^{58}Ni(^{36}Ar,5pγ) 1993Bo33,1993Si14

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 114, 1 (2013)	20-Oct-2012

Related references: 1995Ka06, 1995Za11, 1994Kr01.

1993Bo33: ^{58}Ni(^{36}Ar,5pγ) E=149 MeV and ^{58}Ni(^{35}Cl,4pγ) E=120 MeV. Measured Eγ, Iγ, $\gamma\gamma$, particle-γ coin, $\gamma(\theta)$, $\gamma\gamma(\theta)$(DCO), lifetimes by delayed-coin method. An array of 12 HPGe detectors used for γ-ray studies. Shell-model calculations.

1993Si14: ^{66}Zn(^{28}Si,3p2nγ) E=110 MeV and ^{66}Zn(^{30}Si,αp2nγ) E=123 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$, $\gamma\gamma(\theta)$(DCO), excitation functions, lifetimes by recoil-distance Doppler-shift method, using an array of five HPGe detectors.

1995Za11: ^{58}Ni(^{35}Cl,4pγ) E=120 MeV. Measured lifetimes by recoil-distance Doppler-shift (RDDS) method.

1995Ka06: ^{58}Ni(^{36}Ar,5pγ) E=149 MeV. Measured lifetimes by nγ(t) coin.

1994Kr01: ^{66}Zn(^{30}Si,αp2nγ) E=115 MeV. Measured g factor by time-differential perturbed angular distribution method following implantation of recoil nuclei.

^{89}Nb Levels

E(level)†	J$^\pi$‡	$T_{1/2}$#	Comments
0.0	(9/2$^+$)		
659.0 *2*	(7/2$^+$)		
1003.4 *1*	(13/2$^+$)		
1935.2 *2*	(17/2$^+$)		
2151.5 *2*	(17/2$^-$)	0.51 ns *5*	$T_{1/2}$: from recoil-distance Doppler shift (1993Bo33).
2191.5 *2*			
2192.8 *2*	(21/2$^+$)	13.8 ns *4*	g=+0.324 *7* (1994Kr01) $T_{1/2}$: from γ(t) (1995Ka06). Other: 14 ns *2* ($\gamma\gamma$(t) 1994Kr01). g: time differential perturbed $\gamma(\theta)$ following recoil implantation (1994Kr01).
2518.2 *3*	(21/2$^-$)		
2522.9 *2*	(19/2$^+$)		
2955.6 *2*	(23/2$^+$)	<0.35 ps	$T_{1/2}$: from RDDS (1995Za11). Other: 5 ps *3* (RDDS 1993Si14).
3141.9 *2*	(21/2$^-$)	<10 ps	$T_{1/2}$: from RDDS (1995Za11).
3402.9 *2*	(25/2$^+$)	3.5 ps *14*	$T_{1/2}$: from RDDS (1993Si14). Other: 2.1 ps *+24−16* (RDDS 1995Za11).
3805.6 *2*	(25/2$^-$)	34.7 ps *14*	$T_{1/2}$: other: 42 ps *8* (RDDS 1993Si14).
4075.9 *2*	(25/2$^+$)		
4553.5 *2*	(27/2$^-$)	<0.7 ps	$T_{1/2}$: from RDDS (1995Za11). Other: <1.4 ps (RDDS 1993Si14).
4797.1? *2*			E(level): ordering of 244-721 cascade is not established.
4808.6 *2*	(29/2$^-$)	2.70 ps *21*	$T_{1/2}$: effective half-life not corrected for feeding (1995Za11). Other: <1.4 ps (RDDS 1993Si14).
4908.5? *3*			E(level): ordering of 498-355 cascade is not established.
5041.3 *2*	(29/2$^+$)	0.76 ps *28*	
5324.0 *2*	(31/2$^-$)		
5407.2 *2*			
5697.6 *2*	(33/2$^-$)		
5916.9? *3*			E(level): ordering of 183-876 cascade is not established.
6100.1 *2*	(33/2$^+$)	1.25 ps *14*	$T_{1/2}$: effective half-life not corrected for feeding (1995Za11).
6131.4 *3*			
6451.7? *3*			E(level): ordering of 498-320 cascade is not established.
6547.4 *3*			
6658.2? *3*			E(level): ordering of 614-558 cascade is not established.
6949.5 *4*			
7272.5 *6*			

† From least-squares fit to Eγ data.

‡ From Adopted Levels.

Weighted average of recoil-distance Doppler shift (RDDS) and differential-decay curve method (DDCM) (1995Za11), unless otherwise stated.

^{58}Ni(^{36}Ar,5pγ) 1993Bo33,1993Si14 (continued)

$\gamma(^{89}Nb)$

A_2, A_4 and R(DCO) (for θ=162° and 115°) are from ^{58}Ni(^{35}Cl,4pγ) (1993Bo33).

Intensities in ^{66}Zn(^{28}Si,3p2nγ) E=110 MeV (1993Si14)

Eγ	Iγ
216.1	18.9 3
254.8	6.9 2
257.6	44.0 4
402.8	19.8 6
447.3	17.6 5
663.0	10.4 4
748.2	14.5 5
763.0	24.5 6
931.7	84.0 14
991.1	43.1 6
1003.7	100.0 16
1059.0	2.3 9
1639.0	9.5 8

Δ(Eγ) ≤ 0.3 keV (1993Si14)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[‡]	α[a]	Comments
183.2 *3*	1.2 *2*	6100.1	(33/2$^+$)	5916.9?					
216.2 *1*	32 *3*	2151.5	(17/2$^-$)	1935.2	(17/2$^+$)	D[&]			A_2=+0.35 *4*, A_4=+0.08 *4*. R(DCO)=0.86 *8* (1993Bo33). A_2=+0.28 *3*, A_4=−0.05 *1*. R(DCO)=0.69 *2* (1993Si14).
244.2 *2*	1.6 *3*	5041.3	(29/2$^+$)	4797.1?					
255.1 *1*	15.1 *20*	4808.6	(29/2$^-$)	4553.5	(27/2$^-$)	D+Q[@]	−0.09 *4*		A_2=−0.39 *2*, A_4=+0.02 *2*. R(DCO)=0.52 *9*. Additional information 6.
257.7 *1*	63 *3*	2192.8	(21/2$^+$)	1935.2	(17/2$^+$)	E2[#]		0.0386	α(K)=0.0334 *5*; α(L)=0.00434 *7*; α(M)=0.000766 *11*; α(N+..)=0.0001139 *16* α(N)=0.0001087 *16*; α(O)=5.18×10^{-6} *8* A_2=+0.35 *2*, A_4=−0.14 *1*. R(DCO)=0.86 *1* (1993Si14).
320.3 *1*	3.9 *6*	6451.7?		6131.4					
330.1 *1*	4.6 *11*	2522.9	(19/2$^+$)	2192.8	(21/2$^+$)				
354.8 *2*	1.9 *4*	4908.5?		4553.5	(27/2$^-$)				
366.7 *2*	3.7 *5*	2518.2	(21/2$^-$)	2151.5	(17/2$^-$)				
373.6 *1*	4.8 *7*	5697.6	(33/2$^-$)	5324.0	(31/2$^-$)				
402.5 *2*	3.4 *17*	6100.1	(33/2$^+$)	5697.6	(33/2$^-$)				R(DCO)=0.95 *19*.
402.7 *1*	15.8 *16*	3805.6	(25/2$^-$)	3402.9	(25/2$^+$)				A_2=+0.39 *3*, A_4=+0.01 *3* (1993Bo33). A_2=−0.14 *2*, A_4=+0.08 *1*. R(DCO)=1.44 *2* (1993Si14).
416.0 *2*	3.0 *5*	6547.4		6131.4					
447.3 *1*	39 *4*	3402.9	(25/2$^+$)	2955.6	(23/2$^+$)	D+Q[@]	−0.10 *5*		A_2=−0.46 *3*, A_4=+0.08 *3*. R(DCO)=0.57 *7*. Additional information 3.
497.8 *2*	3.2 *4*	6949.5		6451.7?					

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^{58}Ni(^{36}Ar,5pγ) 1993Bo33,1993Si14 (continued)

$\gamma(^{89}Nb)$ (continued)

E_γ [†]	I_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ [‡]	Comments
498.4 *3*	1.3 *2*	5407.2		4908.5?				
515.4 *1*	8.6 *10*	5324.0	(31/2$^-$)	4808.6	(29/2$^-$)	@		R(DCO)=0.65 *22*.
558.1 *2*	2.8 *5*	6658.2?		6100.1	(33/2$^+$)			
614.3 *5*	2.1 *4*	7272.5		6658.2?				
619.0 *1*	3.6 *5*	3141.9	(21/2$^-$)	2522.9	(19/2$^+$)			
659.0 *2*		659.0	(7/2$^+$)	0.0	(9/2$^+$)			
663.7 *1*	21.3 *26*	3805.6	(25/2$^-$)	3141.9	(21/2$^-$)	(E2)#		A_2=+0.30 *2*, A_4=+0.01 *7*. R(DCO)=1.05 *12*. Additional information 4.
721.2 *2*	2.0 *5*	4797.1?		4075.9	(25/2$^+$)			
724.3 *2*	7.2 *10*	6131.4		5407.2				
747.9 *1*	20.8 *22*	4553.5	(27/2$^-$)	3805.6	(25/2$^-$)	D+Q@	−0.09 *6*	A_2=−0.44 *3*, A_4=+0.05 *4*. R(DCO)=0.51 *8*. Additional information 5.
762.8 *1*	50 *3*	2955.6	(23/2$^+$)	2192.8	(21/2$^+$)	D(+Q)@	−0.03 *2*	A_2=−0.27 *2*, A_4=+0.05 *2*. R(DCO)=0.57 *7*. Additional information 1.
850.1 *2*	1.2 *2*	3805.6	(25/2$^-$)	2955.6	(23/2$^+$)			
853.8 *2*	2.1 *2*	5407.2		4553.5	(27/2$^-$)			
875.7 *3*	1.1 *2*	5916.9?		5041.3	(29/2$^+$)			
931.8 *1*	100 *3*	1935.2	(17/2$^+$)	1003.4	(13/2$^+$)	Q#		A_2=+0.25 *3*, A_4=−0.24 *1* (1993Si14). R(DCO)=0.98 *8* (1993Bo33), 0.78 *1* (1993Si14).
949.0 *2*	0.3 *1*	3141.9	(21/2$^-$)	2192.8	(21/2$^+$)			
965.3 *1*	4.0 *8*	5041.3	(29/2$^+$)	4075.9	(25/2$^+$)			
990.3 *1*	20.8 *22*	3141.9	(21/2$^-$)	2151.5	(17/2$^-$)	(E2)#		A_2=+0.28 *2*, A_4=−0.02 *2*. R(DCO)=1.10 *11*. Additional information 2.
1003.0 *1*	10 *3*	4808.6	(29/2$^-$)	3805.6	(25/2$^-$)			
1003.4 *1*	111 *3*	1003.4	(13/2$^+$)	0.0	(9/2$^+$)	Q#		A_2=+0.27 *2*, A_4=−0.12 *1* (1993Si14). R(DCO)=0.94 *8* (1993Bo33), 0.83 *1* (1993Si14).
1058.8 *1*	12.0 *12*	6100.1	(33/2$^+$)	5041.3	(29/2$^+$)	(E2)#		A_2=+0.34 *3*, A_4=+0.01 *5*. R(DCO)=1.09 *17*.
1120.3 *1*	3.7 *4*	4075.9	(25/2$^+$)	2955.6	(23/2$^+$)	D+Q@	−0.12 *7*	A_2=−0.39 *3*, A_4=+0.01 *3*.
1188.1 *2*	10.9 *5*	2191.5		1003.4	(13/2$^+$)			
1223.2 *2*	1.3 *2*	6547.4		5324.0	(31/2$^-$)			
1601.6 *2*	3.9 *5*	5407.2		3805.6	(25/2$^-$)			
1638.3 *2*	15.2 *15*	5041.3	(29/2$^+$)	3402.9	(25/2$^+$)	(E2)#		A_2=+0.30 *2*, A_4=−0.03 *2*. R(DCO)=0.98 *20* (1993Bo33). A_2=−0.02 *2*, A_4=−0.02 *2*. R(DCO)=0.93 *2* (1993Si14).
1738.9 *2*	2.9 *4*	6547.4		4808.6	(29/2$^-$)			
1883.1 *2*	5.8 *6*	4075.9	(25/2$^+$)	2192.8	(21/2$^+$)			A_2=+0.17 *2*, A_4=−0.02 *3*.

[†] From ^{58}Ni(^{36}Ar,5pγ) E=149 MeV (1993Bo33), unless otherwise stated.
[‡] From 1993Bo33. Sign(δ) is reversed following policies in.
[#] $\gamma(\theta)$ and/or R(DCO) is consistent with ΔJ=2, quadrupole. RUL gives E2.
[@] $\gamma(\theta)$ and/or R(DCO) is consistent with ΔJ=1, dipole or D+Q (most likely M1+E2).
[&] $\gamma(\theta)$ and/or R(DCO) is consistent with ΔJ=0, dipole (most likely E1).
[a] 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.

^{58}Ni(^{36}Ar,5pγ) 1993Bo33,1993Si14

Level Scheme

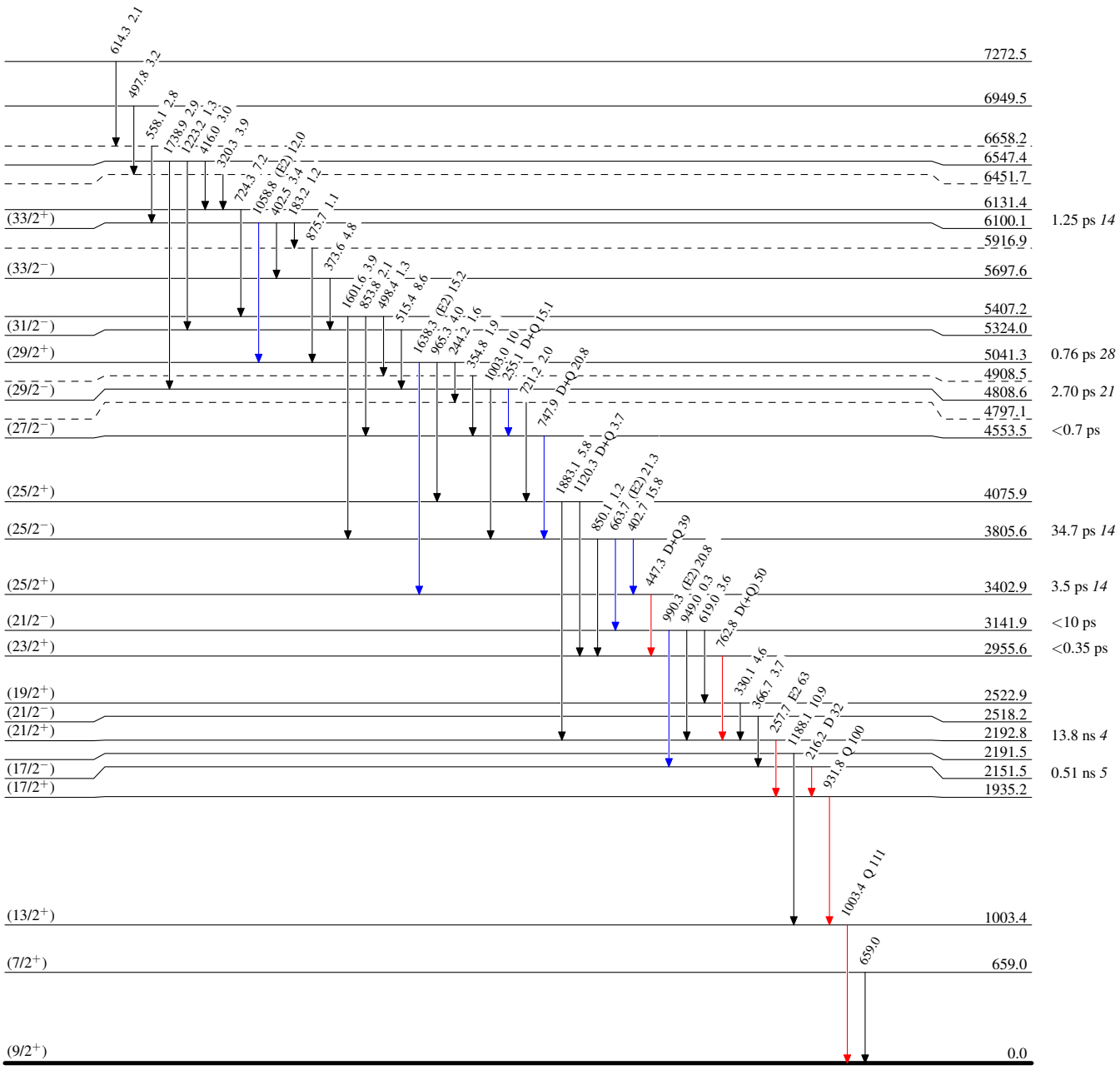
Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$



$^{89}_{41}Nb_{48}$