^{76}Se(α,2nγ) 1985Wi01,1982An06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Ameenah R. Farhan, Balraj Singh	NDS 110, 1917 (2009)	30-Jun-2009

1985WI01: Measured Eγ, lifetimes by DSAM and recoil-distance Doppler-shift (RDDS) methods.

1982An06 (many authors are common with 1985Wi01): Measured Eγ, Iγ, Measured lifetimes by line shapes, DSAM and recoil-distance Doppler-shift (RDDS) methods.

Others:

1973Wy01 (also 1971WyZW thesis): E=27.5 MeV. ce data.

1971Mc12 (also 1970McZS thesis): ^{76}Se(α,2nγ) E=30 MeV; ^{77}Se(α,3nγ) E=35 MeV; ^{78}Se(α,4nγ) E=65 MeV. Measured Eγ, Iγ, $\gamma\gamma$. The $\gamma(\theta)$ data were obtained from (α,2nγ) reaction. The ground-state band established up to 10^+ with γ cascade 1110-1015-858-664-454.

Additional information 1.

α measurements are from 1973Wy01 who report α values for intense transitions in in-beam ce measurements. Authors use α(K)=3.75×10^{-3} for 455γ of E2 mult as a reference for other transitions.

^{78}Kr Levels

E(level)[†]	J$^\pi$[a]	T$_{1/2}$[‡]	Comments
0.0[b]	0$^+$		
454.9[b] 4	2$^+$	22.9[&] ps 21	
1119.1[b] 5	4$^+$	2.56[&] ps 35	
1147.3[c] 4	2$^+$	3.1[#&] ps 6	
1564.3[c] 5	3$^+$	5.1[#&] ps 4	
1872.0[c] 5	4$^+$	2.1[#&] ps 7	
1977.3[b] 6	6$^+$	0.59 ps 14	T$_{1/2}$: average of 0.48 ps 14 (DSAM) and 0.69 ps 14 (RDDS) (1985Wi01). Additional information 2.
2299.1[c] 6	5$^+$	1.1[#&] ps 3	
2398.8[d] 8	3$^-$	0.62[@] ps 14	
2730.1[c] 7	(6$^+$)	1.4[#&] ps 7	
2749.0[d] 6	5$^-$	0.76[@] ps +62−28	
2763.4[e] 6	(4$^-$)	2.08 ps 35	T$_{1/2}$: effective half-life (1985Wi01) from RDDS method. Other: >1.4 ps from DSAM (1985Wi01).
2993.0[b] 7	8$^+$	0.25[@] ps 4	T$_{1/2}$: 0.30 ps +10−7 (DSAM,1982An06).
3063.7 8		1.0[#@] ps +8−4	J$^\pi$: (5$^-$) in 'Adopted Levels'.
3202.0[c] 6	(7$^+$)	0.62[#@] ps 21	T$_{1/2}$: 0.38 ps 14 (DSAM,1982An06).
3219.5[e] 6	(6$^-$)	4.9[&] ps 14	Additional information 3.
3287.6[d] 7	7$^-$	1.94[&] ps 21	
3606.8 7	7$^-$	1.9[#@] ps 5	J$^\pi$: (8$^+$) In 1982An06.
3705.3 8	(7$^+$)		J$^\pi$: (7$^-$) in 'Adopted Levels'.
3768.8[c] 9	(8$^+$)	0.190[#] ps 35	T$_{1/2}$: weighted average of 0.16 ps 5 (line shape), 0.208 ps 35 (DSAM In (α,2nγ)) and 0.187 ps 35 (DSAM In (^{12}C,2nγ)) (1982An06).
3772.3? 8		0.62[#@] ps +49−21	
3793.3 8		>0.7[#@] ps	
3918.0[e] 7	(8$^-$)	0.83[&] ps 35	Additional information 4.
4027.9[d] 7	(9$^-$)	1.05 ps 35	T$_{1/2}$: average of 0.97 ps 35 (DSAM) and 1.2 ps 5 (RDDS) (1985Wi01). Additional information 5.
4105.6[b] 7	(10$^+$)	0.208[@] ps 35	T$_{1/2}$: 0.097 ps 28 (DSAM In (α,2nγ)) (1982An06).
4253.2[c] 8	(9$^+$)	0.08[#@] ps 3	Additional information 6.
4396.3 7	(10$^+$)	0.146[@] ps 28	T$_{1/2}$: 0.08 ps +5−4 (DSAM In (α,2nγ)) (1982An06).

Continued on next page (footnotes at end of table)

^{76}Se(α,2nγ) 1985Wi01,1982An06 (continued)

^{78}Kr Levels (continued)

E(level)[†]	J$^\pi$[a]	T$_{1/2}$[‡]	Comments
4807.9[e] *8*	(10$^-$)	1.25[@] ps *35*	T$_{1/2}$: 1.11 ps *35* (RDDS, effective half-life,1985Wi01). Additional information 7.
4953.3[c] *10*	(10$^+$)	0.45[#@] ps *17*	T$_{1/2}$: 0.12 ps *6* (DSAM) (1982An06).
4964.8[d] *9*	(11$^-$)	0.38 ps *7*	T$_{1/2}$: 0.44 ps *+23−15* (DSAM,1982An06).
5217.7[b] *8*	(12$^+$)	0.17[@] ps *10*	
5442.7[c] *10*	(11$^+$)	0.24[#@] ps *10*	T$_{1/2}$: 0.18 ps *9* (DSAM,1982An06).
6480.7[b] *10*	(14$^+$)		

[†] From least-squares fitting to Eγ's, assuming Δ(Eγ)=0.5 keV for each γ ray.
[‡] 1985Wi01 and 1982An06 measured lifetimes by line shapes and DSAM (τ< 2 ps) and by recoil-distance Doppler-shift (RDDS) methods for longer lifetimes. Values are from 1985Wi01 whenever available. Many values are similar in 1982An06 The information about half-lives is the same in this dataset and in (^{12}C,2nγ) E=36 MeV.
[#] From 1982An06.
[@] From DSAM, includes line shape analysis.
[&] From RDDS.
[a] As proposed by 1982An06 based on earlier J$^\pi$ assignments for low-lying levels and their $\gamma(\theta)$ data and band assignments. The assignments are about the same In 'Adopted Levels', except that some are given In parentheses there.
[b] Band(A): g.s. band.
[c] Band(B): γ band.
[d] Band(C): 3$^-$ band.
[e] Band(D): 4$^-$ band.

γ(^{78}Kr)

A$_2$ and A$_4$ are from 1985Wi01, when only A$_2$ is given, A$_4$ was not included In the fitting procedure.

E$_\gamma$[†]	I$_\gamma$[‡]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[#]	Comments
290.1	1.0	4396.3	(10$^+$)	4105.6	(10$^+$)		I$_\gamma$: Iγ(290γ)/Iγ(1403γ)=12 *4*/88 *12* (1985Wi01). A$_2$=+0.40 *20*.
350.2	0.3	2749.0	5$^-$	2398.8	3$^-$		I$_\gamma$: Iγ(350)/Iγ(1630γ)=4 *2*/96 *10* (1985Wi01).
417.0	2.0	1564.3	3$^+$	1147.3	2$^+$		
445.0	0.6	1564.3	3$^+$	1119.1	4$^+$		
454.9	100	454.9	2$^+$	0.0	0$^+$	E2	σ(at 30 MeV α)=0.99 b *10* (1971Mc12). Additional information 8. A$_2$=+0.26 *2*, A$_4$=−0.05 *2*.
456	<0.5	3219.5	(6$^-$)	2763.4	(4$^-$)		I$_\gamma$: Iγ(456)/Iγ(920)=<10/>38 (1985Wi01).
470.4	1.4	3219.5	(6$^-$)	2749.0	5$^-$		Additional information 14. A$_2$=−0.38 *7*. I$_\gamma$: Iγ(470)/Iγ(920)=>14/>38 (1985Wi01).
488[&]		3219.5	(6$^-$)	2730.1	(6$^+$)		
538.7	3.9	3287.6	7$^-$	2749.0	5$^-$		Iγ(539)/Iγ(1310)=43 *4*/57 *6* (1985Wi01). Additional information 15. A$_2$=+0.36 *5*, A$_4$=−0.09 *7*.
613.8	1.5	3606.8	7$^-$	2993.0	8$^+$		
664.2	69	1119.1	4$^+$	454.9	2$^+$	E2	σ(at 30 MeV α)=0.78 b *8* (1971Mc12). A$_2$=+0.30 *2*, A$_4$=−0.08 *3*. Additional information 9.

Continued on next page (footnotes at end of table)

^{76}Se(α,2nγ) 1985Wi01,1982An06 (continued)

$\gamma(^{78}Kr)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
692.7	9.3	1147.3	2^+	454.9	2^+		
698.4	4.4	3918.0	(8^-)	3219.5	(6^-)	E2	Additional information 17. A_2=+0.25 *8*, A_4=−0.04 *9*.
716	0.3	3918.0	(8^-)	3202.0	(7^+)		I_γ: Iγ(716)/Iγ(698)=6 *3*/94 *15* (1985Wi01).
724.8	5.5	1872.0	4^+	1147.3	2^+		
734.8	6.4	2299.1	5^+	1564.3	3^+		
740.1	5.7	4027.9	(9^-)	3287.6	7^-	E2	Additional information 18. A_2=+0.27 *4*, A_4=−0.10 *6*.
753.1	3.3	1872.0	4^+	1119.1	4^+		
753.1[&]	1.4	2730.1	(6^+)	1977.3	6^+		
790		4396.3	(10^+)	3606.8	7^-		
821	0.2	5217.7	(12^+)	4396.3	(10^+)		I_γ: Iγ(821γ)/Iγ(1112.5γ from 5217 level)=9 *4*/91 *20* from $\gamma\gamma$ (1985Wi01).
858	7.0	2730.1	(6^+)	1872.0	4^+		
858.4	40	1977.3	6^+	1119.1	4^+	E2	σ(at 30 MeV α)=0.56 b *6* (1971Mc12). Additional information 10. A_2=+0.29 *4*, A_4=−0.08 *5*.
889.9	2.0	4807.9	(10^-)	3918.0	(8^-)		Additional information 21. A_2=+0.25 *12*, A_4=−0.07 *15* (1985Wi01).
902.7	4.4	3202.0	(7^+)	2299.1	5^+		
920.5	1.8	3219.5	(6^-)	2299.1	5^+		A_2=−0.40 *20*.
925		3918.0	(8^-)	2993.0	8^+		
936.9	2.7	4964.8	(11^-)	4027.9	(9^-)	(E2)	Additional information 22. A_2=+0.25 *14*.
1015.4	18.6	2993.0	8^+	1977.3	6^+	E2	α(K)exp=0.00015 *4* (1973Wy01) σ(at 30 MeV α)=0.35 b *3* (1971Mc12). Additional information 13. A_2=+0.38 *7*, A_4=−0.09 *9*.
1035		4027.9	(9^-)	2993.0	8^+		
1038.7	1.4	3768.8	(8^+)	2730.1	(6^+)		
1051.2	1.0	4253.2	(9^+)	3202.0	(7^+)		
1086.4	1.0	3063.7		1977.3	6^+		
1109.5	9.5	1564.3	3^+	454.9	2^+		α(K)exp=0.00033 *8* (1973Wy01) for 1110+1112 doublet, consistent with E2 or M1 assignment.
1112.5[@]	8.0[@]	4105.6	(10^+)	2993.0	8^+	E2	σ(at 30 MeV α)=0.169 b *17* (1971Mc12). A_2=+0.35 *10*, A_4=−0.15 *12*. Additional information 19.
1112.5[@]	2.0[@]	5217.7	(12^+)	4105.6	(10^+)		
1147.3	4.3	1147.3	2^+	0.0	0^+		
1180.0	2.3	2299.1	5^+	1119.1	4^+		
1184.5	0.8	4953.3	(10^+)	3768.8	(8^+)		
1189.4	0.7	5442.7	(11^+)	4253.2	(9^+)		
1199.2	1.5	2763.4	(4^-)	1564.3	3^+		Additional information 12. A_2=−0.28 *9*.
1225		3202.0	(7^+)	1977.3	6^+		
1242.1	1.8	3219.5	(6^-)	1977.3	6^+		I_γ: Iγ(1242)/Iγ(920)=>38/>38 (1985Wi01). A_2=+0.43 *6*.
1263		6480.7	(14^+)	5217.7	(12^+)		
1310.1	7.2	3287.6	7^-	1977.3	6^+	D	Additional information 16. A_2=−0.29 *4*, A_4=+0.06 *5*.
1402.8	2.2	4396.3	(10^+)	2993.0	8^+		Additional information 20. A_2=+0.32 *6*, A_4=−0.10 *8*. I_γ: see 290.1γ. Transition is placed from the 4396 level by 1985Wi01 and 1982An06. A 1402.5γ is placed by 1989Gr21 from an 8469 level. The 8469 level would not likely have been populated by 1985Wi01 or 1982An06.

Continued on next page (footnotes at end of table)

^{76}Se(α,2nγ) 1985Wi01,1982An06 (continued)

$\gamma(^{78}Kr)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
1416.9		1872.0	4^+	454.9	2^+		
1629.8	8.0	2749.0	5^-	1119.1	4^+	D	Additional information 11. A_2=−0.26 *3*, A_4=−0.03 *5*.
1630.0	2.3	3606.8	7^-	1977.3	6^+		
1644.0	1.1	2763.4	(4^-)	1119.1	4^+		I_γ: Iγ(1644)/Iγ(1199)=43 *5*/57 *7* (1985Wi01). A_2=+0.33 *13*.
1728		3705.3	(7^+)	1977.3	6^+		
1795	1.2	3772.3?		1977.3	6^+		
1816	1.0	3793.3		1977.3	6^+		
1944 *2*	2.0	2398.8	3^-	454.9	2^+		A_2=−0.24 *12*.

[†] From 1985Wi01 and/or 1982An06. Values are nearly the same in the two papers. If available, value given here is from 1985Wi01.
[‡] From 1982An06. 1985Wi01 list branching ratios.
[#] From $\gamma(\theta)$ and RUL (for E2 and M2 transitions).
[@] Multiply placed with intensity suitably divided.
[&] Placement of transition in the level scheme is uncertain.

^{76}Se(α,2nγ) 1985Wi01,1982An06

Level Scheme

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

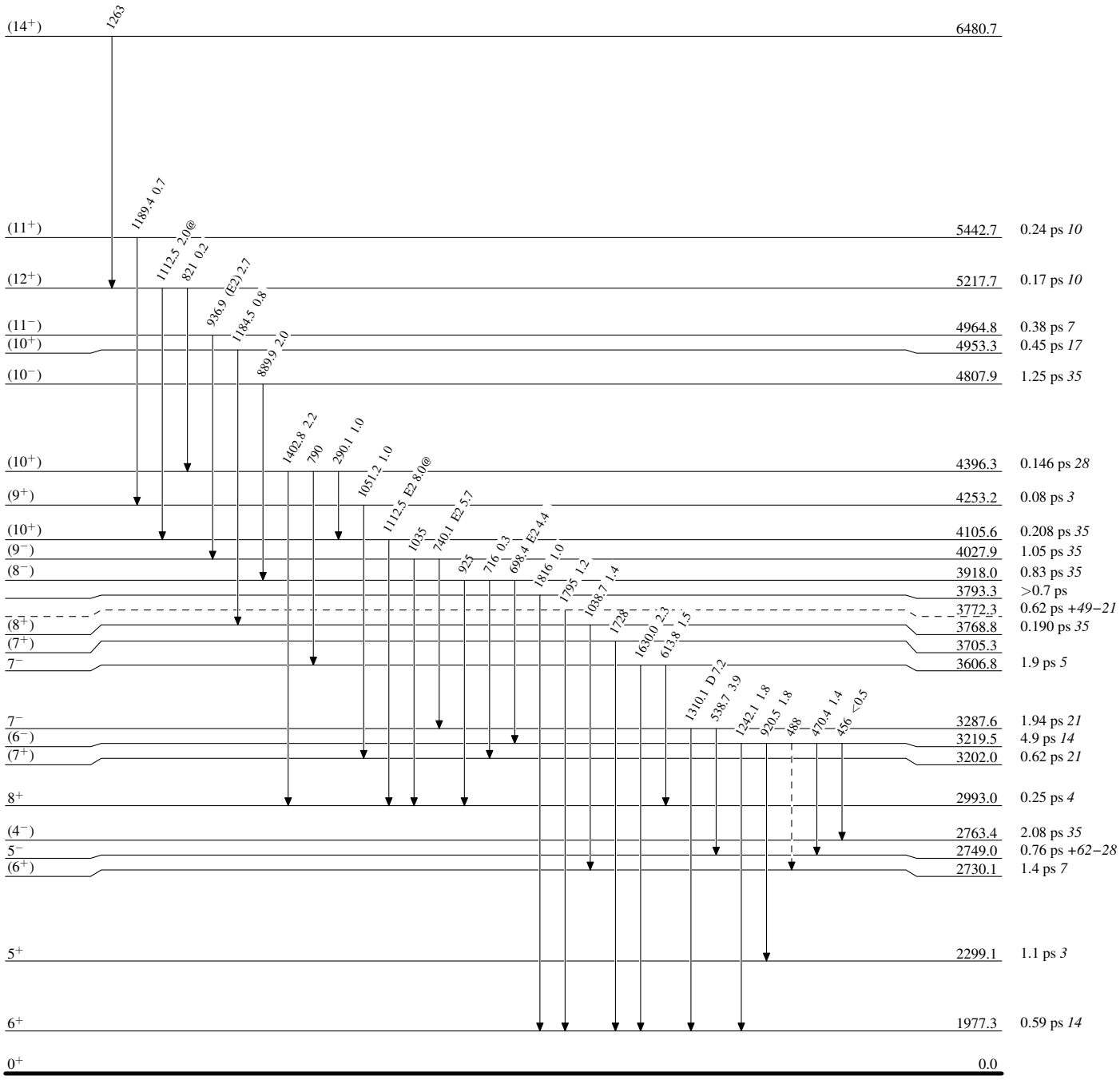
Legend

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

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

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

γ Decay (Uncertain)



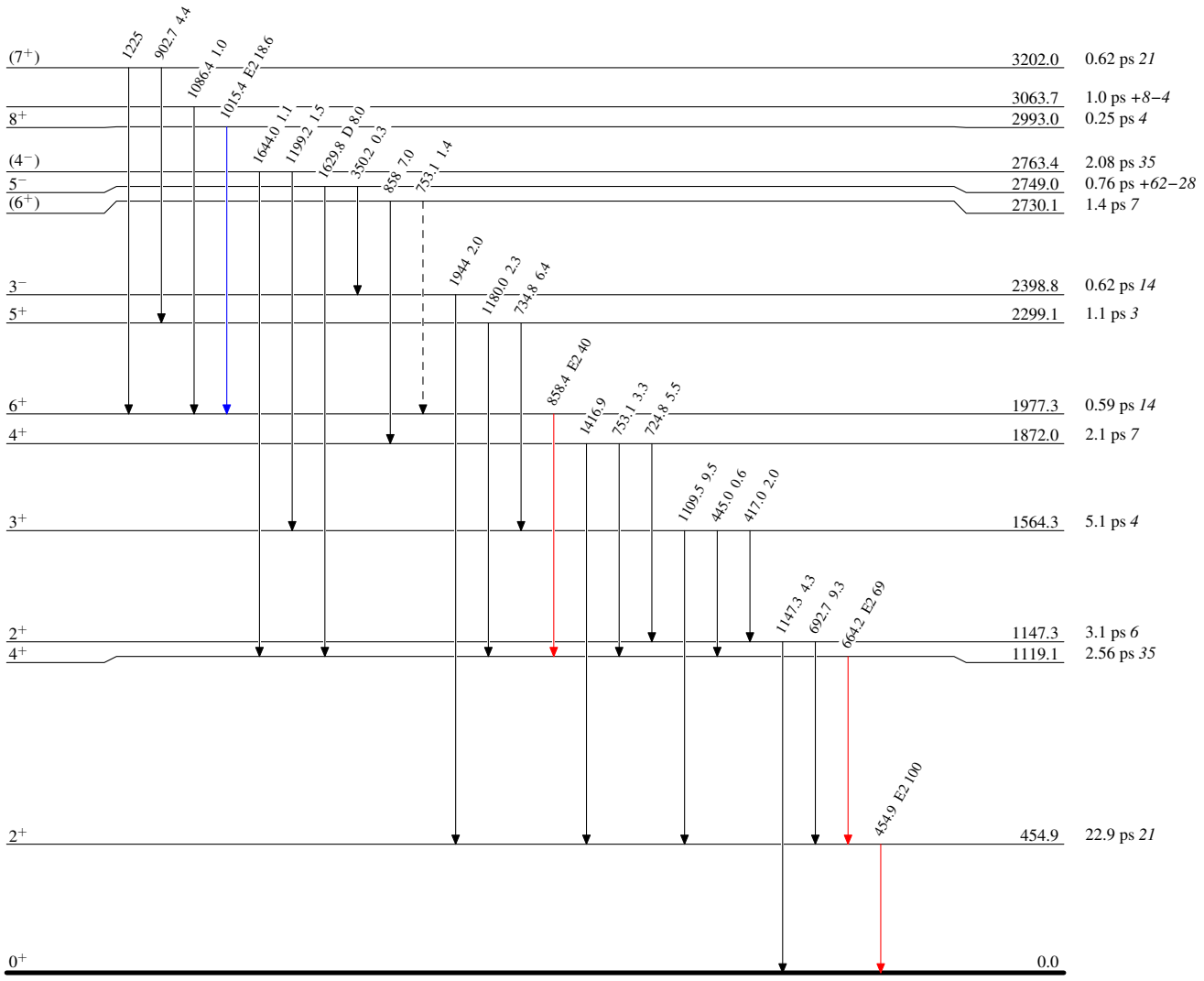
$^{78}_{36}Kr_{42}$

^{76}Se(α,2nγ) 1985Wi01,1982An06

Level Scheme (continued)

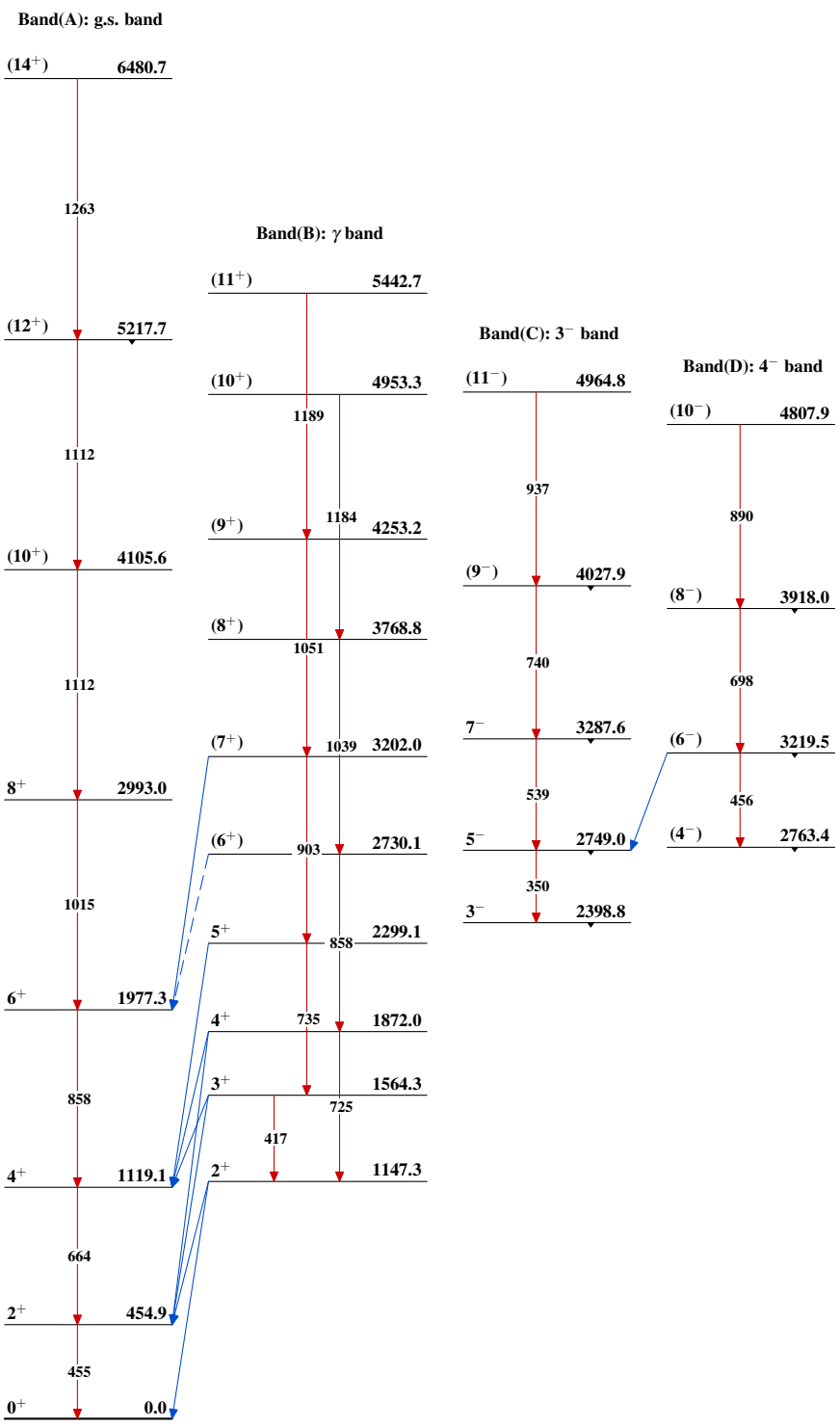
Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

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



$^{78}_{36}Kr_{42}$

^{76}Se(α,2nγ) 1985Wi01,1982An06



$^{78}_{36}Kr_{42}$