^{66}Zn(^{12}C,2nγ),^{58}Ni(^{24}Mg,α2pγ) 1982Pi01,1989Gr21,1988Ka28

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jun Chen and Ameenah R. Farhan	NDS 194,3 (2024)	8-Jan-2024

Also includes data from reactions: ^{51}V(^{28}Si,p2nγ), ^{58}Ni(^{24}Mg,α2pγ), ^{62}Ni(^{16}O,2nγ), ^{63}Cu(^{16}O,p2nγ), ^{63}Cu(^{19}F,α2nγ), ^{66}Zn(^{12}C,2nγ), ^{74}Se(α,2nγ).

1982Pi01 (also 1981Pi12,1982So09): ^{66}Zn(^{12}C,2nγ),E=39 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$, $\gamma\gamma(\theta)$(DCO at 0° and 90°), $T_{1/2}$ by DSAM. Level structure explained by 2−quasiparticle + rotor model (1982So09).

1989Gr21 (also 1990He04,1988Gr23): ^{58}Ni(^{24}Mg,α2pγ),E=85,110 MeV ^{40}Ca(^{40}Ca,4pγ),E=155 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin, (particle)γ-coin, $T_{1/2}$ of three levels in ground band by DSAM method. Intrinsic structure of bands explained by Woods-Saxon-Strutinsky cranking model.

1988Ka28: ^{63}Cu(^{16}O,p2nγ),E=69 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin.

1998Sk01: ^{58}Ni(^{20}Ne,2pγ),E=80,84 MeV; measured Eγ, $\gamma\gamma$-coin, lifetimes of 424, 611 and 824 levels by RDDS method using gating from above in $\gamma\gamma$-coin data, and differential decay curve analysis (DDCM).

1999Mu21: ^{51}V(^{28}Si,p2nγ),E=115 MeV; measured Eγ, Iγ, level lifetimes by DSAM using an array of 12 Compton-suppressed HPGe detectors with a 14-element BGO multiplicity filter at 15-UD Pelletron facility of IUAC, New Delhi. Deduced B(E2) and transition quadrupole moments.

2005Go43: ^{40}Ca(^{40}Ca,4pγ),E=147 MeV. Measured Eγ, $\gamma\gamma$-coin, lifetimes by recoil-distance Doppler-shift (RDDS) method using GASP array of 32 Compton-suppressed HPGe detectors and inner ball of BGO scintillators. Differential decay curve analysis of $\gamma\gamma$-coin data used to extract level lifetimes.

Others:

1984Wo10: ^{63}Cu(^{16}O,p2nγ),E=49-58 MeV. Measured $T_{1/2}$ of ground-state band members up to 10^+ by DSA method.

1982Ke01: ^{63}Cu(^{19}F,α2nγ),E=58 MeV. Measured $T_{1/2}$ of the first 2^+ by RDDS method.

1982WiZS (also 1982DuZY): ^{74}Se(α,2nγ),E=27 MeV. Measured $T_{1/2}$ by DSA method.

1974No08 (also 1970No03): ^{62}Ni(^{16}O,2nγ),E=42 MeV. Measured $T_{1/2}$ by RDDS method.

The level scheme proposed by 1982Pi01, 1988Ka28 and 1989Gr21 is based on $\gamma\gamma$-coin data.

^{76}Kr Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0.0[&]	0^+		
423.9[&] *2*	2^+	25.2 ps *10*	$T_{1/2}$: from RDDS. Weighted average of 28.8 ps *6* (2005Go43), 21.5 ps *21* (1998Sk01), 26.1 ps *21* (1990He04), 24.9 ps *7* (1984Wo10), 24.3 ps *21* (1982Ke01), 23.6 ps *14* (priv comm quoted by 1984Wo10), assuming a minimum uncertainty of 5% to account for systematic uncertainties. Other: 37 ps *5* (1974No08) is in disagreement with more recent measurements. Q(transition)=2.90 *4*, 2.60 *11*, 2.39 *10*, 2.66 *13*, 2.53 *17* (1989Gr21, deduced from transitions up to 10^+). This leads to β_2=0.33 *1* for the yrast band. Q(transition)=3.1 *3* (1998Sk01).
769.6? *6*	0^+		Level shown by 1982Pi01 only.
1034.5[&] *3*	4^+	2.52 ps *16*	$T_{1/2}$: weighted average (NRM) of 2.54 ps *6* (RDDS,2005Go43), 2.08 ps *21* (RDDS,1998Sk01), 3.4 ps *3* (RDDS,1984Wo10); 3.5 ps *14* (DSA,1982Pi01); 2.9 ps *7* (RDDS,1982WiZS), assuming a minimum uncertainty of 5% to account for systematic uncertainties. Others: 5.7 ps *16* (RDDS,1974No08), 4.30 ps *14* (RDDS,effective half-life, 1982Ke01). Q(transition)=3.3 *3* (1998Sk01).
1221.6[a] *4*	2^+	≈1 ps	$T_{1/2}$: estimated from RDDS (1982Ke01).
1687.6 *12*	2^+		E(level): from 1982Pi01 only.
1733.4[a] *7*	3^+	≈1 ps	$T_{1/2}$: estimated from RDDS (1982Ke01).
1859.0[&] *7*	6^+	0.81 ps *8*	$T_{1/2}$: weighted average of 0.67 ps *20* (RDDS,2005Go43); 0.55 ps *21* (RDDS, 1998Sk01); 0.82 ps *9* (DSA,1989Gr21); 1.04 ps *14* (RDDS,1984Wo10); 0.87 ps *8* (DSA,1982Pi01); 0.55 ps *14* (RDDS,1982WiZS). Q(transition)=2.9 *11* (1998Sk01).
1957.2[a] *4*	4^+	0.90[#] ps *28*	$T_{1/2}$: other: ≈1.0 ps (RDDS,1982Ke01).

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^{66}Zn(^{12}C,2nγ),^{58}Ni(^{24}Mg,α2pγ) 1982Pi01,1989Gr21,1988Ka28 (continued)

^{76}Kr Levels (continued)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
2226.8[b] *6*	2^-		E(level): level from 1989Gr21 only.
2257.7[c] *7*	3^-		E(level): from 1989Gr21 only.
2452.0[a] *5*	5^+	0.76[#] ps *28*	
2622.0[b] *6*	$4^{(-)}$		
2682.7[c] *8*	(5^-)		
2762.9[a] *6*	(6^+)		
2878.7[&] *7*	8^+	0.22 ps *2*	$T_{1/2}$: weighted average of 0.23 ps *2* (DSA,1989Gr21); 0.208 ps *21* (DSA,1982Pi01); 0.22 ps *3* (RDDS,1982WiZS). Other: 0.31 ps *5* (DSA,1984Wo10,effective half-life).
3175.2[b] *8*	$6^{(-)}$		
3287.5[c] *7*	(7^-)	1.80[@] ps *+76−44*	$T_{1/2}$: other: 0.256 ps *42* (DSAM,1982Pi01). Q(transition)=4.5 *7* (1999Mu21).
3332.0[a] *8*	7^+	0.71[#] ps *21*	
3571.0[a] *9*	(8^+)		
3901.9[b] *13*	$8^{(-)}$	1.12[@] ps *+28−19*	Q(transition)=2.99 *+29−32* (1999Mu21).
4067.9[&] *12*	10^+	0.104 ps *14*	$T_{1/2}$: from DSA method. Weighted average of 0.097 ps *14* (1982Pi01) and 0.12 ps *3* (1982WiZS). Others (effective half-lives): 0.56 ps *11* (1989Gr21), 0.14 ps *4* (1984Wo10).
4071.9[c] *12*	(9^-)	0.56[@] ps *+9−8*	$T_{1/2}$: other from 1982Pi01: 0.35 ps *8* (effective half-life from DSAM), 0.111 ps *42* (from DSAM by gating from above). Q(transition)=3.66 *27* (1999Mu21).
4403.0[a] *13*	(9^+)	0.29[#] ps *7*	
4807.6[b] *14*	(10^-)	0.55[@] ps *+12−16*	Q(transition)=2.34 *+43−22* (1999Mu21).
5050.4[c] *10*	(11^-)	0.163 ps *27*	$T_{1/2}$: from DSAM. Weighted average of 0.12 ps *5* (1982Pi01) and 0.180 ps *+35−28* (1999Mu21). Q(transition)=3.80 *+41−37* from averaged $T_{1/2}$=0.15 ps (1999Mu21).
5347.0[&] *15*	12^+	0.166[#] ps *35*	
5874.2[b] *14*	(12^-)	0.173[@] ps *+35−28*	Q(transition)=2.71 *+25−23* (1999Mu21).
6219.2[c] *12*	(13^-)	0.090[@] ps *28*	$T_{1/2}$: Other: 0.24 ps *6* (effective half-life from DSAM,1982Pi01). Q(transition)=3.06 *+62−38* (1999Mu21).
6647.0[&] *16*	14^+		
7109.7[b] *15*	(14^-)	<0.19[@] ps	Q(transition)>1.75 (1999Mu21).
7577.2[c] *14*	(15^-)	<0.14[@] ps	Q(transition)>1.67 (1999Mu21).
7996.3[&] *18*	16^+		
8520.9[b] *18*	(16^-)		
9110.7[c] *15*	(17^-)		
9396.0[&] *19*	18^+		
10056.4[b] *21*	(18^-)		
10631.7[c] *15*	(19^-)		E(level): 1988Ka28 show a 1521γ deexciting a 17^- level, and a 1532γ deexciting a 19^- level of the same band, but no 1521γ is observed by 1989Gr21; instead, a 1533.5γ (probably the same as 1532γ from 1988Ka28) is suggested (1989Gr21) to deexcite 17^- level and a 1615γ a 19^- level. Ordering of the 1615-1521-1536 cascade is based on results in 2005Va09 in ^{40}Ca(^{40}Ca,4pγ).
10930[&] *3*	20^+		
11650?[b] *3*	(20^-)		
12246.7?[c] *20*	(21^-)		See comment for 10631.7, (19^-) level.
12686[&] *3*	22^+		

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^{66}Zn(^{12}C,2nγ),^{58}Ni(^{24}Mg,α2pγ) 1982Pi01,1989Gr21,1988Ka28 (continued)

^{76}Kr Levels (continued)

E(level)[†]	J$^{\pi}$[‡]
13347?[b] *4*	(22$^-$)
14735?[&] *3*	24$^+$

† From a least-squares fit to Eγ data.
‡ From Adopted Levels.
# Effective half-life from DSA method (1982Pi01), not corrected for side feeding.
@ From DSAM (1999Mu21).
& Band(A): Yrast band. Band crossings are attributed to alignments of pairs of $g_{9/2}$ protons and neutrons (1989Gr21). Q(intrinsic)=2.90 *4* (1989Gr21).
[a] Band(B): $K^{\pi}=2^+$, γ-band.
[b] Band(C): Band based on (2$^-$),α=0. Configuration=π3/2[431]$\otimes\pi$3/2[312] (1989Gr21).
[c] Band(D): Band based on 3$^-$,α=1. Configuration=π3/2[431]$\otimes\pi$3/2[312] (1989Gr21).

γ(^{76}Kr)

A_2 and A_4 values are from 1982Pi01.

E$_\gamma$[†]	I$_\gamma$[‡]	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Mult.[#]	δ[#]	Comments
345.7[@] *5*	1.0 *1*	769.6?	0$^+$	423.9	2$^+$			A_2=+0.06 *5*, A_4=−0.06 *7* from (346γ)(424γ)(θ).
395.2[a] *6*		2622.0	4$^{(-)}$	2226.8	2$^-$			
423.9 *2*	100 *10*	423.9	2$^+$	0.0	0$^+$	E2		A_2=+0.31 *1*; A_4=−0.14 *1*
425[a] *1*		2682.7	(5$^-$)	2257.7	3$^-$			
553.1 *6*		3175.2	6$^{(-)}$	2622.0	4$^{(-)}$			
604.9 *5*	5.0 *5*	3287.5	(7$^-$)	2682.7	(5$^-$)	E2		A_2=+0.38 *5*; A_4=−0.29 *7*
610.6 *2*	85 *9*	1034.5	4$^+$	423.9	2$^+$	E2		A_2=+0.36 *1*, A_4=−0.15 *1* from (611γ)(424γ)(θ).
719.9 *10*	4.0 *4*	2452.0	5$^+$	1733.4	3$^+$			
723.5 *10*	5.0 *5*	3175.2	6$^{(-)}$	2452.0	5$^+$			
726.7 *10*	5.0 *5*	3901.9	8$^{(-)}$	3175.2	6$^{(-)}$			
736.0[&] *5*	4.0 *4*	1957.2	4$^+$	1221.6	2$^+$	E2		A_2=+0.28 *3*; A_4=−0.18 *4*
784.4 *4*	4.0 *4*	4071.9	(9$^-$)	3287.5	(7$^-$)			
797.7[&] *5*	6.0 *6*	1221.6	2$^+$	423.9	2$^+$	(M1+E2)	+0.2 *1*	δ: from (798γ)(424γ)(θ).
805.7[&] *5*	2.0 *2*	2762.9	(6$^+$)	1957.2	4$^+$			
808 *1*	2.0 *2*	3571.0	(8$^+$)	2762.9	(6$^+$)			
824.4 *7*	50 *5*	1859.0	6$^+$	1034.5	4$^+$	E2		A_2=+0.30 *2*, A_4=−0.14 *2* from (824γ)(611γ)(θ) and (824γ)(424γ)(θ).
879.9[&] *5*	3.0 *3*	3332.0	7$^+$	2452.0	5$^+$			
887 *1*		2622.0	4$^{(-)}$	1733.4	3$^+$			γ from 1988Ka28 only.
905.5 *5*	≤2	4807.6	(10$^-$)	3901.9	8$^{(-)}$			
918[@] *1*	<1	1687.6	2$^+$	769.6?	0$^+$			
922.6[@] *5*	7.0 *7*	1957.2	4$^+$	1034.5	4$^+$	M1+E2	−0.84 *5*	δ: A_2=−0.19 *2*, A_4=−0.22 *3* from γ(θ). Other: −1.0 *5* from (923γ)(424γ)(θ).
978.5 *6*	<1	5050.4	(11$^-$)	4071.9	(9$^-$)			
1005[a] *1*		2226.8	2$^-$	1221.6	2$^+$			
1019.7 *2*	18 *2*	2878.7	8$^+$	1859.0	6$^+$	E2		A_2=+0.39 *2*, A4=−0.13 *2* from (1020γ)(825γ)(θ) and (1020γ)(424γ)(θ).
1036[a] *1*		2257.7	3$^-$	1221.6	2$^+$			

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^{66}Zn(^{12}C,2nγ),^{58}Ni(^{24}Mg,α2pγ) 1982Pi01,1989Gr21,1988Ka28 (continued)

γ(^{76}Kr) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	Comments
1066.6 *4*		5874.2	(12$^-$)	4807.6	(10$^-$)			
1071[&] *1*	<1	4403.0	(9$^+$)	3332.0	7$^+$			
1168.8 *6*	<1	6219.2	(13$^-$)	5050.4	(11$^-$)			
1189.2 *10*	9.0 *9*	4067.9	10$^+$	2878.7	8$^+$	E2		A_2=+0.30 *2*; A_4=−0.16 *3*
1221.8[&] *5*	3.0 *3*	1221.6	2$^+$	0.0	0$^+$	E2		A_2=+0.52 *4*; A_4=−0.12 *5*
1235.5 *5*		7109.7	(14$^-$)	5874.2	(12$^-$)			
1279.1 *9*	4.0 *4*	5347.0	12$^+$	4067.9	10$^+$			
1300.0 *6*		6647.0	14$^+$	5347.0	12$^+$			
1309.2 *10*	10 *1*	1733.4	3$^+$	423.9	2$^+$	(M1+E2)	+0.38 *4*	A_2=+0.24 *3*, A_4=−0.02 *2*; δ from (1309γ)(424γ)(θ).
1349.2 *7*		7996.3	16$^+$	6647.0	14$^+$			
1358.0 *6*		7577.2	(15$^-$)	6219.2	(13$^-$)			
1399.7 *7*		9396.0	18$^+$	7996.3	16$^+$			
1411.2 *10*		8520.9	(16$^-$)	7109.7	(14$^-$)			
1417.2[&] *5*	4.0 *4*	2452.0	5$^+$	1034.5	4$^+$	M1+E2	+4 *2*	δ: from A_2=+0.34 *4*, A_4=+0.20 *5* from (1417γ)(611γ)(θ).
1428.5 *5*	4.0 *4*	3287.5	(7$^-$)	1859.0	6$^+$	D(+Q)	0.00 *4*	A_2=−0.31 *4*; A_4=+0.05 *5*
1521		10631.7	(19$^-$)	9110.7	(17$^-$)			
1532.9[@] *5*	2.0 *2*	1957.2	4$^+$	423.9	2$^+$			
1533.5 *6*		9110.7	(17$^-$)	7577.2	(15$^-$)			
1534.2 *20*		10930	20$^+$	9396.0	18$^+$			
1535.6 *10*		10056.4	(18$^-$)	8520.9	(16$^-$)			
1588.8 *10*		2622.0	4$^{(-)}$	1034.5	4$^+$			
1593[b] *2*		11650?	(20$^-$)	10056.4	(18$^-$)			
1615[ab]		12246.7?	(21$^-$)	10631.7	(19$^-$)			
1648.4 *20*	7.0 *7*	2682.7	(5$^-$)	1034.5	4$^+$	D+Q	+0.04 *3*	A_2=−0.21 *3*; A_4=−0.07 *5*
1697[ab] *2*		13347?	(22$^-$)	11650?	(20$^-$)			
1712[@] *1*	<1	3571.0	(8$^+$)	1859.0	6$^+$			
1755.5 *10*		12686	22$^+$	10930	20$^+$			
1803[a] *1*		2226.8	2$^-$	423.9	2$^+$			
1834[a] *1*		2257.7	3$^-$	423.9	2$^+$			
2049[ab]		14735?	24$^+$	12686	22$^+$			

[†] From 1989Gr21, unless otherwise stated.
[‡] From 1982Pi01. Detailed values are not available from any other study; authors give general $\Delta I\gamma\approx 5\%$. Evaluators assign 10% for each Iγ value. 1982Ke01 in ^{63}Cu(^{19}F,α2nγ),E=58 MeV give relative intensities of g.s. transitions from 424, 770, 1035, 1221, 1733 and 3 *2*, 71 *9*, 10 *2*, 15 *4* and 4 *2*, respectively, relative to 100 for 1957γ. Intensities of γ rays in three bands (yrast band, K^π=1$^-$ odd J, K^π=1$^-$ even J) are given by 1989Gr21 from $\gamma\gamma$-coin spectra and the ordering of the transitions in the cascades is based on such intensities.
[#] From $\gamma(\theta)$ (1982Pi01) and RUL for E2 and M2 transitions.
[@] From 1982Pi01. Uncertainty=0.5 or 1 is assigned by evaluators for values quoted to tenth keV and keV, respectively.
[&] Weighted average of available values. Uncertainty=0.5 or 1 assigned by the evaluators.
[a] γ reported by 1989Gr21 only.
[b] Placement of transition in the level scheme is uncertain.

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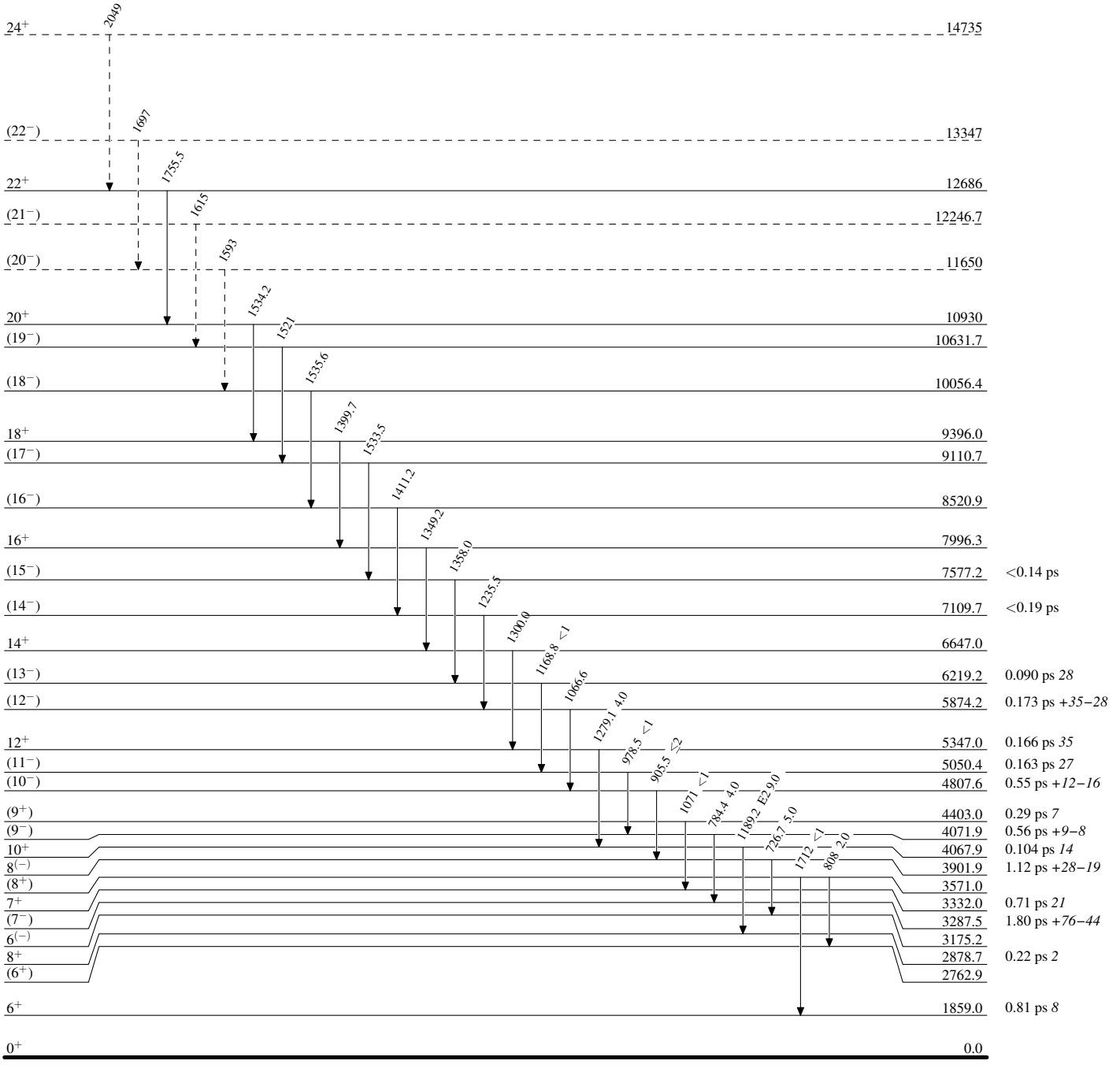
Legend

Level Scheme

Intensities: Relative I_γ

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



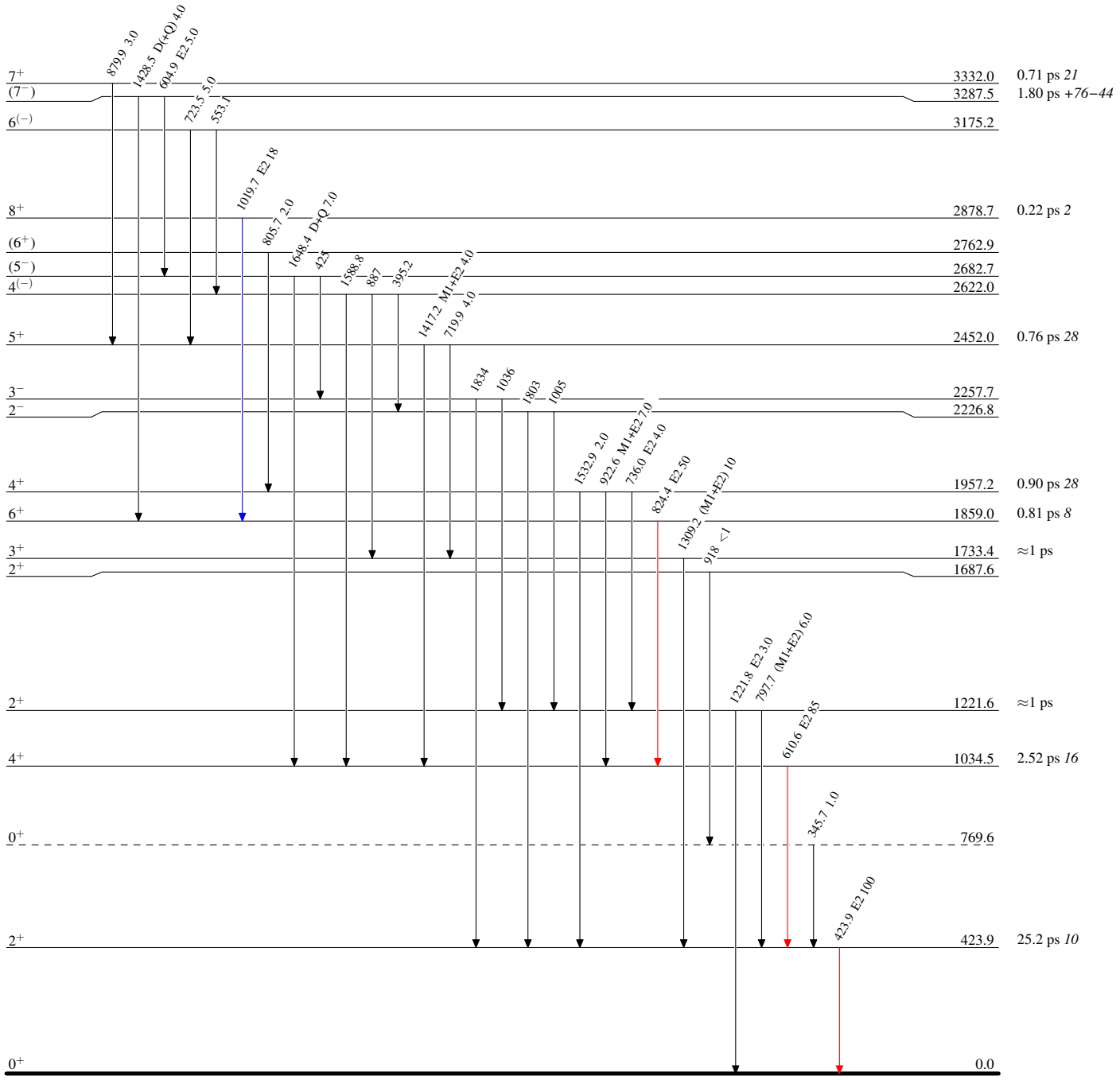
$^{76}_{36}Kr_{40}$

^{66}Zn(^{12}C,2nγ),^{58}Ni(^{24}Mg,α2pγ) 1982Pi01,1989Gr21,1988Ka28

Level Scheme (continued)

Intensities: Relative I_γ

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



$^{76}_{36}Kr_{40}$

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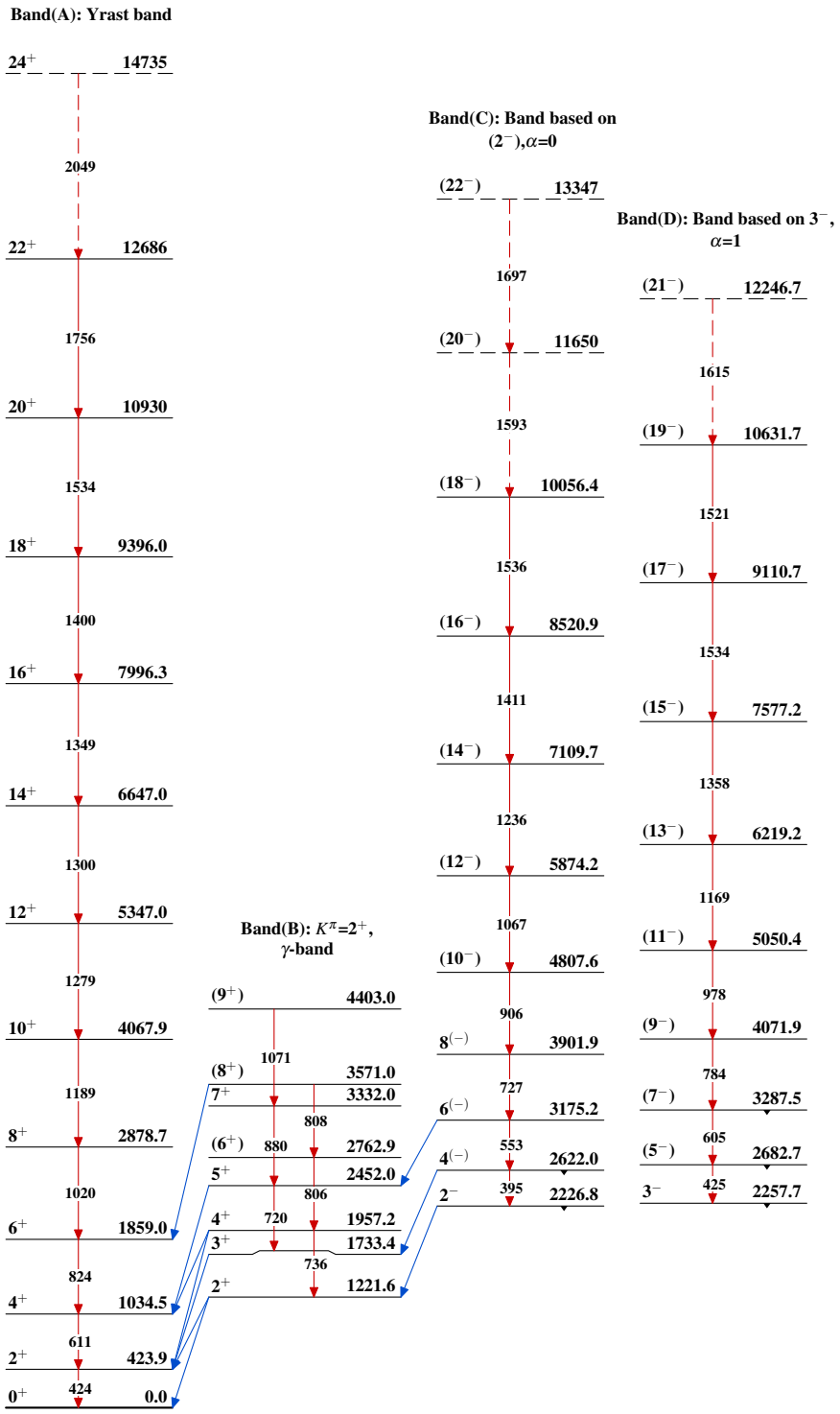

$^{76}_{36}Kr_{40}$