^{150}Nd(^{13}C,α3nγ) 2001Su06

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

Additional information 1.

^{150}Nd(^{13}C,α3nγ), E(^{13}C)=65 MeV. Self-supporting Nd metallic foil, 2 mg/cm^2 thick, enriched to 96.1% in ^{150}Nd. γ rays detected in an array of 12 HPGe detectors with Compton suppressors and in coincidence with outgoing particles detected in a Si-ball particle filter having 20 detectors. The HPGE detectors were placed at angles of 32°, 58°, 90°, 122° and 148° with respect to the beam direction. For the γ detectors, the energy resolutions were 2.0-2.3 keV at 1.33 MeV and the efficiencies were≈40% (relative to a 3" by 3" NaI(Tl) detector). Measured Eγ, Iγ, two- and higher-fold coincidences and angular-distribution (ADO) ratios. Iγ obtained from gated spectra, and spin assignments from ADO ratios at 32° and 90°.

As an offshoot of an earlier, and presumably related, study of the high-spin states of ^{155}Gd using the ^{150}Nd(^{12}C,αxnγ) reaction, 1999HaZT report the population of the g.s. band of ^{156}Gd up through the J$^\pi$=22$^+$ member. Since this work involves many of the same authors as 2001Su06 (presumably even using the same target), but is much less complete, the evaluator has assumed that this information has been superseded by that in 2001Su06.

^{156}Gd Levels

E(level)[†]	J$^\pi$[‡]	Comments
0[@]	0$^+$	
88.7[@]	2$^+$	
287.8[@]	4$^+$	
584.2[@]	6$^+$	
964.3[@]	8$^+$	
1415.0[@]	10$^+$	
1506.3[a]	5$^+$	
1705.3[c]	6$^-$	
1849.2[a]	7$^+$	
1923.0[@]	12$^+$	
1956.5[b]	9$^-$	
2027.2[c]	8$^-$	
2248.8[a]	9$^+$	
2359.4[b]	11$^-$	
2427.7[c]	10$^-$	
2441.9[&]	10$^+$	
2474.3[@]	14$^+$	
2489.1[d]	J[#]	J$^\pi$: By analogy with the situation in the isotonic nuclide, ^{158}Dy, 2001Su06 assign J=(10) or J=(11).
2685.6[a]	11$^+$	
2822.2[d]	J+2[#]	
2827.6[b]	13$^-$	
2898.0[c]	12$^-$	
2921.6[e]	12$^+$	Previously assigned as the 12$^+$ member of the γ-vibrational band, but this band member has been placed at 2957 keV by 2011Su15 (in Coul. ex.), which has some of the same authors as 2001Su06. Level sequence may result from a band crossing involving a level from another configuration.
3058.0[@]	16$^+$	
3174.1[a]	13$^+$	
3233.4[d]	J+4[#]	
3348.9[b]	(15$^-$)	
3428.1[c]	14$^-$	
3436.9[e]	14$^+$	

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^{150}Nd(^{13}C,α3nγ) 2001Su06 (continued)

^{156}Gd Levels (continued)

E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]
3672.0[@]	18$^+$	3994[e]	16$^+$	4522.2[b]	(19$^-$)	5181[b]	(21$^-$)
3713.9[d]	J+6[#]	4004[c]	16$^-$	4603[c]	(18$^-$)	5777[@]	24$^+$
3714.1[a]	15$^+$	4256[d]	J+8[#]	4856[d]	(J+10)[#]	6581[@]	(26$^+$)
3912.8[b]	(17$^-$)	4324[@]	20$^+$	5024[@]	22$^+$		

[†] Computed by the evaluator from the γ energies. 2001Su06 do not report the level energies. In this fitting, the evaluator has chosen to assign equal uncertainties to all of the Eγ values.
[‡] From the Adopted Values, unless noted otherwise.
[#] As proposed by 2001Su06, based on a presumed analogy to one or the other of two side bands in the isotonic nuclide, ^{158}Dy. 2001Su06 propose that J=(10) or (11) for the lowest reported band member. The J values for the higher-lying states are based on the presumed quadrupole (E2) character of the connecting intraband transitions.
[@] Band(A): g.s. band.
[&] Band(B): Even-spin member of the γ-vibrational band.
[a] Band(b): Odd-spin member of the γ-vibrational band.
[b] Band(C): Negative-parity band, odd-spin member. At the lower spins, these are members of the K$^\pi$=1$^-$ octupole-vibrational band.
[c] Band(c): Negative-parity band, even-spin member. At the lower spins, these are members of the K$^\pi$=1$^-$ octupole-vibrational band.
[d] Band(D): Portion of a rotational band.
[e] Band(E): Level sequence based on 12$^+$.

γ(^{156}Gd)

The angular-distribution (ADO) ratios listed here for the various transitions are defined by 2001Su06 as the ratio of the γ intensity, in coincidence with all other γ's, at 32° to that at 90°. Such ratios, for known γ's, are≈0.7 and≈1.5 for stretched dipole and stretched quadrupole transitions, respectively.

E$_\gamma$[†]	I$_\gamma$	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[‡]	Comments
88.7	26.8 *16*	88.7	2$^+$	0	0$^+$	E2	
199.1	97 *6*	287.8	4$^+$	88.7	2$^+$	E2	ADO=1.52 *18*.
296.4	100 *6*	584.2	6$^+$	287.8	4$^+$	E2	ADO=1.70 *20*.
321.7	2.0	2027.2	8$^-$	1705.3	6$^-$	E2	ADO=1.28 *24*.
333.4	2.2 *2*	2822.2	J+2	2489.1	J	E2[#]	ADO=1.38 *21*.
380.3	95 *6*	964.3	8$^+$	584.2	6$^+$	E2	ADO=1.58 *19*.
399.6	0.6 *1*	2248.8	9$^+$	1849.2	7$^+$		ADO=1.6 *6*.
399.8	3.6	2427.7	10$^-$	2027.2	8$^-$	E2	ADO=1.51 *21*.
403.5	0.4 *2*	2359.4	11$^-$	1956.5	9$^-$	E2[#]	ADO=1.5 *7*.
411.1	3.0 *2*	3233.4	J+4	2822.2	J+2	E2[#]	ADO=1.45 *20*.
436.4	2.0 *2*	2685.6	11$^+$	2248.8	9$^+$	E2	ADO=1.25 *24*.
451.0	77 *5*	1415.0	10$^+$	964.3	8$^+$	E2	ADO=1.47 *18*.
468.3	0.4 *1*	2827.6	13$^-$	2359.4	11$^-$		ADO=1.6 *8*.
470.3	3.6 *2*	2898.0	12$^-$	2427.7	10$^-$	E2[#]	ADO=1.39 *20*.
479.4	0.7 *1*	2921.6	12$^+$	2441.9	10$^+$		
481.0	3.6 *3*	3713.9	J+6	3233.4	J+4	E2[#]	ADO=1.70 *23*.
488.5	1.9 *2*	3174.1	13$^+$	2685.6	11$^+$	E2[#]	ADO=1.9 *4*.
508.1	63 *4*	1923.0	12$^+$	1415.0	10$^+$	E2	ADO=1.54 *15*.
515.3	0.9 *1*	3436.9	14$^+$	2921.6	12$^+$	E2[#]	ADO=1.34 *20*.

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^{150}Nd(^{13}C,α3nγ) 2001Su06 (continued)

γ(^{156}Gd) (continued)

E_γ †	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	Comments
521.3	0.6 *1*	3348.9	(15^-)	2827.6	13^-		ADO=1.1 *3*.
530.1	2.9 *2*	3428.1	14^-	2898.0	12^-	E2#	ADO=1.62 *18*.
540.0	1.1 *1*	3714.1	15^+	3174.1	13^+	E2#	ADO=1.39 *19*.
541.4	0.7 *3*	1956.5	9^-	1415.0	10^+		
542.5	2.5 *2*	4256	J+8	3713.9	J+6	E2#	ADO=1.32 *13*.
551.3	41.4 *25*	2474.3	14^+	1923.0	12^+	E2	ADO=1.63 *19*.
557.2	0.9 *1*	3994	16^+	3436.9	14^+	E2#	ADO=1.7 *3*.
563.6	1.8 *2*	3912.8	(17^-)	3348.9	(15^-)		ADO=1.18 *14*.
576.0	2.2 *2*	4004	16^-	3428.1	14^-	E2#	ADO=1.31 *15*.
583.6	26.0 *16*	3058.0	16^+	2474.3	14^+	E2#	ADO=1.34 *20*.
599.4	1.6 *2*	4603	(18^-)	4004	16^-		
599.5	2.0 *3*	4856	(J+10)	4256	J+8		ADO=1.0 *6*.
609.4	3.1 *3*	4522.2	(19^-)	3912.8	(17^-)		ADO=1.4 *6*.
614.0	16.6 *10*	3672.0	18^+	3058.0	16^+	E2#	ADO=1.45 *14*.
652.4	6.7 *4*	4324	20^+	3672.0	18^+	E2#	ADO=1.47 *18*.
655.5	0.9 *1*	3713.9	J+6	3058.0	16^+		
658.9	1.6 *2*	5181	(21^-)	4522.2	(19^-)	E2#	ADO=1.87 *23*.
700.1	3.3 *2*	5024	22^+	4324	20^+	E2#	ADO=1.44 *14*.
752.7	1.1 *1*	5777	24^+	5024	22^+	E2#	ADO=1.52 *21*.
759.5	0.4 *1*	3233.4	J+4	2474.3	14^+		ADO=1.4 *6*.
803.9	0.7 *1*	6581	(26^+)	5777	24^+		ADO=1.21 *23*.
850.3	0.6 *1*	4522.2	(19^-)	3672.0	18^+	D	ADO=0.8 *3*.
854.9	1.6 *2*	3912.8	(17^-)	3058.0	16^+		ADO=0.92 *19*.
874.4	2.2 *2*	3348.9	(15^-)	2474.3	14^+	D#	ADO=0.65 *10*.
898.9	1.9 *2*	2822.2	J+2	1923.0	12^+		ADO=1.14 *17*.
904.6	2.5 *2*	2827.6	13^-	1923.0	12^+		ADO=0.68 *8* d.
943.8	2.9 *2*	2359.4	11^-	1415.0	10^+	D	ADO=0.81 *10*.
993.1	1.9 *2*	1956.5	9^-	964.3	8^+	E1	ADO=0.84 *12*.
999.0	0.5 *1*	2921.6	12^+	1923.0	12^+		ADO=1.7 *6*.
1013.4	2.4 *2*	2427.7	10^-	1415.0	10^+		ADO=1.3 *4*.
1026.5	1.5 *2*	2441.9	10^+	1415.0	10^+		ADO=1.2 *4*.
1062.5	3.7 *2*	2027.2	8^-	964.3	8^+		ADO=1.0 *4*.
1074.4	2.4 *2*	2489.1	J	1415.0	10^+		ADO=1.48 *24*.
1120.8	2.0 *3*	1705.3	6^-	584.2	6^+	E1	ADO=1.5 *4*.
1218.5	2.2 *3*	1506.3	5^+	287.8	4^+	E2	ADO=0.6 *3*.
1265.0	2.1 *2*	1849.2	7^+	584.2	6^+	D#	ADO=0.69 *21*.
1271.1	0.8 *1*	2685.6	11^+	1415.0	10^+	D#	ADO=0.99 *30*.
1284.0	3.2 *2*	2248.8	9^+	964.3	8^+	E2(+M1)	ADO=0.67 *18*.

† 2001Su06 state that the uncertainties for the Eγ values range from 0.1 keV to 1.0 keV, depending on the extent to which the peaks overlap. No values are listed here.

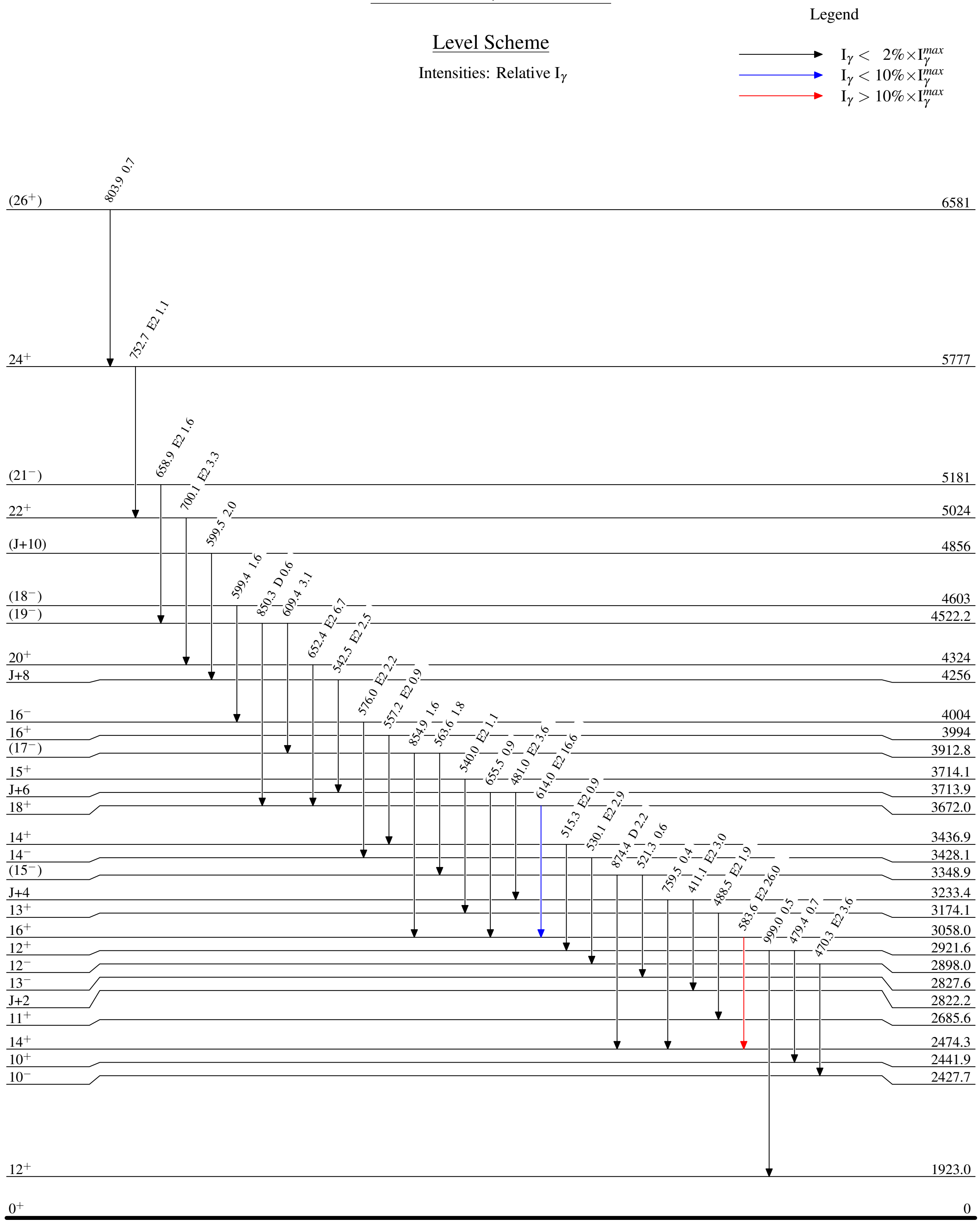
‡ From the adopted values, where previously known. Otherwise, from the ADO ratios of 2001Su06. Note that, in several cases, the ADO ratios appear to indicate multipolarities that differ from the adopted ones and, also, that these ratios do not distinguish between stretched quadrupole transitions and ΔJ=0 dipole transitions or ΔJ=1 transitions with large quadrupole admixtures. In treating the ADO data, the evaluator has assumed that the stretched quadrupole transitions are E2.

From ADO ratios.

^{150}Nd(^{13}C,α3nγ) 2001Su06

Level Scheme

Intensities: Relative I_γ

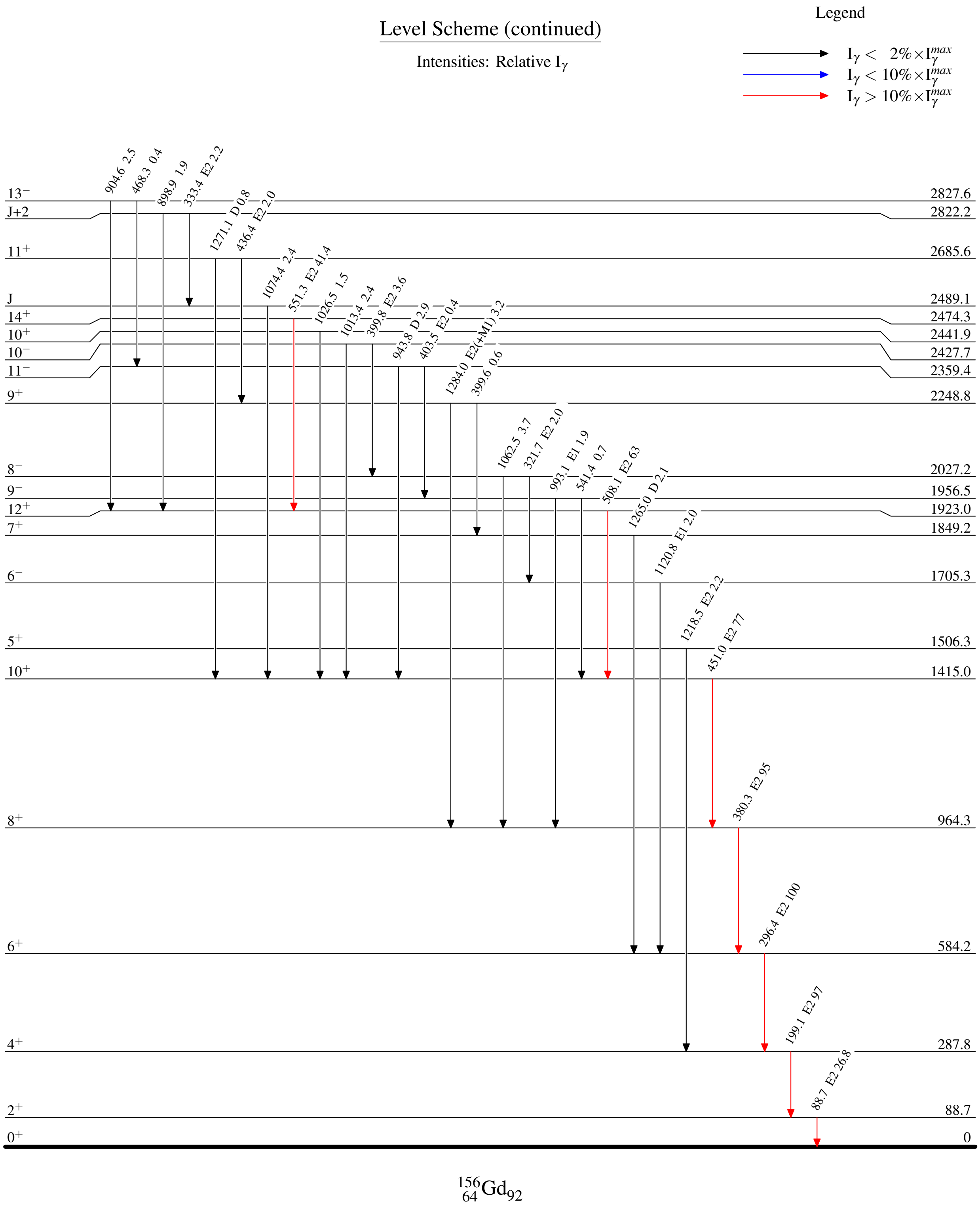


$^{156}_{64}Gd_{92}$

^{150}Nd(^{13}C,α3nγ) 2001Su06

Level Scheme (continued)

Intensities: Relative I_γ



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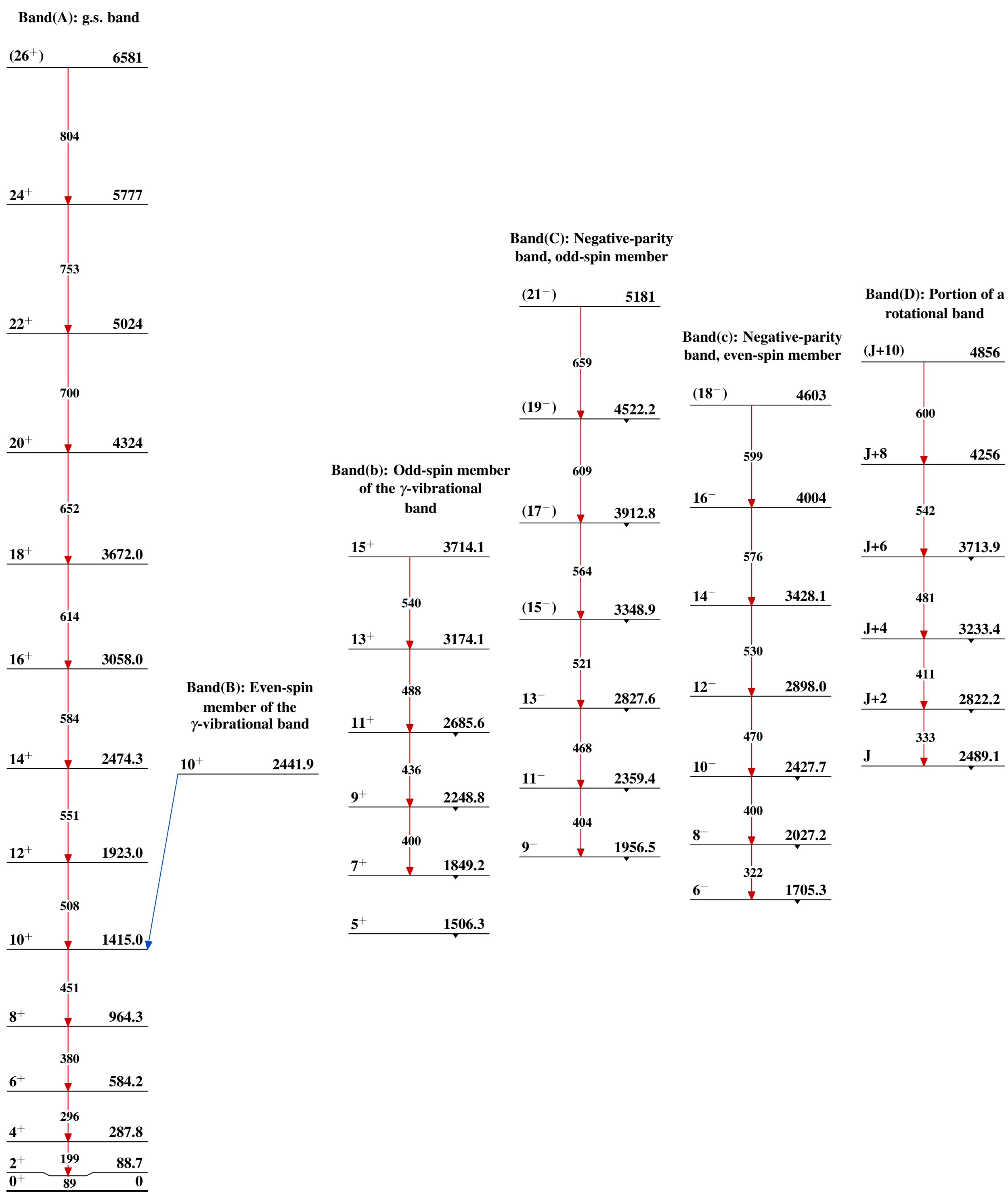

$^{156}_{64}Gd_{92}$

^{150}Nd(^{13}C,α3nγ) 2001Su06 (continued)