^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 152, 331 (2018)	1-Apr-2018

2008Mu19: Quasi-monoenergetic neutrons from the ^{3}H(p,n)^{3}He reaction. E(n)=2.2 to 3.9 MeV in 100 keV steps. Measured Eγ, Iγ, γ(θ), excitation function using HPGe detector; deduced $T_{1/2}$ using Doppler Shift Attenuation Method (DSAM).

1994Al17: Fast reactor neutrons. Measured Eγ, Iγ, γ(θ), linear polarization using HPGe detectors.

1985Di10: Fast reactor neutrons. Measured Eγ, Iγ, γ(θ) using a Ge(Li) detector.

^{136}Ba Levels

Levels at 2070.4, 2150.4, 2711.1 and 2717.1 keV proposed by 1985Di10 were determined to be based on transitions from the decay of ^{137}Ba by 1994Al17 and are not included here.

E(level)†	Jπ‡	$T_{1/2}$#	Comments
0.0	0^+		
818.521 *9*	2^+		
1550.989 *13*	2^+	0.77 ps *+24−19*	$T_{1/2}$: possible feeding from the 2222.7-keV level (2008Mu19).
1578.973 *22*	0^+	>735 fs	
1866.598 *19*	4^+	0.76 ps *+49−22*	
2030.47 *4*	7^-		
2053.84 *3*	4^+	0.87 ps *+84−29*	
2080.13 *3*	2^+	1.0 ps *+11−4*	
2128.868 *13*	2^+	48.5 fs *69*	
2140.15 *4*	5^-		
2141.38 *3*	0^+	0.26 ps *+13−7*	Jπ: isotropic angular distrubution of 1323γ and low population of level favors $J^\pi=0^+$ (1994Al17).
2207.08 *3*	6^+		
2222.709 *19*	$(2,1)^+$	0.63 ps *+44−19*	
2298.60 *6*	(6^-)		
2315.26 *3*	0^+	>0.85 ps	Jπ: isotropic angular distrubution of 1497γ and low population of level favors $J^\pi=0^+$ (1994Al17).
2356.492 *21*	4^+	0.51 ps *+52−18*	
2373.59 *3*	5^+		
2390.814 *21*	3^-	0.21 ps *+8−5*	
2399.94 *3*	$(1)^+$	118 fs *+28−21*	Jπ: excitation function of 1581γ suggests $J^\pi=1^+$ (2008Mu19).
2430.938 *22*	3^+	0.20 ps *+7−4*	
2485.10 *5*	2^+	146 fs *+35−28*	
2532.655 *22*	3^-	76 fs *7*	
2544.483 *24*	4^+	0.44 ps *+56−17*	
2587.07 *3*	$(5)^+$	>0.83 ps	Jπ: 5,6 from γ(θ) in 2008Mu19. J=5 is favored from excitation function in 2008Mu19. $J^\pi=4^+,(6^+)$ is proposed by 1994Al17 based on γ(θ) and linear polarization.
2640.79 *4*	(1^+)	55 fs *7*	Jπ: excitation function of 1822γ suggests $J^\pi=1^+$ (2008Mu19).
2659.64 *5*	$(3,4,5)^+$		
2661.48 *5*	$1,2^+$	73 fs *14*	
2693.81 *5*	1	104 fs *+35−28*	
2694.38 *4*	5^+		
2773.64 *3*	2^+	180 fs *+60−40*	
2779.99 *5*	2^+	0.28 ps *+37−11*	
2784.42 *6*	0^+	42 fs *+21−14*	Jπ: isotropic γ(θ) and excitation function suggest J=0 (2008Mu19).
2812.02 *7*	(3^+)	0.15 ps *+22−7*	
2820.18 *10*			
2840.73 *10*	(4^+)		
2935.1? *9*	$(1,2^+)$		

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^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10 (continued)

^{136}Ba Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#	E(level)†	Jπ‡
2977.67 *18*		0.11 ps *+16–6*	3435.5 *3*	1^-
2985.00 *6*	$(2^+,3^+,4^+)$	0.11 ps *+19–6*	3508.7 *3*	(4^+)
3022.14 *8*	$(1,2^+)$	0.14 ps *+6–4*	3526.7 *4*	2^+
3044.52 *5*	$1^{(-)}$		3550.70? *20*	
3077.32 *5*	3^+	0.11 ps *+8–4*	3706.1 *6*	$(1,2^+)$
3109.59 *9*	2^+	0.27 ps *+13–7*	3795.5 *3*	$(1,2^+)$
3116.08 *6*	2^+	83 fs *+21–14*	3852.7? *6*	$(1,2^+)$
3241.84 *12*		42 fs *+21–14*	3882.9? *4*	$(1,2^+)$
3335.6 *3*			3962.9? *8*	
3354.5 *3*			3979.1 *10*	(1)
3370.07 *21*	1			

† From a least-squares fit to Eγ, by evaluator.
‡ From the Adopted Levels. Additional support obtained from measurements in this dataset are indicated in the comments.
# From DSAM in 2008Mu19.

γ(^{136}Ba)

Unplaced γ′s from 1994Al17 only. See 1985Di10 for additional unplaced γ-rays not observed by 1994Al17 or 2008Mu19.

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
153.29[‡] *8*	0.23 *2*	2207.08	6^+	2053.84	4^+				
158.45 *4*	1.58 *8*	2298.60	(6^-)	2140.15	5^-	D+Q	+0.11 *2*		E_γ: weighted average of 158.44 *2* (1994Al17) and 158.59 *8* (1985Di10). I_γ: other: 0.9 *2* (1985Di10). Mult.: A_2=−0.052 *7*, A_4=0.004 *10* (1994Al17).
163.96 *5*	0.42 *3*	2030.47	7^-	1866.598	4^+				E_γ: weighted average of 163.95 *5* (1994Al17) and 164.02 *12* (1985Di10). I_γ: other: 3 *1* (1985Di10).
166.61 *4*	0.41 *3*	2373.59	5^+	2207.08	6^+	D+Q			E_γ: weighted average of 166.61 *4* (1994Al17) and 166.7 *2* (1985Di10). I_γ: other: 0.2 *1* (1985Di10). Mult.: A_2=−0.05 *2*, A_4=−0.06 *4* (1994Al17). δ: −0.08 *4* or −5.9 *20* (1994Al17).
[x]169.22 *18*	0.030 *9*								
176.69 *5*	0.38 *3*	2207.08	6^+	2030.47	7^-	D(+Q)	−0.01 *2*		E_γ: weighted average of 176.68 *5* (1994Al17) and 176.9 *2* (1985Di10). I_γ: other: 0.3 *1* (1985Di10). Mult.: A_2=−0.11 *2*, A_4=0.00 *3* (1994Al17).
187.24[‡] *10*	0.21 *2*	2053.84	4^+	1866.598	4^+	D+Q	+0.8 *6*		Mult.: A_2=0.27 *4*, A_4=−0.04 *6* (1994Al17). δ: from 2008Mu19. Other: −0.04 *6* or +1.07 *13* (1994Al17).
234.1[@] *3*	0.097 *11*	2373.59	5^+	2140.15	5^-				E_γ: from 1994Al17.
[x]262.4 *3*	0.054 *10*								
268.3[‡] *3*	0.027 *10*	2298.60	(6^-)	2030.47	7^-				
273.56 *4*	2.66 *18*	2140.15	5^-	1866.598	4^+	D(+Q)	0.00 *2*		E_γ: weighted average of 273.53 *1* (2008Mu19), 273.65 *2* (1994Al17), 273.81 *6* (1985Di10). I_γ: other: 2.4 *2* (1985Di10). Mult.: A_2=−0.205 *9*, A_4=0.010 *13* (1994Al17).
287.42 *12*	0.263 *16*	2820.18		2532.655	3^-				E_γ: weighted average of 287.23 *7* (2008Mu19) and 287.56 *6* (1994Al17). Other: 287.61 *8* for unplaced transition with Iγ=0.2 *1* (1985Di10). A_2=0.30 *2*, A_4=0.03 *3* (1994Al17).
302.37 *8*	0.277 *14*	2356.492	4^+	2053.84	4^+	M1(+E2)	+0.3 *+5−3*	0.16 *1*	E_γ: weighted average of 302.33 *3* (2008Mu19), 302.61 *8* (1994Al17), 302.9 *2* (1985Di10). I_γ: other: 0.3 *1* (1985Di10). Mult.: A_2=0.33 *3*, A_4=0.03 *4*, POL=1.4 *+15−7* (1994Al17). δ: other: 0.00 *6* or +1.07 *12* (1994Al17).
319.81 *6*	0.42 *3*	2373.59	5^+	2053.84	4^+	M1+E2	0.30 *1*		E_γ: weighted average of 319.72 *4* (2008Mu19), 319.88 *4* (1994Al17), 320.1 *2* (1985Di10). I_γ: other: 0.4 *1* (1985Di10).

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γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
									Mult.: A_2=−0.07 *2*, A_4=0.06 *3*, POL=0.9 *+4−3* (1994Al17). δ: from 2008Mu19. Other: +0.09 *4* or 1/δ=0.00 *1* (1994Al17).
336.75 *12*	0.269 *16*	2390.814	3−	2053.84	4+	E1(+M2)	+0.01 *5*	0.16 *1*	E_γ: weighted average of 336.68 *4* (2008Mu19) and 336.97 *7* (1994Al17). Mult.,δ: A_2=−0.09 *5*, A_4=0, POL=1.6 *+17−5* (1994Al17).
340.53 *7*	1.23 *7*	2207.08	6+	1866.598	4+	E2			E_γ: weighted average of 340.42 *4* (2008Mu19), 340.55 *3* (1994Al17), 340.75 *7* (1985Di10). I_γ: other: 1.1 *1* (1985Di10). Mult.: A_2=0.282 *12*, A_4=−0.106 *17*, POL=2.6 *7* (1994Al17); A_2=0.29 *3*, A_4=0.05 *3* (1985Di10).
389.5[‡] *2*	0.067 *10*	2820.18		2430.938	3+				
[x]427.53 *17*	0.138 *12*								
[x]467.1 *2*	0.058 *9*								
487.17 *8*	0.189 *13*	2694.38	5+	2207.08	6+	D+Q		0.42 *3*	E_γ: weighted average of 487.15 *2* (2008Mu19) and 487.47 *7* (1994Al17). Mult.: A_2=−0.28 *4*, A_4=0.07 *6* (1994Al17). δ: +0.12 *3* or 1/δ=+0.03 *2* (1994Al17).
489.93 *5*	0.51 *3*	2356.492	4+	1866.598	4+	D+Q		0.26 *1*	E_γ: weighted average of 489.64 *2* (2008Mu19), 489.93 *5* (1994Al17), 489.9 *7* (1985Di10). I_γ: other: 0.6 *2* (1985Di10). Mult.: A_2=0.377 *17*, A_4=−0.004 *20* (1994Al17). δ: =+0.14 *4* or +0.79 (1994Al17); 0.02 *+19−13* or 1.0 *+4−3* (2008Mu19).
506.91 *3*	≈0.75	2373.59	5+	1866.598	4+	D+Q	0.70 *1*		E_γ: weighted average of 506.91 *1* (2008Mu19) and 507.12 *7* (1994Al17). Mult.,δ: from γ(θ) in 2008Mu19.
528.96 *8*	0.245 *15*	2080.13	2+	1550.989	2+	D+Q			E_γ: weighted average of 528.94 *8* (1994Al17) and 529.1 *2* (1985Di10). I_γ: other: 0.2 *1* (1985Di10). Mult.: A_2=0.00 *3*, A_4=−0.08 *5* (1994Al17). δ: −0.28 *5* or +7 *+4−2* (1994Al17).
[x]546.40 *14*	0.144 *13*								
[x]556.92 *7*	0.258 *15*								
[x]605.4 *2*	0.123 *12*								
[x]616.57 *15*	0.135 *12*								
640.57 *4*	0.310 *15*	2694.38	5+	2053.84	4+	M1+E2	−0.33 *2*	0.58 *3*	E_γ: weighted average of 640.55 *2* (2008Mu19), 640.72 *6* (1994Al17), 640.7 *2* (1985Di10). I_γ: other: 0.3 *1* for unplaced 640.7γ (1985Di10). Mult.: A_2=−0.69 *3*, A_4=−0.01 *4*, POL=0.8 *3* (1994Al17).
[x]658.33 *15*	0.143 *12*								
671.65 *3*	1.13 *6*	2222.709	(2,1)+	1550.989	2+	M1(+E2)	+0.001 *14*	0.47 *2*	E_γ: weighted average of 671.64 *1* (2008Mu19), 671.73 *3* (1994Al17), 671.76 *7* (1985Di10). I_γ: other: 0.9 *2* (1985Di10). Mult.: A_2=0.197 *6*, A_4=−0.012 *12*, POL=2.0 *+6−4* (1994Al17);

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^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10 (continued)

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
									A_2=0.19 *7*, A_4=0.02 *10* (1985Di10). δ: others: +0.03 *+3−100* or +2 *1* (2008Mu19), −0.01 *+11−12* or 2.5 *+12−8* (1985Di10).
[x]677.85 *16*	0.114 *11*								
[x]715.3 *3*	0.085 *10*								
720.47 *2*	0.75 *4*	2587.07	$(5)^+$	1866.598	4^+	M1+E2	−0.14 *2*		E_γ: weighted average of 720.46 *1* (2008Mu19), 720.54 *4* (1994Al17), 720.6 *2* (1985Di10). E_γ: a 720.6γ is unplaced in 1985Di10. I_γ: other: 0.5 *1* (1985Di10). Mult.,δ: A_2=0.239 *11*, A_4=−0.020 *16*, POL=3.7 *+36−11* (1994Al17).
732.41 *2*	8.0 *4*	1550.989	2^+	818.521	2^+	M1+E2	−1.00 *4*	0.48 *1*	E_γ: weighted average of 732.39 *1* (2008Mu19), 732.46 *2* (1994Al17), 732.48 *5* (1985Di10). I_γ: other: 7.3 *3* (1985Di10). Mult.: A_2=−0.205 *6*, A_4=−0.018 *9*, POL=1.6 *+23−14* (1994Al17); A_2=−0.21 *2*, A_4=0.01 *2* (1985Di10). δ: others:−1.5 *+7−4* (2008Mu19), −1.5 *+6−10* (1985Di10).
740.1[‡] *3*	0.049 *8*	2820.18		2080.13	2^+				
[x]746.90 *11*	0.247 *14*								
760.45 *2*	3.14 *10*	1578.973	0^+	818.521	2^+	Q			E_γ: weighted average of 760.44 *1* (2008Mu19), 760.49 *2* (1994Al17), 760.51 *6* (1985Di10). I_γ: other: 2.8 *2* (1985Di10). Mult.: A_2=−0.01 *2*, A_4=0.00 *3* (1985Di10).
[x]764.48 *10*	0.226 *13*								
793.04 *5*	0.60 *3*	2659.64	$(3,4,5)^+$	1866.598	4^+	M1+E2	−0.08 *2*		E_γ: weighted average of 793.00 *3* (2008Mu19), 793.16 *5* (1994Al17), 793.1 *2* (1985Di10). I_γ: other: 0.4 *1* (1985Di10). E_γ: a 793.1γ is unplaced in 1985Di10. Mult.,δ: A_2=0.272 *15*, A_4=−0.010 *22*, POL=4.0 *+160−2* (1994Al17).
805.54 *3*		2356.492	4^+	1550.989	2^+	Q		0.18 *1*	E_γ: from 2008Mu19. A 805.55 *16* transition is observed by 1994Al17 and tentatively placed from a level at 2934 keV. In their excitation function, 2008Mu19 observe a threshold below 2.5 MeV for the 805.5γ. Mult.: from γ(θ) in 2008Mu19.
818.51 *1*	100 *4*	818.521	2^+	0.0	0^+	E2			E_γ: from 2008Mu19. Others: 818.51 *2* (1994Al17), 818.54 *4* (1985Di10). I_γ: ΔIγ from 1985Di10. Mult.: A_2=0.210 *5*, A_4=−0.088 *7*, POL=2.0 *+3−2* (1994Al17); A_2=0.18 *1*, A_4=−0.09 *2* (1985Di10).
839.82[‡] *11*	0.066 *8*	2390.814	3^-	1550.989	2^+				
[x]859.4 *3*	0.027 *6*								
879.94 *2*	0.84 *5*	2430.938	3^+	1550.989	2^+	M1+E2	−1.9 *4*	0.52 *1*	E_γ: weighted average of 879.94 *2* (2008Mu19), 879.93 *3* (1994Al17), 879.99 *6* (1985Di10).

^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10 (continued)

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
									I_γ: other: 0.6 *1* (1985Di10). Mult.: A_2=−0.37 *2*, A_4=0.09 *3*, POL=1.7 *+6−4* (1994Al17), A_2=−0.43 *7*, A_4=0.12 *5* (1985Di10). δ: weighted average of −1.4 *5* (2008Mu19) and −2.3 *4* (1994Al17). Other: −0.27 *8* or −2.1 *2* (1985Di10).
948.62 *14*		3077.32	3^+	2128.868	2^+	D+Q		0.15 *3*	E_γ: from 2008Mu19. δ: 0.3 *+5−3* or 6.9 *+10−50* (2008Mu19).
[x]955.2 *2*	0.084 *8*								
974.10 *15*	0.285 *13*	2840.73	(4^+)	1866.598	4^+	(M1+E2)		0.41 *3*	E_γ: weighted average of 974.3 *6* (2008Mu19) and 974.10 *15* (1994Al17). Other: 974.2 *2* for unplaced transition with Iγ=0.2 *1* (1985Di10). Mult.: A_2=0.16 *3*, A_4=−0.13 *4*, POL=9 *+75−6* (1994Al17). δ: +0.05 *15* or +1.0 *2* (1994Al17).
981.65 *2*	0.64 *3*	2532.655	3^-	1550.989	2^+	E1+M2	+0.11 *2*	0.34 *1*	E_γ: weighted average of 981.66 *2* (2008Mu19), 981.60 *6* (1994Al17), 981.54 *9* (1985Di10). I_γ: other: 0.6 *1* (1985Di10). Mult.,δ: A_2=−0.078 *14*, A_4=0.002 *20*, POL=3.7 *+35−11* (1994Al17).
993.49 *2*	1.04 *5*	2544.483	4^+	1550.989	2^+	Q			E_γ: weighted average of 993.50 *2* (2008Mu19), 993.44 *4* (1994Al17), 993.50 *8* (1985Di10). E_γ: 1985Di10 place the 993.50γ as depopulating a tentative level at 1812.0 keV. I_γ: other: 0.9 *1* (1985Di10). Mult.: A_2=0.328 *10*, A_4=−0.042 *13*, POL=3.8 *+35−12* (1994Al17).
1048.06 *2*	14.6 *7*	1866.598	4^+	818.521	2^+	E2			E_γ: weighted average of 1047.98 *5* (2008Mu19), 1048.07 *2* (1994Al17), 1048.08 *4* (1985Di10). I_γ: other: 13.5 *5* (1985Di10). Mult.: A_2=0.277 *5*, A_4=−0.054 *7*, POL=2.6 *+5−3* (1994Al17); A_2=0.33 *4*, A_4=0.06 *5* (1985Di10).
[x]1068.65 *11*	0.059 *14*								
[x]1092.05 *16*	0.098 *9*								
1110.50 *5*		2661.48	$1,2^+$	1550.989	2^+			0.19 *2*	E_γ: placement from 2008Mu19. A 1110.26 *14* transition with Iγ=0.25 *2* is placed from the 2977-keV level by 1994Al17. Mult.: γ(θ) is consistent with Q or D+Q with δ=+8 *5* or +0.3 *3* (2008Mu19).
1118.40 *6*	0.155 *11*	2985.00	$(2^+,3^+,4^+)$	1866.598	4^+				E_γ: from 2008Mu19. E_γ: weighted average of 1118.41 *6* (2008Mu19) and 1118.32 *14* (1994Al17). Other: 1118.1 *3* for unplaced transition with Iγ=0.1 *1* (1985Di10). A_2=−0.01 *3*, A_4=0.03 *4* (1994Al17).
[x]1132.2 *2*	0.147 *11*								
1142.39[@] *12*	0.253 *14*	2693.81	1	1550.989	2^+				E_γ: weighted average of 1142.37 *13* (1994Al17) and 1142.6 *4* (1985Di10).

$^{136}_{56}Ba_{80}$-6

^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10 (continued)

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
									I_γ: other: 0.2 *1* (1985Di10). E_γ: placement from 1985Di10 and 1994Al17 could not be confirmed in 2008Mu19. Excitation function for 1142-keV transition yields threshold of 3.0 MeV suggesting transition originates from a level at higher excitation energy (2008Mu19); transition not included in Adopted Levels, Gammas.
[x]1159.98 *15*	0.035 *7*								
1210.70 *6*	0.118 *10*	3077.32	3+	1866.598	4+			0.37 *4*	E_γ: weighted average of 1210.70 *6* (2008Mu19) and 1210.72 *18* (1994Al17). δ: 0.2 *2* or 12 *+1−8* (2008Mu19).
1222.2 *6*	0.114 *11*	2773.64	2+	1550.989	2+				E_γ: weighted average of 1222.6 *2* (1994Al17) and 1221.4 *3* (1985Di10). I_γ: other: 0.2 *1* (1985Di10).
1229.14 *10*	0.161 *12*	2779.99	2+	1550.989	2+	D+Q		0.39 *3*	E_γ: weighted average of 1229.18 *5* (2008Mu19) and 1228.87 *14* (1994Al17). Other: 1229.0 *3* for unplaced transition with Iγ=0.1 *1* (1985Di10). Mult.: A_2=0.05 *4*, A_4=0.00 *5* (1994Al17). δ: +5 *+3−1* or −0.20 *12* (1994Al17); −0.3 *2* or 16 *5* (2008Mu19).
1235.29 *3*	7.5 *4*	2053.84	4+	818.521	2+	E2			E_γ: weighted average of 1235.41 *1* (2008Mu19), 1235.26 *3* (1994Al17), 1235.33 *4* (1985Di10). I_γ: other: 6.8 *2* (1985Di10). Mult.: A_2=0.304 *7*, A_4=−0.069 *9*, POL=3.2 *+9−4* (1994Al17); A_2=0.28 *3*, A_4=−0.06 *4* (1985Di10).
[x]1247.2 *2*	0.025 *6*								
1261.65 *4*	2.31 *10*	2080.13	2+	818.521	2+	M1+E2	−1.00 *5*	0.62 *1*	E_γ: weighted average of 1261.67 *1* (2008Mu19), 1261.49 *3* (1994Al17), 1261.55 *5* (1985Di10). I_γ: other: 1.9 *1* (1985Di10). Mult.: A_2=−0.211 *5*, A_4=−0.019 *7*, POL=1.6 *+3−2* (1994Al17); A_2=−0.23 *4*, A_4=−0.02 *5* (1985Di10). δ: others: −1.3 *+14−3* (2008Mu19), −1.5 *+6−15* (1985Di10).
1310.34 *1*	2.52 *10*	2128.868	2+	818.521	2+	M1(+E2)	+0.005 *9*	0.69 *1*	E_γ: weighted average of 1310.34 *1* (2008Mu19), 1310.33 *3* (1994Al17), 1310.31 *5* (1985Di10). I_γ: other: 2.0 *1* (1985Di10). Mult.: A_2=0.200 *7*, A_4=−0.012 *9*, POL=2.0 *+5−3* (1994Al17); A_2=0.22 *7*, A_4=0.06 *8* (1985Di10). δ: others: −0.002 *31* (2008Mu19), 0.03 *+18−15* or 2.2 *+16−8* (1985Di10).
1322.85 *3*	0.83 *4*	2141.38	0+	818.521	2+	E2			E_γ: weighted average of 1322.86 *3* (2008Mu19), 1322.87 *4* (1994Al17), 1322.76 *7* (1985Di10). I_γ: other: 0.6 *1* (1985Di10). Mult.: A_2=0.008 *10*, A_4=−0.008 *12*, POL=1.0 *+4−3* (1994Al17); A_2=0.08 *9*, A_4=0.13 *10* (1985Di10).
[x]1351.4 *2*	0.113 *11*								
[x]1364.2 *3*	0.109 *10*								

$^{136}_{56}Ba_{80}$-7

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
[x]1372.6 *3*	0.062 *7*								
[x]1382.3 *2*	0.053 *9*								
1404.21 *2*	1.12 *5*	2222.709	(2,1)$^+$	818.521	2$^+$	M1+E2	+1.92 *10*	0.53 *2*	E_γ: weighted average of 1404.22 *2* (2008Mu19), 1404.20 *3* (1994Al17), 1404.19 *9* (1985Di10). I_γ: other: 0.9 *1* (1985Di10). Mult.: A_2=0.251 *8*, A_4=0.010 *11*, POL=0.9 *+4−3* (1994Al17); A_2=0.15 *9*, A_4=−0.02 *12* (1985Di10). δ: others: +1.5 *1* or +0.22 *10* (2008Mu19), 0.01 *+9* or 2.3 *+7−5* (1985Di10).
[x]1426.4 *3*	0.083 *9*								
1428.7[‡] *4*	0.060 *9*	3508.7	(4$^+$)	2080.13	2$^+$				
[x]1444.74 *13*	0.159 *10*								
[x]1453.4 *3*	0.024 *6*								
1494.1[‡@] *6*	0.062 *9*	3044.52	1$^{(-)}$	1550.989	2$^+$				
1496.73 *3*	0.47 *3*	2315.26	0$^+$	818.521	2$^+$	Q			E_γ: weighted average of 1496.71 *3* (2008Mu19), 1496.82 *7* (1994Al17), 1496.7 *2* (1985Di10). I_γ: other: 0.4 *1* (1985Di10). Mult.: A_2=−0.00 *2*, A_4=0.02 *3* (1994Al17).
[x]1516.3 *4*	0.033 *5*								
[x]1526.3 *3*	0.039 *6*								
1537.95 *3*	0.87 *4*	2356.492	4$^+$	818.521	2$^+$	E2		0.40 *1*	E_γ: weighted average of 1537.95 *3* (2008Mu19), 1537.98 *4* (1994Al17), 1537.90 *7* (1985Di10). I_γ: other: 0.8 *1* (1985Di10). Mult.: A_2=0.326 *12*, A_4=−0.074 *15*, POL=2.8 *+28−10* (1994Al17); A_2=0.32 *4*, A_4=−0.06 *5* (1985Di10).
1550.99 *2*	8.7 *4*	1550.989	2$^+$	0.0	0$^+$	E2		0.52 *1*	E_γ: weighted average of 1551.00 *1* (2008Mu19), 1550.96 *2* (1994Al17), 1550.95 *4* (1985Di10). I_γ: other: 8.2 *2* (1985Di10). Mult.: A_2=0.260 *7*, A_4=−0.102 *8*, POL=2.3 *+4−2* (1994Al17); A_2=0.26 *2*, A_4=−0.10 *2* (1985Di10).
1572.29 *2*	1.48 *6*	2390.814	3$^-$	818.521	2$^+$	E1+M2	−0.050 *10*		E_γ: weighted average of 1572.29 *2* (2008Mu19), 1572.28 *3* (1994Al17), 1572.25 *8* (1985Di10). I_γ: other: 1.2 *1* (1985Di10). Mult.,δ: A_2=−0.286 *6*, A_4=−0.007 *9*, POL=1.3 *+4−3* (1994Al17), A_2=−0.33 *5*, A_4=0.12 *4* (1985Di10).
1581.41 *3*	1.02 *5*	2399.94	(1)$^+$	818.521	2$^+$	M1+E2			E_γ: weighted average of 1581.44 *3* (2008Mu19), 1581.36 *4* (1994Al17), 1581.34 *9* (1985Di10). I_γ: other: 0.8 *1* (1985Di10). Mult.: A_2=−0.027 *6*, A_4=−0.012 *8*, POL=0.6 *3* (1994Al17), A_2=−0.10 *2*, A_4=−0.03 *3* (1985Di10). δ: 1/δ=0.019 *17* (1994Al17); −2 *+6−2* or −0.2*+60−4* (2008Mu19).
1612.46 *5*	0.71 *4*	2430.938	3$^+$	818.521	2$^+$	M1+E2	−4.0 *4*	0.48 *1*	E_γ: weighted average of 1612.51 *3* (2008Mu19), 1612.37 *4*

$^{136}_{56}Ba_{80}$-8

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	Iγ[rel#]	Comments
									(1994Al17), 1612.5 *1* (1985Di10). I_γ: other: 0.5 *1* (1985Di10). Mult.: A_2=−0.193 *13*, A_4=0.111 *17*, POL=1.8 *+12−2* (1994Al17), A_2=−0.31 *7*, A_4=0.16 *7* (1985Di10). δ: others: −3 *1* (2008Mu19); −0.15 *9* or −2.8 *6* (1985Di10).
[x]1631.8 *4*	0.068 *7*								
1666.57 *5*	0.91 *5*	2485.10	2^+	818.521	2^+	M1+E2	+0.24 *4*	0.43 *8*	E_γ: weighted average of 1666.60 *2* (2008Mu19), 1666.44 *4* (1994Al17), 1666.5 *2* (1985Di10). I_γ: other: 0.7 *1* (1985Di10). Mult.: A_2=0.200 *9*, A_4=−0.002 *12*, POL=1.6 *+13−4* (1994Al17), A_2=0.29 *8*, A_4=0.12 *10* (1985Di10). δ: others: 0.10 *7* or 2 *1* (2008Mu19); 0.07 *+36−20* or 1.9 *+20−13* (1985Di10).
1690.6[‡@] *3*	0.090 *7*	3241.84		1550.989	2^+				
1714.20 *6*	1.00 *6*	2532.655	3^-	818.521	2^+	E1+M2	+0.010 *8*	0.65 *1*	E_γ: weighted average of 1714.24 *2* (2008Mu19), 1714.10 *4* (1994Al17), 1713.90 *8* (1985Di10). I_γ: other: 1.1 *1* (1985Di10). Mult.,δ: A_2=−0.197 *4*, A_4=0.004 *19*, POL=2.1 *+30−4* (1994Al17).
[x]1751.6 *2*	0.100 *9*								
1822.26 *4*	0.57 *4*	2640.79	(1^+)	818.521	2^+	D+Q	−0.1 *+50−1*		E_γ: weighted average of 1822.29 *4* (2008Mu19), 1822.20 *6* (1994Al17), 1822.2 *2* (1985Di10). I_γ: other: 0.5 *1* (1985Di10). Mult.: A_2=−0.076 *15*, A_4=0.020 *20*, POL=3.7 *+36−11* (1994Al17). δ: from 2008Mu19. Other: −0.64 *7* or −13 *+9−4* (1994Al17).
1842.89 *10*	0.77 *4*	2661.48	$1,2^+$	818.521	2^+	D+Q	+0.7 *3*	0.81 *2*	E_γ: weighted average of 1843.00 *1* (2008Mu19), 1842.85 *5* (1994Al17), 1843.1 *1* (1985Di10). I_γ: other: 0.7 *1* (1985Di10). Mult.,δ: A_2=0.25 *2*, A_4=0.01 *3*, POL=4.0 *+160−2* (1994Al17). Mult.,δ: other: γ(θ) is consistent with Q or D+Q with δ=+1.7 *4* or +0.2 *1* (2008Mu19).
1875.29 *7*	0.353 *16*	2693.81	1	818.521	2^+	D+Q	−0.8 *+34−7*	0.15 *7*	E_γ: weighted average of 1875.36 *5* (2008Mu19), 1875.15 *8* (1994Al17), 1875.1 *2* (1985Di10). I_γ: other: 0.3 *1* (1985Di10). Mult.: A_2=0.00 *2*, A_4=0.01 *2* (1994Al17). δ: from 2008Mu19. Other: −2.6 *+30−9* or −0.07 *+25−17* (1994Al17).
1955.03 *5*	0.41 *2*	2773.64	2^+	818.521	2^+	D+Q	+0.65 *25*	0.22 *10*	E_γ: weighted average of 1955.03 *5* (2008Mu19), 1955.05 *8* (1994Al17), 1954.8 *3* (1985Di10). I_γ: other: 0.4 *1* (1985Di10). Mult.,δ: A_2=0.236 *17*, A_4=−0.043 *26* (1994Al17). δ: other: 0.4 *+10−2* or 0.8 *+5−8* (2008Mu19).
1961.40 *6*	0.273 *12*	2779.99	2^+	818.521	2^+	D+Q		0.61 *2*	E_γ: weighted average of 1961.39 *6* (2008Mu19) and 1961.42 *11* (1994Al17). Mult.: A_2=0.183 *15*, A_4=−0.013 *20* (1994Al17). δ: +1.50 *17* or +0.20 *6* (1994Al17); 5 *+27−3* or −0.2 *2* (2008Mu19).
1965.88 *6*	0.182 *10*	2784.42	0^+	818.521	2^+	Q			E_γ: weighted average of 1965.88 *6* (2008Mu19) and 1965.90 *13*

$^{136}_{56}Ba_{80}$-9

^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10 (continued)

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[†]	$I\gamma^{rel}$[#]	Comments
									(1994Al17). Mult.: A_2=0.01 *5*, A_4=0.0 *20* (1994Al17).
[x]1972.9 *4*	0.072 *7*								
1993.48 *7*	0.327 *14*	2812.02	(3$^+$)	818.521	2$^+$	D+Q			E_γ: weighted average of 1993.57 *7* (2008Mu19), 1993.42 *7* (1994Al17), 1993.3 *2* (1985Di10). I_γ: other: 0.3 *1* (1985Di10). Mult.: A_2=−0.445 *15*, A_4=0.103 *21* (1994Al17). δ: −2.0 *2* or −0.26 *4* (1994Al17); 2 *1* or 0.3 *1* (2008Mu19).
1999.7[‡@] *2*	0.108 *8*	3550.70?		1550.989	2$^+$				multiply placed from a 3551-keV level or a 3866-keV level (1994Al17). A_2=0.32 *6*, A_4=−0.09 *8* (1994Al17).
[x]2010.3 *2*	0.056 *6*								
2022.22 *14*	0.226 *10*	2840.73	(4$^+$)	818.521	2$^+$	Q		0.59 *3*	E_γ: weighted average of 2022.32 *8* (2008Mu19), 2022.15 *12* (1994Al17), 2021.7 *2* (1985Di10). I_γ: other: 0.2 *1* (1985Di10). Mult.: A_2=0.21 *3*, A_4=−0.05 *4* (1994Al17).
2080.11 *7*	1.40 *5*	2080.13	2$^+$	0.0	0$^+$	Q		0.38 *1*	E_γ: weighted average of 2080.25 *4* (2008Mu19), 2080.04 *3* (1994Al17), 2080.0 *2* (1985Di10). I_γ: other: 1.1 *1* (1985Di10). Mult.: A_2=0.277 *8*, A_4=−0.093 *10* (1994Al17); A_2=0.32 *5*, A_4=−0.07 *7* (1985Di10).
2128.88 *5*	1.26 *4*	2128.868	2$^+$	0.0	0$^+$	Q		0.31 *1*	E_γ: weighted average of 2128.94 *3* (2008Mu19), 2128.81 *4* (1994Al17), 2128.75 *9* (1985Di10). I_γ: other: 1.0 *1* (1985Di10). Mult.: A_2=0.288 *8*, A_4=−0.121 *12* (1994Al17); A_2=0.38 *4*, A_4=0.03 *5* (1985Di10).
2159.13 *18*	0.070 *7*	2977.67		818.521	2$^+$				E_γ: weighted average of 2159.19 *10* (2008Mu19) and 2158.6 *3* (1994Al17).
2166.3[‡] *3*	0.096 *8*	2985.00	(2$^+$,3$^+$,4$^+$)	818.521	2$^+$				
[x]2190.6 *3*	0.089 *8*								
[x]2198.3 *3*	0.040 *6*								
2203.60 *8*	0.212 *12*	3022.14	(1,2$^+$)	818.521	2$^+$				E_γ: weighted average of 2203.63 *5* (2008Mu19) and 2203.40 *12* (1994Al17). A_2=0.00 *3*, A_4=−0.01 *4* (1994Al17).
2223[@]	≈0.1	2222.709	(2,1)$^+$	0.0	0$^+$				
2244.8[‡] *4*	0.016 *5*	3795.5	(1,2$^+$)	1550.989	2$^+$				
2258.76 *9*	0.116 *10*	3077.32	3$^+$	818.521	2$^+$	D+Q	−4.5 *+16−10*	0.48 *5*	E_γ: weighted average of 2258.73 *9* (2008Mu19) and 2258.9 *2* (1994Al17). Mult.: A_2=−0.20 *7*, A_4=0.16 *9* (1994Al17). δ: other: −2.9 *+50−17* (2008Mu19).
[x]2287.9 *4*	0.069 *8*								
2291.13 *12*	0.115 *10*	3109.59	2$^+$	818.521	2$^+$	D+Q		0.18 *13*	E_γ: weighted average of 2291.13 *12* (2008Mu19) and 2291.1 *4* (1994Al17).

$^{136}_{56}Ba_{80}$-10

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	$I\gamma^{rel}$[#]	Comments
								Mult.: A_2=0.04 *6*, A_4=−0.07 *8* (1994Al17). δ: +4 *+4−1* or −0.13 *14* (1994Al17); 3 *+6−1* or 0.04 *+25−20* (2008Mu19).
2297.4[‡] *4*	0.005 *4*	3116.08	2^+	818.521	2^+			
[x]2338.0 *3*	0.092 *8*							
[x]2397.9 *4*	0.064 *7*							
[x]2413.7 *4*	0.044 *6*							
2423.34 *13*	0.131 *10*	3241.84		818.521	2^+			E_γ: weighted average of 2423.28 *10* (2008Mu19) and 2423.6 *2* (1994Al17). A_2=0.31 *6*, A_4=−0.02 *8* (1994Al17).
[x]2475.7 *3*	0.055 *6*							
2485.02 *14*	0.38 *3*	2485.10	2^+	0.0	0^+	Q	0.57 *8*	E_γ: weighted average of 2485.11 *6* (2008Mu19), 2484.94 *10* (1994Al17), 2484.3 *2* (1985Di10). I_γ: other: 0.3 *1* (1985Di10). Mult.: A_2=0.179 *15*, A_4=−0.079 *21* (1994Al17).
2517.1[‡] *3*	0.127 *10*	3335.6		818.521	2^+			A_2=0.00 *4*, A_4=−0.01 *5* (1994Al17).
2536.0[‡] *3*	0.126 *10*	3354.5		818.521	2^+			
[x]2554.0 *5*	0.035 *6*							
[x]2624.2 *8*	0.030 *6*							
2661.7[‡] *6*	0.039 *6*	2661.48	$1,2^+$	0.0	0^+			
[x]2681.0 *4*	0.092 *10*							
2690.1[‡] *4*	0.094 *8*	3508.7	(4^+)	818.521	2^+			A_2=0.14 *6*, A_4=−0.01 *8* (1994Al17).
2693.92 *7*	0.228 *15*	2693.81	1	0.0	0^+	D	0.85 *7*	E_γ: weighted average of 2693.92 *7* (2008Mu19), 2694.0 *4* (1994Al17), 2693.7 *4* (1985Di10). I_γ: other: 0.2 *1* (1985Di10). Mult.: A_2=−0.10 *3*, A_4=0.01 *4* (1994Al17).
2709.0[‡] *8*	0.042 *6*	3526.7	2^+	818.521	2^+			
[x]2723.0 *7*	0.055 *6*							
2773.66 *4*	0.185 *14*	2773.64	2^+	0.0	0^+	Q	0.78 *10*	E_γ: weighted average of 2773.66 *4* (2008Mu19) and 2773.53 *25* (1994Al17). Mult.: A_2=0.18 *3*, A_4=−0.07 *5* (1994Al17).
2779.5[‡] *7*	0.057 *8*	2779.99	2^+	0.0	0^+	Q		Mult.: A_2=0.15 *13*, A_4=−0.03 *20* (1994Al17).
[x]2914.9 *6*	0.048 *6*							
2935.1[‡@] *9*	0.040 *6*	2935.1?	$(1,2^+)$	0.0	0^+			
[x]2958.1 *6*	0.035 *6*							
2976.5[‡] *5*	0.064 *7*	3795.5	$(1,2^+)$	818.521	2^+			
3021.9[‡] *9*	0.021 *5*	3022.14	$(1,2^+)$	0.0	0^+			
3044.48 *5*	0.213 *12*	3044.52	$1^{(-)}$	0.0	0^+			E_γ: weighted average of 3044.49 *5* (2008Mu19) and 3044.39 *17* (1994Al17). A_2=−0.14 *3*, A_4=0.00 *4* (1994Al17).
3064.3[‡@] *4*	0.064 *7*	3882.9?	$(1,2^+)$	818.521	2^+			A_2=−0.03 *8*, A_4=−0.03 *12* (1994Al17).
3109.43 *14*	0.137 *11*	3109.59	2^+	0.0	0^+	Q	0.81 *13*	E_γ: weighted average of 3109.41 *14* (2008Mu19) and 3109.5 *3* (1994Al17). Mult.: A_2=0.17 *5*, A_4=−0.09 *7* (1994Al17).
3116.04 *6*	0.245 *16*	3116.08	2^+	0.0	0^+	Q		E_γ: weighted average of 3116.06 *5* (2008Mu19) and 3115.8 *2* (1994Al17). Mult.: A_2=0.20 *6*, A_4=−0.08 *7* (1994Al17).

$^{136}_{56}Ba_{80}$-11

^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10 (continued)

γ(^{136}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
3144.3[‡@] *8*	0.075 *8*	3962.9?		818.521	2^+		
[x]3195.8 *6*	<0.068						
[x]3220.3 *5*	0.058 *7*						
[x]3350.8 *5*	0.024 *6*						
3370.03[‡] *21*	0.119 *9*	3370.07	1	0.0	0^+		A_2=−0.11 *5*, A_4=0.01 *7* (1994Al17).
3435.5[‡] *3*	0.112 *9*	3435.5	1^-	0.0	0^+		A_2=−0.08 *5*, A_4=0.00 *6* (1994Al17).
[x]3451.3 *5*	0.067 *7*						
[x]3468.1 *7*	0.039 *7*						
3526.4[‡] *4*	0.062 *7*	3526.7	2^+	0.0	0^+	Q	Mult.: A_2=0.21 *6*, A_4=−0.07 *9* (1994Al17).
[x]3683.6 *5*	0.060 *7*						
3706.0[‡] *6*	0.069 *8*	3706.1	$(1,2^+)$	0.0	0^+		A_2=−0.09 *11*, A_4=0.0 (1994Al17).
3852.6[‡@] *6*	0.117 *8*	3852.7?	$(1,2^+)$	0.0	0^+		A_2=0.23 *5*, A_4=−0.14 *6* (1994Al17).
3979.0[‡] *10*	0.031 *7*	3979.1	(1)	0.0	0^+		
[x]3999.9 *10*	0.022 *6*						

[†] From 1994Al17, except where noted.
[‡] Observed by 1994Al17 only.
[#] Relative photon branching ratios from individual levels (2008Mu19).
[@] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{136}_{56}Ba_{80}$-12

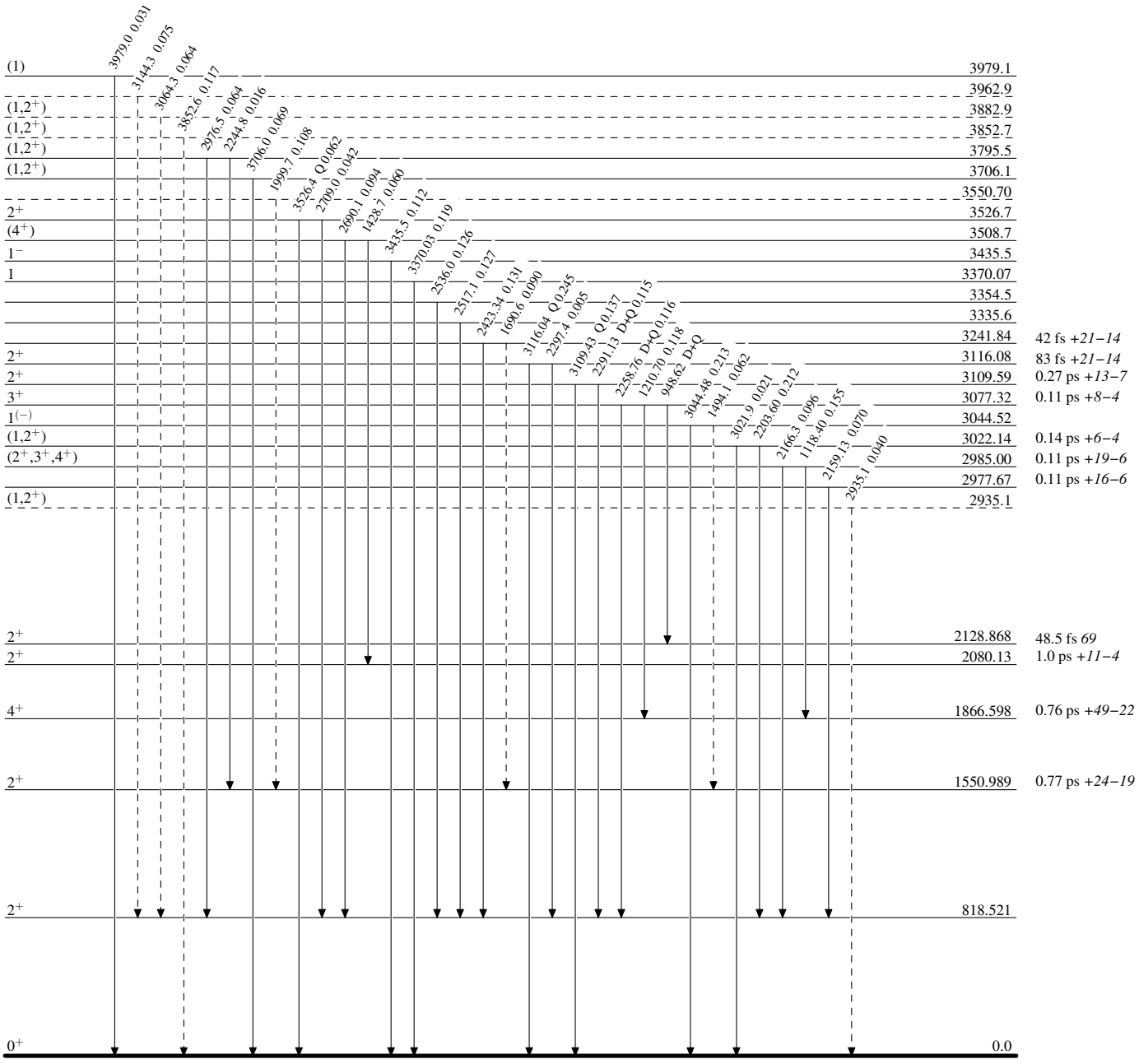
^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10

Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)

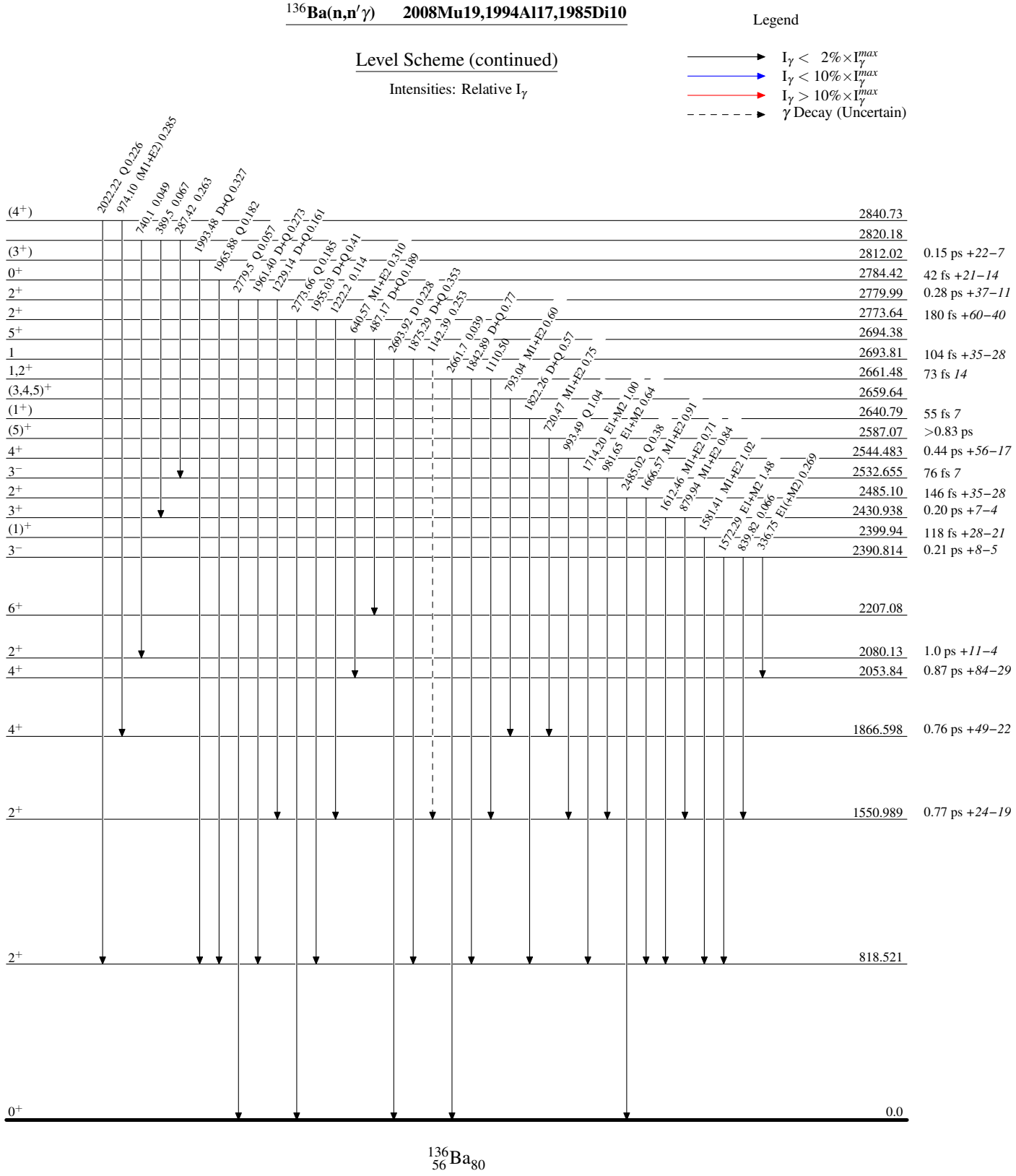


$^{136}_{56}Ba_{80}$

^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10

Level Scheme (continued)

Intensities: Relative I_γ



$^{136}_{56}Ba_{80}$

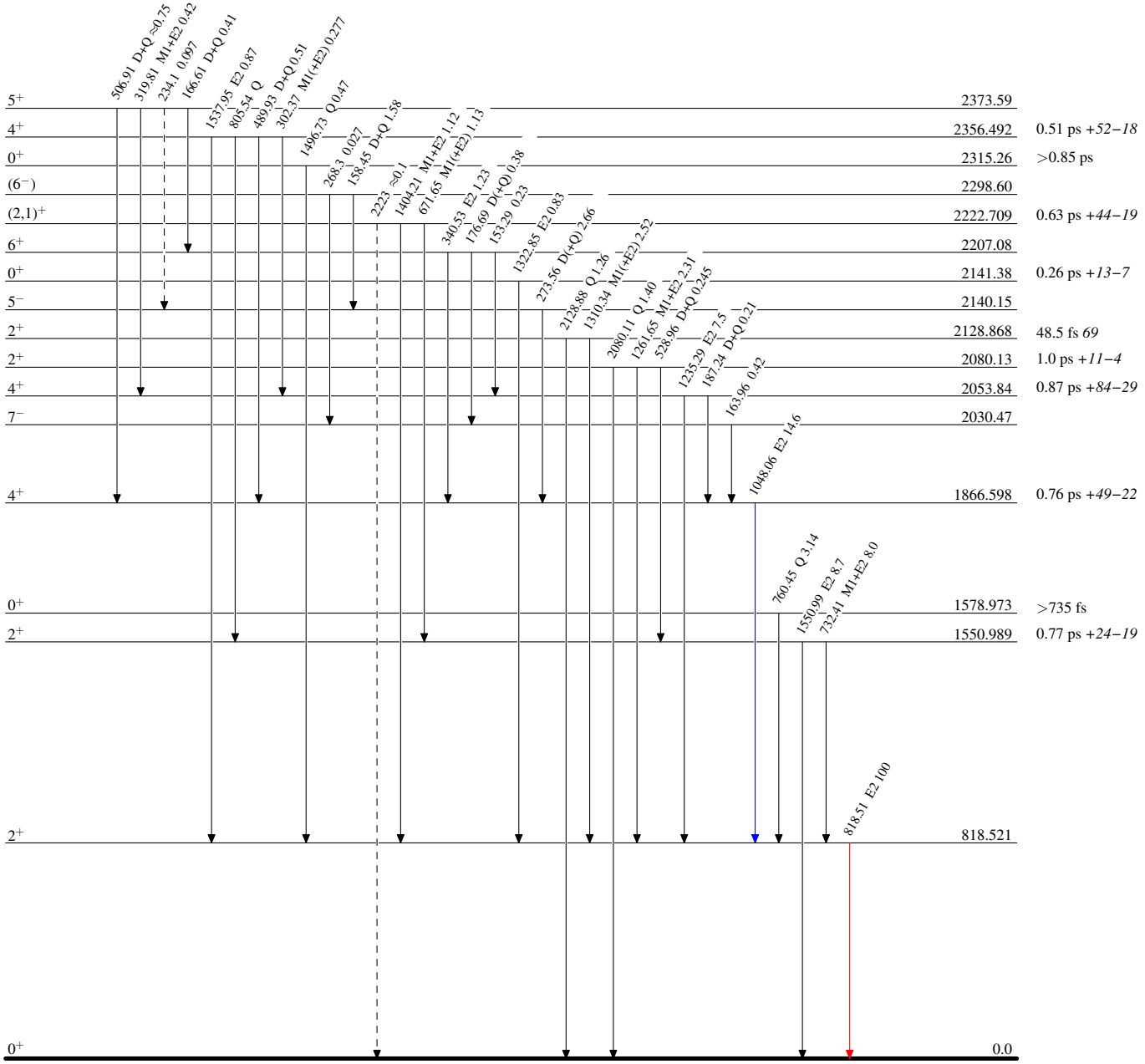
^{136}Ba(n,n′γ) 2008Mu19,1994Al17,1985Di10

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)



$^{136}_{56}Ba_{80}$