Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 157 (2012)	31-Dec-2010

Q(β^-)=−2768.5 *20*; S(n)=9.21×10^3 *3*; S(p)=4211 *4*; Q(α)=1496 *10* 2017Wa10
Q(ε)=1838 *3*; S(2n)=16639 *3*; S(2p)=11144 *4* 2017Wa10
Additional information 1.
Additional information 2.
Data are from ^{159}Ho ε decay (1977Bo26,1979Ad08); (α,4nγ) and (^{3}He,3nγ) (1975Fo11,1977Sp04); ^{152}Sm(^{11}B,4nγ) (2000Ma06); ^{159}Ho isomeric decay (1971Ge01); and (^{3}He,d), (α,t), and (p,α) studies.

^{159}Ho Levels

For discussions of configurations for nonrotational states, see 1970So12 and 1973Ga29; 1990Na14 list the bandhead assignments; and 1992Bo45 calculated Nilsson level energies.

Cross Reference (XREF) Flags

A	^{159}Er ε decay	E	^{158}Dy(α,t)
B	^{159}Tb(α,4nγ),(^{3}He,3nγ)	F	^{162}Er(p,α)
C	^{152}Sm(^{11}B,4nγ)	G	^{159}Ho IT decay
D	^{158}Dy(^{3}He,d)		

E(level)[†]	J$^\pi$	T$_{1/2}$	XREF	Comments
0[‡]	7/2$^-$	33.05 min *11*	ABCDEFG	%ε+%β^+=100 μ=+4.28 *3*; Q=+3.19 *13* J$^\pi$: J measured by atomic-beam magnetic resonance (1969Ek01) and laser spectroscopy (1970LiZY,1988NeZZ,1989Al27). π=− from the *au* ε+β^+ decay (log *ft*=4.8) to the 5/2$^-$ level at 309 keV in ^{159}Dy. This *au* ε transition establishes the J$^\pi$ values and configurations of both levels involved. The conf assignment of this level is also supported by the μ value: the alternate Nilsson-assignment, π7/2[404], would give μ of about +2.0. T$_{1/2}$: From 1982Vy02; others: 33 min *3* (1958To32), 35 min *5* (1964Ma10), and 33 min *1* (1966La11). All values are from the ^{159}Ho ε decay. 1958To32 measured activity with Geiger counter and others measured γ(t) with NaI(Tl), Si, or Ge detector. μ: From 1989Ra17 evaluation, and based on an earlier report by the authors of 1989Al27 (where value is 4.27 *3*). See, also, the compilation by 2005St24. Q: From 1989Ra17 evaluation, and based on an earlier report by the authors of 1989Al27 (where the same value is given). See, also, the compilation by 2005St24. E(level): Δ<r^2> results are given by 1987AlZU and 1988NeZZ only in plots. From a table of 1989Al27, δ<r^2>(^{159}Ho−^{165}Ho)=0.350 fm^2 *2*. Deduced by evaluator from table of 1989Al27, δ<r^2>(^{157}Ho−^{159}Ho)=0.140 *3*, δ<r^2>(^{158}Ho−^{159}Ho)=0.104 *5*, δ<r^2>(^{159}Ho−^{160}Ho)=0.013 *3*, and δ<r^2>(^{159}Ho−^{161}Ho)=0.110 *3*, all in fm^2. From an evaluation of data on nuclear rms charge radii, 2004An14 report <r^2>$^{1/2}$=5.168 fm *31*.
97.45[#] *5*	9/2$^-$		ABCDEF	J$^\pi$: From M1 γ to 7/2$^-$ level and expected band structure.
165.91[&] *10*	7/2$^+$		ABCDEFG	J$^\pi$: From E1 γ to 7/2$^-$ level, L=4 in (^{3}He,d), and expected occurrence of the π7/2[404] Nilsson orbital in this region.
205.91[b] *5*	1/2$^+$	8.30 s *8*	ABC G	%IT=100 J$^\pi$: From E3 γ to 7/2$^-$ level, and expected occurrence of the π1/2[411] Nilsson

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{159}Ho Levels (continued)

E(level)[†]	Jπ	XREF	Comments
			state in this region.
			$T_{1/2}$: From 1971Ge01, other: 6.9 s *3* (1966Bo02); both from ^{159}Ho IT decay.
212.81[a] *13*	3/2$^+$	ABCD	Jπ: From assignment as the 3/2$^+$ member of the π1/2[411] band, with the bandhead at 205 keV. L=(2) in (^{3}He,d).
218.65[‡] *24*	11/2$^-$	BC EF	XREF: F(216). Jπ: From L=5 in (p,α), L=(5) in (α,t), and expected band structure.
252.69[c] *18*	5/2$^+$	A CDEF	Jπ: From E1 γ to 7/2$^-$ level and L=2 in (^{3}He,d) and (p,α). Jπ: Calculated configuration (1973Ga29) gives 56% π5/2[402] and 28% π5/2[413].
296.6[@] *4*	9/2$^+$	A C	
312.81[b] *7*	5/2$^+$	A DEF	Jπ: From L=2 in (^{3}He,d) and (p,α) and expected band structure.
341.6[a] *5*	7/2$^+$	BCDE	Jπ: From γ to 3/2$^+$ level and proposed band structure.
364	(7/2$^+$)	DEF	Jπ: From cross-section patterns in (p,α), where it is assigned as the 7/2,π5/2[402] state. However, here this conf is assigned to the 381.7 level.
369.2[#] *3*	13/2$^-$	BC	Jπ: From γ's to 9/2$^-$ and 11/2$^-$ levels and proposed band structure.
381.7[c] *6*	(7/2$^+$)	C	Jπ: From γ to 5/2$^+$ level and band assignment. In the (p,α) study, the 7/2,5/2[402] state is assigned to the 364 level.
382[i]	3/2$^+$,5/2$^+$	DEF	Jπ: From L=2 in (^{3}He,d) and (p,α). Band assignment, from (p,α), implies 5/2$^+$.
424.30[d] *10*	1/2$^-$	A DE	Jπ: From E1 γ to 3/2$^+$ level, γ to 1/2$^+$, L=1 in (^{3}He,d), and intensity pattern for those levels assigned to the π1/2[541] band in (^{3}He,d).
449.8[&] *4*	11/2$^+$	C	Jπ: From γ's to 7/2$^+$ and 9/2$^-$ levels and expected band structure.
464.27[d] *14*	5/2$^-$	A DEF	Jπ: From L=3 in (^{3}He,d) and band assignment.
482[i]	7/2$^+$,9/2$^+$	DEF	Jπ: From L=4 in (p,α) (1982Ha17). Other: L=2,3 in (^{3}He,d) and in (α,t) (1977Pa23). Band assignment, from (p,α), implies 7/2$^+$.
520.50[d] *11*	3/2$^-$	A DE	Jπ: From E1 γ to 1/2$^+$ level, L=1 in (^{3}He,d), and intensity pattern for those levels assigned to the π1/2[541] band in (^{3}He,d).
536.5[‡] *4*	15/2$^-$	BC EF	Jπ: From γ's to 11/2$^-$ and 13/2$^-$ levels and expected band structure.
562		F	
580.97[e] *10*	(3/2)$^-$	A	Jπ: From E2 γ to 7/2$^-$ level and proposed band structure.
589.9[d] *6*	9/2$^-$	BCDEF	Jπ: From L=5 in (α,t) and band structure.
598.7[a] *6*	11/2$^+$	BC	E(level): From ^{152}Sm(^{11}B,4nγ). Other: 595.4, from (α,4nγ),(^{3}He,3nγ). Jπ: From γ to 7/2$^+$ level and proposed band structure.
624.5[@] *5*	13/2$^+$	C	Jπ: From γ's to 9/2$^+$ and 11/2$^-$ levels and band structure.
624.52[f] *10*	5/2$^-$	A	Jπ: From M1 γ to 7/2$^-$ level and log *ft*=5.6 from ^{159}Er g.s. (Jπ=3/2$^-$).
630[i]	(9/2$^+$)	F	Jπ: From intensity pattern and band assignment in (p,α).
649.15[e] *17*	5/2$^-$	A	Jπ: From E1 γ to 3/2$^+$ level and M1 to 7/2$^-$.
671.27[g] *14*	5/2$^+$	A F	Jπ: From L=2 in (p,α) and M1 γ to 7/2$^+$ level.
680[d]	7/2$^-$	DE	Jπ: From L=3 in (^{3}He,d) and expected band structure.
692		DEF	
718[f]	(7/2$^-$)	DEF	Jπ: Assigned (3/2$^+$,5/2$^+$) from L=2 in (^{3}He,d) and (5/2$^-$,7/2$^-$) from L=(3) in (p,α). Band assignment, from (p,α), requires 7/2$^-$.
740.1[#] *4*	17/2$^-$	BC	Jπ: From γ's to 13/2$^-$ and 15/2$^-$ levels and expected band structure.
775.5		B	
781[g]	7/2$^+$	DEF	Jπ: From L=4 in (p,α) and proposed band structure.
805.8[d] *6*	13/2$^-$	BC	Jπ: From γ's to 9/2$^-$ and 11/2$^+$ levels and expected band structure.
815[f]	(9/2$^-$)	F	Jπ: From L=(5) in (p,α) and proposed band structure.
815.01[j] *19*	3/2$^+$	A DE	Jπ: From E1 γ to 1/2$^-$ level, M1 to 5/2$^+$, and L=2 in (^{3}He,d) and (α,t).
819.9[&] *5*	15/2$^+$	C	Jπ: From γ's to 11/2$^+$ and 13/2$^-$ levels. The 775 level has also been proposed as the 15/2,π7/2[404] level.
875[k]	1/2$^+$	DEF	Jπ: From L=0 in (^{3}He,d).
899[f]	9/2$^-$,11/2$^-$	F	Jπ: From L=5 in (p,α). Band assignment, from (p,α), requires 11/2$^-$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{159}Ho Levels (continued)

E(level)[†]	Jπ	XREF	Comments
907		DE	Jπ: Jπ=(1/2⁻) or (3/2⁺,5/2⁺) from L=1,2 in (^{3}He,d).
934[g]	9/2⁺	DEF	Jπ: From L=4 in (^{3}He,d) and proposed band assignment.
945.0[‡] 5	19/2⁻	BC	Jπ: From γ's to 17/2⁻ and 15/2⁻ levels and band structure.
947.4[a] 7	15/2⁺	BC	XREF: B(940). Jπ: From γ's to 13/2⁻ and 11/2⁺ levels and band structure.
966		F	
1031.1[@] 5	17/2⁺	C	Jπ: From γ's to 13/2⁺ and 15/2⁻ levels and band structure.
1042		DE	
1074		F	
1110.0[d] 7	17/2⁻	BC	Jπ: From γ's to 13/2⁻ and 15/2⁺ levels and band structure.
1156[l]	11/2⁻	DE	Jπ: From L=5 in (^{3}He,d), Jπ=9/2⁻,11/2⁻. Population in the single-nucleon-transfer experiments indicates 11/2⁻.
1178	1/2⁺	D F	Jπ: From L=0 in (^{3}He,d).
1198.0[#] 5	21/2⁻	BC	Jπ: From γ's to 17/2⁻ and 19/2⁻ levels and band structure.
1201[h]	1/2⁺	D F	Jπ: From L=0 in (p,α).
1249	(7/2⁺,9/2⁺)	F	Jπ: From L=(4) in (p,α).
1261.7[&] 6	19/2⁺	C	Jπ: From γ's to 15/2⁺ and 17/2⁻ levels and band structure.
1270		DEF	Jπ: From (^{3}He,d), L≥3.
1296		DE	Jπ: L=(2) in (^{3}He,d) for 1296+1310 levels.
1310		DE	Jπ: L=(2) in (^{3}He,d) for 1296+1310 levels.
1319	(3/2⁺,5/2⁺)	F	Jπ: From L=(2) in (p,α). Tentatively assigned (1982Ha17) as the 5/2⁺ member of the π1/2[420] band.
1332	(1/2⁻,3/2)	DEF	Jπ: From L=1 in (^{3}He,d), Jπ=1/2⁻,3/2⁻. Tentatively assigned (1982Ha17) as the 3/2⁺ member of the π1/2[420] band. Level may be a doublet.
1355.4 6	(5/2)⁺	A	Jπ: From M1 γ to 7/2⁺ level, possible γ to (3/2⁻), and log *ft*=7.2 from the ^{159}Er g.s. (Jπ=3/2⁻).
1367.2		B	See the comment on this level in the (α,4nγ),(^{3}He,3nγ) data set. Jπ: γ to 17/2⁻. Proposed as (17/2⁺) in (α,4nγ),(^{3}He,3nγ).
1375.4[a] 8	19/2⁺	BC	Jπ: From γ to 15/2⁺ level and band structure.
1398.45 23	(5/2⁻,7/2⁻)	A	Jπ: From M1,E2 γ to (3/2⁻) level and (E1) to 7/2⁺.
1404		DE	
1428	3/2⁺,5/2⁺	DE	Jπ: From L=2 in (^{3}He,d).
1431.3[‡] 5	23/2⁻	BC	Jπ: From γ's to 19/2⁻ and 21/2⁻ levels and band structure.
1450		DE	
1468.7 4	3/2⁻,5/2⁻	A	Jπ: From M1(+E2) γ to 5/2⁻ level and log *ft*=6.6 from the ^{159}Er g.s. (Jπ=3/2⁻). Jπ: Assigned as the π3/2[541] bandhead by 1990Na14.
1480		DE	Jπ: From (^{3}He,d), L≤2.
1493.0 5	3/2⁻,5/2⁻	A	Jπ: From M1 γ to 3/2⁻ level and γ to 5/2⁺. Jπ: Assigned as the π3/2[532] bandhead by 1990Na14.
1495.7 5	(5/2⁻,7/2⁻)	A DE	XREF: D(1502). Jπ: From (E1) γ to 7/2⁺ level and L=2,3 in (^{3}He,d) and (α,t).
1498.8[d] 9	21/2⁻	C	Jπ: From γ to 17/2⁻ level and band structure.
1503.2[@] 6	21/2⁺	C	Jπ: From γ's to 17/2⁺ and 19/2⁻ levels and band structure.
1521		DE	Jπ: In (^{3}He,d), L=2,3.
1552		F	Jπ: In (p,α), L=(4,5).
1558.3 6	5/2(⁻)	A	Jπ: From (E1) γ to 7/2⁺ and log *ft*=6.6 from the ^{159}Er g.s. (Jπ=3/2⁻).
1588	1/2,3/2⁻	DE	Jπ: From L < 2 in (^{3}He,d).
1617		D	
1636		D	
1680.0 3	3/2⁻,5/2⁻	A	Jπ: From γ's to 1/2⁻ and 7/2⁻ levels.
1690.1 3	5/2⁺	A DE	Jπ: From M1 γ to 7/2⁺ level, log *ft*=6.6 from the ^{159}Er g.s. (Jπ=3/2⁻), and L≤2 in (^{3}He,d).
1726.8[#] 6	25/2⁻	BC	Jπ: From γ's to 21/2⁻ and 23/2⁻ levels and band structure.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{159}Ho Levels (continued)

E(level)[†]	Jπ	XREF	Comments
1752	1/2+	DE	Jπ: From L=0 in (=3He,d).
1758.7[&] 7	23/2+	C	Jπ: From γ's to 19/2+ and 21/2− levels and band structure.
1779.8 3	3/2−,5/2−	A	Jπ: From E2 γ to 1/2− level.
1789		D	
1804	(7/2+,9/2+)	DE	Jπ: From L=(4) in (^{3}He,d).
1822		DE	
1839		E	
1855		D	Jπ: In (^{3}He,d) L=2,3.
1863		E	
1866.2[a] 9	23/2+	BC	Jπ: From γ to 19/2+ level and band structure.
1891.2 4	3/2−,5/2+	A	Jπ: From γ's to 1/2+ and 7/2− levels and log *ft*=6.1 from the ^{159}Er g.s. (Jπ=3/2−).
1901.7 9	(3/2−,5/2−)	A	Jπ: From (E1) γ to 5/2+ level and log *ft*=6.8 from the ^{159}Er g.s. (Jπ=3/2−).
1967.2[d] 10	25/2−	BC	Jπ: From γ to 21/2− level and band structure.
1982.0[‡] 6	27/2−	BC	Jπ: From γ's to 23/2− and 25/2− levels and band structure.
2001.9 6	(5/2+)	A	Jπ: From (E1) γ to 7/2− level and log *ft*=6.3 from the ^{159}Er g.s. (Jπ=3/2−).
2022.0[@] 9	25/2+	C	Jπ: From γ to 21/2+ level and band structure.
2091.1 6	(3/2−,5/2−)	A	Jπ: From (E1) γ to 5/2+ level and log *ft*=6.0 from the ^{159}Er g.s. (Jπ=3/2−).
2293.9[&] 9	27/2+	C	Jπ: From γ to 23/2+ level and band structure.
2305.2[#] 7	29/2−	BC	Jπ: From γ's to 25/2− and 27/2− levels and band structure.
2402.8[a] 14	27/2+	BC	Jπ: From γ to 23/2− level and band structure.
2508.6[d] 12	29/2−	BC	Jπ: From γ to 25/2− level and band structure.
2569.7[@] 13	29/2+	C	Jπ: From γ to 25/2+ level and band structure.
2574.5[‡] 7	31/2−	BC	Jπ: From γ's to 27/2− and 29/2− levels and band structure.
2849.3[&] 14	(31/2+)	C	Jπ: From γ to 27/2+ level and band structure.
2893.1[#] 8	33/2−	BC	Jπ: From γ to 29/2− level and band structure.
2978.2[a] 17	(31/2+)	C	Jπ: From γ to 27/2+ level and band structure.
3112.7[d] 13	33/2−	C	Jπ: From γ to 29/2− level and band structure.
3128.6[@] 17	(33/2+)	C	Jπ: From γ to 29/2+ level and band structure.
3160.6[‡] 8	35/2−	BC	Jπ: From γ's to 31/2− and 33/2− levels and band structure.
3419.3[&] 17	(35/2+)	C	Jπ: From γ to (31/2+) level and band structure.
3437.1[#] 9	37/2−	C	Jπ: From γ's to 33/2− and 35/2− levels and band structure.
3521.0[a] 20	(35/2+)	C	Jπ: From γ to (31/2+) level and band structure.
3708.5[‡] 10	39/2−	BC	Jπ: From γ's to 35/2− and 37/2− levels and band structure.
3771.4[d] 17	37/2−	C	Jπ: From γ to 33/2− level and band structure.
3992.5[#] 11	41/2−	C	Jπ: From γ's to 37/2− and (39/2−) levels and band structure.
4090.5[a] 22	(39/2+)	C	Jπ: From γ to (35/2+) level and band structure.
4294.7[‡] 12	(43/2−)	C	Jπ: From γ's to (39/2−) and 41/2− levels and band structure.
4464.6[d] 20	(41/2−)	C	Jπ: From γ to 37/2− level and band structure.
4620.6[#] 12	(45/2−)	C	Jπ: From γ's to 41/2− and (43/2−) levels and band structure.
4955.0[‡] 13	(47/2−)	C	Jπ: From γ's to (43/2−) and (45/2−) levels and band structure.
5174.4[d] 22	(45/2−)	C	Jπ: From γ to (41/2−) level and band structure.
5331.0[#] 16	(49/2−)	C	Jπ: From γ to (45/2−) level and band structure.

[†] From least-squares fit to γ energies or an average of reaction level energies.
[‡] Band(A): Kπ=7/2−, π7/2[523] band, α=−1/2 branch. α=10.7 keV, β=+9.5 eV, from the energies of the 7/2− through 11/2− levels.
[#] Band(a): Kπ=7/2−, π7/2[523] band, α=+1/2 branch. See the comment on the α=−1/2 branch.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{159}Ho Levels (continued)

[@] Band(B): $K^{\pi}=7/2^+$, $\pi 7/2[404]$ band, $\alpha=+1/2$ branch. $\alpha=15.0$ keV, $\beta=-30$ eV, from the energies of the $7/2^+$ through $11/2^+$ levels.
[&] Band(b): $K^{\pi}=7/2^+$, $\pi 7/2[404]$ band, $\alpha=-1/2$ branch. See the comment on the $\alpha=+1/2$ branch.
[a] Band(C): $K^{\pi}=1/2^+$, $\pi 1/2[411]$ band, $\alpha=-1/2$ branch. The rotational level-energy expression does not provide a good description of the level energies of this band.
[b] Band(c): $K^{\pi}=1/2^+$, $\pi 1/2[411]$ band, $\alpha=+1/2$ branch. See the comment on the $\alpha=-1/2$ branch.
[c] Band(D): $K^{\pi}=5/2^+$, $\pi 5/2[402]$ band. $\alpha=18.4$ keV, from the energies of the $5/2^+$ and $7/2^+$ levels.
[d] Band(E): $K^{\pi}=1/2^-$, $\pi 1/2[541]$ band. $\alpha=10.9$ keV, $\beta=-63$ eV, a=+2.0, from the energies of the $1/2^-$ through 7/2-levels. These values do not give a good prediction of the energy of the $9/2^-$ band member.
[e] Band(F): $K^{\pi}=3/2^-$,K−2 γ-vibr band. Built on the $\pi 7/2[523]$ g.s. For J≥5/2, mixed with $\pi 5/2[532]$. $\alpha=13.6$ keV, from the energies of the $3/2^-$ and $5/2^-$ levels.
[f] Band(G): $K^{\pi}=5/2^-$, $\pi 5/2[532]$ band. Contains an admixture of the K-2 γ-vibrational band built on the $\pi 7/2[523]$ g.s. $\alpha=15.3$ keV, $\beta=-0.161$ keV, from the energies of the $5/2^-$ through $9/2^-$ levels. Note that this B value is quite large.
[g] Band(H): $K^{\pi}=5/2^+$, $\pi 5/2[413]$ band. $\alpha=14.7$ keV, $\beta=+83$ eV, from the energies of the $5/2^+$ through $9/2^+$ levels. The value of B seems rather large.
[h] Band(I): $K^{\pi}=1/2^+$, $\pi 1/2[420]$ bandhead. If the proposed $3/2^+$ and $5/2^+$ band members are correctly assigned, then $\alpha=20.5$ keV and a=+1.1 are deduced for the band parameters.
[i] Band(J): Suggested $\pi 3/2[411]$ band.
[j] Band(K): $K^{\pi}=3/2^+$, K-2 γ-vibr bandhead. probable bandhead of the K-2 γ vibration built on $\pi 7/2[404]$, with an admixture of $\pi 3/2[402]$.
[k] Band(L): $K^{\pi}=1/2^+$, K-2 γ-vibr bandhead. probable bandhead of the K-2 γ vibration built on $\pi 5/2[402]$, with an admixture of $\pi 1/2[400]$.
[l] Band(M): $\pi 9/2[514]$ band member.

Adopted Levels, Gammas (continued)

γ(^{159}Ho)

E_i(level)	J_i^π	E_γ †	I_γ	E_f	J_f^π	Mult.‡	δ	α#	$I_{(\gamma+ce)}$	Comments
97.45	9/2⁻	97.45 *5*	100	0	7/2⁻	M1(+E2)	≤1.7	2.92 *12*		
165.91	7/2⁺	165.9 *3*	100	0	7/2⁻	E1		0.0823		
205.91	1/2⁺	40.0 *1*	6.8×10^{-4} *8*	165.91	7/2⁺	[M3]		2.10×10^{4} *5*	14.2 *9*	B(M3)(W.u.)=0.153 *19* E_γ: a transition of this energy may also depopulate the 464 level. I_γ: Calculated from Iγ(1+α) and α. $I_{(\gamma+ce)}$: From Iγ(1+α)/Iγ(206)=0.142 *9*, as observed in the isomeric decay.
		205.92 *5*	100 *10*	0	7/2⁻	E3		1.363		B(E3)(W.u.)=0.0025 *4*
212.81	3/2⁺	(6.77)		205.91	1/2⁺					E_γ: From level energy difference; γ not observed.
218.65	11/2⁻	121.3 *3*	100 *6*	97.45	9/2⁻					
		217.8 *7*	16.2 *28*	0	7/2⁻					I_γ: From ^{152}Sm(^{11}B,4nγ). Other: 7.8 from (α,4nγ),(^{3}He,3nγ).
252.69	5/2⁺	252.4 *3*	100	0	7/2⁻	E1		0.0276		
296.6	9/2⁺	130.7 *6*	75 *38*	165.91	7/2⁺					
		296.6 *7*	100 *25*	0	7/2⁻					
312.81	5/2⁺	106.90 *5*	100	205.91	1/2⁺	E2		2.20		Mult.: Measured data are consistent with M1,E2, but J^π's require E2.
341.6	7/2⁺	88.7 *6*	100 *18*	252.69	5/2⁺					
		129.1 *6*	<30	212.81	3/2⁺					
369.2	13/2⁻	150.5 *3*	100 *4*	218.65	11/2⁻					
		271.8 *4*	35 *6*	97.45	9/2⁻					
381.7	(7/2⁺)	129.0 *6*	100	252.69	5/2⁺					
424.30	1/2⁻	211.48 *10*	100 *20*	212.81	3/2⁺	E1		0.0435		
		218.4 *1*	≈80	205.91	1/2⁺	[E1]		0.0400		
449.8	11/2⁺	153.2 *6*	70 *30*	296.6	9/2⁺					
		283.9 *7*	80 *30*	165.91	7/2⁺					
		352.3 *8*	100 *20*	97.45	9/2⁻					
464.27	5/2⁻	40.0 *1*		424.30	1/2⁻					
520.50	3/2⁻	307.7 *3*	29 *6*	212.81	3/2⁺	[E1]		0.01677		
		314.6 *1*	100 *20*	205.91	1/2⁺	E1		0.01588		
536.5	15/2⁻	167.3 *3*	100 *6*	369.2	13/2⁻					
		317.8 *5*	62 *7*	218.65	11/2⁻					
580.97	(3/2)⁻	581.0 *1*	100	0	7/2⁻	E2		0.01081		δ: δ(E2/M1)≥2.4. J^π's require pure E2.
589.9	9/2⁻	208.1 *7*	83 *28*	381.7	(7/2⁺)					
		248.4 *7*	100 *11*	341.6	7/2⁺					
598.7	11/2⁺	257.1 *4*	100	341.6	7/2⁺					
624.5	13/2⁺	174.8 *6*	46 *23*	449.8	11/2⁺					
		328.0 *8*	92 *31*	296.6	9/2⁺					
		405.8 *8*	100 *38*	218.65	11/2⁻					
624.52	5/2⁻	624.5 *1*	100	0	7/2⁻	M1		0.0183		
649.15	5/2⁻	436.4	1.1 *3*	212.81	3/2⁺	E1		0.00729		
		551.7 *2*	10 *2*	97.45	9/2⁻	E2		0.01229		δ: Measured data imply E2(+M1); J^π's require E2.

$^{159}_{67}Ho_{92}$-6

Adopted Levels, Gammas (continued)

γ(^{159}Ho) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ	E_f	J_f^π	Mult.[‡]	δ	α[#]	Comments
649.15	5/2⁻	649.1 *3*	100 *10*	0	7/2⁻	M1(+E2)		0.012 *5*	
671.27	5/2⁺	373.6[a] *3*		296.6	9/2⁺				
		418.2 *3*	10 *3*	252.69	5/2⁺	M1(+E2)		0.038 *13*	
		505.4 *1*	100 *22*	165.91	7/2⁺	M1(+E2)		0.023 *8*	
740.1	17/2⁻	203.6 *4*	100 *12*	536.5	15/2⁻				
		370.9 *5*	89 *6*	369.2	13/2⁻				
775.5		239[a]	14	536.5	15/2⁻				
		406.3	100	369.2	13/2⁻				
805.8	13/2⁻	207.2 *7*	31 *13*	598.7	11/2⁺				
		215.9 *4*	100 *10*	589.9	9/2⁻				
815.01	3/2⁺	165.5	<77	649.15	5/2⁻				
		390.6 *2*	100 *23*	424.30	1/2⁻	E1		0.00943	
		562.6 *3*	77 *23*	252.69	5/2⁺	M1(+E2)	≤1.9	0.019 *5*	
819.9	15/2⁺	195.4 *6*	<40	624.5	13/2⁺				
		370.2 *8*	100 *27*	449.8	11/2⁺				
		450.7 *8*	87 *13*	369.2	13/2⁻				
945.0	19/2⁻	204.8 *4*	77 *13*	740.1	17/2⁻				
		408.4 *5*	100 *12*	536.5	15/2⁻				
947.4	15/2⁺	141.4 *6*	19 *8*	805.8	13/2⁻				
		348.6 *5*	100 *8*	598.7	11/2⁺				
1031.1	17/2⁺	211.2 *7*	<27	819.9	15/2⁺				
		406.6 *8*	100 *36*	624.5	13/2⁺				
		494.6 *8*	50 *23*	536.5	15/2⁻				
1110.0	17/2⁻	162.3 *6*	10 *4*	947.4	15/2⁺				
		304.5 *5*	100 *8*	805.8	13/2⁻				
1198.0	21/2⁻	253.1 *4*	67 *6*	945.0	19/2⁻				
		457.9 *5*	100 *6*	740.1	17/2⁻				
1261.7	19/2⁺	230.6 *7*	<20	1031.1	17/2⁺				
		441.8 *8*	100 *8*	819.9	15/2⁺				
		521.6 *10*	40 *12*	740.1	17/2⁻				
1355.4	(5/2)⁺	774.2[a] *3*	86 *27*	580.97	(3/2)⁻				
		1189.5 *6*	100 *30*	165.91	7/2⁺	M1		0.00377	
1367.2		257.2	100	1110.0	17/2⁻				
1375.4	19/2⁺	265.6 *7*	<12	1110.0	17/2⁻				
		427.9 *5*	100 *9*	947.4	15/2⁺				
1398.45	(5/2⁻,7/2⁻)	817.6 *3*	48 *14*	580.97	(3/2)⁻	M1,E2		0.0071 *23*	
		1232.4 *3*	100 *19*	165.91	7/2⁺	(E1)			
1431.3	23/2⁻	233.3 *4*	46 *4*	1198.0	21/2⁻				
		486.4 *3*	100 *7*	945.0	19/2⁻				

$^{159}_{67}Ho_{92}$-7

Adopted Levels, Gammas (continued)

γ(^{159}Ho) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ	E_f	J_f^π	Mult.[‡]	α[#]	Comments
1468.7	3/2⁻,5/2⁻	844.0 *4*	100 *19*	624.52	5/2⁻	M1(+E2)	0.0078 *9*	
		888.1 *5*	71 *14*	580.97	(3/2)⁻			
		947.3[a]	21	520.50	3/2⁻	M1,E2	0.0051 *15*	
		1255.7[@a] *7*		212.81	3/2⁺			I_γ: < 25, which is total Iγ for both placements.
1493.0	3/2⁻,5/2⁻	973.0 *6*	25 *7*	520.50	3/2⁻	M1	0.00612	
		1239.9 *6*	100 *22*	252.69	5/2⁺	(E1)	0.00089	
1495.7	(5/2⁻,7/2⁻)	1329.5 *7*	100 *30*	165.91	7/2⁺	(E1)		
		1496.0 *7*	47 *14*	0	7/2⁻			
1498.8	21/2⁻	388.8 *5*	100	1110.0	17/2⁻			
1503.2	21/2⁺	241.5 *7*	<15	1261.7	19/2⁺			
		472.1 *8*	100 *19*	1031.1	17/2⁺			
		558.3 *10*	35 *19*	945.0	19/2⁻			
1558.3	5/2(⁻)	1392.7 *7*	100 *18*	165.91	7/2⁺	(E1)		
		1557.9 *8*	82 *18*	0	7/2⁻	M1,E2	0.0018 *4*	
1680.0	3/2⁻,5/2⁻	1255.7[@] *7*	24 *7*	424.30	1/2⁻			I_γ: a portion of this Iγ may be from the 1468 level.
		1427.2 *6*	100 *22*	252.69	5/2⁺			
		1680.0 *3*	19 *6*	0	7/2⁻			
1690.1	5/2⁺	1226.1 *3*	100 *30*	464.27	5/2⁻			
		1477.5 *8*	66 *19*	212.81	3/2⁺			
		1522.8 *7*	50 *15*	165.91	7/2⁺	M1	0.00219	
1726.8	25/2⁻	295.5 *4*	52 *4*	1431.3	23/2⁻			
		528.8 *6*	100 *9*	1198.0	21/2⁻			
1758.7	23/2⁺	255.5 *7*		1503.2	21/2⁺			
		497.0 *8*	100 *41*	1261.7	19/2⁺			
		560.7 *10*	<24	1198.0	21/2⁻			
1779.8	3/2⁻,5/2⁻	1198.8 *5*	86 *17*	580.97	(3/2)⁻	M1	0.00370	
		1316.2	16 *5*	464.27	5/2⁻			
		1355.3 *6*	100 *21*	424.30	1/2⁻	E2	0.00177	
		1467.6 *8*	27 *8*	312.81	5/2⁺			
		1566.3 *8*	28 *8*	212.81	3/2⁺			
1866.2	23/2⁺	490.8 *5*	100	1375.4	19/2⁺			
1891.2	3/2⁻,5/2⁺	1678.8 *7*	7.1 *23*	212.81	3/2⁺			
		1685.0 *7*	12 *4*	205.91	1/2⁺			
		1891.0 *7*	100 *19*	0	7/2⁻			
1901.7	(3/2⁻,5/2⁻)	1230.4 *8*	100	671.27	5/2⁺	(E1)		
1967.2	25/2⁻	468.4 *5*	100	1498.8	21/2⁻			
1982.0	27/2⁻	255.2 *4*	35 *4*	1726.8	25/2⁻			
		550.7 *3*	100 *12*	1431.3	23/2⁻			
2001.9	(5/2⁺)	1749.5 *8*	12 *4*	252.69	5/2⁺			
		2001.6 *7*	100 *21*	0	7/2⁻	(E1)		
2022.0	25/2⁺	518.8 *6*	100	1503.2	21/2⁺			
2091.1	(3/2⁻,5/2⁻)	1838.3 *7*	100 *19*	252.69	5/2⁺	(E1)		
		2091.2 *8*	23 *7*	0	7/2⁻			

Adopted Levels, Gammas (continued)

γ(^{159}Ho) (continued)

E_i(level)	J_i^π	E_γ [†]	I_γ	E_f	J_f^π	Comments
2293.9	$27/2^+$	535.2 *6*	100	1758.7	$23/2^+$	
2305.2	$29/2^-$	323.2 *8*	40 *4*	1982.0	$27/2^-$	
		578.4 *6*	100 *11*	1726.8	$25/2^-$	
2402.8	$27/2^+$	536.6 *10*	100	1866.2	$23/2^+$	
2508.6	$29/2^-$	541.4 *6*	100	1967.2	$25/2^-$	
2569.7	$29/2^+$	547.7 *10*	100	2022.0	$25/2^+$	
2574.5	$31/2^-$	269.3 *7*	33 *11*	2305.2	$29/2^-$	I_γ: From ^{152}Sm(^{11}B,4nγ). Other: 74 (α,4nγ),(^{3}He,3nγ).
		592.5 *4*	100 *13*	1982.0	$27/2^-$	
2849.3	$(31/2^+)$	555.4 *10*	100	2293.9	$27/2^+$	
2893.1	$33/2^-$	318.6[&a] *8*	38[&] *12*	2574.5	$31/2^-$	
		587.9 *6*	100 *31*	2305.2	$29/2^-$	
2978.2	$(31/2^+)$	575.4 *10*	100	2402.8	$27/2^+$	
3112.7	$33/2^-$	604.1 *6*	100	2508.6	$29/2^-$	
3128.6	$(33/2^+)$	558.9 *10*	100	2569.7	$29/2^+$	
3160.6	$35/2^-$	267.5 *7*	51 *14*	2893.1	$33/2^-$	
		586.1 *6*	100 *35*	2574.5	$31/2^-$	
3419.3	$(35/2^+)$	570.0 *10*	100	2849.3	$(31/2^+)$	
3437.1	$37/2^-$	276.5 *7*	69 *9*	3160.6	$35/2^-$	
		544.0 *6*	100 *23*	2893.1	$33/2^-$	
3521.0	$(35/2^+)$	542.8 *10*	100	2978.2	$(31/2^+)$	
3708.5	$39/2^-$	271.4 *7*	76 *32*	3437.1	$37/2^-$	
		547.9 *10*	100 *32*	3160.6	$35/2^-$	
3771.4	$37/2^-$	658.7 *10*	100	3112.7	$33/2^-$	
3992.5	$41/2^-$	284.0 *7*	61 *9*	3708.5	$39/2^-$	
		555.4 *10*	100 *17*	3437.1	$37/2^-$	
4090.5	$(39/2^+)$	569.5 *10*	100	3521.0	$(35/2^+)$	
4294.7	$(43/2^-)$	302.3 *8*	73 *27*	3992.5	$41/2^-$	
		586.3 *10*	100 *40*	3708.5	$39/2^-$	
4464.6	$(41/2^-)$	693.2 *10*	100	3771.4	$37/2^-$	
4620.6	$(45/2^-)$	325.9 *8*	<58	4294.7	$(43/2^-)$	
		628.0 *10*	100 *33*	3992.5	$41/2^-$	
4955.0	$(47/2^-)$	334.4 *8*	<50	4620.6	$(45/2^-)$	
		660.3 *10*	100 *40*	4294.7	$(43/2^-)$	
5174.4	$(45/2^-)$	709.8 *10*	100	4464.6	$(41/2^-)$	
5331.0	$(49/2^-)$	376.1[a] *8*		4955.0	$(47/2^-)$	
		710.5 *10*		4620.6	$(45/2^-)$	

[†] Unplaced γ′s are not listed here; see ^{159}Er ε decay.

[‡] Primarily from α_K(exp) and a few α_L(exp), from ^{159}Er ε decay (1977Bo26,1979Ad08), plus two from the ^{159}Ho isomeric decay (8.3 s). See (α,4nγ),(^{3}He,3nγ) for many D and Q assignments by the evaluator from γ(θ) results; these have not been adopted because they were not assigned by the

$^{159}_{67}Ho_{92}$-9

Adopted Levels, Gammas (continued)

$\gamma(^{159}Ho)$ (continued)

authors.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[@] Multiply placed.

[&] Multiply placed with undivided intensity.

[a] Placement of transition in the level scheme is uncertain.

$^{159}_{67}Ho_{92}$-10

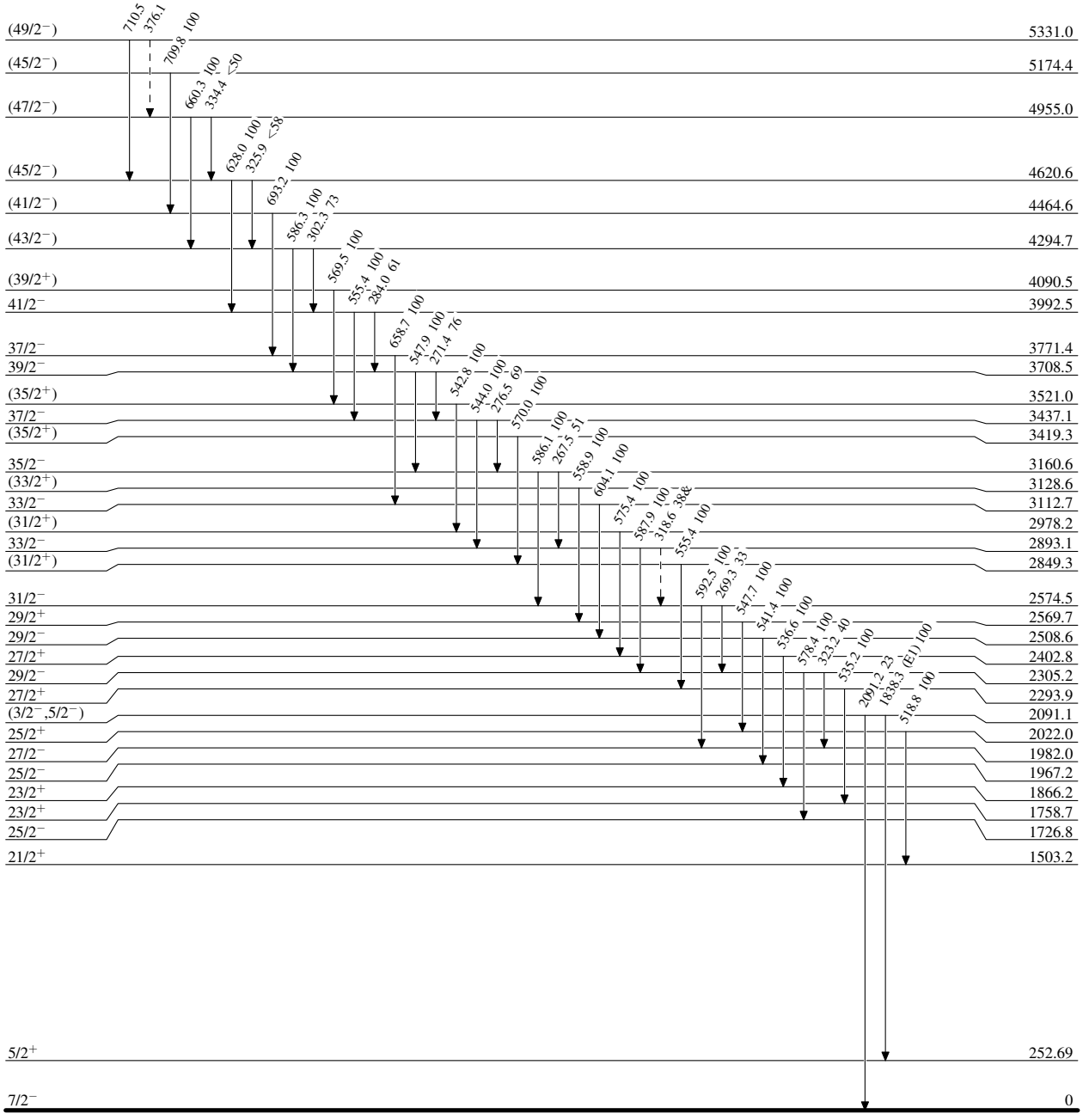
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

– – – – – – ► γ Decay (Uncertain)

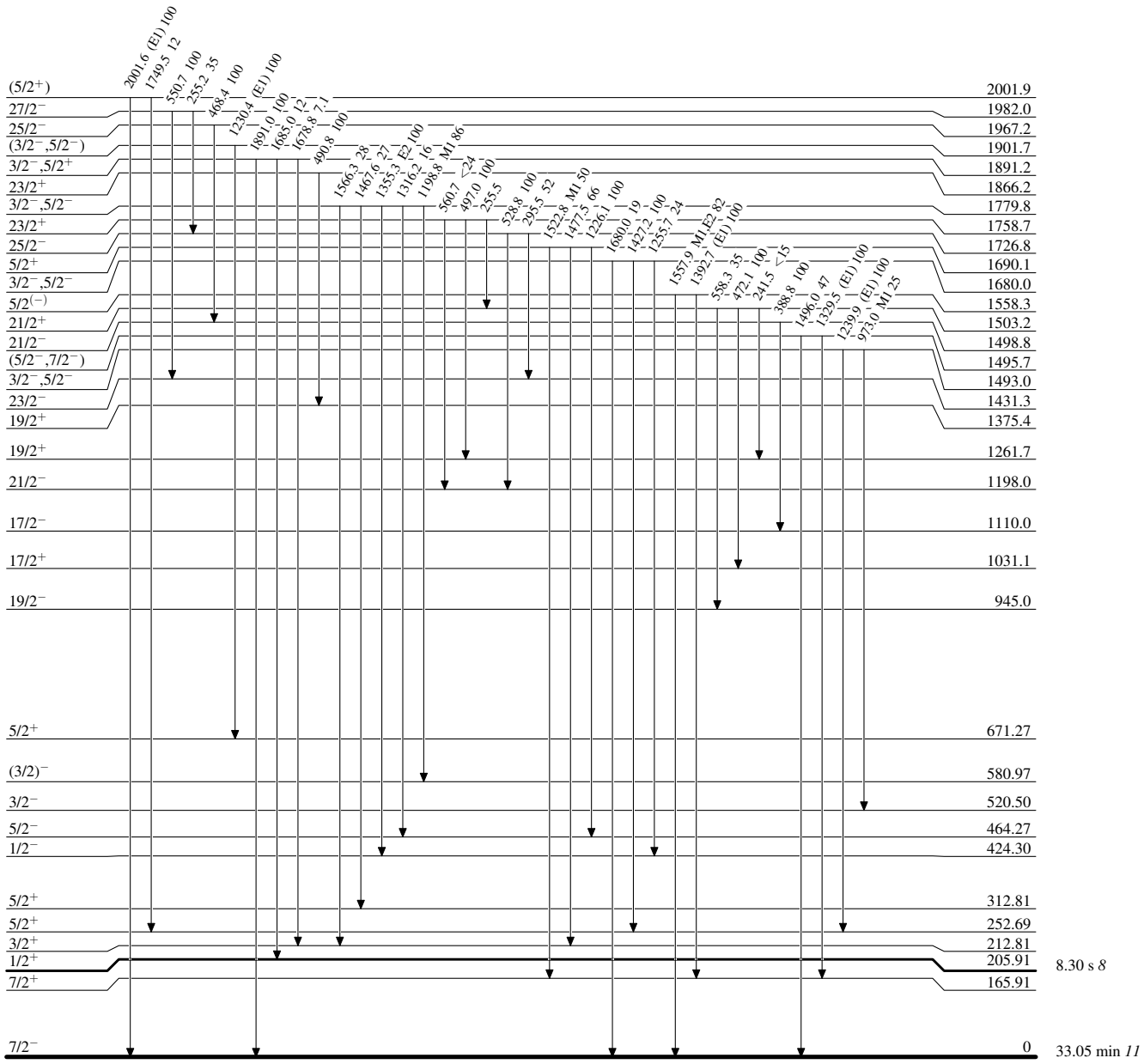


$^{159}_{67}Ho_{92}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



$^{159}_{67}Ho_{92}$

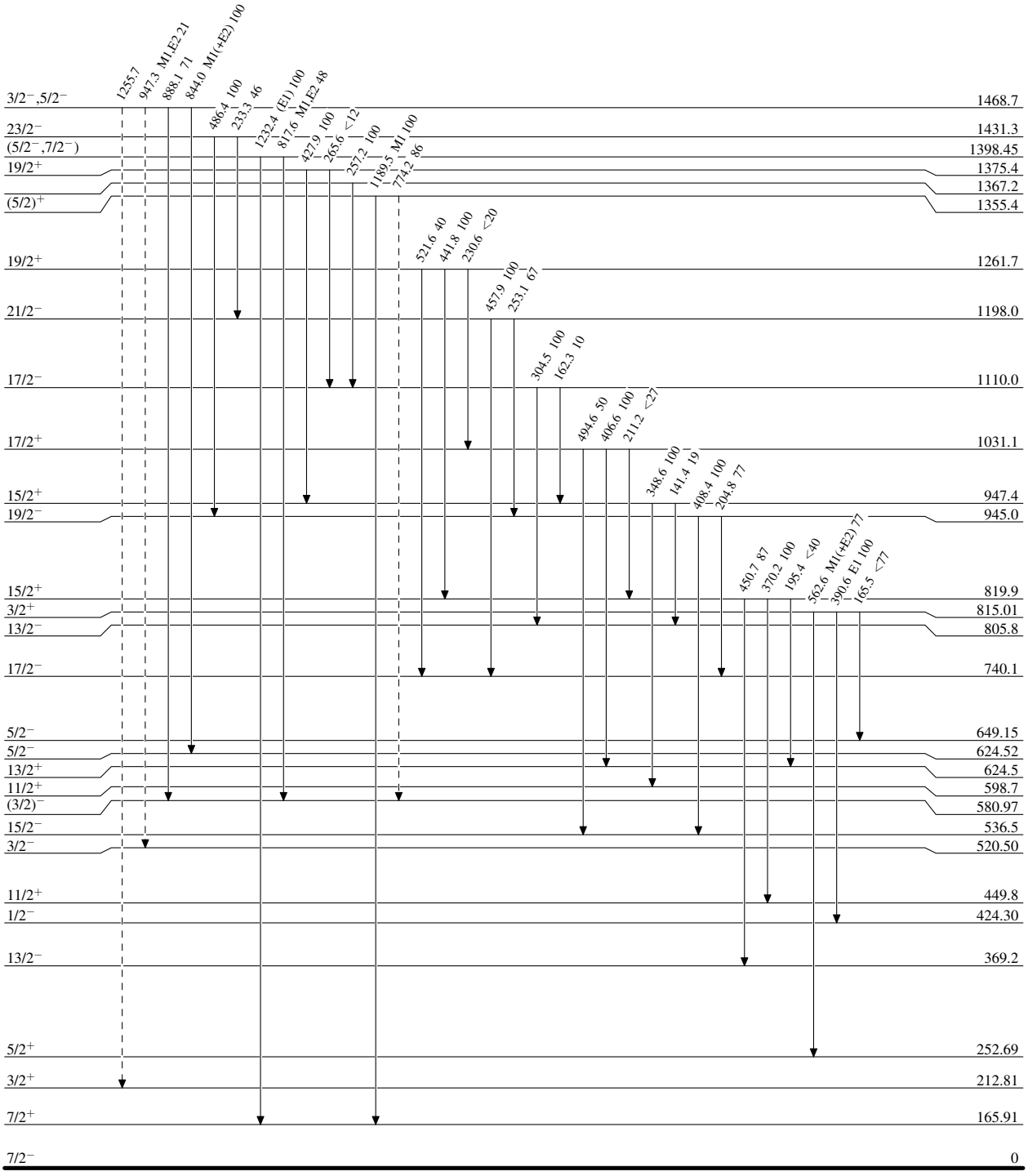
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

– – – – – – ► γ Decay (Uncertain)



$^{159}_{67}Ho_{92}$

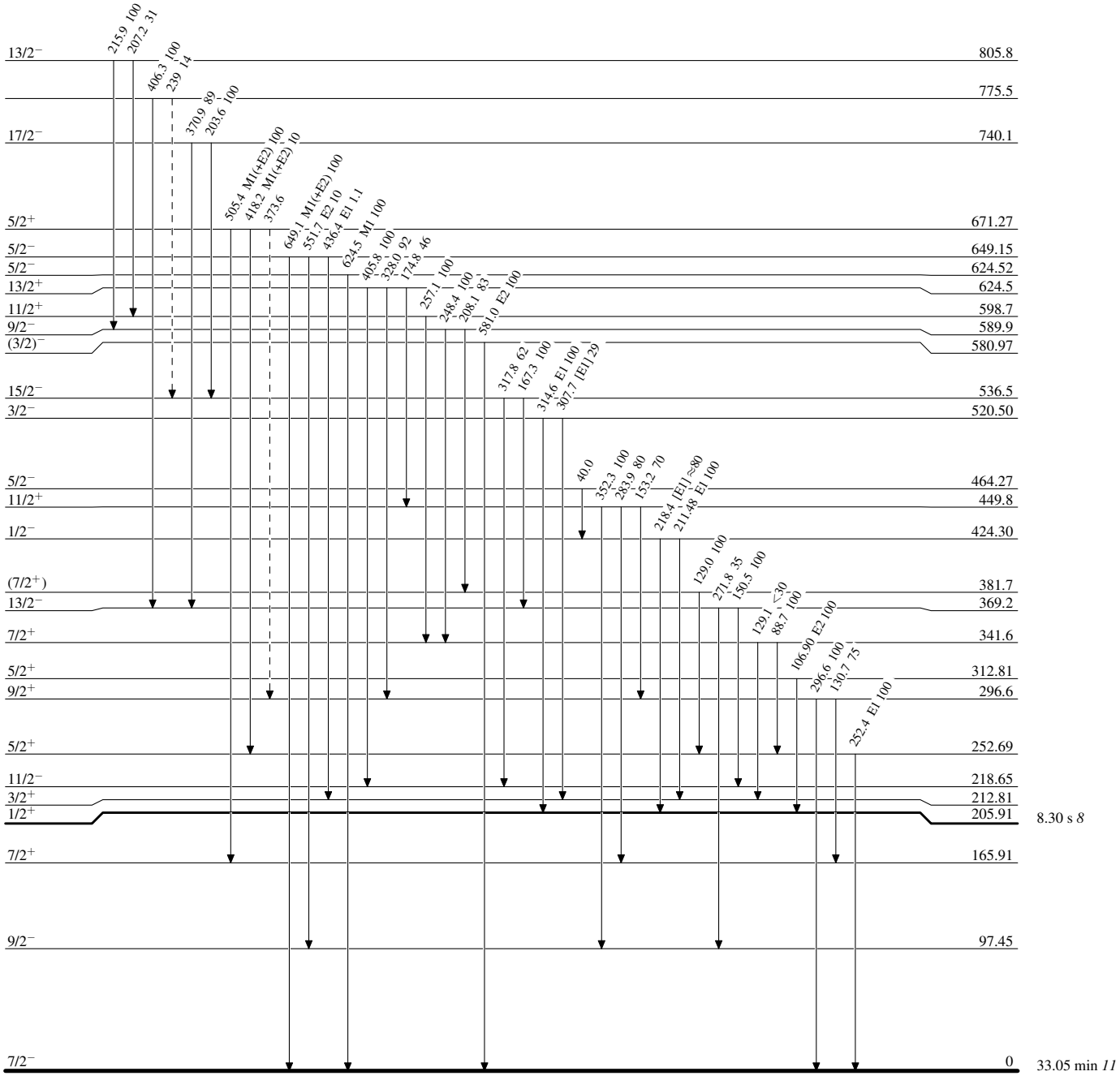
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

– – – – – – ► γ Decay (Uncertain)

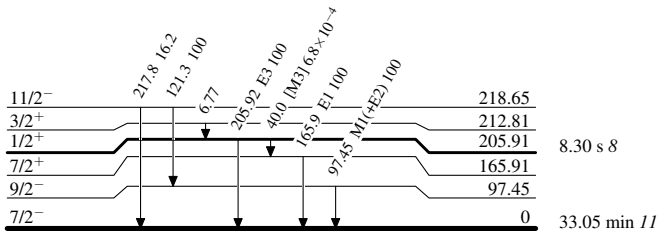


$^{159}_{67}Ho_{92}$

Adopted Levels, Gammas

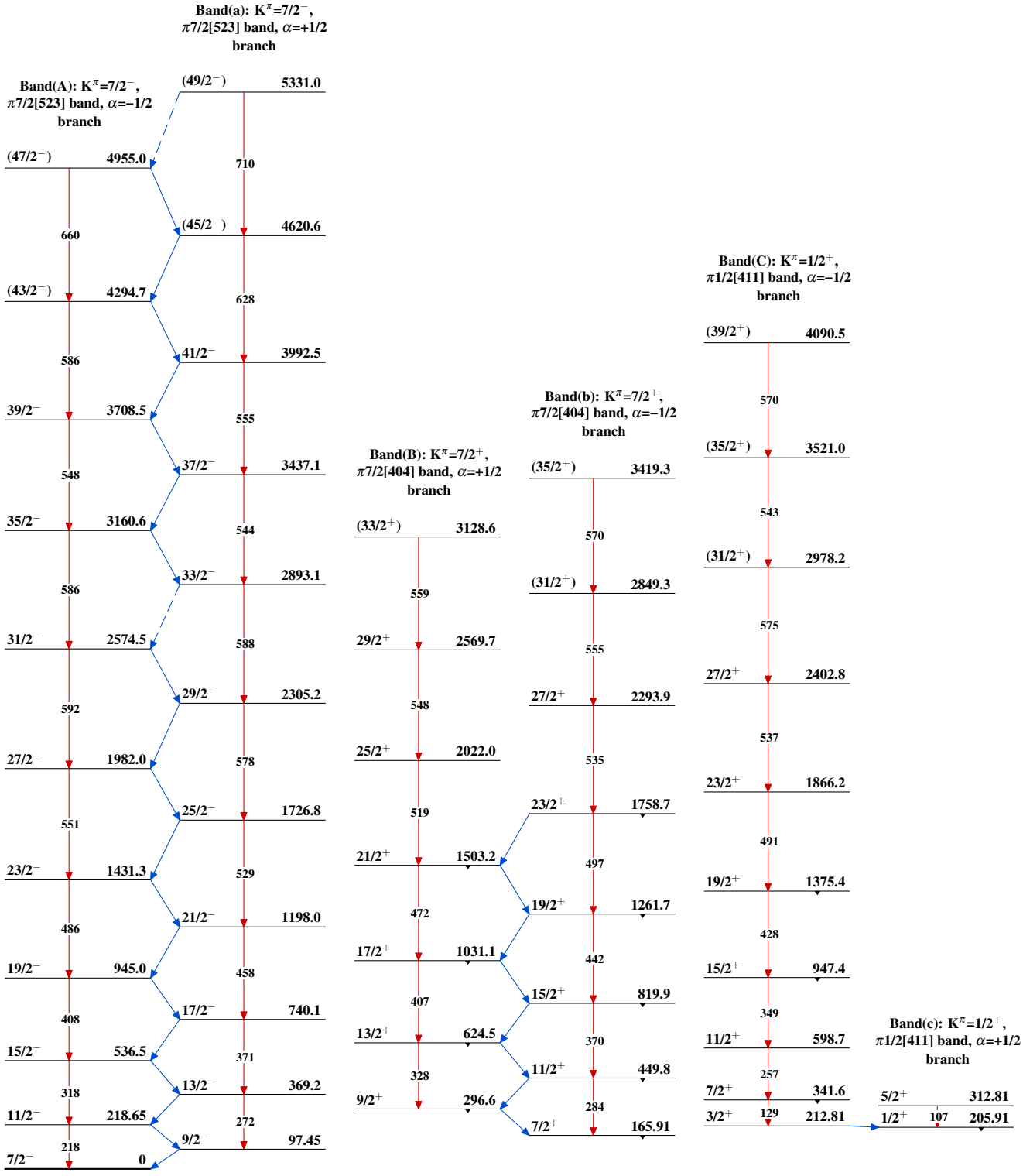
Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

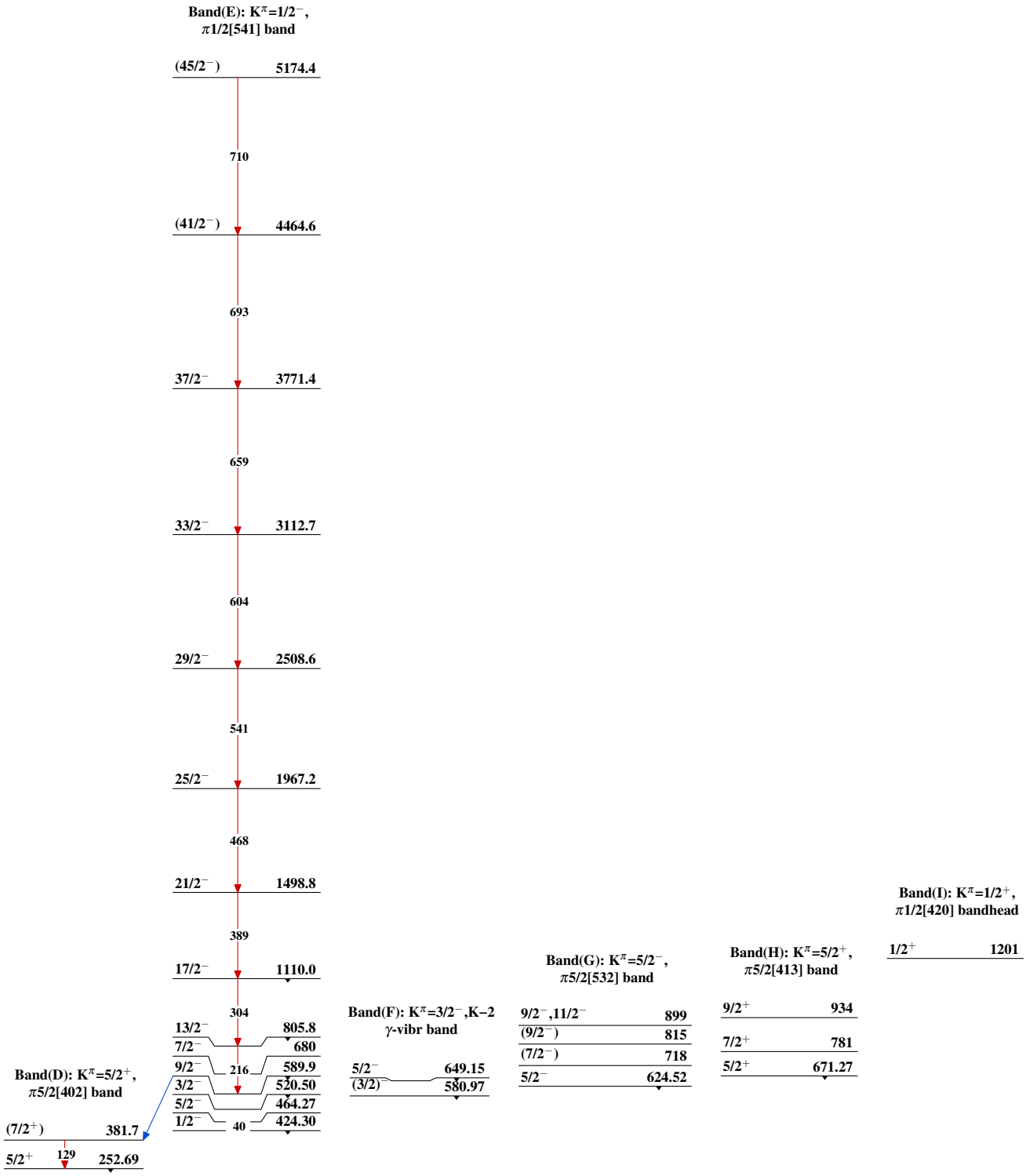


$^{159}_{67}Ho_{92}$

Adopted Levels, Gammas



Adopted Levels, Gammas (continued)



Adopted Levels, Gammas (continued)

Band(M): π9/2[514] band member

11/2$^-$ 1156

Band(L): K$^\pi$=1/2$^+$, K-2 γ-vibr bandhead

1/2$^+$ 875

Band(K): K$^\pi$=3/2$^+$, K-2 γ-vibr bandhead

3/2$^+$ 815.01

Band(J): Suggested π3/2[411] band

(9/2$^+$) 630

7/2$^+$,9/2$^+$ 482

3/2$^+$,5/2$^+$ 382