

$^{80}\text{Se}(\alpha, n\gamma)$ 1981Ca01, 1982Es01, 1986Pi05

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 125, 201 (2015)	31-Dec-2014

1981Ca05: $E(\alpha)=14$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ using two Ge(Li) detectors, $\gamma(\theta)$ using a Compton-suppressed Ge(Li) detector, and γ lin pol using a three Ge(Li) Compton polarimeter; deduced $T_{1/2}$ from Doppler Shift Attenuation Method (DSAM) measurement.

1982Es01: $E(\alpha)=10, 12.8$, and 14.8 MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma(\theta)$, excitation function using Ge(Li) detectors.

1984Ku23: $E(\alpha)=11.1$ and 14.8 MeV. Measured $E\gamma$, $I\gamma$ using Ge(Li) detector; deduced $T_{1/2}$ from Doppler Shift Attenuation Method (DSAM) and Recoil Distance Doppler Shift (employing a plunger) measurements.

1996Pi05: $E(\alpha)=11, 13, 15$, and 17 MeV. Measured $E\gamma$, $\gamma\gamma$, $\gamma(\theta)$, excitation function using two Ge(Li) detectors.

 ^{83}Kr Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\#$	Comments
0	$9/2^+$		
9.4057 6	$7/2^+$		
41.5573 8	$1/2^-$	1.83 h 2	$T_{1/2}$: from the Adopted Levels.
561.94 8	$5/2^-$	6.2@ ps 21	
571.14 9	$(3/2^-)$	1.04 ps 35	
690.02 10	$5/2^-$	10.4@ ps 35	
798.49 13	$5/2^+$	1.7 ps 5	
1011.84 9	$11/2^+$	0.76 ps 14	J^π : proposed as $J^\pi=7/2^+$ by 1981Co01 based on M1+E2 assignment to 1003 γ .
1102.81 12	$9/2^+$	0.24 ps 8	$T_{1/2}$: weighted average of 0.21 ps 6 (1981Ca01) and 0.42 ps 14 (1984Ku23).
1122.02 9	$13/2^+$	1.3 ps 4	$T_{1/2}$: other: 1.2 ps 4 (1981Ca01).
1170.38 10	$(7/2^-)$	2.1 ps 6	$T_{1/2}$: weighted average of 1.9 ps 6 (1981Ca01) and 2.4 ps +10-7 (1984Ku23).
1221.85 17	$(5/2, 7/2^-)$	1.3 ps 5	$T_{1/2}$: weighted average of 1.25 ps +50-35 (1981Ca01) and 1.5 ps 7 (1984Ku23).
1277.8 3	$1/2^+$		
1516.56 22	$(7/2^+)$	0.31 ps 14	
1529.12 16	$9/2^-$	0.90 ps 21	
1533.51 21			
1538.0?& 6			
1642.47 21	$(7/2^+, 9/2, 11/2^+)$	0.21 ps 7	$T_{1/2}$: other: 0.45 ps 13 (1981Ca01).
1721.56 13	$13/2^+$	0.49 ps 14	J^π : proposed as $J^\pi=9/2^+$ by 1981Co01 based on M1+E2 assignment to 1722 γ .
1738.43 16	$11/2^+$	0.35 ps +14-7	$T_{1/2}$: other: 0.64 ps 17 (1981Ca01).
1780.9?& 4		0.31 ps +35-14	$T_{1/2}$: from 1981Ca01.
1888.81 24	$(^-)$	0.7 ps 3	$T_{1/2}$: weighted average of 1.0 ps 4 (1981Ca01) and 0.6 ps 3 (1984Ku23).
2145.3?& 7			
2265.85 17	$(15/2^+)$	1.0 ps 5	J^π : assigned as $J^\pi=11/2^+$ in 1981Ca01. Analysis of 1144 γ in excitation function data in 1986Pi05 suggests $J^\pi=15/2^+$.
2271.5 3			
2290.40 25			
2338.18 23	$(11/2^-)$		
2470.64 23	$(17/2^-)$	24@ ps 10	
2483.60 21	$17/2^+$	0.21 ps +14-7	$T_{1/2}$: other: 1.0 ps +12-6 (1981Ca01).
2510.29 24	$(13/2^-)$	2.1@ ps +21-10	
2550.74 24	$17/2^+$	0.9@ ps 7	
2640.80 23	$(15/2^-)$	4@ ps 2	
2733.7 3	$(9/2^+, 17/2^+)$	0.35 ps 10	

Continued on next page (footnotes at end of table)

 $^{80}\text{Se}(\alpha, n\gamma)$ [1981Ca01](#), [1982Es01](#), [1986Pi05](#) (continued)

 ^{83}Kr Levels (continued)

<u>E(level)[†]</u>	<u>J^π[‡]</u>	<u>T_{1/2}[#]</u>
2841.5 3	(17/2 ⁻)	4.9 [@] ps 14
3157.9 3	(19/2 ⁻)	1.2 [@] ps +6-3

[†] From a least-squares fit to E γ , by evaluator.

[‡] From the Adopted Levels. Discrepancies between spin and parity assignments of [1981Ca01](#) and [1982Es01](#) have been resolved by [1986Pi05](#) using $\gamma(\theta)$ and relative γ -ray excitation functions. These discrepancies are noted in the comments.

[#] From Doppler-shift attenuation method (DSAM) in [1984Ku23](#), except where noted.

[@] From Recoil Distance Doppler Shift method (RDDM) in [1984Ku23](#) using a plunger device.

[&] Observed by [1981Ca01](#) only. Not included in Adopted Levels.

$\gamma(^{83}\text{Kr})$

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	δ @	Comments
(9.4057 6)		9.4057	7/2 ⁺	0	9/2 ⁺			E_γ : from the Adopted Levels.
(32.1516 5)		41.5573	1/2 ⁻	9.4057	7/2 ⁺			E_γ : from the Adopted Levels.
118.9 2	1.6 3	690.02	5/2 ⁻	571.14	(3/2 ⁻)	(D+Q)		I_γ : other: $I_\gamma(119\gamma)/I_\gamma(648\gamma)=0.24$ 1 (1981Ca01).
130.5 2	5.7 7	2640.80	(15/2 ⁻)	2510.29	(13/2 ⁻)	(D+Q)		
172.1 2	9.3 10	2510.29	(13/2 ⁻)	2338.18	(11/2 ⁻)	(D+Q)		
200.7 2	8.4 10	2841.5	(17/2 ⁻)	2640.80	(15/2 ⁻)	(D+Q)		
204.8 2	11 1	2470.64	(17/2 ⁻)	2265.85	(15/2 ⁺)	(D+Q)		
238.8 3	2.1 5	2510.29	(13/2 ⁻)	2271.5		(D+Q)		
285.1 3	2.7 5	2550.74	17/2 ⁺	2265.85	(15/2 ⁺)	(D+Q)		
316.4 2	3.7 6	3157.9	(19/2 ⁻)	2841.5	(17/2 ⁻)	(D+Q)		
350.5 2	3.9 6	2640.80	(15/2 ⁻)	2290.40		(D+Q)		
370.9 3	1.6 10	2841.5	(17/2 ⁻)	2470.64	(17/2 ⁻)	(E2)		Mult.: stretched Q from $\gamma(\theta)$ in 1982Es01 , M2 excluded by comparison with RUL.
480.4 2	5.8 6	1170.38	(7/2 ⁻)	690.02	5/2 ⁻	(M1+E2) ^c	-0.58 3	I_γ : other: $I_\gamma(480\gamma)/I_\gamma(1061\gamma)=0.71$ 2 (1981Ca01).
520 ^d		1533.51		1011.84	11/2 ⁺			
520.4 1	22 2	561.94	5/2 ⁻	41.5573	1/2 ⁻	E2 ^b		
529.6 1	19 2	571.14	(3/2 ⁻)	41.5573	1/2 ⁻	(M1+E2) ^b	-0.20 +5-1	
544.4 2	5.3 6	2265.85	(15/2 ⁺)	1721.56	13/2 ⁺	(M1+E2) ^c	+0.15 +2-1	I_γ : other: $I_\gamma(544\gamma)/I_\gamma(1144\gamma)=0.20$ 1 (1981Ca01).
								δ : other: 0.9 +7-5 (1986Pi05).
552.2 3	13 3	2290.40		1738.43	11/2 ⁺			
552.4 3	7.7 10	561.94	5/2 ⁻	9.4057	7/2 ⁺	(E1) ^b		I_γ : other: $I_\gamma(552\gamma)/I_\gamma(520\gamma)=0.24$ 1 (1981Ca01).
559.0 ^{&d} 4		1780.9?		1221.85	(5/2, 7/2 ⁻)			
594 ^{&}		2483.60	17/2 ⁺	1888.81	(-)			
599.3 3	5.8 10	1721.56	13/2 ⁺	1122.02	13/2 ⁺			
608.4 2	3.4 6	1170.38	(7/2 ⁻)	561.94	5/2 ⁻	(M1+E2) ^c	-0.36 2	I_γ : other: $I_\gamma(608\gamma)/I_\gamma(1061\gamma)=0.41$ 2 (1981Ca01).
616.9 3	3 2	1738.43	11/2 ⁺	1122.02	13/2 ⁺	(M1+E2) ^c	+0.18 1	I_γ : other: $I_\gamma(617\gamma)/I_\gamma(1729\gamma)=0.83$ 2 (1981Ca01).
618.8 2	6 3	1721.56	13/2 ⁺	1102.81	9/2 ⁺	E2		Mult.: stretched Q from $\gamma(\theta)$ in 1986Pi05 , M2 excluded by comparison to RUL.
630.6 3	2.4 5	1642.47	(7/2 ⁺ , 9/2, 11/2 ⁺)	1011.84	11/2 ⁺			
635.5 2	4.2 7	1738.43	11/2 ⁺	1102.81	9/2 ⁺	(M1+E2) ^c	+1.1 +1-5	I_γ : other: $I_\gamma(636\gamma)/I_\gamma(1729\gamma)=0.32$ 1 (1981Ca01).
648.5 2	18 2	690.02	5/2 ⁻	41.5573	1/2 ⁻	E2 ^b		
650.8 3	2.9 8	1221.85	(5/2, 7/2 ⁻)	571.14	(3/2 ⁻)			I_γ : other: $I_\gamma(681\gamma)/I_\gamma(648\gamma)=0.24$ 1 (1981Ca01).
680.7 2	5.7 7	690.02	5/2 ⁻	9.4057	7/2 ⁺			Mult.: indicated as M1+E2 in 1981Ca01 with $\delta=-0.10$ +2-3, however, this is inconsistent with their assignment as a 5/2 ⁻ to 7/2 ⁺ transition.
706.7 3	<2	1277.8	1/2 ⁺	571.14	(3/2 ⁻)			
709.8 2	10 2	1721.56	13/2 ⁺	1011.84	11/2 ⁺	(M1+E2)	+0.6 +4-2	
717.9 3	2.4 5	1516.56	(7/2 ⁺)	798.49	5/2 ⁺	(M1+E2) ^c	0.47 +40-20	I_γ : other: $I_\gamma(718\gamma)/I_\gamma(1517\gamma)=0.40$ 2 (1981Ca01).
789.0 2	8.6 10	798.49	5/2 ⁺	9.4057	7/2 ⁺	M1+E2 ^b	>9	δ : value given by 1981Ca01 is $\delta=19 +\infty-10$.

$^{80}\text{Se}(\alpha, n\gamma)$ **1981Ca01, 1982Es01, 1986Pi05** (continued) $\gamma(^{83}\text{Kr})$ (continued)

E_γ †	I_γ ‡	E_i (level)	J_i^π	E_f	J_f^π	Mult. #	δ @	Comments
798.5 2	3.0 6	798.49	5/2 ⁺	0	9/2 ⁺	E2 ^b		I_γ : other: $I_\gamma(799\gamma)/I_\gamma(789\gamma)=0.36$ 1 (1981Ca01).
839.2 4	1.8 6	1529.12	9/2 ⁻	690.02	5/2 ⁻	E2		Mult.: stretched Q from $\gamma(\theta)$ in 1986Pi05, M2 excluded by comparison to RUL.
843.7 3	3.3 7	1533.51		690.02	5/2 ⁻			
848 & d		1538.0?		690.02	5/2 ⁻			
962.3 d		1533.51		571.14	(3/2 ⁻)			E_γ : from 1986Pi05. Not observed in 1982Es01.
967 & d		1538.0?		571.14	(3/2 ⁻)			
967.4 3	8.5 10	1529.12	9/2 ⁻	561.94	5/2 ⁻	E2		Mult.: stretched Q from $\gamma(\theta)$ in 1986Pi05, M2 excluded by comparison to RUL.
971.5 3	1.5 5	1533.51		561.94	5/2 ⁻			
976 & d		1538.0?		561.94	5/2 ⁻			
1002.7 3	2.5 10	1011.84	11/2 ⁺	9.4057	7/2 ⁺	E2		Mult.: $\gamma(\theta)$ in 1982Es01 and 1986Pi05 both indicate stretched Q character. 1981Ca01 found (M1+E2) multipolarity with $\delta=-1.43$ +24-5.
1011.8 1	49 4	1011.84	11/2 ⁺	0	9/2 ⁺	(M1+E2) ^c	1.07 ^a +10-20	I_γ : other: $I_\gamma(1003\gamma)/I_\gamma(1012\gamma)=0.071$ 3 (1981Ca01).
1093.4 2	24 2	1102.81	9/2 ⁺	9.4057	7/2 ⁺	(M1+E2) ^c	0.27 +7-6	δ : other: $\delta=-1.73$ +31-19 (1981Ca01).
1102.7 3	2.2 5	1102.81	9/2 ⁺	0	9/2 ⁺	(M1+E2) ^c	1.3 +4-3	δ : other: $\delta=0.7$ +5-4 (1986Pi05).
1122.0 1	100	1122.02	13/2 ⁺	0	9/2 ⁺	E2 ^b		I_γ : other: $I_\gamma(1093\gamma)/I_\gamma(1103\gamma)=0.094$ 4 (1981Ca01).
1143.8 3	20 2	2265.85	(15/2 ⁺)	1122.02	13/2 ⁺	(M1+E2) ^c	-1.73 +25-7	
1161.0 2	10 1	1170.38	(7/2 ⁻)	9.4057	7/2 ⁺	(E1) ^b		δ : $\delta(E1/M2)=-0.14$ 14 (1981Ca01).
1167.5 6	7 3	2338.18	(11/2 ⁻)	1170.38	(7/2 ⁻)	(E2) ^b		
1168.7 5	4 2	2271.5		1102.81	9/2 ⁺			
1170.3 2	6.7 10	1170.38	(7/2 ⁻)	0	9/2 ⁺	(E1) ^b		I_γ : other: $I_\gamma(1170\gamma)/I_\gamma(1061\gamma)=0.63$ 2 (1981Ca01).
1198.7 3	3.9 6	1888.81	(⁻)	690.02	5/2 ⁻	E2 ^b		δ : $\delta(E1/M2)=0.00$ 1 (1981Ca01).
1212.4 2	1.9 4	1221.85	(5/2, 7/2 ⁻)	9.4057	7/2 ⁺			
1235.4 3	3.5 6	2338.18	(11/2 ⁻)	1102.81	9/2 ⁺			
1236.2 d		1277.8	1/2 ⁺	41.5573	1/2 ⁻			E_γ : tentative transition in 1981Ca01; not observed in 1982Es01 or 1986Pi05.
1313 & d		2483.60	17/2 ⁺	1170.38	(7/2 ⁻)			
1318 &		1888.81	(⁻)	571.14	(3/2 ⁻)			
1326.8 & 4		1888.81	(⁻)	561.94	5/2 ⁻			
1361.6 2	5.9 8	2483.60	17/2 ⁺	1122.02	13/2 ⁺	(E2)		Mult.: stretched Q from $\gamma(\theta)$ in 1986Pi05, M2 excluded by comparison to RUL.
1428.5 3	3.3 6	2550.74	17/2 ⁺	1122.02	13/2 ⁺	(E2)		Mult.: stretched Q from $\gamma(\theta)$ in 1986Pi05 and 1982Es01, M2 excluded by comparison with RUL.
^x 1453.2 3	28 6							
1516 & d		2640.80	(15/2 ⁻)	1122.02	13/2 ⁺			
1516.7 3	1.7 5	1516.56	(7/2 ⁺)	0	9/2 ⁺	(M1+E2) ^c	-0.6 +4-5	

⁸⁰Se($\alpha, n\gamma$) **1981Ca01, 1982Es01, 1986Pi05** (continued)

$\gamma(^{83}\text{Kr})$ (continued)								
$E_\gamma^\dagger$	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	$\delta^\oplus$	Comments
1519.5 3	4.1 8	1529.12	9/2 ⁻	9.4057	7/2 ⁺			
1529.0 3	3.6 6	1529.12	9/2 ⁻	0	9/2 ⁺			
1583.3 & d 7		2145.3?		561.94	5/2 ⁻			
1611.7 3	2.1 5	2733.7	(9/2 ⁺ , 17/2 ⁺)	1122.02	13/2 ⁺	E2		Mult.: stretched Q from $\gamma(\theta)$ in 1986Pi05 and 1982Es01 , M2 excluded by comparison with RUL.
1633.0 3	2.3 7	1642.47	(7/2 ⁺ , 9/2, 11/2 ⁺)	9.4057	7/2 ⁺			
1643.0 8	2.4 7	1642.47	(7/2 ⁺ , 9/2, 11/2 ⁺)	0	9/2 ⁺	(D+Q)		E_γ : weighted average of 1644.4 5 (1981Ca01) and 1642.5 3 (1982Es01).
1721.9 4	9.3 10	1721.56	13/2 ⁺	0	9/2 ⁺	E2		Mult.: $\gamma(\theta)$ in 1982Es01 and 1986Pi05 both indicate stretched Q character and comparison to RUL excluded M2. 1981Ca01 found (M1+E2) multipolarity with $\delta=0.51 +2-4$.
1729.1 6	7.0 10	1738.43	11/2 ⁺	9.4057	7/2 ⁺	E2 ^b		E_γ : weighted average of 1728.5 3 (1982Es01) and 1729.7 3 (1981Ca01).
1738.4 5	6.6 10	1738.43	11/2 ⁺	0	9/2 ⁺	(M1+E2) ^c	+0.84 10	I_γ : other: $I_\gamma(1738\gamma)/I_\gamma(1729\gamma)=0.97$ 3 (1981Ca01).

[†] Weighted average of **1982Es01** and **1981Ca01**, unless noted otherwise.

[‡] From **1982Es01**. **1981Ca01** give branching ratios for only select levels. Where available, these data are included in the comments, given as a ratio to the strongest depopulating transition.

From angular distribution measurements in **1981Ca01**, **1982Es01**, and **1986Pi05**, except where noted.

@ From angular distribution and polarization measurements in **1981Ca01**, except where noted. Sign of delta should be taken as relative, as sign convention is not explicitly stated by **1981Ca01**.

& Observed by **1981Ca01** only.

^a From $\gamma(\theta)$ in **1986Pi05**.

^b From angular distribution in **1981Ca01**, **1982Es01**, and **1986Pi05**; electric or magnetic character from γ -ray linear polarization measurements in **1981Ca01**.

^c D+Q from $\gamma(\theta)$, comparison with RUL excludes E1+M2.

^d Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

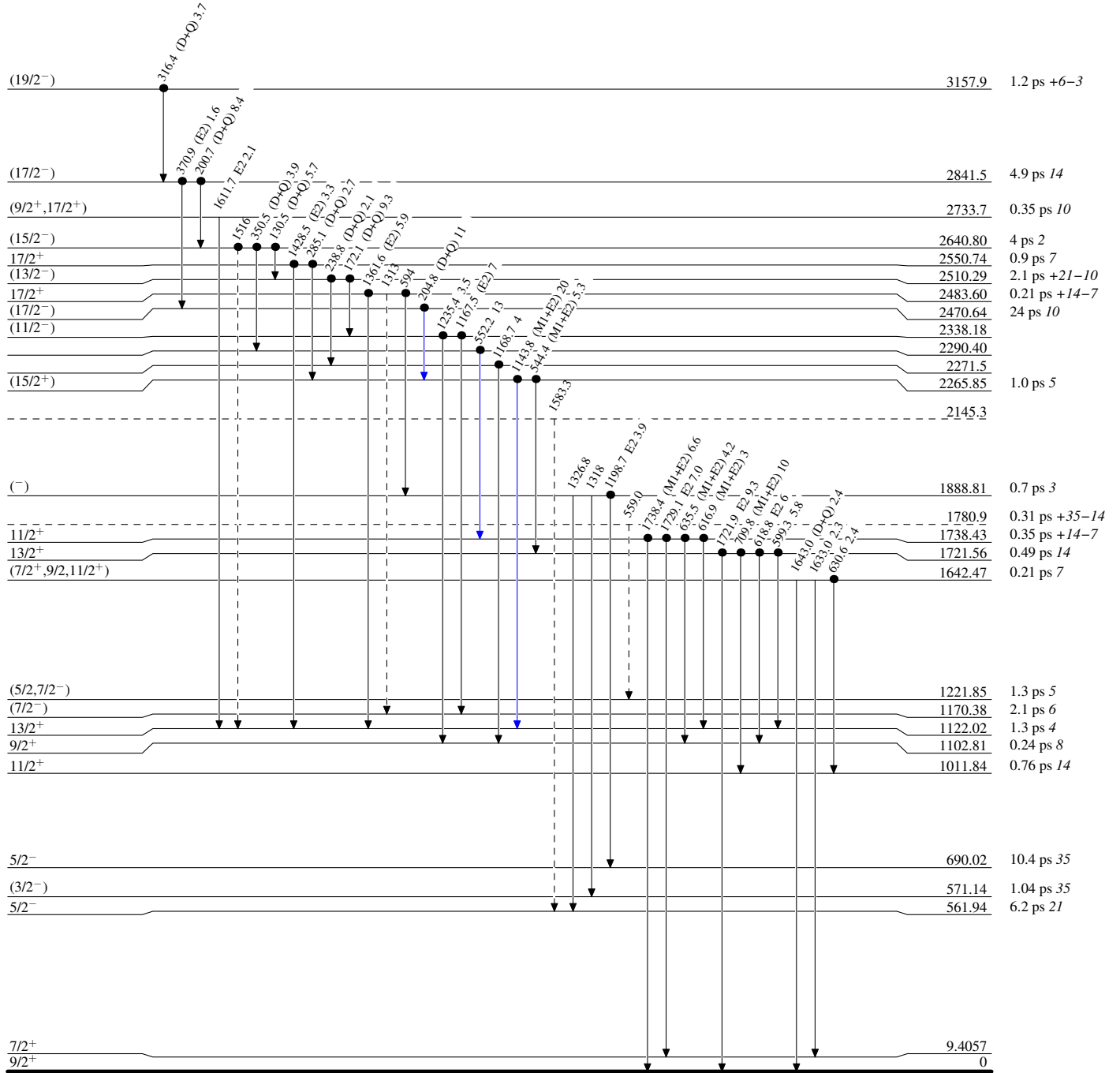
$^{80}\text{Se}(\alpha, n\gamma)$ 1981Ca01, 1982Es01, 1986Pi05

Level Scheme

Intensities: Relative I_γ

Legend

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

 $^{83}_{36}\text{Kr}_{47}$

$^{80}\text{Se}(\alpha, n\gamma)$ 1981Ca01, 1982Es01, 1986Pi05

Level Scheme (continued)

Intensities: Relative I_γ

Legend

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

