Energy levels and branching ratios [01Bu16].

$^{139}_{59}$Pr

E^* [keV]	$2J^\pi$	L (p,t)	$T_{1/2}$ or Γ_{cm}	Ref.	E_f^*: $2J_f^\pi$:	Branching ratios in percentage 0.0 5^+	113.9 7^+	405.1 3^+	589.4 5^+	822.0 11^-
0.0	5^+	0	4.41(4) h	72Go25						
113.92(5)	7^+		2.60(8) ns			100				
405.11(7)	3^+	2		72Go25		100				
589.41(7)	5^+	2		72Go25		24(2)	50(4)	26(2)		
821.98(7)	11^-		43.4(16) ns			6.1(11)	94			
827.92(9)	9^+	2		72Go25		100				
851.87(9)	11^+	incl		72Go25		≤0.5	100			
916.92(23)	1^+–5^+	2		72Go25		100				
1023.91(19)	9^+	2		72Go25			100			
1074.21(21)	1^+,3,5					56(6)		34(4)	10(2)	
1124.02(11)							x			
1147										
1311.8(4)	1^+,3,5					100				
1328.43(21)	1^+,3,5					13(4)	15(5)	64(6)		
1369.69(10)	9^-,11^-									100
1369.7(2)						100				
1405.5(5)	1^+,3,5					100				
1449.0(10)	1^+,3,5					100				
1493										
1501.3(4)	1^+,3,5					39(12)		61(12)		
1523.11(9)	13^-									100
1532.0(10)	1^+,3,5					100				
1584.27(22)										
1624.31(9)	9^-	1,3		72Go25			1.0(4)			51(5)
1722.17(10)	15^-									96(7)
1782										
1790.22(22)	$\langle 13\rangle^+$									
1833.99(9)	9^-,11^-									6.8(5)
1867.6(4)	$\langle 15\rangle^+$									
1910										
1926.90(10)	$\langle 11,13\rangle^-$									27(2)
1941.50(11)	$\langle 17\rangle^-$									
1942.0(7)										
1980										
2029.51(14)										
2048.57(10)	9^-,11^-	1,3		72Go25						23(3)
2050.1(7)										
2098										
2174.49(12)	9^-	$\langle 3\rangle$		72Go25			62(7)			
2187.48(12)	$\langle 19,15\rangle^-$									
2196.45(10)	9^-,11,13^-									8(3)
2205.8(5)										
2277.96(13)	$\langle 19,15\rangle^-$									
2291.9(4)	9,11,13^+									61(15)
2367.12(12)	$\langle 13$–$21\rangle^-$									

(continued) **$^{139}_{59}$Pr**

E^*	$2J^\pi$	L	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
					E_f^*:	0.0	113.9	405.1	589.4	822.0
[keV]		(p,t)	Γ_{cm}		$2J_f^\pi$:	5^+	7^+	3^+	5^+	11^-
2456.29(14)										
2481.38(16)										
2484.2(4)										
≈2660										
2700.65(25)										
2730.0(5)										
2741.42(19)										
2761.11(13)	$\langle 15,19\rangle^-$									
2820.2(7)										
2821.22(13)	$\langle 13–21\rangle^+$									
2909.7(5)										
2985.62(16)										
3021.48(14)	$\langle 15–23\rangle^+$									
3203.97(14)										
3265.90(14)	X^+									
3483.89(15)										
3579.68(17)										
3627.44(16)										
3697.83(14)										
3972.50(17)										
4052.62(15)										
4100.56(16)										
4377.37(18)										
4536.56(19)										
4862.57(22)										
		72Go25		Ref.						

Additional data on this isotope can be found in [01Ch91].

Energy levels and branching ratios [01Bu16]. Part 2 **$^{139}_{59}$Pr**

E^*	$2J^\pi$		Branching ratios in percentage									
		E_f^*:	827.9	851.9	916.9	1023.9	1369.7	1523.1	1624.3	1722.2	1790.2	1834.0
[keV]		$2J_f^\pi$:	9^+	11^+		9^+		13^-	9^-	15^-	$\langle 13\rangle^+$	9^-,11^-
1328.43(21)	1^+,3,5				7(2)							
1584.27(22)				100								
1624.31(9)	9^-		31(3)	3.0(5)		4.1(7)	8.8(10)	1.3(4)				
1722.17(10)	15^-							4.0(7)				
1790.22(22)	$\langle 13\rangle^+$		100									
1833.99(9)	9^-,11^-		7.9(7)	65(2)		15.7(16)			4.4(5)			
1867.6(4)	$\langle 15\rangle^+$			100								
1926.90(10)	$\langle 11,13\rangle^-$			34(2)				24(2)	5.5(9)			10(2)
1941.50(11)	$\langle 17\rangle^-$							3.2(12)		97(7)		

(continued) **$^{139}_{59}$Pr**

E^*	$2J^\pi$	Branching ratios in percentage									
	E_f^*:	827.9	851.9	916.9	1023.9	1369.7	1523.1	1624.3	1722.2	1790.2	1834.0
[keV]	$2J_f^\pi$:	9^+	11^+		9^+		13^-	9^-	15^-	$\langle 13\rangle^+$	9^-,11^-
1942.0(7)			100								
2029.51(14)								100			
2048.57(10)	9^-,11^-	29(3)			26(2)			13(2)			9(1)
2050.1(7)										100	
2174.49(12)	9^-		29(4)		1.6(3)						7.8(12)
2196.45(10)	9^-,11,13^-		9(3)				12(1)	15(3)			44(4)
2291.9(4)	9,11,13^+	34(11)			4.8(11)						
2456.29(14)											100
2484.2(4)									<35		

Energy levels and branching ratios [01Bu16]. Part 3 **$^{139}_{59}$Pr**

E^*	$2J^\pi$	Branching ratios in percentage									
	E_f^*:	1867.6	1941.5	2029.5	2048.6	2187.5	2278.0	2367.1	2481.4	2484.2	2730.0
[keV]	$2J_f^\pi$:	$\langle 15\rangle^+$	$\langle 17\rangle^-$		9^-,11^-						
2187.48(12)	$\langle 19,15\rangle^-$		100								
2196.45(10)	9^-,11,13^-				12(2)						
2205.8(5)		100									
2277.96(13)	$\langle 19,15\rangle^-$		100								
2367.12(12)	$\langle 13–21\rangle^-$					100					
2481.38(16)						100					
2484.2(4)			100								
2700.65(25)				100							
2730.0(5)										100	
2741.42(19)									x		
2761.11(13)	$\langle 15,19\rangle^-$		100								
2821.22(13)	$\langle 13–21\rangle^+$		WEAK			x	77(8)	18.3(3)			
2909.7(5)											100
2985.62(16)								100			
3697.83(14)								100			

Energy levels and branching ratios [01Bu16]. Part 4 **$^{139}_{59}$Pr**

E^*	$2J^\pi$	Branching ratios in percentage										
	E_f^*:	2761.1	2821.2	3021.5	3204.0	3265.9	3483.9	3627.4	3697.8	3972.5	4100.6	4536.6
[keV]	$2J_f^\pi$:					X^+						
2821.22(13)	$\langle 13–21\rangle^+$	4.6(3)										
3021.48(14)	$\langle 15–23\rangle^+$		100									
3203.97(14)			100	x								

(continued) **$^{139}_{59}$Pr**

E^*	$2J^\pi$					Branching ratios in percentage								
		E_f^*:	2761.1	2821.2	3021.5	3204.0	3265.9	3483.9	3627.4	3697.8	3972.5	4100.6	4536.6	
[keV]		$2J_f^\pi$:					X^+							
3265.90(14)	X^+			57(7)	43(7)									
3483.89(15)						100								
3579.68(17)					100									
3627.44(16)					100									
3697.83(14)								WEAK						
3972.50(17)									100					
4052.62(15)							90(6)			10.0(7)				
4100.56(16)										90(9)	9.7(14)			
4377.37(18)						x								
4536.56(19)												100		
4862.57(22)													100	

Energy levels and branching ratios [94Pe19]. **$^{140}_{59}$Pr**

E^*	J^π	L	S_N	L	S_N	L	$d\sigma/d\Omega$	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
										E_f^*:	0.0	27.2	29.5	127	192
[keV]			(p,d)		(d,t)		*rel.*	Γ_{cm}		J_f^π:	1^+	2^+	3^+	5^+	3^+
0.0	1^+	2	0.37	2	0.48(4)	0+2	0.2	3.39(1) m	73He02						
27.23(3)	2^+	2	1.63	2	2.00(13)	2	0.08		73He02		100				
29.5(3)	3^+					4	0.10		83SmZX						
127.5(3)	5^+					6	0.13	0.35(2) μs	83SmZX				100		
191.8(3)	3^+	0+2	0.1+0.04	0+2	0.02+0.1	⟨2⟩	0.02		73He02			x	x		
271.0(3)	2^+			2	0.06(1)	⟨2⟩	0.10		74Hu03		x	x	x		
287.1(3)	3^+	0	0.86	0	1.00(8)	⟨2⟩	0.07		73He02		x	x	x		x
331.0(5)	⟨4,5⟩$^+$	2	1.41	2	1.30(20)	4	0.07		73He02				x		x
390.8(4)	⟨4,5⟩$^+$					4	0.05		83SmZX					x	x
419.9(3)	⟨2,3⟩$^+$	0	0.56	0	0.07(5)	2	0.04		73He02		x	x	x		x
576.6(4)	⟨4,5⟩$^+$			2	0.09(1)	4	0.03		74Hu03				x		x
604.4(4)	⟨3⟩$^+$			0	0.05(1)				74Hu03				x		x
630(2)	⟨1–3⟩$^+$					2			83SmZX						
642(2)															
670.2(2)													x		
763.3(7)	⟨8⟩$^-$	5		5	2.1(4)	⟨7⟩	0.34	3.05(20) μs	73He02					100	
784(2)	⟨7⟩$^-$			5	2.6(5)				74Hu03						
862.0(5)	⟨4⟩$^-$			5	3.2(6)	⟨5⟩	0.16		74Hu03						x
888.0(4)						⟨1⟩			83SmZX		x				
889(2)	⟨5⟩$^-$			5	1.6(3)	⟨5⟩	0.07		74Hu03						
904.1(4)	⟨2$^-$⟩			⟨5⟩	0.2(1)				74Hu03		x				
913.4(7)															
967.0(6)											x	x			
983.4(8)												x			
1018(2)	3^+–5^+					4			83SmZX						

(continued) **$^{140}_{59}$Pr**

E^*	J^π	L	S_N	L	S_N	L	$d\sigma/d\Omega$	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
										E_f^*:	0.0	27.2	29.5	127	192
[keV]			(p,d)		(d,t)		*rel.*	Γ_{cm}		J_f^π:	1^+	2^+	3^+	5^+	3^+
1033.9(6)	3^-			5	0.9(2)	3			74Hu03						
1053.8(6)	$\langle 1^+–3^+\rangle$			$\langle 5\rangle$	0.4(1)				74Hu03		x				
1061.6(8)				$\langle 5\rangle$	0.4(1)				74Hu03						
1147.1(6)	2^-										x				
1183.2(7)	$\langle 2\rangle^+$			2	0.17(2)	$\langle 2\rangle$			74Hu03		x	x			
1204(2)	$\langle 5^+\rangle$														
1230(2)	$\langle 5^+\rangle$			2	0.09(1)	4+6	0.03+0.05		74Hu03						
1293(2)	$1^+–3^+$			2	0.06(1)	2			74Hu03						
1320	$\langle 5^+–7^+\rangle$					$\langle 6\rangle$			83SmZX						
1370	4^-					3+5	0.02+0.08		83SmZX						
1430	$\langle 1^+–3^+\rangle$					$\langle 2\rangle$			83SmZX						
1860	$1^+–3^+$					2			83SmZX						
1960	$4^-–6^-$					5			83SmZX						
			73He02		74Hu03		83SmZX		Ref.						

S_N from the (d,t) reaction was extracted using the relation $d\sigma/d\Omega_{exp}$=3.33σ_{DWBA} [74Hu03].

Energy levels and branching ratios [94Pe19]. Part 2 **$^{140}_{59}$Pr**

E^*	J^π									
		E_f^*:	271.0	287.1	331.0	390.8	604.4	670.2	913.4	
[keV]		J_f^π:	2^+	3^+	$\langle 4,5\rangle^+$	$\langle 4,5\rangle^+$	$\langle 3\rangle^+$			
419.9(3)	$\langle 2,3\rangle^+$			x						
604.4(4)	$\langle 3\rangle^+$					x				
862.0(5)	$\langle 4\rangle^-$					x				
904.1(4)	$\langle 2^-\rangle$		x							
913.4(7)								x		
983.4(8)					x					
1033.9(6)	3^-		x							
1053.8(6)	$\langle 1^+–3^+\rangle$						x		x	
1061.6(8)					x					
1147.1(6)	2^-		x							
1183.2(7)	$\langle 2\rangle^+$			x						

Energy levels and branching ratios [01Tu02, 94De56, 92De16]. **$^{141}_{59}$Pr**

E^*	$2J^\pi$	L	S_N	L	C^2S	$S_{\tau d}$	$S_{\tau d}$	L	S_N	L	β_L	$\Gamma_\circ$	$S_{d\tau}$	$S_{d\tau}$	Ref.
[keV]			(d,n)		(τ,d)	*mod.*	*stand*		(e,e′p)		(α,α')	[meV]	*mod.*	*stand*	
0.0	5^+	2	0.47	2	1.00	0.64	0.64	2	1.39(26)				2.70	2.12	76AdZR
145.4434(14)	7^+	4	0.28	4	0.56	0.28	0.35	4	3.14(53)		<0.01		6.06	6.20	71Wi04
1117.97(10)	11^-	5	0.14	5	1.31	0.96	0.84	5	0.56(9)				1.03	0.86	93La16
1127.00(11)	3^+						incl								
1292.70(11)	$\langle 5\rangle^+$					0.61	0.65						0.09	0.09	
1298.72(17)	1^+	0	0.35	0	1.02	incl	incl	0	0.05(1)	2	0.027				80Cl08
1435.59(21)	3^+														
1452.46(11)	$\langle 7\rangle^+$									2	0.022				71Ba15
1455.06(22)	X^+														
1457.24(14)	9^+														
1494.57(13)	11^+														
1510.3(11)															
1521.27(12)	9^+									2	0.032				71Ba15
1579.96(17)	5^-														
1609.55(20)	$\langle 3\rangle^+$	2	0.58	2	1.92	1.04	1.23								76AdZR
1651.06(14)	$\langle 9^+\rangle$					0.51	0.54			2	0.022				71Ba15
1657.99(13)	1^+	0	0.14	0	0.84	incl	incl								71Wi04
1768.20(15)	13^+														
1786.48(13)	$\langle 5^+,7^+\rangle$														
1796.99(18)	15^+														
1812.61(12)	$\langle 5^+\rangle$														
1842.06(14)	$\langle 3^+,5^+\rangle$														
1853.89(19)	$\langle 7^+\rangle$														
1910.49(20)															
1913.5(8)															
1943.3(11)															
1975.89(13)	$\langle 3^+,5,7^+\rangle$														
1986.81(18)	13^+														
2001.06(18)	$\langle 9\rangle^-$									3	0.030				71Ba15
2005.80(17)															
2017.88(14)															
2045.79(17)															
2069.65(17)	17^+														
2075.54(22)															
2075.68(20)	X^-									3					71Ba15
2102.40(25)															
2105.44(17)	7^-									3					71Ba15
2108.9(3)	$15^{\langle+\rangle}$														
2123.87(20)	$X^{\langle+\rangle}$														
2136.02(16)															
2154.10(21)															
2172.26(20)															
2178(10)	$\langle 5^-\rangle$									3	0.026				71Ba15
2190.08(17)															
2190.30(23)															

(continued) **$^{141}_{59}$Pr**

E^* [keV]	$2J^\pi$	L	S_N (d,n)	L	C^2S (τ,d)	$S_{\tau d}$ *mod.*	$S_{\tau d}$ *stand*	L	S_N (e,e′p)	L	β_L (α,α')	$\Gamma_\circ$ [meV]	$S_{d\tau}$ *mod.*	$S_{d\tau}$ *stand*	Ref.
2206.45(19)															
2228.9(3)															
2230.9(4)															
2233(5)	3														
2243.74(16)															
2248.1(3)															
2254.0(18)	X^+														
2264.80(24)															
2267.83(20)															
2303.87(18)															
2315.98(22)	X^-									3	0.035				71Ba15
2342.0(11)															
2353.7(19)															
2363.1(4)	X^-									3					71Ba15
2364.8(8)															
2383.3(7)	X^-									3					71Ba15
2399.28(22)															
2403.3(7)															
2420.07(24)															
2462.4(3)															
2472(5)															
2499.08(22)															
2522(5)															
2563.4(4)															
2583.6(7)															
2609(10)	X^+									2	0.029				71Ba15
2627.0(4)	$\langle 15^- \rangle$														
2684(10)	X^-									3	0.026				71Ba15
2698(5)															
2730(10)															
2749.58(17)															
2789(5)															
2820(10)															
2843(10)	$\langle 3 \rangle$														
2876(10)															
2928.07(22)	19^-														
2940(10)															
2963.4(3)	19^+														
2986(10)	X^+									2	0.022				71Ba15
3017.7(3)	21^+														
3019.77(24)	$\langle 17 \rangle^-$														
3080	$\langle 5 \rangle$														
3135(10)															
3200(20)	$X^{\langle - \rangle}$														
3330(20)	$\langle 7 \rangle$														

(continued) **$^{141}_{59}$Pr**

E^*	$2J^\pi$	L	S_N	L	C^2S	$S_{\tau d}$	$S_{\tau d}$	L	S_N	L	β_L	$\Gamma_\circ$	$S_{d\tau}$	$S_{d\tau}$	Ref.
[keV]			(d,n)		(τ,d)	*mod.*	*stand*		(e,e′p)		(α,α')	[meV]	*mod.*	*stand*	
3397.5(3)	21^-														
3430(20)															
3471.7(3)	23^-														
3527.4(3)	$\langle 21^-\rangle$														
3586.3(4)	23^+														
3590(20)															
3644.1(5)															
4371.2(4)	X^+														
4741.4(4)															
6116.8(4)	$7^{\langle+\rangle}$											28(8)			70Sc27
6878.6(4)*	7^+														
7186.6(6)	5														
7244.5(5)*	5^-														
7630(1)*	5^+											≈600			70Sc27
7915(1)*	5^+														
8880.5(5)	$\langle 5,7\rangle$														
9751	7^-														
10405	3^-														
10882	1^-														
11100	$\langle 9^-\rangle$														
11251	$\langle 5\rangle^-$														
11493	$\langle 5^-\rangle$														
			76AdZR			71Wi04	71Wi04		93La16		71Ba15	70Sc27	71Wi04	71Wi04	Ref.

Additional data on this isotope can be found in [94De56, 93Vo05, 92De16, 72Go25, 70Da02].
Abundance: 100 %.
* Levels observed by photoexcitation [72Wo21]; see $\Gamma_\circ/\Gamma$ and Γ_γ therein.
Two pairs of proton-transfer parameters $S_{\tau d}=d\sigma/d\Omega_{exp}/N(\tau,d)(2J+1/2I+1)d\sigma/d\Omega_{DWBA}$ and $S_{d\tau}=d\sigma/d\Omega_{exp}/N(d,\tau)d\sigma/d\Omega_{DWBA}$ were given in [71Wi04] as "the standard" (*stand*, the second) and "the modified" (*mod.* values, see definitions therein).
Data for this isotope are considered in vol. LB I/18B.

Energy levels and branching ratios [01Tu02, 94De56, 92De16]. Part 2 **$^{141}_{59}$Pr**

E^*	$2J^\pi$	C^2S	$T_{1/2}$ or	Ref.	Branching ratios in percentage						
					E_f^*:	0.0	145.4	1118	1127	1293	1299
[keV]		(^{7}Li,^{6}He)	Γ_{cm}		$2J_f^\pi$:	5^+	7^+	11^-	3^+	$\langle 5\rangle^+$	1^+
0.0	5^+	1.00(14)	Stable	76AdZR							
145.4434(14)	7^+	0.63(14)	1.85(3) ns	71Wi04		100					
1117.97(10)	11^-	1.36(21)	4.8(1) ns	93La16		11(1)	89(4)				
1127.00(11)	3^+					97(10)	2.7(3)				
1292.70(11)	$\langle 5\rangle^+$					60(5)	40(2)				
1298.72(17)	1^+	0.88(13)		80Cl08		100					

(continued) **$^{141}_{59}$Pr**

E^*	$2J^\pi$	C^2S	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
				E_f^*:	0.0	145.4	1118	1127	1293	1299
[keV]		(^{7}Li,^{6}He)	Γ_{cm}	$2J_f^\pi$:	5^+	7^+	11^-	3^+	$\langle 5\rangle^+$	1^+
1435.59(21)	3^+				44(4)	56(5)				
1452.46(11)	$\langle 7\rangle^+$			71Ba15	18.5(2)	81(7)				
1455.06(22)	X^+				100					
1457.24(14)	9^+				22(2)	61(6)	17			
1494.57(13)	11^+				9	91				
1510.3(11)										
1521.27(12)	9^+			71Ba15	88(9)	10(2)	1.8(4)			
1579.96(17)	5^-				24.6(2)	75(7)				
1609.55(20)	$\langle 3\rangle^+$			76AdZR	100					
1651.06(14)	$\langle 9^+\rangle$			71Ba15	83(7)	6.9(7)	9.9			
1657.99(13)	1^+			71Wi04	37(4)	21		43(4)		
1768.20(15)	13^+						76(6)			
1786.48(13)	$\langle 5^+,7^+\rangle$				63(6)	30(3)			6(1)	
1796.99(18)	15^+		1.0(1) ns							
1812.61(12)	$\langle 5^+\rangle$				29(3)	57(6)				
1842.06(14)	$\langle 3^+,5^+\rangle$				61(6)	36(4)				3.2(4)
1853.89(19)	$\langle 7^+\rangle$				8.3(9)	88(9)			3.7	
1910.49(20)					x	x				
1913.5(8)							x			
1943.3(11)										
1975.89(13)	$\langle 3^+,5,7^+\rangle$				38(4)	21(2)		33(3)		
1986.81(18)	13^+						61(6)			
2001.06(18)	$\langle 9\rangle^-$			71Ba15		58(6)	30(3)			
2005.80(17)					23	77				
2017.88(14)					50	25				
2045.79(17)						79(8)				
2069.65(17)	17^+									
2075.54(22)					40	60				
2075.68(20)	X^-			71Ba15				81	19	
2102.40(25)					34			66		
2105.44(17)	7^-			71Ba15	34(3)	49(5)	18(2)			
2108.9(3)	$15^{\langle+\rangle}$									
2123.87(20)	$X^{\langle+\rangle}$									
2136.02(16)					58(6)	22(2)				
2154.10(21)									50	50
2172.26(20)						100				
2178(10)	$\langle 5^-\rangle$			71Ba15						
2190.08(17)					65	35				
2190.30(23)									100	
2206.45(19)						78				
2228.9(3)					40(4)	60(6)				
2230.9(4)										
2233(5)	3									
2243.74(16)										
2248.1(3)					100					

(continued) **$^{141}_{59}$Pr**

E^*	$2J^\pi$	C^2S	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
					E_f^*: 0.0	145.4	1118	1127	1293	1299
[keV]		(^{7}Li,^{6}He)	Γ_{cm}		$2J_f^\pi$: 5^+	7^+	11^-	3^+	$\langle 5\rangle^+$	1^+
2254.0(18)	X^+				100					
2264.80(24)					32(3)	68(7)				
2267.83(20)					23(2)			22(2)	55(5)	
2303.87(18)						68			32	
2315.98(22)	X^-			71Ba15	44(4)				56(6)	
2342.0(11)										
2353.7(19)					100					
2363.1(4)	X^-			71Ba15				100		
2364.8(8)							x	x		
2383.3(7)	X^-			71Ba15			100			
2399.28(22)							100			
2403.3(7)						100				
2420.07(24)					47(5)	53(5)				
2462.4(3)					100					
2472(5)										
2499.08(22)							100			
2522(5)										
2563.4(4)					100					
2583.6(7)					100					
2609(10)	X^+			71Ba15						
2627.0(4)	$\langle 15^-\rangle$						x			
2684(10)	X^-			71Ba15						
2698(5)										
2730(10)										
2749.58(17)										
2789(5)										
2820(10)										
2843(10)	$\langle 3\rangle$		0.01 eV							
2876(10)										
2928.07(22)	19^-									
2940(10)										
2963.4(3)	19^+									
2986(10)	X^+			71Ba15						
3017.7(3)	21^+									
3019.77(24)	$\langle 17\rangle^-$		0.2(1) ns							
3080	$\langle 5\rangle$		0.02 eV							
3135(10)										
3200(20)	$X^{\langle -\rangle}$									
3330(20)	$\langle 7\rangle$		0.05 eV							
3397.5(3)	21^-									
3430(20)										
3471.7(3)	23^-									
3527.4(3)	$\langle 21^-\rangle$									
3586.3(4)	23^+		0.2(1) ns							
3590(20)										

(continued) **$^{141}_{59}$Pr**

E^*	$2J^\pi$	C^2S	$T_{1/2}$ or	Ref.	Branching ratios in percentage						
					E_f^*:	0.0	145.4	1118	1127	1293	1299
[keV]		(^{7}Li,^{6}He)	Γ_{cm}		$2J_f^\pi$:	5^+	7^+	11^-	3^+	$\langle 5\rangle^+$	1^+
3644.1(5)											
4371.2(4)	X^+										
4741.4(4)											
6116.8(4)	$7^{\langle+\rangle}$		52(10) meV	70Sc27		55.7(5)	26.4(4)			1.3(4)	
6878.6(4)*	7^+		85(10) meV			x	x				
7186.6(6)	5					85(3)	12(2)	3(2)			
7244.5(5)*	5^-		0.29(3) eV			52(4)	34(3)	5(3)			
7630(1)*	5^+		90(10) meV	70Sc27		48(5)	7.5(1)		8.5(1)	0	
7915(1)*	5^+		7(3) meV			100					
8880.5(5)	$\langle 5,7\rangle$					55(4)	8.1(24)			2(2)	
9751	7^-										
10405	3^-										
10882	1^-										
11100	$\langle 9^-\rangle$										
11251	$\langle 5\rangle^-$										
11493	$\langle 5^-\rangle$										
		80Cl08		Ref.							

Energy levels and branching ratios [01Tu02, 94De56, 92De16]. Part 3 **$^{141}_{59}$Pr**

E^*	$2J^\pi$					Branching ratios in percentage						
		E_f^*:	1436	1452	1455.1	1457.2	1494.6	1510.3	1521.3	1580.0	1609.5	1651.1
[keV]		$2J_f^\pi$:	3^+	$\langle 7\rangle^+$	X^+	9^+	11^+		9^+	5^-	$\langle 3\rangle^+$	$\langle 9^+\rangle$
1768.20(15)	13^+					4.0(5)	20.0(2)					
1796.99(18)	15^+						64(2)					
1812.61(12)	$\langle 5^+\rangle$			14(2)								
1975.89(13)	$\langle 3^+,5,7^+\rangle$									8		
1986.81(18)	13^+								14(2)			
2001.06(18)	$\langle 9\rangle^-$			12(2)								
2017.88(14)				25								
2045.79(17)									14(2)	7(2)		
2123.87(20)	$X^{\langle+\rangle}$				69				31			
2136.02(16)						20(2)						
2206.45(19)				22								
2230.9(4)							100					
2243.74(16)							100					
6116.8(4)	$7^{\langle+\rangle}$					8.7(11)					1.3(4)	
6878.6(4)*	7^+					x			x	x		x
7244.5(5)*	5^-		<4.5							3.4(21)		5.3(21)
7630(1)*	5^+		7.5(1)	9.0(1)				x		1.5(2)		x
8880.5(5)	$\langle 5,7\rangle$							6.7(30)				9.8(31)

Energy levels and branching ratios [01Tu02, 94De56, 92De16]. Part 4 **$^{141}_{59}$Pr**

E^*	$2J^\pi$		Branching ratios in percentage									
		E_f^*:	1768.2	1786.5	1797.0	1812.6	1842.1	1943.3	1986.8	2005.8	2017.9	2069.6
[keV]		$2J_f^\pi$:	13^+	$\langle 5^+,7^+\rangle$	15^+	$\langle 5^+\rangle$	$\langle 3^+,5^+\rangle$		13^+			17^+
1796.99(18)	15^+		36(1)									
1913.5(8)			x									
1986.81(18)	13^+		25(2)									
2069.65(17)	17^+		2.7		97							
2108.9(3)	$15^{\langle+\rangle}$		x		x				x			
2749.58(17)				100								
2928.07(22)	19^-											100
2963.4(3)	19^+											56.6(20)
3017.7(3)	21^+											100
6116.8(4)	$7^{\langle+\rangle}$									1.1(6)		
6878.6(4)*	7^+			x		x						
7630(1)*	5^+						2.5(3)				0	
8880.5(5)	$\langle 5,7\rangle$						5.2(31)	13.2(34)				

Energy levels and branching ratios [01Tu02, 94De56, 92De16]. Part 5 **$^{141}_{59}$Pr**

E^*	$2J^\pi$		Branching ratios in percentage									
		E_f^*:	2108.9	2233	2267.8	2316.0	2342.0	2472	2522	2563.4	2583.6	2627.0
[keV]		$2J_f^\pi$:	$15^{\langle+\rangle}$	3		X^-						$\langle 15^-\rangle$
2963.4(3)	19^+		43.4(20)									
6116.8(4)	$7^{\langle+\rangle}$					1.4(3)	1.5(4)					2.5(3)
7630(1)*	5^+			8.0	1		1.5(2)	x	1.5(2)	0	0	

Energy levels and branching ratios [01Tu02, 94De56, 92De16]. Part 6 **$^{141}_{59}$Pr**

E^*	$2J^\pi$		Branching ratios in percentage									
		E_f^*:	2698	2789	2928.1	2963.4	3017.7	3019.77	3397.5	3471.7	3527.4	4371.2
[keV]		$2J_f^\pi$:			19^-	19^+	21^+	$\langle 17\rangle^-$	21^-	23^-	$\langle 21^-\rangle$	X^+
3019.77(24)	$\langle 17\rangle^-$				100							
3397.5(3)	21^-					100						
3471.7(3)	23^-						92.3(6)		7.7(13)			
3527.4(3)	$\langle 21^-\rangle$						58(29)	42(5)				
3586.3(4)	23^+						100					
3644.1(5)											100	
4371.2(4)	X^+									78.6(28)	21.4(14)	
4741.4(4)										85.2(82)		14.8(41)
7630(1)*	5^+		x	1.5(2)								

Energy levels and branching ratios [00Tu01].

$^{142}_{59}$Pr

E^*	J^π	L	σ (d,p)	$d\sigma/d\Omega$	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
							E_f^*:	0.0	3.69	17.7	63.7	72.3	85.0
[keV]			*rel.*	μb/sr	Γ_{cm}		J_f^π:	2^-	5^-	3^-	6^-	4^-	1^-
0.0	2^-	3	16.7(8)		19.12(4) h	68Ke08							
3.694(3)	5^-		incl	233(17)	14.6(5) m			x					
17.750(4)	3^-	3	5.0(5)	103(11)		68Ke08							
63.757(4)	6^-	3	30.5(15)	450(28)		68Ke08			100				
72.307(3)	4^-								56(28)	44(13)			
84.9986(20)	1^-	3	5.5(3)	108(10)		68Ke08		100					
90.3(9)	$\langle 6^- \rangle$								100				
128.262(4)	5^-	3	12.8(6)	156(13)		68Ke08			23(3)		66	11	
144.599(4)	4^-	3	17.4(9)	241(20)		68Ke08			60	40(4)			
153.5(10)								x					
176.8856(19)	$\langle 3 \rangle^-$	3	9.9(5)	134(11)		68Ke08		91(19)		0.5(2)		3.3(13)	
200.531(4)	$\langle 2 \rangle^-$	3	2.3(2)	29(5)		68Ke08		8(2)		83(20)			9(2)
358.4(9)	$\langle 7^- \rangle$										27(14)		
631.3(6)								x					x
637.24(10)	4^-	1	45.8(6)	526(34)		68Ke08			19(6)	29(7)	16(4)		
664.9(15)				72(9)									
681.6(7)				16(4)									
702.5(3)									41(10)			31(10)	
704.75(16)	3^-,4^-	1	6.4(2)	81(10)		68Ke08			x	x		x	
747.01(10)	2^-,3^-	1	22.9(4)	287(21)		68Ke08		34(7)		17(4)			
767.0(8)				19(4)									
790.39(9)	3^-,2^-	1	24.6(2)	297(21)		68Ke08		11(4)		7(2)		9(2)	12(4)
823.20(10)	2^-,3^-	1	3.4(3)	56(6)		68Ke08		24(6)		30(12)			36(9)
889.983(4)													
911.4(13)	$\langle 9^+ \rangle$				61(6) ns								
978.19(9)	3^-	1	11.7(2)	136(10)		68Ke08			22(6)				32(9)
1041.92(13)	2^-,3^-	1	17.9(4)	219(14)		68Ke08				9(4)			41(9)
1072.34(4)													
1111.790(7)													
1114.61(10)				94(13)									
1119.8(5)	3^-			43(11)						23(9)			
1150.94(14)	2^-–4^-	1	6.2(2)	77(6)		68Ke08		40(9)					
1157.34(10)													
1158.81(10)													
1175.7(5)										x			x
1182.39(10)				56(5)									
1200.4(11)				34(4)									
1220.2(17)				7(2)									
1236.6(10)				7(2)									
1250.80(10)		$\langle 1 \rangle$		74(6)									
1263.44(10)		$\langle 1 \rangle$		148(12)									
1290.52(10)													
1346.64(10)				17(3)									
1362.7(17)				10(2)									
1381.50(10)				16(4)									

(continued) **$^{142}_{59}$Pr**

E^*	J^π	L	σ (d,p)	$d\sigma/d\Omega$	$T_{1/2}$ orRef.	Branching ratios in percentage					
					E_f^*:	0.0	3.69	17.7	63.7	72.3	85.0
[keV]			*rel.*	μb/sr	Γ_{cm}	J_f^π: 2^-	5^-	3^-	6^-	4^-	1^-
1393.82(10)				96(12)							
1402.54(10)				71(11)							
1428.9(10)				38(5)							
1444.7(15)				8(3)							
1460.12(10)				46(5)							
1466.42(10)				incl							
1470.55(10)				52(11)							
1495.46(10)											
1499.38(10)				33(5)							
1511.84(10)											
1517.59(10)				178(15)							
1527.38(10)											
1538.46(10)				39(8)							
1540.43(10)											
1556.0(13)				30(7)							
1564.08(10)											
1566.54(10)				65(7)							
1590.95(10)				72(10)							
1599.22(10)				28(6)							
1616.30(10)				59(10)							
1622.81(10)				incl							
1639.88(10)				71(10)							
1650.28(10)											
1666.09(10)				90(16)							
1679.20(10)				87(10)							
1683.58(10)											
1693.16(10)				38(7)							
1709.05(10)				43(15)							
1722.32(10)				41(20)							
1733.59(10)											
1747.43(10)											
1752.94(10)				230(20)							
1758.70(10)											
1764.38(10)											
1769.23(10)				63(8)							
1785.03(10)											
1793.17(10)											
1798.23(10)				144(17)							
1807.11(10)											
1813.71(10)				53(14)							
1824.05(10)											
1826.46(10)											
1830.88(10)				92(7)							
1842.11(10)				48(9)							
1866.2(8)				101(9)							

(continued) **$^{142}_{59}$Pr**

E^*	J^π	L	σ (d,p)	$d\sigma/d\Omega$	$T_{1/2}$ orRef.	Branching ratios in percentage					
					E_f^*:	0.0	3.69	17.7	63.7	72.3	85.0
[keV]			*rel.*	μb/sr	Γ_{cm}	J_f^π:	2^-	5^-	3^-	6^-	4^-	1^-
1875.58(10)												
1880.31(10)												
1883.53(10)				21(6)								
1895.99(10)												
1901.90(10)				92(10)								
1913.93(10)												
1920.02(10)				66(9)								
1922.77(10)												
1927.93(10)												
1932.01(10)				104(10)								
1940.60(10)												
1950.47(10)				94(16)								
1953.72(10)												
1959.10(10)				144(13)								
1969.18(10)												
1971.40(10)												
1974.66(10)												
1980.23(10)				177(14)								
1984.88(10)				incl								
1993.29(10)				31(6)								
2012.81(10)				53(7)								
2017.43(10)				incl								
2022.67(10)												
2028.12(10)												
2031.46(10)												
2037.10(10)												
2043.06(10)												
2048.01(10)												
2052.73(10)												
2058.00(10)												
2060.78(10)												
2066.64(10)												
2071.21(10)												
2074.75(10)												
2080.84(10)												
2092.21(10)												
2096.63(10)												
2100.64(10)												
2106.94(10)												
2115.07(10)												
2126.83(10)												
2129.37(10)												
2133.46(10)												
2141.57(10)												
2148.20(10)												

(continued) **$^{142}_{59}$Pr**

E^*	J^π	L	σ (d,p)	$d\sigma/d\Omega$	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
							E_f^*:	0.0	3.69	17.7	63.7	72.3	85.0
[keV]			*rel.*	μb/sr	Γ_{cm}		J_f^π:	2^-	5^-	3^-	6^-	4^-	1^-
2151.45(10)													
2152.83(10)													
2164.74(10)													
2167.62(10)													
2178.75(10)													
2183.27(10)													
2184.96(10)													
2188.63(10)													
2191.37(10)													
2192.90(10)													
2197.28(10)													
2200.58(10)													
2212.25(10)													
2213.91(10)													
2223.09(10)													
2227.85(10)													
2232.51(10)													
2240.59(10)													
2243.96(10)													
2252.07(10)													
2255.26(10)													
2260.63(10)													
2268.28(10)													
2274.06(10)													
2277.04(10)													
2278.18(10)													
2279.88(10)													
2286.26(10)													
2293.40(10)													
2307.78(10)													
2310.27(10)													
2316.06(10)													
2320.46(10)													
2328.69(10)													
2334.35(10)													
2590.5(1)													
			68Ke08	68Ke08		Ref.							

$d\sigma/d\Omega$ for 8 angles were measured in [68Ke08], here data for about 45° are presented.

Energy levels and branching ratios [00Tu01]. Part 2 **$^{142}_{59}$Pr**

E^*	J^π				Branching ratios in percentage						
		E_f^*:	90.3	128.3	144.599	176.886	200.531	358.4	637.24	704.75	747.01	790.39
[keV]		J_f^π:	$\langle 6^- \rangle$	5^-	4^-	$\langle 3 \rangle^-$	$\langle 2 \rangle^-$	$\langle 7^- \rangle$	4^-	3^-,4^-	2^-,3^-	3^-,2^-
176.8856(19)	$\langle 3 \rangle^-$				4.7							
358.4(9)	$\langle 7^- \rangle$		73									
631.3(6)							x					
637.24(10)	4^-			22		14(3)						
702.5(3)					29(8)							
704.75(16)	3^-,4^-			x	72(22)	28(9)						
747.01(10)	2^-,3^-					19(6)	30(7)		x			
790.39(9)	3^-,2^-				59(12)				1.9(5)			
823.20(10)	2^-,3^-				x				10(3)			
911.4(13)	$\langle 9^+ \rangle$							100				
978.19(9)	3^-					28(9)					4(1)	14(3)
1041.92(13)	2^-,3^-					38(9)					8(2)	5(1)
1119.8(5)	3^-			52(13)	23(6)					2.9(13)		
1150.94(14)	2^-–4^-				37(9)	12(4)					6(2)	5(1)
1175.7(5)						x	x					

Energy levels and branching ratios [01Tu07]. **$^{143}_{59}$Pr**

E^*	$2J^\pi$	$T_{1/2}$ or		Branching ratios in percentage				
			E_f^*:	0.0	57.3	351	490	614
[keV]		Γ_{cm}	$2J_f^\pi$:	7^+	5^+	3^+	7^+	5^+,7^+
0.0	7^+	13.57(2) d						
57.356(7)	5^+	4.14(5) ns		100				
298								
350.622(4)	3^+	59(10) ps		7.02(6)	93.0(3)			
490.362(7)	7^+			90(1)	6.6(2)	3.2(2)		
614.22(2)	5^+,7^+			28(3)	72(4)			
721.923(1)	5^+			41	43	0.19(2)	16	
740.26(2)	$\langle 1 \rangle^+$				19(4)	81(4)		
787.33(9)				50(10)	50(10)			
848.42(2)					23(1)	76(5)	1.0(4)	
937.82(1)	3^+,5^+			1.9(1)	74(1)	19.3(4)	4.3(2)	
1014.3(1)				30(10)	30(10)		40(10)	
1060.21(2)	5^+,3^+			20(1)	42(1)	4.8(7)	2.9(10)	8(2)
1156.94(2)	1^+,3^+					81(2)		
1160.58(2)	$\langle 3 \rangle^+$			0.52(7)	90(1)	6.8(2)	1.8(4)	
1236								
1381.84(3)	5^+,3^+			1.1(4)	4.7(1)	60.3(26)	24.4(26)	9.5(10)
1397.40(4)	3^+,5^+				17.9(8)	70(5)	7.5(24)	
1526								
1980								
2141								

(continued) **$^{143}_{59}$Pr**

E^*	$2J^\pi$	$T_{1/2}$ or	Branching ratios in percentage					
			E_f^*:	0.0	57.3	351	490	614
[keV]		Γ_{cm}	$2J_f^\pi$:	7^+	5^+	3^+	7^+	$5^+,7^+$
2512								
15668	3^-	86(20) keV						
15687	7^-	84(5) keV						
16478	3^-	110(10) keV						
16536	$\langle 1\rangle^-$	80(10) keV						
16826	3^-	60(20) keV						
16859	$3^-,\langle 1\rangle^-$	34(20) keV						
16869	$\langle 5\rangle^-$	102(30) keV						
16957	$\langle 5\rangle^-$	95(20) keV						

Data for this isotope are considered in vol. LB I/18B.

Energy levels and branching ratios [01Tu07]. Part 2 **$^{143}_{59}$Pr**

E^*	$2J^\pi$	Branching ratios in percentage				
		E_f^*:	722	740	787	937.82
[keV]		$2J_f^\pi$:	5^+	$\langle 1\rangle^+$		$3^+,5^+$
937.82(1)	$3^+,5^+$			0.19(10)		
1060.21(2)	$5^+,3^+$		1.9(10)		≤19	19(3)
1156.94(2)	$1^+,3^+$			19(3)		
1160.58(2)	$\langle 3\rangle^+$		0.9(2)			
1381.84(3)	$5^+,3^+$				≤7	
1397.40(4)	$3^+,5^+$		4.9(49)			

Energy levels and branching ratios [01So16]. **$^{144}_{59}$Pr**

E^*	J^π	$T_{1/2}$ or	Branching ratios in percentage				
			E_f^*:	0.0	59.03	80.120	99.952
[keV]		Γ_{cm}	J_f^π:	0^-	3^-	1^-	2^-
0.0	0^-	17.28(5) m					
59.03(3)	3^-	7.2(3) m		100			
80.120(4)	1^-	136(9) ps		100			
99.952(9)	2^-	0.66(6) ns		11.0(12)	89(5)		
133.5152(20)	1^-	7(4) ps		97(4)		0.83(5)	2.51(19)

Energy levels and branching ratios [93Pe07]. **$^{145}_{59}$Pr**

E^*	$2J^\pi$	S_N	$T_{1/2}$ or	Ref.	Branching ratios in percentage				
					E_f^*: 0.0	62.6	188.8	347	351
[keV]		(e,e′p)	Γ_{cm}		$2J_f^\pi$: 7^+	5^+	$\langle 3\rangle^+$	3^+	5
0.0	7^+	1.59(26)	5.984(10) h	93La16					
62.65(1)	5^+	1.04(16)	4.0(16) ns	93La16	100				
188.84(1)	$\langle 3\rangle^+$	0.18(3)		93La16	56(2)	44(1)			
347.18(1)	3^+	0.08(2)		93La16	8.6(1)	91(1)	0.33(6)		
350.91(3)	5				95(1)	4.7(5)			
540.09(2)					24(1)	3.1(4)	54(1)	6.7(7)	12.3(4)
550	7^+	0.23(4)		93La16					
554.81(1)	3^+				6.0(1)	24(1)	12.3(3)	41	17.1(2)
697.20(4)						88(3)	12(4)	x	
766.31(3)									
786.91(1)	$\langle 3\rangle^-$					84.9	0.56(4)	9.7(2)	1.73(3)
806.43(4)	$\langle 3\rangle^+$					100			
835.64(5)					12(3)	88(14)			
845.94(2)					9.3(2)	73(1)	7(2)	10.9(2)	
859.43(4)							5(2)	83(17)	
948.4(1)	$\langle 7^+\rangle$				35(5)	65(5)			
1046.97(4)					20(1)		38(13)		22(1)
1110.56(3)	$\langle 5\rangle^+$				81(2)		4.9(2)	2.7(10)	11.1(4)
1210.54(2)	5^-				5.1(3)	50		1.3	9
1244									
1318.4(1)									
1330.1(1)									88(6)
1493									
1560.46(5)					18(9)	24(3)	35(3)		
1608.8(1)					4(2)	6(2)			
		93La16		Ref.					

Energy levels and branching ratios [93Pe07]. Part 2 **$^{145}_{59}$Pr**

E^*	$2J^\pi$				Branching ratios in percentage						
		E_f^*:	540	555	697.20	766.31	786.91	806.43	835.64	845.94	859.43
[keV]		$2J_f^\pi$:		3^+			$\langle 3\rangle^-$	$\langle 3\rangle^+$			
766.31(3)				100							
786.91(1)	$\langle 3\rangle^-$		0.20(1)	2.93(5)							
859.43(4)			3.0(6)	9.4(6)							
1046.97(4)			19(4)								
1210.54(2)	5^-		2.6(3)	5.1(3)	0.9(3)	x	21			0.19(3)	4.9
1318.4(1)									71(7)	29(7)	
1330.1(1)								12(6)			
1560.46(5)					6(3)					12(6)	6(3)
1608.8(1)					52(2)			10(2)	20(4)	8(4)	