⁵⁸Ni(³²S,3pnγ) 2000Wi10,1997Ta10,1999Co10

History									
Туре	Author	Citation	Literature Cutoff Date						
Full Evaluation	A. Negret and B. Singh	NDS 203,283 (2025)	20-Jan-2025						

Includes 1998Ka19.

1997Ta10: E=135 MeV. Measured E γ , I γ , $\gamma\gamma$ and $\gamma\gamma(\theta)$ (DCO) using Gammasphere, an array consisting of 36

Compton-suppressed Ge detectors, in conjunction with Microball, a 95-element detector array.

2000Wi10: E=135 MeV. Measured lifetimes by DSAM using Gammasphere array in conjunction with Microball.

1999Co10: E=130 MeV. Measured γ -ray linear polarization with a four- crystal Clover polarimeter, and $\gamma(\theta)$ with one HPGe detector.

1998Ka19: E=130 MeV. Measured lifetimes of two levels using RDM.

⁸⁶Nb Levels

E(level) [†]	Jπ‡	$T_{1/2}^{\#}$	Comments
0.0&	(6^{+})		
26.3 4	(7^+)		J^{π} : from 1999Co10 and 2000Wi10.
$274.4^{\&}$ 3	(8^+)	0.84 ns 14	I^{π} , from γ (lin pol) (1999Co10)
2,	(0)	010111011	$T_{1/2}$: from RDM (1998Ka19).
494.3 ^{<i>d</i>} 3	(6 ⁻)	0.25 ns 7	J^{π} : from $\gamma(\text{lin pol})$ (1999Co10). T _{1/2} : from RDM (1998Ka19).
724.7 [°] 4	(9 ⁺)		
887.7 <mark>°</mark> 4	(7^{-})		
1134.1 ^{&} 4	(10^{+})		
1283.8 ^d 4	(8-)		
1498.4 ^h 5	(8 ⁻)		
1601.1 [°] 4	(11^{+})	0.34 ps +10-8	
1710.7 ^e 4	(9 ⁻)		
2026.3 ^d 4	(10^{-})		
2209.6 ^h 11	(10^{-})		
2211.5 ^{&} 5	(12^{+})	0.46 ps +8-6	
2454.8 ^e 5	(11 ⁻)	1	
2599.1 <mark>8</mark> 6	(11^{-})		
2684.0 [°] 5	(13^{+})	0.35 ps +10-8	
2779.5 ^d 5	(12^{-})		
3065.4 ^h 15	(12^{-})		
3302.2 ^e 5	(13 ⁻)	0.45 ps +7-6	
3377.5 ⁸ 6	(13 ⁻)	0.65 ps +33-29	
3468.2 ^{&} 6	(14^{+})	0.35 ps +10-8	
3687.4 ^d 6	(14 ⁻)	0.76 ps +11-9	
3902.4 [°] 6	(15^{+})	0.34 ps +6-4	
3987.4 ⁰ 6	(15^{+})	0.21 ps +8-6	
4070.0 ^h 6	(14^{-})	0.45 ps +26-21	
4317.9 ^e 6	(15^{-})	0.48 ps +11-9	
4370.4 ⁸ 6	(15 ⁻)	0.62 ps +9-8	
4777.2 ^{<i>d</i>} 7	(16 ⁻)	0.34 ps +6-4	
4840.6 ^{&} 8 5027.5 9	(16 ⁺) (16 ⁺)	0.52 ps +19-17	
5153.2 ^h 7	(16 ⁻)	0.21 ps +19-14	
5274.1 [°] 7	(17^{+})	0.30 ps +8-6	
		-	

2000Wi10,1997Ta10,1999Co10 (continued)

			86	⁸⁶ Nb Levels (continued)			
E(level) [†]	J ^π ‡	T _{1/2} #	E(level) [†]	J ^π ‡	T _{1/2} #		
5307.8 ^b 7	(17^{+})	0.40 ps +10-9	8603 ^a 4	(21^{+})	0.30 ps +15-11		
5441.9 <mark>°</mark> 7	(17-)	0.14 ps +8-6	9064.8 ^d 17	(22^{-})	0.055 ps 14		
5504.3 <mark>8</mark> 8	(17 ⁻)	0.32 ps +8-6	9381.7 ^b 19	(23^{+})	0.22 ps 6		
5532.9 7	(17^{+})		9649 ^e 4	(23 ⁻)	0.23 [@] ps +8-6		
5605.5 ^f 12	(17 ⁻)	0.14 ps +12-11	9728.6 ⁸ 18	(23 ⁻)	0.055 ps +21-14		
6035.4 d 10	(18 ⁻)	0.132 ps +28-21	9774 ^{&} 3	(22^{+})	-		
6361.5 ^{&} 11	(18^{+})		10052.5 ^c 25	(23^{+})	0.11 ps +7-6		
6479.3 ^e 11	(19 ⁻)	1.25 ps +27-21	10430 ^{<i>a</i>} 5	(23 ⁺)	$0.08^{\textcircled{0}}$ ps +5-4		
6644.9 <mark>b</mark> 8	(19 ⁺)	0.55 ps +16-14	10866.5 ^d 21	(24 ⁻)	0.042 ps + 21 - 14		
6722.1 [°] 11	(19 ⁺)	0.19 ps +11-9	11283 ^b 3	(25^{+})	0.07 ps +4-3		
6807.7 <mark>8</mark> 12	(19 ⁻)	0.17 ps +4-3	11456.9 <mark>8</mark> 21	(25 ⁻)	0.083 ps +28-21		
6957.6 ^a 13	(19 ⁺)	0.50 ps +24-18	12013 ^c 4	(25^+)	0.042 ^(a) ps +28-21		
6972.6 ^f 16	(19 ⁻)	0.25 ps +6-5	12407? ^a 3	(25^+)			
7460.7 <mark>d</mark> 14	(20 ⁻)	0.13 ps +5-3	12886 ^d 4	(26 ⁻)	$0.021^{\textcircled{0}}$ ps $+21-14$		
7665.3 12	(20^{+})		13417 <mark>8</mark> <i>3</i>	(27 ⁻)	0.042 [@] ps 14		
7819.3 ^e 14	(21 ⁻)	0.79 ps +19-16	13509 ^b 4	(27^{+})	$0.062^{\textcircled{0}}$ ps +28-21		
7906.2 <mark>b</mark> 13	(21^{+})	0.45 ps +15-14	13568 4	(27^{+})	$0.06^{\textcircled{0}}$ ps +4-3		
7965.5 <mark>&</mark> 19	(20^{+})	-	15095 ^d 5	(28 ⁻)	-		
8214.1 ⁸ 15	(21 ⁻)	0.125 ps +28-21	15662 ⁸ 4	(29 ⁻)			
8270.1 ^c 19	(21^{+})	0.12 ps +7-5	18058 ^g 5	(31 ⁻)			
8429 [†] 3	(21 ⁻)	0.16 [@] ps +6-5	20786? ^g 3	(33 ⁻)			

⁵⁸Ni(³²S,3pnγ)

[†] From least-squares fit to $E\gamma$ values. Arguments for assuming 6⁺ as the g.s. of ⁸⁶Nb are given by 1999Co10.

[‡] From 1997Ta10 based on $\gamma\gamma(\theta)$ (DCO) data and band associations, unless otherwise stated. The parentheses in most cases are added by evaluators due to lack of strong arguments for these assignments.

[#] From DSA measurements of 2000Wi10, unless otherwise stated. [@] Effective half-life (2000Wi10), not corrected for side feeding.

[&] Band(A): Band based on (6^+) .

- ^{*a*} Band(B): Band based on (19^+) .
- ^b Band(C): Band based on (15⁺).
- ^c Band(D): Band based on (9⁺).
- ^d Band(E): Band based on (6⁻).
- ^e Band(F): Band based on (7⁻).
- ^f Band(G): Band based on (17⁻).
- ^g Band(H): Band based on (11⁻).
- ^h Band(I): Band based on (8⁻).

$\gamma(^{86}\text{Nb})$

E_{γ}^{\dagger}	I_{γ}^{\dagger}	E _i (level)	\mathbf{J}_i^{π}	E_f J	\int_{f}^{π} Mul	t. [‡] Comments
26.4 [@]		26.3	(7^{+})	0.0 (6	+)	
214.7 5	2.5 9	1498.4	(8 ⁻)	1283.8 (8	_)	Additional information 1.
225.1 4	2.0 7	5532.9	(17^{+})	5307.8 (1)	7 ⁺)	
240.9 8	3.3 9	7906.2	(21^{+})	7665.3 (2)	0 ⁺) D	DCO=0.52 12

⁵⁸ Ni(³² S,3pnγ)	2000Wi10,1997Ta10,1999Co10 (continued)
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γ (⁸⁶Nb) (continued)

E_{γ}^{\dagger}	I_{γ}^{\dagger}	E _i (level)	\mathbf{J}_i^π	E_f	\mathbf{J}_f^{π}	Mult. [‡]	δ^{\ddagger}	α #	Comments
248.1 3	49.6 15	274.4	(8 ⁺)	26.3 ((7 ⁺)	M1+E2	0.066	0.0199 3	$A_2 = -0.411\ 25;\ A_4 = -0.032\ 26;\ POL = -0.29\ 11\ (1999Co10);\ DCO = 0.59\ 3$
258.8 4	2.6 8	5532.9	(17^{+})	5274.1 ((17^{+})				
274.5 3	63.5 15	274.4	(8+)	0.0 ((6 ⁺)	E2		0.0310 4	A ₂ =+0.272 <i>30</i> ; A ₄ =-0.024 <i>31</i> ; POL=+0.67 7 (1999Co10); DCO=0.82 <i>4</i>
288.7 4	6.0 15	5441.9	(17^{-})	5153.2 ((16 ⁻)	D			DCO=0.54 10
300.3 4	51	4370.4	(15 ⁻)	4070.0 ((14 ⁻)	D			DCO=0.62 17
315.7 3	15.0 5	2026.3	(10^{-})	1710.7 ((9 ⁻)	D			DCO=0.47 5
324.6 <i>3</i>	22.1 15	2779.5	(12^{-})	2454.8 ((11^{-})	D			DCO=0.49 13
360.6 4	1.3 <i>3</i>	6722.1	(19^{+})	6361.5 ((18^{+})				
385.3 4	16.7 15	3687.4	(14^{-})	3302.2 ((13^{-})	D			DCO=0.52 10
393.3 <i>3</i>	36.0 14	887.7	(7^{-})	494.3 ((6^{-})	D			DCO=0.42 5
396.1 3	14.2 12	1283.8	(8 ⁻)	887.7 ((7^{-})	D			DCO=0.47 5
409.4 3	5.5 7	1134.1	(10^{+})	724.7 ((9+)	D			DCO=0.45 5
427.1 5	10 3	1710.7	(9 ⁻)	1283.8 ((8 ⁻)	(D)			DCO=0.48 5
100 0 1	10.0		<i></i>		(10-)	-			DCO for 427.1+428.2.
428.2 6	10 3	2454.8	(11^{-})	2026.3 ((10^{-})	(D)			DCO=0.48 5
12105	5 0 10	2002 ((15+)	2460.2	(1 1 ±)	Ð			DCO for 427.1+428.2.
434.0 5	5.3 12	3902.4	(15')	3468.2 ((14')	D			DCO=0.47 10
434 1	31	5274.1	$(1/^{+})$	4840.6 ((10°)				
444 ^w		6479.3	(19 ⁻)	6035.4 ((18 ⁻)				
450.3 <i>3</i>	20.3 12	724.7	(9+)	274.4 ((8+)	D			DCO=0.48 5
459.1 5	6.2 7	4777.2	(16 ⁻)	4317.9 ((15 ⁻)	D			DCO=0.64 9
466.9 3	27.7 12	1601.1	(11^+)	1134.1 ((10^+)	D			DCO=0.43 4
467.27	9.5 16	5307.8	(17^{+})	4840.6 ((16^{+})	Ð			
4/2.4 3	13.5 18	2684.0	(13^{+})	2211.5 ((12^{+})	D F1			DCO=0.42 4
494.2 3	80.8 15	494.3	(6)	0.0 ((0')	EI			$A_2 = +0.029$ 5; $A_4 = +0.13$ 5; POL=-0.61 15 (1999Co10); DCO=0.92 6
505.1 8	4.8 10	5532.9	(17^{+})	5027.5 ((16^{+})				
519.4 4	10.7 13	3987.4	(15^{+})	3468.2 ((14^{+})	D			DCO=0.48 9
522.8 4	19.8 <i>15</i>	3302.2	(13 ⁻)	2779.5 ((12 ⁻)	D			DCO=0.54 10
573.0 5	6.8 10	2599.1	(11^{-})	2026.3 ((10^{-})	D			DCO=0.57 9
594 2	2.1 4	6035.4	(18^{-})	5441.9 ((17^{-})				
597.9 7	9.7 12	3377.5	(13^{-})	2779.5 ((12^{-})	D			DCO=0.62 9
610.2 4	9.3 11	2211.5	(12^{+})	1601.1 ((11^{+})				
610.5 5	6.3 9	1498.4	(8 ⁻)	887.7 ((7 ⁻)	D			DCO=0.51 10
630.5 5	10.8 20	4317.9	(15^{-})	3687.4 ((14 ⁻)	D			DCO=0.49 6
664.6 7	5.2.9	5441.9	(17^{-})	4777.2 ((16^{-})	D			DCO=0.48 9
707.4 9	1.2 4	7665.3	(20^+)	6957.6 ((19^+)				
711.2.9	4.78	2209.6	(10^{-})	1498.4 ((8 ⁻)				
727 2	1.8 4	5504.3	(17^{-})	4777.2 ((16^{-})	0			
742.2 4	35.8	2026.3	(10^{-})	1283.8 ((8^{-})	Q			DCO=0.95 8
744.17	15 4	2454.8	(11)	1/10.7 ((9)	Q			DCO=0.92 8
133.23	33.3 23	2119.5	(12)	2026.3 ((10)	Q			DCU=1.02 13
101.04	0.89	4070.0	(14)	3502.2 (2500.1 ((15)	E2			$DCO_{-1}04.21$
1/0.//	15.0 15	5152 0	(15)	2399.1 (1270 4 4	(11)	Ē2			$DCO=1.04\ 21$
103.1 0 701 5 5	2.4 4 7 0 10	2155.2	(10)	43/0.4 ((13)				
780 6 1	1.0 19	1283 8	(14) (8^{-})	2004.0 (101.2 ((13)	0			DCO = 1.00.9
877 0 3	33.2 13 33.2 14	1203.0	(0^{-})	474.J (8877 ((7^{-})	N N			DCO = 1.00
835 7 8	25.214	5153.2	(7)	43170 ((15^{-})	V			DCO-1.10 11
84735	68 10	3302.2	(10^{-})	7454.8 ((11^{-})				
855.8 10	4.1 10	3065.4	(12^{-})	2209.6 ((10 ⁻)				

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⁵⁸Ni(³²S,3pnγ) **2000Wi10,1997Ta10,1999Co10** (continued)

γ (⁸⁶Nb) (continued)

E_{γ}^{\dagger}	I_{γ}^{\dagger}	E_i (level)	\mathbf{J}_i^{π}	$\mathbf{E}_f \mathbf{J}_f^{\pi}$	Mult. [‡]	Comments
859.8 4	100	1134.1	(10^{+})	274.4 (8 ⁺)	0	DCO=0.91 8
876.5 4	15.6 10	1601.1	(11^+)	724.7 (9+)	Ē2	DCO=0.95 8
892.4 6	3.3 4	2026.3	(10^{-})	1134.1 (10+)	Q	DCO=0.98 10
907.7 5	46.5 20	3687.4	(14^{-})	2779.5 (12-)	E2	DCO=1.06 8
922.8 8	14.7 <i>14</i>	3377.5	(13^{-})	2454.8 (11-)	E2	DCO=1.10 17
993.1 7	22.4 25	4370.4	(15^{-})	3377.5 (13-)	E2	DCO=0.92 8
1015.6 9	20 4	4317.9	(15^{-})	3302.2 (13-)	E2	DCO=0.91 7
1020.6 12	6.1 18	7665.3	(20^{+})	6644.9 (19 ⁺)	D	DCO=0.50 14
1037.4 8	26.7 22	6479.3	(19 ⁻)	5441.9 (17-)	E2	DCO=1.11 14
1071.2 8	18.6 27	5441.9	(17^{-})	4370.4 (15-)	E2	DCO=1.04 11
1077.6 6	69.0 20	2211.5	(12^{+})	1134.1 (10 ⁺)	E2	DCO=0.94 8
1083.1 5	26.6 20	2684.0	(13^{+})	1601.1 (11 ⁺)	E2	DCO=0.97 9
1083.1 9	3.8 7	5153.2	(16 ⁻)	4070.0 (14-))	
1089.9 6	35 <i>3</i>	4777.2	(16 ⁻)	3687.4 (14 ⁻)	E2	DCO=0.98 9
1113 2	3.1 8	6644.9	(19 ⁺)	5532.9 (17 ⁺))	
1124.5 8	13.5 16	5441.9	(17^{-})	4317.9 (15 ⁻)	E2	DCO=1.13 11
1124.8 8	5.3 15	5027.5	(16^{+})	3902.4 (15 ⁺))	
1133.9 8	13.4 15	5504.3	(17^{-})	4370.4 (15 ⁻)	E2	DCO=1.04 9
1178.5 6	8.3 10	2779.5	(12^{-})	$1601.1 (11^+)$)	
1186.5 8	11.4 <i>14</i>	5504.3	(17^{-})	4317.9 (15 ⁻)	E2	DCO=0.95 9
1218.4 5	25.4 14	3902.4	(15^{+})	2684.0 (13 ⁺)	E2	DCO=0.98 7
1256.4 6	42.3 25	3468.2	(14^{+})	$2211.5(12^+)$	E2	DCO=0.97 9
1258.2 8	23.5 20	6035.4	(18^{-})	4777.2 (16 ⁻)	E2	DCO=0.91 9
1261.4 14	14.5 20	7906.2	(21^{+})	6644.9 (19 ⁺)	E2	DCO=0.97 9
1286.8 6	8.6 12	5274.1	(17^{+})	$3987.4 (15^+)$	E2	DCO=0.98 9
1287.6 10	5.0 10	5605.5	(17^{-})	4317.9 (15 ⁻)	E2	DCO=0.88 11
1303.4 4	31.8 18	3987.4	(15 ⁺)	2684.0 (13 ⁺)	E2	DCO=1.00 7
1303.4 9	20.6 20	6807.7	(19^{-})	5504.3 (17 ⁻)	E2	DCO=1.01 9
1320.3 /	26.4 20	5307.8	(1/')	3987.4 (15')	E2	DCO=0.97 9
1320.8 /	93	2454.8	(11)	$1134.1 (10^{+})$	50	
1337.1 5	20.5 20	6644.9	(19^{+})	5307.8 (17)	E2	DCO = 1.00 II
1340.0 9	15.8 18	/819.3	(21)	64/9.3 (19)	EZ	DC0=1.04 15
1307.1 10	5.9 12	6614.0	(19)	5005.5(17)	(E2)	$DCO_{-1}02.8$
1370.9 10	83	0044.9	(19^{+})	3274.1 (17)	(E2)	$DCO = 1.05 \ 0$ $DCO = 1.05 \ 0$
1271 4 10	10 6	5074 1	(17^{+})	2002 4 (15+)	(E2)	DCO = 102.8
13/1.4 10	18.0	3274.1	(17)	5902.4 (15)	(E2)	DCO = 1.05 o DCO = 1272 o + 1271 d + 1270 o
1272 0 10	10 4	1810 6	(16^{+})	2469 2 (14+)	(E2)	DCO = 102.8
1373.0 10	10 4	4640.0	(10)	5406.2 (14)	(E2)	DCO = 1.05 o DCO for 1373 0 + 1371 4 + 1370 0
1406 4 9	20.3.20	821/11	(21^{-})	$6807.7 (10^{-1})$	E2	DCO = 0.08.0
1414 2	4712	6722.1	(21) (10^+)	5307.8 (17+)	62	De0=0.98 9
1474 2	83	6957.6	(19^+)	5532.9 (17 ⁺)		
1425 2 9	21 9 20	7460.7	(20^{-})	$60354(18^{-1})$	F2	DCO=1.06.10
1436 3 8	647	1710 7	(20^{-})	$274.4(8^+)$	12	De0-1.00 10
1448 1 10	10.9.75	6722.1	(19^{+})	$5274.1 (17^{+})$		
1456.2	1.8.5	8429	(21^{-})	6972.6 (19-)		
1475.5 14	10.0.20	9381.7	(23^+)	7906.2 (21+)	E2	DCO=0.98 15
1514.4 10	15.6 16	9728.6	(23^{-})	8214.1 (21-)	E2	DCO=1.11 15
1520.8 15	6.3 10	6361.5	(18^+)	4840.6 (16 ⁺)		
1548.0 15	11.5 18	8270.1	(21^+)	6722.1 (19+)		
1604.0 15	5.6 12	7965.5	(20^{+})	6361.5 (18+))	
1604.1 10	14.2 15	9064.8	(22^{-})	7460.7 (20-	E2	DCO=1.14 12
1645 <i>3</i>	62	8603	(21^{+})	6957.6 (19+	-	
1649 <i>3</i>	12 3	6957.6	(19+)	5307.8 (17+)	
1728.3 11	11.2 13	11456.9	(25-)	9728.6 (23-)	E2	DCO=0.99 13

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	⁵⁸ Ni(³² S,3pnγ) 2000Wi10,1997Ta10,1999Co10 (continued)											
γ ⁽⁸⁶ Nb) (continued)												
E_{γ}^{\dagger}	I_{γ}^{\dagger}	E _i (level)	\mathbf{J}_i^{π}	E_f	\mathbf{J}_{f}^{π}	Mult. [‡]		Comments				
1782.3 17	5.7 18	10052.5	(23^{+})	8270.1	(21^{+})							
1801.7 <i>12</i>	9.6 12	10866.5	(24 ⁻)	9064.8	(22 ⁻)	E2	DCO=0.91 10					
1808 2	6.5 20	9774	(22^{+})	7965.5	(20^{+})							
1827 <i>3</i>	4 2	10430	(23^{+})	8603	(21^{+})							
1830 <i>3</i>	5.5 10	9649	(23^{-})	7819.3	(21^{-})							
1901 2	6.0 20	11283	(25^{+})	9381.7	(23^{+})							
1959.6 <i>14</i>	8.3 13	13417	(27^{-})	11456.9	(25^{-})							
1961 <i>3</i>	3.7 15	12013	(25^{+})	10052.5	(23^{+})							
1978 [@]		12407?	(25 ⁺)	10430	(23+)							
2019 3	2.8 7	12886	(26^{-})	10866.5	(24^{-})							
2209 3	<2	15095	(28^{-})	12886	(26 ⁻)							
2226 3	2.0 8	13509	(27^{+})	11283	(25^{+})							
2245 3	4 1	15662	(29 ⁻)	13417	(27^{-})							
2285 <i>3</i>	1.6 7	13568	(27^{+})	11283	(25^{+})							
2396 <i>3</i>	<2	18058	(31 ⁻)	15662	(29 ⁻)							
2729 [@]		20786?	(33-)	18058	(31-)							

[†] From 1997Ta10. [‡] From $\gamma\gamma(\theta)$ (DCO) data (gated on E2 transitions, 1997Ta10) and $\gamma(\text{lin pol})$ data for selected transitions. For $\Delta J=2$ stretched

transitions, mult=E2 is from RUL. # Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with "Frozen Orbitals"

approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified. [@] Placement of transition in the level scheme is uncertain.

 $^{86}_{41}\text{Nb}_{45}\text{-}6$



86 41Nb45

 ${}^{86}_{41}\text{Nb}_{45}\text{-}7$



7



⁸⁶₄₁Nb₄₅





86 41Nb45





 $^{86}_{41}\text{Nb}_{45}$