^{113}In(α,nγ) 1991Ga16

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jean Blachot	NDS 111, 717 (2010)	1-Dec-2009

E=14,16 MeV.
E(α)=14.5,16 MeV (1991Ga16).
Measured: Eγ, Iγ, $\gamma\gamma$, excit ce supermagnetic lens spectrometer, Si (1991Ga16).
The α(K)exp were normalized using the 719 and 1160 γ in ^{117}Sb taken as E2.
The level scheme is as given by 1991Ga16.

^{116}Sb Levels

E(level)	J$^{\pi}$[†]	Comments
0	3^+	J$^{\pi}$: adopted values.
93.858 *22*	1^+	J$^{\pi}$: adopted value.
103.037 *15*	2^+	
383 *40*	8^-	E(level): from Adopted Levels.
410.863 *20*	4^+	
455.206 *22*	3^-	
466.101 *22*	3^+	
503.09 *5*	$5^{(+)}$	
518.048 *24*	2^-	
546.34 *6*	4^+	
550.86 *3*	2^+	
574.58 *4*	2^+	
612.84 *3*	4^-	
654.32 *5*	3^+	
681.7 *1*	$(6)^-$	
735.42 *3*	4^+	
809.18 *14*	7^-	
815.13 *3*	3^+	
820.92 *4*	5^-	
841.12 *5*	$6^{(+)}$	
881.65 *3*	3^+	
917.82 *8*	1^+	
948.29 *4*	4^+	
997.95 *21*	$(3^-,4^-)$	
1037.7 *5*	$(4^+,5^+)$	
1045.40 *4*	$(4)^-$	
1065.31 *5*	$(5)^+$	
1076.76 *5*	$(5,3)^+$	
1087.54 *5*	$4^+,3^+,2^+$	
1096.10 *11*	(2,3,4)	
1122.3 *10*	1^+ to 5^+	
1135.50 *18*	9^-	
1138.85 *7*	4^+	
1155.42 *8*	$(6,7)^-$	
1158.42 *12*	7^+	
1164.09 *13*		
1200.0 *10*		
1208.2 *7*	$(4^-,5^-)$	
1212.1 *5*	$(4,3)^+$	
1223.21 *8*	3,2	
1226.12 *8*		
1267.85 *8*	$(6,7)^-$	
1289.1 *3*	6^-	
1307.41 *21*	$(6,7,8)^-$	

Continued on next page (footnotes at end of table)

^{113}In(α,nγ) 1991Ga16 (continued)

^{116}Sb Levels (continued)

E(level)	Jπ†	E(level)	Jπ†	E(level)	Jπ†	E(level)	Jπ†
1312.4 *10*	(−)	1407.91 *11*	(3,4)	1493.32 *9*	(6,7,8)−	1685.01 *12*	(6,7,8)−
1336.58 *10*	2,3	1436.2 *10*		1570.20 *21*		1703.90 *13*	
1351.38 *14*	7−	1451.15 *16*	8−	1626.24 *9*	+	1782.11 *18*	11+
1385.75 *11*	1,2,3	1473.07 *8*	5− to 9−	1658.27 *10*			
1386.72 *11*	(5,6)+	1483.34 *11*	(2 to 5)−	1666.4 *4*	9−		

† Spins have been determined from ce and by Hauser-Feshbach analysis of normalized cross sections.

γ(^{116}Sb)

Eγ†	Iγ†	Ei(level)	J_i^π	E_f	J_f^π	Mult.	α[f]	Comments
92.23 *4*	178 *10*	503.09	5(+)	410.863	4+			
93.88 *3*	48 *5*	93.858	1+	0	3+	E2	2.06	α(K)=1.435 *21*; α(L)=0.503 *7*; α(M)=0.1039 *15*; α(N+..)=0.0203 *3* α(N)=0.0189 *3*; α(O)=0.001398 *20*
x95.2 *4*	WEAK							
100.3 *4*	26 *2*	1451.15	8−	1351.38	7−			
103.01 *2*	529 *17*	103.037	2+	0	3+	M1		α(K)exp=0.499 *15*
108.47 *3*	5.7 *9*	574.58	2+	466.101	3+			
127.3 *2*	5.3 *12*	809.18	7−	681.7	(6)−			
x151.7 *3*	2.9 *7*							
157.60 *3*	391 *11*	612.84	4−	455.206	3−	M1		α(K)exp=0.150 *5*
x162.6 *1*	4.9 *7*							
189.2 *4*	WEAK	735.42	4+	546.34	4+			
192.50 *3*	36.5 *12*	1351.38	7−	1158.42	7+	E1		α(K)exp=0.027 *3*
208.09 *2*	173 *5*	820.92	5−	612.84	4−	M1,E2		α(K)exp=0.090 *20*
215.02 *2*	38.0 *12*	1666.4	9−	1451.15	8−	M1+E2		α(K)exp= 0.0083 *3*
224.14 *2*	≤53‡	1065.31	(5)+	841.12	6(+)	M1		α(K)exp=0.058 *3*
224.5 *5*	≤53‡	1045.40	(4)−	820.92	5−			
274.5 *4*	WEAK	1626.24	+	1351.38	7−			
x287.8 *1*	6.5 *9*							
293.95 *9*	20.1 *8*	948.29	4+	654.32	3+	M1,E2		α(K)exp=0.029 *7*
298.53 *2*	309 *8*	681.7	(6)−	383	8−	E2		α(K)exp=0.00322 *9*
302.4 *4*	WEAK	1037.7	(4+,5+)	735.42	4+			
307.79 *3*	105.2 *24*	410.863	4+	103.037	2+	E2,(M1)		α(K)exp=0.0286 *22*
x317.04 *5*	15.7 *21*							
321.41 *5*	18.0 *10*	1386.72	(5,6)+	1065.31	(5)+	M1,E2		α(K)exp=0.022 *4*
x324.25 *5*	18.8 *4*							
330.9g *1*	4.6g *7*	881.65	3+	550.86	2+			
330.9g *1*	4.6g *7*	1782.11	11+	1451.15	8−			
x335.6 *4*	WEAK							α(K)exp=32.9 *9*
338.01 *1*	232 *4*	841.12	6(+)	503.09	5(+)	M1,(E2)		α(K)exp=0.0214 *5*
341.34 *3*	70.3 *15*	1076.76	(5,3)+	735.42	4+	M1,E2		α(K)exp=0.0182 *10*
346.1 *2*	8 *1*	1155.42	(6,7)−	809.18	7−			
349.66 *8*	66.8 *15*	1158.42	7+	809.18	7−	E1		α(K)exp=0.0051 *10*
x352.0 *4*	<100							
352.16 *2*	415 *13*	455.206	3−	103.037	2+	E1		α(K)exp=0.0055 *5*
363.06 *2*	160 *3*	466.101	3+	103.037	2+	M1,E2		α(K)exp=0.0153 *18*
x365.1 *4*	≤12#							
365.5 *1*	≤12#	820.92	5−	455.206	3−			
x374.56 *5*	7.8 *16*							

Continued on next page (footnotes at end of table)

^{113}In(α,nγ) 1991Ga16 (continued)

$\gamma(^{116}Sb)$ (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
x377.34 *6*	11.5 *7*						
x378.9 *2*	≤24@						
379.09 *5*	≤24@	1200.0		820.92	5^-		
x382.3 *3*	WEAK						
387.18 *5*	15.4 *7*	1208.2	$(4^-,5^-)$	820.92	5^-		
x391.60 *5*	20.1 *8*						
401.9 *2*	15.9 *8*	948.29	4^+	546.34	4^+		
404.27 *3*	18.6 *9*	815.13	3^+	410.863	4^+		
x405.3							
410.91 *3*	≤1022&	410.863	4^+	0	3^+	M1,E2	α(K)exp=0.0117 *10* I_γ: Iγ=100 in 1991Ga16, certainly a misprint.
411.2 *2*	≤1022&	1570.20		1158.42	7^+		
424.20 *3*	106.2 *24*	518.048	2^-	93.858	1^+	E1	
426.13 *2*	369 *8*	809.18	7^-	383	8^-	M1,E2	α(K)exp=0.00106 *5*
432.51 *4*	24 *2*	1045.40	$(4)^-$	612.84	4^-		
447.83 *6*	4.3 *6*	550.86	2^+	103.037	2^+	M1,E2	α(K)exp=0.0089 *20*
455.19 *7*	115.1 *20*	455.206	3^-	0	3^+	E1	α(K)exp=0.00030 *5*
457.01 *2*	19.9 *9*	550.86	2^+	93.858	1^+	M1,E2	
458.64 *6*	22.7 *11*	1267.85	$(6,7)^-$	809.18	7^-	M1,E2	
466.11 *5*	29.3 *13*	466.101	3^+	0	3^+	M1,E2	α(K)exp=0.0079 *15*
467.24 *5*	15.0 *13*	1626.24	$^+$	1158.42	7^+	(E2)	
470.79 *4*	21.0 *8*	881.65	3^+	410.863	4^+	M1,E2	α(K)exp=0.0085 *16*
471.62 *6*	WEAK	574.58	2^+	103.037	2^+	M1,E2	
473.63 *3*	36.5 *10*	1155.42	$(6,7)^-$	681.7	$(6)^-$		
476.59 *5*	19.7 *9*	1212.1	$(4,3)^+$	735.42	4^+	M1,E2	α(K)exp=0.0072 *15*
479.9g *2*	78g *7*	997.95	$(3^-,4^-)$	518.048	2^-	(M1,E2)	
479.9g *2*	78g *7*	1289.1	6^-	809.18	7^-		
x480.2 *4*	≤52a						
480.8 *4*	≤52a	574.58	2^+	93.858	1^+	(M1,E2)	
482.3 *1*	≤10.5b	1164.09		681.7	$(6)^-$		
484.6 *1*	≤10.5b	1138.85	4^+	654.32	3^+		
491.45g *7*	42.6g *12*	1037.7	$(4^+,5^+)$	546.34	4^+	(M1,E2)	α(K)exp=0.0070 *7*
491.45g *7*	42.6g *12*	1312.4	$(^-)$	820.92	5^-	(M1,E2)	
498.2 *2*	5.6 *10*	1307.41	$(6,7,8)^-$	809.18	7^-	M1,E2	
503.2 *1*	6.9 *10*	503.09	$5^{(+)}$	0	3^+		
518.04 *3*	34.3 *12*	518.048	2^-	0	3^+	E1	α(K)exp=0.0018 *5*
x529.4 *1*	10.3 *9*						
534.49 *6*	9.1 *9*	1037.7	$(4^+,5^+)$	503.09	$5^{(+)}$	M1,E2	α(K)exp=0.006 *3*
537.43 *5*	14.2 *9*	948.29	4^+	410.863	4^+		
542.4 *2*	15 *4*	1351.38	7^-	809.18	7^-		
545.4 *2*	≤221c	1386.72	$(5,6)^+$	841.12	$6^{(+)}$		
546.33 *6*	≤221c	546.34	4^+	0	3^+	M1,(E2)	α(K)exp=0.0066 *10*
550.83 *7*	98 *13*	550.86	2^+	0	3^+	(M1,E2)	α(K)exp=0.0054 *6*
551.4 *1*	98 *10*	654.32	3^+	103.037	2^+	(M1,E2)	
x558.4 *1*	7.3 *9*						
x560.9 *1*	11.8 *12*						
562.27 *5*	36.7 *14*	1065.31	$(5)^+$	503.09	$5^{(+)}$	M1,E2	α(K)exp=0.0053 *7*
571.80 *6*	15.7 *24*	1226.12		654.32	3^+		
574.5 *1*	8.2 *9*	574.58	2^+	0	3^+	M1,E2	
586.0 *4*	6.0 *20*	1267.85	$(6,7)^-$	681.7	$(6)^-$		
x587.7 *2*	5.0 *20*						
590.22 *3*	54.3 *17*	1045.40	$(4)^-$	455.206	3^-	M1,(E2)	α(K)exp=0.0048 *4*
595.5 *3*	<29	1208.2	$(4^-,5^-)$	612.84	4^-	M1,E2	α(K)exp=0.0050 *6*
x602.8 *2*	6.4 *12*						

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^{113}In(α,nγ) 1991Ga16 (continued)

$\gamma(^{116}Sb)$ (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
612.89 *5*	28.8 *10*	612.84	4^-	0	3^+	E1	α(K)exp=0.0015 *9*
621.47 *5*	20.1 *9*	1087.54	$4^+,3^+,2^+$	466.101	3^+	M1	α(K)exp=0.0054 *11*
x624.3 *4*	WEAK						
626.8 *1*	45.5 *13*	1037.7	$(4^+,5^+)$	410.863	4^+		
x628.66 *3*	≤22 [d]						
630.0 *1*	≤22 [d]	1096.10	(2,3,4)	466.101	3^+		
x633.5 *1*	9.9 *9*						
x635.5 *1*	8.4 *9*						
642.59 *7*	15.8 *13*	1451.15	8^-	809.18	7^-	M1,E2	α(K)exp=0.0037 *10*
646.4 *4*	WEAK	1782.11	11^+	1135.50	9^-		
654.60 *5*	24.6 *10*	1065.31	$(5)^+$	410.863	4^+	(M1,E2)	α(K)exp=0.0043 *9*
663.86 *5*	24.6 *11*	1473.07	5^- to 9^-	809.18	7^-	E2	
665.8 *1*	9.4 *10*	1212.1	$(4,3)^+$	546.34	4^+		
669.86 *5*	19.3 *10*	1351.38	7^-	681.7	$(6)^-$	E2,(M1)	α(K)exp=0.0026 *7*
672.6 *2*	3.5 *10*	1138.85	4^+	466.101	3^+		
x676.1 *2*	4.8 *9*						
x681.5 *3*	5.2 *13*						
684.11 *6*	15.4 *10*	1493.32	$(6,7,8)^-$	809.18	7^-	M1,(E2)	
x700.7 *9*	13.7 *10*						
705.2	10 *5*	1223.21	3,2	518.048	2^-		
712.07 *4*	31.6 *12*	815.13	3^+	103.037	2^+	E2,(M1)	α(K)exp=0.0023 *4*
x725.2 *2*	9.6 *4*						
735.42 *3*	216 *8*	735.42	4^+	0	3^+	M1,E2	α(K)exp=0.0026 *3*
752.78 *3*	63 *9*	1135.50	9^-	383	8^-	M1	α(K)exp=0.0033 *5*
x753.9 *5*	WEAK						
x758.0 *4*	WEAK						
762.0 *1*	6.8 *10*	1336.58	2,3	574.58	2^+		
x771.0 *4*	10.2 *10*						
775.87 *2*	127 *5*	1158.42	7^+	383	8^-	E1	α(K)exp=0.00093 *23*
778.59 *3*	22.1 *14*	881.65	3^+	103.037	2^+		
x782.6 *1*	9.2 *15*						
x783.6 *4*	WEAK						
x784.1 *3*	5.3 *14*						
785.7 *2*	5.6 *10*	1336.58	2,3	550.86	2^+		
x791.6 *2*	8.7 *11*						
801.2 *2*	8.9 *14*	1212.1	$(4,3)^+$	410.863	4^+		
x802.9 *4*	5.9 *14*						
x813.8 *2*	6.6 *11*						
815.3	8.5 *11*	815.13	3^+	0	3^+		
823.4 *1*	15.4 *16*	1436.2		612.84	4^-		
x831.4 *3*	3.7 *12*						
x836.6 *1*	11 *3*						
x845.0 *4*	WEAK						
x848.5 *3*	9.2 *16*						
x858.2 *3*	5.7 *11*						
x860.5 *2*	WEAK						
867.7 *1*	10.3 *11*	1385.75	1,2,3	518.048	2^-		
870.5 *1*	33.7 *18*	1483.34	$(2$ to $5)^-$	612.84	4^-	M1,E2	α(K)exp= 0.0018 *4*
x874.7 *1*	<5						
875.8 *1*	17.9 *18*	1685.01	$(6,7,8)^-$	809.18	7^-		
x885.3 *4*	WEAK						
x893.2 *2*	5.2 *10*						
x897.3 *1*	16.2 *12*						
906.1 *1*	11.3 *12*	1289.1	6^-	383	8^-		
x908.9 *2*	6.7 *17*						
917.82 *8*	5.0 *13*	917.82	1^+	0	3^+		

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^{113}In(α,nγ) 1991Ga16 (continued)

$\gamma(^{116}Sb)$ (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
x919.4 2	WEAK						
926.9 h 4	8.8 13	1336.58	2,3	410.863	4^+		
x939.3 2	WEAK						
x942.2 1	12.3 19						
x944.0 4	WEAK						
948.28 6	23.4 17	948.29	4^+	0	3^+	E2,(M1)	α(K)exp=0.0011 4
x950.6 2	6.2 14						
952.7 1	14.9 15	1407.91	(3,4)	455.206	3^-		
968.47 2	102 5	1351.38	7^-	383	8^-	E2,(M1)	α(K)exp=0.00138 12
976.47 7	15.6 14	1658.27		681.7	$(6)^-$		
x978.3 4	WEAK						
x979.6 1	6.8 13						
x988.6 4	WEAK						
x1010.1 2	7.5 12						
x1012.7 1	15.7 16						
x1021.3 4	WEAK						
1022.1 1	11.4 14	1703.90		681.7	$(6)^-$		
x1038.8 2	13.6 20						
1068.4 4	WEAK	1451.15	8^-	383	8^-		
1087.4 1	19 4	1087.54	$4^+,3^+,2^+$	0	3^+		
x1101.4 2	8.7 14						
x1109.8 1	16.8 16						
1122.26 1	51 3	1122.3	1^+ to 5^+	0	3^+	E2,(M1)	α(K)exp=0.00097 13
1129.3 1	<11	1223.21	3,2	93.858	1^+		
x1136.6 4	WEAK						
1138.8 1	28.4 16	1138.85	4^+	0	3^+	E2,(M1)	α(K)exp=0.00083 17
x1147.5 2	9.0 12						
x1153.4 4	WEAK						
x1167.7 4	WEAK						
x1173.3 4	WEAK						
x1180.0 5	WEAK						
1212.1 1	13.7 13	1212.1	$(4,3)^+$	0	3^+	(M1,E2)	α(K)exp=0.0007 3
x1224.2 2	4.9 22						
x1238.3 4	WEAK						
x1258.8 2	9.9 12						
1283.8 4	WEAK	1666.4	9^-	383	8^-		
x1317.3 3	12.1 16						
x1328.1 4	WEAK						
x1351.6 2	5 3						
x1377.9 1	19.6 14						
x1398.3 4	≤13.7 e						
1398.9 4	≤13.7 e	1782.11	11^+	383	8^-		
x1470.1 4	WEAK						
x1483.4 4	WEAK						

† From 1991Ga16. Evaluators give the relative branchings given in the table which are often discrepant with the branching ratios in the level scheme. See (p,nγ).
‡ Iγ=50.8 18 for 224 doublet.
# Iγ=11.0 9 for 365 doublet.
@ Iγ=23.0 9 for 379 doublet.
& Iγ=1000 22 for 411 doublet.
a Iγ=46 6 for 480 doublet.

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^{113}In(α,nγ) 1991Ga16 (continued)

$\gamma(^{116}Sb)$ (continued)

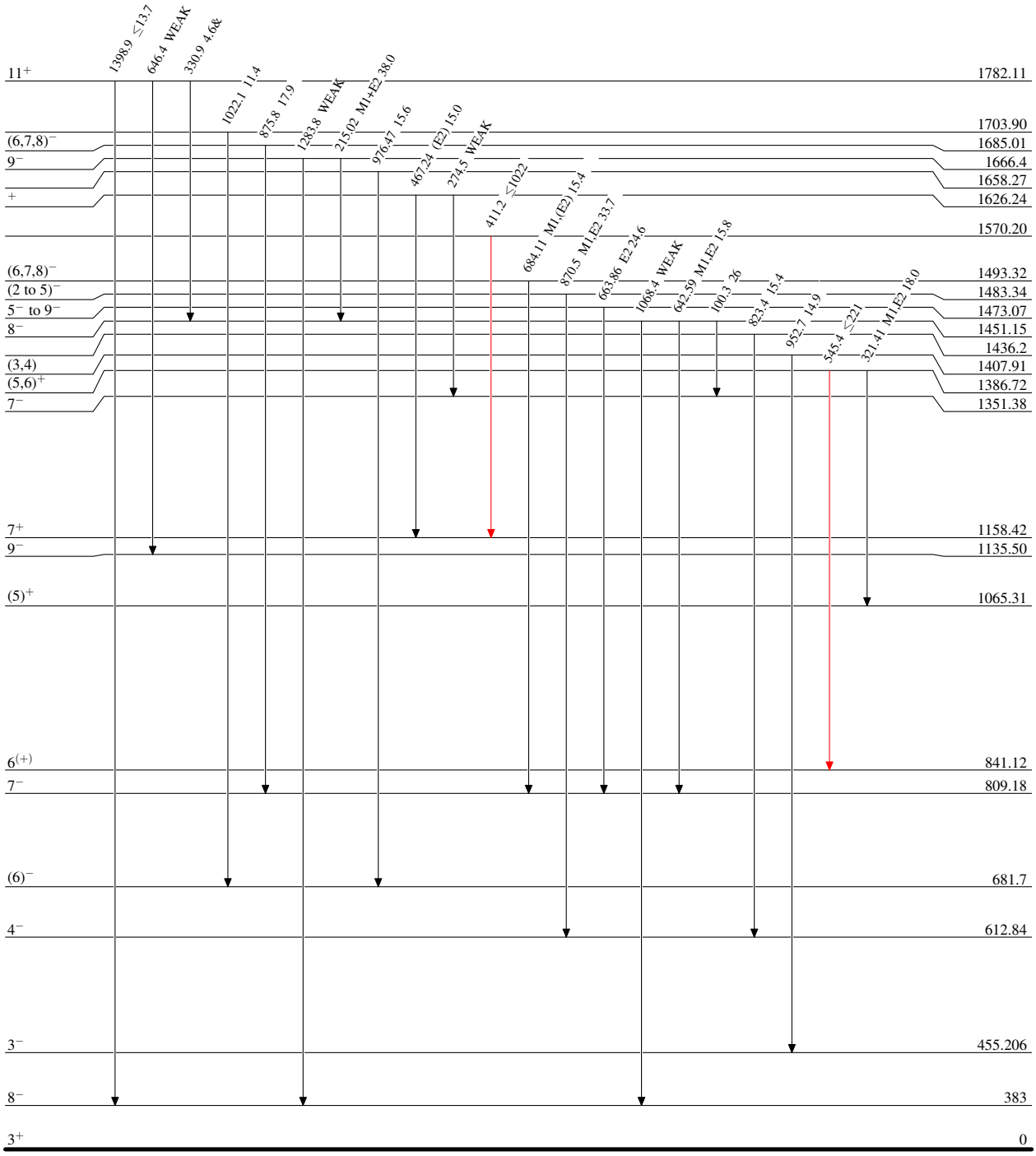
[b] Iγ=9.8 *7* for 483 doublet.
[c] Iγ=216 *5* for 546 doublet.
[d] Iγ=20.9 *10* for 629 doublet.
[e] Iγ=12.4 *13* for 1398 doublet.
[f] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[g] Multiply placed with undivided intensity.
[h] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{113}In(α,nγ) 1991Ga16

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



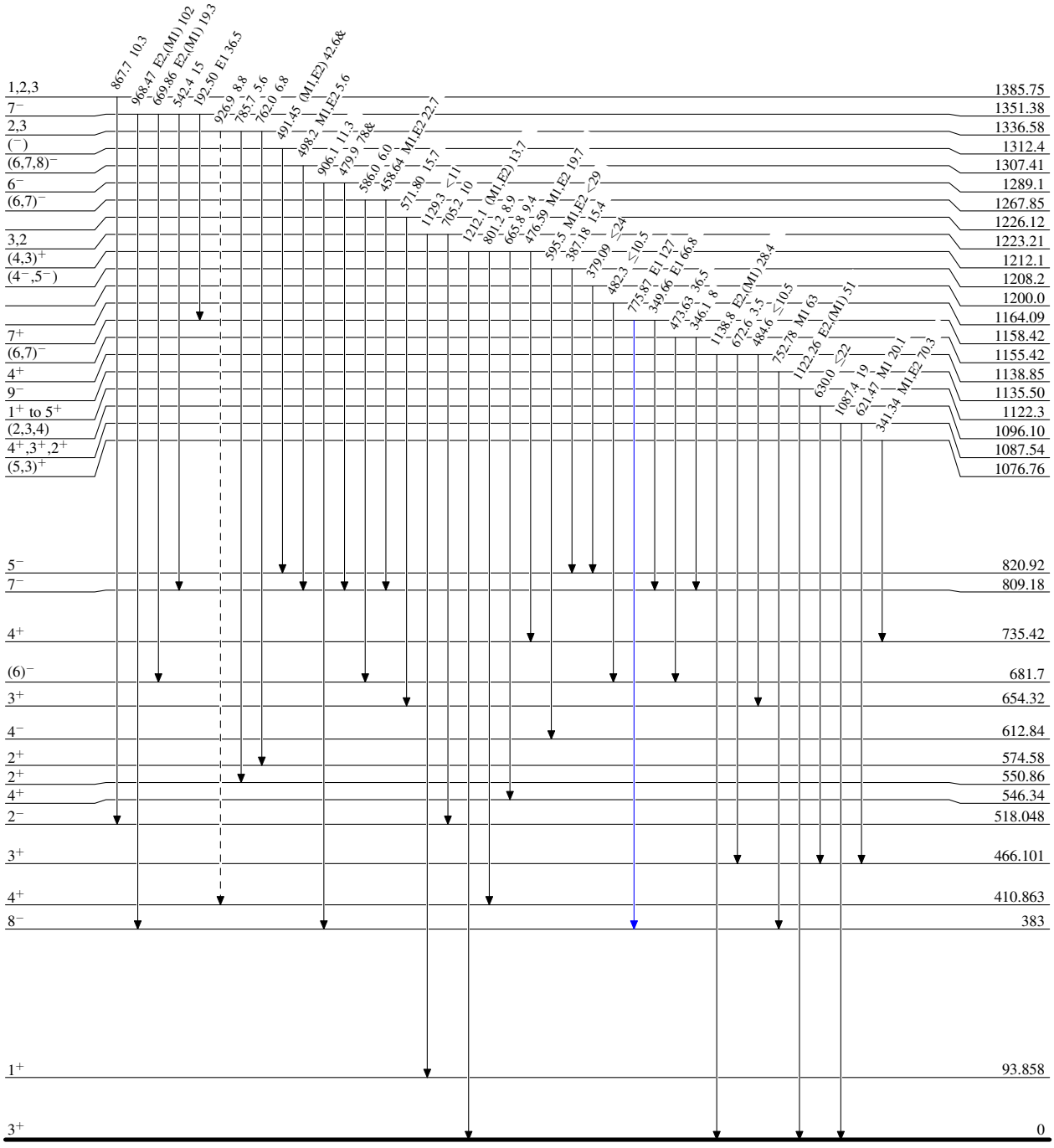
$^{116}_{51}Sb_{65}$

^{113}In(α,nγ) 1991Ga16

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)



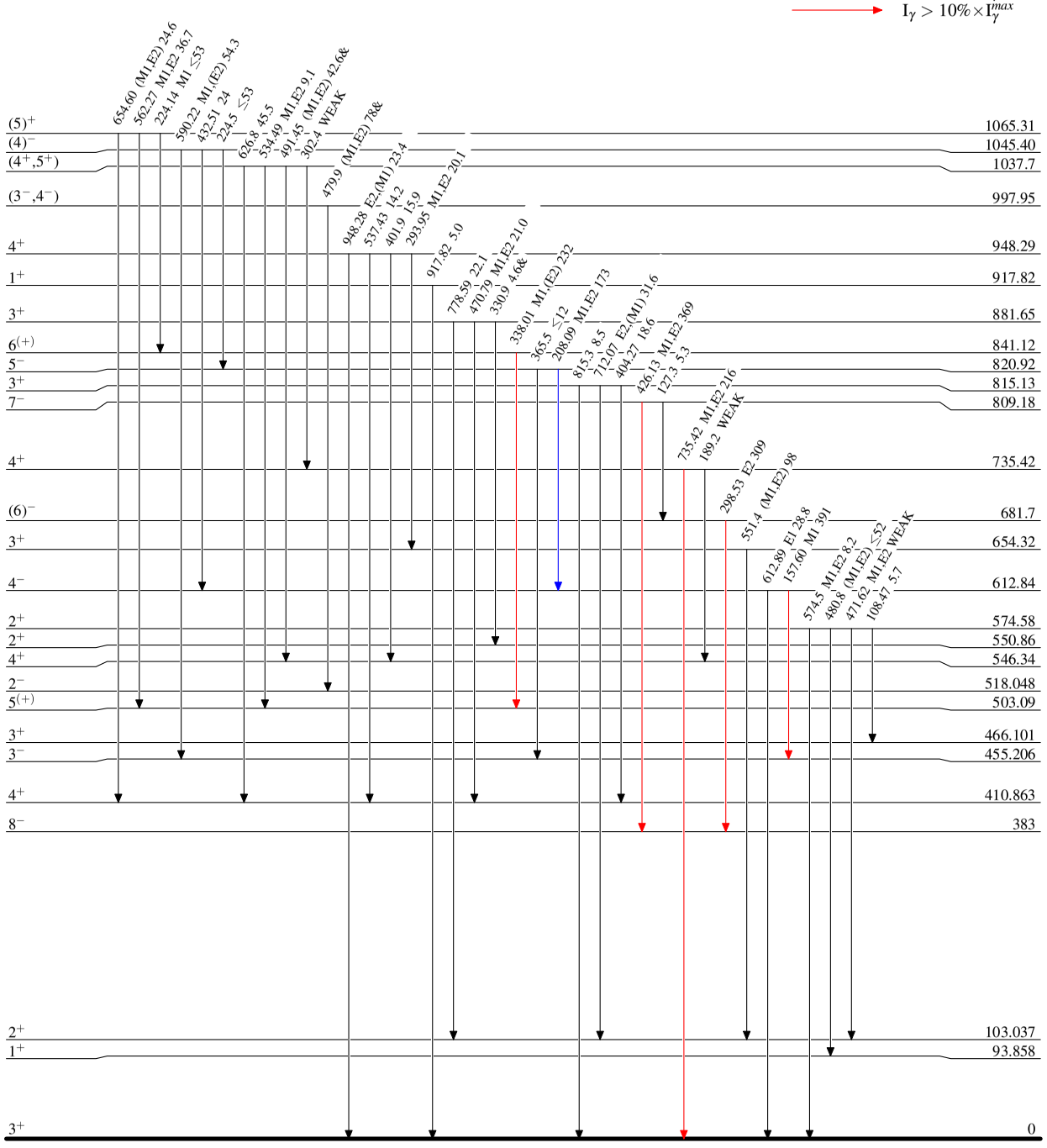
$^{116}_{51}Sb_{65}$

^{113}In(α,nγ) 1991Ga16

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



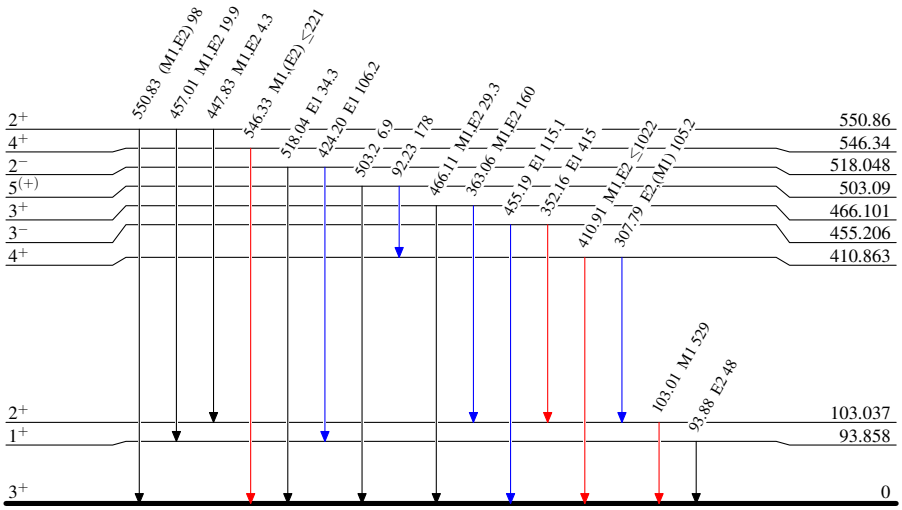
$^{116}_{51}Sb_{65}$

^{113}In(α,nγ) 1991Ga16

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{116}_{51}Sb_{65}$