

$^{100}\text{Mo}(p,n\gamma),(d,2n\gamma)$ 1981Ar06,1980Bi01

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen		NDS 172, 1 (2021)	31-Jan-2021

1981Ar06, 1981Ar24: (p,n γ) E=1.2-4.0 MeV proton beams were produced from the 5-MV Van de Graaff accelerator of the Institute of Nuclear Research, Debrecen. Targets were 88 mg/cm² and 0.48 mg/cm² 92.2% enriched metallic ^{100}Mo . γ rays were detected with a Ge(Li) detector and a low-energy photon (HPGe) spectrometer (LEPS); conversion electrons were detected with a superconducting magnet transporter Si(Li) spectrometer (SMS). Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, E(ce), I(ce). Deduced levels, J, π , γ -ray conversion coefficients, multipolarities.

1980Bi01: (p,n γ) E=4.0-6.8 MeV proton beams were produced from the 7.5-MV Van de Graaff of the Laboratori Nazionali di Legnaro. Target was a ≈ 100 $\mu\text{g}/\text{cm}^2$ 97.42% enriched ^{100}Mo oxide layer. γ rays were detected with an intrinsic Ge detector for low-energy γ ray and a Ge(Li) counter. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma(t)$ and ce(t) (pulsed beam). Deduced levels, $T_{1/2}$.

1979Pi08: (d,2n γ) E=12 MeV. Measured $\gamma(t)$ (pulsed-beam).

1978Ma36: (p,n γ) E=3.7 MeV. Measured $\gamma(t)$ (pulsed-beam).

1961Sc11: (p,n γ) E=2.4-3.2 MeV. Measured $\gamma(t)$ (pulsed-beam).

Others: **1979Pi08, 1978Ma36, 1981Ar24** (same as **1981Ar06**), **1967Iv04**.

$^{100}\text{Mo}(p,n)$: **1995Zh44, 1987Ku13, 1987Sk06, 1985FI01, 1982FI03, 1976Ma07, 1975Kn06, 1975Gr01, 1974Po11**.

Additional information 1.

 ^{100}Tc Levels

E(level) [†]	J π [‡]	$T_{1/2}$ [#]	Comments
0.0	1 ⁺		
172.08 4	2 ⁺	<3 ns	
200.38 4	(4) ⁺	8.26 μs 10	$T_{1/2}$: unweighted average of 8.18 μs 7 (1980Bi01), 8.46 μs 5 (1978Ma36), and 8.15 μs 20 (1961Sc11). Methods: 172 $\gamma(t)$, ce(L)(28.6 γ)(t) (1980Bi01); 28.6 $\gamma(t)$ (1978Ma36); 172 $\gamma(t)$ (1961Sc11). Others: 10.2 μs 1 ce(28.6 γ)(t) (1979Pi08) seems discrepant.
223.30 8	(2) ⁻	<3 ns	
243.7 [@] 1	(6) ⁺	3.2 μs 2	$T_{1/2}$: from 43 $\gamma(t)$ (1980Bi01). Others: 4.6 μs 5 (43 $\gamma(t)$, 1979Pi08), 15.5 μs 8 (1961Sc11) and 16 μs 3 (1967Iv04) from 43 $\gamma(t)$ seem discrepant.
263.36 4	(3) ⁺	<3 ns	
287.05 7	(5) ⁺	<3 ns	
294.8? [@]	(4) ⁺		
299.57 7	(2,3) ⁺	<3 ns	
319.3 [@] 1	(5) ⁺		
335.03 4		<3 ns	
340.90 5	(3) ⁺		
355.34 4		<3 ns	
400.5? [@]			
424.3 1			
454.0 1	(4,5) ⁺		
459.02 [@] 4			
476.0 1			
483.9? 1	(≤ 3)		
493.3 [@] 1	4 ⁺ ,5 ⁺		
499.7 1	(2,3) ⁻		
499.85 6	(4,5) ⁻		
520.8? [@]			
635.41 5			
679.9 1	(4,5,6) ⁻		
830.20 7	(2,3) ⁺		
906.05 8			

Continued on next page (footnotes at end of table)

$^{100}\text{Mo}(\text{p},\text{n}\gamma),(\text{d},2\text{n}\gamma)$ [1981Ar06](#),[1980Bi01](#) (continued)

^{100}Tc Levels (continued)

† From least-squares fit to $E\gamma$ data.

‡ From the Adopted Levels.

From $\gamma(t)$ or $\text{ce}(t)$ ([1980Bi01](#)).

@ Level suggested by [1980Bi01](#), not in the scheme given by [1981Ar06](#). The existence of this level is consistent with $\gamma\gamma$ data and energy sums.

¹⁰⁰Mo(p,nγ),(d,2nγ) **1981Ar06,1980Bi01** (continued)

$\gamma(^{100}\text{Tc})$									
E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	δ [‡]	α^a	Comments
28.6 4		200.38	(4) ⁺	172.08	2 ⁺	E2		112 7	$\alpha(\text{K})=38.9$ 11; $\alpha(\text{L})=60$ 5; $\alpha(\text{M})=11.2$ 8 $\alpha(\text{N})=1.57$ 12; $\alpha(\text{O})=0.00676$ 24 E_γ : from 1978Ma36. Mult.: from comparison of observed and predicted x-ray intensity (1978Ma36), also Adopted Gammas where assignment is from ce data in (n,γ) dataset.
31.4&		294.8?	(4) ⁺	263.36	(3) ⁺				
39.5&c		493.3	4 ⁺ ,5 ⁺	454.0	(4,5) ⁺				
43.57 ^{b@} 10		243.7	(6) ⁺	200.38	(4) ⁺	E2		24.4	$\alpha(\text{K})=14.59$ 23; $\alpha(\text{L})=8.11$ 15; $\alpha(\text{M})=1.52$ 3 $\alpha(\text{N})=0.215$ 4; $\alpha(\text{O})=0.00234$ 4 Mult.: from the Adopted Gammas.
43.57 ^{b@} 10		287.05	(5) ⁺	243.7	(6) ⁺				
46.1&		340.90	(3) ⁺	294.8?	(4) ⁺				
62.97 2		263.36	(3) ⁺	200.38	(4) ⁺				
68.8&c		424.3		355.34					
71.66 2		335.03		263.36	(3) ⁺				
75.63 [@] 7		319.3	(5) ⁺	243.7	(6) ⁺				
86.93 10		287.05	(5) ⁺	200.38	(4) ⁺				
91.26 2	6.4 10	263.36	(3) ⁺	172.08	2 ⁺				
92.00 2	5.7 10	355.34		263.36	(3) ⁺				
99.09 10	≤1.7	299.57	(2,3) ⁺	200.38	(4) ⁺				
103.78 4	0.9 3	459.02		355.34					
105.7&c		400.5?		294.8?	(4) ⁺				
113.16 13	0.29 13	454.0	(4,5) ⁺	340.90	(3) ⁺				
124.01 5	1.2 3	459.02		335.03					
127.53 7	11.6 14	299.57	(2,3) ⁺	172.08	2 ⁺	E2(+M1)	>1.4	0.46 7	$\alpha(\text{K})=0.38$ 6; $\alpha(\text{L})=0.065$ 11; $\alpha(\text{M})=0.0120$ 19 $\alpha(\text{N})=0.0018$ 3; $\alpha(\text{O})=7.1 \times 10^{-5}$ 9 Mult., δ : $\alpha(\text{K})\text{exp}=0.37$ 4 (1981Ar06).
140.31 12	≤2.3	340.90	(3) ⁺	200.38	(4) ⁺				
152.7&c		493.3	4 ⁺ ,5 ⁺	340.90	(3) ⁺				
160.9&c		424.3		263.36	(3) ⁺				
163.05 7	1.1 4	335.03		172.08	2 ⁺				
166.69 21	≈0.5	454.0	(4,5) ⁺	287.05	(5) ⁺				
168.90 4	≈2.9	340.90	(3) ⁺	172.08	2 ⁺				
172.07 9	100 11	172.08	2 ⁺	0.0	1 ⁺	M1+E2	0.42 14	0.086 15	$\alpha(\text{K})=0.074$ 13; $\alpha(\text{L})=0.0098$ 22; $\alpha(\text{M})=0.0018$ 4 $\alpha(\text{N})=0.00028$ 6; $\alpha(\text{O})=1.58 \times 10^{-5}$ 22 Mult., δ : $\alpha(\text{K})\text{exp}=0.073$ 11, $\alpha(\text{L}+\text{M})\text{exp}=0.010$ 2 (1981Ar06).
176.36 8	≈1.5	476.0		299.57	(2,3) ⁺				
180.08 6	10.3 13	679.9	(4,5,6) ⁻	499.85	(4,5) ⁻	E2(+M1)	>0.9	0.12 3	$\alpha(\text{K})=0.106$ 22; $\alpha(\text{L})=0.015$ 4; $\alpha(\text{M})=0.0028$ 7

¹⁰⁰Mo(p,nγ),(d,2nγ) 1981Ar06,1980Bi01 (continued)

γ(¹⁰⁰Tc) (continued)

<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[‡]</u>	<u>δ[‡]</u>	<u>α^a</u>	<u>Comments</u>
190.7&c		454.0	(4,5) ⁺	263.36	(3) ⁺				α(N)=0.00043 11; α(O)=2.1×10 ⁻⁵ 4 Mult.,δ: α(K)exp=0.102 16 (1981Ar06).
206.25@ 9	1.3 3	493.3	4 ⁺ ,5 ⁺	287.05	(5) ⁺				
223.35 11	43 5	223.30	(2) ⁻	0.0	1 ⁺	E1+M2	0.24 4	0.022 3	α(K)=0.019 3; α(L)=0.0023 4; α(M)=0.00043 7 α(N)=6.7×10 ⁻⁵ 10; α(O)=4.3×10 ⁻⁶ 7 Mult.,δ: α(K)exp=0.019 2 (1981Ar06).
230.1&c		493.3	4 ⁺ ,5 ⁺	263.36	(3) ⁺				
^x 238.57 11	≤1.1								
252.20 11	3.3 5	424.3		172.08	2 ⁺				
257.5&c		520.8?		263.36	(3) ⁺				
260.7#c 3		483.9?	(≤3)	223.30	(2) ⁻				
263.43 4	9.9 12	263.36	(3) ⁺	0.0	1 ⁺			0.034	
276.35 8	5.3 7	499.7	(2,3) ⁻	223.30	(2) ⁻				
286.90 6	1.6 3	459.02		172.08	2 ⁺				
^x 291.04 6	2.81 24								
295.2 2	≤2.1	635.41		340.90	(3) ⁺				
299.47bc 4		299.57	(2,3) ⁺	0.0	1 ⁺				I _γ : only a small fraction of the total I _γ =15.9 may be associated with this level.
299.47b 4	15.9 18	499.85	(4,5) ⁻	200.38	(4) ⁺	(E1+M2)	0.3 1	0.011 4	α(K)=0.009 3; α(L)=0.0012 4; α(M)=0.00021 7 α(N)=3.3×10 ⁻⁵ 11; α(O)=2.1×10 ⁻⁶ 7 Mult.,δ: α(K)exp=0.009 2 (1981Ar06).
^x 321.2 3	0.8 3								
^x 324.32 9	3.6 6								
335.09 8	2.1 4	335.03		0.0	1 ⁺				
340.22 19	1.5 4	340.90	(3) ⁺	0.0	1 ⁺				
348.70b@c 8		520.8?		172.08	2 ⁺				This γ deexcites mainly the 635.5 level (1981Ar06).
348.70b 8	1.8 4	635.41		287.05	(5) ⁺				
355.6&c		355.34		0.0	1 ⁺				
^x 356.35 6	5.2 8								
372.0 3	0.48 19	635.41		263.36	(3) ⁺				
^x 377.54 9	0.52 17								
^x 389.97 10	≤1.2								
392.72 19	1.24 21	679.9	(4,5,6) ⁻	287.05	(5) ⁺				
^x 398.20 15	≤1.0								
^x 408.92 17	≤0.7								
^x 413.7#c 3									
422.14 10	0.80 23	906.05		483.9?	(≤3)				
^x 454.96 3	3.5 5								
458.66 8	2.5 4	459.02		0.0	1 ⁺				
^x 474.6 5	0.46 17								
475.9&		476.0		0.0	1 ⁺				

¹⁰⁰Mo(p,nγ),(d,2nγ) **1981Ar06,1980Bi01** (continued)

γ(¹⁰⁰Tc) (continued)

<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>
483.93 5	2.9 6	483.9?	(≤3)	0.0	1 ⁺	657.79 12	0.61 13	830.20	(2,3) ⁺	172.08	2 ⁺
^x 503.52 6	2.1 5					^x 678.2 3	≤0.8				
^x 554.82 5	2.7 4					682.80 9	2.9 4	906.05		223.30	(2) ⁻
564.84 23	0.8 4	906.05		340.90	(3) ⁺	^x 719.46 22	1.1 3				
^x 583.29 6	≤2.4					830.29 7	1.9 4	830.20	(2,3) ⁺	0.0	1 ⁺
^x 611.6 1	≤2.5					^x 870.66 7	1.0 2				
^x 624.72 4	1.6 5					^x 875.3 3	1.5 3				
^x 633.13 15	0.46 21					^x 892.05 20	0.61 19				
^x 639.39 13	1.13 23					905.5 4	0.52 25	906.05		0.0	1 ⁺
^x 644.20 17	0.48 20					^x 983.93 18	1.0 4				
^x 652.20 10	0.90 17					^x 1048.96 18	1.6 4				

[†] From [1981Ar06](#). I_γ's are at 3.6 MeV, the only I_γ's available in literature.

[‡] From ce data in [1981Ar06](#), unless otherwise noted. The 263.43γ, treated as E2 (α(K)=0.034) was used for normalization of ce data for other transitions. Quoted values of mixing ratio are deduced from the ce data in [1981Ar06](#) using the BrIccMixing code by evaluators.

Reported as weak, no I_γ given ([1981Ar06](#)).

@ Placement from [1980Bi01](#), energy and intensity taken from [1981Ar06](#).

& γ reported by [1980Bi01](#) only.

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

^b Multiply placed.

^c Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

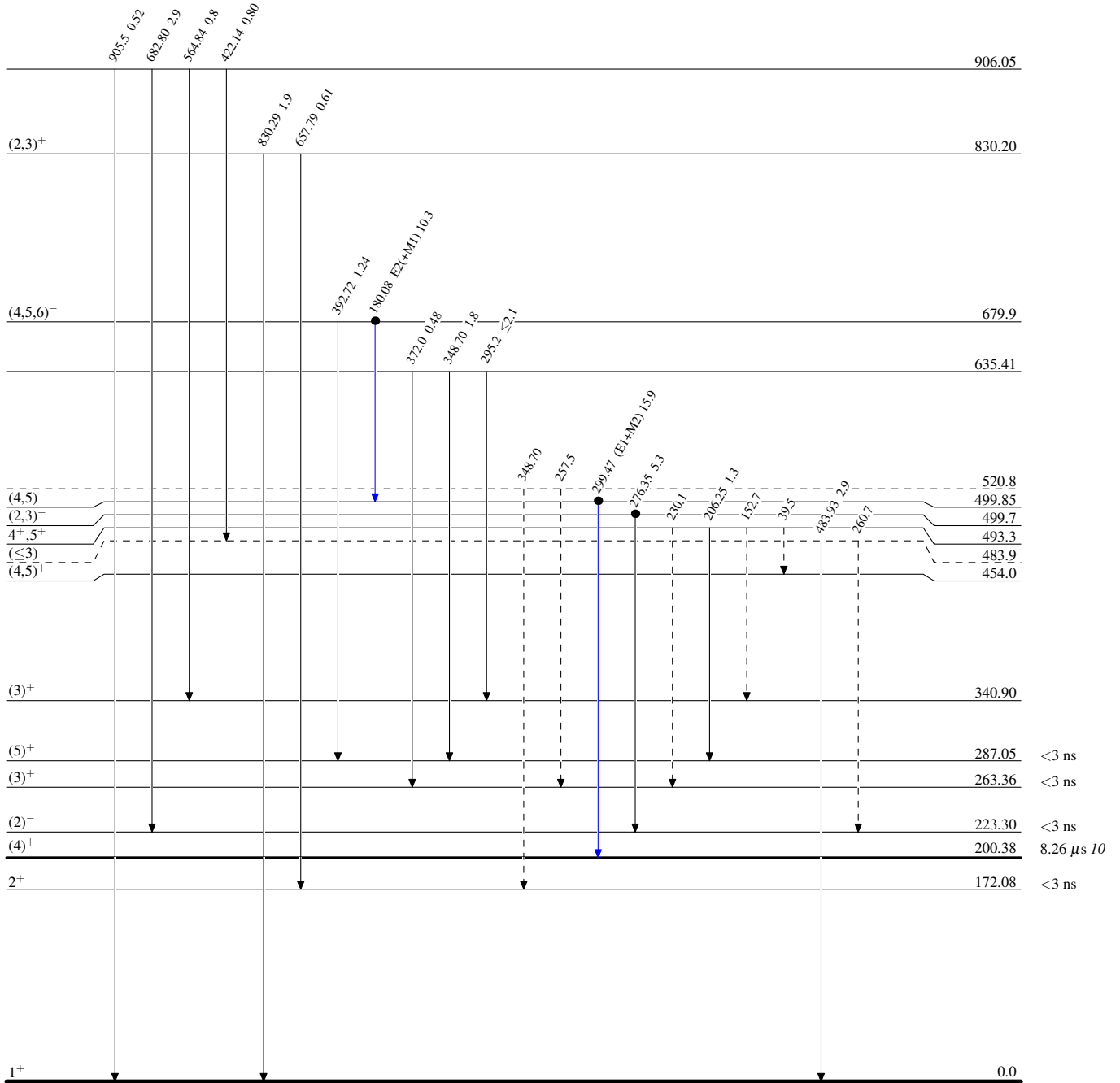
$^{100}\text{Mo}(p,n\gamma),(d,2n\gamma)$ 1981Ar06,1980Bi01

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)
- Coincidence

 $^{100}_{43}\text{Tc}_{57}$

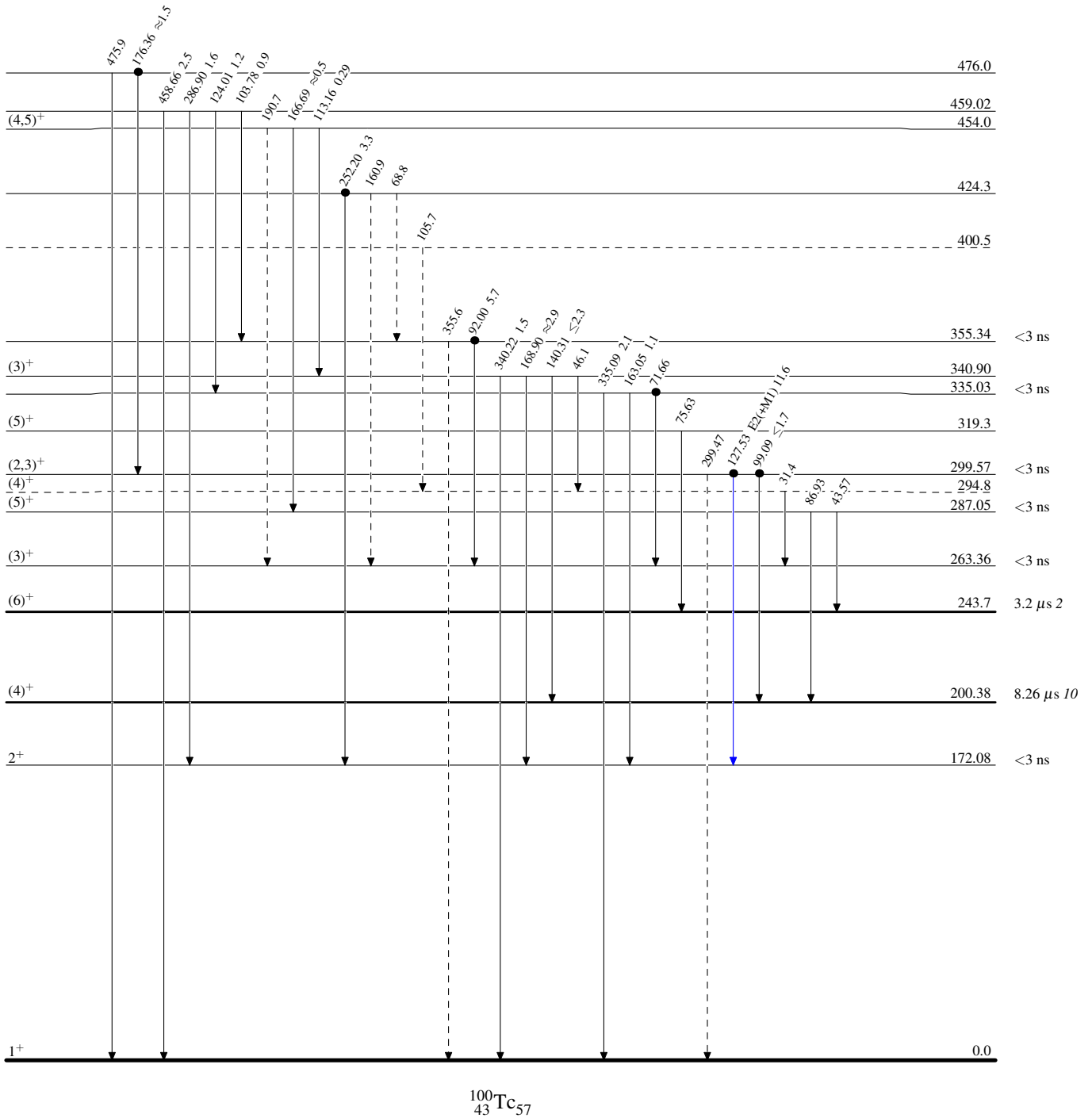
$^{100}\text{Mo}(p,n\gamma),(d,2n\gamma)$ 1981Ar06,1980Bi01

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)
- Coincidence



$^{100}\text{Mo}(p,n\gamma),(d,2n\gamma)$ 1981Ar06,1980Bi01

Legend

Level Scheme (continued)

Intensities: Relative I_γ

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

