^{164}Er(n,n′γ) 1981Bo40

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen[#]	NDS 147, 1 (2018)	30-Nov-2017

E=fast neutrons from a reactor.
1981Bo40, 1982Bo39: 57% enriched target, measured Eγ, Iγ.
The 1189 and 1307 levels are omitted since the deexciting γ rays of 131.0 and 243.0 (from 1189 level) and 249.0 (from 1307 level) probably arise from ^{164}Er(n,γ) and ^{166}Er(n,γ). These levels have not been reported in any other study (see Adopted Levels). The γ-ray spectroscopic data are from 1981Bo40, whereas J^{π} and band assignments are discussed in 1982Bo39.

^{164}Er Levels

Band assignments were proposed by 1982Bo39.

E(level)[†]	Jπ[‡]	Comments
0.0[#]	0^+	
91.19[#] *18*	2^+	
299.37[#] *22*	4^+	
614.3[#] *3*	6^+	
860.34[@] *21*	2^+	
946.2[@] *3*	3^+	
1024.5[#] *5*	8^+	
1058.0[@] *3*	4^+	
1197.4[@] *4*	5^+	
1246.0[a] *4*	0^+	
1314.19[a] *25*	2^+	
1358.2[@] *5*	6^+	
1386.9 *3*	1^-	
1416.3[&] *4*	1^+	Upper limit of Iγ to g.s. <2.
1433.7 *4*	3^-	
1469.6[a] *3*	4^+	
1483.5[&] *3*	2^+	
1494.8 *6*		
1555.2 *4*	$(5)^-$	Jπ: 1982Bo39 suggested 7^+ as member of γ band, but $(5)^-$ is recommended in Adopted Levels.
1568.6 *4*	3^-	
1578.1 *6*	(1^-)	Jπ: (3^+), and assigned as member of γ band in 1982Bo39, is incorrect as there is γ to 0^+ g.s. $J^{\pi}=1^-$ in Adopted Levels.
1631.4 *5*		
1639.8 *6*	4^-	
1663.9 *5*	5^-	
1701.9[b] *4*	0^+	
1706.6[a] *7*	$(6)^+$	
1741.6 *4*		
1744.5 *11*		
1765.8[c] *8*	0^+	
1788.8[b] *6*	2^+	
1798.6 *4*		
1833.1[c] *4*	2^+	
1845.6 *11*		
1874.8 *4*		
1911.2 *11*		
1953.8 *6*		

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^{164}Er(n,n′γ) 1981Bo40 (continued)

^{164}Er Levels (continued)

E(level)[†]	Jπ[‡]	E(level)[†]	E(level)[†]	E(level)[†]	Jπ[‡]
1969.4[b] 6	4+	2021.9 4	2035.6 8	2172.0 8	0+
2002.4[c] 5	4+	2025.9 6	2068.2 6	2254.4 11	

† From least-squares fit to Eγ data.
‡ As given in 1982Bo39, unless otherwise stated. See also Adopted Levels, where some of the assignments are different.
# Band(A): g.s. band.
@ Band(B): γ band.
& Band(C): Kπ=1+ band.
a Band(D): Kπ=0+ band based on 1246 level.
b Band(E): Kπ=0+ band based on 1702 level.
c Band(F): Possible Kπ=0+ band. Band based on 1765 level.

γ(^{164}Er)

Eγ	Iγ[d]	Ei(level)	Jiπ	Ef	Jfπ	Mult.[e]	α[f]	Comments
91.4 3	170 20	91.19	2+	0.0	0+	E2	4.14	
x120.0 3	3 1							
x131.0†# 4	8.5 30							
208.1 3	250 20	299.37	4+	91.19	2+	E2	0.22 1	
x218.8‡ 3	11.1 6							
x243.0‡@ 3	41 3							Additional information 1.
x249.0‡& 3	3.1 7							
x256.5 5	3 1							
x292.5‡ 5	4.1 7							
x296.5‡ 4	14 3							
x307.0‡ 5	3.2 7							
314.9g 3	41g 2	614.3	6+	299.37	4+	E2	0.05 96	
314.9g 3	42g 3	1701.9	0+	1386.9	1−			
x321.3† 4	3.4 5							
x329.8 4	4.5 7							
x356.2‡ 5	2.6 7							
358.0 5	1.5 5	1555.2	(5)−	1197.4	5+			
x366.2‡ 4	1.9 8							
x376.6 6	2.3 9							
x385.2 6	4.0 9							
410.2 3	4.4 9	1024.5	8+	614.3	6+			
x421.5‡ 5	3.9 10							
x430.7‡ 6	3.3 10							
x456.4‡ 8	5.1 10							
x493.0 6	6.8 12							
x530.0‡ 6	6.6 25							
x536.4 4	5.0 13							
547.1	<3	1744.5		1197.4	5+			
561	<6	860.34	2+	299.37	4+			
x566.5 5	6 3							
568.4 5	7.7 25	2002.4	4+	1433.7	3−			
582.0 5	7.9 15	1639.8	4−	1058.0	4+			

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^{164}Er(n,n′γ) 1981Bo40 (continued)

γ(^{164}Er) (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Comments
583.2 5	4.0 8	1197.4	5^+	614.3	6^+	
589.0 6	3.2 10	2021.9		1433.7	3^-	
x606.4 7	8.6 15					
634.5[g] 5	17.8[g] 15	1494.8		860.34	2^+	
634.5[g] 5	17.8[g] 3	2021.9		1386.9	1^-	
634.5[g] 5	17.8[g] 15	2068.2		1433.7	3^-	
646.9 3	22 2	946.2	3^+	299.37	4^+	
x663.5[a] 5	9.5 15					
743.9 4	6.3 13	1358.2	6^+	614.3	6^+	
758.0 4	36 4	1058.0	4^+	299.37	4^+	
769.0 3	83 5	860.34	2^+	91.19	2^+	
x775.4 3	9 3					
x793.6‡ 5	3 1					
x806.0‡ 4	5 2					
842.0	<1.5	1701.9	0^+	860.34	2^+	
x843.6 5	5 2					
855.0 3	96 8	946.2	3^+	91.19	2^+	
860.3 3	65 5	860.34	2^+	0.0	0^+	
881.0 4	3 1	1741.6		860.34	2^+	
x886.0 5	1.1 5					
898.0 3	27 3	1197.4	5^+	299.37	4^+	
905.7	<1	1765.8	0^+	860.34	2^+	
941.0 5	2.0 6	1555.2	$(5)^-$	614.3	6^+	
x952.4‡ 5	2.4 6					
967.2 3	13.0 13	1058.0	4^+	91.19	2^+	
x994.5 5	1.9 6					
x998.5 5	1.9 6					
x1007.5[b] 5	3.1 12					
1014.4[g] 4	12.1[g] 15	1314.19	2^+	299.37	4^+	
1014.4[g] 4	12.1[g] 15	1874.8		860.34	2^+	Additional information 2.
1017.2[h]	<0.5	1631.4		614.3	6^+	
1049.5 5	2.7 12	1663.9	5^-	614.3	6^+	
1092.4 8	3.5 13	1706.6	$(6)^+$	614.3	6^+	
x1101.5 8	2.8 7					
1134.4 3	9 2	1433.7	3^-	299.37	4^+	
1154.8 3	12 2	1246.0	0^+	91.19	2^+	
1165	<1	2025.9		860.34	2^+	
1170.2 3	10 2	1469.6	4^+	299.37	4^+	
1184.3[g] 3	8.1[g] 14	1483.5	2^+	299.37	4^+	
1184.3[g] 3	8.1[g] 14	1798.6		614.3	6^+	
1223.1 3	20 3	1314.19	2^+	91.19	2^+	
1231.2	<1.5	1845.6		614.3	6^+	
1255.5[ch] 5	5 1	1555.2	$(5)^-$	299.37	4^+	
1269.2 3	5 2	1568.6	3^-	299.37	4^+	
1295	<30	1386.9	1^-	91.19	2^+	
1311.5 10	3.6 20	2172.0	0^+	860.34	2^+	
1314.4 4	9.0 10	1314.19	2^+	0.0	0^+	
1325.2 4	10.1 10	1416.3	1^+	91.19	2^+	
1332.0 5	5 2	1631.4		299.37	4^+	
1339.5 10	3 2	1639.8	4^-	299.37	4^+	
1342.6 10	15 3	1433.7	3^-	91.19	2^+	
1364.6 5	6 2	1663.9	5^-	299.37	4^+	
1379.0 5	2 2	1469.6	4^+	91.19	2^+	
1386.6 3	14 2	1386.9	1^-	0.0	0^+	

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^{164}Er(n,n′γ) 1981Bo40 (continued)

γ(^{164}Er) (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Comments
1392.0 *5*	5 *2*	1483.5	2^+	91.19	2^+	
1407 *1*	2 *1*	1706.6	$(6)^+$	299.37	4^+	
1442.4 *5*	4 *1*	1741.6		299.37	4^+	
[x]1458 *1*	5 *2*					
[x]1466 *2*	3 *1*					
1477.3 *5*	12 *2*	1568.6	3^-	91.19	2^+	
1483.2 *10*	3 *2*	1483.5	2^+	0.0	0^+	
[x]1484.5 *10*	5 *2*					
1486.5 *8*	11 *3*	1578.1	(1^-)	91.19	2^+	
1489.5 *10*	4.3 *20*	1788.8	2^+	299.37	4^+	
1499 *1*	3.6 *15*	1798.6		299.37	4^+	
[x]1507.5 *5*	5.1 *11*					
1534.3 *5*	2.1 *11*	1833.1	2^+	299.37	4^+	
[x]1543 *1*	3.2 *12*					
[x]1558 *1*	2.2 *12*					
1578.5 *8*	4.3 *15*	1578.1	(1^-)	0.0	0^+	In 1982Bo39, placement of this γ from (3^+) (for 1578 level) to 0^+ g.s. is highly unlikely.
1611.4 *8*	3.3 *13*	1701.9	0^+	91.19	2^+	
1651.5 *10*	4.6 *13*	1741.6		91.19	2^+	
1654.5 *10*	1.8 *8*	1953.8		299.37	4^+	
1671.5 *10*	3.5 *13*	1969.4	4^+	299.37	4^+	
1674.3 *10*	1.2 *6*	1765.8	0^+	91.19	2^+	
1697.5 *10*	3.8 *14*	1788.8	2^+	91.19	2^+	
1703.5 *7*	3.0 *15*	2002.4	4^+	299.37	4^+	
[x]1725.7 *7*	5.1 *15*					
1742.0 *10*	1.3 *7*	1833.1	2^+	91.19	2^+	
1783.5 *10*	3.8 *4*	1874.8		91.19	2^+	
1788.7	<1.3	1788.8	2^+	0.0	0^+	
1820	<3	1911.2		91.19	2^+	
1832.0 *7*	1.5 *8*	1833.1	2^+	0.0	0^+	
1862.0 *7*	7.2 *15*	1953.8		91.19	2^+	
1875	<1.5	1874.8		0.0	0^+	
1877.5 *7*	5.8 *15*	1969.4	4^+	91.19	2^+	
1935.2	4.6 *15*	2025.9		91.19	2^+	
1944	<3	2035.6		91.19	2^+	
1955[g] *1*	4.6[g] *15*	1953.8		0.0	0^+	
1955[g] *1*	4.6[g] *15*	2254.4		299.37	4^+	
1977	<1.5	2068.2		91.19	2^+	
2022 *1*	2.4 *8*	2021.9		0.0	0^+	
2026 *1*	3.2 *15*	2025.9		0.0	0^+	
2036 *1*	3.2 *15*	2035.6		0.0	0^+	
2081	<2	2172.0	0^+	91.19	2^+	Additional information 3.
[x]2112.2 *5*	6.7 *15*					
[x]2136.0 *15*	3.4 *15*					

† γ probably from ^{166}Er(n,γ).
‡ γ probably from ^{164}Er(n,γ).
# Placed from 1189,4^- or 2^- level (1981Bo40,1982Bo39).
@ Placed from 1189,4^- or 2^- level (1981Bo40,1982Bo39).
& Placed from 1307,5^- level (1981Bo40,1982Bo39).
[a] A 663.7γ together with an equally intense 413.2γ deexcite a 1610 level.
[b] Placed from 1307,5^- level (1981Bo40,1982Bo39).

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^{164}Er(n,n′γ) 1981Bo40 (continued)

γ(^{164}Er) (continued)

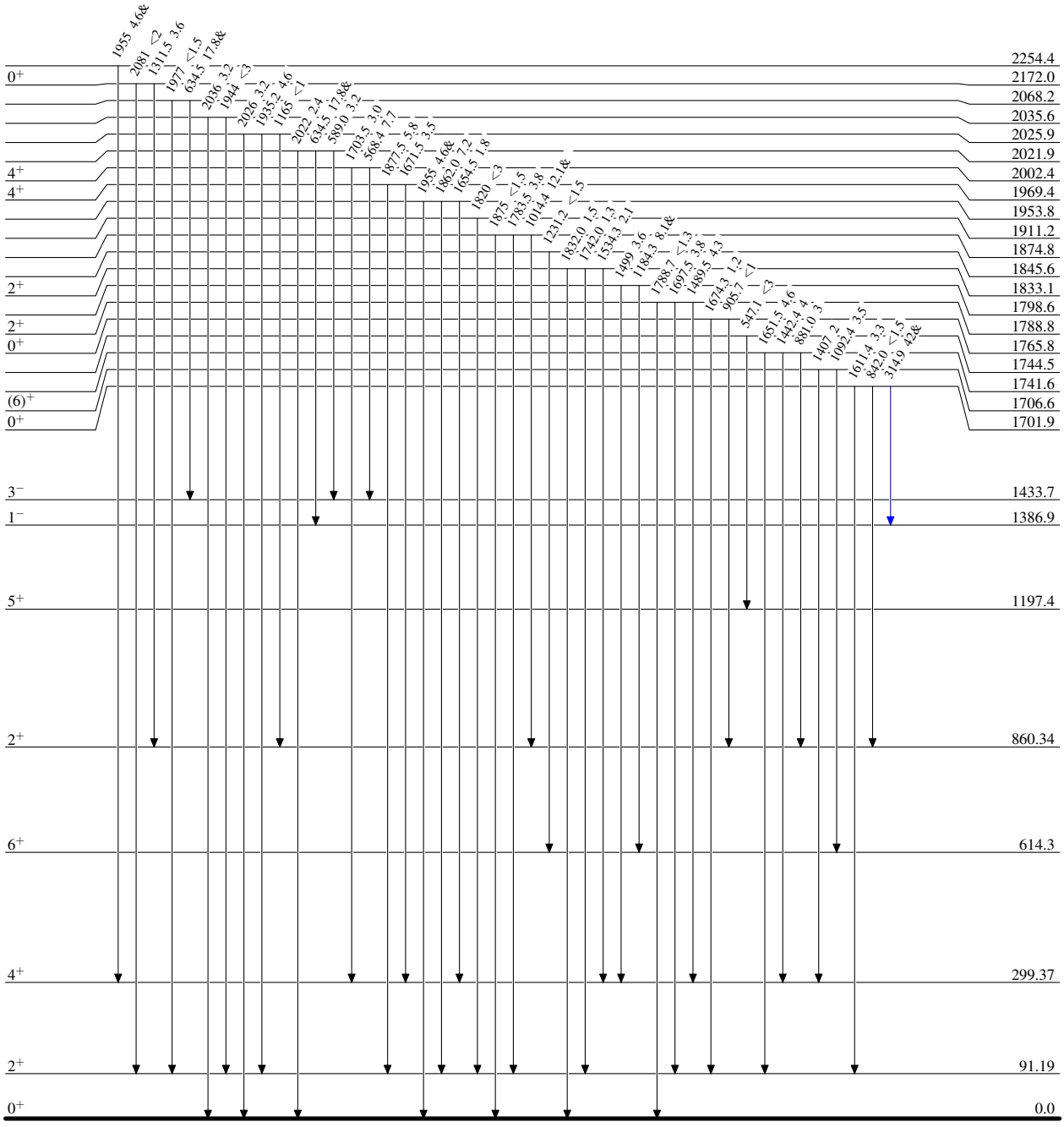
[c] Placement (by evaluators) based on Adopted Gammas.
[d] Normalized to Iγ(847γ,^{56}Fe)=1000 for equal weight of ^{56}Fe and ^{164}Er.
[e] From Adopted Gammas.
[f] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[g] Multiply placed with undivided intensity.
[h] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{164}Er(n,n′γ) 1981Bo40

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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

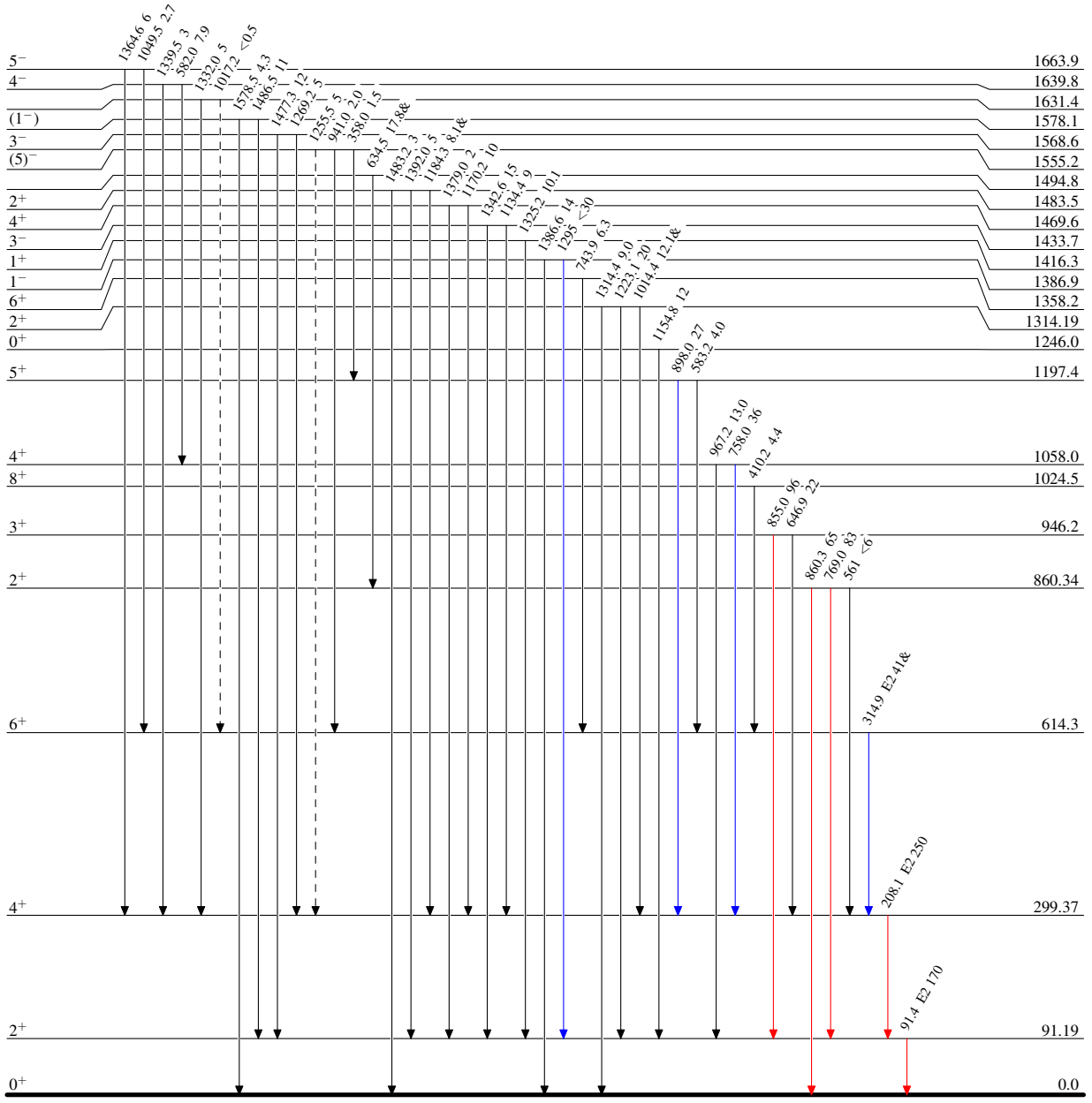


^{164}Er(n,n′γ) **1981Bo40**

Level Scheme (continued)

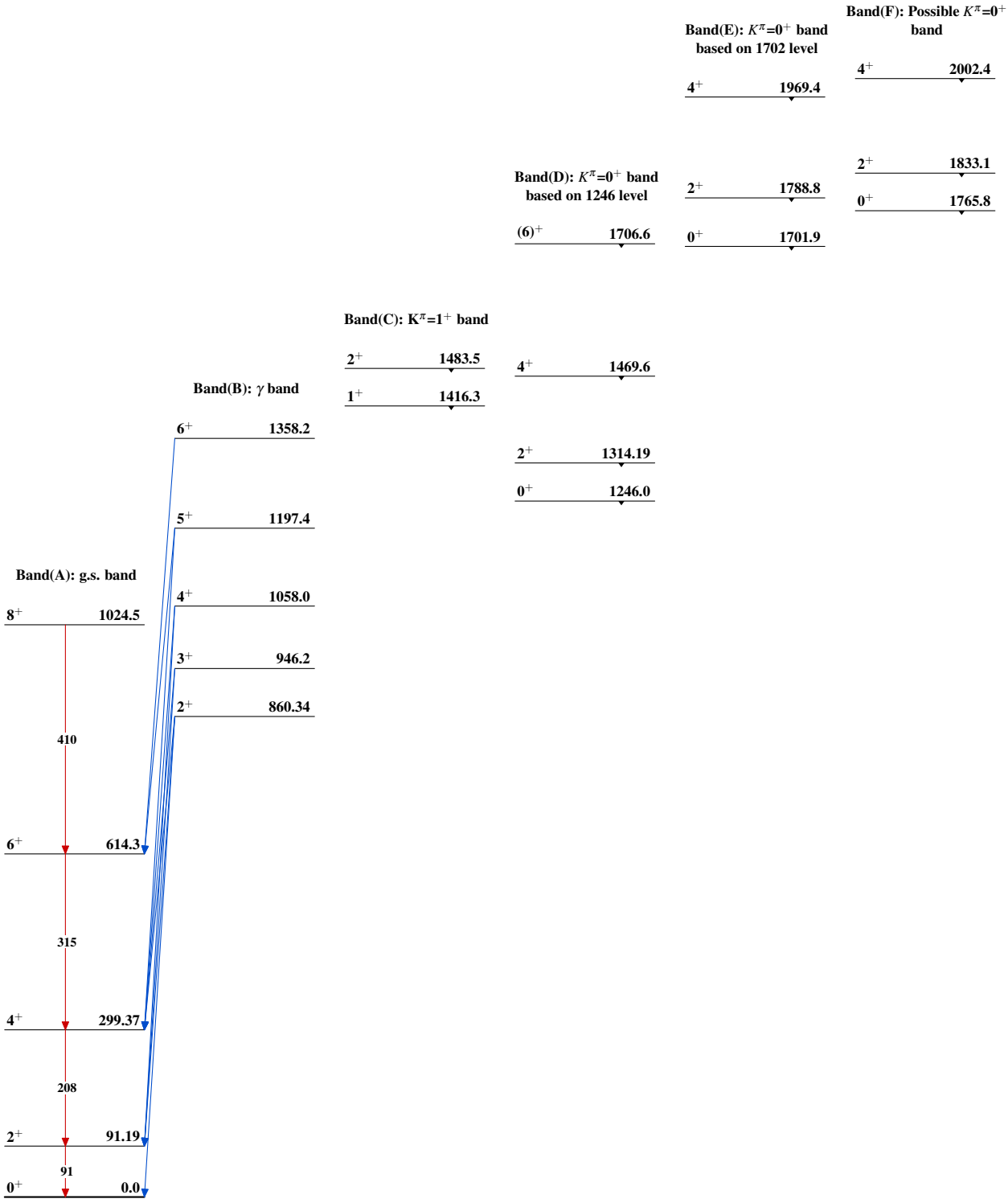
Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)



$^{164}_{68}Er_{96}$

^{164}Er(n,n′γ) 1981Bo40



$^{164}_{68}Er_{96}$