Adopted Levels, Gammas

Type	Author	Citation	Literature Cutoff Date
	History		
Full Evaluation	T. D. Johnson, D. Symochko(a), M. Fadil(b), and J. K. Tuli	NDS 112,1949 (2011)	1-Jun-2010

Q(β^-)=2161.6 *15*; S(n)=5843.15 *8*; S(p)=5641.2 *11*; Q(α)=309 *4* 2012Wa38
Note: Current evaluation has used the following Q record 2161.6 155843.15 *85641.2 11309* 3 2011AuZZ.
Q(β^-n)=−7666 *3*, Q(εp)=−8143 *4* 2011AuZZ.
Values in 2003Au03: Q(β^-)=2162.5 *15*, S(n)=5843 *15*, S(p)=5641.2 *11*, Q(α)=307 *3* Q(β^-n)=−7666 *3*, Q(εp)=−8143 *4*.
2001Ko07: ^{141}Pr(n,γ):
^{142}Pr was produced, in addition to other isotopes, to explore the potential of using a small HPGe detector to obtain $\beta^{\pm}$ maximum energies. Q(β^-)=2154 *3* as compared to 2162.5 *5* (2003Au03).
There have been no significant changes in this nuclide since its last evaluation.

^{142}Pr Levels

Cross Reference (XREF) Flags

A	^{142}Pr IT decay	E	^{141}Pr(n,γ) E=85.2 eV	I	^{141}Pr(n,γ) E=635.7 eV
B	^{139}La(α,nγ), ^{142}Ce(p,nγ)	F	^{141}Pr(n,γ) E=215.6 eV	J	^{130}Te(^{18}O,p5nγ)
C	^{141}Pr(d,p)	G	^{141}Pr(n,γ) E=231.7 eV		
D	^{141}Pr(n,γ) E=thermal	H	^{141}Pr(n,γ) E=519.2 eV		

E(level)[#]	J$^{\pi}$[†]	$T_{1/2}$	XREF	Comments
0.0	2$^-$	19.12 h *4*	ABCDEFGHI	%ε=0.0164 *8*; %β^-=99.9836 *8* μ=+0.234 *1* (2005St24) Q=+0.030 *9* (2005St24) $T_{1/2}$: weighted average: 19.14 h *5* (1966Ot03), 19.09 h *7* (1968La17). E(level): from (n,γ). See 1985AlZN. J$^{\pi}$: atomic beam (1976Fu06), first-forbidden unique β^- transition to 0$^+$ ^{142}Nd g.s. (1966Be12).
3.694 *3*	5$^-$[‡]	14.6 min *5*	ABCD	%IT=100 μ=2.2 *1* (1989Ra17) $T_{1/2}$: from 1967Ke05, 1968Ke08. J$^{\pi}$: atomic beam (1976Fu06), L=3 in (d,p).
17.750 *4*	3$^-$		BCDEFGHI	J$^{\pi}$: L=3 in (d,p); γ from 4$^-$ is dipole [$\gamma(\theta)$ in (n,γ) on oriented nuclei], dipole γ from 2$^+$ neutron resonance E(n)=519 eV.
63.757 *4*	6$^-$[‡]		BCD	J$^{\pi}$: L=3 in (d,p), γ only to 5$^-$, the level with largest σ(L=3) in (d,p).
72.307 *3*	4$^-$		BCD FG I	J$^{\pi}$: γ to 3$^-$,5$^-$; no γ from 2$^+$ resonances and strong γ from 3$^+$ resonances in (n,γ), shell model.
84.9986 *20*	1$^-$		BCDE H	J$^{\pi}$: L=3 in (d,p); γ only to 2$^-$; γ from 2$^+$ resonances and no γ from 3$^+$ resonances in (n,γ).
90.3 *9*	(6$^-$)[‡]		B D	
128.262 *4*	5$^-$		BCD	J$^{\pi}$: L=3 in (d,p); strong γ to 6$^-$ suggests D, γ to 4$^-$ is D.
144.599 *4*	4$^-$		BCD FG I	J$^{\pi}$: $\gamma(\theta)$ for 140.9γ in (n,γ) on oriented nuclei; γ from 3$^+$ neutron resonances and no γ from 2$^+$ neutron resonances in (n,γ), L=3 in (d,p).
153.5? *10*			B	
176.8856 *19*	(3)$^-$		BCDEFGHI	J$^{\pi}$: L=3 in (d,p); γ from 2$^+$ and 3$^+$ neutron resonances in (n,γ); γ's to 2$^-$,3$^-$,4$^-$, no γ to 1$^-$.
200.531 *4*	(2)$^-$		BCDEFGHI	J$^{\pi}$: L=3 in (d,p); γ to 1$^-$, no γ to 4$^-$; γ from 2$^+$ and 3$^+$ neutron resonances in (n,γ).
358.4 *9*	(7$^-$)[‡]		B E J	
631.3 *6*			B D	
637.24 *10*	4$^-$		BCD FG I	J$^{\pi}$: L=1 in (d,p); γ to 6$^-$.
664.9 *15*			C	
681.6 *7*			C	

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Adopted Levels, Gammas (continued)

^{142}Pr Levels (continued)

E(level)[#]	Jπ[†]	$T_{1/2}$	XREF	Comments
702.5 *3*			B DEFGHI	
704.75 *16*	3⁻,4⁻		BCD	Jπ: L=1 in (d,p); γ′s to 3⁻ and 5⁻.
747.01 *10*	2⁻,3⁻		BCDEFGHI	Jπ: L=1 in (d,p); γ′s from 2⁺ and 3⁺ resonances.
767.0 *8*			C	
790.39 *9*	3⁻,2⁻		BCD FG	
823.20 *10*	2⁻,3⁻		BCDEFG	Jπ: L=1 in (d,p); γ from 2⁺,3⁺ resonance and γ to states at 1⁻,2⁻, and 3⁻.
889.983 *4*			D	E(level),Jπ: 5⁻,6⁻ from 1985AlZN; populating and depopulating γ′s not given.
911.4 *13*	(9⁺)[‡]	61 ns *6*	B J	%IT=100 $T_{1/2}$: from (α,nγ) (1975Sc17).
978.19 *9*	2⁻,3⁻		BCD G	Jπ: L=1 in (d,p); γ from 2⁺,3⁺ resonance and γ to states at 1⁻,2⁻,and 3⁻.
1041.92 *13*	2⁻,3⁻		BCDE G	Jπ: L=1 in (d,p); γ from 2⁺,+3⁺ resonance.
1072.34 *4*			D	
1111.790 *7*			CD	
1114.61 *10*			D	
1119.8 *5*	3⁻,4⁻		BCD FG	Jπ: γ to 3⁻,4⁻, and 5⁻; γ from 2⁺,3⁺ resonance.
1150.94 *14*	2⁻,3⁻,4⁻		BCD FG	Jπ: L=1 in (d,p).
1157.34 *10*			D	
1158.81 *10*			D	
1175.7 *5*			B D	
1182.39 *10*			CD	
1200.4 *11*			C	
1220.2 *17*			C	
1236.6 *10*			C	
1250.80 *10*			CDE G	
1263.44 *10*			CD	
1290.52 *10*			D	
1346.64 *10*			CD FG	
1362.7 *17*			C	
1381.50 *10*			CD	
1393.82 *10*			CD FG	
1402.54 *10*			CDEFG	
1428.9 *10*			C	
1444.7 *15*			C	
1460.12 *10*			CD	
1466.42 *10*			D	
1470.55 *10*			CDEFG	
1495.46 *10*			CDEFG	
1499.38 *10*			D	
1511.84 *10*			D	
1517.59 *10*			CD	
1527.38 *10*			D	
1538.46 *10*			CD	
1540.43 *10*			D	
1556.0 *13*			C	
1564.08 *10*			D	
1566.54 *10*			CDEF	
1590.95 *10*			CDEF	
1599.22 *10*			CD	
1616.30 *10*			CD	
1622.81 *10*			D	
1639.88 *10*			CD	
1650.28 *10*			CD	
1666.09 *10*			CD	
1679.20 *10*			CD	
1683.58 *10*			D	
1693.16 *10*			CD	

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Adopted Levels, Gammas (continued)

^{142}Pr Levels (continued)

E(level)[#]	XREF	E(level)[#]	XREF	E(level)[#]	XREF	E(level)[#]	XREF
1709.05 *10*	CD	1922.77 *10*	D	2071.21 *10*	D	2212.25 *10*	D
1722.32 *10*	CD	1927.93 *10*	D	2074.75 *10*	D	2213.91 *10*	D
1733.59 *10*	D	1932.01 *10*	CD	2080.84 *10*	D	2223.09 *10*	D
1747.43 *10*	D	1940.60 *10*	CD	2092.21 *10*	D	2227.85 *10*	D
1752.94 *10*	CD	1950.47 *10*	D	2096.63 *10*	D	2232.51 *10*	D
1758.70 *10*	D	1953.72 *10*	CD	2100.64 *10*	D	2240.59 *10*	D
1764.38 *10*	D	1959.10 *10*	D	2106.94 *10*	D	2243.96 *10*	D
1769.23 *10*	CD	1969.18 *10*	D	2115.07 *10*	D	2252.07 *10*	D
1785.03 *10*	D	1971.40 *10*	D	2126.83 *10*	D	2255.26 *10*	D
1793.17 *10*	D	1974.66 *10*	D	2129.37 *10*	D	2260.63 *10*	D
1798.23 *10*	CD	1980.23 *10*	CD	2133.46 *10*	D	2268.28 *10*	D
1807.11 *10*	CD	1984.88 *10*	D	2141.57 *10*	D	2274.06 *10*	D
1813.71 *10*	D	1993.29 *10*	D	2148.20 *10*	D	2277.04 *10*	D
1824.05 *10*	D	2012.81 *10*	CD	2151.45 *10*	D	2278.18 *10*	D
1826.46 *10*	D	2017.43 *10*	D	2152.83 *10*	D	2279.88 *10*	D
1830.88 *10*	CD	2022.67 *10*	D	2164.74 *10*	D	2286.26 *10*	D
1842.11 *10*	CD	2028.12 *10*	D	2167.62 *10*	D	2293.40 *10*	D
1866.2 *8*	C	2031.46 *10*	D	2178.75 *10*	D	2307.78 *10*	D
1875.58 *10*	D	2037.10 *10*	D	2183.27 *10*	D	2310.27 *10*	D
1880.31 *10*	CD	2043.06 *10*	D	2184.96 *10*	D	2316.06 *10*	D
1883.53 *10*	D	2048.01 *10*	D	2188.63 *10*	D	2320.46 *10*	D
1895.99 *10*	CD	2052.73 *10*	D	2191.37 *10*	D	2328.69 *10*	D
1901.90 *10*	D	2058.00 *10*	D	2192.90 *10*	D	2334.35 *10*	D
1913.93 *10*	CD	2060.78 *10*	D	2197.28 *10*	D	2590.5 *1*	G
1920.02 *10*	D	2066.64 *10*	D	2200.58 *10*	D		

† From analysis of γ-depopulation of levels in (n,γ), except where noted otherwise.

‡ Cascade of γ's from isomeric level 912 was terminated at 5^- level and is not connected with any lower J≤4 level. This is consistent with expected decay of 9^+ isomeric state (π(h11/2),ν(f7/2)) to 7^- (π(g7/2),ν(f7/2)) to 6^- (π(g7/2+d5/2),ν(f7/2)) to 5^- (π(d5/2),ν(f7/2)) states which is similar to π(h11/2) to π(g7/2) to π(d5/2) decays in odd-A Pr nuclei; $T_{1/2}$=61 ns is consistent with M2 for 553.0 and B(M2)(W.u.)=0.35 is similar to B(M2)(W.u.)=0.24 for h11/2 to g7/2 isomeric transition in ^{141}Pr.

From least-squares fit to Eγ.

$\gamma(^{142}Pr)$

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α[†]	Comments
3.694	5^-	(3.683 *4*)		0.0	2^-	M3	1.17×10^{10}	B(M3)(W.u.)=0.95 *5* Mult.,α: from IT decay (1991Ba63).
63.757	6^-	60.064 *2*	100	3.694	5^-			α(K)= 4.88; α(L)= 0.678; α(M)= 0.1420; α(N+..)= 0.0389
72.307	4^-	54.568 *8*	78 *24*	17.750	3^-			α(K)= 6.46; α(L)= 0.898; α(M)= 0.1882; α(N+..)= 0.0515
		68.610 *2*	100 *50*	3.694	5^-			α(K)= 3.32; α(L)= 0.459; α(M)= 0.0963; α(N+..)= 0.0264
84.9986	1^-	84.998 *2*	100	0.0	2^-			α(K)= 1.787; α(L)= 0.2464; α(M)= 0.0517; α(N+..)=0.01417
90.3	(6^-)	86.8	100	3.694	5^-			
128.262	5^-	55.950 *7*	17	72.307	4^-			α(K)= 6.01; α(L)= 0.835; α(M)= 0.1748; α(N+..)= 0.0479 I_γ: from (n,γ), <1 in (α,nγ).
		64.506 *2*	100	63.757	6^-			α(K)= 3.97; α(L)= 0.550; α(M)= 0.1152; α(N+..)= 0.0316
		124.565 *6*	34 *4*	3.694	5^-			α(K)= 0.600; α(L)= 0.0824; α(M)=0.01729;

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Adopted Levels, Gammas (continued)

γ(^{142}Pr) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	Comments
							α(N+..)=0.00473 I_γ: from (n,γ), 15 *3* in (α,nγ).
144.599	4⁻	126.845 *3*	68 *6*	17.750	3⁻		α(K)= 0.570; α(L)= 0.0783; α(M)=0.01642; α(N+..)=0.00450
		140.906 *3*	100	3.694	5⁻		α(K)= 0.424; α(L)= 0.0582; α(M)=0.01219; α(N+..)=0.00334
153.5?		153.5		0.0	2⁻		
176.8856	(3)⁻	32.278 *6*	5.1	144.599	4⁻		α(L)= 4.22; α(M)= 0.885
		104.569 *4*	3.6 *14*	72.307	4⁻		α(K)= 0.986; α(L)= 0.1352; α(M)= 0.0285; α(N+..)=0.00780 I_γ: from (n,γ), 6.0 *6* in (α,nγ).
		159.11 *6*	0.6 *2*	17.750	3⁻		α(K)= 0.302; α(L)= 0.0413; α(M)=0.00866; α(N+..)=0.00237 I_γ: from (n,γ), <0.2 in (α,nγ).
		176.8889 *20*	100 *21*	0.0	2⁻		α(K)= 0.2253; α(L)= 0.0308; α(M)=0.00645; α(N+..)=0.00177
200.531	(2)⁻	115.529 *5*	11 *3*	84.9986	1⁻		α(K)= 0.742; α(L)= 0.1018; α(M)=0.02143; α(N+..)=0.00587 I_γ: from (n,γ), 17.3 *19* in (α,nγ).
		182.785 *5*	100 *24*	17.750	3⁻		α(K)= 0.2057; α(L)= 0.0281; α(M)=0.00589; α(N+..)=0.00161
		200.520 *14*	9 *2*	0.0	2⁻		α(K)= 0.1597; α(L)=0.02174; α(M)=0.00456; α(N+..)=0.00125 I_γ: from (n,γ), 10.4 *12* in (α,nγ).
358.4	(7⁻)	268.2	100	90.3	(6⁻)		
		294.5	37 *19*	63.757	6⁻		
631.3		430.5		200.531	(2)⁻		
		546.5‡	‡	84.9986	1⁻		
		631.4‡	‡	0.0	2⁻		
637.24	4⁻	460.0 *4*	48 *10*	176.8856	(3)⁻		
		509.0 *4*	75	128.262	5⁻		
		573.4 *3*	55 *15*	63.757	6⁻		
		620.2 *6*	100 *25*	17.750	3⁻		
		634.2 *7*	65 *20*	3.694	5⁻		
702.5		557.5 *3*	70 *20*	144.599	4⁻		
		631.2‡ *7*	75‡ *25*	72.307	4⁻		
		699.8 *6*	100 *25*	3.694	5⁻		E_γ: from (n,γ); may be identical with 701.0γ seen in (α,nγ) (see γ's from 705.094 level).
704.75	3⁻,4⁻	527.83 *19*	39 *13*	176.8856	(3)⁻		
		560.2 *3*	100 *30*	144.599	4⁻		
		577.3		128.262	5⁻		
		633.1		72.307	4⁻		
		687.0		17.750	3⁻		
		701.0		3.694	5⁻		
747.01	2⁻,3⁻	109.8		637.24	4⁻		
		546.38‡ *19*	89‡ *22*	200.531	(2)⁻		
		569.9 *6*	56 *17*	176.8856	(3)⁻		
		729.5 *6*	50 *11*	17.750	3⁻		
		747.6 *5*	100 *22*	0.0	2⁻		
790.39	3⁻,2⁻	153.15 *6*	3.2 *9*	637.24	4⁻		
		645.70 *13*	100 *21*	144.599	4⁻		
		705.5 *8*	21 *6*	84.9986	1⁻		
		718.6 *6*	15 *4*	72.307	4⁻		
		771.3 *8*	12 *4*	17.750	3⁻		

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Adopted Levels, Gammas (continued)

γ(^{142}Pr) (continued)

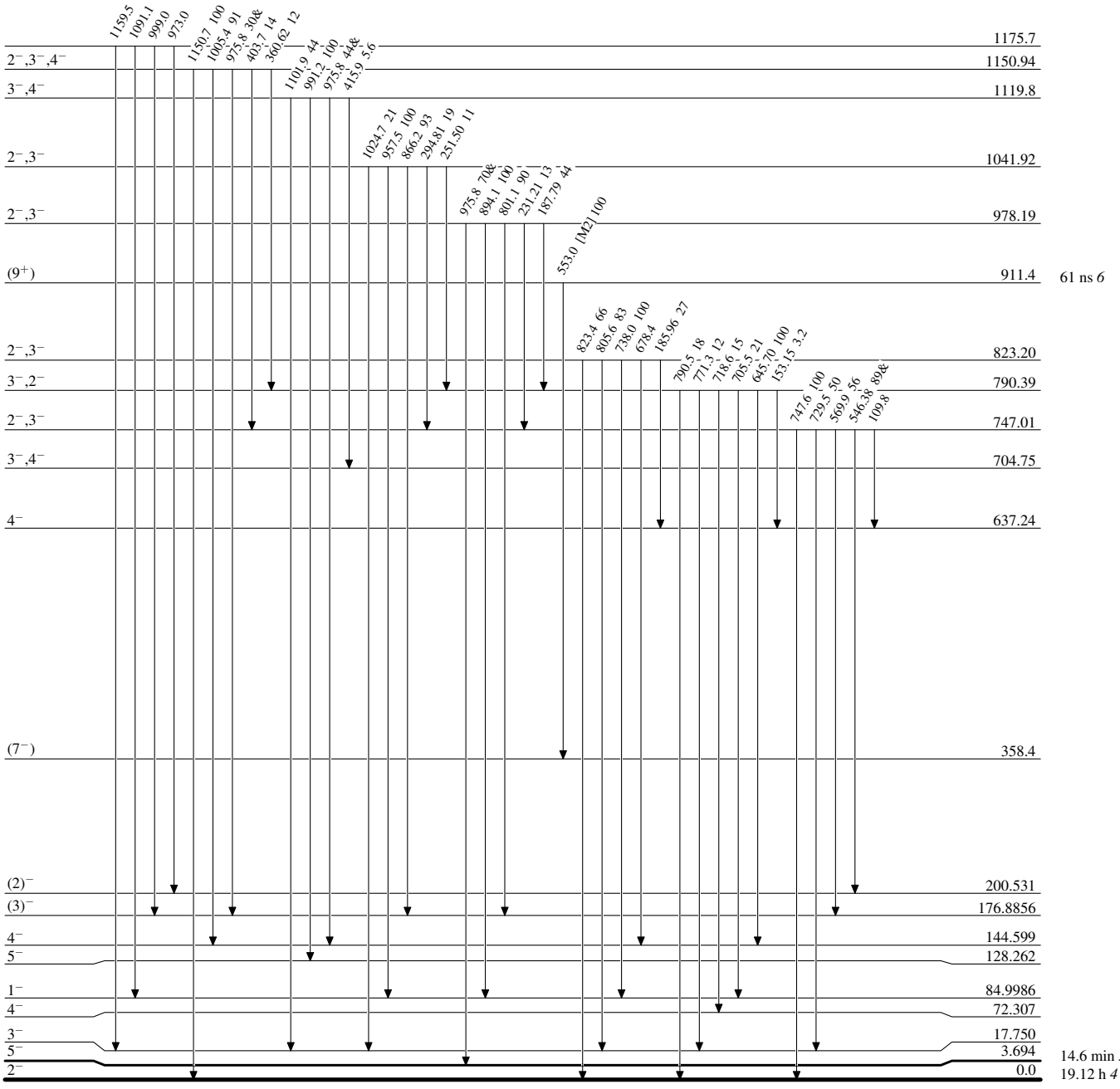
E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α†	Comments
790.39	3⁻,2⁻	790.5 *6*	18 *6*	0.0	2⁻			
823.20	2⁻,3⁻	185.96 *3*	27 *7*	637.24	4⁻			
		678.4		144.599	4⁻			
		738.0 *7*	100 *25*	84.9986	1⁻			
		805.6 *8*	83 *32*	17.750	3⁻			
		823.4 *8*	66 *16*	0.0	2⁻			
911.4	(9⁺)	553.0	100	358.4	(7⁻)	[M2]	0.0405	B(M2)(W.u.)=0.36 *4* α(K)=0.0342 *5*; α(L)=0.00503 *7*; α(M)=0.001070 *15*; α(N+..)=0.000281 *4* α(N)=0.000240 *4*; α(O)=3.85×10^{-5} *6*; α(P)=2.79×10^{-6} *4*
978.19	2⁻,3⁻	187.79 *2*	44 *11*	790.39	3⁻,2⁻			
		231.21 *7*	13 *4*	747.01	2⁻,3⁻			
		801.1 *7*	90 *30*	176.8856	(3)⁻			
		894.1 *6*	100 *30*	84.9986	1⁻			
		975.8‡ *15*	70‡ *20*	3.694	5⁻			
1041.92	2⁻,3⁻	251.50 *13*	11 *3*	790.39	3⁻,2⁻			
		294.81 *17*	19 *4*	747.01	2⁻,3⁻			
		866.2 *6*	93 *21*	176.8856	(3)⁻			
		957.5 *7*	100 *21*	84.9986	1⁻			
		1024.7 *8*	21 *9*	17.750	3⁻			
1119.8	3⁻,4⁻	415.9 *10*	5.6 *25*	704.75	3⁻,4⁻			
		975.8‡ *15*	44‡ *12*	144.599	4⁻			
		991.2 *6*	100 *25*	128.262	5⁻			
		1101.9 *8*	44 *18*	17.750	3⁻			
1150.94	2⁻,3⁻,4⁻	360.62 *12*	12 *3*	790.39	3⁻,2⁻			
		403.7 *3*	14 *4*	747.01	2⁻,3⁻			
		975.8‡ *15*	30‡ *9*	176.8856	(3)⁻			
		1005.4 *6*	91 *22*	144.599	4⁻			
		1150.7 *6*	100 *22*	0.0	2⁻			
1175.7		973.0		200.531	(2)⁻			
		999.0		176.8856	(3)⁻			
		1091.1		84.9986	1⁻			
		1159.5		17.750	3⁻			

† Additional information 1.
‡ Multiply placed with undivided intensity.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



$^{142}_{59}Pr_{83}$

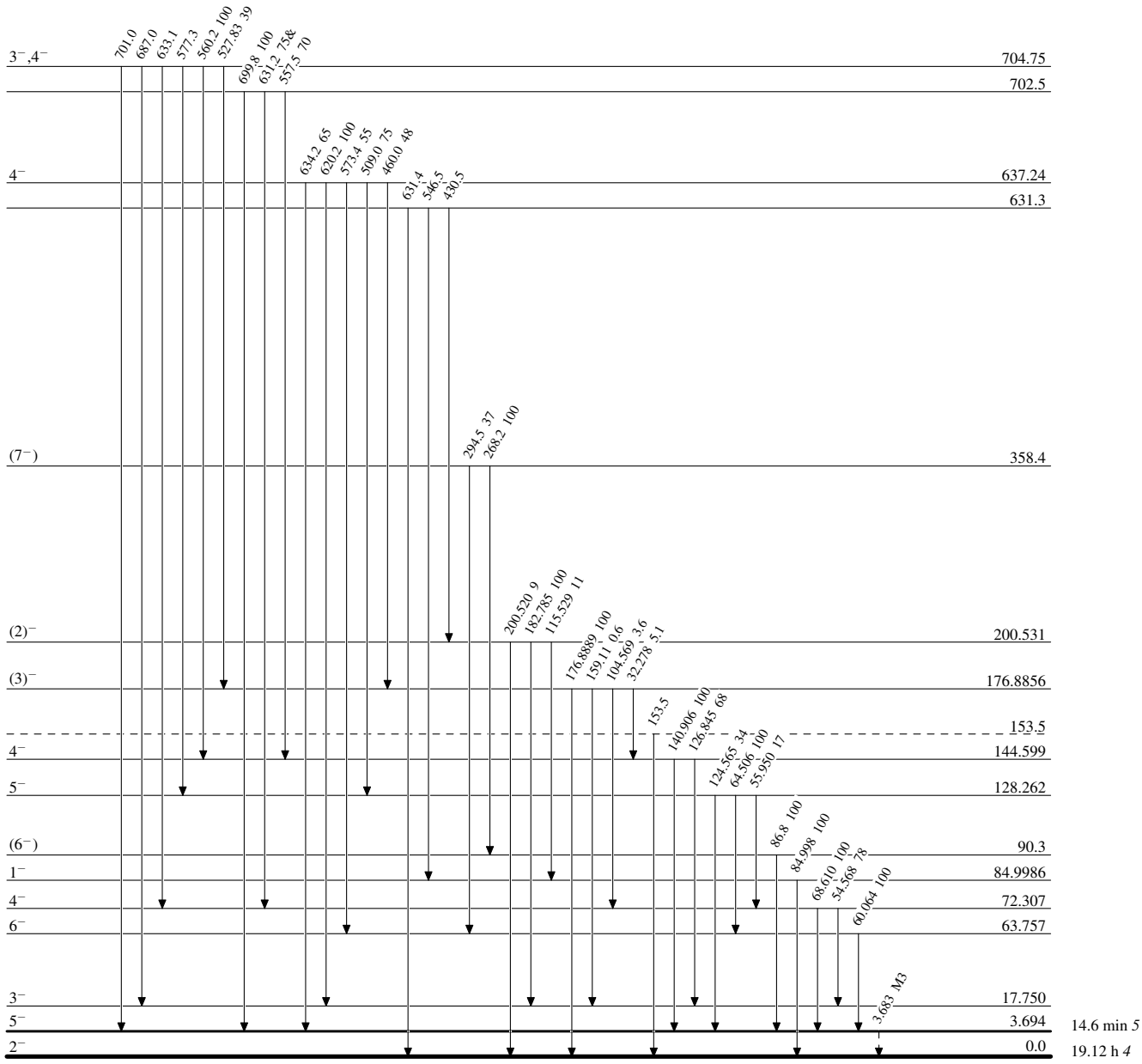
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

- - - - - - ► γ Decay (Uncertain)



$^{142}_{59}Pr_{83}$