^{162}Dy(α,2nγ) 1984Fi07,1976We24

History

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

Includes ^{165}Ho(p,2nγ); ^{165}Ho(d,3nγ); ^{164}Dy(^{3}He,3nγ); ^{164}Dy(α,4nγ).

1984Fi07 (also 1982Fi06): ^{162}Dy(α,2nγ) E=24 MeV and ^{165}Ho(p,2nγ) E=23 MeV. Measured Eγ, Iγ, $\gamma\gamma$, ce, $\gamma(\theta)$. Main results are from (α,2nγ).

1976We24: E=24 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$. Data for g.s. band up to 12^{+}, γ band up to 7^{+} and for 7^{-} isomer.

Others:

1983Na14: ^{164}Dy(α,4nγ) E=47 MeV. Measured $\gamma(\theta)$ and ce data for 436γ from 12^{+} bandhead of Super band.

1980Ya03: ^{164}Dy(α,4nγ) E=51 MeV.

1977Dr03: ^{165}Ho(d,3nγ) E=18-24 MeV. Measured Eγ, Iγ, γ(t), excitation functions. Deduced ground-state band up to 12^{+} and lifetime for 7^{-} state at 1985 through intensity of delayed transitions.

1976Da10: ^{164}Dy(α,4nγ) E=45 MeV and ^{154}Sm(^{14}C,4nγ) E=62 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma\gamma$(t), $\gamma(\theta)$ for ground-state band up to 18^{+}.

1974Ba07: ^{164}Dy(α,4nγ) E=46-97 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma(\theta)$, $\alpha\gamma$(t) for g.s. band up to 16^{+}.

1972Fe08: ^{163}Dy(α,3nγ), ^{164}Dy(α,4nγ) E=40 MeV. Measured relative cross sections of prompt and delayed γ rays for g.s. band up to 16^{+} and γ band up to 8^{+}.

1970Je09: ^{162}Dy(α,2nγ) E=21.8 and 27.4 MeV; ^{164}Dy(^{3}He,3nγ) E=21.8 MeV; ^{165}Ho(d,3nγ) E=17.4 MeV; ^{165}Ho(p,2nγ) E=16.8 and 21.4 MeV. Measured σ(Eγ) for g.s. band up to 14^{+}, γ band up to 9^{+} and β band up to 10^{+}.

1969Mi03: E=19.2-31.7 MeV. Measured σ(Eγ) for g.s. band members.

1969Ka03: E=27.5 MeV. Measured Eγ, Iγ. Deduced g.s. band up to 10^{+}.

1966Mo01: E=27-52 MeV. Measured γ. Deduced g.s. band up to 10^{+}.

1966Gr04 (also 1963Ha39): ^{165}Ho(p,2nγ) E=12 MeV. Measured ce, γ ce coin. Deduced ground-state, γ, and β bands up to 8^{+}.

Cross section and multiplicity measurements:

1973Sa14: analysis of g.s. band data up to 14^{+} from (α,xn).

1983Ma32 (also 1979Na05,1979Ki05): ^{162}Dy(α,2nγ), ^{164}Dy(α,4nγ) E=50-120 MeV. Measured neutron multiplicity and production cross sections.

The following levels (deexciting transitions) proposed by 1976We24 (with spins in the range of 6 to 8) have been omitted due to lack of confirmation in other studies: 1698.5 (501.1γ, 1083.3γ); 1788.5 (430.7γ, 1174γ); 1922.5 (178γ, 378γ, 564γ); 2140.4 (218γ, 596γ); 2360.4 (220γ, 438γ, 616γ) and 2952.1 (1030γ, 1164γ).

^{164}Er Levels

E(level)[†]	J$^{\pi}$[‡]	Comments
0.0[b]	0^{+}	
91.389[b] *10*	2^{+}	
299.47[b] *3*	4^{+}	
614.39[b] *6*	6^{+}	
860.79[c] *7*	2^{+}	
946.36[c] *7*	3^{+}	
1024.60[b] *8*	8^{+}	
1058.23[c] *9*	4^{+}	From relative γ-branching ratios, a 967.8γ should have been seen in (α,2ng) with expected intensity of 4.4 units.
1197.52[c] *7*	5^{+}	
1308[ad] *4*	2^{+}	
1358.50[c] *7*	6^{+}	
1468.87[d] *11*	(4^{+})	
1495.4[f] *5*	(2^{-})[#]	
1507.67 *11*	(6^{+})	J$^{\pi}$: from Fig. 3a in 1984Fi07, not given in authors; Table 1.
1518.09[b] *11*	10^{+}	

Continued on next page (footnotes at end of table)

^{162}Dy(α,2nγ) 1984Fi07,1976We24 (continued)

^{164}Er Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$[@]
1544.73[c] *8*	7$^+$	
1553.47[e] *11*	(5$^-$)	
1609.7[f] *5*	(4$^-$)[#]	
1664.27[g] *11*	5$^-$	
1702.70[h] *13*	(4$^+$)[#]	
1706.69[d] *11*	6$^+$	
1726.1 *5*		
1744.62[g] *9*	6$^-$	
1744.90[c] *9*	8$^+$	
1763.59[e] *12*	(7$^-$)	
1797.70[f] *12*	5$^-$	
1806.2[h] *10*	(5$^+$)[#]	
1813.77[f] *10*	6$^-$	
1845.40[g] *9*	7$^-$	
1929.5[h] *10*	(6$^+$)[#]	
1964.6[g] *4*	8$^-$	
1976.84[c] *11*	9$^+$	
1985.01[i] *11*	7$^-$	22.0[&] ns *15*
2005.40[j] *13*	8$^+$	
2017.99[f] *12*	7$^-$[#]	
2046.5 *20*		
2054.60[e] *13*	(9$^-$)	
2068.90[d] *13*	8$^+$	
2081.7[h] *5*	(7$^+$)	
2082.79[b] *15*	12$^+$	
2090.71[f] *9*	8$^-$	
2093.60 *13*		
2108.60[g] *13*	(9$^-$)	
2141.5 *20*		
2151.4 *10*		
2163.51[i] *15*	(8$^-$)	
2184.29[c] *12*	10$^+$	
2240.1?[j] *10*	(10$^+$)[#]	
2261.4[g] *4*	10$^-$	
2278.9[h] *10*	(8$^+$)[#]	
2337.30[f] *13*	(9$^-$)	
2356.4 *20*		
2363.31[i] *18*	(9$^-$)	
2408.19[g] *15*	(11$^-$)	
2420.83[f] *12*	(10$^-$)	
2448.1 *5*		
2462.69[d] *15*	10$^+$	
2470.1[e] *10*	(11$^-$)[#]	
2479.15[c] *15*	(11)$^+$	
2483.4 *20*		
2519.3[j] *4*	12$^+$	
2583.40[i] *20*	(10$^-$)	
2591.6 *10*		
2631.4[g] *7*	(12$^-$)	

Continued on next page (footnotes at end of table)

^{162}Dy(α,2nγ) 1984Fi07,1976We24 (continued)

^{164}Er Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	Comments
2702.60[b] *18*	14^{+}	
2815.2[g] *4*	(13^{-})	
2822.1[i] *4*	(11^{-})	
3066.8[g] *9*	(14^{-})	
3263.0[b] *4*	16^{+}	J$^{\pi}$: from 1976Da10.
3768.5[b] *4*	18^{+}	J$^{\pi}$: from 1976Da10.

[†] From least-squares fit to Eγ data.

[‡] As proposed by 1984Fi07, based on $\gamma(\theta)$ and ce data, and band structures. See also Adopted Levels.

[#] As suggested by 1984Fi07. This assignment is considered as tentative (evaluators) due to lack of supporting experimental evidence, thus it is not given in Adopted Levels.

[@] From $\gamma\gamma$(t), no evidence for a level of $T_{1/2}$>5 ns.

[&] Weighted average of 23 ns *+7−5*, 24.1 ns *+36−27* and 21.6 ns *15* (1977Dr03) in (d,3nγ) for γ(t) of 241γ, 241γ (from 1744 level) and 208γ (from 299 level).

[a] Level and J^{π} from 1966Gr04 in (p,2nγ). Level energy is 1314 keV in Adopted Levels.

[b] Band(A): K$^{\pi}$=0^{+} ground-state band.

[c] Band(B): K$^{\pi}$=2^{+} γ-vibrational band.

[d] Band(C): K$^{\pi}$=0^{+} band.

[e] Band(D): K$^{\pi}$=0^{-}.

[f] Band(E): K$^{\pi}$=2^{-}. This band is not listed in Adopted Levels due to uncertain spin assignments (evaluators).

[g] Band(F): K$^{\pi}$=5^{-}. Probable configuration=ν5/2[642]ν5/2[523], but mixing expected between K$^{\pi}$=5^{-}, K$^{\pi}$=0^{-} octupole band and K$^{\pi}$=2^{-} band.

[h] Band(G): K$^{\pi}$=(4^{+}). Probable configuration=ν3/2[521]+ν5/2[523]. This band is not listed in Adopted Levels due to uncertain spin assignments (evaluators).

[i] Band(H): K$^{\pi}$=7^{-}. Configuration=π7/2[404]+π7/2[523] based on its feeding in β decay from K$^{\pi}$=6^{-},π7/2[404]+ν5/2[523] isomeric state in ^{164}Tm. γ-decay to K$^{\pi}$=0^{+} band members shows small admixture of K=0 or 1 components.

[j] Band(I): Super (S) band. Configuration=$\nu i^2_{13/2}$. This band is not listed in Adopted Levels due to uncertain spin assignments (evaluators).

γ(^{164}Er)

The following γ rays assigned by 1974Ba07 to ^{164}Er have been omitted: 217.5, 505.6 and 577.6. These are not confirmed in any other study.
α(K)exp, A_2 and A_4 values are from 1984Fi07, unless indicated otherwise by another reference.

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡j]	α[k]	Comments
80.6 *5*	0.35	1744.62	6^-	1664.27	5^-			A_2=−0.56 *11* Mult.: negative A_2 is consistent with ΔJ=1, dipole or quadrupole. Mult=E2 in Adopted Levels, Gammas dataset based on ce data in ε decay.
91.39[#] *1*	18	91.389	2^+	0.0	0^+	E2	4.15	A_2=+0.33 *1* α(K)=1.314 *19*; α(L)=2.17 *3*; α(M)=0.528 *8* α(N)=0.1194 *17*; α(O)=0.01397 *20*; α(P)=5.51×10^{-5} *8* I_γ: 1.8 relative to 100 for 315γ seems too low by a factor of 10. Iγ(91)/Iγ(315)=0.30 (1976We24). Additional information 1. Other A_2 and A_4: 1976We24.
119.2 *5*	<0.5	1964.6	8^-	1845.40	7^-			
139.5 *1*	1.2	1985.01	7^-	1845.40	7^-			A_2=+0.28 *4*; A_4=−0.05 *6* Additional information 9. Mult.: γ(θ) data are consistent with ΔJ=0, dipole, although, 1976We24 give δ=+5.0 *+55−47*, and dominant E2 in ^{164}Tm ε decay (5.1 min). Other A2, A4: 1976We24.
152.8 *5*	<0.5	2261.4	10^-	2108.60	(9^-)			
178.5 *1*	2.1	2163.51	(8^-)	1985.01	7^-			A_2=+0.28 *3*
199.8 *1*	2.1	2363.31	(9^-)	2163.51	(8^-)			
208.08[#] *3*	69.2	299.47	4^+	91.389	2^+	E2	0.221	A_2=+0.25 *1*; A_4=−0.06 *1* α(K)=0.1445 *21*; α(L)=0.0587 *9*; α(M)=0.01396 *20* α(N)=0.00318 *5*; α(O)=0.000394 *6*; α(P)=6.87×10^{-6} *10* I_γ: 147 *5* (1976We24). Additional information 2. Other γ(θ): 1976We24, 1976Da10, 1974Ba07.
219.9 *5*	<3.2[a]	1964.6	8^-	1744.62	6^-			
220.1 *1*	<3.2[a]	2583.40	(10^-)	2363.31	(9^-)			
235[l]		2240.1?	(10^+)	2005.40	8^+			
239.0 *5*	0.5	2822.1	(11^-)	2583.40	(10^-)			
240.5 *1*	4.8	1985.01	7^-	1744.62	6^-			A_2=+0.06 *23*; A_4=−0.35 *31* (1976We24); A_2=+0.22 *2* (1984Fi07)
251.2 *1*	0.82	1197.52	5^+	946.36	3^+			
277.0 *1*	1.1	2090.71	8^-	1813.77	6^-	(E2)	0.0882	A_2=+0.30 *7*; A_4=−0.10 *9* α(K)=0.0633 *9*; α(L)=0.0192 *3*; α(M)=0.00451 *7* α(N)=0.001031 *15*; α(O)=0.0001314 *19*; α(P)=3.21×10^{-6} *5*
279[l]		2519.3	12^+	2240.1?	(10^+)			
296.9 *5*	<2.4[b]	2261.4	10^-	1964.6	8^-	[c]		

$^{164}_{68}$Er$_{96}$-4

γ(^{164}Er) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡j]	δ[‡]	α[k]	Comments
298.7 *5*	<2.4[b]	2005.40	8^+	1706.69	6^+	[c]			
300.3 *1*	2.9	1358.50	6^+	1058.23	4^+	E2		0.0688	α(K)exp=0.061 *9* α(K)=0.0504 *7*; α(L)=0.01423 *20*; α(M)=0.00333 *5* α(N)=0.000762 *11*; α(O)=9.80$\times10^{-5}$ *14*; α(P)=2.60$\times10^{-6}$ *4*
314.87[#] *5*	100.0	614.39	6^+	299.47	4^+	E2		0.0597	A_2=+0.23 *1*; A_4=−0.11 *1* α(K)=0.0442 *7*; α(L)=0.01199 *17*; α(M)=0.00280 *4* α(N)=0.000641 *9*; α(O)=8.28$\times10^{-5}$ *12*; α(P)=2.29$\times10^{-6}$ *4* Additional information 3. Other $\gamma(\theta)$: 1976We24, 1976Da10, 1974Ba07.
330.2 *1*	1.2	2420.83	(10^-)	2090.71	8^-				A_2=+0.12 *11*
346.1 *1*	0.8 *3*	2090.71	8^-	1744.62	6^-				A_2=+0.22 *4* A_2 for 346.1+347.2.
347.2 *1*	1.6 *3*	1544.73	7^+	1197.52	5^+				A_2=+0.22 *4* A_2 for 346.1+347.2.
370.0 *5*	0.34	2631.4	(12^-)	2261.4	10^-				A_2=−0.06 *21*
386.6 *1*	3.0	1744.90	8^+	1358.50	6^+	E2		0.0329	A_2=+0.17 *5*; A_4=−0.17 *5*; α(K)exp=0.025 *3* α(K)=0.0253 *4*; α(L)=0.00588 *9*; α(M)=0.001359 *19* α(N)=0.000312 *5*; α(O)=4.12$\times10^{-5}$ *6*; α(P)=1.358$\times10^{-6}$ *19* Additional information 8. Other $\gamma(\theta)$: 1976We24.
407.1 *5*	<0.5	2815.2	(13^-)	2408.19	(11^-)				
410.00[#] *10*	54.6	1024.60	8^+	614.39	6^+	E2		0.0279	A_2=+0.28 *1*; A_4=−0.08 *1*; α(K)exp=0.020 *3* α(K)=0.0217 *3*; α(L)=0.00484 *7*; α(M)=0.001116 *16* α(N)=0.000257 *4*; α(O)=3.41$\times10^{-5}$ *5*; α(P)=1.172$\times10^{-6}$ *17* Additional information 5. Other $\gamma(\theta)$: 1976We24, 1976Da10, 1974Ba07.
432.0 *1*	4.0	1976.84	9^+	1544.73	7^+	E2		0.0242	A_2=+0.34 *5*; A_4=+0.05 *6*; α(K)exp=0.020 *1* α(K)=0.0189 *3*; α(L)=0.00409 *6*; α(M)=0.000940 *14* α(N)=0.000216 *3*; α(O)=2.89$\times10^{-5}$ *4*; α(P)=1.031$\times10^{-6}$ *15*
435.4 *5*	<0.8[d]	3066.8	(14^-)	2631.4	(12^-)	[e]			
436.5 *5*	<0.8[d]	2519.3	12^+	2082.79	12^+	M1(+E2)[e]	<0.35	0.0481 *16*	A_2=+0.35 *4*; A_4=−0.02 *3* α(K)exp=0.045 *4* (1983Na14) α(K)=0.0405 *14*; α(L)=0.00595 *15*; α(M)=0.00132 *3* α(N)=0.000307 *8*; α(O)=4.44$\times10^{-5}$ *12*; α(P)=2.45$\times10^{-6}$ *9* Mult.,δ: from $\gamma(\theta)$ and α(K)exp.
439.4 *1*	4.2	2184.29	10^+	1744.90	8^+	E2		0.0231	A_2=+0.50 *4*; α(K)exp=0.0200 *15* α(K)=0.0181 *3*; α(L)=0.00388 *6*; α(M)=0.000890 *13* α(N)=0.000205 *3*; α(O)=2.74$\times10^{-5}$ *4*; α(P)=9.89$\times10^{-7}$ *14*
443.9 *1*	4.6	2420.83	(10^-)	1976.84	9^+	E1		0.00730	A_2=+0.47 *7*; A_4=+0.01 *8*; α(K)exp<0.004 α(K)=0.00618 *9*; α(L)=0.000871 *13*; α(M)=0.000192 *3* α(N)=4.44$\times10^{-5}$ *7*; α(O)=6.31$\times10^{-6}$ *9*; α(P)=3.29$\times10^{-7}$ *5*
458.5 *5*	0.50	2822.1	(11^-)	2363.31	(9^-)				

γ(^{164}Er) (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡ j	δ‡	α k	Comments
493.5 *1*	19.6	1518.09	10^+	1024.60	8^+	E2		0.01701	A_2=+0.19 *2*; A_4=−0.08 *2*; α(K)exp=0.0144 *1* α(K)=0.01352 *19*; α(L)=0.00271 *4*; α(M)=0.000618 *9* α(N)=0.0001425 *20*; α(O)=1.93×10^{-5} *3*; α(P)=7.47×10^{-7} *11* Additional information 7. Other γ(θ): 1976We24, 1976Da10, 1974Ba07.
502.3 *1*	1.5	2479.15	$(11)^+$	1976.84	9^+	E2		0.01625	α(K)exp=0.0141 *14* α(K)=0.01295 *19*; α(L)=0.00257 *4*; α(M)=0.000586 *9* α(N)=0.0001350 *19*; α(O)=1.83×10^{-5} *3*; α(P)=7.17×10^{-7} *10*
505.5 *2*		3768.5	18^+	3263.0	16^+				A_2=+0.36 *12* (1976Da10) E_γ: from 1976Da10. I_γ: Iγ(505)/Iγ(315)=0.024 *12* (1976Da10).
520.3 *1*	1.3	1544.73	7^+	1024.60	8^+	E2+M1	2.1 *+26−7*	0.018 *3*	α(K)exp=0.0145 *20* α(K)=0.0146 *23*; α(L)=0.00259 *24*; α(M)=0.00059 *5* α(N)=0.000136 *12*; α(O)=1.87×10^{-5} *19*; α(P)=8.3×10^{-7} *15* Uncertainty of 0.0002 seems too low, evaluators consider 0.0020.
534 *1*	<0.5	2278.9	(8^+)	1744.90	8^+				
537.0 *5*	1.6 *4*	2081.7	(7^+)	1544.73	7^+				Additional information 10.
546.0 *1*	3.2 *6*	2090.71	8^-	1544.73	7^+				α(K)exp=0.0011 *6* α(K)exp for 546.0+547.2.
547.2 *1*	2.8 *6*	1744.62	6^-	1197.52	5^+	(E1)		0.0046	α(K)exp=0.0011 *6* α(K)exp for 546.0+547.2.
560.5 *2*		3263.0	16^+	2702.60	14^+				A_2=+0.31 *15*; A_4=+0.04 *22* (1974Ba07); A_2=+0.42 *8* (1976Da10) E_γ: from 1976Da10. I_γ: Iγ(560)/Iγ(315)=0.037 *12* (1976Da10), 0.057 *17* (1974Ba07).
564.7 *1*	6.0	2082.79	12^+	1518.09	10^+	E2		0.01210	A_2=+0.37 *3*; A_4=−0.11 *5* (1976Da10); α(K)exp=0.092 *7* α(K)=0.00976 *14*; α(L)=0.00182 *3*; α(M)=0.000414 *6* α(N)=9.56×10^{-5} *14*; α(O)=1.307×10^{-5} *19*; α(P)=5.45×10^{-7} *8* Additional information 11. Other γ(θ): 1974Ba07, 1976We24.
583.2 *1*	3.0	1197.52	5^+	614.39	6^+	M1+E2	3.1 *8*	0.0124 *9*	α(K)exp=0.0097 *10* A_2=−0.10 *11*; A_4=−0.04 *15* (1976We24) α(K)=0.0101 *8*; α(L)=0.00178 *9*; α(M)=0.000401 *18* α(N)=9.3×10^{-5} *5*; α(O)=1.28×10^{-5} *7*; α(P)=5.7×10^{-7} *5* Additional information 6. δ: from α(K)exp. Other: +0.02 *+111−2* or +12 *+∞−7* (1976We24) from γ(θ).
616.3 *1*	2.1	1813.77	6^-	1197.52	5^+	E1		0.00356	A_2=−0.54 *10*; α(K)exp=0.0054 *12* α(K)=0.00302 *5*; α(L)=0.000418 *6*; α(M)=9.18×10^{-5} *13* α(N)=2.13×10^{-5} *3*; α(O)=3.05×10^{-6} *5*; α(P)=1.634×10^{-7} *23*
619.8 *1*	0.74	2702.60	14^+	2082.79	12^+	Q			A_2=+0.38 *5*; A_4=−0.10 *8* (1976Da10) Other γ(θ): 1974Ba07.
634.6 *5*	<0.5	1495.4	(2^-)	860.79	2^+				
646.9 *1*	1.8	946.36	3^+	299.47	4^+	E2+M1	2.7 *10*	0.0099 *13*	α(K)exp=0.0081 *12*

γ(^{164}Er) (continued)

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[‡j]	δ[‡]	α[k]	Comments
									α(K)=0.0081 *12*; α(L)=0.00137 *13*; α(M)=0.00031 *3* α(N)=7.1×10^{-5} *7*; α(O)=9.9×10^{-6} *11*; α(P)=4.6×10^{-7} *8*
663.3 *5*	<0.5	1609.7	(4$^-$)	946.36	3$^+$				
666.2 *1*	0.65	2184.29	10$^+$	1518.09	10$^+$	M1(+E2)	<0.9	0.0149 *20*	α(K)exp=0.015 *4* α(K)=0.0125 *17*; α(L)=0.00184 *20*; α(M)=0.00041 *5* α(N)=9.5×10^{-5} *10*; α(O)=1.37×10^{-5} *16*; α(P)=7.5×10^{-7} *11* δ: from α(K)exp.
720.1 *1*	2.8	1744.90	8$^+$	1024.60	8$^+$	E2+M1	−1.5 *+8−30*	0.0090 *26*	A$_2$=+0.21 *21*; A$_4$=−0.20 *26* (1976We24) α(K)exp=0.0058 *5* α(K)=0.0075 *23*; α(L)=0.0012 *3*; α(M)=0.00026 *6* α(N)=6.1×10^{-5} *14*; α(O)=8.6×10^{-6} *21*; α(P)=4.4×10^{-7} *14* δ: −1.5 *+8−30* or +12 *+∞−7* (1976We24) from $\gamma(\theta)$. α(K)exp gives δ<2.8, supporting the lower value.
722[l]	<0.5	2240.1?	(10$^+$)	1518.09	10$^+$				
732	<0.25[f]	1929.5	(6$^+$)	1197.52	5$^+$	[g]			
732.4 *5*	<0.25[f]	2815.2	(13$^-$)	2082.79	12$^+$	[g]			
744.2 *1*	6.0	1358.50	6$^+$	614.39	6$^+$	M1+E2	3.7 *+19−8*	0.0068 *3*	A$_2$=−0.24 *14*; A$_4$=−0.04 *18* (1976We24) A$_2$=+0.14 *3*; α(K)exp=0.0056 *2* α(K)=0.00559 *23*; α(L)=0.00092 *3*; α(M)=0.000205 *7* α(N)=4.75×10^{-5} *15*; α(O)=6.67×10^{-5} *22*; α(P)=3.19×10^{-7} *15* δ: from α(K)exp. Other: −1.9 *+16−10* or >+3.3 (1976We24) from $\gamma(\theta)$ supporting the lower value.
748	0.16	1806.2	(5$^+$)	1058.23	4$^+$				
758.8 *1*	9.4	1058.23	4$^+$	299.47	4$^+$	E2(+M1)	>+7	0.00618 *15*	A$_2$=−0.24 *10*; A$_4$=−0.11 *14* (1976We24); A$_2$=+0.05 *4*; α(K)exp=0.0053 *5* α(K)=0.00510 *13*; α(L)=0.000841 *13*; α(M)=0.000189 *4* α(N)=4.37×10^{-5} *9*; α(O)=6.11×10^{-6} *13*; α(P)=2.90×10^{-7} *8* δ: −1.2 *+4−10* or >+7 (1976We24), α(K)exp giving dominant E2 supports higher value.
769.9[&] *2*	2.8	860.79	2$^+$	91.389	2$^+$	E2(+M1)	>1.8	0.00725 *11*	α(K)exp=0.0050 *10* α(K)=0.00604 *9*; α(L)=0.000943 *14*; α(M)=0.000210 *3* α(N)=4.88×10^{-5} *7*; α(O)=6.93×10^{-6} *10*; α(P)=3.50×10^{-7} *5*
820.6 *1*	1.4	1845.40	7$^-$	1024.60	8$^+$	E1		0.00199	α(K)exp=0.0050 *5* α(K)=0.001698 *24*; α(L)=0.000231 *4*; α(M)=5.07×10^{-5} *7* α(N)=1.178×10^{-5} *17*; α(O)=1.694×10^{-6} *24*; α(P)=9.26×10^{-8} *13* Mult.: α(K)exp gives E1+M2 with δ=0.44 *4*; also consistent with E2, but ΔJ^π suggests E1. M2 component of 16% is less likely from RUL, assuming the level half-life is <20 ns or so.
841.9 *1*	1.5	1702.70	(4$^+$)	860.79	2$^+$				
854[@] *5*		1468.87	(4$^+$)	614.39	6$^+$				
855.0 *1*	9.6	946.36	3$^+$	91.389	2$^+$	E2+M1	−2.8 *7*	0.0052 *4*	A$_2$=−0.28 *4*; A$_4$=−0.08 *4* α(K)=0.0043 *3*; α(L)=0.00067 *4*; α(M)=0.000150 *8*

γ(^{164}Er) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡j]	δ[‡]	α[k]	Comments
									α(N)=3.47×10^{-5} *18*; α(O)=4.9×10^{-6} *3*; α(P)=2.47×10^{-7} *18* Additional information 4. δ: from A_2=−0.28 *4*, A_4=−0.08 *4*. Other: +0.13 *26* or −7.7 *+51−∞* (from γ(θ), 1976We24).
860.3[&] *2*	2.3	860.79	2$^+$	0.0	0$^+$	E2		0.00461	α(K)exp=0.0036 *1* α(K)=0.00383 *6*; α(L)=0.000609 *9*; α(M)=0.0001361 *19* α(N)=3.16×10^{-5} *5*; α(O)=4.45×10^{-6} *7*; α(P)=2.17×10^{-7} *3*
890.1 *1*	0.70	2408.19	(11$^-$)	1518.09	10$^+$	E1		1.70×10^{-3}	α(K)exp=0.0046 *3* α(K)=0.001452 *21*; α(L)=0.000197 *3*; α(M)=4.32×10^{-5} *6* α(N)=1.003×10^{-5} *14*; α(O)=1.444×10^{-6} *21*; α(P)=7.94×10^{-8} *12* Mult.: α(K)exp gives E1+M2 with δ=0.49 *3*; also consistent with E2+M1, δ=1.5 *3* but ΔJ^π suggests E1. M2 component of 19% is less likely from RUL, assuming the level half-life is <20 ns or so.
898.1 *1*	13.1	1197.52	5$^+$	299.47	4$^+$	M1+E2	−2.1 *+11−5*	0.0049 *4*	A_2=−0.22 *7*; A_4=+0.08 *11* (1976We24); α(K)exp=0.0041 *3* α(K)=0.0041 *4*; α(L)=0.00063 *4*; α(M)=0.000139 *9* α(N)=3.24×10^{-5} *21*; α(O)=4.6×10^{-6} *4*; α(P)=2.37×10^{-7} *21* δ: from α(K)exp, sign from γ(θ). Other: −4.8 *+15−59* or 0.00 *+7−14* (1976We24) from γ(θ).
930.1 *1*	6.0	1544.73	7$^+$	614.39	6$^+$	E2+M1	−2.4 *3*	0.00442 *15*	A_2=−0.32 *10*; A_4=+0.31 *15* (1976We24); A_2=−0.47 *3*; α(K)exp=0.0046 *3* α(K)=0.00370 *13*; α(L)=0.000563 *16*; α(M)=0.000125 *4* α(N)=2.91×10^{-5} *9*; α(O)=4.14×10^{-6} *13*; α(P)=2.13×10^{-7} *8* δ: from 1984Fi07. Others: −6.5 *+22−55* (1976We24), 1.1 *2* from α(K)exp.
939.1[l] *5*	0.7 *5*	1553.47	(5$^-$)	614.39	6$^+$	E1		1.54×10^{-3}	α(K)exp=0.0010 *1* α(K)=0.001312 *19*; α(L)=0.0001775 *25*; α(M)=3.89×10^{-5} *6* α(N)=9.04×10^{-6} *13*; α(O)=1.303×10^{-6} *19*; α(P)=7.18×10^{-8} *10*
944.6 *1*	0.89	2462.69	10$^+$	1518.09	10$^+$	E2+M1+E0		0.0144 *5*	α(K)exp=0.0115 *4*
952	<1.5[h]	2470.1	(11$^-$)	1518.09	10$^+$	[i]			
952.6 *5*	<1.5[h]	1976.84	9$^+$	1024.60	8$^+$	[i]			
961.3 *5*	0.35	2479.15	(11)$^+$	1518.09	10$^+$				
980.8 *1*	1.7	2005.40	8$^+$	1024.60	8$^+$	E2+M1+E0		0.0114 *19*	α(K)exp=0.0091 *15*

From ENSDF

γ(^{164}Er) (continued)

Eγ†	Iγ†	Ei(level)	J^π_i	Ef	J^π_f	Mult.‡j	δ‡	α k	Comments
1001.2 *5*	0.44	2519.3	12+	1518.09	10+	E2		0.00335	α(K)exp=0.0041 *11* A_2=+0.40; A_4=−0.16 (1983Na14) α(K)=0.00280 *4*; α(L)=0.000429 *6*; α(M)=9.54×10^{-5} *14* α(N)=2.21×10^{-5} *4*; α(O)=3.14×10^{-6} *5*; α(P)=1.596×10^{-7} *23*
1009@ *5*		1308	2+	299.47	4+				
1030.0 *1*	2.7	2054.60	(9−)	1024.60	8+	E1		1.30×10^{-3}	α(K)exp=0.0011 *2* α(K)=0.001105 *16*; α(L)=0.0001488 *21*; α(M)=3.26×10^{-5} *5* α(N)=7.58×10^{-6} *11*; α(O)=1.094×10^{-6} *16*; α(P)=6.06×10^{-8} *9*
1044.3 *1*	1.5	2068.90	8+	1024.60	8+	E2+M1	1.3 *7*	0.0040 *9*	α(K)exp=0.0030 *11* α(K)=0.0034 *8*; α(L)=0.00049 *10*; α(M)=0.000109 *22* α(N)=2.5×10^{-5} *5*; α(O)=3.6×10^{-6} *8*; α(P)=2.0×10^{-7} *5*
1049.9 *1*	3.0	1664.27	5−	614.39	6+	E1		1.25×10^{-3}	α(K)exp=0.0006 *2* α(K)=0.001067 *15*; α(L)=0.0001436 *21*; α(M)=3.14×10^{-5} *5* α(N)=7.31×10^{-6} *11*; α(O)=1.055×10^{-6} *15*; α(P)=5.85×10^{-8} *9*
1059.1 *1*	2.7	1358.50	6+	299.47	4+	E2		0.00299	α(K)exp=0.0019 *2* α(K)=0.00250 *4*; α(L)=0.000378 *6*; α(M)=8.40×10^{-5} *12* α(N)=1.95×10^{-5} *3*; α(O)=2.78×10^{-6} *4*; α(P)=1.426×10^{-7} *20*
1069.0 *1*	0.62	2093.60		1024.60	8+	M1+E2	0.9 *5*	0.0042 *8*	α(K)exp=0.0031 *10* α(K)=0.0036 *7*; α(L)=0.00051 *8*; α(M)=0.000113 *18* α(N)=2.6×10^{-5} *4*; α(O)=3.8×10^{-6} *6*; α(P)=2.1×10^{-7} *4*
1084.0 *1*	3.2	2108.60	(9−)	1024.60	8+	E1		1.18×10^{-3}	A_2=−0.40 *4*; α(K)exp=0.0014 *2* α(K)=0.001007 *14*; α(L)=0.0001353 *19*; α(M)=2.96×10^{-5} *5* α(N)=6.89×10^{-6} *10*; α(O)=9.94×10^{-7} *14*; α(P)=5.53×10^{-8} *8*
1092.3 *1*	2.0	1706.69	6+	614.39	6+	M1(+E2)	<0.4	0.00483 *17*	α(K)exp=0.0040 *3* α(K)=0.00409 *14*; α(L)=0.000577 *19*; α(M)=0.000127 *4* α(N)=2.97×10^{-5} *10*; α(O)=4.31×10^{-6} *14*; α(P)=2.43×10^{-7} *9*
1111.7 *5*	0.32	1726.1		614.39	6+				
1149.2 *1*	2.9	1763.59	(7−)	614.39	6+	E1		1.07×10^{-3}	A_2=−0.31 *12*; α(K)exp=0.0009 *2* α(K)=0.000906 *13*; α(L)=0.0001214 *17*; α(M)=2.66×10^{-5} *4* α(N)=6.18×10^{-6} *9*; α(O)=8.93×10^{-7} *13*; α(P)=4.98×10^{-8} *7*; α(IPF)=7.39×10^{-6} *11*
1169.4 *1*	1.8	1468.87	(4+)	299.47	4+	M1(+E2)	<0.5	0.00405 *19*	A_2=+0.31 *15*; α(K)exp=0.0043 *7* α(K)=0.00343 *16*; α(L)=0.000483 *21*; α(M)=0.000106 *5* α(N)=2.48×10^{-5} *11*; α(O)=3.61×10^{-6} *16*; α(P)=2.03×10^{-7} *10*; α(IPF)=3.05×10^{-6} *7*
1183.3 *1*	1.1	1797.70	5−	614.39	6+	E1		1.02×10^{-3}	α(K)exp=0.0012 *6* α(K)=0.000860 *12*; α(L)=0.0001151 *17*; α(M)=2.52×10^{-5} *4* α(N)=5.86×10^{-6} *9*; α(O)=8.47×10^{-7} *12*; α(P)=4.73×10^{-8} *7*; α(IPF)=1.643×10^{-5} *24*
1208.2 *1*	0.56	1507.67	(6+)	299.47	4+	(E2)		0.00230	α(K)exp=0.0025 *9* α(K)=0.00193 *3*; α(L)=0.000284 *4*; α(M)=6.30×10^{-5} *9*

γ(^{164}Er) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡j]	α[k]	Comments
								α(N)=1.463×10^{-5} *21*; α(O)=2.09×10^{-6} *3*; α(P)=1.101×10^{-7} *16*; α(IPF)=5.99×10^{-6} *9* Mult.: α(K)exp gives M1,E2, but ΔJ^π consistent with E2.
1217[@] *5*		1308	2$^+$	91.389	2$^+$			
1231.1 *1*	4.9	1845.40	7$^-$	614.39	6$^+$	E1	9.74×10^{-4}	A_2=−0.39 *4*; A_4=+0.04 *5*; α(K)exp=0.0005 *1* α(K)=0.000801 *12*; α(L)=0.0001071 *15*; α(M)=2.34×10^{-5} *4* α(N)=5.45×10^{-6} *8*; α(O)=7.88×10^{-7} *11*; α(P)=4.41×10^{-8} *7*; α(IPF)=3.53×10^{-5} *5*
1254.0 *1*	0.95	1553.47	(5$^-$)	299.47	4$^+$			
1312.7 *1*	0.84	2337.30	(9$^-$)	1024.60	8$^+$			
1364.6 *4*	4.1	1664.27	5$^-$	299.47	4$^+$			
1370.7 *5*	0.46	1985.01	7$^-$	614.39	6$^+$			
1375[@] *5*		1468.87	(4$^+$)	91.389	2$^+$			
1391[l]		2005.40	8$^+$	614.39	6$^+$			
1403.6 *1*	0.96	2017.99	7$^-$	614.39	6$^+$			
1423.5 *5*	1.1 *6*	2448.1		1024.60	8$^+$			
1454.5 *7*	0.6 *4*	2068.90	8$^+$	614.39	6$^+$			
1498.7 *7*	1.7 *7*	1797.70	5$^-$	299.47	4$^+$			
1537 *1*	2.8 *10*	2151.4		614.39	6$^+$			
1567 *1*	1.6 *6*	2591.6		1024.60	8$^+$			
1742 *2*	1.5 *5*	2356.4		614.39	6$^+$			
1747 *2*	2.6 *11*	2046.5		299.47	4$^+$			
1842 *2*	3.8 *15*	2141.5		299.47	4$^+$			
1869 *2*	1.1 *5*	2483.4		614.39	6$^+$			

[†] From (α,2nγ) E=24 MeV at 120° (1984Fi07) unless otherwise stated. Δ(Eγ)=0.1 assigned for strong transitions (Iγ>0.5) and 0.5 for weak and unresolved peaks, as suggested by 1984Fi07. Δ(Iγ)=5%.

[‡] From α(K)exp and $\gamma(\theta)$ data of 1984Fi07. The δ(E2/M1) values based on α(K)exp values have been deduced here by the evaluators.

[#] Precise value from 1970Je09, measured using curved-crystal spectrometer. Values from other studies are in agreement, but less precise.

[@] From 1966Gr04. Δ(Eγ)=5 keV assigned (evaluators) based on comparison with Eγ known from other reactions.

[&] Δ(Eγ) assigned as 0.2 keV (evaluators) due to poor fit.

[a] 3.2 for 219.9+220.1.

[b] 2.4 for 296.9+298.7.

[c] A_2=+0.18 *10*, A_4=−0.02 *11*. α(K)exp=0.054 *9* for 296.9+298.7.

[d] 0.8 for 435.4+436.5.

[e] A_2=+0.30 *6*, A_4=−0.06 *8*. α(K)exp=0.020 *1* for 435.4+436.5.

[f] 0.25 for 732+732.4.

[g] α(K)exp<0.004 for 732+732.4.

[h] 1.5 for 952+952.6.

$^{164}_{68}$Er$_{96}$-10

γ(^{164}Er) (continued)

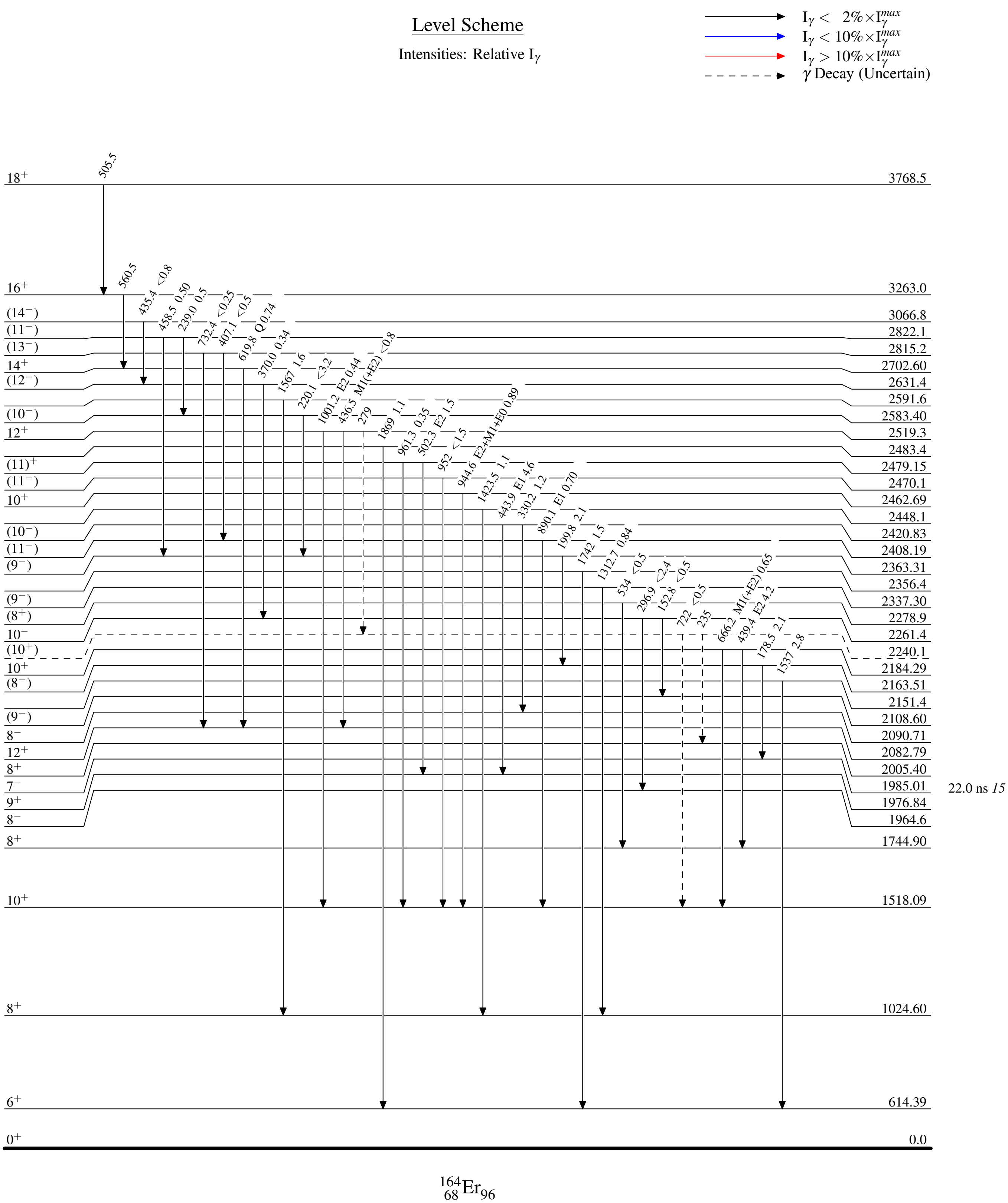
[i] $A_2=-0.25$ *8* for 952+952.6.
[j] From Adopted Gammas for levels below 800 keV.
[k] Additional information 12.
[l] Placement of transition in the level scheme is uncertain.

$^{164}_{68}Er_{96}$-11

^{162}Dy(α,2nγ) 1984Fi07,1976We24

Level Scheme

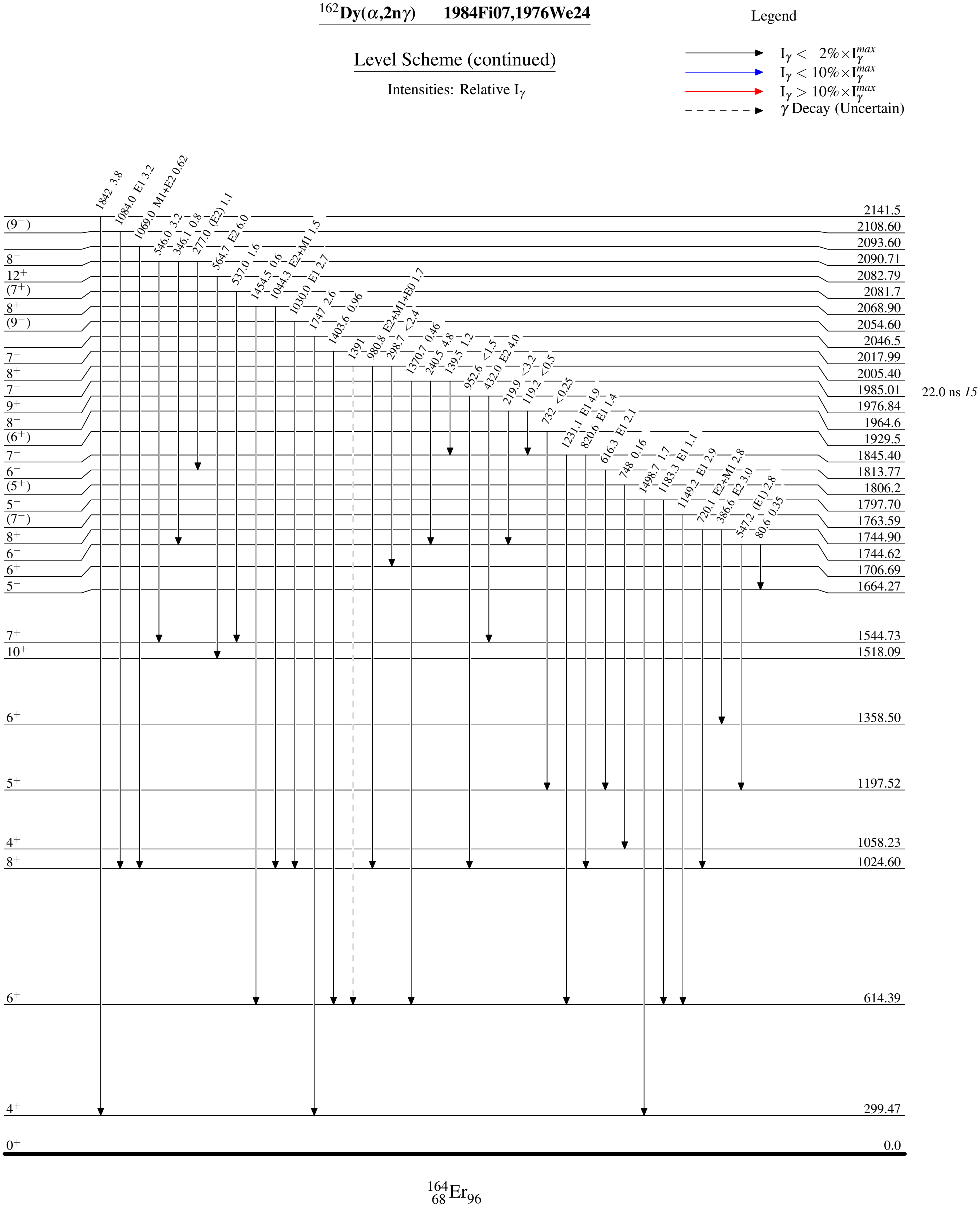
Intensities: Relative I_γ



^{162}Dy(α,2nγ) 1984Fi07,1976We24

Level Scheme (continued)

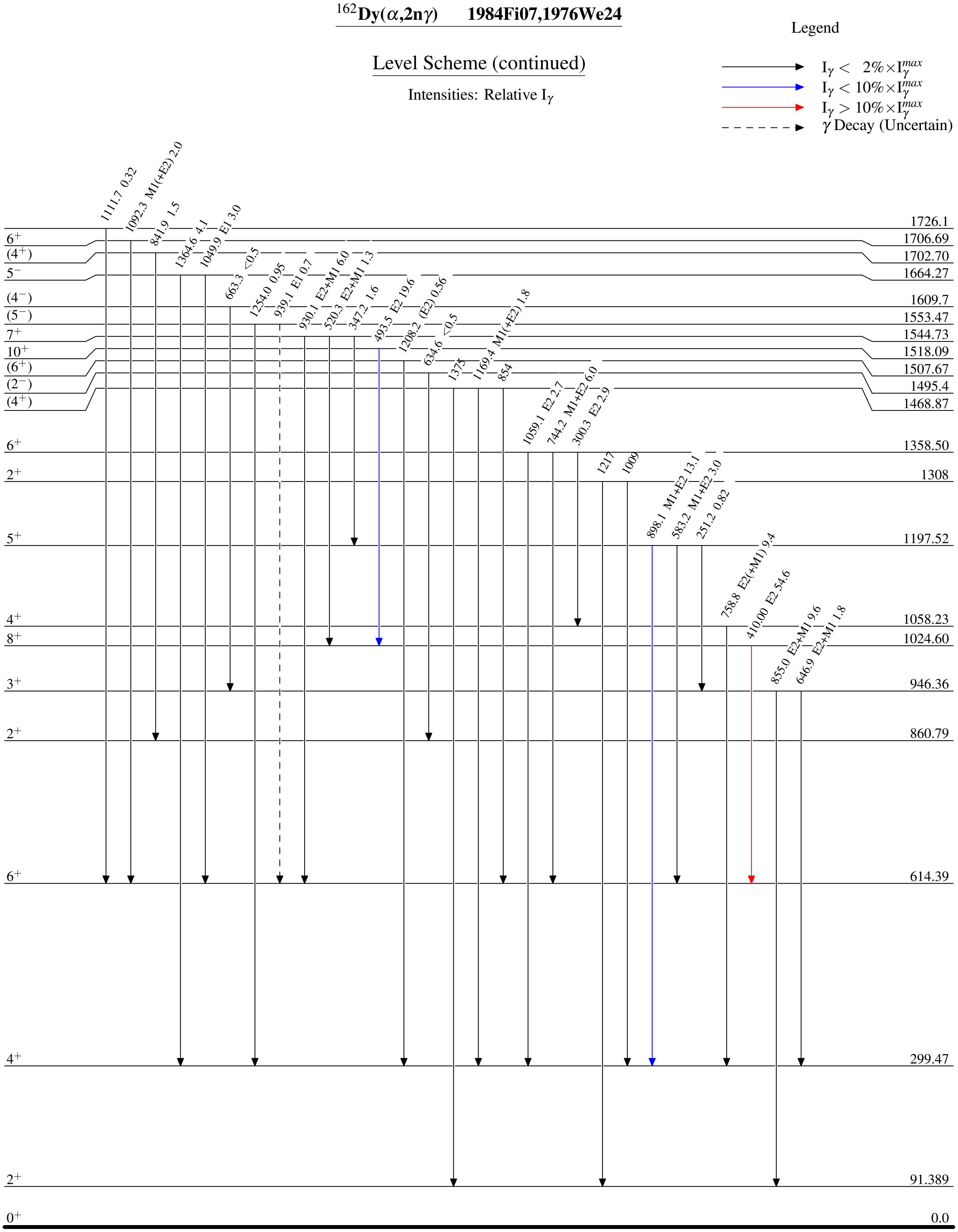
Intensities: Relative I_γ



^{162}Dy(α,2nγ) 1984Fi07,1976We24

Level Scheme (continued)

Intensities: Relative I_γ

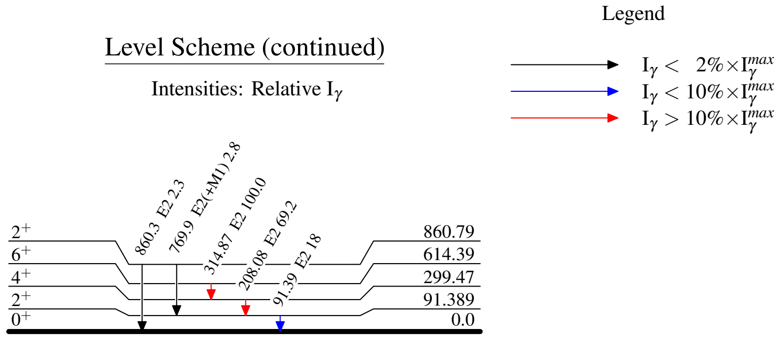


$^{164}_{68}Er_{96}$

^{162}Dy(α,2nγ) 1984Fi07,1976We24

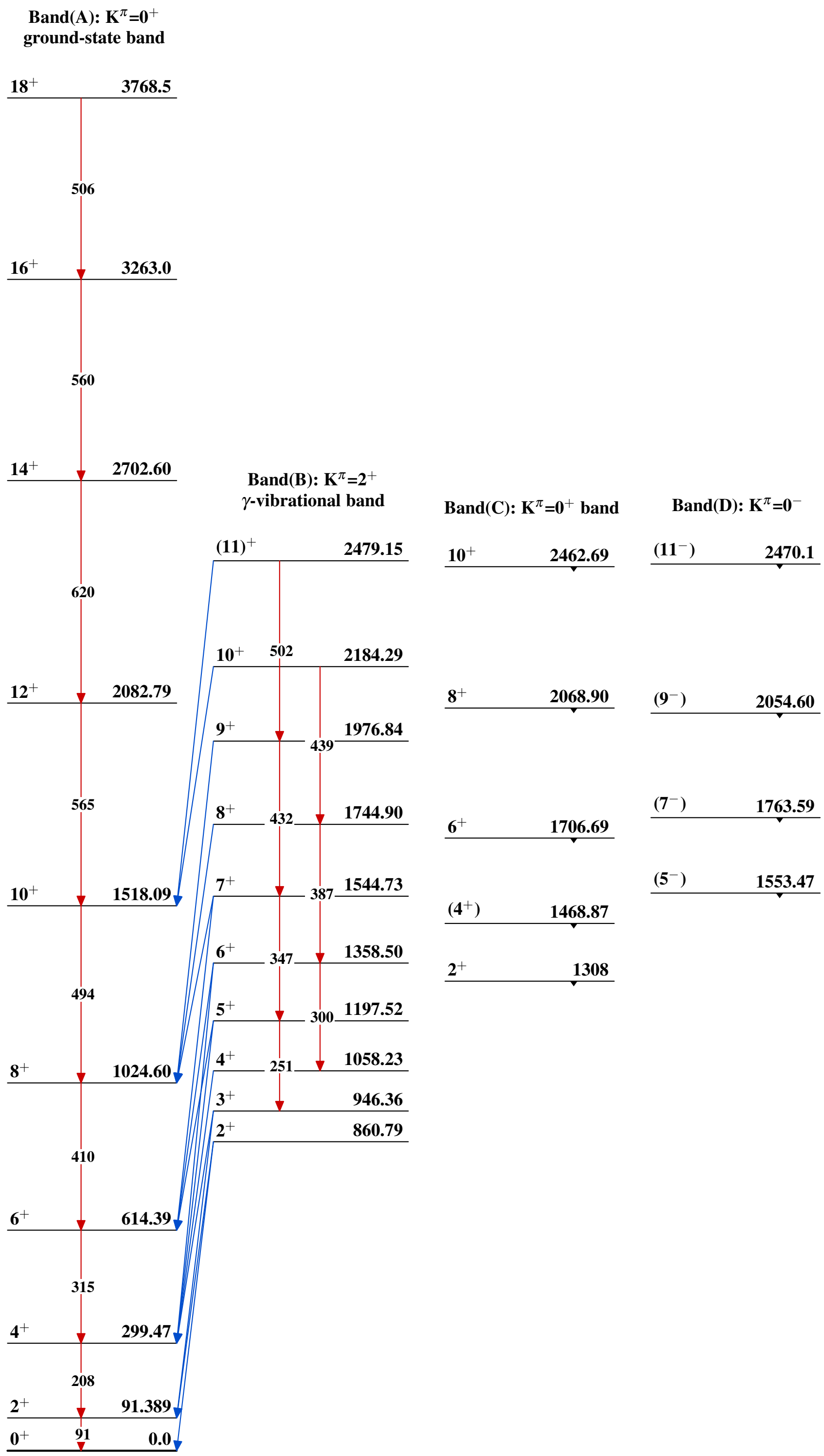
Level Scheme (continued)

Intensities: Relative I_γ



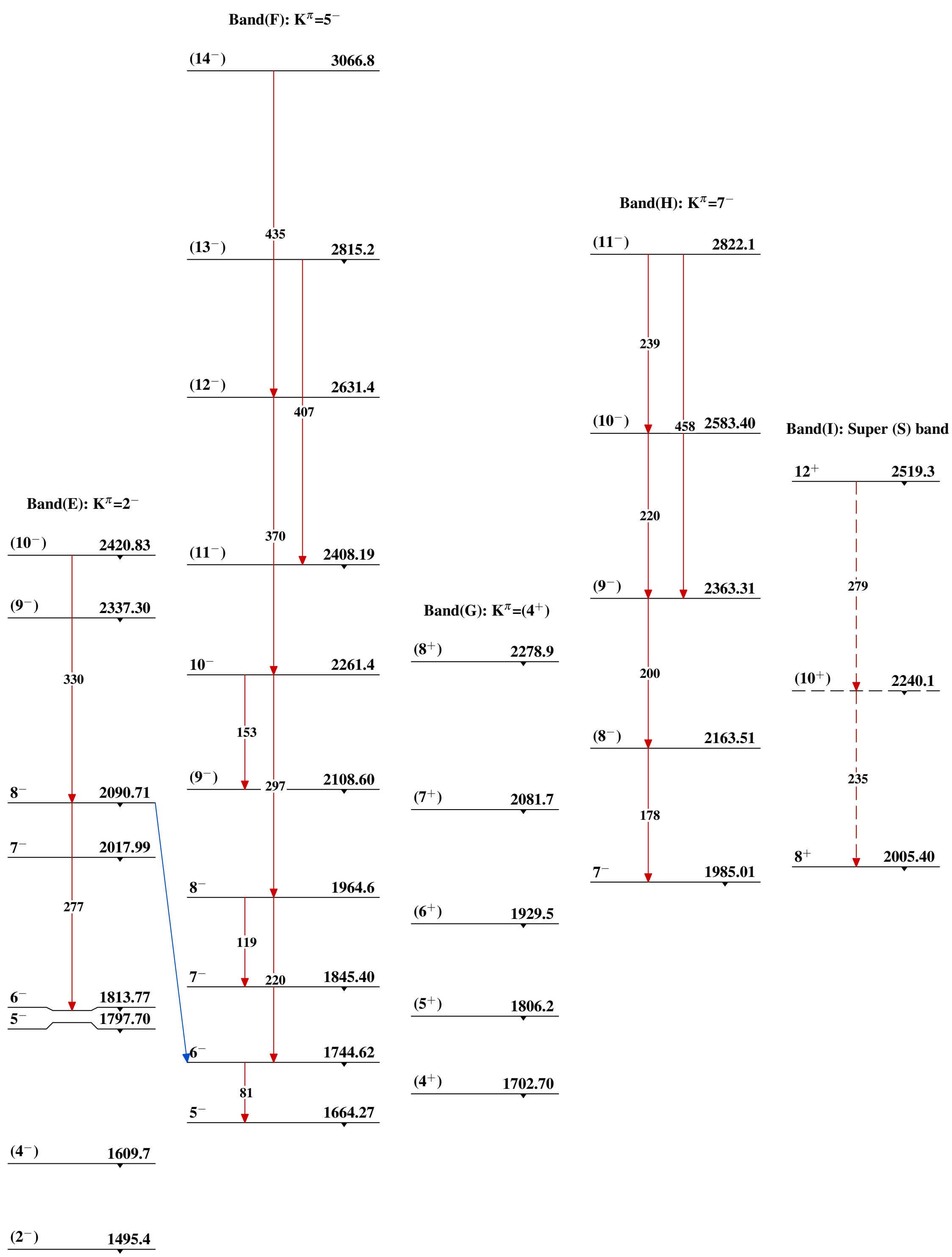
$^{164}_{68}Er_{96}$

^{162}Dy(α,2nγ) 1984Fi07,1976We24



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

^{162}Dy(α,2nγ) 1984Fi07,1976We24 (continued)



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