^{99}Ru(n,γ) E=res 1982Co15,1974Ri03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 172, 1 (2021)	31-Jan-2021

J^π(^{99}Ru g.s.)=5/2$^+$ implies J^π(resonance states)=2$^+$, 3$^+$.

1982Co15: secondary γ-ray data for 10.05 eV, 25.2 eV, 57.1 eV, 81.6 eV and 198.9 eV resonances. Neutron beams were produced by photo-neutron and photo-fission reactions in a uranium target with electron beams from the electron linac of CBNM Euratom, Geel. Natural Ru target. Neutron energies were measured with a resolution of 0.5% by the time-of-flight technique. γ rays were detected with a Ge(Li) crystal. Measured Eγ, Iγ. Deduced levels.

1974Ri03: primary γ-ray data for 10.0 eV, 25.2 eV, 57.1 eV, and 81.6 eV resonances. Neutron beams were produced from the fast chopper facility of the High Flux Beam Reactor of BNL. Target was a sample of 150 g of natural Ru in powder form. γ rays were detected with a Ge(Li) detector. Measured Eγ, Iγ. Deduced levels.

^{100}Ru Levels

E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]
0.0	0$^+$	2527.4 *7*	5$^-$	3332.5 *23*		4256.6 *12*	
539.6 *5*	2$^+$	2570.3 *7*	(3)$^-$	3347.5 *14*		4273.5 *16*	
1130.4 *7*	0$^+$	2592.2 *7*	4$^-$	3376.6 *19*		4307.4 *10*	
1226.6 *7*	4$^+$	2667.2 *9*	(2,3)	3419.8 *20*	(2$^+$)	4335.9 *18*	
1362.3 *7*	2$^+$	2747.9 *5*		3460.4 *15*		4366.4 *18*	
1741.9 *7*	0$^+$	2764.5 *19*	2$^+$,3$^+$	3466.4 *8*	(1$^+$,2)	4376.1 *11*	
1865.3 *7*	2$^+$	2773.1 *21*		3730.3 *9*		4403.6 *12*	
1881.4 *5*	3$^+$	2802.5 *17*		3778.5 *23*		4519.5 *9*	
2053.0 *5*	0$^+$	2832.8 *17*		3875.7 *13*	2$^+$,3$^+$	4530 *3*	
2062.9 *5*	4$^+$	2877.4 *8*	2$^+$,3$^+$	3880.9 *8*		4543.7 *18*	
2075.9 *7*	6$^+$	2917.2 *8*	2$^-$	3972.3 *21*		4585.6 *12*	
2099.3 *5*	2$^+$	2982.8 *10*		3984.4 *8*		4601.2 *12*	
2167.0 *7*	3$^-$	3018.3 *8*		3999.1 *8*		4651.1 *20*	
2241.1 *7*	2$^+$	3058.1 *10*	(2,3,4)	4049.5 *12*		(S(n)+0.01005[‡])	3$^+$[&]
2351.5 *5*	4$^+$	3070.4 *11*	(1,2)$^-$	4091.5 *14*		(S(n)+0.0252[‡])	3$^+$[@]
2413.5 *5*		3110.5 *8*	(2$^+$,3$^+$)	4101.9 *11*		(S(n)+0.0571[‡])	3$^+$[@]
2469.4 *7*	2$^-$	3301.1 *23*	2$^+$,3$^+$	4149.1 *23*		(S(n)+0.0816[‡])	2$^+$[@]
2514.6 *25*	1$^-$	3325.9 *17*		4185.9 *23*		(S(n)+0.104[‡])	3$^+$[@]

[†] From least-squares fit to Eγ data, assuming Δ(Eγ)=0.5 keV for each of the secondary γ rays.
[‡] S(n)=9673.32 *3* (2017Wa10).
[#] From the Adopted Levels, unless otherwise stated.
[@] From 1968Co23.
[&] From 1982Co15.

γ(^{100}Ru)

E_i(level)	J_i^π	E_γ[†]	Population Ratio[‡#]	E_f	J_f^π	E_i(level)	J_i^π	E_γ[†]	Population Ratio[‡#]	E_f	J_f^π
539.6	2$^+$	539.6	1.29 *1*	0.0	0$^+$	1881.4	3$^+$	519.1	1.63 *7*	1362.3	2$^+$
1130.4	0$^+$	590.8	0.56 *2*	539.6	2$^+$			654.7	2.2 *6*	1226.6	4$^+$
1226.6	4$^+$	687.0	2.44 *7*	539.6	2$^+$			1341.8	1.9 *3*	539.6	2$^+$
1362.3	2$^+$	822.7	1.00 *8*	539.6	2$^+$	2053.0	0$^+$	1513.4	0.51 *20*	539.6	2$^+$
		1362.3	1.12 *11*	0.0	0$^+$	2062.9	4$^+$	700.5	2.2 *6*	1362.3	2$^+$
1741.9	0$^+$	1202.3	0.20 *12*	539.6	2$^+$			836.3	2.4 *3*	1226.6	4$^+$
1865.3	2$^+$	734.9	0.91 *4*	1130.4	0$^+$			1523.3	2.5 *12*	539.6	2$^+$
		1325.8	0.87 *6*	539.6	2$^+$	2075.9	6$^+$	849.3	15 *8*	1226.6	4$^+$
		1865.3	0.95 *20*	0.0	0$^+$	2099.3	2$^+$	736.5	0.59 *13*	1362.3	2$^+$

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^{99}Ru(n,γ) E=res 1982Co15,1974Ri03 (continued)

$\gamma(^{100}Ru)$ (continued)

E_i(level)	J_i^π	E_γ[†]	Population Ratio[‡#]	E_f	J_f^π
2099.3	2^+	1559.7	0.66 *15*	539.6	2^+
2167.0	3^-	1627.4	1.65 *21*	539.6	2^+
2241.1	2^+	1701.5	0.81 *6*	539.6	2^+
2351.5	4^+	1124.9	1.6 *5*	1226.6	4^+
		1811.9	1.3 *4*	539.6	2^+
2413.5		1873.9	1.0 *3*	539.6	2^+
2469.4	2^-	1107.1	1.01 *19*	1362.3	2^+
2527.4	5^-	1300.8	5 *2*	1226.6	4^+
2570.3	$(3)^-$	403.3	1.5 *2*	2167.0	3^-
		1208.0	1.4 *4*	1362.3	2^+
2592.2	4^-	425.2[&]	2.2 *6*	2167.0	3^-
		710.8	2.6 *3*	1881.4	3^+
		1365.3	2.5 *2*	1226.6	4^+
2747.9		1521.3	2.9 *15*	1226.6	4^+
(S(n)+0.01005)	3^+	5021.6 *18*		4651.1	
		5071.5 *10*		4601.2	
		5087.1 *10*		4585.6	
		5129.0 *16*		4543.7	
		5142.6 *28*		4530	
		5153.2 *7*		4519.5	
		5269.1 *10*		4403.6	
		5296.6 *9*		4376.1	
		5306.3 *16*		4366.4	
		5336.8 *16*		4335.9	
		5365.3 *8*		4307.4	
		5399.2 *14*		4273.5	
		5416.1 *10*		4256.6	
		5486.8 *21*		4185.9	
		5581.2 *12*		4091.5	
		5673.6 *5*		3999.1	
		5688.3 *5*		3984.4	
		5700.4 *19*		3972.3	
		5797.0 *11*		3875.7	$2^+,3^+$
		5894.2 *21*		3778.5	
		5942.4 *7*		3730.3	
		6206.3 *5*		3466.4	$(1^+,2)$
		6212.3 *13*		3460.4	
		6296.1 *17*		3376.6	
		6325.2 *12*		3347.5	
		6340.2 *21*		3332.5	
		6346.8 *15*		3325.9	
		6371.6 *21*		3301.1	$2^+,3^+$
		6562.2 *5*		3110.5	$(2^+,3^+)$
		6602.3 *9*		3070.4	$(1,2)^-$
		6654.4 *5*		3018.3	
		6689.9 *8*		2982.8	
		6795.3 *6*		2877.4	$2^+,3^+$
		6899.6 *19*		2773.1	
		7080.0 *4*		2592.2	4^-
		7102.7 *21*		2570.3	$(3)^-$
		7202.3 *12*		2469.4	2^-
		7504.5 *4*		2167.0	3^-
		7574.9 *5*		2099.3	2^+
		7611.0 *15*		2062.9	4^+
		7806.0 *10*		1865.3	2^+
		8308.5 *15*		1362.3	2^+

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^{99}Ru(n,γ) E=res 1982Co15,1974Ri03 (continued)

γ(^{100}Ru) (continued)

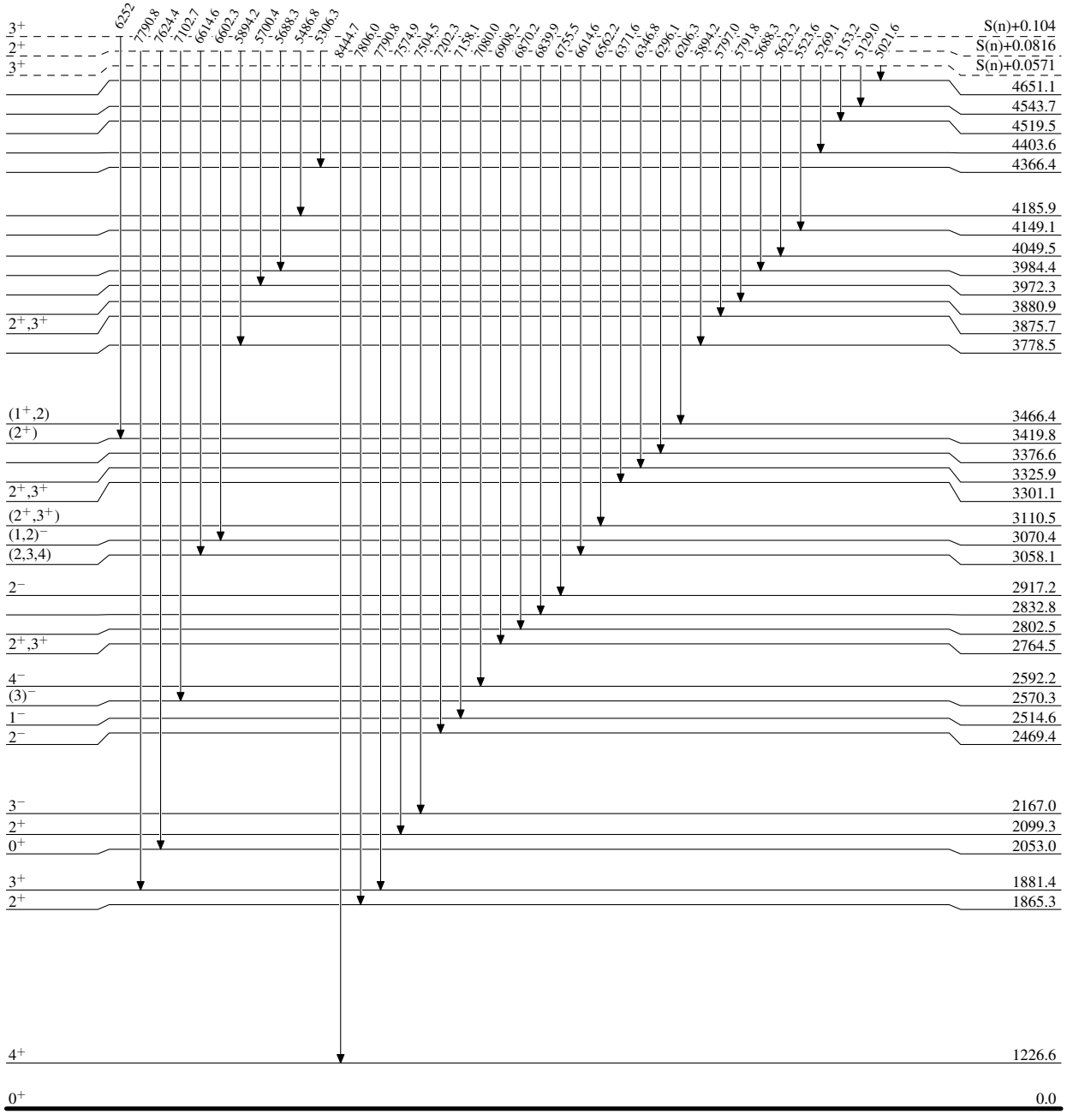
E_i(level)	J_i^π	E_γ †	E_f	J_f^π
(S(n)+0.01005)	3^+	8444.7 *5*	1226.6	4^+
(S(n)+0.0252)	3^+	5021.6 *18*	4651.1	
		5129.0 *16*	4543.7	
		5142.6 *28*	4530	
		5296.6 *9*	4376.1	
		5336.8 *16*	4335.9	
		5365.3 *8*	4307.4	
		5399.2 *14*	4273.5	
		5416.1 *10*	4256.6	
		5523.6 *22*	4149.1	
		5570.8 *9*	4101.9	
		5581.2 *12*	4091.5	
		5673.6 *5*	3999.1	
		5688.3 *5*	3984.4	
		5700.4 *19*	3972.3	
		5791.8 *5*	3880.9	
		5894.2 *21*	3778.5	
		5942.4 *7*	3730.3	
		6212.3 *13*	3460.4	
		6296.1 *17*	3376.6	
		6325.2 *12*	3347.5	
		6340.2 *21*	3332.5	
		6371.6 *21*	3301.1	$2^+,3^+$
		6562.2 *5*	3110.5	$(2^+,3^+)$
		6602.3 *9*	3070.4	$(1,2)^-$
		6689.9 *8*	2982.8	
		6755.5 *6*	2917.2	2^-
		6839.9 *15*	2832.8	
		6870.2 *15*	2802.5	
		6899.6 *19*	2773.1	
		6908.2 *17*	2764.5	$2^+,3^+$
		6925.5 *6*	2747.9	
		7005.5 *7*	2667.2	(2,3)
		7102.7 *21*	2570.3	$(3)^-$
		7158.1 *24*	2514.6	1^-
		7504.5 *4*	2167.0	3^-
		7574.9 *5*	2099.3	2^+
		7611.0 *15*	2062.9	4^+
		7624.4 *15*	2053.0	0^+
		7790.8 *5*	1881.4	3^+
		8308.5 *15*	1362.3	2^+
(S(n)+0.0252)	3^+	8447.7 *5*	1226.6	4^+
		9135.9 *13*	539.6	2^+
(S(n)+0.0571)	3^+	5021.6 *18*	4651.1	
		5129.0 *16*	4543.7	
		5153.2 *7*	4519.5	
		5269.1 *10*	4403.6	
		5523.6 *22*	4149.1	
		5623.2 *10*	4049.5	
		5688.3 *5*	3984.4	
		5791.8 *5*	3880.9	
		5797.0 *11*	3875.7	$2^+,3^+$
		5894.2 *21*	3778.5	
		6206.3 *5*	3466.4	$(1^+,2)$
		6296.1 *17*	3376.6	
		6346.8 *15*	3325.9	
		6371.6 *21*	3301.1	$2^+,3^+$
		6562.2 *5*	3110.5	$(2^+,3^+)$
		6614.6 *8*	3058.1	(2,3,4)
		6755.5 *6*	2917.2	2^-
		6839.9 *15*	2832.8	
		6870.2 *15*	2802.5	
		6908.2 *17*	2764.5	$2^+,3^+$
		7080.0 *4*	2592.2	4^-
		7158.1 *24*	2514.6	1^-
		7202.3 *12*	2469.4	2^-
		7504.5 *4*	2167.0	3^-
		7574.9 *5*	2099.3	2^+
		7790.8 *5*	1881.4	3^+
		7806.0 *10*	1865.3	2^+
		8444.7 *5*	1226.6	4^+
(S(n)+0.0816)	2^+	5306.3 *16*	4366.4	
		5486.8 *21*	4185.9	
		5688.3 *5*	3984.4	
		5700.4 *19*	3972.3	
		5894.2 *21*	3778.5	
		6602.3 *9*	3070.4	$(1,2)^-$
		6614.6 *8*	3058.1	(2,3,4)
		7102.7 *21*	2570.3	$(3)^-$
		7624.4 *15*	2053.0	0^+
		7790.8 *5*	1881.4	3^+
(S(n)+0.104)	3^+	6252 *2*	3419.8	(2^+)

† Secondary γ rays are from 1982Co15 and primary γ rays are from 1974Ri03.
‡ For secondary γ rays, relative population (1982Co15) is given. For primary transitions see 1974Ri03 for partial widths.
# population ratio R=(population from 3^+ resonances)/(population from 2^+ resonances) (1982Co15).
@ A 1535.6 *5* γ from a 2075 level is reported in ^{100}Rh ε decay (4.6 min), but 2000Ge01 point out that a γ ray close to this energy in (α,2nγ) experiment shows coincidence in 687.0γ gate, suggesting that 1536γ may be from a level near 2762 keV.
& Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

^{99}Ru(n,γ) E=res 1982Co15,1974Ri03

Level Scheme

Intensities: Population ratio=Iγ(from 3^+)/Iγ(from 2^+)

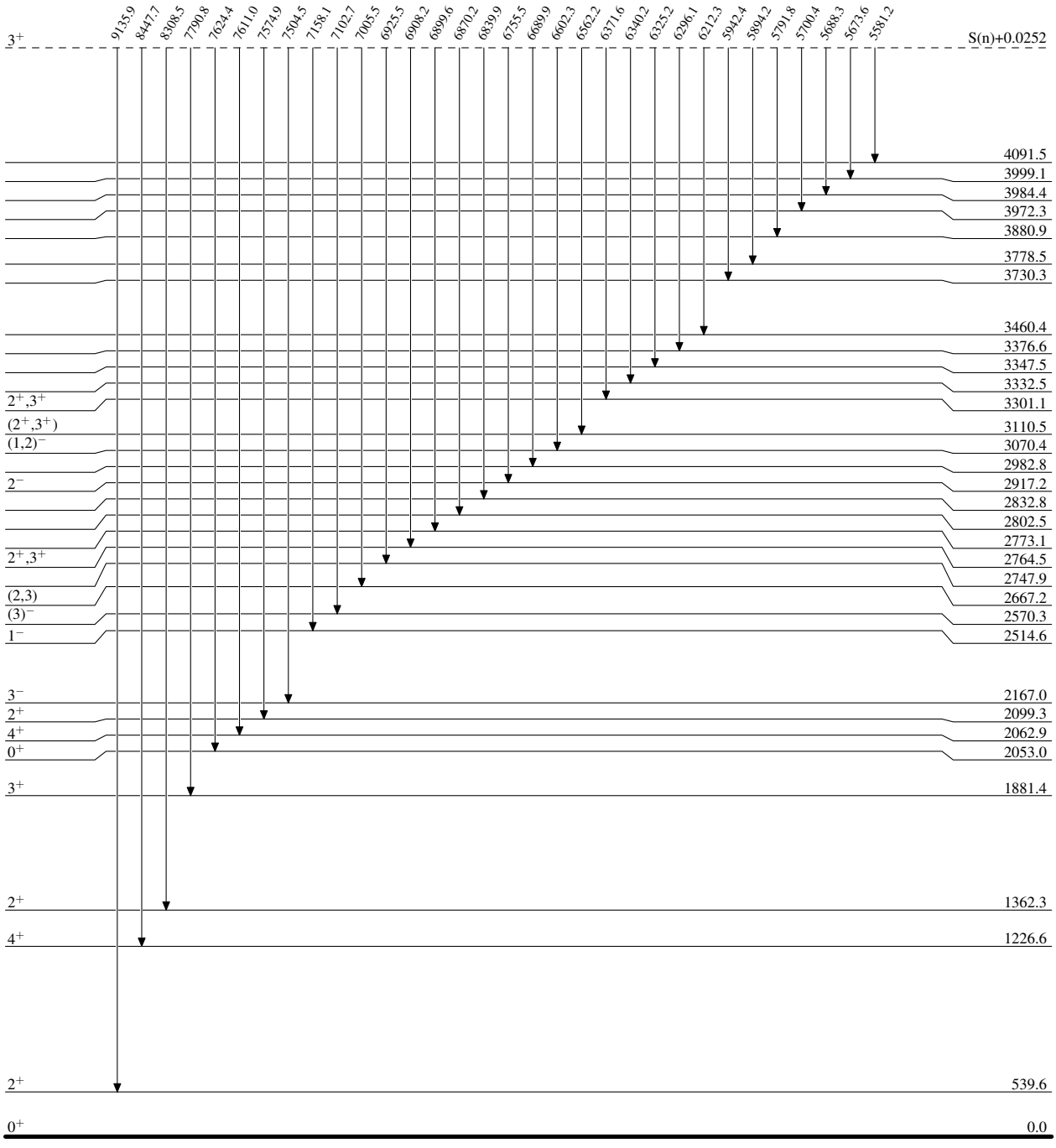


$^{100}_{44}Ru_{56}$

^{99}Ru(n,γ) E=res 1982Co15,1974Ri03

Level Scheme (continued)

Intensities: Population ratio=Iγ(from 3^+)/Iγ(from 2^+)

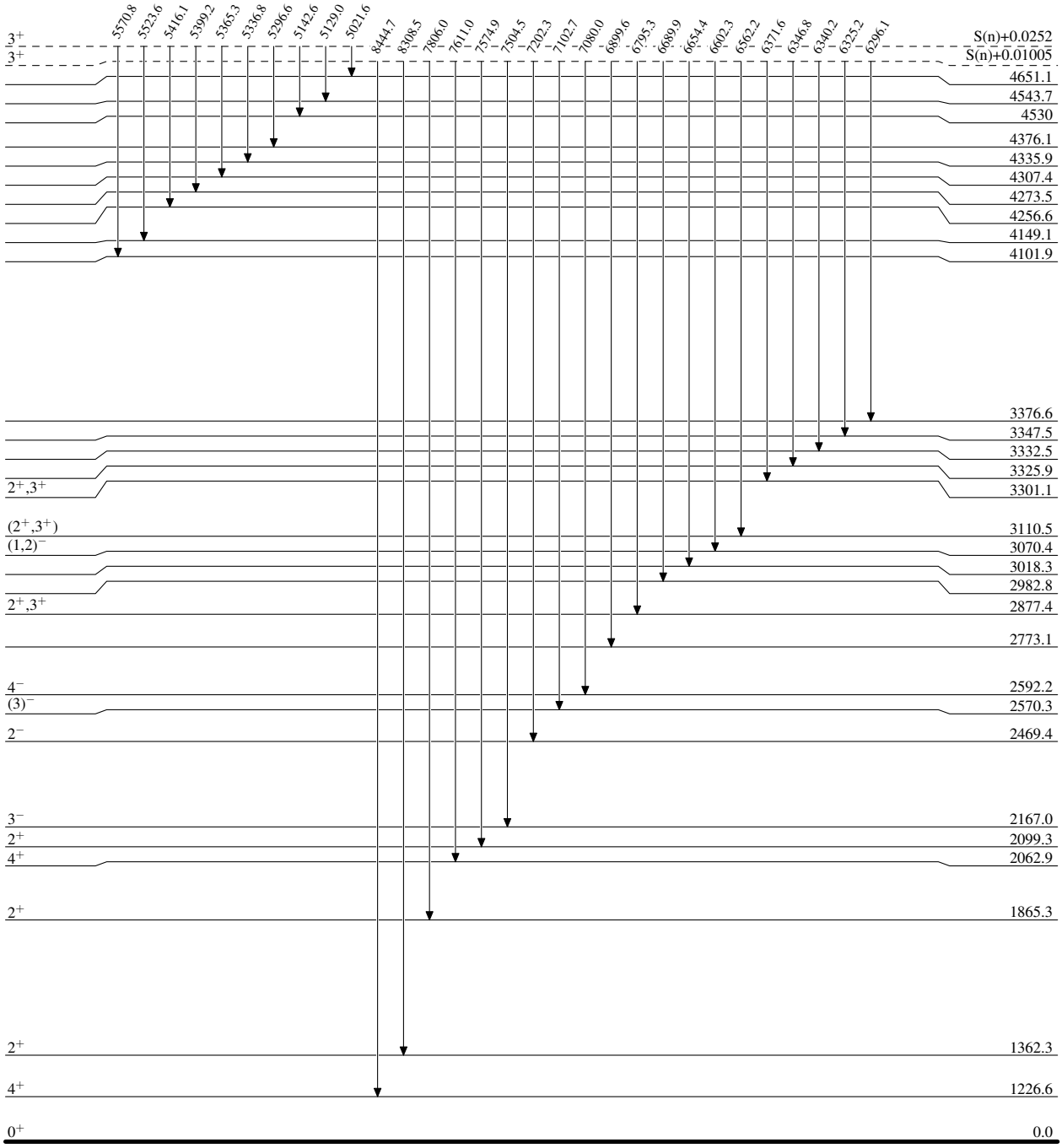


$^{100}_{44}Ru_{56}$

^{99}Ru(n,γ) E=res 1982Co15,1974Ri03

Level Scheme (continued)

Intensities: Population ratio=Iγ(from 3^+)/Iγ(from 2^+)



$^{100}_{44}Ru_{56}$

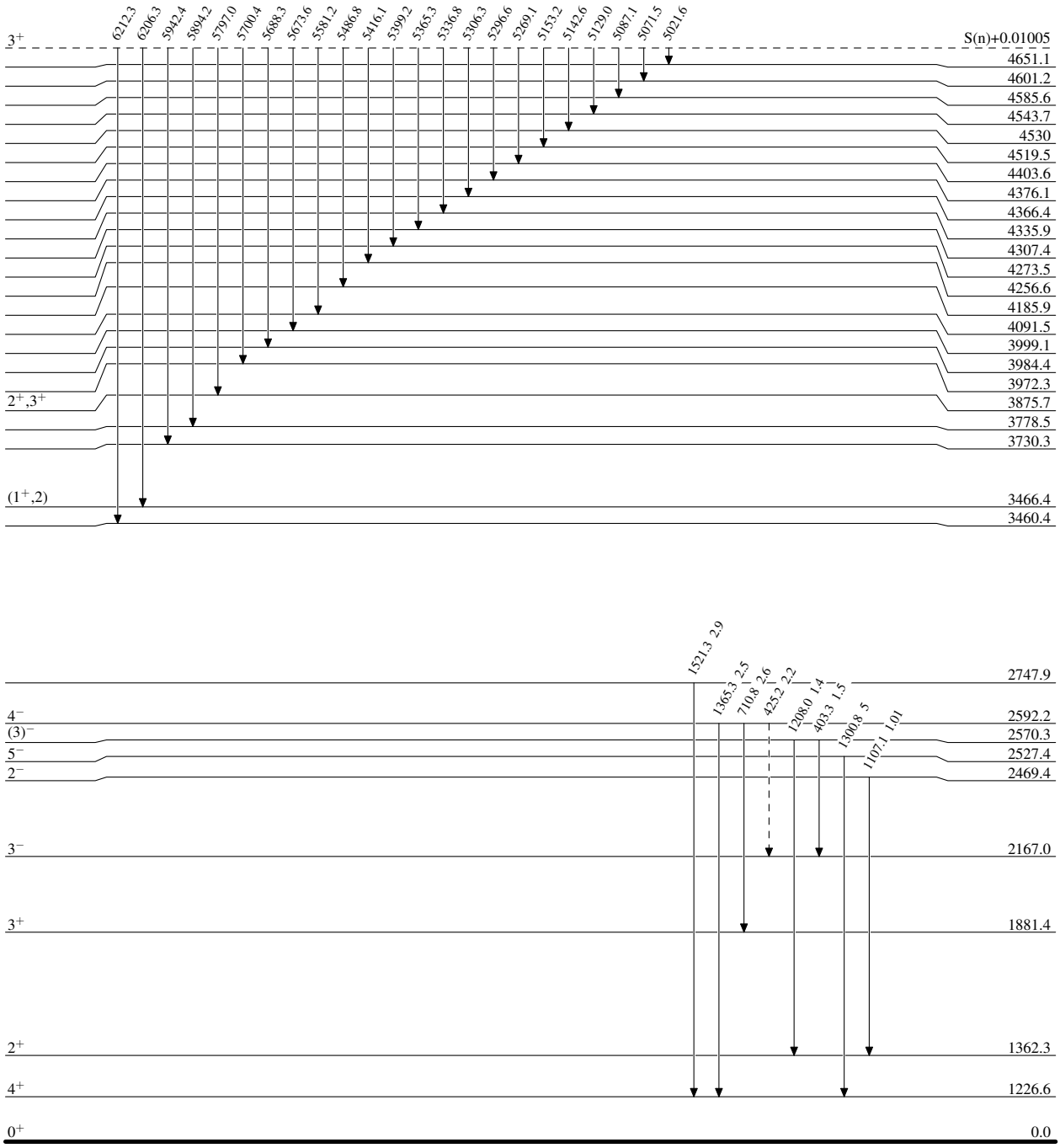
^{99}Ru(n,γ) E=res 1982Co15,1974Ri03

Legend

Level Scheme (continued)

Intensities: Population ratio=Iγ(from 3^+)/Iγ(from 2^+)

γ Decay (Uncertain)

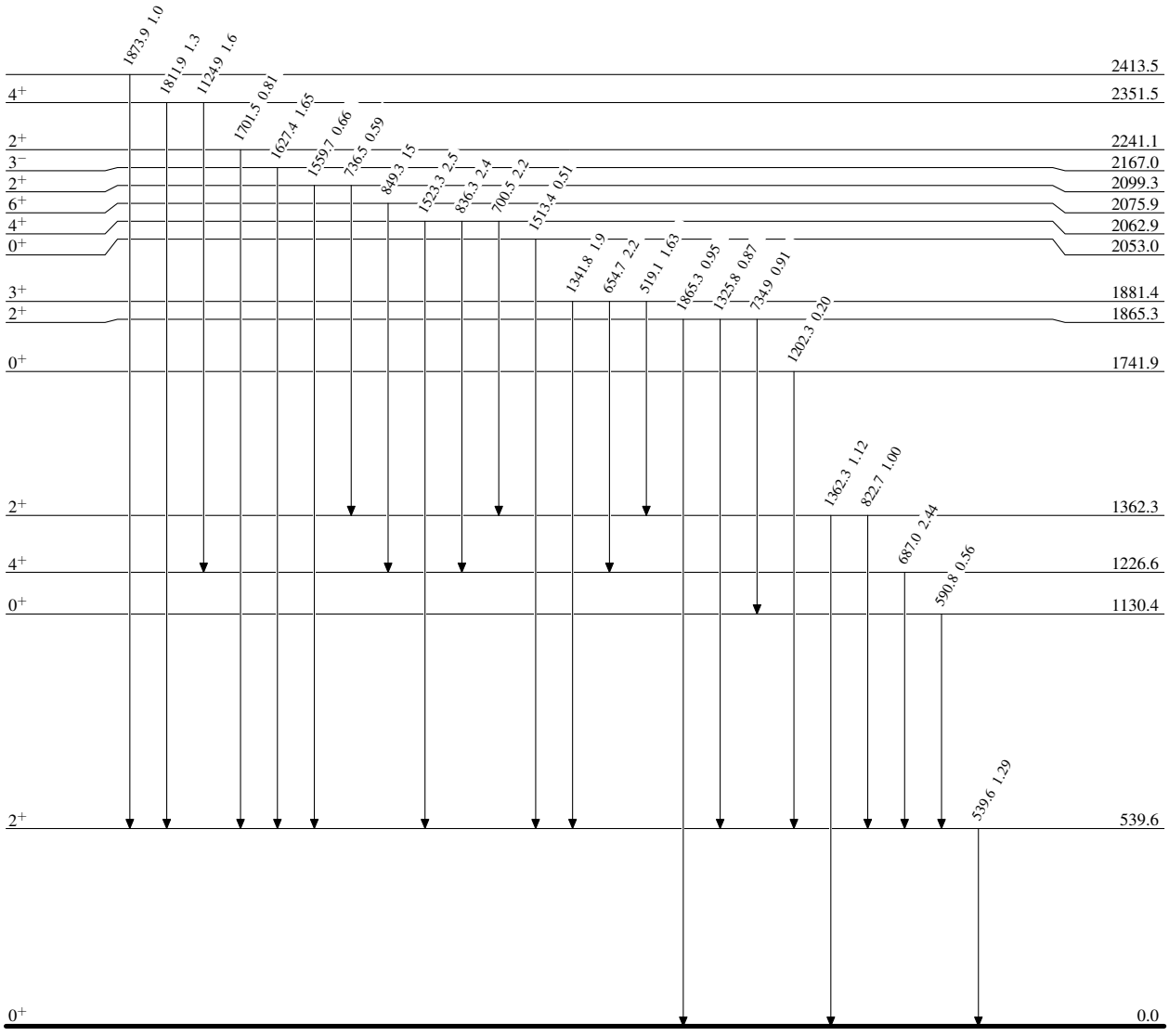


$^{100}_{44}Ru_{56}$

^{99}Ru(n,γ) E=res 1982Co15,1974Ri03

Level Scheme (continued)

Intensities: Population ratio=Iγ(from 3^+)/Iγ(from 2^+)



$^{100}_{44}Ru_{56}$