^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn) 1997La13

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	G. Gürdal and F. G. Kondev	NDS 113, 1315 (2012)	1-Aug-2011

^{54}Fe(^{59}Co,2pn): E(^{59}Co)=230 MeV. Target: Two stacked 440 μg/cm^2 ^{54}Fe targets. ^{59}Co beam was provided by the 88-inch cyclotron at Lawrence Berkeley National Laboratory. γ-rays were detected with 36 HPGe detectors from the early implementation of Gammasphere. Measured: Eγ, Iγ, $\gamma\gamma\gamma$, DCO. Deduced ^{110}Sb levels, J^π.

^{56}Fe(^{58}Ni,3pn): E(^{58}Ni)=240 MeV. Target: 590 μg/cm^2. ^{58}Ni beam was provided by ATLAS at Argonne National Laboratory. γ-rays were detected using Ayeball array, which for this experiment consisted of 16 HPGe detectors. FMA was used to identify the evaporation residues recoiling out of the thin target while 15 NE213 liquid scintillator detectors were used to identify the neutrons via pulse shape and time of flight. Measured: Eγ, Iγ, $\gamma\gamma\gamma$, DCO. Deduced: ^{110}Sb levels, J^π.

^{55}Mn(^{58}Ni,2pn): E(^{58}Ni)=240 MeV beam was provided by VICKSI accelerator at Hahn-Meitner Institute. 2 μg/cm^2 ^{55}Mn with a 23 μg/cm^2 gold backing was used as target. γ-rays were detected using OSIRIS spectrometer, consisting of eleven HPGe detectors. Measured: Eγ, Iγ, T$_{1/2}$.

^{110}Sb Levels

E(level)[†]	J^π[‡]	T$_{1/2}$	Comments
0.0	4$^+$		
194.7 *7*	5$^+$		
340.5 *8*	6$^+$		
370.1 *8*			
629.5 *10*			
1136.2 *7*			
1152.9 *10*	8$^-$	24 ns *1*	T$_{1/2}$: From 812γ(t), 146γ(t), 195γ(t) and 1035γ(t) deduced by examining data sets from the OSIRIS Spectrometer at Hahn-Meitner Institute.
1159.4 *11*			
1298.2 *8*			
1299.8 *10*			
1508.5 *11*			
1691.1 *11*			
1768.5 *11*	(9$^-$)		
1841.3 *9*			
1927.3[b] *11*	8$^-$		
2128.2[b] *11*	9$^-$		
2169.5 *13*	(10$^-$)		
2188.1 *12*	10$^-$		
2441.5[b] *12*	10$^-$		
2670.1 *14*	11$^{(+)}$		
2791.0[b] *11*	11$^-$		
3121.4 *12*	12$^-$		
3165.5[b] *12*	12$^-$		
3472.4 *14*	(13$^-$)		
3563.0[b] *13*	13$^-$		
3711.9 *14*	13$^{(+)}$		
3828.0 *13*	(14$^-$)		
3996.0[b] *14*	14$^-$		
4389.3 *15*	(13$^+$)		
4471.5[b] *15*	15$^-$		
4662.0 *16*	15$^{(+)}$		
4907.0 *17*			
4930.1[@] *16*	15$^{(+)}$		
5010.5 *14*	(15$^+$)		
5023			

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^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn) 1997La13 (continued)

^{110}Sb Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	Comments
5681.2[@] *15*	17$^{(+)}$	
6505.2[@] *18*	19$^{(+)}$	
7418.2[@] *21*	21$^{(+)}$	
8405.2[@] *23*	23$^{(+)}$	
9472.2[@] *25*	25$^{(+)}$	
10627[@] *3*	27$^{(+)}$	
11878[@] *3*	29$^{(+)}$	
13233[@] *3*	31$^{(+)}$	
14705[@] *4*	33$^{(+)}$	
16319[@] *4*	35$^{(+)}$	
18103[@] *4*	37$^{(+)}$	
20084[@] *4*	39$^{(+)}$	
22301[@] *4*	41$^{(+)}$	
24786[@] *4*	43$^{(+)}$	
27548[@]	(45^{+})	
x+0.0[&]	(19^{-})[#]	Additional information 1.
x+824.0[&] *10*	(21^{-})	
x+1754.0[&] *15*	(23^{-})	
x+2762.0[&] *18*	(25^{-})	
x+3872.0[&] *20*	(27^{-})	
x+5118.0[&] *23*	(29^{-})	
x+6527.0[&] *25*	(31^{-})	
x+8146[&] *3*	(33^{-})	
x+10007[&] *3*	(35^{-})	
x+12076[&] *3*	(37^{-})	
y+0.0[a]	(20^{-})[#]	Additional information 2.
y+882.0[a] *10*	(22^{-})	
y+1854.0[a] *15*	(24^{-})	
y+2924.0[a] *18*	(26^{-})	
y+4141.0[a] *20*	(28^{-})	
y+5513.0[a] *23*	(30^{-})	
y+7076.0[a] *25*	(32^{-})	
y+8824[a] *3*	(34^{-})	
y+10756[a] *3*	(36^{-})	
y+12880[a]	(38^{-})	

[†] From least-squares fit to Eγ's. ΔEγ=1 keV by the evaluators.
[‡] Based on the deduced γ-ray transition multipolarities using DCO ratios, band structure and systematics, unless otherwise stated. All J^{π} values are tentative.
[#] Discrete decays out of this band have not been established. However, feeding of preferentially negative parity, low-spin states has been observed.
[@] Band(A): band A, based on the 4930 keV (J$^{\pi}$=15^{+}) level.
[&] Band(B): band B, based on the J$^{\pi}$=(19^{-}) level.
[a] Band(C): band C, based on the J$^{\pi}$=(20^{-}) level.
[b] Band(D): band D, based on the 1927 keV (J$^{\pi}$=8^{-}) level.

$^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn)$ 1997La13 (continued)

$\gamma(^{110}Sb)$

E_γ †	E_i(level)	J^π_i	E_f	J^π_f	Mult. ‡	Comments
86	1927.3	8^-	1841.3			
146	340.5	6^+	194.7	5^+	M1(+E2)	Mult.: Authors stated that DCO ratio was consistent with a stretched dipole with small multiple mixing ratio.
147	1299.8		1152.9	8^-		
150	1841.3		1691.1			
164	1299.8		1136.2			
195	194.7	5^+	0.0	4^+	M1(+E2)	Mult.: Authors stated that DCO ratio was consistent with a stretched dipole with small multiple mixing ratio.
201	2128.2	9^-	1927.3	8^-		
260	1768.5	(9^-)	1508.5			
265	3828.0	(14^-)	3563.0	13^-		
306	3472.4	(13^-)	3165.5	12^-		
313	2441.5	10^-	2128.2	9^-		
331	3121.4	12^-	2791.0	11^-		
349	2791.0	11^-	2441.5	10^-		
352	3472.4	(13^-)	3121.4	12^-		
370	370.1		0.0	4^+		
374	3165.5	12^-	2791.0	11^-		
398	3563.0	13^-	3165.5	12^-		
401	2169.5	(10^-)	1768.5	(9^-)		
433	3996.0	14^-	3563.0	13^-		
435	629.5		194.7	5^+		
475	4471.5	15^-	3996.0	14^-		
482	2670.1	$11^{(+)}$	2188.1	10^-	E1	
514	2441.5	10^-	1927.3	8^-		
538	1691.1		1152.9	8^-		
541#	4930.1	$15^{(+)}$	4389.3	(13^+)		
542	1841.3		1299.8			
543	1841.3		1298.2			
552#	5023		4471.5	15^-		
590	3711.9	$13^{(+)}$	3121.4	12^-	E1	
616	1768.5	(9^-)	1152.9	8^-		
621	5010.5	(15^+)	4389.3	(13^+)		
628	1927.3	8^-	1299.8			
663	2791.0	11^-	2128.2	9^-		
663	3828.0	(14^-)	3165.5	12^-		
671	5681.2	$17^{(+)}$	5010.5	(15^+)		
682	1841.3		1159.4			
688	1841.3		1152.9	8^-		
724	3165.5	12^-	2441.5	10^-		
751	5681.2	$17^{(+)}$	4930.1	$15^{(+)}$	E2	
766	1136.2		370.1			
772	3563.0	13^-	2791.0	11^-		
796	1136.2		340.5	6^+		
812	1152.9	8^-	340.5	6^+	(M2)	Mult.: Suggested by the authors based on systematics and the observed level $T_{1/2}$.
819	1159.4		340.5	6^+		
824	x+824.0	(21^-)	x+0.0	(19^-)	E2	
824	6505.2	$19^{(+)}$	5681.2	$17^{(+)}$	E2	
830	3996.0	14^-	3165.5	12^-		
882	y+882.0	(22^-)	y+0.0	(20^-)	E2	
909	4471.5	15^-	3563.0	13^-		
913	7418.2	$21^{(+)}$	6505.2	$19^{(+)}$	E2	
928	1298.2		370.1			

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$^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn)$ 1997La13 (continued)

$\gamma(^{110}Sb)$ (continued)

E_γ †	E_i(level)	J^π_i	E_f	J^π_f	Mult. ‡
930	x+1754.0	(23^-)	x+824.0	(21^-)	E2
933	3121.4	12^-	2188.1	10^-	E2
942	1136.2		194.7	5^+	
950	4662.0	$15^{(+)}$	3711.9	$13^{(+)}$	E2
958	1298.2		340.5	6^+	
972	y+1854.0	(24^-)	y+882.0	(22^-)	E2
975	2128.2	9^-	1152.9	8^-	
987	8405.2	$23^{(+)}$	7418.2	$21^{(+)}$	E2
996	3165.5	12^-	2169.5	(10^-)	
1008	x+2762.0	(25^-)	x+1754.0	(23^-)	E2
1019	5681.2	$17^{(+)}$	4662.0	$15^{(+)}$	E2
1023	2791.0	11^-	1768.5	(9^-)	
1027#	5023		3996.0	14^-	
1035	2188.1	10^-	1152.9	8^-	E2
1042	3711.9	$13^{(+)}$	2670.1	$11^{(+)}$	E2
1067	9472.2	$25^{(+)}$	8405.2	$23^{(+)}$	E2
1070	y+2924.0	(26^-)	y+1854.0	(24^-)	E2
1079	4907.0		3828.0	(14^-)	
1103	1298.2		194.7	5^+	
1110	x+3872.0	(27^-)	x+2762.0	(25^-)	E2
1136	1136.2		0.0	4^+	
1155	10627	$27^{(+)}$	9472.2	$25^{(+)}$	E2
1168	1508.5		340.5	6^+	
1183	5010.5	(15^+)	3828.0	(14^-)	
1212	1841.3		629.5		
1217	y+4141.0	(28^-)	y+2924.0	(26^-)	E2
1218	4930.1	$15^{(+)}$	3711.9	$13^{(+)}$	E2
1246	x+5118.0	(29^-)	x+3872.0	(27^-)	E2
1251	11878	$29^{(+)}$	10627	$27^{(+)}$	E2
1355	13233	$31^{(+)}$	11878	$29^{(+)}$	E2
1372	y+5513.0	(30^-)	y+4141.0	(28^-)	E2
1409	x+6527.0	(31^-)	x+5118.0	(29^-)	E2
1472	14705	$33^{(+)}$	13233	$31^{(+)}$	E2
1563	y+7076.0	(32^-)	y+5513.0	(30^-)	E2
1614	16319	$35^{(+)}$	14705	$33^{(+)}$	E2
1619	x+8146	(33^-)	x+6527.0	(31^-)	E2
1719	4389.3	(13^+)	2670.1	$11^{(+)}$	
1748	y+8824	(34^-)	y+7076.0	(32^-)	E2
1784	18103	$37^{(+)}$	16319	$35^{(+)}$	E2
1861	x+10007	(35^-)	x+8146	(33^-)	E2
1932	y+10756	(36^-)	y+8824	(34^-)	E2
1981	20084	$39^{(+)}$	18103	$37^{(+)}$	E2
2069	x+12076	(37^-)	x+10007	(35^-)	E2
2124#	y+12880	(38^-)	y+10756	(36^-)	E2
2217	22301	$41^{(+)}$	20084	$39^{(+)}$	E2
2485	24786	$43^{(+)}$	22301	$41^{(+)}$	E2
2762#	27548	(45^+)	24786	$43^{(+)}$	E2

† From 1997La13.
‡ From the measured DCO ratios, obtained by gating on intense stretched E2 transitions in band 1. Authors did not provide numerical values. Stretched quadrupole transitions are assumed to be E2, while the stretched-dipole, intra-band transitions are assumed to be E1.
# Placement of transition in the level scheme is uncertain.

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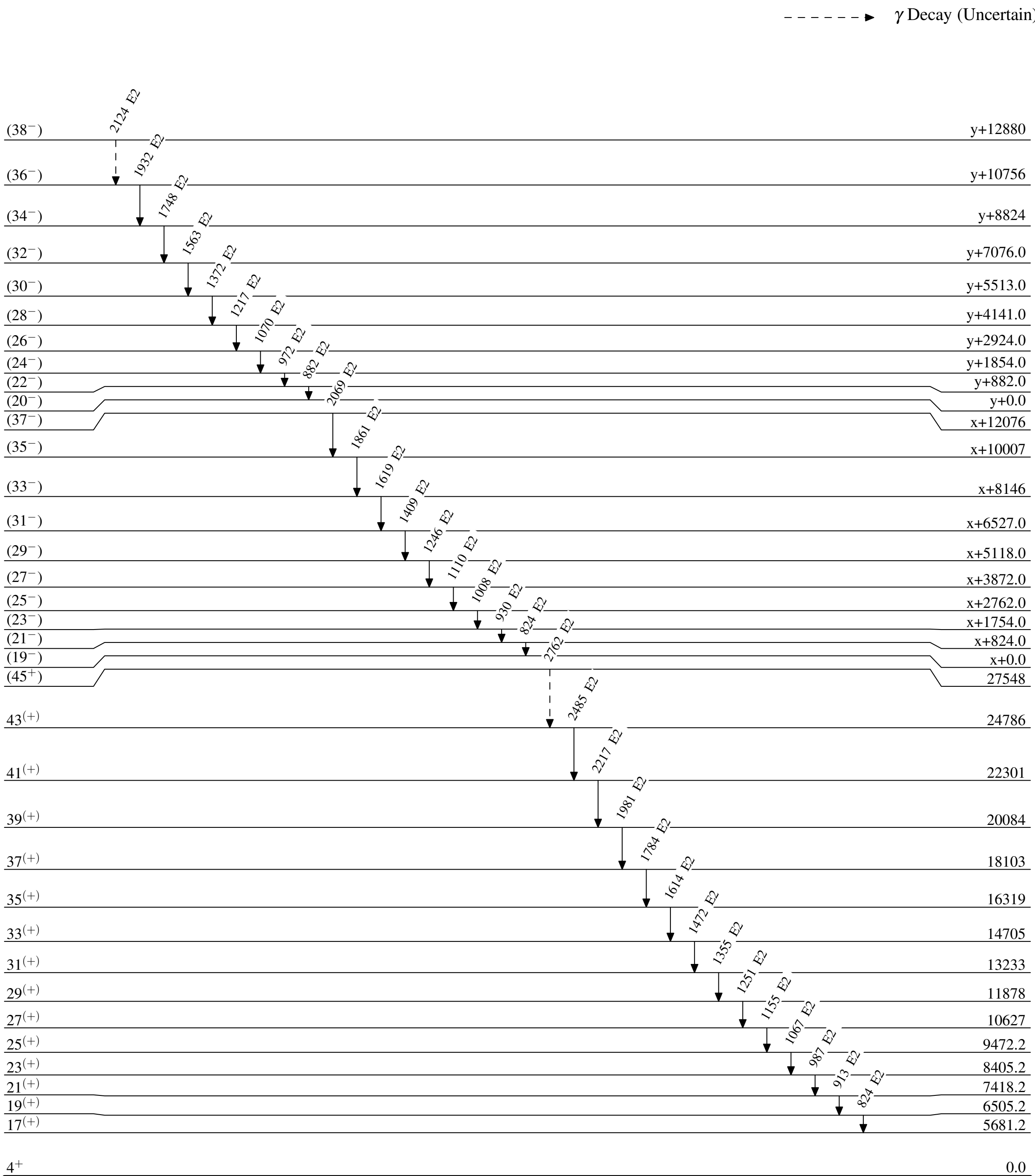
Level Scheme



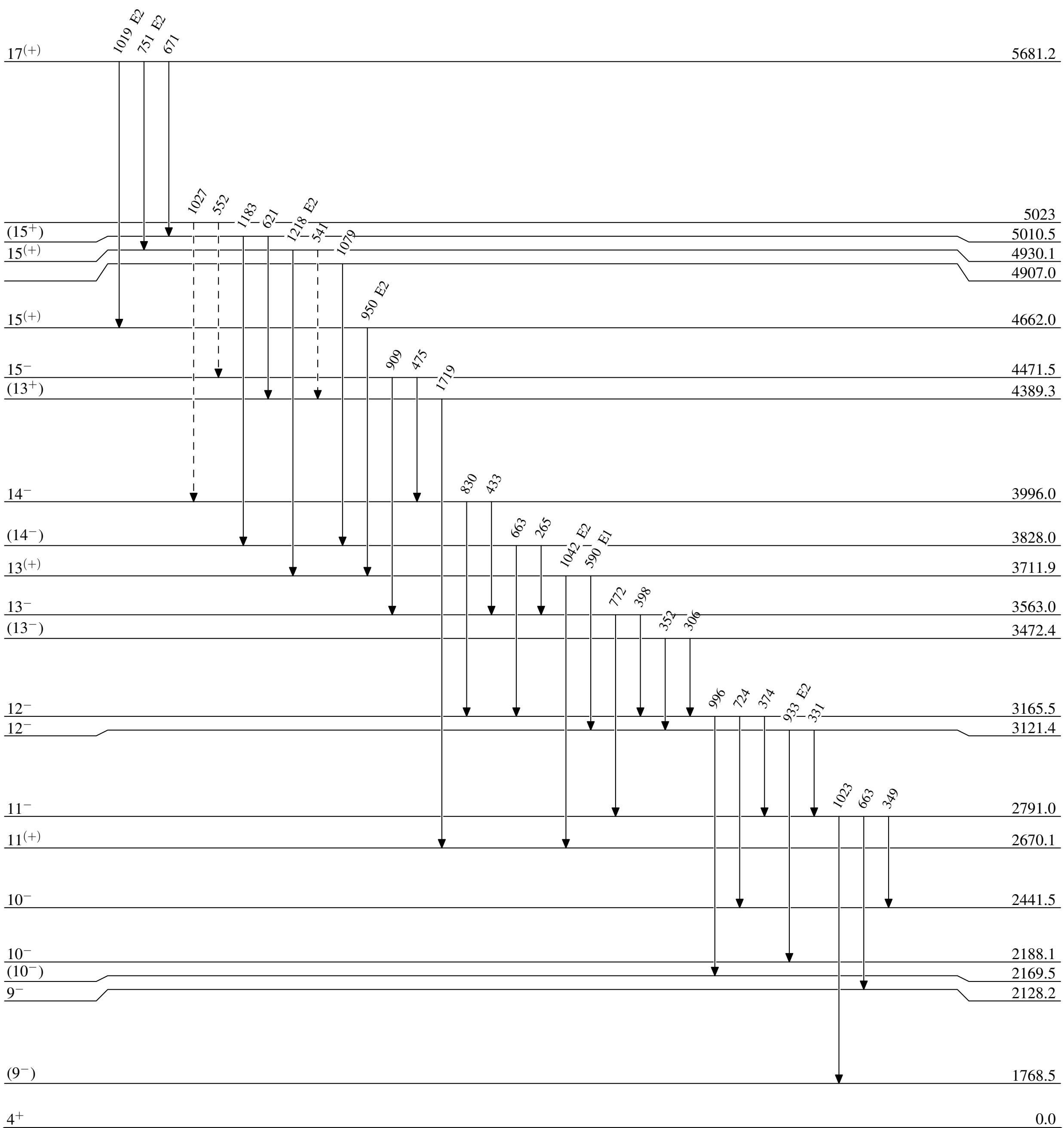
$^{110}_{51}Sb_{59}$

Legend

$^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn)$ 1997La13

Level Scheme (continued)

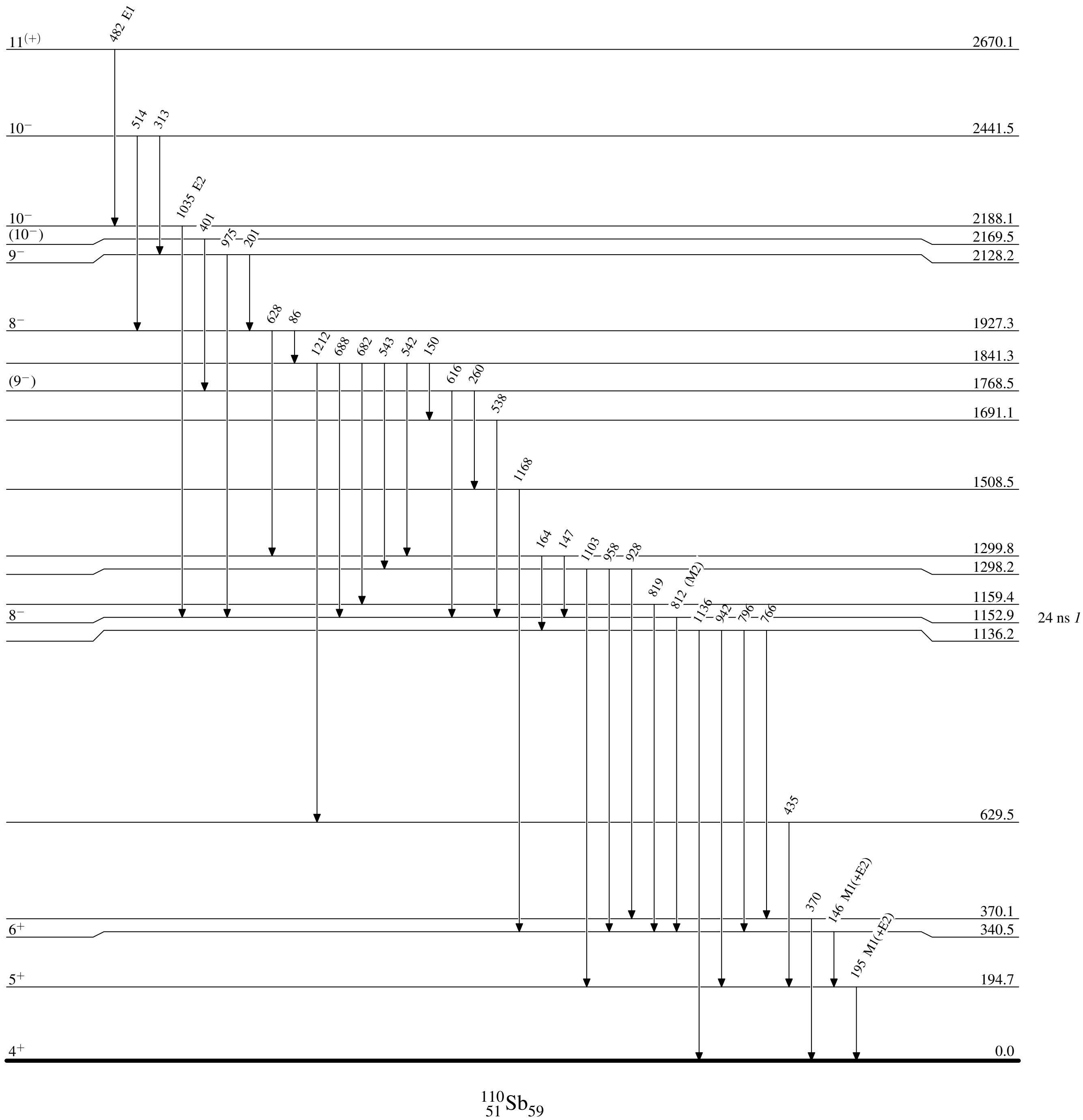
- - - - - - ► γ Decay (Uncertain)



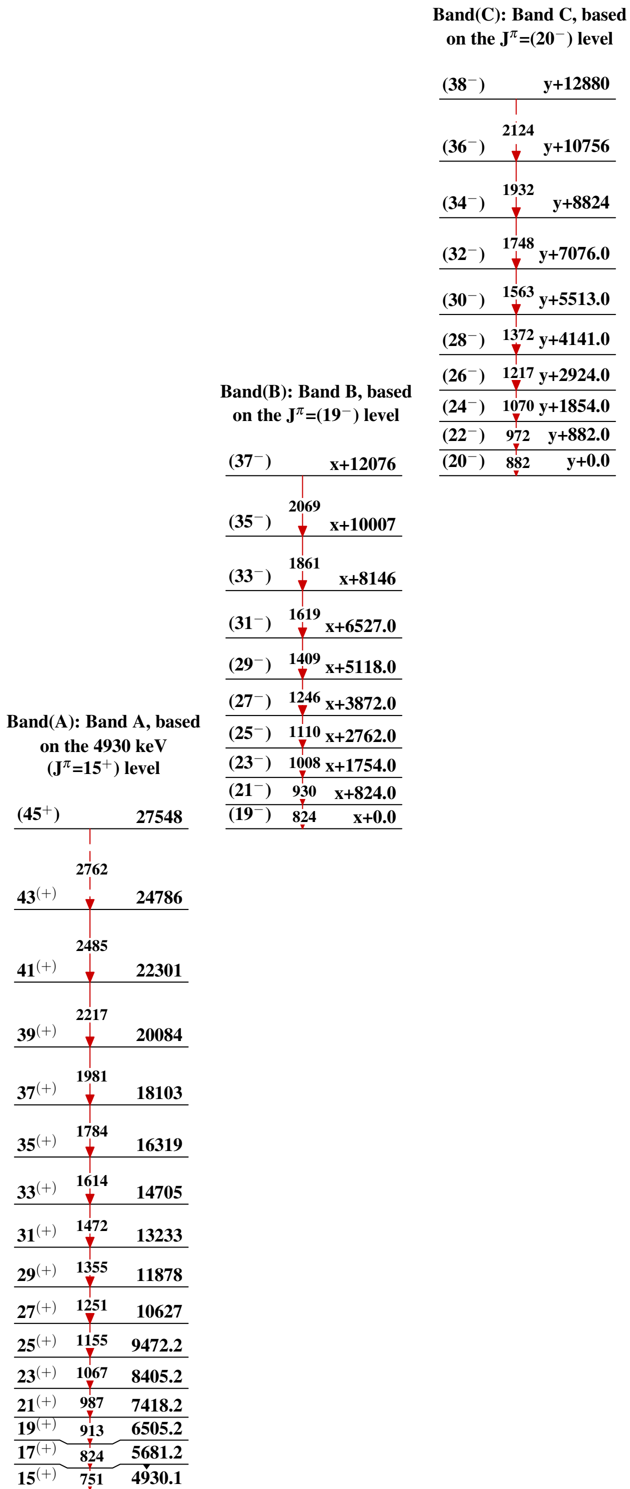
$^{110}_{51}Sb_{59}$

$^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn)$ 1997La13

Level Scheme (continued)



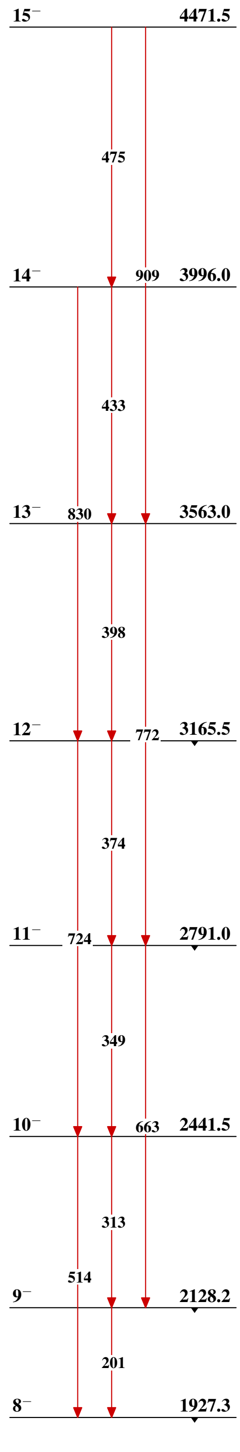
$^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn)$ 1997La13



$^{110}_{51}Sb_{59}$

$^{54}Fe(^{59}Co,2pn),^{56}Fe(^{58}Ni,3pn)$ 1997La13 (continued)

Band(D): Band D, based on the 1927 keV ($J^\pi=8^-$) level



$^{110}_{51}Sb_{59}$