Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, M. S. Basunia, Murray Martin et al. ,	NDS 160,405 (2019)	30-Oct-2019

Q(β^-)=−1520 *50*; S(n)=5930 *50*; S(p)=2340 *50*; Q(α)=9380 *50* 2017Wa10
S(2n)=13440 *50*, S(2p)=6710 *50* (2017Wa10).
Additional information 1.
Assignment: daughter of ^{222}Pa α decay (1970Bo13).
Theory references: consult NSR database (www.nndc.bnl.gov/nsr/) for 15 primary references for calculations of half-lives of radioactive decays, and two for nuclear structure.
Review of level data for nuclides with reflection asymmetry: 1996Bu45.

^{218}Ac Levels

Cross Reference (XREF) Flags

A ^{222}Pa α decay (4.1 ms)
B ^{209}Bi(^{12}C,3nγ)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0	(1$^-$)	1.03 μs *5*		%α=100 E(level): From ^{218}Ac α decay. Only the α-decay mode has been observed. Theoretical partial $T_{1/2}$=13.1 s for ^{218}Ac $\varepsilon+\beta^+$ decay (2019Mo01) gives %ε+%β^+=8×10^{-6}. J$^\pi$: from the systematics of odd-odd nuclides in this mass region, the probable configuration is $\pi h_{9/2}\otimes\nu g_{9/2}$, as proposed in ^{209}Bi(^{12}C,3nγ). $T_{1/2}$: from α decay. Weighted average of 0.98 μs *12* (2017Su18), 0.96 μs *5* (2015Kh09), 1.06 μs *9* (1989Mi17), 1.31 μs *12* (1989De06) and 1.12 μs *11* (1983Sc23). Others: 1.8 μs *1* (2019Mi08, from correlated α decays in ^{226}Np and ^{222}Pa decay chains, authors also give $T_{1/2}$=1.5 μs *1*); 0.27 μs *4* (1970Bo13) seem discrepant values. Note that statistics is poor in 2019Mi08.
0+x			B	E(level): see comment for ≈407−keV level.
122.5+x *2*			B	E(level): see comment for ≈529−keV level.
122.5+y[#]	(9$^-$)	32 ns *9*	B	%IT=100 Additional information 2. E(level): y=x+z, where z is expected to be less than 100 keV. J$^\pi$: from the systematics of neighboring odd-odd nuclides, probable configuration=$\pi h_{9/2}\otimes\nu g_{9/2}$. $T_{1/2}$: from delayed component in (122.5γ)(total γ)(t) curve (1994De04). 1994De04 noted that mult(122.5γ)=M1 would give a much shorter half-life for 122.5+x level, and suggested one or more intermediate transitions of <100 keV from the (9$^-$) state to the 122.5+x level. 1994De04 also pointed out contribution from a prompt component in the (122.5γ)(total γ)(t) distribution, which may suggest population of the 122.5+x level by γ rays from higher levels of short half−lives. Half−life of 32 ns is assigned by the evaluators to the 122.5+y, (9$^-$) level, while noting that 1994De04 did not explicitly assign this half-life to the (9$^-$) or any other level, either in their level-scheme Fig. 2 or in the text of their paper. Occurrence of (1$^-$) ground states and (9$^-$) isomers in ^{216}Ac; and also in N=129 isotones ^{214}At and possibly in ^{212}Bi seem to support the assignment of (9$^-$) isomer in ^{218}Ac.
≈193			A	
226.90+y *24*	(9$^-$)		B	J$^\pi$: ΔJ=1, 189.2 M1 γ from 416.1+y (10$^-$) level.
≈407			A	E(level): this level may correspond to 0+x level from ^{209}Bi(^{12}C,3nγ) reaction.
416.10+y *14*	(10$^-$)		B	J$^\pi$: ΔJ=1, 293.6 (M1) γ to 122.5+y, (9$^-$) level; probable configuration=$(\pi h_{9/2}\otimes\nu i_{11/2})10^-\otimes 0^+$ core.

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Adopted Levels, Gammas (continued)

^{218}Ac Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	XREF	Comments
506.99+y[b] *13*	(11$^+$)	103 ns *11*	B	%IT=100 J$^{\pi}$: M2 γ to (9$^-$); (E1) γ to (10$^-$); possible bandhead. $T_{1/2}$: 384.5γ(t) in ^{209}Bi(^{12}C,3nγ).
≈529			A	E(level): this level may correspond to 122.5+x level from ^{209}Bi(^{12}C,3nγ) reaction which deexcites by 122.5γ.
≈560			A	
≈580			A	
600.94+y *16*	(10$^-$)		B	J$^{\pi}$: ΔJ=1, M1 γ to (9$^-$). Possible configuration=($\pi h_{9/2}\nu g_{9/2}$)8$^-$ $\otimes$ 2$^+$ (unfavored). E(level): the ordering of the 81-478 cascade is not established experimentally, the ordering given here is preferred by 1994De04 from theoretical considerations.
630.38+y[#] *14*	(11$^-$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (9$^-$).
681.98+y[a] *14*	(11$^+$)		B	J$^{\pi}$: ΔJ=1, E1 γ to (10$^-$); ΔJ=0, M1 γ to (11$^+$).
789.16+y[@] *15*	(12$^+$)		B	J$^{\pi}$: ΔJ=1, E1 γ to (11$^-$); ΔJ=1, M1 γ to (11$^+$).
990.45+y[&] *15*	(12$^-$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (10$^-$); ΔJ=1 γ to (11$^+$).
1044.89+y[b] *17*	(13$^+$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (11$^+$).
1088.50+y[#] *17*	(13$^-$)		B	J$^{\pi}$: ΔJ=2 γ to (11$^-$); ΔJ=1, E1 γ to (12$^+$).
1181.93+y[a] *17*	(13$^+$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (11$^+$); (E1) γ to (12$^-$).
1258.07+y[@] *19*	(14$^+$)		B	J$^{\pi}$: ΔJ=2 γ to (12$^+$); ΔJ=1, E1 γ to (13$^-$).
1335.86+y[c] *22*	(14$^-$)		B	J$^{\pi}$: ΔJ=1 γ to (13$^+$).
1418.54+y[&] *17*	(14$^-$)		B	J$^{\pi}$: ΔJ=2 γ to (12$^-$); ΔJ=1, M1 γ to (13$^-$).
1509.83+y[b] *19*	(15$^+$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (13$^+$); ΔJ=1, (E1) γ to (14$^-$).
1557.23+y[#] *19*	(15$^-$)		B	J$^{\pi}$: ΔJ=2 γ to (13$^-$); ΔJ=1, E1 γ to (14$^+$).
1625.41+y[a] *19*	(15$^+$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (13$^+$); ΔJ=1, (E1) γ to (14$^-$).
1697.60+y[@] *23*	(16$^+$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (14$^+$); ΔJ=1, E1 γ to (15$^-$).
1789.45+y[&] *19*	(16$^-$)		B	J$^{\pi}$: ΔJ=2, E2 γ to (14$^-$); ΔJ=1, M1 γ to (15$^-$).
1843.1+y[c] *3*	(16$^-$)		B	J$^{\pi}$: ΔJ=1 γ to (15$^+$);
1939.4+y[b] *3*	(17$^+$)		B	J$^{\pi}$: ΔJ=2 γ to (15$^+$); (E1) γ to (16$^-$).
1990.2+y *3*	(17$^+$)		B	J$^{\pi}$: ΔJ=1, E1 γ to (16$^-$).
2025.8+y[a] *3*	(17$^+$)		B	J$^{\pi}$: ΔJ=2 γ to (15$^+$); possible γ to (16$^-$).
2121.0+y[c] *4*	(18$^-$)		B	J$^{\pi}$: γ to (16$^-$); possible γ to (17$^+$).
2141.0+y[@] *3*	(18$^+$)		B	J$^{\pi}$: ΔJ=2 γ to (16$^+$).
2239.6+y[b] *4*	(19$^+$)		B	J$^{\pi}$: ΔJ=2 γ to (17$^+$).
2630.2+y[@] *4*	(20$^+$)		B	J$^{\pi}$: ΔJ=(2) γ to (18$^+$).

[†] From least-squares fit to Eγ data.

[‡] All assignments are made from the γ-ray multipolarities, E1, E2, M1 branching ratios, and shell-model considerations and band associations. For high-spin (J>10) levels, ascending order of spins with excitation energy is assumed.

[#] Band(A): Band based on (9$^-$), s=+1. Configuration=($\pi h_{9/2}\otimes\nu g_{9/2}$)$\otimes$(0$^+$,2$^+$,..core).

[@] Band(a): Band based on (12$^+$), s=+1. Configuration=($\pi h_{9/2}\otimes\nu g_{9/2}$)$\otimes$(3$^-$,5$^-$,..core).

[&] Band(B): Band based on (12$^-$), s=−1. Configuration=($\pi h_{9/2}\otimes\nu i_{11/2}$)$\otimes$(0$^+$,2$^+$,..core).

[a] Band(b): Band based on (11$^+$), s=−1. Configuration=($\pi h_{9/2}\otimes\nu i_{11/2}$)$\otimes$(3$^-$,5$^-$,..core).

[b] Band(C): Band based on (11$^+$), s=−1. Configuration=($\pi i_{13/2}\otimes\nu g_{9/2}$)$\otimes$(0$^+$,2$^+$,..core).

[c] Band(c): Band based on (14$^-$), s=−1. Configuration=($\pi i_{13/2}\otimes\nu g_{9/2}$)$\otimes$(3$^-$,5$^-$,..core).

Adopted Levels, Gammas (continued)

γ(^{218}Ac)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[‡]	Comments
122.5+x		122.5 *2*	100	0+x		M1	9.56	
122.5+y	(9$^-$)	(z)		122.5+x				E_γ: z corresponds to either one or more gamma rays, with energy of <100 keV.
416.10+y	(10$^-$)	189.2 *2*	100 *9*	226.90+y	(9$^-$)	M1	2.79	
		293.6 *2*	24 *3*	122.5+y	(9$^-$)	(M1)	0.820	
506.99+y	(11$^+$)	91.0 *2*	85.3 *24*	416.10+y	(10$^-$)	(E1)	0.1461 *23*	B(E1)(W.u.)=6.5×10^{-7} *8*
		384.5 *2*	100.0 *14*	122.5+y	(9$^-$)	M2	1.201	B(M2)(W.u.)=0.31 *4*
600.94+y	(10$^-$)	478.5 *2*	100	122.5+y	(9$^-$)	M1	0.217	
630.38+y	(11$^-$)	507.8 *2*	100	122.5+y	(9$^-$)	E2	0.0392	
681.98+y	(11$^+$)	81.1 *2*	24 *10*	600.94+y	(10$^-$)	(E1)	0.198	
		175.0 *2*	26 *10*	506.99+y	(11$^+$)	M1	3.48	
		265.8 *2*	100 *14*	416.10+y	(10$^-$)	E1	0.0476	
789.16+y	(12$^+$)	107.0 *2*	7.8 *22*	681.98+y	(11$^+$)	(M1+E2)		
		158.8 *2*	100 *13*	630.38+y	(11$^-$)	E1	0.1601	
		282.3 *2*	15 *4*	506.99+y	(11$^+$)	M1	0.914	
990.45+y	(12$^-$)	308.5 *2*	13.8 *25*	681.98+y	(11$^+$)	D		
		360.0 *2*	2.9 *10*	630.38+y	(11$^-$)	[M1]	0.469	
		574.3 *2*	100 *6*	416.10+y	(10$^-$)	E2	0.0295	
1044.89+y	(13$^+$)	537.9 *2*	100	506.99+y	(11$^+$)	E2	0.0342	
1088.50+y	(13$^-$)	299.3 *2*	100 *10*	789.16+y	(12$^+$)	E1	0.0364	
		458.1 *2*	50 *4*	630.38+y	(11$^-$)	Q		
1181.93+y	(13$^+$)	137.0 *2*	3.3 *9*	1044.89+y	(13$^+$)	[M1+E2]	4.8 *22*	
		191.4 *2*	74 *8*	990.45+y	(12$^-$)	(E1)	0.1024	
		500.1 *2*	100 *7*	681.98+y	(11$^+$)	E2	0.0406	
1258.07+y	(14$^+$)	169.5 *2*	64 *4*	1088.50+y	(13$^-$)	E1	0.1369	
		468.9 *2*	100 *11*	789.16+y	(12$^+$)	Q		
1335.86+y	(14$^-$)	291.0 *2*	100	1044.89+y	(13$^+$)	D		
1418.54+y	(14$^-$)	236.6 *2*	76 *5*	1181.93+y	(13$^+$)	E1	0.0622	
		330.1 *2*	35 *4*	1088.50+y	(13$^-$)	M1	0.595	
		373.5 *2*	8 *3*	1044.89+y	(13$^+$)	D		
		428.1 *2*	100 *7*	990.45+y	(12$^-$)	Q		
1509.83+y	(15$^+$)	174.0 *2*	25 *5*	1335.86+y	(14$^-$)	(E1)	0.1286	
		465.1 *2*	100 *6*	1044.89+y	(13$^+$)	E2	0.0483	
1557.23+y	(15$^-$)	299.1 *2*	100 *10*	1258.07+y	(14$^+$)	E1	0.0364	
		468.7 *2*	36 *5*	1088.50+y	(13$^-$)	Q		
1625.41+y	(15$^+$)	115.6 *2*	6.5 *32*	1509.83+y	(15$^+$)	[M1+E2]	8.4 *29*	
		206.8 *2*	90 *12*	1418.54+y	(14$^-$)	(E1)	0.0853	
		443.5 *2*	100 *14*	1181.93+y	(13$^+$)	E2	0.0544	
1697.60+y	(16$^+$)	140.4 *2*	45 *4*	1557.23+y	(15$^-$)	E1	0.215	
		439.5 *2*	100 *6*	1258.07+y	(14$^+$)	E2	0.0556	
1789.45+y	(16$^-$)	164.0 *2*	12.7 *10*	1625.41+y	(15$^+$)	E1	0.1482	
		232.1 *2*	15.3 *13*	1557.23+y	(15$^-$)	M1	1.574	
		279.8 *2*	100	1509.83+y	(15$^+$)	(E1)	0.0423	
		370.9 *2*	100 *9*	1418.54+y	(14$^-$)	E2	0.0868	
1843.1+y	(16$^-$)	333.2 *2*	100 *18*	1509.83+y	(15$^+$)	D		
		507.0[#]		1335.86+y	(14$^-$)			E_γ: this γ is expected but not seen with certainty probably because it is obscured by strong 507.8γ.
1939.4+y	(17$^+$)	96.2 *2*	48 *16*	1843.1+y	(16$^-$)	(E1)	0.1262 *19*	
		429.6 *2*	100 *11*	1509.83+y	(15$^+$)	Q		
1990.2+y	(17$^+$)	200.7 *2*	100	1789.45+y	(16$^-$)	E1	0.0915	
2025.8+y	(17$^+$)	236.1[#]		1789.45+y	(16$^-$)			
		400.4 *2*	100 *24*	1625.41+y	(15$^+$)	Q		

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Adopted Levels, Gammas (continued)

$\gamma(^{218}Ac)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[‡]
2121.0+y	(18^-)	181.5[#]		1939.4+y	(17^+)		
		277.9 *2*	100 *38*	1843.1+y	(16^-)	[E2]	0.203
2141.0+y	(18^+)	443.4 *2*	100	1697.60+y	(16^+)	Q	
2239.6+y	(19^+)	300.2 *2*	100	1939.4+y	(17^+)	(Q)	
2630.2+y	(20^+)	489.2 *2*	100	2141.0+y	(18^+)	(Q)	

[†] From $^{209}Bi(^{12}C,3n\gamma)$.

[‡] 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.

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

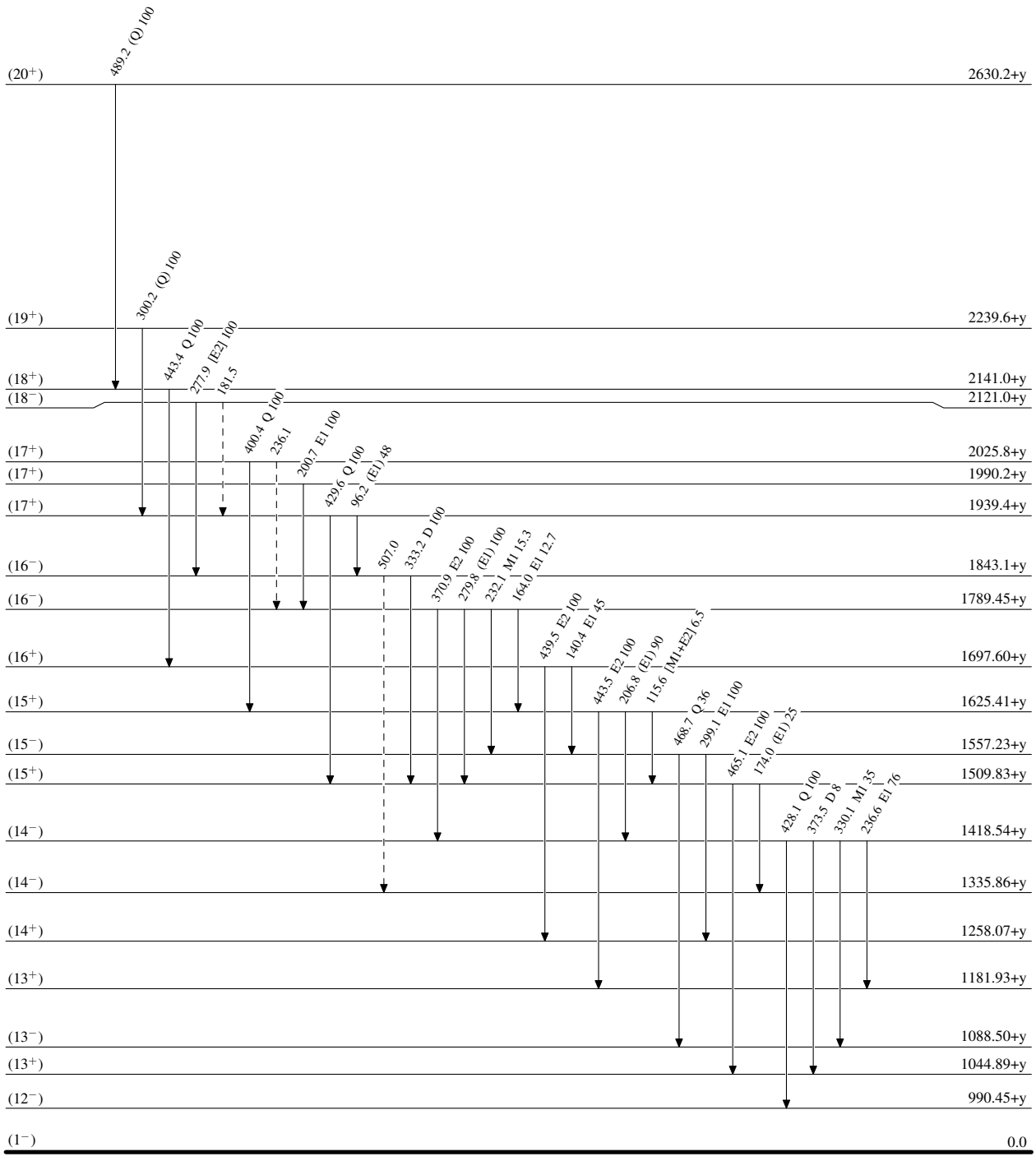
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{218}_{89}Ac_{129}$

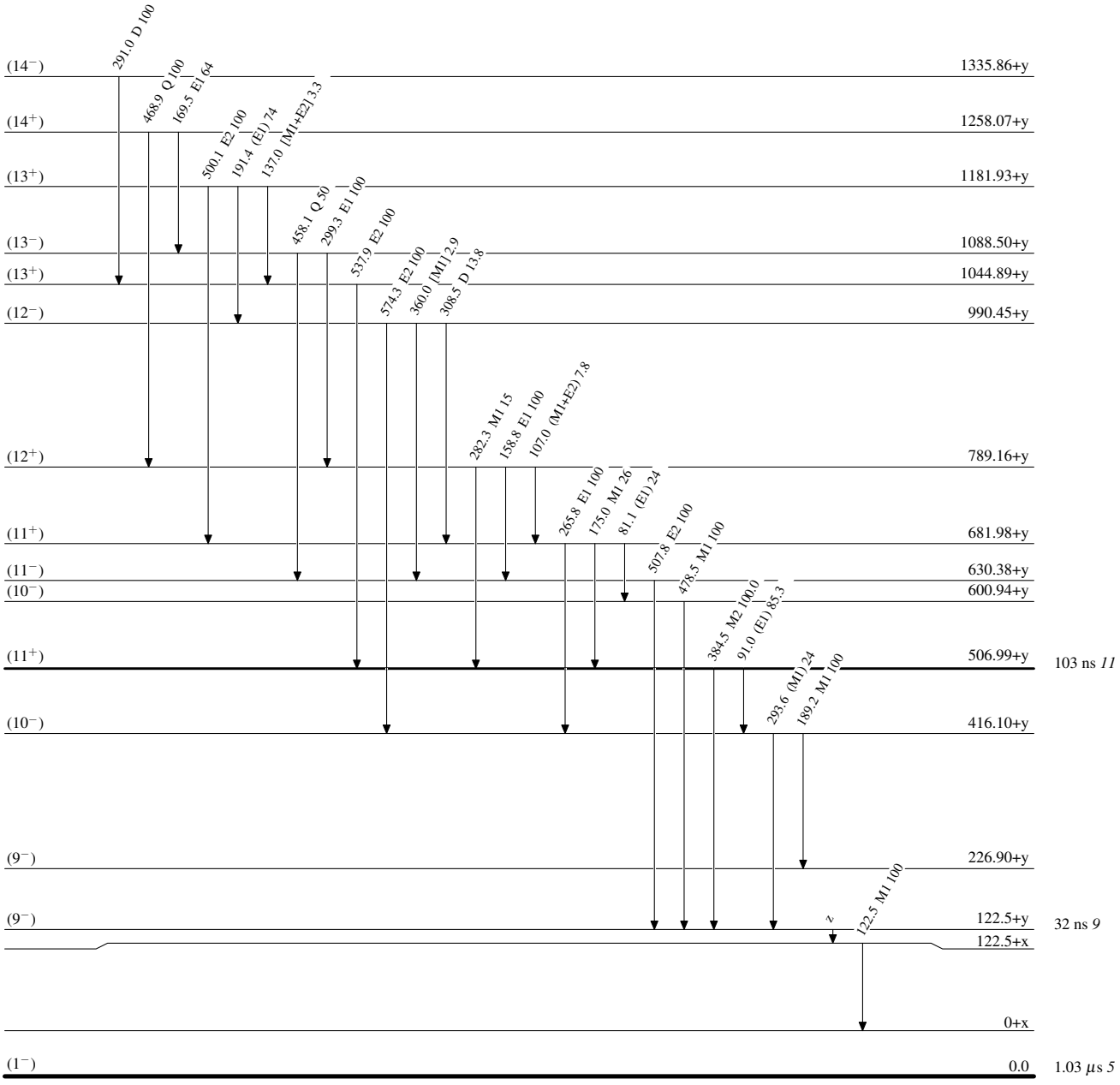
Adopted Levels, Gammas

Legend

Level Scheme (continued)

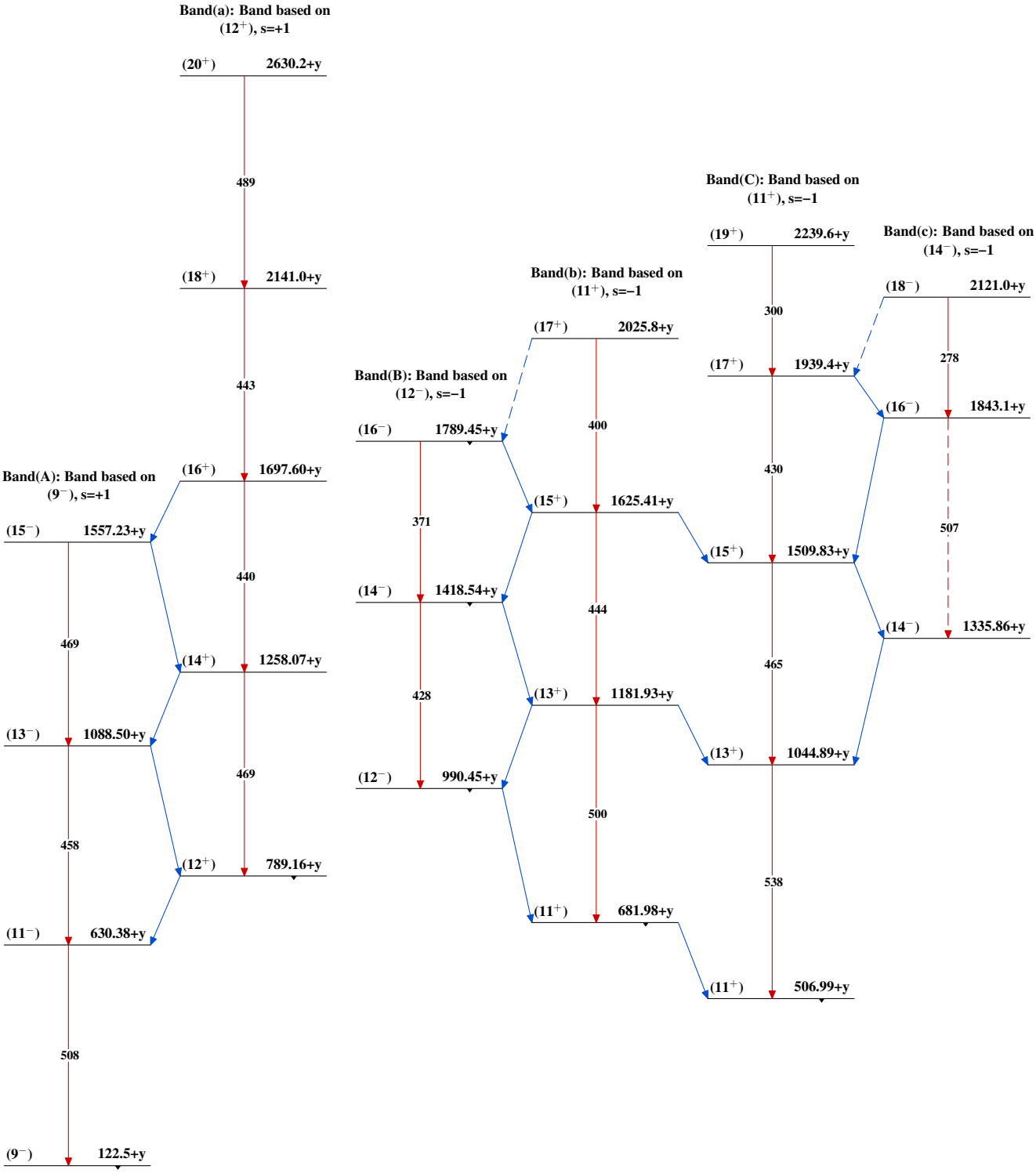
Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{218}_{89}Ac_{129}$

Adopted Levels, Gammas



$^{218}_{89}Ac_{129}$