^{78}Kr(α,nγ),^{80}Kr(α,3nγ) 1983Ar16

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 199,271 (2025)	1-Sep-2024

See also 1983ArZY.
(α,nγ): Eα=14-18 MeV, 99% ^{78}Kr solid and gas targets.
(α,3nγ): Eα=45 MeV, 70% ^{80}Kr gas target.
Measured Eγ, Iγ with coaxial Ge(Li) and low-energy photon detectors. γ(θ) measured with escape-suppression spectrometer, γ linear polarization with 3-crystal Ge(Li) Compton spectrometer. Also measured excit, γγ coin, n-γ coin, $T_{1/2}$ from DSAM.

^{81}Sr Levels

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
0[c]	1/2−		
79.2[b] 4	5/2−	0.55[@] μs 10	
89.0[a] 6	(7/2+)	>1.5[@] μs	
119.8[&] 4	1/2(+)	24[@] ns 4	
132.2[a] 7	(9/2+)	<9[@] ns	
155.3[c] 3	3/2−	74 ps 20	
203.5 5	(5/2+)	1.1 ns 3	
221.0[&] 4	3/2(+)	0.63 ns 20	Jπ: 3/2 from 221γ(θ).
294.9 4	3/2−		
336.5[&] 4	5/2(+)	160 ps 50	
366.6[b] 5	7/2−	53 ps 15	
379.3[c] 3	5/2−	12 ps 6	
535.8 6	(5/2−)		
558.4[&] 5	7/2(+)	17 ps 17	
611.8 7	(7/2+)		
632.6[c] 4	7/2−		
706.9[b] 5	9/2−		
796.8[&] 6	9/2(+)		
810.7[a] 8	(11/2+)	2.8 ps 9	
904.7[a] 8	(13/2+)	4.6 ps 13	
999.9[c] 4	(9/2−)		
1055.6[b] 7	11/2−		
1109.5[&] 6	11/2(+)		
1332.6[c] 6	11/2−		
1470.8[&] 7	13/2(+)		
1505.6[b] 7	13/2−		
1739.8[a] 8	(15/2+)		
1804.2[c] 6	(13/2−)		
1862.5[&] 7	(15/2)		
1865.3[a] 9	(17/2+)	1.0 ps 3	
1910.9[b] 8	(15/2−)		
2212.6[c] 7	(15/2−)		
2326.1[&] 8	(17/2)		
2447.6[b] 8	(17/2−)		
2962.4[a] 10			

[†] From a least-squares fit to Eγ.

Continued on next page (footnotes at end of table)

^{78}Kr(α,nγ),^{80}Kr(α,3nγ) 1983Ar16 (continued)

^{81}Sr Levels (continued)

‡ Authors′ values, based on $\gamma(\theta)$, γ linear polarization, $T_{1/2}$ and reaction systematics. Consistent (apart from use of parentheses) with adopted values.
# From DSAM in (α,nγ) at Eα=18 MeV, except as noted.
@ From pulsed beam measurements (3 ns pulse width, 1 μs pulse separation).
& Band(A): K^{π}=1/2^{+} band.
[a] Band(B): $g_{9/2}$ band.
[b] Band(C): K^{π}=5/2^{-} band.
[c] Band(D): K^{π}=1/2^{-} band.

γ(^{81}Sr)

A_2, A_4 from γ(θ) along with pol(90°) (γ linear polarization at 90°) are given in comments.

E_γ[†]	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[@]	α[&]	Comments
(9.8)		89.0	(7/2$^+$)	79.2	5/2$^-$				E_γ: from Adopted Gammas. Not seen by 1983Ar16; probably below detection threshold (1983ArZY). $I_{(\gamma+ce)}$: ≥521 from intensity balance at 89 level.
43.2 4	158	132.2	(9/2$^+$)	89.0	(7/2$^+$)	D+Q	−0.08 3		A_2=−0.32 3; A_4=0 Mult.: probably an M1+E2, ΔJ=1 transition; A_2 is somewhat negative for pure D (1983Ar16).
^{x}61.1 4									
79.2 4	275	79.2	5/2$^-$	0	1/2$^-$	(E2)		2.39 6	A_2=+0.10 2; A_4=+0.02 2 Mult.: A_2, A_4; attenuated due to level $T_{1/2}$ and consistent with Q; α(exp)>1.7 from intensity balance at 79 level rules out E1 and pure M1; excit for 79γ limits J(79 level) to 3/2 or 5/2.
101.2 4	33	221.0	3/2$^{(+)}$	119.8	1/2$^{(+)}$	D+Q	−0.5 2		A_2=+0.14 7; A_4=0.
114.5[b] 4	10	203.5	(5/2$^+$)	89.0	(7/2$^+$)				E_γ: assignment to ^{81}Sr uncertain.
115.5 4	38	336.5	5/2$^{(+)}$	221.0	3/2$^{(+)}$	D+Q	−0.2 1		A_2=−0.38 6; A_4=0. Mult.: anisotropy suggests a mixed ΔJ=1 transition (1983Ar16).
119.8 4	100	119.8	1/2$^{(+)}$	0	1/2$^-$	(E1)		0.0597 11	A_2=−0.02 2; A_4=−0.01 2 Mult.: authors consider B(E1)(W.u.)=8.3×10^{-6} 14 more likely in this mass region than B(M1)(W.u.)=5.0×10^{-4} 9.
^{x}122.0 4									
124.2 4	80	203.5	(5/2$^+$)	79.2	5/2$^-$	D			A_2=+0.14 3; A_4=0.00 3
155.2 4	160	155.3	3/2$^-$	0	1/2$^-$	D(+Q)	+0.1 1		A_2=−0.06 4; A_4=−0.02 5
216.7[‡] 4	47[‡] 12	336.5	5/2$^{(+)}$	119.8	1/2$^{(+)}$	(E2)		0.0605	36<Iγ<59. A_2=+0.26 4, A_4=0.00 5, pol (90°)=+0.25 17 for possible doublet are consistent with mult.=E2; polarization excludes J to (J-1) transition (1983Ar16).
221.0 4	104	221.0	3/2$^{(+)}$	0	1/2$^-$	(E1)		0.01002	A_2=−0.14 3; A_4=+0.04 3 Pol(90°)=+0.12 7. Mult.: authors consider B(E1)(W.u.)=2.6×10^{-5} more likely in this mass region than B(M1)(W.u.)≈1.0×10^{-3}.
221.9 4	18	558.4	7/2$^{(+)}$	336.5	5/2$^{(+)}$				
224.3 4	67	379.3	5/2$^-$	155.3	3/2$^-$	M1+E2	+0.13 8	0.0193 10	A_2=−0.09 4; A_4=+0.03 4 Pol(90°)=−0.67 12.
240.9 4	37	535.8	(5/2$^-$)	294.9	3/2$^-$	(D)			A_2=−0.18 5; A_4=−0.08 5
253.5 4	30	632.6	7/2$^-$	379.3	5/2$^-$	M1		0.01373	A_2=0.00 5; A_4=0.00 Pol(90°)=−0.38 12.
277.5[‡] 4	58[‡]	366.6	7/2$^-$	89.0	(7/2$^+$)				A_2=+0.01 3; A_4=−0.03 3 Pol(90°)=−0.22 4. I_γ: Iγ=94 (58+36), A_2, A_4, Pol(90°) all for a doublet. A_2(277.5γ) is

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γ(^{81}Sr) (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[&]	Comments
									clearly >0 from I(278γ)/I(287γ) in spectrum gated by 689γ (assuming γ(θ) from 1976Fr10 for mult=(M1) γ in ^{81}Rb); this implies considerable mixing for a ΔJ=1 transition.
287.3 *4*	113	366.6	7/2$^-$	79.2	5/2$^-$	M1+E2	+2.2 *8*	0.0203 *21*	A_2=+0.48 *2*; A_4=+0.17 *2* Pol(90°)=−0.15 *6*.
294.9 *4*	55	294.9	3/2$^-$	0	1/2$^-$	M1		0.00939	A_2=−0.01 *5*; A_4=−0.03 *6* Pol(90°)=−0.57 *12*.
300.0 *4*	14	379.3	5/2$^-$	79.2	5/2$^-$				
337.4 *4*	70	558.4	7/2$^{(+)}$	221.0	3/2$^{(+)}$	E2		0.01299 *23*	A_2=+0.33 *4*; A_4=−0.06 *5* Pol(90°)=+0.60 *10*.
367.2 *4*	12	999.9	(9/2$^-$)	632.6	7/2$^-$				
379.4 *4*	71	379.3	5/2$^-$	0	1/2$^-$	E2		0.00876	A_2=+0.30 *2*; A_4=−0.08 *3* Pol(90°)=+0.51 *11*.
408.3 *4*	38	611.8	(7/2$^+$)	203.5	(5/2$^+$)	(M1)		0.00424	A_2=−0.30 *6*; A_4=+0.02 *6* Mult.: D from γ(θ); adopted Δπ=(no).
460.3 *4*	65	796.8	9/2$^{(+)}$	336.5	5/2$^{(+)}$	Q			A_2=+0.41 *4*; A_4=−0.05 *5*
477.0[‡] *4*	74[‡]	632.6	7/2$^-$	155.3	3/2$^-$				A_2=+0.13 *4*, A_4=−0.08 *5*, Pol(90°)=+0.10 *6*, and Iγ=95 (74+(21)) for a doublet.
551.1 *4*	63	1109.5	11/2$^{(+)}$	558.4	7/2$^{(+)}$	Q			A_2=+0.37 *2*; A_4=−0.14 *3*
620.8 *4*	62	999.9	(9/2$^-$)	379.3	5/2$^-$	Q			A_2=+0.37 *3*; A_4=−0.04 *4*
627.7 *4*	94	706.9	9/2$^-$	79.2	5/2$^-$	E2		0.00190	A_2=+0.40 *2*; A_4=−0.02 *3* Pol(90°)=+0.68 *8*.
674.0 *4*	37	1470.8	13/2$^{(+)}$	796.8	9/2$^{(+)}$	Q			A_2=+0.30 *3*; A_4=−0.08 *4*
678.6 *4*	87	810.7	(11/2$^+$)	132.2	(9/2$^+$)	M1+E2	−0.41 *−6+2*	1.34×10^{-3} *2*	A_2=−0.85 *4*; A_4=0.00 *3* Pol(90°)=−0.07 *6*.
689.1 *4*	63	1055.6	11/2$^-$	366.6	7/2$^-$	E2		1.47×10^{-3}	A_2=+0.36 *4*; A_4=−0.17 *5* Pol(90°)=+0.62 *10*.
700.0[‡] *4*	31[‡]	1332.6	11/2$^-$	632.6	7/2$^-$				A_2=+0.22 *4*, A_4=−0.06 *4*, pol (90°)=+0.18 *7* for a possible doublet with Iγ=60 (31+(29)).
753.0 *4*	22	1862.5	(15/2)	1109.5	11/2$^{(+)}$				
772.3 *4*	140	904.7	(13/2$^+$)	132.2	(9/2$^+$)	E2		1.09×10^{-3}	A_2=+0.32 *4*; A_4=−0.08 *5* Pol(90°)=+0.55 *7*.
798.6 *4*	68	1505.6	13/2$^-$	706.9	9/2$^-$	(Q)			A_2=+0.36 *3*; A_4=+0.08 *4*
804.2[‡] *4*	27[‡]	1804.2	(13/2$^-$)	999.9	(9/2$^-$)				A2=+0.34 *5*, A_4=−0.05 *5* for a possible doublet with Iγ=56 (27+(29)).
^{x}825.0 *4*									I_γ: 26<Iγ<83.
835.0 *4*	40	1739.8	(15/2$^+$)	904.7	(13/2$^+$)	E2+M1		0.00086 *4*	A_2=−0.33 *4*; A_4=0.00 *4* Pol(90°)=+0.19 *9*.
855.3[a] *4*	35[a]	1910.9	(15/2$^-$)	1055.6	11/2$^-$	Q			A_2=+0.36 *4*, A_4=−0.15 *5*, and Iγ=48 (35+13) for a doublet.

^{78}Kr(α,nγ),^{80}Kr(α,3nγ) 1983Ar16 (continued)

γ(^{81}Sr) (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	α[&]	Comments
855.3[a] *4*	13[a]	2326.1	(17/2)	1470.8	$13/2^{(+)}$	(Q)		A2=+0.36 *4*, A_4=−0.15 *5*, and Iγ=48 (35+13) for a doublet.
880.0 *4*	23 *4*	2212.6	($15/2^-$)	1332.6	$11/2^-$			
929.3[b] *4*	16	1739.8	($15/2^+$)	810.7	($11/2^+$)			
942.0 *4*	17	2447.6	($17/2^-$)	1505.6	$13/2^-$			
960.6 *4*	36	1865.3	($17/2^+$)	904.7	($13/2^+$)	E2	6.36×10^{-4}	A_2=+0.44 *4*; A_4=−0.02 *5* Pol(90°)=+0.95 *20*.
1097.5 *4*		2962.4		1865.3	($17/2^+$)			

† ΔE=0.1-0.4 keV depending on Iγ and on the complexity of the spectrum; evaluator assigns 0.4 keV throughout.
‡ Not resolved from ^{81}Rb transition; Iγ divided by 1983Ar16 based on Iγ for ^{81}Rb in 1976Fr10.
# For (α,nγ) at Eα=18 MeV; based on $\gamma(\theta)$ or yield at 54°. Uncertainty not stated.
@ From $\gamma(\theta)$ and/or γ linear polarization data (pol (90°)) given in comments.
& 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.
a Multiply placed with intensity suitably divided.
b Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

From ENSDF

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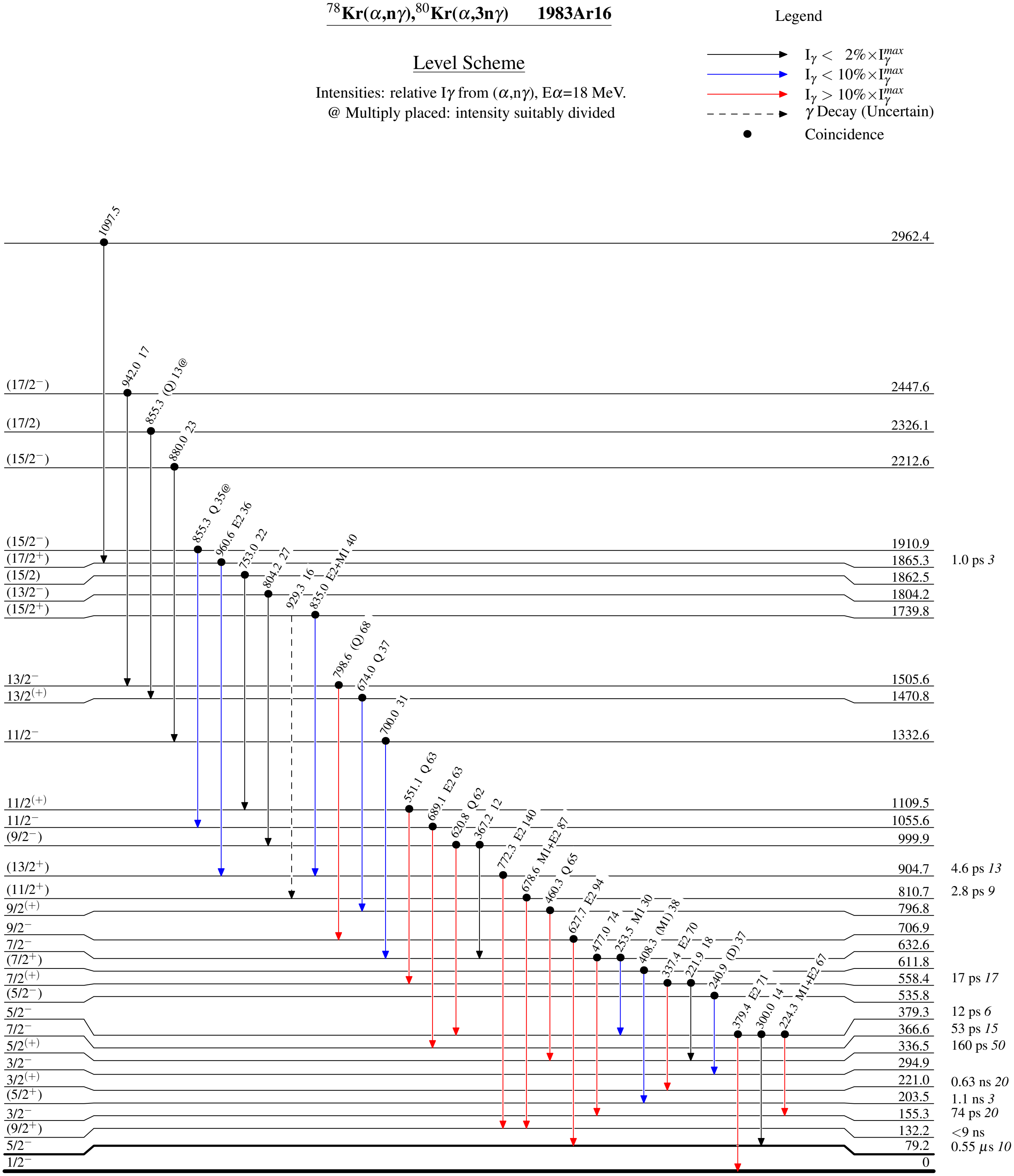
^{78}Kr(α,nγ),^{80}Kr(α,3nγ) 1983Ar16

Level Scheme

Intensities: relative Iγ from (α,nγ), Eα=18 MeV.
@ Multiply placed: intensity suitably divided



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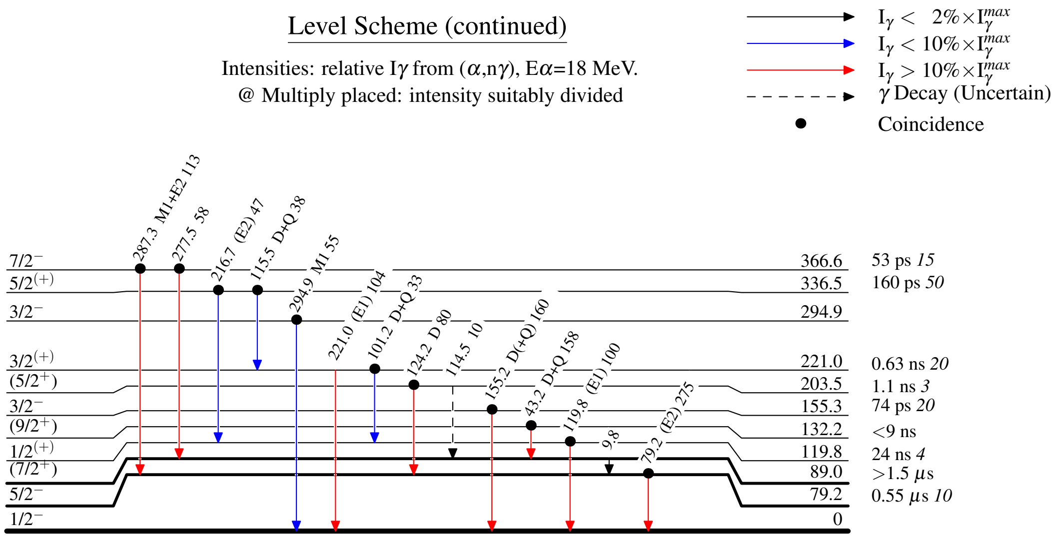
^{78}Kr(α,nγ),^{80}Kr(α,3nγ) 1983Ar16

Level Scheme (continued)

Intensities: relative Iγ from (α,nγ), Eα=18 MeV.
@ Multiply placed: intensity suitably divided



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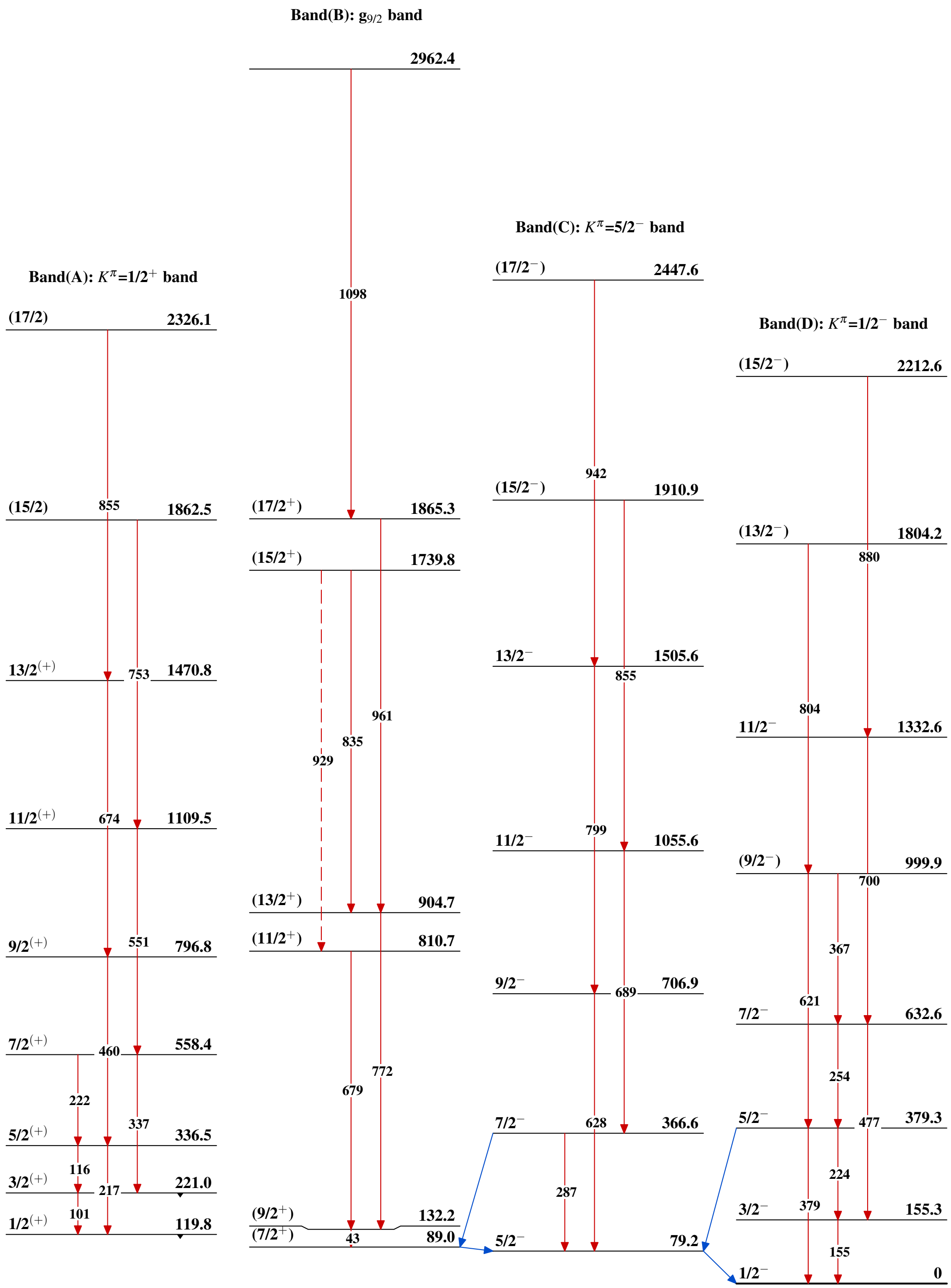
^{78}Kr(α,nγ),^{80}Kr(α,3nγ) 1983Ar16



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