

Adopted Levels, Gammas

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	D. Abriola(a), A. A. Sonzogni		NDS 111,1 (2010)	1-May-2009

$Q(\beta^-) = -8801.7$; $S(n) = 12793.4$; $S(p) = 7264.5$; $Q(\alpha) = -3314.3$ [2012Wa38](#)

Note: Current evaluation has used the following Q record -8799.7 12796.7 7265.5 -3315.7 [2009AuZZ](#).

 ^{72}Se LevelsCross Reference (XREF) Flags

A	^{72}Br ε decay	D	$^{74}\text{Se}(p,t)$
B	^{73}Kr εp decay (27.3 s)	E	(HI,xn γ)
C	$^{70}\text{Ge}(\alpha,2n\gamma)$, $^{72}\text{Ge}(\alpha,4n\gamma)$	F	$^{54}\text{Fe}(^{24}\text{Mg},\alpha 2p\gamma)$

E(level) [†]	J ^π [‡]	T _{1/2} ^{&}	XREF	Comments
0 ^a	0 ⁺	8.40 d 8	ABCDEF	% ε =100 T _{1/2} : from 1958Cu91 . Other: 9.7 d (1950Ho26).
862.07 ^a 8	2 ⁺ #	2.82 ps 20	ABCDEF	
937.22 ^b 15	0 ⁺ #	17.5 ns 17	ABCDEF	T _{1/2} : unweighted average of delayed coincidence measurements: 19.3 ns 4 from $^{70}\text{Ge}(\alpha,2n\gamma)$ (1974Dr02) and 15.8 ns 10 from ^{72}Br ε decay (1974Ha04).
1316.68 8	2 ⁺	8.7 ps 3	AB E	J ^π : from $\gamma(\theta)$ in (HI,xn γ) and γ to 0 ⁺ .
1636.86 ^a 12	4 ⁺	2.07 ps 16	A C EF	J ^π : stretched E2 γ to 2 ⁺ .
1876.23 17	(2,4)		A E	
1998.93 ^b 13	2 ⁺		A EF	J ^π : from γ 's to 0 ⁺ and 2 ⁺ , and $\gamma(\theta)$ (HI,xn γ).
2150.1 8	(2 ⁺)		A	J ^π : γ 's to 0 ⁺ , 2 ⁺ , and 4 ⁺ .
2293.69 11	(2)	<1.0 ps	E	
2371.50 21			A E	E(level): may be a doublet: J ^π =(2) ⁺ from γ to 0 ⁺ and log ft=6.34 from 3 ⁺ , J=(3) from $\gamma(\theta)$ in (HI,xn γ).
2405.74 21	3 ⁻ #	<1.0 ps	DE	
2433.76 ^c 10	3 ⁻ @	<1.0 ps	A EF	
2466.77 ^a 15	6 ⁺	1.24 ps 8	C EF	J ^π : stretched E2 γ to 4 ⁺ .
2586.35 16	(3)		A E	
2843	5 ⁻ #		D	
2929	3 ⁻ #		D	
2965.75 23			A	
3124.07 21	(4 ⁺)		A DE	J ^π : L(p,t)=4 at 3138 20. γ 's to 2 ⁺ , (3).
3173.20 ^c 12	5 ⁻ @	<1.0 ps	EF	
3213.51 16	(2 ⁺ ,3,4 ⁺)		E	J ^π : γ 's to (2 ⁺) and (4 ⁺).
3226.2 3	(2,3,4 ⁺)		A	J ^π : γ 's to 2 ⁺ and log ft=6.43 from 3 ⁺ .
3232.09 13			E	
3239.3 9			A	
3349.91 13	5 ⁻ @	<1.0 ps	DE	J ^π : L(p,t)=(5) for E $\approx$ 3340.
3382.6 3			E	
3424.77 ^a 25	8 ⁺	0.51 ps 5	EF	J ^π : stretched E2 γ to 6 ⁺ .
3450	2 ⁺ #		D	
3521.95 14	6 ⁻ @	2.9 ps 3	E	
3762	4 ⁺ #		D	
3769.99 14	7 ⁻ @	2.8 ps 2	EF	
3917.25 ^c 15	7 ⁻ @	0.79 ps 17	EF	
4092.8 3			E	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{72}Se Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2} ^{&}	XREF	Comments
4217.7 3			E	
4310	6 ⁺ #		D	
4325.7 4			E	J ^π : π=– from placement in the band.
4504.3 ^a 3	10 ⁺	0.22 ps 2	EF	J ^π : stretched E2 γ to 8 ⁺ .
4713.20 25			E	
4762.83 ^c 19	(9 ⁻)@	0.59 ps 8	EF	
5709.7 ^a 3	12 ⁺	0.14 ps 2	EF	J ^π : stretched E2 γ to 10 ⁺ .
5830.8 ^c 9	(11 ⁻)@	0.83 ps 10	EF	
6686.5 9	(11 ⁻)@		EF	
7038.1 ^a 6	14 ⁺	0.097 ps 8	EF	J ^π : stretched E2 γ to 12 ⁺ .
7041.9 ^c 12	(13 ⁻)@	<0.69 ps	EF	
7190.7 10	(12 ⁻)@		EF	
7795.7 14	(13 ⁻)@		EF	
8089.7 ^c 12	(14 ⁻)@		EF	
8495.1 ^a 12	16 ⁺	0.040 ps 7	EF	J ^π : stretched E2 γ to 14 ⁺ .
10095.1 ^a 15	18 ⁺	0.042 ps 10	EF	J ^π : stretched E2 γ to 16 ⁺ .
11832.2 ^a 18	20 ⁺	0.069 ps 14	EF	J ^π : stretched E2 γ to 18 ⁺ .
13742.2 ^a 21	22 ⁺	<0.05 ps	EF	J ^π : stretched E2 γ to 20 ⁺ .
15896.2 ^a 23	24 ⁺	<0.3 ps	EF	J ^π : stretched E2 γ to 22 ⁺ .
18216 ^a 3	(26 ⁺)	<0.3 ps	E	E(level): 1991Ch14 observed a 26 ⁺ level at 18184 3 which decays to the 24 ⁺ level.
				J ^π : stretched (E2) γ to 24 ⁺ .
20798 ^a 3	(28 ⁺)	<0.3 ps	E	J ^π : stretched (E2) γ to (26 ⁺).

[†] Levels not connected to any other level are taken from $^{74}\text{Se}(p,t)$; other level energies are calculated from the adopted E_γ data.

[‡] From γ(θ) in (HI,xnγ) and γ decay mode, except as noted.

From L(p,t).

@ From DCO ratios and systematics (1989My01).

& From (HI,xnγ), except as noted.

^a Band(A): g.s. band.

^b Band(B): second 0⁺ band.

^c Band(C): negative parity.

Adopted Levels, Gammas (continued)

$\gamma(^{72}\text{Se})$									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	I_γ	E_f	J_f^π	Mult. [‡]	$\alpha^@$	Comments	
862.07	2 ⁺	862.03 12	100	0	0 ⁺	E2	6.03×10 ⁻⁴	$\alpha(\text{K})=0.000537$ 8; $\alpha(\text{L})=5.65\times 10^{-5}$ 8; $\alpha(\text{M})=8.79\times 10^{-6}$ 13; $\alpha(\text{N})=7.47\times 10^{-7}$ 11; $\alpha(\text{N}+..)=7.47\times 10^{-7}$ 11 B(E2)(W.u.)=23.7 17	
937.22	0 ⁺	75 2		862.07	2 ⁺	[E2]	2.4 3	$\alpha(\text{K})=2.05$ 22; $\alpha(\text{L})=0.32$ 4; $\alpha(\text{M})=0.050$ 6; $\alpha(\text{N})=0.0036$ 5; $\alpha(\text{N}+..)=0.0036$ 5 Mult.: from adopted J^π values. $\text{I}(\gamma+\text{ce})=100$ 17. B(E2)(W.u.)=162 28. Mult.: from ce data in $(\alpha,4n\gamma)$. $\text{I}(\gamma+\text{ce})=37$ 17.	
1316.68	2 ⁺	937 379.55 23	35 2	0 937.22	0 ⁺ 0 ⁺	E0 [E2]	0.00666	$\alpha(\text{K})=0.00591$ 9; $\alpha(\text{L})=0.000648$ 10; $\alpha(\text{M})=0.0001006$ 15; $\alpha(\text{N})=8.38\times 10^{-6}$ 12 $\alpha(\text{N}+..)=8.38\times 10^{-6}$ 12 B(E2)(W.u.)=77 6	
		454.70 10 1316.70 10	76 5 100 6	862.07 0	2 ⁺ 0 ⁺	E2	2.60×10 ⁻⁴	$\alpha(\text{K})=0.000203$ 3; $\alpha(\text{L})=2.11\times 10^{-5}$ 3; $\alpha(\text{M})=3.28\times 10^{-6}$ 5; $\alpha(\text{N})=2.81\times 10^{-7}$ 4; $\alpha(\text{N}+..)=3.20\times 10^{-5}$ 5 B(E2)(W.u.)=0.44 4	
1636.86	4 ⁺	774.73 17	100	862.07	2 ⁺	E2	7.92×10 ⁻⁴	$\alpha(\text{K})=0.000705$ 10; $\alpha(\text{L})=7.45\times 10^{-5}$ 11; $\alpha(\text{M})=1.158\times 10^{-5}$ 17; $\alpha(\text{N})=9.83\times 10^{-7}$ 14 $\alpha(\text{N}+..)=9.83\times 10^{-7}$ 14 B(E2)(W.u.)=55 5	
1876.23	(2,4)	559.34 24 1014.0 8	100 6 27 14	1316.68 862.07	2 ⁺ 2 ⁺				
1998.93	2 ⁺	1061.69 10	79 7	937.22	0 ⁺	[E2]	3.66×10 ⁻⁴	$\alpha(\text{K})=0.000326$ 5; $\alpha(\text{L})=3.41\times 10^{-5}$ 5; $\alpha(\text{M})=5.30\times 10^{-6}$ 8; $\alpha(\text{N})=4.52\times 10^{-7}$ 7; $\alpha(\text{N}+..)=4.52\times 10^{-7}$ 7	
2150.1	(2 ⁺)	1136.87 12 512 & 2 832 2	100 10 100 40 100 40	862.07 1636.86 1316.68	2 ⁺ 4 ⁺ 2 ⁺				
2293.69	(2)	2150.7 10 977.1 1	48 14 100 8	0 1316.68	0 ⁺ 2 ⁺				
2371.50		1431.2 2 1054.7 3 1433.6 10 1509.8 4 2371.9 7	87 3 50 8 13 5 44 7 100 10	862.07 1316.68 937.22 862.07 0	2 ⁺ 2 ⁺ 0 ⁺ 2 ⁺ 0 ⁺				
2405.74	3 ⁻	1088.9 3	100	1316.68	2 ⁺	[E1]	1.55×10 ⁻⁴	$\alpha(\text{K})=0.0001380$ 20; $\alpha(\text{L})=1.422\times 10^{-5}$ 20; $\alpha(\text{M})=2.21\times 10^{-6}$ 3; $\alpha(\text{N}+..)=1.89\times 10^{-7}$ 3 B(E1)(W.u.)>0.00030	
2433.76	3 ⁻	1117.2 1 1571.58 10 2432.7 8	25.0 19 100 5 33 7	1316.68 862.07 0	2 ⁺ 2 ⁺ 0 ⁺				
2466.77	6 ⁺	830.1 2	100	1636.86	4 ⁺	E2	6.63×10 ⁻⁴	$\alpha(\text{K})=0.000590$ 9; $\alpha(\text{L})=6.22\times 10^{-5}$ 9; $\alpha(\text{M})=9.67\times 10^{-6}$ 14;	

Adopted Levels, Gammas (continued)

$\gamma(^{72}\text{Se})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	I_γ	E_f	J_f^π	Mult. [‡]	$\alpha^@$
$\alpha(\text{N})=8.22\times 10^{-7} \text{ } 12$; $\alpha(\text{N}+..)=8.22\times 10^{-7} \text{ } 12$ $\text{B(E2)}(\text{W.u.})=65 \text{ } 5$							
2586.35	(3)	710.12 <i>18</i>	47 <i>10</i>	1876.23	(2,4)		
		1269.5 <i>5</i>	24 <i>12</i>	1316.68	2 ⁺		
		1724.43 <i>19</i>	100 <i>8</i>	862.07	2 ⁺		
2965.75		379.9& <i>3</i>	≤ 100	2586.35	(3)		
		1089.2& <i>3</i>	≤ 88	1876.23	(2,4)		
		1648.5 <i>5</i>	43 <i>12</i>	1316.68	2 ⁺		
3124.07	(4 ⁺)	537.6 <i>3</i>	24 <i>8</i>	2586.35	(3)		
		752.8 <i>4</i>	55 <i>8</i>	2371.50			
		1125.1 <i>3</i>	100 <i>11</i>	1998.93	2 ⁺		
		1807.4 <i>6</i>	33 <i>7</i>	1316.68	2 ⁺		
3173.20	5 ⁻	739.5 <i>1</i>	18 <i>3</i>	2433.76	3 ⁻		
		879.3 <i>2</i>	≤ 13	2293.69	(2)		
		1536.1 <i>3</i>	100 <i>4</i>	1636.86	4 ⁺		
3213.51	(2 ⁺ ,3,4 ⁺)	807.7 <i>2</i>	100 <i>18</i>	2405.74	3 ⁻		
		920.0 <i>2</i>	36 <i>9</i>	2293.69	(2)		
		1576.5 <i>2</i>	91 <i>18</i>	1636.86	4 ⁺		
3226.2	(2,3,4 ⁺)	1227.3 <i>4</i>	47 <i>19</i>	1998.93	2 ⁺		
		1349.9 <i>3</i>	100 <i>19</i>	1876.23	(2,4)		
		1909.4 <i>7</i>	59 <i>16</i>	1316.68	2 ⁺		
3232.09		798.3 <i>1</i>	92 <i>8</i>	2433.76	3 ⁻		
		1595.3 <i>2</i>	100 <i>15</i>	1636.86	4 ⁺		
3239.3		1089.2 <i>3</i>	100	2150.1	(2 ⁺)		
3349.91	5 ⁻	916.1 <i>2</i>	11.6 <i>23</i>	2433.76	3 ⁻		
		1713.0 <i>1</i>	100 <i>7</i>	1636.86	4 ⁺		
3382.6		1088.9 <i>3</i>	100	2293.69	(2)		
3424.77	8 ⁺	958.0 <i>2</i>	100	2466.77	6 ⁺	E2	4.66×10^{-4}
$\alpha(\text{K})=0.000415 \text{ } 6$; $\alpha(\text{L})=4.35\times 10^{-5} \text{ } 6$; $\alpha(\text{M})=6.77\times 10^{-6} \text{ } 10$; $\alpha(\text{N})=5.76\times 10^{-7} \text{ } 8$; $\alpha(\text{N}+..)=5.76\times 10^{-7} \text{ } 8$ $\text{B(E2)}(\text{W.u.})=77 \text{ } 8$							
3521.95	6 ⁻	172.0 <i>1</i>	45 <i>3</i>	3349.91	5 ⁻		
		348.8 <i>1</i>	100 <i>3</i>	3173.20	5 ⁻		
3769.99	7 ⁻	248.1		3521.95	6 ⁻		
		596.7 <i>1</i>	39 <i>3</i>	3173.20	5 ⁻		
		1303.3 <i>1</i>	100 <i>3</i>	2466.77	6 ⁺		
3917.25	7 ⁻	744.1 <i>1</i>	100 <i>9</i>	3173.20	5 ⁻		
		1450.3 <i>2</i>	78 <i>22</i>	2466.77	6 ⁺		
4092.8		879.3 <i>2</i>	100	3213.51	(2 ⁺ ,3,4 ⁺)		
4217.7		1750.9 <i>2</i>	100	2466.77	6 ⁺		
4325.7		555.7 <i>4</i>	100	3769.99	7 ⁻		
4504.3	10 ⁺	1079.5 <i>1</i>	100	3424.77	8 ⁺	E2	3.52×10^{-4}
$\alpha(\text{K})=0.000314 \text{ } 5$; $\alpha(\text{L})=3.28\times 10^{-5} \text{ } 5$; $\alpha(\text{M})=5.10\times 10^{-6} \text{ } 8$;							

Adopted Levels, Gammas (continued)

$\gamma(^{72}\text{Se})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	I_γ	E_f	J_f^π	Mult. [‡]	$\alpha^@$	Comments	
								$\alpha(\text{N})=4.35\times 10^{-7} \text{ 6}$; $\alpha(\text{N}+..)=4.35\times 10^{-7} \text{ 6}$ B(E2)(W.u.)=99 9	
4713.20		943.2 2	100	3769.99	7 ⁻				
4762.83	(9 ⁻)	845.6 2	100 13	3917.25	7 ⁻				
		992.8 2	38 13	3769.99	7 ⁻				
		1338.3		3424.77	8 ⁺				
5709.7	12 ⁺	1205.4 2	100	4504.3	10 ⁺	E2	2.85×10^{-4}	$\alpha(\text{K})=0.000246 \text{ 4}$; $\alpha(\text{L})=2.56\times 10^{-5} \text{ 4}$; $\alpha(\text{M})=3.98\times 10^{-6} \text{ 6}$; $\alpha(\text{N})=3.40\times 10^{-7} \text{ 5}$; $\alpha(\text{N}+..)=9.54\times 10^{-6} \text{ 14}$ B(E2)(W.u.)=89 13	
5830.8	(11 ⁻)	1068.0	100	4762.83	(9 ⁻)				
6686.5	(11 ⁻)	1923.6	100	4762.83	(9 ⁻)				
7038.1	14 ⁺	1328.4 5	100	5709.7	12 ⁺	E2	2.58×10^{-4}	$\alpha(\text{K})=0.000199 \text{ 3}$; $\alpha(\text{L})=2.07\times 10^{-5} \text{ 3}$; $\alpha(\text{M})=3.22\times 10^{-6} \text{ 5}$; $\alpha(\text{N})=2.75\times 10^{-7} \text{ 4}$; $\alpha(\text{N}+..)=3.48\times 10^{-5} \text{ 5}$ B(E2)(W.u.)=79 7	
7041.9	(13 ⁻)	1211.0	100	5830.8	(11 ⁻)				
7190.7	(12 ⁻)	504.2		6686.5	(11 ⁻)				
		1359.8		5830.8	(11 ⁻)				
7795.7	(13 ⁻)	605.0	100	7190.7	(12 ⁻)				
8089.7	(14 ⁻)	899.0		7190.7	(12 ⁻)				
		1047.8		7041.9	(13 ⁻)				
8495.1	16 ⁺	1457	100	7038.1	14 ⁺	E2 [#]	2.55×10^{-4}	$\alpha(\text{K})=0.0001648 \text{ 23}$; $\alpha(\text{L})=1.708\times 10^{-5} \text{ 24}$; $\alpha(\text{M})=2.66\times 10^{-6} \text{ 4}$; $\alpha(\text{N})=2.27\times 10^{-7} \text{ 4}$; $\alpha(\text{N}+..)=7.05\times 10^{-5} \text{ 10}$ B(E2)(W.u.)=121 22	
10095.1	18 ⁺	1600	100	8495.1	16 ⁺	E2 [#]	2.79×10^{-4}	$\alpha(\text{K})=0.0001367 \text{ 20}$; $\alpha(\text{L})=1.414\times 10^{-5} \text{ 20}$; $\alpha(\text{M})=2.20\times 10^{-6} \text{ 3}$; $\alpha(\text{N})=1.88\times 10^{-7} \text{ 3}$; $\alpha(\text{N}+..)=0.0001262 \text{ 18}$ B(E2)(W.u.)=72 18	
11832.2	20 ⁺	1737	100	10095.1	18 ⁺	E2 [#]	3.17×10^{-4}	$\alpha(\text{K})=0.0001165 \text{ 17}$; $\alpha(\text{L})=1.204\times 10^{-5} \text{ 17}$; $\alpha(\text{M})=1.87\times 10^{-6} \text{ 3}$; $\alpha(\text{N})=1.603\times 10^{-7} \text{ 23}$; $\alpha(\text{N}+..)=0.000186 \text{ 3}$ B(E2)(W.u.)=29 6	
13742.2	22 ⁺	1910	100	11832.2	20 ⁺	E2 [#]	3.75×10^{-4}	$\alpha(\text{K})=9.74\times 10^{-5} \text{ 14}$; $\alpha(\text{L})=1.005\times 10^{-5} \text{ 14}$; $\alpha(\text{M})=1.563\times 10^{-6} \text{ 22}$; $\alpha(\text{N})=1.339\times 10^{-7} \text{ 19}$ $\alpha(\text{N}+..)=0.000266 \text{ 4}$ B(E2)(W.u.)>25	
15896.2	24 ⁺	2154	100	13742.2	22 ⁺	E2 [#]	4.72×10^{-4}	$\alpha(\text{K})=7.82\times 10^{-5} \text{ 11}$; $\alpha(\text{L})=8.06\times 10^{-6} \text{ 12}$; $\alpha(\text{M})=1.253\times 10^{-6} \text{ 18}$; $\alpha(\text{N})=1.074\times 10^{-7} \text{ 15}$ $\alpha(\text{N}+..)=0.000385 \text{ 6}$ B(E2)(W.u.)>2.3	
18216	(26 ⁺)	2320	100	15896.2	24 ⁺	(E2) [#]	5.43×10^{-4}	$\alpha(\text{K})=6.86\times 10^{-5} \text{ 10}$; $\alpha(\text{L})=7.05\times 10^{-6} \text{ 10}$; $\alpha(\text{M})=1.097\times 10^{-6} \text{ 16}$; $\alpha(\text{N})=9.41\times 10^{-8} \text{ 14}$	

Adopted Levels, Gammas (continued)

<u>$\gamma(^{72}\text{Se})$ (continued)</u>								
<u>$E_i(\text{level})$</u>	<u>J_i^π</u>	<u>$E_\gamma^\dagger$</u>	<u>I_γ</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[‡]</u>	<u>$\alpha^@$</u>	Comments
20798	(28 ⁺)	2582	100	18216	(26 ⁺)	(E2) [#]	6.54×10^{-4}	$\alpha(\text{N}+..)=0.000466$ 7 B(E2)(W.u.)>1.6 $\alpha(\text{K})=5.70 \times 10^{-5}$ 8; $\alpha(\text{L})=5.86 \times 10^{-6}$ 9; $\alpha(\text{M})=9.11 \times 10^{-7}$ 13; $\alpha(\text{N})=7.81 \times 10^{-8}$ 11; $\alpha(\text{N}+..)=0.000591$ 9 B(E2)(W.u.)>0.92

[†] γ data from levels above 3.3 MeV are from (HI,xn γ); for other γ radiations, data are from ^{72}Br ε decay and (HI,xn γ); averages have been calculated where possible.

[‡] Mult=E2 from $\gamma(\theta)$ in (HI,xn γ) and RUL, except as noted.

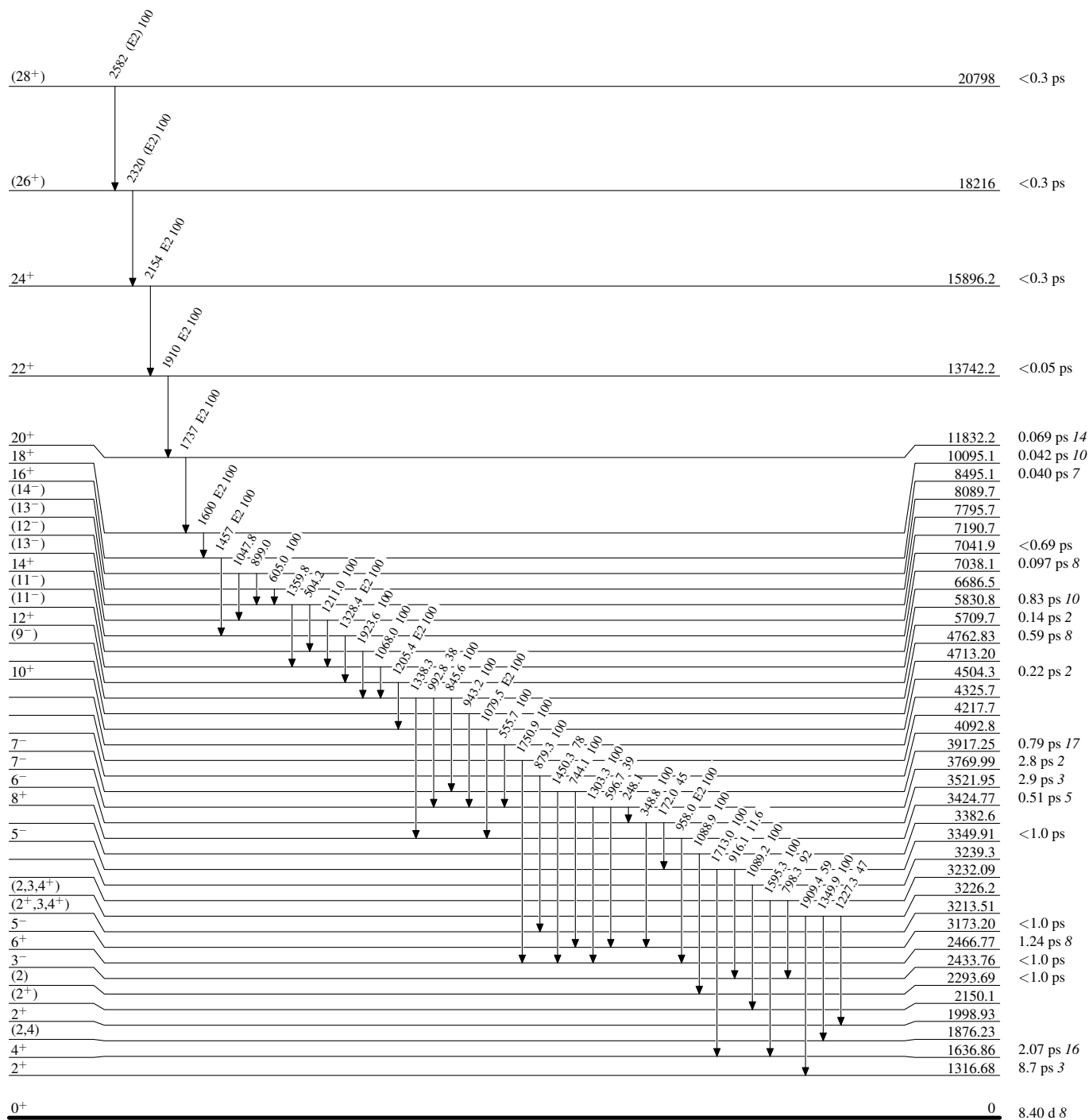
[#] Stretched E2 transitions from DCO ratios ≈ 1 , (HI,xn γ).

[@] 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.

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

Adopted Levels, GammasLevel Scheme

Intensities: Relative photon branching from each level

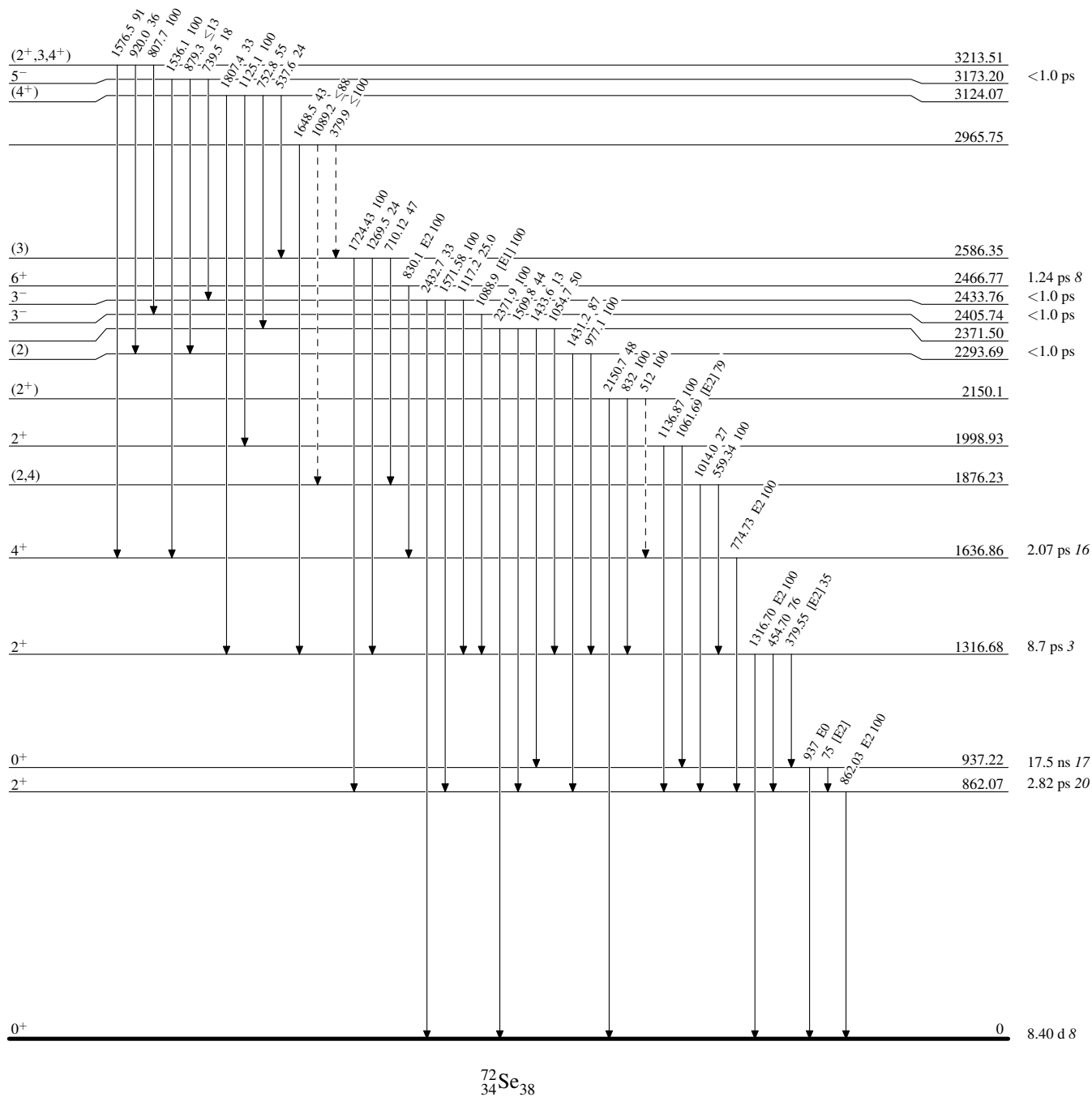


Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

Adopted Levels, Gammas

