

Adopted Levels, Gammas

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

$Q(\beta^-)=-5841$  4;  $S(n)=11401$  4;  $S(p)=2999$  4;  $Q(\alpha)=-4016$  6 [2017Wa10](#)  
 $S(2n)=25190$  150;  $S(2p)=9130$  60;  $Q(\epsilon p)=2612$  (syst) 24 [\(2017Wa10\)](#).

$\alpha$ : [Additional information 1](#).

 $^{90}\text{Tc}$  LevelsCross Reference (XREF) Flags

- A  $^{90}\text{Ru}$   $\epsilon$  decay
- B (Hl,xn $\gamma$ )
- C Ni( $^{40}\text{Ca}$ ,X)

E(level) <sup>†</sup>	$J^\pi$ <sup>‡</sup>	$T_{1/2}$ <sup>#</sup>	XREF	Comments
0	(8 <sup>+</sup> )	49.2 s 4	BC	$T_{1/2}$ : from 809.8 $\gamma$ (t) <a href="#">(1981Ox01)</a> . Other: 50.7 s 63 <a href="#">(2012Ka12)</a> , based on analysis of data in <a href="#">2008We10</a> . E(level): TOF spectra in Ni( $^{40}\text{Ca}$ ,X) reaction give population fractions of 89 % 5 and 11 % 5 for the ground state and isomer, respectively <a href="#">(2012Ka12)</a> . As high-spin levels are more favorably produced in these reactions, the ground state is assigned as the $J^\pi=(8^+)$ level. $J^\pi$ : from systematics of $J^\pi=8^+$ states in neighboring odd-odd $^{92}\text{Tc}(N=43)$ , $^{90}\text{Nb}(N=49)$ and $^{88}\text{Nb}(N=47)$ nuclei and supported by shell-model calculations <a href="#">(1993Ru03)</a> .
103.70 22	(6 <sup>+</sup> )		B	$J^\pi$ : shell-model calculations predict a $J^\pi=6^+$ state at 106 keV <a href="#">(1993Ru03)</a> ; in $^{90}\text{Nb}$ a 6 <sup>+</sup> isomeric level lies at 123 keV with $T_{1/2} = 60 \mu\text{s}$ , which could explain the non-observation of a depopulating 104-keV transition.
144.1 17	1 <sup>+</sup>	8.7 s 2	A C	$\% \epsilon + \% \beta^+ = 100$ E(level): from Penning-trap mass measurement <a href="#">(2012Ka12)</a> : mass excess = -70724.7 keV 11 for $^{90}\text{Tc}$ g.s. and -70580.6 keV 13 for $^{90}\text{Tc}$ isomer <a href="#">(2012Ka12)</a> . $T_{1/2}$ : from two component fit to 944.7 $\gamma$ +948.1 $\gamma$ (t) <a href="#">(1981Ox01)</a> . Other: 7.9 s 2 <a href="#">(1974Ia01)</a> . $J^\pi$ : theoretical prediction is 2 <sup>+</sup> but 1 <sup>+</sup> is suggested from log $ft$ value to 0 <sup>+</sup> and 2 <sup>+</sup> states in $^{90}\text{Mo}$ . If g.s. feeding is not properly determined then 2 <sup>+</sup> is possible <a href="#">(2012Ka11)</a> .
152.52 <sup>&amp;</sup> 20 298.7 1	(4 <sup>-</sup> )		B A	$J^\pi$ : 187.8 $\gamma$ from (5 <sup>-</sup> ).
340.33 <sup>&amp;</sup> 18 494.09 <sup>a</sup> 8	(5 <sup>-</sup> ) (9 <sup>+</sup> )		B B	$J^\pi$ : E2 683.5 $\gamma$ from (7 <sup>-</sup> ). $J^\pi$ : (M1+E2) 494.1 $\gamma$ to (8 <sup>+</sup> ).
636.9 993.72 <sup>a</sup> 8	(10 <sup>+</sup> )	1.4 ps 5	A B	$J^\pi$ : E2 993.7 $\gamma$ to (8 <sup>+</sup> ).
1023.83 <sup>&amp;</sup> 15 1485.90 <sup>a</sup> 10	(7 <sup>-</sup> ) (11 <sup>+</sup> )	<5 ps	B B	$J^\pi$ : E2 608.1 $\gamma$ from (9 <sup>-</sup> ). $J^\pi$ : (M1+E2) 492.1 $\gamma$ to (10 <sup>+</sup> ).
1613.85 10 1631.93 <sup>&amp;</sup> 12 1698.77 13	(9 <sup>-</sup> )		B B	$J^\pi$ : E2 363.3 $\gamma$ from (11 <sup>-</sup> ).
1938.56 <sup>a</sup> 10 1995.09 <sup>&amp;</sup> 9 2186.48 11 2247.95 18	(12 <sup>+</sup> ) (11 <sup>-</sup> ) (11 <sup>-</sup> )	2.8 ps 5 33 ps 4 13 ps 2	B B B	$J^\pi$ : E2 944.9 $\gamma$ to (10 <sup>+</sup> ). $J^\pi$ : D 1001.4 $\gamma$ to (10 <sup>+</sup> ), (M1+E2) 191.6 $\gamma$ from (11 <sup>-</sup> ). $J^\pi$ : E2 554.4 $\gamma$ to (9 <sup>-</sup> ).
2537.40 <sup>a</sup> 11 2557.88 <sup>&amp;</sup> 11	(13 <sup>+</sup> ) (12 <sup>-</sup> )	<0.7 ps <0.7 ps	B B	$J^\pi$ : 1051.5 $\gamma$ to (11 <sup>+</sup> ), D+Q 598.9 $\gamma$ to (12 <sup>+</sup> ). $J^\pi$ : (M1+E2) 562.8 $\gamma$ to (11 <sup>-</sup> ).

Continued on next page (footnotes at end of table)

**Adopted Levels, Gammas (continued)** ${}^{90}\text{Tc}$  Levels (continued)

E(level) <sup>†</sup>	$J^\pi$ <sup>‡</sup>	$T_{1/2}$ <sup>#</sup>	XREF	Comments
2600.48 <i>11</i>	(12 <sup>-</sup> )	5.3 <sup>@</sup> ps 8	B	$J^\pi$ : (D+Q) 605.2 $\gamma$ to (11 <sup>-</sup> ); assignment to negative-parity sequence.
2775.61 & <i>10</i>	(13 <sup>-</sup> )	2.7 ps 3	B	$J^\pi$ : E2 780.6 $\gamma$ to (11 <sup>-</sup> ).
2946.74 <i>12</i>			B	
2982.00 <i>12</i>			B	
3167.77 <sup>a</sup> <i>11</i>	(14 <sup>+</sup> )	1.0 ps 3	B	$J^\pi$ : E2 1229.0 $\gamma$ to (12 <sup>+</sup> ).
3201.19 <i>14</i>			B	
3383.26 <sup>a</sup> <i>13</i>	(15 <sup>+</sup> )	1.8 ps 4	B	$J^\pi$ : E2 845.8 $\gamma$ to (13 <sup>+</sup> ).
3405.73 <i>15</i>			B	
3488.64 & <i>12</i>	(14 <sup>-</sup> )	<1.4 ps	B	$J^\pi$ : (E2) 930.6 $\gamma$ to (12 <sup>-</sup> ).
3593.08 <i>13</i>	(15 <sup>+</sup> )	1.2 ps 4	B	$J^\pi$ : E2 919.1 $\gamma$ from (17 <sup>+</sup> ).
3672.91 & <i>12</i>	(15 <sup>-</sup> )	1.1 ps 3	B	$J^\pi$ : E2 897.4 $\gamma$ to (13 <sup>-</sup> ).
4486.41 <sup>a</sup> <i>15</i>	(16 <sup>+</sup> )		B	$J^\pi$ : 1103 $\gamma$ to (15 <sup>+</sup> ); assignment to positive parity sequence.
4512.12 <sup>a</sup> <i>14</i>	(17 <sup>+</sup> )	1.5 ps 3	B	$J^\pi$ : E2 1128.8 $\gamma$ to (15 <sup>+</sup> ).
4637.12 & <i>16</i>	(17 <sup>-</sup> )	1.6 ps 2	B	$J^\pi$ : E2 964.2 $\gamma$ to (15 <sup>-</sup> ).
4864.66 <i>17</i>	(17 <sup>+</sup> )		B	$J^\pi$ : 378.1 $\gamma$ to (16 <sup>+</sup> ), 1481.9 $\gamma$ to (15 <sup>+</sup> ).
5599.18 <sup>a</sup> <i>17</i>	(18 <sup>+</sup> )		B	$J^\pi$ : 1087.1 $\gamma$ to (17 <sup>+</sup> ); assignment to positive parity sequence.
5651.25 <sup>a</sup> <i>17</i>	(19 <sup>+</sup> )	2.4 ps 1	B	$J^\pi$ : E2 1139.1 $\gamma$ to (17 <sup>+</sup> ).
5705.92 & <i>19</i>	(19 <sup>-</sup> )	1.3 ps 2	B	$J^\pi$ : E2 1068.8 $\gamma$ to (17 <sup>-</sup> ).
5808.21 <i>21</i>			B	
6338.54 <i>24</i>			B	
6455.27 <sup>a</sup> <i>21</i>	(20 <sup>+</sup> )	<0.7 <sup>@</sup> ps	B	$J^\pi$ : (D+Q) 803.9 $\gamma$ to (19 <sup>+</sup> ); assignment to positive parity sequence.
6884.81 <sup>a</sup> <i>23</i>	(21 <sup>+</sup> )		B	$J^\pi$ : (D+Q) 429.6 $\gamma$ to (20 <sup>+</sup> ); assignment to positive parity sequence.
6993.93 & <i>21</i>	(21 <sup>-</sup> )	0.8 <sup>@</sup> ps 2	B	$J^\pi$ : E2 1288.0 $\gamma$ to (19 <sup>-</sup> ).
7373.4 <i>3</i>			B	
7439.6 & <i>4</i>	(22 <sup>-</sup> )		B	$J^\pi$ : 445.7 $\gamma$ to (21 <sup>-</sup> ); assignment to negative parity sequence.
7678.8 <i>3</i>			B	
8394.4 & <i>4</i>	(23 <sup>-</sup> )		B	$J^\pi$ : 954.8 $\gamma$ to (22 <sup>-</sup> ); assignment to negative parity sequence.
8756.5 <sup>a</sup> <i>3</i>	(22 <sup>+</sup> )		B	$J^\pi$ : 1872.2 $\gamma$ to (21 <sup>+</sup> ), 2300.8 $\gamma$ to (20 <sup>+</sup> ).
9342.1 <i>3</i>			B	
9804.2 <i>3</i>			B	
11246.4 <i>4</i>			B	

<sup>†</sup> Deduced by evaluators from a least-squares fit to  $E_\gamma$ , except where noted.

<sup>‡</sup> Spin and parity assignments for excited states are based on  $\gamma$ -ray multiplicities and on the assumption that  $\gamma$ -ray deexcitation takes place through yrast states. Spin and parities of the (8<sup>+</sup>) and (6<sup>+</sup>) levels are based on shell-model calculations which use a configuration space of only the 2p<sub>1/2</sub> and 1g<sub>9/2</sub> orbitals for protons and neutrons (1993Ru03).

<sup>#</sup> From recoil-distance Doppler-shift method in (HI,xn $\gamma$ ), except where noted. (1994Ru13).

<sup>@</sup> Effective half-life from (HI,xn $\gamma$ ), not corrected for feeding.

& Band(A): Negative-parity sequence.

<sup>a</sup> Band(B): Positive-parity sequence.

Adopted Levels, Gammas (continued)

$\gamma(^{90}\text{Tc})$									
$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$	Mult.‡	$\delta^\ddagger$	$\alpha$	Comments
152.52	(4 <sup>-</sup> )	48.8 1	100	103.70	(6 <sup>+</sup> )				$E_\gamma, I_\gamma$ : from $^{90}\text{Ru}$ $\epsilon$ decay.
298.7		154.6 1	100	144.1	1 <sup>+</sup>				
340.33	(5 <sup>-</sup> )	187.8 1	100 12	152.52	(4 <sup>-</sup> )	(M1+E2)	0.23 +7-6	0.054 3	$\alpha(\text{K})=0.0471$ 23; $\alpha(\text{L})=0.0057$ 4; $\alpha(\text{M})=0.00104$ 7; $\alpha(\text{N})=0.000164$ 11; $\alpha(\text{O})=1.05\times 10^{-5}$ 4 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HL,xny); non-zero value of $\delta$ suggests M1+E2 character.
494.09	(9 <sup>+</sup> )	236.8 3 494.1 1	10 6 100	103.70 (6 <sup>+</sup> ) 0 (8 <sup>+</sup> )		(M1+E2)	0.20 +6-5	0.00440	$\alpha(\text{K})=0.00386$ 6; $\alpha(\text{L})=0.000443$ 7; $\alpha(\text{M})=8.02\times 10^{-5}$ 13; $\alpha(\text{N})=1.278\times 10^{-5}$ 20; $\alpha(\text{O})=8.59\times 10^{-7}$ 13 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HL,xny); non-zero value of $\delta$ suggests M1+E2 character.
636.9		492.8 1	100	144.1	1 <sup>+</sup>				$E_\gamma, I_\gamma$ : from $^{90}\text{Ru}$ $\epsilon$ decay.
993.72	(10 <sup>+</sup> )	499.7 1	5.5 3	494.09	(9 <sup>+</sup> )	M1+E2	0.3 2	0.00432 12	$\alpha(\text{K})=0.00379$ 10; $\alpha(\text{L})=0.000436$ 14; $\alpha(\text{M})=7.9\times 10^{-5}$ 3; $\alpha(\text{N})=1.26\times 10^{-5}$ 4; $\alpha(\text{O})=8.41\times 10^{-7}$ 17 B(M1)(W.u.)=0.0060 +31-19; B(E2)(W.u.)=2.3 +40-18 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HL,xny); $\Delta\pi$ =no from level scheme.
		993.7 1	100 3	0 (8 <sup>+</sup> )		E2		$8.39\times 10^{-4}$	$\alpha(\text{K})=0.000737$ 11; $\alpha(\text{L})=8.44\times 10^{-5}$ 12; $\alpha(\text{M})=1.526\times 10^{-5}$ 22; $\alpha(\text{N})=2.42\times 10^{-6}$ 4 $\alpha(\text{O})=1.604\times 10^{-7}$ 23 B(E2)(W.u.)=16 +9-4
1023.83	(7 <sup>-</sup> )	683.5 1	100	340.33	(5 <sup>-</sup> )	E2		0.00210	$\alpha(\text{K})=0.00184$ 3; $\alpha(\text{L})=0.000217$ 3; $\alpha(\text{M})=3.92\times 10^{-5}$ 6; $\alpha(\text{N})=6.21\times 10^{-6}$ 9; $\alpha(\text{O})=3.97\times 10^{-7}$ 6
1485.90	(11 <sup>+</sup> )	492.1 1	100 4	993.72	(10 <sup>+</sup> )	(M1+E2)	0.15 4	0.00443	$\alpha(\text{K})=0.00389$ 6; $\alpha(\text{L})=0.000446$ 7; $\alpha(\text{M})=8.07\times 10^{-5}$ 12; $\alpha(\text{N})=1.285\times 10^{-5}$ 19; $\alpha(\text{O})=8.66\times 10^{-7}$ 13 B(M1)(W.u.)>0.031; B(E2)(W.u.)>1.7 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HL,xny); non-zero value of $\delta$ suggests M1+E2 character.
1613.85		991.5 2 620.2 4 1119.8 1	10.1 22 21 6 100 6	494.09 (9 <sup>+</sup> ) 993.72 (10 <sup>+</sup> ) 494.09 (9 <sup>+</sup> )		[E2]			B(E2)(W.u.)>0.35
1631.93	(9 <sup>-</sup> )	608.1 1	100 9	1023.83	(7 <sup>-</sup> )	E2		0.00288	$\alpha(\text{K})=0.00252$ 4; $\alpha(\text{L})=0.000300$ 5; $\alpha(\text{M})=5.43\times 10^{-5}$ 8; $\alpha(\text{N})=8.57\times 10^{-6}$ 12; $\alpha(\text{O})=5.41\times 10^{-7}$ 8
1698.77		1137.8 3 1204.4 4	45 11 100	494.09 (9 <sup>+</sup> ) 494.09 (9 <sup>+</sup> )					
1938.56	(12 <sup>+</sup> )	452.6 1	5.8 4	1485.90	(11 <sup>+</sup> )	M1+E2		0.0061 7	$\alpha(\text{K})=0.0053$ 6; $\alpha(\text{L})=0.00063$ 10; $\alpha(\text{M})=0.000115$ 17; $\alpha(\text{N})=1.8\times 10^{-5}$ 3; $\alpha(\text{O})=1.15\times 10^{-6}$ 10 B(M1)(W.u.)<0.0062; B(E2)(W.u.)<32 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HL,xny); $\Delta\pi$ =no from level scheme.
		944.9 1	100 3	993.72	(10 <sup>+</sup> )	E2		$9.42\times 10^{-4}$	$\alpha(\text{K})=0.000827$ 12; $\alpha(\text{L})=9.50\times 10^{-5}$ 14; $\alpha(\text{M})=1.719\times 10^{-5}$ 24; $\alpha(\text{N})=2.73\times 10^{-6}$ 4;

**Adopted Levels, Gammas (continued)**

$\gamma(^{90}\text{Tc})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^\ddagger$	$\alpha$	Comments	
1995.09	(11 <sup>-</sup> )	296.3 1	1.7 7	1698.77					$\alpha(\text{O})=1.80 \times 10^{-7}$ 3 B(E2)(W.u.)=10.6 +23-16	
		363.3 1	6.1 14	1631.93	(9 <sup>-</sup> )	[E2]		0.01355	$\alpha(\text{K})=0.01174$ 17; $\alpha(\text{L})=0.001491$ 21; $\alpha(\text{M})=0.000271$ 4; $\alpha(\text{N})=4.23 \times 10^{-5}$ 6; $\alpha(\text{O})=2.45 \times 10^{-6}$ 4 B(E2)(W.u.)=5.1 +14-12	
		381.3 1	5.0 10	1613.85					1.51 $\times 10^{-3}$	$\alpha(\text{K})=0.001330$ 19; $\alpha(\text{L})=0.0001500$ 21; $\alpha(\text{M})=2.71 \times 10^{-5}$ 4; $\alpha(\text{N})=4.30 \times 10^{-6}$ 6; $\alpha(\text{O})=2.85 \times 10^{-7}$ 4 B(E1)(W.u.)=1.30 $\times 10^{-5}$ +21-18 Mult.: D from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =yes from level scheme.
		509.1 1	22.9 21	1485.90	(11 <sup>+</sup> )	(E1)			3.53 $\times 10^{-4}$	$\alpha(\text{K})=0.000311$ 5; $\alpha(\text{L})=3.46 \times 10^{-5}$ 5; $\alpha(\text{M})=6.25 \times 10^{-6}$ 9; $\alpha(\text{N})=9.95 \times 10^{-7}$ 14; $\alpha(\text{O})=6.73 \times 10^{-8}$ 10 B(E1)(W.u.)=7.5 $\times 10^{-6}$ +10-8 Mult.: D from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =yes from level scheme.
2186.48	(11 <sup>-</sup> )	191.6 1	100 6	1995.09	(11 <sup>-</sup> )	(M1+E2)	0.20 +30-10	0.050 12	$\alpha(\text{K})=0.044$ 10; $\alpha(\text{L})=0.0053$ 17; $\alpha(\text{M})=9.6 \times 10^{-4}$ 31; $\alpha(\text{N})=1.52 \times 10^{-4}$ 46; $\alpha(\text{O})=9.8 \times 10^{-6}$ 18 B(M1)(W.u.)=0.124 +20-27 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.	
		554.4 1	67.3 20	1631.93	(9 <sup>-</sup> )	E2		0.00373	$\alpha(\text{K})=0.00326$ 5; $\alpha(\text{L})=0.000392$ 6; $\alpha(\text{M})=7.10 \times 10^{-5}$ 10; $\alpha(\text{N})=1.119 \times 10^{-5}$ 16; $\alpha(\text{O})=6.98 \times 10^{-7}$ 10 B(E2)(W.u.)=12.5 +24-18 B(E1)(W.u.)=1.1 $\times 10^{-6}$ 5	
2247.95		1192.8 5	14 6	993.72	(10 <sup>+</sup> )	[E1]				
2537.40	(13 <sup>+</sup> )	309.5 2	100	1938.56	(12 <sup>+</sup> )					
2537.40	(13 <sup>+</sup> )	598.9 1	100 3	1938.56	(12 <sup>+</sup> )	(M1+E2)	0.07 +10-8	0.00278	$\alpha(\text{K})=0.00244$ 4; $\alpha(\text{L})=0.000278$ 4; $\alpha(\text{M})=5.03 \times 10^{-5}$ 8; $\alpha(\text{N})=8.01 \times 10^{-6}$ 12; $\alpha(\text{O})=5.43 \times 10^{-7}$ 8 B(M1)(W.u.)>0.12 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.	
2557.88	(12 <sup>-</sup> )	1051.5 1	15.9 11	1485.90	(11 <sup>+</sup> )	[E2]			B(E2)(W.u.)>3.3	
		371.4 1	8.1 7	2186.48	(11 <sup>-</sup> )					
		562.8 1	100 3	1995.09	(11 <sup>-</sup> )	(M1+E2)	0.08 3	0.00321	$\alpha(\text{K})=0.00282$ 4; $\alpha(\text{L})=0.000322$ 5; $\alpha(\text{M})=5.82 \times 10^{-5}$ 9; $\alpha(\text{N})=9.28 \times 10^{-6}$ 13; $\alpha(\text{O})=6.28 \times 10^{-7}$ 9 B(M1)(W.u.)>0.16; B(E2)(W.u.)>1.4 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); non-zero value of $\delta$ suggests M1+E2 character.	
2600.48	(12 <sup>-</sup> )	413.9 1	60 5	2186.48	(11 <sup>-</sup> )	D+Q				
		605.2 1	100 5	1995.09	(11 <sup>-</sup> )	D+Q				
2775.61	(13 <sup>-</sup> )	175.0 1	17.4 19	2600.48	(12 <sup>-</sup> )	(M1+E2)		0.114 54	$\alpha(\text{K})=0.097$ 45; $\alpha(\text{L})=0.0138$ 76; $\alpha(\text{M})=0.0025$ 14;	

Adopted Levels, Gammas (continued)

$\gamma(^{90}\text{Tc})$  (continued)

<u>E<sub>i</sub>(level)</u>	<u>J<sub>i</sub><sup><math>\pi</math></sup></u>	<u>E<sub><math>\gamma</math></sub><sup>†</sup></u>	<u>I<sub><math>\gamma</math></sub><sup>†</sup></u>	<u>E<sub>f</sub></u>	<u>J<sub>f</sub><sup><math>\pi</math></sup></u>	<u>Mult.<sup>‡</sup></u>	<u><math>\delta^{\ddagger}</math></u>	<u><math>\alpha</math></u>	<u>Comments</u>
									$\alpha(\text{N})=3.9\times 10^{-4}$ 21; $\alpha(\text{O})=1.97\times 10^{-5}$ 78 B(M1)(W.u.)<0.18 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.
2775.61	(13 <sup>-</sup> )	217.7 1	100 4	2557.88	(12 <sup>-</sup> )	(M1+E2)	0.06 3	0.0341 6	$\alpha(\text{K})=0.0298$ 5; $\alpha(\text{L})=0.00350$ 6; $\alpha(\text{M})=0.000636$ 11; $\alpha(\text{N})=0.0001011$ 16; $\alpha(\text{O})=6.71\times 10^{-6}$ 10 B(M1)(W.u.)=0.42 5; B(E2)(W.u.)=35 +44-25 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.
		589.3 1	7.4 12	2186.48	(11 <sup>-</sup> )	[E2]			B(E2)(W.u.)=5.0 10
		780.6 1	39.9 16	1995.09	(11 <sup>-</sup> )	E2		1.49 $\times 10^{-3}$	$\alpha(\text{K})=0.001310$ 19; $\alpha(\text{L})=0.0001525$ 22; $\alpha(\text{M})=2.76\times 10^{-5}$ 4; $\alpha(\text{N})=4.37\times 10^{-6}$ 7; $\alpha(\text{O})=2.84\times 10^{-7}$ 4 B(E2)(W.u.)=6.5 +9-7
		837.1 1	15.9 8	1938.56	(12 <sup>+</sup> )	[E1]		5.03 $\times 10^{-4}$	$\alpha(\text{K})=0.000443$ 7; $\alpha(\text{L})=4.95\times 10^{-5}$ 7; $\alpha(\text{M})=8.93\times 10^{-6}$ 13; $\alpha(\text{N})=1.421\times 10^{-6}$ 20; $\alpha(\text{O})=9.56\times 10^{-8}$ 14 B(E1)(W.u.)=1.82 $\times 10^{-5}$ +24-21
2946.74		409.4 1	74 5	2537.40	(13 <sup>+</sup> )				
		698.9 2	37 11	2247.95					
		1008.5 2	100 21	1938.56	(12 <sup>+</sup> )				
2982.00		381.3 1	25 5	2600.48	(12 <sup>-</sup> )				
		424.2 1	100 9	2557.88	(12 <sup>-</sup> )				
3167.77	(14 <sup>+</sup> )	221.2 1	9.4 7	2946.74		(M1+E2)		0.053 21	$\alpha(\text{K})=0.045$ 17; $\alpha(\text{L})=0.0061$ 28; $\alpha(\text{M})=0.00110$ 50; $\alpha(\text{N})=1.71\times 10^{-4}$ 75; $\alpha(\text{O})=9.4\times 10^{-6}$ 30 B(M1)(W.u.)<0.26 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.
		630.4 1	9 1	2537.40	(13 <sup>+</sup> )	(M1+E2)		0.00254 9	$\alpha(\text{K})=0.00222$ 7; $\alpha(\text{L})=0.000258$ 13; $\alpha(\text{M})=4.68\times 10^{-5}$ 24; $\alpha(\text{N})=7.4\times 10^{-6}$ 4; $\alpha(\text{O})=4.87\times 10^{-7}$ 9 B(M1)(W.u.)<0.011; B(E2)(W.u.)<29 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.
		1229.0 1	100 4	1938.56	(12 <sup>+</sup> )	E2		5.38 $\times 10^{-4}$	$\alpha(\text{K})=0.000462$ 7; $\alpha(\text{L})=5.24\times 10^{-5}$ 8; $\alpha(\text{M})=9.46\times 10^{-6}$ 14; $\alpha(\text{N})=1.506\times 10^{-6}$ 21; $\alpha(\text{O})=1.009\times 10^{-7}$ 15 B(E2)(W.u.)=7.1 +30-17
3201.19		600.9 2	100	2600.48	(12 <sup>-</sup> )				
3383.26	(15 <sup>+</sup> )	215.5 1	100 4	3167.77	(14 <sup>+</sup> )	(M1+E2)	$\leq 0.06$	0.0349	$\alpha(\text{K})=0.0306$ 5; $\alpha(\text{L})=0.00359$ 6; $\alpha(\text{M})=0.000651$ 10; $\alpha(\text{N})=0.0001036$ 15; $\alpha(\text{O})=6.88\times 10^{-6}$ 10 B(M1)(W.u.)=0.81 +26-17; B(E2)(W.u.)<88 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi$ =no from level scheme.
		845.8 1	47.8 20	2537.40	(13 <sup>+</sup> )	E2		1.23 $\times 10^{-3}$	$\alpha(\text{K})=0.001075$ 15; $\alpha(\text{L})=0.0001245$ 18; $\alpha(\text{M})=2.25\times 10^{-5}$ 4; $\alpha(\text{N})=3.57\times 10^{-6}$ 5; $\alpha(\text{O})=2.33\times 10^{-7}$ 4 B(E2)(W.u.)=9.6 +27-18

Adopted Levels, Gammas (continued)

$\gamma(^{90}\text{Tc})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\delta^\ddagger$	$\alpha$	Comments
3405.73		238.1 2	26 11	3167.77	(14 <sup>+</sup> )				
		868.4 2	100 21	2537.40	(13 <sup>+</sup> )				
3488.64	(14 <sup>-</sup> )	287.5 1	21.8 23	3201.19					
		506.5 1	49 6	2982.00					
		713.1 1	100 3	2775.61	(13 <sup>-</sup> )	(M1+E2)	0.14 +9-6	0.00186	$\alpha(\text{K})=0.001633$ 23; $\alpha(\text{L})=0.000185$ 3; $\alpha(\text{M})=3.35\times 10^{-5}$ 5; $\alpha(\text{N})=5.34\times 10^{-6}$ 8; $\alpha(\text{O})=3.63\times 10^{-7}$ 5 B(M1)(W.u.)>0.019; B(E2)(W.u.)>0.27 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi=\text{no}$ from level scheme.
		930.6 2	33.3 23	2557.88	(12 <sup>-</sup> )	(E2)		$9.76\times 10^{-4}$	$\alpha(\text{K})=0.000857$ 12; $\alpha(\text{L})=9.86\times 10^{-5}$ 14; $\alpha(\text{M})=1.783\times 10^{-5}$ 25; $\alpha(\text{N})=2.83\times 10^{-6}$ 4; $\alpha(\text{O})=1.86\times 10^{-7}$ 3 B(E2)(W.u.)>3.5
3593.08	(15 <sup>+</sup> )	187.4 1	41 4	3405.73					
		210.1 4	11 5	3383.26	(15 <sup>+</sup> )				
		425.3 1	100 4	3167.77	(14 <sup>+</sup> )	(M1+E2)			B(M1)(W.u.)<0.25 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi=\text{no}$ from level scheme.
3672.91	(15 <sup>-</sup> )	184.2 1	43.5 17	3488.64	(14 <sup>-</sup> )	(M1+E2)		0.096 44	$\alpha(\text{K})=0.082$ 36; $\alpha(\text{L})=0.0115$ 61; $\alpha(\text{M})=0.0021$ 12; $\alpha(\text{N})=3.2\times 10^{-4}$ 17; $\alpha(\text{O})=1.67\times 10^{-5}$ 64 B(M1)(W.u.)<1.4 Mult.: D+Q from $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in (HI,xn $\gamma$ ); $\Delta\pi=\text{no}$ from level scheme.
		505.0 2	5.0 10	3167.77	(14 <sup>+</sup> )	[E1]			B(E1)(W.u.)= $7.8\times 10^{-5}$ +34-22
		897.4 1	100 4	2775.61	(13 <sup>-</sup> )	E2		$1.06\times 10^{-3}$	$\alpha(\text{K})=0.000933$ 13; $\alpha(\text{L})=0.0001076$ 15; $\alpha(\text{M})=1.95\times 10^{-5}$ 3; $\alpha(\text{N})=3.09\times 10^{-6}$ 5; $\alpha(\text{O})=2.03\times 10^{-7}$ 3 B(E2)(W.u.)=24 +9-5
4486.41	(16 <sup>+</sup> )	1103.0 1	100	3383.26	(15 <sup>+</sup> )				
4512.12	(17 <sup>+</sup> )	919.1 1	32.1 13	3593.08	(15 <sup>+</sup> )	E2		$1.01\times 10^{-3}$	$\alpha(\text{K})=0.000882$ 13; $\alpha(\text{L})=0.0001016$ 15; $\alpha(\text{M})=1.84\times 10^{-5}$ 3; $\alpha(\text{N})=2.92\times 10^{-6}$ 4; $\alpha(\text{O})=1.92\times 10^{-7}$ 3 B(E2)(W.u.)=5.8 +15-10
		1128.8 1	100 3	3383.26	(15 <sup>+</sup> )	E2		$6.33\times 10^{-4}$	$\alpha(\text{K})=0.000555$ 8; $\alpha(\text{L})=6.31\times 10^{-5}$ 9; $\alpha(\text{M})=1.141\times 10^{-5}$ 16; $\alpha(\text{N})=1.81\times 10^{-6}$ 3; $\alpha(\text{O})=1.209\times 10^{-7}$ 17 B(E2)(W.u.)=6.5 +17-11
4637.12	(17 <sup>-</sup> )	964.2 1	100	3672.91	(15 <sup>-</sup> )	E2		$8.99\times 10^{-4}$	$\alpha(\text{K})=0.000789$ 11; $\alpha(\text{L})=9.06\times 10^{-5}$ 13; $\alpha(\text{M})=1.639\times 10^{-5}$ 23; $\alpha(\text{N})=2.60\times 10^{-6}$ 4 $\alpha(\text{O})=1.718\times 10^{-7}$ 24 B(E2)(W.u.)=17.7 +26-20
4864.66	(17 <sup>+</sup> )	378.1 1	43 9	4486.41	(16 <sup>+</sup> )				
		1481.9 2	100 9	3383.26	(15 <sup>+</sup> )				
5599.18	(18 <sup>+</sup> )	1087.1 1	100	4512.12	(17 <sup>+</sup> )				
5651.25	(19 <sup>+</sup> )	1139.1 1	100	4512.12	(17 <sup>+</sup> )	E2		$6.21\times 10^{-4}$	$\alpha(\text{K})=0.000544$ 8; $\alpha(\text{L})=6.18\times 10^{-5}$ 9; $\alpha(\text{M})=1.118\times 10^{-5}$ 16; $\alpha(\text{N})=1.778\times 10^{-6}$ 25

**Adopted Levels, Gammas (continued)**

$\gamma(^{90}\text{Tc})$  (continued)

<u>E<sub>i</sub>(level)</u>	<u>J<sub>i</sub><sup><math>\pi</math></sup></u>	<u>E<sub><math>\gamma</math></sub><sup>†</sup></u>	<u>I<sub><math>\gamma</math></sub><sup>†</sup></u>	<u>E<sub>f</sub></u>	<u>J<sub>f</sub><sup><math>\pi</math></sup></u>	<u>Mult.<sup>‡</sup></u>	<u><math>\alpha</math></u>	<u>Comments</u>
5705.92	(19 <sup>-</sup> )	1068.8 1	100	4637.12	(17 <sup>-</sup> )	E2	7.12×10 <sup>-4</sup>	$\alpha(\text{O})=1.186\times 10^{-7}$ 17 B(E2)(W.u.)=5.13 21 $\alpha(\text{K})=0.000625$ 9; $\alpha(\text{L})=7.13\times 10^{-5}$ 10; $\alpha(\text{M})=1.290\times 10^{-5}$ 18; $\alpha(\text{N})=2.05\times 10^{-6}$ 3; $\alpha(\text{O})=1.363\times 10^{-7}$ 19 B(E2)(W.u.)=13.0 +24-17
5808.21		209.2 2	100	5599.18	(18 <sup>+</sup> )			
6338.54		1473.8 2	100	4864.66	(17 <sup>+</sup> )			
6455.27	(20 <sup>+</sup> )	647.1 1	12.3 14	5808.21				
		803.9 2	100 4	5651.25	(19 <sup>+</sup> )	(D+Q)		
6884.81	(21 <sup>+</sup> )	429.6 1	100	6455.27	(20 <sup>+</sup> )	(D+Q)		
6993.93	(21 <sup>-</sup> )	1288.0 1	100	5705.92	(19 <sup>-</sup> )	E2	5.00×10 <sup>-4</sup>	$\alpha(\text{K})=0.000419$ 6; $\alpha(\text{L})=4.73\times 10^{-5}$ 7; $\alpha(\text{M})=8.56\times 10^{-6}$ 12; $\alpha(\text{N})=1.362\times 10^{-6}$ 19; $\alpha(\text{O})=9.14\times 10^{-8}$ 13 B(E2)(W.u.)=8.3 +28-17
7373.4		1722.2 5	100	5651.25	(19 <sup>+</sup> )			
7439.6	(22 <sup>-</sup> )	445.7 3	100	6993.93	(21 <sup>-</sup> )			
7678.8		305.4 2	53 13	7373.4				
		1340.2 2	100 7	6338.54				
8394.4	(23 <sup>-</sup> )	954.8 2	100	7439.6	(22 <sup>-</sup> )			
8756.5	(22 <sup>+</sup> )	1077.8 5	42 17	7678.8				
		1872.2 3	100 25	6884.81	(21 <sup>+</sup> )			
		2300.8 3	83 17	6455.27	(20 <sup>+</sup> )			
9342.1		585.7 2	100 12	8756.5	(22 <sup>+</sup> )	(D+Q)		
		1663.0 4	30 6	7678.8				
9804.2		462.1 1	100	9342.1		(D+Q)		
11246.4		1442.2 2	100	9804.2		(E2)		

<sup>†</sup> From (HI,xn $\gamma$ ), except where noted.

<sup>‡</sup> From  $\gamma(\theta)$  in <sup>58</sup>Ni(<sup>35</sup>Cl,2pn $\gamma$ ) and DCO ratios in <sup>58</sup>Ni(<sup>36</sup>Ar,3pn $\gamma$ ), both from (HI,xn $\gamma$ ) dataset.

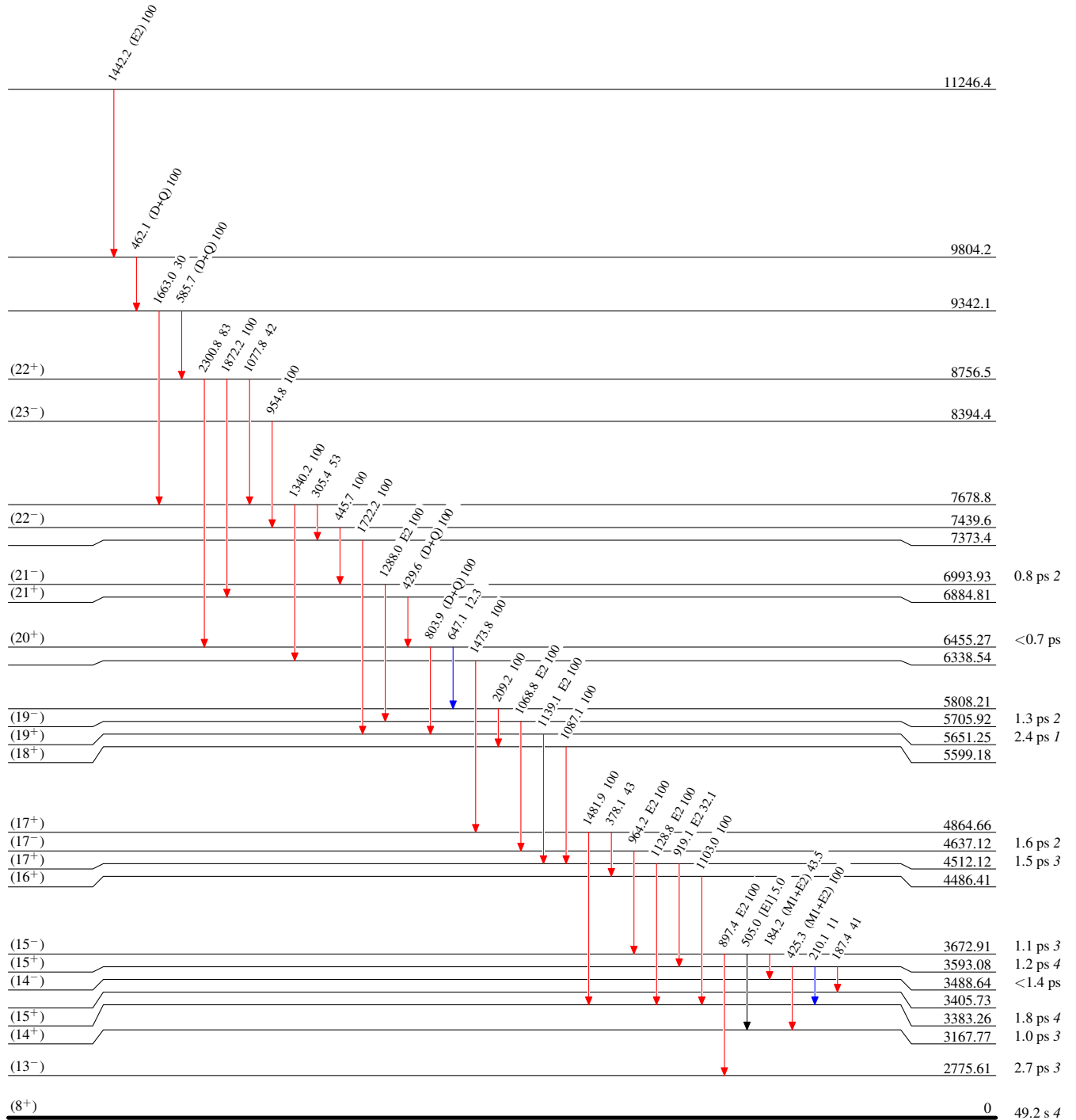
**Adopted Levels, Gammas**

**Level Scheme**

Intensities: Type not specified

**Legend**

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



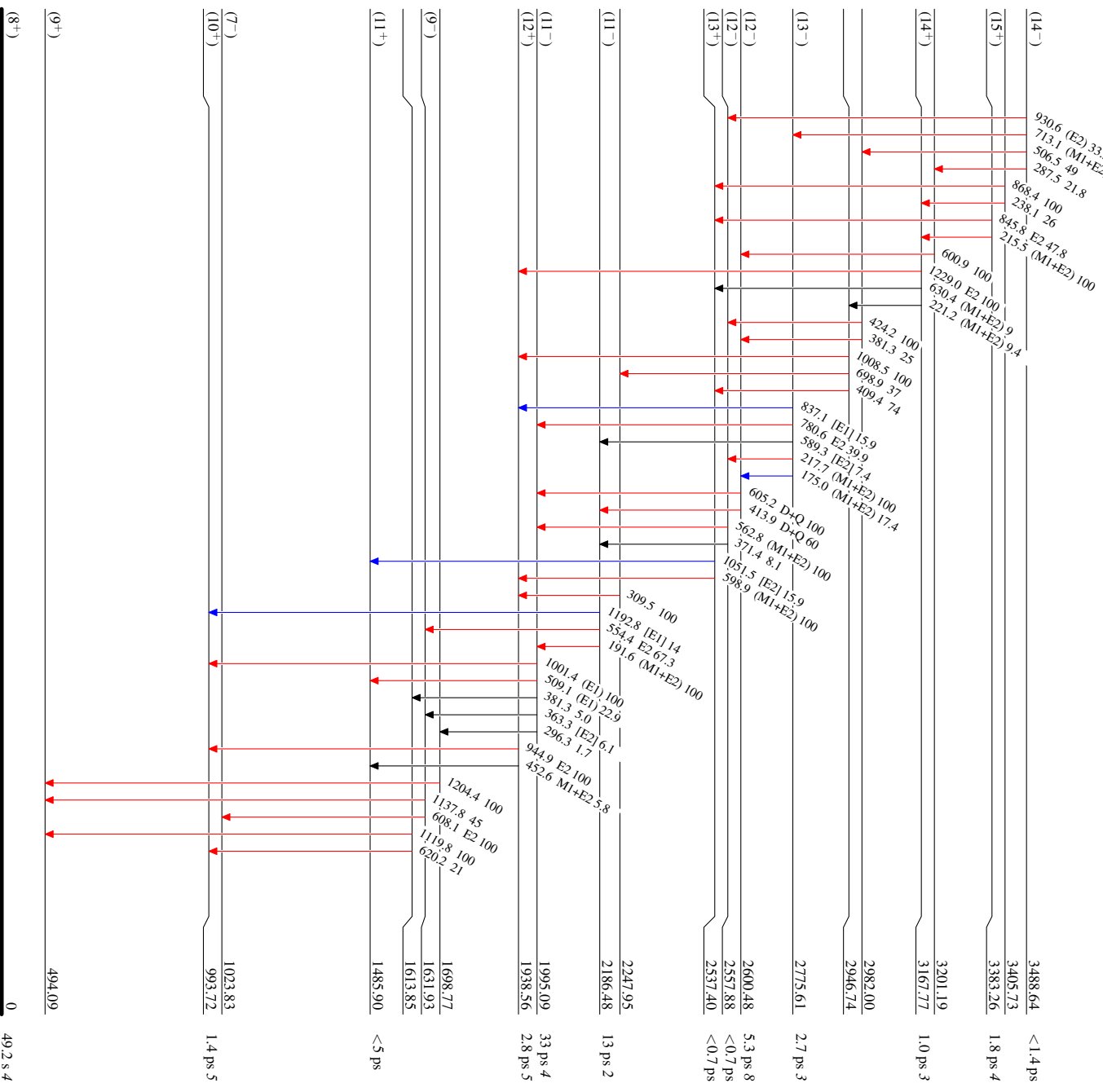
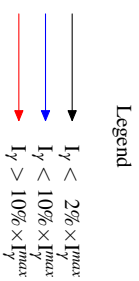
<sup>90</sup>Tc<sub>47</sub>



**Adopted Levels, Gammas**

**Level Scheme (continued)**

Intensities: Type not specified



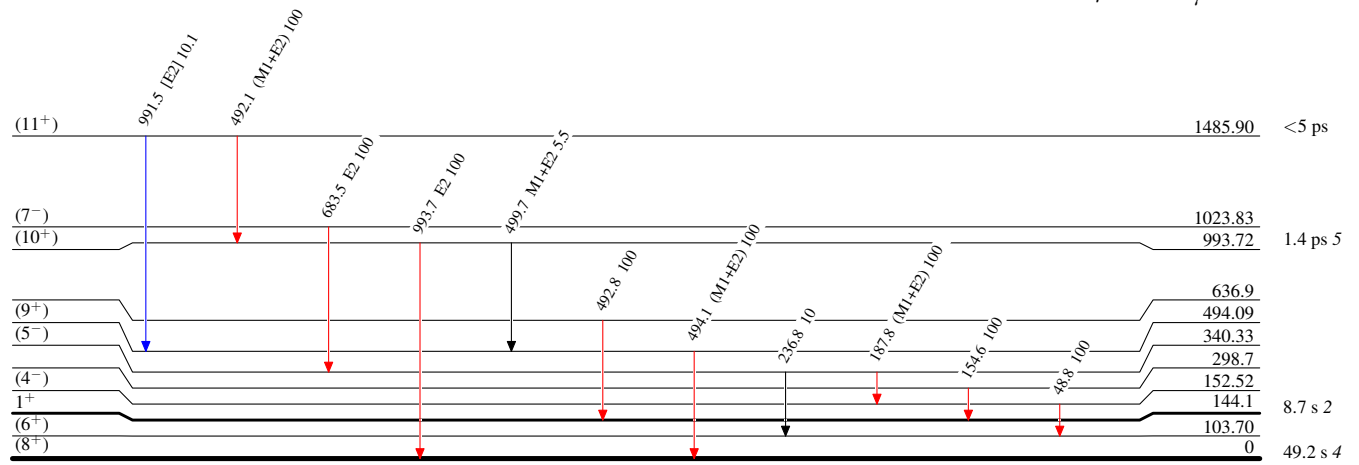
<sup>90</sup>Tc<sub>47</sub>

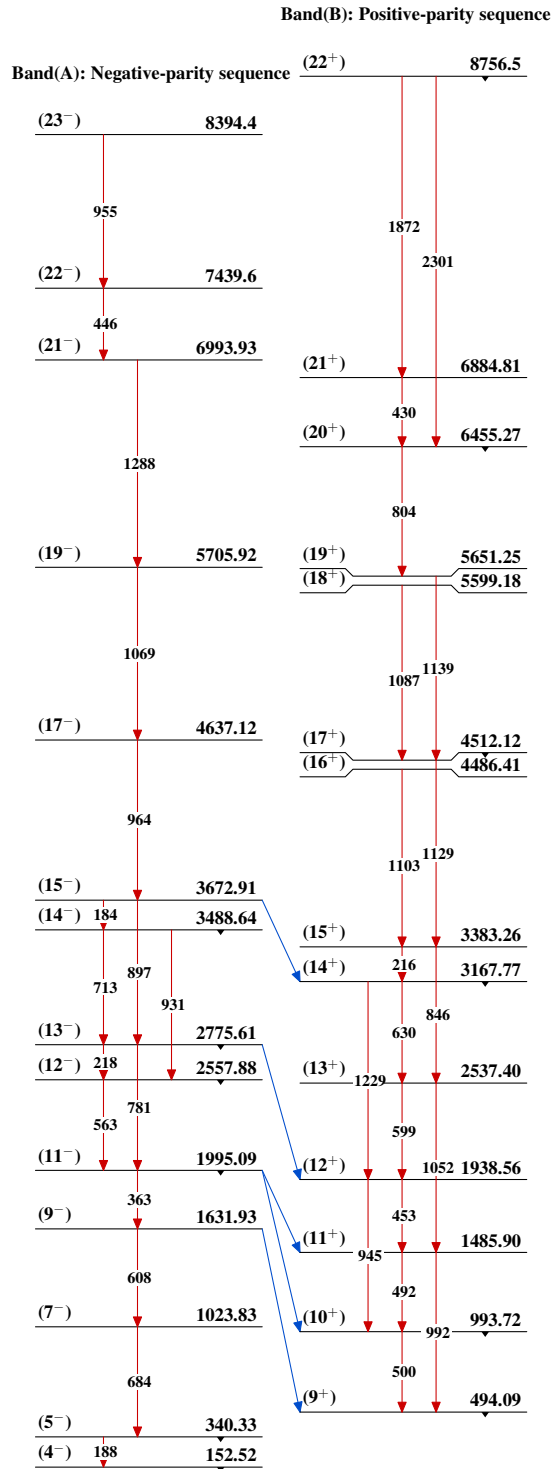
**Adopted Levels, Gammas****Level Scheme (continued)**

Intensities: Type not specified

## Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$

 ${}^{90}_{43}\text{Tc}_{47}$

Adopted Levels, Gammas ${}^{90}_{43}\text{Tc}_{47}$