^{148}Pr β^- decay (2.29 min) 1988Ka14,1997Gr09

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 117, 1 (2014)	1-Oct-2013

Parent: ^{148}Pr: E=0.0; J$^\pi$=1$^-$; $T_{1/2}$=2.29 min *2*; Q(β^-)=4872 *15*; %β^- decay=100.0

1997Gr09,1996Gr20: total absorption γ-ray spectrometer (TAGS) system used to measure β^-decay intensities, and the g.s. β^- feeding when operated in the 4$\pi\gamma$-β coin mode.

Measured: γ, $\gamma\gamma$ (1988Ka14,1986Wa06,1986BuZV,1979Ta17,1979Ik06,1979Bo26,1977Re11,1977Bj02,1976Ya06,1976Sk04) $\gamma\gamma(\theta)$ (1988Ka14,1979Ik06), β, $\beta\gamma$ (1986Gr11,1979Ik06,1978St03,1976LoZT).

Level scheme is that of 1988Ka14. TAGS data with a number of pseudolevels with≈25% β^- feeding to them indicates that the level scheme is not complete and has large uncertainties associated with it.

^{148}Nd Levels

E(level)†	J$^\pi$‡	Comments
0.0	0$^+$	
301.703 *16*	2$^+$	
752.21 *13*	4$^+$	J=4 from $\gamma\gamma(\theta)$ (1988Ka14).
916.88 *10*	0$^+$	J=0 from $\gamma\gamma(\theta)$ (1979Ik06,1988Ka14).
999.29 *10*	3$^-$	J=3 from $\gamma\gamma(\theta)$ (1988Ka14); consistent with J=3 from $\gamma\gamma(\theta)$ (1979Ik06).
1023.19 *13*	1$^-$	J=1 from $\gamma\gamma(\theta)$ (1988Ka14); consistent with J=1 from $\gamma\gamma(\theta)$ (1979Ik06).
1170.92 *13*	2$^+$	J=2 from $\gamma\gamma(\theta)$ (1988Ka14); consistent with J=2 from $\gamma\gamma(\theta)$ (1979Ik06).
1248.63 *9*	2$^+$	J=2 from $\gamma\gamma(\theta)$ (1988Ka14).
1511.54 *14*	3$^+$	J=(1,3) from $\gamma\gamma(\theta)$ (1988Ka14).
1515.6 *4*		
1645.58 *25*		J=0 from $\gamma\gamma(\theta)$ (1988Ka14).
1659.91 *6*	2$^+$	J=(2,3) from $\gamma\gamma(\theta)$ (1988Ka14).
1683.3 *4*	4$^+$	J=(3,4) from $\gamma\gamma(\theta)$ (1988Ka14).
2073.67 *16*	2$^{(+)}$	J=2 from $\gamma\gamma(\theta)$ (1988Ka14).
2182.2 *4*		J=(1-4) from $\gamma\gamma(\theta)$ (1988Ka14).
2236.8 *9*		
2406.01 *20*	2$^+$	
2431.33 *18*	2$^+$	
2545.0 *7*	(1$^-$)	
2930.63 *22*	(2$^-$)	
3036.8 *9*		
3129.9 *9*		E(level): from 1979Ik06; level not observed by 1988Ka14.

† From a least-squares fit to Eγ data.
‡ Adopted values; supported by $\gamma\gamma(\theta)$ from this data set.

β^- radiations

E(decay)	E(level)	Iβ^-†‡#	Log *ft*	Comments
(1742 *15*)	3129.9	0.081 *19*	7.78 *11*	av Eβ=655.6 *66* Iβ^-: 1.23 from TAGS (1997Gr09).
(1835 *15*)	3036.8	1.1 *5*	6.74 *20*	av Eβ=696.6 *67* Iβ^-: 1.45 from TAGS (1997Gr09).
(1941 *15*)	2930.63	4.1 *6*	6.26 *7*	av Eβ=743.5 *67* Iβ^-: 6.43 from TAGS (1997Gr09).
(2327 *15*)	2545.0	0.9 *3*	7.24 *15*	av Eβ=916.3 *68* Iβ^-: 1.24 from TAGS (1997Gr09).
(2441 *15*)	2431.33	3.7 *6*	6.71 *8*	av Eβ=967.7 *68* Iβ^-: 5.26 from TAGS (1997Gr09).

Continued on next page (footnotes at end of table)

^{148}Pr β^- decay (2.29 min) 1988Ka14,1997Gr09 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ⁻ [†‡#]	Log *ft*	Comments
(2466 *15*)	2406.01	1.8 *4*	7.04 *10*	av Eβ=979.2 *68* Iβ⁻: 2.48 from TAGS (1997Gr09).
(2635[@] *15*)	2236.8	0.1 *4*	8.4 *18*	av Eβ=1056.1 *69* Iβ⁻: 0.75 from TAGS (1997Gr09).
(2690 *15*)	2182.2	0.5 *3*	7.7 *3*	av Eβ=1081.0 *69* Iβ⁻: 0.75 from TAGS (1997Gr09).
(2798 *15*)	2073.67	5.7 *4*	6.76 *4*	av Eβ=1130.6 *69* Iβ⁻: 4.72 from TAGS (1997Gr09).
(3189 *15*)	1683.3	2.6 *6*	7.34 *10*	av Eβ=1309.9 *70* Iβ⁻: 1.55 from TAGS (1997Gr09).
(3212 *15*)	1659.91	8.8 *12*	6.82 *6*	av Eβ=1320.7 *70* Iβ⁻: 5.27 from TAGS (1997Gr09).
(3226 *15*)	1645.58	0.93 *15*	7.81 *7*	av Eβ=1327.3 *70* Iβ⁻: 0.54 from TAGS (1997Gr09).
(3356 *15*)	1515.6	1.00 *19*	7.85 *9*	av Eβ=1387.2 *70* Iβ⁻: 0.32 from TAGS (1997Gr09).
(3360[@] *15*)	1511.54	0.4 *10*	8.2 *11*	av Eβ=1389.1 *70* Iβ⁻: 0.143 from TAGS (1997Gr09).
(3623 *15*)	1248.63	4.2 *16*	7.36 *17*	av Eβ=1510.6 *70* Iβ⁻: 0.30 from TAGS (1997Gr09).
(3701 *15*)	1170.92	2.5 *9*	7.63 *16*	av Eβ=1546.6 *70* Iβ⁻: 0.51 from TAGS (1997Gr09).
(3849 *15*)	1023.19	4.3 *11*	7.46 *12*	av Eβ=1615.1 *70* Iβ⁻: 0.36 from TAGS (1997Gr09). E(decay): 3000 *250* (1976LoZT).
(3873 *15*)	999.29	4.2 *9*	7.49 *10*	av Eβ=1626.2 *70* Iβ⁻: 0.29 from TAGS (1997Gr09).
(3955 *15*)	916.88	1.9 *4*	7.87 *10*	av Eβ=1664.4 *70* Iβ⁻: 0.96 from TAGS (1997Gr09).
(4120 *15*)	752.21	1.3 *6*	8.11 *20*	av Eβ=1740.9 *70* Iβ⁻: 0.0 from TAGS (1997Gr09).
4.5×10^3 *2*	301.703	27.6 *23*	6.98 *4*	av Eβ=1950.3 *70* Iβ⁻: 18.22 from TAGS (1997Gr09). E(decay): 3630 *200* (1976LoZT).
4.8×10^3 *2*	0.0	21.9 *15*	7.20 *3*	av Eβ=2090.8 *70* E(decay): from 1979Ik06. Other: 5.01×10^3 *12* (1978St03); see 1986Gr11. Iβ⁻: from TAGS (1997Gr09).

† From I(γ+ce) imbalance at each level, unless indicated otherwise.

‡ TAGS analysis gives the following pseudolevels and associated Iβ (in %) in addition to the discrete levels listed. 2650 keV 1.18; 2750 keV 1.39; 2850 keV 0.80; 3200 keV 0.70; 3300 keV 0.80; 3400 keV 1.39; 3500 keV 1.61; 3600 keV 0.86; 3700 keV 0.75; 3800 keV 1.29; 3900 keV 2.04; 4000 keV 4.82; 4100 keV 4.50; 4200 keV 1.82; 4300 keV 0.96; 4400 keV 0.32; 4500 keV 0.064; 4600 keV 0.032; 4700 keV 0.011. The TAGS spectrum is estimated to have≈1.5% uncorrected contamination of ^{148}Pr(2.0 min). Since the resolution of the TAGS system is typically 50-100 keV, the intensity assigned to a pseudolevel may represent β^- feeding to a single level or a group of levels. The same limitation applies to the intensity assigned to a known level, since it could include feeding to known or unknown levels in the resolution energy range.

\# Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

γ(^{148}Nd)

Iγ normalization: Σ I(γ+ce) and g.s. β^- feeding of 21.9% 15 from TAGS analysis (1997Gr09). The uncertainty in Iγ normalization does not include that due to an incomplete decay scheme as indicated by≈25% β^- feeding to the pseudolevels observed in the TAGS measurements.

E_γ[@]	I_γ[@&]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[‡]	α[†]	Comments
247.4 *3*	1.3 *5*	999.29	3⁻	752.21	4⁺				
301.702 *16*	100	301.703	2⁺	0.0	0⁺	E2		0.0515	α(K)=0.0408 *6*; α(L)=0.00840 *12*; α(M)=0.00184 *3*; α(N+..)=0.000463 *7* α(N)=0.000404 *6*; α(O)=5.69×10⁻⁵ *8*; α(P)=2.24×10⁻⁶ *4* Mult.: from γγ(θ) (1979Ik06). Eγ: from 1979Bo26. Eγ,Iγ: also seen in 1986Wa06.
418.7 *1*	0.3 *2*	1170.92	2⁺	752.21	4⁺				
450.8 *3*	4.7 *7*	752.21	4⁺	301.703	2⁺	E2		0.01564	α(K)=0.01286 *19*; α(L)=0.00219 *3*; α(M)=0.000472 *7*; α(N+..)=0.0001204 *17* α(N)=0.0001045 *15*; α(O)=1.515×10⁻⁵ *22*; α(P)=7.46×10⁻⁷ *11*
492.4 *3*	1.6 *3*	1515.6		1023.19	1⁻				
496.8 *6*	0.4 *3*	1248.63	2⁺	752.21	4⁺				
512.2 *4*	0.5 *3*	1683.3	4⁺	1170.92	2⁺				
522.2 *4*	0.4 *1*	2182.2		1659.91	2⁺				
562.4 *2*	0.5 *1*	2073.67	2⁽⁺⁾	1511.54	3⁺				
615.1 *1*	3.9 *6*	916.88	0⁺	301.703	2⁺	E2		0.00687 *10*	α=0.00687 *10*; α(K)=0.00575 *8*; α(L)=0.000881 *13*; α(M)=0.000188 *3*; α(N+..)=4.84×10⁻⁵ *7* α(N)=4.19×10⁻⁵ *6*; α(O)=6.18×10⁻⁶ *9*; α(P)=3.42×10⁻⁷ *5*
622.7 *4*	0.8 *2*	1645.58		1023.19	1⁻				
636.5 *3*	1.8 *3*	1659.91	2⁺	1023.19	1⁻				
660.0 *3*	2.8 *3*	1659.91	2⁺	999.29	3⁻				
697.5 *1*	9.3 *11*	999.29	3⁻	301.703	2⁺	E1		0.00191 *3*	α=0.00191 *3*; α(K)=0.001640 *23*; α(L)=0.000211 *3*; α(M)=4.42×10⁻⁵ *7*; α(N+..)=1.147×10⁻⁵ *16* α(N)=9.88×10⁻⁶ *14*; α(O)=1.495×10⁻⁶ *21*; α(P)=9.63×10⁻⁸ *14* δ(Q/D)=+0.08 *77* (1988Ka14).
721.3 *3*	6.1 *10*	1023.19	1⁻	301.703	2⁺	E1		0.001778 *25*	α=0.001778 *25*; α(K)=0.001530 *22*; α(L)=0.000196 *3*; α(M)=4.12×10⁻⁵ *6*; α(N+..)=1.069×10⁻⁵ *1* α(N)=9.21×10⁻⁶ *13*; α(O)=1.394×10⁻⁶ *20*; α(P)=9.00×10⁻⁸ *13* δ(Q/D)=+0.04 *+70−60* (1988Ka14).
759.3 *3*	0.4 *1*	1511.54	3⁺	752.21	4⁺	M1+E2		0.0053 *12*	α=0.0053 *12*; α(K)=0.0045 *11*; α(L)=0.00062 *12*; α(M)=0.000132 *24*; α(N+..)=3.4×10⁻⁵ *7* α(N)=2.9×10⁻⁵ *6*; α(O)=4.4×10⁻⁶ *9*; α(P)=2.8×10⁻⁷ *8* δ: +0.035 *15* or +5.0 *+15−22*.
800.0 *1*	0.6 *5*	3036.8		2236.8					
825.3 *9*	2.7 *2*	2073.67	2⁽⁺⁾	1248.63	2⁺				
869.2 *2*	6.6 *10*	1170.92	2⁺	301.703	2⁺	M1+E2	+8 *+12−2*	0.00307 *5*	α=0.00307 *5*; α(K)=0.00260 *5*; α(L)=0.000366 *6*;

From ENSDF

$\gamma(^{148}$Nd) (continued)

E_γ [@]	I_γ [@&]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	α [†]	Comments
								α(M)=7.78×10^{-5} *12*; α(N+..)=2.01×10^{-5} *3* α(N)=1.73×10^{-5} *3*; α(O)=2.60×10^{-6} *4*; α(P)=1.57×10^{-7} *3*
894.4 *4*	0.8 *1*	2406.01	2$^+$	1511.54	3$^+$			
903.1 *7*	2.1 *3*	2073.67	2$^{(+)}$	1170.92	2$^+$			
918.4 *6*	0.4 *3*	2431.33	2$^+$	1511.54	3$^+$			
933.7 *24*	0.3 *1*	1683.3	4$^+$	752.21	4$^+$			
947.1 *3*	2.8 *5*	1248.63	2$^+$	301.703	2$^+$	E2(+M1)	0.0032 *7*	α=0.0032 *7*; α(K)=0.0027 *6*; α(L)=0.00036 *7*; α(M)=7.7×10^{-5} *14*; α(N+..)=2.0×10^{-5} *4* α(N)=1.7×10^{-5} *4*; α(O)=2.6×10^{-6} *5*; α(P)=1.7×10^{-7} *4* δ: >+100 or<−9.
^{x}999.0 *5*	0.7 *4*							
1023.2 *2*	9.1 *10*	1023.19	1$^-$	0.0	0$^+$	E1	0.000895 *13*	α=0.000895 *13*; α(K)=0.000772 *11*; α(L)=9.76×10^{-5} *14*; α(M)=2.05×10^{-5} *3*; α(N+..)=5.32×10^{-6} *8* α(N)=4.58×10^{-6} *7*; α(O)=6.96×10^{-7} *10*; α(P)=4.57×10^{-8} *7*
1050.5 *7*	0.6 *1*	2073.67	2$^{(+)}$	1023.19	1$^-$			
1065.5 *13*	0.7 *3*	2236.8		1170.92	2$^+$			
1156.5 *2*	0.8 *2*	2073.67	2$^{(+)}$	916.88	0$^+$			
1157.4 *2*	2.1 *6*	2406.01	2$^+$	1248.63	2$^+$			
1171.2 *3*	1.7 *5*	1170.92	2$^+$	0.0	0$^+$	E2	0.001616 *23*	α=0.001616 *23*; α(K)=0.001378 *20*; α(L)=0.000185 *3*; α(M)=3.91×10^{-5} *6*; α(N+..)=1.334×10^{-5} *1* α(N)=8.74×10^{-6} *13*; α(O)=1.321×10^{-6} *19*; α(P)=8.36×10^{-8} *12*; α(IPF)=3.19×10^{-6} *5*
1182.7 *2*	0.5 *1*	2431.33	2$^+$	1248.63	2$^+$			
1209.9 *2*	2.6 *14*	1511.54	3$^+$	301.703	2$^+$	M1+E2	0.0018 *4*	α=0.0018 *4*; α(K)=0.0016 *3*; α(L)=0.00021 *4*; α(M)=4.4×10^{-5} *8*; α(N+..)=1.85×10^{-5} *21* α(N)=9.8×10^{-6} *17*; α(O)=1.5×10^{-6} *3*; α(P)=9.8×10^{-8} *20*; α(IPF)=7.15×10^{-6} *15* δ: >400,<−28 or 0.20 *4*.
1248.6 *1*	8.8 *24*	1248.63	2$^+$	0.0	0$^+$	E2	0.001429 *20*	α=0.001429 *20*; α(K)=0.001213 *17*; α(L)=0.0001616 *23*; α(M)=3.41×10^{-5} *5*; α(N+..)=2.12×10^{-5} α(N)=7.63×10^{-6} *11*; α(O)=1.154×10^{-6} *17*; α(P)=7.36×10^{-8} *11*; α(IPF)=1.233×10^{-5} *18*
1260.7 *4*	1.3 *5*	2431.33	2$^+$	1170.92	2$^+$			
1271.2 *5*	0.8 *2*	2930.63	(2$^-$)	1659.91	2$^+$			
1343.7 *3*	0.7 *1*	1645.58		301.703	2$^+$			
1358.23 *5*	10.7 *18*	1659.91	2$^+$	301.703	2$^+$			
1382.1 *10*	3.4 *8*	1683.3	4$^+$	301.703	2$^+$			
1409.8 *9*	0.2 *2*	2431.33	2$^+$	1023.19	1$^-$			
1418.6 *7*	0.7 *3*	2930.63	(2$^-$)	1511.54	3$^+$			
1521.8 *6*	1.4 *4*	2545.0	(1$^-$)	1023.19	1$^-$			
^{x}1658.5 *12*	0.6 *4*							
^{x}1682.8 *10*	0.7 *3*							

$^{148}_{60}$Nd$_{88}$-4

γ(^{148}Nd) (continued)

E_γ[@]	I_γ[@&]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[‡]	α[†]	Comments
1771.7 *6*	2.4 *2*	2073.67	$2^{(+)}$	301.703	2^+	(M1(+E2))	−0.03[#] *+25−28*	0.001116 *24*	α=0.001116 *24*; α(K)=0.000789 *19*; α(L)=0.0001012 *24*; α(M)=2.13×10^{-5} *5*; α(N+..)=0.000205 α(N)=4.77×10^{-6} *11*; α(O)=7.30×10^{-7} *17*; α(P)=4.92×10^{-8} *13*; α(IPF)=0.000199 *3*
1880.9 *7*	0.4 *4*	2182.2		301.703	2^+				
1907.1 *3*	1.7 *5*	2930.63	(2^-)	1023.19	1^-				
1931.9 *5*	1.0 *4*	2930.63	(2^-)	999.29	3^-				
2106.7 *8*	0.13 *3*	3129.9		1023.19	1^-				E_γ,I_γ: from 1979Ik06; γ not observed by 1988Ka14. 1979Ik06 also place a 2130.37γ 20 depopulating this level. 1988Ka14; however, show a 2129.6γ 5 depopulating the 2431.7 level.
2129.6 *5*	3.6 *6*	2431.33	2^+	301.703	2^+				
^{x}2141.8 *10*	0.6 *4*								
^{x}2222.5 *10*	0.6 *5*								
2629.0 *6*	2.4 *6*	2930.63	(2^-)	301.703	2^+				
2735.3 *11*	1.2 *5*	3036.8		301.703	2^+				
^{x}2982.6 *5*	1.0 *2*								

† Additional information 1.

‡ From adopted gammas; supported by $\gamma\gamma(\theta)$ from this data set.

From $\gamma\gamma(\theta)$ (1988Ka14).

@ From 1988Ka14.

& For absolute intensity per 100 decays, multiply by 0.622 *18*.

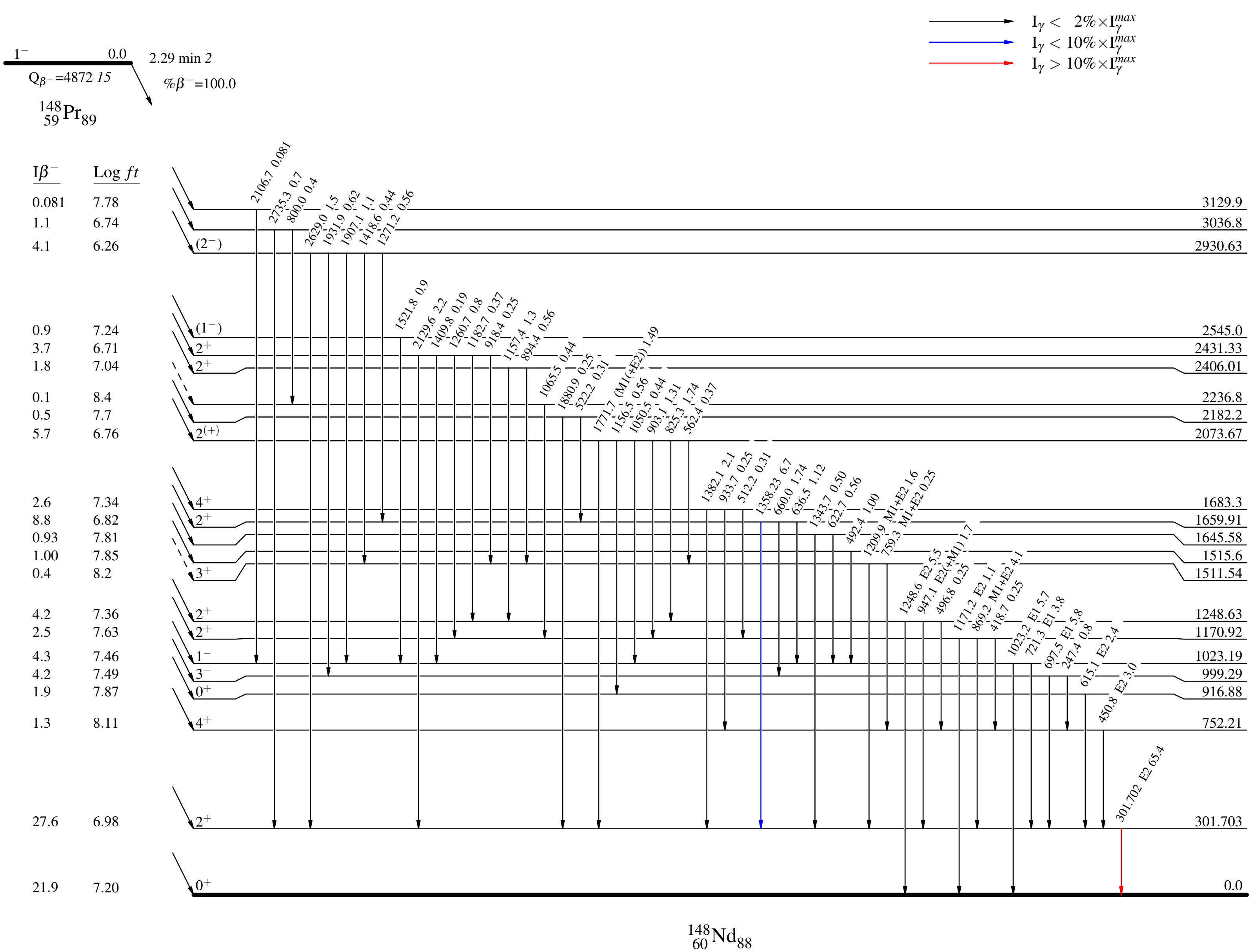
^{x} γ ray not placed in level scheme.

$^{148}_{60}$Nd$_{88}$-5

^{148}Pr β^- decay (2.29 min) 1988Ka14,1997Gr09

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



$^{148}_{60}Nd_{88}$-6