^{48}Ti(γ,γ),(γ,γ') 1990De20,1976Ra03

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

1990De20: (γ,γ') E=4.1-14 MeV bremsstrahlung was produced from the 65 MeV Giessen electron linear accelerator (15-30% polarized beam). Targets were 5 g TiO_2 power. γ rays were detected with four Ge detectors. Measured Eγ, Iγ, $\gamma(\theta)$, and azimuthal asymmetries (Φ=0°, 90°, 180°, 270°). Deduced levels, J, π, widths, transition probabilities.

1976Ra03: E=1.3-4.7 MeV bremsstrahlung was produced at the Bartol Research Foundation of the Franklin Institute. γ rays were detected with two Ge(Li) detectors and the Ge(Li) slab Compton polarimeter. Measured Eγ Iγ, $\gamma(\theta$=96°,126°), γ(lin pol). Deduced levels, J, π, widths, $T_{1/2}$, γ-ray multipolarities, mixing ratios.

1963Ak03,1963Ak02: E=983; γ from ^{48}V ε,β+ decay. Measured resonance scattering cross section using a NaI.

1983Mo06: E=6.60 MeV. Measured Eγ, Iγ, $\gamma(\theta$=90° to 150°), polarization of elastically scattered γ rays and ratio of σ at 296° K and 78° K with a Compton polarimeter.

1995IsZW,1995Ka58,1996Is04: E≤6.6 MeV bremsstrahlung from the RTM injector at the Institute of Nuclear Physics of Moscow State University. γ rays were detected with a Ge(Li) detector. Measured Eγ, Iγ, $\gamma(\theta)$. Deduced levels, J, π, widths, γ-ray, deformation parameter, multipolarities, transition strengths. See also 2002IsZY, 1996BoZX, 1995IsZW, 1994AlZX.

Others: 1981Ca10, 1977Ca14, 1964Bo22, 1958Kn36.

^{48}Ti Levels

Additional information 1.

E(level)†	J$^\pi$#	$T_{1/2}$&	Γ_0^2/Γ (eV)	Comments
0.0	0$^+$@			E(level): deformation parameters: δ=0.26 *4* and γ=19 deg 2 from B(M1)↑ for 3740 and 5643 transitions (1995Ka58,1996Is04,2002IsZY).
983.5	2$^+$@	4.6 ps *4*		E(level): rounded value from Adopted Levels. $T_{1/2}$: weighted average of 4.64 ps *42* (1981Ca10), 4.9 ps *15* (1963Ak03), and 4.2 ps *14* (1958Kn36). Other: 2.5 ps *11* from 1964Bo22 is discrepant. Additional information 2.
2304	4$^+$@	1.4 ps *+6−5*		E(level),$T_{1/2}$: from 1963Ak03, with $T_{1/2}$ determined from dependence of cross section for resonance scattering of 983γ, following β+ and 1320γ decay of ^{48}V versus T of gaseous source, assuming $T_{1/2}$(983)=4.9 ps *16* (1963Ak03). Other $T_{1/2}$: 0.15 ps *+6−4* from 1964Bo22 is discrepant.
2421‡	2$^+$@	33 fs *+16−9*	3.7×10^{-5}‡ *9*	
3371‡	2$^+$@	12.5 fs *+35−27*	7.4×10^{-4}‡ *8*	
3699.9 *7*	1$^{(-)}$	6.1 fs *+16−12*	0.0101 *10*	Γ_0^2/Γ (eV): weighted average of 0.0096 eV *10* (1976Ra03), 0.012 eV *2* (1990De20), and 0.010 eV *+2−1* (1996Is04). Other: 0.010 eV *3* (1995IsZW).
3738.9 *7*	1$^+$	3.1 fs *+9−7*	0.060 *4*	Γ_0^2/Γ (eV): weighted average of 0.066 eV *4* (1976Ra03), 0.058 eV *7* (1990De20), and 0.054 eV *4* (1996Is04). Other: 0.054 eV *5* (1995IsZW).
4310.2 *20*	1$^+$	3.8 fs *+39−17*	0.041 *15*	Γ_0^2/Γ (eV): weighted average of 0.070 eV *20* (1990De20) and 0.034 eV *10* (1995IsZW). Other: 0.023 eV *4* (1996Is04) is discrepant with the value from 1990De20.
5340 *3*	1$^{(-)}$		0.08 *3*	$T_{1/2}$: 5.7 fs *22* if Γ_0/Γ=1.0.
5526 *3*	1		0.07 *3*	$T_{1/2}$: 6.5 fs *28* if Γ_0/Γ=1.0.
5639.9 *17*	1$^+$	<0.96 fs	0.191 *20*	Γ_0^2/Γ (eV): weighted average of 0.174 eV *20* (1996Is04), 0.20 eV *7* (1990De20), and 0.208 eV *20* (1995IsZW).
6086 *4*	1		0.11 *4*	$T_{1/2}$: 4.4 fs *15* if Γ_0/Γ=1.0.
6126 *3*	1		0.173 *10*	$T_{1/2}$: 2.64 fs *15* if Γ_0/Γ=1.0. Γ_0^2/Γ (eV): from 1995IsZW. Other: 0.16 eV *6* (1990De20); note that 0.056 eV *10* (1996Is04) is discrepant.

Continued on next page (footnotes at end of table)

^{48}Ti(γ,γ),(γ,γ′) 1990De20,1976Ra03 (continued)

^{48}Ti Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[&]	Γ_0^2/Γ (eV)	Comments
6138 *4*	$1^{(+)}$		0.09 *4*	$T_{1/2}$: 5.1 fs *23* if Γ_0/Γ=1.0.
6236 *3*	2^+		0.07 *4*	$T_{1/2}$: 6.5 fs *37* if Γ_0/Γ=1.0.
6604.3 *24*	1^-	0.86 eV *20*	0.52 *18*	$T_{1/2}$: from resonance σ versus temperature (1983Mo06). Other: 0.92 eV *32* from Γ_0^2/Γ and adopted branching ratios.
6979 *3*	1^-		0.38 *14*	
7041 *4*	1,2		0.11 *7*	
7071 *4*	1^+		0.40 *15*	
7110 *5*	1		0.24 *11*	
7124 *3*	1^-		0.63 *23*	
7221.6 *20*	1^+		1.3 *5*	
7450 *3*	1^-		0.32 *11*	
7484 *4*	1		0.16 *10*	
7586 *4*	$1^{(-)}$		0.9 *4*	
7969 *4*	1		0.19 *11*	
8010 *4*	1		0.34 *13*	
8199 *4*	1,2		0.17 *9*	
8255 *4*	1		0.32 *13*	
8572 *4*	$1^{(-)}$		0.30 *13*	
8592 *4*	1		0.61 *22*	
8672 *5*	1		0.45 *18*	
8933 *5*	1		0.20 *12*	
8996 *5*	$1^{(+)}$		0.30 *14*	
9025 *5*	1		0.66 *25*	
9977 *6*	1^-		0.40 *23*	

[†] From a least-squares fit to γ-ray energies, assuming ΔEγ=1 keV where not given.
[‡] From 1976Ra03.
[#] From γ(θ) and azimuthal asymmetries in 1990De20, except as noted.
[@] From Adopted Levels.
[&] From Γ, deduced by the evaluator from Γ_0^2/Γ in this dataset and the adopted branching ratio (Γ_0/Γ), except as noted.

γ(^{48}Ti)

E_i(level)	J_i^π	E_γ[†]	I_γ	E_f	J_f^π	Mult.[&]	Comments
983.5	2^+	983[‡]		0.0	0^+		
2304	4^+	1320[‡]		983.5	2^+		
3371	2^+	2388[#]		983.5	2^+	D+Q	Mult.,δ: from γ(θ) in 1976Ra03, with 0.1<δ<0.8.
3699.9	$1^{(-)}$	2716 *1*	52[#] *3*	983.5	2^+	(E1)	
		3700 *1*	48[#] *3*	0.0	0^+	(E1)[a]	
3738.9	1^+	2755 *1*		983.5	2^+	(M1)	
		3739 *1*		0.0	0^+	M1[a]	
4310.2	1^+	4310 *2*		0.0	0^+	M1[a]	
5340	$1^{(-)}$	5340 *3*		0.0	0^+	(E1)	
5526	1	5526 *3*		0.0	0^+	D	
5639.9	1^+	4655 *3*		983.5	2^+	M1	
		5640 *2*		0.0	0^+	M1[a]	
6086	1	6086 *4*		0.0	0^+	D	
6126	1	6126 *3*		0.0	0^+	D	
6138	$1^{(+)}$	6138 *4*		0.0	0^+	(M1)	

Continued on next page (footnotes at end of table)

^{48}Ti(γ,γ),(γ,γ') 1990De20,1976Ra03 (continued)

$\gamma(^{48}Ti)$ (continued)

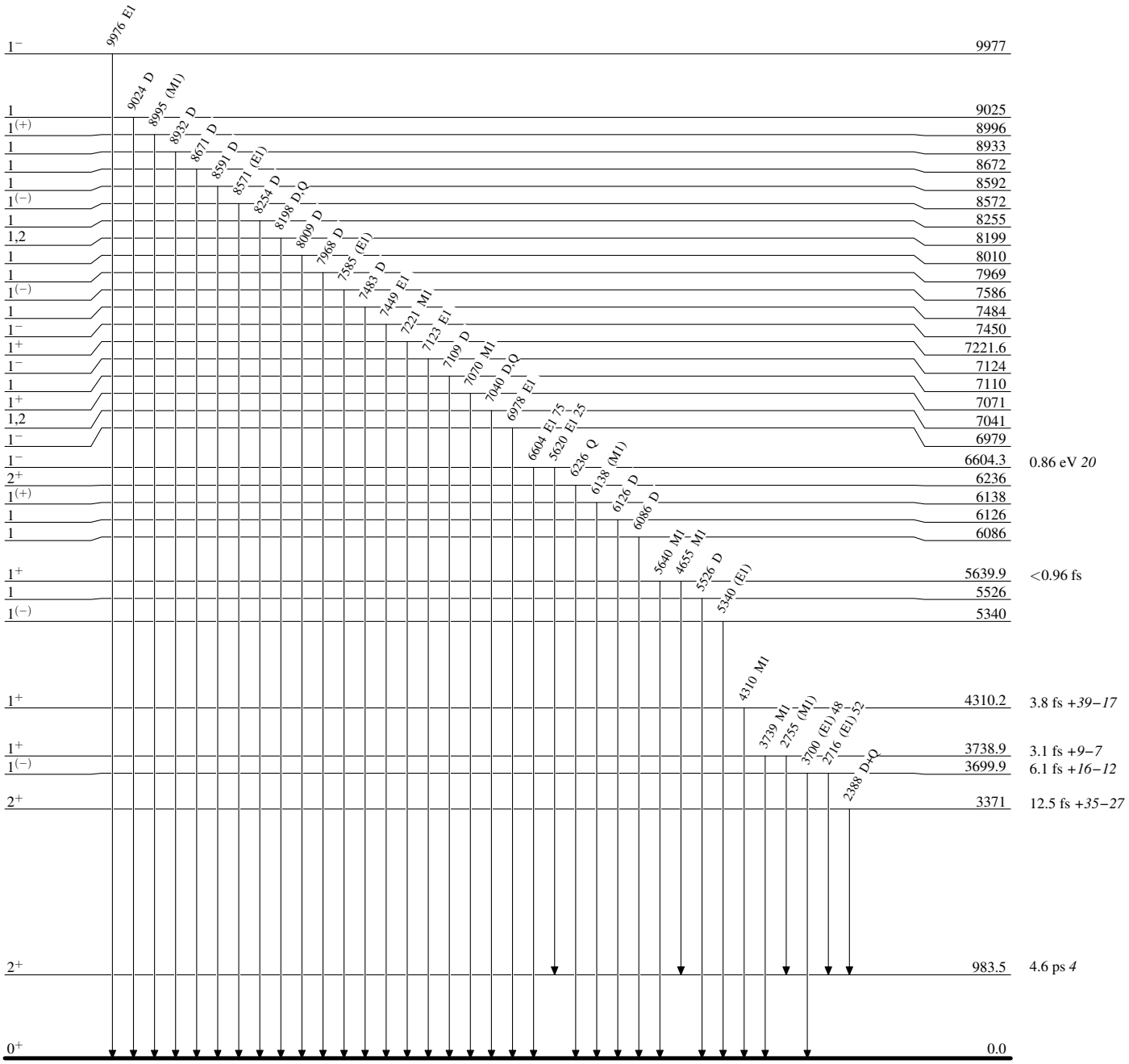
E_i(level)	J_i^π	E_γ[†]	I_γ	E_f	J_f^π	Mult.[&]	Comments
6236	2^+	6236 *3*		0.0	0^+	Q	I_γ: weak (1990De20).
6604.3	1^-	5620 *4*	25[@]	983.5	2^+	E1	Mult.: $\gamma(\theta)$ consistent with 1→2 (1983Mo06).
		6604 *3*	75[@]	0.0	0^+	E1	Mult.: elastic scattering polarization data consistent with 0+→1−→0^+ (1983Mo06).
6979	1^-	6978 *3*		0.0	0^+	E1	
7041	1,2	7040 *4*		0.0	0^+	D,Q	
7071	1^+	7070 *4*		0.0	0^+	M1	
7110	1	7109 *5*		0.0	0^+	D	
7124	1^-	7123 *3*		0.0	0^+	E1	
7221.6	1^+	7221 *2*		0.0	0^+	M1	
7450	1^-	7449 *3*		0.0	0^+	E1	
7484	1	7483 *4*		0.0	0^+	D	
7586	$1^{(-)}$	7585 *4*		0.0	0^+	(E1)	
7969	1	7968 *4*		0.0	0^+	D	
8010	1	8009 *4*		0.0	0^+	D	
8199	1,2	8198 *4*		0.0	0^+	D,Q	
8255	1	8254 *4*		0.0	0^+	D	
8572	$1^{(-)}$	8571 *4*		0.0	0^+	(E1)	
8592	1	8591 *4*		0.0	0^+	D	
8672	1	8671 *5*		0.0	0^+	D	
8933	1	8932 *5*		0.0	0^+	D	
8996	$1^{(+)}$	8995 *5*		0.0	0^+	(M1)	
9025	1	9024 *5*		0.0	0^+	D	
9977	1^-	9976 *6*		0.0	0^+	E1	

[†] From 1990De20, unless otherwise noted.
[‡] From 1963Ak03.
[#] From 1976Ra03. Iγ′s of γ′s from 3700 state are discrepant with adopted Iγ(3699γ)/Iγ(2716γ)=0.54 *4*.
[@] From 1983Mo06.
[&] From $\gamma(\theta)$ and azimuthal asymmetries in 1990De20, except as noted. Additional supporting arguments from other references are given in footnotes.
[a] $\gamma(90°)/\gamma(127°)$ consistent with 0→1→0 (1996Is04).

^{48}Ti(γ,γ),(γ,γ′) 1990De20,1976Ra03

Level Scheme

Intensities: % photon branching from each level

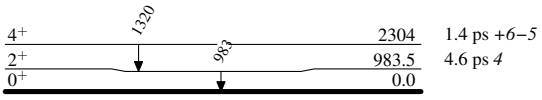


$^{48}_{22}Ti_{26}$

^{48}Ti(γ,γ),(γ,γ') 1990De20,1976Ra03

Level Scheme (continued)

Intensities: % photon branching from each level



$^{48}_{22}Ti_{26}$