

<sup>82</sup>Se( $\alpha, n\gamma$ ) 1986ZoZW, 1986ZoZV

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen		NDS 116, 1 (2014)	31-Dec-2013

1986ZoZW, 1986ZoZV, 1986ZoZU (also thesis by A.E. Zobov, Leningrad university, 1986): E=12.5 MeV. Measured E $\gamma$ , I $\gamma$ ,  $\gamma\gamma$ ,  $\gamma(\theta)$ , excitation functions, lifetime measurements using DSAM.

Additional information 1.

1989Wi01, 1992Wi16: E=13-21 MeV. Measured delayed  $\gamma$  rays from the (17/2<sup>+</sup>) isomer at 1992 keV; and excitation functions.

1971AnZH (annual lab report): Se( $\alpha, n\gamma$ ): only a level scheme is given with levels at 305, 1108, 1141, 1167, 1224, 1343, 1416,

1612, 1846, 1874, 1931, 2004 and 2379 keV with spins ranging from 1/2 to 13/2. A total of 17  $\gamma$  rays were shown in the level scheme. All the levels and associated  $\gamma$  rays are present in 1986ZoZW.

<sup>85</sup>Kr Levels

E(level) <sup>†</sup>	J $\pi$ <sup>#</sup>	T <sub>1/2</sub> <sup>&amp;</sup>	Comments
0.0	9/2 <sup>+</sup> @		
304.9	1/2 <sup>-</sup> @	4.480 h 8	T <sub>1/2</sub> : from Adopted Levels.
1107.3	1/2 <sup>-</sup> , 3/2 <sup>-</sup> @		
1140.3	5/2 <sup>+</sup> @	3.5 ps +28-14	
1166.7	(5/2 <sup>-</sup> )@		
1223.8	(5/2 <sup>-</sup> )	2.4 ps +6-4	
1342.7	(3/2 <sup>+</sup> )@		
1416.3	5/2 <sup>+</sup> @	0.42 ps 7	
1430.6	1/2 <sup>+</sup> @		
1611.6	(11/2 <sup>+</sup> )	0.12 ps 3	
1846.9	(7/2 <sup>+</sup> )	0.08 ps +3-2	
1873.8	(5/2 <sup>+</sup> )@	0.21 ps 14	
1931.4	(13/2 <sup>+</sup> )	0.33 ps 4	
1990.1	(9/2 <sup>+</sup> )	0.23 ps 3	
1991.7	(17/2 <sup>+</sup> ) <sup>a</sup>	1.2 <sup>b</sup> $\mu$ s +10-4	
2004.2	(7/2 <sup>+</sup> )	0.21 ps 4	
2031.9	1/2 <sup>-</sup> , 3/2 <sup>-</sup> , 5/2 <sup>-</sup> @		
2113.4	(9/2 <sup>+</sup> )	0.63 ps 6	
2135.1	(9/2 <sup>+</sup> )	0.22 ps 3	
2137.5	(3/2, 5/2) <sup>-</sup> @	0.48 ps 21	
2144.9	(7/2 <sup>+</sup> )	0.31 ps 6	
2235.2			
2383.5	(7/2 <sup>+</sup> )	0.08 ps 3	
2497.9	(9/2 <sup>-</sup> )		
2534.4			
2602.2			
2616.0		0.42 ps 14	
2636.7	(11/2 <sup>+</sup> )	0.17 ps 3	
2784.5			
2814.8	(9/2 <sup>+</sup> )	0.24 ps 6	
2929.4			
3139.2		0.31 ps +10-3	
3193.5		0.19 ps 3	
3412.8	(13/2)	0.69 ps 21	
3535.4 <sup>‡</sup> 2	(17/2 <sup>-</sup> )		
3804.4 <sup>‡</sup> 3	(19/2 <sup>-</sup> )		
4111.4 <sup>‡</sup> 3	(21/2 <sup>-</sup> )		

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 ${}^{82}\text{Se}(\alpha, n\gamma)$  **1986ZoZW, 1986ZoZV (continued)**

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 ${}^{85}\text{Kr}$  Levels (continued)

† From least-squares fit to  $E\gamma$  data.

‡ Level from 1992Wi16.

# From 1986ZoZV (angular distribution if not indicated otherwise).

@ From Adopted Levels.

& From DSAM (1986ZoZU), unless otherwise stated.

<sup>a</sup> E2  $\gamma$  to  $J^\pi=(13/2^+)$ . From comparison of the excitation functions of 60 $\gamma$  and 1931 $\gamma$ , 1989Wi01 conclude that  $J>13/2$ .

<sup>b</sup> From 1989Wi01,  $p\gamma(t)$  in  ${}^{82}\text{Se}({}^7\text{Li}, p3n\gamma)$ .

<sup>82</sup>Se( $\alpha,\gamma$ ) **1986ZoZW,1986ZoZV (continued)**

$\gamma(^{85}\text{Kr})$									
$E_\gamma$ †	$I_\gamma$ †	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	$\delta^\ddagger$	$\alpha\&$	Comments
60.3	4.5	1991.7	(17/2 <sup>+</sup> )	1931.4	(13/2 <sup>+</sup> )	E2		5.94 11	$\alpha(\text{K})=4.79$ 9; $\alpha(\text{L})=0.98$ 2; $\alpha(\text{M})=0.159$ 4; $\alpha(\text{N})=0.0135$ 3 $\alpha(\text{exp})=7$ +3-2 $E_\gamma$ : from 1989Wi01. $I_\gamma$ : from 1989Wi01: $I_\gamma(60)/I_\gamma(1932)=0.045$ ( $E(\alpha)=21$ MeV), 0.040 ( $E(\alpha)=19$ MeV), 0.038 ( $E(\alpha)=16$ MeV), 0.019 ( $E(\alpha)=13$ MeV). Mult.: from $\alpha(\text{exp})=7.1$ 14 (1989Wi01, from an intensity balance in delayed $\gamma$ -ray spectrum). M2 is possible from $\alpha(\text{exp})$ but rejected by RUL.
176.0		1342.7	(3/2 <sup>+</sup> )	1166.7	(5/2 <sup>-</sup> )				
201.2		1342.7	(3/2 <sup>+</sup> )	1140.3	5/2 <sup>+</sup>				
235.6		1342.7	(3/2 <sup>+</sup> )	1107.3	1/2 <sup>-</sup> , 3/2 <sup>-</sup>				
269.0 @ 1		3804.4	(19/2 <sup>-</sup> )	3535.4	(17/2 <sup>-</sup> )				
271.2	4.1	2144.9	(7/2 <sup>+</sup> )	1873.8	(5/2 <sup>+</sup> )	(M1+E2) #	-0.06 6		
304.9		304.9	1/2 <sup>-</sup>	0.0	9/2 <sup>+</sup>	M4			Mult.: from Adopted Gammas.
307.0 @ 1		4111.4	(21/2 <sup>-</sup> )	3804.4	(19/2 <sup>-</sup> )				
320.0	2.9	1931.4	(13/2 <sup>+</sup> )	1611.6	(11/2 <sup>+</sup> )	(M1+E2)	+0.05 2		
378.6	4.1	1990.1	(9/2 <sup>+</sup> )	1611.6	(11/2 <sup>+</sup> )	(M1+E2)	+0.13 5		
430.4	1.6	1846.9	(7/2 <sup>+</sup> )	1416.3	5/2 <sup>+</sup>	(M1+E2) #	-0.03 7		
501.6		2113.4	(9/2 <sup>+</sup> )	1611.6	(11/2 <sup>+</sup> )				
523.3	7.3	2636.7	(11/2 <sup>+</sup> )	2113.4	(9/2 <sup>+</sup> )	(M1+E2)	-0.11 4		
531.1	15	1873.8	(5/2 <sup>+</sup> )	1342.7	(3/2 <sup>+</sup> )	(M1+E2)	+0.07 3		
588.3		2004.2	(7/2 <sup>+</sup> )	1416.3	5/2 <sup>+</sup>				
598		2602.2		2004.2	(7/2 <sup>+</sup> )				
639.6		2784.5		2144.9	(7/2 <sup>+</sup> )				
742.2		2616.0		1873.8	(5/2 <sup>+</sup> )				
794.7		2137.5	(3/2,5/2) <sup>-</sup>	1342.7	(3/2 <sup>+</sup> )				
802.4		1107.3	1/2 <sup>-</sup> , 3/2 <sup>-</sup>	304.9	1/2 <sup>-</sup>				
816.0		2929.4		2113.4	(9/2 <sup>+</sup> )				
861.8		1166.7	(5/2 <sup>-</sup> )	304.9	1/2 <sup>-</sup>				
865.2		2031.9	1/2 <sup>-</sup> , 3/2 <sup>-</sup> , 5/2 <sup>-</sup>	1166.7	(5/2 <sup>-</sup> )				
<sup>x</sup> 883									$E_\gamma$ : 1986ZoZW placed this $\gamma$ from a 2395 level, but no such level is evident in the current level scheme.
886.3		2497.9	(9/2 <sup>-</sup> )	1611.6	(11/2 <sup>+</sup> )				
913.8		2137.5	(3/2,5/2) <sup>-</sup>	1223.8	(5/2 <sup>-</sup> )				
915		3412.8	(13/2)	2497.9	(9/2 <sup>-</sup> )				
919.1	39	1223.8	(5/2 <sup>-</sup> )	304.9	1/2 <sup>-</sup>	(E2)			
924.6		2031.9	1/2 <sup>-</sup> , 3/2 <sup>-</sup> , 5/2 <sup>-</sup>	1107.3	1/2 <sup>-</sup> , 3/2 <sup>-</sup>				
967.9	3.9	2814.8	(9/2 <sup>+</sup> )	1846.9	(7/2 <sup>+</sup> )	(M1+E2)	+0.04 2		
1004.7	4.4	2144.9	(7/2 <sup>+</sup> )	1140.3	5/2 <sup>+</sup>	(M1+E2)	-0.8 7		
1037.7		1342.7	(3/2 <sup>+</sup> )	304.9	1/2 <sup>-</sup>				
1125.7		1430.6	1/2 <sup>+</sup>	304.9	1/2 <sup>-</sup>				

$\gamma(^{85}\text{Kr})$  (continued)

$E_\gamma$ †	$I_\gamma$ †	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. ‡	$\delta^\ddagger$	Comments
1140.6	42	1140.3	5/2 <sup>+</sup>	0.0	9/2 <sup>+</sup>	(E2)		
1207.9		3139.2		1931.4	(13/2 <sup>+</sup> )			
1262.1	20	3193.5		1931.4	(13/2 <sup>+</sup> )			
1274.0	8.0	2497.9	(9/2 <sup>-</sup> )	1223.8	(5/2 <sup>-</sup> )	(E2)		
1367.7		2534.4		1166.7	(5/2 <sup>-</sup> )			
1416.5	27	1416.3	5/2 <sup>+</sup>	0.0	9/2 <sup>+</sup>	(E2)		
1427.1		2534.4		1107.3	1/2 <sup>-</sup> , 3/2 <sup>-</sup>			
1475.6		2616.0		1140.3	5/2 <sup>+</sup>			
1527.4		3139.2		1611.6	(11/2 <sup>+</sup> )			
1543.6 @ 1		3535.4	(17/2 <sup>-</sup> )	1991.7	(17/2 <sup>+</sup> )			
1611.6	99	1611.6	(11/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2) #	-0.85 15	$\delta$ : -0.7 > $\delta$ > -1.0 ( <a href="#">1986ZoZV</a> ).
1801.1	4.7	3412.8	(13/2)	1611.6	(11/2 <sup>+</sup> )	D(+Q)	+0.03 3	
1832.4		2137.5	(3/2, 5/2) <sup>-</sup>	304.9	1/2 <sup>-</sup>			
1847.1	19	1846.9	(7/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2)	+1.7 13	$E_\gamma$ : 1874.1 in <a href="#">1986ZoZV</a> seems a misprint. $\delta$ : +0.45 to +3.0 ( <a href="#">1986ZoZV</a> ).
1931.4	100	1931.4	(13/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(E2)		
1990.0	24	1990.1	(9/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2)	-0.24 8	
2003.8	15	2004.2	(7/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2)	+0.63 20	$\delta$ : +0.43 to +0.82 ( <a href="#">1986ZoZV</a> ).
2113.6	22	2113.4	(9/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2)	+0.40 25	
2135.1	14	2135.1	(9/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(D+Q)	+0.10 16	$\delta$ : -0.06 to +0.26 ( <a href="#">1986ZoZV</a> ).
2144.6	14	2144.9	(7/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2)	-0.21 5	
2235.2		2235.2		0.0	9/2 <sup>+</sup>			
2383.5	8.6	2383.5	(7/2 <sup>+</sup> )	0.0	9/2 <sup>+</sup>	(M1+E2)	+0.3 1	

† From [1986ZoZW](#) unless otherwise stated.

‡ From  $\gamma(\theta)$  data in [1986ZoZU](#). Values of angular distribution coefficients  $A_2$  and  $A_4$  are not listed in this report.

# From Adopted  $J^\pi$ , mult is assumed to be M1(+E2).

@ From [1992Wi16](#).

& Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on  $\gamma$ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

x  $\gamma$  ray not placed in level scheme.

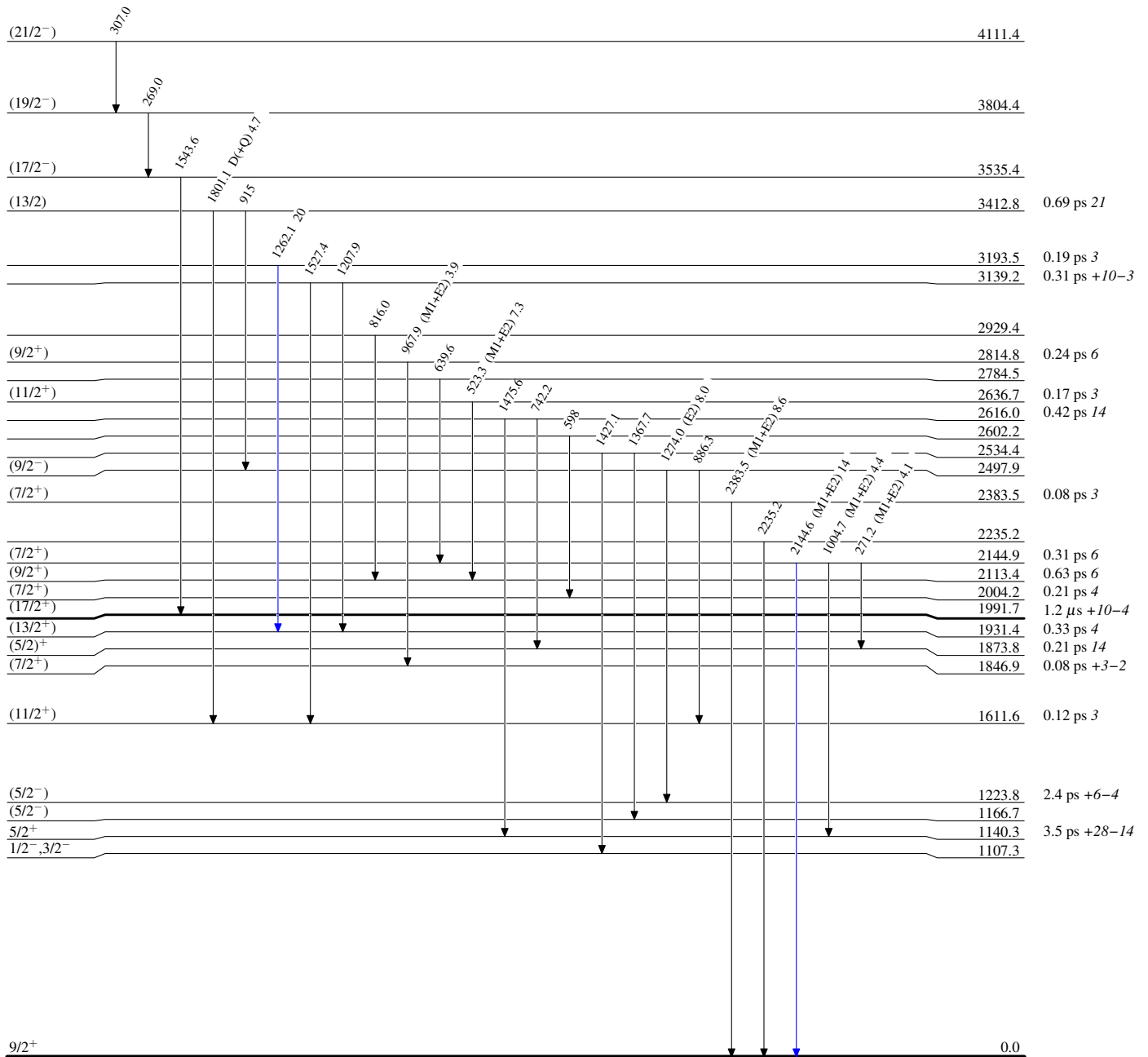
$^{82}\text{Se}(\alpha, n\gamma)$  1986ZoZW,1986ZoZV

Level Scheme

Intensities: Relative  $I_\gamma$

Legend

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



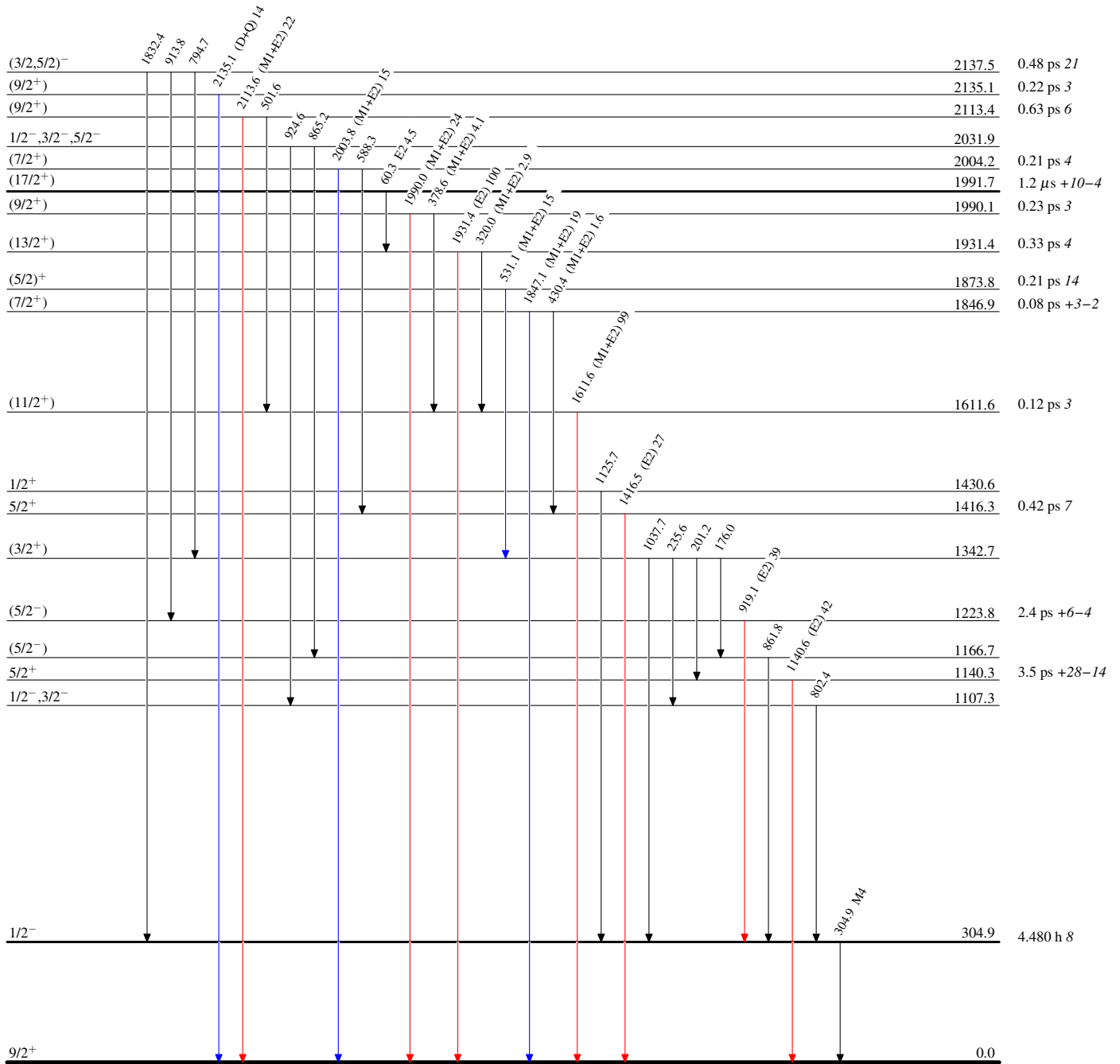
<sup>82</sup>Se(α,nγ) 1986ZoZW,1986ZoZV

Level Scheme (continued)

Intensities: Relative I<sub>γ</sub>

Legend

- I<sub>γ</sub> < 2% × I<sub>γ</sub><sup>max</sup>
- I<sub>γ</sub> < 10% × I<sub>γ</sub><sup>max</sup>
- I<sub>γ</sub> > 10% × I<sub>γ</sub><sup>max</sup>



<sup>85</sup>Kr<sub>36</sub>49