Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. M. Baglin[1], E. A. Mccutchan[2], S. Basunia[1]	NDS 153, 1 (2018)	1-Oct-2018

Q(β^-)=−4987 *25*; S(n)=8575 *25*; S(p)=1284 *28*; Q(α)=4760 *40* 2017Wa10
S(2n)=19261 *39*; S(2p)=5097 *36*; Q(εp)=4088 (syst) *36* (2017Wa10).
Other Reactions: ^{144}Sm(^{29}Si,p2nγ) (1992DrZZ): Measured γ singles, $\gamma\gamma$ coin, γ-x coin, γ(t); observed several bands, probably arising from coupling of (π 9/2[514]) to either a 5/2[523] or an $i_{13/2}$ neutron, and two of those bands are connected at low spin via a 280 ns isomer. No further details this work have been reported.

^{170}Re Levels

Cross Reference (XREF) Flags

A	^{170}Os ε decay	D	^{118}Sn(^{55}Mn,3nγ)
B	^{174}Ir α decay (7.9 s)	E	^{142}Nd(^{32}S,p3nγ)
C	^{174}Ir α decay (5.01 s)		

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0	(5$^+$)	9.2 s *2*	BC E	%ε+%β^+=100 J$^\pi$: (E2) 210γ from (7$^+$); (E2) 225γ from (3$^+$). Possible configuration=(π 1/2[541])+(ν 5/2[523]) (1992Me10). $T_{1/2}$: from 1992Me10. Others: 8.0 s *5* (1975St02), 9 s *2* (1974Be59). %ε+%β^+: %α<0.01 from systematics of partial $T_{1/2}(\alpha)$ vs Q(α).
0.0+x[@]	(9$^-$)	DE	
0.0+y[&]	(10$^+$)	D	
0.0+z		A	
20.13 *23*	(6$^-$)	C	E(level): order of 20.2γ and 190.2γ not established; reverse ordering would result in a level at 190.2 keV. J$^\pi$: (E1) γ from (7$^+$); (E1) γ to (5$^+$).
31.3 *3*	(4$^+$)	B	E(level): order of 31.4γ and 193.5γ not established, reverse ordering would result in a level at 193.5 keV. J$^\pi$: (M1) 31γ to (5$^+$); absence of α feeding from (7$^+$) parent.
83.2+x[#] *2*	(10$^-$)	DE	
161.8+z *4*	(≤2)	A	J$^\pi$: level fed In ε decay from ^{170}Os (J^π=0$^+$).
210.32 *19*	(7$^+$)	C E	J$^\pi$: α from (7$^+$) ^{174}Ir to this level probably is a favored transition (hindrance factor=1.9 *3*). Possible parent configuration=(π 11/2[505])+(ν 3/2[521]) (1992Sc16).
215.1+x[@] *3*	(11$^-$)	E	
216.3+z *4*	(≤2)	A	J$^\pi$: probably fed In ε decay from 0$^+$ ^{170}Os.
224.7 *3*	(3$^+$)	B	J$^\pi$: α from (3$^+$) ^{174}Ir to this level probably is a favored transition (hindrance factor=1.7 *11*). Possible parent configuration=(π 11/2[505])-(ν 5/2[523]) (1992Sc16).
263.80+y[a] *20*	(11$^+$)	D	
370.1 *6*	(≥5)	C	J$^\pi$: 160γ to (7$^+$).
403.8+x[#] *3*	(12$^-$)	DE	
543.3+y[&] *3*	(12$^+$)	D	
622.3+x[@] *3*	(13$^-$)	DE	
817.4+y[a] *3*	(13$^+$)	D	
889.6+x[#] *3*	(14$^-$)	DE	
1036.4+y[&] *3*	(14$^+$)	D	
1169.4+x[@] *3*	(15$^-$)	DE	
1226.6+y[a] *3*	(15$^+$)	D	

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Adopted Levels, Gammas (continued)

^{170}Re Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
1341.8+y& *4*	(16+)	D	3057.4+x@ *4*	(21−)	DE	5494.7+x# *5*	(28−)	D
1486.8+x# *4*	(16−)	DE	3332.8+x# *4*	(22−)	D	5736.3+y& *6*	(30+)	D
1487.5+y*a* *4*	(17+)	D	3400.5+y& *6*	(24+)	D	5952.2+x@ *5*	(29−)	D
1662.8+y& *5*	(18+)	D	3636.7+x@ *4*	(23−)	D	6155.2+y*a* *7*	(31+)	D
1806.2+x@ *4*	(17−)	DE	3771.4+y*a* *6*	(25+)	D	6402.0+x# *5*	(30−)	D
1870.4+y*a* *5*	(19+)	D	3953.2+x# *4*	(24−)	D	6601.3+y& *8*	(32+)	D
2114.4+y& *5*	(20+)	D	4151.7+y& *6*	(26+)	D	6899.2+x@ *7*	(31−)	D
2146.3+x# *4*	(18−)	DE	4310.5+x@ *5*	(25−)	D	7049.2+y*a* *9*	(33+)	D
2392.6+y*a* *5*	(21+)	D	4532.0+y*a* *6*	(27+)	D	7371.0+x# *7*	(32−)	D
2472.4+x@ *4*	(19−)	DE	4675.4+x# *5*	(26−)	D	7517.3+y?& *9*	(34+)	D
2702.8+y& *5*	(22+)	D	4926.6+y& *6*	(28+)	D	7885.2+x@ *9*	(33−)	D
2778.2+x# *4*	(20−)	DE	5084.9+x@ *5*	(27−)	D	7983.2+y?*a* *10*	(35+)	D
3041.8+y*a* *5*	(23+)	D	5322.1+y*a* *6*	(29+)	D	8388.0+x# *9*	(34−)	D

† From least-squares fit to Eγ, holding the energies of the 0+x, 0+y and 0+z levels fixed.

‡ Values indicated for excited states populated in α decay are the most plausible (1992Sc16), but highly tentative. Spin assignments for levels with J ≥ 9 are from (^{55}Mn,3nγ) based on multipolarities of transitions determined through γγ(θ) measurements and band assignments.

Band(A): πh$_{11/2}$⊗νi$_{13/2}$, α=0. Tentative Jπ assigned by 2013Ha02 based on systematics of neighboring nuclei and configuration proposed for sequence. Initial alignment ≈6 ħ; AB alignment blocked but BC alignment occurs At ħω=0.29 MeV, close to value predicted by cranked shell model, so ν i$_{13/2}$ orbital is probably involved. The π h$_{11/2}$ orbital is yrast for low J in ^{169}Re. Observed B(M1)/B(E2) ratios agree well with those expected for the proposed configuration.

@ Band(a): πh$_{11/2}$⊗νi$_{13/2}$, α=1. See comment on signature partner band.

& Band(B): πh$_{11/2}$⊗νh$_{9/2}$, α=0. Tentative Jπ assigned by 2013Ha02 based on proposed configuration (for which theoretical B(M1)/B(E2) ratios following the AB crossing agree with the experimental ones). An additional band crossing is observed At ħω=0.37 MeV, probably associated with α pair of i$_{13/2}$ quasineutrons.

a Band(b): πh$_{11/2}$⊗νh$_{9/2}$, α=1. See comment on signature partner band.

γ(^{170}Re)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.†	α&	Comments
20.13	(6−)	20.2@ *4*	100@	0.0	(5+)	(E1)	5.7 *4*	Mult.: intensity balance at 20 level in α decay (5.01 s) requires mult(20γ)=E1 if mult(190γ)=E1, E2 or M1.
31.3	(4+)	31.4# *4*	100#	0.0	(5+)	(M1)	26.6 *11*	Mult.: from intensity balance at 31 level in α decay (7.9 s), assuming mult(194γ)=E1, E2 or M1.
83.2+x	(10−)	83.2 *2*	100	0.0+x	(9−)	[M1,E2]		Eγ: 82.5 *5* line placed by 2004Wa35 in (^{32}S,p3nγ) by analogy with corresponding (10−) to (9−), 95.6 transition in ^{172}Re.
161.8+z	(≤2)	161.8 *4*	100	0.0+z				Eγ: from ε decay.
210.32	(7+)	190.2@ *2*	28@ *3*	20.13	(6−)	(E1)	0.0732	Mult.: intensity balance at 20 level in α decay (5.01 s) (assuming mult(20γ)=E1) implies mult(190γ)=E1, but E2 cannot be ruled out.
		210.3@ *2*	100@ *8*	0.0	(5+)	(E2)	0.270	Mult.: Δπ=no from level scheme; E2 is consistent with I(K x ray) in ^{171}Ir α decay (5.01 s), M1 is not.

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Adopted Levels, Gammas (continued)

γ(^{170}Re) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[&]	Comments
215.1+x	(11$^-$)	131.9 *2*	100	83.2+x	(10$^-$)	(M1)		
216.3+z	(≤2)	216.3 *4*	100	0.0+z				E_γ: from ε decay.
224.7	(3$^+$)	193.5[#] *2*	100[#] *15*	31.3	(4$^+$)	(E2)[‡]	0.358	
		224.6[#] *4*	67[#] *13*	0.0	(5$^+$)	(E2)[‡]	0.218 *4*	
263.80+y	(11$^+$)	263.8 *2*	100	0.0+y	(10$^+$)			
370.1	(≥5)	159.8[@] *5*	100[@]	210.32	(7$^+$)	[M1,E2]	1.0 *4*	
403.8+x	(12$^-$)	188.6 *2*	100 *8*	215.1+x	(11$^-$)	(M1)		
		320.6 *2*	6 *3*	83.2+x	(10$^-$)			I_γ: from (^{32}S,p3nγ); other Iγ:≈19 from (^{55}Mn,3nγ).
543.3+y	(12$^+$)	279.5 *2*	100	263.80+y	(11$^+$)			
622.3+x	(13$^-$)	218.5 *2*	100 *4*	403.8+x	(12$^-$)	(M1)		
		407.1 *2*	≈30	215.1+x	(11$^-$)			
817.4+y	(13$^+$)	274.1 *2*	62 *4*	543.3+y	(12$^+$)			
		553.6 *2*	100 *6*	263.80+y	(11$^+$)			
889.6+x	(14$^-$)	267.4 *2*	100 *6*	622.3+x	(13$^-$)	(M1)		
		485.8 *2*	51 *4*	403.8+x	(12$^-$)			
1036.4+y	(14$^+$)	219.0 *2*	100 *9*	817.4+y	(13$^+$)			
		493.1 *2*	74 *6*	543.3+y	(12$^+$)			
1169.4+x	(15$^-$)	279.7 *2*	100 *11*	889.6+x	(14$^-$)			
		547.2 *2*	64 *5*	622.3+x	(13$^-$)	(E2)		
1226.6+y	(15$^+$)	190.1 *2*	100 *7*	1036.4+y	(14$^+$)			
		409.2 *2*	80 *5*	817.4+y	(13$^+$)			
1341.8+y	(16$^+$)	115.2 *2*	100	1226.6+y	(15$^+$)			
1486.8+x	(16$^-$)	317.4 *2*	100 *6*	1169.4+x	(15$^-$)			
		597.2 *2*	70 *4*	889.6+x	(14$^-$)			
1487.5+y	(17$^+$)	145.7 *2*	100	1341.8+y	(16$^+$)			
1662.8+y	(18$^+$)	175.3 *2*	100	1487.5+y	(17$^+$)			
1806.2+x	(17$^-$)	319.4 *2*	100 *11*	1486.8+x	(16$^-$)			
		636.9 *2*	93 *5*	1169.4+x	(15$^-$)	(E2)		
1870.4+y	(19$^+$)	207.6 *2*	100	1662.8+y	(18$^+$)			
2114.4+y	(20$^+$)	244.0 *2*	100 *6*	1870.4+y	(19$^+$)			
		451.7 *2*	33.5 *24*	1662.8+y	(18$^+$)			
2146.3+x	(18$^-$)	340.1 *2*	100 *7*	1806.2+x	(17$^-$)	(M1)		
		659.5 *2*	89 *7*	1486.8+x	(16$^-$)	(E2)		
2392.6+y	(21$^+$)	278.3 *2*	100 *7*	2114.4+y	(20$^+$)			
		522.2 *2*	62 *4*	1870.4+y	(19$^+$)			
2472.4+x	(19$^-$)	326.1 *2*	100 *7*	2146.3+x	(18$^-$)	(M1)		
		666.1 *2*	98 *7*	1806.2+x	(17$^-$)	(E2)		
2702.8+y	(22$^+$)	310.2 *2*	100 *6*	2392.6+y	(21$^+$)			
		588.4 *2*	61 *4*	2114.4+y	(20$^+$)			
2778.2+x	(20$^-$)	305.9 *2*	100 *13*	2472.4+x	(19$^-$)			
		631.9 *2*	71 *5*	2146.3+x	(18$^-$)	(E2)		
3041.8+y	(23$^+$)	339.0 *2*	100 *6*	2702.8+y	(22$^+$)			
		649.2 *2*	88 *6*	2392.6+y	(21$^+$)			
3057.4+x	(21$^-$)	279.1 *2*	100 *11*	2778.2+x	(20$^-$)			
		585.0 *2*	97 *8*	2472.4+x	(19$^-$)			
3332.8+x	(22$^-$)	275.4 *2*	100 *6*	3057.4+x	(21$^-$)	(M1)		
		554.6 *2*	68 *6*	2778.2+x	(20$^-$)			
3400.5+y	(24$^+$)	358.6 *2*	100 *8*	3041.8+y	(23$^+$)			
		697.6 *2*	83 *6*	2702.8+y	(22$^+$)			
3636.7+x	(23$^-$)	303.8 *2*	100 *10*	3332.8+x	(22$^-$)			Additional information 1.
		579.3 *2*	47 *3*	3057.4+x	(21$^-$)	(E2)		
3771.4+y	(25$^+$)	370.9 *2*	67 *7*	3400.5+y	(24$^+$)			
		729.6 *2*	100 *7*	3041.8+y	(23$^+$)			

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Adopted Levels, Gammas (continued)

γ(^{170}Re) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.†	Comments
3953.2+x	(24$^-$)	316.5 *2*	100 *14*	3636.7+x	(23$^-$)		Additional information 2.
		620.4 *2*	91 *9*	3332.8+x	(22$^-$)	(E2)	
4151.7+y	(26$^+$)	380.3 *2*	97 *10*	3771.4+y	(25$^+$)		
		751.3 *2*	100 *8*	3400.5+y	(24$^+$)		
4310.5+x	(25$^-$)	357.3 *2*	100 *5*	3953.2+x	(24$^-$)	(M1)	
		673.9 *2*	53 *4*	3636.7+x	(23$^-$)		
4532.0+y	(27$^+$)	380.4 *2*	63 *7*	4151.7+y	(26$^+$)		
		760.6 *2*	100 *7*	3771.4+y	(25$^+$)		
4675.4+x	(26$^-$)	364.9 *2*	100 *6*	4310.5+x	(25$^-$)	(M1)	
		722.2 *2*	63 *6*	3953.2+x	(24$^-$)		
4926.6+y	(28$^+$)	394.6 *2*	62 *7*	4532.0+y	(27$^+$)		
		774.8 *2*	100 *7*	4151.7+y	(26$^+$)		
5084.9+x	(27$^-$)	409.5 *2*	100 *8*	4675.4+x	(26$^-$)		
		774.4 *2*	83 *5*	4310.5+x	(25$^-$)		
5322.1+y	(29$^+$)	395.5 *2*	76 *8*	4926.6+y	(28$^+$)		
		790.1 *2*	100 *8*	4532.0+y	(27$^+$)		
5494.7+x	(28$^-$)	409.8 *2*	89 *8*	5084.9+x	(27$^-$)		
		819.3 *2*	100 *8*	4675.4+x	(26$^-$)		
5736.3+y	(30$^+$)	414.2 *5*	62 *7*	5322.1+y	(29$^+$)		
		809.7 *2*	100 *7*	4926.6+y	(28$^+$)		
5952.2+x	(29$^-$)	457.5 *2*	88 *4*	5494.7+x	(28$^-$)		
		867.3 *2*	100 *6*	5084.9+x	(27$^-$)		
6155.2+y	(31$^+$)	419.0 *5*	100	5736.3+y	(30$^+$)		
		833.0 *5*	100	5322.1+y	(29$^+$)		
6402.0+x	(30$^-$)	449.9 *5*	<69	5952.2+x	(29$^-$)		
		907.3 *2*	100 *10*	5494.7+x	(28$^-$)		
6601.3+y	(32$^+$)	865.0 *5*	100	5736.3+y	(30$^+$)		
6899.2+x	(31$^-$)	947.0 *5*	100	5952.2+x	(29$^-$)		
7049.2+y	(33$^+$)	894.0 *5*	100	6155.2+y	(31$^+$)		
7371.0+x	(32$^-$)	969.0 *5*	100	6402.0+x	(30$^-$)		
7517.3+y?	(34$^+$)	916.0[a] *5*	100	6601.3+y	(32$^+$)		
7885.2+x	(33$^-$)	986.0 *5*	100	6899.2+x	(31$^-$)		
7983.2+y?	(35$^+$)	934.0[a] *5*	100	7049.2+y	(33$^+$)		
8388.0+x	(34$^-$)	1017.0 *5*	100	7371.0+x	(32$^-$)		

† From ^{118}Sn(^{55}Mn,3nγ), except As noted; Eγ and Iγ from (^{32}S,p3nγ) are generally less precise but In satisfactory agreement. D and Q transitions from (^{55}Mn,3nγ) have been assigned Δπ=(+) based on deduced band structure.

‡ E1 or E2 based on I(K x ray) in ^{174}Ir α decay (7.9 s); placement requires Δπ=(no).

From α decay (7.9 s).

@ From α decay (5.01 s).

& 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.

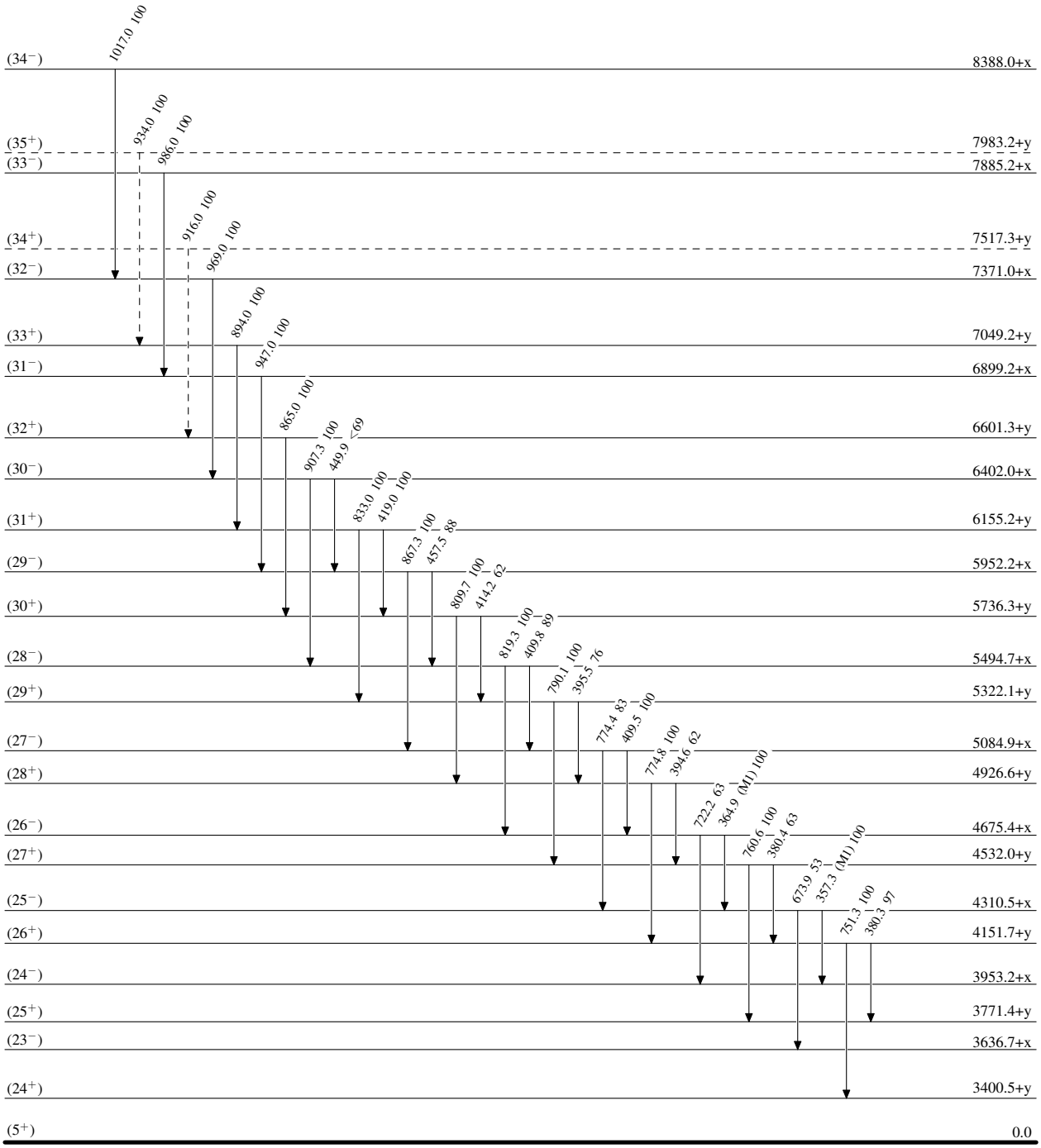
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

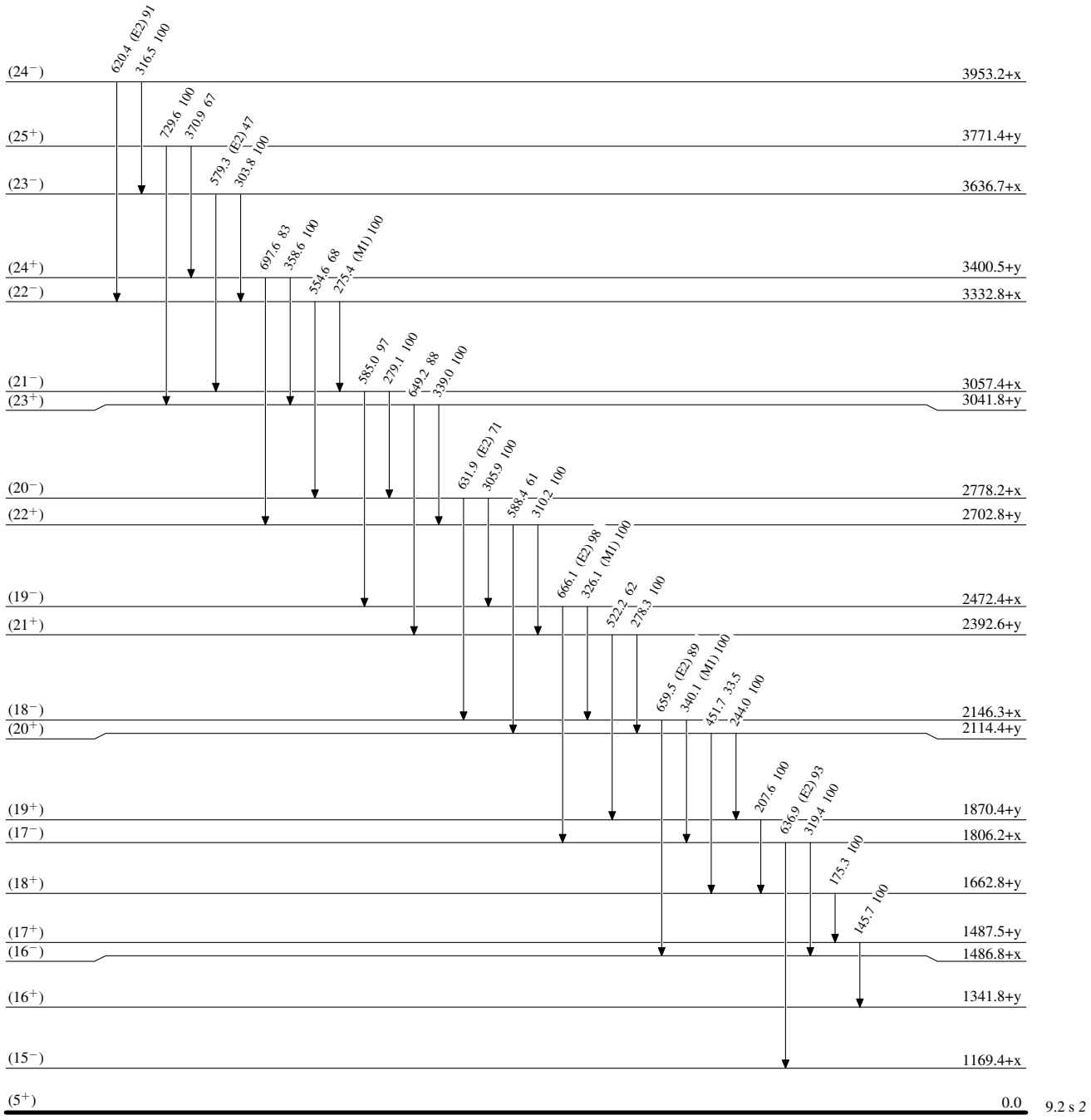


$^{170}_{75}Re_{95}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

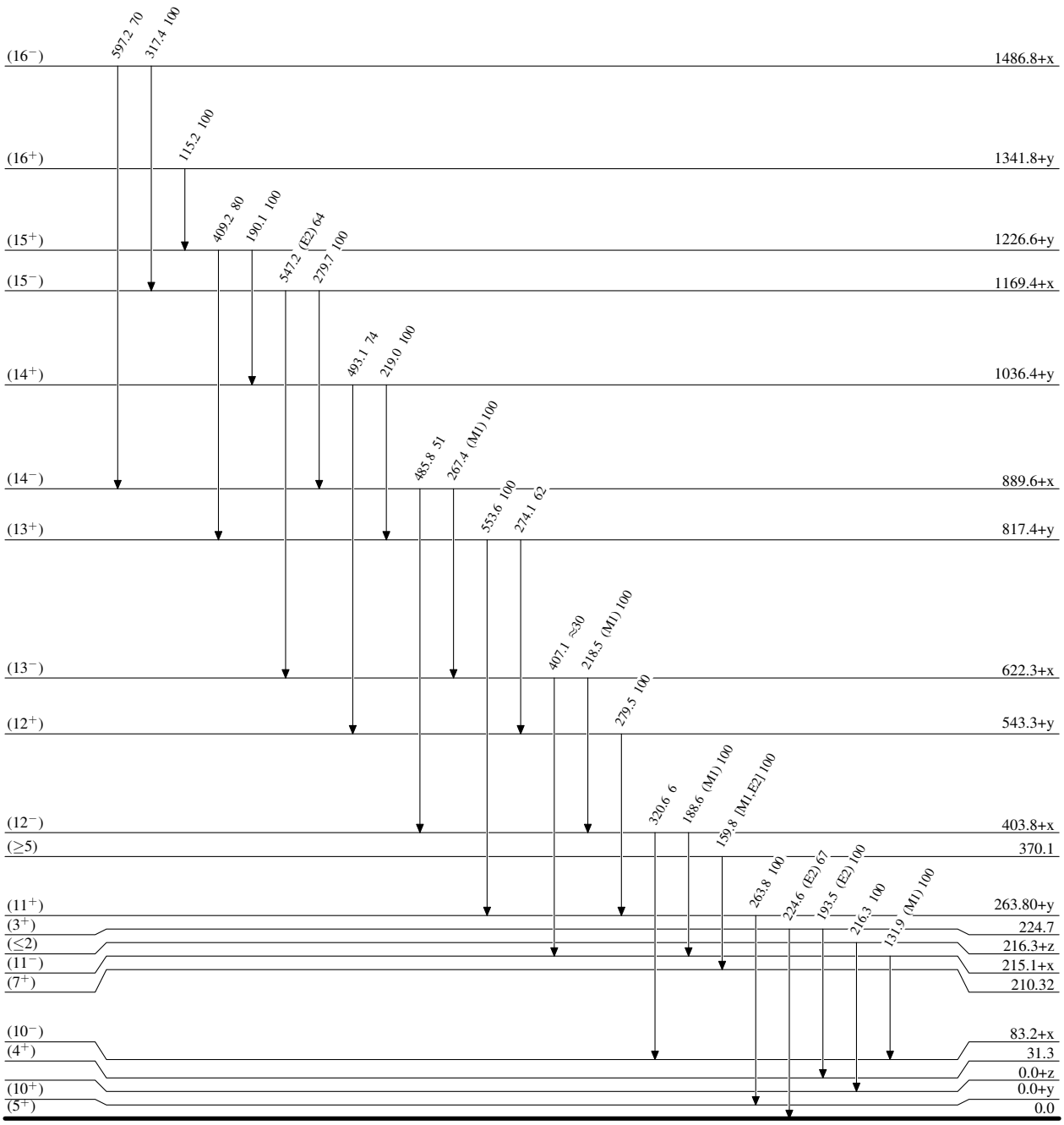


$^{170}_{75}Re_{95}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

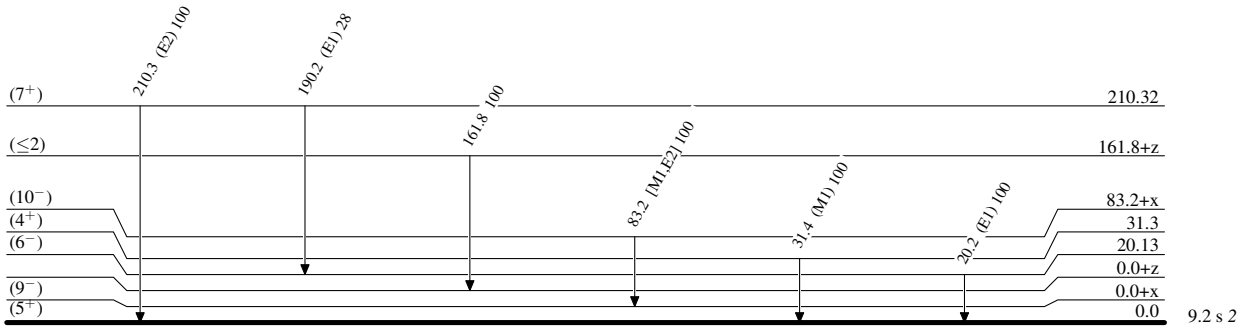


$^{170}_{75}Re_{95}$

Adopted Levels, Gammas

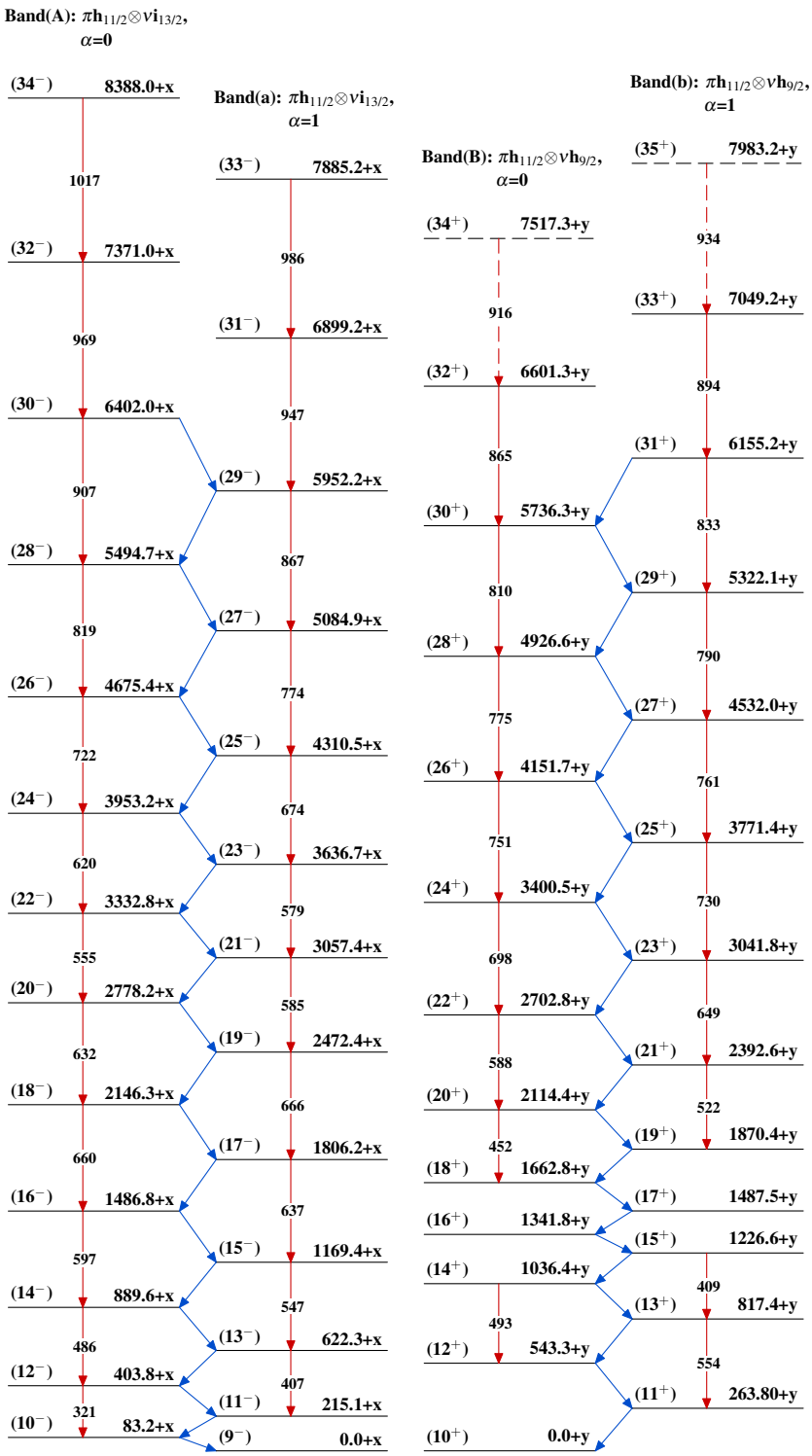
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{170}_{75}Re_{95}$

Adopted Levels, Gammas



$^{170}_{75}Re_{95}$