^{46}Ti(^{3}He,nγ) 2003Je06

Type	Author	History Citation	Literature Cutoff Date
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2003Je06: E=7-12 MeV ^{3}He beams were produced from the FN Tandem accelerator of the University of Cologne. Target was a 0.94 mg/cm^2 self-supporting foil of ^{46}Ti. γ rays were detected with the MINIBALL spectrometer consisting of 18 six-fold segmented encapsulated Ge detectors, clustered in six triple-cluster cryostats. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma$-excitation functions. Measured $\gamma\gamma(\theta)$ with the OSIRIS-6 cube spectrometer in Cologne in an additional measurement. Deduced levels, J, π, band structures, γ-ray multipolarities, mixing ratios. Comparisons with shell-model and cluster-model calculations.

1974Ka24: E=10 MeV ^{3}He beam was produced from the AVF cyclotron der Vrije Universiteit. Target was a 2 mg/cm^2 86.1% enriched self-supporting foil of ^{46}Ti. γ rays were detected with a Ge(Li) detector and neutrons were detected with a liquid scintillator. Measured Eγ, Iγ, nγ-coin. Deduced levels. Comparisons with available data and shell-model calculations.

Other: 1979Ha45 mention their (^{3}He,nγ) measurement, but give no details and data.

^{48}Cr Levels

2003Je06 note that, except for the 2^+ and 4^+ excited states, no other excited states were observed below 3.4 MeV and that this is a fairly notable result since the γ-ray spectroscopy for (^{3}He,n) can be regarded as complete in the spin range of 3 to 4 up to about 4 MeV.

E(level)[†]	J$^\pi$[‡]	Comments
0.0[@]	0^+	
752.4[@] *5*	2^+	
1858.9[@] *7*	4^+	
3445.9[@] *13*	6^+	
3524.5 *12*	(0,1,2,3)	J$^\pi$: from γ excitation function (2003Je06).
3534.2[&] *13*	$4^{(-)}$[#]	J$^\pi$: spin=4 from γ excitation function and $\gamma\gamma(\theta)$ (2003Je06). Other: (6^+) proposed in 1974Ka24 with no argument given.
3632.5 *12*	$(2^+,3^-)$	J$^\pi$: (<4) from γ excitation function (2003Je06).
4034.5 *12*	(0,1,2,3)	J$^\pi$: from γ excitation function (2003Je06).
4064.2 *9*	$3^{(-)}$	J$^\pi$: spin=3 from γ excitation function and $\gamma\gamma(\theta)$; π=− suggested by shell-model calculations (2003Je06).
4065.2[&] *16*	$5^{(-)}$[#]	J$^\pi$: spin=5 from γ excitation function and $\gamma\gamma(\theta)$ (2003Je06).
4766.0 *13*	(4,5)	J$^\pi$: from γ excitation function (2003Je06).
4877.2[&] *16*	(6^-)	J$^\pi$: (5,6) from γ excitation function (2003Je06).
5131.3 *14*		
5189.0[@] *16*	8^+	
5596.3 *16*		
5650.3[&] *19*	(7^-)	
5786.0 *16*		
5835.3 *16*		

[†] From a least-squares fit to γ-ray energies, assuming $\Delta E\gamma$=1 keV where not given.

[‡] From Adopted Levels. Assignments and supporting arguments from this dataset are given under comments, which are from analysis of the γ-ray excitation functions or $\gamma\gamma(\theta)$ in 2003Je06. Adopted $J^\pi(1858)=4^+$ and $J^\pi(3445)=6^+$ served as references for the comparison of the different intensity curves in 2003Je06.

[#] ^{48}Cr is a well-deformed nucleus with $\beta\approx0.3$ suggesting that K is a good quantum number (1998Br34). The band head at 3533 has J=4 and and the state directly above this connected by 531γ has J=5, both from γ excitation functions, establishing K=4. $\delta(1675\gamma)$ excludes an appreciable Q component and strongly favors $\Delta\pi$=−. $T_{1/2}(3533)$=3.3 ns *8* from the Adopted Levels and almost pure D character of 1675γ excludes twofold K-forbidden E2. However, threefold K-forbidden, isospin-forbidden E1 and twofold K-forbidden M2 are consistent with expected transition probabilities. Therefore, π=− is assigned to the 3533 and the band

Continued on next page (footnotes at end of table)

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^{48}Cr Levels (continued)

built on it (2003Je06). Note, also, that, if $\pi(3533)=+$, considerable E2 character of the 1675γ and an E2 γ to 2^+ would be expected and that no γ from the 4064, J=5, to 1854, J=4^+ was observed.

@ Band(A): g.s. band.

& Band(B): Negative-parity non-yrast band. See footnote on $J^\pi(3533)$ and $J^\pi(4064)$ for arguments assigning negative parity to this band.

$\gamma(^{48}Cr)$

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult. ‡	δ ‡	Comments
531	8.8 *7*	4065.2	$5^{(-)}$	3534.2	$4^{(-)}$	D,Q		δ: δ(Q/D)=+0.01 *5* or ≥7.
752.4 *5*		752.4	2^+	0.0	0^+			E_γ: from 1974Ka24. Other: 752 (2003Je06). I_γ: I(752γ)/I(1106γ)=100/18 *3* (1974Ka24).
1067	1.7 *2*	5131.3		4064.2	$3^{(-)}$			
1106.4 *5*	100	1858.9	4^+	752.4	2^+			E_γ: from 1974Ka24. Other: 1106 (2003Je06).
1343	2.0 *2*	4877.2	(6^-)	3534.2	$4^{(-)}$			
1585		5650.3	(7^-)	4065.2	$5^{(-)}$			
1587		3445.9	6^+	1858.9	4^+			
1675.3 *10*	24.4 *20*	3534.2	$4^{(-)}$	1858.9	4^+	D(+Q)	−0.01 *5*	E_γ: from 1974Ka24. Other: 1675 (2003Je06). I_γ: I(1675γ)/I(1106γ)=19 *2*/18 *3* (1974Ka24).
1743		5189.0	8^+	3445.9	6^+			
2062	1.2 *2*	5596.3		3534.2	$4^{(-)}$			
2205	7.8# *6*	4064.2	$3^{(-)}$	1858.9	4^+	D,Q		δ: δ(Q/D)=−0.05 *5* or ≥10.
2301	0.9 *2*	5835.3		3534.2	$4^{(-)}$			
2340	0.8 *1*	5786.0		3445.9	6^+			
2772	3.9 *4*	3524.5	(0,1,2,3)	752.4	2^+			
2880	6.8 *6*	3632.5	$(2^+,3^-)$	752.4	2^+			
2907	2.4 *2*	4766.0	(4,5)	1858.9	4^+			
3282	8.8 *7*	4034.5	(0,1,2,3)	752.4	2^+			
3312	3.0# *3*	4064.2	$3^{(-)}$	752.4	2^+			

† From 2003Je06 with intensities determined by gating on 752γ, unless otherwise noted.

‡ From $\gamma\gamma(\theta)$ in 2003Je06. $\gamma\gamma(\theta)$ data are not explicitly given in 2003Je06.

Iγ(2205γ)/Iγ(3312γ)=100 *13*/28 *6* from $\gamma\gamma(\theta)$ measurements in 2003Je06.

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Level Scheme

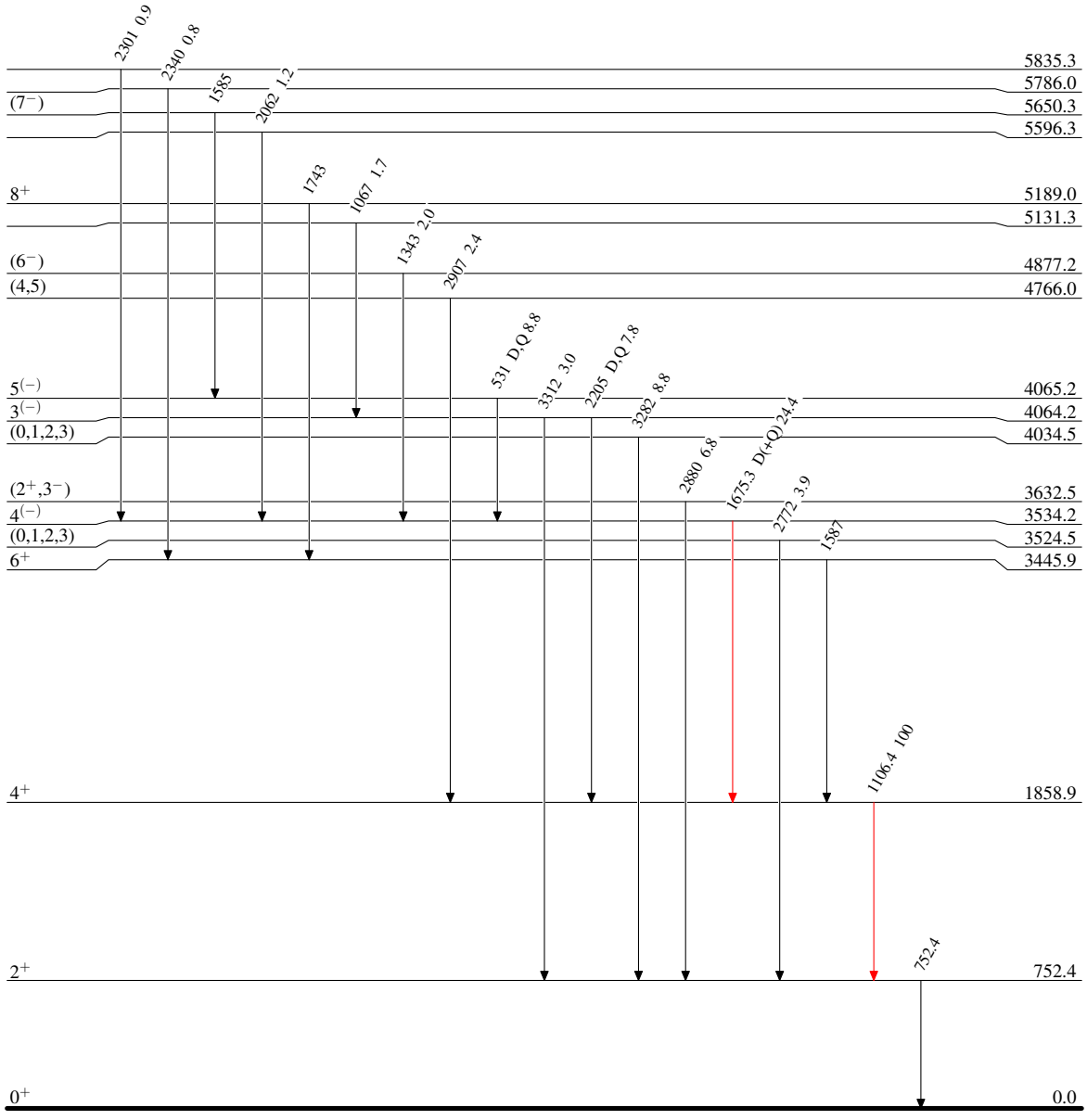
Intensities: Relative I_γ

Legend

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

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

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



$^{48}_{24}Cr_{24}$

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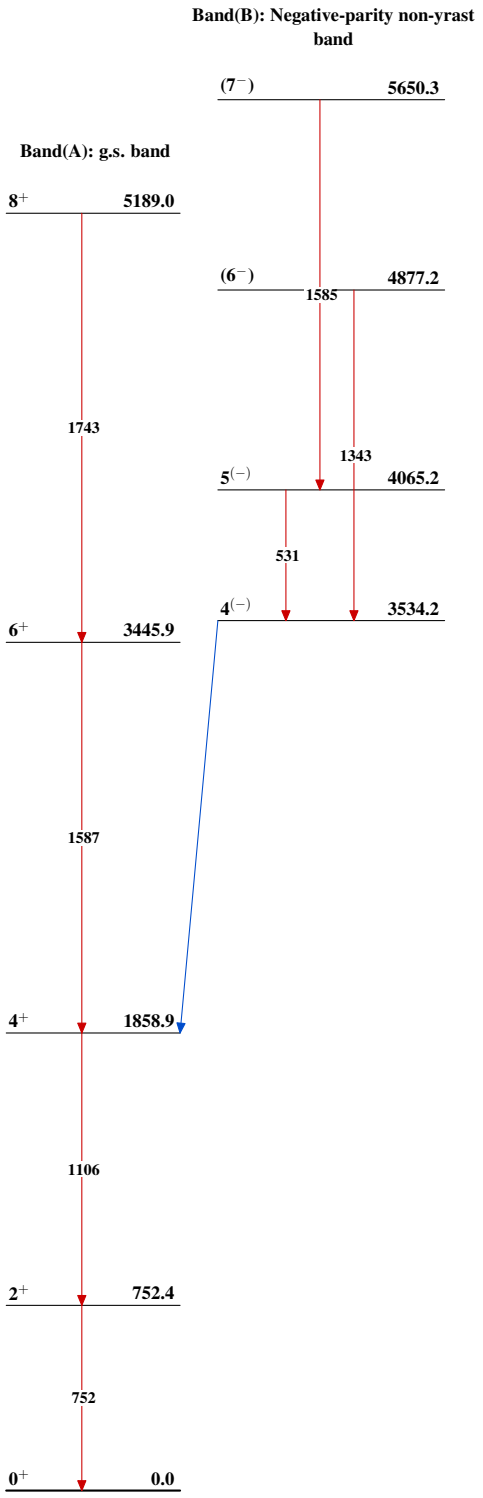

$^{48}_{24}Cr_{24}$