^{114}Cd(^{48}Ca,6nγ):2 2011Re06

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

Additional information 1.

This study complements an earlier high-spin study (2009Pa17) using the same reaction at the same bombarding energy by some of the same authors. It provides new information on some of the lower-spin non-yrast states in ^{156}Er, although it does not extend to states having spins as high as those reported in the earlier study.

Reaction initiated using a 215-MeV ^{48}Ca beam from the ATLAS facility at ANL. 1-mg/cm^2 ^{114}Cd target (enrichment not given), backed by a 13-mg/cm^2 ^{197}Au layer to stop the recoils and help reduce the effect of Doppler broadening in those instances where the recoils had stopped prior to γ emission. γ radiation studied using the Gammasphere array consisting of 101 HPGe detectors. Report Eγ and "angular-intensity ratios". Discuss properties of the γ-vibrational band as relating to nuclear triaxiality, as well as the alignment characteristics of several of the bands.

^{156}Er Levels

E(level)[†‡]	J$^\pi$[#]	E(level)[†‡]	J$^\pi$[#]	E(level)[†‡]	J$^\pi$[#]	E(level)[†‡]	J$^\pi$[#]
0[@]	0$^+$	2028.1[b]	7$^-$	3625.9[e]	12$^+$	5369.3[a]	18$^+$
344.4[@]	2$^+$	2367.5[d]	(7$^+$)	3650.0[a]	12$^+$	5535.6[f]	18$^+$
796.5[@]	4$^+$	2375.7[c]	8$^+$	3834.6[&]	14$^+$	5713.8[&]	20$^+$
930.0[c]	2$^+$	2479.4[a]	8$^+$	4086.1[f]	14$^+$	5927.8[e]	20$^+$
930.2[a]	0$^+$	2488.1[b]	9$^-$	4183.3[e]	14$^+$	6055.9[a]	20$^+$
1219.7[a]	2$^+$	2631.9[@]	10$^+$	4246.2[a]	14$^+$	6294.1	(20$^+$)
1339.7[@]	6$^+$	2759.6[f]	8$^+$	4268.7[d]	(13$^+$)	6409.6[f]	(20$^+$)
1350.0[d]	3$^+$	2941.5[c]	10$^+$	4278.7[c]	14$^+$	6485.8[&]	22$^+$
1404.7[c]	4$^+$	2960.2[d]	(9$^+$)	4378.8[&]	16$^+$	6658.8[e]	22$^+$
1545.4[a]	4$^+$	2996.6[f]	10$^+$	4762.5[f]	16$^+$	6821.9[a]	(22$^+$)
1610.8[b]	5$^-$	3041.1[a]	10$^+$	4780.3[e]	16$^+$	7312.8[&]	24$^+$
1834.2[d]	5$^+$	3312.8[&]	12$^+$	4811.6[a]	16$^+$	7438.8[e]	24$^+$
1884.7[c]	6$^+$	3492.2[f]	12$^+$	4966.3[d]	(15$^+$)	8079[&]	26$^+$
1957.6[@]	8$^+$	3586.7[c]	12$^+$	5003.8[&]	18$^+$	8206[e]	26$^+$
1968.4[a]	6$^+$	3598.2[d]	(11$^+$)	5335.9[e]	18$^+$		

[†] As the level energies increase, the energies reported here differ increasingly from those in the related study of 2009Pa17 as the level energies increase, being lower by≈4 keV at J=26.

[‡] From a least-squares fit using the listed γ-ray energies. Since 2011Re06 list no uncertainties for the Eγ values, the evaluator has assigned equal weights to them and has not quoted uncertainties for the resultant level energies.

[#] Primarily from 2011Re06 and based on considerations of expected band structure and multipolarities of γ transitions, using values previously established in earlier studies.

[@] Band(A): g.s. band Band crossed by an aligned ($i_{13/2}$) two-quasineutron (AB) éxcitation near hω=0.30 MeV (above J=10).

[&] Band(a): Aligned $i_{13/2}$ two-quasineutron (AB) configuration.

[a] Band(B): First excited 0$^+$ band.

[b] Band(C): Odd-spin negative-parity band.

[c] Band(D): γ-vibrational band, α=0 branch.

[d] Band(d): γ-vibrational band, α=1 branch.

[e] Band(E): Band based on a 12$^+$ level. Band possibly results from the coupling of the aligned $i_{13/2}$ two-quasineutron (AB) band and the γ-vibrational band.

[f] Band(F): Band based on an 8$^+$ level. Possible aligned $((\nu\ h_{9/2})(n\ f_{7/2}))_{2+}$ configuration.

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γ(^{156}Er)

2011Re06 define the angular-intensity ratio, R, as follows: R=$I_{\gamma\gamma}$(θ=150 DEG or 30 DEG)/$I_{\gamma\gamma}$(90 DEG). Expected R values are≈1.1 for stretched quadrupole transitions and≈0.7 for pure stretched dipole transitions.

E_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
237.2	2996.6	10+	2759.6	8+		R=1.31 *24*.
289.5	1219.7	2+	930.2	0+		
325.5	1545.4	4+	1219.7	2+		
344.2	344.4	2+	0	0+	E2	R=1.11 *5*.
364.6	2996.6	10+	2631.9	10+		R=0.27 *3*. The small R value suggests that this transition is a mixed E2/M1 transition with a large negative mixing ratio (2011Re06).
392.4	2759.6	8+	2367.5	(7+)		
417	2028.1	7−	1610.8	5−		
420.6	1350.0	3+	930.0	2+		
422.9	1968.4	6+	1545.4	4+		R=1.18 *12*.
452.4	796.5	4+	344.4	2+	E2	R=1.30 *6*.
460	2488.1	9−	2028.1	7−		
475.0	1404.7	4+	930.0	2+		
479.7	1884.7	6+	1404.7	4+		
483.7	1834.2	5+	1350.0	3+		
490.6	2375.7	8+	1884.7	6+		
495.6	3492.2	12+	2996.6	10+		R=1.12 *14*.
501.6	4780.3	16+	4278.7	14+		E_γ: γ not reported by 2009Pa17.
508.6	2996.6	10+	2488.1	9−	[E1]	R=0.76 *5*.
510.9	2479.4	8+	1968.4	6+		
521.8	2479.4	8+	1957.6	8+		
522	3834.6	14+	3312.8	12+		
530.4	2488.1	9−	1957.6	8+	E1	R=0.73 *6*.
533.5	2367.5	(7+)	1834.2	5+		
543.1	1339.7	6+	796.5	4+	E2	R=1.16 *6*.
544	4378.8	16+	3834.6	14+		
544.7	1884.7	6+	1339.7	6+		
553.4[‡]	1350.0	3+	796.5	4+		
555.7	5335.9	18+	4780.3	16+		
557.3	4183.3	14+	3625.9	12+		
557.7	5369.3	18+	4811.6	16+		R=1.10 *13*.
561.7	3041.1	10+	2479.4	8+		R=1.04 *9*.
565.4	4811.6	16+	4246.2	14+		R=1.09 *6*.
565.8	2941.5	10+	2375.7	8+		
585.5	930.0	2+	344.4	2+		
592	5927.8	20+	5335.9	18+		
592.7	2960.2	(9+)	2367.5	(7+)		
593.9	4086.1	14+	3492.2	12+		R=1.28 *12*.
596.2	4246.2	14+	3650.0	12+		R=1.14 *11*.
596.7	4780.3	16+	4183.3	14+		E_γ: γ not reported by 2009Pa17.
608.1	1404.7	4+	796.5	4+		
608.9	3650.0	12+	3041.1	10+		
617.9	1957.6	8+	1339.7	6+	E2	R=1.17 *9*.
625	5003.8	18+	4378.8	16+		
628.6	1968.4	6+	1339.7	6+		R=0.79 *20*.
638.0	3598.2	(11+)	2960.2	(9+)		
645.2	3586.7	12+	2941.5	10+		
670.5	4268.7	(13+)	3598.2	(11+)		
674.1	2631.9	10+	1957.6	8+	E2	R=0.98 *19*.
676.4	4762.5	16+	4086.1	14+		R=0.97 *20*.

Continued on next page (footnotes at end of table)

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γ(^{156}Er) (continued)

E_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.†	Comments
681	3312.8	12^+	2631.9	10^+		
684.3	3625.9	12^+	2941.5	10^+		
686.5	6055.9	20^+	5369.3	18^+		R=1.29 *24*.
688.6	2028.1	7^-	1339.7	6^+	E1	R=0.64 *19*.
692.1	4278.7	14^+	3586.7	12^+		
697.6	4966.3	(15^+)	4268.7	(13^+)		
710	5713.8	20^+	5003.8	18^+		
731	6658.8	22^+	5927.8	20^+		
731.4	2759.6	8^+	2028.1	7^-		R=1.01 *14*.
748.7	1545.4	4^+	796.5	4^+		R=0.65 *23*.
758.3	6294.1	(20^+)	5535.6	18^+		
766.0	6821.9	(22^+)	6055.9	20^+		
766	8079	26^+	7312.8	24^+		
767	8206	26^+	7438.8	24^+		
772	6485.8	22^+	5713.8	20^+		
773.1	5535.6	18^+	4762.5	16^+		R=1.05 *18*.
780	7438.8	24^+	6658.8	22^+		
814	1610.8	5^-	796.5	4^+		
827	7312.8	24^+	6485.8	22^+		
870.4	4183.3	14^+	3312.8	12^+		
873.8	6409.6	(20^+)	5535.6	18^+		
875.4	1219.7	2^+	344.4	2^+		
924	5927.8	20^+	5003.8	18^+		
930.4	930.0	2^+	0	0^+		
946	4780.3	16^+	3834.6	14^+		
957	5335.9	18^+	4378.8	16^+		
1006.0	1350.0	3^+	344.4	2^+		
1027.8	2367.5	(7^+)	1339.7	6^+		
1036.3	2375.7	8^+	1339.7	6^+		
1038.0	1834.2	5^+	796.5	4^+		R=0.55 *9*.
1060.0	1404.7	4^+	344.4	2^+		
1088.4	1884.7	6^+	796.5	4^+		
1139.7	2479.4	8^+	1339.7	6^+		
1172.1	1968.4	6^+	796.5	4^+		R=1.1 *4*.
1201.2	1545.4	4^+	344.4	2^+		R=0.9 *3*.
1219.4	1219.7	2^+	0	0^+		

† 2011Re06 list mults for a number of γ′s, some of them from other sources. These are listed here.
‡ Placement of transition in the level scheme is uncertain.

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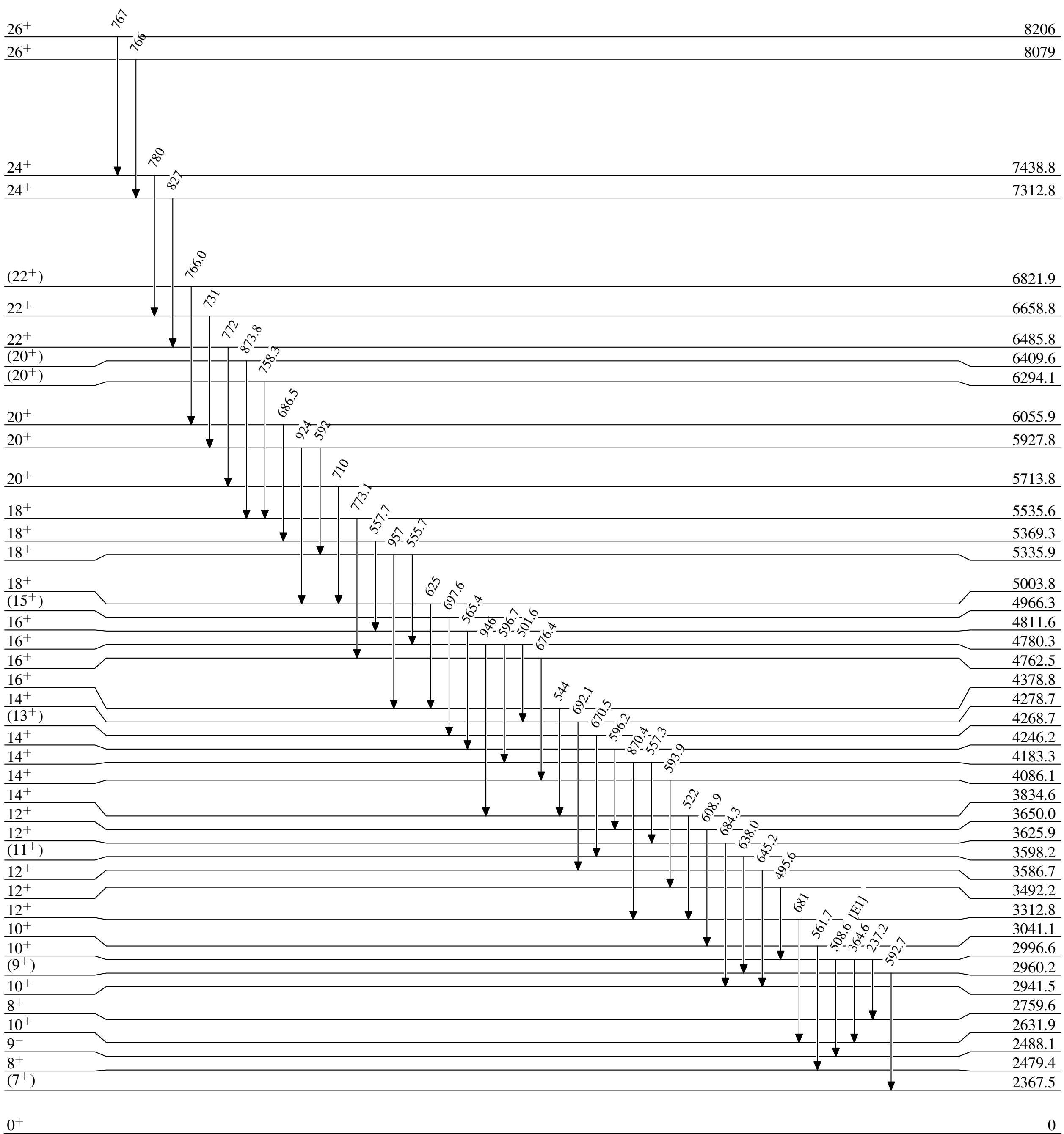
Level Scheme



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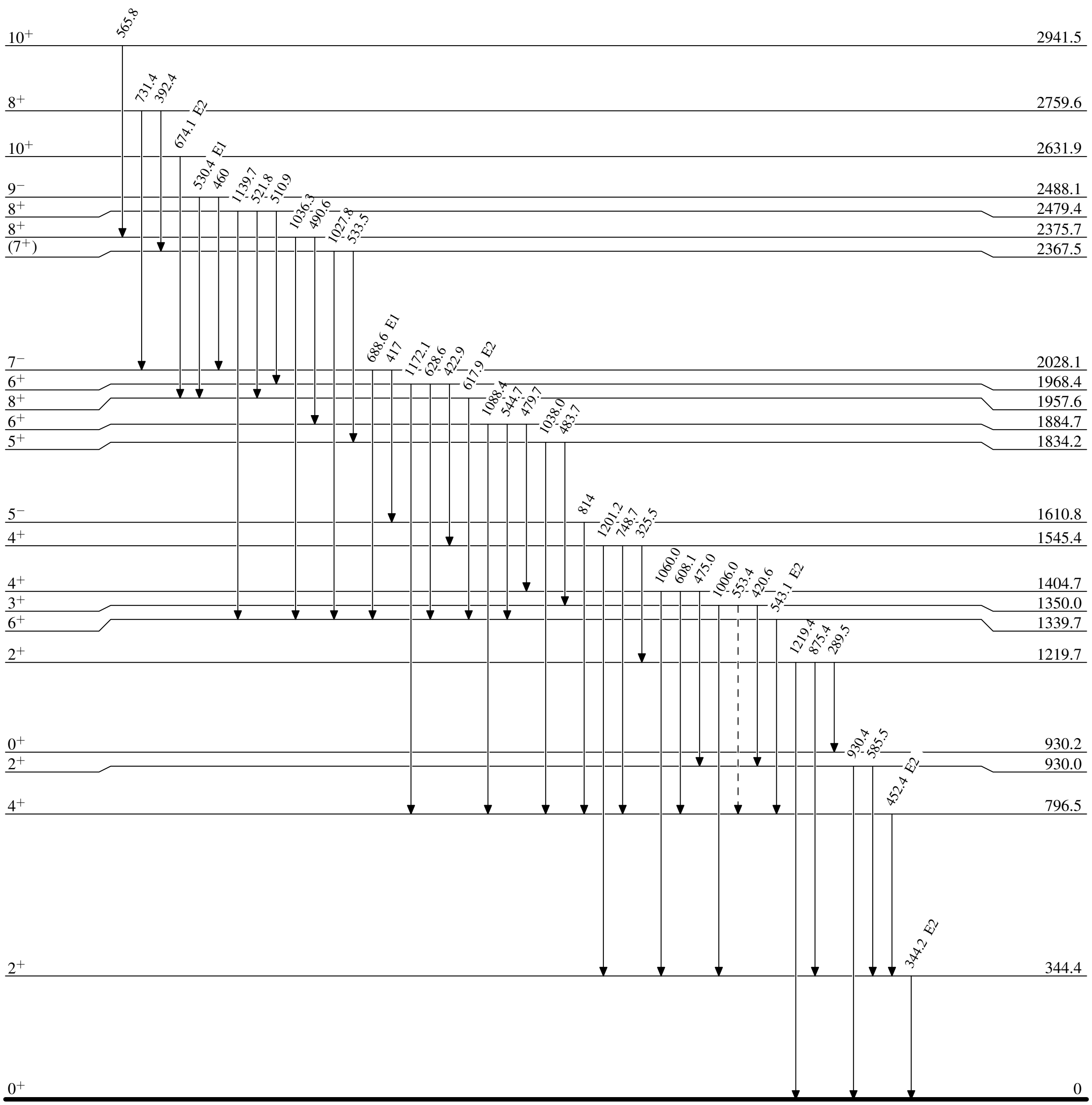
Legend

Level Scheme (continued)

γ Decay (Uncertain)



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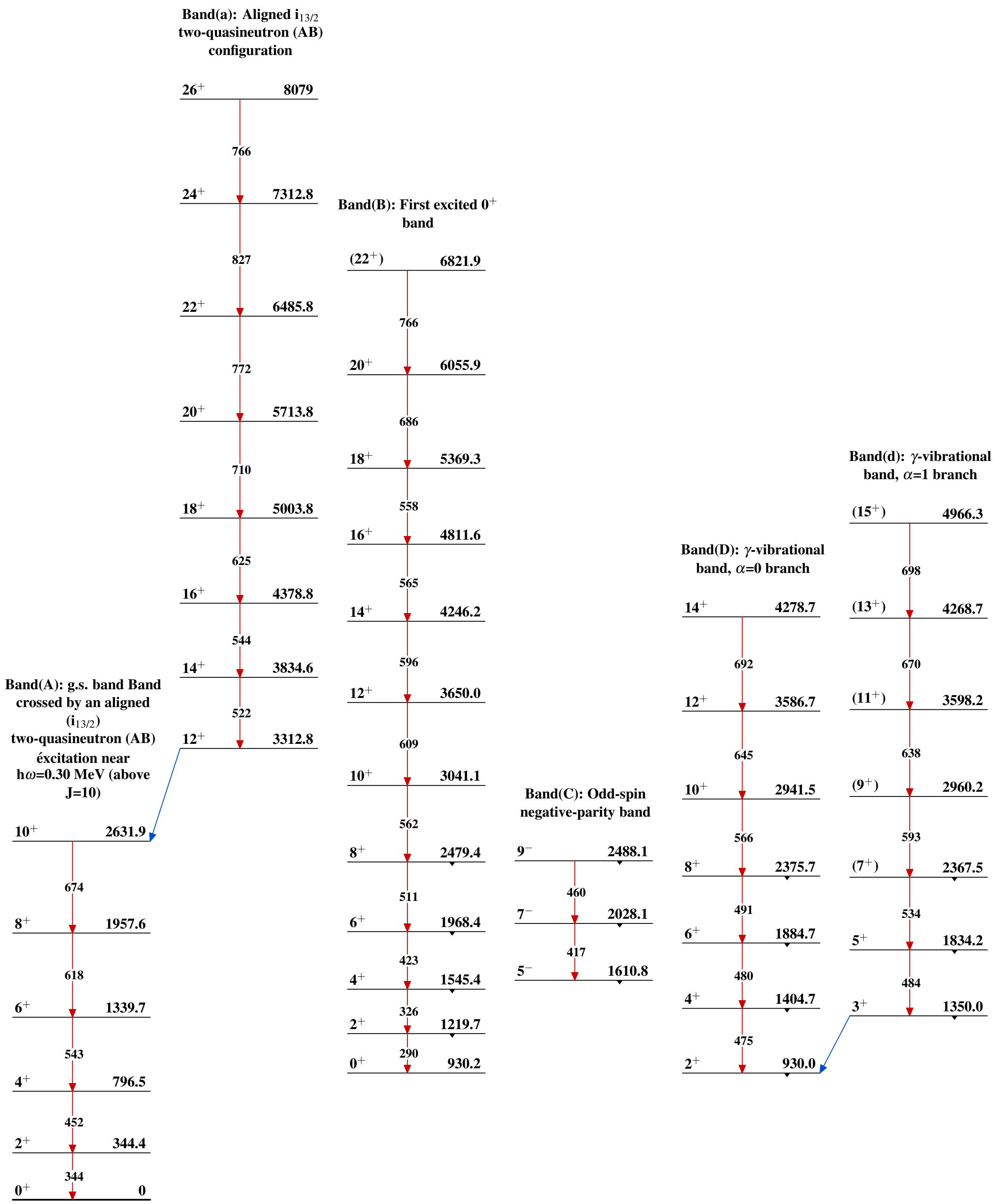

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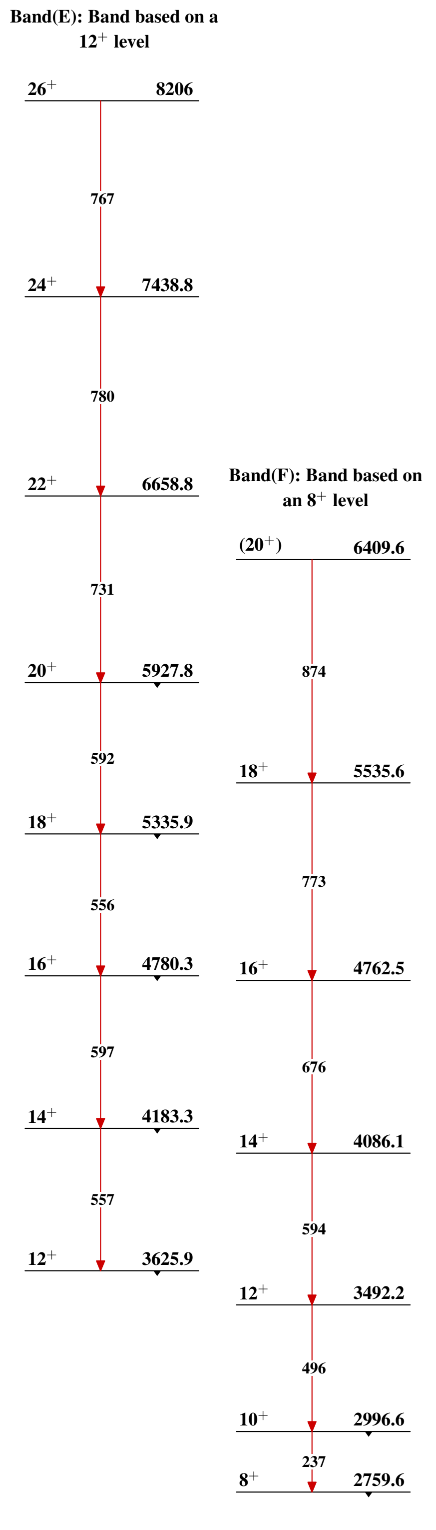

$^{156}_{68}Er_{88}$