^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 151, 1 (2018)	1-Apr-2018

Others: 1956Tr33, 1961Tr03, 1961Ve03, 1962Mi10, 1964Co13, 1966Ab03, 1967Ba79, 1967Bo13, 1968Bo12, 1971Kn06, 1975HoYT, 1975Wi06, 1977Is01, 1972St06, 1992Ku17, 1997Ve03.

2004Ra23: 99.93% enriched ^{58}Ni target; Projectile: neutron, E=Thermal. Measured Eγ, Iγ, $\gamma\gamma$ with a coaxial intrinsic Ge detector positioned inside a NaI(Tl) annulus. This Ge detector was operated either in the Compton-suppressed mode or in the pair-spectrometer mode. Deduced S(n)=8999.28 *5*.

1993Ha05: 99.8% enriched ^{58}Ni target; Compton suppressed Ge(Li)+NaI pair spectrometer; measured Eγ, absolute Iγ (^{36}Cl standard), deduced S(n)=8999.15 *23*.

1991Ul01,1992Ku17: Deduced $T_{1/2}$ from Doppler shift of secondary γ emitted by nucleus recoiling after emission of primary γ (GRID method); natural Ni target. 1992Ku17 reanalyzed selected data from 1991Ul01 using molecular dynamic simulation for slowing of recoils and demonstrated consistency of $T_{1/2}$ from such an analysis with $T_{1/2}$ from DSAM.

1977Is01: Measured Eγ, Eγ>1900, Iγ, semi-scin pair spectrometer, natural (68% ^{58}Ni) target and enriched ^{60}Ni, ^{62}Ni and ^{64}Ni targets for comparison.

1975HoYT: Measured Eγ, %Iγ; semi, pair spectrometer, 99.9% ^{58}Ni target.

Circular polarization data:

1972St06: Measured circular polarization of primary γ-transitions, semi, natural Ni target.

Other polarized n data: 1971Kn06, 1962Mi10, 1961Ve03.

The level scheme of this dataset is from 2004Ra23. Nearly three-fourths of the observed 414 γ rays, have been incorporated into the level scheme consisting of 65 bound levels. 41 levels reported in 1993Ha05 are confirmed in 2004Ra23, except 3858.26 and 5994.17 keV levels.

^{59}Ni Levels

E(level)[#]	J$^\pi$[@]	$T_{1/2}$[&]	Comments
0.0	3/2$^-$		
339.417 *12*	5/2$^-$		J$^\pi$: From Adopted Levels. 3/2$^-$ in table IV of 2004Ra23 seems a misprint.
464.937[†] *15*	1/2$^-$		J$^\pi$: 8534γ-465$\gamma(\theta)$ isotropic to within 1.5% (1964Co13), favoring J=1/2.
877.967[‡] *14*	3/2$^-$	0.43 ps *+62−24*	J$^\pi$: 8122γ-878$\gamma(\theta)$ is anisotropic (A_2=−0.210 *25*) (1964Co13), indicating J ≠ 1/2.
1188.791 *16*	5/2$^-$	0.14 ps *+6−4*	
1301.436[‡] *15*	1/2$^-$	0.14 ps *+6−4*	J$^\pi$: assignment supported by $\gamma\gamma(\theta)$ (1964Co13).
1337.91[†] *3*	7/2$^-$		
1679.695[‡] *21*	5/2$^-$		
1734.701[‡] *17*	3/2$^-$		
1948.32[‡] *17*	7/2$^-$		
2414.899[‡] *17*	3/2$^-$	38 fs *6*	
2421.95[†] *6*			
2627.03[†] *8*	7/2$^-$		
2679.58[‡] *14*	(5/2$^-$)		
2715.04[‡] *11*			
2893.558[‡] *22*	3/2$^{(-)}$	30 fs *6*	
3025.774[‡] *24*	(1/2$^-$,3/2$^-$)		
3126.12[‡] *17*			
3181.574[‡] *17*	3/2$^{(-)}$	26 fs *3*	J$^\pi$: less precise CP(γ) data of 1971Kn06 indicate J=1/2.
3343.21 *6*			
3377.28[‡] *5*			
3413.52 *15*			J$^\pi$: In 2004Ra23 J$^\pi$=1/2$^+$ proposed based on evaluation of literature data.

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

^{59}Ni Levels (continued)

E(level)[#]	Jπ[@]	$T_{1/2}$[&]	Comments
			Arguments not given.
3452.43 *5*	3/2−		
3540.10 *6*			
3562.99[‡] *3*	1/2−,3/2−		
3686.124[‡] *22*	(3/2)+		
3730.26 *3*	(3/2)−		
3853.69[‡] *4*	3/2−		
3889.74 *6*			
4021.93[†] *5*	1/2−,3/2−		
4140.247 *23*	3/2−	4.5 fs *10*	
4252.88[†] *5*	(1/2−,3/2−)		
4352.45 *6*			
4494.19 *12*	5/2+		
4532.8[†] *3*			
4715.34[†] *4*	(3/2)−		
4782.90 *17*			Jπ: In 2004Ra23 Jπ=(3/2)+ proposed based on evaluation of literature data. Arguments not given.
4949.15[‡] *5*	(1/2−,3/2−)		
4968.90 *3*	1/2−,3/2−		
5069.05[†] *4*	1/2−,3/2−		
5131.93 *18*			Jπ: In 2004Ra23 Jπ=1/2+ proposed based on evaluation of literature data. Arguments not given.
5384.73 *5*	3/2+		
5443.87[†] *13*	3/2+,5/2+		
5494.22[†] *11*			
5617.31[†] *5*	1/2−,3/2−		
5632.13[†] *4*			
5676.86[‡] *18*	1/2+		
5702.39 *5*			
5754.60[†] *6*	1/2−,3/2−		
5808.79 *8*			
5957.31[†] *6*			
6030.57[†] *4*	(1/2−,3/2−)		
6101.59[†] *9*			
6106.82[‡] *11*			
6141.66[‡] *5*	1/2−,3/2−		
6183.67[†] *14*			
6279.86[†] *7*			
6431.33[†] *9*			
6498.28[‡] *16*			
6562.15[†] *6*			
6598.36 *5*			
6873.63 *7*			
6948.40 *15*	1/2+		
7187.21 *14*			
7270.54 *6*			
(8999.267 *15*)	1/2+		E(level): S(n)=8999.28 *5* (2017Wa10).

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

^{59}Ni Levels (continued)

† Intensity imbalance [I_γ(in)-I_γ(out)] at this level is positive.
‡ Intensity imbalance [I_γ(in)-I_γ(out)] at this level is negative.
# From least-squares fit to Eγ's.
@ Proposed by 2004Ra23, based on γ ray decay of the present work and data in the literature. Other arguments/suggestions are listed as comments.
& From γ-ray induced Doppler-broadening technique (GRID); $T_{1/2}$ values quoted in 1991Ul01 have been revised based on analysis method of 1992Ku17 which uses a more realistic description of slowing down of low velocity recoil nuclei. $T_{1/2}$ for 2894, 3182, 4140 levels are from the reanalysis by 1992Ku17 of data from 1991Ul01; other values are deduced by the evaluator by scaling $T_{1/2}$ in 1991Ul01 by a factor of 0.69 (as shown in 1992Ku17 to be appropriate).

γ(^{59}Ni)

Iγ normalization: From Σ Iγ to g.s.=100, i.e. 100/σ, where σ=4.13 b *5* (2004Ra23). Cross section should be considered as a lower limit, due to undetected γ rays and incomplete decay scheme, noted in 2004Ra23.

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
310.78 *4*	3.02 *7*	1188.791	5/2$^-$	877.967	3/2$^-$	
339.418‡ *15*	221 *5*	339.417	5/2$^-$	0.0	3/2$^-$	E_γ: Other 339.37 *3* (2004Ra23).
412.96 *9*	0.64 *6*	877.967	3/2$^-$	464.937	1/2$^-$	
423.465‡ *19*	13.7 *14*	1301.436	1/2$^-$	877.967	3/2$^-$	
450.0 *3*	0.28 *5*	3343.21		2893.558	3/2$^{(-)}$	
x451.58 *14*	0.34 *5*					
x454.77 *10*	0.40 *4*					
464.94 *3*	1126 *28*	464.937	1/2$^-$	0.0	3/2$^-$	
538.54 *4*	4.47 *6*	877.967	3/2$^-$	339.417	5/2$^-$	
545.87 *5*	4.47 *7*	1734.701	3/2$^-$	1188.791	5/2$^-$	
x609.2 *3*	0.16 *4*					
x712.75‡ *7*						E_γ: In 1993Ha05, placement from 4253.02 keV level. γ-ray not reported in 2004Ra23.
723.93 *7*	1.02 *6*	1188.791	5/2$^-$	464.937	1/2$^-$	
x731.85 *20*	0.31 *5*					
735.2 *4*	0.15 *5*	2414.899	3/2$^-$	1679.695	5/2$^-$	
759.3 *3*	0.23 *5*	1948.32	7/2$^-$	1188.791	5/2$^-$	
766.65 *4*	3.58 *8*	3181.574	3/2$^{(-)}$	2414.899	3/2$^-$	
797.03 *6*	0.97 *5*	4140.247	3/2$^-$	3343.21		
801.78 *15*	0.34 *4*	1679.695	5/2$^-$	877.967	3/2$^-$	
816.3 *5*	0.29 *5*	5069.05	1/2$^-$,3/2$^-$	4252.88	(1/2$^-$,3/2$^-$)	
x818.1 *7*	0.12 *5*					
x822.6 *3*	0.21 *5*					
828.2 *3*	0.16 *5*	3853.69	3/2$^-$	3025.774	(1/2$^-$,3/2$^-$)	E_γ: Weighted average of 827.9 *5* (2004Ra23) and 828.3 *3* (1993Ha05).
836.48 *3*	12.0 *13*	1301.436	1/2$^-$	464.937	1/2$^-$	
840.8 *3*	0.35 *6*	4021.93	1/2$^-$,3/2$^-$	3181.574	3/2$^{(-)}$	E_γ: Weighted average of 840.6 *3* (2004Ra23) and 841.0 *3* (1993Ha05).
x843.57‡ *17*						E_γ: In 1993Ha05, placement from 6598.19 keV level. γ-ray not reported in 2004Ra23.
849.36 *4*	3.4 *8*	1188.791	5/2$^-$	339.417	5/2$^-$	
877.94 *3*	325 *3*	877.967	3/2$^-$	0.0	3/2$^-$	
962.00 *19*	0.34 *5*	1301.436	1/2$^-$	339.417	5/2$^-$	
998.50 *3*	3.65 *8*	1337.91	7/2$^-$	339.417	5/2$^-$	
1006.3 *4*	0.22 *5*	3686.124	(3/2)$^+$	2679.58	(5/2$^-$)	
1008.9 *4*	0.22 *5*	4352.45		3343.21		

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
x1031.5 *3*	0.34 *6*					
x1045.76 *18*	0.59 *6*					
x1048.8 *3*	0.38 *6*					
1051.0 *6*	0.18 *6*	3730.26	(3/2)$^-$	2679.58	(5/2$^-$)	
x1078.27 *10*	0.87 *6*					
1103.2 *4*	0.22 *5*	3730.26	(3/2)$^-$	2627.03	7/2$^-$	
1113.38 *6*	2.25 *7*	2414.899	3/2$^-$	1301.436	1/2$^-$	E_γ: In 1993Ha05, a comparable 1114.0 *3* γ − placed from 4140.34 level.
x1132.21‡ *16*						E_γ: In 1993Ha05, placement from 6101.41 keV level. γ-ray not reported in 2004Ra23.
1147.98 *10*	0.64 *5*	3562.99	1/2$^-$,3/2$^-$	2414.899	3/2$^-$	
x1156.1 *5*	0.16 *4*					
1158.6 *3*	0.26 *5*	2893.558	3/2$^{(-)}$	1734.701	3/2$^-$	
x1163.5 *3*	0.38 *8*					
1188.77 *3*	76.9 *8*	1188.791	5/2$^-$	0.0	3/2$^-$	
1210.5 *4*	0.37 *8*	3889.74		2679.58	(5/2$^-$)	E_γ: In 1993Ha05, a comparable 1210.2 *5* placed from 5069.01 level.
1213.92‡ *5*	2.95 *18*	2893.558	3/2$^{(-)}$	1679.695	5/2$^-$	E_γ: Other: 1213.81 *9* (2004Ra23).
1214.7 *4*	0.42 *15*	1679.695	5/2$^-$	464.937	1/2$^-$	
1226.08 *3*	17.9 *3*	2414.899	3/2$^-$	1188.791	5/2$^-$	
x1256.49 *18*	0.55 *7*					
1264.18 *20*	0.82 *9*	3686.124	(3/2)$^+$	2421.95		
1269.74 *3*	4.16 *8*	1734.701	3/2$^-$	464.937	1/2$^-$	
x1274.5 *7*	0.28 *9*					
1275.9 *4*	0.52 *13*	5808.79		4532.8		
1301.44 *3*	76.6 *8*	1301.436	1/2$^-$	0.0	3/2$^-$	
1337.87 *5*	1.68 *12*	1337.91	7/2$^-$	0.0	3/2$^-$	
1340.28 *3*	27.3 *3*	1679.695	5/2$^-$	339.417	5/2$^-$	
x1362.80‡ *6*						E_γ: In 1993Ha05, placement from 5384.71 keV level. γ-ray not reported in 2004Ra23.
1379.00 *13*	0.50 *5*	5632.13		4252.88	(1/2$^-$,3/2$^-$)	E_γ: Weighted average of 1379.40 *19* (2004Ra23) and 1378.96 *6* (1993Ha05).
x1382.1 *3*	0.32 *6*					
x1386.8‡ *3*						E_γ: In 1993Ha05, placement from 6101.73 keV level. γ-ray not reported in 2004Ra23.
1386.8 *3*	0.31 *6*	6101.59		4715.34	(3/2)$^-$	
1395.27 *3*	6.68 *10*	1734.701	3/2$^-$	339.417	5/2$^-$	
1405.7 *8*	0.17 *7*	4968.90	1/2$^-$,3/2$^-$	3562.99	1/2$^-$,3/2$^-$	E_γ: alternative placement: 4782−>3377 transition.
x1414.2 *6*	0.19 *7*					
x1434.12 *16*	0.76 *7*					
1438.58 *10*	2.03 *8*	3853.69	3/2$^-$	2414.899	3/2$^-$	
1446.85 *4*	14.86 *16*	3181.574	3/2$^{(-)}$	1734.701	3/2$^-$	
x1449.0 *4*	0.48 *9*					
1474.81 *9*	1.38 *7*	3889.74		2414.899	3/2$^-$	
1490.6 *3*	0.67 *11*	2679.58	(5/2$^-$)	1188.791	5/2$^-$	
1492.3 *4*	0.48 *11*	5632.13		4140.247	3/2$^-$	
x1496.2 *4*	0.27 *6*					
1501.84 *3*	21.23 *22*	3181.574	3/2$^{(-)}$	1679.695	5/2$^-$	
1513.0 *4*	0.31 *6*	4140.247	3/2$^-$	2627.03	7/2$^-$	
1536.90 *3*	27.3 *4*	2414.899	3/2$^-$	877.967	3/2$^-$	
x1539.5 *3*	0.58 *8*					
x1545.54 *11*	0.96 *6*					
1555.8 *3*	0.59 *9*	2893.558	3/2$^{(-)}$	1337.91	7/2$^-$	E_γ: alternative placement: 5808−>4252 transition.
x1557.7 *7*	0.21 *8*					

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

$\gamma(^{59}Ni)$ (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
x1567.5 *6*	0.18 *6*					E_γ: In 1993Ha05, a comparable 1568.48 *26* γ placed from 7270.4 keV level.
1572.1 *5*	0.23 *7*	4949.15	$(1/2^-,3/2^-)$	3377.28		
1592.06 *8*	1.58 *8*	2893.558	$3/2^{(-)}$	1301.436	$1/2^-$	
x1595.2‡ *6*						E_γ: In 1993Ha05, placement from 5617.22 keV level. γ-ray not reported in 2004Ra23.
1599.8 *6*	0.22 *6*	4021.93	$1/2^-,3/2^-$	2421.95		
x1605.0‡ *3*						E_γ: In 1993Ha05, placement from 5957.26 level. γ-ray not reported in 2004Ra23.
1607.07 *16*	1.21 *10*	4021.93	$1/2^-,3/2^-$	2414.899	$3/2^-$	
1609.0 *3*	0.89 *11*	1948.32	$7/2^-$	339.417	$5/2^-$	E_γ: alternative placement: 6141−>4532 transition.
x1613.8 *4*	0.35 *6*					
x1615.2‡ *6*						E_γ: In 1993Ha05, multiple placement from 3452.41 and 4140.34 keV levels. γ-ray not reported in 2004Ra23.
1616.1 *9*	0.29 *7*	5069.05	$1/2^-,3/2^-$	3452.43	$3/2^-$	E_γ: Unweighted average of 1617.0 *5* (2004Ra23) and 1615.2 *6* (1993Ha05).
x1623.49 *13*	0.93 *7*					
1663.7 *8*	0.22 *9*	3343.21		1679.695	$5/2^-$	
x1665.8 *3*	0.55 *9*					
1679.59‡ *7*	4.3 *4*	1679.695	$5/2^-$	0.0	$3/2^-$	E_γ: Other: 1679.73 *14* (2004Ra23).
1688.00 *14*	1.08 *9*	3025.774	$(1/2^-,3/2^-)$	1337.91	$7/2^-$	
x1695.64 *25*	0.78 *11*					
1704.78 *9*	4.30 *13*	2893.558	$3/2^{(-)}$	1188.791	$5/2^-$	E_γ: Weighted average of 1704.67 *6* (2004Ra23) and 1704.86 *5* (1993Ha05).
1717.65 *21*	0.95 *11*	3452.43	$3/2^-$	1734.701	$3/2^-$	
1724.17 *12*	7.43 *9*	3025.774	$(1/2^-,3/2^-)$	1301.436	$1/2^-$	
1725.33 *21*	4.0 *8*	4140.247	$3/2^-$	2414.899	$3/2^-$	E_γ: alternative placement: 4352−>2627 transition.
1728.71 *7*	3.78 *13*	(8999.267)	$1/2^+$	7270.54		
1734.70 *3*	24.0 *3*	1734.701	$3/2^-$	0.0	$3/2^-$	
1778.92 *20*	0.81 *8*	4494.19	$5/2^+$	2715.04		
x1782.97 *10*	1.95 *10*					
x1800.02 *17*	1.37 *12*					
1802.0 *3*	0.95 *13*	2679.58	$(5/2^-)$	877.967	$3/2^-$	
1812.05 *14*	0.93 *7*	(8999.267)	$1/2^+$	7187.21		
x1816.76‡ *8*						E_γ: In 1993Ha05, placement from 5957.26 level. γ-ray not reported in 2004Ra23.
x1818.7 *6*	0.32 *10*					
x1820.6 *3*	0.72 *9*					
1827.8 *5*	0.23 *6*	3562.99	$1/2^-,3/2^-$	1734.701	$3/2^-$	
x1833.3 *6*	0.22 *7*					
1836.97 *12*	1.04 *9*	2715.04		877.967	$3/2^-$	E_γ: In 1993Ha05, a comparable γ 1837.4 *4* multiply placed from 3025.83 and 4253.02 keV levels.
x1851.12 *17*	1.05 *9*					
1864.2 *3*	0.50 *9*	5754.60	$1/2^-,3/2^-$	3889.74		E_γ: Weighted average of 1864.9 *4* (2004Ra23) and 1865.3 *3* (1993Ha05).
x1872.2 *3*	0.58 *9*					
1880.19 *7*	5.61 *13*	3181.574	$3/2^{(-)}$	1301.436	$1/2^-$	E_γ: Weighted average of 1880.12 *5* (2004Ra23) and 1880.26 *5* (1993Ha05).
x1889.13‡ *17*						E_γ: In 1993Ha05, placement from 6141.66 keV level. γ-ray not reported in 2004Ra23.
1889.13 *17*	1.88 *16*	6141.66	$1/2^-,3/2^-$	4252.88	$(1/2^-,3/2^-)$	
x1891.0 *7*	0.40 *14*					
1901.75‡ *18*	0.75 *14*	5632.13		3730.26	$(3/2)^-$	E_γ: Other: 1901.9 *3* (2004Ra23).

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ [†]	I_γ [&a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]1917.0 *9*	0.19 *8*					
1923.4 *4*	0.74 *13*	4949.15	(1/2$^-$,3/2$^-$)	3025.774	(1/2$^-$,3/2$^-$)	
1937.7 *3*	0.93 *13*	4352.45		2414.899	3/2$^-$	
1943.3 *4*	0.73 *13*	4968.90	1/2$^-$,3/2$^-$	3025.774	(1/2$^-$,3/2$^-$)	
1948.3 *4*	1.3 *2*	1948.32	7/2$^-$	0.0	3/2$^-$	
1949.92 *3*	67.6 *14*	2414.899	3/2$^-$	464.937	1/2$^-$	
1992.76 *4*	21.21 *22*	3181.574	3/2$^{(-)}$	1188.791	5/2$^-$	
[x]2001.93 *10*	2.34 *12*					
2015.62 *9*	16.94 *19*	2893.558	3/2$^{(-)}$	877.967	3/2$^-$	E_γ: Unweighted average of 2015.53 *3* (2004Ra23) and 2015.70 *5* (1993Ha05).
2042.0 *7*	1.0 *3*	5384.73	3/2$^+$	3343.21		E_γ: alternative placement: 3343−>1301 transition.
2050.78 *15*	1.35 *11*	(8999.267)	1/2$^+$	6948.40	1/2$^+$	E_γ: In 1993Ha05 2050.78 *10* placed from 3730.34 keV level.
2075.37 *6*	3.44 *12*	4968.90	1/2$^-$,3/2$^-$	2893.558	3/2$^{(-)}$	E_γ: In 1993Ha05 − placement from 2414.93 keV level.
[x]2094.05 *16*	1.21 *9*					
2112.0 *3*	0.74 *9*	3413.52		1301.436	1/2$^-$	
2125.60 *7*	2.50 *12*	(8999.267)	1/2$^+$	6873.63		
2147.77 *3*	17.31 *20*	3025.774	(1/2$^-$,3/2$^-$)	877.967	3/2$^-$	
2154.3 *4*	0.57 *11*	3343.21		1188.791	5/2$^-$	
[x]2174.55 *21*	1.13 *11*					
2177.3 *9*	0.26 *9*	6030.57	(1/2$^-$,3/2$^-$)	3853.69	3/2$^-$	E_γ: In 1993Ha05, a comparable 2178.63 *8* γ placed from 3858.26 level, not confirmed by 2004Ra23.
[x]2242.9 *5*	0.32 *8*					
2248.2 *3*	0.51 *8*	3126.12		877.967	3/2$^-$	E_γ: alternative placement: 6101−>3853 transition (as of 1993Ha05).
2254.68 *17*	0.99 *8*	5632.13		3377.28		
2258.03 *13*	1.38 *9*	6279.86		4021.93	1/2$^-$,3/2$^-$	
2261.44 *15*	2.42 *15*	3562.99	1/2$^-$,3/2$^-$	1301.436	1/2$^-$	
2263.35 *25*	1.14 *17*	3452.43	3/2$^-$	1188.791	5/2$^-$	E_γ: alternative placement: 5676−>3413 transition.
[x]2267.96 *11*	1.46 *8*					
2287.61 *17*	1.25 *14*	2627.03	7/2$^-$	339.417	5/2$^-$	E_γ: In 1993Ha05 2287.8 *4* γ multiply placed from 4021.92 and 6141.53 keV levels.
[x]2297.0 *4*	0.42 *10*					
[x]2300.8[‡] *3*						E_γ: In 1993Ha05, multiply placed from 4715.36 and 7270.4 keV levels. γ-ray not reported in 2004Ra23.
2303.53 *5*	5.94 *14*	3181.574	3/2$^{(-)}$	877.967	3/2$^-$	
[x]2323.5 *3*	0.54 *9*					
[x]2328.7 *5*	0.87 *25*					
[x]2330.8 *4*	1.55 *20*					
[x]2345.2 *4*	0.45 *9*					
[x]2380.4 *5*	0.44 *8*					
2384.64 *4*	9.97 *14*	3686.124	(3/2)$^+$	1301.436	1/2$^-$	
2400.85 *5*	7.97 *11*	(8999.267)	1/2$^+$	6598.36		E_γ: Weighted average of 2400.75 *5* (2004Ra23) and 2400.95 *5* (1993Ha05).
2414.92 *6*	18.0 *3*	2414.899	3/2$^-$	0.0	3/2$^-$	E_γ: Unweighted average of 2414.86 *4* (2004Ra23) and 2412.97 *4* (1993Ha05).
2421.89 *6*	4.02 *10*	2421.95		0.0	3/2$^-$	E_γ: alternative placement: 6562−>4140 transition.
[x]2425.06 *19*	1.06 *8*					
2428.53 *4*	9.7 *12*	2893.558	3/2$^{(-)}$	464.937	1/2$^-$	
2437.06 *6*	3.54 *9*	(8999.267)	1/2$^+$	6562.15		
2450.52[‡] *19*	0.23 *6*	5632.13		3181.574	3/2$^{(-)}$	E_γ: Other: 2450.9 *9* (2004Ra23).
2460.67 *20*	0.44 *4*	4140.247	3/2$^-$	1679.695	5/2$^-$	E_γ: Weighted average of 2460.2 *4* (2004Ra23) and 2460.76 *17* (1993Ha05).
2465.5 *4*	0.39 *8*	5808.79		3343.21		E_γ: alternative placement: 3343−>877 transition.
[x]2483.16 *12*	1.41 *8*					

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
2491.3 *4*	0.50 *8*	5617.31	$1/2^-$,$3/2^-$	3126.12		E_γ: alternative placement: 5384−>2893 transition.
2497.41 *7*	8.35 *15*	3686.124	$(3/2)^+$	1188.791	$5/2^-$	E_γ: Weighted average of 2497.33 *6* (2004Ra23) and 2497.47 *5* (1993Ha05).
2499.18 *11*	2.54 *24*	3377.28		877.967	$3/2^-$	
2500.6 *3*	1.23 *15*	(8999.267)	$1/2^+$	6498.28		
2505.1@ *5*	0.36 *9*	5957.31		3452.43	$3/2^-$	E_γ: 2504.83 *18* (1993Ha05).
x2517.8‡ *6*						E_γ: In 1993Ha05, placement from 4253.02 keV level. γ-ray not reported in 2004Ra23.
2535.3 *4*	0.76 *12*	3413.52		877.967	$3/2^-$	
2541.45 *12*	1.19 *12*	3730.26	$(3/2)^-$	1188.791	$5/2^-$	E_γ: Weighted average of 2541.30 *22* (2004Ra23) and 2541.49 *12* (1993Ha05). An additional placement from 5995.2 keV level is not confirmed in 2004Ra23.
2545.7 *4*	0.69 *12*	4494.19	$5/2^+$	1948.32	$7/2^-$	
2554.10 *4*	62.6 *8*	2893.558	$3/2^{(-)}$	339.417	$5/2^-$	E_γ: Weighted average of 2554.06 *4* (2004Ra23) and 2554.14 *4* (1993Ha05).
x2560.55‡ *13*						E_γ: In 1993Ha05, placement from 3025.80 keV level. γ-ray not reported in 2004Ra23.
2567.89 *9*	3.20 *14*	(8999.267)	$1/2^+$	6431.33		
2574.55 *11*	1.24 *13*	3452.43	$3/2^-$	877.967	$3/2^-$	E_γ: Weighted average of 2574.29 *21* (2004Ra23) and 2574.62 *11* (1993Ha05). Uncertainty lowest input value.
x2616.2 *3*	0.97 *13*					E_γ: In 1993Ha05, a comparable 2616.66 *19* γ placed from 5994.2 keV level.
x2618.6 *3*	1.03 *13*					
2626.70 *19*	1.48 *16*	2627.03	$7/2^-$	0.0	$3/2^-$	
x2629.21 *16*	1.76 *12*					
x2633.38 *22*	1.02 *11*					
x2636.61 *22*	1.00 *11*					
x2645.94 *19*	1.51 *10*					
2653.90 *18*	1.57 *12*	5069.05	$1/2^-$,$3/2^-$	2414.899	$3/2^-$	
2662.0 *3*	0.40 *13*	3540.10		877.967	$3/2^-$	E_γ: Weighted average of 2662.0 *3* (2004Ra23) and 2661.38 *24* (1993Ha05).
2664.80 *19*	1.19 *11*	3853.69	$3/2^-$	1188.791	$5/2^-$	
2679.6 *3*	0.90 *12*	2679.58	$(5/2^-)$	0.0	$3/2^-$	
2684.97@ *5*	16.0 *3*	3562.99	$1/2^-$,$3/2^-$	877.967	$3/2^-$	E_γ: Other: 2685.13 *4* (1993Ha05).
2689.0 *4*	0.86 *12*	6141.66	$1/2^-$,$3/2^-$	3452.43	$3/2^-$	
x2703.78 *14*	1.71 *11*					
2716.62‡ *6*	3.55 *14*	3181.574	$3/2^{(-)}$	464.937	$1/2^-$	E_γ: Other 2716.57 *10* (2004Ra23).
2719.38 *7*	4.89 *15*	(8999.267)	$1/2^+$	6279.86		
2723.93‡ *23*	0.37 *9*	5617.31	$1/2^-$,$3/2^-$	2893.558	$3/2^{(-)}$	E_γ: Other placement from 6101.41 in 1993Ha05 not confirmed. 2723.2 *5* (2004Ra23).
x2727.6 *3*	0.76 *12*					
2738.70‡ *13*	0.61 *9*	5632.13		2893.558	$3/2^{(-)}$	E_γ: Other: 2739.0 *4* (2004Ra23).
2757.59 *9*	2.55 *12*	5384.73	$3/2^+$	2627.03	$7/2^-$	
2763.93‡ *23*	0.58 *9*	6106.82		3343.21		E_γ: Other placement in 1993Ha05 of 2763.92 *12* γ from 6141.66 keV level.
x2771.07 *24*	0.82 *9*					
2786.5 *3*	0.69 *9*	3126.12		339.417	$5/2^-$	
2808.15 *5*	12.25 *20*	3686.124	$(3/2)^+$	877.967	$3/2^-$	E_γ: alternative placement: 6948−>4140 transition (2004Ra23). E_γ: Weighted average of 2808.09 *5* (2004Ra23) and 2808.19 *4* (1993Ha05).
2815.52 *14*	2.14 *12*	(8999.267)	$1/2^+$	6183.67		
x2823.1 *4*	0.74 *11*					
2833.18 *11*	2.74 *13*	4021.93	$1/2^-$,$3/2^-$	1188.791	$5/2^-$	

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
2838.67 *11*	4.03 *17*	4140.247	3/2⁻	1301.436	1/2⁻	
2842.10‡ *4*	67.3 *7*	3181.574	3/2(⁻)	339.417	5/2⁻	E_γ: Other 2842.07 *6* (2004Ra23).
2852.2 *4*	0.76 *12*	3730.26	(3/2)⁻	877.967	3/2⁻	
2857.56‡ *5*	4.67 *15*	(8999.267)	1/2⁺	6141.66	1/2⁻,3/2⁻	E_γ: Other: 2857.40 *12* (2004Ra23).
2878.22 *18*	1.53 *18*	3343.21		464.937	1/2⁻	
2892.3 *5*	5.1 *7*	(8999.267)	1/2⁺	6106.82		
2893.3 *3*	11.7 *12*	2893.558	3/2(⁻)	0.0	3/2⁻	
2897.65 *9*	4.72 *17*	(8999.267)	1/2⁺	6101.59		E_γ: Weighted average of 2897.50 *9* (2004Ra23) and 2897.70 *5* (1993Ha05).
2912.7@ *8*	0.82 *25*	3377.28		464.937	1/2⁻	E_γ: alternative placement: 6598−>3686 transition. Other: 2911.28 *12* (1993Ha05).
x2927.0 *4*	0.54 *9*					
2948.3 *3*	1.29 *11*	3413.52		464.937	1/2⁻	
2951.3 *3*	2.19 *12*	4252.88	(1/2⁻,3/2⁻)	1301.436	1/2⁻	E_γ: Unweighted average of 2951.06 *15* (2004Ra23) and 2951.58 *9* (1993Ha05).
x2963.28 *17*	1.21 *9*					
2968.52‡ *5*	12.6 *3*	(8999.267)	1/2⁺	6030.57	(1/2⁻,3/2⁻)	E_γ: Other: 2968.5 *7* (2004Ra23).
x2976.5 *9*	0.18 *8*					E_γ: In 1993Ha05, a comparable 2975.5 *3* γ placed from 3853.68 keV level.
2980.2 *4*	0.60 *10*	6106.82		3126.12		E_γ: alternative placement: 4715−>1734 transition.
2987.5 *5*	0.41 *10*	3452.43	3/2⁻	464.937	1/2⁻	E_γ: alternative placement: 5702−>2715 transition.
3003.9 *9*	1.9 *5*	3343.21		339.417	5/2⁻	
3005.2 *5*	3.0 *5*	6030.57	(1/2⁻,3/2⁻)	3025.774	(1/2⁻,3/2⁻)	E_γ: in 1993Ha05, a comparable 3004.84 *6* γ placed from capture state 8999.
x3012.1‡ *4*						E_γ: In 1993Ha05, placement from 3889.74 keV level − γ not reported in 2004Ra23.
3025.67 *5*	17.65 *20*	3025.774	(1/2⁻,3/2⁻)	0.0	3/2⁻	E_γ: Weighted average of 3025.63 *5* (2004Ra23) and 3025.73 *6* (1993Ha05).
3029.17 *20*	1.69 *12*	5443.87	3/2⁺,5/2⁺	2414.899	3/2⁻	
3037.73 *6*	6.53 *15*	3377.28		339.417	5/2⁻	
3041.70 *8*	6.68 *14*	(8999.267)	1/2⁺	5957.31		E_γ: Weighted average of 3041.60 *7* (2004Ra23) and 3041.77 *6* (1993Ha05).
3045.66 *17*	1.79 *12*	6498.28		3452.43	3/2⁻	
3051.21 *15*	0.83 *16*	4352.45		1301.436	1/2⁻	E_γ: Weighted average of 3051.5 *3* (2004Ra23) and 3051.14 *15* (1993Ha05).
3063.85 *11*	2.86 *13*	4252.88	(1/2⁻,3/2⁻)	1188.791	5/2⁻	E_γ: alternative placement: 5957−>2893 transition (as of 1993Ha05).
3072.2 *4*	0.64 *12*	5494.22		2421.95		
x3111.0 *3*	1.06 *12*					
3112.8‡ *3*	0.50 *16*	3452.43	3/2⁻	339.417	5/2⁻	E_γ: Other: 3113.0 *8* (2004Ra23).
3125.6 *6*	0.52 *12*	3126.12		0.0	3/2⁻	
3136.75‡ *9*	0.99 *13*	6030.57	(1/2⁻,3/2⁻)	2893.558	3/2(⁻)	
3143.84‡ *6*	3.03 *15*	4021.93	1/2⁻,3/2⁻	877.967	3/2⁻	E_γ: Other: 3143.78 *14* (2004Ra23).
3156.28 *16*	1.38 *11*	4494.19	5/2⁺	1337.91	7/2⁻	
3163.55‡ *11*	1.12 *20*	4352.45		1188.791	5/2⁻	E_γ: Other: 3163.5 *4* (2004Ra23).
3181.45 *6*	15.50 *17*	3181.574	3/2(⁻)	0.0	3/2⁻	
3184.56 *25*	1.64 *13*	6598.36		3413.52		E_γ: alternative placement: 6562−>3377 transition.
3190.39 *8*	2.84 *10*	(8999.267)	1/2⁺	5808.79		
3200.54 *7*	4.87 *12*	3540.10		339.417	5/2⁻	
3214.7 *4*	0.55 *11*	4949.15	(1/2⁻,3/2⁻)	1734.701	3/2⁻	
3221.04 *5*	21.5 *3*	3686.124	(3/2)⁺	464.937	1/2⁻	
3234.08‡ *18*	0.59 *11*	4968.90	1/2⁻,3/2⁻	1734.701	3/2⁻	E_γ: Other: 3234.2 *4* (2004Ra23).
3244.55 *6*	3.11 *13*	(8999.267)	1/2⁺	5754.60	1/2⁻,3/2⁻	E_γ: Weighted average of 3244.50 *7* (2004Ra23) and 3244.58 *6* (1993Ha05).

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
3250.0 *4*	0.70 *10*	6431.33		3181.574	$3/2^{(-)}$	
x3256.63 *15*	1.60 *10*					
3262.24 *14*	1.59 *16*	4140.247	$3/2^-$	877.967	$3/2^-$	E_γ: alternative placement: 6948−>3686 transition. E_γ: Weighted average of 3262.01 *18* (2004Ra23) and 3262.32 *11* (1993Ha05).
3265.27 *6*	7.75 *16*	3730.26	$(3/2)^-$	464.937	$1/2^-$	E_γ: Weighted average of 3265.23 *7* (2004Ra23) and 3265.31 *6* (1993Ha05).
3268.8 *4*	0.89 *12*	4949.15	$(1/2^-,3/2^-)$	1679.695	$5/2^-$	
3289.3 *4*	0.67 *11*	4968.90	$1/2^-,3/2^-$	1679.695	$5/2^-$	
x3295.57 *20*	2.35 *25*					
3296.62 *6*	4.9 *6*	(8999.267)	$1/2^+$	5702.39		E_γ: Other: 3297.0 *3* (2004Ra23).
x3303.20 *16*	1.66 *11*					
x3317.58 *23*	1.09 *11*					
3322.7 *5*	0.53 *11*	(8999.267)	$1/2^+$	5676.86	$1/2^+$	
3334.59‡ *25*	0.39 *12*	5069.05	$1/2^-,3/2^-$	1734.701	$3/2^-$	E_γ: Other: 3334.2 *6* (2004Ra23).
3339.2 *5*	0.46 *11*	5754.60	$1/2^-,3/2^-$	2414.899	$3/2^-$	
3346.62 *5*	9.34 *14*	3686.124	$(3/2)^+$	339.417	$5/2^-$	
3367.02 *6*	10.65 *16*	(8999.267)	$1/2^+$	5632.13		
3374.9 *7*	0.60 *17*	4252.88	$(1/2^-,3/2^-)$	877.967	$3/2^-$	
3377.34 *17*	2.72 *18*	4715.34	$(3/2)^-$	1337.91	$7/2^-$	E_γ: In 1993Ha05 3377.14 *9* − placed from 3377.22 keV level.
3381.83 *6*	8.95 *15*	(8999.267)	$1/2^+$	5617.31	$1/2^-,3/2^-$	
3388.79‡ *13*	0.97 *21*	3853.69	$3/2^-$	464.937	$1/2^-$	E_γ: Other: 3388.4 *5* (2004Ra23).
3390.6 *4*	1.56 *20*	3730.26	$(3/2)^-$	339.417	$5/2^-$	E_γ: Other: 3391.23 *14* (1993Ha05) yields 3 to 4 σ deviation in least-squares fit.
3393.8 *5*	0.61 *12*	5808.79		2414.899	$3/2^-$	
x3412.03‡ *16*						E_γ: In 1993Ha05, placement from 7270.4 keV level − γ not reported in 2004Ra23.
x3437.7 *6*	0.44 *10*					
3452.32 *8*	1.33 *13*	3452.43	$3/2^-$	0.0	$3/2^-$	E_γ: alternative placement: 5131−>1679 transition. E_γ: Weighted average of 3452.08 *17* (2004Ra23) and 3452.37 *8* (1993Ha05).
3496.9 *6*	0.52 *12*	6873.63		3377.28		
3504.94 *12*	3.28 *20*	(8999.267)	$1/2^+$	5494.22		
3514.06‡ *7*	2.16 *18*	3853.69	$3/2^-$	339.417	$5/2^-$	E_γ: Other: 3514.05 *18* (2004Ra23).
3525.8 *8*	0.38 *12*	4715.34	$(3/2)^-$	1188.791	$5/2^-$	
x3545.2 *3*	1.38 *17*					
3555.47 *16*	2.74 *20*	(8999.267)	$1/2^+$	5443.87	$3/2^+,5/2^+$	
3562.87 *7*	9.1 *3*	3562.99	$1/2^-,3/2^-$	0.0	$3/2^-$	E_γ: Weighted average of 3562.82 *7* (2004Ra23) and 3562.91 *7* (1993Ha05).
x3578.6‡ *7*						E_γ: In 1993Ha05, placement from 5994.2 keV level − γ not reported in 2004Ra23.
x3585.2‡ *5*						E_γ: In 1993Ha05, placement from 7270.4 keV level − γ not reported in 2004Ra23.
3614.38 *7*	7.4 *3*	(8999.267)	$1/2^+$	5384.73	$3/2^+$	
x3635.2 *5*	0.69 *15*					
x3648.3‡ *8*						E_γ: In 1993Ha05, placement from 5384.71 keV level − γ not reported in 2004Ra23.
3667.42‡ *8*	1.80 *14*	4968.90	$1/2^-,3/2^-$	1301.436	$1/2^-$	E_γ: Other: 3667.53 *18* (2004Ra23).
3675.23 *4*	39.4 *5*	4140.247	$3/2^-$	464.937	$1/2^-$	
3679.2 *5*	1.08 *16*	6101.59		2421.95		
3685.98 *15*	16.8 *9*	3686.124	$(3/2)^+$	0.0	$3/2^-$	
3705.3 *5*	0.55 *12*	5384.73	$3/2^+$	1679.695	$5/2^-$	E_γ: 1993Ha05 also propose from 6598.19 level (multiple placement).

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
x3712.07 *18*	2.44 *20*					
3719.1 *6*	0.75 *18*	6141.66	1/2−,3/2−	2421.95		
3730.11# *5*	2.0 *3*	3730.26	(3/2)−	0.0	3/2−	I_γ: Inferred from the measured intensity of the 3730.11+3730.35 doublet.
3730.35# *10*	2.7 *3*	7270.54		3540.10		I_γ: inferred from the intensity balance requirement for the 7270 level.
3734.0 *9*	0.27 *13*	7187.21		3452.43	3/2−	
3767.43‡ *9*	0.80 *16*	5069.05	1/2−,3/2−	1301.436	1/2−	E_γ: Other: 3747.3 *5* (2004Ra23).
3779.94 *7*	10.4 *3*	4968.90	1/2−,3/2−	1188.791	5/2−	
3787.85‡ *8*	1.12 *18*	4252.88	(1/2−,3/2−)	464.937	1/2−	E_γ: Other: 3787.5 *4* (2004Ra23).
3800.79‡ *7*	3.05 *24*	4140.247	3/2−	339.417	5/2−	E_γ: Other: 3800.69 *15* (2004Ra23).
x3818.5‡ *5*						E_γ: In 1993Ha05, placement from 7270.4 keV level − γ not reported in 2004Ra23.
x3838.1 *5*	0.71 *16*					
3853.72‡ *9*	2.37 *18*	3853.69	3/2−	0.0	3/2−	E_γ: Other: 3853.71 *16* (2004Ra23).
3857.8 *3*	1.36 *17*	6279.86		2421.95		E_γ: In 1993Ha05, a comparable 3858.04 *10* placed from 3858.26 level, not confirmed by 2004Ra23.
3867.15 *20*	2.06 *19*	(8999.267)	1/2+	5131.93		
3880.1‡ *3*	0.58 *15*	5069.05	1/2−,3/2−	1188.791	5/2−	E_γ: Other: 3879.8 *6* (2004Ra23).
3889.53‡ *8*	3.06 *19*	3889.74		0.0	3/2−	E_γ: Other: 3853.71 *16* (2004Ra23).
3897.11‡ *19*	0.50 *15*	5632.13		1734.701	3/2−	E_γ: Other: 3897.7 *7* (2004Ra23).
x3905.8 *7*	0.51 *15*					
3913.2‡ *3*	0.49 *14*	4252.88	(1/2−,3/2−)	339.417	5/2−	E_γ: Other: 3912.7 *6* (2004Ra23).
3930.06 *5*	16.7 *4*	(8999.267)	1/2+	5069.05	1/2−,3/2−	
3937.49‡ *18*	0.39 *9*	5617.31	1/2−,3/2−	1679.695	5/2−	E_γ: Other: 3937.5 *8* (2004Ra23).
3952.24‡ *9*	1.11 *16*	5632.13		1679.695	5/2−	E_γ: Other: 3952.6 *4* (2004Ra23).
x3972.64 *21*	1.51 *17*					
x3989.9 *4*	0.72 *14*					
x4019.88‡ *20*						E_γ: In 1993Ha05, placement from 5754.59 keV level − γ not reported in 2004Ra23.
4021.85 *18*	1.73 *16*	4021.93	1/2−,3/2−	0.0	3/2−	E_γ: Weighted average of 4021.69 *21* (2004Ra23) and 4021.96 *18* (1993Ha05).
4030.26 *4*	20.9 *4*	(8999.267)	1/2+	4968.90	1/2−,3/2−	
4049.99 *5*	14.1 *3*	(8999.267)	1/2+	4949.15	(1/2−,3/2−)	
x4056.1 *6*	0.56 *14*					
4067.4 *6*	0.64 *15*	4532.8		464.937	1/2−	
4071.5 *4*	0.90 *15*	4949.15	(1/2−,3/2−)	877.967	3/2−	
4083.23‡ *11*	0.74 *15*	5384.73	3/2+	1301.436	1/2−	E_γ: Other: 4083.0 *5* (2004Ra23).
4090.79‡ *15*	0.67 *14*	4968.90	1/2−,3/2−	877.967	3/2−	E_γ: Other: 4090.6 *5* (2004Ra23).
x4119.4 *9*	0.38 *16*					
4140.07 *7*	10.0 *4*	4140.247	3/2−	0.0	3/2−	E_γ: alternative placement: 6562−>2421 transition. E_γ: Weighted average of 4140.10 *8* (2004Ra23) and 4140.05 *7* (1993Ha05).
4191.04 *10*	4.72 *19*	5069.05	1/2−,3/2−	877.967	3/2−	
4216.08 *20*	1.87 *20*	(8999.267)	1/2+	4782.90		
x4237.6 *5*	0.76 *16*					
x4244.70‡ *25*						E_γ: In 1993Ha05, placement from 7270.4 keV level − γ not reported in 2004Ra23.
4250.6 *5*	1.6 *3*	4715.34	(3/2)−	464.937	1/2−	
4253.6 *4*	2.20 *5*	5131.93		877.967	3/2−	E_γ: In 1993Ha05, placement of 4253.05 *9* from 4253.02 keV level.
4283.77 *5*	18.5 *5*	(8999.267)	1/2+	4715.34	(3/2)−	

Continued on next page (footnotes at end of table)

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

$\gamma(^{59}Ni)$ (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
4295.55 *12*	0.89 *15*	6030.57	(1/2$^-$,3/2$^-$)	1734.701	3/2$^-$	
4305.2 *3*	1.42 *16*	5494.22		1188.791	5/2$^-$	
x4314.5‡ *3*						E_γ: In 1993Ha05, placement from 5994.2 keV level – γ not reported in 2004Ra23.
4317.5 *3*	1.17 *16*	4782.90		464.937	1/2$^-$	
x4332.4‡ *8*						E_γ: In 1993Ha05, placement from 5632.09 keV level – γ not reported in 2004Ra23.
4352.19‡ *8*	2.22 *19*	4352.45		0.0	3/2$^-$	E_γ: Other: 4352.4 *3* (2004Ra23).
4375.31 *19*	2.44 *19*	5676.86	1/2$^+$	1301.436	1/2$^-$	
x4401.8‡ *7*						E_γ: In 1993Ha05, placement from 5702.33 keV level – γ not reported in 2004Ra23.
x4406.5‡ *10*						E_γ: In 1993Ha05, placement from 6141.53 keV level – γ not reported in 2004Ra23.
x4420.8‡ *7*						E_γ: In 1993Ha05, placement from 6101.57 keV level – γ not reported in 2004Ra23.
4428.24 *19*	1.70 *17*	5617.31	1/2$^-$,3/2$^-$	1188.791	5/2$^-$	
x4442.54‡ *23*						E_γ: In 1993Ha05, placement from 5632.09 keV level – γ not reported in 2004Ra23.
4452.3 *9*	0.30 *12*	6873.63		2421.95		E_γ: In 1993Ha05, 4452.8 *3* γ placed from 5754.59 keV level.
x4459.2‡ *9*						E_γ: In 1993Ha05, placement from 6141.53 keV level – γ not reported in 2004Ra23.
4466.2 *6*	0.52 *13*	(8999.267)	1/2$^+$	4532.8		
4504.7 *3*	2.33 *18*	(8999.267)	1/2$^+$	4494.19	5/2$^+$	E_γ: In 1993Ha05, a comparable 4503.57 *13* γ placed from 4968.9 level.
4507.9 *5*	0.80 *25*	7187.21		2679.58	(5/2$^-$)	E_γ: In 1993Ha05, a comparable 4506.5 *3* placed from 5384.71 level,
x4565.99‡ *23*						E_γ: In 1993Ha05, placement from 5754.59 keV level – γ not reported in 2004Ra23.
4604.0 *4*	0.44 *13*	5069.05	1/2$^-$,3/2$^-$	464.937	1/2$^-$	E_γ: Weighted average of 4604.1 *7* (2004Ra23) and 4603.9 *4* (1993Ha05).
4609.3 *4*	0.66 *14*	4949.15	(1/2$^-$,3/2$^-$)	339.417	5/2$^-$	
4629.3 *3*	0.61 *14*	4968.90	1/2$^-$,3/2$^-$	339.417	5/2$^-$	E_γ: Weighted average of 4629.7 *6* (2004Ra23) and 4629.2 *3* (1993Ha05).
4646.56 *13*	5.67 *25*	(8999.267)	1/2$^+$	4352.45		E_γ: Unweighted average of 4646.69 *9* (2004Ra23) and 4646.44 *8* (1993Ha05).
4715.16 *6*	12.0 *4*	4715.34	(3/2)$^-$	0.0	3/2$^-$	
4729.19‡ *15*	0.83 *15*	5069.05	1/2$^-$,3/2$^-$	339.417	5/2$^-$	E_γ: Other: 4729.8 *5* (2004Ra23).
4746.06 *11*	5.84 *25*	(8999.267)	1/2$^+$	4252.88	(1/2$^-$,3/2$^-$)	E_γ: Weighted average of 4746.19 *10* (2004Ra23) and 4745.96 *9* (1993Ha05).
x4753.6‡ *4*						E_γ: In 1993Ha05, placement from 5632.09 keV level – γ not reported in 2004Ra23.
4805.03 *16*	2.96 *19*	6106.82		1301.436	1/2$^-$	E_γ: In 1993Ha05, 4805.10 *10* placed from 5994.26 level, not confirmed by 2004Ra23.
4823.91‡ *11*	1.10 *18*	5702.39		877.967	3/2$^-$	E_γ: Other: 4824.1 *5* (2004Ra23).
4841.20‡ *19*	0.55 *15*	6030.57	(1/2$^-$,3/2$^-$)	1188.791	5/2$^-$	
4858.84 *3*	64.2 *8*	(8999.267)	1/2$^+$	4140.247	3/2$^-$	
4912.8‡ *4*	0.41 *15*	6101.59		1188.791	5/2$^-$	
4919.54‡ *11*	1.32 *21*	5384.73	3/2$^+$	464.937	1/2$^-$	E_γ: Other: 4919.8 *3* (2004Ra23).
4949.02 *10*	11.7 *5*	4949.15	(1/2$^-$,3/2$^-$)	0.0	3/2$^-$	
4968.6 *4*	1.79 *23*	4968.90	1/2$^-$,3/2$^-$	0.0	3/2$^-$	
4977.14 *14*	10.6 *4*	(8999.267)	1/2$^+$	4021.93	1/2$^-$,3/2$^-$	E_γ: Unweighted average of 4977.27 *8* (2004Ra23) and 4977.00 *9* (1993Ha05).

Continued on next page (footnotes at end of table)

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

$\gamma(^{59}Ni)$ (continued)

E_γ †	I_γ &a	E_i(level)	J_i^π	E_f	J_f^π	Comments
5029.6 *9*	0.38 *18*	5494.22		464.937	$1/2^-$	
5044.89‡ *11*	1.06 *17*	5384.73	$3/2^+$	339.417	$5/2^-$	E_γ: Other: 5044.9 *4* (2004Ra23).
5068.80 *17*	4.47 *22*	5069.05	$1/2^-$,$3/2^-$	0.0	$3/2^-$	E_γ: Unweighted average of 5068.97 *13* (2004Ra23) and 5068.63 *9* (1993Ha05).
5078.92 *12*	0.94 *16*	5957.31		877.967	$3/2^-$	
5109.22 *15*	4.36 *21*	(8999.267)	$1/2^+$	3889.74		E_γ: Unweighted average of 5109.37 *12* (2004Ra23) and 5109.06 *9* (1993Ha05).
x5113.8 *9*	0.49 *16*					
x5115.9‡ *3*						E_γ: In 1993Ha05, placement from 5994.2 keV level.
x5130.7 *3*	1.40 *15*					
x5140.3 *6*	0.79 *15*					E_γ: In 1993Ha05, 5140.76 *16* placed from capture state at 8999.
5145.25 *10*	5.91 *23*	(8999.267)	$1/2^+$	3853.69	$3/2^-$	E_γ: Weighted average of 5145.34 *10* (2004Ra23) and 5145.18 *9* (1993Ha05).
5152.30‡ *10*	1.87 *16*	6030.57	$(1/2^-,3/2^-)$	877.967	$3/2^-$	E_γ: alternative placement: 5617−>464 transition.
x5167.6‡ *3*						E_γ: In 1993Ha05, placement from 5632.09 keV level – γ not reported in 2004Ra23.
x5169.2 *9*	0.35 *14*					
5224.0 *4*	0.95 *15*	6562.15		1337.91	$7/2^-$	E_γ: Other: 5223.38 *13* placement from 6101.57 (1993Ha05).
5228.6 *7*	0.40 *13*	6106.82		877.967	$3/2^-$	
x5237.0‡ *6*						E_γ: In 1993Ha05, placement from 5702.33 keV level – γ not reported in 2004Ra23.
5268.79 *5*	12.3 *4*	(8999.267)	$1/2^+$	3730.26	$(3/2)^-$	
5277.35‡ *15*	0.85 *15*	5617.31	$1/2^-$,$3/2^-$	339.417	$5/2^-$	E_γ: Other: 5277.5 *5* (2004Ra23).
x5287.3 *6*	0.84 *18*					
5292.69‡ *13*	1.49 *19*	5632.13		339.417	$5/2^-$	E_γ: Other: 5292.7 *4* (2004Ra23).
5312.95 *4*	75.4 *9*	(8999.267)	$1/2^+$	3686.124	$(3/2)^+$	
5362.67‡ *11*	1.93 *21*	5702.39		339.417	$5/2^-$	E_γ: Other: 5362.5 *3* (2004Ra23).
5384.52‡ *13*	0.78 *23*	5384.73	$3/2^+$	0.0	$3/2^-$	E_γ: Other: 5384.6 *7* (2004Ra23).
5409.4 *6*	0.88 *18*	6598.36		1188.791	$5/2^-$	
5436.00 *4*	26.3 *5*	(8999.267)	$1/2^+$	3562.99	$1/2^-$,$3/2^-$	
5458.74‡ *10*	3.19 *22*	(8999.267)	$1/2^+$	3540.10		E_γ: Other: 5458.79 *18* (2004Ra23).
5469.4 *6*	0.68 *16*	5808.79		339.417	$5/2^-$	
5492.1 *6*	0.68 *14*	5957.31		464.937	$1/2^-$	
5546.69 *11*	2.87 *17*	(8999.267)	$1/2^+$	3452.43	$3/2^-$	E_γ: Weighted average of 5546.80 *14* (5546.8 probably a typo in 2004Ra23) and 5546.62 *11* (1993Ha05).
5553.0 *4*	0.98 *14*	6431.33		877.967	$3/2^-$	
x5566.4 *8*	0.61 *16*					
5585.2 *6*	0.70 *14*	(8999.267)	$1/2^+$	3413.52		
x5590.0‡ *5*						E_γ: In 1993Ha05, placement from 7270.4 keV level – γ not reported in 2004Ra23.
5617.07 *12*	3.10 *17*	5617.31	$1/2^-$,$3/2^-$	0.0	$3/2^-$	E_γ: Weighted average of 5617.12 *18* (2004Ra23) and 5617.04 *12* (1993Ha05).
5621.48 *11*	5.29 *20*	(8999.267)	$1/2^+$	3377.28		E_γ: Weighted average of 5621.60 *14* (5621.6 probably a typo in 2004Ra23) and 5621.41 *11* (1993Ha05).
5631.99‡ *22*	0.47 *15*	5632.13		0.0	$3/2^-$	E_γ: Other: 5632.4 *9* (2004Ra23).
x5636.8‡ *4*						E_γ: In 1993Ha05, placement from 6101.57 keV level – γ not reported in 2004Ra23.
5641.65 *25*	2.16 *20*	6106.82		464.937	$1/2^-$	
5655.5 *5*	1.18 *18*	(8999.267)	$1/2^+$	3343.21		
x5676.80‡ *24*						E_γ: In 1993Ha05, placement from 6141.53 keV level – γ not reported in 2004Ra23.

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

γ(^{59}Ni) (continued)

E_γ [†]	I_γ [&a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]5682.5 *7*	0.67 *16*					
5701.76[‡] *14*	1.38 *17*	5702.39		0.0	$3/2^-$	E_γ: Other: 5701.5 *4* (2004Ra23).
5754.36[‡] *17*	0.86 *22*	5754.60	$1/2^-$,$3/2^-$	0.0	$3/2^-$	E_γ: Other: 5754.6 *7* (2004Ra23).
5817.35 *5*	151.9 *20*	(8999.267)	$1/2^+$	3181.574	$3/2^{(-)}$	
5843.7 *7*	1.05 *25*	6183.67		339.417	$5/2^-$	
[x]5887.1 *6*	0.94 *17*					
[x]5901.6 *6*	0.90 *18*					
[x]5935.0 *9*	0.50 *17*					
5956.75[‡] *12*	2.5 *3*	5957.31		0.0	$3/2^-$	
5973.14 *5*	36.8 *8*	(8999.267)	$1/2^+$	3025.774	$(1/2^-,3/2^-)$	
[x]5994.0 *4*	1.24 *17*					E_γ: Other: 5993.84 *14* placement from 5994.2 keV level in 1993Ha05.
6030.34[‡] *14*	1.73 *17*	6030.57	$(1/2^-,3/2^-)$	0.0	$3/2^-$	
6105.38 *6*	98.0 *14*	(8999.267)	$1/2^+$	2893.558	$3/2^{(-)}$	
[x]6111.6 *4*	1.48 *23*					
6141.42 *23*	2.37 *19*	6141.66	$1/2^-$,$3/2^-$	0.0	$3/2^-$	E_γ: Weighted average of 6141.42 *23* (2004Ra23) and 6141.2 *12* (1993Ha05).
[x]6160.0 *7*	0.74 *16*					
6258.74[‡] *15*	1.56 *16*	6598.36		339.417	$5/2^-$	
6279.0 *9*	0.38 *16*	6279.86		0.0	$3/2^-$	
6371.2 *9*	0.55 *16*	(8999.267)	$1/2^+$	2627.03	$7/2^-$	E_γ: ΔJ=3 for this transition.
6391.9 *5*	1.10 *17*	7270.54		877.967	$3/2^-$	
[x]6401.2 *7*	0.77 *16*					
6408.0 *5*	1.06 *17*	6873.63		464.937	$1/2^-$	
[x]6499.0 *8*	0.65 *15*					
[x]6516.2 *9*	0.43 *15*					
6561.7 *8*	0.79 *22*	6562.15		0.0	$3/2^-$	
6576.8 *6*	1.47 *23*	(8999.267)	$1/2^+$	2421.95		
6583.98 *6*	109.4 *15*	(8999.267)	$1/2^+$	2414.899	$3/2^-$	
6597.76 *19*	3.5 *3*	6598.36		0.0	$3/2^-$	E_γ: Weighted average of 6598.15 *25* (2004Ra23) and 6597.67 *12* (1993Ha05).
[x]6617.5 *9*	0.60 *19*					
[x]6644.2 *9*	0.44 *18*					
[x]6752.6 *8*	0.58 *16*					
6872.8 *8*	0.63 *15*	6873.63		0.0	$3/2^-$	
[x]6892.0 *9*	0.46 *14*					
[x]6940.3 *8*	0.53 *15*					
6947.6 *4*	1.33 *16*	6948.40	$1/2^+$	0.0	$3/2^-$	
7050.1 *9*	0.43 *16*	(8999.267)	$1/2^+$	1948.32	$7/2^-$	E_γ: ΔJ=3 for this transition.
7264.18 *6*	9.3 *3*	(8999.267)	$1/2^+$	1734.701	$3/2^-$	
7697.30 *6*	51.7 *7*	(8999.267)	$1/2^+$	1301.436	$1/2^-$	
8120.75 *7*	177 *3*	(8999.267)	$1/2^+$	877.967	$3/2^-$	
8533.71 *7*	996 *15*	(8999.267)	$1/2^+$	464.937	$1/2^-$	
8998.63 *7*	2082 *30*	(8999.267)	$1/2^+$	0.0	$3/2^-$	

[†] From 2004Ra23, except otherwise noted. Overall Eγ values in 2004Ra23 (reported 416 Eγ) and 1993Ha05 (reported 257 Eγ) are in good agreement. Some γ placements in 1993Ha05, not confirmed by 2004Ra23. Evaluator considers the latest work – as a comprehensive work and noted the differences of γ placements, whenever available.

[‡] From 1993Ha05.

[#] 3730.11γ and 3730.35γ form an unresolved doublet, energy deduced for one member of the doublet from level-energy difference obtained from least-squares fit procedure excluding this transition.

[@] γ-ray energy from 1993Ha05 yields 5 to 6 σ deviation in least squares fit, if considered in Adopted Levels,Gammas dataset.

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^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01 (continued)

$\gamma(^{59}Ni)$ (continued)

& From 2004Ra23, in units of millibarns. The cross sections were normalized with σ_γ(2200 m/s)=332.6 mb *7* of ^{1}H.

[a] For intensity per 100 neutron captures, multiply by <0.0242.

[x] γ ray not placed in level scheme.

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme

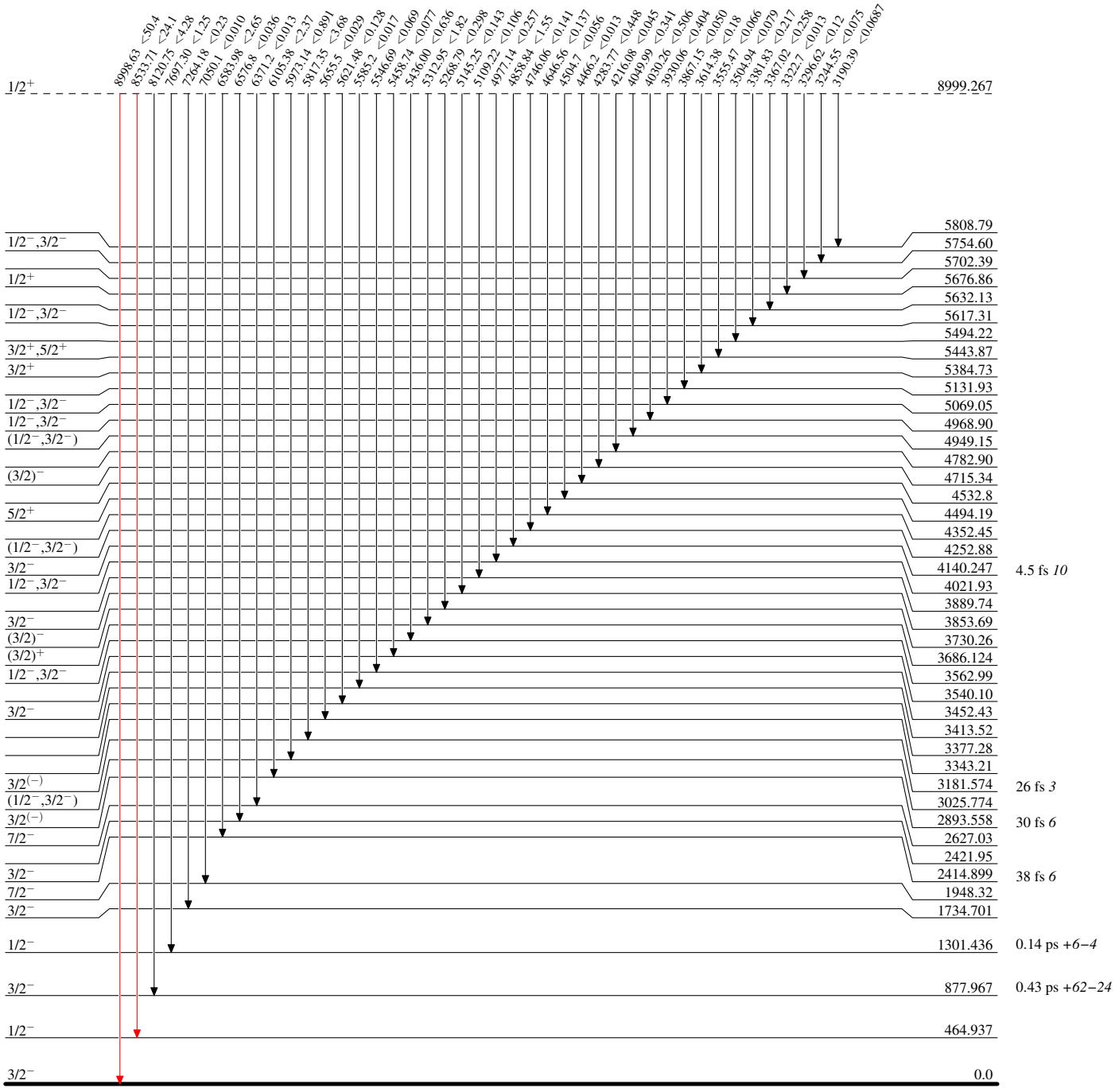
Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

Legend

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

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

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



$^{59}_{28}Ni_{31}$

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme (continued)

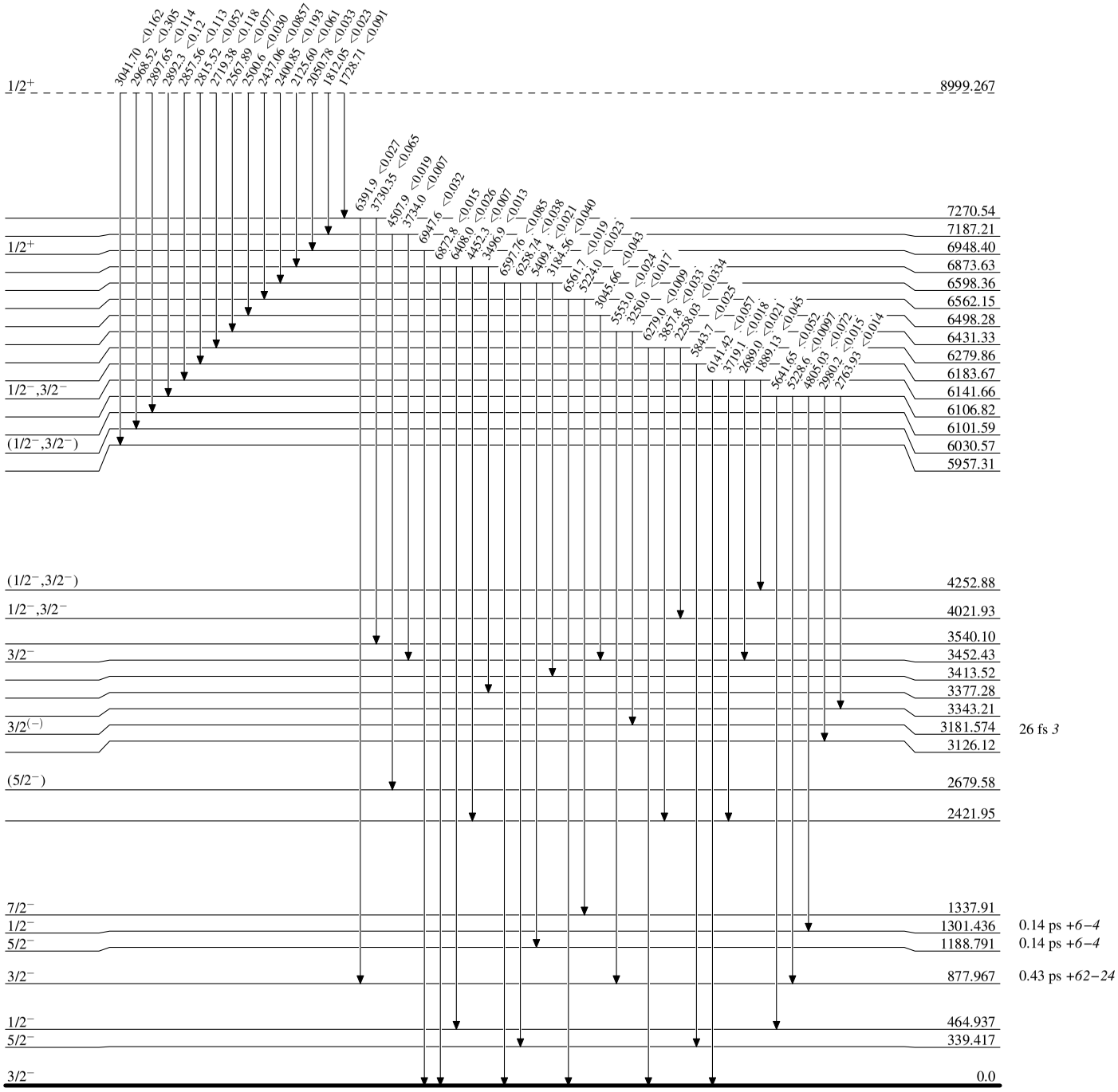
Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

Legend

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

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

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



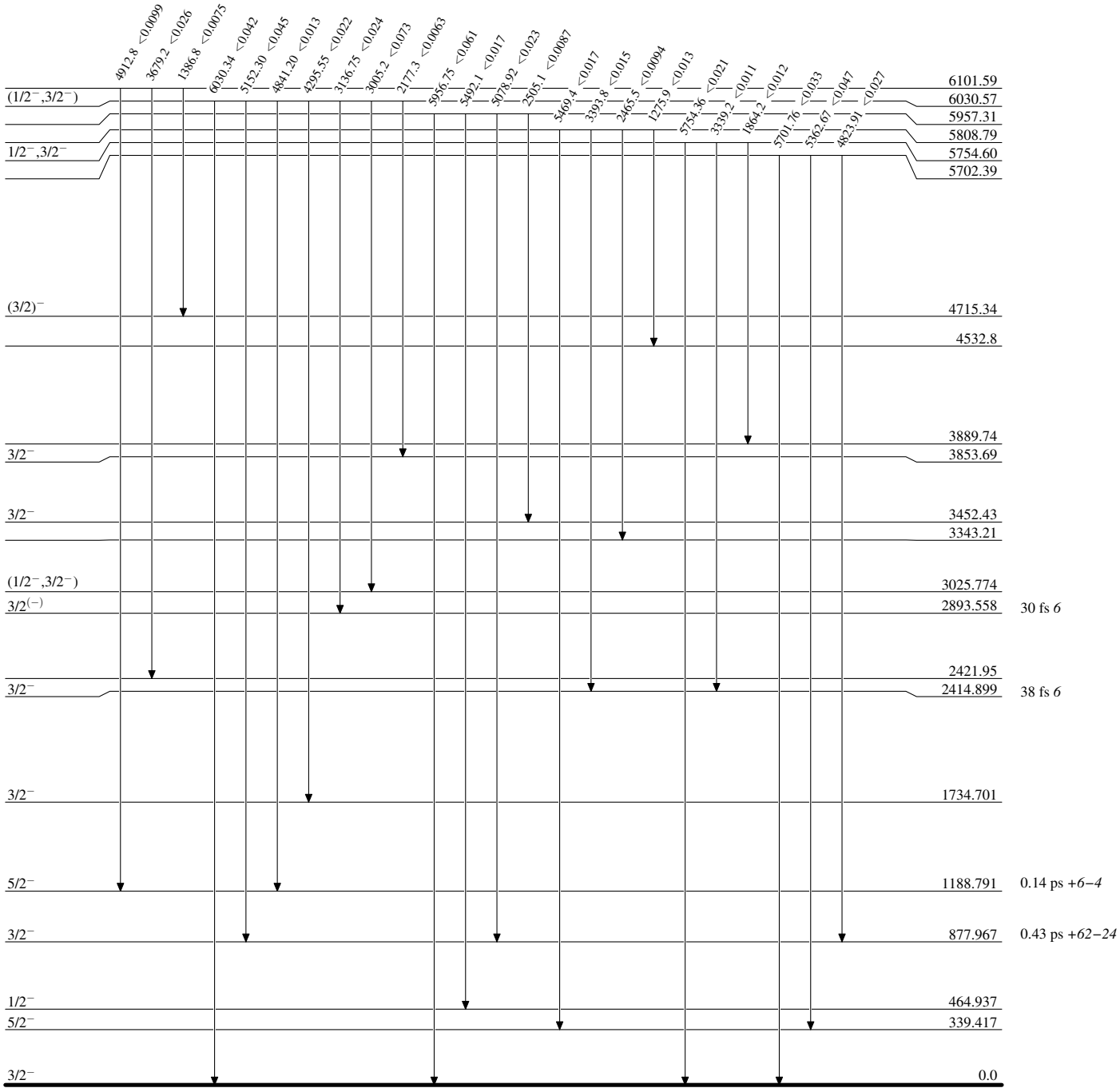
$^{59}_{28}Ni_{31}$

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

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



$^{59}_{28}Ni_{31}$

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme (continued)

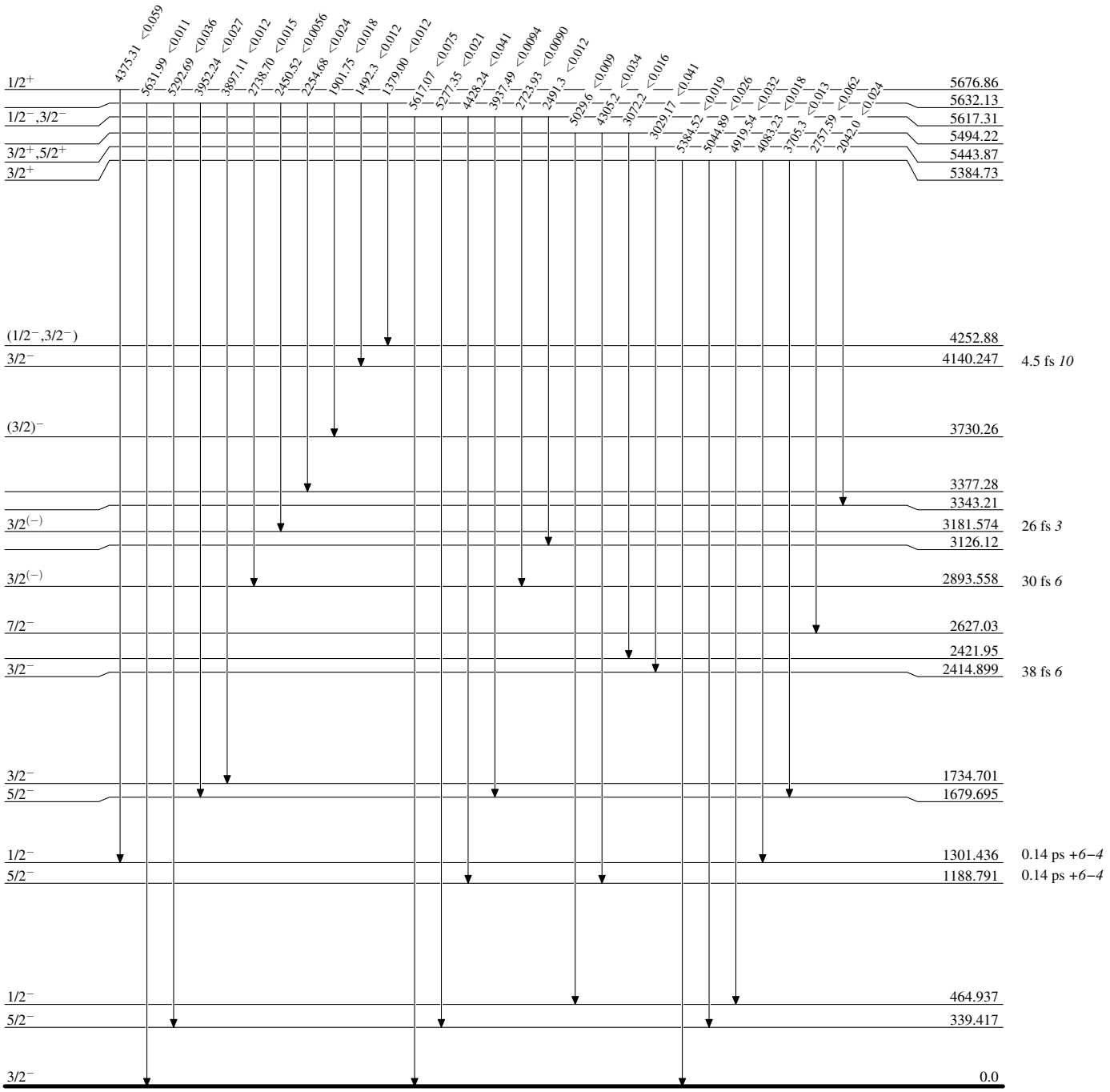
Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

Legend

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

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

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



$^{59}_{28}Ni_{31}$

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme (continued)

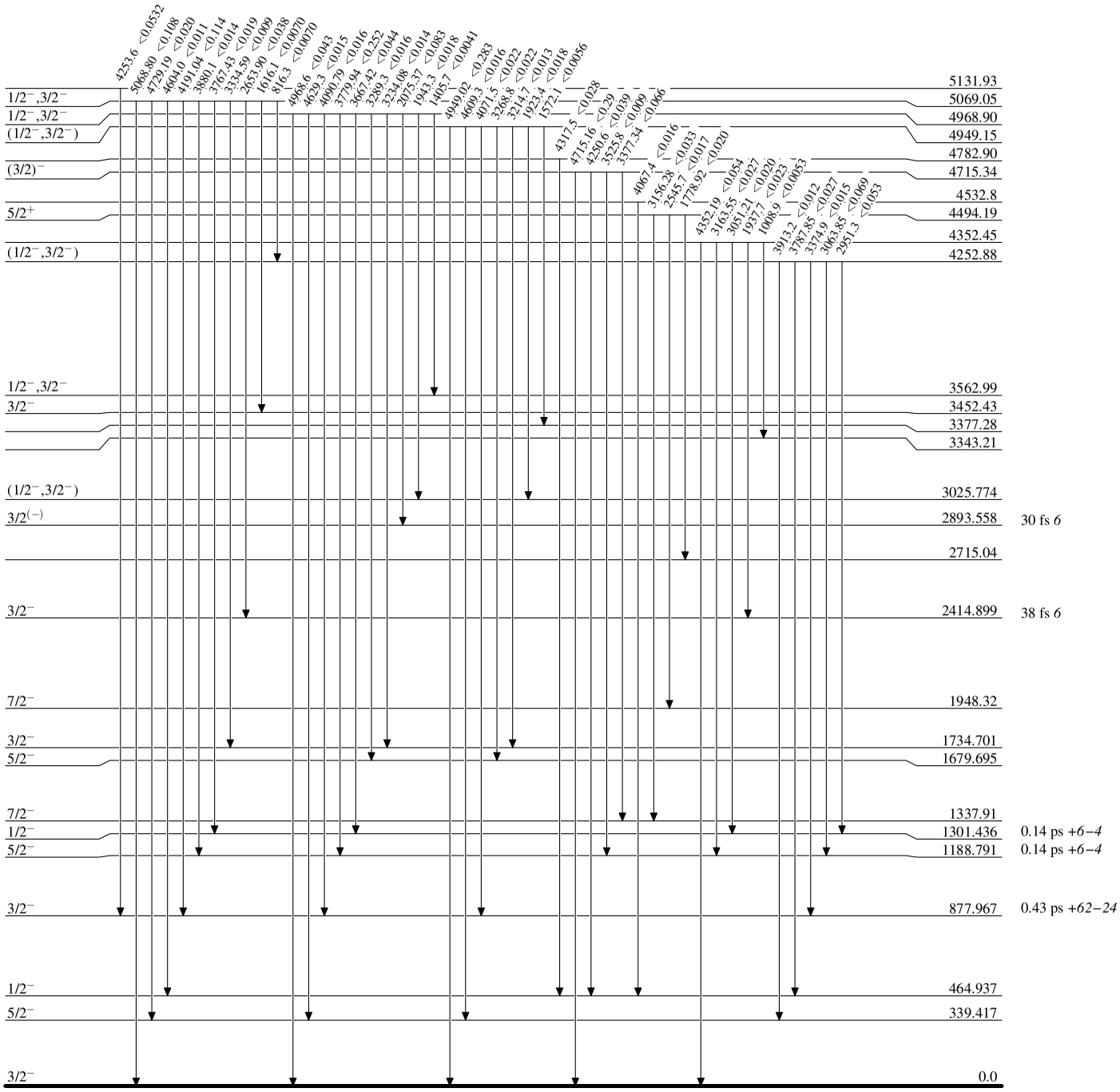
Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

Legend

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

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

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



$^{59}_{28}Ni_{31}$

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme (continued)

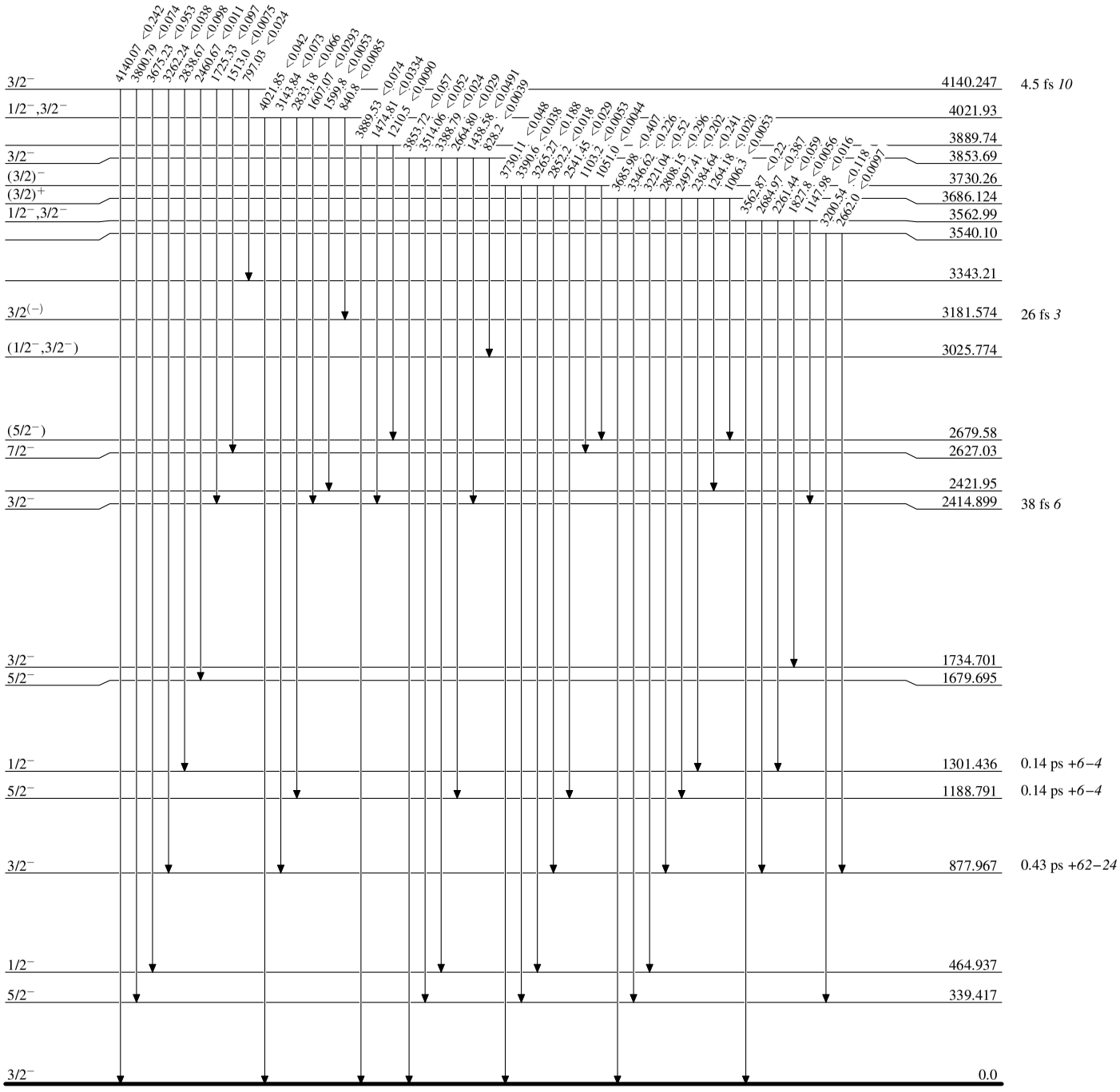
Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

Legend

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

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

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



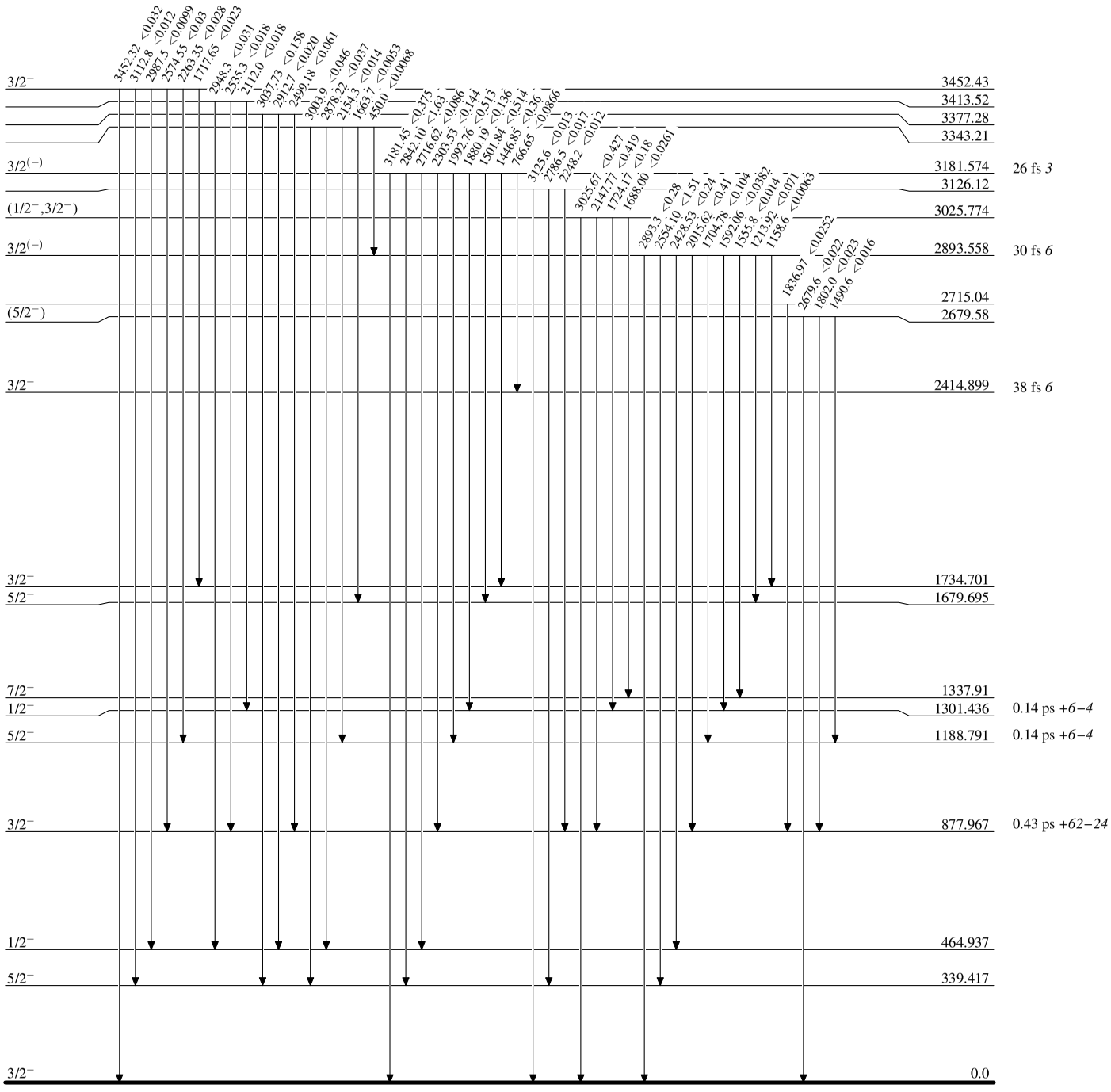
$^{59}_{28}Ni_{31}$

^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Level Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

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



$^{59}_{28}Ni_{31}$

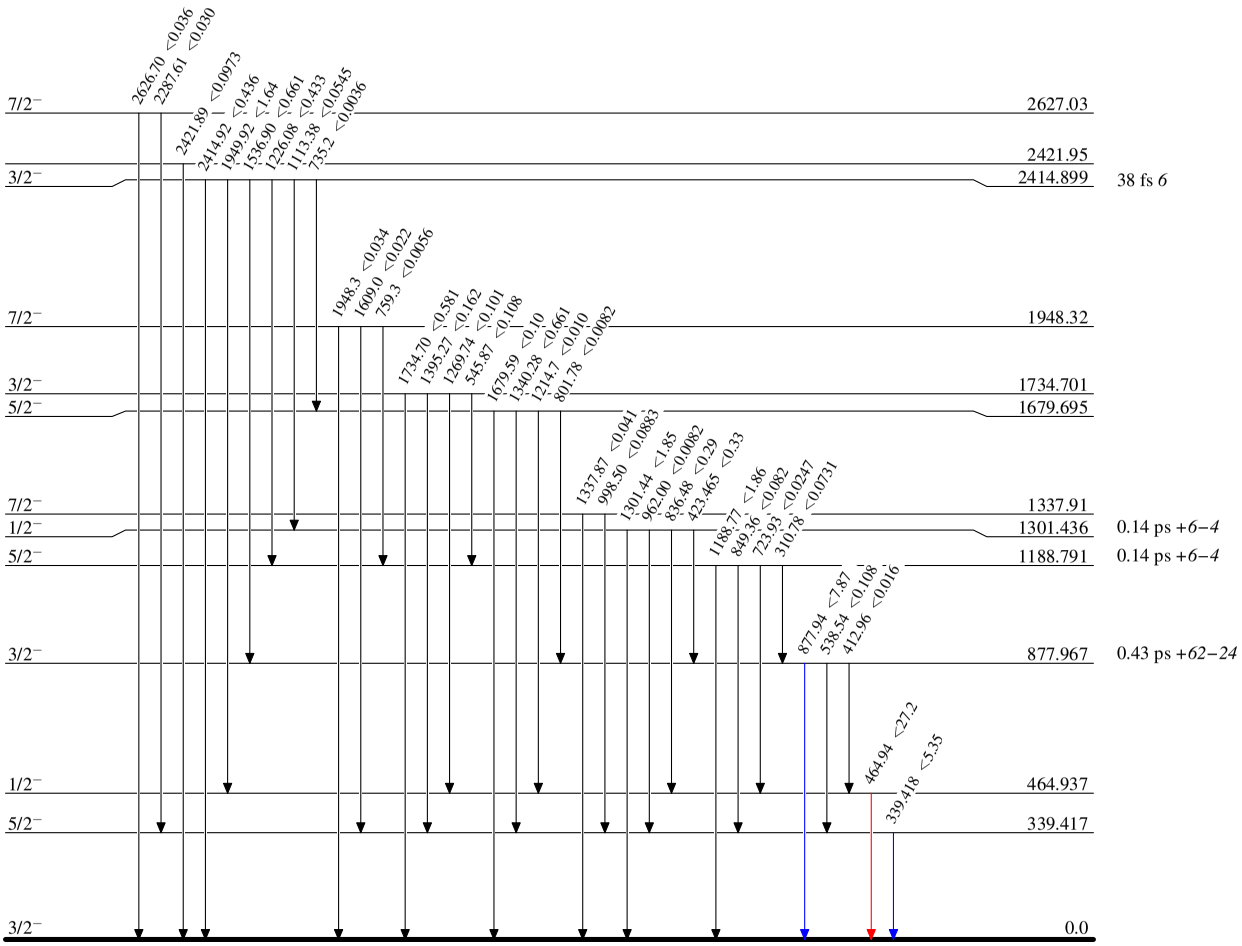
^{58}Ni(n,γ), (pol n,γ) E=thermal 2004Ra23,1993Ha05,1991Ul01

Legend

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

Level Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures



$^{59}_{28}Ni_{31}$