^{148}Nd(n,γ) E=th 1976Pi04

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 185, 2 (2022)	23-Aug-2022

1976Pi04: target material neodymium oxide powder enriched in ^{148}Nd to 95% to yield a capture contribution of 57%. The remaining contribution is from ^{142}Nd (3.9%), ^{143}Nd (33.4%), ^{144}Nd (0.8%), ^{145}Nd (4.3%), ^{146}Nd (0.4%), ^{150}Nd (0.28%). γ rays were measured with curved-crystal spectrometer, and Ge(Li) detectors at Grenoble. See also thesis by 1976RoYT from the same group.

Others (cross section data):
1999An02: E(n)=0.46-3.44 MeV.
1997Wi13: E(n)=10, 30 keV.
1995To01: E(n)=25, 30 keV.
1978Ko04: E(n)=5-350 keV.
1974Si11 (also 1973Si45): E(n)=18-28 keV.
1973Ri08: deduced resonance integrals.
1972Th03: E(n)=25 keV.
1972Ki24: E=th.
1967Al12: E=th and res.
1979NaZZ, 1973LaYG, 1973HaYX: cross section data.
Additional information 1.

^{149}Nd Levels

E(level)[†]	J$^\pi$[‡]	Comments
0.0	$5/2^-$	
108.5206 *10*	$7/2^-$	
138.4465 *8*	$5/2^-$	
165.0867 *8*	$3/2^-$,$1/2^-$	
220.7057 *23*	$9/2^-$	
258.3303 *9*	$3/2^-$	
270.8587 *23*	$(9/2^+)$	
285.4818 *11*	$1/2^-$	
316.230 *3*	$(5/2^-,7/2^-)$	
321.1435 *15*	$(5/2^-,7/2^-)$	
332.928 *5*	$5/2^+$	
365.9311 *15*	$3/2^-$	
403.7289 *14*	$1/2^-$	
459.529 *4*	$(3/2^-,5/2^-)$	
482.6729 *14*	$1/2^+$	
517.44 *4*	(3/2,5/2,7/2)	
548.645 *5*	$3/2^-$	
571.442 *8*	$3/2^+$	
705.128 *25*	(3/2,5/2)	
709.045 *18*	$(3/2,5/2^-)$	
741.06 *8*	$3/2^+$	
814.40 *3*	$1/2^+$	
881.17 *16*	$3/2^+$	
913.58 *8*	(1/2,3/2)	
(5038.82 *3*)	$1/2^+$	J$^\pi$: s-wave capture in ^{148}Nd ($J^\pi=0^+$). E(level): S(n)=5038.79 *7* (2021Wa16).

[†] From least-squares fit to Eγ data. Reduced χ^2=2.2 is somewhat larger than critical χ^2 of 1.5, with four γ rays fitting poorly, two each from 548 and 571 levels.
[‡] From the Adopted Levels. The primary transitions in (n,γ) populate mainly 1/2 and 3/2 states since J^π(capture state)=$1/2^+$.

^{148}Nd(n,γ) E=th 1976Pi04 (continued)

$\gamma(^{149}Nd)$

Iγ normalization: absolute γ yields (per 100 neutrons) deduced from the absolute intensity (photons per 100 decays) of the 114.3γ=19.2 *15* in the decay of ^{149}Nd to ^{149}Pm.

E_γ	I_γ[‡g]	E_i(level)	J_i^π	E_f	J_f^π
x26.8528[†] *4*					
32.999[†i] *1*	≈1.0	365.9311	3/2$^-$	332.928	5/2$^+$
x35.4085[†] *22*					
x56.731[†] *1*	1.17				
x67.234[†] *4*	0.13				
x72.516 *2*	0.11				
x75.084[†] *3*	0.28				
78.943 *1*	0.24 *2*	482.6729	1/2$^+$	403.7289	1/2$^-$
80.449 *2*	0.87 *9*	365.9311	3/2$^-$	285.4818	1/2$^-$
88.731[†ei] *4*	0.05	571.442	3/2$^+$	482.6729	1/2$^+$
93.243 *1*	0.37 *4*	258.3303	3/2$^-$	165.0867	3/2$^-$,1/2$^-$
x96.588[†] *4*	0.07				
x97.533[†] *4*	0.04				
x100.031 *4*	0.05				
x100.947 *5*	0.07				
x101.781 *5*	0.06				
x102.328 *4*	0.07				
x103.194 *4*	0.05				
x104.858 *4*	0.07				
x106.873 *5*	0.06				
108.520 *1*	3.2 *3*	108.5206	7/2$^-$	0.0	5/2$^-$
x111.067 *3*	0.11				
x111.337 *5*	0.15				
112.185 *2*	0.14 *1*	220.7057	9/2$^-$	108.5206	7/2$^-$
x112.598 *4*	0.08				
x115.513 *4*	0.09				
116.742 *1*	1.45 *2*	482.6729	1/2$^+$	365.9311	3/2$^-$
x117.371 *6*	0.09				
118.244 *3*	0.12 *1*	403.7289	1/2$^-$	285.4818	1/2$^-$
119.885 *1*	0.61 *6*	258.3303	3/2$^-$	138.4465	5/2$^-$
120.395 *1*	5.7 *6*	285.4818	1/2$^-$	165.0867	3/2$^-$,1/2$^-$
x124.975 *4*	0.06				
x127.865 *25*	0.07[#]				
x128.585 *10*	0.04				
x129.726 *13*	0.06				
x132.490 *7*	0.09				
x133.804 *6*	0.12				
x135.166 *13*	0.09				
x135.460 *10*	0.07				
x137.040 *8*	0.07				
138.447 *1*	8.7 *9*	138.4465	5/2$^-$	0.0	5/2$^-$
143.299 *2*	0.38 *4*	459.529	(3/2$^-$,5/2$^-$)	316.230	(5/2$^-$,7/2$^-$)
x143.638 *9*	0.04				
145.397[c] *2*	0.39 *4*	403.7289	1/2$^-$	258.3303	3/2$^-$
x146.656 *8*	0.07				
147.036 *2*	0.25 *3*	285.4818	1/2$^-$	138.4465	5/2$^-$
x147.566 *4*	0.08				
149.790 *8*	0.08 *1*	258.3303	3/2$^-$	108.5206	7/2$^-$
x150.57 *4*	0.08				

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^{148}Nd(n,γ) E=th 1976Pi04 (continued)

γ(^{149}Nd) (continued)

E_γ	I_γ ‡ g	E_i(level)	J_i^π	E_f	J_f^π	Comments
x150.992 5	0.08					
x151.01 5	0.13					
151.120 20	0.060 6	316.230	(5/2$^-$,7/2$^-$)	165.0867	3/2$^-$,1/2$^-$	
x151.468 4	0.13					
x152.666 10	0.06					
x155.433 12	0.06					
156.061 2	1.15 11	321.1435	(5/2$^-$,7/2$^-$)	165.0867	3/2$^-$,1/2$^-$	
x158.018 5	0.12					
x158.78 3	0.03					
x159.843 24	0.04					
x160.684 14	0.06					
162.338 2	0.47 5	270.8587	(9/2$^+$)	108.5206	7/2$^-$	
x163.645 5	0.09					
x164.882 20	0.20					
165.087 1	20.1 20	165.0867	3/2$^-$,1/2$^-$	0.0	5/2$^-$	
x167.789 2	0.24					
x168.578 8	0.10					
x172.278 7	0.16					
x172.942 20	0.06					
174.031 18	0.07 1	459.529	(3/2$^-$,5/2$^-$)	285.4818	1/2$^-$	
177.783 10	0.10 1	316.230	(5/2$^-$,7/2$^-$)	138.4465	5/2$^-$	
182.694 2	0.98 10	321.1435	(5/2$^-$,7/2$^-$)	138.4465	5/2$^-$	
x191.451 8	0.10					
x192.76 4	0.05					
194.468 10	0.12 1	332.928	5/2$^+$	138.4465	5/2$^-$	
x196.144 12	0.14					
197.194 2	1.58 16	482.6729	1/2$^+$	285.4818	1/2$^-$	
x197.610 9	0.14					
200.844 5	0.53 5	365.9311	3/2$^-$	165.0867	3/2$^-$,1/2$^-$	
x201.916 4	0.35					
x206.002 15	0.10					
207.710 3	0.80 8	316.230	(5/2$^-$,7/2$^-$)	108.5206	7/2$^-$	
212.613 4	0.57 6	321.1435	(5/2$^-$,7/2$^-$)	108.5206	7/2$^-$	
215.724 4	0.61 6	548.645	3/2$^-$	332.928	5/2$^+$	
220.78 5	<0.06	220.7057	9/2$^-$	0.0	5/2$^-$	
x222.689 24	0.12					
224.350 10	0.63 6	482.6729	1/2$^+$	258.3303	3/2$^-$	
224.437 10	0.48 5	332.928	5/2$^+$	108.5206	7/2$^-$	
x224.92 4	0.09					
227.481 h 6	2.7 h 3	365.9311	3/2$^-$	138.4465	5/2$^-$	
227.481 hd 6	1.4 h 2	548.645	3/2$^-$	321.1435	(5/2$^-$,7/2$^-$)	Level-energy difference=227.501.
238.453 20	0.30 3	571.442	3/2$^+$	332.928	5/2$^+$	Level-energy difference=238.514.
238.638 3	2.1 2	403.7289	1/2$^-$	165.0867	3/2$^-$,1/2$^-$	
x244.744 6	<0.04					
245.588 25	0.30 3	705.128	(3/2,5/2)	459.529	(3/2$^-$,5/2$^-$)	
249.51 5	0.09 1	709.045	(3/2,5/2$^-$)	459.529	(3/2$^-$,5/2$^-$)	
x255.59 7	0.07					
257.442 20	0.30 3	365.9311	3/2$^-$	108.5206	7/2$^-$	
258.327 2	6.2 6	258.3303	3/2$^-$	0.0	5/2$^-$	
x260.22 9	0.14					
265.290 8	0.87 9	403.7289	1/2$^-$	138.4465	5/2$^-$	
x266.10 3	0.16					
x272.26 10	<0.04					
x284.95 4	0.22 @					
285.511 20	0.58 6	285.4818	1/2$^-$	0.0	5/2$^-$	

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^{148}Nd(n,γ) E=th 1976Pi04 (continued)

γ(^{149}Nd) (continued)

E_γ	I_γ[‡][g]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]290.56 3	0.30					
294.44 4	0.35 4	459.529	(3/2$^-$,5/2$^-$)	165.0867	3/2$^-$,1/2$^-$	
[x]301.823 23	0.23					
305.325 22	0.29[@] 3	709.045	(3/2,5/2$^-$)	403.7289	1/2$^-$	
[x]309.3 3	0.27					
[x]310.45 3	0.30					
313.088 14	0.41 4	571.442	3/2$^+$	258.3303	3/2$^-$	
[x]314.89 8	0.16[#]					
316.236 10	0.83 8	316.230	(5/2$^-$,7/2$^-$)	0.0	5/2$^-$	
317.57 3	0.25 3	482.6729	1/2$^+$	165.0867	3/2$^-$,1/2$^-$	
321.12[h]	<0.06[h]	459.529	(3/2$^-$,5/2$^-$)	138.4465	5/2$^-$	
321.124[h] 8	1.29[h] 13	321.1435	(5/2$^-$,7/2$^-$)	0.0	5/2$^-$	
[x]322.32 4	0.23					
332.944 13	7.7 8	332.928	5/2$^+$	0.0	5/2$^-$	
[x]337.57 5	0.20					
[x]341.46 13	0.35					
[x]347.96 4	0.32					
351.001 20	0.37 4	459.529	(3/2$^-$,5/2$^-$)	108.5206	7/2$^-$	
354.89 4	0.32 3	814.40	1/2$^+$	459.529	(3/2$^-$,5/2$^-$)	
[x]356.67 5	0.23					
[x]359.92 8	0.20					
365.953 8	5.4 5	365.9311	3/2$^-$	0.0	5/2$^-$	
[x]370.74[&] 17	0.1					
375.95 8	0.23 2	709.045	(3/2,5/2$^-$)	332.928	5/2$^+$	
383.566 21	1.01 10	548.645	3/2$^-$	165.0867	3/2$^-$,1/2$^-$	
387.93 12	0.29 3	709.045	(3/2,5/2$^-$)	321.1435	(5/2$^-$,7/2$^-$)	
[x]388.83 10	0.33					
389.00 10	0.36 4	705.128	(3/2,5/2)	316.230	(5/2$^-$,7/2$^-$)	
403.51 17	0.7[@] 1	403.7289	1/2$^-$	0.0	5/2$^-$	
406.400 12	2.3 2	571.442	3/2$^+$	165.0867	3/2$^-$,1/2$^-$	Level-energy difference=406.355.
408.92 15	0.25 2	517.44	(3/2,5/2,7/2)	108.5206	7/2$^-$	
410.29 3	1.04 10	548.645	3/2$^-$	138.4465	5/2$^-$	Level-energy difference=410.20.
[x]412.04 23	0.20					
[x]414.20 11	0.28					
[x]422.05[&] 15	0.4					
430.76 15	0.60 6	913.58	(1/2,3/2)	482.6729	1/2$^+$	
432.95 3	1.38 14	571.442	3/2$^+$	138.4465	5/2$^-$	
[x]436.14[&] 16	0.4					
[x]446.60[&] 20	0.015					
450.72 5	0.77 8	709.045	(3/2,5/2$^-$)	258.3303	3/2$^-$	
455.55[&] 20	0.19 2	741.06	3/2$^+$	285.4818	1/2$^-$	
459.52[&] 11	0.61 6	459.529	(3/2$^-$,5/2$^-$)	0.0	5/2$^-$	
[x]464.45 10	0.9					
[x]468.42[&] 18	0.25					
[x]493.14[&] 14	0.25					
[x]495.49 9	0.66					
517.44 4	1.95 20	517.44	(3/2,5/2,7/2)	0.0	5/2$^-$	
528.91[a] 10	1.1 1	814.40	1/2$^+$	285.4818	1/2$^-$	
[x]530.48 11	0.94					
[x]531.98 21	0.17					
[x]539.24 12	0.63					
[x]543.39 12	0.48					
548.72 17	0.22 2	548.645	3/2$^-$	0.0	5/2$^-$	

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^{148}Nd(n,γ) E=th 1976Pi04 (continued)

γ(^{149}Nd) (continued)

E_γ	I_γ ‡ g	E_i(level)	J_i^π	E_f	J_f^π
x553.58 17	0.19				
566.85 16	0.24 2	705.128	(3/2,5/2)	138.4465	5/2⁻
570.72 10	0.86 9	709.045	(3/2,5/2⁻)	138.4465	5/2⁻
576.03 12	0.87 8	741.06	3/2⁺	165.0867	3/2⁻,1/2⁻
x581.65 16	0.50				
x606.70 13	0.53				
x608.09 13	0.61				
x613.01 21	0.14				
622.84 16	0.33 3	881.17	3/2⁺	258.3303	3/2⁻
x624.30 23	0.18				
x628.13 13	0.30				
x632.8 3	0.10				
x637.41 19	0.17				
x642.21 16	0.23				
649.22 16	0.19 2	814.40	1/2⁺	165.0867	3/2⁻,1/2⁻
x657.80 10	0.92				
x674.22 14	0.33				
675.90 f 7	2.10 16	814.40	1/2⁺	138.4465	5/2⁻
x680.83 17	0.17				
x688.80 20	0.19				
x706.30 16	0.27				
x727.29 15	0.31				
x748.02 12	0.90				
x750.94 14	0.62				
x762.0 3	0.17				
x763.82 17	0.31				
x780.18 11	1.40				
x782.15 18	0.24				
x788.80 25	0.13				
x793.45 22	0.17				
x811.80 17	0.27				
x816.48 15	0.38				
x819.89 16	0.30				
x824.62 20	0.26				
x829.04 14	0.49				
x839.81 21	0.28				
x841.1 3	0.21				
x846.76 12	0.86				
x870.58 17	0.69				
x875.37 20	0.29				
x879.5 3	0.20				
x884.81 11	0.96				
x891.7 4	0.14				
x897.65 10	3.56				
x902.56 19	0.27				
x907.29 20	0.26				
x915.22 14	0.60				
x917.22 25	0.45				
x918.69 13	1.02				
x929.73 24	0.20				
x944.30 10	4.89				
x960.13 16	0.47				
x962.17 10	3.15				
x977.17 10	2.14				
x985.49 24	0.34				
x998.40 12	0.87				

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^{148}Nd(n,γ) E=th 1976Pi04 (continued)

γ(^{149}Nd) (continued)

E_γ	I_γ[‡g]	E_i(level)
[x]1004.02 *14*	0.61	
[x]1010.2 *3*	0.21	
[x]1035.8 *3*	0.20	
[x]1046.14 *12*	0.71	
[x]1051.1 *3*	0.19	
[x]1061.5 *3*	0.17	
[x]1065.66 *13*	0.71	
[x]1070.24 *22*	0.24	
[x]1080.50 *19*	0.34	
[x]1091.47 *24*	0.20	
[x]1099.59 *24*	0.33	
[x]1105.7 *3*	0.24	
[x]1107.64 *10*	2.98	
[x]1119.24 *10*	1.87	
[x]1129.5 *3*	0.34	
[x]1131.1 *3*	0.30	
[x]1137.04 *12*	0.82	
[x]1141.34 *12*	0.83	
[x]1153.82 *12*	0.85	
[x]1159.02 *12*	0.89	
[x]1183.81 *16*	1.14	
[x]1185.67 *22*	1.81	
[x]1186.97 *12*	3.37	
[x]1204.59 *21*	0.53	
[x]1219.60 *13*	0.79	
[x]1222.4 *3*	0.28	
[x]1230.54 *13*	0.74	
[x]1242.9 *3*	0.22	
[x]1259.62 *18*	0.64	
[x]1261.67 *20*	0.94	
[x]1278.47 *15*	0.53	
[x]1297.62 *24*	0.31	
[x]1343.7 *3*	0.22	
[x]1364.15 *23*	0.34	
[x]1372.78 *21*	0.39	
[x]1378.82 *17*	0.60	
[x]1384.45 *13*	0.61	
[x]1388.0 *3*	0.38	
[x]1449.8 *3*	0.33	
[x]1463.3 *3*	0.33	
[x]1505.1 *4*	0.24	
[x]1552.50 *14*	0.96	
[x]1568.2 *3*	0.28	
[x]1587.3 *3*	0.29	
[x]1590.2 *3*	0.37	
[x]1596.25 *16*	0.70	
[x]1636.3 *3*	0.31	
[x]1664.4 *4*	0.24	
[x]1678.52 *16*	0.73	
[x]1726.9 *3*	0.27	
[x]1791.5 *3*	0.34	
[x]1799.12 *24*	0.46	
[x]1811.1 *3*	0.39	
[x]1813.5 *4*	0.31	
[x]1819.8 *3*	0.32	
[x]1827.3 *4*	0.22	
[x]1840.0 *3*	0.36	

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^{148}Nd(n,γ) E=th 1976Pi04 (continued)

γ(^{149}Nd) (continued)

E_γ	I_γ[‡][g]	E_i(level)	J_i^π	E_f	J_f^π
[x]1857.1 *4*	0.25				
[x]1863.9 *4*	0.28				
[x]1884.77 *16*	0.98				
[x]1938.31 *25*	0.56				
[x]1951.49 *24*	0.60				
[x]1958.1 *3*	0.42				
[x]2011.4 *3*	0.30				
[x]2134.0 *4*	0.27				
[x]2149.5 *4*	0.29				
[x]2196.4 *4*	0.31				
[x]2294.79[b] *10*	0.68				
[x]2359.69 *13*	0.46				
[x]2532.30 *9*	0.58				
[x]2644.65 *12*	0.56				
[x]2797.75 *9*	0.51				
[x]2835.25 *9*	0.69				
[x]2893.77 *9*	0.49				
[x]2924.87 *9*	0.37				
[x]2947.17 *9*	0.65				
[x]2971.69 *10*	0.28				
[x]3053.98 *9*	0.46				
[x]3165.43 *8*	0.53				
[x]3210.92 *8*	0.48				
[x]3260.97 *9*	0.76				
[x]3359.19 *8*	0.41				
[x]3416.28 *7*	1.43				
[x]3448.02 *9*	0.58				
[x]3485.67 *7*	2.03				
[x]3504.06 *9*	0.30				
[x]3526.59 *15*	0.21				
[x]3533.12 *11*	0.22				
[x]3617.86 *8*	0.59				
[x]3789.19 *7*	1.00				
[x]3850.24 *11*	0.17				
[x]3859.54 *7*	1.01				
[x]3888.35 *9*	0.44				
[x]3954.77 *7*	2.25				
4125.13 *9*	0.38 *4*	(5038.82)	$1/2^+$	913.58	(1/2,3/2)
[x]4199.49 *7*	0.81				
4224.33 *8*	0.45 *5*	(5038.82)	$1/2^+$	814.40	$1/2^+$
4297.73 *10*	0.17 *2*	(5038.82)	$1/2^+$	741.06	$3/2^+$
4329.74 *7*	0.93 *9*	(5038.82)	$1/2^+$	709.045	$(3/2,5/2^-)$
4467.28 *8*	0.24 *2*	(5038.82)	$1/2^+$	571.442	$3/2^+$
4556.07 *9*	0.21 *2*	(5038.82)	$1/2^+$	482.6729	$1/2^+$
4634.98 *8*	0.32 *3*	(5038.82)	$1/2^+$	403.7289	$1/2^-$
4672.82 *7*	8.02 *8*	(5038.82)	$1/2^+$	365.9311	$3/2^-$
4753.26 *7*	1.62 *16*	(5038.82)	$1/2^+$	285.4818	$1/2^-$
4780.43 *10*	0.16 *2*	(5038.82)	$1/2^+$	258.3303	$3/2^-$
4873.68 *8*	0.53 *5*	(5038.82)	$1/2^+$	165.0867	$3/2^-,1/2^-$

[†] γ assigned tentatively to Nd(n,γ).
[‡] Uncertainties are 10% for curved-crystal and 5% to 8% for Ge(Li) measurements.
[#] Part of intensity belongs to the neighboring Nd isotopes.

Continued on next page (footnotes at end of table)

^{148}Nd(n,γ) E=th 1976Pi04 (continued)

$\gamma(^{149}Nd)$ (continued)

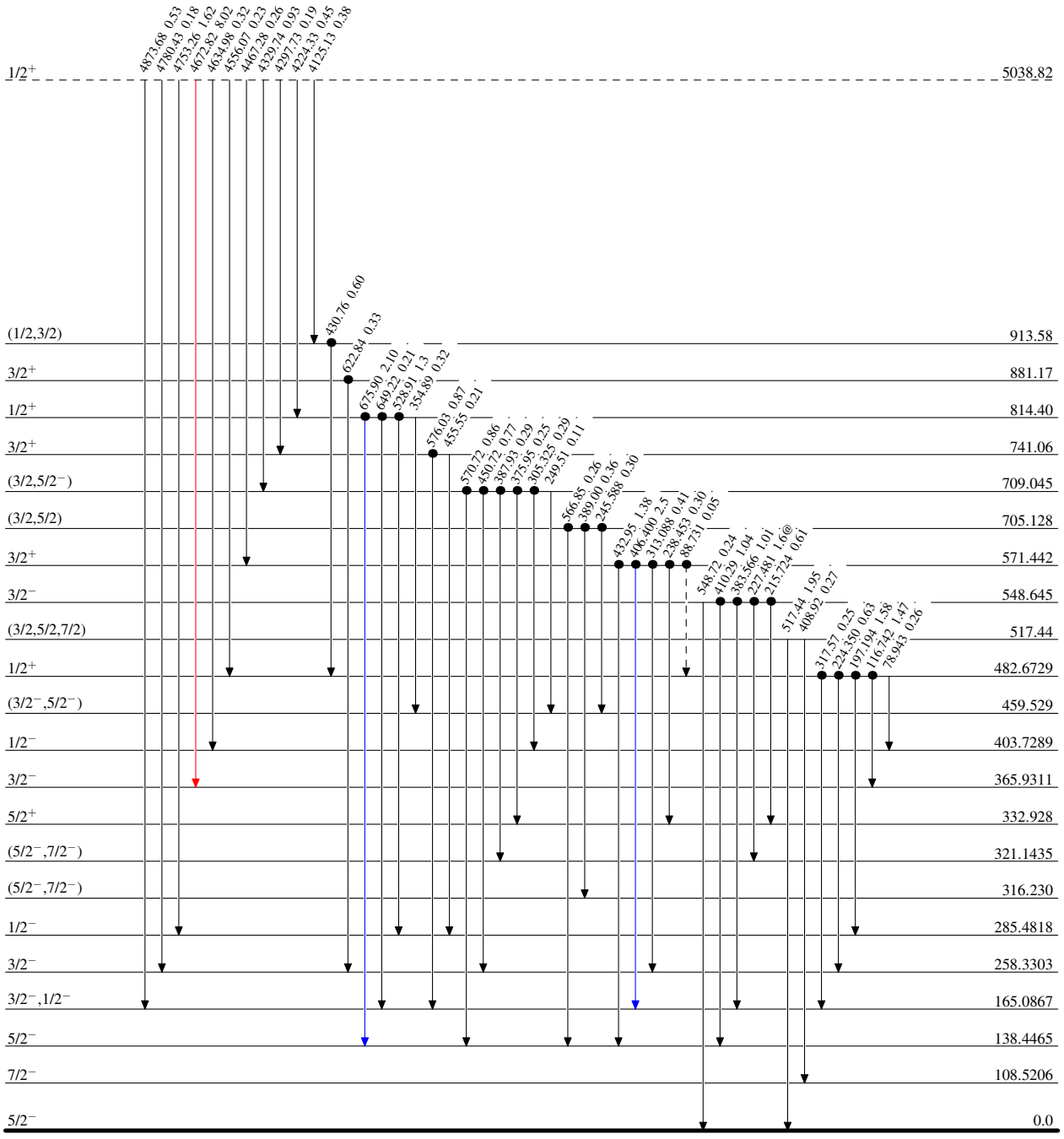
@ Part of intensity attributed to ^{150}Sm.
& Observed only with the Ge(Li) detector.
a Data from the anti-Compton spectrometer.
b Data from the pair spectrometer.
c 1976Pi04 quote 145.370 in table and 145.397 in level scheme. The latter value is chosen due to its good fit.
d Uncertainty increased from 2 eV to 6 eV (evaluators).
e Fitted value deviates by 0.037 keV.
f Placement from 814 level probably incorrect since it requires 675γ to be M2.
g Intensity per 100 neutron captures.
h Multiply placed with intensity suitably divided.
i Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

^{148}Nd(n,γ) E=th 1976Pi04

Level Scheme

Intensities: Per 100 neutron captures
@ Multiply placed: intensity suitably divided

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)
- Coincidence



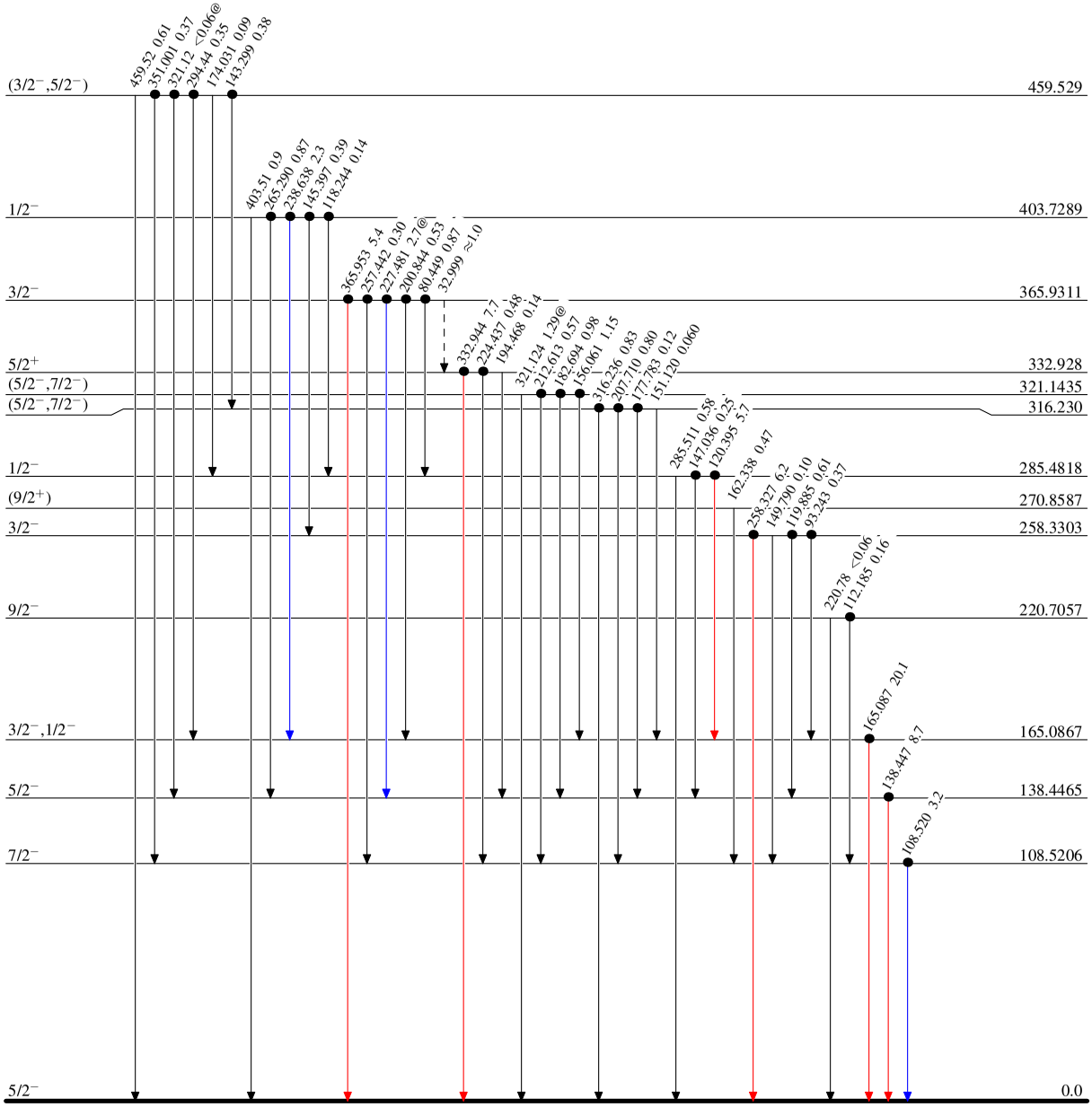
$^{149}_{60}Nd_{89}$

^{148}**Nd(n,γ) E=th 1976Pi04**

Level Scheme (continued)

Intensities: Per 100 neutron captures
@ Multiply placed: intensity suitably divided

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)
Coincidence



$^{149}_{60}Nd_{89}$