^{209}Bi(^{12}C,3nγ) 1994De04

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

1994De04 (also 1989De06): E=64-82 MeV. Measured Eγ, Iγ, $\gamma\gamma$, ce, $\gamma(\theta)$, $\gamma\gamma(\theta)$(DCO), $\gamma\gamma$(t). 1994De04 also studied (^{13}C,4nγ), but no data were given from this reaction.

^{218}Ac Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
0+x			Additional information 1.
122.5+x *2*			
122.5+y[@]	(9$^-$)[#]	32 ns *9*	E(level): y=x+z, where z is expected to be less than 100 keV. $T_{1/2}$: 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. Additional information 2.
226.90+y *24*	(9$^-$)		
416.10+y *14*	(10$^-$)		Configuration=(πh$_{9/2}\otimes\nu$i$_{11/2}$)10$^-$ $\otimes$ 0$^+$ core (1994De04).
506.99+y[c] *13*	(11$^+$)	103 ns *11*	$T_{1/2}$: from 384.5γ(t) (1994De04).
600.94+y *16*	(10$^-$)		E(level): the ordering of the 81-478 cascade is not established experimentally, the ordering given here is preferred by 1994De04 from theoretical considerations. Configuration=(πh$_{9/2}\otimes\nu$g$_{9/2}$)8$^-$ $\otimes$ 2$^+$ (unfavored).
630.38+y[@] *14*	(11$^-$)		
681.98+y[b] *14*	(11$^+$)		
789.16+y[&] *15*	(12$^+$)		
990.45+y[a] *15*	(12$^-$)		
1044.89+y[c] *17*	(13$^+$)		
1088.50+y[@] *17*	(13$^-$)		
1181.93+y[b] *17*	(13$^+$)		
1258.07+y[&] *19*	(14$^+$)		
1335.86+y[d] *22*	(14$^-$)		
1418.54+y[a] *17*	(14$^-$)		
1509.83+y[c] *19*	(15$^+$)		
1557.23+y[@] *19*	(15$^-$)		
1625.41+y[b] *19*	(15$^+$)		
1697.60+y[&] *23*	(16$^+$)		
1789.45+y[a] *19*	(16$^-$)		
1843.1+y[d] *3*	(16$^-$)		
1939.4+y[c] *3*	(17$^+$)		
1990.2+y *3*	(17$^+$)		
2025.8+y[b] *3*	(17$^+$)		
2121.0+y[d] *4*	(18$^-$)		
2141.0+y[&] *3*	(18$^+$)		
2239.6+y[c] *4*	(19$^+$)		
2630.2+y[&] *4*	(20$^+$)		

Continued on next page (footnotes at end of table)

^{209}Bi(^{12}C,3nγ) 1994De04 (continued)

^{218}Ac Levels (continued)

† From least-squares fit to γ-ray energies.

‡ Spin, parity and approximate configurations (with only the strongest components given) are as proposed by 1994De04, based on γ multipolarities, E1, E2, and M1 branching ratios, and shell-model considerations. Since the spins of low-energy levels have not been determined, all the J^{π} values are given in parentheses. The assignments are the same in the Adopted Levels. Note that all the parities were assigned outside parentheses in the level-scheme Fig. 2 of 1994De04.

From the systematics of neighboring odd-odd nuclides, configuration=$\pi h_{9/2}\otimes\nu g_{9/2}$.

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

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

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

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

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

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

^{209}Bi(^{12}C,3nγ) 1994De04 (continued)

$\gamma(^{218}Ac)$

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[b]	$I_{(\gamma+ce)}$	Comments
(z)		122.5+y	(9$^-$)	122.5+x					E_γ: z corresponds to either one or more gamma rays, with energy of <100 keV.
81.1[a] *2*	10[#] *4*	681.98+y	(11$^+$)	600.94+y	(10$^-$)	(E1)[@]	0.198		α(L)=0.1499 *24*; α(M)=0.0364 *6* α(N)=0.00950 *15*; α(O)=0.00210 *4*; α(P)=0.000346 *6*; α(Q)=1.77×10^{-5} *3*
91.0 *2*	29.0[#] *8*	506.99+y	(11$^+$)	416.10+y	(10$^-$)	(E1)[@]	0.1461 *23*		α(L)=0.1105 *17*; α(M)=0.0268 *4* α(N)=0.00700 *11*; α(O)=0.001552 *24*; α(P)=0.000258 *4*; α(Q)=1.374×10^{-5} *21*
96.2 *2*	6.2[#] *21*	1939.4+y	(17$^+$)	1843.1+y	(16$^-$)	(E1)[@]	0.1262 *19*		α(L)=0.0954 *15*; α(M)=0.0231 *4* α(N)=0.00604 *9*; α(O)=0.001342 *21*; α(P)=0.000224 *4*; α(Q)=1.215×10^{-5} *18*
107.0 *2*	2.5[#] *7*	789.16+y	(12$^+$)	681.98+y	(11$^+$)	(M1+E2)[@]		39 *11*	$I_{(\gamma+ce)}$: listed in 1994De04. No ce data given for this transition, and since the γ energy is very close to the K-binding energy, the theoretical conversion coefficients are not reliable. Intensity balance at the 789.16+y level: [I(γ+ce)(107.0γ) + I(γ+ce)(158.8γ) + I(γ+ce)(282.3γ)] − [I(γ+ce)(468.9γ) + I(γ+ce)(299.3γ)] = −19 *16*.
115.6 *2*	0.8[#] *4*	1625.41+y	(15$^+$)	1509.83+y	(15$^+$)	[M1+E2]	8.4 *29*		α(K)=4.6 *44*; α(L)=2.8 *11*; α(M)=0.74 *33* α(N)=0.195 *87*; α(O)=0.043 *19*; α(P)=0.0072 *25*; α(Q)=2.3×10^{-4} *19*
[x]118.5 *2*	12.1 *13*					D			A_2=−0.40 *15*; DCO(D)=0.81 *20*
122.5 *2*	32.3 *25*	122.5+x		0+x		M1[@]	9.56		A_2=+0.04 *8*; DCO(Q)=1.24 *23*; α(L)exp=1.3 *9* α(K)=7.65 *12*; α(L)=1.448 *22*; α(M)=0.347 *6* α(N)=0.0921 *14*; α(O)=0.0214 *4*; α(P)=0.00396 *6*; α(Q)=0.000351 *6*
[x]130.7 *2*	6.1 *8*								A_2=+0.36 *15*; DCO(D)=0.69 *20*
137.0 *2*	1.1[#] *3*	1181.93+y	(13$^+$)	1044.89+y	(13$^+$)	[M1+E2][@]	4.8 *22*		DCO(Q)=0.72 *20* α(K)=2.9 *27*; α(L)=1.42 *37*; α(M)=0.37 *12* α(N)=0.098 *32*; α(O)=0.0219 *64*; α(P)=0.0037 *8*; α(Q)=1.4×10^{-4} *12*
140.4 *2*	15.1[#] *13*	1697.60+y	(16$^+$)	1557.23+y	(15$^-$)	E1	0.215		DCO(Q)=2.03 *23*; DCO(D)=0.91 *13*; α(L)exp<0.04 *6* α(K)=0.1684 *25*; α(L)=0.0355 *6*; α(M)=0.00855 *13* α(N)=0.00224 *4*; α(O)=0.000503 *8*; α(P)=8.63×10^{-5} *13*; α(Q)=5.23×10^{-6} *8*
158.8 *2*	32[#] *4*	789.16+y	(12$^+$)	630.38+y	(11$^-$)	E1	0.1601		A_2=−0.19 *14*; DCO(Q)=1.80 *16*; DCO(D)=0.95 *10*; α(L)exp<0.07 *6*

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^{209}Bi(^{12}C,3nγ) 1994De04 (continued)

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

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[b]	Comments
								α(K)=0.1260 *18*; α(L)=0.0258 *4*; α(M)=0.00622 *9* α(N)=0.001630 *24*; α(O)=0.000367 *6*; α(P)=6.34×10^{-5} *9*; α(Q)=3.97×10^{-6} *6*
164.0 *2*	12.7[#] *10*	1789.45+y	(16$^-$)	1625.41+y	(15$^+$)	E1	0.1482	A_2=−0.13 *6*; DCO(Q)=1.67 *23*; DCO(D)=0.92 *14*; α(L)exp=0.025 *14* α(K)=0.1168 *17*; α(L)=0.0238 *4*; α(M)=0.00572 *9* α(N)=0.001501 *22*; α(O)=0.000339 *5*; α(P)=5.85×10^{-5} *9*; α(Q)=3.70×10^{-6} *6*
169.5 *2*	30.2 *15*	1258.07+y	(14$^+$)	1088.50+y	(13$^-$)	E1	0.1369	A_2=−0.24 *8*; DCO(Q)=1.77 *12*; DCO(D)=0.95 *7*; α(L)exp=0.07 *4* α(K)=0.1080 *16*; α(L)=0.0219 *4*; α(M)=0.00526 *8* α(N)=0.001380 *20*; α(O)=0.000311 *5*; α(P)=5.39×10^{-5} *8*; α(Q)=3.43×10^{-6} *5*
174.0 *2*	8.4[#] *15*	1509.83+y	(15$^+$)	1335.86+y	(14$^-$)	(E1)	0.1286	A_2=−0.25 *14*; DCO(Q)=1.7 *3* α(K)=0.1016 *15*; α(L)=0.0205 *3*; α(M)=0.00492 *7* α(N)=0.001291 *19*; α(O)=0.000291 *5*; α(P)=5.05×10^{-5} *8*; α(Q)=3.24×10^{-6} *5*
175.0 *2*	11[#] *4*	681.98+y	(11$^+$)	506.99+y	(11$^+$)	M1	3.48	A_2=+0.40 *10*; DCO(Q)=1.02 *15*; α(L)exp=0.5 *2* α(K)=2.79 *4*; α(L)=0.523 *8*; α(M)=0.1253 *18* α(N)=0.0332 *5*; α(O)=0.00773 *12*; α(P)=0.001429 *21*; α(Q)=0.0001267 *19*
181.5[&c]		2121.0+y	(18$^-$)	1939.4+y	(17$^+$)			From 277.9γ-96.2γ, Eγ=181.7 *3*.
189.2 *2*	37[#] *3*	416.10+y	(10$^-$)	226.90+y	(9$^-$)	M1	2.79	A_2=−0.03 *4*; DCO(Q)=1.7 *3*; DCO(D)=0.87 *16*; α(L)exp=0.33 *10* α(K)=2.24 *4*; α(L)=0.419 *6*; α(M)=0.1004 *15* α(N)=0.0266 *4*; α(O)=0.00619 *9*; α(P)=0.001146 *17*; α(Q)=0.0001015 *15*
191.4 *2*	24.2[#] *25*	1181.93+y	(13$^+$)	990.45+y	(12$^-$)	(E1)	0.1024	A_2=−0.29 *8*; DCO(Q)=1.93 *25*; DCO(D)=0.92 *14* α(K)=0.0812 *12*; α(L)=0.01608 *23*; α(M)=0.00386 *6* α(N)=0.001014 *15*; α(O)=0.000229 *4*; α(P)=4.00×10^{-5} *6*; α(Q)=2.62×10^{-6} *4*
200.7 *2*	70 *3*	1990.2+y	(17$^+$)	1789.45+y	(16$^-$)	E1	0.0915	A_2=−0.14 *6*; DCO(Q)=1.84 *14*; α(L)exp<0.05 α(K)=0.0727 *11*; α(L)=0.01428 *21*; α(M)=0.00343 *5* α(N)=0.000900 *13*; α(O)=0.000204 *3*; α(P)=3.56×10^{-5} *5*; α(Q)=2.36×10^{-6} *4*
[x]204.3 *2*	8.7 *6*					(E1)	0.0878	A_2=+0.10 *6*; DCO(D)=0.88 *13* α(K)=0.0697 *10*; α(L)=0.01366 *20*; α(M)=0.00328 *5* α(N)=0.000861 *13*; α(O)=0.000195 *3*; α(P)=3.41×10^{-5} *5*; α(Q)=2.27×10^{-6} *4*
206.8 *2*	11.1[#] *14*	1625.41+y	(15$^+$)	1418.54+y	(14$^-$)	(E1)	0.0853	A_2=−0.02 *6*; DCO(Q)=1.96 *23*; DCO(D)=1.06 *14* α(K)=0.0678 *10*; α(L)=0.01325 *19*; α(M)=0.00318 *5* α(N)=0.000835 *12*; α(O)=0.000189 *3*; α(P)=3.31×10^{-5} *5*; α(Q)=2.21×10^{-6} *4*
232.1 *2*	7.2 *6*	1789.45+y	(16$^-$)	1557.23+y	(15$^-$)	M1	1.574	A_2=−0.60 *14*; DCO(Q)=2.5 *3*; DCO(D)=1.1 *1*; α(L1)exp+α(L2)exp=0.31 *10* α(K)=1.263 *18*; α(L)=0.236 *4*; α(M)=0.0565 *8* α(N)=0.01498 *22*; α(O)=0.00348 *5*; α(P)=0.000644 *10*; α(Q)=5.71×10^{-5} *9*
236.1[&c]		2025.8+y	(17$^+$)	1789.45+y	(16$^-$)			Eγ: this γ was probably obscured in the singles by the 236.6γ. From 400.4γ-164.0γ, Eγ=236.4 *3*.
236.6 *2*	24.3[#] *16*	1418.54+y	(14$^-$)	1181.93+y	(13$^+$)	E1	0.0622	A_2=−0.18 *8*; DCO(Q)=1.83 *15*; DCO(D)=0.81 *12*; α(K)exp=0.06 *3* α(K)=0.0497 *7*; α(L)=0.00951 *14*; α(M)=0.00228 *4* α(N)=0.000599 *9*; α(O)=0.0001360 *20*; α(P)=2.39×10^{-5} *4*; α(Q)=1.649×10^{-6} *24*

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^{209}Bi(^{12}C,3nγ) 1994De04 (continued)

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

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[b]	Comments
265.8 *2*	42[#] *6*	681.98+y	(11^+)	416.10+y	(10^-)	E1	0.0476	A_2=−0.15 *5*; DCO(Q)=1.86 *18*; α(K)exp<0.06 *3*; α(L)exp<0.009 *6* α(K)=0.0381 *6*; α(L)=0.00717 *11*; α(M)=0.001716 *25* α(N)=0.000451 *7*; α(O)=0.0001028 *15*; α(P)=1.82×10^{-5} *3*; α(Q)=1.283×10^{-6} *18*
277.9 *2*	1.3[#] *5*	2121.0+y	(18^-)	1843.1+y	(16^-)	[E2]	0.203	α(K)=0.0840 *12*; α(L)=0.0876 *13*; α(M)=0.0235 *4* α(N)=0.00624 *9*; α(O)=0.001378 *20*; α(P)=0.000224 *4*; α(Q)=4.42×10^{-6} *7*
279.8 *2*	2.0 *8*	1789.45+y	(16^-)	1509.83+y	(15^+)	(E1)	0.0423	DCO(Q)=1.6 *4* α(K)=0.0339 *5*; α(L)=0.00635 *9*; α(M)=0.001518 *22* α(N)=0.000399 *6*; α(O)=9.10×10^{-5} *13*; α(P)=1.611×10^{-5} *23*; α(Q)=1.150×10^{-6} *17* Mult.: from intensity balance (1994De04) at the 1509.83+y level.
282.3 *2*	4.8 *11*	789.16+y	(12^+)	506.99+y	(11^+)	M1	0.914	DCO(D)=1.15 *20*; α(K)exp=0.4 *3* α(K)=0.734 *11*; α(L)=0.1365 *20*; α(M)=0.0327 *5* α(N)=0.00867 *13*; α(O)=0.00202 *3*; α(P)=0.000373 *6*; α(Q)=3.30×10^{-5} *5*
[x]286.9 *2*	3.8 *7*							
291.0 *2*	11.1[#] *22*	1335.86+y	(14^-)	1044.89+y	(13^+)	D		DCO(Q)=1.51 *18*; DCO(D)=1.06 *12*
293.6 *2*	9.0[#] *10*	416.10+y	(10^-)	122.5+y	(9^-)	(M1)	0.820	DCO(D)=0.88 *16* α(K)=0.659 *10*; α(L)=0.1224 *18*; α(M)=0.0293 *5* α(N)=0.00778 *11*; α(O)=0.00181 *3*; α(P)=0.000334 *5*; α(Q)=2.96×10^{-5} *5*
[x]295.6 *2*	42[#] *4*					D		A_2=−0.12 *5*; DCO(D)=0.94 *11*
299.1 *2*	40[#] *4*	1557.23+y	(15^-)	1258.07+y	(14^+)	E1[@]	0.0364	A_2=−0.19 *4*; DCO(Q)=1.64 *24*; DCO(D)=1.00 *10*; α(K)exp=0.02 *2* α(K)=0.0293 *5*; α(L)=0.00542 *8*; α(M)=0.001295 *19* α(N)=0.000341 *5*; α(O)=7.78×10^{-5} *11*; α(P)=1.381×10^{-5} *20*; α(Q)=9.99×10^{-7} *14* A_2, DCO and α(K)exp are for 299.3+299.1.
299.3 *2*	54[#] *5*	1088.50+y	(13^-)	789.16+y	(12^+)	E1[@]	0.0364	A_2=−0.19 *4*; DCO(Q)=1.64 *24*; DCO(D)=1.00 *10*; α(K)exp=0.02 *2* α(K)=0.0292 *5*; α(L)=0.00541 *8*; α(M)=0.001293 *19* α(N)=0.000340 *5*; α(O)=7.76×10^{-5} *11*; α(P)=1.379×10^{-5} *20*; α(Q)=9.97×10^{-7} *14* A_2, DCO and α(K)exp are for 299.3+299.1.
300.2 *2*	5.0 *10*	2239.6+y	(19^+)	1939.4+y	(17^+)	(Q)		DCO(Q)=0.75 *16*
308.5 *2*	5.6 *10*	990.45+y	(12^-)	681.98+y	(11^+)	D		DCO(Q)=1.8 *2*; DCO(D)=1.11 *17* Uncertainty of 0.02 in DCO(Q) and 0.017 in DCO(D) in Table 1 of 1994De04 seem misprints.
[x]325.2 *2*	20 *4*					D		A_2=−0.10 *6*; DCO(D)=1.00 *15*
330.1 *2*	11.2 *13*	1418.54+y	(14^-)	1088.50+y	(13^-)	M1	0.595	A_2=−0.28 *8*; DCO(Q)=2.5 *5*; DCO(D)=0.95 *14*; α(L1)exp+α(L2)exp=0.06 *3* α(K)=0.478 *7*; α(L)=0.0886 *13*; α(M)=0.0212 *3* α(N)=0.00562 *8*; α(O)=0.001308 *19*; α(P)=0.000242 *4*; α(Q)=2.14×10^{-5} *3*
333.2 *2*	8.0 *14*	1843.1+y	(16^-)	1509.83+y	(15^+)	D		A_2=−0.18 *11*; DCO(Q)=2.3 *5*

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^{209}Bi(^{12}C,3nγ) 1994De04 (continued)

γ(^{218}Ac) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[b]	Comments
[x]333.5 *2*	32[#] *6*							A_2=−0.30 *5*
[x]342.0 *2*	3.8 *23*							
360.0 *2*	1.2[#] *4*	990.45+y	(12$^-$)	630.38+y	(11$^-$)	[M1]	0.469	α(K)=0.377 *6*; α(L)=0.0698 *10*; α(M)=0.01670 *24* α(N)=0.00443 *7*; α(O)=0.001030 *15*; α(P)=0.000191 *3*; α(Q)=1.688×10^{-5} *24* The intensity balance at the 990.45+y level is [I(γ+ce)(308.5γ)+I(γ+ce)(360.0γ)+I(γ+ce)(574.3γ)]-[I(γ+ce)(191.4γ)+I(γ+ce)(428.1γ)]=−11 *5*. Any E2 admixture would lower the conversion coefficient, and the intensity imbalance would become worse.
370.9 *2*	47[#] *4*	1789.45+y	(16$^-$)	1418.54+y	(14$^-$)	E2	0.0868	A_2=+0.31 *6*; DCO(Q)=0.95 *8*; DCO(D)=0.52 *6*; α(K)exp=0.07 *3* α(K)=0.0468 *7*; α(L)=0.0296 *5*; α(M)=0.00780 *11* α(N)=0.00207 *3*; α(O)=0.000461 *7*; α(P)=7.64×10^{-5} *11*; α(Q)=2.29×10^{-6} *4* Mult.: E1 in Table 2 of 1994De04 is a misprint.
373.5 *2*	2.5 *10*	1418.54+y	(14$^-$)	1044.89+y	(13$^+$)	D		DCO(Q)=2.0 *4*
384.5 *2*	34 *3*	506.99+y	(11$^+$)	122.5+y	(9$^-$)	M2	1.201	A_2=−0.08 *8*; α(K)exp=0.9 *3*; α(L1)exp+α(L2)exp=0.29 *13*; α(M)exp=0.05 *3* α(K)=0.891 *13*; α(L)=0.232 *4*; α(M)=0.0583 *9* α(N)=0.01561 *22*; α(O)=0.00362 *6*; α(P)=0.000661 *10*; α(Q)=5.48×10^{-5} *8*
400.4 *2*	5.9 *14*	2025.8+y	(17$^+$)	1625.41+y	(15$^+$)	Q		DCO(Q)=1.24 *25*
428.1 *2*	32.0[#] *21*	1418.54+y	(14$^-$)	990.45+y	(12$^-$)	Q		A_2=+0.26 *5*; DCO(Q)=1.0 *1*
429.6 *2*	13.0[#] *14*	1939.4+y	(17$^+$)	1509.83+y	(15$^+$)	Q		A_2=+0.29 *8*; DCO(Q)=1.02 *11*
439.5 *2*	33.5 *21*	1697.60+y	(16$^+$)	1258.07+y	(14$^+$)	E2	0.0556	A_2=+0.17 *5*; DCO(Q)=0.93 *11*; DCO(D)=0.50 *6*; α(K)exp=0.030 *9* α(K)=0.0335 *5*; α(L)=0.01644 *24*; α(M)=0.00429 *6* α(N)=0.001139 *16*; α(O)=0.000255 *4*; α(P)=4.28×10^{-5} *6*; α(Q)=1.588×10^{-6} *23*
443.4 *2*	24[#] *3*	2141.0+y	(18$^+$)	1697.60+y	(16$^+$)	Q		DCO(Q)=0.94 *12*; DCO(D)=0.53 *8*
443.5 *2*	12.4[#] *17*	1625.41+y	(15$^+$)	1181.93+y	(13$^+$)	E2	0.0544	DCO(Q)=0.84 *14*; DCO(D)=0.42 *7*; α(K)exp=0.05 *3* α(K)=0.0329 *5*; α(L)=0.01595 *23*; α(M)=0.00416 *6* α(N)=0.001104 *16*; α(O)=0.000247 *4*; α(P)=4.15×10^{-5} *6*; α(Q)=1.557×10^{-6} *22* α(K)exp for 443.5+443.4.
458.1 *2*	27.2 *21*	1088.50+y	(13$^-$)	630.38+y	(11$^-$)	Q		A_2=+0.33 *7*; DCO(Q)=0.90 *13*; DCO(D)=0.58 *7*
465.1 *2*	33.0 *20*	1509.83+y	(15$^+$)	1044.89+y	(13$^+$)	E2	0.0483	A_2=+0.17 *4*; DCO(Q)=0.97 *13*; α(K)exp=0.020 *16* α(K)=0.0300 *5*; α(L)=0.01364 *20*; α(M)=0.00354 *5* α(N)=0.000941 *14*; α(O)=0.000211 *3*; α(P)=3.56×10^{-5} *5*; α(Q)=1.408×10^{-6} *20*
468.7 *2*	14.4[#] *20*	1557.23+y	(15$^-$)	1088.50+y	(13$^-$)	Q		A_2=+0.23 *5*; DCO(D)=0.55 *6* A_2 and DCO are for 468.9+468.7.
468.9 *2*	47[#] *5*	1258.07+y	(14$^+$)	789.16+y	(12$^+$)	Q		A_2=+0.23 *5*; DCO(D)=0.55 *6* A_2 and DCO are for 468.9+468.7.
478.5[a] *2*	16[#] *4*	600.94+y	(10$^-$)	122.5+y	(9$^-$)	M1	0.217	DCO(Q)=1.18 *20*; α(K)exp=0.31 *9*; α(L1)exp+α(L2)exp=0.06 *2* α(K)=0.1748 *25*; α(L)=0.0321 *5*; α(M)=0.00769 *11* α(N)=0.00204 *3*; α(O)=0.000474 *7*; α(P)=8.77×10^{-5} *13*; α(Q)=7.78×10^{-6} *11*
489.2 *2*	16.2 *17*	2630.2+y	(20$^+$)	2141.0+y	(18$^+$)	(Q)		A_2=+0.14 *8*

$^{218}_{89}Ac_{129}$-6

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

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[b]	Comments
[x]492.9 *2*	14.6 *13*							A_2=+0.24 *7*; DCO(Q)=1.4 *3*
500.1 *2*	32.9[#] *21*	1181.93+y	(13^+)	681.98+y	(11^+)	E2	0.0406	A_2=+0.32 *5*; DCO(Q)=1.12 *14*; DCO(D)=0.58 *7*; α(K)exp=0.026 *10* α(K)=0.0261 *4*; α(L)=0.01081 *16*; α(M)=0.00279 *4* α(N)=0.000741 *11*; α(O)=0.0001663 *24*; α(P)=2.83×10^{-5} *4*; α(Q)=1.210×10^{-6} *17*
507.0[&c]		1843.1+y	(16^-)	1335.86+y	(14^-)			E_γ: this γ was probably obscured in the singles by the 507.8γ. From 333.2γ+174.0γ, Eγ=507.2 *3*.
507.8 *2*	83 *5*	630.38+y	(11^-)	122.5+y	(9^-)	E2	0.0392	A_2=+0.30 *5*; DCO(Q)=1.06 *13*; DCO(D)=0.52 *5*; α(K)exp=0.022 *7* α(K)=0.0253 *4*; α(L)=0.01030 *15*; α(M)=0.00266 *4* α(N)=0.000706 *10*; α(O)=0.0001584 *23*; α(P)=2.69×10^{-5} *4*; α(Q)=1.172×10^{-6} *17*
537.9 *2*	57 *5*	1044.89+y	(13^+)	506.99+y	(11^+)	E2	0.0342	A_2=+0.23 *4*; DCO(Q)=0.97 *10*; α(K)exp=0.030 *8* α(K)=0.0227 *4*; α(L)=0.00862 *13*; α(M)=0.00221 *4* α(N)=0.000588 *9*; α(O)=0.0001322 *19*; α(P)=2.26×10^{-5} *4*; α(Q)=1.041×10^{-6} *15*
574.3 *2*	40.7 *24*	990.45+y	(12^-)	416.10+y	(10^-)	E2	0.0295	A_2=+0.19 *5*; DCO(Q)=1.05 *10*; α(K)exp=0.04 *2* α(K)=0.0200 *3*; α(L)=0.00708 *10*; α(M)=0.00181 *3* α(N)=0.000480 *7*; α(O)=0.0001082 *16*; α(P)=1.86×10^{-5} *3*; α(Q)=9.11×10^{-7} *13*
[x]854.1 *2*	12.8 *14*							

[†] Measured by 1994De04 at E(^{12}C)=72 MeV bombarding energy.
[‡] Adopted by 1994De04 from their conversion electron and $\gamma\gamma(\theta)$ DCO-measurements.
[#] Intensities were deduced from coincidence data; the peaks were contaminated (1994De04).
[@] The electric/magnetic character is deduced from the intensity balance (1994De04).
[&] This transition is not listed in 1994De04; however, it is shown dashed on their level scheme, with a note that the line was not confirmed by $\gamma\gamma$ coincidences. Therefore, it is assumed that the γ is an expected transition, not seen.
[a] The ordering of the 81-478 cascade is not established experimentally.
[b] 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.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{209}Bi(^{12}C,3nγ) **1994De04**

Level Scheme

Intensities: Relative I_γ

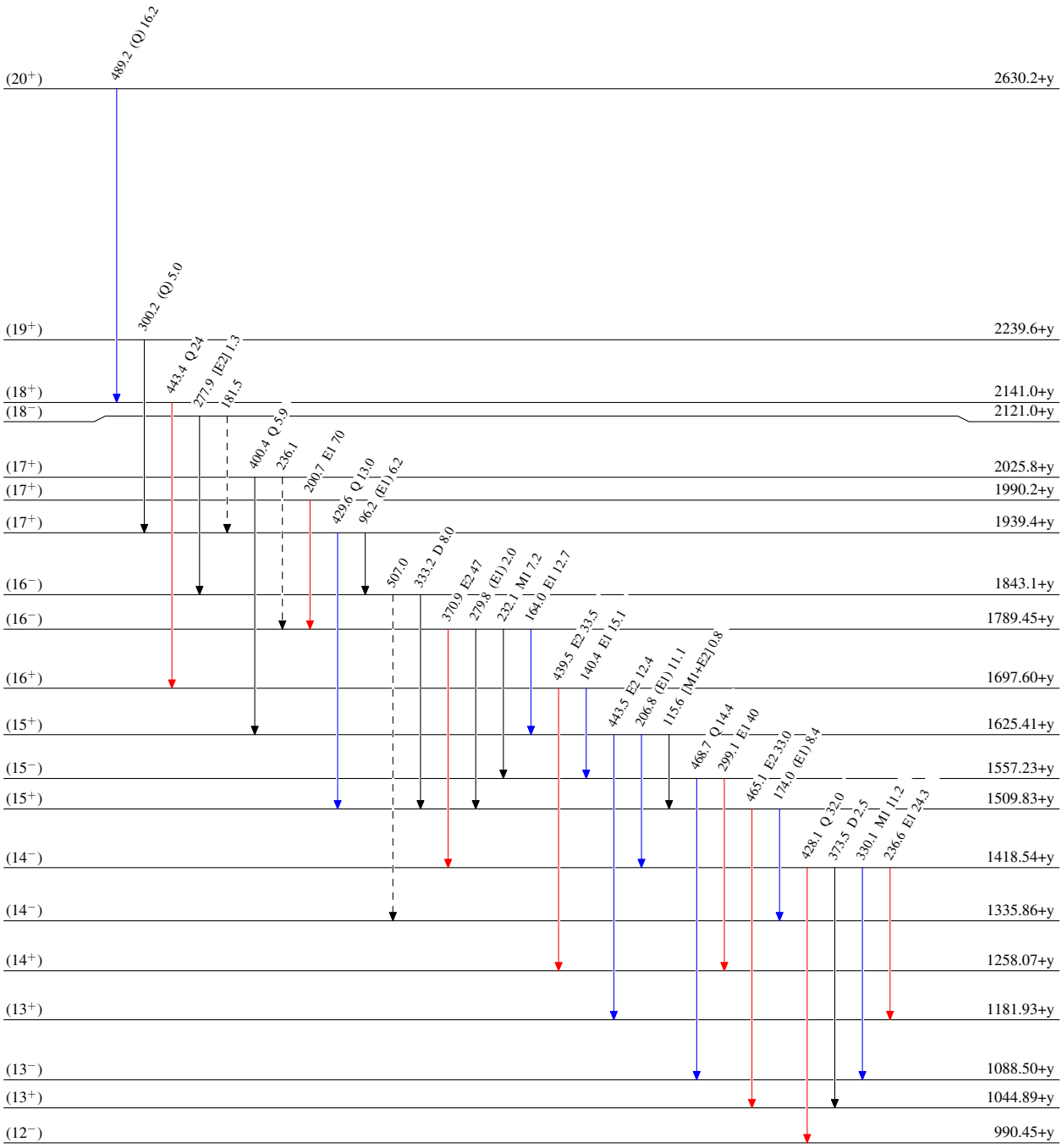
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



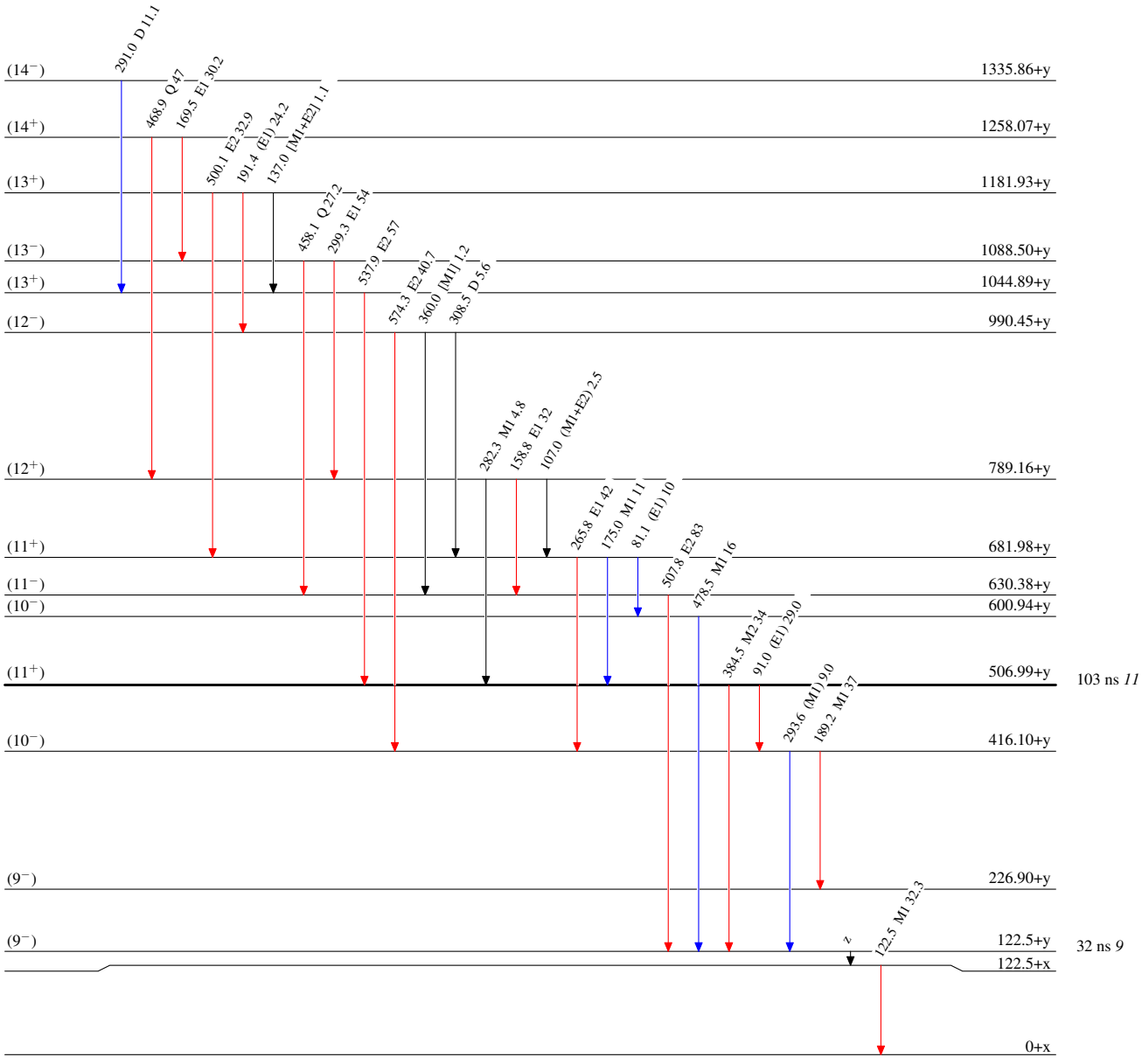
$^{218}_{89}Ac_{129}$

^{209}Bi(^{12}C,3nγ) **1994De04**

Level Scheme (continued)

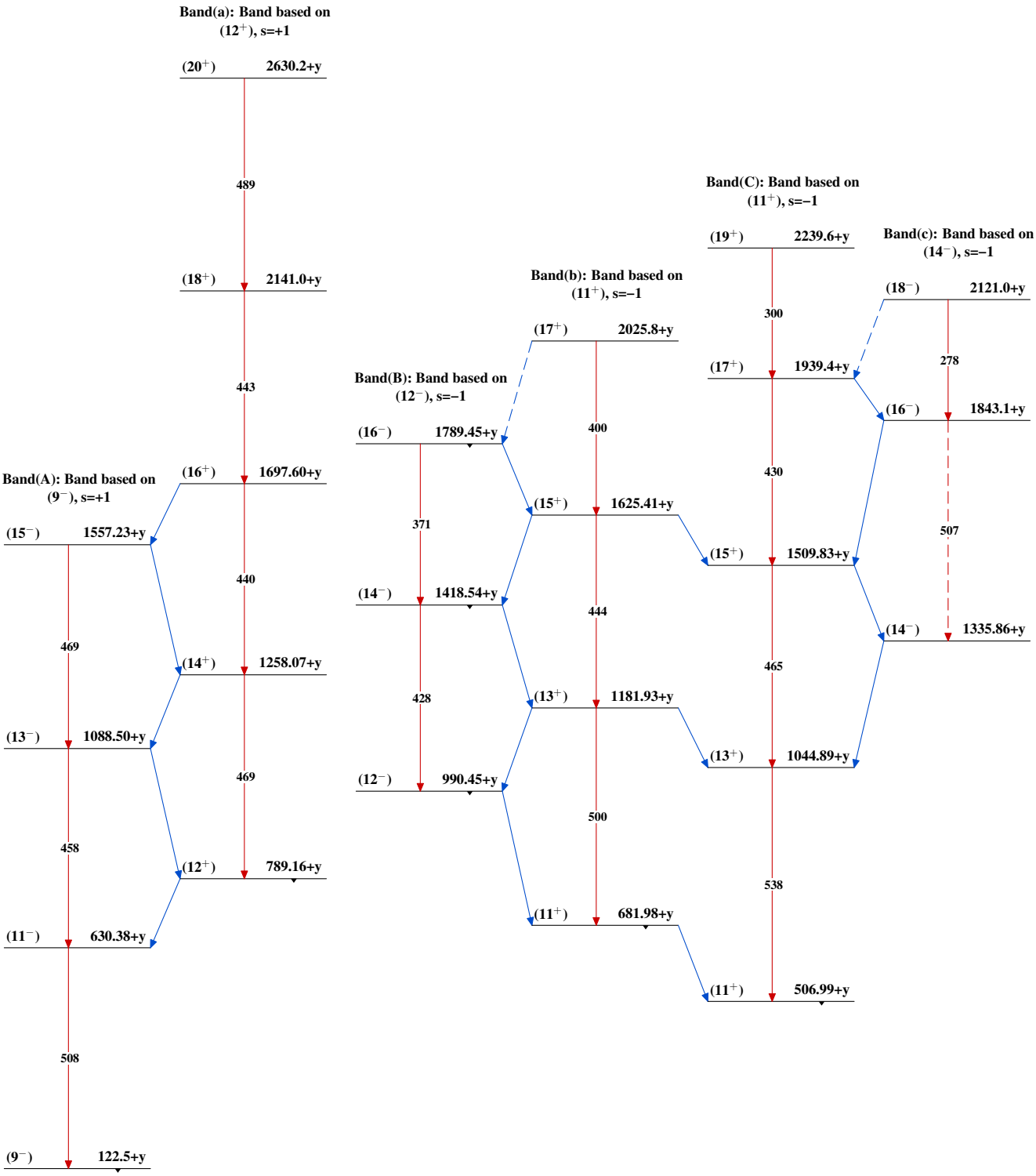
Intensities: Relative I_γ

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)



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

$^{209}Bi(^{12}C,3n\gamma)$ 1994De04



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