

$^{120}\text{Sn}(^{55}\text{Mn},3n\gamma)$ 2014Ha22

Type	History		Literature Cutoff Date
	Author	Citation	
Full Evaluation	Balraj Singh	ENSDF	31-Dec-2015

2014Ha22: E=257 MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma(\theta)$ ratios using Gammasphere array at ATLAS-ANL facility. Deduced high-spin levels, J, π , bands, configurations.

[Additional information 1.](#)

 ^{172}Re Levels

A, B, C and D correspond to first, second, third and fourth lowest $i_{13/2}$ quasineutrons.

E(level) [†]	J ^{π}	Comments
0+z		Additional information 2.
52.0+z 18		
194.0+z [‡] 19	(4 ⁺)	
223+z [#]	(5 ⁺)	
292.0+z [‡] 17	(6 ⁺)	
381.0+z 10		
390.0+z [#] 15	(7 ⁺)	
501.0+z [‡] 13	(8 ⁺)	
646.0+z [#] 13	(9 ⁺)	
806.0+z [‡] 14	(10 ⁺)	
991.0+z [#] 16	(11 ⁺)	
1196.1+z [‡] 17	(12 ⁺)	
1407.9+z [#] 18	(13 ⁺)	
1649.1+z [‡] 19	(14 ⁺)	
1868.9+z [#] 19	(15 ⁺)	
2127.4+z [‡] 20	(16 ⁺)	
2173.9+z [@] 20	(16 ⁺)	
2356.8+z [#] 20	(17 ⁺)	
2410.4+z ^{&} 21	(17 ⁺)	
2616.5+z [‡] 20	(18 ⁺)	
2706.6+z [@] 20	(18 ⁺)	
2872.8+z [#] 20	(19 ⁺)	
2920.4+z ^{&} 21	(19 ⁺)	
3173.3+z [‡] 21	(20 ⁺)	
3288.5+z [@] 21	(20 ⁺)	
3443.0+z [#] 21	(21 ⁺)	
3493.4+z ^{&} 21	(21 ⁺)	
3792.3+z [‡] 23	(22 ⁺)	
3915.5+z [@] 23	(22 ⁺)	
4070.0+z [#] 23	(23 ⁺)	
4125.4+z ^{&} 24	(23 ⁺)	
4469.3+z [‡] 25	(24 ⁺)	
4593.6+z [@] 25	(24 ⁺)	
4744+z [#] 3	(25 ⁺)	
4817+z ^{&} 3	(25 ⁺)	

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$^{120}\text{Sn}(^{55}\text{Mn},3n\gamma)$ **2014Ha22** (continued) ^{172}Re Levels (continued)

E(level) [†]	J ^π	Comments
5202+z [‡] 3	(26 ⁺)	
5324+z [@] 3	(26 ⁺)	
5453+z [#] 3	(27 ⁺)	
5570+z ^{&} 3	(27 ⁺)	
5992+z [‡] 3	(28 ⁺)	
6197+z [#] 3	(29 ⁺)	
6382+z ^{&} 3	(29 ⁺)	
6838+z [‡] 3	(30 ⁺)	
6989+z [#] 3	(31 ⁺)	
7245+z ^{&} 3	(31 ⁺)	
7735+z [‡] 4	(32 ⁺)	
7844+z [#] 4	(33 ⁺)	
8141+z ^{&} 4	(33 ⁺)	
8679+z [‡] 4	(34 ⁺)	
8766+z [#] 4	(35 ⁺)	
9069+z ^{&} 4	(35 ⁺)	
9674+z [‡] 4	(36 ⁺)	
9755+z [#] 4	(37 ⁺)	
10803+z [#] 4	(39 ⁺)	
0+u		Additional information 3.
96+u ^a 4	(6 ⁻)	
186.0+u ^d 10	(9 ⁻)	
187+u ^b 4	(7 ⁻)	
214+u ^a 3	(8 ⁻)	
282.0+u ^c 15	(10 ⁻)	
364+u ^b 3	(9 ⁻)	
408+u ^a 3	(10 ⁻)	
421.0+u ^d 18	(11 ⁻)	
606.2+u ^c 19	(12 ⁻)	
622+u ^b 3	(11 ⁻)	
706+u ^a 3	(12 ⁻)	
820.8+u ^d 19	(13 ⁻)	
968+u ^b 3	(13 ⁻)	
1072.7+u ^c 20	(14 ⁻)	
1113+u ^a 3	(14 ⁻)	
1341.4+u ^d 21	(15 ⁻)	
1401+u ^b 3	(15 ⁻)	
1615+u ^a 3	(16 ⁻)	
1637.4+u ^c 21	(16 ⁻)	
1913+u ^b 3	(17 ⁻)	
1942.8+u ^d 22	(17 ⁻)	
2195+u ^a 3	(18 ⁻)	
2262.6+u ^c 22	(18 ⁻)	
2490+u ^b 3	(19 ⁻)	
2588.7+u ^d 22	(19 ⁻)	
2833.9+u ^a 25	(20 ⁻)	
2914.6+u ^c 23	(20 ⁻)	

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$^{120}\text{Sn}(^{55}\text{Mn},3n\gamma)$ **2014Ha22 (continued)** ^{172}Re Levels (continued)

E(level) [†]	J ^π	E(level) [†]	J ^π	E(level) [†]	J ^π	E(level) [†]	J ^π
3116+u ^b 3	(21 ⁻)	4554.2+u ^d 25	(25 ⁻)	6573+u ^c 3	(30 ⁻)	8514+u ^a 4	(34 ⁻)
3240.9+u ^d 23	(21 ⁻)	4912.2+u ^c 25	(26 ⁻)	6692+u ^a 3	(30 ⁻)	8771+u ^b 4	(35 ⁻)
3518.7+u ^a 25	(22 ⁻)	5025+u ^a 3	(26 ⁻)	6879+u ^b 4	(31 ⁻)	9462+u ^a 4	(36 ⁻)
3554.1+u ^c 24	(22 ⁻)	5225+u ^b 4	(27 ⁻)	7048+u ^d 3	(31 ⁻)	9792+u ^b 4	(37 ⁻)
3780+u ^b 3	(23 ⁻)	5312+u ^d 3	(27 ⁻)	7505+u ^c 3	(32 ⁻)	9807+u 4	
3874.1+u ^d 24	(23 ⁻)	5707+u ^c 3	(28 ⁻)	7594+u ^a 4	(32 ⁻)	10451+u ^a 4	(38 ⁻)
4194.3+u ^c 24	(24 ⁻)	5835+u ^a 3	(28 ⁻)	7796+u ^b 4	(33 ⁻)	10834+u ^b 4	(39 ⁻)
4254.9+u ^a 25	(24 ⁻)	6022+u ^b 4	(29 ⁻)	8014+u ^d 3	(33 ⁻)		
4481+u ^b 3	(25 ⁻)	6145+u ^d 3	(29 ⁻)	8495+u ^c 3	(34 ⁻)		

[†] From least-squares fit to E γ data, assuming 1 keV uncertainty for each γ ray.

[‡] Band(A): $\pi h_{9/2} \otimes \nu(f_{7/2}/h_{9/2}, \alpha=0$. Band 3 in [2014Ha22](#). Crossing at $\hbar\omega \approx 0.24$ MeV due to AB alignment; second crossing at $\hbar\omega \approx 0.33$ MeV.

[#] Band(a): $\pi h_{9/2} \otimes \nu(f_{7/2}/h_{9/2}, \alpha=1$. Band 3 in [2014Ha22](#). Crossing at $\hbar\omega \approx 0.24$ MeV due to AB alignment.

[@] Band(B): $\pi h_{9/2} \otimes \nu(p_{3/2}AB), \alpha=0$ Band 4 in [2014Ha22](#).

[&] Band(C): Band based on (16⁺) Band 5 in [2014Ha22](#).

^a Band(D): $\pi h_{9/2} \otimes \nu i_{13/2}, \alpha=0$. Band 1 in [2014Ha22](#), semi-decoupled structure. Crossing at $\hbar\omega \approx 0.38$ MeV due to AD alignment, higher frequency crossing at $\hbar\omega \approx 0.5$ MeV.

^b Band(d): $\pi h_{9/2} \otimes \nu i_{13/2}, \alpha=1$. Band 1 in [2014Ha22](#). Crossing at $\hbar\omega \approx 0.34$ MeV.

^c Band(E): $\pi h_{11/2} \otimes \nu i_{13/2}, \alpha=0$. Band 2 in [2014Ha22](#). Crossing at $\hbar\omega \approx 0.30$ MeV due to BC alignment.

^d Band(e): $\pi h_{11/2} \otimes \nu i_{13/2}, \alpha=1$. Band 2 in [2014Ha22](#). Crossing at $\hbar\omega \approx 0.30$ MeV due to BC alignment.

 $\gamma(^{172}\text{Re})$

E γ	E _i (level)	J _i ^π	E _f	J _f ^π
91	187+u	(7 ⁻)	96+u	(6 ⁻)
96	282.0+u	(10 ⁻)	186.0+u	(9 ⁻)
98	292.0+z	(6 ⁺)	194.0+z	(4 ⁺)
111	501.0+z	(8 ⁺)	390.0+z	(7 ⁺)
118	214+u	(8 ⁻)	96+u	(6 ⁻)
120	501.0+z	(8 ⁺)	381.0+z	
139	421.0+u	(11 ⁻)	282.0+u	(10 ⁻)
145	646.0+z	(9 ⁺)	501.0+z	(8 ⁺)
150	364+u	(9 ⁻)	214+u	(8 ⁻)
160	806.0+z	(10 ⁺)	646.0+z	(9 ⁺)
167 [†]	390.0+z	(7 ⁺)	223+z	(5 ⁺)
177	364+u	(9 ⁻)	187+u	(7 ⁻)
185	606.2+u	(12 ⁻)	421.0+u	(11 ⁻)
186	186.0+u	(9 ⁻)	0+u	
194	408+u	(10 ⁻)	214+u	(8 ⁻)
209	501.0+z	(8 ⁺)	292.0+z	(6 ⁺)
214	622+u	(11 ⁻)	408+u	(10 ⁻)
215	820.8+u	(13 ⁻)	606.2+u	(12 ⁻)
252	1072.7+u	(14 ⁻)	820.8+u	(13 ⁻)
256	646.0+z	(9 ⁺)	390.0+z	(7 ⁺)
256	2872.8+z	(19 ⁺)	2616.5+z	(18 ⁺)
258	622+u	(11 ⁻)	364+u	(9 ⁻)
262	968+u	(13 ⁻)	706+u	(12 ⁻)

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$^{120}\text{Sn}(^{55}\text{Mn},3n\gamma)$ **2014Ha22** (continued) $\gamma(^{172}\text{Re})$ (continued)

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
265	646.0+z	(9 ⁺)	381.0+z			
269	1341.4+u	(15 ⁻)	1072.7+u	(14 ⁻)		
270	3443.0+z	(21 ⁺)	3173.3+z	(20 ⁺)		
282	3116+u	(21 ⁻)	2833.9+u	(20 ⁻)		
283	2410.4+z	(17 ⁺)	2127.4+z	(16 ⁺)	D	R _{ang} =0.6 1.
288	1401+u	(15 ⁻)	1113+u	(14 ⁻)		
295	2490+u	(19 ⁻)	2195+u	(18 ⁻)		
296	1637.4+u	(16 ⁻)	1341.4+u	(15 ⁻)		
298	706+u	(12 ⁻)	408+u	(10 ⁻)		
298	1913+u	(17 ⁻)	1615+u	(16 ⁻)		
304	2920.4+z	(19 ⁺)	2616.5+z	(18 ⁺)		
305	806.0+z	(10 ⁺)	501.0+z	(8 ⁺)		
305	1942.8+u	(17 ⁻)	1637.4+u	(16 ⁻)		
313	3554.1+u	(22 ⁻)	3240.9+u	(21 ⁻)		
320	3493.4+z	(21 ⁺)	3173.3+z	(20 ⁺)		
320	2262.6+u	(18 ⁻)	1942.8+u	(17 ⁻)		
320	3874.1+u	(23 ⁻)	3554.1+u	(22 ⁻)		
320	4194.3+u	(24 ⁻)	3874.1+u	(23 ⁻)		
326	2588.7+u	(19 ⁻)	2262.6+u	(18 ⁻)		
326	2914.6+u	(20 ⁻)	2588.7+u	(19 ⁻)		
326	3240.9+u	(21 ⁻)	2914.6+u	(20 ⁻)		
329 [†]	1401+u	(15 ⁻)	1072.7+u	(14 ⁻)		
338	390.0+z	(7 ⁺)	52.0+z			
345	991.0+z	(11 ⁺)	646.0+z	(9 ⁺)		
346	968+u	(13 ⁻)	622+u	(11 ⁻)		
358	4912.2+u	(26 ⁻)	4554.2+u	(25 ⁻)		
360	4554.2+u	(25 ⁻)	4194.3+u	(24 ⁻)		
381	381.0+z		0+z			
390	1196.1+z	(12 ⁺)	806.0+z	(10 ⁺)		
395	5707+u	(28 ⁻)	5312+u	(27 ⁻)		
400	820.8+u	(13 ⁻)	421.0+u	(11 ⁻)		
400	5312+u	(27 ⁻)	4912.2+u	(26 ⁻)		
407	1113+u	(14 ⁻)	706+u	(12 ⁻)		
417	1407.9+z	(13 ⁺)	991.0+z	(11 ⁺)		
428	6573+u	(30 ⁻)	6145+u	(29 ⁻)		
433	1401+u	(15 ⁻)	968+u	(13 ⁻)		
438	6145+u	(29 ⁻)	5707+u	(28 ⁻)		
453	1649.1+z	(14 ⁺)	1196.1+z	(12 ⁺)		
461	1868.9+z	(15 ⁺)	1407.9+z	(13 ⁺)		
466	1072.7+u	(14 ⁻)	606.2+u	(12 ⁻)		
475	7048+u	(31 ⁻)	6573+u	(30 ⁻)		
478	2127.4+z	(16 ⁺)	1649.1+z	(14 ⁺)		
488	2356.8+z	(17 ⁺)	1868.9+z	(15 ⁺)		
489	2616.5+z	(18 ⁺)	2127.4+z	(16 ⁺)		
502	1615+u	(16 ⁻)	1113+u	(14 ⁻)		
510	2920.4+z	(19 ⁺)	2410.4+z	(17 ⁺)		
512	1913+u	(17 ⁻)	1401+u	(15 ⁻)		
516	2872.8+z	(19 ⁺)	2356.8+z	(17 ⁺)		
521	1341.4+u	(15 ⁻)	820.8+u	(13 ⁻)		
525	2173.9+z	(16 ⁺)	1649.1+z	(14 ⁺)	Q	R _{ang} =0.95 6.
533	2706.6+z	(18 ⁺)	2173.9+z	(16 ⁺)		
557	3173.3+z	(20 ⁺)	2616.5+z	(18 ⁺)		
564	1637.4+u	(16 ⁻)	1072.7+u	(14 ⁻)		
570	3443.0+z	(21 ⁺)	2872.8+z	(19 ⁺)		
573	3493.4+z	(21 ⁺)	2920.4+z	(19 ⁺)		

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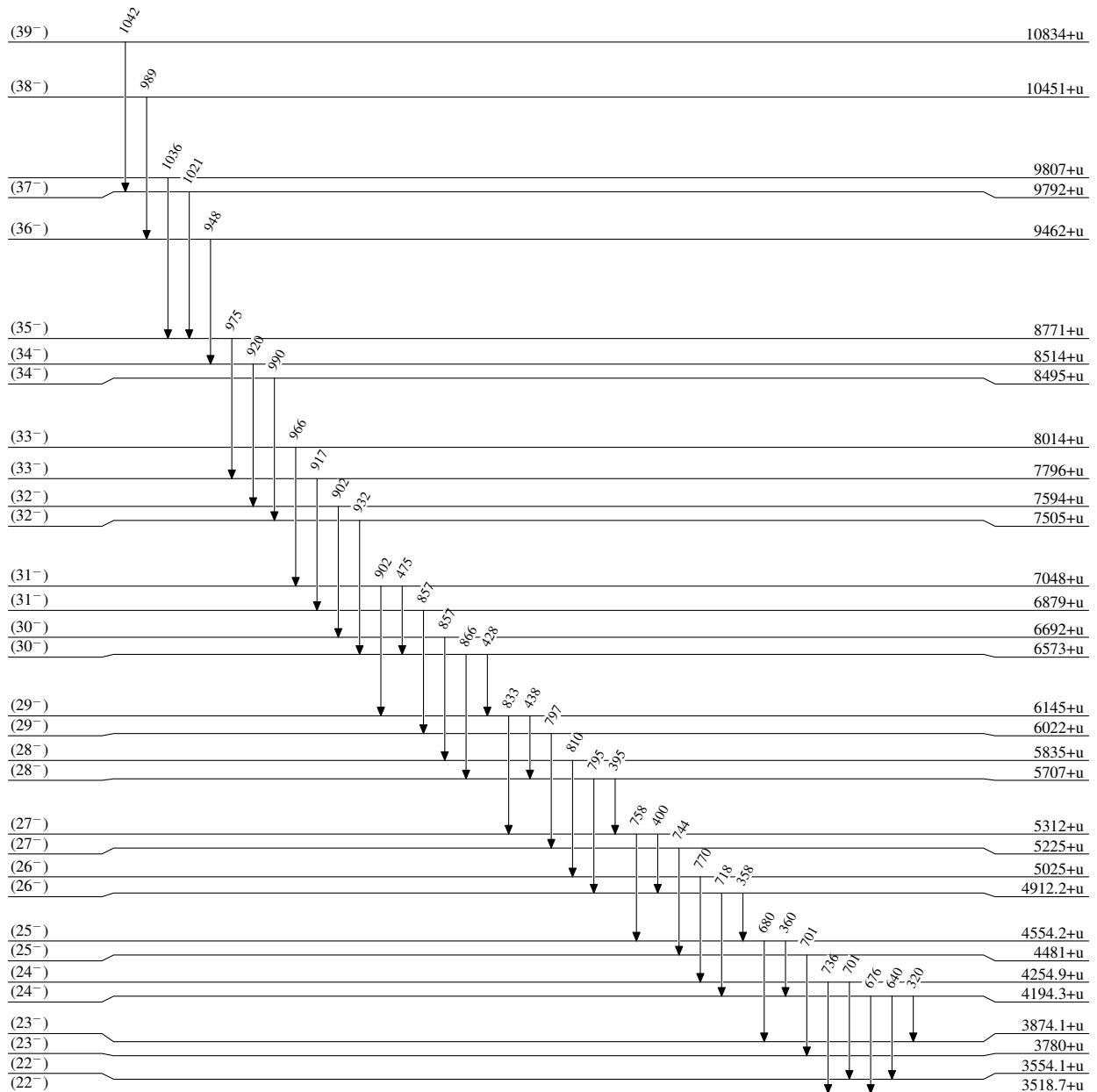
$^{120}\text{Sn}(^{55}\text{Mn},3n\gamma)$ **2014Ha22** (continued) $\gamma(^{172}\text{Re})$ (continued)

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π
577	2490+u	(19 ⁻)	1913+u	(17 ⁻)	753	5570+z	(27 ⁺)	4817+z	(25 ⁺)
579	2706.6+z	(18 ⁺)	2127.4+z	(16 ⁺)	758	5312+u	(27 ⁻)	4554.2+u	(25 ⁻)
580	2195+u	(18 ⁻)	1615+u	(16 ⁻)	770	5025+u	(26 ⁻)	4254.9+u	(24 ⁻)
582	3288.5+z	(20 ⁺)	2706.6+z	(18 ⁺)	790	5992+z	(28 ⁺)	5202+z	(26 ⁺)
602	1942.8+u	(17 ⁻)	1341.4+u	(15 ⁻)	792	6989+z	(31 ⁺)	6197+z	(29 ⁺)
619	3792.3+z	(22 ⁺)	3173.3+z	(20 ⁺)	795	5707+u	(28 ⁻)	4912.2+u	(26 ⁻)
625	2262.6+u	(18 ⁻)	1637.4+u	(16 ⁻)	797	6022+u	(29 ⁻)	5225+u	(27 ⁻)
626	3116+u	(21 ⁻)	2490+u	(19 ⁻)	810	5835+u	(28 ⁻)	5025+u	(26 ⁻)
627	3915.5+z	(22 ⁺)	3288.5+z	(20 ⁺)	812	6382+z	(29 ⁺)	5570+z	(27 ⁺)
627	4070.0+z	(23 ⁺)	3443.0+z	(21 ⁺)	833	6145+u	(29 ⁻)	5312+u	(27 ⁻)
632	4125.4+z	(23 ⁺)	3493.4+z	(21 ⁺)	846	6838+z	(30 ⁺)	5992+z	(28 ⁺)
633	3874.1+u	(23 ⁻)	3240.9+u	(21 ⁻)	855	7844+z	(33 ⁺)	6989+z	(31 ⁺)
639	2833.9+u	(20 ⁻)	2195+u	(18 ⁻)	857	6692+u	(30 ⁻)	5835+u	(28 ⁻)
640	3554.1+u	(22 ⁻)	2914.6+u	(20 ⁻)	857	6879+u	(31 ⁻)	6022+u	(29 ⁻)
640	4194.3+u	(24 ⁻)	3554.1+u	(22 ⁻)	863	7245+z	(31 ⁺)	6382+z	(29 ⁺)
646	2588.7+u	(19 ⁻)	1942.8+u	(17 ⁻)	866	6573+u	(30 ⁻)	5707+u	(28 ⁻)
652	2914.6+u	(20 ⁻)	2262.6+u	(18 ⁻)	896	8141+z	(33 ⁺)	7245+z	(31 ⁺)
652	3240.9+u	(21 ⁻)	2588.7+u	(19 ⁻)	897	7735+z	(32 ⁺)	6838+z	(30 ⁺)
664	3780+u	(23 ⁻)	3116+u	(21 ⁻)	902	7048+u	(31 ⁻)	6145+u	(29 ⁻)
672	3288.5+z	(20 ⁺)	2616.5+z	(18 ⁺)	902	7594+u	(32 ⁻)	6692+u	(30 ⁻)
674	4744+z	(25 ⁺)	4070.0+z	(23 ⁺)	917	7796+u	(33 ⁻)	6879+u	(31 ⁻)
676	4194.3+u	(24 ⁻)	3518.7+u	(22 ⁻)	920	8514+u	(34 ⁻)	7594+u	(32 ⁻)
677	4469.3+z	(24 ⁺)	3792.3+z	(22 ⁺)	922	8766+z	(35 ⁺)	7844+z	(33 ⁺)
678	4593.6+z	(24 ⁺)	3915.5+z	(22 ⁺)	928	9069+z	(35 ⁺)	8141+z	(33 ⁺)
680	4554.2+u	(25 ⁻)	3874.1+u	(23 ⁻)	932	7505+u	(32 ⁻)	6573+u	(30 ⁻)
685	3518.7+u	(22 ⁻)	2833.9+u	(20 ⁻)	944	8679+z	(34 ⁺)	7735+z	(32 ⁺)
692	4817+z	(25 ⁺)	4125.4+z	(23 ⁺)	948	9462+u	(36 ⁻)	8514+u	(34 ⁻)
701	4254.9+u	(24 ⁻)	3554.1+u	(22 ⁻)	966	8014+u	(33 ⁻)	7048+u	(31 ⁻)
701	4481+u	(25 ⁻)	3780+u	(23 ⁻)	975	8771+u	(35 ⁻)	7796+u	(33 ⁻)
709	5453+z	(27 ⁺)	4744+z	(25 ⁺)	989	9755+z	(37 ⁺)	8766+z	(35 ⁺)
718	4912.2+u	(26 ⁻)	4194.3+u	(24 ⁻)	989	10451+u	(38 ⁻)	9462+u	(36 ⁻)
720	3554.1+u	(22 ⁻)	2833.9+u	(20 ⁻)	990	8495+u	(34 ⁻)	7505+u	(32 ⁻)
730	5324+z	(26 ⁺)	4593.6+z	(24 ⁺)	995	9674+z	(36 ⁺)	8679+z	(34 ⁺)
733	5202+z	(26 ⁺)	4469.3+z	(24 ⁺)	1021	9792+u	(37 ⁻)	8771+u	(35 ⁻)
736	4254.9+u	(24 ⁻)	3518.7+u	(22 ⁻)	1036	9807+u		8771+u	(35 ⁻)
744	6197+z	(29 ⁺)	5453+z	(27 ⁺)	1042	10834+u	(39 ⁻)	9792+u	(37 ⁻)
744	5225+u	(27 ⁻)	4481+u	(25 ⁻)	1048	10803+z	(39 ⁺)	9755+z	(37 ⁺)

† Placement of transition in the level scheme is uncertain.

$^{120}\text{Sn}(^{55}\text{Mn}, 3n\gamma)$ 2014Ha22

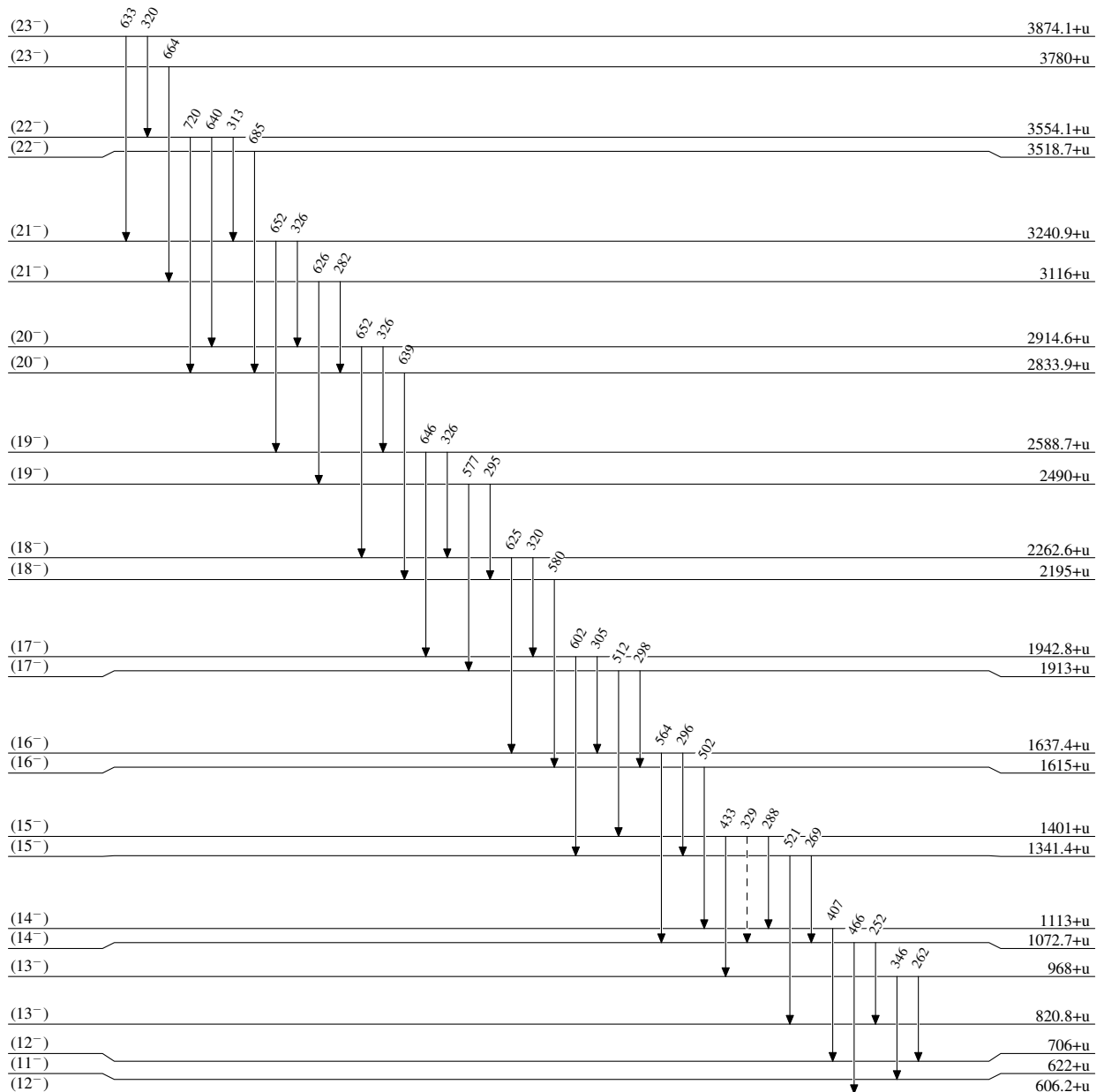
Level Scheme

 $^{172}_{75}\text{Re}_{97}$

$^{120}\text{Sn}(^{55}\text{Mn}, 3n\gamma)$ 2014Ha22

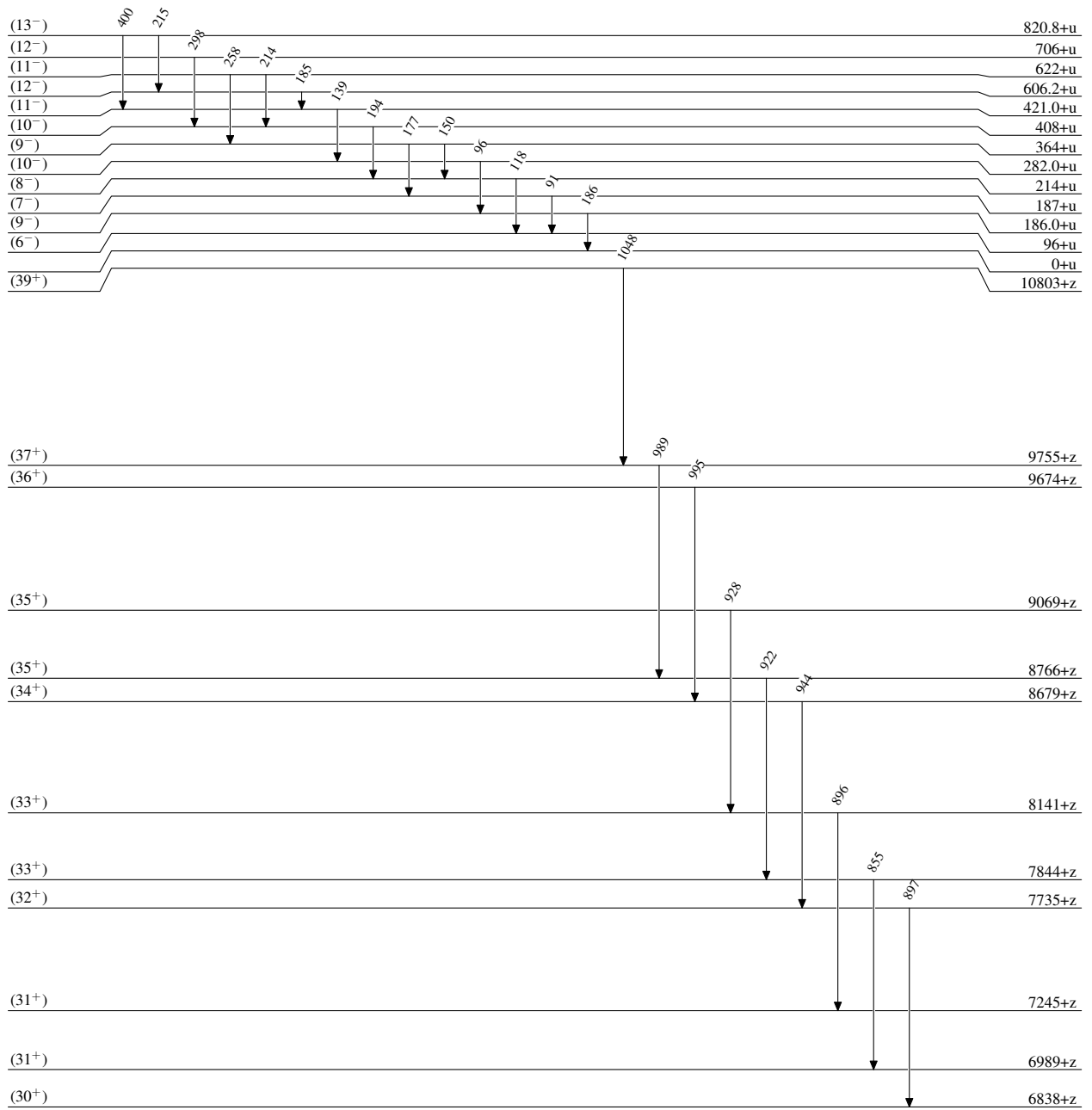
Legend

Level Scheme (continued)

-----► γ Decay (Uncertain) $^{172}_{75}\text{Re}_{97}$

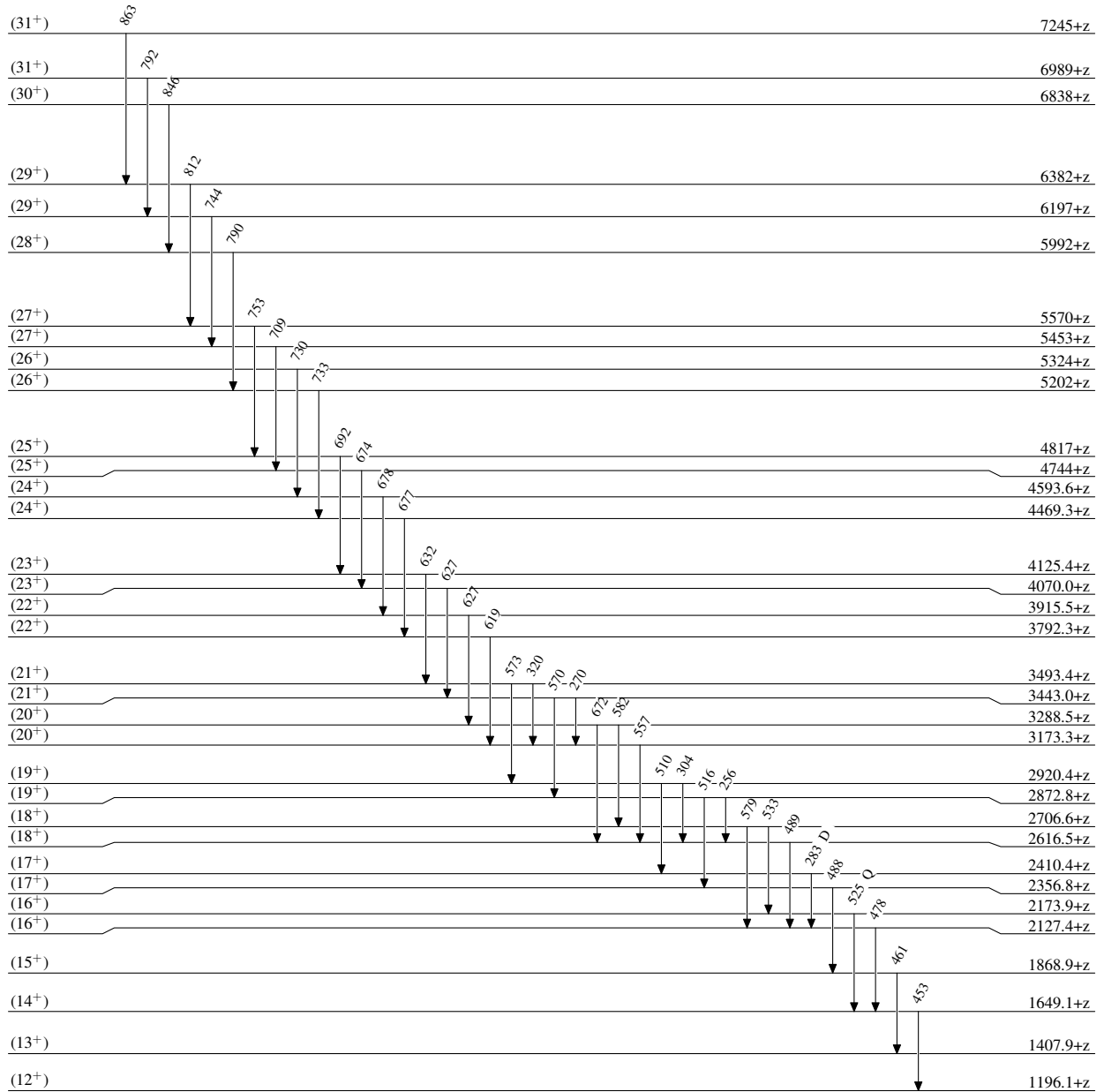
$^{120}\text{Sn}(^{55}\text{Mn}, 3n\gamma)$ 2014Ha22

Level Scheme (continued)

 $^{172}_{75}\text{Re}_{97}$

$^{120}\text{Sn}(^{55}\text{Mn}, 3n\gamma)$ 2014Ha22

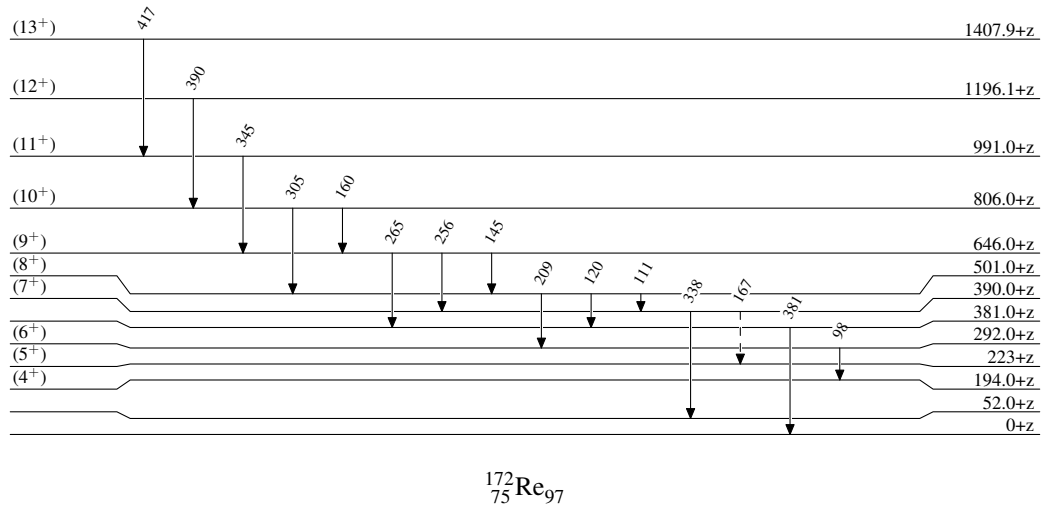
Level Scheme (continued)

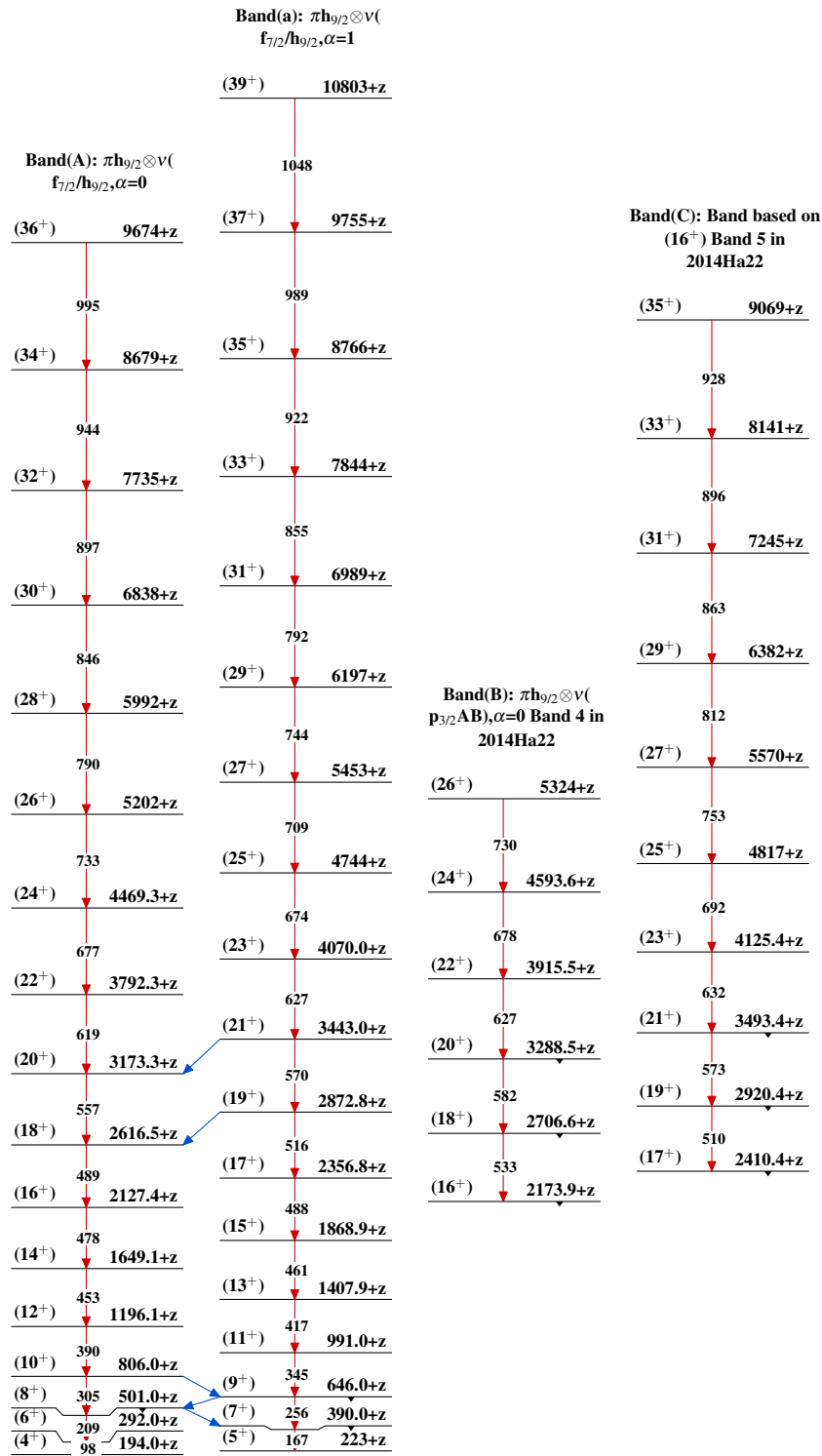


$^{120}\text{Sn}(^{55}\text{Mn},3n\gamma)$ 2014Ha22

Legend

Level Scheme (continued)

-----> γ Decay (Uncertain) $^{172}_{75}\text{Re}_{97}$

$^{120}\text{Sn}(^{55}\text{Mn}, 3n\gamma) \quad 2014\text{Ha22}$ 

$^{120}\text{Sn}(^{55}\text{Mn}, 3n\gamma)$ 2014Ha22 (continued)