^{58}Ni(^{40}Ca,α4pγ) 1992Ar15

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. K. Basu, E. A. Mccutchan	NDS 165, 1 (2020)	1-Mar-2020

1992Ar15: 99.7% enriched ^{58}Ni(^{40}Ca,α4pγ) reaction, E=180, 187 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma\gamma(\theta)$. NORDBALL array, consisting of 15 Compton-suppressed HPGe detectors, a forward wall of 11 liquid scintillator neutron detectors and a 4π silicon-ball consisting of 21 detectors for protons and alphas.

^{90}Mo Levels

E(level)‡	J$^{\pi}$†	T$_{1/2}$	Comments
0.0#	0$^+$		
947.71# *20*	2$^+$		
2001.7# *3*	4$^+$		
2548.3& *3*	5$^-$		
2810.9# *3*	6$^+$		
2874.0# *8*	8$^+$		
3105.2@ *8*	8$^+$		
3366.9& *4*	7$^-$		
4077.7# *8*	(10$^+$)		
4191.3@ *8*	(10$^+$)		
4297.2& *4*	(9$^-$)		
4554.4# *8*	(12$^+$)	0.4 ns *1*	T$_{1/2}$: Doppler-shift method.
4840.7& *8*	(11$^-$)		
5375.5 *8*	(13$^+$)		
5623.2# *8*	(14$^+$)		
5698.0& *8*	(13$^-$)		
5901.8 *8*	(14$^+$)		
6146.0 *8*	(15$^+$)		
6473.8 *11*	(14$^-$)		
6641.0& *8*	(15$^-$)		
6743.8# *8*	(16$^+$)		
7383.1 *11*	(16$^-$)		
7512.6& *8*	(17$^-$)		
8064.8 *9*	(17$^+$)		
8120.4& *9*	(18$^-$)		
8523.0# *10*	(18$^+$)		
8674.3& *11*	(19$^-$)		
9134.0 *11*	(18$^+$)		
9316.5 *11*	(19$^-$)		
9441.1 *13*	(19$^+$)		
9737.2 *10*	(19$^+$)		
9784.5# *15*	(20$^+$)		
9991.5 *11*	(20$^-$)		
10232.5 *11*	(20$^+$)		
10475.0 *12*	(20$^+$)		
10532.8 *12*	(21$^-$)		
10852.4 *12*	(21$^+$)		
11264.6 *14*	(21$^-$)		
11573.8 *15*	(22$^+$)		
11732.4 *12*	(22$^+$)		

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^{58}Ni(^{40}Ca,α4pγ) 1992Ar15 (continued)

^{90}Mo Levels (continued)

E(level)‡	Jπ†	E(level)‡	Jπ†	E(level)‡	Jπ†
12012.2 *13*	(23+)	12378.4 *14*	(23−)	14275.5 *17*	(24+,25+)
12252.6 *16*	(22−)	12488.8? *16*		14406.9 *17*	(25−)
				14482.3 *17*	(25+)

† Assignments were mostly based on γ-ray anisotropies determined by $\gamma\gamma(\theta)$ measurements.
‡ Deduced from a least-squares fit to Eγ, by evaluators.
# Seq.(A): Ground state sequence.
@ Seq.(B): Positive-parity sequence.
& Seq.(C): Negative-parity sequence.

γ(^{90}Mo)

γ-ray anisotropies R=2 Iγ(143°)/[Iγ(79°) + Iγ(101°)] provided some information on γ-ray multipolarities. From systematics of transitions with known multipolarity, R≈1.7 for Q transitions, R≈0.9 for D transitions.

E$_\gamma$†	I$_\gamma$	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Anisotropy@	Comments
62.9 *10*		2874.0	8+	2810.9	6+		E$_\gamma$: From Adopted Gammas. Not measured in this experiment.
113.9 *10*	29 *3*	4191.3	(10+)	4077.7	(10+)	1.85 *36*	
129.6 *10*	65 *4*	7512.6	(17−)	7383.1	(16−)	0.82 *9*	
167.2 *10*	89 *4*	6641.0	(15−)	6473.8	(14−)	0.80 *7*	
231.2 *2*	1000 *10*	3105.2	8+	2874.0	8+	1.66 *3*	
244.1 *2*	286 *9*	6146.0	(15+)	5901.8	(14+)	0.75 *3*	
247.5 *2*	455 *7*	5623.2	(14+)	5375.5	(13+)	0.85 *3*	
262.5 *10*	17‡ *3*	2810.9	6+	2548.3	5−	1.12 *25*	
279.6 *10*	98 *5*	12012.2	(23+)	11732.4	(22+)	0.84 *9*	See Adopted Levels, Gammas for adopted placement from 11136 level (1992Ka27).
343.2 *10*	73 *4*	9784.5	(20+)	9441.1	(19+)	0.92 *12*	
363.1 *2*	488 *8*	4554.4	(12+)	4191.3	(10+)	1.65 *5*	
377.3 *10*	14 *3*	10852.4	(21+)	10475.0	(20+)	0.74 *25*	
438.3 *10*	16 *3*	12012.2	(23+)	11573.8	(22+)	0.91 *36*	
458.0 *5*	153 *5*	8523.0	(18+)	8064.8	(17+)	0.79 *6*	
476.7 *2*	910 *11*	4554.4	(12+)	4077.7	(10+)	1.72 *4*	
495.3 *5*	108 *4*	10232.5	(20+)	9737.2	(19+)	0.70 *6*	
522.8 *2*	449 *8*	6146.0	(15+)	5623.2	(14+)	0.73 *3*	
526.2 *2*	261 *6*	5901.8	(14+)	5375.5	(13+)	0.72 *4*	
541.7# *10*		10532.8	(21−)	9991.5	(20−)		
543.6# *10*	268 *6*	4840.7	(11−)	4297.2	(9−)	1.37 *6*	Iγ is for 543.6 + 541.7 doublet.
546.6 *2*	223 *6*	2548.3	5−	2001.7	4+	0.93 *5*	
554.3 *10*	92 *4*	8674.3	(19−)	8120.4	(18−)	0.83 *10*	
597.8 *2*	380 *7*	6743.8	(16+)	6146.0	(15+)	0.80 *4*	
603.4 *5*	119 *5*	9737.2	(19+)	9134.0	(18+)	0.79 *4*	
607.8 *2*	160 *6*	8120.4	(18−)	7512.6	(17−)	0.75 *6*	
620.0 *5*	125 *5*	10852.4	(21+)	10232.5	(20+)	0.78 *6*	
649.5 *10*	92 *5*	4840.7	(11−)	4191.3	(10+)	0.93 *9*	
675.2 *10*	83 *5*	9991.5	(20−)	9316.5	(19−)	0.82 *11*	
742.1 *10*	75 *4*	7383.1	(16−)	6641.0	(15−)	0.63 *7*	
768.6 *5*	147 *6*	7512.6	(17−)	6743.8	(16+)	0.80 *6*	
775.9 *10*	84 *5*	6473.8	(14−)	5698.0	(13−)	0.66 *7*	

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^{58}Ni(^{40}Ca,α4pγ) 1992Ar15 (continued)

γ(^{90}Mo) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Anisotropy[@]	Comments
809.2 *2*	192[‡] *6*	2810.9	6^+	2001.7	4^+	1.31 *7*	
818.6 *2*	223 *8*	3366.9	7^-	2548.3	5^-	1.33 *8*	
820.9 *2*	738 *12*	5375.5	(13^+)	4554.4	(12^+)	0.85 *3*	
857.3 *2*	246 *7*	5698.0	(13^-)	4840.7	(11^-)	1.86 *9*	
871.6 *2*	399 *8*	7512.6	(17^-)	6641.0	(15^-)	1.69 *7*	
879.9 *5*	96 *4*	11732.4	(22^+)	10852.4	(21^+)	0.80 *10*	See Adopted Levels, Gammas for adopted placement from 12016 level (1992Ka27).
918.0 *10*	47 *4*	9441.1	(19^+)	8523.0	(18^+)	0.99 *16*	
930.3 *2*	248 *7*	4297.2	(9^-)	3366.9	7^-	1.65 *8*	
943.1 *2*	238 *7*	6641.0	(15^-)	5698.0	(13^-)	1.81 *9*	
947.7 *2*	427[‡] *9*	947.71	2^+	0.0	0^+	1.48 *6*	
972.5 *2*	985 *14*	4077.7	(10^+)	3105.2	8^+	1.65 *4*	
1017.7 *5*	172 *6*	6641.0	(15^-)	5623.2	(14^+)	0.86 *5*	
1054.0 *2*	448[‡] *10*	2001.7	4^+	947.71	2^+	1.36 *5*	
1068.9 *2*	350 *8*	5623.2	(14^+)	4554.4	(12^+)	1.72 *8*	
1113.5 *10*	22 *3*	12378.4	(23^-)	11264.6	(21^-)	1.52 *31*	See Adopted Levels, Gammas for adopted placement from 12383.5 level (1992Ka27).
1143.8 *5*	139 *7*	5698.0	(13^-)	4554.4	(12^+)	0.91 *8*	
1160.2 *10*	14 *4*	12012.2	(23^+)	10852.4	(21^+)	1.49 *44*	
1196.3 *10*	14 *3*	9316.5	(19^-)	8120.4	(18^-)	0.30 *3*	
1213.6 *10*	16 *3*	9737.2	(19^+)	8523.0	(18^+)	0.92 *40*	
1317.4[#] *2*	510 *11*	4191.3	(10^+)	2874.0	8^+	1.64 *6*	Iγ is for 1317.4 + 1318.0 doublet.
1318.0[#&] *10*		9991.5	(20^-)	8674.3	(19^-)		
1320.9 *10*	71 *7*	8064.8	(17^+)	6743.8	(16^+)	0.73 *12*	
1672.4 *10*	28 *5*	9737.2	(19^+)	8064.8	(17^+)	1.83 *41*	
1719.8 *10*	4 *3*	12252.6	(22^-)	10532.8	(21^-)	0.50 *23*	
1779.0 *10*	73 *6*	8523.0	(18^+)	6743.8	(16^+)	1.58 *21*	
1789.1 *10*	9 *4*	11573.8	(22^+)	9784.5	(20^+)	1.50 *65*	
1804.0 *10*	87 *6*	9316.5	(19^-)	7512.6	(17^-)	1.40 *16*	
1845.8 *10*	45 *4*	12378.4	(23^-)	10532.8	(21^-)	1.67 *32*	See Adopted Levels, Gammas for adopted placement from 12383.5 level (1992Ka27).
1858.2 *10*	11 *3*	10532.8	(21^-)	8674.3	(19^-)	1.83 *84*	
1870.5 *10*	12 *4*	9991.5	(20^-)	8120.4	(18^-)	1.16 *52*	
1918.7 *5*	145 *6*	8064.8	(17^+)	6146.0	(15^+)	1.42 *11*	
1951.9 *10*	12 *3*	10475.0	(20^+)	8523.0	(18^+)	2.02 *68*	
1956.0[&] *10*	11 *4*	12488.8?		10532.8	(21^-)		
2028.5 *10*	14 *5*	14406.9	(25^-)	12378.4	(23^-)	1.67 *64*	
2263.2 *10*	5 *2*	14275.5	$(24^+,25^+)$	12012.2	(23^+)		
2391.1 *10*	13 *3*	9134.0	(18^+)	6743.8	(16^+)	2.31 *73*	
2470.0 *10*	16 *3*	14482.3	(25^+)	12012.2	(23^+)	2.70 *83*	
2590.0 *10*	6 *2*	11264.6	(21^-)	8674.3	(19^-)	1.79 *99*	

[†] Uncertainties vary from 0.2 to 1.0 keV, depending on the energy and the intensity of the transition. The evaluator has adopted the values given here for individual γ rays.

[‡] The measured intensity is lower because the γ of the gate is considerably shorter than 1 μs, the half-life of the 2875 level.

[#] Doublet.

[@] Anisotropy=2 Iγ(143°)/[Iγ(79°) + Iγ(101°)].

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

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Level Scheme

Intensities: Relative I_γ

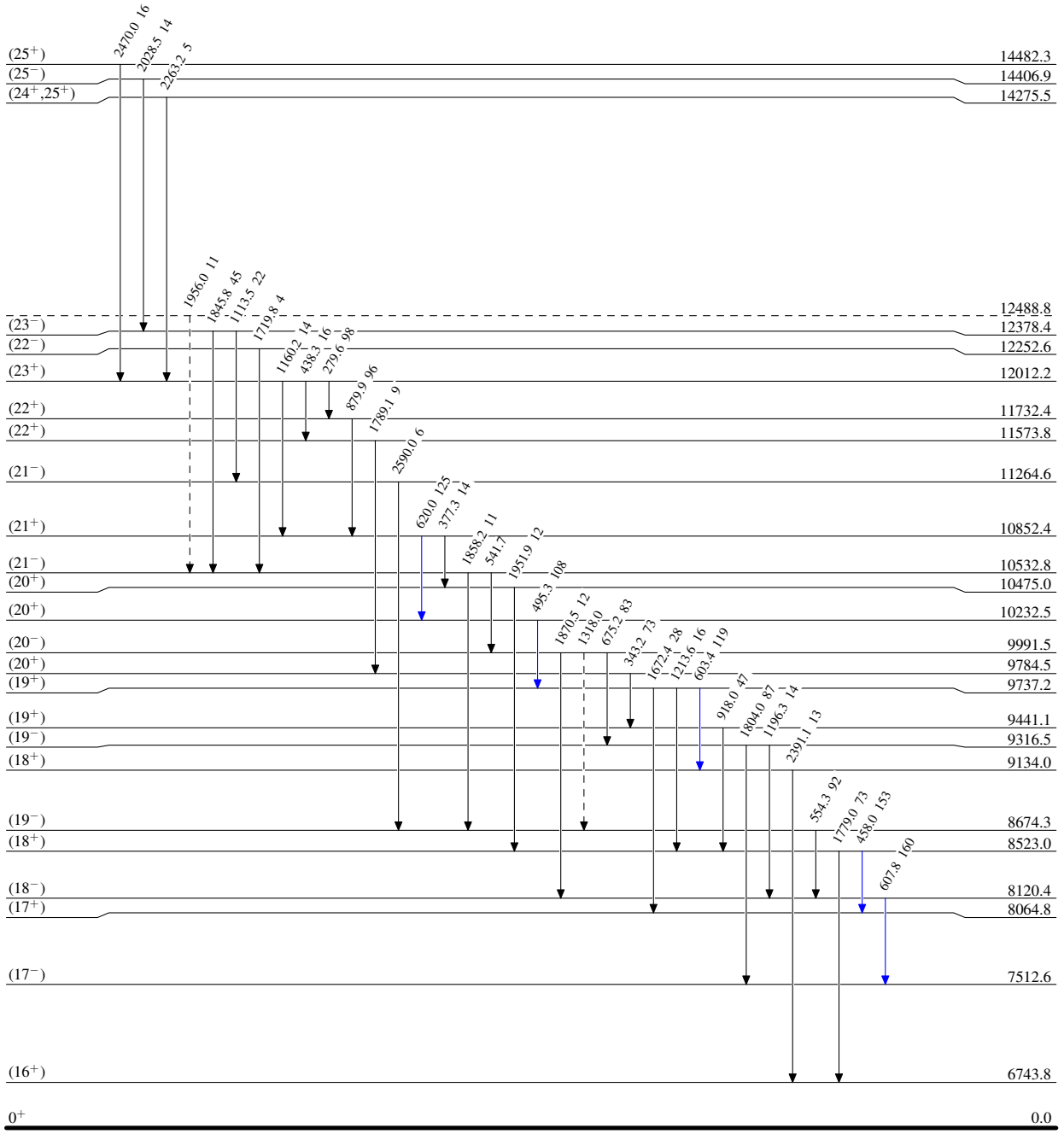
Legend

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

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

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

γ Decay (Uncertain)



$^{90}_{42}Mo_{48}$

^{58}Ni(^{40}Ca,α4pγ) 1992Ar15

Level Scheme (continued)

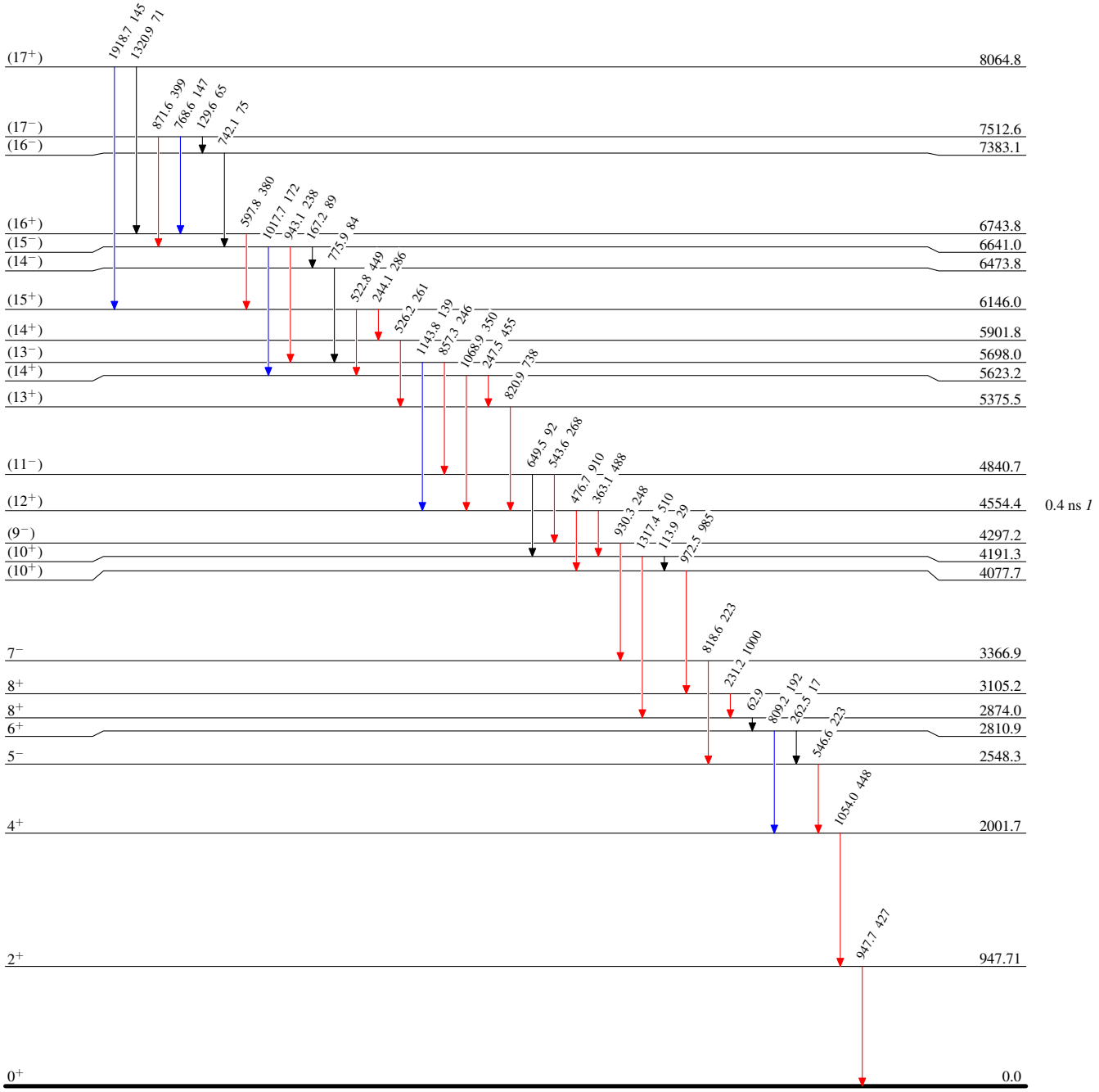
Intensities: Relative I_γ

Legend

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

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

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



$^{90}_{42}Mo_{48}$

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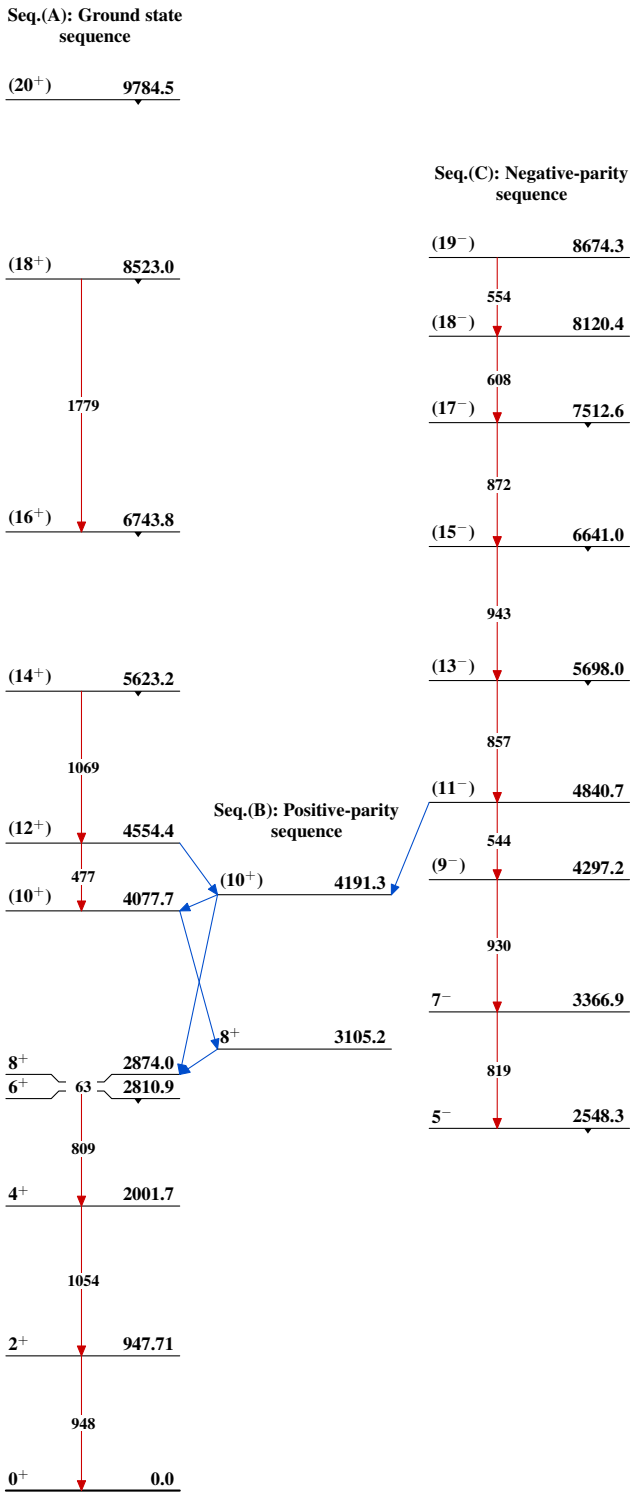

$^{90}_{42}Mo_{48}$