^{147}Ce β^- decay 1993Ma39,1997Gr09

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	N. Nica and B. Singh	NDS 181, 1 (2022)	9-Mar-2022

Parent: ^{147}Ce: E=0.0; J$^\pi$=(5/2$^-$); $T_{1/2}$=56.4 s *10*; Q(β^-)=3430 *16*; %β^- decay=100.0

^{147}Ce-E,J$^\pi$,$T_{1/2}$: From ^{147}Ce Adopted Levels.

^{147}Ce-Q(β^-): From 2021Wa16.

1997Gr09, 1996Gr20: ^{252}Cf SF, measured β^--decay intensity distribution by total absorption γ-ray spectrometer (TAGS).

1993Ma39: n_{th}-induced ^{235}U fission products analyzed with Tristan ISOL isotope separator at BNL with thermoionization source and moving tape collector. Used two Ge(Li), two Ge and Si(Li). Measured γ, $\gamma\gamma$, α(K)exp. Supersede 1988MaZI, 1987MaZO.

1987ScZG, 1981ScZM: fission products analyzed with ISOL systems Lohengrin and Ostis (ILL Grenoble), and Josef (K.F.A Julich). Measured γ, $\gamma\gamma$, $\gamma\gamma$(t), $\beta\gamma$(t). Measured conversion electrons and mixing ratios (K/L ratio).

1984So18: measured ratio of count rates of a γ ray relative to a reference γ ray (with known %Iγ relative to the β^- decay of the parent) using mass separators (HELIOS, OSTIS) and Ge(Li) detectors at radioactive equilibrium.

1979Bo26: precision Eγ with curved-crystal spectrometer; used the 411.8044 keV γ transition in ^{198}Au β^- decay as energy-calibration standard (so called gold standard) to obtain 98.4345 keV for the uranium KL3 x-ray. 2000He14 recommend 411.80205 keV *17* for the gold standard (data reported here are not adjusted).

Others: 1995Ik03, 1986Gr11 (β, $\beta\gamma$, β end point, Q(β^-)), 1993Sh33, 1975Pi03, 1964Ho03 (see ^{147}Pr β^-, used for Iγ normalization), 1982To16 (γ, $\gamma\gamma$), 1981Ya06 (γ, $\gamma\gamma$, $\beta\gamma$, $T_{1/2}$, Q(β^-)), 1977Bj02 (γ, $\gamma\gamma$), 1977Re11 (γ, $T_{1/2}$), 1975Do15 (γ, $\gamma\gamma$, $T_{1/2}$).

Level scheme is from 1993Ma39 and might be incomplete.

^{147}Pr Levels

E(level)†	J$^\pi$‡	$T_{1/2}$	E(level)†	J$^\pi$‡
0.0	(3/2$^+$)	13.44‡ min *10*	961.06 *17*	(5/2$^+$,7/2)
2.67 *11*	(5/2$^+$)		978.07 *17*	(7/2$^-$)
27.77 *11*	(7/2$^+$)		1045.94 *13*	(3/2$^-$,5/2)
93.29 *9*	(5/2$^+$)	12# ns	1058.90 *24*	(7/2$^-$,9/2$^+$)
246.52 *11*	(9/2$^+$)		1068.05 *16*	(7/2$^+$)
291.82 *9*	(5/2$^+$)		1159.58 *24*	(3/2,5/2,7/2$^-$)
362.03 *10*	(7/2$^-$)		1170.20 *16*	(7/2$^+$)
384.76 *15*	(11/2$^-$)		1172.88 *20*	(3/2$^-$,5/2,7/2$^-$)
452.32 *12*	(3/2$^-$,5/2$^-$)		1194.43 *14*	(5/2$^+$,7/2$^+$)
467.49 *10*	(3/2$^-$,5/2$^-$)		1267.30 *18*	(5/2$^+$,7/2)
470.69 *15*	(9/2$^+$)		1285.79 *20*	(3/2$^-$,5/2,7/2$^-$)
545.91 *14*	(9/2$^+$)		1724.93 *14*	(5/2$^+$,7/2$^+$)
608.01 *14*	(7/2$^-$)		1845.92 *15*	(5/2,7/2$^-$)
638.00 *20*	(3/2,5/2,7/2$^-$)		1856.34 *20*	(3/2$^-$,5/2,7/2)
701.32 *14*	(5/2$^-$)		1864.94 *15*	(3/2$^-$,5/2$^-$,7/2$^-$)
748.88 *15*	(5/2$^+$,7/2)		1943.85 *13*	(7/2$^-$)
783.6 *4*			2060.58 *18*	(5/2,7/2)
802.84 *13*	(5/2$^+$)		2135.32 *18*	(7/2$^-$)
931.57 *17*	(3/2,5/2,7/2$^+$)		2182.85 *16*	(7/2$^-$)
951.63 *14*	(5/2$^+$,7/2$^+$)		2249.64 *18*	(7/2$^-$)

† From least-squares fit to Eγ's; as Eγ's were reported with no uncertainties, ΔEγ=0.30 keV assumed for least-squares fitting.

‡ From Adopted Levels.

From 1981ScZM.

^{147}Ce β^- decay 1993Ma39,1997Gr09 (continued)

β^- radiations

Q(β^-)≈3.4 MeV and the highest level at ≈2.2 MeV indicate that the level scheme might be incomplete. However based on the existing data, ΣIβ=102 *17*, which indicates that the level scheme is rather complete. This contradiction suggests that these data should be used rather cautiously; new studies are needed for ^{147}Ce β^- decay.

Although 1993Ma39 and 1997Gr09 are in general agreement, there is an excess of Iβ for states <1300 keV and a deficient of Iβ for states >1300 keV of 1993Ma39 compared to 1997Gr09 (1997Gr09 used 1993Ma39 level scheme for TAGS simulated spectrum). Based on substantial agreement between measured and simulated shapes of TAGS spectra, 1997Gr09 suggest that 1993Ma39 failed to identify all the level deexcitation modes (rather than undetected levels).

E(decay)	E(level)	Iβ^-†‡	Log *ft*†	Comments
(1180 *16*)	2249.64	1.5	5.5	av Eβ=416.0 *67* Iβ^-: 4.97 (1997Gr09).
(1247 *16*)	2182.85	1.3	5.6	av Eβ=443.9 *68* Iβ^-: 2.22 (1997Gr09).
(1295 *16*)	2135.32	1.1	5.7	av Eβ=463.9 *68* Iβ^-: 1.83 (1997Gr09).
(1369 *16*)	2060.58	0.96	5.9	av Eβ=495.5 *69* Iβ^-: 4.41 (1997Gr09).
(1486 *16*)	1943.85	4.4	5.4	av Eβ=545.4 *69* Iβ^-: 9.65 (1997Gr09).
(1565 *16*)	1864.94	1.9	5.8	av Eβ=579.5 *70* Iβ^-: 6.20 (1997Gr09).
(1574 *16*)	1856.34	0.7	6.3	av Eβ=583.3 *70* Iβ^-: 2.48 (1997Gr09).
(1584 *16*)	1845.92	1.8	5.9	av Eβ=587.8 *70* Iβ^-: 5.70 (1997Gr09).
(1705 *16*)	1724.93	1.5	6.1	av Eβ=640.6 *71* Iβ^-: 4.82 (1997Gr09).
(2144 *16*)	1285.79	1.1	6.6	av Eβ=835.6 *72* Iβ^-: 0.69 (1997Gr09).
(2163 *16*)	1267.30	1.3	6.5	av Eβ=843.9 *72* Iβ^-: 0.84 (1997Gr09).
(2236 *16*)	1194.43	3.0	6.2	av Eβ=876.8 *73* Iβ^-: 2.03 (1997Gr09).
(2257 *16*)	1172.88	1.7	6.5	av Eβ=886.5 *73* Iβ^-: 1.29 (1997Gr09).
(2260 *16*)	1170.20	0.52	7.0	av Eβ=887.7 *73* Iβ^-: 0.35 (1997Gr09).
(2270 *16*)	1159.58	0.61	7.0	av Eβ=892.5 *73* Iβ^-: 0.40 (1997Gr09).
(2362 *16*)	1068.05	1.6	6.6	av Eβ=933.9 *73* Iβ^-: 0.59 (1997Gr09).
(2371 *16*)	1058.90	0.23	7.5	av Eβ=938.0 *73* Iβ^-: 0.085 (1997Gr09).
(2384 *16*)	1045.94	1.9	6.6	av Eβ=943.9 *73* Iβ^-: 0.65 (1997Gr09).
(2452 *16*)	978.07	0.14	7.7	av Eβ=974.7 *73* Iβ^-: 0.0 (1997Gr09).
(2469 *16*)	961.06	0.95	6.9	av Eβ=982.4 *73* Iβ^-: 0.21 (1997Gr09).
(2478 *16*)	951.63	2.0	6.6	av Eβ=986.7 *73* Iβ^-: 0.48 (1997Gr09).
(2498 *16*)	931.57	0.99	6.9	av Eβ=995.8 *73* Iβ^-: 0.27 (1997Gr09).
(2627 *16*)	802.84	2.3	6.6	av Eβ=1054.5 *73* Iβ^-: 0.69 (1997Gr09).

Continued on next page (footnotes at end of table)

^{147}Ce β^- decay 1993Ma39,1997Gr09 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^- †‡	Log *ft* †	Comments
(2646 *16*)	783.6	0.29	7.6	av Eβ=1063.3 *74* Iβ^-: 0.0 (1997Gr09).
(2681 *16*)	748.88	1.6	6.8	av Eβ=1079.1 *74* Iβ^-: 0.35 (1997Gr09).
(2729 *16*)	701.32	3.8	6.5	av Eβ=1100.9 *74* Iβ^-: 1.24 (1997Gr09).
(2792 *16*)	638.00	0.24	7.7	av Eβ=1129.9 *74* Iβ^-: 0.0 (1997Gr09).
(2822 *16*)	608.01	8.3	6.2	av Eβ=1143.6 *74* Iβ^-: 2.00 (1997Gr09).
(2884 *16*)	545.91	0.58	7.4	av Eβ=1172.1 *74* Iβ^-: 0.83 (1997Gr09).
(2963 *16*)	467.49	5.9	6.4	av Eβ=1208.2 *74* Iβ^-: 2.09 (1997Gr09).
(2978 *16*)	452.32	2.6	6.8	av Eβ=1215.1 *74* Iβ^-: 0.93 (1997Gr09).
(3068 *16*)	362.03	5.2	6.6	av Eβ=1256.7 *74* Iβ^-: 1.31 (1997Gr09).
(3138 *16*)	291.82	1.2	7.2	av Eβ=1289.1 *74*
(3183 *16*)	246.52	0.34	7.8	av Eβ=1310.0 *74*
(3337 *16*)	93.29	6	6.7	av Eβ=1380.8 *74*
(3402 *16*)	27.77			Iβ^-: included in g.s. Iβ.
(3427 *16*)	2.67			Iβ^-: included in g.s. Iβ.
(3430 *16*)	0.0	32	6.0	av Eβ=1423.9 *74* Iβ^-: sum of Iβ for g.s. plus first two excited states (obtained from Iγ imbalance at each level); compare to 12.8 (1993Ma39) and 79 *3* (1992De38); also compare the sum of Iβ for ground state plus first three excited states obtained here, 38 *8*, with 14.0 *20* (1996Gr20, 1997Gr09, TAGS, same group). The differences are due to different Iγ normalizations (see ^{147}Pr β^- decay dataset).

† The uncertainties are underestimated because measured Iγ values have no reported uncertainties, which makes these values tentative.
‡ Absolute intensity per 100 decays.

γ(^{147}Pr)

Iγ normalization: 0.092 *12* based on the average ratio, 0.0635 *52*, of γ-ray counting rates (at radioactive equilibrium) of five γ rays in this decay (269γ, 374γ, 467γ, 452γ, and 219γ) to that of 315γ (^{147}Pr β^- decay), all measured by 1984So18, with %Iγ(315γ)=12.6 (1975Pi03) used by 1984So18 replaced by evaluator with %Iγ(315γ)=18.2 *18* (see discussion on Iγ normalization in ^{147}Pr β^- decay in ^{147}Nd datasets). Alternatively if one uses %Iβ=14.0 *20* from 1997Gr09 (for the β feeding of g.s., 2.7, 28, and 93 levels) one gets 0.121 *5* for Iγ normalization.

E$_\gamma$[†]	I$_\gamma$[‡b]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[@]	α[c]	Comments
(2.7 *10*)		2.67	(5/2$^+$)	0.0	(3/2$^+$)			
23[e]	≈2	384.76	(11/2$^-$)	362.03	(7/2$^-$)	[E2]	1067	
25.3		27.77	(7/2$^+$)	2.67	(5/2$^+$)	[M1,E2]	3.4×10^2 *33*	
^{x}48.4[&]	3[&]							%Iγ=0.28
65.21	10.3	93.29	(5/2$^+$)	27.77	(7/2$^+$)	[M1,E2]	7.3 *29*	%Iγ=0.95
69.89	2	362.03	(7/2$^-$)	291.82	(5/2$^+$)	[E1]	0.667	%Iγ=0.18
^{x}77.2[&]	3.5[&]							%Iγ=0.32
90.44	15	93.29	(5/2$^+$)	2.67	(5/2$^+$)	[M1,E2]	2.39 *66*	%Iγ=1.4
93.17	73	93.29	(5/2$^+$)	0.0	(3/2$^+$)	M1	1.586	%Iγ=6.7 α(K)=1.350 *19*; α(L)=0.186 *3*; α(M)=0.0393 *6* α(N)=0.00879 *13*; α(O)=0.001414 *20*; α(P)=0.0001037 *15*
105.59	0.7	467.49	(3/2$^-$,5/2$^-$)	362.03	(7/2$^-$)	[M1,E2]	1.4 *4*	%Iγ=0.064
108.9	0.5	470.69	(9/2$^+$)	362.03	(7/2$^-$)	[E1]	0.199	%Iγ=0.046
115.5	0.36	362.03	(7/2$^-$)	246.52	(9/2$^+$)	[E1]	0.1691	%Iγ=0.033
138.37	7.4	384.76	(11/2$^-$)	246.52	(9/2$^+$)	[E1]	0.1029	%Iγ=0.68
161.56	4.1	545.91	(9/2$^+$)	384.76	(11/2$^-$)	[E1]	0.0674	%Iγ=0.38
175.37	6.7	467.49	(3/2$^-$,5/2$^-$)	291.82	(5/2$^+$)	(E1)	0.0539	%Iγ=0.62 α(K)=0.0460 *7*; α(L)=0.00622 *9*; α(M)=0.001303 *19* α(N)=0.000288 *4*; α(O)=4.53×10^{-5} *7*; α(P)=2.93×10^{-6} *5* Mult.: from α(K)exp=0.087 *8* (1993Ma39); comparing α(K)exp with calculated values, E1 is least discrepant.
178.72	4.5	470.69	(9/2$^+$)	291.82	(5/2$^+$)	(E2)	0.278	%Iγ=0.41 α(K)=0.203 *3*; α(L)=0.0586 *9*; α(M)=0.01296 *19* α(N)=0.00282 *4*; α(O)=0.000409 *6*; α(P)=1.201×10^{-5} *17* Mult.: from α(K)exp=0.317 *13* (1993Ma39).
183.8	0.2	545.91	(9/2$^+$)	362.03	(7/2$^-$)	[E1]	0.0474	%Iγ=0.018
185.7	3.2	638.00	(3/2,5/2,7/2$^-$)	452.32	(3/2$^-$,5/2$^-$)		0.15[a] *10*	%Iγ=0.29
198.534[#] *12*	33.6	291.82	(5/2$^+$)	93.29	(5/2$^+$)	M1	0.190	%Iγ=3.1 α(K)=0.1621 *23*; α(L)=0.0221 *3*; α(M)=0.00465 *7* α(N)=0.001040 *15*; α(O)=0.0001675 *24*; α(P)=1.239×10^{-5} *18* E$_\gamma$: 198.214 (1993Ma39). Mult.: from α(K)exp=0.175 *5* (1993Ma39).
202.87	1.5	748.88	(5/2$^+$,7/2)	545.91	(9/2$^+$)		0.11[a] *7*	%Iγ=0.14

$\gamma(^{147}Pr)$ (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ	α[c]	Comments
218.751[#] *10*	25.5	246.52	$(9/2^+)$	27.77	$(7/2^+)$	M1+E2	0.57	0.1446	%Iγ=2.4 α(K)=0.1203 *17*; α(L)=0.0192 *3*; α(M)=0.00410 *6* α(N)=0.000910 *13*; α(O)=0.0001423 *20*; α(P)=8.80×10^{-6} *13* E_γ: 218.384 (1993Ma39). Mult.: from α(K)exp=0.175 *4* (1993Ma39); M1 in 1993Ma39.
233.95	1.5	701.32	$(5/2^-)$	467.49	$(3/2^-,5/2^-)$			0.07[a] *5*	%Iγ=0.14
243.693	8.6	246.52	$(9/2^+)$	2.67	$(5/2^+)$	E2		0.0985	%Iγ=0.79 α(K)=0.0908 *13*; α(L)=0.01326 *19*; α(M)=0.00281 *4* α(N)=0.000626 *9*; α(O)=9.95×10^{-5} *14*; α(P)=6.78×10^{-6} *10* Mult.: from α(K)exp=0.077 *4* (1993Ma39); E2 in 1993Ma39.
248.5	3.4	701.32	$(5/2^-)$	452.32	$(3/2^-,5/2^-)$			0.06[a] *4*	%Iγ=0.31
254.09	11.6	545.91	$(9/2^+)$	291.82	$(5/2^+)$	E2		0.0859 *12*	%Iγ=1.1 α(K)=0.075 *9*; α(L)=0.0130 *18*; α(M)=0.0028 *5* α(N)=0.00062 *9*; α(O)=9.5×10^{-5} *10*; α(P)=5.3×10^{-6} *11* Mult.: from α(K)exp=0.078 *3* (1993Ma39).
263.70	1.2	291.82	$(5/2^+)$	27.77	$(7/2^+)$			0.05[a] *4*	%Iγ=0.11
268.80[#] *6*	100	362.03	$(7/2^-)$	93.29	$(5/2^+)$	E1		0.01725	%Iγ=9.2 α(K)=0.01478 *21*; α(L)=0.00196 *3*; α(M)=0.000410 *6* α(N)=9.10×10^{-5} *13*; α(O)=1.441×10^{-5} *21*; α(P)=9.82×10^{-7} *14* E_γ: 268.913 (1993Ma39). Mult.: from α(K)exp=0.0140 *4* (1993Ma39); M1+E2 (1981ScZM).
289.345	21.4	291.82	$(5/2^+)$	2.67	$(5/2^+)$	M1		0.0690	%Iγ=2.0 α(K)=0.0590 *9*; α(L)=0.00795 *12*; α(M)=0.001672 *24* α(N)=0.000374 *6*; α(O)=6.03×10^{-5} *9*; α(P)=4.49×10^{-6} *7* Mult.: from α(K)exp=0.074 *2* (1993Ma39).
292.036	6.9	291.82	$(5/2^+)$	0.0	$(3/2^+)$	M1+E2		0.061 *7*	%Iγ=0.64 α(K)=0.051 *7*; α(L)=0.0083 *6*; α(M)=0.00178 *15* α(N)=0.00039 *3*; α(O)=6.1×10^{-5} *3*; α(P)=3.6×10^{-6} *8* Mult.: from α(K)exp=0.0522 *4* (1993Ma39).
297.37	2.4	1045.94	$(3/2^-,5/2)$	748.88	$(5/2^+,7/2)$			0.04[a] *3*	%Iγ=0.22
299.63	1.1	545.91	$(9/2^+)$	246.52	$(9/2^+)$			0.04[a] *3*	%Iγ=0.10
316.4	5	608.01	$(7/2^-)$	291.82	$(5/2^+)$			0.03[a] *2*	%Iγ=0.46
335.2	4	802.84	$(5/2^+)$	467.49	$(3/2^-,5/2^-)$			0.03[a] *2*	%Iγ=0.37
344.25	2.2	1045.94	$(3/2^-,5/2)$	701.32	$(5/2^-)$			0.03[a] *2*	%Iγ=0.20
350.4	1.5	802.84	$(5/2^+)$	452.32	$(3/2^-,5/2^-)$			0.03[a] *2*	%Iγ=0.14
358.95[d]	15.4[d]	362.03	$(7/2^-)$	2.67	$(5/2^+)$	(E1)		0.00828	%Iγ=1.4 α(K)=0.00710 *10*; α(L)=0.000929 *13*; α(M)=0.000194 *3* α(N)=4.33×10^{-5} *6*; α(O)=6.89×10^{-6} *10*; α(P)=4.82×10^{-7} *7* Mult.: from α(K)exp=0.0077 *11* for unresolved 359γ+359γ+361γ multiplet (1993Ma39).
358.96[d]	8.4[d]	452.32	$(3/2^-,5/2^-)$	93.29	$(5/2^+)$	(E1)		0.00828	%Iγ=0.77

γ(^{147}Pr) (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	α[c]	Comments
								α(K)=0.00710 *10*; α(L)=0.000929 *13*; α(M)=0.000194 *3* α(N)=4.33×10^{-5} *6*; α(O)=6.89×10^{-6} *10*; α(P)=4.82×10^{-7} *7* Mult.: from α(K)exp=0.0077 *11* for unresolved 359γ+359γ+361γ multiplet (1993Ma39); assignment made tentative by evaluator.
361.42[d]	9[d]	608.01	(7/2$^-$)	246.52	(9/2$^+$)			%Iγ=0.83
361.7[d]	1[d]	362.03	(7/2$^-$)	0.0	(3/2$^+$)			%Iγ=0.092
374.23[#] *6*	55.0	467.49	(3/2$^-$,5/2$^-$)	93.29	(5/2$^+$)	E1	0.00747	%Iγ=5.1 α(K)=0.00641 *9*; α(L)=0.000838 *12*; α(M)=0.0001752 *25* α(N)=3.90×10^{-5} *6*; α(O)=6.21×10^{-6} *9*; α(P)=4.36×10^{-7} *7* E_γ: 374.313 (1993Ma39). Mult.: from α(K)exp=0.061 *6* (1993Ma39).
377.59	4.1	470.69	(9/2$^+$)	93.29	(5/2$^+$)			%Iγ=0.38
386.8	2.1	748.88	(5/2$^+$,7/2)	362.03	(7/2$^-$)			%Iγ=0.19
414.8	1.5	961.06	(5/2$^+$,7/2)	545.91	(9/2$^+$)			%Iγ=0.14
440.62	8.2	802.84	(5/2$^+$)	362.03	(7/2$^-$)			%Iγ=0.75
442.55	4.8	470.69	(9/2$^+$)	27.77	(7/2$^+$)			%Iγ=0.44
449.55	10.7	452.32	(3/2$^-$,5/2$^-$)	2.67	(5/2$^+$)	(E1)	0.00481	%Iγ=0.98 α(K)=0.00413 *6*; α(L)=0.000536 *8*; α(M)=0.0001120 *16* α(N)=2.50×10^{-5} *4*; α(O)=3.99×10^{-6} *6*; α(P)=2.84×10^{-7} *4* Mult.: from α(K)exp=0.0034 *5* for unresolved 450γ+452γ multiplet (1993Ma39); assignment made tentative by evaluator.
452.222	47.2	452.32	(3/2$^-$,5/2$^-$)	0.0	(3/2$^+$)	(E1)	0.00474	%Iγ=4.3 α(K)=0.00408 *6*; α(L)=0.000528 *8*; α(M)=0.0001105 *16* α(N)=2.46×10^{-5} *4*; α(O)=3.93×10^{-6} *6*; α(P)=2.80×10^{-7} *4* Mult.: from α(K)exp=0.0034 *5* for unresolved 450γ+452γ multiplet @ (1993Ma39); assignment made tentative by evaluator.
455.3	1.29	701.32	(5/2$^-$)	246.52	(9/2$^+$)			%Iγ=0.12
456.9	1.4	748.88	(5/2$^+$,7/2)	291.82	(5/2$^+$)			%Iγ=0.13
464.2[d]	3[d]	931.57	(3/2,5/2,7/2$^+$)	467.49	(3/2$^-$,5/2$^-$)			%Iγ=0.28
464.713[d]	18.1[d]	467.49	(3/2$^-$,5/2$^-$)	2.67	(5/2$^+$)	(E1)	0.00445	%Iγ=1.7 α(K)=0.00383 *6*; α(L)=0.000495 *7*; α(M)=0.0001035 *15* α(N)=2.31×10^{-5} *4*; α(O)=3.69×10^{-6} *6*; α(P)=2.63×10^{-7} *4* Mult.: from α(K)exp=0.0062 *15* (1993Ma39); comparing α(K)exp with calculated values, E1 is least discrepant.
467.33	43	467.49	(3/2$^-$,5/2$^-$)	0.0	(3/2$^+$)	E1	0.00439	%Iγ=4.0 α(K)=0.00378 *6*; α(L)=0.000489 *7*; α(M)=0.0001022 *15* α(N)=2.28×10^{-5} *4*; α(O)=3.64×10^{-6} *5*; α(P)=2.60×10^{-7} *4* Mult.: from α(K)exp=0.0047 *7* (1993Ma39).
484.56	4.0	951.63	(5/2$^+$,7/2$^+$)	467.49	(3/2$^-$,5/2$^-$)			%Iγ=0.37
489.99	1.9	961.06	(5/2$^+$,7/2)	470.69	(9/2$^+$)			%Iγ=0.18
493.44	3.1	961.06	(5/2$^+$,7/2)	467.49	(3/2$^-$,5/2$^-$)			%Iγ=0.29
502.31	3.3	748.88	(5/2$^+$,7/2)	246.52	(9/2$^+$)			%Iγ=0.30

$^{147}_{59}$Pr$_{88}$-6

$\gamma(^{147}Pr)$ (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	α[c]	Comments
510.4[d]	1.1[d]	978.07	(7/2⁻)	467.49	(3/2⁻,5/2⁻)			%Iγ=0.10
510.9[d]	1.4[d]	802.84	(5/2⁺)	291.82	(5/2⁺)			%Iγ=0.13
514.81	6.3	608.01	(7/2⁻)	93.29	(5/2⁺)			%Iγ=0.58
530.7	2.5	1724.93	(5/2⁺,7/2⁺)	1194.43	(5/2⁺,7/2⁺)			%Iγ=0.23
537.10	3.1	783.6		246.52	(9/2⁺)			%Iγ=0.29
544.89	3.8	638.00	(3/2,5/2,7/2⁻)	93.29	(5/2⁺)			%Iγ=0.35
578.5	3.4	1045.94	(3/2⁻,5/2)	467.49	(3/2⁻,5/2⁻)			%Iγ=0.31
580.28	63	608.01	(7/2⁻)	27.77	(7/2⁺)	(E1)	0.00269	%Iγ=5.8 α(K)=0.00232 *4*; α(L)=0.000297 *5*; α(M)=6.21×10⁻⁵ *9* α(N)=1.384×10⁻⁵ *20*; α(O)=2.22×10⁻⁶ *4*; α(P)=1.609×10⁻⁷ *23* Mult.: from α(K)exp=0.0027 *4* for unresolved 579γ+580γ multiplet (1993Ma39); assignment made tentative by evaluator.
593.0[d]	3.2[d]	1045.94	(3/2⁻,5/2)	452.32	(3/2⁻,5/2⁻)			%Iγ=0.29
593.29[d]	5.1[d]	978.07	(7/2⁻)	384.76	(11/2⁻)			%Iγ=0.47
599.52	2.8	961.06	(5/2⁺,7/2)	362.03	(7/2⁻)			%Iγ=0.26
605.4	22.7	608.01	(7/2⁻)	2.67	(5/2⁺)	(E1)	0.00245	%Iγ=2.1 α(K)=0.00211 *3*; α(L)=0.000270 *4*; α(M)=5.65×10⁻⁵ *8* α(N)=1.260×10⁻⁵ *18*; α(O)=2.02×10⁻⁶ *3*; α(P)=1.469×10⁻⁷ *21* Mult.: K-conversion peak not observed excludes M1+E2 (1993Ma39).
607.60	9.3	701.32	(5/2⁻)	93.29	(5/2⁺)			%Iγ=0.86
616.0	2.9	978.07	(7/2⁻)	362.03	(7/2⁻)			%Iγ=0.27
639.3	1.8	931.57	(3/2,5/2,7/2⁺)	291.82	(5/2⁺)			%Iγ=0.17
649.13	2.5	1194.43	(5/2⁺,7/2⁺)	545.91	(9/2⁺)			%Iγ=0.23
656.07	3.8	748.88	(5/2⁺,7/2)	93.29	(5/2⁺)			%Iγ=0.35
659.15[d]	4.6[d]	951.63	(5/2⁺,7/2⁺)	291.82	(5/2⁺)			%Iγ=0.42
659.6[d]	0.3[d]	1267.30	(5/2⁺,7/2)	608.01	(7/2⁻)			%Iγ=0.028
674.08	1.5	1058.90	(7/2⁻,9/2⁺)	384.76	(11/2⁻)			%Iγ=0.14
676.4	2	1845.92	(5/2,7/2⁻)	1170.20	(7/2⁺)			%Iγ=0.18
682.9	1.1	1068.05	(7/2⁺)	384.76	(11/2⁻)			%Iγ=0.10
684.2	1.7	1045.94	(3/2⁻,5/2)	362.03	(7/2⁻)			%Iγ=0.16
698.59	6.3	701.32	(5/2⁻)	2.67	(5/2⁺)			%Iγ=0.58
701.13	27.9	701.32	(5/2⁻)	0.0	(3/2⁺)	(E1)	0.00180	%Iγ=2.6 α(K)=0.001547 *22*; α(L)=0.000197 *3*; α(M)=4.11×10⁻⁵ *6* α(N)=9.17×10⁻⁶ *13*; α(O)=1.473×10⁻⁶ *21*; α(P)=1.081×10⁻⁷ *16* Mult.: K-conversion peak not observed excludes M1+E2 (1993Ma39).
705.5[d]	9[d]	1172.88	(3/2⁻,5/2,7/2⁻)	467.49	(3/2⁻,5/2⁻)			%Iγ=0.83
705.6[d]	1[d]	951.63	(5/2⁺,7/2⁺)	246.52	(9/2⁺)			%Iγ=0.092
705.7[d]	2[d]	1068.05	(7/2⁺)	362.03	(7/2⁻)			%Iγ=0.18
707.4	3	1159.58	(3/2,5/2,7/2⁻)	452.32	(3/2⁻,5/2⁻)			%Iγ=0.28
709.4	2	802.84	(5/2⁺)	93.29	(5/2⁺)			%Iγ=0.18
714.9	1	961.06	(5/2⁺,7/2)	246.52	(9/2⁺)			%Iγ=0.092

γ(^{147}Pr) (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	α[c]	Comments
721.0	5.9	1172.88	(3/2$^-$,5/2,7/2$^-$)	452.32	(3/2$^-$,5/2$^-$)			%Iγ=0.54
727.01	6.1	1194.43	(5/2$^+$,7/2$^+$)	467.49	(3/2$^-$,5/2$^-$)			%Iγ=0.56
746.36	7.3	748.88	(5/2$^+$,7/2)	2.67	(5/2$^+$)			%Iγ=0.67
754.66	1.4	1045.94	(3/2$^-$,5/2)	291.82	(5/2$^+$)			%Iγ=0.13
773.53	6.9	1724.93	(5/2$^+$,7/2$^+$)	951.63	(5/2$^+$,7/2$^+$)			%Iγ=0.64
776.53	7.4	1068.05	(7/2$^+$)	291.82	(5/2$^+$)			%Iγ=0.68
785.67	2.3	1170.20	(7/2$^+$)	384.76	(11/2$^-$)			%Iγ=0.21
796.8	4.6	1267.30	(5/2$^+$,7/2)	470.69	(9/2$^+$)			%Iγ=0.42
799.7[d]	1.0[d]	1845.92	(5/2,7/2$^-$)	1045.94	(3/2$^-$,5/2)			%Iγ=0.092
799.81[d]	≈3[d]	1267.30	(5/2$^+$,7/2)	467.49	(3/2$^-$,5/2$^-$)			
802.86	11.5	802.84	(5/2$^+$)	0.0	(3/2$^+$)	(M1+E2)	0.0044 *10*	%Iγ=1.1 α(K)=0.0037 *8*; α(L)=0.00050 *9*; α(M)=0.000106 *19* α(N)=2.4×10^{-5} *5*; α(O)=3.8×10^{-6} *7*; α(P)=2.7×10^{-7} *7* Mult.: from α(K)exp=0.009 *2* for unresolved 800γ+802γ multiplet (1993Ma39).
808.2	1.6	1170.20	(7/2$^+$)	362.03	(7/2$^-$)			%Iγ=0.15
810.3	3.2	1172.88	(3/2$^-$,5/2,7/2$^-$)	362.03	(7/2$^-$)			%Iγ=0.29
818.22	2.7	1285.79	(3/2$^-$,5/2,7/2$^-$)	467.49	(3/2$^-$,5/2$^-$)			%Iγ=0.25
832.346	18	1194.43	(5/2$^+$,7/2$^+$)	362.03	(7/2$^-$)			%Iγ=1.7
833.5	3.8	1285.79	(3/2$^-$,5/2,7/2$^-$)	452.32	(3/2$^-$,5/2$^-$)			%Iγ=0.35
838.62	0.8	931.57	(3/2,5/2,7/2$^+$)	93.29	(5/2$^+$)			%Iγ=0.074
857.87	8.5	951.63	(5/2$^+$,7/2$^+$)	93.29	(5/2$^+$)			%Iγ=0.78
867.98	6.6	1845.92	(5/2,7/2$^-$)	978.07	(7/2$^-$)			%Iγ=0.61
878.5	1.1	1170.20	(7/2$^+$)	291.82	(5/2$^+$)			%Iγ=0.10
921.5		1724.93	(5/2$^+$,7/2$^+$)	802.84	(5/2$^+$)			
923.79	5.2	1285.79	(3/2$^-$,5/2,7/2$^-$)	362.03	(7/2$^-$)			%Iγ=0.48
931.57	5.2	931.57	(3/2,5/2,7/2$^+$)	0.0	(3/2$^+$)			%Iγ=0.48
949.13	4	951.63	(5/2$^+$,7/2$^+$)	2.67	(5/2$^+$)			%Iγ=0.37
951.93[d]	6[d]	951.63	(5/2$^+$,7/2$^+$)	0.0	(3/2$^+$)			%Iγ=0.55
952.3[d]	0.7[d]	1045.94	(3/2$^-$,5/2)	93.29	(5/2$^+$)			%Iγ=0.064
965.4	1.0	1943.85	(7/2$^-$)	978.07	(7/2$^-$)			%Iγ=0.092
987.76	4.4	2182.85	(7/2$^-$)	1194.43	(5/2$^+$,7/2$^+$)			%Iγ=0.41
1042.9		1845.92	(5/2,7/2$^-$)	802.84	(5/2$^+$)			
1045.82	6.9	1045.94	(3/2$^-$,5/2)	0.0	(3/2$^+$)			%Iγ=0.64
1056.27	1.02	1058.90	(7/2$^-$,9/2$^+$)	2.67	(5/2$^+$)			%Iγ=0.094
1062.14	4.1	1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	802.84	(5/2$^+$)			%Iγ=0.38
1065.41	4.8	1068.05	(7/2$^+$)	2.67	(5/2$^+$)			%Iγ=0.44
1068.40	1.7	1068.05	(7/2$^+$)	0.0	(3/2$^+$)			%Iγ=0.16
1100.94	8.2	1194.43	(5/2$^+$,7/2$^+$)	93.29	(5/2$^+$)			%Iγ=0.75
1116.42	3.1	1724.93	(5/2$^+$,7/2$^+$)	608.01	(7/2$^-$)			%Iγ=0.29
1156.77	3.6	1159.58	(3/2,5/2,7/2$^-$)	2.67	(5/2$^+$)			%Iγ=0.33
1166.2	3.3	1194.43	(5/2$^+$,7/2$^+$)	27.77	(7/2$^+$)			%Iγ=0.30

γ(^{147}Pr) (continued)

E_γ [†]	I_γ [‡b]	E_i(level)	J^π_i	E_f	J^π_f	Comments
1170.5	2.6	1170.20	(7/2$^+$)	0.0	(3/2$^+$)	%Iγ=0.24
1179.1	1.9	1724.93	(5/2$^+$,7/2$^+$)	545.91	(9/2$^+$)	%Iγ=0.18
1193.97	1.7	1194.43	(5/2$^+$,7/2$^+$)	0.0	(3/2$^+$)	%Iγ=0.56
1227.13	4.9	1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	638.00	(3/2,5/2,7/2$^-$)	%Iγ=0.45
1257.0	3.4	1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	608.01	(7/2$^-$)	%Iγ=0.31
1264.13	6.1	1267.30	(5/2$^+$,7/2)	2.67	(5/2$^+$)	%Iγ=0.56
1335.93	7.1	1943.85	(7/2$^-$)	608.01	(7/2$^-$)	%Iγ=0.65
1378.29	2.6	1845.92	(5/2,7/2$^-$)	467.49	(3/2$^-$,5/2$^-$)	%Iγ=0.24
1388.81	4.0	1856.34	(3/2$^-$,5/2,7/2)	467.49	(3/2$^-$,5/2$^-$)	%Iγ=0.37
1393.72	3.8	1845.92	(5/2,7/2$^-$)	452.32	(3/2$^-$,5/2$^-$)	%Iγ=0.35
1397.49	3.5	1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	467.49	(3/2$^-$,5/2$^-$)	%Iγ=0.32
1412.52	3.2	1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	452.32	(3/2$^-$,5/2$^-$)	%Iγ=0.29
1452.88	2.8	2060.58	(5/2,7/2)	608.01	(7/2$^-$)	%Iγ=0.26
1473.16	4.9	1943.85	(7/2$^-$)	470.69	(9/2$^+$)	%Iγ=0.45
1476.60	10.7	1943.85	(7/2$^-$)	467.49	(3/2$^-$,5/2$^-$)	%Iγ=0.98
1478.7	0.8	1724.93	(5/2$^+$,7/2$^+$)	246.52	(9/2$^+$)	%Iγ=0.074
1483.51	3.1	1845.92	(5/2,7/2$^-$)	362.03	(7/2$^-$)	%Iγ=0.29
1491.84	6.9	1943.85	(7/2$^-$)	452.32	(3/2$^-$,5/2$^-$)	%Iγ=0.64
1494.3	3.0	1856.34	(3/2$^-$,5/2,7/2)	362.03	(7/2$^-$)	%Iγ=0.28
1548.08	6.2	2249.64	(7/2$^-$)	701.32	(5/2$^-$)	%Iγ=0.57
1564.53	0.9	1856.34	(3/2$^-$,5/2,7/2)	291.82	(5/2$^+$)	%Iγ=0.083
1572.8		1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	291.82	(5/2$^+$)	
1582.06	2.4	1943.85	(7/2$^-$)	362.03	(7/2$^-$)	%Iγ=0.22
1589.51	2.2	2135.32	(7/2$^-$)	545.91	(9/2$^+$)	%Iγ=0.20
1637.2	2.3	2182.85	(7/2$^-$)	545.91	(9/2$^+$)	%Iγ=0.21
1697.29	2.4	1943.85	(7/2$^-$)	246.52	(9/2$^+$)	%Iγ=0.22
1725.2	0.6	1724.93	(5/2$^+$,7/2$^+$)	0.0	(3/2$^+$)	%Iγ=0.055
1768.4	3.1	2060.58	(5/2,7/2)	291.82	(5/2$^+$)	%Iγ=0.29
1773.4	4.3	2135.32	(7/2$^-$)	362.03	(7/2$^-$)	%Iγ=0.40
1779.0	5.8	2249.64	(7/2$^-$)	470.69	(9/2$^+$)	%Iγ=0.53
1798.0	1.3	2182.85	(7/2$^-$)	384.76	(11/2$^-$)	%Iγ=0.12
1843.5	1.5	2135.32	(7/2$^-$)	291.82	(5/2$^+$)	%Iγ=0.14
1850.0	7.5	1943.85	(7/2$^-$)	93.29	(5/2$^+$)	%Iγ=0.69
1862.3	1.3	1864.94	(3/2$^-$,5/2$^-$,7/2$^-$)	2.67	(5/2$^+$)	%Iγ=0.12
1887.8	2.1	2249.64	(7/2$^-$)	362.03	(7/2$^-$)	%Iγ=0.19
1915.8	1.0	1943.85	(7/2$^-$)	27.77	(7/2$^+$)	%Iγ=0.092
1936.8	3.3	2182.85	(7/2$^-$)	246.52	(9/2$^+$)	%Iγ=0.30
1941.5	4.4	1943.85	(7/2$^-$)	2.67	(5/2$^+$)	%Iγ=0.41
2032.5	0.20	2060.58	(5/2,7/2)	27.77	(7/2$^+$)	%Iγ=0.018
2058.2	4.3	2060.58	(5/2,7/2)	2.67	(5/2$^+$)	%Iγ=0.40
2089.4	1.8	2182.85	(7/2$^-$)	93.29	(5/2$^+$)	%Iγ=0.17
2107.3	3.4	2135.32	(7/2$^-$)	27.77	(7/2$^+$)	%Iγ=0.31

γ(^{147}Pr) (continued)

E_γ [†]	I_γ [‡b]	E_i(level)	J^π_i	E_f	J^π_f	Comments
2180.3	0.56	2182.85	(7/2$^-$)	2.67	(5/2$^+$)	%Iγ=0.052
2246.9	1.7	2249.64	(7/2$^-$)	2.67	(5/2$^+$)	%Iγ=0.16

[†] From 1993Ma39, except when noted. Eγ's listed in table are given with one, two, or three decimal digits as listed in 1993Ma39, although usually one does not expect more than one significant decimal digit for their method.

[‡] From 1993Ma39 (no uncertainties are reported).

[#] Eγ is from measurements with curved crystal spectrometers (1979Bo26).

[@] From 1981ScZM based on γ-ray, conversion electron studies and K/L ratios (values not given), except as noted (same values are adopted in the Adopted Levels, Gammas dataset).

[&] From 1981ScZM.

[a] α not known. The value shown is the average of the smallest and largest values for the E1, E2, and M1 multipolarities for this transition with an uncertainty taken large enough to overlap these values.

[b] For absolute intensity per 100 decays, multiply by 0.092.

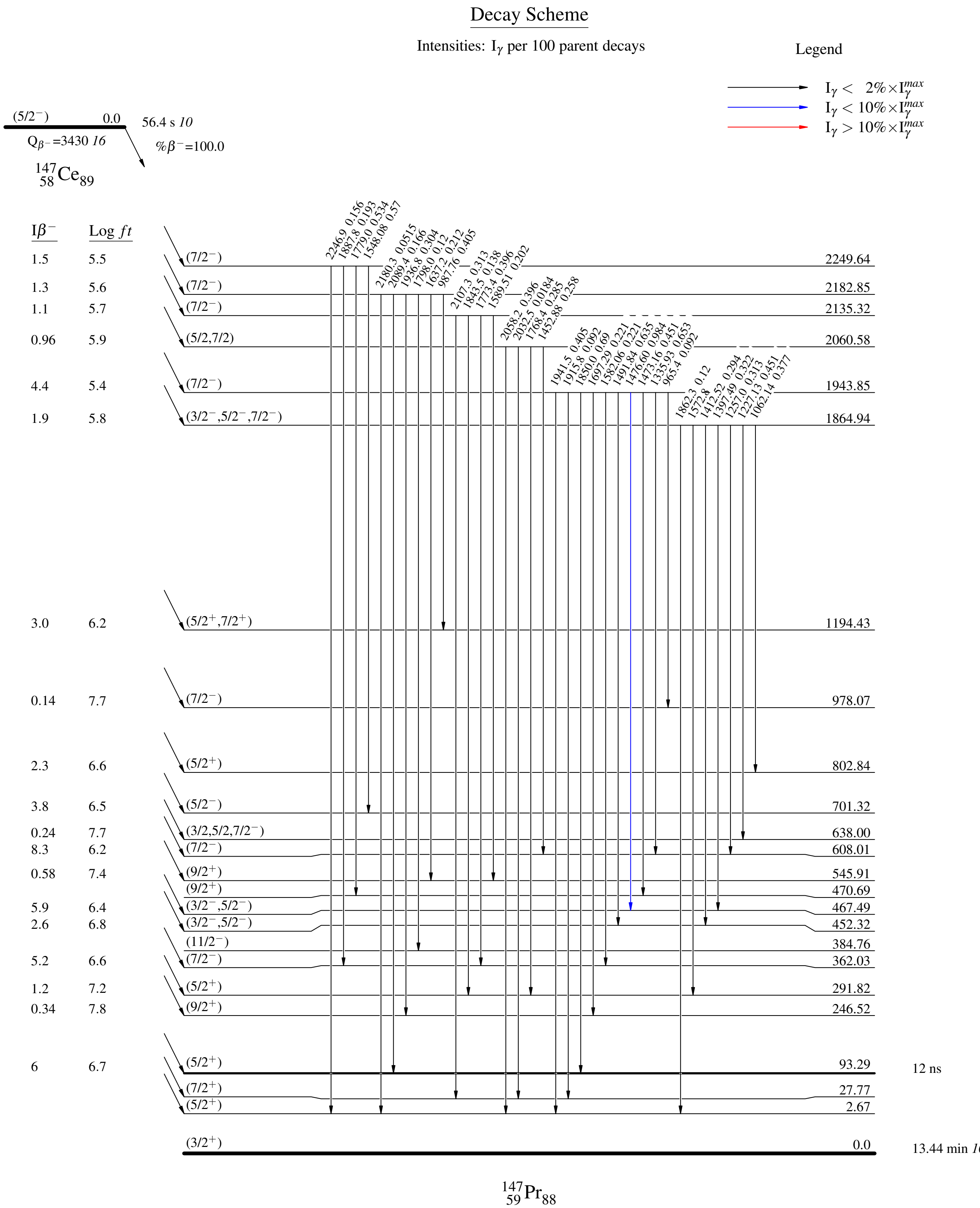
[c] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[d] Multiply placed with intensity suitably divided.

[e] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

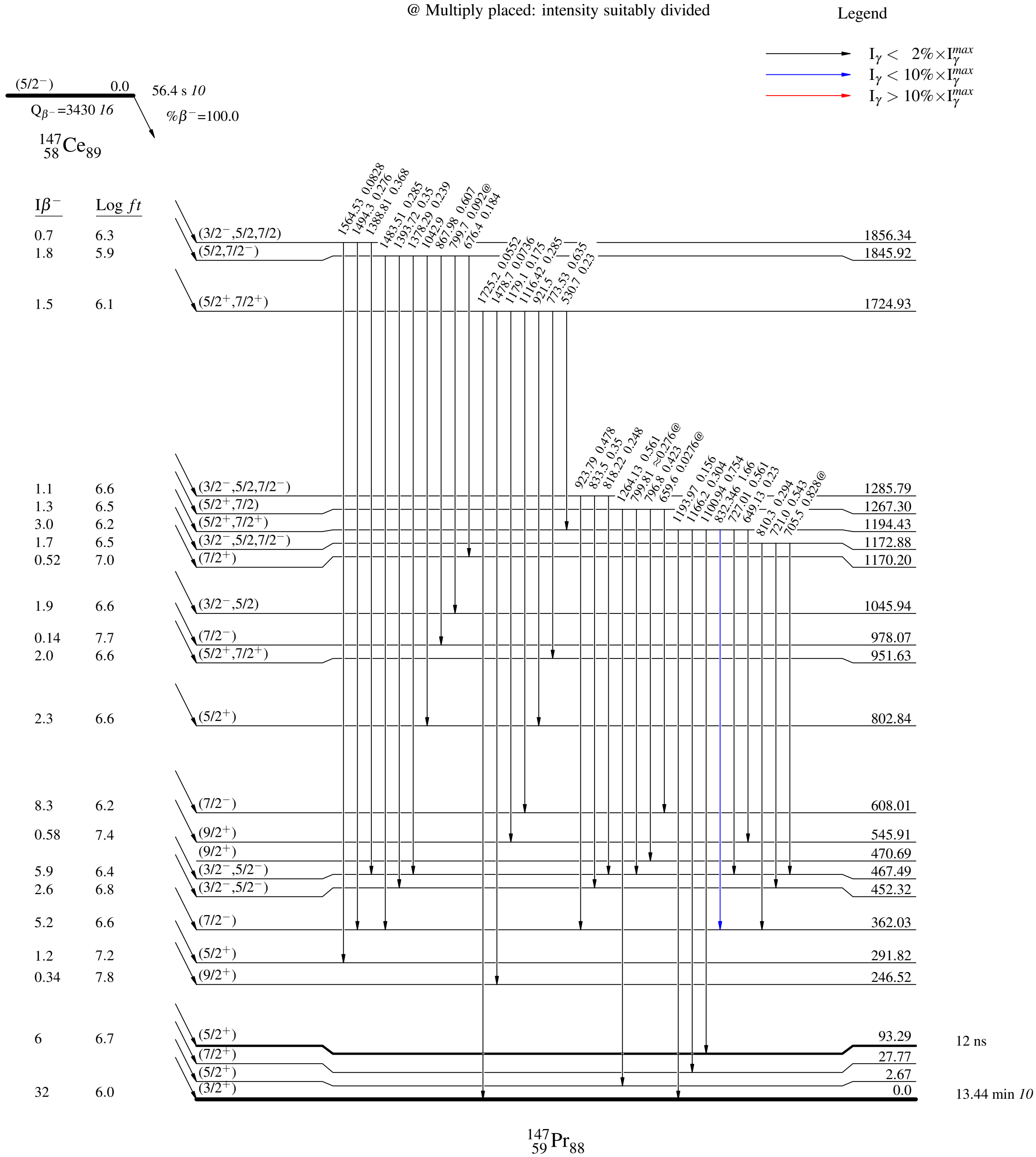
^{147}Ce β^- decay 1993Ma39,1997Gr09



^{147}Ce β^- decay 1993Ma39,1997Gr09

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays
@ Multiply placed: intensity suitably divided

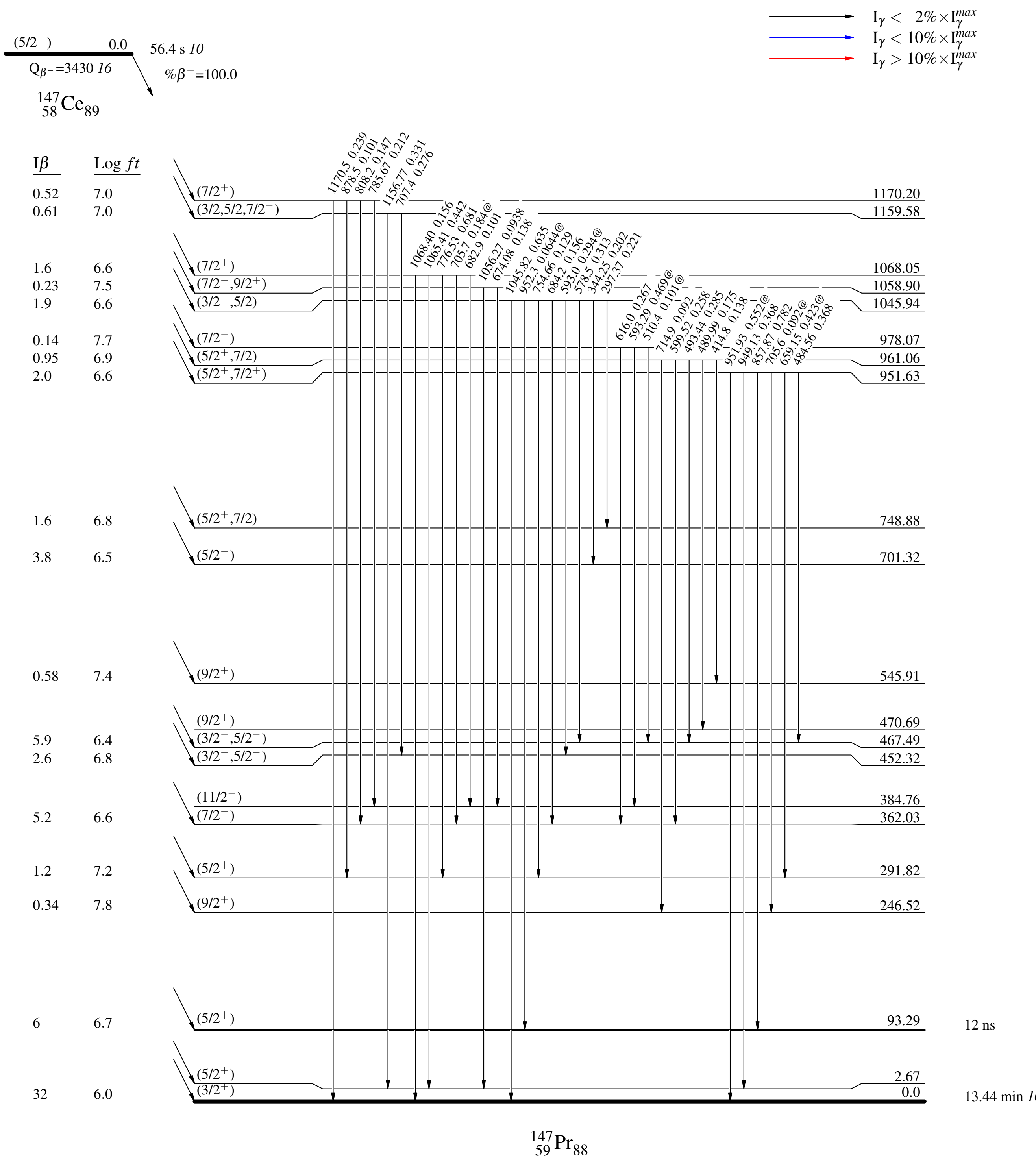


$^{147}Ce\ \beta^-$ decay 1993Ma39,1997Gr09

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays

@ Multiply placed: intensity suitably divided

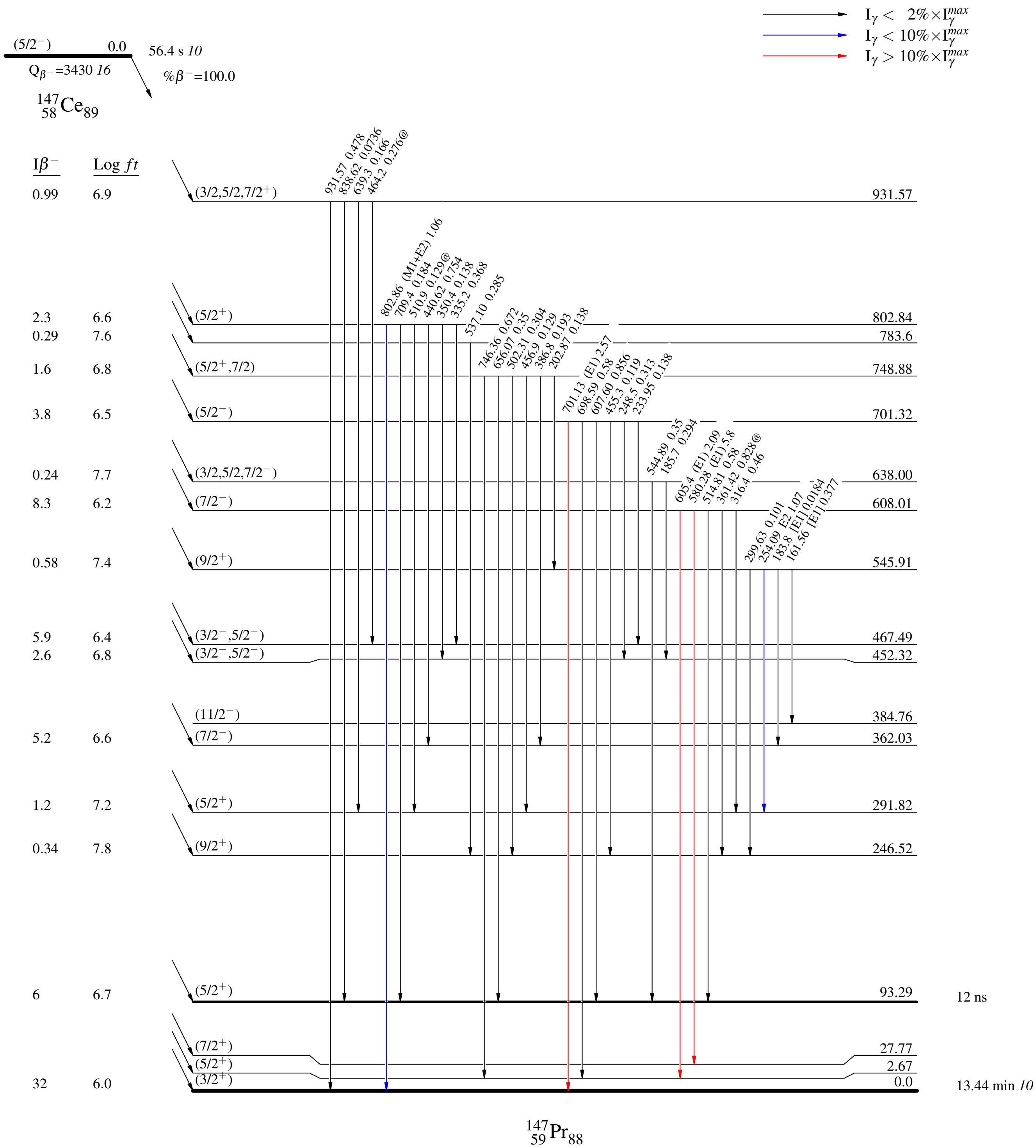


^{147}Ce β^- decay 1993Ma39,1997Gr09

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays

@ Multiply placed: intensity suitably divided



^{147}Ce β^- decay 1993Ma39,1997Gr09

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays
@ Multiply placed: intensity suitably divided