Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	30-Sep-2020

Q(β^-)=−5339.0 *24*; S(n)=9227 *4*; S(p)=7169 *10*; Q(α)=−4367 *8* 2017Wa10
S(2n)=21988 *8*, S(2p)=12577.9 *20* (2017Wa10).
1948Wo07: ^{77}Kr isotope identified and produced in ^{74}Se(α,n) reaction, and subsequent counting of β and γ spectra.
Mass measurements: 2006Ro11 and 2002He23 (Penning-trap method), 1987Mo06.
Additional information 1.
Hyperfine structure measurements (laser spectroscopy): 1996Li25, 1995Ke04, 1993ArZW, 1992Ne09.
Theoretical calculations: consult the NSR database at www.nndc.bnl.gov for 13 primary theory references dealing with nuclear structure calculations.

^{77}Kr Levels

Cross Reference (XREF) Flags

A	^{77}Rb ε decay (3.78 min)	F	^{63}Cu(^{16}O,pnγ) E=42 MeV
B	^{48}Ti(^{32}S,2pnγ)	G	^{78}Kr(p,d)
C	^{52}Cr(^{28}Si,2pnγ)	H	^{78}Kr(pol d,t)
D	^{58}Ni(^{29}Si,2α2pγ)	I	^{80}Kr(^{3}He,^{6}He)
E	^{63}Cu(^{16}O,pnγ) E=49-58 MeV		

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
0.0[@]	5/2$^+$	71.25 min *42*	ABCDEFGH	%ε+%β^+=100 μ=−0.583 *3* (1995Ke04,2019StZV) Q=+0.948 *10* (1995Ke04,2016St14) Evaluated charge radius <r^2>$^{1/2}$=4.2082 fm *37* (2013An02). Evaluated δ<r^2>(^{86}Kr,^{77}Kr)=0.209 fm^2 *5* (2013An02). J$^\pi$: hyperfine structure (1995Ke04); L+1/2 and L=2 in (pol d,t). μ,Q: from hyperfine-structure measurement using collinear fast-beam LASER spectroscopy (1995Ke04). Δ<r^2>(^{86}Kr−^{77}Kr)=0.209 fm^2 *5* (1995Ke04). The uncertainty is statistical. Total uncertainty including systematic errors is 0.060 fm^2 (1995Ke04); rms charge radius=4.2082 fm *16* (1995Ke04). $T_{1/2}$: from 2019Ze02 (decay curves for the two strong γ rays from the decay of ^{77}Kr, and weighted average of six measurements). Value from 2019Ze02 is adopted here as this work gives full details of the measurements and uncertainty assignments, while little details are provided in the older references. Others: 73.5 min *11* (1974Ho37), 75 min *3* (1973Ba22), 74.7 min *7* (1971Bo30), 71.1 min *5* (1960Bu22), 69 min *6* (1957Be46), 73 min (1955Th01), 66 min (1948Wo07). Weighted average of values from 2019Ze02, 1974Ho37, 1973Ba22, 1971Bo30, 1960Bu22 and 1957Be46 is 71.9 min *6*, but with normalized χ^2=4.9. The NRM weighted average, where the uncertainty in the value from 1971Bo30 gets doubled, is 71.57 min *45*, with acceptable normalized χ^2=2.3.
66.50[a] *5*	3/2$^-$	118 ns *12*	ABCDEF HI	%IT=100 J$^\pi$: L(d,t)=1 and L+1/2 from analyzing powers in (pol d,t). $T_{1/2}$: from $\gamma\gamma$(t) (1975No11, ^{63}Cu(^{16}O,pnγ) E=42 MeV).
149.93[&] *9*	7/2$^+$	163 ps *14*	ABCDEF H	J$^\pi$: ΔJ=1, M1+E2 γ to 5/2$^+$; band member. $T_{1/2}$: RDDS (1984Wo10). Other: 232 ps *10* (1982ZoZY).
245.32[b] *6*	5/2$^-$	37 ps *4*	AB DEFGHI	XREF: G(230). J$^\pi$: analyzing power in (pol d,t) gives J^π=5/2$^-$ and 9/2$^+$ for the 245 and 279 unresolved doublet; ΔJ=1 γ to 3/2$^-$. L(p,d)=(1) for a 230 level implying

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Adopted Levels, Gammas (continued)

^{77}Kr Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
				(1/2⁻,3/2⁻) is in disagreement. $T_{1/2}$: from RDDS in (^{16}O,pnγ) E=49-58 MeV (1984Wo10); others: 33 ps *9* (from Doppler-shift method, (^{16}O,pnγ) E=42 MeV, 1975No11), 32 ps 8 (1982ZoZY).
278.83[@] *12*	9/2⁺	133 ps *7*	BCDEF H	Jπ: ΔJ=2, E2 γ to 5/2⁺. J=1/2 ruled out by asymmetric γ(θ). $T_{1/2}$: RDDS (1984Wo10). Other: 114 ps *14* (1982ZoZY).
459.88 *9*	1/2⁻		A H	Jπ: L(d,t)=1 and L-1/2 from analyzing powers in (pol d,t).
499.50[a] *11*	7/2⁻	5.2 ps *8*	AB DEFGH	XREF: G(430). Jπ: ΔJ=2, E2 γ to 3/2⁻; 1/2 not allowed by γ(θ). L(p,d)=(4) for a 430 level implying (7/2⁺,9/2⁺) is in disagreement. $T_{1/2}$: from RDDS (1984Wo10). Other: 13 ps *2* (RDDS,1982ZoZY).
577.2 *6*	(3/2⁻,5/2,7/2⁻)		A G	XREF: G(610). Jπ: gammas to 3/2⁻ and 7/2⁻. L(p,d)=(1) for a 610 level supports 3/2⁻.
674.98 *21*	(3/2⁺,5/2)		A	Jπ: log *ft*=6.7 from 3/2⁻; γ to 7/2⁺.
714.36 *8*	(1/2⁻,3/2,5/2⁻)		A	Jπ: gammas to 1/2⁻ and 5/2⁻.
733.3 *6*	(1/2,3/2,5/2)		A	Jπ: log *ft*=7.14 from 3/2⁻.
747.17 *23*	(3/2⁺,5/2)		A	Jπ: log *ft*=7.3 from 3/2⁻; γ to 7/2⁺.
784.1[&] *3*	11/2⁺	1.5 ps *4*	BCDEF	Jπ: ΔJ=2, E2 γ to 7/2⁺; ΔJ=1, M1+E2 γ to 9/2⁺. $T_{1/2}$: weighted average of 1.19 *24* (DSAM,1990Jo07) and 2.1 ps *3* (RDDS,1984Wo10).
790.53 *12*	(1/2⁻,3/2,5/2)		A	Jπ: log *ft*=7.0 from 3/2⁻; γ to 5/2⁻.
799.11[b] *13*	9/2⁻	2.6 ps *3*	B DEF	Jπ: ΔJ=2, E2 γ to 5/2⁻; ΔJ=1, (M1+E2) γ to 7/2⁻; 1/2 not allowed by γ(θ). $T_{1/2}$: RDDS (1984Wo10).
872.01 *7*	(3/2,5/2)		A G	XREF: G(850). Jπ: log *ft*=6.7 from 3/2⁻; gammas to 5/2⁻ and 5/2⁺. L(p,d)=(3) for an 850 level supports 5/2⁻.
955.5 *7*	(3/2⁺,5/2)		A	Jπ: log *ft*=7.2 from 3/2⁻; γ to 7/2⁺.
957.83 *10*			A	Jπ: γ to 5/2⁻ suggests 1/2⁻ to 9/2⁻.
1002.6[@] *3*	13/2⁺	1.87 ps *21*	BCDEF	Jπ: ΔJ=2, E2 γ to 9/2⁺; ΔJ=1, dipole γ to 11/2⁺. $T_{1/2}$: RDDS (1984Wo10). Other: 1.8 *5* (DSAM,1990Jo07).
1013.0 *6*	(1/2⁺,3/2,5/2⁻)		A G	XREF: G(1000). Jπ: gammas to 1/2⁻ and 5/2⁺. L(p,d)=(4) for a 1000 level implying (7/2⁺,9/2⁺) is in disagreement.
1020.77 *22*			A	
1024.8 *6*	(3/2,5/2)		A	Jπ: log *ft*=6.8 from 3/2⁻; gammas to 5/2⁻ and 5/2⁺.
1037.42 *6*	(3/2,5/2)		A	Jπ: log *ft*=6.8 from 3/2⁻; gammas to 5/2⁻ and 5/2⁺.
1055.5? *10*			A	Jπ: γ to 3/2⁻ suggests 1/2 to 7/2⁻.
1108.65 *12*	(5/2)		A	Jπ: log *ft*=6.4 from 3/2⁻; gammas to 7/2⁻ and 7/2⁺.
1154.2? *7*			A	
1176.44[a] *15*	11/2⁻	1.19 ps *12*	B DEF	Jπ: ΔJ=2, E2 γ to 7/2⁻; ΔJ=1, M1+E2 γ to 9/2⁻. $T_{1/2}$: weighted average of 1.07 *21* (DSAM,1990Jo07) and 1.25 ps *14* (RDDS,1984Wo10).
1243.09 *14*	(1/2⁺,3/2,5/2⁻)		A GH	XREF: G(1210). Jπ: gammas to 1/2⁻ and 5/2⁺. L(p,d)=(1) for a 1210 level supports 3/2⁻.
1312.44 *15*	(1/2,3/2,5/2⁻)		A	Jπ: log *ft*=6.8 from 3/2⁻; γ to 1/2⁻.
1444.1 *7*	(1/2,3/2,5/2)		A G	XREF: G(1400). Jπ: log *ft*=6.8 from 3/2⁻. L(p,d)=(2) for a 1400 level supports 3/2⁺,5/2⁺.
1509.5 *7*	(3/2⁺,5/2)		A G	XREF: G(1530). Jπ: log *ft*=6.6 from 3/2⁻; γ to 7/2⁺.
1568.36[b] *16*	13/2⁻	0.64 ps *9*	B DEF	Jπ: ΔJ=2, E2 γ to 9/2⁻; ΔJ=1, M1+E2 γ to 11/2⁻.

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Adopted Levels, Gammas (continued)

^{77}Kr Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
				$T_{1/2}$: weighted average of 0.60 *12* (DSAM,1990Jo07) and 0.69 ps *14* (RDDS, 1984Wo10). Other: 0.9 ps *2* (1982ZoZY).
1658.9[&] *3*	15/2⁺	0.62 ps *15*	BCDEF	Jπ: ΔJ=2, E2 γ to 11/2⁺; ΔJ=1, M1+E2 γ to 13/2⁺. $T_{1/2}$: weighted average of 0.51 *10* (DSAM,1990Jo07) and 0.83 ps *14* (DSAM, 1984Wo10).
1672.48 *12*	(3/2,5/2)		A G	XREF: G(1680). Jπ: log *ft*=6.4 from 3/2⁻; gammas to 5/2⁻ and 5/2⁺.
1782.23 *11*	(1/2,3/2,5/2)		A	Jπ: log *ft*=6.4 from 3/2⁻.
1838.37 *8*	(1/2⁺,3/2,5/2)		A G	XREF: G(1810). Jπ: log *ft*=6.1 from 3/2⁻; γ to 5/2⁺.
1865.6 *9*	(3/2⁺,5/2)		A	Jπ: log *ft*=7.2 from 3/2⁻; γ to 7/2⁺.
1907.6 *12*	(3/2⁻,5/2⁻)		A	Jπ: log *ft*=6.8 from 3/2⁻; gammas to 1/2⁻ and 7/2⁻.
1913.49 *13*	(1/2⁻,3/2,5/2)		A G	XREF: G(1930). Jπ: log *ft*=6.5 from 3/2⁻; γ to 5/2⁻.
1917.1[@] *4*	17/2⁺	0.48 ps *11*	BCDEF	Jπ: ΔJ=2, E2 γ to 13/2⁺; ΔJ=1, dipole γ to 15/2⁺. $T_{1/2}$: weighted average of 0.39 *8* (DSAM,1990Jo07) and 0.62 ps *10* (DSAM, 1984Wo10). Other: 0.5 ps *2* (1982ZoZY).
2025.73 *7*	(1/2⁻,3/2⁻,5/2⁻)		A G	XREF: G(?). Jπ: log *ft*=5.6 from 3/2⁻.
2061.97[a] *25*	15/2⁻	0.58 ps *12*	B DEF	XREF: F(?). Jπ: ΔJ=2, E2 γ to 11/2⁻; ΔJ=1, (M1+E2) γ to 13/2⁻. $T_{1/2}$: DSAM (1990Jo07). Other: 0.90 ps *21* (DSAM,1984Wo10,not corrected for side feeding).
2140			G	
2280			G	
2390			G	
2519.1[b] *3*	17/2⁻	0.35 ps *7*	B DE	Jπ: ΔJ=2, E2 γ to 13/2⁻; ΔJ=1, (M1+E2) γ to 15/2⁻. $T_{1/2}$: DSAM (1990Jo07). Other: 0.7 ps *3* (DSAM,1984Wo10,not corrected for side feeding).
2560			G	
2605.1[c] *7*	(15/2⁻)		D	Jπ: γ to 13/2⁺; ΔJ=2, Q γ from (19/2⁻).
2706.7[&] *5*	19/2⁺	0.30 ps *9*	BCDE	Jπ: ΔJ=2, E2 γ to 15/2⁺; ΔJ=1, M1+E2 γ to 17/2⁺. $T_{1/2}$: DSAM (1990Jo07). Other: 0.28 ps *14* (DSAM,1984Wo10,not corrected for side feeding).
2822.66 *19*	(3/2⁻,5/2⁻)		A	Jπ: log *ft*=5.8 from 3/2⁻; γ to 5/2⁺.
2938.1[d] *3*	(17/2⁻)		D	Jπ: ΔJ=2, Q γ to 13/2⁻; γ to 15/2⁺.
2988.8[@] *5*	21/2⁺	0.17 ps *3*	BCDE	Jπ: ΔJ=2, E2 γ to 17/2⁺; ΔJ=1 D γ to 19/2⁺. $T_{1/2}$: DSAM. Weighted average of 0.16 *4* (1990Jo07) and 0.18 ps *6* (1984Wo10).
3007.68 *19*	(3/2⁻,5/2⁻)		A	Jπ: log *ft*=5.5 from 3/2⁻; γ to 7/2⁻.
3054.30 *15*	(1/2⁻,3/2⁻,5/2⁻)		A	Jπ: log *ft*=5.8 from 3/2⁻.
3110.4[a] *4*	19/2⁻	0.35 ps *7*	B DE	Jπ: ΔJ=2, E2 γ to 15/2⁻; ΔJ=1, (M1+E2) γ to 17/2⁻. $T_{1/2}$: DSAM (1990Jo07).
3255.0[c] *3*	(19/2⁻)		D	Jπ: ΔJ=2, (Q) γ to 15/2⁻; ΔJ=1, D γ to (17/2⁻).
3602.6[b] *4*	21/2⁻	<0.39 ps	B DE	Jπ: ΔJ=2, E2 γ to 17/2⁻; ΔJ=1, (M1+E2) γ to 19/2⁻. $T_{1/2}$: 0.33 ps *6* from DSAM (1990Jo07), not corrected for side feeding.
3678.4[d] *5*	(21/2⁻)		D	Jπ: ΔJ=2, Q γ to 17/2⁻; γ to (19/2⁻).
3769.0[&] *5*	23/2⁺	0.21 ps *4*	BCDE	Jπ: ΔJ=2, E2 γ to 19/2⁺; ΔJ=1, M1+E2 γ to 21/2⁺. $T_{1/2}$: DSAM (1990Jo07).
4025.2[c] *3*	(23/2⁻)		D	Jπ: ΔJ=2, Q γ to 19/2⁻; ΔJ=1, D γ to 21/2⁻.
4151.2[@] *5*	25/2⁺	0.111 ps *21*	BCDE	Jπ: ΔJ=2, E2 γ to 21/2⁺; ΔJ=1, (M1) γ to 23/2⁺. $T_{1/2}$: DSAM (1990Jo07). Other: 0.30 ps *10* (1984Wo10, not

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Adopted Levels, Gammas (continued)

^{77}Kr Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				corrected for side feeding.
4232.2[a] *5*	(23/2⁻)		D	J^{π}: ΔJ=2, (Q) γ to 19/2⁻; ΔJ=1 γ to 21/2⁻.
4642.9[d] *4*	(25/2⁻)		D	J^{π}: ΔJ=2, Q γ to 21/2⁻; ΔJ=1, D γ to (23/2⁻).
4744.2[b] *5*	(25/2⁻)		B D	J^{π}: ΔJ=2, Q γ to 21/2⁻; ΔJ=1, D+Q γ to (23/2⁻).
4811.0[&] *6*	27/2⁺	0.17 ps *4*	BCD	J^{π}: ΔJ=2, (E2) γ to 23/2⁺; ΔJ=1, dipole γ to 25/2⁺. $T_{1/2}$: DSAM (1990Jo07).
5019.6[c] *5*	(27/2⁻)		D	J^{π}: ΔJ=2, Q γ to (23/2⁻); ΔJ=1, D γ to (25/2⁻).
5353.9[a] *7*	(27/2⁻)		D	J^{π}: ΔJ=(2) γ to (23/2⁻); ΔJ=(1) γ to (25/2⁻); band member.
5373.5[@] *6*	29/2⁺	0.16 ps *4*	BCD	J^{π}: ΔJ=2, E2 γ to 25/2⁺; ΔJ=1, (M1) γ to 27/2⁺. $T_{1/2}$: DSAM (1990Jo07).
5829.6[d] *11*	(29/2⁻)		D	J^{π}: ΔJ=2, Q γ to (25/2⁻); band member.
5965.4[b] *7*	(29/2⁻)		D	J^{π}: ΔJ=2, Q γ to (25/2⁻); ΔJ=1 γ to (27/2⁻).
6081.3[&] *7*	31/2⁺	<0.111 ps	BCD	J^{π}: ΔJ=2, E2 γ to 27/2⁺; ΔJ=1, dipole γ to 29/2⁺. $T_{1/2}$: 0.090 ps *21* from DSAM (1990Jo07), not corrected for side feeding.
6207.6[c] *12*	(31/2⁻)		D	J^{π}: ΔJ=2, Q γ to (27/2⁻); band member.
6670.7[a] *8*	(31/2⁻)	<0.17 ps	D	J^{π}: ΔJ=2, (E2) γ to (27/2⁻); band member. $T_{1/2}$: 0.14 ps *3* from DSAM for 1317γ which was placed from a 5620 level in (^{32}S,2pnγ) (1990Jo07). Adopted placement of 1317γ is from ^{58}Ni(^{29}Si,2p2αγ). Lifetime is not corrected for side feeding.
6703.5[@] *8*	(33/2⁺)	0.055 ps *14*	BCD	J^{π}: ΔJ=2, E2 γ to 29/2⁺; ΔJ=1, dipole γ to 31/2⁺. $T_{1/2}$: DSAM (1990Jo07).
7179.2[d] *23*	(33/2⁻)		D	J^{π}: ΔJ=2, Q γ to (29/2⁻); band member.
7389.3[b] *10*	(33/2⁻)		D	J^{π}: ΔJ=2, Q γ to (29/2⁻); ΔJ=(1) γ to (31/2⁻).
7572.6[c] *13*	(35/2⁻)		D	J^{π}: ΔJ=2, Q γ to (31/2⁻); band member.
7639.4[&] *10*	35/2⁺		BCD	J^{π}: ΔJ=2, Q γ to 31/2⁺; band member.
8208.3[@] *11*	37/2⁺	<0.076 ps	BCD	J^{π}: ΔJ=2, E2 γ to 33/2⁺; γ to 35/2⁺. $T_{1/2}$: 0.062 ps 14 from DSAM (1990Jo07), not corrected for feeding.
8677[d] *3*	(37/2⁻)		D	J^{π}: γ to (33/2⁻); band member.
8969.3[b] *11*	(37/2⁻)		D	J^{π}: ΔJ=2, Q γ to (33/2⁻); band member.
9116.8[c] *14*	(39/2⁻)		D	J^{π}: ΔJ=2, Q γ to (35/2⁻).
9487.3[&] *16*	39/2⁺		D	J^{π}: ΔJ=2, Q γ to 35/2⁺; band member.
9905.3[@] *14*	41/2⁺		B D	J^{π}: ΔJ=2, Q γ to 37/2⁺; band member.
10336[d] *5*	(41/2⁻)		D	J^{π}: γ to (37/2⁻); band member.
10853.7[c] *15*	(43/2⁻)		D	J^{π}: ΔJ=2, Q γ to (39/2⁻); band member.
11747.5[@] *19*	(45/2⁺)		B D	XREF: B(11759.3). J^{π}: ΔJ=2, Q γ to 41/2⁺; band member.
11839.9 *19*	(45/2⁺)		D	J^{π}: ΔJ=2, Q γ to (41/2⁺).
12183[d] *6*	(45/2⁻)		D	J^{π}: γ to (41/2⁻); band member.
12796.6[c] *16*	(47/2⁻)		D	J^{π}: ΔJ=2, (Q) γ to (43/2⁻).
14955.4[c] *19*	(51/2⁻)		D	J^{π}: γ to (47/2⁻); band member.
17354[c] *3*	(55/2⁻)		D	J^{π}: γ to (51/2⁻), band member.

† From least-squares fit to Eγ data.

‡ In adopting J values from heavy-ion reactions the general assumption of ascending J values with increasing excitation energy was assumed. For high-spin (J>13/2 or so) states, band assignments and large B(E2)(W.u.) values also support increasing order of spins.

\# From (^{32}S,2pnγ) and (^{16}O,pnγ) (both E=49-58 MeV and E=42 MeV datasets) using recoil-distance Doppler-shift and DSA

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Adopted Levels, Gammas (continued)

^{77}Kr Levels (continued)

methods.

[@] Band(A): ν5/2[422], α=+1/2. $g_{9/2}$ neutron orbital. First band crossing at $\hbar\omega$=0.5-0.6 MeV due to $\pi g^2_{9/2}$ alignment. The second band crossing at $\hbar\omega$=0.8 MeV is due to $\nu g^2_{9/2}$ alignment. Q(transition)=1.1 to 2.9 implies β_2=0.20 to 0.36 for the two signature partners.

[&] Band(a): ν5/2[422], α=−1/2. $g_{9/2}$ neutron orbital. First band crossing at $\hbar\omega$=0.5-0.6 MeV due to $\pi g^2_{9/2}$ alignment.

[a] Band(B): ν3/2[501], α=−1/2. First band crossing at $\hbar\omega\approx$0.55 MeV due to $\pi g^2_{9/2}$ alignment. Q(transition)=1.4 to 3.7 implies β_2=0.23 to 0.45 for the two signature partners.

[b] Band(b): ν3/2[501], α=+1/2. First band crossing at $\hbar\omega$=0.5-0.6 MeV due to $\pi g^2_{9/2}$ alignment. The second band crossing at $\hbar\omega$=0.7 MeV due to alignment of protons.

[c] Band(C): 3-qp band, α=−1/2. Possible configuration=ν1/2[431]$\otimes\pi$3/2[312]$\otimes\pi$3/2[431].

[d] Band(c): 3-qp band, α=+1/2. Possible configuration=ν1/2[431]$\otimes\pi$3/2[312]$\otimes\pi$3/2[431].

Adopted Levels, Gammas (continued)

$\gamma(^{77}Kr)$

E_i(level)	J_i^π	E_γ[†]	I_γ	E_f	J_f^π	Mult.[‡]	δ[#]	α[@]	Comments
66.50	3/2⁻	66.52 5	100	0.0	5/2⁺	(E1)		0.300	B(E1)(W.u.)=8.3×10⁻⁶ 9 α(K)=0.266 4; α(L)=0.0292 5; α(M)=0.00468 7; α(N)=0.000453 7 Mult.: from delayed x-ray and γ spectra in $^{63}Cu(^{16}O,pn\gamma)$ reaction, 1982ClZZ give α(K)exp<0.78, while α(K)=0.30 for E1 and 0.40 for M1 (2008Ki07). The decay scheme supports E1.
149.93	7/2⁺	149.93 9	100	0.0	5/2⁺	M1+E2	−0.16 10	0.047 7	α(K)=0.042 6; α(L)=0.0047 8; α(M)=0.00076 12; α(N)=7.6×10⁻⁵ 11 B(M1)(W.u.)=0.037 4; B(E2)(W.u.)=6.E+1 +7−6
245.32	5/2⁻	178.78 8	100 3	66.50	3/2⁻	(M1(+E2))	−0.09 9	0.0278 20	α(K)=0.0246 17; α(L)=0.00272 22; α(M)=0.00044 4; α(N)=4.4×10⁻⁵ 4 B(M1)(W.u.)=0.097 12; B(E2)(W.u.)=30 +70−30 Mult.: D(+Q) from γ(θ) in in-beam γ-ray data.
		245.24 10	3.7 12	0.0	5/2⁺	[E1]			B(E1)(W.u.)=2.4×10⁻⁵ 9
278.83	9/2⁺	128.9 1	100 2	149.93	7/2⁺	(M1(+E2))	<0.24	0.073 9	B(M1)(W.u.)=0.064 14; B(E2)(W.u.)<300 α(K)=0.064 7; α(L)=0.0073 10; α(M)=0.00119 16; α(N)=0.000118 15 Mult.,δ: dipole from γγ(θ) in in-beam γ-ray data. RUL≤300 for E2 gives δ<0.24.
		278.8 3	14 2	0.0	5/2⁺	E2		0.0219	α(K)=0.0193 3; α(L)=0.00225 4; α(M)=0.000363 6; α(N)=3.54×10⁻⁵ 6 B(E2)(W.u.)=15.0 24
459.88	1/2⁻	216.0[b] 15	≈0.6	245.32	5/2⁻				
		393.37 9	100 4	66.50	3/2⁻				
499.50	7/2⁻	254.3 3	100 1	245.32	5/2⁻	(M1(+E2))	<0.05	0.01102	B(M1)(W.u.)=0.17 3; B(E2)(W.u.)<10 α(K)=0.00976 15; α(L)=0.001065 16; α(M)=0.000173 3; α(N)=1.74×10⁻⁵ 3 Mult.,δ: dipole from γγ(θ) in in-beam γ-ray data.
		433.06 14	48 3	66.50	3/2⁻	E2			B(E2)(W.u.)=118 20
577.2	(3/2⁻,5/2,7/2⁻)	78.1 7	14 5	499.50	7/2⁻	[D,E2]		1.3 11	
		511 2	≈100	66.50	3/2⁻				
674.98	(3/2⁺,5/2)	525.0 15	≈4.6	149.93	7/2⁺				
		608.6 3	100 12	66.50	3/2⁻				
		674.9 3	11 4	0.0	5/2⁺				
714.36	(1/2⁻,3/2,5/2⁻)	254.5 3	23 4	459.88	1/2⁻				
		468.99 19	46 3	245.32	5/2⁻				
		647.88 10	100 7	66.50	3/2⁻				
733.3	(1/2,3/2,5/2)	666.8 7	100	66.50	3/2⁻				
747.17	(3/2⁺,5/2)	597.25 21	100 5	149.93	7/2⁺				
		746.5 15	≈25	0.0	5/2⁺				
784.1	11/2⁺	506.1 4	100 3	278.83	9/2⁺	M1+E2	−0.35 6		B(M1)(W.u.)=0.073 20; B(E2)(W.u.)=46 19

γ(^{77}Kr) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ	E_f	J^π_f	Mult.[‡]	δ[#]	α[@]	Comments
784.1	11/2+	634.0 *14*	38 *3*	149.93	7/2+	E2			B(E2)(W.u.)=52 *15*
790.53	(1/2−,3/2,5/2)	545.23 *15*	100 *5*	245.32	5/2−				
		724.5 *7*	45 *10*	66.50	3/2−				
799.11	9/2−	299.7 *1*	89 *4*	499.50	7/2−	(M1(+E2))	−0.08 *3*	0.00736 *12*	B(M1)(W.u.)=0.147 *19*; B(E2)(W.u.)=14 *11* α(K)=0.00653 *11*; α(L)=0.000709 *12*; α(M)=0.0001149 *19*; α(N)=1.158×10^{-5}
		553.5 *2*	100 *4*	245.32	5/2−	E2			B(E2)(W.u.)=114 *15*
872.01	(3/2,5/2)	626.69 *12*	100 *9*	245.32	5/2−				
		805.6[a] *1*	45[a] *11*	66.50	3/2−				
		871.3 *8*	9 *4*	0.0	5/2+				
955.5	(3/2+,5/2)	805.6[a] *7*	100[a]	149.93	7/2+				
957.83		712.36 *12*	100	245.32	5/2−				
1002.6	13/2+	218.5 *1*	15 *7*	784.1	11/2+	(M1(+E2))	−0.03 *5*	0.0162 *3*	B(M1)(W.u.)=0.15 *8*; B(E2)(W.u.)=4 +*13*−*4*
		723.3 *3*	100 *2*	278.83	9/2+	E2			B(E2)(W.u.)=68 *9*
1013.0	(1/2+,3/2,5/2−)	554 *1*	38 *13*	459.88	1/2−				
		946.8 *10*	44 *13*	66.50	3/2−				
		1012.3 *8*	100 *19*	0.0	5/2+				
1020.77		306.43 *25*	100	714.36	(1/2−,3/2,5/2−)				
1024.8	(3/2,5/2)	779.8 *8*	100 *16*	245.32	5/2−				
		1023.9 *10*	42 *11*	0.0	5/2+				
1037.42	(3/2,5/2)	792.2 *3*	13 *3*	245.32	5/2−				
		970.87 *10*	100 *5*	66.50	3/2−				
		1037.43 *10*	50 *3*	0.0	5/2+				
1055.5?		988.27[b] *10*	100	66.50	3/2−				
1108.65	(5/2)	237.1 *5*	26 *7*	872.01	(3/2,5/2)				
		609.04 *29*	38 *8*	499.50	7/2−				
		958.7 *1*	100 *7*	149.93	7/2+				
		1109 *1*	22 *7*	0.0	5/2+				
1154.2?		129 *1*	≈4.8	1024.8	(3/2,5/2)				
		577.2 *5*	100 *14*	577.2	(3/2−,5/2,7/2−)				
1176.44	11/2−	377.2 *1*	85 *3*	799.11	9/2−	M1+E2	−0.18 *3*		B(M1)(W.u.)=0.153 *17*; B(E2)(W.u.)=46 *16*
		676.9 *2*	100 *4*	499.50	7/2−	E2			B(E2)(W.u.)=93 *11*
1243.09	(1/2+,3/2,5/2−)	568.9 *10*	39 *13*	674.98	(3/2+,5/2)				
		782.6 *5*	96 *34*	459.88	1/2−				
		1176.67 *15*	100 *12*	66.50	3/2−				
		1242.9 *3*	36 *5*	0.0	5/2+				
1312.44	(1/2,3/2,5/2−)	354.1 *8*	43 *14*	957.83					
		852.58 *13*	100 *5*	459.88	1/2−				
1444.1	(1/2,3/2,5/2)	291.0 *15*	43 *14*	1154.2?					
		729.1 *9*	57 *28*	714.36	(1/2−,3/2,5/2−)				
		1378.1 *15*	100 *43*	66.50	3/2−				
1509.5	(3/2+,5/2)	776.1 *9*	100 *25*	733.3	(1/2,3/2,5/2)				
		834.1 *10*	50 *25*	674.98	(3/2+,5/2)				

γ(^{77}Kr) (continued)

E_i(level)	J^π_i	E_γ†	I_γ	E_f	J^π_f	Mult.‡	δ#	α@	Comments
1509.5	(3/2+,5/2)	1360 *2*	≈37	149.93	7/2+				
		1511 *2*	≈37	0.0	5/2+				
1568.36	13/2−	391.8 *1*	34 *3*	1176.44	11/2−	M1+E2	−0.12 *2*		B(M1)(W.u.)=0.143 *25*; B(E2)(W.u.)=18 *7*
		769.8 *2*	100 *3*	799.11	9/2−	E2			B(E2)(W.u.)=125 *19*
1658.9	15/2+	656.3 *1*	92 *4*	1002.6	13/2+	M1+E2	−0.21 *5*		B(M1)(W.u.)=0.058 *15*; B(E2)(W.u.)=8 *4*
		874.9 *11*	100 *4*	784.1	11/2+	E2			B(E2)(W.u.)=48 *12*
1672.48	(3/2,5/2)	617 *1*	≈42	1055.5?					
		634.0 *8*	56 *14*	1037.42	(3/2,5/2)				
		1427.2 *4*	47 *17*	245.32	5/2−				
		1606.00 *12*	100 *6*	66.50	3/2−				
		1672.4 *3*	74 *4*	0.0	5/2+				
1782.23	(1/2,3/2,5/2)	745.0 *3*	31 *4*	1037.42	(3/2,5/2)				
		910.2 *1*	100 *4*	872.01	(3/2,5/2)				
		991.67 *20*	51 *4*	790.53	(1/2−,3/2,5/2)				
1838.37	(1/2+,3/2,5/2)	800.94 *11*	72 *3*	1037.42	(3/2,5/2)				
		966.34 *10*	92 *5*	872.01	(3/2,5/2)				
		1123.83 *30*	28 *1*	714.36	(1/2−,3/2,5/2−)				
		1838.41 *13*	100 *5*	0.0	5/2+				
1865.6	(3/2+,5/2)	756.0 *15*	≈100	1108.65	(5/2)				
		1716 *1*	≈50	149.93	7/2+				
1907.6	(3/2−,5/2−)	1408 *2*	≈33	499.50	7/2−				
		1448 *2*	≈67	459.88	1/2−				
		1662 *2*	≈100	245.32	5/2−				
1913.49	(1/2−,3/2,5/2)	1199.2 *4*	61 *14*	714.36	(1/2−,3/2,5/2−)				
		1668.15 *12*	100 *4*	245.32	5/2−				
1917.1	17/2+	258.2 *5*	4 *2*	1658.9	15/2+	(M1+E2)	−0.09 *7*	0.0107 *4*	B(M1)(W.u.)=0.10 *6*; B(E2)(W.u.)=16 *+27−16*
		914.5 *3*	100 *1*	1002.6	13/2+	E2			B(E2)(W.u.)=91 *21*
2025.73	(1/2−,3/2−,5/2−)	713.4 *4*	16 *3*	1312.44	(1/2,3/2,5/2−)				
		988.27 *10*	100 *6*	1037.42	(3/2,5/2)				
		1067.79 *10*	38 *2*	957.83					
		1153.79 *10*	61 *4*	872.01	(3/2,5/2)				
		1235.35 *25*	4.6 *10*	790.53	(1/2−,3/2,5/2)				
		1311.37 *10*	19 *1*	714.36	(1/2−,3/2,5/2−)				
2061.97	15/2−	493.9 *4*	39 *3*	1568.36	13/2−	(M1+E2)			Mult.: ΔJ=1, D+Q from γ(θ) and γγ(θ); (M1+E2) from RUL.
		885.3 *3*	100 *3*	1176.44	11/2−	E2			B(E2)(W.u.)=66 *14*
2519.1	17/2−	457.1 *1*	20 *3*	2061.97	15/2−	(M1+E2)			Mult.: ΔJ=1, D from γ(θ) and D+Q from γγ(θ); (M1+E2) from RUL.
		951.2 *5*	100 *4*	1568.36	13/2−	E2			B(E2)(W.u.)=89 *19*
2605.1	(15/2−)	1602.5 *22*	100	1002.6	13/2+				
2706.7	19/2+	789.8 *3*	100 *10*	1917.1	17/2+	M1+E2	−0.32 *6*		B(M1)(W.u.)=0.08 *3*; B(E2)(W.u.)=17 *9*
		1048.0 *21*	69 *10*	1658.9	15/2+	E2			B(E2)(W.u.)=31 *11*
2822.66	(3/2−,5/2−)	1801.9 *3*	47 *6*	1020.77					

$\gamma(^{77}Kr)$ (continued)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}	E_f	J^{π}_f	Mult.[‡]	δ[#]	α[@]	Comments
2822.66	(3/2⁻,5/2⁻)	2577.28 *25*	100 *10*	245.32	5/2⁻				
		2822.6 *4*	49 *6*	0.0	5/2⁺				
2938.1	(17/2⁻)	333.0 *8*	100	2605.1	(15/2⁻)	D			
		1279.1 *11*	25	1658.9	15/2⁺				
		1368.4 *10*	75	1568.36	13/2⁻	Q			
2988.8	21/2⁺	281.8 *6*	5 *2*	2706.7	19/2⁺	(M1)		0.0085	B(M1)(W.u.)=0.28 *12*
		1071.2 *5*	100 *2*	1917.1	17/2⁺	E2			B(E2)(W.u.)=116 *21*
3007.68	(3/2⁻,5/2⁻)	2508.00 *25*	21 *3*	499.50	7/2⁻				
		2762.45 *25*	100 *8*	245.32	5/2⁻				
3054.30	(1/2⁻,3/2⁻,5/2⁻)	2340.03 *25*	64 *9*	714.36	(1/2⁻,3/2,5/2⁻)				
		2594.33 *14*	100 *9*	459.88	1/2⁻				
3110.4	19/2⁻	591.5 *3*	22 *12*	2519.1	17/2⁻	(M1+E2)			Mult.: ΔJ=1, D from $\gamma(\theta)$ and D+Q from $\gamma\gamma(\theta)$; (M1+E2) from RUL.
		1048.0 *5*	100 *12*	2061.97	15/2⁻	E2			B(E2)(W.u.)=54 *15*
3255.0	(19/2⁻)	316.9 *1*	58	2938.1	(17/2⁻)	D			
		650.0 *15*	100	2605.1	(15/2⁻)	Q			
		735[b]		2519.1	17/2⁻				
		1193.0 *1*	67	2061.97	15/2⁻	(Q)			
3602.6	21/2⁻	491.8 *4*	13	3110.4	19/2⁻	(M1+E2)			Mult.: ΔJ=1, D from $\gamma(\theta)$ and D+Q from $\gamma\gamma(\theta)$; (M1+E2) from ΔJ^{π} and Weisskopf estimates for <0.39 ps half-life of level.
		1083.5 *4*	100	2519.1	17/2⁻	E2			B(E2)(W.u.)>44
3678.4	(21/2⁻)	423.8 *6*	89	3255.0	(19/2⁻)				
		740.6 *7*	56	2938.1	(17/2⁻)	(Q)			
		1159 *3*	100	2519.1	17/2⁻	Q			
3769.0	23/2⁺	780.6 *21*	100 *5*	2988.8	21/2⁺	M1+E2	−0.25 *6*		B(M1)(W.u.)=0.13 *3*; B(E2)(W.u.)=17 *9*
		1062.4 *2*	64 *5*	2706.7	19/2⁺	E2			B(E2)(W.u.)=40 *9*
4025.2	(23/2⁻)	347.4 *6*	28	3678.4	(21/2⁻)	D			
		423.1 *10*	8	3602.6	21/2⁻	D			
		770.1 *2*	100	3255.0	(19/2⁻)	Q			
		914.8 *4*	52	3110.4	19/2⁻	Q			
4151.2	25/2⁺	382.4 *3*	14 *5*	3769.0	23/2⁺	(M1(+E2))	−0.07 *7*		B(M1)(W.u.)=0.43 *18*; B(E2)(W.u.)=19 *+39−19*
		1162.4 *1*	100 *3*	2988.8	21/2⁺	E2			B(E2)(W.u.)=108 *22*
4232.2	(23/2⁻)	629.8 *10*	21	3602.6	21/2⁻	D+Q			
		1122.4[&] *5*	100	3110.4	19/2⁻	(Q)			
4642.9	(25/2⁻)	617.8 *4*	33	4025.2	(23/2⁻)	D			
		964.6 *10*	100	3678.4	(21/2⁻)	Q			
		1040.2 *5*	50	3602.6	21/2⁻	Q			
4744.2	(25/2⁻)	512.1 *5*	13	4232.2	(23/2⁻)	D+Q			
		1141.2 *4*	100	3602.6	21/2⁻	Q			
4811.0	27/2⁺	659.8 *2*	100 *11*	4151.2	25/2⁺	(M1)			B(M1)(W.u.)=0.13 *5* Mult.: ΔJ=1, D from $\gamma(\theta)$ and $\gamma\gamma(\theta)$; (M1) from ΔJ^{π}.

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Adopted Levels, Gammas (continued)

$\gamma(^{77}Kr)$ (continued)

E_i(level)	J^{π}_i	E_γ [†]	I_γ	E_f	J^{π}_f	Mult. [‡]	δ [#]	Comments
4811.0	27/2+	1042.0 *21*	240 *60*	3769.0	23/2+	(E2)		B(E2)(W.u.)=1.0×10^2 *4*
5019.6	(27/2−)	376.7 *4*	8	4642.9	(25/2−)	D		
		994.5 *6*	100	4025.2	(23/2−)	Q		
5353.9	(27/2−)	608.8 *17*	25	4744.2	(25/2−)	(D)		
		1122.4 [&] *5*	100	4232.2	(23/2−)	(Q)		
5373.5	29/2+	562.6 *4*	54 *5*	4811.0	27/2+	(M1(+E2))	0.00 *7*	B(M1)(W.u.)=0.27 *8*
								Mult.: ΔJ=1, D from $\gamma(\theta)$ and $\gamma\gamma(\theta)$; (M1(+E2)) from ΔJ^{π}.
		1222.3 *4*	100 *5*	4151.2	25/2+	E2		B(E2)(W.u.)=43 *12*
5829.6	(29/2−)	1186.7 *10*	100	4642.9	(25/2−)	Q		
5965.4	(29/2−)	613.5 *10*	17	5353.9	(27/2−)	D		
		1220.6 *5*	100	4744.2	(25/2−)	Q		
6081.3	31/2+	707.8 *4*	20 *8*	5373.5	29/2+	(M1)		B(M1)(W.u.)>0.093
								Mult.: ΔJ=1, D from $\gamma\gamma(\theta)$; (M1) from ΔJ^{π}.
		1270.1 *12*	100 *10*	4811.0	27/2+	E2		B(E2)(W.u.)>66
6207.6	(31/2−)	1188.0 *10*	100	5019.6	(27/2−)	Q		
6670.7	(31/2−)	1316.8 *4*	100	5353.9	(27/2−)	(E2)		B(E2)(W.u.)>43
6703.5	(33/2+)	622.2 *4*	35 *3*	6081.3	31/2+	(M1)		B(M1)(W.u.)=0.43 *12*
								Mult.: ΔJ=1, D from $\gamma\gamma(\theta)$; (M1) from ΔJ^{π}.
		1330.2 *12*	100 *5*	5373.5	29/2+	E2		B(E2)(W.u.)=94 *25*
7179.2	(33/2−)	1349.6 *20*	100	5829.6	(29/2−)	Q		
7389.3	(33/2−)	719 *1*	25	6670.7	(31/2−)	(D)		
		1423.5 *11*	100	5965.4	(29/2−)	Q		
7572.6	(35/2−)	1365.0 *6*	100	6207.6	(31/2−)	Q		
7639.4	35/2+	1557.9 *8*	100	6081.3	31/2+	Q		
8208.3	37/2+	568.8 *5*	23	7639.4	35/2+			
		1505.2 *15*	100	6703.5	(33/2+)	E2		B(E2)(W.u.)>40
8677	(37/2−)	1498.0 *20*	100	7179.2	(33/2−)			
8969.3	(37/2−)	1579.9 *5*	100	7389.3	(33/2−)	Q		
9116.8	(39/2−)	1544.1 *5*	100	7572.6	(35/2−)	Q		
9487.3	39/2+	1847.9 *12*	100	7639.4	35/2+	Q		
9905.3	41/2+	1697.0 *9*	100	8208.3	37/2+	Q		
10336	(41/2−)	1659 *3*	100	8677	(37/2−)			
10853.7	(43/2−)	1736.9 *5*	100	9116.8	(39/2−)	Q		
11747.5	(45/2+)	1842.2 *12*	100	9905.3	41/2+	Q		E_γ: 1847.1 in (^{32}S,2pnγ).
11839.9	(45/2+)	1934.6 *12*	100	9905.3	41/2+	Q		
12183	(45/2−)	1847 *3*	100	10336	(41/2−)			
12796.6	(47/2−)	1942.9 *7*	100	10853.7	(43/2−)	(Q)		
14955.4	(51/2−)	2158.8 *10*	100	12796.6	(47/2−)			
17354	(55/2−)	2398.7 *20*	100	14955.4	(51/2−)			

† For high-spin levels, values are from ^{58}Ni(^{29}Si,2p2$\alpha\gamma$) (1997Sy01) which provides the most complete information and a third-order polynomial was used in

$^{77}_{36}Kr_{41}$-10

γ(^{77}Kr) (continued)

energy fitting with calibrants. When the γ rays are common with the ^{77}Rb ε decay, the latter were adopted.

‡ D, Q or D+Q from $\gamma(\theta)$ and/or DCO ratios in in-beam γ-ray studies; RUL for E2 and M2 used when level lifetimes are known.

From $\gamma(\theta)$ data in ^{52}Cr(^{28}Si,2pnγ) and/or ^{63}Cu(^{16}O,pnγ); unless otherwise stated.

@ 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.

& Multiply placed.

[a] Multiply placed with undivided intensity.

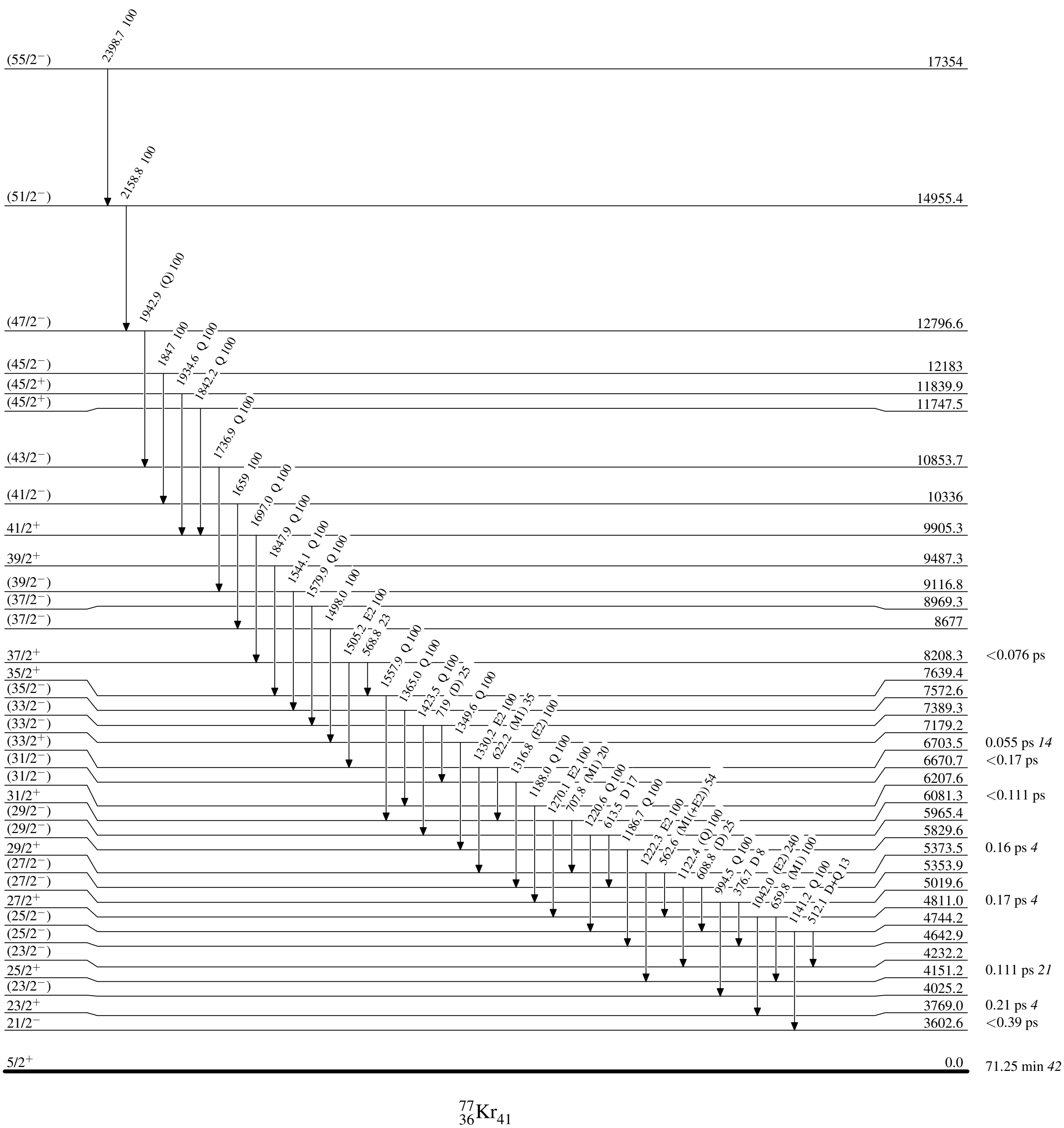
[b] Placement of transition in the level scheme is uncertain.

$^{77}_{36}$Kr$_{41}$-11

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



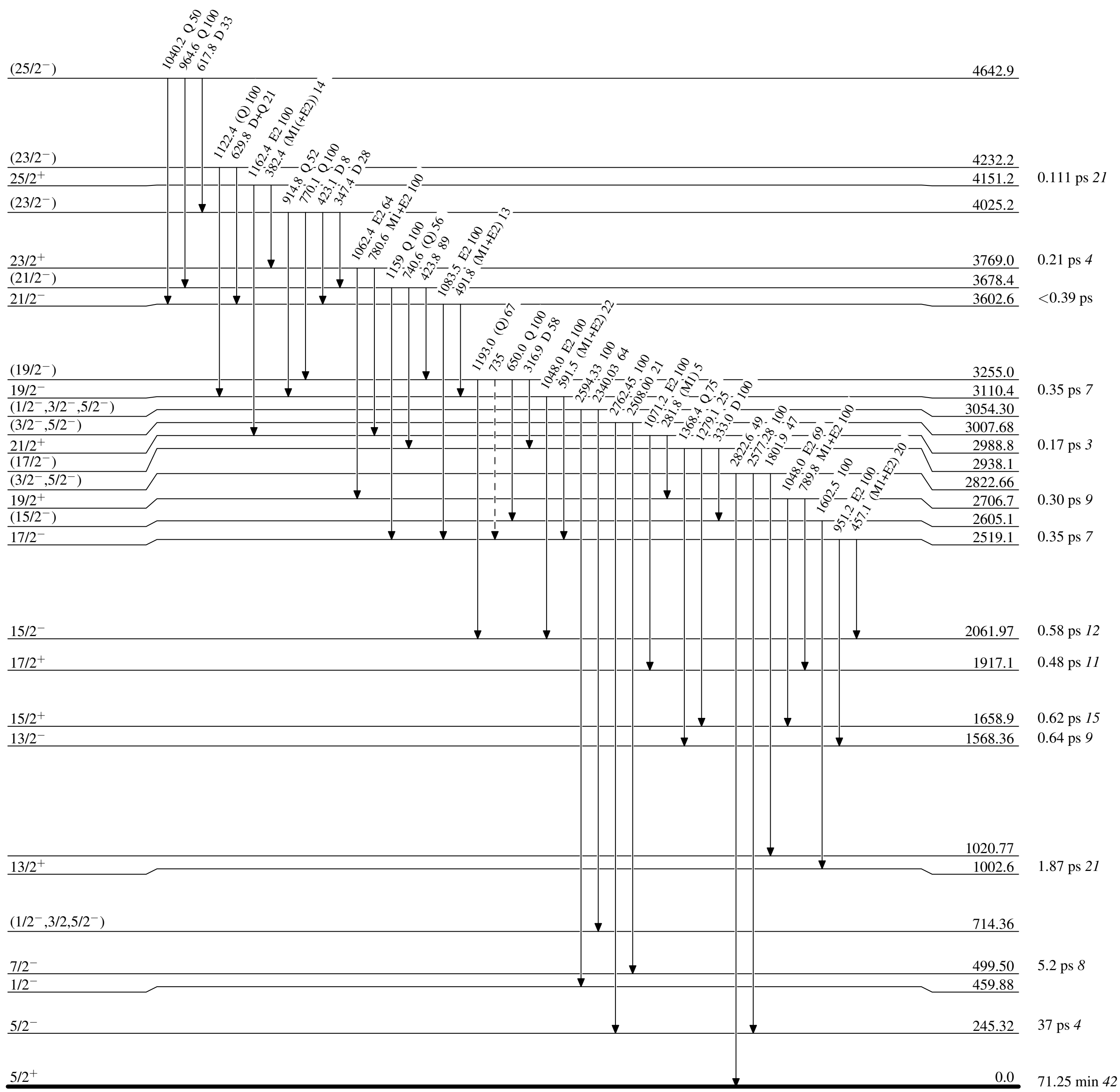
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

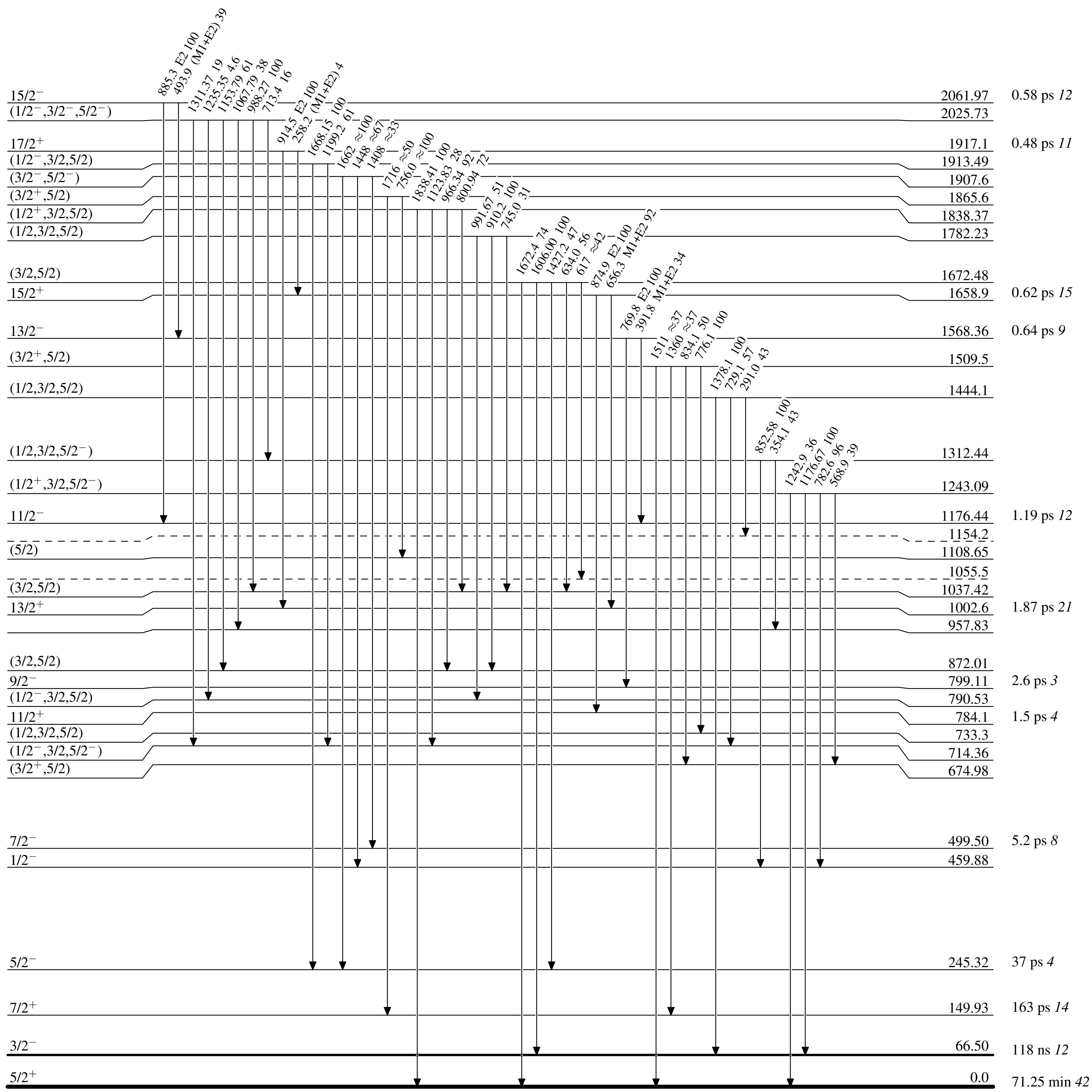


$^{77}_{36}Kr_{41}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

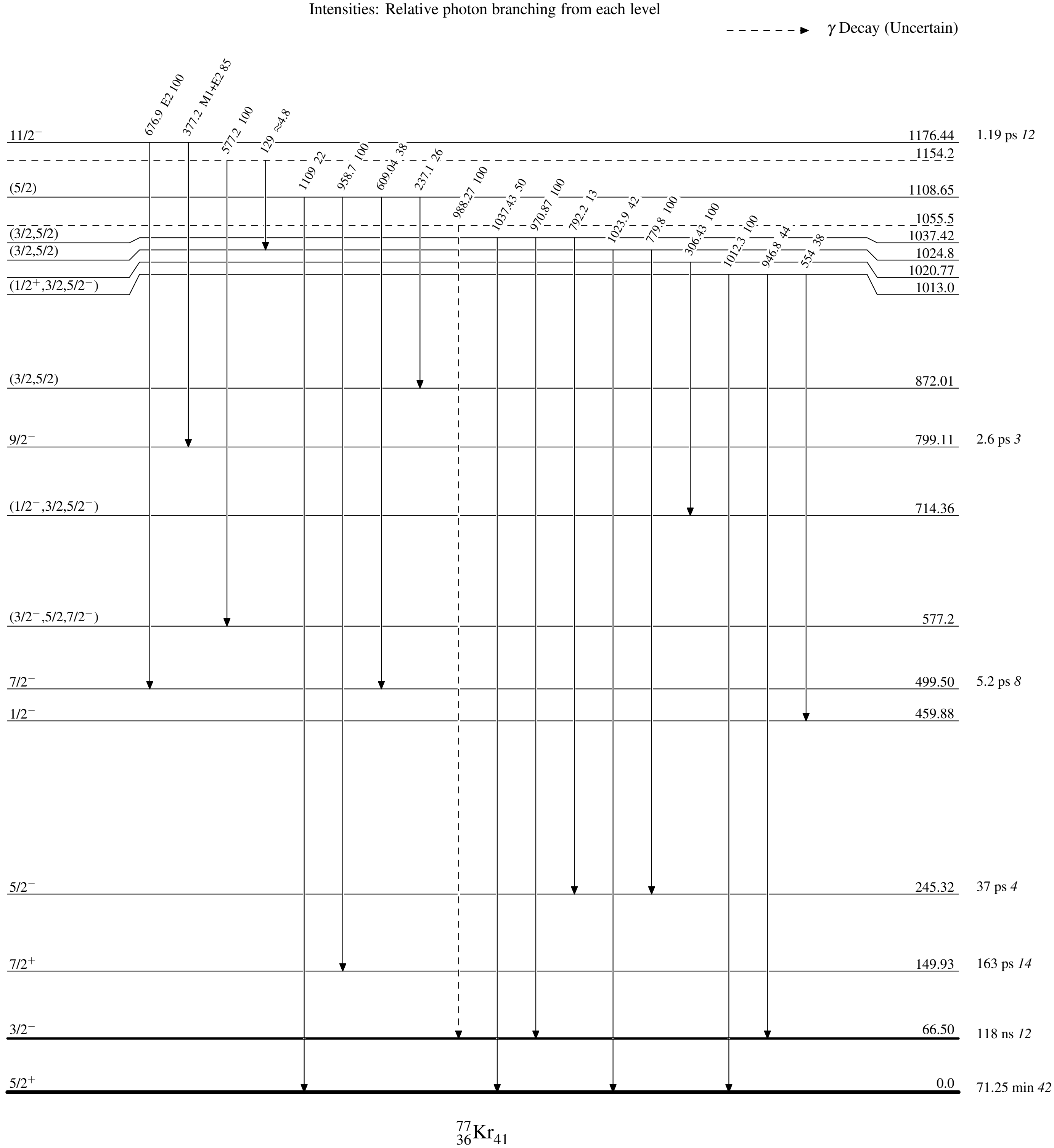


$^{77}_{36}Kr_{41}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



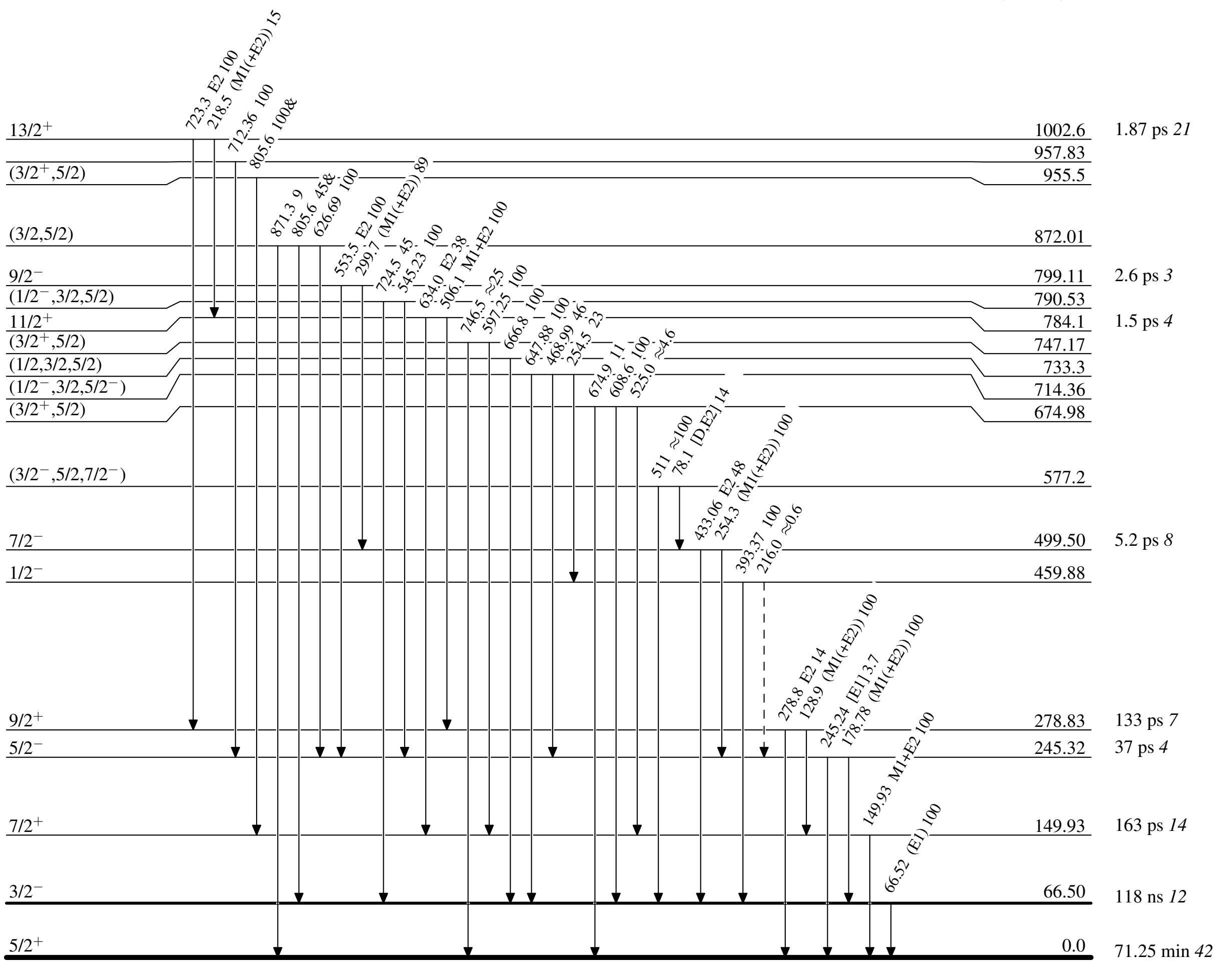
Adopted Levels, Gammas

Legend

Level Scheme (continued)

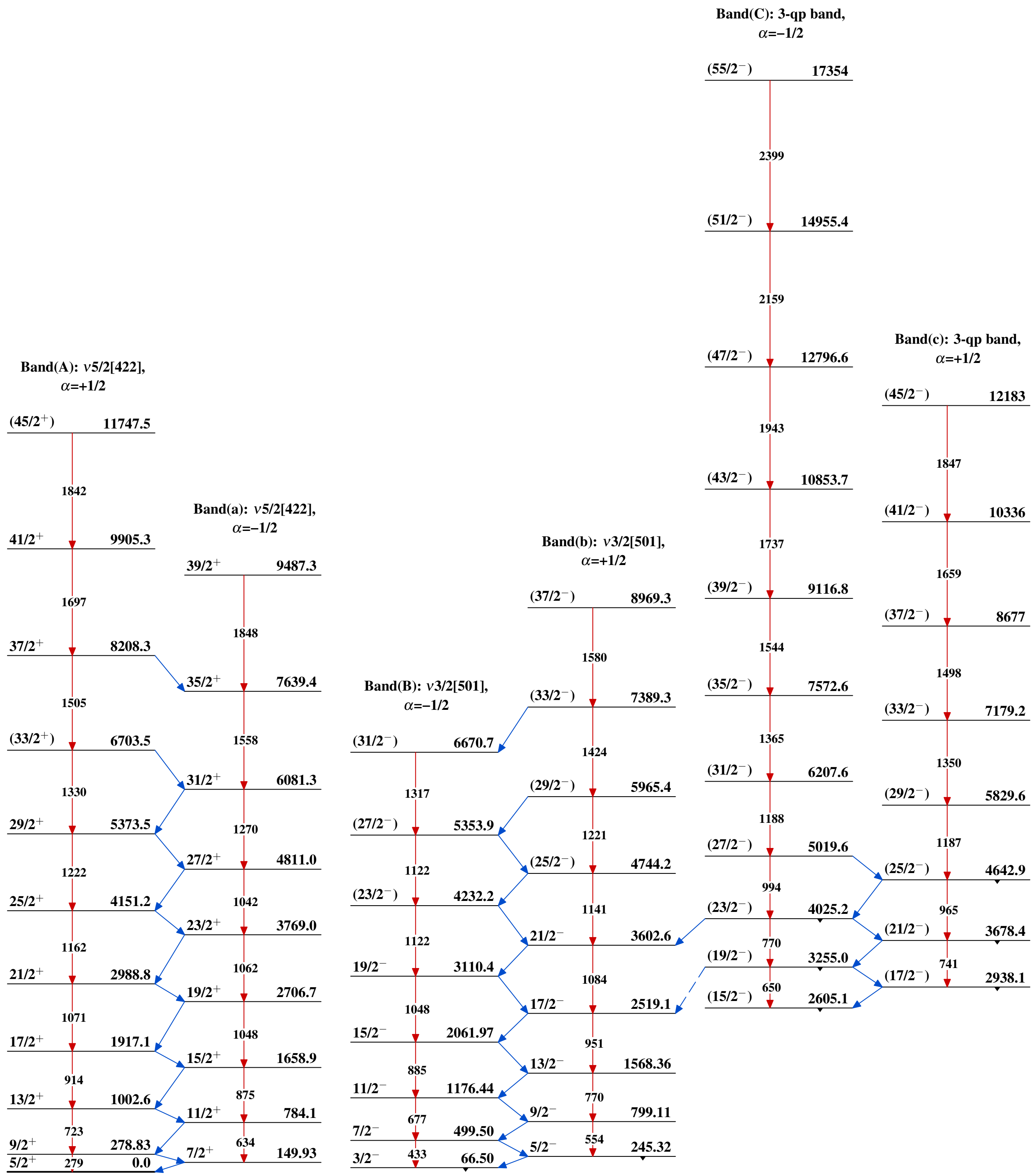
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

γ Decay (Uncertain)



$^{77}_{36}Kr_{41}$

Adopted Levels, Gammas



$^{77}_{36}Kr_{41}$