^{155}Gd(n,γ) E=58 keV 1999GrZN

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 2537 (2012)	1-Mar-2012

$J^\pi(^{155}Gd)=3/2^-$. Conf=ν3/2[521].

Measured primary capture γ-ray transitions from 58-keV n neutron capture in ^{155}Gd. The energy spread of the incident n beam produces an averaging over many compound-nucleus states, which greatly reduces the statistical (e.g., Porter-Thomas) fluctuations commonly observed in the intensities of the primary transitions from thermal-neutron capture. These averaged γ-ray intensities provide useful information for determining J^π values for the nuclear levels directly populated by these primary transitions.

1999GrZN give no experimental details. Such details are given in 1993Kl03 (thermal-n capture). They include the following. Target is 60 g of Gd oxide, enriched to 91.9% in ^{155}Gd. Neutron beams formed using "filters" of ^{46}Sc, ^{60}Ni and ^{56}Fe (these authors report ^{54}Fe, but the evaluator assumes that that is a misprint). γ radiation measured using 3 pair spectrometers having FWHM$\approx$10 keV at 8 MeV.

The tabular information presenting the data given by 1999GrZN for both 58- and 1.9-keV n capture is given under 1.9-keV n capture.

^{156}Gd Levels

E(level)	J^π [†]	E(level)	J^π [†]	E(level)	J^π [†]	E(level)	J^π [†]
0[a]	0^+	2011.9	3^-	2293.2	1^-	2571.9	$1^+,2^+$
89.0[a]	2^+	2024.9[o]	3^-	2300.8[t]	1^+	2581	$1^-,2^-$
288.2[a]	4^+	2026.7[l]	1^+	2302.6[s]	2^+	2588.9	$1^+,2^+$
1049.5[b]	0^+	2029.8	4^-	2316.6	$1^-,2^-$	2598	$1^+,2^+$
1129.4[b]	2^+	2044.9[m]	4^-	2321.9	3^+	2607.9	(1^-)
1154.1[c]	2^+	2047.8[p]	2^+	2323.3[t]	2^+	2617.2	$1^+,2^+$
1168.2[d]	0^+	2054.1[l]	2^+	2340.2	(2^-)	2622.1	1^- to 3^-
1242.5[e]	1^-	2070.3[k]	3^+	2343.9	1^-	2640.5	(3^+)
1248.0[c]	3^+	2082.0[q]	0^+	2349.6[s]	3^+	2647.5	$1^+,2^+$
1258.1[d]	2^+	2103.4	3^-	2360.8[u]	1^+	2650.7	3^+
1276.1[e]	3^-	2106.7[l]	3^+	2367.5	2^+	2652.0	
1319.7[e]	2^-	2121.4	2^-	2382.3[u]	2^+	2665.3	$0^+,3^+$
1366.5[f]	1^-	2139.8[r]	3^+	2391.7	(2^-)	2676.6	
1468.5[e]	4^-	2147.4[q]	2^+	2402.7[v]	1^+	2684	$1^+,2^+$
1538.9[f]	3^-	2155.6[o]	4^-	2406.1	$1^-,3^-$	2689.5	3^+
1715.2[g]	0^+	2160.7	(3^+)	2416.2[u]	3^+	2701.0	(2^+)
1771.1[g]	2^+	2170.8	1^-	2423.0	$0^+,3^+$	2718.4	$1^+,2^+$
1780.5[h]	2^-	2174.3[x]	2^+	2428.0[v]	2^+	2722.9	3^+
1827.8[i]	2^+	2175.1	4^-	2434.7	$1^+,2^+$	2738.0	(3^+)
1851.2[j]	0^+	2186.8[n]	1^+	2436.7	(2^+)	2750.6	$1^+,2^+$
1851.8[h]	3^-	2190.6	2^+	2446.2	2^+	2761.7	$1^+,2^+$
1914.8[j]	2^+	2190.9[l]	4^+	2449.7	1^-	2770.5	$0^+,3^+$
1916.5[i]	3^+	2199.8[w]	2^-	2451.5	(2^+)	2776.8	$1^+,2^+$
1934.1[o]	2^-	2203.3	$1^-,2^-$	2462		2784.7	$1^+,2^+$[#]
1934.4	3^-	2205.6	1^-	2467.6[v]	3^+	2787.8	3^+
1946.4	1^-	2216.6[n]	2^+	2478.6	3^+	2794.7	$1^+,2^+$
1952.4[h]	4^-	2227.6	3^-	2494.1	(1^-)	2804.5	(2^+)
1952.4	0^-	2231.5[x]	3^+	2502.0	3^+	2816.3	3^-
1962.0	1^-	2232.5	4^-	2506.2	2^+	2826.7	3^+
1965.1	4^-	2240.4	3^-[‡]	2517.8	$0^+,3^+$	2831.3	2^+
1965.9[k]	1^+	2256.7[n]	3^+	2528.9	(3^+)	2839.6	2^+
1988.2[p]	0^+	2259.7	1^-	2534.7	(3^+)	2846.8	$2^+,3^+$
2003.7[k]	2^+	2269.9[s]	1^+	2554.4	(1^-)	2853.9	$1^+,2^+$

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^{155}Gd(n,γ) E=58 keV 1999GrZN (continued)

^{156}Gd Levels (continued)

E(level)	J$^\pi$ †	E(level)	J$^\pi$ †	E(level)	J$^\pi$ †	E(level)	J$^\pi$ †
2873.8	(2$^+$)	2900	0$^+$ to 3$^+$	2928.4		2946.7	3$^+$
2878.9	1$^+$,2$^+$	2907.4	1$^+$,2$^+$	2931.8	1$^+$,2$^+$	8594@	&
2894.0	0$^+$,3$^+$	2918.5	1$^+$,2$^+$	2943.2	1$^-$ to 3$^-$		

† Values reported by 1999GrZN. These generally agree with the adopted values.
‡ J$^\pi$=2$^+$,3$^+$ is ADOPTED.
# J$^\pi$=1$^+$ is ADOPTED.
@ Neutron-capture “state”. Energy is the sum of S(n) and the 58-keV average energy of the neutron beam.
& From s-wave n capture in ^{155}Gd (J$^\pi$=3/2$^-$), the states excited can have J$^\pi$=1$^-$ and 2$^-$. At 58 keV, p-wave also occurs (1999GrZN), making possible capture states having J$^\pi$=0$^+$ through 3$^+$. Due to the finite energy spread in the n beam, many states, having these J$^\pi$ values are populated in the capture reaction.
a Band(A): K$^\pi$=0$^+$ g.s. band.
b Band(B): First excited K$^\pi$=0$^+$ band.
c Band(C): K$^\pi$=2$^+$ γ-vibrational band.
d Band(D): K$^\pi$=0$^+$ band.
e Band(E): K$^\pi$=1$^-$ octupole-vibrational band.
f Band(F): K$^\pi$=0$^-$ octupole-vibrational band.
g Band(G): K$^\pi$=0$^+$ band.
h Band(H): K$^\pi$=2$^-$ octupole-vibrational band.
i Band(I): K$^\pi$=2$^+$ band.
j Band(J): K$^\pi$=0$^+$ band.
k Band(K): K$^\pi$=1$^+$ band.
l Band(L): K$^\pi$=1$^+$ band.
m Band(M): K$^\pi$=4$^-$ band. Dominant conf=ν3/2[521]+ν5/2[642].
n Band(N): K$^\pi$=1$^+$ band.
o Band(O): K$^\pi$=2$^-$ band.
p Band(P): K$^\pi$=0$^+$ band.
q Band(Q): K$^\pi$=0$^+$ band.
r Band(R): Probable bandhead of a K$^\pi$=3$^+$ band.
s Band(S): K$^\pi$=1$^+$ band.
t Band(T): K$^\pi$=1$^+$ band.
u Band(U): K$^\pi$=1$^+$ band.
v Band(V): K$^\pi$=1$^+$ band.
w Band(W): Probable K$^\pi$=2$^-$ bandhead. Conf=ν3/2[521]+ν1/2[400].
x Band(X): K$^\pi$=2$^+$ band.

γ(^{156}Gd)

E$_\gamma$ †	I$_\gamma$ #	E$_i$(level)	E$_f$	J$^\pi_f$	E$_\gamma$ †	I$_\gamma$ #	E$_i$(level)	E$_f$	J$^\pi_f$
5973	22 *6*	8594	2622.1	1$^-$ to 3$^-$	6066	33 *19*	8594	2528.9	(3$^+$)
5977	109 *6*	8594	2617.2	1$^+$,2$^+$	6077	17 *3*	8594	2517.8	0$^+$,3$^+$
5986	35 *5*	8594	2607.9	(1$^-$)	6088	59 *4*	8594	2506.2	2$^+$
5996	57 *4*	8594	2598	1$^+$,2$^+$	6132‡	54 *4*	8594	2462	
6006	51 *6*	8594	2588.9	1$^+$,2$^+$	6144‡	74 *5*	8594	2449.7	1$^-$
6013	61 *7*	8594	2581	1$^-$,2$^-$	6147‡	59 *5*	8594	2446.2	2$^+$
6040	33 *3*	8594	2554.4	(1$^-$)	6159‡	70 *7*	8594	2434.7	1$^+$,2$^+$
6060	14 *10*	8594	2534.7	(3$^+$)	6169‡	84 *4*	8594	2423.0	0$^+$,3$^+$

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^{155}Gd(n,γ) E=58 keV 1999GrZN (continued)

γ(^{156}Gd) (continued)

E_γ †	I_γ #	E_i(level)	E_f	J^π_f	E_γ †	I_γ #	E_i(level)	E_f	J^π_f
6178	27 *3*	8594	2416.2	3+	6582	29 *3*	8594	2011.9	3−
6190‡	79 *3*	8594	2402.7	1+	6591	66 *3*	8594	2003.7	2+
6203	25 *3*	8594	2391.7	(2−)	6606	31 *3*	8594	1988.2	0+
6212	62 *3*	8594	2382.3	2+	6630‡	159 *6*	8594	1965.1	4−
6227	90 *10*	8594	2367.5	2+	6642‡	43 *8*	8594	1952.4	4−
6234	55 *10*	8594	2360.8	1+	6648	41 *8*	8594	1946.4	1−
6245‡	13 *7*	8594	2349.6	3+	6660‡	73 *4*	8594	1934.1	2−
6252‡	50 *7*	8594	2340.2	(2−)	6679‡	115.4 *14*	8594	1914.8	2+
6268‡	91 *5*	8594	2323.3	2+	6743‡	63 *7*	8594	1851.2	0+
6278	25 *6*	8594	2316.6	1−,2−	6767	93 *3*	8594	1827.8	2+
6293	114 *16*	8594	2300.8	1+	6814	66 *3*	8594	1780.5	2−
6301	50 *5*	8594	2293.2	1−	6823	94 *3*	8594	1771.1	2+
6324	67 *4*	8594	2269.9	1+	6879	35 *2*	8594	1715.2	0+
6336‡	56 *3*	8594	2256.7	3+	7056	49 *2*	8594	1538.9	3−
6354‡	24 *5*	8594	2240.4	3−	7126	21 *1*	8594	1468.5	4−
6364‡	44 *4*	8594	2231.5	3+	7228	62 *3*	8594	1366.5	1−
6378	55 *5*	8594	2216.6	2+	7275	69 *13*	8594	1319.7	2−
6406‡	141 *5*	8594	2186.8	1+	7318	47 *3*	8594	1276.1	3−
6419‡	96 *4*	8594	2175.1	4−	7336	122 *3*	8594	1258.1	2+
6436‡	34 *4*	8594	2155.6	4−	7346	80 *10*	8594	1248.0	3+
6447	61 *6*	8594	2147.4	2+	7352	60 *10*	8594	1242.5	1−
6455	38 *6*	8594	2139.8	3+	7426	70 *2*	8594	1168.2	0+
6473	33 *3*	8594	2121.4	2−	7440	147 *3*	8594	1154.1	2+
6490‡	70 *2*	8594	2103.4	3−	7465	132 *3*	8594	1129.4	2+
6512	31 *3*	8594	2082.0	0+	7545	67 *2*	8594	1049.5	0+
6524	38 *2*	8594	2070.3	3+	8306	8.7 *8*	8594	288.2	4+
6539‡	62 *5*	8594	2054.1	2+	8505	319 *5*	8594	89.0	2+
6548‡	85 *3*	8594	2044.9	4−	8594	163 *2*	8594	0	0+
6567‡	104 *3*	8594	2026.7	1+					

† Computed from the energy difference of the n-capture state and the final state. Recoil effects are not taken into account, since they are much smaller than the uncertainties involved.

‡ Peak consists of more than one transition.

Relative values from 1999GrZN.

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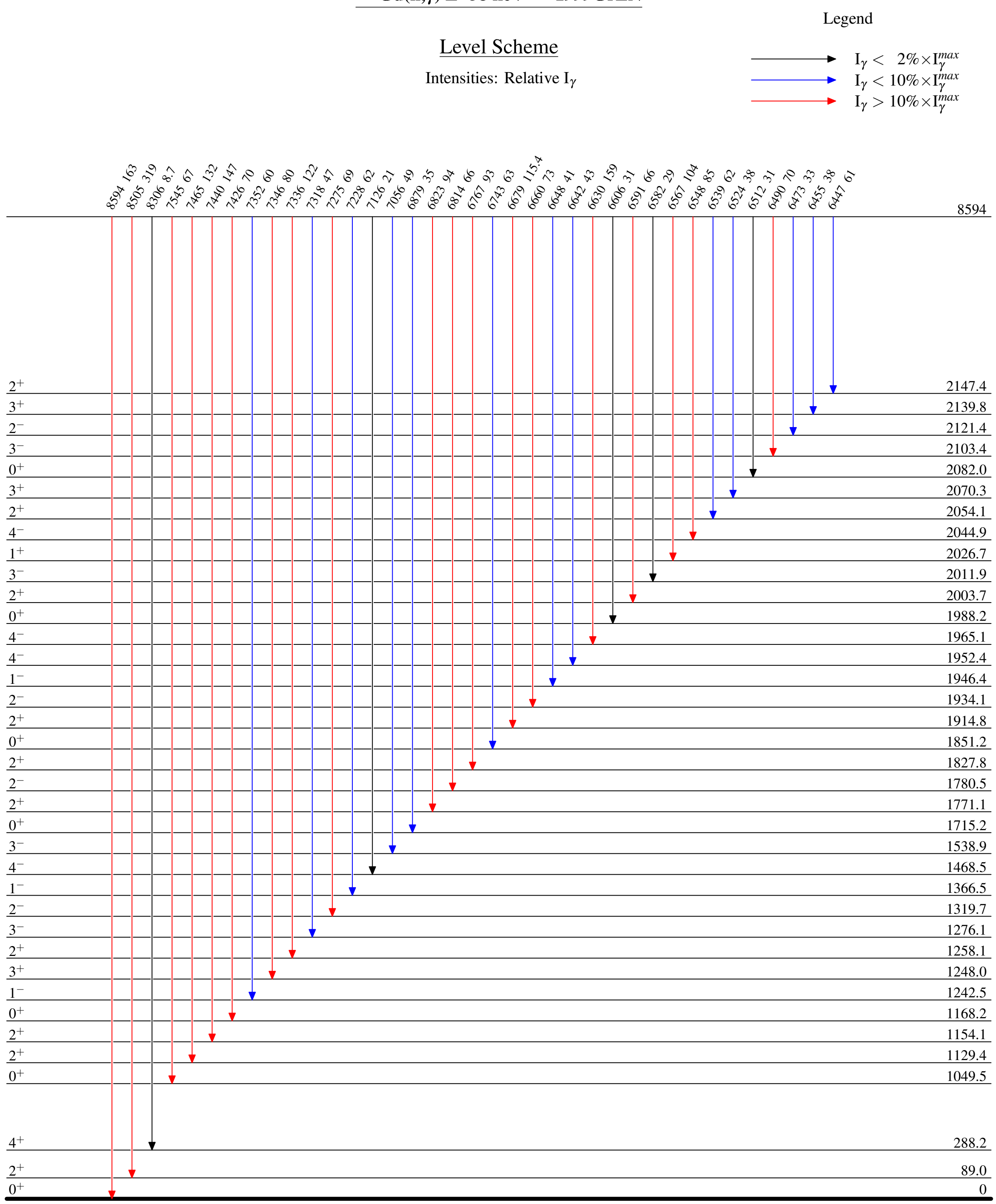
Level Scheme

Intensities: Relative I_γ

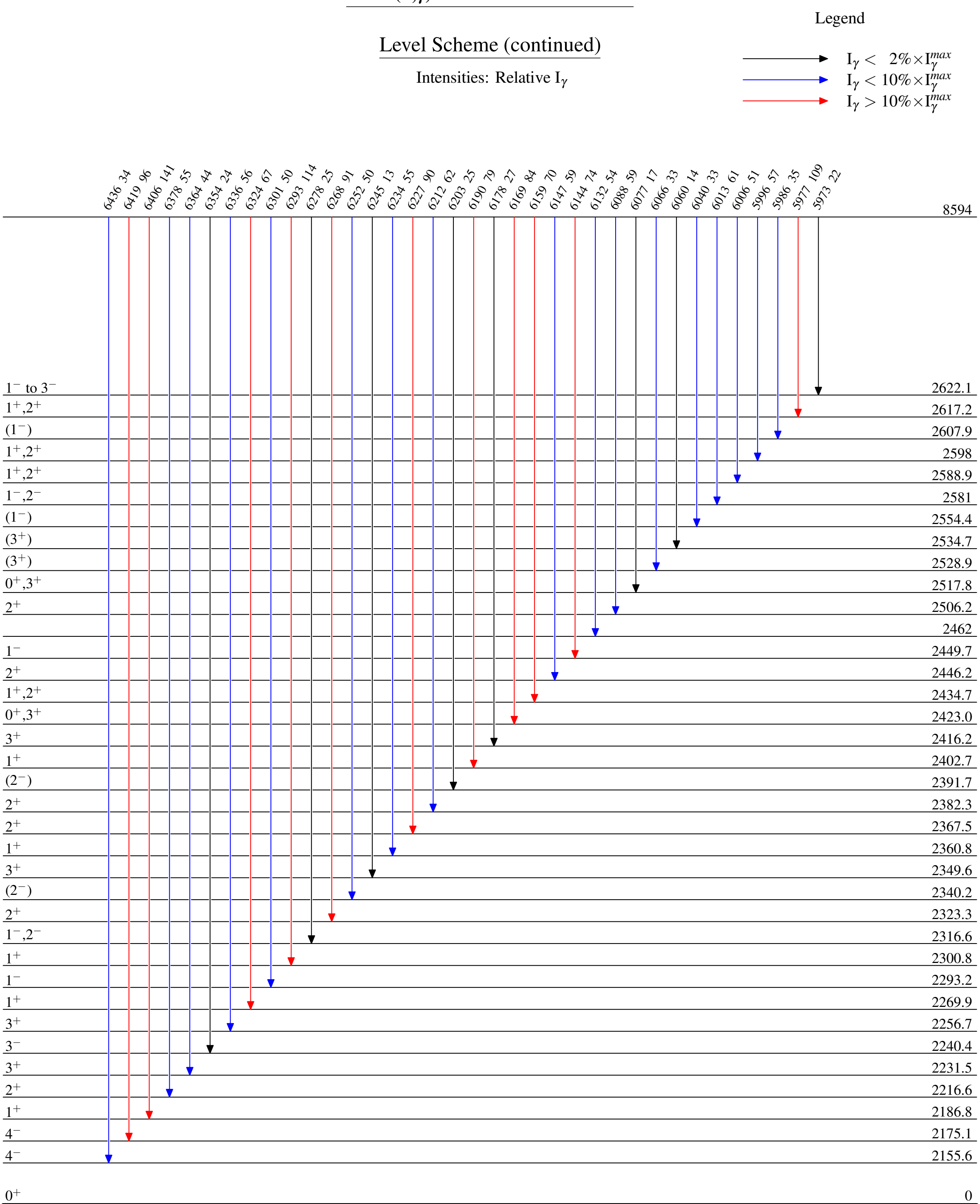


$^{156}_{64}Gd_{92}$

$^{155}Gd(n,\gamma)$ E=58 keV 1999GrZN

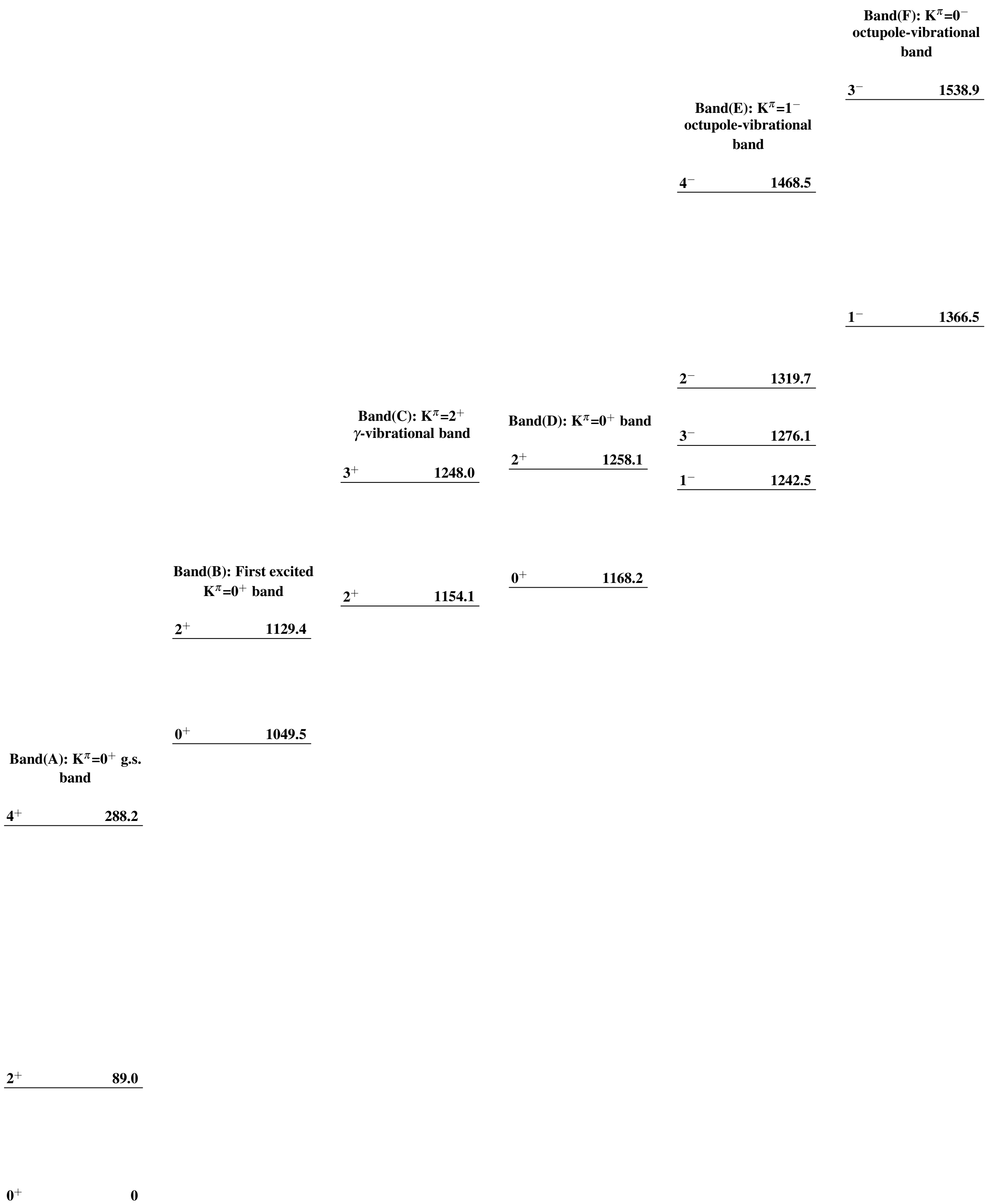
Level Scheme (continued)

Intensities: Relative I_γ



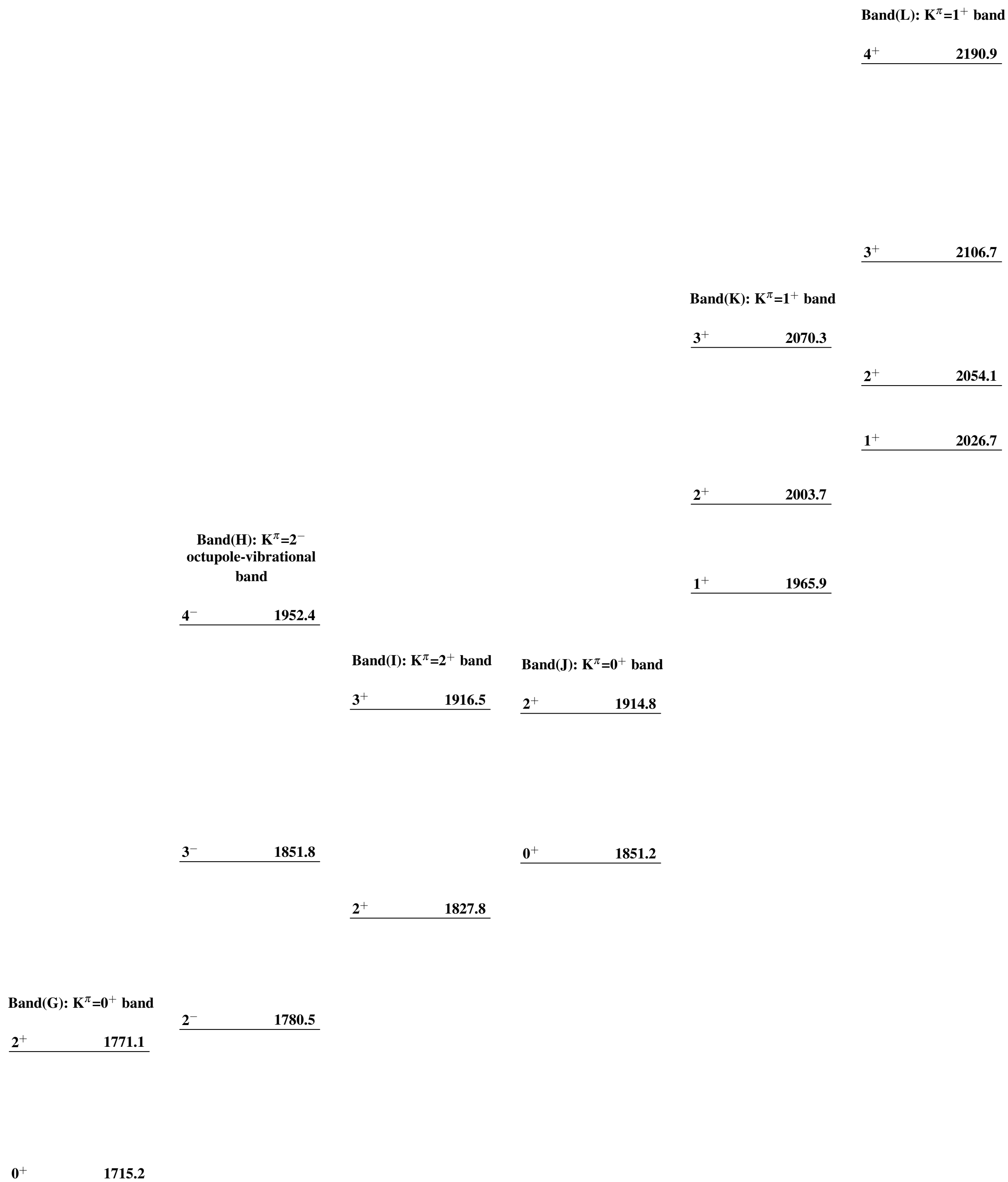
$^{156}_{64}Gd_{92}$

$^{155}Gd(n,\gamma)$ E=58 keV 1999GrZN



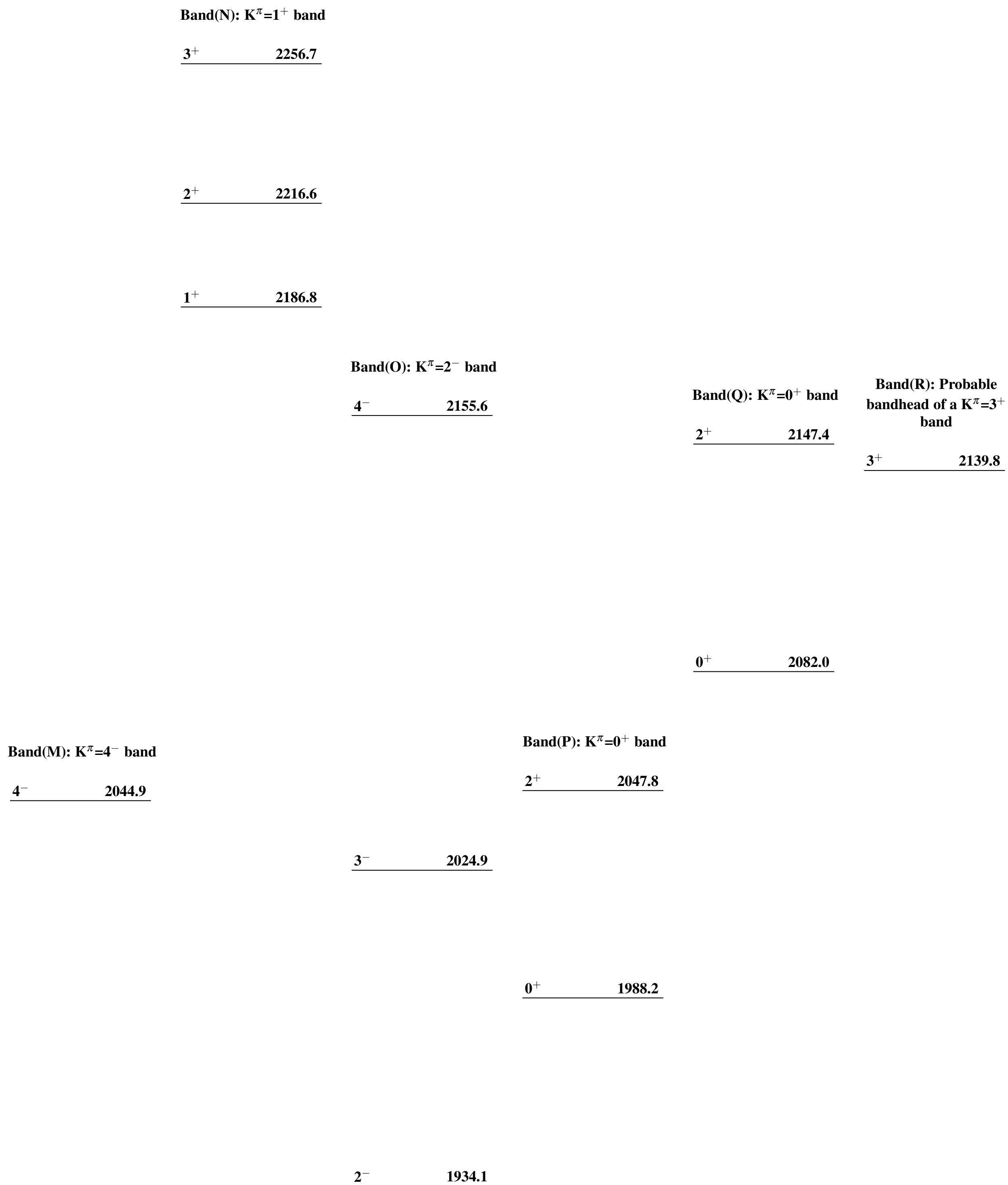
$^{156}_{64}Gd_{92}$

$^{155}Gd(n,\gamma)$ E=58 keV 1999GrZN (continued)



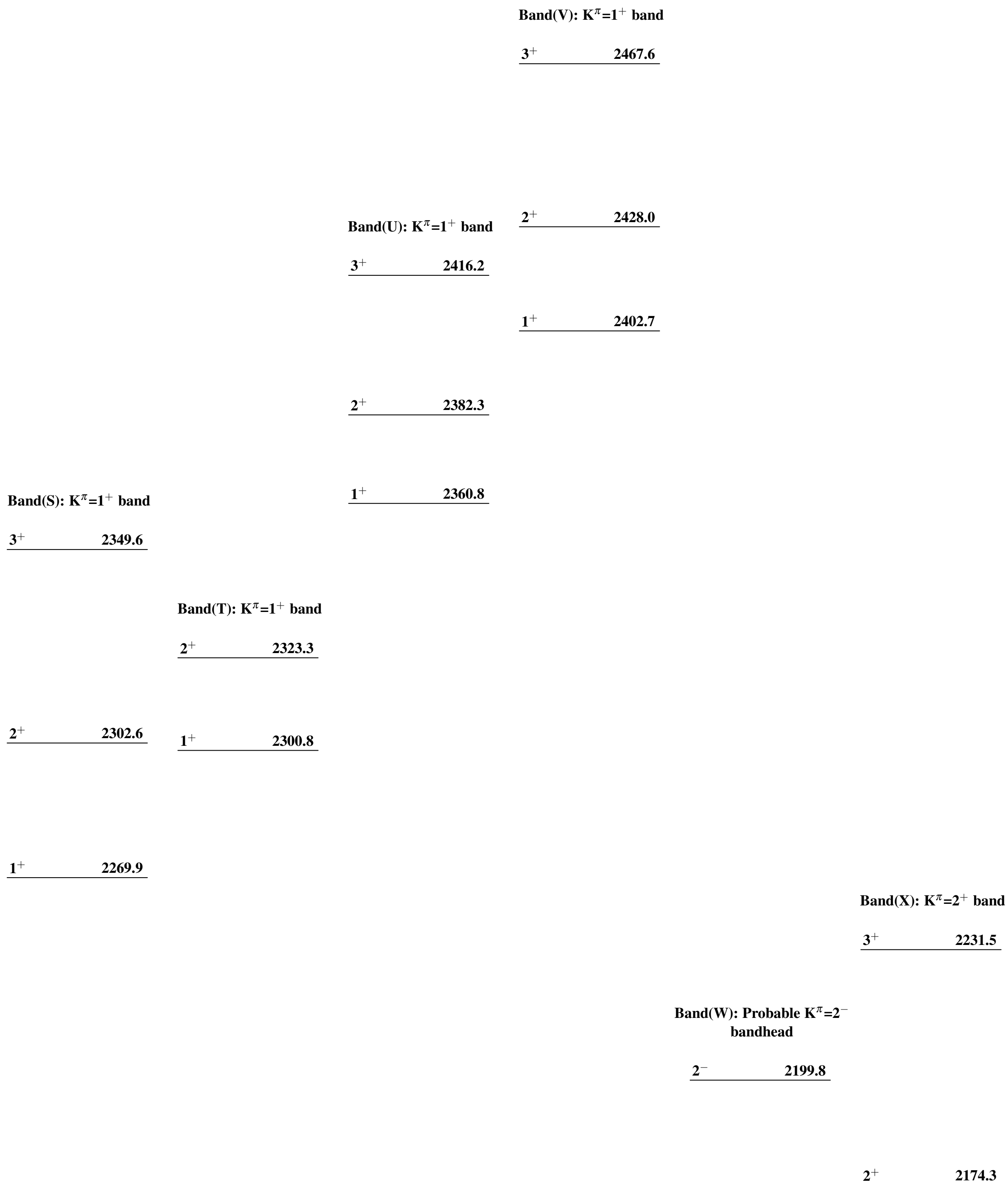
$^{156}_{64}Gd_{92}$

^{155}Gd(n,γ) E=58 keV 1999GrZN (continued)



$^{156}_{64}Gd_{92}$

^{155}Gd(n,γ) E=58 keV 1999GrZN (continued)



$^{156}_{64}Gd_{92}$