^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 196,17 (2024)	30-Sep-2023

(n,γ) measurements:

1992Ha21: thermal neutrons were produced from the ILL high-flux reactor. Target was 97.5% enriched ^{62}Ni. γ rays were detected with a Ge pair spectrometer. Measured Eγ, Iγ. Deduced levels.

1977Is01: thermal neutrons were produced from the McMaster Nuclear reactor. Target was 98.7% enriched ^{62}Ni. γ rays were detected with a Ge(Li)-NaI(Tl) pair spectrometer. Measured Eγ, Iγ. Deduced levels.

1970GaZQ (thesis): thermal neutron beam was produced at University of Paris. Measured Eγ, Iγ, $\gamma\gamma$-coin. Deduced levels.

1964Co13: thermal neutrons from the CP-5 reactor at ANL. Measured $\gamma\gamma(\theta)$ for three levels using NaI(Tl).

1997Ve03: thermal neutrons from the IEA-R1 reactor of IPEN, Brazil. Measured Eγ, Iγ using a pair spectrometer of Ge(Li) and NaI(Tl).

1991Ul01: thermal neutrons from the ILL high-flux reactor. Measured γ-ray induced Doppler broadening. Deduced lifetime of 1001 level. See 1992Ku17 for reanalysis of some data in 1991Ul01 using a more realistic description of slowing down of low velocity recoil nuclei.

2009OsZZ: thermal neutrons from the JAEA Research Reactor, JRR-3. Measured Eγ, Iγ using an array of 8 EURYSIS type clover Ge detectors. Deduced levels. A level scheme is presented but no numerical data are given in this conference proceeding.

(pol n,γ) measurements:

1972Ko15: polarized thermal neutrons were produced from the Reactor Centrum Nederland. Target was 98.75% enriched ^{62}Ni. γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, γ(circ pol). Deduced level, J, π.

Others: 1967Bo13, 1961Tr03, 1971Kn06, 1972St06.

^{63}Ni Levels

E(level)†	J$^\pi$‡	$T_{1/2}$	Comments
0	1/2$^-$		
87.225 *29*			
155.512 *18*	3/2$^-$		J$^\pi$: 1/2$^-$,(3/2)$^-$ from γ(circ pol) in 1972Ko15; 3/2 from $\gamma\gamma(\theta)$ in 1964Co13.
517.899 *30*	3/2$^-$		J$^\pi$: spin=3/2 also from $\gamma\gamma(\theta)$ in 1964Co13.
1001.255 *22*	1/2$^-$	0.29 ps *+22−11*	J$^\pi$: spin=1/2 also from $\gamma\gamma(\theta)$ in 1964Co13. $T_{1/2}$: from τ=0.60 ps *+44−23* in 1991Ul01 based on γ-ray induced Doppler broadening method (GRID), with a correction for 30% reduction claimed by 1992Ku17 based on re-analysis of some data in 1991Ul01 using a more realistic description of slowing down of low velocity recoil nuclei compared to that in 1991Ul01. Note that the main authors of 1991Ul01 including the first author are also among the authors of 1992Ku17.
1323.707 *25*	3/2$^-$		
2352.95 *5*			
2695.97 *4*	1/2$^-$		
3236.63? *7*			
3283.53 *5*			
3420?#			Additional information 1.
3633.67 *7*			
3739.04 *4*			J$^\pi$: (3/2) proposed in 1977Is01 from γ decays with approximately equal branching to lowest 1/2$^-$, 3/2$^-$, 5/2$^-$ levels, but no other supporting evidence is available.
4054.61 *5*			
4312.38 *6*			
4332.0? *8*			
4459.15 *6*			
4710?#			Additional information 2.
5178.59 *6*			
5323?#			Additional information 3.
5363.92 *8*			
5477?#			Additional information 4.
5673?#			Additional information 5.

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^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ (continued)

^{63}Ni Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	Comments
(6838.08 *4*)	1/2$^+$	J$^{\pi}$: s-wave neutron capture. S(n)=6837.77 *6* (2021Wa16).

[†] From least-squares fit to γ-ray energies.
[‡] From γ(circ pol) in 1972Ko15 which populate known L(d,p)=1 levels, unless otherwise noted.
[#] Read from Fig.5 of 2009OsZZ, reported as preliminary results.

γ(^{63}Ni)

E$_{\gamma}$[†]	I$_{\gamma}$[†@]	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Comments
155.505 *22*	7.0	155.512	3/2$^-$	0	1/2$^-$	E$_{\gamma}$: other: 155.5 *2* (1970GaZQ).
322.36 *24*		1323.707	3/2$^-$	1001.255	1/2$^-$	
362.40 *8*	2.9	517.899	3/2$^-$	155.512	3/2$^-$	E$_{\gamma}$: weighted average of 362.1 *2* (1970GaZQ) and 362.42 *5* (1992Ha21).
430.71 *5*	0.07	517.899	3/2$^-$	87.225		E$_{\gamma}$: other: 430.7 *3* (1970GaZQ).
483.38 *5*	3.8 *8*	1001.255	1/2$^-$	517.899	3/2$^-$	E$_{\gamma}$: other: 483.2 *3* (1970GaZQ).
517.61 *31*	0.86 *17*	517.899	3/2$^-$	0	1/2$^-$	E$_{\gamma}$: unweighted average of 517.3 *3* (1970GaZQ) and 517.91 *4* (1992Ha21).
805.84 *5*	0.055 *11*	1323.707	3/2$^-$	517.899	3/2$^-$	
845.739 *32*	4.2 *8*	1001.255	1/2$^-$	155.512	3/2$^-$	E$_{\gamma}$: other: 845.5 *3* (1970GaZQ).
913.96 *4*	0.097 *19*	1001.255	1/2$^-$	87.225		
[x]981.81 *5*	0.075 *15*					
1001.259 *33*	0.25 *5*	1001.255	1/2$^-$	0	1/2$^-$	E$_{\gamma}$: other: 1001.1 *4* (1970GaZQ).
[x]1069.15 *5*	0.053 *11*					
1165[‡&]		(6838.08)	1/2$^+$	5673?		
1168.152 *30*	1.17 *23*	1323.707	3/2$^-$	155.512	3/2$^-$	E$_{\gamma}$: other: 1168.2 *4* (1970GaZQ).
1236.51 *4*	0.40 *8*	1323.707	3/2$^-$	87.225		E$_{\gamma}$: weighted average of 1237.0 *4* (1970GaZQ) and 1236.502 *32* (1992Ha21).
1323.66 *5*	0.51 *10*	1323.707	3/2$^-$	0	1/2$^-$	E$_{\gamma}$: weighted average of 1324.1 *3* (1970GaZQ) and 1323.651 *33* (1992Ha21).
1361[‡&]		(6838.08)	1/2$^+$	5477?		
1474.09 *10*	0.056 *11*	(6838.08)	1/2$^+$	5363.92		
[x]1506.32 *8*	0.046 *9*					
[x]1512.71 *7*	0.041 *8*					
1515[‡&]		(6838.08)	1/2$^+$	5323?		
[x]1581.38 *12*	0.020 *4*					
[x]1621.76 *17*	0.039 *8*					
[x]1623.26 *27*	0.027 *5*					
1659.38 *6*	0.061 *12*	(6838.08)	1/2$^+$	5178.59		
[x]1691.39 *10*	0.029 *6*					
1694.60 *12*	0.023 *5*	2695.97	1/2$^-$	1001.255	1/2$^-$	
[x]1719.47 *12*	0.045 *9*					
[x]1762.04 *13*	0.019 *4*					
[x]1844.22 *19*	0.041 *8*					
[x]1889.29 *13*	0.022 *4*					
[x]1900.83 *9*	0.034 *7*					
[x]2042.76 *8*	0.044 *4*					
[x]2070.75 *11*	0.046 *5*					
2129[‡&]		(6838.08)	1/2$^+$	4710?		
2177.94 *8*	0.046 *5*	2695.97	1/2$^-$	517.899	3/2$^-$	
2265.66 *7*	0.078 *8*	2352.95		87.225		E$_{\gamma}$: other: 2265.9 *8* (1977Is01).

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^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ (continued)

γ(^{63}Ni) (continued)

E_γ †	I_γ †@	E_i(level)	J_i^π	E_f	J_f^π	Comments
						I_γ: weighted average of 0.07 *2* (1977Is01) and 0.079 *8* (1992Ha21).
2352.92 *6*	0.323 *30*	2352.95		0	1/2$^-$	E_γ: other: 2353.1 *4* (1977Is01). I_γ: weighted average of 0.30 *3* (1977Is01) and 0.354 *35* (1992Ha21).
2378.88# *6*	0.123 *12*	(6838.08)	1/2$^+$	4459.15		E_γ,I_γ: other: 2379.2 *8* with Iγ=0.12 *2* (1977Is01).
x2452.71 *16*	0.066 *7*					
2525.61 *7*	0.046 *5*	(6838.08)	1/2$^+$	4312.38		E_γ,I_γ: other: 2525.8 *14* with Iγ=0.05 *2* (1977Is01). Placement from 1992Ha21; unplaced 1977Is01.
2540.45 *6*	0.249 *26*	2695.97	1/2$^-$	155.512	3/2$^-$	E_γ: weighted average of 2540.9 *4* (1977Is01) and 2540.44 *5* (1992Ha21). I_γ: weighted average of 0.23 *2* (1977Is01) and 0.285 *28* (1992Ha21).
x2577.63 *9*	0.023 *2*					
x2632.30 *6*	0.044 *4*					
2695.92 *6*	0.139 *29*	2695.97	1/2$^-$	0	1/2$^-$	E_γ: weighted average of 2696.8 *8* (1977Is01) and 2695.92 *5* (1992Ha21). I_γ: unweighted average of 0.11 *2* (1977Is01) and 0.167 *17* (1992Ha21).
2783.43 *5*	0.124 *13*	(6838.08)	1/2$^+$	4054.61		E_γ: other: 2784.0 *6* (1977Is01). I_γ: weighted average of 0.12 *2* (1977Is01) and 0.126 *13* (1992Ha21).
x2821.90 *7*	0.025 *2*					
x2858.75 *8*	0.019 *2*					
x2941.49 *7*	0.029 *3*					
x2986.60 *7*	0.030 *3*					
x3041.28 *8*	0.028 *3*					
x3047.23 *8*	0.027 *1*					
3098.98 *6*	0.495 *25*	(6838.08)	1/2$^+$	3739.04		E_γ: weighted average of 3099.4 *4* (1977Is01) and 3098.97 *6* (1992Ha21). I_γ: weighted average of 0.48 *6* (1977Is01) and 0.498 *25* (1992Ha21).
3115.82# *7*	0.050 *2*	3633.67		517.899	3/2$^-$	E_γ,I_γ: other: 3115.1 *23* with Iγ=0.04 *2* (1977Is01). I_γ: other: 0.04 *2* (1977Is01).
3127.91# *6*	0.065 *25*	3283.53		155.512	3/2$^-$	E_γ: other: 3128.5 *24* (1977Is01). I_γ: unweighted average of 0.04 *2* (1977Is01) and 0.090 *5* (1992Ha21).
x3151.88 *8*	0.091 *5*					
x3204.52 *6*	0.187 *9*					
3205.60 *25*	0.26 *2*	(6838.08)	1/2$^+$	3633.67		E_γ,I_γ: from 1977Is01. It is likely a doublet of unplaced 3204.5+3206.7 in 1992Ha21.
x3206.69 *7*	0.090 *5*					
3221.05 *8*	0.027 *1*	3739.04		517.899	3/2$^-$	E_γ: other: 3221.6 *14* (1977Is01). I_γ: other: 0.02 *1* (1977Is01).
3236.57# *9*	0.024 *2*	3236.63?		0	1/2$^-$	E_γ: other: 3237.4 *24* (1977Is01). I_γ: weighted average of 0.01 *1* (1977Is01) and 0.024 *1* (1992Ha21).
x3256.52 *7*	0.053 *3*					E_γ,I_γ: other: 3256.6 *7* with Iγ=0.05 *1* (1977Is01).
3264‡&		3420?		155.512	3/2$^-$	
x3362.22 *7*	0.043 *3*					E_γ: other: 3363.1 *14* (1977Is01). I_γ: weighted average of 0.03 *1* (1977Is01) and 0.043 *2* (1992Ha21).
3419‡&		(6838.08)	1/2$^+$	3420?		
x3419.79 *8*	0.084 *6*					E_γ: other: 3419.6 *9* (1977Is01).

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^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ (continued)

γ(^{63}Ni) (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π	Comments
						I_γ: weighted average of 0.07 *1* (1977Is01) and 0.086 *4* (1992Ha21).
3420[‡&]		3420?		0	1/2$^-$	
3476.4[#] *5*	0.118 *7*	3633.67		155.512	3/2$^-$	E_γ: unweighted average of 3476.91 *35* (1977Is01) and 3475.93 *8* (1992Ha21). I_γ: weighted average of 0.13 *1* (1977Is01) and 0.114 *6* (1992Ha21).
[x]3530.37 *10*	0.016 *1*					
3554.40[#] *7*	0.100 *20*	(6838.08)	1/2$^+$	3283.53		E_γ: weighted average of 3555.0 *6* (1977Is01) and 3554.39 *7* (1992Ha21). I_γ: unweighted average of 0.08 *1* (1977Is01) and 0.119 *6* (1992Ha21).
3583.50 *10*	0.131 *7*	3739.04		155.512	3/2$^-$	E_γ: weighted average of 3583.97 *33* (1977Is01) and 3583.48 *7* (1992Ha21). I_γ: weighted average of 0.13 *1* (1977Is01) and 0.132 *7* (1992Ha21).
3601.39[#] *12*	0.040 *2*	(6838.08)	1/2$^+$	3236.63?		E_γ,I_γ: other: 3601.5 *9* with Iγ=0.04 *1* (1977Is01).
[x]3634.29 *13*	0.022 *1*					E_γ,I_γ: other: 3635.8 *17* with Iγ=0.03 *1* (1977Is01).
3651.69 *7*	0.107 *6*	3739.04		87.225		E_γ: other: 3652.1 *7* (1977Is01). I_γ: weighted average of 0.10 *1* (1977Is01) and 0.110 *6* (1992Ha21).
3739.6 *7*	0.106 *5*	3739.04		0	1/2$^-$	E_γ: unweighted average of 3740.3 *7* (1977Is01) and 3738.94 *7* (1992Ha21). I_γ: other: 0.11 *2* (1977Is01).
3794.19 *12*	0.013 *1*	4312.38		517.899	3/2$^-$	
[x]3823.58 *8*	0.028 *1*					E_γ: weighted average of 3824.7 *11* (1977Is01) and 3823.57 *8* (1992Ha21). I_γ: other: 0.02 *1* (1977Is01).
3899.06 *9*	0.030 *1*	4054.61		155.512	3/2$^-$	E_γ: weighted average of 3900.0 *12* (1977Is01) and 3899.05 *9* (1992Ha21). I_γ: other: 0.03 *1* (1977Is01).
4054.46 *8*	0.050 *10*	4054.61		0	1/2$^-$	E_γ: weighted average of 4055.7 *12* (1977Is01) and 4054.45 *8* (1992Ha21). I_γ: unweighted average of 0.04 *1* (1977Is01) and 0.060 *3* (1992Ha21).
[x]4134.43 *20*	0.006 *1*					
4141.96 *10*	0.504 *26*	(6838.08)	1/2$^+$	2695.97	1/2$^-$	E_γ: weighted average of 4142.5 *4* (1977Is01) and 4141.94 *7* (1992Ha21). I_γ: weighted average of 0.46 *5* (1977Is01) and 0.516 *26* (1992Ha21).
[x]4171.86 *19*	0.015 *1*					
4176.1[&] *32*	0.01 *1*	4332.0?		155.512	3/2$^-$	
4192[‡&]		4710?		517.899	3/2$^-$	
4225.08 *13*	0.011 *1*	4312.38		87.225		
[x]4293.37 *29*	0.009 *1*					
[x]4295.7 *4*	0.007 *1*					
[x]4330.3 *4*	0.016 *1*					
[x]4331.7 *4*	0.015 *1*					
4331.9[&] *8*	0.03 *1*	4332.0?		0	1/2$^-$	E_γ,I_γ: from 1977Is01. It is likely a doublet of unplaced 4330.3+4331.7 in 1992Ha21.
4362.41 *11*	0.016 *1*	5363.92		1001.255	1/2$^-$	
4458.98[#] *14*	0.043 *2*	4459.15		0	1/2$^-$	E_γ: weighted average of 4460.8 *12* (1977Is01) and 4458.97 *9*

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^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ (continued)

γ(^{63}Ni) (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π	Comments
						(1992Ha21). I_γ: other: 0.04 *1* (1977Is01).
4485.2 *5*	0.363 *18*	(6838.08)	1/2$^+$	2352.95		E_γ: unweighted average of 4485.71 *34* (1977Is01) and 4484.78 *8* (1992Ha21). I_γ: other: 0.36 *3* (1977Is01).
4554[‡&]		4710?		155.512	3/2$^-$	
4660.17 *16*	0.011 *1*	5178.59		517.899	3/2$^-$	
4710[‡&]		4710?		0	1/2$^-$	
4805[‡&]		5323?		517.899	3/2$^-$	
4959[‡&]		5477?		517.899	3/2$^-$	
5022.72 *13*	0.015 *1*	5178.59		155.512	3/2$^-$	
5155[‡&]		5673?		517.899	3/2$^-$	
5167[‡&]		5323?		155.512	3/2$^-$	
5209.0 *5*	0.010 *1*	5363.92		155.512	3/2$^-$	
[x]5248.10 *17*	0.011 *1*					
[x]5254.67 *12*	0.022 *1*					
5321[‡&]		5477?		155.512	3/2$^-$	
5323[‡&]		5323?		0	1/2$^-$	
5477[‡&]		5477?		0	1/2$^-$	
5513.95 *14*	1.66 *8*	(6838.08)	1/2$^+$	1323.707	3/2$^-$	E_γ: weighted average of 5514.64 *32* (1977Is01), 5513.89 *9* (1992Ha21), and 5514.2 *6* (1972Ko15). I_γ: weighted average of 1.70 *10* (1977Is01), 1.63 *8* (1992Ha21). Others: 1.28 *8* (1997Ve03) and 1.3 *2* (1972Ko15) seem discrepant.
5517[‡&]		5673?		155.512	3/2$^-$	
5673[‡&]		5673?		0	1/2$^-$	
[x]5820.50 *32*	0.011 *1*					
5836.45 *29*	6.62 *23*	(6838.08)	1/2$^+$	1001.255	1/2$^-$	E_γ: unweighted average of 5837.03 *24* (1977Is01), 5836.22 *10* (1992Ha21), and 5836.1 *6* (1972Ko15). I_γ: weighted average of 6.5 *5* (1977Is01), 6.30 *32* (1992Ha21), 6.86 *17* (1997Ve03), 5.5 *5* (1972Ko15).
6319.81 *27*	4.05 *20*	(6838.08)	1/2$^+$	517.899	3/2$^-$	E_γ: unweighted average of 6320.34 *27* (1977Is01), 6319.48 *11* (1992Ha21), and 6319.6 *7* (1972Ko15). I_γ: others: 4.1 *3* (1977Is01), 3.9 *4* (1972Ko15).
6682.40 *26*	1.46 *6*	(6838.08)	1/2$^+$	155.512	3/2$^-$	E_γ: unweighted average of 6682.63 *24* (1977Is01), 6681.88 *12* (1992Ha21), 6682.7 *7* (1972Ko15). I_γ: weighted average of 1.47 *8* (1977Is01), 1.42 *7* (1992Ha21), 1.50 *6* (1997Ve03), 1.3 *2* (1972Ko15).
6837.92 *26*	85 *4*	(6838.08)	1/2$^+$	0	1/2$^-$	E_γ: unweighted average of 6838.16 *23* (1977Is01), 6837.40 *12* (1992Ha21), and 6838.2 *7* (1972Ko15). I_γ: unweighted average of 85 *4* (1992Ha21), 86 *6* (1977Is01), and 76 *4* (1972Ko15), and 94.1 *20* (1997Ve03).

[†] From 1992Ha21, unless otherwise noted. Intensities are for per 100 neutron captures.
[‡] Seen in the level scheme in Fig. 5 of 2009OsZZ, reported as preliminary results. Quoted value is from level-energy difference.
[#] Unplaced in 1992Ha21; placement from 1977Is01.
[@] Intensity per 100 neutron captures.
[&] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

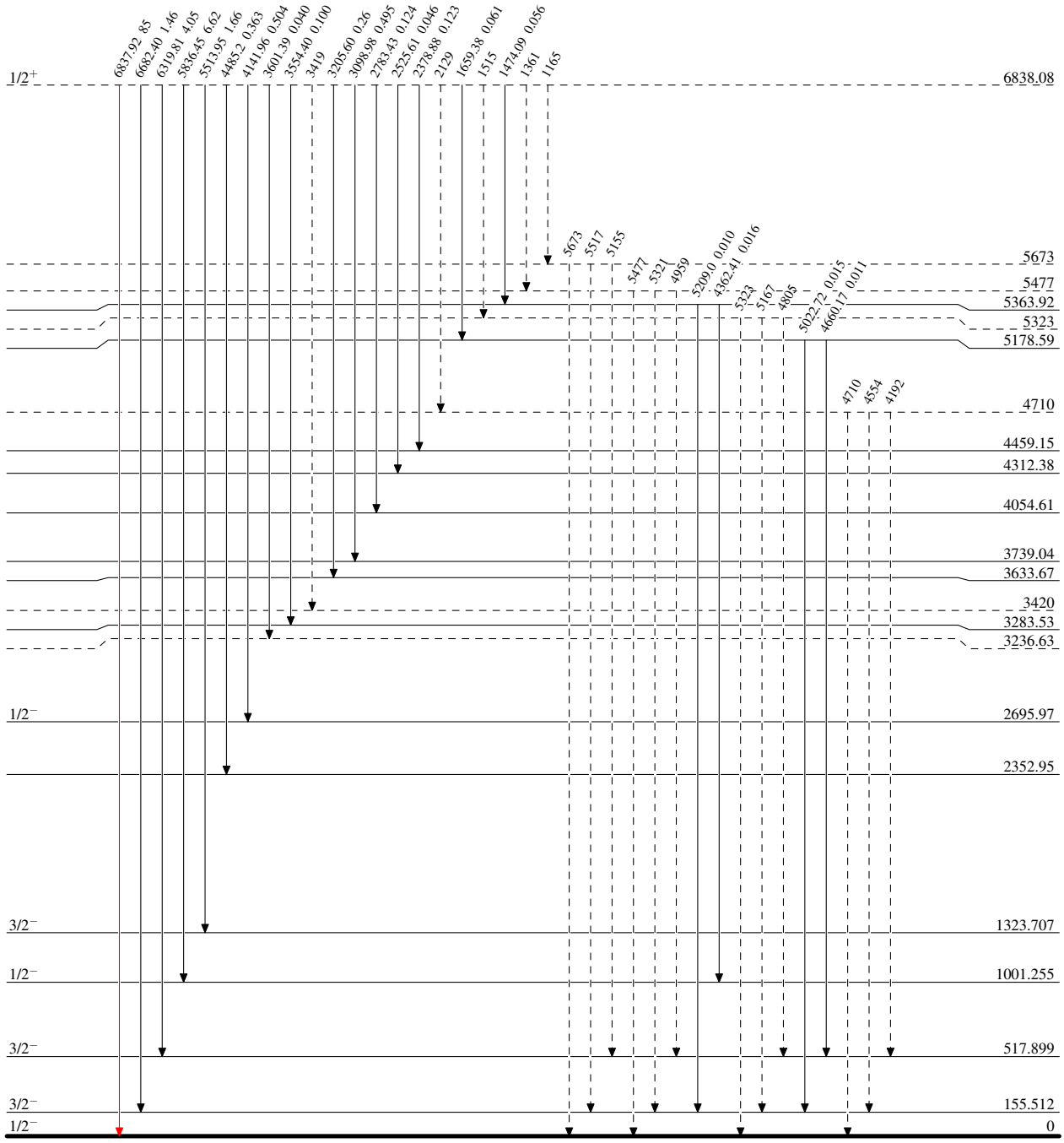
^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ

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)

Level Scheme

Intensities: photon intensity per 100 neutron captures



$^{63}_{28}Ni_{35}$

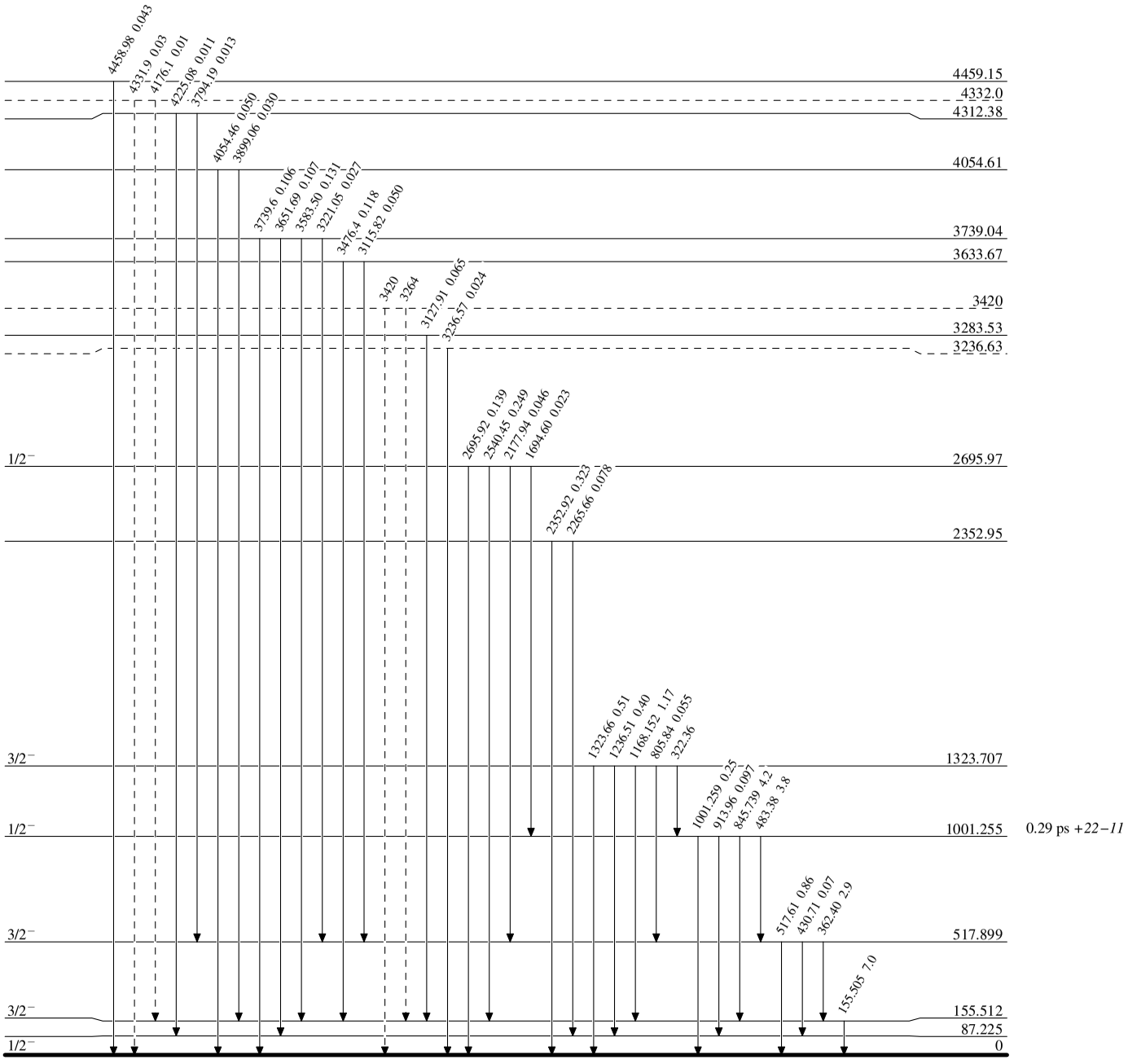
^{62}Ni(n,γ),(pol n,γ) E=th 1992Ha21,1977Is01,1970GaZQ

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)

Level Scheme (continued)

Intensities: photon intensity per 100 neutron captures



$^{63}_{28}Ni_{35}$