Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 188,1 (2023)	17-Jan-2023

Q(β^-)=−1018×10[1] *13*; S(n)=13148 *16*; S(p)=1861 *6*; Q(α)=−2340 *5* 2021Wa16
S(2n)=26390 *40*, S(2p)=7970 *30*, Q(εp)=543 *6*, Q(ε)=6644 *6* (2021Wa16).
Mass measurements: 2021Ma22, 2009Sa12, 2002Li24.
1964Fl03: $^{70-72}$Br or $^{70-72}$Kr claimed to have been produced in Ni(^{20}Ne,X) E=140 MeV reaction and a delayed proton group of 2.5 MeV with a half-life of 23 s *4*. It is not possible to associate this observation with a presently known activity.
1976Ro01: possible identification of ^{71}Br isotope (from buildup of ^{71}Se activity) in ^{58}Ni(^{16}O,p2n) reaction at 54 MeV, crude estimate of half-life.
1981Vo04: ^{71}Br identified and produced in Nb(p,X) reaction at E=600 MeV, measured half-life and yield.
1982Ha32: ^{71}Br identified and produced in ^{40}Ca(^{35}Cl,2n2p) reaction followed by mass separation. Measured Eγ, $T_{1/2}$. Earlier report on ^{71}Br nuclide by the same group in Proc. Int. Conf. on Nuclei far from Stability, Helsingor (June 1981).
Additional information 1.
Theoretical structure calculations: 1998Ur03: calculated Gamow-Teller strengths, deformations, levels, J^π using Hartree-Fock approach.

^{71}Br Levels

Cross Reference (XREF) Flags

A ^{71}Kr ε decay (94.9 ms)
B ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ),
C ^{40}Ca(^{40}Ca,2αpγ)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0	(5/2)$^-$	21.4 s *6*	ABC	%ε+%β^+=100 J$^\pi$: log *ft*=5.1 to 5/2$^-$ state in ^{71}Se; systematics. $T_{1/2}$: from 1982Ha32, time decay of 4 strongest γ rays and Se x-rays. Others: 21.5 s *5* (1981Vo04, multiscaling of β activity), <1 min (1976Ro01). The evaluators recommend $T_{1/2}$ from 1982Ha32 because of better isotopic selectivity through γ-ray detection, even though this value has somewhat larger uncertainty than in 1981Vo04.
9.86 *14*	(1/2$^-$)		ABC	Possible configuration=π1/2[301] as for ground state of ^{73}Br.
207.89[&] *13*	(3/2$^-$)		ABC	
407.09[d] *16*	(5/2)$^-$		ABC	J$^\pi$: allowed β (log *ft*=4.87) from (5/2)$^-$; ΔJ=0, 407.3γ to (5/2)$^-$.
615.13 *24*	(3/2,7/2$^-$)		C	
669.61[a] *14*	(5/2$^+$)		BC	
722.1? *3*	(7/2$^-$)		C	
759.09[c] *19*	(9/2$^+$)	32.5 ns *25*	BC	$T_{1/2}$: from $\gamma\gamma$(t) in ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ),
776.2[@] *4*	(5/2$^-$)		C	
806.6[&] *3*	(7/2$^-$)		BC	
892.12[b] *22*	(7/2$^+$)		C	
929.30[#] *25*	(7/2$^-$)		C	
1055.4?[#] *4*	(9/2$^-$)		C	
1070.3?[d] *4*	(7/2$^-$)		C	
1174.06[a] *22*	(9/2$^+$)		C	
1490.2[b] *3*	(11/2$^+$)		C	
1491.8[d] *3*	(9/2$^-$)		C	
1496.6[c] *3*	(13/2$^+$)		BC	
1586.1 *4*	(11/2$^+$)		C	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{71}Br Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
1683.4@ 4	(9/2⁻)	C	4313.8f 6	(21/2⁺)	C	7789.9c 12	(33/2⁺)	C
1714.2& 3	(11/2⁻)	BC	4503.0e 6	(25/2⁺)	C	8244.9a 12	(33/2⁺)	C
2122.0f 3	(13/2⁺)	C	4741.9& 5	(23/2⁻)	C	8422.6g 9		C
2216.6# 4	(13/2⁻)	C	4743.6c 7	(25/2⁺)	C	8955.7e 17	(37/2⁺)	C
2217.1a 4	(13/2⁺)	C	4745.9b 9	(23/2⁺)	C	9090.5b 14	(35/2⁺)	C
2352.4b 4	(15/2⁺)	C	4969.4 6	(25/2⁺)	C	9194.8@ 10	(37/2⁻)	C
2392.8c 4	(17/2⁺)	BC	5313.7a 8	(25/2⁺)	C	9320.5& 22	(35/2⁻)	C
2477.6@ 4	(13/2⁻)	C	5375.2@ 5	(25/2⁻)	C	9526.7c 23	(37/2⁺)	C
2520.0& 4	(15/2⁻)	BC	5811.8e 6	(29/2⁺)	C	9721.7g 13		C
3046.6a 4	(17/2⁺)	C	5994.8b 10	(27/2⁺)	C	9996.9a 24	(37/2⁺)	C
3187.9# 5	(17/2⁻)	C	6167.2& 6	(27/2⁻)	C	10752.2b 20	(39/2⁺)	C
3262.0f 5	(17/2⁺)	C	6190.9c 8	(29/2⁺)	C	10992.4e 23	(41/2⁺)	C
3376.9@ 4	(17/2⁻)	C	6613.4@ 6	(29/2⁻)	C	11030.9@ 23	(41/2⁻)	C
3434.0b 6	(19/2⁺)	C	6709.2a 9	(29/2⁺)	C	11434c 3	(41/2⁺)	C
3475.2c 5	(21/2⁺)	BC	7157.2e 8	(33/2⁺)	C	11487.7g 24		C
3529.3& 4	(19/2⁻)	C	7424.8g 9		C	12381b 3	(43/2⁺)	C
4015.9 4	(21/2⁻)	C	7470.8b 11	(31/2⁺)	C	12875e 3	(45/2⁺)	C
4092.2a 7	(21/2⁺)	C	7759.2& 17	(31/2⁻)	C	13472c 4	(45/2⁺)	C
4311.1@ 4	(21/2⁻)	C	7785.5@ 8	(33/2⁻)	C	14959e 4	(49/2⁺)	C

† From least-squares fit to Eγ data taken from ^{40}Ca(^{40}Ca,2αpγ).

‡ As proposed in ^{40}Ca(^{40}Ca,2αpγ) for excited states, but with all assignments given in parentheses, as complete details of this study are not available, thus the assignments cannot be supported by strong arguments.

Band(A): π5/2[312]. Configuration contains small admixtures from 5/2 members of other rotational bands.

@ Band(B): π3/2[312],α=+1/2.

& Band(b): π3/2[312],α=−1/2.

a Band(C): π5/2[422],α=+1/2.

b Band(c): π5/2[422],α=−1/2.

c Band(D): Band based on (9/2⁺). Probable oblate structure.

d Band(E): Band based on (5/2)⁻.

e Band(F): Band based on (25/2⁺).

f Band(G): Band based on (13/2⁺).

g Seq.(H): γ cascade.

Adopted Levels, Gammas (continued)

$\gamma(^{71}Br)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[@]	δ[@]	α[&]	$I_{(\gamma+ce)}$	Comments
9.86	(1/2$^-$)	(9.86 *14*)		0.0	(5/2)$^-$				100	E_γ: from level-energy difference.
207.89	(3/2$^-$)	198.0 *2*	100[‡] *29*	9.86	(1/2$^-$)	(M1+E2)	+0.21 *7*			
		207.9 *2*	73[‡] *12*	0.0	(5/2)$^-$					E_γ: weighted average of 208.0 *2* in ^{71}Kr ε decay and 207.7 *2* in (^{40}Ca,2αpγ).
407.09	(5/2)$^-$	199.0 *5*	100[‡] *11*	207.89	(3/2$^-$)					
		397.2 *2*	21.5[‡] *31*	9.86	(1/2$^-$)	Q				E_γ: weighted average of 397.1 *3* in ^{71}Kr ε decay and 397.2 *2* in (^{40}Ca,2αpγ).
		407.3 *3*	47[‡] *8*	0.0	(5/2)$^-$	(M1+E2)	−0.74 *14*			E_γ: weighted average of 407.4 *4* in ^{71}Kr ε decay and 407.2 *3* in (^{40}Ca,2αpγ).
615.13	(3/2,7/2$^-$)	208.0 *5*		407.09	(5/2)$^-$					
		407.2 *3*		207.89	(3/2$^-$)					
669.61	(5/2$^+$)	54.8 *5*		615.13	(3/2,7/2$^-$)					
		262.5 *3*	38.2 *17*	407.09	(5/2)$^-$	D				
		461.7 *2*	100.0 *22*	207.89	(3/2$^-$)	D				
		669.5 *2*	68 *4*	0.0	(5/2)$^-$					
722.1?	(7/2$^-$)	514.3[b] *3*	100	207.89	(3/2$^-$)					
759.09	(9/2$^+$)	89.3 *4*	100[#]	669.61	(5/2$^+$)	(E2)		1.34 *3*		B(E2)(W.u.)=53 *5* Mult.: from α(K)exp in ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ), and RUL.
		759.1 *3*	100[#]	0.0	(5/2)$^-$	(M2)				B(M2)(W.u.)=0.066 *6* Mult.: from $\gamma(\theta)$ in ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ) and ΔJ^π.
776.2	(5/2$^-$)	568.3 *4*	100	207.89	(3/2$^-$)	(D(+Q))	+0.03 *9*			
806.6	(7/2$^-$)	598.7 *3*	100	207.89	(3/2$^-$)	Q				I_γ: intensity for 598.0 and 598.7 γ rays is undivided. Mult.: from DCO in ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ).
892.12	(7/2$^+$)	133.2 *3*	100 *7*	759.09	(9/2$^+$)	(D(+Q))	+0.02 *16*			
		222.4[a] *3*	<274[a]	669.61	(5/2$^+$)	(M1+E2)	+0.12 *5*			
		276.5 *5*	22 *4*	615.13	(3/2,7/2$^-$)	D				
929.30	(7/2$^-$)	522.2 *4*	100 *4*	407.09	(5/2)$^-$					
		721.0 *10*	58 *3*	207.89	(3/2$^-$)					
		929.3 *4*	89 *5*	0.0	(5/2)$^-$					
1055.4?	(9/2$^-$)	1055.7 *5*	100	0.0	(5/2)$^-$					
1070.3?	(7/2$^-$)	663.4[b] *4*	100	407.09	(5/2)$^-$	(M1+E2)	+0.24 *7*			
1174.06	(9/2$^+$)	281.9 *3*	39.3 *18*	892.12	(7/2$^+$)	(D+Q)	+0.14 *13*			
		414.8 *3*	93.4 *33*	759.09	(9/2$^+$)	(M1+E2)	−0.5 *4*			
		504.5 *3*	100 *4*	669.61	(5/2$^+$)					

Adopted Levels, Gammas (continued)

γ(^{71}Br) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. @	δ @	Comments
1490.2	(11/2$^+$)	316.1 *3*	43.1 *28*	1174.06	(9/2$^+$)	(D(+Q))	+0.02 *13*	
		598.0 *4*	<707	892.12	(7/2$^+$)			I_γ: intensity for 598.0 and 598.7 γ rays is undivided.
		731.2 *4*	100 *6*	759.09	(9/2$^+$)	(M1+E2)	+0.64 *8*	
1491.8	(9/2$^-$)	562.5 *3*	100	929.30	(7/2$^-$)	(M1+E2)	+0.30 *3*	
1496.6	(13/2$^+$)	737.6 *3*	100	759.09	(9/2$^+$)	(Q)		Mult.: from DCO in ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ).
1586.1	(11/2$^+$)	827.2 *4*	100	759.09	(9/2$^+$)			
1683.4	(9/2$^-$)	613.4 *4*	100 *6*	1070.3?	(7/2$^-$)			
		907.2 *4*	<870	776.2	(5/2$^-$)			I_γ: intensity for 907.2 and 907.7 γ rays is undivided.
1714.2	(11/2$^-$)	222.4[a] *3*	<50[a]	1491.8	(9/2$^-$)	(M1+E2)	+0.23 *10*	
		907.7 *4*	<183	806.6	(7/2$^-$)			I_γ: intensity for 907.2 and 907.7 γ rays is undivided.
		954.2 *5*	100 *5*	759.09	(9/2$^+$)	(D(+Q))	−0.03 *7*	
		992.4 *5*		722.1?	(7/2$^-$)			
2122.0	(13/2$^+$)	535.9 *4*	16.1 *14*	1586.1	(11/2$^+$)			
		625.4 *4*	7.4 *9*	1496.6	(13/2$^+$)	(D(+Q))	−0.4 *7*	
		947.8 *4*	100 *7*	1174.06	(9/2$^+$)			
2216.6	(13/2$^-$)	724.5 *5*	100.0 *30*	1491.8	(9/2$^-$)			
		1161.3 *4*	79.9 *30*	1055.4?	(9/2$^-$)			
2217.1	(13/2$^+$)	631.2 *4*		1586.1	(11/2$^+$)	(D(+Q))	+0.06 *9*	
		727.0 *5*		1490.2	(11/2$^+$)			
2352.4	(15/2$^+$)	861.9 *4*	100	1490.2	(11/2$^+$)			
2392.8	(17/2$^+$)	896.2 *3*	100	1496.6	(13/2$^+$)			
2477.6	(13/2$^-$)	762.8 *4*	100.0 *27*	1714.2	(11/2$^-$)	(M1+E2)	+0.27 *5*	
		794.5 *5*	90.4 *27*	1683.4	(9/2$^-$)			
2520.0	(15/2$^-$)	303.4 *5*	1.1 *3*	2216.6	(13/2$^-$)			
		806.0 *3*	100.0 *21*	1714.2	(11/2$^-$)			
3046.6	(17/2$^+$)	653.8 *4*		2392.8	(17/2$^+$)			
		693.8 *5*		2352.4	(15/2$^+$)			
		829.9 *5*	100	2217.1	(13/2$^+$)			
		924.6 *5*		2122.0	(13/2$^+$)			
3187.9	(17/2$^-$)	971.4 *4*	100	2216.6	(13/2$^-$)			
3262.0	(17/2$^+$)	869.4 *4*	19 *3*	2392.8	(17/2$^+$)			
		1139.8 *5*	100 *6*	2122.0	(13/2$^+$)			
3376.9	(17/2$^-$)	857.1 *4*	100.0 *27*	2520.0	(15/2$^-$)	(M1+E2)	−0.11 *4*	
		898.9 *4*	73 *8*	2477.6	(13/2$^-$)			
3434.0	(19/2$^+$)	1081.6 *4*	100	2352.4	(15/2$^+$)			
3475.2	(21/2$^+$)	1082.4 *4*	100	2392.8	(17/2$^+$)			
3529.3	(19/2$^-$)	1009.4 *3*	100	2520.0	(15/2$^-$)			
4015.9	(21/2$^-$)	486.8 *3*	100.0 *29*	3529.3	(19/2$^-$)	(M1+E2)	−0.18	
		638.8 *3*	60.1 *23*	3376.9	(17/2$^-$)			
4092.2	(21/2$^+$)	1045.6 *5*	100	3046.6	(17/2$^+$)			
4311.1	(21/2$^-$)	781.7 *4*	35.1 *13*	3529.3	(19/2$^-$)	(D(+Q))	−0.06 *6*	

$^{71}_{35}Br_{36}$-4

γ(^{71}Br) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[@]	δ[@]
4311.1	(21/2⁻)	934.2 *4*	83.1 *28*	3376.9	(17/2⁻)		
		1123.3 *4*	100.0 *31*	3187.9	(17/2⁻)		
4313.8	(21/2⁺)	1051.8 *4*	100	3262.0	(17/2⁺)		
4503.0	(25/2⁺)	1027.8 *4*	100	3475.2	(21/2⁺)		
4741.9	(23/2⁻)	1212.3 *4*	100	3529.3	(19/2⁻)		
4743.6	(25/2⁺)	1268.4 *4*	100	3475.2	(21/2⁺)		
4745.9	(23/2⁺)	1311.9 *6*	100	3434.0	(19/2⁺)		
4969.4	(25/2⁺)	655.7 *3*	100.0 *28*	4313.8	(21/2⁺)		
		1494.1 *6*	94 *6*	3475.2	(21/2⁺)		
5313.7	(25/2⁺)	1221.5 *4*	100	4092.2	(21/2⁺)		
5375.2	(25/2⁻)	633.1 *3*	64.2 *11*	4741.9	(23/2⁻)	(M1+E2)	−0.18 *4*
		1064.0 *4*	100.0 *22*	4311.1	(21/2⁻)		
		1359.7 *5*	54.8 *20*	4015.9	(21/2⁻)		
5811.8	(29/2⁺)	842.3 *4*	100.0 *25*	4969.4	(25/2⁺)		
		1308.7 *6*	84 *4*	4503.0	(25/2⁺)		
5994.8	(27/2⁺)	1248.9 *4*	100	4745.9	(23/2⁺)		
6167.2	(27/2⁻)	1426.0 *10*	100	4741.9	(23/2⁻)		
6190.9	(29/2⁺)	1447.2 *5*	100	4743.6	(25/2⁺)		
6613.4	(29/2⁻)	446.2 *3*	3.4 *4*	6167.2	(27/2⁻)	(M1+E2)	−0.36 *13*
		1238.2 *3*	100.0 *22*	5375.2	(25/2⁻)		
6709.2	(29/2⁺)	1395.5 *5*	100	5313.7	(25/2⁺)		
7157.2	(33/2⁺)	1345.4 *4*	100	5811.8	(29/2⁺)		
7424.8		1258.0 *10*		6167.2	(27/2⁻)		
7470.8	(31/2⁺)	1476.0 *5*	100	5994.8	(27/2⁺)		
7759.2	(31/2⁻)	1591.9 *15*		6167.2	(27/2⁻)		
7785.5	(33/2⁻)	1171.9 *6*	100	6613.4	(29/2⁻)		
7789.9	(33/2⁺)	1599.0 *8*	100	6190.9	(29/2⁺)		
8244.9	(33/2⁺)	1535.6 *8*	100	6709.2	(29/2⁺)		
8422.6		637.0 *5*		7785.5	(33/2⁻)		
		998.0 *5*		7424.8			
8955.7	(37/2⁺)	1798.5 *15*	100	7157.2	(33/2⁺)		
9090.5	(35/2⁺)	1619.6 *8*	100	7470.8	(31/2⁺)		
9194.8	(37/2⁻)	1409.3 *6*	100	7785.5	(33/2⁻)		
9320.5	(35/2⁻)	1561.3 *15*		7759.2	(31/2⁻)		
9526.7	(37/2⁺)	1736.8 *20*		7789.9	(33/2⁺)		
9721.7		1299 *1*	100	8422.6			
9996.9	(37/2⁺)	1752 *2*		8244.9	(33/2⁺)		
10752.2	(39/2⁺)	1661.7[b] *15*	100	9090.5	(35/2⁺)		
10992.4	(41/2⁺)	2036.7[b] *15*	100	8955.7	(37/2⁺)		
11030.9	(41/2⁻)	1836 *2*	100	9194.8	(37/2⁻)		
11434	(41/2⁺)	1907[b] *2*		9526.7	(37/2⁺)		

$^{71}_{35}Br_{36}$-5

Adopted Levels, Gammas (continued)

γ(^{71}Br) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π
11487.7		1766 *2*		9721.7	
12381	(43/2$^+$)	1629[b] *2*		10752.2	(39/2$^+$)
12875	(45/2$^+$)	1883[b] *2*	100	10992.4	(41/2$^+$)
13472	(45/2$^+$)	2038[b] *2*		11434	(41/2$^+$)
14959	(49/2$^+$)	2084[b] *2*		12875	(45/2$^+$)

† From ^{40}Ca(^{40}Ca,2αpγ), unless otherwise stated. Exceptions are noted.
‡ From ^{71}Kr ε decay.
# From ^{40}Ca(^{34}S,p2nγ),(^{35}Cl,2p2nγ).
@ From gated γ(θ) data in ^{40}Ca(^{40}Ca,2αpγ), although, details in terms of angular correlation coefficients are not available in 2005Fi10. Many transitions are assigned E2 and E1 in 2005Fi10, but in the absence of details of these data, the evaluators consider all such assignments as implied from ΔJ^π. Further, when quoted mixing ratio shows a significant quadrupole admixture, the evaluators assign (M1+E2), while D(+Q) is assigned when the quoted mixing ratio overlaps value for pure dipole.
& 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 undivided intensity.
[b] Placement of transition in the level scheme is uncertain.

$^{71}_{35}Br_{36}$-6

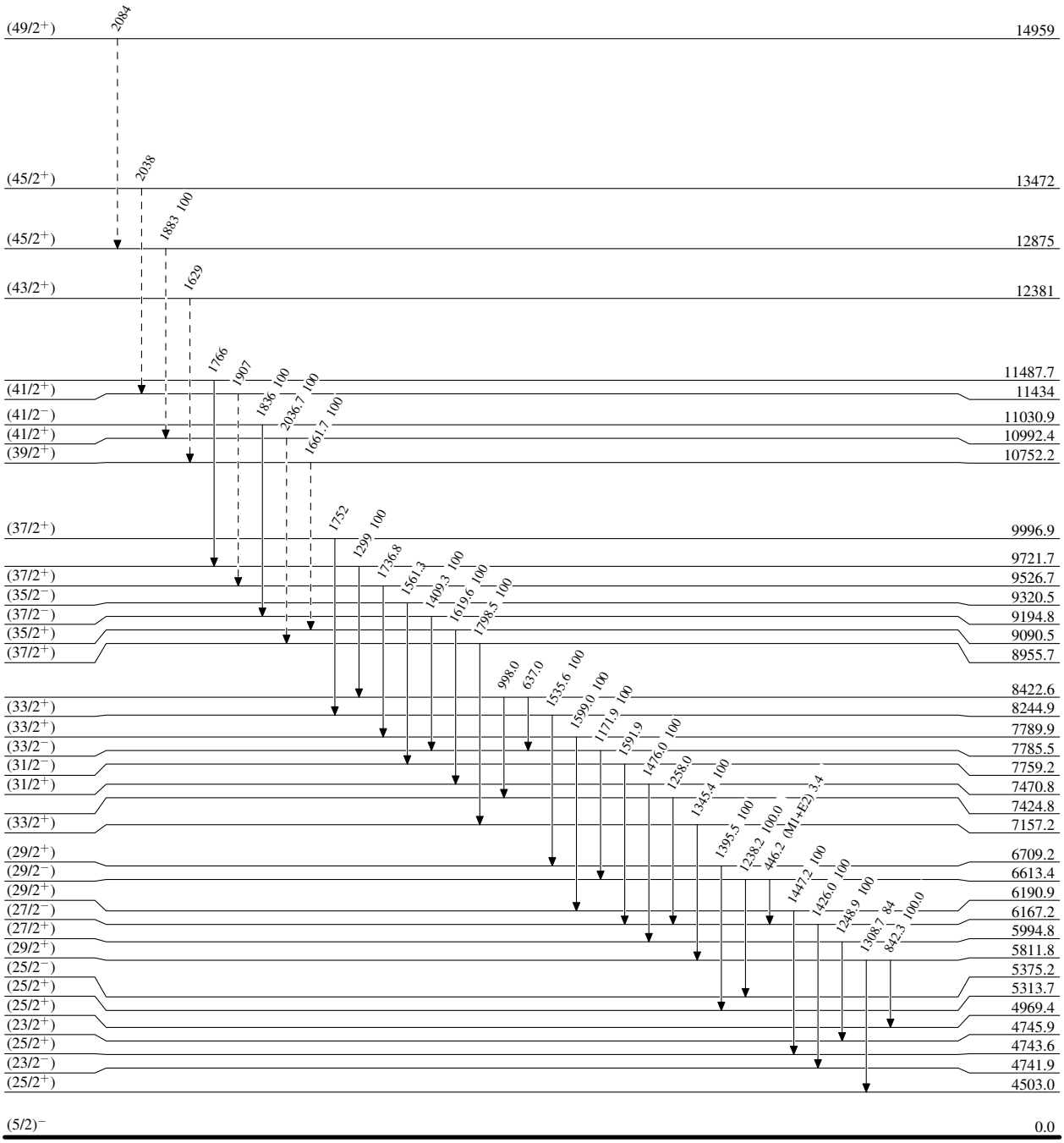
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)

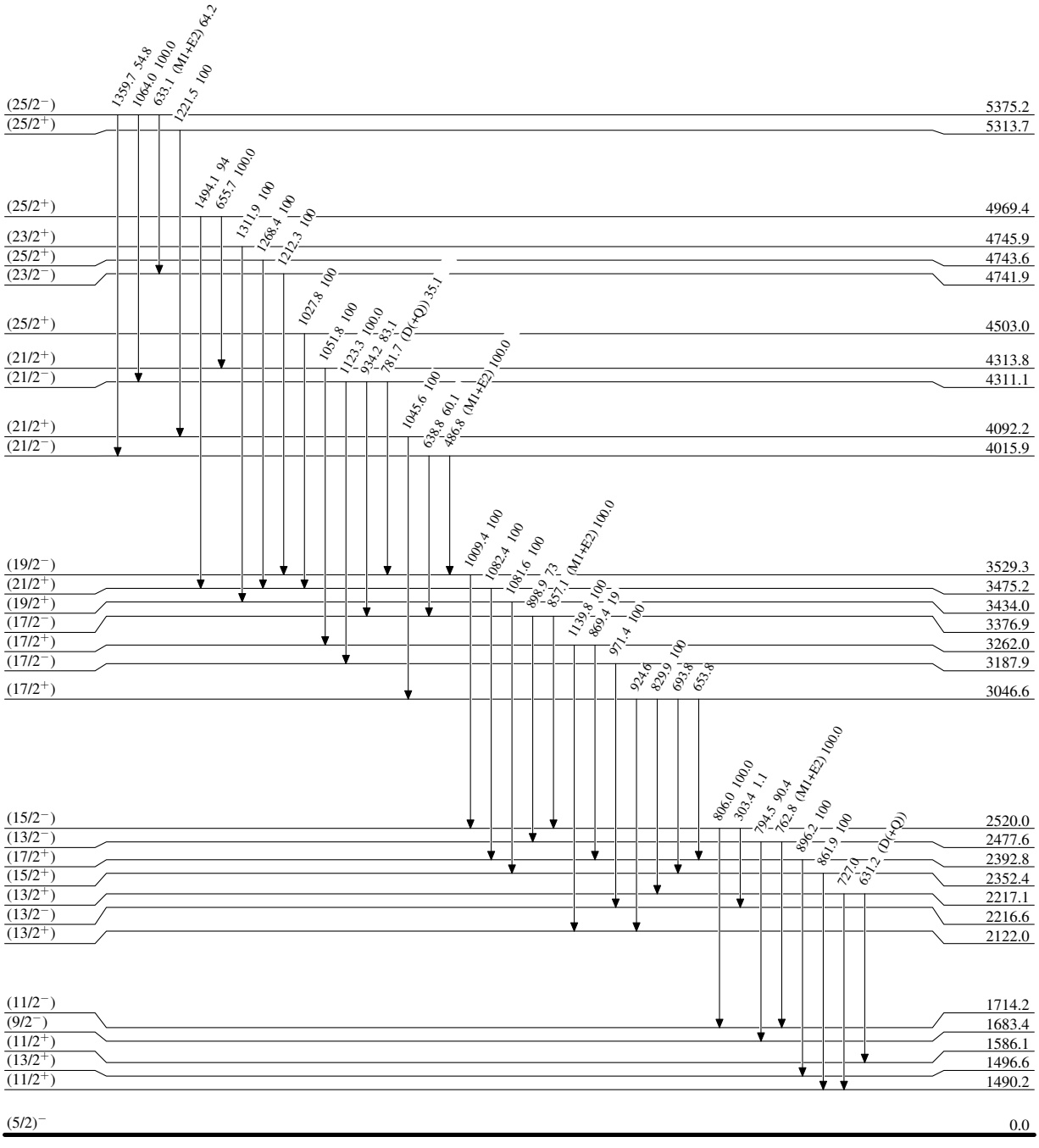


$^{71}_{35}Br_{36}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{71}_{35}Br_{36}$

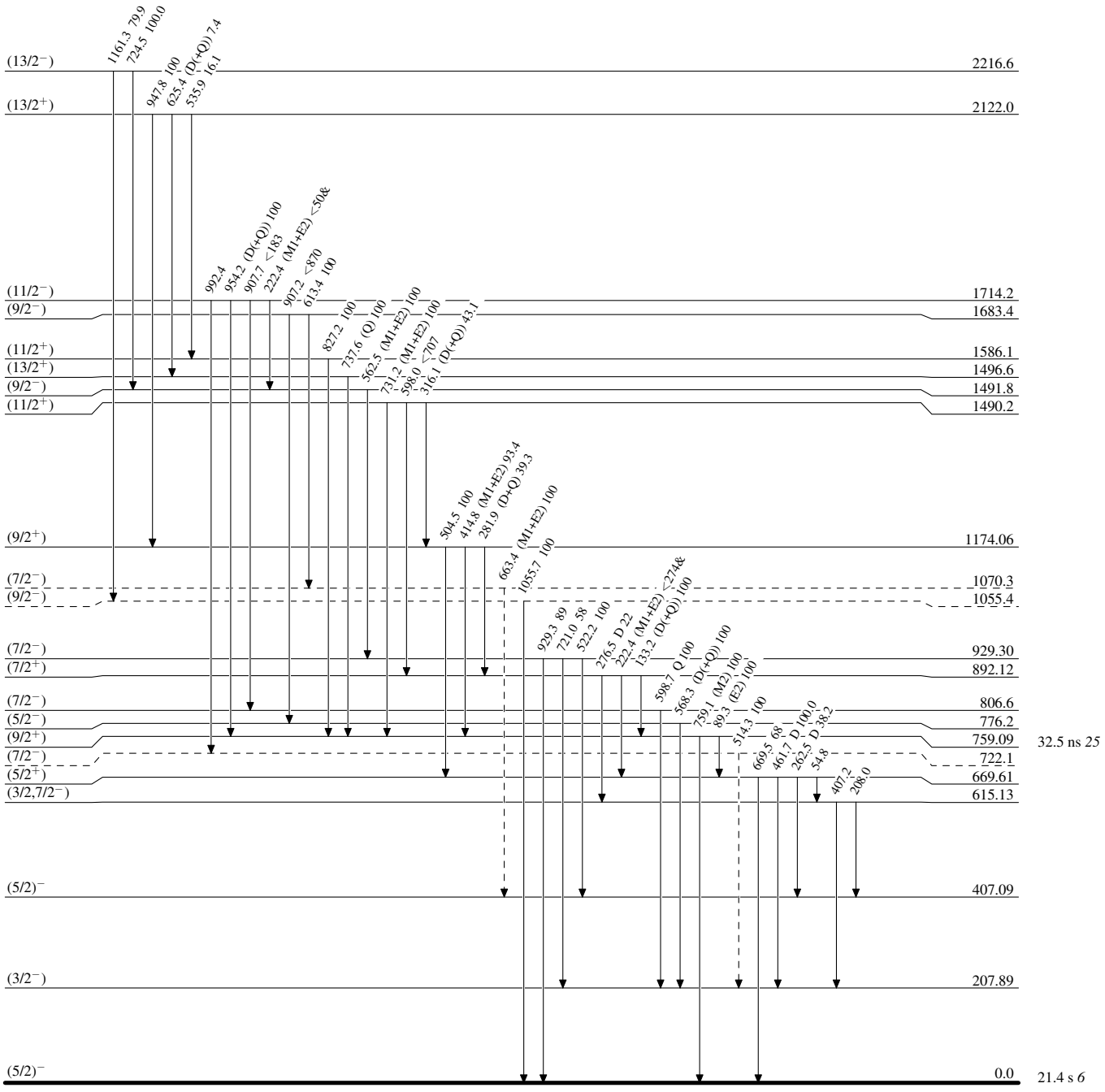
Adopted Levels, Gammas

Legend

Level Scheme (continued)

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

γ Decay (Uncertain)



$^{71}_{35}Br_{36}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
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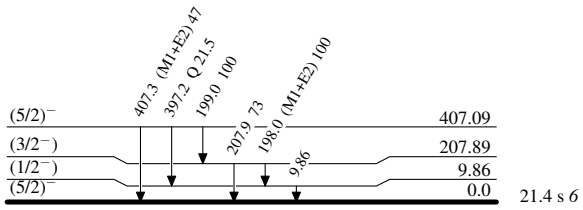
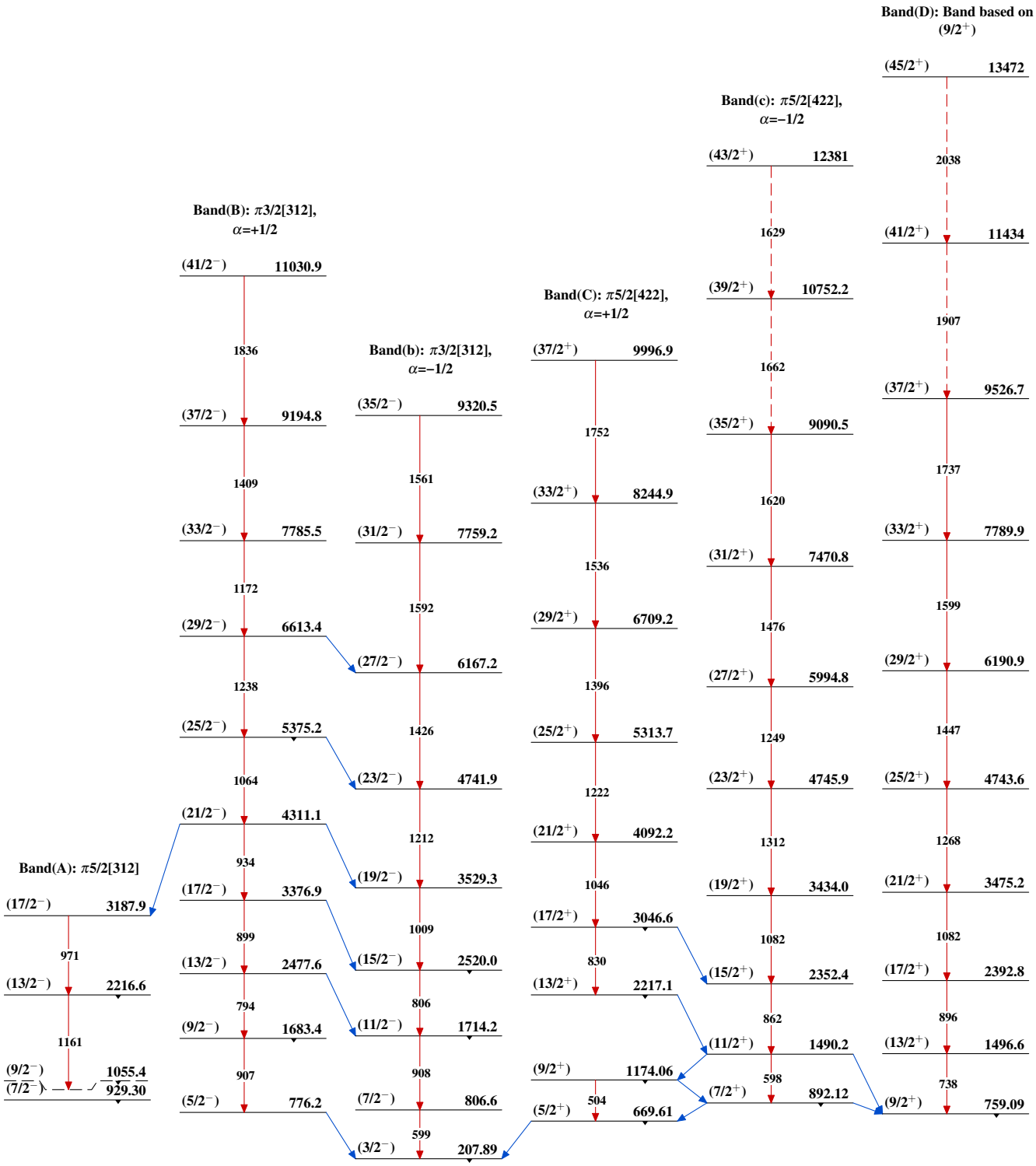
– – – – – – ► γ Decay (Uncertain)



$^{71}_{35}Br_{36}$

Adopted Levels, Gammas



Adopted Levels, Gammas (continued)