See also 2006MuZX evaluation.

^{135}Ba Levels

Cross Reference (XREF) Flags

A	^{135}Cs β^- decay (2.3×10^6 y)	E	^{134}Ba(n,γ) E=th	I	^{134}Ba(d,p)
B	^{135}Ba IT decay (28.7 h)	F	^{134}Ba(n,γ) E=102 eV	J	^{135}Ba(γ,γ')
C	^{135}La ε decay (19.5 h)	G	^{134}Ba(n,γ) E=2 keV:arc	K	^{135}Ba(n,n'γ)
D	^{130}Te(^{9}Be,4nγ)	H	^{134}Ba(n,γ) E=24.3 keV:arc	L	Coulomb excitation

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0[a]	3/2$^+$	stable	ABCDEFGHIJKL	μ=+0.837943 *17* (1972Ol01,1989Ra17) Q=+0.160 *3* (1988We07,1989Ra17) (<r^2>)$^{1/2}$=4.827 fm *5* (2004An14, evaluation). Additional information 2. μ: optical pumping with radiative detection (1972Ol01,1966Ol02). Others: +0.8386274 *21* (1978Lu07,NMR); 1990MiZF, 1966Co32, 1963Ja15, 1963Na11, 1960Ka24, 1959Ku82, 1956Wa20, 1941Ha14. See also 2005St24 compilation. Q: others: +0.146 *16* (1976Ma28,1983Mu12), +0.150 *15* (1986Si03), 0.158 *32* (1979Ba74), 0.22 *3* (1982Gr14,1979Gu09), 1968Be60, 1968Op01, 1966Co26, 1964Ja11, 1963Zu05, 1963Ja15, 1962Ko22, 1962Wi10, 1960Ka24. See also 2005St24 compilation. Δ<r^2>(^{138}Ba−^{135}Ba)=−0.079 fm^2 *12* (1979Be25). J$^\pi$: spin from atomic beam (1950Ar51,1941Ha14) and optical spectroscopy (1937Be09,1932Mu06); parity from L(d,p)=2.
220.968 *13*	1/2$^+$	0.64 ns *27*	C EFGHIJKL	J$^\pi$: L(d,p)=0. $T_{1/2}$: from B(E2)=0.0095 *4*.
268.218[b] *20*	11/2$^-$	28.7 h *2*	BCDEFGHI K	%IT=100 μ=−1.001 *15* (1979Be25,1989Ra17) Q=+0.96 *8* (1983Mu12,1989Ra17) Configuration=$\nu h_{11/2}^{-1}$. μ, Q: LASER spectroscopy (1979Be25,1983Mu12). Δ<r^2>(^{138}Ba−^{135}Ba isomer)=−0.053 fm^2 *12* (1979Be25). J$^\pi$: M4 γ to 3/2$^+$. $T_{1/2}$: from 1960Wi10. Others: 28.7 h (1948Yu01), 27.2 h *15* (1968Bo28).

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Adopted Levels, Gammas (continued)

^{135}Ba Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
480.532 *14*	$5/2^+$	13 ps *2*	C EFGHIJKL	Jπ: γ(θ) in Coul. ex.; M1+E2 γ to $3/2^+$. $T_{1/2}$: from B(E2)=0.176 *6*. Other: ≤10 ps from γγ(t). g: 0.00 *15* from γ(θ,H) in Coul. ex.
587.827 *15*	$3/2^+$		C EFGHIJKL	B(E2)↑=0.074 *4* Jπ: M1(+E2) γ to $1/2^+$; log *ft*=7.9 from $5/2^+$.
714.20 *4*	$(7/2^-)$		EFGHIJK	Jπ: strong three-step cascade from $1/2^+$ capture state to $11/2^-$, assuming primary transition as dipole.
855.012 *14*	$3/2^+$		C EFGHI KL	B(E2)↑=0.029 *4* Jπ: M1(+E2) γ to $1/2^+$; log *ft*=7.8 from $5/2^+$.
874.518[a] *18*	$7/2^+$	1.32 ps *5*	CDEFGH JKL	(2J+1)Γ_0/4=0.00092 eV *12*, B(E2)=0.22 *3* in (γ,γ′). Jπ: γ(θ) in Coul. ex.; E2 γ to $3/2^+$. $T_{1/2}$: from B(E2)=0.163 *6*.
910.29 *3*	$1/2^+$		C EFGHIJKL	B(E2)↑=0.024 *2* Jπ: L(d,p)=0.
950.5[b] *3*	$(15/2^-)$[#]		D	Configuration=$\nu h^{-1}_{11/2}\otimes 2^+$.
979.965 *18*	$3/2^+,5/2^+$		C EFGHIJKL	B(E2)↑≤0.003 Jπ: L(d,p)=2. (2J+1)Γ_0/4=0.0028 eV *5* in (γ,γ′).
1008.00? *10*			C	
1130?			L	B(E2)↑=0.099
1165.2? *22*			F H	
1200.48? *6*			K	
1213.73 *7*	(3/2)		EFGHiJK	(2J+1)Γ_0/4=0.00092 eV *21* in (γ,γ′). Jπ: primary γ (assumed dipole) from $1/2^+$; and statistical model comparisons in (n,n′γ).
1225.86 *7*	(3/2)		EFGHi K	Jπ: primary γ (assumed dipole) from $1/2^+$; statistical model comparisons in (n,n′γ).
1238.41 *7*	$(5/2)$[&]		E K	
1298.54 *10*	$(1/2^+,3/2^+)$[@]		E K	
1446.41 *7*	$7/2^-$		E I K	Jπ: L(d,p)=3; γ to $11/2^-$.
1557.35 *5*	$(5/2,7/2^+)$[&]		K	
1584.52 *6*	$(3/2)^-$		EFGHI K	Jπ: L(d,p)=1; γ to $1/2^+$; shell-model considerations.
1609.31 *14*	$(1/2^+,3/2^+)$[@]		E K	
1670.67 *12*	$(3/2^-)$		EFGH K	Jπ: strong three-step cascade from $1/2^+$ capture state to $11/2^-$; assuming primary transition as dipole.
1719.57 *13*	$(1/2^+,3/2^+)$[@]		E K	
1787.42 *18*	$(5/2^-)$		E K	Jπ: from comparison of level populations in (n,n′γ) and (n,γ); no γ from $1/2^+$ capture states.
1794.4 *6*	(1/2,3/2)[@]		FG	
1830.5 *4*	(1/2,3/2)[@]		FGH	
1871.46 *22*	$(3/2^+,5/2)$[&]		iJK	(2J+1)Γ_0/4=0.0059 eV *16* in (γ,γ′).
1878.9 *3*	(1/2,3/2)[@]		FGHi	
1941.17 *20*	$(3/2^+,5/2^+)$		JK	(2J+1)Γ_0/4=0.0024 eV *6* in (γ,γ′). Jπ: γ′s to $1/2^+$ and $7/2^+$.
1955.4[a] *5*	$(11/2^+)$[#]		D	
1964.83 *17*	$(1/2^+,3/2^+)$[@]		E iJ	(2J+1)Γ_0/4=0.0025 eV *17* in (γ,γ′). Jπ: possible γ to $7/2^+$ disfavors $1/2^+$.
1971.6 *3*	$(3/2,5/2)$[&]		GHi K	
1991.02 *16*	$(3/2,5/2)$[&]		E JK	(2J+1)Γ_0/4=0.0041 eV *7* in (γ,γ′).
1997.57 *9*	$(1/2)^-$		EFGHI	Jπ: L(d,p)=1; shell-model considerations.
2002.6[b] *5*	$(19/2^-)$[#]		D	Configuration=$\nu h^{-1}_{11/2}\otimes 4^+$.
2075.43 *16*	$(3/2,5/2^+)$		K	Jπ: γ to $1/2^+$; statistical model calculations.

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Adopted Levels, Gammas (continued)

^{135}Ba Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
2077.43 *13*	(1/2$^-$,3/2$^-$)	EFGHIJ	(2J+1)Γ$_0$/4=0.0045 eV *13* in (γ,γ′). J$^{\pi}$: L(d,p)=(1).
2117.8 *9*	(1/2,3/2)[@]	FGHI	
2133.9 *5*	(19/2$^-$)	D	
2150.7 *5*	(1/2,3/2)	FGHI	J$^{\pi}$: primary γ from 1/2$^+$. L(d,p)=(3) for a 2152 group disagrees with this assignment. There may be two different levels near this energy.
2283		J	(2J+1)Γ$_0$/4=0.0013 eV *3*.
2334		J	(2J+1)Γ$_0$/4=0.0018 eV *3*.
2388.0 *6*		D	J$^{\pi}$: γ to (19/2$^-$) suggests (19/2 to 23/2$^-$).
2393.5[b] *5*	(21/2$^-$)	D	
2396.6 *3*	(1/2$^+$,3/2)	E	J$^{\pi}$: primary γ from 1/2$^+$; γ to 5/2$^+$.
2420		J	(2J+1)Γ$_0$/4=0.0018 eV *3*.
2440		J	(2J+1)Γ$_0$/4=0.0022 eV *3*.
2447.76 *20*	1/2$^-$,3/2$^-$	E IJ	(2J+1)Γ$_0$/4=0.0039 eV *8* in (γ,γ′). J$^{\pi}$: L(d,p)=1.
2478 *15*	(5/2$^-$)	IJ	J$^{\pi}$: L(d,p)=(3); dipole excitation in (γ,γ′) from 3/2$^+$. (2J+1)Γ$_0$/4=0.0021 eV *3* in (γ,γ′).
2485		J	(2J+1)Γ$_0$/4=0.0027 eV *4*.
2496		J	(2J+1)Γ$_0$/4=0.0019 eV *3*.
2579.2 *3*	(1/2$^+$,3/2)	E I	XREF: I(?). J$^{\pi}$: primary γ from 1/2$^+$; γ to 5/2$^+$.
2602?		iJ	(2J+1)Γ$_0$/4=0.0017 eV *3* in (γ,γ′).
2621		iJ	(2J+1)Γ$_0$/4=0.0036 eV *4* in (γ,γ′).
2638		J	(2J+1)Γ$_0$/4=0.0023 eV *4*.
2651		J	(2J+1)Γ$_0$/4=0.0018 eV *4*.
2658.5 *3*	(1/2,3/2)[@]	E IJ	XREF: I(?). (2J+1)Γ$_0$/4=0.0025 eV *9* in (γ,γ′).
2667?		J	(2J+1)Γ$_0$/4=0.0056 eV *7*.
2688.0 *3*	(1/2,3/2)[@]	E I	XREF: I(?).
2708?		J	(2J+1)Γ$_0$/4=2.3×10^{-3} eV *5* or 4.0×10^{-3} eV *5*.
2710.78 *25*	1/2,3/2	E IJ	XREF: I(?). (2J+1)Γ$_0$/4=0.0105 eV *9* in (γ,γ′). J$^{\pi}$: primary γ from 1/2$^+$. Parity is negative if L(d,p)=(1) group at 2709 corresponds to this level.
2730.05 *14*	1/2,3/2	EF IJ	XREF: I(?). (2J+1)Γ$_0$/4=0.0061 eV *14* in (γ,γ′). J$^{\pi}$: primary γ from 1/2$^+$. Parity is negative if L(d,p)=1 group at 2728 corresponds to this level.
2739.6[d] *6*	(23/2$^-$)	D	
2781	(1/2$^-$,3/2$^-$)	IJ	XREF: I(?). (2J+1)Γ$_0$/4=0.0029 eV *4* in (γ,γ′). J$^{\pi}$: L(d,p)=(1).
2824.7 *6*	(23/2$^+$)	D	
2850? *15*	(5/2$^-$,7/2$^-$)	I	J$^{\pi}$: L(d,p)=3.
2873.0 *3*	(1/2,3/2)[@]	E IJ	XREF: I(?). (2J+1)Γ$_0$/4=0.0056 eV *7* in (γ,γ′).
2888.1 *6*	(1/2,3/2)[@]	E i	XREF: i(?).
2897.1 *4*	(1/2$^+$,3/2)	E i	XREF: i(?). J$^{\pi}$: primary γ from 1/2$^+$; γ to 5/2$^+$.
2947	(5/2$^-$)	IJ	XREF: I(?). (2J+1)Γ$_0$/4=0.0237 eV *18* in (γ,γ′). J$^{\pi}$: L(d,p)=3; dipole excitation in (γ,γ′) from 3/2$^+$.
3084.1[c] *5*	(21/2$^+$)	D	Configuration=$\nu h^{-2}_{11/2}\otimes\nu s_{1/2}$.

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Adopted Levels, Gammas (continued)

^{135}Ba Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
3085.84 *22*	1/2,3/2	E I	XREF: I(?). J$^{\pi}$: primary γ from 1/2$^+$. Parity is negative if L(d,p)=1 group at 3085 corresponds to this level.
3092.6 *3*	(1/2,3/2)[@]	E J	(2J+1)Γ_0/4=0.0225 eV *17* in (γ,γ') for 51% branch to the g.s., 0.0183 eV *16* for 63% branch to g.s.
3111		J	(2J+1)Γ_0/4=0.0026 eV *6*.
3122		J	(2J+1)Γ_0/4=0.0027 eV *6*.
3126		J	(2J+1)Γ_0/4=0.0082 eV *10*.
3148		J	(2J+1)Γ_0/4=0.0074 eV *10* for 52% branch to the g.s., 0.0039 eV *6* for 100% branch to the g.s.
3154.1 *3*	(1/2$^-$,3/2$^-$)[@]	E	
3163		J	(2J+1)Γ_0/4=0.0064 eV *10* for 25% branch to the g.s., 0.0016 eV *5* for 100% branch to the g.s.
3169.2 *3*	(1/2,3/2)[@]	E	
3182		J	(2J+1)Γ_0/4=0.0036 eV *5*.
3190		J	(2J+1)Γ_0/4=0.0165 eV *14*.
3196		J	(2J+1)Γ_0/4=0.0028 eV *6*.
3210.3[d] *6*	(27/2$^-$)	D	
3211.8[c] *6*	(23/2$^+$)	D	Configuration=$\nu h^{-1}_{11/2}\otimes\pi(h_{11/2}d^{-1}_{5/2})$.
3272?		J	(2J+1)Γ_0/4=0.0116 eV *12*.
3294.0 *4*	(1/2,3/2)[@]	E	
3324?		I J	XREF: I(?). (2J+1)Γ_0/4=0.0023 eV *6* in (γ,γ').
3410		J	(2J+1)Γ_0/4=0.0285 eV *23* for 85% branch to the g.s., 0.0334 eV *24* for 100% branch to the g.s.
3415		J	(2J+1)Γ_0/4=0.0028 eV *7*.
3415.7[c] *6*	(25/2$^+$)	D	Configuration=$\nu h^{-1}_{11/2}\otimes\pi(h_{11/2}d^{-1}_{5/2})$.
3422		J	(2J+1)Γ_0/4=0.0028 eV *6*.
3454		J	(2J+1)Γ_0/4=0.0183 eV *17*.
3510.3 *3*	(1/2,3/2)[@]	E	
3587		J	(2J+1)Γ_0/4=0.0032 eV *10*.
3632.6 *5*	(1/2,3/2)[@]	E I J	XREF: I(?). (2J+1)Γ_0/4=0.0037 eV *9* in (γ,γ').
3647.5 *7*	(29/2$^-$)	D	
3656		J	(2J+1)Γ_0/4=0.0108 eV *17*.
3670? *20*		I	
3696		J	(2J+1)Γ_0/4=0.0045 eV *10*.
3708		J	(2J+1)Γ_0/4=0.0161 eV *18*.
3720		J	(2J+1)Γ_0/4=0.0128 eV *15*.
3753		J	(2J+1)Γ_0/4=0.026 eV *3* for 33% branch to the g.s., 0.0087 eV *16* for 100% branch to the g.s.
3758.3[c] *7*	(27/2$^+$)	D	Configuration=$\nu h^{-1}_{11/2}\otimes\pi(h_{11/2}g^{-1}_{7/2})$.
3779		J	(2J+1)Γ_0/4=0.043 eV *5* for 26% branch to the g.s., 0.0112 eV *19* for 100% branch to the g.s.
3786.0 *3*	(1/2,3/2)[@]	E I	XREF: I(?).
3805.2[d] *7*	(29/2$^-$)	D	
3813		J	(2J+1)Γ_0/4=0.0071 eV *20*.
3881		J	(2J+1)Γ_0/4=0.0090 eV *18*.
3929.7? *20*		E I	
4072.3? *20*		E I	
4180.9[c] *7*	(29/2$^+$)	D	Configuration=$\nu h^{-1}_{11/2}\otimes\pi(h_{11/2}g^{-1}_{7/2})\otimes 2^+$.
4254.1 *7*	(31/2$^+$)	D	

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Adopted Levels, Gammas (continued)

^{135}Ba Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
4269? *20*		I	
4695.8[c] *8*	(31/2$^+$)	D	Configuration=$\nu h^{-1}_{11/2}\otimes\pi(h_{11/2}g^{-1}_{7/2})\otimes 2^+$.
4713.2 *8*	(35/2$^+$)	D	
4729? *20*		I	
4816.6[d] *7*	(33/2$^-$)	D	
4890? *20*		I	
4940? *20*		I	
5023.4 *8*	(33/2$^+$)	D	
5235.8[c] *8*	(33/2$^+$)	D	
5850.2[c] *9*	(35/2$^+$)	D	

[†] From least-squares fit to Eγ's including primary γ rays from (n,γ) reactions, 0.3 keV uncertainty when not stated. For 86 neutron resonances in the range 102 eV to 10.6 keV see ^{134}Ba(n,γ):resonances dataset.

[‡] For high-spin (J>11/2), the assignments are as proposed by 2006Ch51 based on their $\gamma\gamma(\theta)$(DCO) data and systematics in this mass region. The evaluators place all the assignments in parentheses.

[#] From proposed band structure.

[@] Primary (assumed dipole) γ from 1/2$^+$ capture states. π: from comparison of reduced intensities of primary transitions to final states with known J^{π}.

[&] From the deexcitation pattern in (n,n'γ), statistical-model comparisons.

[a] Band(A): $\nu d_{3/2}$, decoupled band (?). VMI analysis: parameter Δ<1 keV. The band assignment is uncertain.

[b] Band(B): $\nu h^{-1}_{11/2}$ multiplet. VMI analysis: parameter Δ=51 keV.

[c] Band(C): γ cascade based on (21/2$^+$).

[d] Band(D): γ cascade based on (23/2$^-$).

Adopted Levels, Gammas (continued)

$\gamma(^{135}Ba)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[a]	α[c]	Comments
220.968	$1/2^+$	220.94 *2*	100	0.0	$3/2^+$	M1+E2	0.38 *8*	0.1110 *17*	B(M1)(W.u.)=0.0025 *11*; B(E2)(W.u.)=4.6 *2* α(K)=0.0941 *14*; α(L)=0.0134 *5*; α(M)=0.00279 *10*; α(N+..)=0.000694 *23* α(N)=0.000598 *21*; α(O)=9.0×10^{-5} *3*; α(P)=6.03×10^{-6} *10*
268.218	$11/2^-$	268.218 *20*	100	0.0	$3/2^+$	M4		5.31	B(M4)(W.u.)=2.50 *7* α(K)=3.79 *6*; α(L)=1.182 *17*; α(M)=0.267 *4*; α(N+..)=0.0658 *10* α(N)=0.0572 *8*; α(O)=0.00820 *12*; α(P)=0.000405 *6* Mult.: from ce data in ^{135}Ba IT decay.
480.532	$5/2^+$	259.58 *4*	0.29 *2*	220.968	$1/2^+$	(E2)		0.0721	B(E2)(W.u.)=2.6 *5* α(K)=0.0579 *9*; α(L)=0.01129 *16*; α(M)=0.00239 *4*; α(N+..)=0.000580 *9* α(N)=0.000505 *7*; α(O)=7.19×10^{-5} *10*; α(P)=3.21×10^{-6} *5*
		480.52 *2*	100	0.0	$3/2^+$	M1+E2	+1.6 *+5−4*	0.0120 *5*	B(M1)(W.u.)=0.0042 *20*; B(E2)(W.u.)=28.3 *10* α(K)=0.0102 *5*; α(L)=0.00146 *4*; α(M)=0.000304 *7*; α(N+..)=7.54×10^{-5} *18* α(N)=6.51×10^{-5} *15*; α(O)=9.7×10^{-6} *3*; α(P)=6.3×10^{-7} *4* δ: other: +0.35 *+12−15* from (n,n′γ).
587.827	$3/2^+$	107.32 *9*	0.93 *4*	480.532	$5/2^+$	E2(+M1)	>1.5	1.39 *11*	α(K)=0.93 *5*; α(L)=0.36 *5*; α(M)=0.079 *11*; α(N+..)=0.019 *3* α(N)=0.0164 *23*; α(O)=0.0022 *3*; α(P)=4.56×10^{-5} *7* I_γ: from ^{135}La ε. Iγ=5.0 *10* in (n,n′γ).
		366.83 *2*	28.8 *6*	220.968	$1/2^+$	M1(+E2)	<0.5	0.0283 *6*	α(K)=0.0243 *6*; α(L)=0.00323 *5*; α(M)=0.000665 *10*; α(N+..)=0.0001669 *24* α(N)=0.0001434 *21*; α(O)=2.19×10^{-5} *3*; α(P)=1.57×10^{-6} *5* δ: other: 0.0 *+11−6* from (n,n′γ).
		587.84 *2*	100 *1*	0.0	$3/2^+$	M1+E2	1.0 *4*	0.0076 *6*	B(E2)(W.u.)=18.0 *10* α(K)=0.0065 *6*; α(L)=0.00088 *5*; α(M)=0.000181 *10*; α(N+..)=4.52×10^{-5} *25* α(N)=3.89×10^{-5} *21*; α(O)=5.9×10^{-6} *4*; α(P)=4.1×10^{-7} *4* δ: other: +0.30 *+9−8* from (n,n′γ).
714.20	$(7/2^-)$	445.97 *3*	100	268.218	$11/2^-$				
855.012	$3/2^+$	267.17 *9*	1.5 *2*	587.827	$3/2^+$				
		374.46 *2*	78 *4*	480.532	$5/2^+$	M1+E2	−0.43 *3*	0.0266	α(K)=0.0227 *4*; α(L)=0.00306 *5*; α(M)=0.000631 *9*; α(N+..)=0.0001581 *23* α(N)=0.0001359 *19*; α(O)=2.07×10^{-5} *3*; α(P)=1.461×10^{-6} *22* δ: other: −0.07 *+16−18* from (n,n′γ).
		634.04 *2*	100 *2*	220.968	$1/2^+$	M1(+E2)	<1.3	0.0067 *7*	α(K)=0.0057 *6*; α(L)=0.00075 *6*; α(M)=0.000155 *11*; α(N+..)=3.9×10^{-5} *3* α(N)=3.34×10^{-5} *25*; α(O)=5.1×10^{-6} *5*; α(P)=3.7×10^{-7} *5* δ: other: +0.28 *+31−15* from (n,n′γ).

$^{135}_{56}Ba_{79}$-6

Adopted Levels, Gammas (continued)

γ(^{135}Ba) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[a]	α[c]	Comments
855.012	3/2$^+$	855.02 *2*	75 *4*	0.0	3/2$^+$	M1(+E2)	<0.5	0.00349 *12*	B(E2)(W.u.)=7.0 *10* α(K)=0.00301 *10*; α(L)=0.000382 *12*; α(M)=7.85×10^{-5} *23*; α(N+..)=1.97×10^{-5} *6* α(N)=1.69×10^{-5} *5*; α(O)=2.60×10^{-6} *8*; α(P)=1.93×10^{-7} *7* δ: other: +0.18 *+41−15* from (n,n′γ).
874.518	7/2$^+$	287[f]		587.827	3/2$^+$	[E2]			B(E2)(W.u.)<1.0 (2006Fe06)
		394.04 *4*	2.4 *2*	480.532	5/2$^+$	[M1,E2]		0.0217 *23*	B(M1)(W.u.)=0.0032 *3*; B(E2)(W.u.)=12.8 *12* α(K)=0.0184 *23*; α(L)=0.00265 *5*; α(M)=0.000550 *8*; α(N+..)=0.0001368 *25* α(N)=0.0001179 *19*; α(O)=1.77×10^{-5} *6*; α(P)=1.15×10^{-6} *20*
		874.51 *2*	100.0 *10*	0.0	3/2$^+$	E2		0.00244	B(E2)(W.u.)=19.9 *8* α(K)=0.00209 *3*; α(L)=0.000279 *4*; α(M)=5.74×10^{-5} *8*; α(N+..)=1.434×10^{-5} *20* α(N)=1.234×10^{-5} *18*; α(O)=1.87×10^{-6} *3*; α(P)=1.289×10^{-7} *18*
910.29	1/2$^+$	322.3 *2*	6.0 *8*	587.827	3/2$^+$				
		689.38 *19*	38 *3*	220.968	1/2$^+$				γ not reported in (n,n′γ).
		910.28 *3*	100 *2*	0.0	3/2$^+$			0.0027 *5*	B(E2)(W.u.)=11.7 *10* α(K)=0.0023 *4*; α(L)=0.00030 *5*
950.5	(15/2$^-$)	682.3	100	268.218	11/2$^-$	Q			
979.965	3/2$^+$,5/2$^+$	124.89[‡] *7*	2.9 *9*	855.012	3/2$^+$	M1,E2		0.70 *18*	α(K)=0.53 *8*; α(L)=0.14 *8*; α(M)=0.029 *17*; α(N+..)=0.007 *4* α(N)=0.006 *4*; α(O)=0.0009 *5*; α(P)=2.95×10^{-5} *5*
		392.08[‡] *9*	3.5 *9*	587.827	3/2$^+$				
		499.36[‡] *6*	3.5 *12*	480.532	5/2$^+$				
		758.94 *9*	14 *3*	220.968	1/2$^+$				E_γ,I_γ: from ^{135}La ε.
		979.98 *2*	100 *6*	0.0	3/2$^+$				
1008.00?		420.12 *10*	100 *30*	587.827	3/2$^+$				
		787.9 *5*	41 *12*	220.968	1/2$^+$				
		1008.4 *5*	7 *4*	0.0	3/2$^+$				
1130?		1130	100	0.0	3/2$^+$				E_γ: unplaced γ rays of Eγ=1130.89 *11* and Eγ=1130.6 *6* were reported in ^{135}La ε decay and (n,n′γ), respectively.
1200.48?		932.25 *5*	100	268.218	11/2$^-$				
1213.73	(3/2)	234.03[@] *22*	5.6 *14*	979.965	3/2$^+$,5/2$^+$				
		359.1[@] *7*	2.1 *11*	855.012	3/2$^+$				
		626.2 *3*	10.4 *21*	587.827	3/2$^+$				
		993.5 *5*	4.9 *14*	220.968	1/2$^+$				

$^{135}_{56}Ba_{79}$-7

Adopted Levels, Gammas (continued)

γ(^{135}Ba) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Comments
1213.73	(3/2)	1213.69 *7*	100 *3*	0.0	$3/2^+$	
1225.86	(3/2)	245.44[@f] *6*	27.5 *13*	979.965	$3/2^+$,$5/2^+$	
		371.1[@] *5*	5.0 *25*	855.012	$3/2^+$	
		638.00 *11*	34 *2*	587.827	$3/2^+$	
		745.4 *1*	27 *2*	480.532	$5/2^+$	
		1005.3[@] *4*	6.3 *13*	220.968	$1/2^+$	
		1225.80 *8*	100 *4*	0.0	$3/2^+$	
1238.41	(5/2)	382.8[@] *7*	6 *3*	855.012	$3/2^+$	
		649.4[@f] *3*	12 *3*	587.827	$3/2^+$	
		757.98 *9*	100 *18*	480.532	$5/2^+$	
		1238.3[e] *1*	<254[e]	0.0	$3/2^+$	
1298.54	($1/2^+$,$3/2^+$)	710.52 *16*	100 *7*	587.827	$3/2^+$	
		1077.30 *21*	42 *6*	220.968	$1/2^+$	
		1298.97[#] *18*	41 *11*	0.0	$3/2^+$	
1446.41	$7/2^-$	732[f]		714.20	($7/2^-$)	From (n,γ) only with Iγ≈200.
		965.88 *7*	100 *5*	480.532	$5/2^+$	δ(Q/D)=+0.07 *+21−37* from (n,n′γ).
		1178.1[@] *2*	42 *4*	268.218	$11/2^-$	
1557.35	($5/2$,$7/2^+$)	682.89 *5*	100 *4*	874.518	$7/2^+$	
		701.96 *14*	28 *4*	855.012	$3/2^+$	
		969.44 *11*	55 *3*	587.827	$3/2^+$	
		1077.1 *4*	≈1.3	480.532	$5/2^+$	
		1557.3 *13*	4.7 *25*	0.0	$3/2^+$	
1584.52	$(3/2)^-$	1363.53 *6*	100.0 *12*	220.968	$1/2^+$	
		1583 *1*	<38	0.0	$3/2^+$	I_γ: from (n,γ) E=24.3 keV.
1609.31	($1/2^+$,$3/2^+$)	1021.5 *3*	100 *7*	587.827	$3/2^+$	
		1128.2[#] *5*	49 *10*	480.532	$5/2^+$	
		1388.2[#] *3*	63 *13*	220.968	$1/2^+$	
		1609.7 *4*	56 *11*	0.0	$3/2^+$	
1670.67	($3/2^-$)	956.43 *12*	100	714.20	($7/2^-$)	
1719.57	($1/2^+$,$3/2^+$)	739.3[e] *3*	<73[e]	979.965	$3/2^+$,$5/2^+$	
		864.5 *4*	100 *27*	855.012	$3/2^+$	
		1238.55[e] *25*	<435[e]	480.532	$5/2^+$	
		1720.0[e] *2*	<270[e]	0.0	$3/2^+$	
1787.42	($5/2^-$)	1073.22 *17*	100	714.20	($7/2^-$)	
1830.5	(1/2,3/2)	1830.7 *5*	100	0.0	$3/2^+$	E_γ: from (n,γ) E=24.3 keV res only.
1871.46	($3/2^+$,5/2)	996.6 *5*	37 *8*	874.518	$7/2^+$	
		1390.7 *4*	45 *9*	480.532	$5/2^+$	
		1871.7 *3*	100 *9*	0.0	$3/2^+$	
1878.9	(1/2,3/2)	1291.3 *3*	100	587.827	$3/2^+$	E_γ: from (n,γ) E=102 eV res only.

$^{135}_{56}Ba_{79}$-8

Adopted Levels, Gammas (continued)

γ(^{135}Ba) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.&	Comments
1941.17	(3/2$^+$,5/2$^+$)	1066.7 *3*	100 *30*	874.518	7/2$^+$		
		1720.2[e] *5*	<44[e]	220.968	1/2$^+$		
		1941.1 *3*	43 *5*	0.0	3/2$^+$		
1955.4	(11/2$^+$)	1080.9	100	874.518	7/2$^+$		
1964.83	(1/2$^+$,3/2$^+$)	739.4[e] *4*	<35[e]	1225.86	(3/2)		
		1054.39 *20*	100 *21*	910.29	1/2$^+$		
		1090.2[f] *5*	60 *10*	874.518	7/2$^+$		
		1964.9 *5*	73 *25*	0.0	3/2$^+$		
1971.6	(3/2,5/2)	1491.1[@] *4*	100 *18*	480.532	5/2$^+$		
		1971.3[@] *7*	80 *12*	0.0	3/2$^+$		
1991.02	(3/2,5/2)	1402.8 *4*	99 *20*	587.827	3/2$^+$		
		1510.6 *2*	100 *20*	480.532	5/2$^+$		
		1990.8[@] *6*	76 *7*	0.0	3/2$^+$		
1997.57	(1/2)$^-$	413.03[#] *7*	72 *4*	1584.52	(3/2)$^-$		
		1142.6[#] *3*	34 *5*	855.012	3/2$^+$		
		1776.6[#] *5*	100 *13*	220.968	1/2$^+$		
2002.6	(19/2$^-$)	1052.1	100	950.5	(15/2$^-$)	Q	
2075.43	(3/2,5/2$^+$)	1165.0 *2*	89 *8*	910.29	1/2$^+$		
		1488.1 *4*	72 *12*	587.827	3/2$^+$		
		1595.3 *7*	70 *12*	480.532	5/2$^+$		
		2075.3 *4*	100 *13*	0.0	3/2$^+$		
2077.43	(1/2$^-$,3/2$^-$)	1489.2[#] *3*	37 *7*	587.827	3/2$^+$		
		1856.4 *2*	100 *8*	220.968	1/2$^+$		
		2077.22 *25*	87 *9*	0.0	3/2$^+$		E_γ,I_γ: from (n,γ) E=th. Eγ=2080.0 *8* in (n,γ) E=102 eV res.
2133.9	(19/2$^-$)	1183.4	100	950.5	(15/2$^-$)	Q	
2150.7	(1/2,3/2)	2150.5[f] *8*	100	0.0	3/2$^+$		E_γ: from (n,γ) E=102 eV res only.
2283		2283	100	0.0	3/2$^+$		
2334		2334	100	0.0	3/2$^+$		
2388.0		254.1	100	2133.9	(19/2$^-$)		
2393.5	(21/2$^-$)	390.6	100	2002.6	(19/2$^-$)	D	
2396.6	(1/2$^+$,3/2)	1916.4 *4*	100 *28*	480.532	5/2$^+$		
		2396.2 *8*	45 *18*	0.0	3/2$^+$		
2420		2420	100	0.0	3/2$^+$		
2440		2440	100	0.0	3/2$^+$		
2447.76	1/2$^-$,3/2$^-$	1466.6[f] *5*	8.2 *20*	979.965	3/2$^+$,5/2$^+$		
		1592.8 *8*	2.8 *14*	855.012	3/2$^+$		
		1860.4 *7*	13.1 *17*	587.827	3/2$^+$		
		2227	15	220.968	1/2$^+$		
		2447.68 *24*	100 *4*	0.0	3/2$^+$		

$^{135}_{56}Ba_{79}$-9

Adopted Levels, Gammas (continued)

γ(^{135}Ba) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	Comments
2478	(5/2$^-$)	2478	100	0.0	3/2$^+$		
2485		2485	100	0.0	3/2$^+$		
2496		2496	100	0.0	3/2$^+$		
2579.2	(1/2$^+$,3/2)	2098.3 *7*	100 *11*	480.532	5/2$^+$		
		2579.4 *5*	27 *7*	0.0	3/2$^+$		
2602?		2602[d]	100	0.0	3/2$^+$		
2621		2621	100	0.0	3/2$^+$		
2638		2638	100	0.0	3/2$^+$		
2651		2651	100	0.0	3/2$^+$		
2658.5	(1/2,3/2)	2177.1[e] *5*	<25[e]	480.532	5/2$^+$		
		2659.2 *4*	100 *13*	0.0	3/2$^+$		
2667?		2447	100 *37*	220.968	1/2$^+$		E_γ: second placement of a γ ray of near this energy is from 2447.6 level.
		2667[d]	41 *7*	0.0	3/2$^+$		
2688.0	(1/2,3/2)	2467.2 *3*	100 *18*	220.968	1/2$^+$		
		2687.7 *5*	64 *20*	0.0	3/2$^+$		
2708?		2708[d]	100	0.0	3/2$^+$		
2710.78	1/2,3/2	1101.6[e] *3*	<96[e]	1609.31	(1/2$^+$,3/2$^+$)		
		2489.3 *5*	98 *18*	220.968	1/2$^+$		
		2710.9 *6*	100 *21*	0.0	3/2$^+$		
2730.05	1/2,3/2	1120.48[#] *23*	13 *3*	1609.31	(1/2$^+$,3/2$^+$)		
		2142.19 *21*	36 *3*	587.827	3/2$^+$		E_γ: from (n,γ) E=th. Eγ=2142.8 *2* in (n,γ) E=102 eV res.
		2510.8[#] *7*	10.1 *27*	220.968	1/2$^+$		
		2730.2[#] *3*	100 *6*	0.0	3/2$^+$		
2739.6	(23/2$^-$)	737.0	100	2002.6	(19/2$^-$)	Q	
2781	(1/2$^-$,3/2$^-$)	2781	100	0.0	3/2$^+$		
2824.7	(23/2$^+$)	431.1	100	2393.5	(21/2$^-$)		
2873.0	(1/2,3/2)	2652.3 *4*	100 *12*	220.968	1/2$^+$		
		2872.2[e] *5*	<100[e]	0.0	3/2$^+$		
2888.1	(1/2,3/2)	2888.1 *6*	100	0.0	3/2$^+$		
2897.1	(1/2$^+$,3/2)	2309.5 *5*	100 *35*	587.827	3/2$^+$		
		2416.5 *11*	90 *40*	480.532	5/2$^+$		
2947	(5/2$^-$)	2947	100	0.0	3/2$^+$		
3084.1	(21/2$^+$)	1081.7	100	2002.6	(19/2$^-$)	D	
3085.84	1/2,3/2	1415.41 *27*	54 *9*	1670.67	(3/2$^-$)		
		2864.7 *4*	100 *20*	220.968	1/2$^+$		
		3085.1 *10*	43 *5*	0.0	3/2$^+$		
3092.6	(1/2,3/2)	1101.6[e] *3*	<92[e]	1991.02	(3/2,5/2)		
		2872.2[e] *5*	<250[e]	220.968	1/2$^+$		
		3094.0 *10*	100 *10*	0.0	3/2$^+$		
3111		3111	100	0.0	3/2$^+$		

$^{135}_{56}Ba_{79}$-10

Adopted Levels, Gammas (continued)

γ(^{135}Ba) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]
3122		3122	100	0.0	3/2$^+$	
3126		2645	100 *38*	480.532	5/2$^+$	
		3126	45 *6*	0.0	3/2$^+$	
3148		2667[d]	92 *33*	480.532	5/2$^+$	
		3148	100 *13*	0.0	3/2$^+$	
3154.1	(1/2$^-$,3/2$^-$)	2566.0 *4*	100 *12*	587.827	3/2$^+$	
		3153.7 *13*	15 *8*	0.0	3/2$^+$	
3163		2683[d]	30×10^1 *14*	480.532	5/2$^+$	
		3163	100 *16*	0.0	3/2$^+$	
3169.2	(1/2,3/2)	1498.1 *3*	100 *18*	1670.67	(3/2$^-$)	
		3173.4[bf]	68 *10*	0.0	3/2$^+$	
3182		3182	100	0.0	3/2$^+$	
3190		2602[d]	135 *50*	587.827	3/2$^+$	
		2708[d]	265 *75*	480.532	5/2$^+$	
		3190	100 *10*	0.0	3/2$^+$	
3196		3196	100	0.0	3/2$^+$	
3210.3	(27/2$^-$)	470.7	100	2739.6	(23/2$^-$)	Q
3211.8	(23/2$^+$)	128.0	73.4 *20*	3084.1	(21/2$^+$)	D
		818.1	100 *3*	2393.5	(21/2$^-$)	D
3272?		2683[d]	100 *30*	587.827	3/2$^+$	
		3272[d]	100 *10*	0.0	3/2$^+$	
3294.0	(1/2,3/2)	2438.8 *4*	36 *11*	855.012	3/2$^+$	
		3298.0[bf]	100 *20*	0.0	3/2$^+$	
3324?		3324	100	0.0	3/2$^+$	
3410		3190[d]	18 *5*	220.968	1/2$^+$	
		3410	100 *7*	0.0	3/2$^+$	
3415		3415	100	0.0	3/2$^+$	
3415.7	(25/2$^+$)	204.0	100 *4*	3211.8	(23/2$^+$)	D
		591.0	<1.5	2824.7	(23/2$^+$)	
3422		3422	100	0.0	3/2$^+$	
3454		2973.5	100 *26*	480.532	5/2$^+$	
		3454	45 *4*	0.0	3/2$^+$	
3510.3	(1/2,3/2)	931.1 *3*	100	2579.2	(1/2$^+$,3/2)	
		3511.8 *12*	55 *23*	0.0	3/2$^+$	
3587		3587	100	0.0	3/2$^+$	
3632.6	(1/2,3/2)	3632.2 *6*	100	0.0	3/2$^+$	
3647.5	(29/2$^-$)	437.2	100	3210.3	(27/2$^-$)	
3656		3068	100 *45*	587.827	3/2$^+$	
		3656	79 *13*	0.0	3/2$^+$	

$^{135}_{56}Ba_{79}$-11

Adopted Levels, Gammas (continued)

γ(^{135}Ba) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]
3696		3696	100	0.0	$3/2^+$	
3708		2799[d]	85 *28*	910.29	$1/2^+$	
		3708	100 *11*	0.0	$3/2^+$	
3720		3720	100	0.0	$3/2^+$	
3753		3272[d]	203 *64*	480.532	$5/2^+$	
		3753	100 *9*	0.0	$3/2^+$	
3758.3	$(27/2^+)$	342.6	100	3415.7	$(25/2^+)$	D
3779		2799[d]	173 *65*	979.965	$3/2^+,5/2^+$	
		3190[d]	112 *42*	587.827	$3/2^+$	
		3779	100 *12*	0.0	$3/2^+$	
3786.0	(1/2,3/2)	2177.1[e] *5*	<65[e]	1609.31	$(1/2^+,3/2^+)$	
		3197.7 *4*	100 *19*	587.827	$3/2^+$	
3805.2	$(29/2^-)$	594.9	100	3210.3	$(27/2^-)$	
3813		3813	100	0.0	$3/2^+$	
3881		3881	100	0.0	$3/2^+$	
4180.9	$(29/2^+)$	422.6	100	3758.3	$(27/2^+)$	D
4254.1	$(31/2^+)$	495.8	100	3758.3	$(27/2^+)$	Q
4695.8	$(31/2^+)$	514.9	100	4180.9	$(29/2^+)$	D
4713.2	$(35/2^+)$	459.1	100	4254.1	$(31/2^+)$	
4816.6	$(33/2^-)$	1011.4	<100	3805.2	$(29/2^-)$	
		1169.1	<100	3647.5	$(29/2^-)$	
5023.4	$(33/2^+)$	327.6	100	4695.8	$(31/2^+)$	D
5235.8	$(33/2^+)$	540.0	100	4695.8	$(31/2^+)$	D
5850.2	$(35/2^+)$	614.4	<63	5235.8	$(33/2^+)$	
		826.8	100 *13*	5023.4	$(33/2^+)$	

† From weighted average of all available values, unless otherwise stated.
‡ γ from ^{135}La ε decay only.
# From (n,γ) E=th only.
@ From (n,n′γ) only.
& For γ rays from low-spin levels, the assignments are from ce data in ^{135}La ε decay. The mult=Q and D are from DCO ratios in ^{130}Te(^{9}Be,4nγ), mult=Q corresponds to ΔJ=2, quadrupole and mult=D to ΔJ=1, dipole (with possible quadrupole admixture for Δπ=no). The mult=Q most likely corresponds to E2 transition.
[a] From ce data in ^{135}La ε decay.
[b] Poor energy fit. Level energy differs by 4 keV.
[c] 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.

$^{135}_{56}Ba_{79}$-12

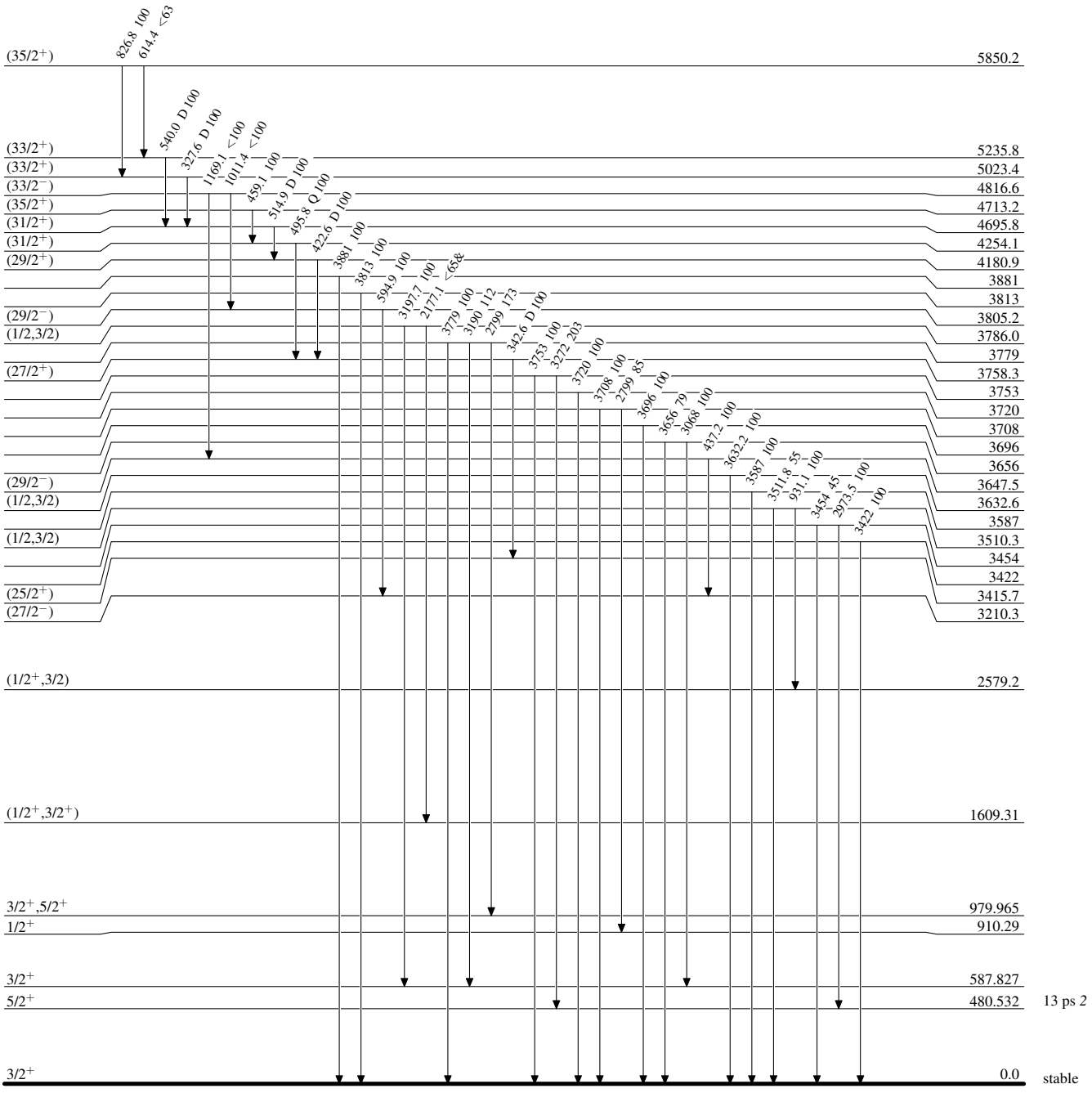
γ(^{135}Ba) (continued)

[d] Multiply placed.
[e] Multiply placed with undivided intensity.
[f] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

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



$^{135}_{56}Ba_{79}$

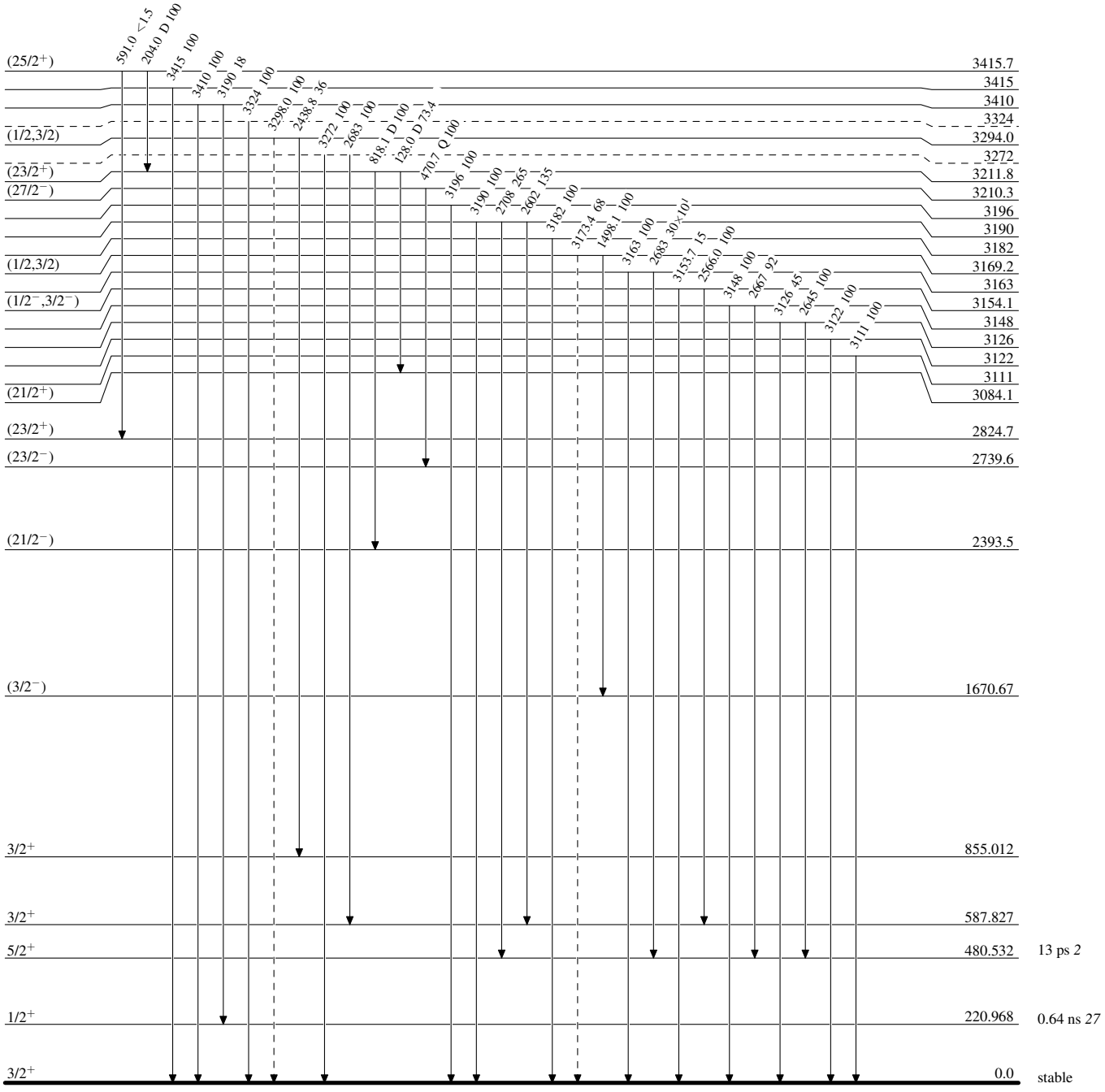
Adopted Levels, Gammas

Legend

Level Scheme (continued)

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

- - - - - - ► γ Decay (Uncertain)

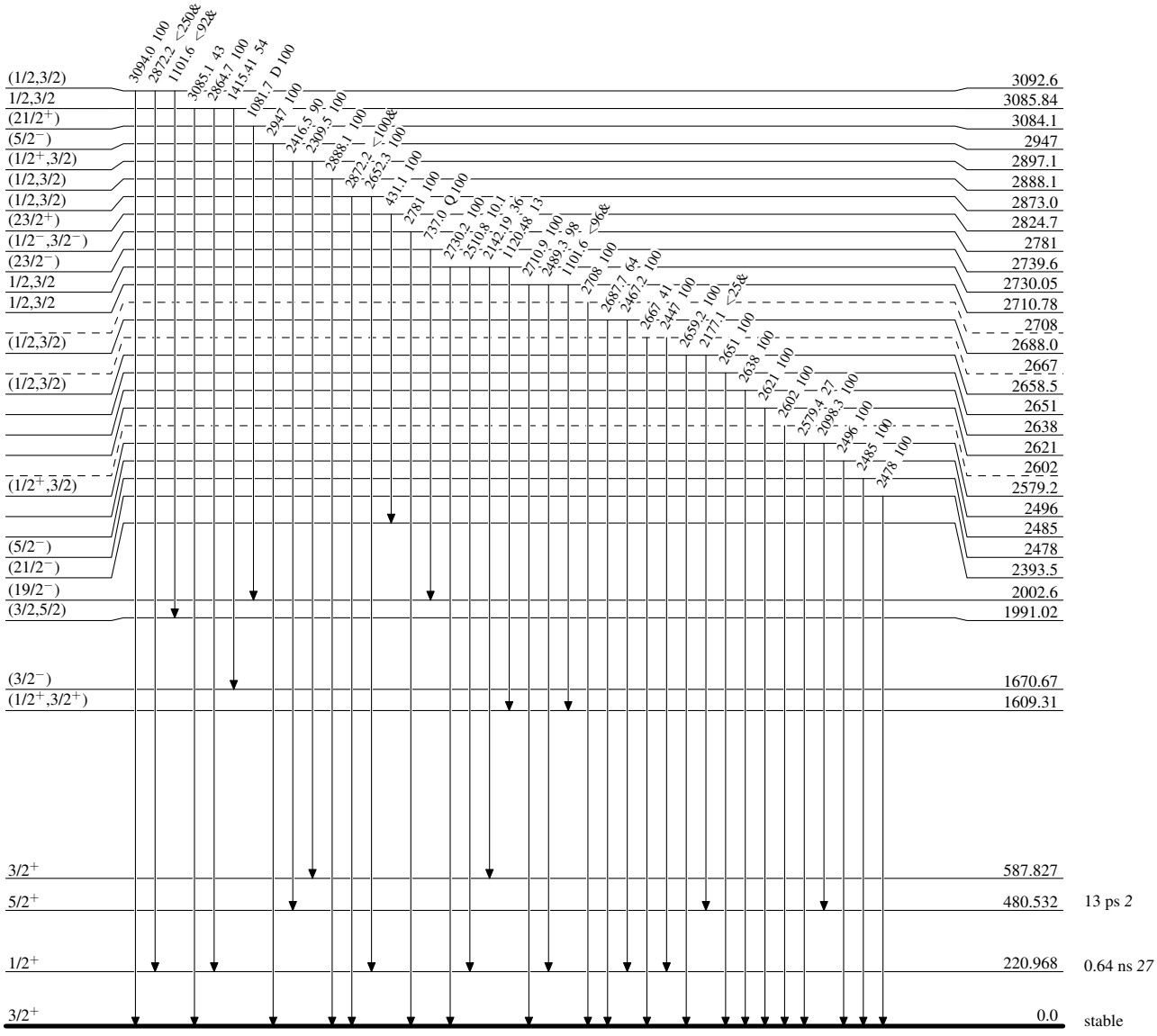


$^{135}_{56}Ba_{79}$

Adopted Levels, Gammas

Level Scheme (continued)

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



$^{135}_{56}Ba_{79}$

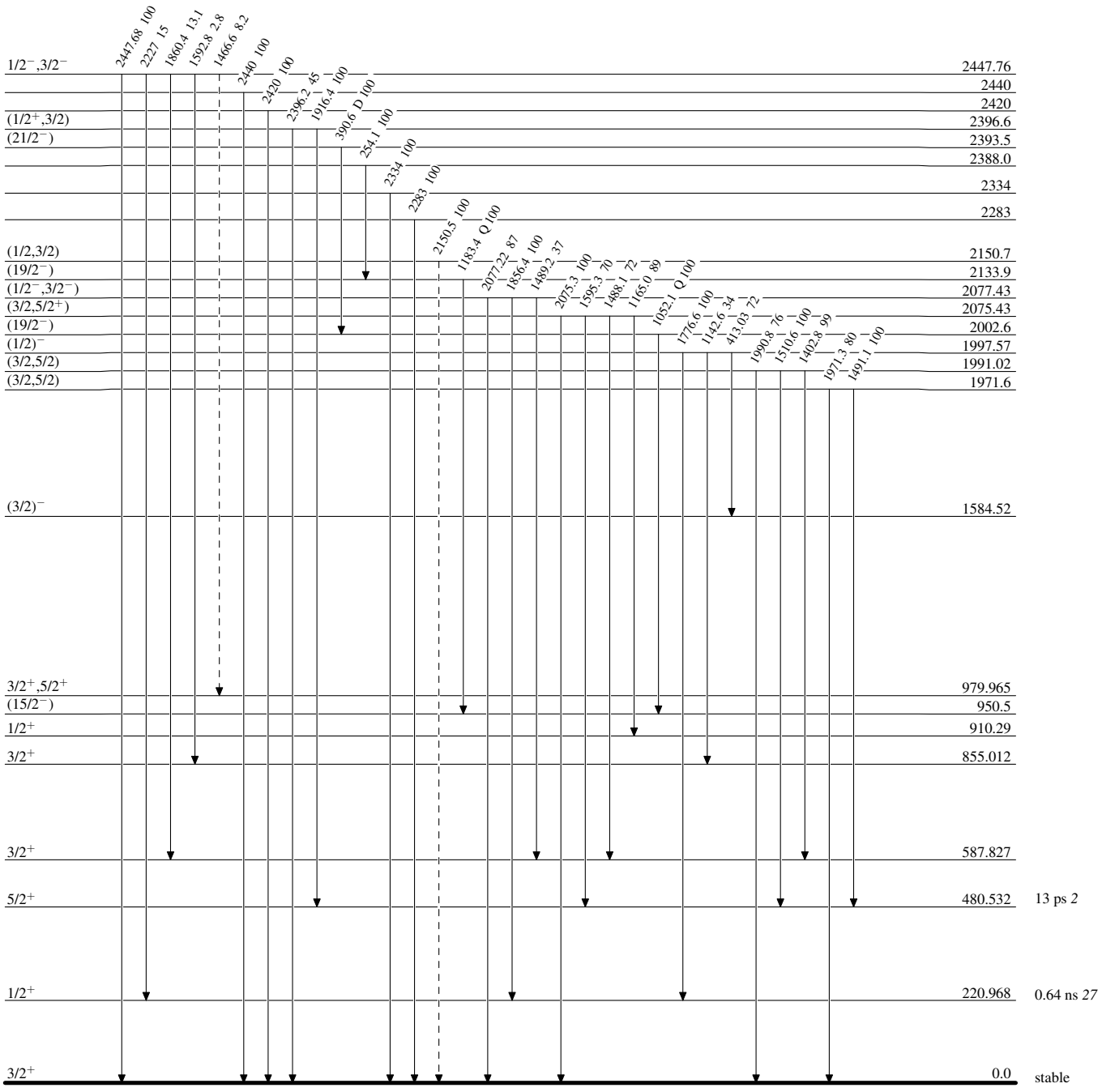
Adopted Levels, Gammas

Legend

Level Scheme (continued)

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

– – – – – – ► γ Decay (Uncertain)



$^{135}_{56}Ba_{79}$

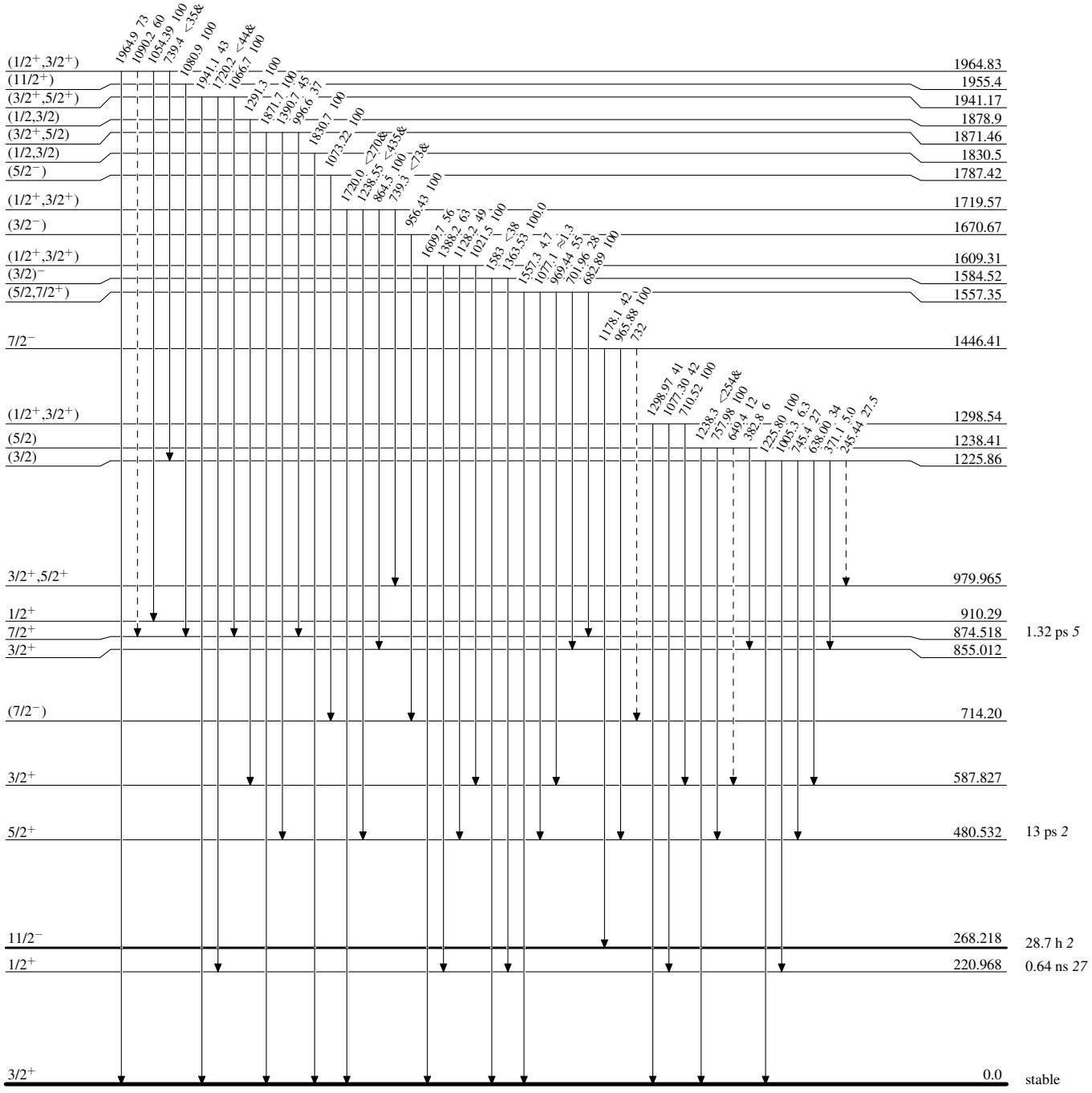
Adopted Levels, Gammas

Level Scheme (continued)

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

Legend

– – – – – – ► γ Decay (Uncertain)



$^{135}_{56}Ba_{79}$

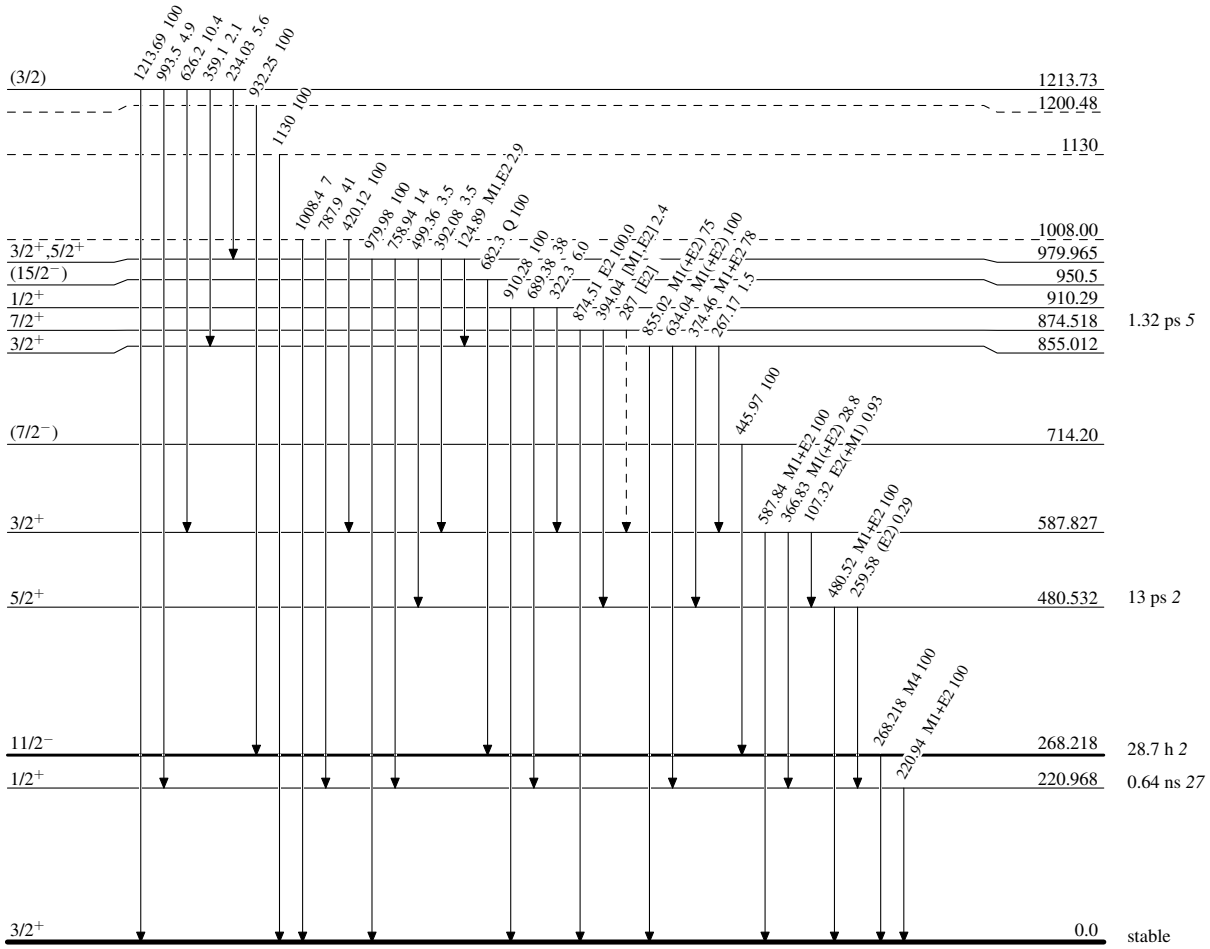
Adopted Levels, Gammas

Legend

Level Scheme (continued)

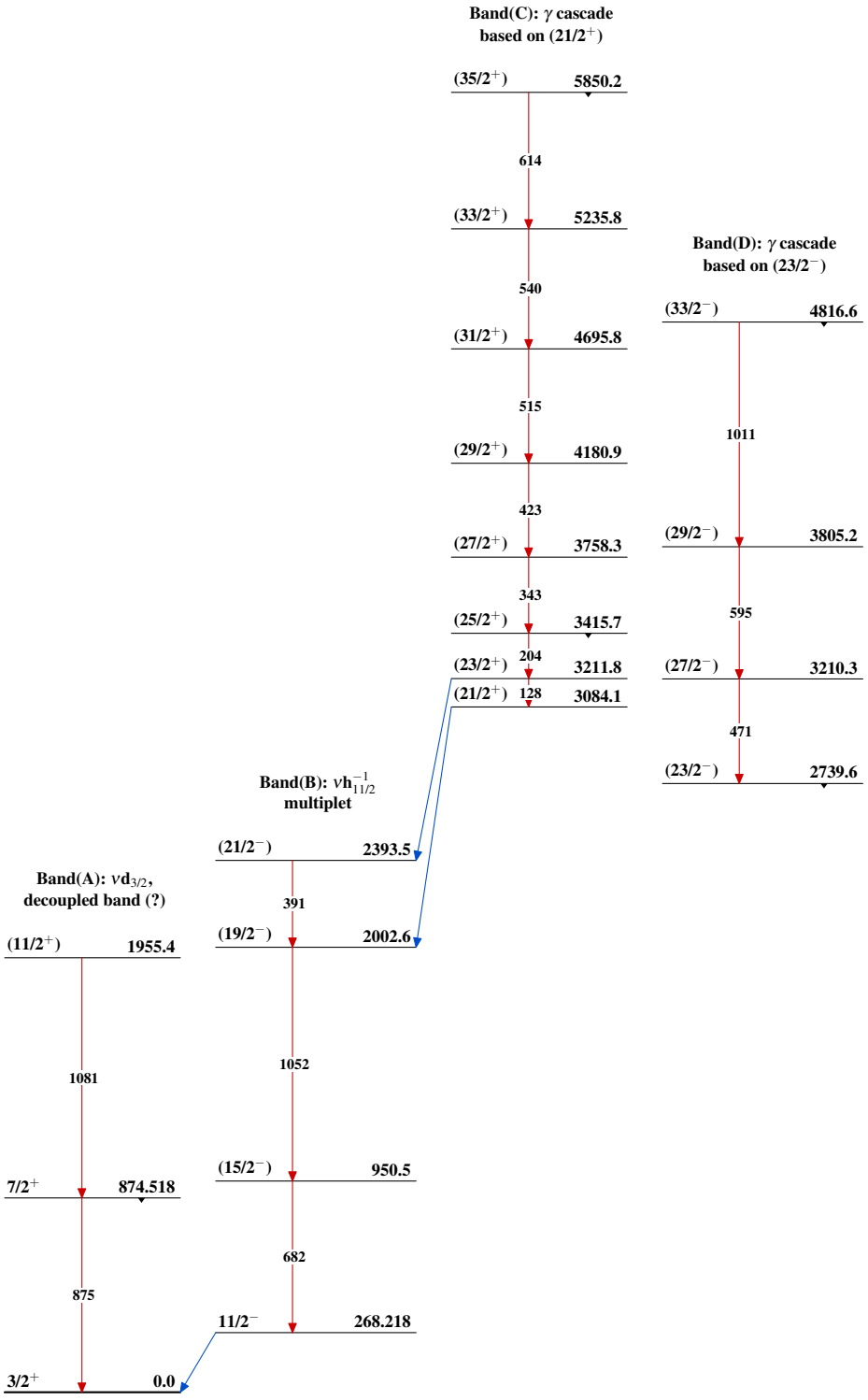
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

γ Decay (Uncertain)



$^{135}_{56}Ba_{79}$

Adopted Levels, Gammas



$^{135}_{56}Ba_{79}$