^{76}Ge(^{18}O,5nγ),^{74}Ge(^{18}O,3nγ) 1986Wa25

History

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

Includes ^{85}Rb(^{7}Li,3nγ) from 1988Ba11 and 1986Bi09.

1986Wa25: ^{74}Ge(^{18}O,3nγ), ^{76}Ge(^{18}O,5nγ) E=40 MeV to 80 MeV. Measured Eγ, Iγ, $\gamma\gamma$, excitation functions, $\gamma(\theta)$, γ(lin pol), level lifetimes by recoil-distance Doppler-shift (RDDS) and Doppler-shift attenuation (DSA) methods. Main reaction used was (^{18}O,5nγ).

1988Ba11: ^{85}Rb(^{7}Li,3nγ) E=28 MeV. Measured TPAD of 271γ, deduced g-factor of the 2995 level.

1986Bi09: ^{85}Rb(^{7}Li,3nγ) E=27 MeV. Measured γ(t) by pulsed beam.

^{89}Zr Levels

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$[#]	Comments
0.0	9/2$^+$		
1943.72 *4*	13/2$^+$	<7[&] ps	
2121.34 *4*	13/2$^-$	2.23[@] ns *12*	T$_{1/2}$: other:≤3.4 ns *2* (RDDS 1986Wa25).
2150.62 *6*	(15/2$^-$)	≤3.4 ns	T$_{1/2}$: ≤3.4 ns *2* (RDDS 1986Wa25).
2159.01 *9*	(17/2$^-$)	≤3.4 ns	T$_{1/2}$: ≤3.4 ns *2* (1986Wa25) (see figure 4 and section 3.1.2). The authors also quote>69 ns in table 2 and<69 ns (from $\gamma\gamma$(t)) in table 4.
2454.6 *6*	(15/2)$^-$	2.5 ps *+28−7*	
2724.07 *6*	17/2$^+$	11[&] ps *3*	
2926.51 *7*	(19/2$^-$)		
2995.30 *7*	21/2$^+$	5.12[@] ns *16*	g=0.89 *4* (1988Ba11) T$_{1/2}$: other: 5.2 ns *3* (RDDS 1986Wa25). g: TDPAD method. Configuration=$(\pi g^2_{9/2})_{8+}(\nu g^{-1}_{9/2})$ + $(\pi g^2_{9/2})_{6+}(\nu g^{-1}_{9/2})$ (1988Ba11).
3111.17 *8*	(19/2)$^+$	>2.8 ps	
3576.15 *20*	(23/2)$^+$	0.35 ps *10*	
3716.9 *3*	(21/2$^-$)	≤0.8 ps	
4277.3 *3*	(25/2$^+$)	≤0.06 ps	
4523.5 *3*	(23/2$^-$)		
4735.36 *20*	25/2$^+$	≤6[&] ps	
5377.8 *4*	(27/2)$^+$	>0.7 ps	

[†] From least-squares fit to Eγ data.
[‡] From Adopted Levels.
[#] From DSA (1986Wa25), unless otherwise stated.
[@] From γ(t) with pulsed beam (1986Bi09).
[&] From RDDS (1986Wa25).

γ(^{89}Zr)

From γγ evidence, majority of unplaced γ rays must lie at the top of level scheme (1986Wa25).

E_γ	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[‡]	α[&]	$I_{(\gamma+ce)}$	Comments
(8.42 *12*)		2159.01	(17/2⁻)	2150.62	(15/2⁻)	[M1]		35.8 *14*	≥15	$I_{(\gamma+ce)}$: from intensity balance at 2159 level.
29.25 *5*	8.4 *20*	2150.62	(15/2⁻)	2121.34	13/2⁻	(M1(+E2))	+0.02 *12*	7.1 *17*	68 *16*	α(K)= 6.2 *8*; α(L)= 0.7 *8*; α(M)= 0.13 *13* E_γ: barely resolved from a 29.57γ in ^{90}Zr. A_2=−0.18 *9*, A_4=0.
68.79 *3*	1.3 *3*	2995.30	21/2⁺	2926.51	(19/2⁻)	(E1)		0.338	1.8 *4*	A_2=−0.30 *8*, A_4=0 gives δ(Q/D)=−0.03 *10*.
115.89 *7*	2.80 *25*	3111.17	(19/2)⁺	2995.30	21/2⁺	(M1(+E2))	+0.12 *15*	0.14 *3*		A_2=−0.30 *8*, A_4=0.
^{x}172.02[@] *4*	2.60 *20*					D+Q	−0.25 *11*			A_2=−0.52 *4*, A_4=+0.04 *6*.
177.615 *20*	46.0 *15*	2121.34	13/2⁻	1943.72	13/2⁺	E1(+M2)	−0.06 *12*	0.014		A_2=+0.31 *1*, A_4=−0.02 *2*, POL=−0.58 *7*.
^{x}178.0[@] *5*	≈2.0									Located somewhere above 4736 level (1986Wa25).
206.94 *8*	3.5 *4*	2150.62	(15/2⁻)	1943.72	13/2⁺	D(+Q)	−0.14 *22*			A_2=−0.41 *15*, A_4=0.
^{x}215.30 *20*	18 *3*									Placement in 2012Sa36: 6244 –> 6029 levels.
271.23 *5*	99 *3*	2995.30	21/2⁺	2724.07	17/2⁺	E2		0.0311		E_γ: barely resolved from a 271.8γ in ^{88}Zr and 269.9γ in ^{90}Zr. A_2=+0.28 *1*, A_4=−0.07 *1*, POL=+0.42 *3*.
333.3 *6*	2.9 *3*	2454.6	(15/2)⁻	2121.34	13/2⁻	M1				A_2=−0.39 *10*, A_4=0, POL=−0.49 *14*.
387.08 *8*	6.9 *5*	3111.17	(19/2)⁺	2724.07	17/2⁺	(M1+E2)	−0.11 *6*			A_2=−0.41 *6*, A_4=+0.09 *6*, POL=−0.44 *12*.
458.1[#] *3*	<2.0	4735.36	25/2⁺	4277.3	(25/2⁺)					
^{x}532.84 *20*	4.6 *5*					(M1(+E2))	−0.12 *11*			A_2=−0.36 *5*, A_4=0, POL=−0.30 *20*. Placement in 2012Sa36: 6029 –> 5496 levels.
565.0 *5*	3.0 *15*	2724.07	17/2⁺	2159.01	(17/2⁻)					E_γ: doublet with a 562.9γ in ^{76}Ge.
573.38[#] *8*	<0.8	2724.07	17/2⁺	2150.62	(15/2⁻)					
580.85 *20*	41 *3*	3576.15	(23/2)⁺	2995.30	21/2⁺	M1+E2	−0.21 *10*			A_2=−0.39 *8*, A_4=0, POL=−0.07 *5*.
^{x}588.01 *20*	10.9 *10*									POL=−0.20 *20*. Placement in 2012Sa36: 6833 –> 6244 levels.
642.4 *3*	9 *3*	5377.8	(27/2)⁺	4735.36	25/2⁺	(M1)				E_γ: only partly resolved from 639γ in ^{90}Zr, 642 and 645γ in ^{88}Zr, 646.0γ in ^{88}Y and 642.3γ in ^{90}Y. A_2=−0.35 *16*, A_4=0, POL=−0.09 *4* for composite peak.
701.10 *20*	16.0 *20*	4277.3	(25/2⁺)	3576.15	(23/2)⁺	D(+Q)	−0.14 *15*			A_2=+0.34 *8*, A_4=0, POL=−0.01 *26*.
767.50 *9*	6.4 *4*	2926.51	(19/2⁻)	2159.01	(17/2⁻)	(M1+E2)	−0.38 *6*			A_2=−0.40 *20*, A_4=0, POL=−0.10 *15*.
775.91[#] *10*	<1.0	2926.51	(19/2⁻)	2150.62	(15/2⁻)					
780.36 *5*	99.4 *25*	2724.07	17/2⁺	1943.72	13/2⁺	E2				A_2=+0.30 *1*, A_4=−0.06 *1*, POL=+0.58 *6*.
790.2 *3*	9 *3*	3716.9	(21/2⁻)	2926.51	(19/2⁻)					A_2=−0.03 *20*, A_4=0, POL=−0.17 *20* for composite peak. E_γ: doublet with an unknown contaminant.
806.55 *10*	4.1 *8*	4523.5	(23/2⁻)	3716.9	(21/2⁻)	D(+Q)	−0.23 *25*			A_2=−0.42 *20*, A_4=0, POL=+0.05 *15*.

$^{89}_{40}$Zr$_{49}$-2

γ(^{89}Zr) (continued)

E_γ	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
[x]950.36[@] *20*	2.30 *25*							
[x]1291.30 *20*	4.0 *5*							Placement in 2012Sa36: 6029 –> 4739 levels.
1558.5 *5*	5.8 *4*	3716.9	(21/2$^-$)	2159.01	(17/2$^-$)	(E2)		A_2=+0.30 *3*, A_4=−0.07 *3*, POL=+0.41 *7*.
1740.04 *20*	16 *3*	4735.36	25/2$^+$	2995.30	21/2$^+$	(E2)		E_γ: doublet with a 1740γ in ^{87}Sr. A_2=+0.20 *3*, A_4=−0.06 *3*, POL=+0.67 *18* for composite peak.
1943.70 *5*	154 *4*	1943.72	13/2$^+$	0.0	9/2$^+$	E2		A_2=+0.309 *5*, A_4=−0.084 *5*, POL=+0.46 *3*.
2121.31 *5*	21.6 *18*	2121.34	13/2$^-$	0.0	9/2$^+$	M2+E3	+1.5 *4*	A_2=+0.69 *3*, A_4=+0.18 *3*, POL=−0.29 *6*.

[†] From ^{76}Ge(^{18}O,5nγ) (probably at E≈65 MeV).
[‡] From $\gamma(\theta)$ and γ(lin pol). Sign(δ) has been reversed by evaluator to conform to Krane-Steffen convention.
[#] From E(level) differences.
[@] Gamma not reported in 2012Sa36.
[&] 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.
[x] γ ray not placed in level scheme.

$^{89}_{40}Zr_{49}$-3

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Level Scheme

Intensities: Relative I_γ