^{209}Bi(^{48}Ca,2nγ) 2009Ke01,2009Je02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 114, 1041 (2013)	1-Nov-2011

Includes 2008Ha31.

2009Ke01: E=219 and 221 MeV ^{48}Ca beam delivered by K130 cyclotron at JYFL. Recoils separated by gas-filled separator RITU and detected by a double-sided silicon strip detector (DSSD) of the focal plane GREAT. Detected γ-rays with JUROGAM array of 43 Compton-suppressed Ge detectors in coincidence with the detection of recoils and subsequent α-decays. Identified ^{255}Lr product by the Lr K-α and K-β x rays and its α-decay. Measured Eγ, Iγ, delayed γ-coin with fusion-evaporation residues, α-gated γ coin, recoil-gated γ-γ coin. Observed two rotational bands.

2009Je02: E=222 MeV ^{48}Ca beam was produced at the 88-inch cyclotron of the LBNL Berkeley and used the Berkeley gas-filled separator (BGS). ^{209}Bi target of 0.4 mg/cm^2 thickness with 35μg/cm^2 carbon backing were mounted on a rotating target wheel. Evaporation residues were separated from the beam and then passed through a multi-wire proportional counter (MWPC) before being implanted in a double-side silicon strip detector (DSSSD). Clover Ge detectors were mounted behind the BGS focal plane. Measured recoil-α coin, recoil-electron bursts, Eγ, Iγ, $\gamma\gamma$, half-life for the isomeric state. Recoil-α decay tagging technique.

2008Ha31: E=219 MeV beam provided by U400 cyclotron at Dubna. VASSILISSA fragment separator. Detected evaporation residues using GABRIELA array of 16 Si strips. Detected conversion electrons using four four-strip Si strips. Measured Eγ, Iγ, γ(ce) coin, recoil-ce correlations using seven Ge detectors for γ rays and Si detectors for electrons.

Other: 2010HaZX.

^{255}Lr Levels

E(level)[c]	J$^\pi$	T$_{1/2}$	Comments
0.0[†a]	[1/2$^-$]	31.1 s *11*	T$_{1/2}$: From Adopted Levels.
38[‡a] *10*	[7/2$^-$]	2.54 s *5*	%α≈40 (2006Ch52) J$^\pi$,T$_{1/2}$: From Adopted Levels.
38+x[‡a]	(9/2$^-$)		
y[#]	(9/2$^+$)		
69.5+y[#b] *4*	(11/2$^+$)		
151.8+y[#b] *5*	(13/2$^+$)		E(level): Y<100 keV, from the observed total energy of the isomer decay.
196.6[†b] *5*	(5/2$^-$)		
227.0+x[‡a] *10*	(11/2$^-$)		
253.0+x[‡a] *10*	(13/2$^-$)		
246.5+y[#b] *5*	(15/2$^+$)		
353.4+y[#b] *6*	(17/2$^+$)		
443.8[†a] *7*	9/2$^-$		
466.0[‡a] *15*	(15/2$^-$)		
517.6+x[‡a] *12*	(17/2$^-$)		
740.0[†a] *9*	(13/2$^-$)		
754.4+x[‡a] *15*	(19/2$^-$)		
740.0+y[&b] *5*	(15/2$^+$)	<1 μs	
831.6+x[‡a]	(21/2$^-$)		
850.4+y[&b] *6*	(17/2$^+$)		
878.8+y[@b] *10*	(19/2$^-$)	≥10 ns	
972.9+y[&b]	(19/2$^+$)		
1016.3+y[@b] *10*	(21/2$^-$)		
1082.9[†a] *10*	17/2$^-$		
1092.4+x[‡a] *18*	(23/2$^-$)		
1108.0+y[&b] *10*	(21/2$^+$)		
1191.6+x[‡a] *16*	(25/2$^-$)		
1164.7+y[@b] *10*	(23/2$^-$)		

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^{209}Bi(^{48}Ca,2nγ) 2009Ke01,2009Je02 (continued)

^{255}Lr Levels (continued)

E(level)[c]	J$^\pi$	T$_{1/2}$	Comments
1408.6+y[b] *10*	(25/2$^+$)	1.70 ms *3*	T$_{1/2}$: Other value: 1.4 ms *1*, from 100-keV conversion electrons observed in coincidence with 588-keV γ ray (2008Ha31); 1.81 ms *2* (2008An16).
1469.9†[a] *15*	(21/2$^-$)		
1476.4‡[a] *21*	(27/2$^-$)		
1899.9†[a] *18*	(25/2$^-$)		

† Band(A): 1/2[521] band.
‡ Band(B): 7/2[514] band.
# Band(C): 9/2[624] band.
@ Band(D): K=(19/2$^-$) band.
& Band(E): K=(15/2$^+$) band.
[a] From 2009Ke02.
[b] From 2009Je02.
[c] Deduced by evaluators from least-squares fit to γ-ray energies.

γ(^{255}Lr)

E$_\gamma$	I$_\gamma$	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.	α#	Comments
(28)		878.8+y	(19/2$^-$)	850.4+y	(17/2$^+$)	[E1]	2.68	α(L)=1.516 *22*; α(M)=0.856 *12*; α(N+..)=0.306 *5* α(N)=0.239 *4*; α(O)=0.0585 *9*; α(P)=0.00763 *11*; α(Q)=0.0001590 *23*
69.5‡ *4*	0.10‡ *4*	69.5+y	(11/2$^+$)	y	(9/2$^+$)	[M1]	41.7 *10*	α(L)=31.1 *7*; α(M)=7.75 *17*; α(N+..)=2.91 *7* α(N)=2.19 *5*; α(O)=0.593 *13*; α(P)=0.118 *3*; α(Q)=0.00765 *17*
82.3‡ *3*	0.16‡ *5*	151.8+y	(13/2$^+$)	69.5+y	(11/2$^+$)	[M1]	25.5 *5*	α(L)=19.0 *4*; α(M)=4.73 *9*; α(N+..)=1.77 *4* α(N)=1.336 *24*; α(O)=0.362 *7*; α(P)=0.0723 *13*; α(Q)=0.00466 *9*
94.7‡ *3*	0.18‡ *4*	246.5+y	(15/2$^+$)	151.8+y	(13/2$^+$)	[M1]	16.9 *3*	α(L)=12.62 *22*; α(M)=3.14 *6*; α(N+..)=1.180 *20* α(N)=0.888 *15*; α(O)=0.241 *4*; α(P)=0.0481 *8*; α(Q)=0.00310 *6*
107		353.4+y	(17/2$^+$)	246.5+y	(15/2$^+$)			E$_\gamma$: From Fig. 2 in 2009Je02.
110.4‡ *3*	0.19‡ *4*	850.4+y	(17/2$^+$)	740.0+y	(15/2$^+$)	[M1]	10.86 *18*	α(L)=8.09 *13*; α(M)=2.02 *4*; α(N+..)=0.756 *13* α(N)=0.569 *10*; α(O)=0.1542 *25*; α(P)=0.0308 *5*; α(Q)=0.00198 *4*
123‡ *1*	0.13‡ *4*	972.9+y	(19/2$^+$)	850.4+y	(17/2$^+$)	[M1]	7.95 *22*	α(L)=5.92 *17*; α(M)=1.48 *4*; α(N+..)=0.554 *16* α(N)=0.417 *12*; α(O)=0.113 *4*; α(P)=0.0225 *7*; α(Q)=0.00145 *4*
135.2‡ *3*	0.22‡ *4*	1108.0+y	(21/2$^+$)	972.9+y	(19/2$^+$)	[M1]	6.06	α(L)=4.51 *7*; α(M)=1.123 *18*; α(N+..)=0.422 *7* α(N)=0.317 *5*; α(O)=0.0860 *14*; α(P)=0.0172 *3*; α(Q)=0.001101 *17*
137.4‡ *4*	0.18‡ *4*	1016.3+y	(21/2$^-$)	878.8+y	(19/2$^-$)	[M1]	5.78 *10*	α(L)=4.31 *7*; α(M)=1.073 *18*; α(N+..)=0.402 *7* α(N)=0.303 *5*; α(O)=0.0821 *14*; α(P)=0.0164 *3*; α(Q)=0.001051 *18*

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^{209}Bi(^{48}Ca,2nγ) 2009Ke01,2009Je02 (continued)

γ(^{255}Lr) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[#]	Comments
148.3‡ *4*	0.25‡ *6*	1164.7+y	(23/2$^-$)	1016.3+y	(21/2$^-$)	[M1]	4.64 *8*	α(L)=3.46 *6*; α(M)=0.861 *14*; α(N+..)=0.323 *6* α(N)=0.243 *4*; α(O)=0.0659 *11*; α(P)=0.01315 *21*; α(Q)=0.000843 *14*
177.0‡ *4*	0.06‡ *2*	246.5+y	(15/2$^+$)	69.5+y	(11/2$^+$)	[E2]	2.79 *5*	α(K)=0.1218 *18*; α(L)=1.91 *4*; α(M)=0.552 *10*; α(N+..)=0.208 *4* α(N)=0.159 *3*; α(O)=0.0416 *8*; α(P)=0.00701 *12*; α(Q)=5.54×10^{-5} *9*
189† *1*		227.0+x	(11/2$^-$)	38	[7/2$^-$]			
196.6† *5*		196.6	(5/2$^-$)	0.0	[1/2$^-$]			
215† *1*		253.0+x	(13/2$^-$)	38+x	(9/2$^-$)			
239† *1*		466.0	(15/2$^-$)	227.0+x	(11/2$^-$)			
243.9‡ *3*	0.73‡ *11*	1408.6+y	(25/2$^+$)	1164.7+y	(23/2$^-$)	[E1]	0.0790	α(K)=0.0596 *9*; α(L)=0.01446 *21*; α(M)=0.00360 *6*; α(N+..)=0.001328 *19* α(N)=0.001009 *15*; α(O)=0.000267 *4*; α(P)=4.92×10^{-5} *7*; α(Q)=2.25×10^{-6} *4*
247.2† *5*		443.8	9/2$^-$	196.6	(5/2$^-$)			
264.6† *5*		517.6+x	(17/2$^-$)	253.0+x	(13/2$^-$)			
288.4† *4*		754.4+x	(19/2$^-$)					
296.2† *5*		740.0	(13/2$^-$)	443.8	9/2$^-$			
300.6‡ *3*	1.20‡ *14*	1408.6+y	(25/2$^+$)	1108.0+y	(21/2$^+$)	[E2]	0.389	α(K)=0.0893 *13*; α(L)=0.215 *4*; α(M)=0.0612 *9*; α(N+..)=0.0230 *4* α(N)=0.0176 *3*; α(O)=0.00462 *7*; α(P)=0.000802 *12*; α(Q)=1.159×10^{-5} *17*
314.0† *5*		831.6+x	(21/2$^-$)	517.6+x	(17/2$^-$)			
338† *1*		1092.4+x	(23/2$^-$)	754.4+x	(19/2$^-$)			
342.9† *5*		1082.9	17/2$^-$	740.0	(13/2$^-$)			
360† *1*		1191.6+x	(25/2$^-$)	831.6+x	(21/2$^-$)			
384† *1*		1476.4	(27/2$^-$)	1082.9	17/2$^-$			
386.6‡ *4*	0.23‡ *8*	740.0+y	(15/2$^+$)	353.4+y	(17/2$^+$)	[M1]	1.341	α(K)=1.030 *15*; α(L)=0.232 *4*; α(M)=0.0576 *9*; α(N+..)=0.0216 *3* α(N)=0.01625 *24*; α(O)=0.00440 *7*; α(P)=0.000877 *13*; α(Q)=5.58×10^{-5} *8*
387† *1*		1469.9	(21/2$^-$)	1082.9	17/2$^-$			
430† *1*		1899.9	(25/2$^-$)	1469.9	(21/2$^-$)			
493.5‡ *3*	1.00‡ *14*	740.0+y	(15/2$^+$)	246.5+y	(15/2$^+$)	[M1]	0.685	α(K)=0.526 *8*; α(L)=0.1181 *17*; α(M)=0.0293 *5*; α(N+..)=0.01098 *16* α(N)=0.00827 *12*; α(O)=0.00224 *4*; α(P)=0.000446 *7*; α(Q)=2.83×10^{-5} *4*
588.1‡ *3*	0.91‡ *15*	740.0+y	(15/2$^+$)	151.8+y	(13/2$^+$)	[M1]	0.424	α(K)=0.326 *5*; α(L)=0.0729 *11*; α(M)=0.0181 *3*; α(N+..)=0.00677 *10* α(N)=0.00510 *8*; α(O)=0.001380 *20*; α(P)=0.000275 *4*; α(Q)=1.746×10^{-5} *25*

† From 2009Ke02, assumed E2.
‡ From 2009Je02. Intensities are relative to Iγ(493.5)=1.00.
# 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.

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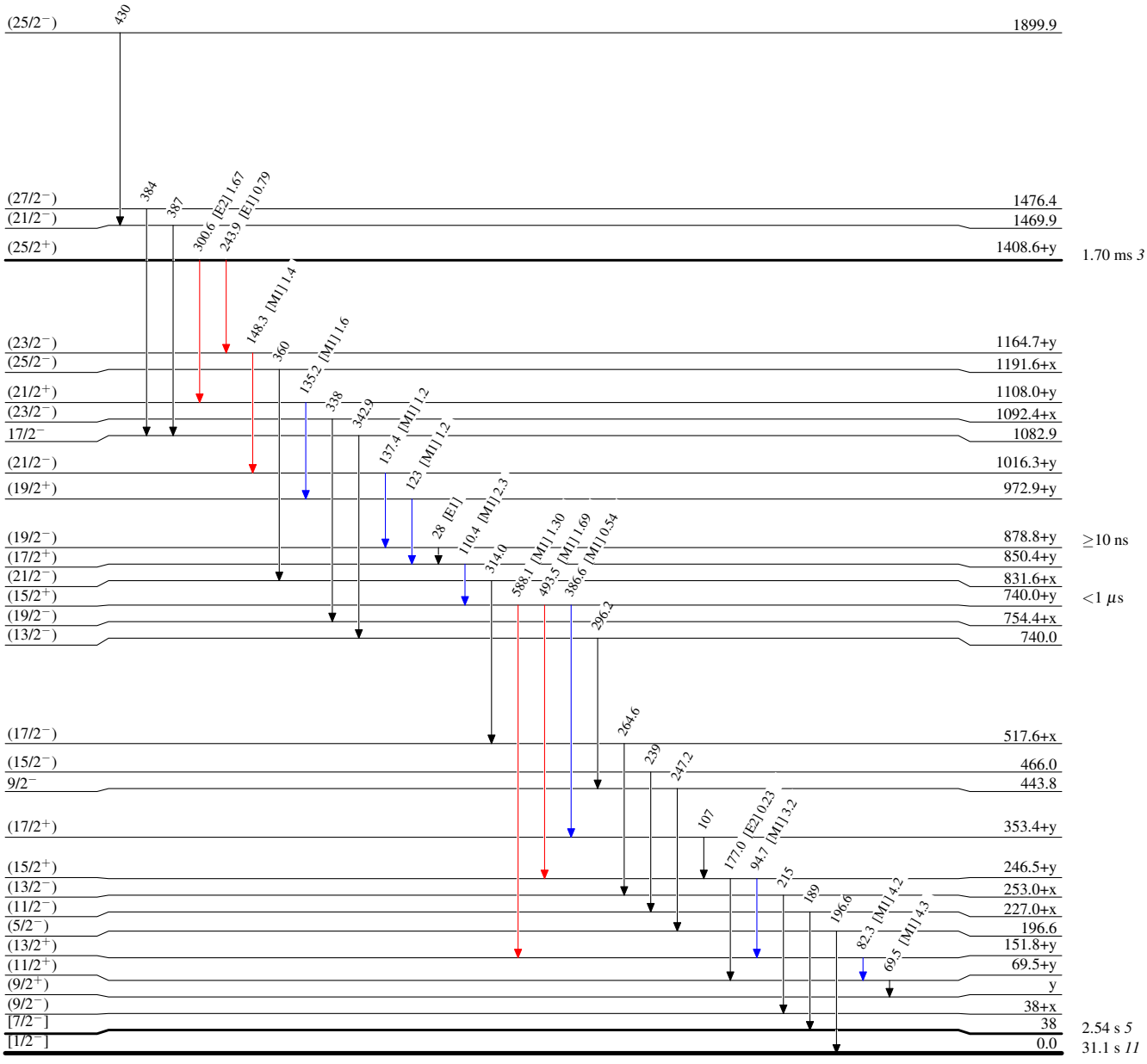
Level Scheme

Intensities: Relative $I_{(\gamma+ce)}$

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)



$^{255}_{103}Lr_{152}$

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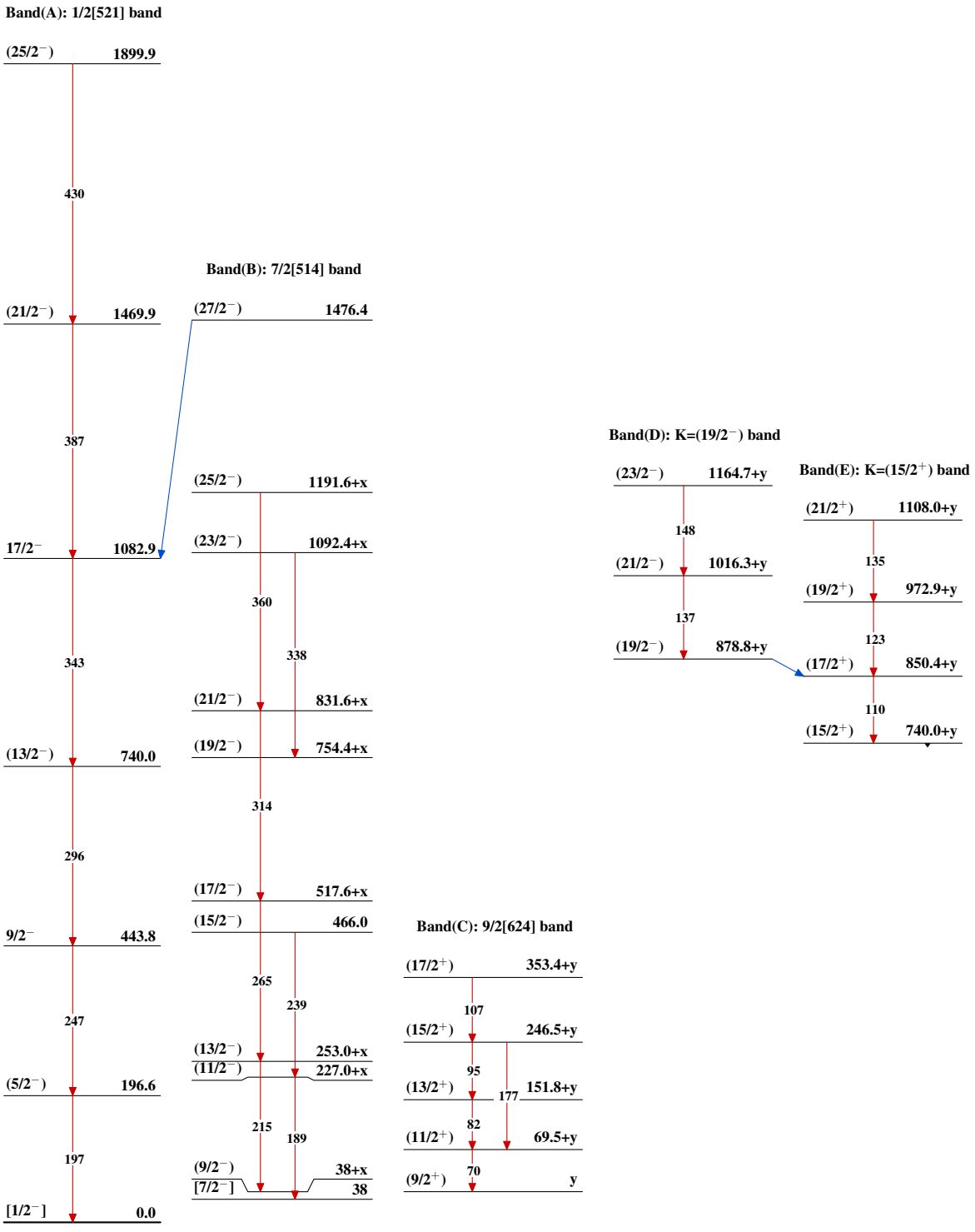

$^{255}_{103}Lr_{152}$