Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	S. -c. Wu	NDS 106,619 (2005)	1-Nov-2005

Q(β^-)=−1012.8 *5*; S(n)=7669 *5*; S(p)=5404.0 *9*; Q(α)=2194.1 *20* 2012Wa38
Note: Current evaluation has used the following Q record −1012.8 4 7667 *4* 5403.8 *9* 2194.6 *19* 2003Au03.
Isotope-shift measurements: 1982Bu14, 1992Si09.

^{185}Re Levels

Cross Reference (XREF) Flags

A	^{185}Os ε decay	F	^{184}W(α,t),(^{3}He,d)
B	^{185}W β^- decay	G	^{185}Re(d,d′) E=12.1 MeV
C	^{186}W(d,3nγ)	H	Re(n,n′) E=250-1500 keV
D	Coulomb excitation	I	(HI,xnγ)
E	^{185}Re(γ,γ′)		

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
0.0#	5/2$^+$	stable	ABCDEFGHI	μ=+3.1871 *3*; Q=+2.18 *2* μ: NMR (2001StZZ). Q: Hyperfine structure of pionic x rays (1981Ko11, 1989Ra17). Other value: Q=+2.21 *4* (hyperfine structure of muonic x rays (1981Ko11)). Q(^{185}Re)/Q(^{187}Re)= 1.0565 *3* (1968Se09), 1.059 *14* (1970Bu09), 1.056709 *17* (1978Se09). Others: 1990Su20. Jπ: J from optical spectroscopy, microwave absorption (1976Fu06). L=2 in (α,t). μ(exp) agrees with value calculated for the 5/2$^+$,5/2[402] Nilsson state. See 1970Va02, 1973Ra06, 1974Ba18, 1974El08, 1976Ga35 for calculated μ values, and see 1977Ra15 for calculated Q. <r^2>$^{1/2}$=5.329 fm 13 based on a global fit to charge radius data for all nuclides (2004An14).
125.3587@ *9*	7/2$^+$	10.2 ps *15*	ABCDEFGHI	μ=2.1 *8* μ: $\gamma\gamma$(H,θ) in ^{185}Os ε decay (2001StZZ). Jπ: 125.3γ M1+E2 to 5/2$^+$; band structure. $T_{1/2}$: from Coulomb excitation.
284.2# *3*	9/2$^+$	5.6 ps *15*	CD FGHI	Jπ: 158.9γ M1+E2 to 7/2$^+$; γ to 5/2$^+$; band structure. $T_{1/2}$: from Coulomb excitation.
368.3& *5*	9/2$^-$	33 ns *3*	C HI	$T_{1/2}$: from ^{186}W(d,3nγ). Jπ: J^π and Nilsson orbital assignment are based on the energy and half-life systematics of the 9/2[514] orbital in odd-A rhenium isotopes. γ to 7/2$^+$ state of the 5/2[402] band; but not to the 5/2$^+$ state.
475.7@ *4*	11/2$^+$		C G I	Jπ: γ to 7/2$^+$ and 9/2$^+$ states; band structure.
547.0a *5*	11/2$^-$		C F I	Jπ: L=5 in (^{3}He,d); band structure.
646.134g *4*	1/2$^+$	6.3 ps *4*	A DEFGH	Jπ: level is Coulomb excited, 646.1γ E2 to 5/2$^+$, L=0,1 in (^{3}He,d). $T_{1/2}$: from ^{185}Re(γ,γ′). Other: 4.5 ps *9* from Coulomb excitation.
697.1# *5*	13/2$^+$		C G I	Jπ: γ to 9/2$^+$ and 11/2$^+$ states; band structure.
717.446g *4*	3/2$^+$	2.6 ps *7*	A DEFG	Jπ: 71.3γ M1+E2 to 1/2$^+$; 592γ E2 to 7/2$^+$. $T_{1/2}$: from ^{185}Re(γ,γ′). Other: 2.6 ps *8* from Coulomb excitation.
757.5& *6*	13/2$^-$		C I	Jπ: γ to 9/2$^-$ and 11/2$^-$ states; band structure.
768.93g *6*	(5/2$^+$)		A D FGH	Jπ: band structure. L=0,1 in (^{3}He,d) is not consistent with J^π assignment.
826 *3*			F	
836 *8*			G	
874.815h *13*	3/2$^+$	1.08 ps *14*	A Ef h	XREF: f(876)h(865). Jπ: 874.8γ M1 to 5/2$^+$, 749.46γ to 7/2$^+$; log *ft*=7.2 (log f^1t=6.1) from

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{185}Re Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	XREF	Comments
				^{185}Os (J^{π}=1/2$^-$) ε decay.
				$T_{1/2}$: from ^{185}Re(γ,γ').
880.331[h] *6*	1/2$^+$		A f h	XREF: f(876)h(865).
				J$^{\pi}$: 234.1γ M1 to 1/2$^+$, $\gamma\gamma(\theta)$ from ^{185}Os ε decay.
917[k] *3*			F	J$^{\pi}$: possible doublet comprising the J^{π}=5/2$^-$ and 9/2$^-$ members of the band. Transition intensity in (^{3}He,d) is consistent with this interpretation. L=4 in (^{3}He,d) is not consistent with π=−.
931.063[i] *20*	(3/2)$^+$		A F	J$^{\pi}$: L=2 in (^{3}He,d); 3/2[402] rotational band head.
949.7[@] *5*	15/2$^+$		C I	J$^{\pi}$: γ to 11/2$^+$ and 13/2$^+$ states; band structure.
966[j] *8*	(9/2)$^+$		D G	J$^{\pi}$: K+2 γ-vibration state based on the g.s.
994.8[a] *7*	15/2$^-$		C I	J$^{\pi}$: band structure.
1013[i] *3*	(5/2)$^+$		F	J$^{\pi}$: L=2 in (^{3}He,d); 3/2[402] rotational band member.
1045[k] *3*	(1/2$^-$)		F	
1143[k] *3*	(3/2$^-$)		F	
1189[k] *3*	(7/2$^-$)		F	
1206.1[b] *7*	15/2	6 ns *2*	I	Possibly 3-quasiparticle configuration, or vibrational configuration 9/2$^-$[514]⊗3$^-$ octupole.
				J$^{\pi}$: DCO ratio for the 449 keV transition to the 13/2$^-$ state is consistent with a ΔJ=1 assignment; γ to 15/2$^-$ state.
				$T_{1/2}$: From (HI,xnγ).
1220 *3*	1/2,3/2$^-$		F	L=0,1 in (^{3}He,d).
1227.9[#] *6*	17/2$^+$		C I	J$^{\pi}$: γ to 13/2$^+$ and 15/2$^+$ states; band structure.
1261.8[&] *9*	17/2$^-$		C I	J$^{\pi}$: band structure.
1278 *3*			F	
1298 *8*			G	
1303 *3*	(11/2$^-$)		F	J$^{\pi}$: L=5 in (^{3}He,d), presented in 1971Lu01; L=4, possibly a misprint, shown in tables (1971Lu01). Probable Nilsson orbital=11/2[505].
1343 *3*			F	L=2,3 in (^{3}He,d).
1410.1[b] *9*	17/2		I	J$^{\pi}$: DCO ratio for the 204 keV transition to the 1206 (J=15/2) state is consistent with a ΔJ=1 assignment; band structure.
1434 *3*			F	L=0,1 in (^{3}He,d).
1496 *3*			F	L=0,2 in (^{3}He,d).
1532.7[@] *7*	19/2$^+$		I	J$^{\pi}$: band structure.
1538 *3*			F	
1548.8[a] *10*	19/2$^-$		I	J$^{\pi}$: band structure.
1596 *3*	7/2$^+$,9/2$^+$		F	L=4 in (^{3}He,d).
1634 *8*			G	
1651 *3*	(3/2)$^+$		F	J$^{\pi}$: L=2 in (^{3}He,d). Probable Nilsson orbital=3/2[651].
1670 *8*			G	
1691.5[b] *10*	19/2		I	J$^{\pi}$: DCO ratio for the 281 keV transition to the 1410 (J=17/2) state is consistent with a ΔJ=1 assignment; band structure.
1700 *3*	1/2$^+$		F	J$^{\pi}$: L=0 in (^{3}He,d). Probable Nilsson orbital=1/2[660].
1862.9[#] *8*	21/2$^+$		I	J$^{\pi}$: band structure.
1865.8[&] *11*	21/2$^-$		I	J$^{\pi}$: band structure.
1999.5[b] *11*	21/2		I	J$^{\pi}$: band structure.
2008.8 *10*	(19/2)		I	J$^{\pi}$: 317γ (M1) to 19/2; 599γ (M1) to 17/2.
2123.8[c] *11*	(21/2)	121 ns *13*	I	J$^{\pi}$: 115γ E1(+M2) to (19/2).
				$T_{1/2}$: Weighted average of 123 ns *23* from (HI,xnγ) (1997Sh37) and 120 ns *15* from (HI,xnγ) 2002Pf01. Other: 164 ns *10* from (HI,xnγ) 2004Va03.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{185}Re Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
2190.8[a] *12*	23/2⁻	I	Jπ: band structure.
2204.7[@] *9*	23/2⁺	I	Jπ: band structure.
2378.0[c] *12*	(25/2)	I	
2552.5 *12*	(23/2)	I	
2587.9[#] *9*	25/2⁺	I	Jπ: band structure.
2817.3[d] *12*	(27/2)	I	
2941.7[@] *10*	27/2⁺	I	Jπ: band structure.
3122.3[d] *13*	(29/2)	I	
3320.9[#] *11*	29/2⁺	I	Jπ: band structure.
3397.3? *13*		I	
3475.3[d] *14*	(31/2)	I	
3675.3[e] *14*	(31/2)	I	
3858.3[d] *15*	(33/2)	I	
3923.3? *14*		I	
3990.3[f] *15*	(33/2)	I	
4385.6[e] *15*	(35/2)	I	
4592.3? *15*		I	
4799.0[f] *15*	(37/2)	I	

[†] From least square fit to Eγ's. ΔE=0.5 keV assumed for gamma energies from (HI,xnγ), and from (d,3nγ) when uncertainties are not specified.

[‡] J^{π} and Nilsson orbital assignments are based on rotational structure and γ-ray decay patterns, on the energy systematics of Nilsson orbitals in other odd-Re isotopes, and on the comparison of spectroscopic factors in (^{3}He,d) and (α,t) with values calculated using the DWBA approximation and Nilsson's model. Specific arguments are presented with individual levels.

[#] Band(A): 5/2[402] rotational band, α=+1/2. Rotational parameters: A=18.1, B=−16.9. Spin members of the band used in the fit: 5/2, 7/2, 9/2.

[@] Band(a): 5/2[402] rotational band, α=−1/2. Rotational parameters: A=18.1, B=−16.9. Spin members of the band used in the fit: 5/2, 7/2, 9/2.

[&] Band(B): 9/2(514) rotational band, α=+1/2. Rotational parameters: A=16.3, B=−2.21. Spin members of the band used in the fit: 9/2, 11/2, 13/2.

[a] Band(b): 9/2(514) rotational band, α=−1/2. Rotational parameters: A=16.3, B=−2.21. Spin members of the band used in the fit: 9/2, 11/2, 13/2.

[b] Band(C): Band on 15/2, 1206 keV level.

[c] Band(D): Band on (21/2), 2124 keV level.

[d] Band(E): Band on (27/2), 2818 keV level.

[e] Band(F): Band on (31/2), 3676 keV level.

[f] Band(f): Band on (31/2), 3676 keV level.

[g] Band(G): 1/2(400) mixed with K-2 γ-vibration based on 5/2[402]. Rotational parameters: A=17.0, a=0.40. Spin members of the band used in the fit: 1/2, 3/2, 5/2.

[h] Band(H): 1/2(411) Coriolis-mixed rotational band.

[i] Band(I): 3/2[402] rotational band. Rotational parameter: A=16.3. Spin members of the band used in the fit: 3/2, 5/2.

[j] Band(J): K+2 γ-vibrational state based on 5/2[402] orbital.

[k] Band(K): 1/2(541)? Coriolis-mixed rotational band.

Adopted Levels, Gammas (continued)

$\gamma(^{185}Re)$

See 1975An21 for a comparison between experimental γ-ray transition probabilities and theoretical Nilsson and Weisskopf values. See also 1974El08.

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[†]	α[&]	Comments
125.3587	7/2$^+$	125.3581 *9*	100	0.0	5/2$^+$	M1+E2	+0.18 *1*	2.76 *2*	B(M1)(W.u.)=0.28 *5*; B(E2)(W.u.)=235 *24*
284.2	9/2$^+$	158.9[#]	100	125.3587	7/2$^+$	M1+E2	+0.142 *15*	1.407 *3*	B(M1)(W.u.)=0.37 *10*; B(E2)(W.u.)=120 *40* I_γ,δ: from Coulomb excitation.
		284.1[#]	20 *5*	0.0	5/2$^+$	[E2]		0.1048	B(E2)(W.u.)=64 *7* I_γ: from Coulomb excitation.
368.3	9/2$^-$	242.9[#]	100	125.3587	7/2$^+$	[E1]		0.0399	B(E1)(W.u.)=4.2×10^{-7} *4*
475.7	11/2$^+$	191.5[#]		284.2	9/2$^+$				
		350.4[#]		125.3587	7/2$^+$				
547.0	11/2$^-$	178.7[#] *1*	100	368.3	9/2$^-$				
646.134	1/2$^+$	646.116 *9*	100	0.0	5/2$^+$	E2		0.01205	B(E2)(W.u.)=12.6 *8*
697.1	13/2$^+$	221.4[#]		475.7	11/2$^+$				
		412.9[#]		284.2	9/2$^+$				
717.446	3/2$^+$	71.313 *2*	6.7 *28*	646.134	1/2$^+$	M1+(E2)	0.12[@] *+2−12*	2.66 *20*	B(M1)(W.u.)=1.0 *5*; B(E2)(W.u.)<1700
		592.074 *4*	33.5 *6*	125.3587	7/2$^+$	E2		0.01472	B(E2)(W.u.)=10 *3*
		717.424 *12*	100 *1*	0.0	5/2$^+$	M1+E2	1.8 *6*	0.013 *3*	B(M1)(W.u.)=0.0034 *20*; B(E2)(W.u.)=9 *3*
757.5	13/2$^-$	210.5[#] *1*		547.0	11/2$^-$				
		389.2[#]		368.3	9/2$^-$				
768.93	(5/2$^+$)	121.2[a] *1*		646.134	1/2$^+$	(E2)		1.966	E_γ: from ^{185}Os ε decay.
		768.93 *6*		0.0	5/2$^+$				B(E2)(W.u.)=4.8 *16* E_γ: from ^{185}Os ε decay.
874.815	3/2$^+$	157.7[a]	<0.25	717.446	3/2$^+$	[M1,E2]		1.1 *4*	
		229.1[a]	<0.25	646.134	1/2$^+$	[M1,E2]		0.36 *15*	
		749.46 *8*	0.050 *6*	125.3587	7/2$^+$	[E2]		0.00868	B(E2)(W.u.)=0.017 *3*
		874.813 *13*	100 *1*	0.0	5/2$^+$	M1		0.01518	B(M1)(W.u.)=0.030 *4*
880.331	1/2$^+$	162.852 *7*	11.0 *3*	717.446	3/2$^+$	M1		1.327	
		234.157 *9*	8.0 *2*	646.134	1/2$^+$	M1		0.484	
		880.523 *13*	100 *1*	0.0	5/2$^+$	E2		0.00618	
931.063	(3/2)$^+$	805.7	0.08 *6*	125.3587	7/2$^+$				
		931.06 *2*	100 *3*	0.0	5/2$^+$	M1		0.01297	
949.7	15/2$^+$	252.5[#]		697.1	13/2$^+$				
		473.9[#]		475.7	11/2$^+$				
994.8	15/2$^-$	237[@]		757.5	13/2$^-$				E_γ: 243 from (d,3nγ).
1206.1	15/2	211[@]		994.8	15/2$^-$				

$^{185}_{75}Re_{110}$-4

Adopted Levels, Gammas (continued)

γ(^{185}Re) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[†]	α[&]	Comments
1206.1	15/2	449[@]		757.5	13/2$^-$	D[@]			
1227.9	17/2$^+$	278[@]		949.7	15/2$^+$				E_γ: 280.9 from (d,3nγ).
		531[@]		697.1	13/2$^+$				
1261.8	17/2$^-$	267[@]		994.8	15/2$^-$				E_γ: 277.0 from (d,3nγ).
1410.1	17/2	204[@]		1206.1	15/2	D[@]			
1532.7	19/2$^+$	583[@]		949.7	15/2$^+$				
1548.8	19/2$^-$	287[@]		1261.8	17/2$^-$				
1691.5	19/2	281[@]		1410.1	17/2	D[@]			
1862.9	21/2$^+$	635[@]		1227.9	17/2$^+$				
1865.8	21/2$^-$	317[@]		1548.8	19/2$^-$				
1999.5	21/2	308[@]		1691.5	19/2				
2008.8	(19/2)	317[@]	≈25[@]	1691.5	19/2	(M1)[@]		0.211	
		599[@]	100[@]	1410.1	17/2	(M1)[@]		0.0397	
2123.8	(21/2)	115[@]		2008.8	(19/2)	E1(+M2)[@]	0.10[@] *+5−8*	0.5 *4*	
2190.8	23/2$^-$	325[@]		1865.8	21/2$^-$				
2204.7	23/2$^+$	672[@]		1532.7	19/2$^+$				
2378.0	(25/2)	254[@]		2123.8	(21/2)	Q[@]			
2552.5	(23/2)	429[@]		2123.8	(21/2)	D[@]			
2587.9	25/2$^+$	725[@]		1862.9	21/2$^+$				
2817.3	(27/2)	265[@]		2552.5	(23/2)	Q[@]			
		439[@]		2378.0	(25/2)	D[@]			
2941.7	27/2$^+$	737[@]		2204.7	23/2$^+$				
3122.3	(29/2)	305[@]		2817.3	(27/2)	D[@]			
3320.9	29/2$^+$	733[@]		2587.9	25/2$^+$				
3397.3?		580		2817.3	(27/2)				
3475.3	(31/2)	353[@]		3122.3	(29/2)				
3675.3	(31/2)	553[@]		3122.3	(29/2)				
3858.3	(33/2)	383[@]		3475.3	(31/2)				
3923.3?		526[@]		3397.3?					
3990.3	(33/2)	315[@]		3675.3	(31/2)				
4385.6	(35/2)	395[@]		3990.3	(33/2)				
4592.3?		669[@]		3923.3?					

$^{185}_{75}Re_{110}$-5

Adopted Levels, Gammas (continued)

$\gamma(^{185}Re)$ (continued)

E_i(level)	J_i^π	E_γ[†]	E_f	J_f^π
4799.0	(37/2)	413[@]	4385.6	(35/2)
		809[@]	3990.3	(33/2)

† From ^{185}Os ε decay, unless otherwise noted.
‡ From ^{185}Os ε decay and from Coulomb excitation, except as noted.
# From ^{186}W(d,3nγ).
@ From (HI,xnγ).
& 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.
a Placement of transition in the level scheme is uncertain.

$^{185}_{75}Re_{110}$-6

Adopted Levels, Gammas

Level Scheme

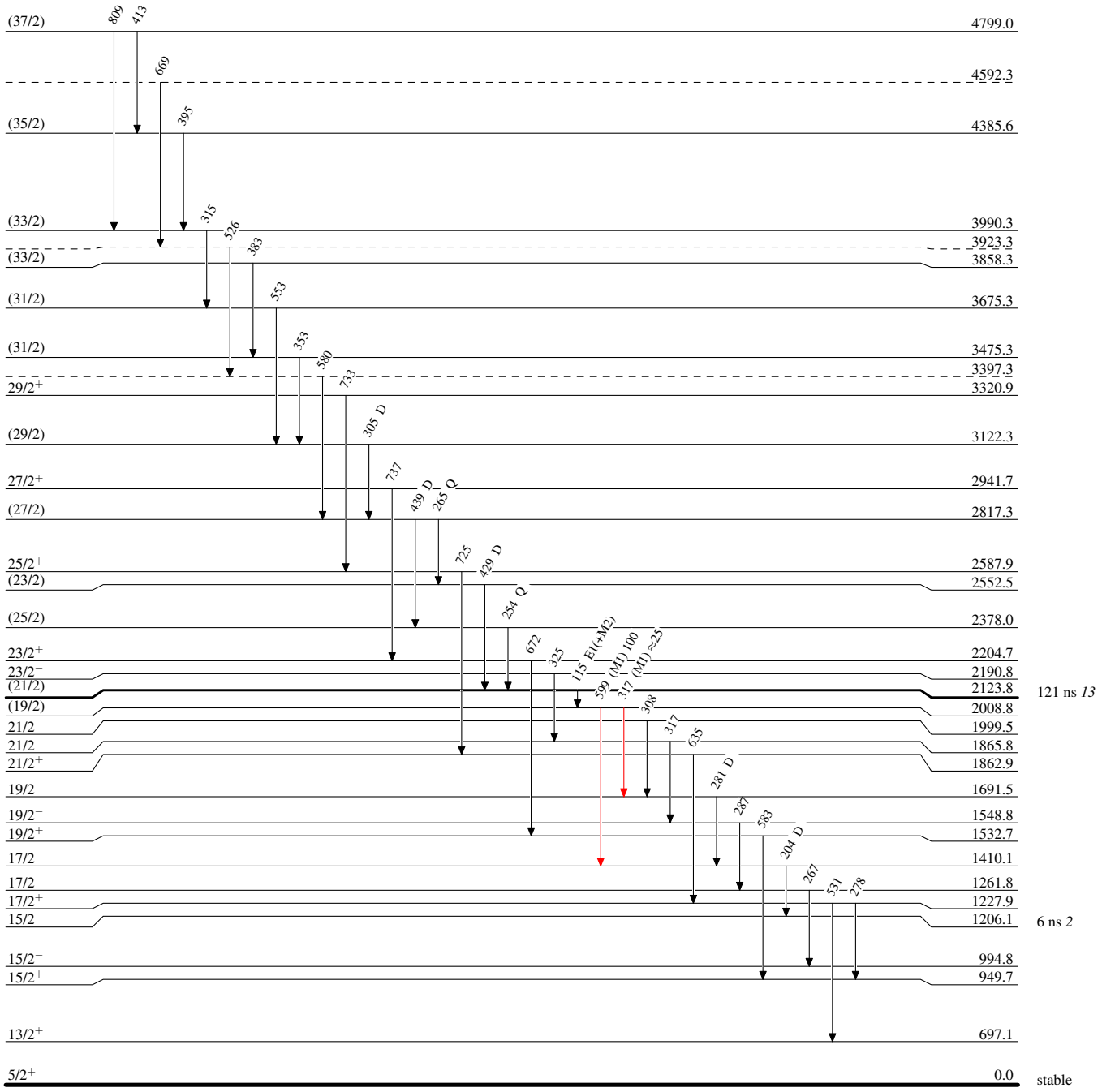
Intensities: Type not specified

Legend

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

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

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

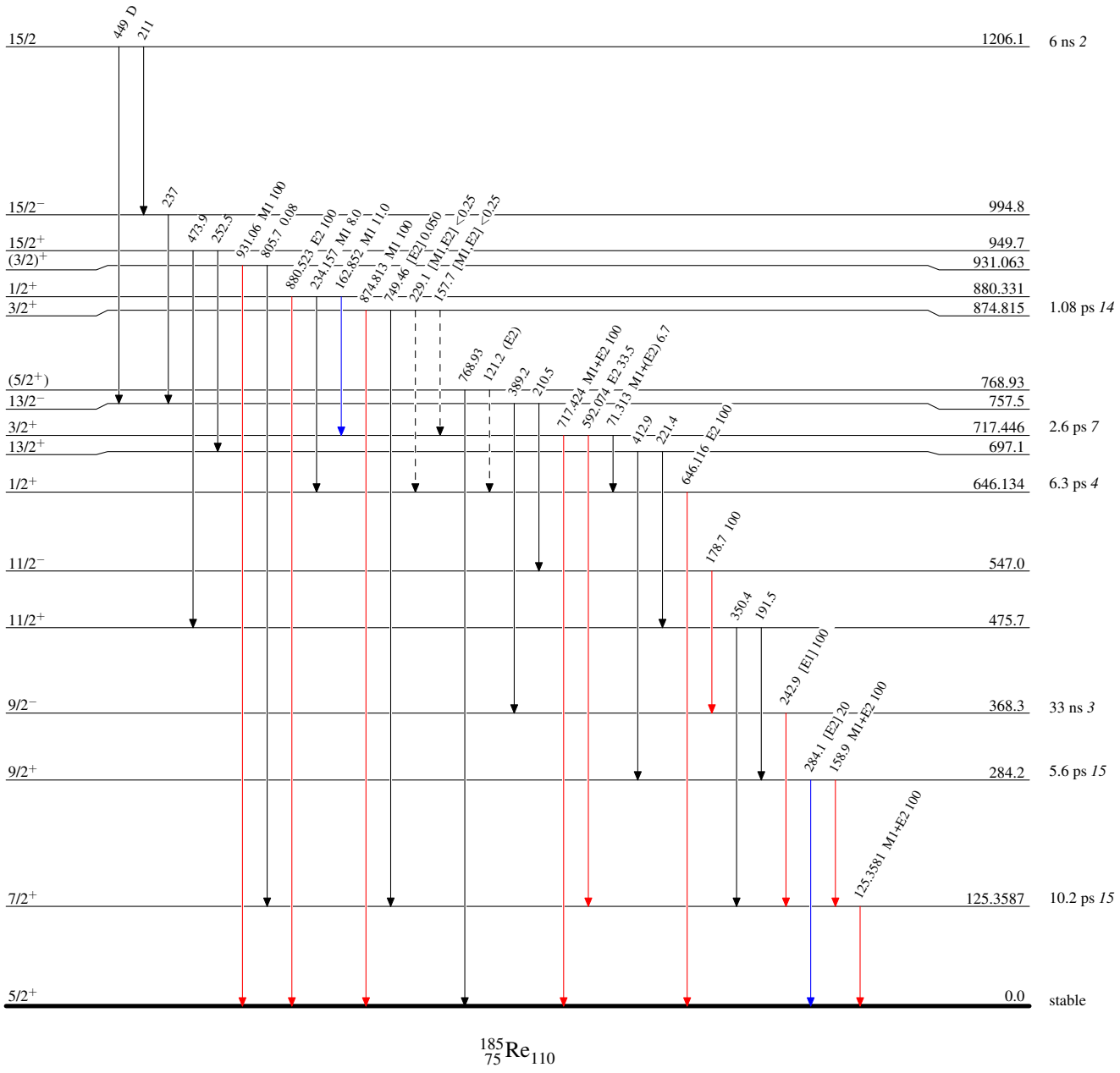


$^{185}_{75}Re_{110}$

Adopted Levels, Gammas

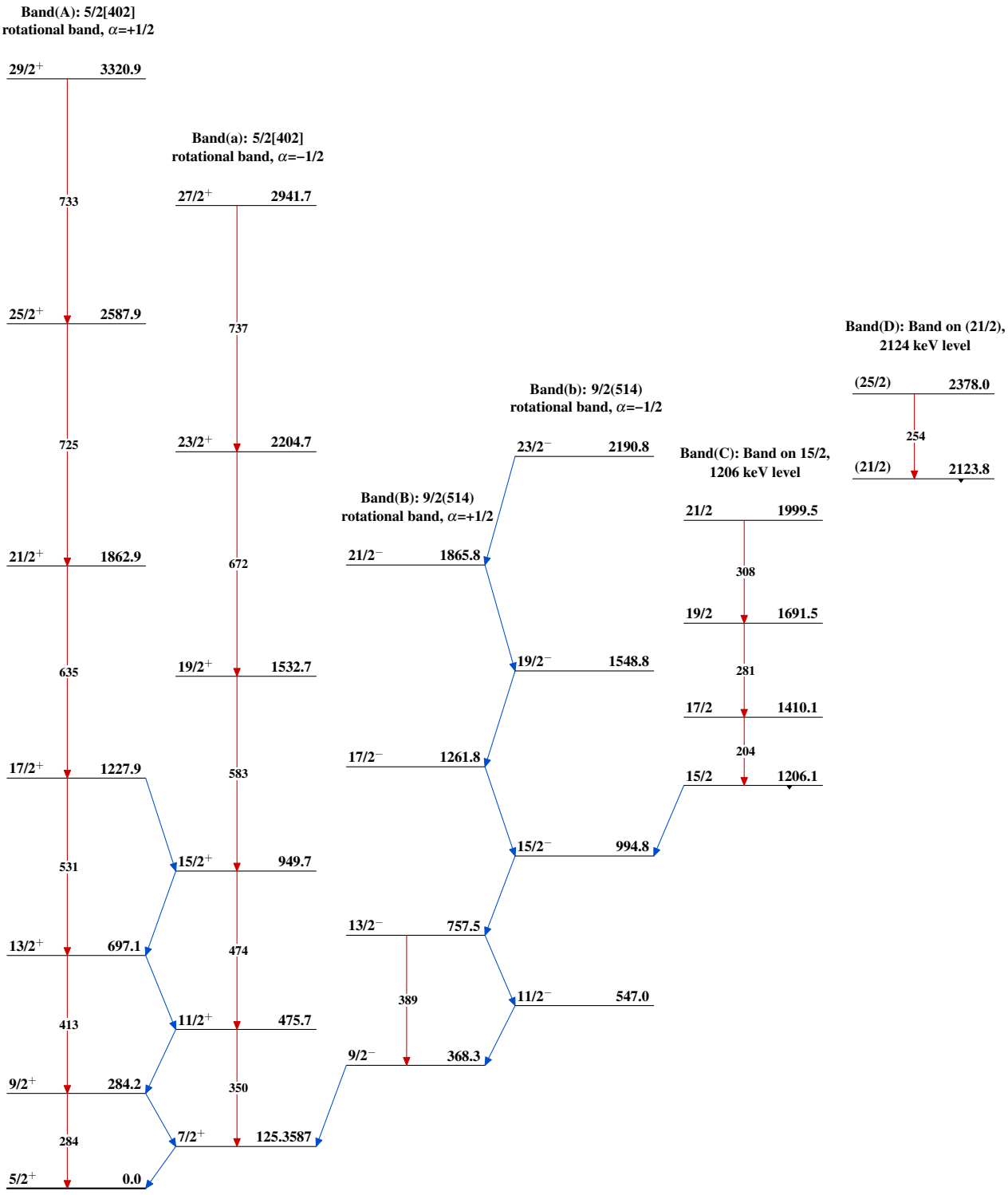
Level Scheme (continued)

Intensities: Type not specified



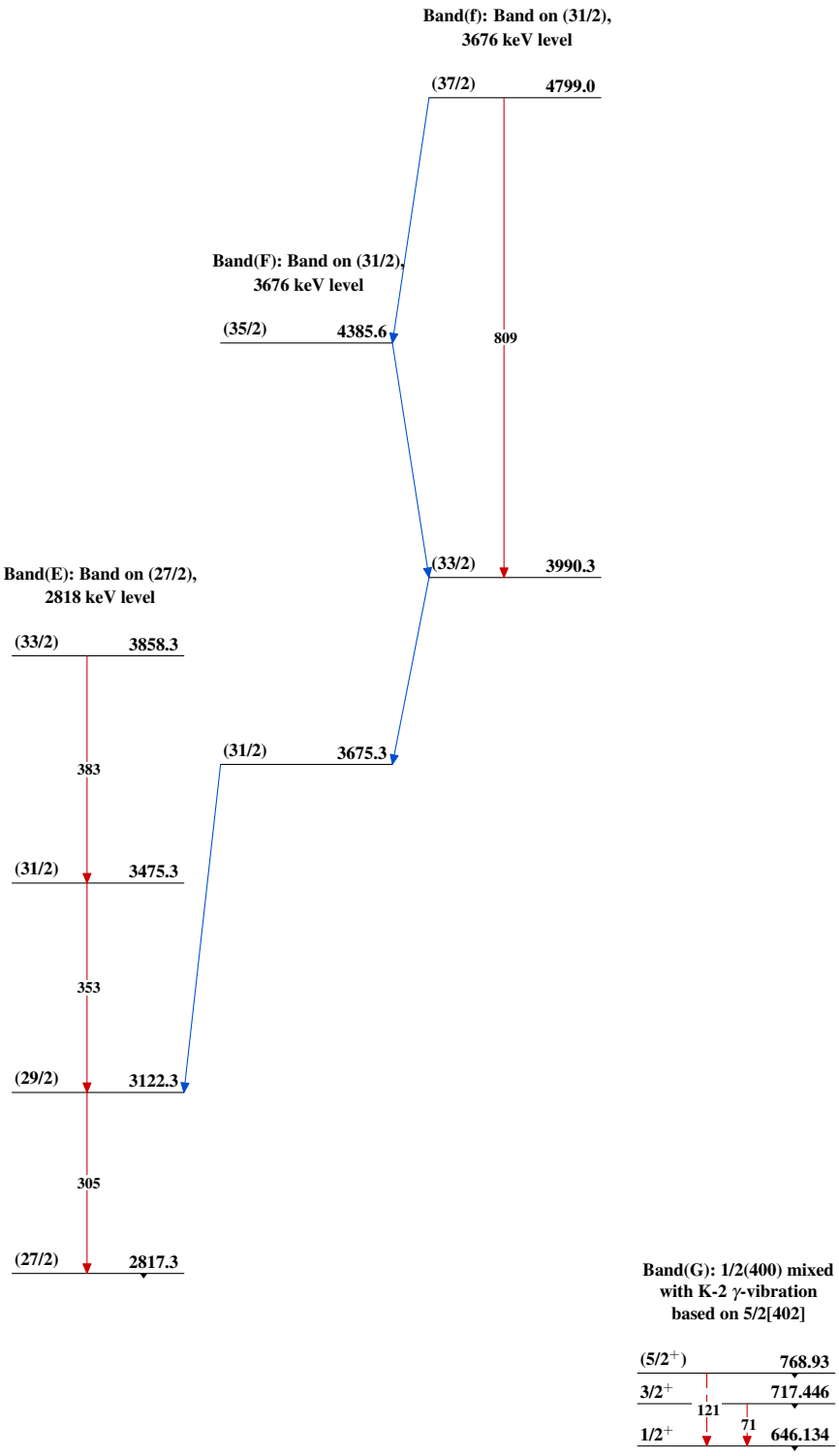
$^{185}_{75}Re_{110}$

Adopted Levels, Gammas



$^{185}_{75}Re_{110}$

Adopted Levels, Gammas (continued)



$^{185}_{75}Re_{110}$

Adopted Levels, Gammas (continued)

Band(K): 1/2(541)? Coriolis-mixed rotational band

$(7/2^-)$ 1189

$(3/2^-)$ 1143

$(1/2^-)$ 1045

Band(I): 3/2[402] rotational band

$(5/2)^+$ 1013

Band(J): K+2 γ-vibrational state based on 5/2[402] orbital

$(9/2)^+$ 966

$(3/2)^+$ 931.063

917

Band(H): 1/2(411) Coriolis-mixed rotational band

$1/2^+$ 880.331

$3/2^+$ 874.815

$^{185}_{75}Re_{110}$