Adopted Levels, Gammas

History

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

$Q(\beta^-)=-1.58\times10^4$ *syst*; $S(n)=1.568\times10^4$ *13*; $S(p)=4727$ *10*; $Q(\alpha)=-2176$ *8* 2012Wa38
Note: Current evaluation has used the following Q record −15824.0 SY1.51E+4 *7* 4.2×10^3 *6* -2.15×10^{33} 2009AuZZ.
$\Delta Q(\beta^-)=503$ (2009AuZZ).
α: Additional information 1.

^{72}Kr Levels

Cross Reference (XREF) Flags

A	(HI,xnγ)	E	$^{16}O(^{58}Ni,2n\gamma)$
B	$^{40}Ca(^{40}Ca,2\alpha\gamma)$	F	Coulomb excitation
C	$^{40}Ca(^{35}Cl,p2n\gamma)$	G	Be(^{78}Kr,X)
D	$^{40}Ca(^{36}Ar,2p2n\gamma)$		

E(level)[†]	J$^{\pi}$[#]	$T_{1/2}$	XREF	Comments
0.0[a]	0+	17.1 s *2*	ABCDEFG	%ε+%β+=100; %εp<1×10^{-6} (2003Pi03) $T_{1/2}$: from γ(t) in 2003Pi03. Others: 17.4 s *4* (1973Da22) and 16.7 s *6* (1973Sc17). <r^2>$^{1/2}$ (mass)=4.43 fm *27* (2008Ya08).
671.0 *10*	0+	26.3 ns *21*	G	$T_{1/2}$: from e(t) in Be(^{78}Kr,x).
709.72[a] *14*	2+	3.1 ps *4*	ABCDEF	$T_{1/2}$: from B(E2) in Coulomb Excitation.
1321.40[a] *20*	4+		ABCDE	
1849.04[c] *24*	(3−)		D	
2112.9[a] *3*	6+		ABCDE	
2455.51[c] *22*	(5−)		D	
3108.4[a] *3*	8+		AB D	
3265.5[c] *20*	(7−)		D	
3797.1[b] *7*			AB D	
4282.7[c] *22*	(9−)		D	
4293.3[a] *4*	10+		AB D	
4756.8[b] *8*			AB D	
5497.0[c] *22*	(11−)		D	
5648.4[a] *4*	12+		AB D	
6048.8[b] *11*			AB	
6891.1[c] *24*	(13−)		D	
7157.2[a] *7*	14+		AB D	
7164.2[b] *14*			AB	
8447[c] *3*	(15−)		D	
8526.4 *10*	(16+)		AB D	
8608.5[b] *16*			AB D	E(level): Assuming that this level de-excites with the 1444 γ and is fed by the 1432 γ. The order of the 1444 and 1432 γ rays is reversed in $^{40}Ca(^{40}Ca,2\alpha\gamma)$.
8745.1[@] *9*	(16+)		AB	
8820.9[&] *13*	(16+)		AB D	
9766.9[@] *10*	(18+)		AB	
10040.9[b] *18*			AB D	
10141[c] *4*	(17−)		D	
10558.5[&] *17*	(18+)		AB D	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{72}Kr Levels (continued)

E(level)†	Jπ#	T1/2	XREF
11233.6@ 13	(20+)		AB
11536.7b 20			AB
12387.5& 23	(20+)		AB D
13135.8b 23			AB
13179.6@ 16	(22+)	42‡ fs 22	AB
14302.6& 24	(22+)	9.7‡ fs 35	AB
14914.8b 25			AB
15639.6@ 23	(24+)		AB
16337& 3	(24+)		AB
16976b 4			AB
18474& 3	(26+)		AB
18703@ 4	(26+)		AB
19491b 4			A
20914& 3	(28+)		A
22420@ 4	(28+)		A
22559b 4			A
23620& 3	(30+)		A

† From least-squares fit to Eγ, assuming ΔEγ=1 keV when unknown.
‡ From DSAM in ^{40}Ca(^{40}Ca,2αγ).
\# From γ-ray multipolarities and band structure.
@ Band(A): Band based on 16+. Q(transition)=2.00 +36−28 (2007An12) from lifetime measurements using DSAM for all in-band transitions up to 26+. Systematic uncertainty due to stopping powers is additional 10%.
& Band(B): Band based on 16+. Q(transition)=2.76 +28−22 (2007An12) from lifetime measurements using DSAM for all in-band transitions. Systematic uncertainty due to stopping powers is additional 10%.
a Band(C): g.s. band.
b Band(D): Side band. Q(transition)=2.40 +26−23 (2007An12) from lifetime measurements using DSAM for all in-band transitions (figure 2 in 2007An12). Systematic uncertainty due to stopping powers is additional 10%. From comparison with calculations which suggest that not all bands have positive-parity, the side band may be a negative-parity band starting with 7− for the 3800-keV level and extending to 29− for the 22571 level.
c Band(E): Band based on 3−.

γ(^{72}Kr)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f	Mult.	α	$I_{(\gamma+ce)}$	Comments
671.0	0^+	671		0.0	0^+	E0		100	
709.72	2^+	709.72 *14*	100	0.0	0^+	E2†	1.17×10^{-3}		α(K)=0.001037 *15*; α(L)=0.0001125 *16*; α(M)=1.82×10^{-5} *3*; α(N)=1.82×10^{-6} *3*; α(N+..)=1.82×10^{-6} *3* B(E2)(W.u.)=57 *8* E_γ: weighted average of 710.1 *2* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 709.7 *1* (^{40}Ca(^{36}Ar,2p2nγ)), 709.1 *3* (^{16}O(^{58}Ni,2nγ)), 709 *4* (Coulomb excitation).
1321.40	4^+	611.68 *14*	100	709.72	2^+	E2†	1.76×10^{-3}		α(K)=0.001562 *22*; α(L)=0.0001707 *24*; α(M)=2.76×10^{-5} *4*; α(N)=2.76×10^{-6} *4*; α(N+..)=2.76×10^{-6} *4* E_γ: weighted average of 611.8 *2* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 611.6 *1* (^{40}Ca(^{36}Ar,2p2nγ)), 612.5 *4* (^{16}O(^{58}Ni,2nγ)).
1849.04	(3^-)	1139.3 *2*	100	709.72	2^+	(E1)†	1.84×10^{-4}		α(K)=0.0001489 *21*; α(L)=1.561×10^{-5} *22*; α(M)=2.52×10^{-6} *4*; α(N)=2.55×10^{-7} *4* α(N+..)=1.667×10^{-5} *25*
2112.9	6^+	791.46 *20*	100	1321.40	4^+	E2†	8.79×10^{-4}		α(K)=0.000780 *11*; α(L)=8.41×10^{-5} *12*; α(M)=1.361×10^{-5} *19*; α(N)=1.366×10^{-6} *20* α(N+..)=1.366×10^{-6} *20* E_γ: weighted average of 791.6 *2* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 791.5 *1* (^{40}Ca(^{36}Ar,2p2nγ)), 790.2 *4* (^{16}O(^{58}Ni,2nγ)).
2455.51	(5^-)	606 *2*	100 *20*	1849.04	(3^-)	(E2)†	0.00181		α(K)=0.00160 *3*; α(L)=0.000175 *3*; α(M)=2.84×10^{-5} *5*; α(N)=2.83×10^{-6} *5*; α(N+..)=2.83×10^{-6} *5*
		1134.1 *1*	100 *20*	1321.40	4^+	(E1)†	1.83×10^{-4}		α(K)=0.0001501 *21*; α(L)=1.574×10^{-5} *22*; α(M)=2.54×10^{-6} *4*; α(N)=2.57×10^{-7} *4* α(N+..)=1.500×10^{-5} *22*
3108.4	8^+	995.50 *9*	100	2112.9	6^+	E2†	5.01×10^{-4}		α(K)=0.000445 *7*; α(L)=4.75×10^{-5} *7*; α(M)=7.69×10^{-6} *11*; α(N)=7.74×10^{-7} *11*; α(N+..)=7.74×10^{-7} *11* E_γ: weighted average of 995.5 *2* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 995.5 *1* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 996 (HI,xnγ).
3265.5	(7^-)	810 *2*	100	2455.51	(5^-)	(E2)†	8.28×10^{-4} *13*		α(K)=0.000735 *12*; α(L)=7.92×10^{-5} *13*; α(M)=1.281×10^{-5} *20*; α(N)=1.287×10^{-6} *20* α(N+..)=1.287×10^{-6} *20*
3797.1		1684.4 *7*	100	2112.9	6^+				E_γ: weighted average of 1685 *1* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1683.9 *9* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1685 (HI,xnγ).
4282.7	(9^-)	1017.2 *8*	100	3265.5	(7^-)	(E2)†	4.76×10^{-4}		α(K)=0.000423 *6*; α(L)=4.52×10^{-5} *7*; α(M)=7.31×10^{-6} *11*; α(N)=7.36×10^{-7} *11*; α(N+..)=7.36×10^{-7} *11*
4293.3	10^+	1184.96 *24*	100	3108.4	8^+	E2†	3.44×10^{-4}		α(K)=0.000300 *5*; α(L)=3.19×10^{-5} *5*; α(M)=5.16×10^{-6} *8*; α(N)=5.20×10^{-7} *8*; α(N+..)=6.78×10^{-6} *10*

$^{72}_{36}$Kr$_{36}$-3

$\gamma(^{72}Kr)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f	Mult.	α	Comments
								α(K)=0.000300 *5*; α(L)=3.19×10^{-5} *5*; α(M)=5.16×10^{-6} *8*; α(N)=5.20×10^{-7} *8*; α(N+..)=6.78×10^{-6} *10* E_γ: weighted average of 1184.9 *2* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1185.9 *8* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1186 (HI,xnγ).
4756.8		959.9 *8*	<100	3797.1				E_γ: weighted average of 959.1 *8* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 960.0 *3* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 960 (HI,xnγ).
		1648 *1*	<100	3108.4	8$^+$			E_γ: From ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1653 (HI,xnγ), not observed by ^{40}Ca(^{36}Ar,2p2nγ). Other: 1643 (HI,xnγ).
5497.0	(11$^-$)	1214.3 *5*	100	4282.7	(9$^-$)	(E2)†	3.31×10^{-4}	α(K)=0.000285 *4*; α(L)=3.02×10^{-5} *5*; α(M)=4.88×10^{-6} *7*; α(N)=4.93×10^{-7} *7*; α(N+..)=1.091×10^{-5} *18*
5648.4	12$^+$	1355.08 *9*	100	4293.3	10$^+$	E2†	2.94×10^{-4}	α(K)=0.000226 *4*; α(L)=2.39×10^{-5} *4*; α(M)=3.86×10^{-6} *6*; α(N)=3.90×10^{-7} *6*; α(N+..)=4.11×10^{-5} *6* E_γ: weighted average of 1354.9 *3* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1355.1 *1* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1356 (HI,xnγ).
6048.8		1292.0 *8*	100	4756.8				E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1292 (HI,xnγ).
6891.1	(13$^-$)	1394 *1*	100	5497.0	(11$^-$)	(E2)†	2.90×10^{-4}	α(K)=0.000213 *3*; α(L)=2.25×10^{-5} *4*; α(M)=3.64×10^{-6} *6*; α(N)=3.68×10^{-7} *6*; α(N+..)=5.11×10^{-5} *8*
7157.2	14$^+$	1508.7 *6*	100	5648.4	12$^+$	E2†	2.92×10^{-4}	α(K)=0.000181 *3*; α(L)=1.91×10^{-5} *3*; α(M)=3.09×10^{-6} *5*; α(N)=3.13×10^{-7} *5*; α(N+..)=8.85×10^{-5} *13* E_γ: weighted average of 1509.2 *3* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1508.1 *3* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1510 (HI,xnγ).
7164.2		1115.4 *8*	100	6048.8				E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1116 (HI,xnγ).
8447	(15$^-$)	1556 *2*	100	6891.1	(13$^-$)	(E2)†	2.98×10^{-4}	α(K)=0.0001704 *25*; α(L)=1.80×10^{-5} *3*; α(M)=2.91×10^{-6} *5*; α(N)=2.94×10^{-7} *5* α(N+..)=0.0001072 *18*
8526.4	(16$^+$)	1368.9 *8*	100	7157.2	14$^+$	†		E_γ: weighted average of 1369.2 *8* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1367 *2* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1368 (HI,xnγ). Mult.: (D) in ^{40}Ca(^{36}Ar,2p2nγ). The other two high-spin datasets would give a Q value based on the level scheme.
8608.5		1444.3$^\#$ *9*	100	7164.2				
8745.1	(16$^+$)	1588.2 *6*	100	7157.2	14$^+$	Q‡		E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1586 (HI,xnγ).
8820.9	(16$^+$)	1663.5 *11*	100	7157.2	14$^+$	(E2)†	3.21×10^{-4}	α(K)=0.0001495 *21*; α(L)=1.574×10^{-5} *23*; α(M)=2.55×10^{-6} *4*; α(N)=2.58×10^{-7} *4* α(N+..)=0.0001532 *22* E_γ: weighted average of 1661.9 *6* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1664.2 *4* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1665 (HI,xnγ).
9766.9	(18$^+$)	1021.9 *6*	100 *11*	8745.1	(16$^+$)	Q‡		E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1021 (HI,xnγ).
		1240 *1*	56 *11*	8526.4	(16$^+$)			E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1241 (HI,xnγ).
10040.9		1432.4 *8*	100	8608.5				E_γ: weighted average of 1432.1 *9* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1434 *2* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1435 (HI,xnγ).

From ENSDF

Adopted Levels, Gammas (continued)

$\gamma(^{72}$Kr) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α	Comments
10141	(17$^-$)	1694# *2*	100	8447	(15$^-$)	(E2)†	3.29×10^{-4}	α(K)=0.0001443 *21*; α(L)=1.519×10^{-5} *22*; α(M)=2.46×10^{-6} *4*; α(N)=2.49×10^{-7} *4* α(N+..)=0.0001666 *25*
10558.5	(18$^+$)	1737.3 *13*	100 *13*	8820.9	(16$^+$)	(E2)†	3.40×10^{-4}	α(K)=0.0001375 *20*; α(L)=1.446×10^{-5} *21*; α(M)=2.34×10^{-6} *4*; α(N)=2.37×10^{-7} *4* α(N+..)=0.000186 *3* E_γ: weighted average of 1738.6 *6* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1736.0 *6* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1741 (HI,xnγ).
		1816 *4*		8745.1	(16$^+$)			E_γ: Observed only by (HI,xnγ). DEγ was taken as 3.7 keV=1741 − 1737.3, that is, the difference between the adopted energy and that from the (HI,xnγ) dataset for the other gamma from the same level.
11233.6	(20$^+$)	1466.7 *8*	100	9766.9	(18$^+$)	Q‡		E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1467 (HI,xnγ).
11536.7		1495.8 *9*	100	10040.9				E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1497 (HI,xnγ).
12387.5	(20$^+$)	1829 *2*	100	10558.5	(18$^+$)	(E2)†	3.67×10^{-4}	α(K)=0.0001247 *18*; α(L)=1.310×10^{-5} *19*; α(M)=2.12×10^{-6} *3*; α(N)=2.15×10^{-7} *3* α(N+..)=0.000227 *4* E_γ: weighted average of 1830 *1* (^{40}Ca(^{40}Ca,2$\alpha\gamma$)), 1825 *2* (^{40}Ca(^{36}Ar,2p2nγ)). Other: 1832 (HI,xnγ).
13135.8		1599 *1*	100	11536.7				
13179.6	(22$^+$)	1946 *1*	100	11233.6	(20$^+$)	E2	4.08×10^{-4}	α(K)=0.0001111 *16*; α(L)=1.166×10^{-5} *17*; α(M)=1.89×10^{-6} *3*; α(N)=1.91×10^{-7} *3* α(N+..)=0.000283 *4* B(E2)(W.u.)=27 *15* E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1949 (HI,xnγ). Mult.: ^{40}Ca(^{40}Ca,2$\alpha\gamma$) gives Mγ=Q. If it were M2, it would have B(M2)(W.u.)=1.5×10^3, which is larger than the recommended upper limit of 1. As a result Mγ=E2 is adopted.
14302.6	(22$^+$)	1915 *1*	100	12387.5	(20$^+$)	(E2)	3.96×10^{-4}	α(K)=0.0001144 *16*; α(L)=1.202×10^{-5} *17*; α(M)=1.94×10^{-6} *3*; α(N)=1.97×10^{-7} *3* α(N+..)=0.000268 *4* B(E2)(W.u.)=1.3×10^2 *5* E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1917 (HI,xnγ). Mult.: (Q) from Level scheme, (M2) is ruled out as it would have B(M2)(W.u.)=7.×10^3, which is larger than the recommended upper limit of 1. As a result Mγ=(E2) is adopted.
14914.8		1779 *1*	100	13135.8				E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 1778 (HI,xnγ).
15639.6	(24$^+$)	2460 *2*	100	13179.6	(22$^+$)			E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 2468 (HI,xnγ).
16337	(24$^+$)	2034 *1*	100	14302.6	(22$^+$)			E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 2038 (HI,xnγ).
16976		2061 *3*	100	14914.8				E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 2062 (HI,xnγ).
18474	(26$^+$)	2137# *2*	100 *20*	16337	(24$^+$)			E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 2143 (HI,xnγ).
		2834# *3*	<100	15639.6	(24$^+$)			E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 2836 (HI,xnγ).
18703	(26$^+$)	3063 *3*	100	15639.6	(24$^+$)			E_γ: from ^{40}Ca(^{40}Ca,2$\alpha\gamma$), other: 3059 (HI,xnγ).
19491		2515	100	16976				
20914	(28$^+$)	2440	100	18474	(26$^+$)			

$^{72}_{36}$Kr$_{36}$-5

Adopted Levels, Gammas (continued)

$\gamma(^{72}Kr)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f
22420	(28^+)	3717#	100	18703	(26^+)
22559		3068	100	19491	
23620	(30^+)	2706	100	20914	(28^+)

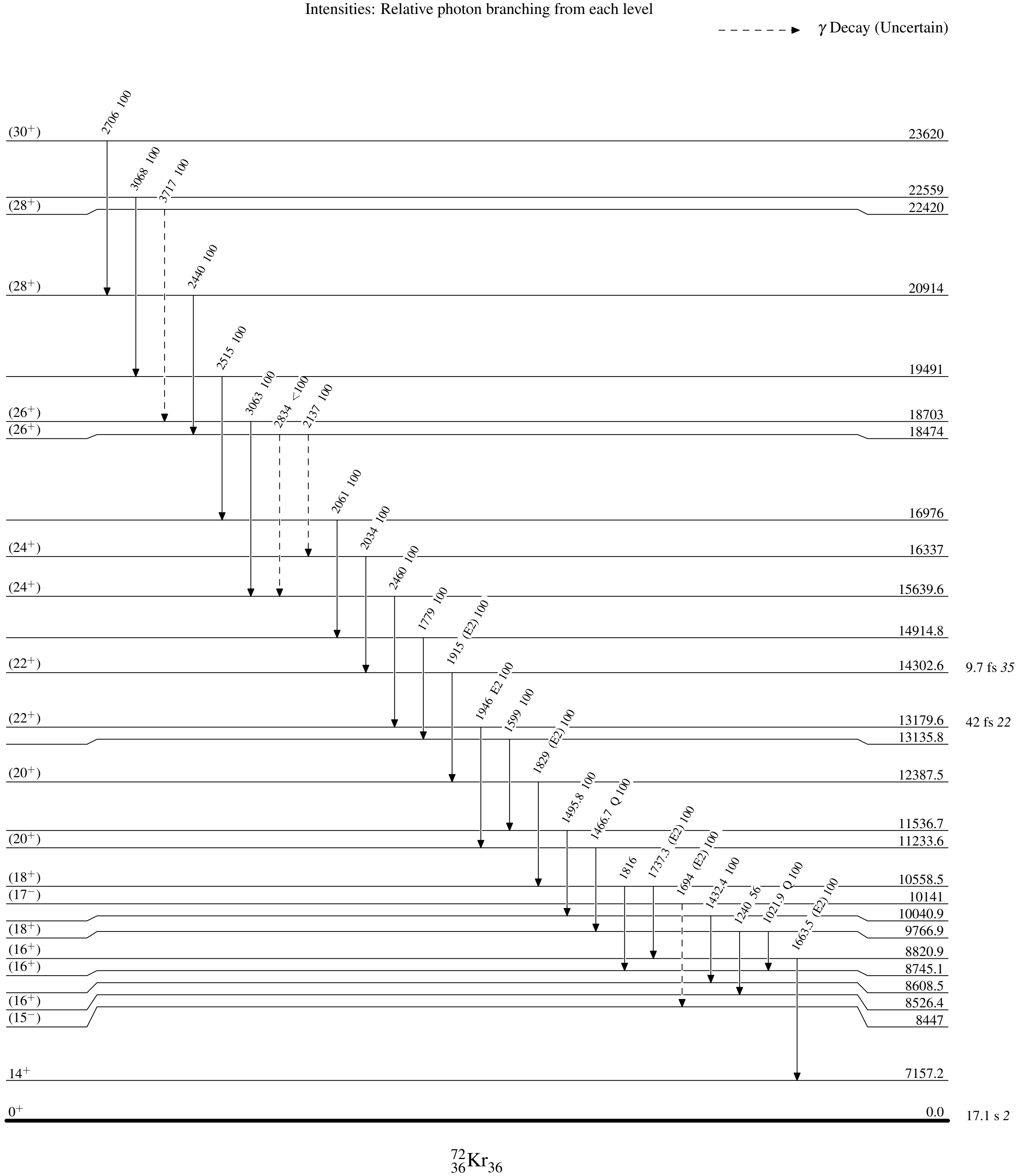
† From $^{40}Ca(^{36}Ar,2p2n\gamma)$.
‡ From $^{40}Ca(^{40}Ca,2\alpha\gamma)$.
# Placement of transition in the level scheme is uncertain.

$^{72}_{36}Kr_{36}$-6

Adopted Levels, Gammas

Level Scheme

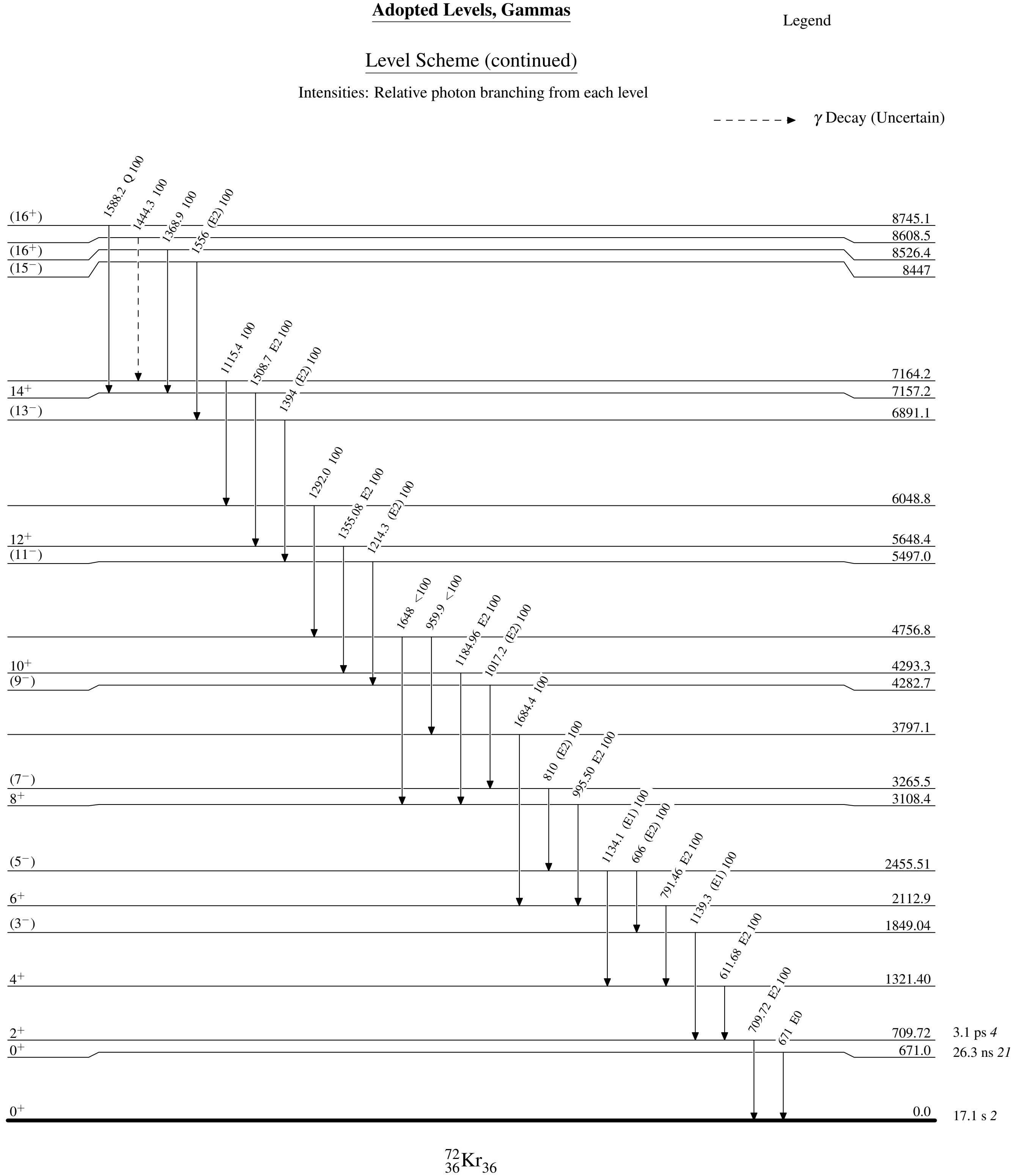
Intensities: Relative photon branching from each level



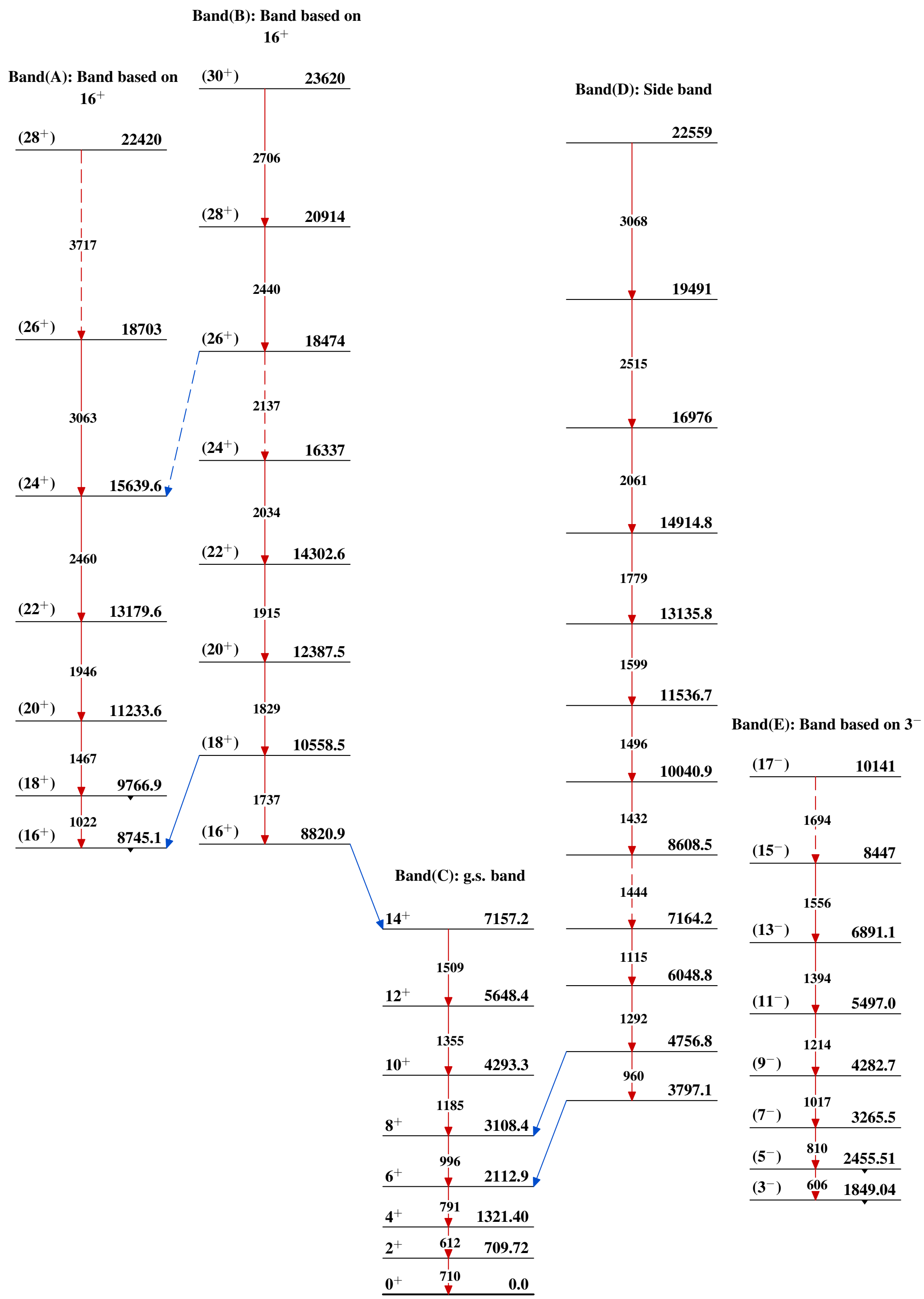
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



Adopted Levels, Gammas



$^{72}_{36}Kr_{36}$