^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Caroline D. Nesaraja, Scott D. Geraedts and Balraj Singh	NDS 111,897 (2010)	12-Jan-2010

1967Te02: E=11-11.5 MeV. FWHM=11 keV.
1967Ja08: E=17.69 MeV. FWHM≈45 keV.
1969Be48: E=8-9 MeV.
1969Va24: E=6.52, 6.92 MeV.
1971St02: E=7.8-8.6 MeV.
1969Be18: E=12 MeV.
1984BeZT (also 1983BeZX, 1982BeZO): E=45 MeV. FWHM=10 keV, 1^+ states.
1984Hi10: E=135-800 MeV. FWHM=100 keV (at E=800 MeV), 50-60 keV (at 333,498 MeV). Analyzing power data from other sources (priv comm) are also included in the analysis.
1986Ho15: E=65 MeV. FWHM=20 keV (pol p), analyzing powers.
1988Fu03, 1983Fu14: E=65 MeV. FWHM=15-22 keV.
1989Fu07: E=65 MeV, FWHM=10-22 keV; measured σ(E,θ), DWBA analysis to extract hexadecapole strength distribution as a function excitation energy. The low-lying states are at an excitation energy of 2.46 MeV, with β_4R=0.35 and %EWSR=0.6. Higher lying 13 states are described by a resonance structure centered at E=4.7 MeV *1*, Γ=0.6 MeV *2* and %EWSR=4.0.
1989LiZJ, 1989LiZK, 1989LiZL, 1989LiZM: E=280,489 MeV, measured σ(E,θ), σ(E′,θ); analyzed the data using relativistic-collective model to extract deformation lengths for the various levels in ^{58}Ni.
1992Ke07: reanalysis of (p,p′) data at E<50 MeV with coupled-channel calculations and Bechetti-Greenlees optical model parameters.
1998Sa12: (pol p,p) E=192, 295, 400 MeV, σ(θ), Ay(θ).
1998Li43: (pol p,p′) E=199 MeV, σ(θ), Ay(θ), deduced neutron and proton multipole matrix elements for first four 2^+, first 3^- and first five 4^+ states.
2001Is03: (pol p,p′) E=394 MeV, σ(θ), analyzing powers, DWBA calculations. Cross sections for GDR, GQR, GMR, SDR.
2002Re15: E=172 MeV, σ(θ); 19 states with $J^\pi=2^-$ (spin-flip transitions) reported but No numerical data available.
2004Sh34: (p,p′) E=200 MeV. Measured σ(θ) for GQR.
2005Ho10: (pol p,p′) E=172 MeV. Measured σ(θ) and analyzing powers. Data for first three 2^+ and 4^+ states, and first 3^- state. DWBA analysis.
2007Fu04: E=160 MeV, enriched target. Scattered protons were analyzed with QDD type magnetic spectrometer and detected with multiwire drift chambers at Indiana Cyclotron facility (IUCF). Spectra measured at 0° and angular distributions were obtained within the 2° acceptance of the magnetic spectrometer placed at 0°. DWBA analysis. FWHM=35 keV. Levels with $J^\pi=1^+$ reported above 8 MeV.
Additional information 1.
2007Ho13: E=172 MeV. Measured σ(θ). DWBA analysis.

Measured: σ(E) (1966Co11,1967Te02,2007Fu04); σ(E,θ) (1983Fu14,1984Hi10, 1967Ja08); γ, pγ (1969Be18,1969Va24,1971St02), γ(θ) (1969Va24,1971St02); internal pair conversion (1986Pa23,1981Pa10,1971Wa13); γ(t) (1969Be48,1971St02), γγ(θ) (1969Va24,1971St02), σ(E,θ); analyzing power (1986Ho15).
Other: 1988Go22.

^{58}Ni Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	L[@]	β_LR[@]	Comments
0.0	0^+				
1454.0 *2*	2^+	0.64 ps *+10−7*	2	0.90	β_2=0.148 *11* (1992Ke07) from a reanalysis of data by 1964St15. $T_{1/2}$: from DSAM: 0.65 ps *8* (1969Be48), 0.64 ps *12* (1973BeYD).
2459.1 *3*	4^+	>0.97 ps	4	0.35	
2775.2 *3*	2^+	0.38 ps *+13−9*	2		
2901.5 *5*	1^+[d]	69 fs *+15−14*	2		Configuration=ν($p_{3/2}f_{5/2}$) (1986Ho15). $T_{1/2}$: from 1971St02.
2942.4 *3*	0^+	2.01 ns *7*	0		$T_{1/2}$: from 1971St02.

Continued on next page (footnotes at end of table)

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24 (continued)

^{58}Ni Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	L[@]	$\beta_L R$[@]	Comments
3037.7 *3*	2$^+$	40 fs *+6−5*	2	0.242	
3263.4 *3*	2$^+$	25 fs *4*	2	0.306	
3420.3 *3*	3$^+$	0.26 ps *+22−10*	2+4		L: from 1971St11.
3530.9 *4*	0$^+$	0.19 ps *6*			629γ to 2901 with J^{π}=1$^+$ was not observed (Iγ<3) (1981Pa10).
3593.4 *4*	(1,2$^+$)	33 fs *+9−8*			
3620.1 *4*	4$^+$	0.11 ps *+9−5*		0.246	
3774.5 *4*	3$^+$	0.28 ps *+14−7*	2+4		$T_{1/2}$,L: from 1971St02.
3898.2 *4*	2$^+$	23 fs *3*	2	0.111	
4020?					E(level),J^{π}: priv comm from L.R.Kouw quoted by 1984Bl19 mentions a J^{π}=0$^+$ level at 4020 observed in high resolution (p,p′) experiment.
4107.6 *5*	2$^+$	65 fs *10*	2	0.063	
4294 *5*	4$^{(+)}$	24 fs *+22−18*	4	0.127	
4346.6[&] *15*		17 fs *+15−13*			
4355 *5*	(2$^+$,3,4$^+$)				
4380 *5*	(5$^+$)				
4404.8[&] *13*	4$^+$	43 fs *+17−14*	4	0.329	
4449 *5*	1$^+$,2$^+$				
4475.3[&] *8*	3$^-$	19 fs *8*	3	0.708	β_3=0.190 *14* (1992Ke07) from a reanalysis of data of 1964St15 and 1967Ja08.
4518 *5*					
4536.1[&] *8*	0$^+$	31 fs *11*			J^{π}: priv comm from L.R.Kouw quoted by 1984Bl19 mentions a J^{π}=0$^+$ level at 4540 observed in high resolution (p,p′) experiment.
4578[a] *7*					
4755 *5*	4$^+$		4	0.403	
4920 *5*					
4962 *5*					
5064 *5*					
5084 *5*					
5128[a] *10*	6$^+$		6		J^{π},L: from σ(θ) and analyzing power data (1984Hi10).
5166 *10*	1$^+$[d]				E(level): weighted average of 5165 *10* (1967Te02) and 5166 *10* (1983Fu14). Configuration=$\nu(p_{3/2}p_{1/2})$ (1986Ho15).
5171[a] *10*					
5380 *5*					
5432 *5*	4$^+$		4	0.151	E(level): weighted average of 5434 *10* (1967Te02) and 5428 *5* (1988Fu03).
5460[a] *10*					
5470 *5*	4$^+$		4	0.080	E(level): 5467 *5* in 1988Fu03 with L=4. E(level): weighted average of 5472 *5* (1967Te02) and 5467 *5* (1988Fu03).
5503 *5*					
5590 *5*	2$^+$				E(level): 5590 and 5592 proposed in 1969Be18 as two separate levels. Doublet also proposed in 1967Te02.
5592 *5*					E(level): see comment for 5590 level.
5706 *5*					
5748 *5*	2$^+$		2	0.048	E(level): weighted average of 5748 *5* (1969Be18), 5747 *5* (1988Fu03).
5766 *5*	4$^+$		4	0.086	E(level): weighted average of 5765 *5* (1969Be18), 5768 *5* (1988Fu03).
5803 *5*					
5824 *5*					E(level): 5846 *10* In 1967Te02 seems to Be the same level As 5824 In 1969Be18.

Continued on next page (footnotes at end of table)

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24 (continued)

^{58}Ni Levels (continued)

E(level)[†]	Jπ[‡]	L[@]	$\beta_L R$[@]	Comments
5896 *5*				
5906 *5*	2+	2	0.115	
5924[a] *10*	(0+)			
5942 *5*	(0+)			
5963[a] *10*	(0+)			
5982[a] *10*	(0+)			
6018 *5*	3−			
6024 *5*	1−			
6066[a] *10*				
6080 *5*				
6116[a] *10*				
6174 *5*				
6199[a] *10*				
6220[a] *10*				
6228 *5*				
6248[a] *10*				
6271[a] *10*				
6274 *5*	4(+)			
6308 *5*	3−	3	0.128	E(level): unweighted average of 6304 *5* (1969Be18) and 6312 *5* (1988Fu03). Other: 6306 *10* (1967Te02).
6323[a] *10*				
6360 *5*				
6389[a] *10*				
6402 *5*				
6417 *5*	2+	2	0.068	E(level): corresponds to 6411 *10* level of 1967Te02.
6437[a] *10*				
6447[a] *10*				
6460 *5*	4+	4	0.098	
6468 *5*				
6478 *5*	2+	2	0.065	E(level): weighted average of 6475 *5* (1969Be18) and 6480 *5* (1988Fu03).
6500[a] *10*				
6507 *5*				
6549[a] *10*	(4+)			
6571 *5*	2+	2	0.056	E(level): weighted average of 6568 *5* (1969Be18) and 6573 *5* (1988Fu03).
6598[a] *10*	(4+)			
6601 *5*				
6665 *5*				
6674[a] *10*				
6714[a] *10*				
6717[a] *10*				
6752 *5*	2+	2	0.141	E(level): corresponds to 6739 *10* level of 1967Te02.
6763[a] *10*	3−			
6793[a] *10*	3−			
6805[a] *10*	3−			
6813[a] *10*				
6844[a] *10*	3−			
6854 *5*	3−	3	0.296	
6886[a] *10*	(2+,3−)			
6912[a] *10*	(2+,3−)			
6925[a] *10*	4+			
6935[a] *10*	4+			
6960[a] *10*				
6983 *5*	2+	2	0.116	E(level): corresponds to 6973 *10* level of 1967Te02.

Continued on next page (footnotes at end of table)

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24 (continued)

^{58}Ni Levels (continued)

E(level)[†]	J^{π}[‡]	L[@]	$\beta_L R$[@]	Comments
6992[a] *10*				
7017[a] *10*				
7042[a] *10*				
7051 *5*	4^+	4	0.090	
7054[a] *10*				
7068 *5*	4^+	4	0.086	
7089[a] *10*				
7111 *5*	3^-	3	0.079	E(level),J^{π}: from 1988Fu03. Corresponds to 7104 *10* level of 1967Te02.
7113	$(1,2^+)$[d]			
7132 *10*				E(level): from 1983BeZX.
7141 *5*	4^+	4	0.112	
7210 *5*	3^-	3	0.323	
7255 *5*	2^+	2	0.088	
7270	1			
7300 *5*	3^-	3	0.063	
7380	$(1,2^+)$			
7420 *5*	3^-	3	0.048	
7450 *10*				
7514 *5*	3^-	3	0.171	
7570 *5*	2^+	2	0.051	
7618 *5*	4^+	4	0.083	
7680				
7700 *10*	1^+			
7721 *10*				E(level): from 1983Fu14. Configuration=$\nu(f^{-1}_{7/2}f_{5/2})$ (1983Fu14).
7751 *10*				
7810	1^-			
7858 *5*	3^-	3	0.106	
7860 *5*	4^+	4	0.097	
7862	$(1,2^+)$[d]			
8110	$(1,2^+)$			
8134 *5*	3^-	3	0.142	
8143 *10*				
8203[b] *10*	(1^+)[c]			dσ/dΩ=0.19 mb/sr *8*.
8238[b] *10*	$[1^-]$[e]			Additional information 2. dσ/dΩ=0.26 mb/sr *8* (2007Fu04).
8274[b] *10*	1^+[c]			dσ/dΩ=0.18 mb/sr *8*.
8316 *10*				
8372[b] *10*	(1^+)[c]			dσ/dΩ=0.16 mb/sr *8*.
8392 *10*				
8419[b] *10*	1^+[d]			Additional information 3. dσ/dΩ=0.17 mb/sr *8* (2007Fu04). Configuration=$\nu(f^{-1}_{7/2}f_{5/2})$ (1986Ho15).
8461[b] *10*	1^+[c]			dσ/dΩ=0.19 mb/sr *8*.
8517[b] *10*	$[1^-]$[e]			dσ/dΩ=0.27 mb/sr *8*.
8556 *10*	$1^{(+)}$[d]			Configuration=$\nu(p_{3/2}p_{1/2})$ (1986Ho15).
8602[b] *10*	1^+[c]			dσ/dΩ=0.57 mb/sr *4*.
8645 *10*	$(3^-,1^-)$			
8677[b] *10*	1^+[c]			dσ/dΩ=1.02 mb/sr *4*.
8692				
8716 *10*				
8797 *5*	3^-	3	0.097	

Continued on next page (footnotes at end of table)

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24 (continued)

^{58}Ni Levels (continued)

E(level)[†]	J^{π}[‡]	L[@]	$\beta_L R$[@]	Comments
8841 *5*	3^-	3	0.112	
8856[b] *10*	$1^{(+)}$[c]			dσ/dΩ=0.41 mb/sr *5*.
8880[b] *10*	[1^-][e]			dσ/dΩ=0.19 mb/sr *8*.
8902 *5*	4^+	4	0.072	
8959[b] *10*	1^+[c]			dσ/dΩ=0.32 mb/sr *4*.
9012 *5*	3^-	3	0.056	
9071[b] *10*	1^+[c]			dσ/dΩ=0.35 mb/sr *4*.
9156[b] *10*	1^+[c]			dσ/dΩ=0.36 mb/sr *4*.
9193[b] *10*	(1^+)[c]			dσ/dΩ=0.18 mb/sr *4*.
9242[b] *10*	(1^+)[c]			Additional information 4. dσ/dΩ=0.17 mb/sr *4*.
9295 *10*	1^+[d]			Configuration=$\nu(f_{7/2}^{-1}f_{5/2})$ (1986Ho15).
9304 *5*	3^-	3	0.065	
9326[b] *10*	(1^+)[c]			Additional information 5. dσ/dΩ=0.20 mb/sr *4*.
9379 *5*	3^-	3	0.106	
9436 *5*	4^+	4	0.071	
9458 *5*	3^-	3	0.082	
9526[b] *10*	(1^+)			J^{π}: from comparison of isobar analog states in 58CU, 2007Fu04 propose 1^+ for this state, but assume E1 transition in their analysis following assignment in (γ,γ′). dσ/dΩ=0.37 mb/sr *4*.
9588 *5*	4^+	4	0.052	
9632 *5*	4^+	4	0.080	
9672 *5*	3^-	3	0.121	
9739[b] *10*	1^+[c]			dσ/dΩ=0.37 mb/sr *11*.
9835 *5*	3^-	3	0.083	
9835[b] *10*	1^+[d]			Additional information 6. dσ/dΩ=0.33 mb/sr *4* (2007Fu04). Configuration=$\nu(p_{3/2}p_{1/2})$ (1986Ho15).
9870 *5*	3^-	3	0.076	
9929 *5*	3^-	3	0.061	
9956 *5*	3^-	3	0.071	
10029 *5*	3^-	3	0.114	
10059 *5*	4^+	4	0.065	
10115[b] *10*	1^+[c]			dσ/dΩ=0.22 mb/sr *4*.
10120 *5*	4^+	4	0.072	
10156[b] *10*	1^+[c]			dσ/dΩ=0.17 mb/sr *4*.
10209 *5*	3^-	3	0.107	dσ/dΩ=0.41 mb/sr *4*.
10211[b] *10*	1^+			E(level): in e-mail reply of April 10, 2008 from the first author of 2007Fu04, 10211, 1^+ is a different level from 10209, L=3 from 1988Fu03, since L>0 transitions are expected to be strongly suppressed in the 0° spectrum of 2007Fu04.
10249 *5*	4^+	4	0.069	
10304 *10*				
10365 *5*	4^+	4	0.082	
10430 *10*				
10460 *5*	4^+	4	0.050	
10492[b] *10*	1^+[c]			dσ/dΩ=0.27 mb/sr *4*.
10523 *5*	4^+	4	0.102	
10586 *5*	3^-	3	0.079	
10638 *5*	3^-	3	0.089	
10664[b] *10*	1^+[d]			Additional information 7.

Continued on next page (footnotes at end of table)

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24 (continued)

^{58}Ni Levels (continued)

E(level)[†]	Jπ[‡]	L[@]	β_LR[@]	Comments
				dσ/dΩ=1.59 mb/sr *5* (2007Fu04). Configuration=$\nu(f_{7/2}^{-1}f_{5/2})$ (1986Ho15).
10744 *5*	4+	4	0.091	
10804 *10*				
10823 *5*	4+	4	0.086	
10902 *5*	4+	4	0.102	
10967 *5*	4+	4	0.075	
11003[b] *10*	1+[c]			Additional information 8. dσ/dΩ=0.27 mb/sr *4* (2007Fu04).
11063[b] *10*	1+			
11158 *5*	3−	3	0.087	Jπ: L(p,p′)=3. dσ/dΩ=0.16 mb/sr *4*.
11165[b] *10*	1+			E(level): in e-mail reply of April 10, 2008 from the first author of 2007Fu04, 11165, 1+ is a different level from 11063, L=3 from 1988Fu03, since L>0 transitions are expected to be strongly suppressed in the 0° spectrum of 2007Fu04.
11203 *5*	4+	4	0.063	
11266 *10*				
11300 *5*	4+	4	0.095	
11341 *10*				
11434 *5*	4+	4	0.097	
11497 *10*	(3−)			
11588 *10*				
11672[b] *10*	1+[c]			dσ/dΩ=0.31 mb/sr *9*.
11728 *5*	4+	4	0.072	
11785 *10*				
11883[b] *10*	1+[c]			Additional information 9. dσ/dΩ=0.29 mb/sr *4*.
12197[b] *10*	1+[c]			dσ/dΩ=0.23 mb/sr *4*.
12293[b] *10*	1+[c]			dσ/dΩ=0.21 mb/sr *4*.
12386[b] *10*	1+[c]			dσ/dΩ=0.17 mb/sr *4*.
12636[b] *10*	1+[c]			dσ/dΩ=0.12 mb/sr *4*.
12738[b] *10*	1+[c]			dσ/dΩ=0.32 mb/sr *4*.
13305[b] *10*	1+[c]			dσ/dΩ=0.22 mb/sr *4*.

[†] For E≤4108, energies are weighted averages of values from 1969Va24 and 1969Be48. Note that 1971St02 also study these levels but only provide nominal energies without uncertainties. Weighted averages provided by 1969Va24 using their data, data of 1969Be48, preliminary data received by 1969Va24 from authors of 1971St02, and preliminary data from ^{58}Cu decay received from authors of 1970Ra34 are not considered valid by the evaluators, since the corresponding published values in 1971St02 and 1970Ra34 differ. Values for E>4108 are from 1969Be18 or 1988Fu03 with ΔE=5 and from 1982BeZO, 1983BeZX or 1984BeZT with ΔE=10, unless indicated otherwise. Many higher energy (>8.2 MeV) levels are from 2007Fu04.

[‡] Adopted values; supporting arguments from this data set are are given in comments.

[#] From DSA (1969Be48), except where noted otherwise.

[@] From 1988Fu03; L(2902,2942 levels) from 1971St11.

[&] From 1969Be48.

[a] From 1967Te02.

[b] From 2007Fu04, uncertainty of 10 keV is assigned from e-mail reply from H. Fujita on April 10, 2008. Most of these levels are interpreted as Gamow-Teller states.

[c] From 2007Fu04, level interpreted as Gamow-Teller state.

[d] From analysis of σ(θ) (1983Fu14,and/or 1986Ho15) and analyzing-power data (1986Ho15,2001Is03).

[e] Assumed as E1 transition, based on (γ,γ′) work.

γ(^{58}Ni)

A_2 and A_4 values are from pγ(θ) data of 1969Va24 at E(p)=6.92 MeV; authors quote values from E(p)=6.52 MeV data also. Similar values are also available from 1971St02.

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[†]	δ	α[&]	$I_{(\gamma+ce)}$	Comments
1454.0	2+	1454.0 *2*	100	0.0	0+	E2				Mult.: A_2=+0.260 *16*, A_4=−0.158 *20*.
2459.1	4+	1005.1 *2*	100	1454.0	2+	E2				Mult.: A_2=+0.343 *11*, A_4=−0.054 *15*.
		2459.1[a]	≤0.5	0.0	0+					
2775.2	2+	316.1	≤0.06	2459.1	4+					
		1321.2 *2*	95.7 *3*	1454.0	2+	M1+E2	−1.1 *1*			Mult.: A_2=−0.174 *10*, A_4=+0.024 *14*. δ: weighted average of −1.1 *2* (1971St02) and −1.1 *2* (1969Va24) whose reported value is −1.14 *+11−19*.
		2775.5 *4*	4.3 *3*	0.0	0+	E2				Mult.: A_2=+0.46 *8*, A_4=+0.01 *11*.
2901.5	1+	442.7	≤0.14	2459.1	4+					
		1448.2 *4*	94.0 *6*	1454.0	2+					
		2901.3 *5*	6.0 *6*	0.0	0+	D				Mult.: A_2=−0.11 *9*.
2942.4	0+	40.3 *4*	72 *3*	2901.5	1+	M1		0.581 *19*		α(K)= 0.519 *17*; α(L)= 0.0541 *18*; α(M)=0.000762 *25* E_γ: from ^{58}Cu ε decay. I_γ: from I(γ+ce)=80% 2 (1971St02) and α. Other: 74 *4* (1969Va24). Mult.: α=0.48 *5* from I(γ+ce) balance in γγ (1971St02).
		167.2 *2*	13.3 *14*	2775.2	2+	[E2]		0.0809		α(K)= 0.0722; α(L)=0.00761; α(M)=0.001063 Mult.: A_2=−0.06 *14*, A_4=−0.06 *16*. I_γ: from I(γ+ce)=10% 1 (1971St02), assuming that internal conversion was taken into account by 1971St02. Other: 13 *3* (1969Va24).
		483.3[a]	≤0.3	2459.1	4+					
		1488.3 *3*	14.3 *14*	1454.0	2+	[E2]				Mult.: A_2=+0.08 *7*, A_4=+0.03 *9*. I_γ: from I(γ+ce)=10% 1 (1971St02). Other: 14 *3* (1969Va24).
		2942.4		0.0	0+	E0			0.021 *3*	$I_{(\gamma+ce)}$: weighted average of 1.9×10^{-4} *3* (1981Pa10) and 2.2×10^{-4} *5* (1971Wa13) per decay for the internal pair decay branch. The transition probability associated with K-shell internal conversion is about 4% of the pair formation (1986PaZM) and is included. ρ^2=0.0000062 *12* (1981Pa10,1986Pa23).
3037.7	2+	95.2	≤0.3	2942.4	0+					
		135.8	≤0.12	2901.5	1+					
		262.6 *3*	1.0 *2*	2775.2	2+	M1(+E2)	−0.03 *5*			Mult.: A_2=+0.22 *10*, A_4=−0.07 *15*.
		578.5	≤0.3	2459.1	4+					
		1583.8 *3*	58.8 *10*	1454.0	2+	M1+E2	+0.21 *3*			Mult.: A_2=+0.379 *13*, A_4=+0.069 *18*. δ: from 1969Va24; 0.12 *12* (1971St02).

γ(^{58}Ni) (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[†]	δ	$I_{(\gamma+ce)}$	Comments
3037.7	2^+	3037.7 *3*	40.2 *11*	0.0	0^+				A_2=+0.283 *20*, A_4=−0.101 *25*.
3263.4	2^+	321	≤0.2	2942.4	0^+				
		361.6	≤0.2	2901.5	1^+				
		488.2	≤0.2	2775.2	2^+				
		804.3	≤1	2459.1	4^+				
		1809.5 *3*	39.7 *11*	1454.0	2^+	M1+E2	+0.7 *4*		δ: from 1971St02. Other: +0.65 or +0.60 with a large χ^2 value (1969Va24). A_2=+0.493 *31*, A_4=+0.041 *43*.
		3263.4 *4*	60.3 *11*	0.0	0^+				A_2=+0.434 *20*, A_4=−0.088 *24*.
3420.3	3^+	382.9 *3*	5.4 *3*	3037.7	2^+	D(+Q)	+0.08 *9*		Mult.: A_2=−0.16 *13*, A_4=0.00 *17*.
		477.9	≤0.6	2942.4	0^+				
		518.5	≤0.7	2901.5	1^+				
		645.1	≤1.1	2775.2	2^+				
		961.0 *2*	94.6 *3*	2459.1	4^+	D(+Q)	−0.02 *3*		δ: from 1969Va24; 0.0 *1* (1971St02).
		1966.3	≤2	1454.0	2^+				
		3420.3	≤0.4	0.0	0^+				
3530.9	0^+	493.3	≤1.0	3037.7	2^+				
		588.5[a]		2942.4	0^+				I_γ: ≤1.0, but none expected from E0 transition.
		629.1	≤1.1	2901.5	1^+				
		755.7	≤1.8	2775.2	2^+				
		1071.8[a]	≤2.9	2459.1	4^+				
		2076.9 *3*	100	1454.0	2^+				A_2=−0.022 *33*, A_4=+0.083 *41*.
		3530.9		0.0	0^+	E0		0.068 *11*	$I_{(\gamma+ce)}$: internal pair decay branch from I(pairs,3530)/Ice(K)(2077γ)=13.9 *22* and α(K)(2077)=4.8×10^{-5} (1981Pa10). The transition probability associated with K-shell internal conversion is about 2% of the pair formation probability (1986PaZM) and is included. ρ^2=0.0008 *3* (1981Pa10).
3593.4	$(1,2^+)$	330.0	≤0.7	3263.4	2^+				
		555.8	≤1.6	3037.7	2^+				
		652.8 *10*	5.4 *6*	2942.4	0^+				
		691.6	<1.0	2901.5	1^+				I_γ: from 1971St02.
		818.4 *4*	17.7 *10*	2775.2	2^+				δ: A_2=+0.21 *16*, −3.8<δ<+0.4.
		1134.3	≤2.3	2459.1	4^+				
		2139.2 *5*	11.7 *6*	1454.0	2^+				A_2=−0.07 *15*.
		3593.3 *6*	65.2 *14*	0.0	0^+				A_2=−0.18 *4*.
3620.1	4^+	582.4	<3	3037.7	2^+				
		844.8	<3	2775.2	2^+				
		1161.2 *3*	83[@] *2*	2459.1	4^+	M1(+E2)	+0.6 *+3−6*		δ: from 1969Va24; −0.14 *17* (1971St02). Mult.: A_2=+0.50 *10*, A_4=+0.13 *14*.
		2165.9 *10*	17[@] *2*	1454.0	2^+				A_2=+0.38 *26*, A_4=−0.29 *32*.

$^{58}_{28}$Ni$_{30}$-8

γ(^{58}Ni) (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[†]	δ	Comments
3620.1	4+	3620.0[a]	<3.5	0.0	0+			
3774.5	3+	354.5 *3*	19 *2*	3420.3	3+	D(+Q)	+0.05 *+21−12*	δ: from 1969Va24; +0.2 *+2−7* (1971St02). Mult.: A_2=+0.40 *7*, A_4=−0.10 *9*.
		736 *2*	9 *2*	3037.7	2+			
		872.6	<2.5	2901.5	1+			
		999.2		2775.2	2+			
		1316.4 *15*	58 *4*	2459.1	4+	M1+E2		I_γ: from 1971St02. Gammas from the cascade through the 2459 and 2775 could not be resolved; it is estimated that the branch to the 2459 level is stronger by at least a factor of 3 (1971St02). δ: −0.19 *15* or −2.8 *+16−15* (1971St02) who also assume the contribution of the 3774 to 2459 to 1454 cascade to be negligible.
		2320.5 *8*	14 *2*	1454.0	2+			
		3774.4	<3	0.0	0+			
3898.2	2+	2444.7 *4*	75.8 *12*	1454.0	2+			δ: +0.13 *10* or +2.2 *6* (1969Va24). A_2=+0.19 *7*, A_4=+0.09 *9*.
		3898.0 *7*	24.2 *12*	0.0	0+			A_2=+0.34 *11*, A_4=+0.03 *14*.
4107.6	2+	687.4	2 *1*	3420.3	3+			
		1205.9	5 *2*	2901.5	1+			
		1332.5	6 *2*	2775.2	2+			
		2654.6 *4*	40.5 *25*	1454.0	2+	M1+E2	−0.58 *+8−9*	I_γ: average of 38 *2* at E(p)=8.295 MeV and 43 *2* at E(p)=8.286 MeV (1971St02). Mult.: A_2=+0.19 *10*, A_4=−0.12 *13*. δ: from 1971St02 at E(p)=8.295 MeV, and −0.31 *+912−11* at E(p)=8.286 MeV; −0.10 *16* or +3.2 *+44−13* (1969Va24).
		4107.4 *7*	46.5 *25*	0.0	0+			I_γ: average of 49 *2* at E(p)=8.295 MeV and 44 *2* at E(p)=8.286 MeV (1971St02). Other: Iγ(4107γ)/Iγ(2655γ)=0.75 *9* (1969Va24) is In agreement with 0.87 *6* adopted here. Mult.: A_2=+0.43 *10*, A_4=+0.04 *12*.
4294	4(+)	1835	50	2459.1	4+			
		2840	50	1454.0	2+			
4355	(2+,3,4+)	1580		2775.2	2+			
		1896		2459.1	4+			
		2901		1454.0	2+			
4380	(5+)	760		3620.1	4+			
		1921		2459.1	4+			
4404.8	4+	2951		1454.0	2+			
4449	1+,2+	829	100	3620.1	4+			
4475.3	3−	3021	100	1454.0	2+			
4518		2059		2459.1	4+			
		3064		1454.0	2+			
4755	4+	1135	80	3620.1	4+			
		2296	20	2459.1	4+			

$^{58}_{28}$Ni$_{30}$-9

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24 (continued)

γ(^{58}Ni) (continued)

E_i(level)	J^{π}_i	E_{γ}[‡]	I_{γ}[#]	E_f	J^{π}_f
4920		1300		3620.1	4^+
		1657		3263.4	2^+
		2461		2459.1	4^+
4962		1342	20	3620.1	4^+
		2505	80	2459.1	4^+
5064		2605		2459.1	4^+
5171		2711		2459.1	4^+
5380		1760		3620.1	4^+
5432	4^+	2977		2459.1	4^+
5470	4^+	3013		2459.1	4^+
		4018		1454.0	2^+
5503		2728		2775.2	2^+
5590	2^+	5590		0.0	0^+
5592		1817	34	3774.5	3^+
		3133	64	2459.1	4^+
		4138	2	1454.0	2^+
5706		2931[a]		2775.2	2^+
		3247		2459.1	4^+
		4252		1454.0	2^+
5748	2^+	2155		3593.4	$(1,2^+)$
		3289		2459.1	4^+
		4294[a]		1454.0	2^+
5766	4^+	3307		2459.1	4^+
		4312		1454.0	2^+
5803		4349		1454.0	2^+
		5803		0.0	0^+
5824		2404		3420.3	3^+
5896		4442		1454.0	2^+
		5896		0.0	0^+
5942	(0^+)	4488		1454.0	2^+
6018	3^-	4564		1454.0	2^+
6024	1^-	3565		2459.1	4^+
		6024		0.0	0^+
6174		3715		2459.1	4^+
		4720[a]		1454.0	2^+
		6174		0.0	0^+
6228		3326		2901.5	1^+
		4774		1454.0	2^+
		6228		0.0	0^+
6274	$4^{(+)}$	3815		2459.1	4^+

E_i(level)	J^{π}_i	E_{γ}[‡]	E_f	J^{π}_f
6308	3^-	3366	2942.4	0^+
		3533	2775.2	2^+
		4854	1454.0	2^+
6360		2940	3420.3	3^+
6402		6402	0.0	0^+
6468		5014	1454.0	2^+
		6468	0.0	0^+
6478	2^+	5024	1454.0	2^+
		6478	0.0	0^+
6507		2887	3620.1	4^+
6571	2^+	5117	1454.0	2^+
6601		2981	3620.1	4^+
		4142	2459.1	4^+
6665		5211	1454.0	2^+
		6665	0.0	0^+
6717		5263	1454.0	2^+
		6717	0.0	0^+
6763	3^-	5309	1454.0	2^+
6805	3^-	5351	1454.0	2^+
6844	3^-	5390	1454.0	2^+
6992		5538	1454.0	2^+
7054		7054	0.0	0^+
7113	$(1,2^+)$	5659	1454.0	2^+
		7113	0.0	0^+
7132		7131	0.0	0^+
7210	3^-	4751	2459.1	4^+
7270	1	5816	1454.0	2^+
		7270	0.0	0^+
7300	3^-	5846	1454.0	2^+
7380	$(1,2^+)$	7380	0.0	0^+
7514	3^-	6060	1454.0	2^+
7570	2^+	7570	0.0	0^+
7680		6226	1454.0	2^+
7700	1^+	7700	0.0	0^+
7810	1^-	6356	1454.0	2^+
		7810	0.0	0^+
7862	$(1,2^+)$	6408	1454.0	2^+
		7862	0.0	0^+
8110	$(1,2^+)$	8110	0.0	0^+

$^{58}_{28}Ni_{30}$-10

γ(^{58}Ni) (continued)

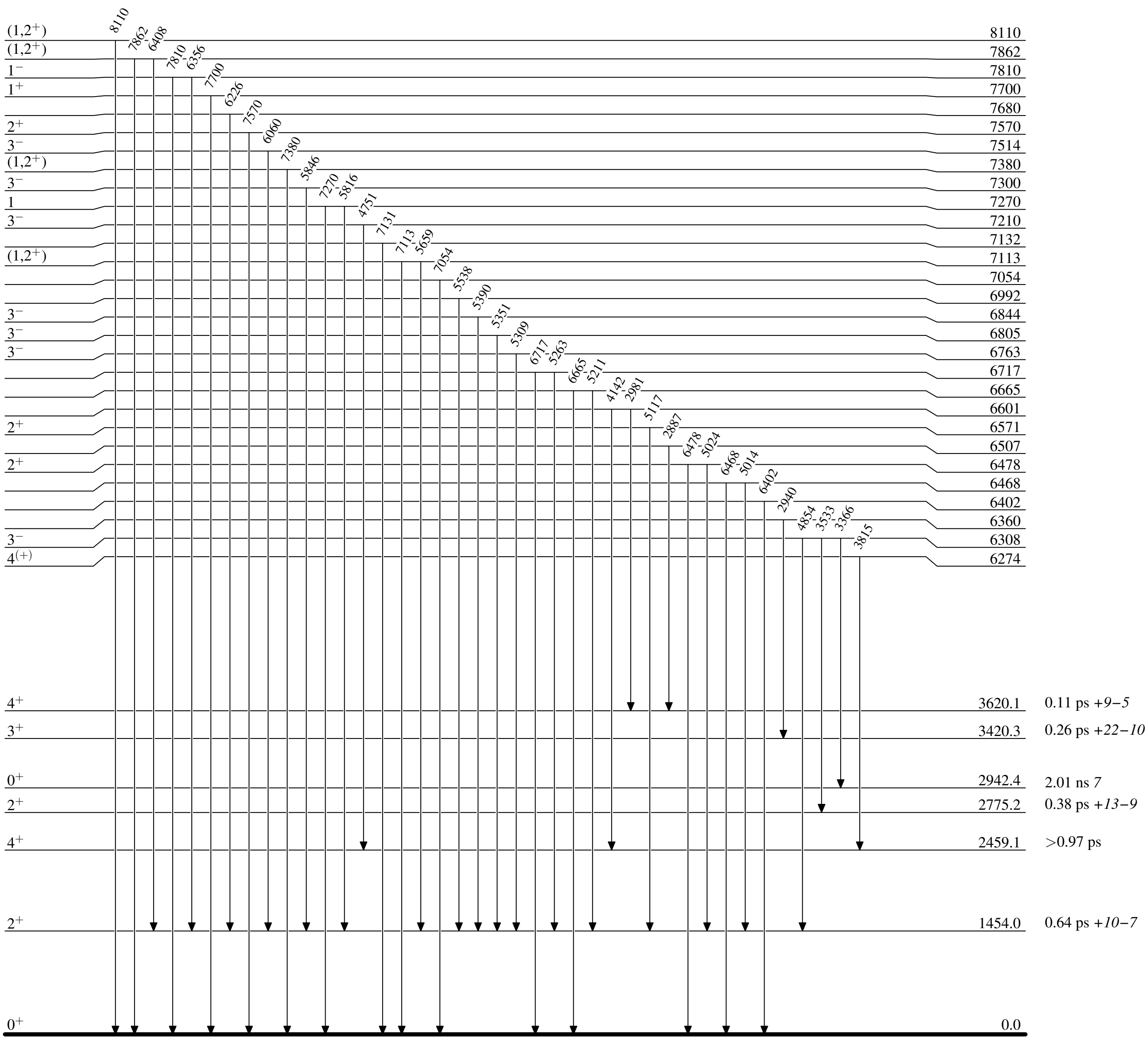
[†] For γ(θ) (1971St02,1969Va24), ΔJ=2, quadrupole transitions are most likely E2, and ΔJ=1, D+Q with significant admixtures are most likely M1+E2. In addition RUL is used when level lifetimes are known.
[‡] Values with uncertainties are from 1969Va24, other Eγ are based on the level scheme of 1969Be18 and derived from level energies adopted in this data set.
[#] Branching ratios from 1969Va24 or 1971St02 for gammas from E≤4108; from 1969Be18 for others.
[@] Weighted average of values from 1969Va24 and 1971St02.
[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with “Frozen Orbitals” approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[a] Placement of transition in the level scheme is uncertain.

$^{58}_{28}Ni_{30}$-11

^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24

Level Scheme

Intensities: % photon branching from each level



$^{58}_{28}Ni_{30}$

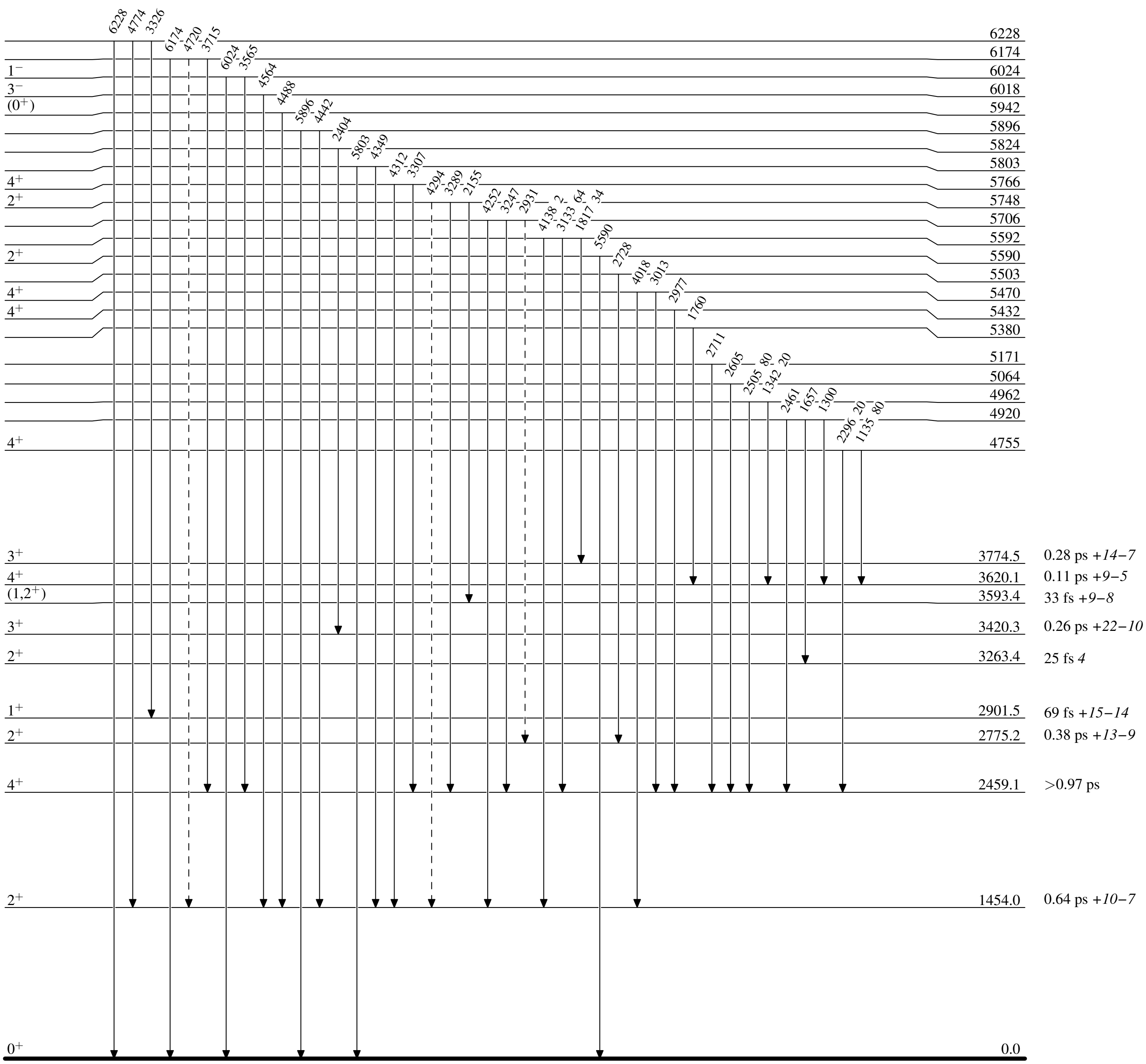
^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

- - - - - ► γ Decay (Uncertain)



$^{58}_{28}Ni_{30}$

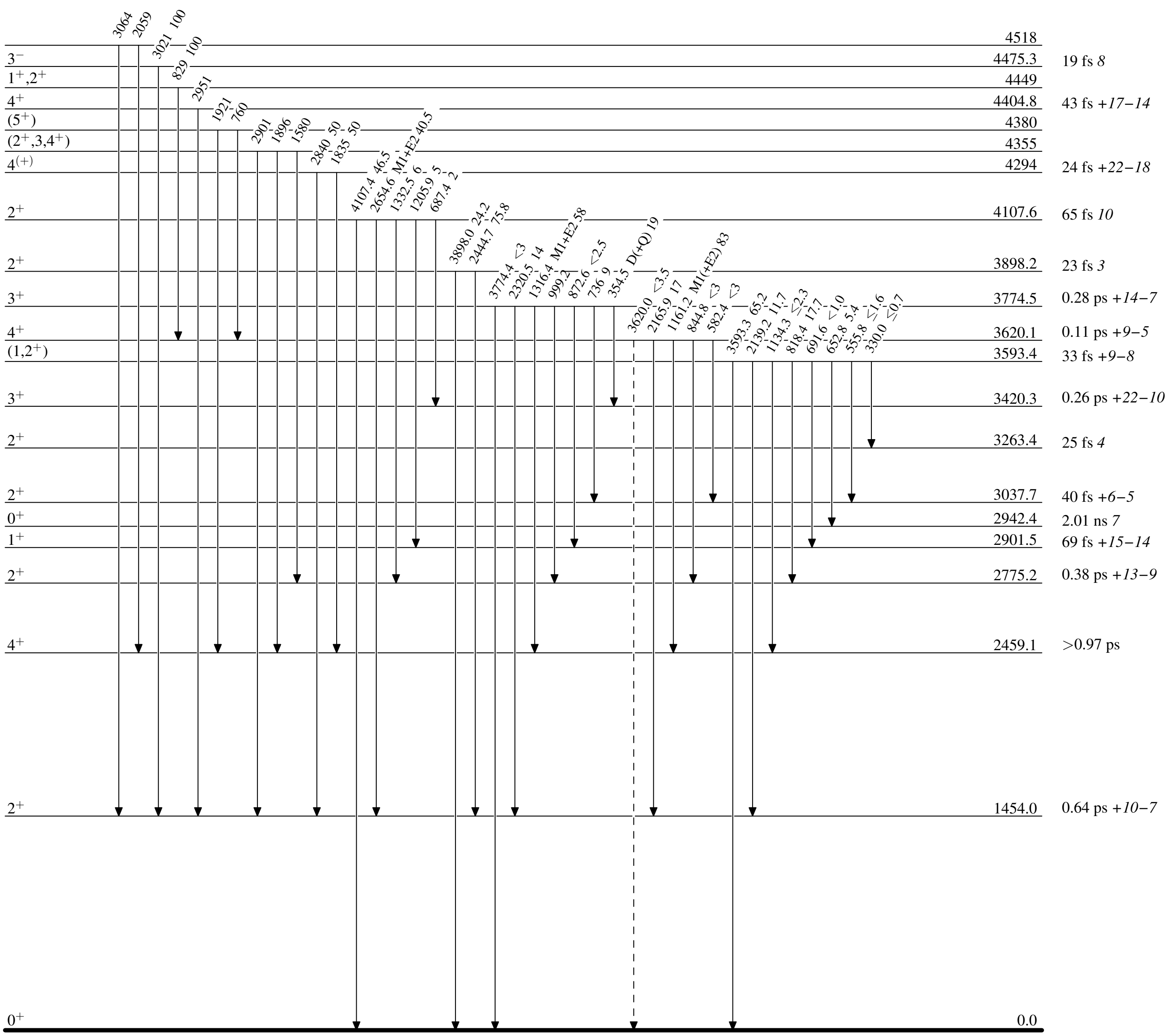
^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{58}_{28}Ni_{30}$

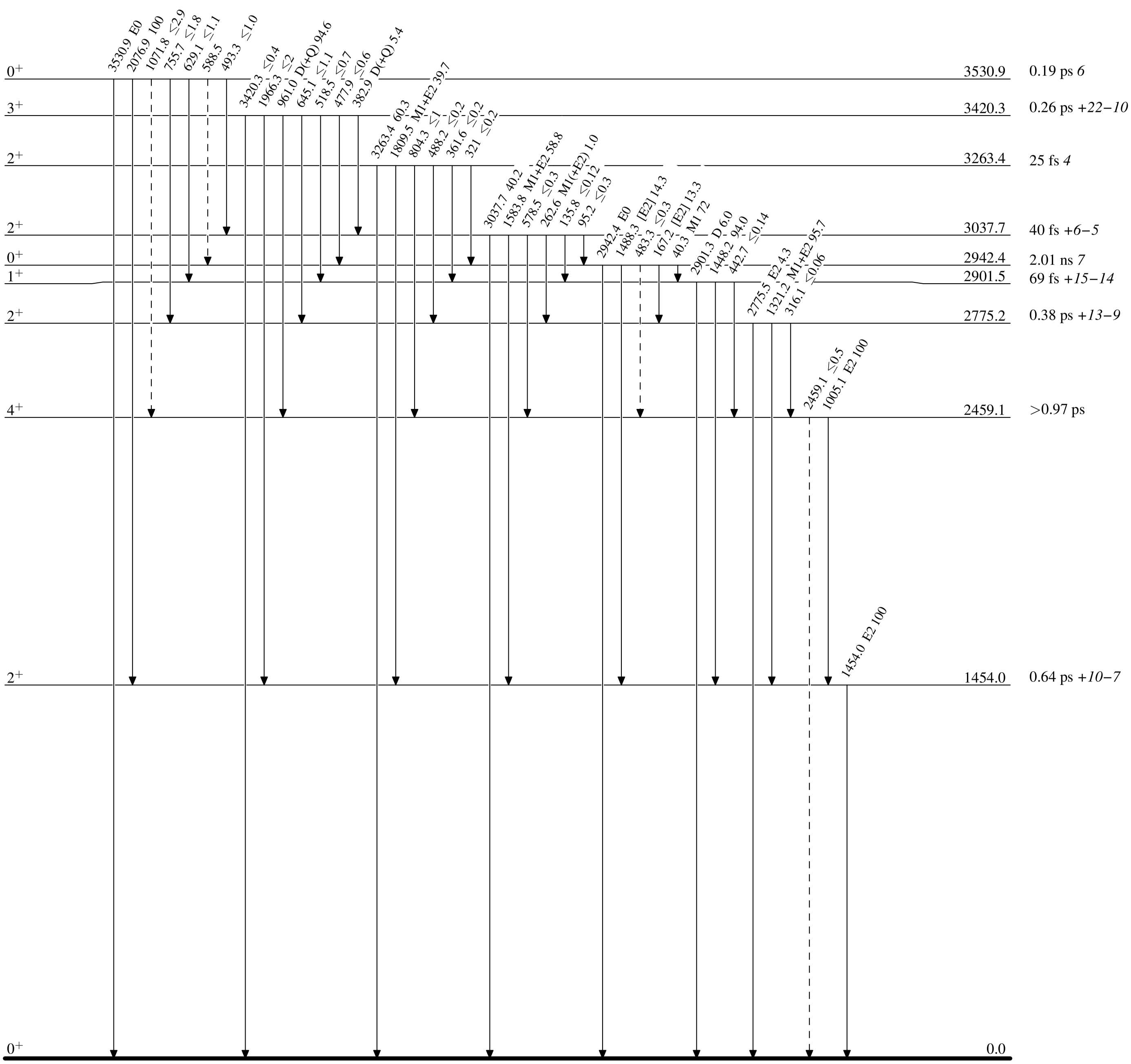
^{58}Ni(p,p′),(pol p,p′),(p,p′γ) 1988Fu03,2007Fu04,1969Va24

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

- - - - - -► γ Decay (Uncertain)



$^{58}_{28}Ni_{30}$