

⁴⁸Ti(α,α') 1973Ja18,1968Be23,1967Yn01

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 179, 1 (2022)	30-Nov-2021

Also includes (¹⁸O,¹⁸O') from 1979Es04.

1973Ja18: E=28.5 MeV α beam was produced from the University of Rochester Tandem Van de Graaff accelerator. Target was $\approx 50 \mu\text{g}/\text{cm}^2$ titanium oxide (99.13% in ⁴⁸Ti) on a $20 \mu\text{g}/\text{cm}^2$ carbon foil. Scattered particles were momentum-analyzed with a split-pole magnetic spectrograph (FWHM ≈ 18 keV) and detected with nuclear emulsions. Measured $\sigma(\theta=13^\circ$ to $45^\circ)$. Deduced levels, L-transfers from DWBA analysis. **1973Ja18** also report data from ⁴⁹Ti(d,t).

1967Yn01: E=43 MeV α beam was produced from the Argonne 60-in cyclotron. Target was 99.08% enriched ⁴⁸Ti. Scattered α particles were detected with a surface-barrier telescope (FWHM ≈ 135 -175 keV). Measured $\sigma(\theta=17^\circ$ to $47^\circ)$. Deduced levels, L transfers, deformation parameters from DWBA analysis.

1970Br07: E=44 MeV α beam was from the Saclay fixed-energy cyclotron. Target was 99.2% enriched ⁴⁸Ti. Measured $\sigma(\theta=7^\circ$ to $173^\circ)$ with Si-Si(Li) detector telescopes (FWHM ≈ 180 keV). Deduced levels, L-transfers, deformation lengths from Austern-Blair model analysis. See also **1967Br25** (thesis).

1968Be23: E=31 MeV α beam was produced from the MIT cyclotron. Target was $\approx 1 \text{ mg}/\text{cm}^2$ 99% enriched metallic ⁴⁸Ti. Measured $\sigma(\theta=15^\circ$ to $60^\circ)$ with Si surface-barrier detectors (FWHM ≈ 100 keV). Deduced levels, J, π , L-transfers from DWBA analysis. Comparisons with available data.

1994Ra29: E=40 and 45 MeV α beams from the Variable Energy Cyclotron Centre, Bhabha Atomic Research Center, Calcutta. Measured $\sigma(\theta_{c.m.}\approx 5^\circ$ to $130^\circ)$. Deduced deformation parameter for the 984, 2⁺ level from DWBA analysis.

1979Es04: E(¹⁸O)=54 MeV from the Munich MP tandem accelerator. Measured $\sigma(\theta_{c.m.}=25^\circ$ to $70^\circ)$ with Si detectors (FWHM ≈ 250 keV). DWBA analysis.

Others: **1989Ai02**, **1982An07**, **1979Ro01**, **1974Re01**, **1974A110**, **1973Bi12**, **1973Se04**.

⁴⁸Ti Levels

Deformation length δ_L given under comments is defined as $\delta_L = \beta_L R$, where β_L is deformation parameter and $R = 1.2 \times A^{1/2}$ is nuclear radius in units of fm.

E(level) [†]	J ^{π}	L [‡]	β_L [#]	Comments
0.0 [@]	0 ⁺			
984 [@]		2	0.21	B(E2) $\uparrow=0.0069$ (1970Br07) E(level): others: 990 (1970Br07), 984 (1968Be23). L: also from 1967Yn01 , 1968Be23 . β_L : others: 0.20 at E $\alpha=40$ MeV and 0.19 at 45 MeV (1994Ra29); 1967Yn01 report 0.187, 0.191 and 0.193 for 3 different potentials. $\delta_2=0.81$ fm (1970Br07).
2300		4		E(level): others: 2299 (1967Yn01), 2210 (1970Br07), 2290 (1968Be23).
2425		2	0.058	E(level): others: 2420 (1967Yn01 , 1968Be23). L: also from 1968Be23 .
3004		(0)		E(level): other: 3000 (1968Be23).
3241		4	0.082	E(level),L: others: 3180 with L=(6) from 1970Br07 ; 3240, L=4 (1968Be23).
3337		6		E(level): other: 3316 (1967Yn01).
3359 ^{&}		(3)	(0.079)	E(level): other: 3360 (1968Be23). L: tentative (1968Be23).
3371 ^{&}				
3510		6		
3616		2		
3852		3	0.056	B(E3) $\uparrow=1.37 \times 10^{-4}$ (1970Br07) E(level): others: 3813 (1967Yn01), 3820 (1970Br07), 3850 (1968Be23). L: also from 1967Yn01 , 1968Be23 . β_L : others: 0.061, 0.063 and 0.063 for 3 different potentials (1967Yn01). $\delta_3=0.32$ fm (1970Br07).

Continued on next page (footnotes at end of table)

$^{48}\text{Ti}(\alpha,\alpha')$ **1973Ja18,1968Be23,1967Yn01** (continued) ^{48}Ti Levels (continued)

E(level) [†]	L [‡]	β_L [#]	Comments
4045	2		E(level): others: 4010 (1967Yn01), 4050 (1968Be23).
4073	2		
4384	4		E(level),L: others: 4380 with L=3 from 1970Br07 (also 1967Br25), B(E3)= 1.05×10^{-4} ; 4390 (1968Be23). 1968Be23 consider the 4380, L=3 level from 1967Br25 the same level as the 4590, L=3 in their work and the 4522, L=3 level in 1967Yn01. $\delta_3=0.28$ fm (1970Br07).
4407	(2)		
4581	3	0.070	E(level): others: 4522 (1967Yn01), 4590 (1968Be23). See also the comment for 4384 level. L: also from 1967Yn01, 1968Be23. β_L : other: 0.068 (1967Yn01).
4722			E(level): other: 4710 (1970Br07).
4792	2		
4916	5		E(level): other: 4890 (1967Yn01).
4966	2	0.045	E(level): other: 4960 (1968Be23). L: also from 1968Be23.
4995			
5146	4	(0.036)	B(E4) $\uparrow=5.70 \times 10^{-6}$ E(level),L: others: 5060 with L=(4) from 1970Br07; 5160, L=(4) from 1968Be23. $\delta_4=0.17$ fm (1970Br07).
5313	(4,2)	(0.051)	E(level): others: 5290 (1967Yn01, 1970Br07), 5340 (1968Be23). L: (4,2) from 1973Ja18, 4 from 1967Yn01, (4) from 1968Be23. β_L : for L=4 (1973Ja18). Other: 0.042 (1967Yn01).
5383	(3)		
5516	3	0.054	E(level): others: 5500 (1967Yn01), 5540 (1968Be23). L: (3) from 1973Ja18, 3 from 1968Be23.
5614	2		E(level),L: others: 1970Br07 report a level at 5600 with L=(6).
5760	(3)		E(level): other: 5790 (1967Yn01).
5822	3		
5843	3	(0.054)	E(level): other: 5860 (1968Be23). L: other: tentative L=(3) (1968Be23).
5885	2		
5914	2		
5999	(2)		
6039	4		
6065	3		E(level): other: 6090 (1968Be23).
6115	2		
6178	2		
6235	3	(0.051)	E(level): others: 6220 (1967Yn01), 6240 (1968Be23). L: other: tentative L=(3) (1968Be23).
6342	3	(0.052)	E(level): other: 6360 (1968Be23). L: other: tentative L=(3) (1968Be23).
6462	3		E(level): other: 6470 (1968Be23).
6509	4		
6579	(3)		
6701	4		
6740	(2,3)		E(level): other: 6760 (1968Be23).
6797	(5,4)		E(level): other: 6810 (1968Be23).
6831	3		
6957	3		E(level): other: 6990 (1968Be23).
7058	(3)		E(level): other: 7150 (1968Be23).
7986	2		

[†] From 1973Ja18. ΔE is not specified in 1973Ja18 but from resolution and statements in paper and a comparison with Adopted Levels levels, ± 10 keV appears a safe upper limit.

${}^{48}\text{Ti}(\alpha, \alpha')$ 1973Ja18, 1968Be23, 1967Yn01 (continued)

${}^{48}\text{Ti}$ Levels (continued)

‡ From DWBA analysis of measured $\sigma(\theta)$ in 1973Ja18, unless otherwise noted.

From DWBA analysis of measured $\sigma(\theta)$ in 1968Be23.

@ Also reported by 1979Es04 in (${}^{18}\text{O}$, ${}^{18}\text{O}'$).

& Unresolved doublet with L=3+2 (1973Ja18); rounded value from Adopted Levels.