^{150}Nd(^{9}Be,5nγ) 1989Mo20

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 200,2 (2025)	22-Aug-2022

Additional information 1.

^{150}Nd(^{9}Be,5nγ), E(^{9}Be)=55 MeV; measured Eγ, Iγ, and $\gamma\gamma(\theta)$ in the TESSA2 multidetector array, consisting of six escape-suppressed Ge detectors and a 50-element BGO crystal ball. Report level scheme and an interpretation in terms of a cranked shell-model calculation.

```
Band-labeling convention for neutrons
  ---------------------------------
      A     (α=+1/2,  π=+)₁
      B     (α=-1/2,  π=+)₁
      C     (α=+1/2,  π=+)₂
      D     (α=-1/2.  π=+)₂
      E     (α=+1/2,  π=-)₁
      F     (α=-1/2,  π=-)₁
      X     (α=+1/2,  π=-)
      Y     (α=-1/2,  π=-)
  ---------------------------------
At ħω=0,  the labels X and Y correspond
to the 11/2⁻[505] Nilsson orbital,
A and B to 3/2⁺[651] Nilsson orbital, and
C and D to 1/2⁺[660] Nilsson orbital.
```

^{154}Gd Levels

E(level)	J$^{\pi}$†	Comments
0‡	0^+	
123.1‡ 1	2^+	
371.1‡ 1	4^+	
717.8‡ 2	6^+	
815.6# 2	2^+	
1047.7# 2	4^+	
1144.5‡ 2	8^+	
1365.9# 2	6^+	
1637.1‡ 2	10^+	
1731.8 6	(7^-)	Additional information 2.
1756.5# 2	8^+	
2040.5& 4	(9^-)	
2137.6c 3	7^-	
2183.3b 3	$8^{(-)}$	
2184.8‡ 2	12^+	
2194.2# 2	10^+	
2251.3a 4	$9^{(-)}$	
2309.6c 3	$8^{(-)}$	J$^{\pi}$: (8^-) in the adopted values.
2475.5c 3	$9^{(-)}$	J$^{\pi}$: (9^-) in the adopted values.
2482.4& 4	(11^-)	
2579.7a 3	$10^{(-)}$	
2616.2c 3	$10^{(-)}$	
2619.7b 3	$10^{(-)}$	
2621.8@ 2	12^+	

Continued on next page (footnotes at end of table)

^{150}Nd(^{9}Be,5nγ) 1989Mo20 (continued)

^{154}Gd Levels (continued)

E(level)	J$^{\pi}$†	E(level)	J$^{\pi}$†	E(level)	J$^{\pi}$†	E(level)	J$^{\pi}$†
2775.5[c] 3	11$^{(-)}$	3599.4[d] 7		4735.6[&] 4	19$^{(-)}$	6121.7[@] 4	24^{+}
2777.4[‡] 2	14^{+}	3629.6[c] 3	15$^{(-)}$	4782.4[‡] 4	20^{+}	6136.3[&] 6	(23^{-})
2950.7[a] 3	12$^{(-)}$	3894.5[b] 3	16$^{(-)}$	4788.7[c] 4	19$^{(-)}$	6178.1[c] 6	(23^{-})
2955.8[b] 3	12$^{(-)}$	3987.4[a] 4	16$^{(-)}$	5116.5[b] 4	20$^{(-)}$	6294.2[‡] 5	24^{+}
2981.4[&] 3	13$^{(-)}$	4016.2[@] 3	18^{+}	5209.3[a] 8	20$^{(-)}$	6535.6[a] 9	(24^{-})
3027.3[@] 3	14^{+}	4087.2[‡] 3	18^{+}	5254.5[d] 10		6555.5[b] 6	(24^{-})
3155.0[d] 5		4099.5[d] 7		5350.0[@] 4	22^{+}	6883.4?[&] 7	(25^{-})
3158.9[c] 3	13$^{(-)}$	4102.1[&] 4	17$^{(-)}$	5415.9[&] 5	21$^{(-)}$	6946.2?[c] 7	(25^{-})
3384.1[b] 4	14$^{(-)}$	4176.5[c] 4	17$^{(-)}$	5457.6[c] 5	21$^{(-)}$	6955.1[@] 6	(26^{+})
3404.5[‡] 3	16^{+}	4475.0[b] 4	18$^{(-)}$	5519.6[‡] 4	22^{+}	7055.6[‡] 6	26^{+}
3428.1[a] 4	14$^{(-)}$	4595.2[a] 5	18$^{(-)}$	5811.0[b] 5	(22^{-})	7274.0?[a] 10	(26^{-})
3490.9[@] 3	16^{+}	4646.4[@] 3	20^{+}	5848.5[a] 8	(22^{-})	7353.2?[b] 10	(26^{-})
3519.2[&] 3	15$^{(-)}$	4656.2[d] 9		5889.6?[d] 11			

† Authors′ assignments, which are based on deduced γ multipolarities and band structure, as well as the previously known assignments. These are in agreement with the Adopted Values, unless noted otherwise.
‡ Band(A): K$^{\pi}$=0^{+} ground-state band.
# Band(B): First excited K$^{\pi}$=0^{+} band. Probable β^{-}vibration.
@ Band(C): Aligned two-neutron-quasiparticle band. Configuration=AB crosses the g.s. band at $\hbar\omega$=0.31 MeV (near the 18^{+} level).
& Band(D): K$^{\pi}$=0^{-} octupole-vibrational band. At higher spins, it can be ascribed to the cranked shell-model configuration AE.
a Band(E): Band interpreted as the two-neutron-quasiparticle configuration AF. Crossed by the configuration βc near $\hbar\omega$=0.30 MeV, with configuration becoming AFBC.
b Band(F): Band interpreted as the two-neutron-quasiparticle configuration AY.
c Band(G): Band interpreted as the two-neutron-quasiparticle configuration AX.
d Band(H): Level sequence.

γ(^{154}Gd)

E$_{\gamma}$	I$_{\gamma}$†	E$_{i}$(level)	J$^{\pi}_{i}$	E$_{f}$	J$^{\pi}_{f}$	Mult.‡	Comments
123.1 1	100	123.1	2^{+}	0	0^{+}	(E2)	DCO=0.90 2.
144.0 2	0.7	2619.7	10$^{(-)}$	2475.5	9$^{(-)}$		
155.6 2	4.7	2775.5	11$^{(-)}$	2619.7	10$^{(-)}$	(D)	DCO=0.29 3.
159.6 2	1.6	2775.5	11$^{(-)}$	2616.2	10$^{(-)}$	(D)	DCO=0.29 5.
165.8 1	2.7	2475.5	9$^{(-)}$	2309.6	8$^{(-)}$	(D)	DCO=0.22 5.
172.0 1	4.2	2309.6	8$^{(-)}$	2137.6	7^{-}	(D)	DCO=0.22 4.
180.3 1	4.7	2955.8	12$^{(-)}$	2775.5	11$^{(-)}$	(D)	DCO=0.30 3.
203.0 1	3.5	3158.9	13$^{(-)}$	2955.8	12$^{(-)}$	(D)	DCO=0.39 3.
225.3 2	3.2	3384.1	14$^{(-)}$	3158.9	13$^{(-)}$	(D)	DCO=0.45 2.
232.0 2	0.7	1047.7	4^{+}	815.6	2^{+}		
245.4 4		3629.6	15$^{(-)}$	3384.1	14$^{(-)}$		
248.0 1	100	371.1	4^{+}	123.1	2^{+}	(E2)	DCO=1.01 2.
264.9 1	1.4	3894.5	16$^{(-)}$	3629.6	15$^{(-)}$	(D)	DCO=0.30 4.
282.0 2	1.1	4176.5	17$^{(-)}$	3894.5	16$^{(-)}$	(D)	DCO=0.34 4.
298.6 3	0.9	4475.0	18$^{(-)}$	4176.5	17$^{(-)}$		
300.4 4	1.0	2775.5	11$^{(-)}$	2475.5	9$^{(-)}$		
313.7 2	0.7	4788.7	19$^{(-)}$	4475.0	18$^{(-)}$		

Continued on next page (footnotes at end of table)

^{150}Nd(^{9}Be,5nγ) 1989Mo20 (continued)

γ(^{154}Gd) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
318.2 *1*	3.3	1365.9	6^+	1047.7	4^+	(E2)	DCO=1.10 *9*.
327.9 *3*		5116.5	$20^{(-)}$	4788.7	$19^{(-)}$		
328.4 *2*	1.7	2579.7	$10^{(-)}$	2251.3	$9^{(-)}$	(D)	DCO=0.58 *6*.
336.0 *2*	1.9	2955.8	$12^{(-)}$	2619.7	$10^{(-)}$	(E2)	DCO=1.30 *13*.
339.7 *4*	1.3	2955.8	$12^{(-)}$	2616.2	$10^{(-)}$	(E2)	DCO=1.00 *9*.
341.2[#] *3*		5457.6	$21^{(-)}$	5116.5	$20^{(-)}$		
346.7 *1*	97.6	717.8	6^+	371.1	4^+	(E2)	DCO=1.12 *2*.
371.1 *2*	4.8	2950.7	$12^{(-)}$	2579.7	$10^{(-)}$	(E2)	DCO=1.14 *7*.
383.4 *1*	3.0	3158.9	$13^{(-)}$	2775.5	$11^{(-)}$	(E2)	DCO=1.11 *9*.
390.6 *1*	10.2	1756.5	8^+	1365.9	6^+	(E2)	DCO=1.11 *6*.
405.6 *2*	12.8	3027.3	14^+	2621.8	12^+	(E2)	DCO=1.16 *3*.
426.8 *2*	89.0	1144.5	8^+	717.8	6^+	(E2)	DCO=1.16 *2*.
427.8 *2*	11.0	2621.8	12^+	2194.2	10^+	(E2)	DCO=1.10 *3*.
428.2 *5*		3384.1	$14^{(-)}$	2955.8	$12^{(-)}$		
433.0 *2*	2.4	2616.2	$10^{(-)}$	2183.3	$8^{(-)}$	(E2)	DCO=1.22 *7*.
436.3 *2*	3.0	2619.7	$10^{(-)}$	2183.3	$8^{(-)}$		
437.7 *1*	13.4	2194.2	10^+	1756.5	8^+	(E2)	DCO=1.15 *3*.
444.4 *4*		3599.4		3155.0			
451.5 *5*		2183.3	$8^{(-)}$	1731.8	(7^-)		
463.6 *1*	9.1	3490.9	16^+	3027.3	14^+	(E2)	DCO=1.15 *3*.
470.7 *1*	3.4	3629.6	$15^{(-)}$	3158.9	$13^{(-)}$	(E2)	DCO=1.16 *12*.
477.4 *2*	3.0	3428.1	$14^{(-)}$	2950.7	$12^{(-)}$	(E2)	DCO=1.26 *9*.
492.6 *1*	63.9	1637.1	10^+	1144.5	8^+	(E2)	DCO=1.16 *1*.
498.9 *3*		2981.4	$13^{(-)}$	2482.4	(11^-)		
500.1 *2*		4099.5		3599.4			
510.5 *6*	2.7	3894.5	$16^{(-)}$	3384.1	$14^{(-)}$		
525.3 *1*	6.0	4016.2	18^+	3490.9	16^+	(E2)	DCO=1.20 *6*.
537.8 *1*	2.8	3519.2	$15^{(-)}$	2981.4	$13^{(-)}$	(E2)	DCO=1.16 *8*.
547.1 *6*	2.4	4176.5	$17^{(-)}$	3629.6	$15^{(-)}$	(E2)	DCO=0.96 *6*.
547.6 *1*	47.4	2184.8	12^+	1637.1	10^+	(E2)	DCO=1.21 *1*.
556.7 *5*		4656.2		4099.5			
557.1 *2*	1.0	2194.2	10^+	1637.1	10^+		
559.3 *2*	2.3	3987.4	$16^{(-)}$	3428.1	$14^{(-)}$	(E2)	DCO=1.24 *8*.
580.5 *2*	2.1	4475.0	$18^{(-)}$	3894.5	$16^{(-)}$	(E2)	DCO=1.17 *13*.
582.9 *2*	4.4	4102.1	$17^{(-)}$	3519.2	$15^{(-)}$	(E2)	DCO=1.24 *7*.
592.6 *1*	34.1	2777.4	14^+	2184.8	12^+	(E2)	DCO=1.18 *2*.
596.3 *3*	2.4	4087.2	18^+	3490.9	16^+	(E2)	DCO=1.07 *9*.
598.3 *5*		5254.5		4656.2			
607.8 *2*	1.6	4595.2	$18^{(-)}$	3987.4	$16^{(-)}$	(E2)	DCO=1.12 *7*.
611.5 *2*	8.5	4016.2	18^+	3404.5	16^+	(E2)	DCO=1.04 *4*.
612.1 *2*	3.8	1756.5	8^+	1144.5	8^+		
612.2 *2*	1.8	4788.7	$19^{(-)}$	4176.5	$17^{(-)}$	(E2)	DCO=0.85 *15*.
614.1 *6*	1.1	5209.3	$20^{(-)}$	4595.2	$18^{(-)}$	(E2)	DCO=1.05 *19*.
627.1 *1*	25.0	3404.5	16^+	2777.4	14^+	(E2)	DCO=1.17 *4*.
630.2 *1*	9.0	4646.4	20^+	4016.2	18^+	(E2)	DCO=1.18 *14*.
633.5 *2*	2.5	4735.6	$19^{(-)}$	4102.1	$17^{(-)}$	(E2)	DCO=1.21 *9*.
635.1[#] *5*		5889.6?		5254.5			
639.2 *3*	0.6	5848.5	(22^-)	5209.3	$20^{(-)}$		
641.5 *2*	1.4	5116.5	$20^{(-)}$	4475.0	$18^{(-)}$	(E2)	DCO=1.42 *22*.
648.1 *2*	5.7	1365.9	6^+	717.8	6^+		DCO=0.89 *9*.
668.9 *3*	0.8	5457.6	$21^{(-)}$	4788.7	$19^{(-)}$	(E2)	DCO=0.95 *23*.
676.6 *2*	3.1	1047.7	4^+	371.1	4^+		DCO=1.08 *9*.
680.3 *3*	1.1	5415.9	$21^{(-)}$	4735.6	$19^{(-)}$	(E2)	DCO=1.25 *13*.

Continued on next page (footnotes at end of table)

^{150}Nd(^{9}Be,5nγ) 1989Mo20 (continued)

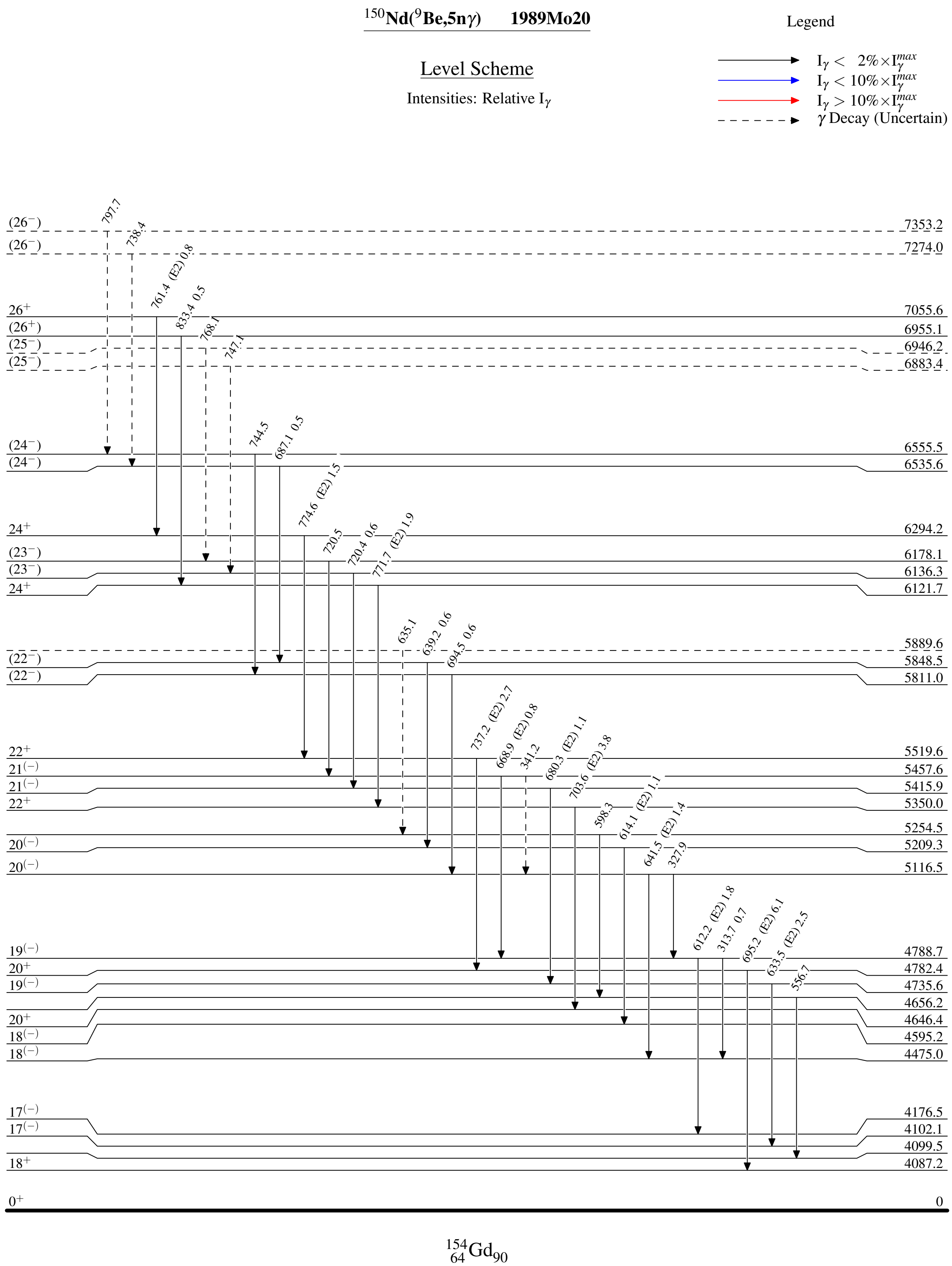
γ(^{154}Gd) (continued)

E_γ	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	Comments
682.7 *2*	7.4	4087.2	18$^+$	3404.5	16$^+$	(E2)	DCO=1.13 *4*.
687.1 *4*	0.5	6535.6	(24$^-$)	5848.5	(22$^-$)		
694.5 *2*	0.6	5811.0	(22$^-$)	5116.5	20$^{(-)}$		
695.2 *2*	6.1	4782.4	20$^+$	4087.2	18$^+$	(E2)	DCO=0.97 *7*.
703.6 *2*	3.8	5350.0	22$^+$	4646.4	20$^+$	(E2)	DCO=1.08 *7*.
713.5 *2*	2.8	3490.9	16$^+$	2777.4	14$^+$	(E2)	DCO=1.12 *7*.
720.4 *3*	0.6	6136.3	(23$^-$)	5415.9	21$^{(-)}$		
720.5 *3*		6178.1	(23$^-$)	5457.6	21$^{(-)}$		
737.2 *1*	2.7	5519.6	22$^+$	4782.4	20$^+$	(E2)	DCO=1.17 *9*.
738.4[#] *4*		7274.0?	(26$^-$)	6535.6	(24$^-$)		
741.8 *2*	4.3	3519.2	15$^{(-)}$	2777.4	14$^+$		DCO=0.71 *13*.
744.5 *3*		6555.5	(24$^-$)	5811.0	(22$^-$)		
747.1[#] *3*		6883.4?	(25$^-$)	6136.3	(23$^-$)		
761.4 *3*	0.8	7055.6	26$^+$	6294.2	24$^+$	(E2)	DCO=0.90 *30*.
765.9 *2*	1.3	2950.7	12$^{(-)}$	2184.8	12$^+$		DCO=1.23 *10*.
768.1[#] *4*		6946.2?	(25$^-$)	6178.1	(23$^-$)		
771.7 *2*	1.9	6121.7	24$^+$	5350.0	22$^+$	(E2)	DCO=0.94 *13*.
774.6 *3*	1.5	6294.2	24$^+$	5519.6	22$^+$	(E2)	DCO=1.07 *12*.
796.6 *2*	4.5	2981.4	13$^{(-)}$	2184.8	12$^+$	(D)	DCO=0.56 *4*.
797.7[#] *4*		7353.2?	(26$^-$)	6555.5	(24$^-$)		
815.6 *3*		815.6	2$^+$	0	0$^+$		
833.4 *4*	0.5	6955.1	(26$^+$)	6121.7	24$^+$		
845.2 *3*		2482.4	(11$^-$)	1637.1	10$^+$		
845.3 *4*		3155.0		2309.6	8$^{(-)}$		
896.0 *3*		2040.5	(9$^-$)	1144.5	8$^+$		
924.4 *3*		1047.7	4$^+$	123.1	2$^+$		
942.6 *2*	4.0	2579.7	10$^{(-)}$	1637.1	10$^+$		DCO=1.37 *10*.
979.5 *3*	3.3	2616.2	10$^{(-)}$	1637.1	10$^+$		DCO=1.53 *20*.
982.4 *2*	3.8	2619.7	10$^{(-)}$	1637.1	10$^+$		DCO=1.33 *12*.
984.7 *3*	1.8	2621.8	12$^+$	1637.1	10$^+$	(E2)	DCO=1.14 *17*.
992.7 *5*		2137.6	7$^-$	1144.5	8$^+$		
994.9 *3*	1.8	1365.9	6$^+$	371.1	4$^+$	(E2)	DCO=1.04 *8*.
1038.9 *5*	1.0	1756.5	8$^+$	717.8	6$^+$		
1039.0 *4*	5.3	2183.3	8$^{(-)}$	1144.5	8$^+$		DCO=1.15 *14*.
1049.8 *5*	1.4	2194.2	10$^+$	1144.5	8$^+$	(E2)	DCO=1.08 *11*.
1107.4 *8*	3.1	2251.3	9$^{(-)}$	1144.5	8$^+$	(D)	DCO=0.49 *7*.
1419.5 *7*		2137.6	7$^-$	717.8	6$^+$		

† Relative values, normalized to Iγ(248.0γ)=100, at E(^{9}Be)=55 MeV.

‡ Values are based on the measured DCO-ratio data. 1989Mo20 point out that DCO ratios near 1.0 correspond to stretched quadrupoles, while those near 0.6 correspond to stretched dipoles. Pure dipoles with $\Delta J=0$ are distinguished from stretched quadrupoles on the basis of the implications for the J^π values of nearby states. These multipolarities are not included in the Adopted Gammas data set.

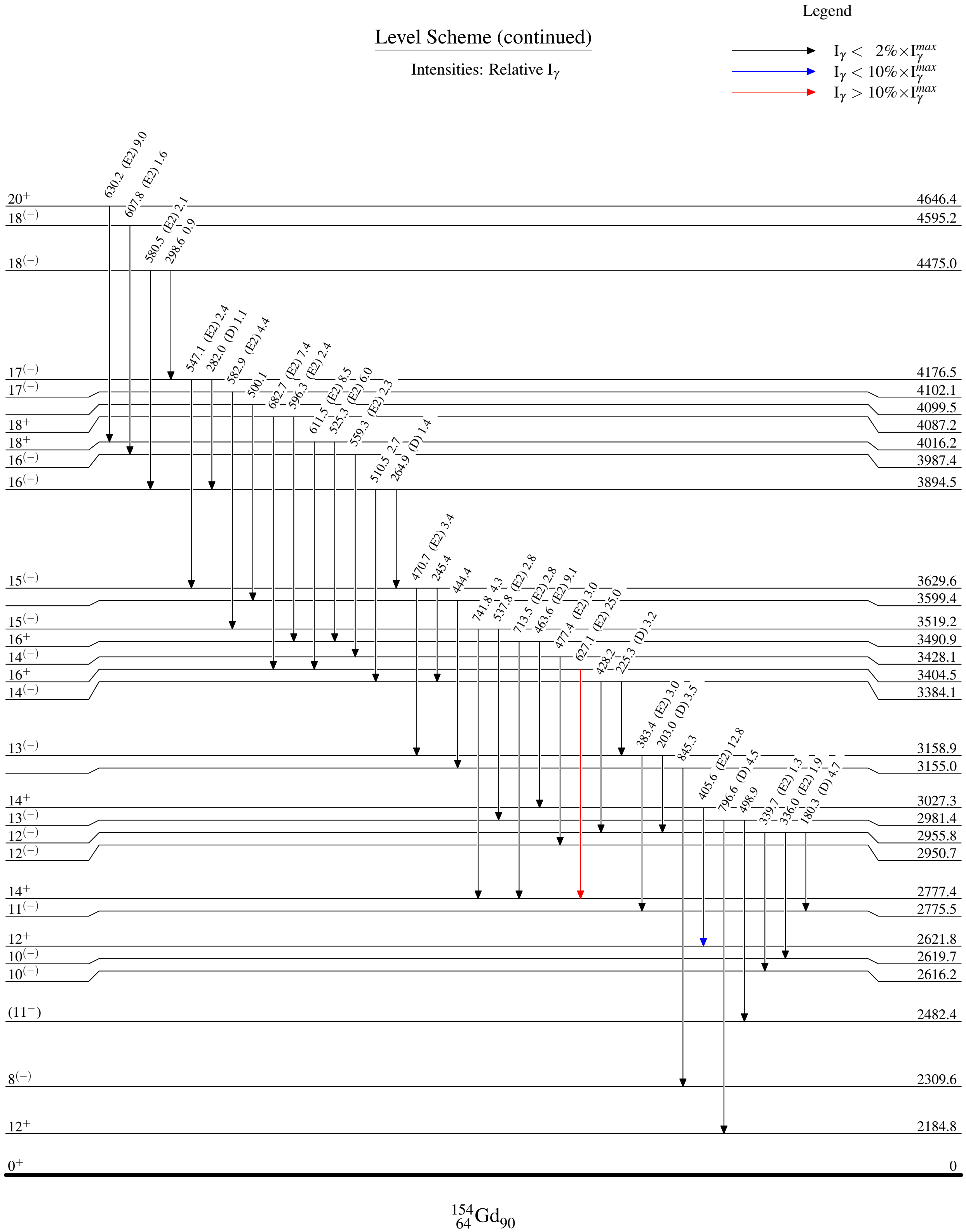
Placement of transition in the level scheme is uncertain.


^{150}Nd(^{9}Be,5nγ) 1989Mo20
Level Scheme
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγ^max
Iγ < 10%×Iγ^max
Iγ > 10%×Iγ^max
γ Decay (Uncertain)
(26−) 7353.2
(26−) 7274.0
26+ 7055.6
(26+) 6955.1
(25−) 6946.2
(25−) 6883.4
(24−) 6555.5
(24−) 6535.6
24+ 6294.2
(23−) 6178.1
(23−) 6136.3
24+ 6121.7
5889.6
(22−) 5848.5
(22−) 5811.0
22+ 5519.6
21(−) 5457.6
21(−) 5415.9
22+ 5350.0
5254.5
20(−) 5209.3
20(−) 5116.5
19(−) 4788.7
20+ 4782.4
19(−) 4735.6
4656.2
20+ 4646.4
18(−) 4595.2
18(−) 4475.0
17(−) 4176.5
17(−) 4102.1
4099.5
18+ 4087.2
0+ 0
797.7
738.4
761.4 (E2) 0.8
833.4 0.5
768.1
747.1
744.5
687.1 0.5
774.6 (E2) 1.5
720.5
720.4 0.6
771.7 (E2) 1.9
635.1
639.2 0.6
694.5 0.6
737.2 (E2) 2.7
668.9 (E2) 0.8
341.2
680.3 (E2) 1.1
703.6 (E2) 3.8
598.3
614.1 (E2) 1.1
641.5 (E2) 1.4
327.9
612.2 (E2) 1.8
313.7 0.7
695.2 (E2) 6.1
633.5 (E2) 2.5
556.7
$^{154}_{64}Gd_{90}$

^{150}Nd(^{9}Be,5nγ) 1989Mo20

Level Scheme (continued)

Intensities: Relative I_γ



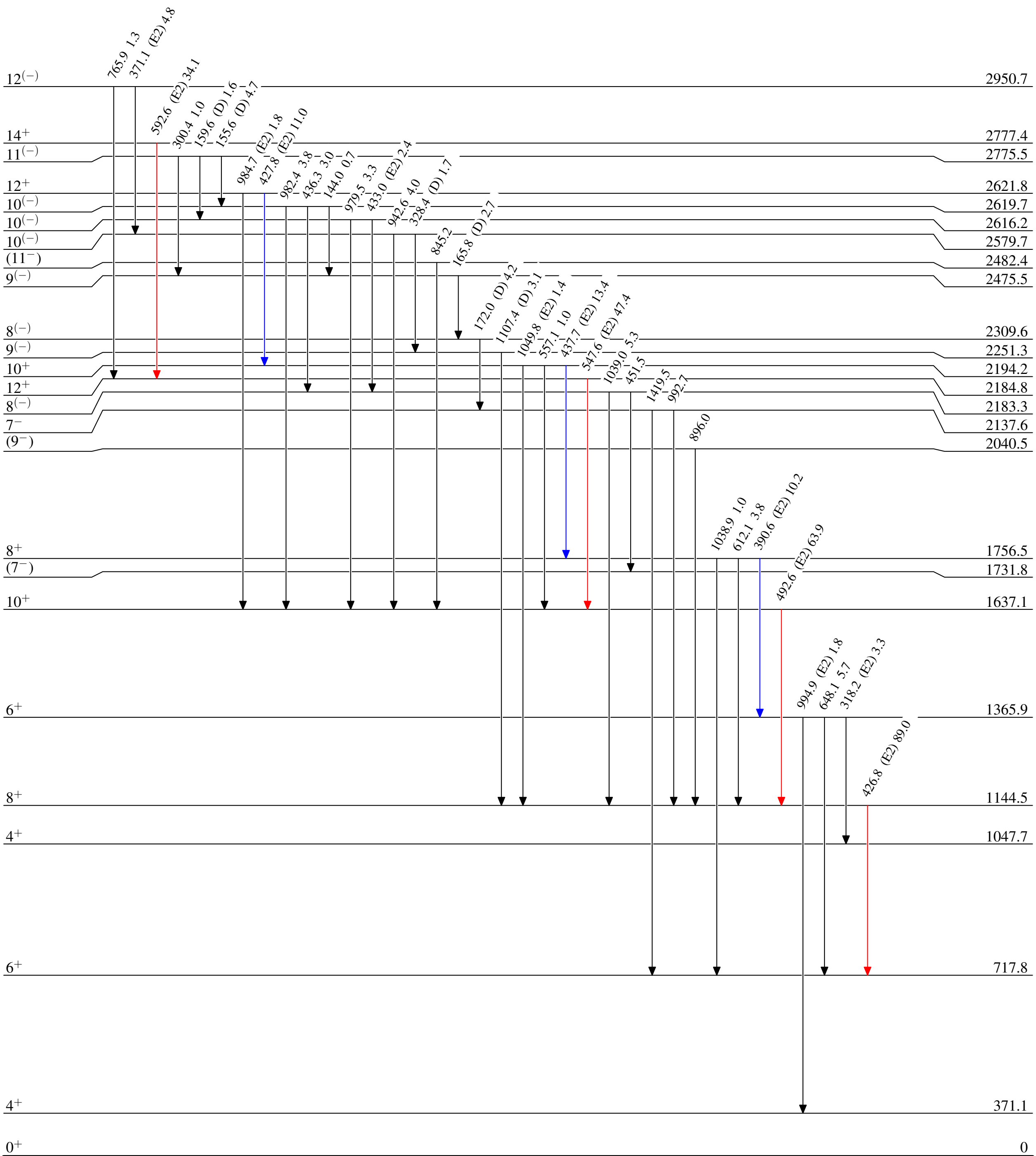
^{150}Nd(^{9}Be,5nγ) 1989Mo20

Level Scheme (continued)

Intensities: Relative I_γ

Legend

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



$^{154}_{64}Gd_{90}$

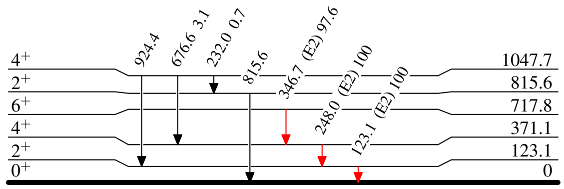
^{150}Nd(^{9}Be,5nγ) 1989Mo20

Level Scheme (continued)

Intensities: Relative I_γ

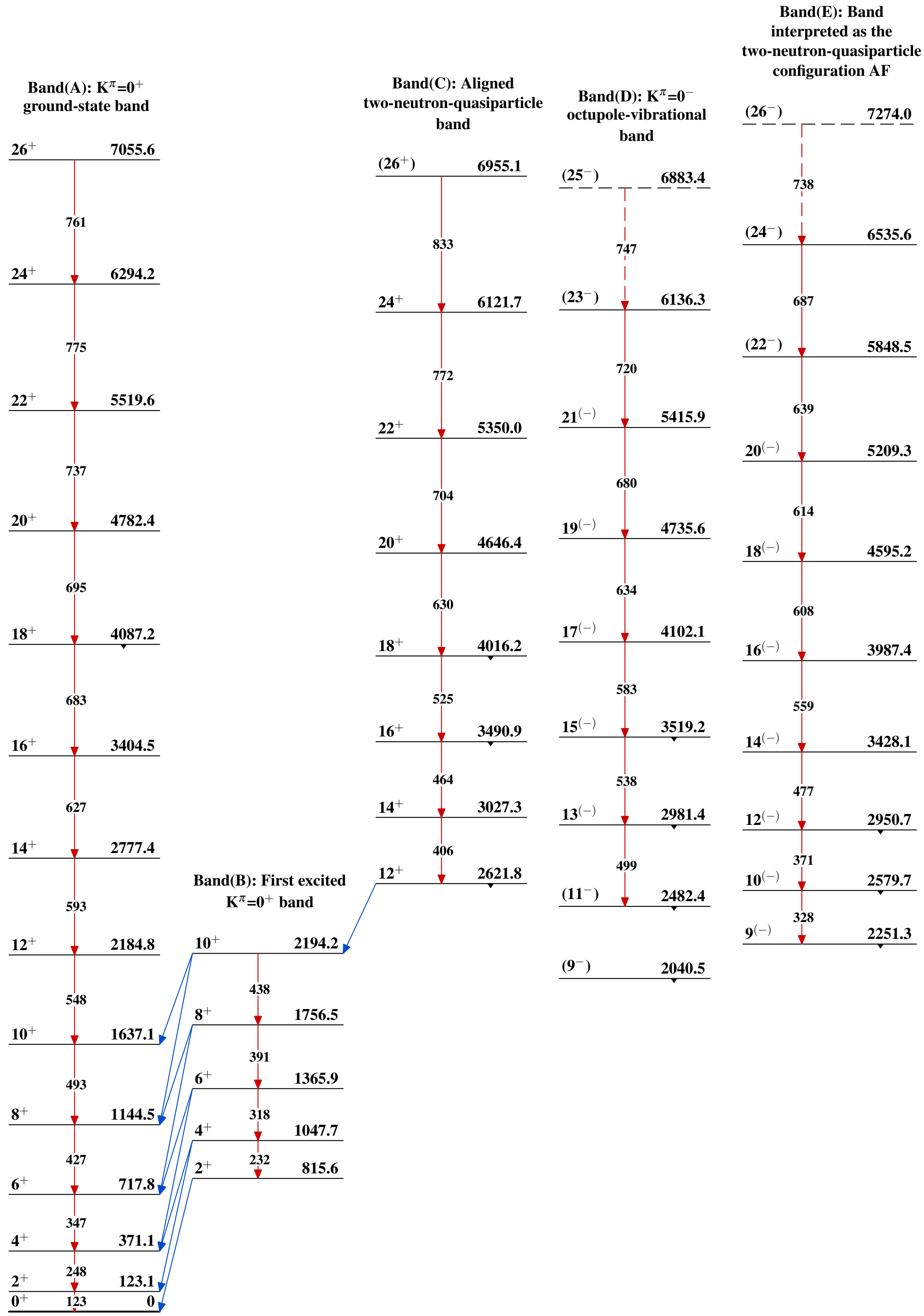
Legend

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



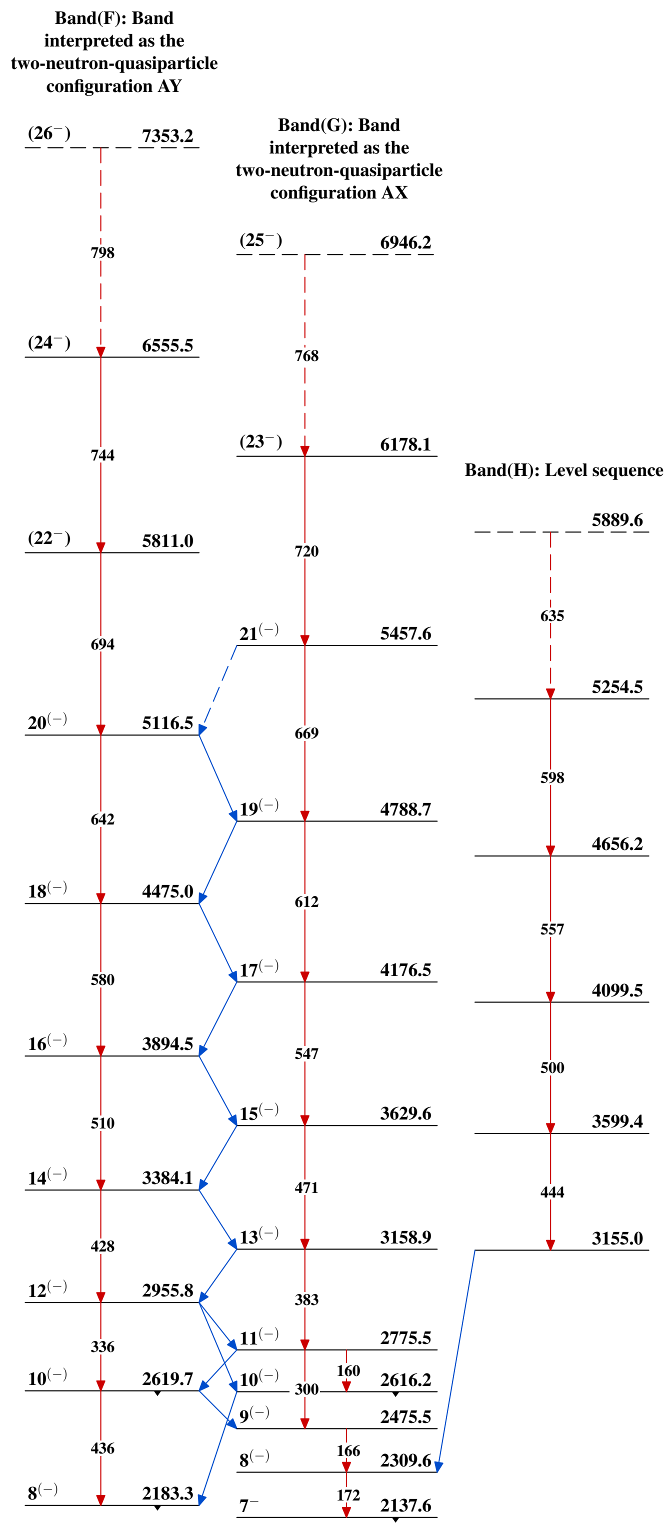
$^{154}_{64}Gd_{90}$

^{150}Nd(^{9}Be,5nγ) 1989Mo20



$^{154}_{64}Gd_{90}$

$^{150}Nd(^{9}Be,5n\gamma)$ 1989Mo20 (continued)



$^{154}_{64}Gd_{90}$