Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 190,1 (2023)	20-Jun-2023

Q(β^-)=−13749 *7*; S(n)=16318 *4*; S(p)=8649.4 *20*; Q(α)=−5127.1 *7* 2021Wa16

Q(β^-),S(n): Deduced by the evaluators from newly measured mass of ^{44}V (M.E.=−23800.4 *71*) and ^{43}Ti (M.E.=−29302.2 *42*), respectively, by 2022Wa39. Others: Q$^-$=−13741 *7* from evaluated M.E.(^{44}V)=23808 *7* and S(n)=16304 *6* from evaluated M.E.(^{43}Ti)=−29316 *6* in 2021Wa16.

Q(ε)=267.4 *19*, S(2n)=28586.9 *7*, S(2p)=13579.2 *7* (2021Wa16).

Other measurements:

Additional information 1.

^{12}C(^{32}S,F),(^{32}S,X)E=140 MeV: fission of ^{44}Ti: 1986Pl02 (E=140 MeV), 1979Os01 (E(c.m.)=20-35 MeV).

^{16}O(^{28}Si,^{28}Si): resonances: 1979Ba49 (E(c.m.)=30.0-32.7 MeV).

^{24}Mg(^{32}S,^{12}C) E=140 MeV: fission fragments: 1990Sa14; E=164 MeV: γ-ray spectroscopy: 2000Th16.

^{40}Ca(α,α): resonances: 1984Ch15, 1976Fr08. See ^{40}Ca(α,α) dataset.

^{40}Ca(^{16}O,^{16}O): resonances: 1984Me01 (E=18.67-22.29 MeV).

^{40}Ca(^{32}S,^{28}Si): α-particle transfer: 1989Di06 (E=90, 100, 110 MeV).

^{44}Ca(π^+,π^-): double-charge exchange reaction: 1979Da16 (E=290 MeV), 1987Gi04 (E=163,210 MeV), 1987Zu03 (E≈292 MeV), 1988We02 (E=35 MeV), 1990Se11 (E=100-300 MeV), 1990We05 (E=35 MeV), 1991Ba05 (E=50 MeV), 1991Wi03 (E=300-550 MeV), 1992Le16 (E=25-65 MeV), 1993Wa02 and 1993Wa30 (E=50 MeV), 1995Si01 (E=32-79 MeV).

See 1998Ya21 and 1998Mi33 for a very detailed review of α-cluster structure as deduced from ^{40}Ca(α,α) and (^{6}Li,d) reactions.

Theoretical structure calculations:

2022Ho15: calculated point-proton and neutron density distributions, point-proton and point-neutron rms radii using antisymmetrized quasi-cluster model (AQCM).

2022Is04: calculated energy curves and rms matter radius for the 0$^+$ state as a function of the distance between ^{4}He and ^{40}Ca using antisymmetrized quasicluster model (AQCM) and iSMT model, with tensor interaction.

2022Ko04: calculated ground state energy, charge rms radius using Coupled cluster (CC) and ab initio density functional theory.

2022Yu04: calculated levels, J^π, yrast states, B(E2) using particle-number conserved Bardeen-Cooper-Schrieffer (NBCS) approximation in the frame of shell-model.

2021Ar13: calculated average neutron-proton interactions, neutron skin thickness, bubble structure, single-particle energy levels, charge form factor using the Skyrme-Hartree-Fock approach.

2021Cs02: calculated levels, J^π, B(E2) using multiconfigurational dynamical symmetry (MUSY) mode.

2018Ar03: calculated levels, J^π, null point-matter radius, γ-decay widths, B(E2), B(E4) using α-cluster model.

2014Ro02, 2010Ro30: calculated levels, J^π, B(E2), static quadrupole moments, g factors using large-scale shell model calculations.

2010Zh48: calculated levels, band structure, J^π, B(E2) of the low-lying states using IBM-3 model.

2009Ma37: calculated levels, J^π, quadrupole moments, magnetic moments, B(E2), yrast bands and polarization effects using microscopic particle-vibration model.

2007Za10, 2007Zd02: calculated levels, J^π, quadrupole deformation parameters for high-spin states using density functional theory and full *sdfp* shell model.

2006Ki03: calculated levels, J^π, B(E2), superdeformation and cluster features using antisymmetrized molecular dynamics model.

2004Al24: calculated levels, J^π, B(M1), B(E2), mixed-symmetry states using interacting boson model.

2004Zh34: calculated levels, J^π, B(E2), symmetry features using interacting boson model.

1998Oh03: calculated levels, J^π, rotational bands using α-cluster model.

1996Zh01, 1994Zh16: calculated intraband B(λ) using Bloch-Brink microscopic α-cluster model.

1995Bu25: calculated levels, B(λ), α-emission widths using universal α-core interaction.

1994Va09: calculated levels, B(λ) using Core-excited α-cluster model.

1989Fa03: calculated levels, B(M1), transition densities using deformed Woods-Saxon potential, quasiparticle RPA.

1989Me05: calculated levels widths using α-cluster model.

1988Hu12: calculated levels. Folded diagram, pairs model space.

1988Mi01, 1988Oh06: calculated levels, B(E2), α-spectroscopic factors, rms radii, widths. Local potential model, α+^{40}Ca cluster structure.

1988Wa23: calculated levels, B(E2), band structure, rms radius using Resonating group method.

1986Mi20, 1986Mi21: calculated levels, B(E2), intercluster rms radii, α-clustering effects.

Adopted Levels, Gammas (continued)

1981It03: calculated levels, B(E2), Sα using shell model and α-cluster models.
1980Pa20: calculated levels, rotational bands, B(E2) using local potential, and α-cluster model.
1980Ru02: calculated binding energy, symmetric shape preference using oscillator basis, and Wigner, Majorana forces.
1978Pi04: calculated cluster levels.
1975Si11: calculated levels, B(E2) using asymmetric rotor model with vibrations.
1974Ba84, 1969Kh03: calculated levels, B(E2).
1972Sh29: calculated levels, quadrupole moment, B(E2) using variation after projection method.
1971Bh02: calculated levels, B(E2) using shell model.
1968Na20: calculated levels using Harmonic-oscillator shell model with ^{40}Ca core.
Other theoretical calculations: 248 references for structure and six for radioactive decays retrieved from the NSR database (www.nndc.bnl.gov/nsr/) are listed in document records which can be accessed via web-based ENSDF database.

^{44}Ti Levels

Cross Reference (XREF) Flags

A	^{44}V ε decay (111 ms)	I	^{28}Si(^{24}Mg,2$\alpha\gamma$)	Q	^{40}Ca(^{12}C,^{8}Be)
B	^{44}V ε decay (150 ms)	J	^{32}S(^{14}N,pnγ),^{42}Ca(α,2nγ)	R	^{40}Ca(^{13}C,^{9}Be),(^{14}N,^{10}B)
C	^{45}Cr εp decay (60.9 ms)	K	^{40}Ca(α,γ) E=res	S	^{40}Ca(^{16}O,^{12}C)
D	^{4}He(^{40}Ca,α'):resonances	L	^{40}Ca(α,γ):resonances	T	^{40}Ca(^{20}Ne,^{16}O)
E	^{12}C(^{40}Ca,^{8}Be)	M	^{40}Ca(α,α):resonances	U	^{40}Ca(^{32}S,^{28}Si)
F	^{24}Mg(^{23}Na,2npγ)	N	^{40}Ca(^{6}Li,d)	V	^{42}Ca(^{3}He,n)
G	^{24}Mg(^{28}Si,2$\alpha\gamma$)	O	^{40}Ca(^{6}Li,pnγ)	W	^{42}Ca(^{16}O,^{14}C)
H	^{28}Si(^{19}F,2npγ)	P	^{40}Ca(^{7}Li,t)	X	^{46}Ti(p,t),(P,tγ)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
0.0[&]	0^+	59.1 y *3*	ABC EFGHIJK NOPQRSTUVWX	%ε=100 Evaluated ($<r^2>)^{1/2}$=3.6115 fm *51* (2013An02 evaluation). Evaluated change in charge radius $\delta<r^2>(^{44}Ti,^{48}Ti)$=+0.143 fm^2 *37* (2013An02). $T_{1/2}$: weighted average of 58.9 y *3* (2006Ah10,timing distribution of ratio of 1157γ from ^{44}Ti decay and 1173γ from ^{60}Co decay, weighted average of 8 measurements at Argonne and two at Hebrew university; earlier value from the same group is 59.0 y *6* (1998Ah03)), 59 y *2* (2001Ha21, specific activity method by counting implanted ^{44}Ti fragments and γ counting of individual and sum peaks), 60.7 y *12* (1999Wi01, time distribution of γ activity), 60.3 y *13* (1998Go05, specific activity method with γ counting), 62 y *2* (1998No06, time distribution of γ activity, preliminary value from the same group is 63 y *3* (1997No06)). Reduced χ^2=1.3. Following result have not been included in the averaging procedure either due to their being outliers or imprecise: 39.0 y *18* and 58 y *10* (1996Me22,specific activity and γ counting), 66.6 y *16* (1990Al11,timing distribution of ratio of β activities from ^{44}Ti, ^{36}Cl and ^{207}Bi), and 54.2 y *21* (1983Fr27, specific activity with accelerator mass spectroscopy) 48.2 y 9 (1965Mo07, specific activity method) and 46.4 y 17 (1965Wi05, specific activity method). Inclusion of results from 1990Al11 and 1983Fr27 gives 59.3 y *7* with reduced χ^2=2.7 and increased uncertainties (0.5 for 2006Ah10, and 3.0 for 1990Al11). 2020Br05 measured decay rate of ^{44}Ti during 5-hour interval following the detection of the first gravitational wave signal from binary neutron star inspiral (GW170817) detected by Advanced LIGO and Advanced VIRGO in 2017, and found no correlation, contradicting previous claims of detection of a 2.5σ

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				correlation. 2018An10 measured decay rate of ^{44}Ti over 84 h around the two correlated solar flares in September 2017, and within 2σ found no correlation. 2020TuZW described a generalized gamma simulator built from the GEANT4 toolkit in connection with $T_{1/2}$ of ^{44}Ti decay. Measured charge radius $(<r^2>)^{1/2}$=3.6185 fm *38* (2004Ga34, 2002Ca47, collinear laser spectroscopy).
1083.10[&] *9*	2$^+$	2.57 ps *37*	ABC EFGHIJK NOPQ ST VWX	T=0 J^{π}: 1083.08γ E2 to 0$^+$. $T_{1/2}$: unweighted average of 1.86 ps *17* from (^{23}Na,2npγ) by RDDS; 3.1 ps *8* from (α,γ) E=res by DSAM; 2.75 ps *20* from DSAM in ^{12}C(^{40}Ca,^{8}Be). Weighted average is 2.58 ps *27* with large reduced χ^2 of 6.3.
1904.4[a] *8*	0$^+$	>0.5 ps	G K N X	J^{π}: L(p,t)=0 from 0$^+$.
2454.32[&] *13*	4$^+$	0.433 ps *35*	BC EFGHIJK NO Q ST wX	T=0 XREF: N(2440)T(2470)w(2500). J^{π}: L(^{6}Li,d)=4 from 0$^+$; 1371.2γ E2, ΔJ=2 to 2$^+$. $T_{1/2}$: weighted average of 0.423 ps *35* from DSAM in (^{6}Li,pnγ); 0.42 ps *7* from DSAM (α,γ) E=res; 0.451 ps *42* from DSAM in ^{12}C(^{40}Ca,^{8}Be).
2530.90[a] *13*	2$^+$	1.02 ps *14*	A E G K N S wX	μ=+1.04 *30* (2003Sc19,2020StZV) T=0 XREF: N(2520)w(2500). J^{π}: L(^{6}Li,d)=2 from 0$^+$; 2530.86γ E2, ΔJ=2 to 0$^+$. $T_{1/2}$: weighted average of 0.97 ps *14* from DSAM (α,γ) E=res; 1.14 ps *21* from DSAM in ^{12}C(^{40}Ca,^{8}Be). μ: transient-magnetic field method (2003Sc19).
2886.2[d] *6*	2$^+$	0.35 ps *7*	G K N X	J^{π}: L(p,t)=2 from 0$^+$; 2886.1γ E2, ΔJ=2 to 0$^+$.
3176.12[b] *29*	3$^-$	15.6 ps *13*	E GHIJK NO X	J^{π}: L(^{6}Li,d)=3 from 0$^+$; ΔJ=3 to 0$^+$ in (α,γ). Other: L(p,t)=(2) for a group at 3175 is inconsistent. $T_{1/2}$: from RDDS in (^{6}Li,pnγ).
3364.88[a] *34*	4$^+$	0.36 ps *7*	G I K N Q ST WX	XREF: N(3350)Q(3340)T(3310). J^{π}: L(^{6}Li,d)=L(p,t)=4 from 0$^+$.
3415.3[d] *3*	(3$^+$)	0.49 ps *7*	G K	Additional information 2. J^{π}: (2,3) from $\gamma(\theta)$ in (α,γ); 3$^+$ from assignment as an unnatural-parity state by 1977Di07 in (α,γ); 565γ from 3980, 4$^+$.
3645.89[c] *30*	4$^-$	76.3 ps *56*	GHIJK NO	XREF: N(3630). J^{π}: spin=4 from $\gamma(\theta)$ in (α,γ) E=res; 469.73γ M1+E2 to 3$^-$. Other: L(^{6}Li,d)=2 from 0$^+$ for a 3630 group disagrees with 4$^-$, which could indicate existence of a different level. $T_{1/2}$: from RDDS in (^{6}Li,pnγ) (2020Ar16). Other: 2.7 ps *9* from RDM in (^{19}F,2npγ) (1974Ko22), which however results in a very large B(E2)(W.u.) exceeding RUL=100 for 469.7γ. 1977Di07 (also 1981Di09 and subsequent private communication to P.M. Endt from W.R. Dixon) 3646 level must be much longer than the reported value of 3.9 ps discussed that lifetime of the by 1974Ko22, based on recommended upper limit (RUL) for E1 transitions.
3755.9 *4*	2$^+$	0.17 ps *4*	K N S X	XREF: N(3740)S(3780)X(3730). Additional information 3.

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				J^{π}: spin=2 from $\gamma(\theta)$ of 3756γ to g.s. and primary 5957γ from 4^+ resonance at 9713 in (α,γ) E=res; 3756γ to g.s. is E2 not M2 based on RUL. 1973Ba13 suggest L(p,t)=(2,3) for a group at 3730 *20*, giving ($2^+,3^-$). However, L(^{6}Li,d)=1 from 0^+ giving 1^- for a group at 3740 *20* disagrees, which could indicate existence of a different level populated in (^{6}Li,d).
3942.7 *3*	3^-	0.8 ps *2*	K N S VWX	XREF: N(3920)S(3990)W(3980). Additional information 4. J^{π}: L(p,t)=L(^{6}Li,d)=3 from 0^+. But L(^{3}He,n)=(2) for a 3940 group is inconsistent with 3^-.
3980[d] *1*	4^+	0.35 ps *14*	K st vwX	XREF: t(4010)v(4010). Additional information 5. J^{π}: L(p,t)=4 from 0^+.
4015.30 *16*	6^+	0.42 ps *6*	B GHIJK NO st vwX	T=0 XREF: N(4000)s(3990)t(4010)v(4010)w(3980). J^{π}: L(^{6}Li,d)=6 from 0^+; spin=6 from $\gamma(\theta)$ in (α,γ) E=res. $T_{1/2}$: weighted average of 0.39 ps *6* from (α,γ) E=res and 0.45 ps *7* from (^{6}Li,pnγ), both by DSAM.
4061.47[b] *31*	(5^-)	1.5 ps *+13−5*	GHIJK NO q X	XREF: q(4100). J^{π}: spin=(3,5) from $\gamma(\theta)$ in (α,γ) E=res with spin=5 preferred in 1977Di07; spin=(5) from $\gamma(\theta)$ in (^{19}F,2npγ); parity from 885.6γ (E2) to 3^-. But L(^{6}Li,d)=3 for a 4060 group favors 3^- and L(p,t)=4 for a 4060 group favors 4^+.
4115.3 *6*	2^+	111 fs *49*	A K N q S	T=0 XREF: N(4100)q(4100). J^{π}: L(^{6}Li,d)=2 from 0^+; spin=2 also from $\gamma(\theta)$ of ΔJ=2 to 0^+ from primary 5582$\gamma(\theta)$ in (α,γ) E=res.
4227 *1*	(3^-)		K	Additional information 6. J^{π}: 581γ to 4^-, 1340γ to 2^+; primary 4727γ from 1^-, 5957γ from 4^+.
4499.94[&] *33*	(6^+)		G I X	J^{π}: 2045.4γ to 4^+; band assignment.
4605 *5*	0^+		X	J^{π}: L(p,t)=0.
4792.2 *5*	(2^+)	0.35 ps *14*	K X	Additional information 7. J^{π}: L(p,t)=(2) from 0^+.
4803.02 *32*	(6^+)		B	T=0 J^{π}: proposed in β^+ decay (150 ms). Unrealistic intensity balance at 4803 level in ^{44}V β^+ decay (150 ms) suggests that other γ transitions, yet unseen, de-excite this level.
4860 *30*	0^+		n S V	XREF: S(4870)V(4860). E(level): weighted average of 4870 *30* from (^{16}O,^{12}C), 4860 *60* from (^{3}He,n), and 4840 *30* from (^{6}Li,d). J^{π}: L(^{6}Li,d)=L(^{3}He,n)=0 from 0^+.
5055 *5*	3^-		N X	XREF: N(5080). J^{π}: L(^{6}Li,d)=3 from 0^+. But L(^{6}Li,d)=(4) favors (4^+) for a group at 5080 *30*.
5151.7[c] *4*	(6^-)		G I O	J^{π}: 1505.5γ to 4^-; band assignment.
5240 *30*	5^-		N S	XREF: N(5230). E(level): weighted average of 5230 *30* from (^{6}Li,d) and 5250 *30* from (^{16}O,^{12}C).

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	XREF	Comments
				J^π: L(^{6}Li,d)=5 from 0^+.
5305 *2*		0.35 ps *14*	K q x	Additional information 8.
5330 *30*	5^-		N q x	E(level): the level in ^{40}Ca(^{6}Li,d) with $J^\pi=5^-$ is considered different from the 5305 level in ^{40}Ca(α,γ), as otherwise, E3 required for 4222γ gives unrealistically large B(E3)(W.u.)=1300 *+800−400*. J^π: L(^{6}Li,d)=5.
5421 *5*	3^-		K N S X	XREF: N(5410)S(5380). Additional information 9. J^π: L(^{6}Li,d)=3 from 0^+ for a 5410 group. But L(p,t)=(2) for a a 5415 *10* group is inconsistent.
5671.5[b] *5*	(7^-)		G I O	J^π:)609.6γ to (5^-); band assignment.
6032 *10*	2^+		N S V X	XREF: S(6050)V(6060). E(level): weighted average of 6030 *30* from (^{6}Li,d), 6050 *30* from (^{16}O,^{12}C), 6060 *60* from (^{3}He,n), and 6030 *10* from (p,t). J^π: L(^{6}Li,d)=2 from 0^+. But L(p,t)=(4) is inconsistent.
6245 *30*	1^-		N S	XREF: S(6270). E(level): weighted average of 6220 *30* from (^{6}Li,d) and 6270 *30* from (^{16}O,^{12}C). J^π: L(^{6}Li,d)=1 from 0^+.
6508.36 *26*	8^+	<0.5 ps	GHIJ N	XREF: N(6470). J^π: L(^{6}Li,d)=8; 2493.16γ E2 to 6^+. $T_{1/2}$: from DSAM in ^{32}S(^{14}N,pnγ) (1975Si19).
6535 *10*			S V X	XREF: S(6540)V(6560).
6572.4[&] *5*	(8^+)		G I s	XREF: s(6540). J^π: 2072.2γ to (6^+); band assignment.
6606.3 *5*	2^+		A k n V x	T=1 J^π: L(p,t)=L(^{3}He,n)=L(^{6}Li,d)=2 from 0^+.
6810 *60*	$(0,2)^+$		N V	XREF: N(6800). J^π: L(^{3}He,n)=0 but L(^{6}Li,d)=2 for a 6800 group.
6848.80 *21*	$(6)^+$		B	T=1 J^π: superallowed β transition (log *ft*=3.44 *5*) from $(6)^+$ parent.
6924.2[c] *5*	(8^-)		G I	J^π: 1772.8γ to (6^-); band assignment.
6959 *7*	(4^+)		N S X	T=1 E(level): from (p,t). J^π: L(^{6}Li,d)=L(p,t)=(4) from 0^+.
7010			P	
7140 *30*			S	
7216 *2*	1^+		K X	T=1 Additional information 10. J^π: $\gamma(\theta)$ of 7216γ to 0^+ is isotropic; primary γ from 0^+ resonances at 9298 and 9338; possible analog of $(1^+;\ 1)$ state at 669 keV in ^{44}Sc (1972Si34).
7340	3^-		N s	XREF: s(7360). J^π: L(^{6}Li,d)=3 from 0^+.
7409.0[b] *5*	(9^-)		G I s	XREF: s(7360). J^π: 1737.3γ to (7^-); band assignment.
7458	(8^+)		G	Additional information 11. J^π: from 3444γ asymmetry in (^{28}Si,2$\alpha\gamma$).
7500 *40*	1^-		V	J^π: L(^{3}He,n)=1 from 0^+.
7570 *30*	3^-		N P S	E(level): weighted average of 7560 *30* from (^{6}Li,d) and

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#	XREF	Comments
				7580 *30* from (^{16}O,^{12}C). Jπ: L(^{6}Li,d)=3 from 0^{+}.
7634 *20*	(1,2^{+})		K	Additional information 12. Jπ: γ rays to 0^{+}.
7670 *10*	6^{+}		n s V X	XREF: n(7670)s(7690)V(7700). E(level): from (p,t). Jπ: L(^{6}Li,d)=6 from 0^{+}.
7670.87 *29*	(10^{+})	1.87 ps *35*	GHIJ n s	XREF: n(7670)s(7690). Jπ: 1162.55 E2, ΔJ=2 to (8^{+}); band assignment. $T_{1/2}$: from DSAM in (^{14}N,pnγ).
7780 *30*			S	
8036.0 *27*	3^{-}		L N s	XREF: N(8040)s(8050). E(level): from (α,γ) E=res. Jπ: L(^{6}Li,d)=3 from 0^{+}.
8039.70 *30*	(12^{+})	2.1 ns *4*	GHIJ s	XREF: s(8050). Jπ: 368.85γ E2, ΔJ=2 to (10^{+}); band assignment. $T_{1/2}$: pulsed beam in (α,2nγ) (1976Br15). Other: >1.4 ns from RDM in (^{19}F,2npγ).
8072.0 *23*	(1^{-},2^{+})		KL s	XREF: K(8067)s(8050). Additional information 13. E(level): from (α,γ): resonances. Jπ: 8067γ to 0^{+}; π=natural for (α,γ) resonance.
8123 *7*			L	
8134.0 *23*			a L	XREF: a(8180).
8170	1^{-}		a N p	XREF: a(8180)p(8200). Jπ: L(^{6}Li,d)=1; L(^{7}Li,t)=(1,2) for a 8200 group.
8195 *3*			a L p	XREF: a(8180)p(8200). Jπ: L(^{7}Li,t)=(1,2) for a 8200 group.
8237 *4*			L p	XREF: p(8200). Jπ: L(^{7}Li,t)=(1,2) for a 8200 group.
8254.0 *18*			L	
8320.0 *20*			KL	Additional information 14. E(level): from (α,γ):resonances. Other: 8318 *5* from (α,γ) E=res.
8382 *3*	2^{+}		KL N s	XREF: N(8380)s(8390). Additional information 15. E(level): from (α,γ):resonances. Other: 8385 *5* from (α,γ) E=res. Jπ: spin=2 from γ(θ) in (α,γ) E=res; π=natural.
8419.0 *25*	(0^{+},1^{-})		KL	Additional information 16. E(level): from (α,γ):resonances. Other: 8416 *5* from (α,γ) E=res. Jπ: spin=(0,1) from γ(θ) in (α,γ) E=res; π=natural.
8449 *5*	2^{+}		K n p	XREF: n(8450)p(8450). Additional information 17. Jπ: spin=2 from γ(θ) in (α,γ) E=res and π=natural. L(^{6}Li,d)=2+3 for a 8450 group which could be a doublet of the 8449 level in (α,γ) E=res and the 8465 level in (α,γ):resonances. The evaluators therefore assign J(8465)=(3^{-}).
8465.0 *23*	(3^{-})		L n p	XREF: n(8450)p(8450). Jπ: see comments for J(8449). L(^{7}Li,t)=3 for a 8450 group.
8511 *5*	2^{+}		K n	XREF: n(8540). Additional information 18. Jπ: spin=2 from γ(θ) in (α,γ) E=res and π=natural.

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^{π}[‡]	XREF	Comments
8524 *3*		L n	XREF: n(8540). J^{π}: L(^{6}Li,d)=2+3 for a 8540 group could suggest a doublet of 2^+ and 3^- around this energy.
8534 *5*	(2^+,3^-)	K n	XREF: n(8540). Additional information 19. J^{π}: spin=(2,3) from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
8568 *3*	2^+	KL n q S	XREF: n(8540)q(8600). Additional information 20. E(level): weighted average of 8565 *5* from (α,γ) E=res and 8569 *3* from (α,γ):resonances. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
8627 *6*	2^+	K q	XREF: q(8600). Additional information 21. J^{π}: spin=3 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
8639.0 *17*	2^+	KL q	XREF: q(8600). Additional information 22. E(level): from (α,γ):resonances. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
8695 *3*		L	
8728 *4*		L n	XREF: n(8750).
8754 *3*	2^+	K N	XREF: N(8750). Additional information 23. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural. But L(^{6}Li,d)=6 for 8750 group suggests 6^+.
8763.0 *13*		L	
8838.0 *19*		L	
8861.9[c] *5*	(10^-)	G I	J^{π}: 1937.3γ to (8^-); band assignment.
8895.0 *26*		L	
8946 *3*	(4^+)	K P s	XREF: P(8950)s(8950). Additional information 24. J^{π}: L(^{7}Li,t)=4 for a 8950 group.
8954 *3*	1^-	K s	XREF: s(8950). Additional information 25. J^{π}: spin=1 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
8962.7 *21*	(3^-,4^+)	KL N s	XREF: s(8950). Additional information 26. E(level): from weighted average of 8964.0 *21* in ^{40}Ca(α,α):resonances, 8960 *3* in ^{40}Ca(α,γ) E=res. J^{π}: from $\gamma(\theta)$ in (α,γ) E=res; π=natural, with 2^+ rejected. L(^{6}Li,d)=2 in one of the studies from 0^+ suggests 2^+, but L=4 in this reaction is also proposed in another experiment. As the uncertainty in the level energy in (^{6}Li,d) is not given, it could possible be a different level from that in (α,γ) E=res.
8984[&]	(10^+)	G	Additional information 27. J^{π}: 2413γ to (8^+); band assignment.
8987 *2*	2^+	K N	Additional information 28. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
8992 *2*	4^+	K n	XREF: n(9000). Additional information 29. J^{π}: spin=4 from $\gamma(\theta)$ in (α,γ) E=res; L(^{6}Li,d)=4 for a 9000 group.
8999.0 *14*	(4^+)	L n	XREF: n(9000). J^{π}: π=natural; L(^{6}Li,d)=4 for a 9000 group.
9046 *6*		L S	XREF: S(9030).
9076.0 *25*	(2^+)[@]	KLM	E(level): from (α,γ):resonances. Other: 9077 *5* from (α,α):resonances,

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^{π}[‡]	XREF	Comments
			9073 *5* from (α,γ) E=res.
9105 *5*	4^{+}[@]	K M	E(level): weighted average of 9100 *5* from (α,γ) E=res and 9109 *5* from (α,α):resonances.
9119 *5*		KL	E(level): weighted average of 9120 *5* from (α,γ) E=res and 9118 *5* from (α,γ):resonances.
9132 *5*	2^{+}[@]	M	
9140 *5*		K M	Additional information 30. E(level): other: 9145 *5* from (α,α):resonances. J^{π}: (0^{+}) from R-Matrix analysis in (α,γ):resonances for a resonance at 9145 *5* is inconsistent with the primary γ to 0^{+} g.s. in (α,γ) E=res, which could imply a different resonance.
9155.0 *17*		L	
9180 *5*		K N	XREF: N(9190). Additional information 31. J^{π}: L(^{6}Li,d)=6 for a group at 9190 suggests 6^{+}.
9191 *5*	4^{+}[@]	Mn	XREF: n(9190). J^{π}: other: L(^{6}Li,d)=6 for a group at 9190 suggests 6^{+}.
9215 *2*	2^{+}	K	T=0 Additional information 32. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural. T: from 1980Di14 in (α,γ) E=res.
9227 *2*	2^{+}[@]	K M	T=1 Additional information 33. J^{π}: spin=2 also from $\gamma(\theta)$ in (α,γ) E=res. T: from 1980Di14 in (α,γ) E=res.
9239 *2*	2^{+}	K	T=0 Additional information 34. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural. T: from 1980Di14 in (α,γ) E=res.
9243.0 *14*		L	
9290 *5*		K s	XREF: s(9310).
9294 *2*		K s	XREF: s(9310).
9299 *2*	0^{+}	K n s X	%α=87 *20* (1978Fr10); %p<6 (1978Fr10) T=1+2 XREF: n(9320)s(9310)X(9304). Additional information 35. J^{π}: L(p,t)=0; L(^{6}Li,d)=(0). T: from 1978Di11 in (α,γ) E=res. Isospin-mixed doublet with the 9338 keV level. Possible isospin mixture of T=0 and 1.
9304 *5*	2^{+}[@]	M	
9338 *2*	0^{+}	K n s V X	T=1+2 XREF: n(9320)s(9310)V(9370). Additional information 36. E(level): other: 9336 *8* from (p,t). J^{π}: L(^{3}He,n)=L(p,t)=0. T: from 1972Si34 in (α,γ) E=res. Possible isospin mixture of T=0 and 1. $\Gamma_{\alpha0}/\Gamma$=0.32 *5*, Γ_{p}/Γ<0.04, Γ_{γ}/Γ=0.54 *11* (1978Fr10).
9350 *5*	4^{+}[@]	M	
9361 *3*	(2^{+},3^{-})	K	Additional information 37. J^{π}: spin=(2,3) from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
9385 *5*	3^{-}[@]	K M	E(level): weighted average of 9382 *5* from (α,α):resonances and 9388 *5* from (α,γ) E=res.
9400	5^{-}	N P	XREF: N(9430). J^{π}: L(^{6}Li,d)=L(^{7}Li,t)=5.

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^{π}[‡]	XREF	Comments
9432 *5*	4^+[@]	K M	E(level): weighted average of 9427 *5* from (α,γ) E=res and 9436 *5* from (α,α):resonances.
9478 *5*		K	
9491 *5*	3^-[@]	K M	XREF: K(9500).
9503	(10^+)	G	Additional information 38. J^{π}: from $\gamma\gamma$(DCO) in (^{28}Si,2$\alpha\gamma$).
9522 *5*	2^+[@]	M	
9542 *5*		K	
9563 *5*	0^+[@]	M	
9589 *5*	5^-	K N P	XREF: N(9580)P(9580). J^{π}: L(^{6}Li,d)=L(^{7}Li,t)=5.
9642 *5*	2^+[@]	K M	E(level): weighted average of 9632 *10* from (α,γ) E=res and 9645 *5* from (α,α):resonances.
9679 *6*	0^+[@]	K M	E(level): weighted average of 9668 *10* from (α,γ) E=res and 9682 *5* from (α,α):resonances.
9698 *5*	2^+	K	Additional information 39. J^{π}: spin=2 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
9713 *3*	4^+	K	Additional information 40. J^{π}: spin=4 from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
9724.2[b] *6*	(11^-)	G I	J^{π}: 2315.0γ to (9^-); band assignment.
9741 *5*	(2^+)[@]	K M	E(level): weighted average of 9737 *5* from (α,γ) E=res and 9745 *5* from (α,α):resonances.
9780 *5*	0^+[@]	M	
9845 *5*	3^-[@]	M	
9880 *5*	3^-[@]	K M	E(level): weighted average of 9873 *10* from (α,γ) E=res and 9882 *5* from (α,α):resonances.
9895 *5*		K	E(level): this resonance in (α,γ) E=res is probably the same level as the 9909 level in (α,α):resonances, since the same E(α) energy is reported in both datasets.
9908 *3*	$(3^-,5^-)$	K	Additional information 41. E(level): this level is considered as a different level from the 9909,(0^+) level in (α,α):resonances due to the contradicting J^{π} assignments, despite close energies. J^{π}: spin=(3,5) from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
9909 *5*	(0^+)[@]	M	E(level): see comments for 9895, 9908 and 9918 levels.
9918 *5*	(0^+)[@]	M	E(level): the same E(α) is reported for this resonance in (α,α):resonances and the 9908 resonance in (α,γ):E=res, but they are considered as different levels due to contradicting J^{π} assignments and discrepant level energies.
9950 *5*	0^+[@]	M	
9977 *5*	0^+[@]	M	
10009 *5*	2^+[@]	K M	XREF: K(10014).
10027 *5*	2^+[@]	M	
10046 *10*		K	
10072 *5*	0^+[@]	M	
10113 *5*	(3^-)[@]	M	
10129 *10*	$(1^-,2^+)$	K	J^{π}: spin=(1,2) from $\gamma(\theta)$ in (α,γ) E=res; π=natural.
10166 *10*		K	
10182 *5*	(0^+)[@]	M	
10209 *5*	$(0^+,1^-,2^+)$	K	J^{π}: spin=(0,1,2) from $\gamma(\theta)$ in (α,γ) E=res; π=natural.

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^π[‡]	XREF	Comments
10227 *5*	(2^+)[@]	M	
10258 *10*		K	
10280	(0^+)	V	J^π: L(^{3}He,n)=0.
10303 *5*		K	
10327 *5*		K	
10386 *6*	$(2^+,3^-)$	K Q	XREF: Q(10400). Additional information 42. J^π: spin=(2,3) from $\gamma(\theta)$ in (α,γ):E=res; π=natural.
10461 *30*	(0^+)	K V	J^π: L(^{3}He,n)=0.
10464.8[c] *5*	(12^-)	G I	XREF: G(10454). J^π: 1602.6γ to (10^-); band assignment.
10520 *10*		K	
10590 *30*	(0^+)	V	J^π: L(^{3}He,n)=0.
10700	4^+	P	J^π: L(^{7}Li,t)=4.
10860	0^+	N	J^π: L(^{6}Li,d)=0.
11040	4^+	N P	XREF: N(11000?). J^π: L(^{7}Li,t)=4.
11072	0^+	M	J^π: L(α,α)=0.
11087.2 *5*		G I	J^π: 12^+ proposed in (^{28}Si,2$\alpha\gamma$), but 13^- in (^{24}Mg,2$\alpha\gamma$).
11110	$(5^-,6^+)$	P	J^π: L(^{7}Li,t)=(5,6).
11191	0^+[@]	D M	
11496	(12^+)	G	Additional information 43. J^π: from $\gamma\gamma$(DCO) in (^{28}Si,2$\alpha\gamma$); 2513γ to (10^+).
11537.6[b] *5*	(13^-)	I	J^π: 1072.6γ to (12^-); band assignment.
11547.8 *6*	(13^-)	G I	XREF: G(11537). J^π: proposed in (^{28}Si,2$\alpha\gamma$).
11660	3^-	PQ	XREF: Q(11600). J^π: L(^{7}Li,t)=3.
11691	1^-[@]	M	
11727	1^-	D M	XREF: D(11750). J^π: L(α,α)=1.
11810	$(4^+,5^-)$	P	J^π: L(^{7}Li,t)=(4,5).
11835[&]	(12^+)	G	Additional information 44. J^π: proposed in (^{28}Si,2$\alpha\gamma$).
11950	7^-	P	J^π: L(^{7}Li,t)=7.
12110	4^+	P	J^π: L(^{7}Li,t)=4.
12118	2^+	M	J^π: L(α,α)=2.
12172	2^+[@]	M	
12.20×10^3 *20*	(1^-)	D K q	XREF: q(12400). Additional information 45. J^π: proposed by 1974Pe13 in (α,γ):E=res.
12563	(3^-)	M q	XREF: q(12400). J^π: L(α,α)=(3).
12580	4^+	Pq	XREF: q(12400). J^π: L(^{7}Li,t)=4.
12772	3^-[@]	M	
12854	(4^+)	M P	XREF: P(12860). J^π: L(^{7}Li,t)=(3,4); L(α,α)=(4).
13.00×10^3 *19*	(1^-)	D K	XREF: D(12940). Additional information 46. J^π: proposed by 1974Pe13 in (α,γ):E=res. Other: 3^- proposed in (^{40}Ca,α').

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Adopted Levels, Gammas (continued)

^{44}Ti Levels (continued)

E(level)†	Jπ‡	XREF	Comments
13240	$(3^-,4^+)$	P	Jπ: L(^{7}Li,t)=(3,4).
13370.6[b] 8	(15^-)	D G I	Jπ: from γγ(DCO) in (^{28}Si,2αγ) and band assignment.
13440	5^-	P	Jπ: L(^{7}Li,t)=5.
13782[c]	(14^-)	G	Additional information 47. Jπ: from γγ(DCO) in (^{28}Si,2αγ) and band assignment.
13970	3^-	P	Jπ: L(^{7}Li,t)=3.
14.10×10^3 18	(3^-)	K	Additional information 48. Jπ: proposed by 1974Pe13 in (α,γ):E=res.
14270	$(4^+,5^-)$	P	Jπ: L(^{7}Li,t)=(4,5).
≈14330	(0^+)	D	Jπ: 0^+ proposed in (^{40}Ca,α′).
14.55×10^3 17	(1^-)	K	Additional information 49. Jπ: proposed by 1974Pe13 in (α,γ):E=res.
14710	$(5^-,6^+)$	D P	XREF: D(14800). Jπ: L(^{7}Li,t)=(5,6).
14830	$(3^-,4^+)$	P	Jπ: L(^{7}Li,t)=(3,4).
15.45×10^3 16		K P	Additional information 50.
15.95×10^3 16	(3^-)	D K	XREF: D(15810). Additional information 51. Jπ: proposed by 1974Pe13 in (α,γ):E=res, but 6^+ proposed in (^{40}Ca,α′) for a group at 15810.
16020		P	
≈16570	(2^+)	D	Jπ: proposed in (^{40}Ca,α′) (2019Ba45).

† For levels connected with γ rays, values are from a least-square fit to γ-ray energies with ΔEγ or without ΔEγ (for which 0.5 keV is assumed) where measured Eγ is available, or taken from (α,γ) E=res where measured Eγ value is not available but E(level) has been deduced by authors from precise Eγ data which however are not listed in the references; for other levels with no γ, E(level) values are from various reactions as indicated, unless otherwise noted.

‡ When assigning J^π to a level based on γ transitions from this level to a level of known J^π, evaluators use the following rules: if Eγ<4 MeV, transitions are only considered to be E1,M1 or E2; if Eγ>4 MeV, M2 and E3 are considered to be possible. For α resonances populated in (α,γ) and (α,α) reactions, π=natural.

From (α,γ) E=res using DSAM, unless otherwise noted.

@ From R-Matrix analysis in (α,α):resonances.

& Band(A): Ground-state band.

a Band(B): Band based on 1904.3, 0^+.

b Band(C): Band based on 3175.8, 3^-.

c Band(D): Band based on 3645.8, 4^-.

d Seq.(E): γ cascade based on 2886, 2^+.

$\gamma(^{44}$Ti)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
1083.10	2^+	1083.08 *10*	100	0.0	0^+	E2		B(E2)(W.u.)=16.0 *+27−20* E_γ: from ^{44}V β^+ decay (111 ms). Mult.: from $\gamma(\theta$,pol) in (^{19}F,2npγ) and $\gamma(\theta)$ in (α,γ) E=res.
1904.4	0^+	821.3 *8*	100	1083.10	2^+	[E2]		B(E2)(W.u.)<330 upper limit exceeds RUL=100, which would require a $T_{1/2}$>1.6 ps.
2454.32	4^+	1371.20 *10*	100	1083.10	2^+	E2		B(E2)(W.u.)=29.2 *24* E_γ: weighted average of 1371.22 *8* from ^{44}V β^+ decay (150 ms), 1370.0 *5* from ^{45}Cr εp decay, 1371.21 *15* from (^{19}F,2npγ), and 1371.4 *5* from (^{14}N,pnγ). Mult.: Q with ΔJ=2 from $\gamma(\theta)$ in (^{28}Si,2$\alpha\gamma$) and (α,γ) E=res and M2 ruled out by RUL.
2530.90	2^+	626	5 *1*	1904.4	0^+	E2		B(E2)(W.u.)=22 *6* E_γ: γ reported in (α,γ) only; not in ^{44}V ε decay.
		1447.77 *12*	100 *10*	1083.10	2^+	E2+M1	−7.5 *+25−80*	B(M1)(W.u.)=0.00009 *+11−6*; B(E2)(W.u.)=6.5 *+10−9* E_γ: weighted average of 1447.88 *13* from ^{44}V β^+ decay (111 ms) and 1447.68 *12* from (α,γ) E=res. I_γ: from ^{44}V β^+ decay (111 ms).
		2530.86 *25*	39 *7*	0.0	0^+	E2		B(E2)(W.u.)=0.157 *36* E_γ: from ^{44}V β^+ decay (111 ms). I_γ: weighted average of 42 *7* from ^{44}V β^+ decay (111 ms) and 35 *7* from (α,γ) E=res.
2886.2	2^+	982	5 *3*	1904.4	0^+	[E2]		B(E2)(W.u.)=6.5 *+47−33*
		1803	43 *14*	1083.10	2^+	[M1,E2]		B(M1)(W.u.)=0.0031 *+11−10* if pure M1, B(E2)(W.u.)=2.7 *+10−8* if pure E2.
		2886.1 *6*	100 *14*	0.0	0^+	E2		B(E2)(W.u.)=0.59 *+17−12*
3176.12	3^-	645	<1.00	2530.90	2^+	[E1]		B(E1)(W.u.)<1.4×10^{-6}
		721.3[@]	2 *1*	2454.32	4^+	[E1]		B(E1)(W.u.)=1.8×10^{-6} *+9−8*
		2093.0 *8*	100 *2*	1083.10	2^+	E1(+M2)	−0.01 *4*	B(E1)(W.u.)=3.6×10^{-6} *3* E_γ: weighted average of 2093.2 *8* from (^{19}F,2npγ), 2092.9 *8* from (^{14}N,pnγ), and 2092.9 *8* from (α,γ) E=res. δ: from $\gamma\gamma(\theta)$ data in ^{40}Ca(α,γ) (1981Di09).
		3175.9[@]	1.0 *5*	0.0	0^+	[E3]		B(E3)(W.u.)=2.0 *+11−9* I_γ: other: 2011Mi02 in (^{6}Li,pnγ) quote 2.0 *3* as from 2000UrZX.
3364.88	4^+	833	5 *2*	2530.90	2^+	[E2]		B(E2)(W.u.)=20 *+10−8*
		2281.8[@]	100 *2*	1083.10	2^+	[E2]		B(E2)(W.u.)=2.6 *+6−4*
3415.3	(3^+)	529	2.2 *5*	2886.2	2^+			
		885	<1.5	2530.90	2^+			
		2332	100.0 *5*	1083.10	2^+	D+Q		δ: δ=+1.6 *+12−6* for J=2; >+6 or +0.4 *+10−9* for J=3 (1971Si13) in (α,γ) E=res.
3645.89	4^-	230[#]	5.9[&]	3415.3	(3^+)			

From ENSDF

$^{44}_{22}$Ti$_{22}$-12

Adopted Levels, Gammas (continued)

$\gamma(^{44}Ti)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[a]	Comments
3645.89	4^-	469.73 *13*	100	3176.12	3^-	E2+M1		E_γ: weighted average of 469.86 *10* from (^{19}F,2npγ) and 469.6 *1* from (^{14}N,pnγ). Mult.,δ: D+Q from $\gamma(\theta)$ in ^{40}Ca(α,γ) E=res (1981Di09); δ=−4.2 *8* for J(8963)=3 or −5.7 *14* for J(8963)=4.
		1191	4.2 *21*	2454.32	4^+	[E1]		B(E1)(W.u.)=1.6×10^{-7} *+8−7*
		2563	<1.0	1083.10	2^+	[M2]		B(M2)(W.u.)<0.003
3755.9	2^+	1852	<6	1904.4	0^+	[E2]		B(E2)(W.u.)<0.99
		2673	39 *7*	1083.10	2^+	[M1,E2]		B(M1)(W.u.)=0.0019 *+6−4* if pure M1, B(E2)(W.u.)=0.73 *+25−17* if pure E2.
		3756	100 *7*	0.0	0^+	E2	1.10×10^{-3} *2*	B(E2)(W.u.)=0.34 *+11−7* Mult.: ΔJ=2 from $\gamma(\theta)$ in (α,γ) E=res; M2 ruled out by RUL.
3942.7	3^-	767	<2	3176.12	3^-	[M1,E2]		B(M1)(W.u.)<0.0016 if pure M1, B(E2)(W.u.)<7.6 if pure E2.
		1412	<2	2530.90	2^+	[E1]		B(E1)(W.u.)<6.3×10^{-6}
		1489	5 *2*	2454.32	4^+	[E1]		B(E1)(W.u.)=1.0×10^{-5} *+5−4*
		2859	100 *3*	1083.10	2^+	[E1]	1.18×10^{-3} *2*	B(E1)(W.u.)=2.7×10^{-5} *+9−6*
3980	4^+	565	8 *4*	3415.3	(3^+)			
		804	8 *6*	3176.12	3^-	[E1]		B(E1)(W.u.)=0.00012 *+14−7*
		1094	48 *10*	2886.2	2^+	[E2]		B(E2)(W.u.)=28 *+18−9*
		1526	29 *10*	2454.32	4^+	[M1,E2]		B(M1)(W.u.)=0.0027 *+19−11* if pure M1, B(E2)(W.u.)=3.2 *+22−13* if pure E2.
		2897	100 *15*	1083.10	2^+	[E2]		B(E2)(W.u.)=0.45 *+28−14*
4015.30	6^+	1560.97 *8*	100	2454.32	4^+	E2		B(E2)(W.u.)=15.8 *+27−20* E_γ: weighted average of 1561.00 *8* from ^{44}V β^+ decay (150 ms), 1560.90 *15* from (^{19}F,2npγ), and 1560.7 *4* from (^{14}N,pnγ). Mult.: Q with ΔJ=2 from $\gamma(\theta)$ in (^{19}F,2npγ) and γ asymmetry in (α,γ) E=res; M2 ruled out by RUL.
4061.47	(5^-)	415.2[@]	8.0[&]	3645.89	4^-	[M1,E2]	0.0011 *5*	B(M1)(W.u.)=0.009 *+5−4* if pure M1. B(E2)(W.u.)=1.5×10^2 *+9−7* exceeds RUL=100 if pure E2.
		696.7[@]		3364.88	4^+	[E1]		
		885.6 *9*	68[&]	3176.12	3^-	(E2)		B(E2)(W.u.)=29 *+15−13* E_γ: unweighted average of 886.4 *5* from (^{19}F,2npγ) and 884.7 *3* from (^{14}N,pnγ). Mult.,δ: −2<δ(Q/D)<2 for J^π= 3^-, 0 for J^π=5^- from $\gamma(\theta)$ with Q preferred in (α,γ) E=res (1977Di07); (Q) from $\gamma(\theta)$ in (^{19}F,2npγ); (M2) ruled out by RUL.
		1607.1 *5*	100[&]	2454.32	4^+	(E1)		B(E1)(W.u.)=4.9×10^{-5} *+26−20* E_γ: weighted average of 1607.2 *5* from (^{19}F,2npγ) and 1607.0 *5* from (^{14}N,pnγ).

$^{44}_{22}Ti_{22}$-13

$\gamma(^{44}Ti)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	α[a]	Comments
								B(E1)(W.u.)=4.9×10^{-5} *+26−20* E_γ: weighted average of 1607.2 *5* from (^{19}F,2npγ) and 1607.0 *5* from (^{14}N,pnγ). δ: δ(Q/D)=+0.15 *10* for J^π= 3$^-$, −0.1<δ<0.1 for J^π=5$^-$ in (α,γ) E=res (1977Di07); (D) from $\gamma(\theta)$ in (^{19}F,2npγ); (E1) from $\Delta\pi$=(yes).
4061.47	(5$^-$)	2978[b]	<4	1083.10	2$^+$	[E3]		E_γ,I_γ: γ from (α,γ) only. B(E3)(W.u.)<124 upper limit exceeds RUL=100.
4115.3	2$^+$	1230	11 *11*	2886.2	2$^+$	[M1,E2]		E_γ: γ reported in (α,γ) only; not in ^{44}V ε decay. B(M1)(W.u.)<0.022 if pure M1, B(E2)(W.u.)<40 if pure E2.
		1585	47 *11*	2530.90	2$^+$	[M1,E2]		E_γ: γ reported in (α,γ) only; not in ^{44}V ε decay. If M1, B(M1)(W.u.)=0.010 *+8−4*. If E2, B(E2)(W.u.)=11 *+9−4*.
		2212	<11	1904.4	0$^+$	[E2]		B(E2)(W.u.)<1.1 E_γ: γ reported in (α,γ) only; not in ^{44}V ε decay.
		3032.1 *6*	100 *16*	1083.10	2$^+$	[M1,E2]		E_γ: from ^{44}V β^+ decay (111 ms). If M1, B(M1)(W.u.)=0.0031 *+24−10*. If E2, B(E2)(W.u.)=1.0 *+7−3*.
		4117	64 *11*	0.0	0$^+$	[E2]	1.22×10^{-3} *2*	B(E2)(W.u.)=0.13 *+10−5* E_γ: γ reported in (α,γ) only; not in ^{44}V ε decay.
4227	(3$^-$)	581	26 *12*	3645.89	4$^-$			
		812	15 *9*	3415.3	(3$^+$)			
		1051	100 *12*	3176.12	3$^-$			
		1341	85 *12*	2886.2	2$^+$			
		1696	50 *12*	2530.90	2$^+$			
		3144	18 *9*	1083.10	2$^+$			
4499.94	(6$^+$)	1135.0[@]		3364.88	4$^+$			
		2045.4[@]	100[&]	2454.32	4$^+$			
4792.2	(2$^+$)	1036	4 *2*	3755.9	2$^+$	[M1,E2]		If M1, B(M1)(W.u.)=0.0020 *+18−10*. If E2, B(E2)(W.u.)=5.2 *+47−26*.
		1617	6 *2*	3176.12	3$^-$	[E1]		B(E1)(W.u.)=2.0×10^{-5} *+15−8*
		1906	3 *2*	2886.2	2$^+$	[M1,E2]		If M1, B(M1)(W.u.)=0.00024 *+26−13*. If E2, B(E2)(W.u.)=0.19 *+20−10*.
		3709	100 *3*	1083.10	2$^+$	[M1,E2]	0.00101 *7*	If M1, B(M1)(W.u.)=0.0011 *+7−3*. If E2, B(E2)(W.u.)=0.22 *+14−7*.
4803.02	(6$^+$)	2348.5 *4*	100	2454.32	4$^+$			E_γ: from ^{44}V β^+ decay (150 ms).
5151.7	(6$^-$)	1090.4[@]	10[&]	4061.47	(5$^-$)			
		1505.5[@]	100[&]	3645.89	4$^-$			
5305		4222	100	1083.10	2$^+$			
5421	3$^-$	4340	100	1083.10	2$^+$			
5671.5	(7$^-$)	513[#]		5151.7	(6$^-$)			E_γ: level-energy difference=519.8.
		1609.6[@]	100[&]	4061.47	(5$^-$)			
6508.36	8$^+$	2008.4[@]	10.5[&]	4499.94	(6$^+$)	[E2]		B(E2)(W.u.)>0.29
		2493.16 *25*	100[&]	4015.30	6$^+$	E2		B(E2)(W.u.)>1.1

$^{44}_{22}Ti_{22}$-14

$\gamma(^{44}Ti)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[a]	Comments
								E_γ: from (^{19}F,2npγ). Other: 2492.6 *14* from (^{14}N,pnγ). Mult.: Q with ΔJ=2 from $\gamma(\theta)$ in (^{19}F,2npγ); M2 ruled out by RUL.
6572.4	(8$^+$)	2072.2[@]	100	4499.94	(6$^+$)			
6606.3	2$^+$	4075.2 *5*	35 *7*	2530.90	2$^+$			E_γ,I_γ: from ^{44}V β^+ decay (111 ms).
		5523.1 *12*	100 *23*	1083.10	2$^+$			E_γ,I_γ: from ^{44}V β^+ decay (111 ms).
6848.80	(6)$^+$	2045.6 *4*	24.6 *18*	4803.02	(6$^+$)			
		2833.42 *14*	100 *7*	4015.30	6$^+$			
6924.2	(8$^-$)	1252.5[@]		5671.5	(7$^-$)			
		1772.4[@]	100[&]	5151.7	(6$^-$)			
7216	1$^+$	5312	3 *1*	1904.4	0$^+$			
		6133	1.0 *5*	1083.10	2$^+$			
		7216	100 *1*	0.0	0$^+$			
7409.0	(9$^-$)	1737.3[@]	100	5671.5	(7$^-$)			
7458	(8$^+$)	3444	100	4015.30	6$^+$			
7634	(1,2$^+$)	5730	61 *32*	1904.4	0$^+$			
		7634	100 *32*	0.0	0$^+$			
7670.87	(10$^+$)	1098.2		6572.4	(8$^+$)			E_γ: from (^{24}Mg,2$\alpha\gamma$).
		1162.55 *15*	100[&]	6508.36	8$^+$	E2		B(E2)(W.u.)=15.4 *+36−24* E_γ: weighted average of 1162.49 *15* from (^{19}F,2npγ) and 1162.8 *3* from (^{14}N,pnγ). Mult.: Q with ΔJ=2 from $\gamma(\theta)$ in (^{19}F,2npγ) and (^{14}N,pnγ); M2 ruled out by RUL.
8039.70	(12$^+$)	368.85 *10*	100	7670.87	(10$^+$)	E2	2.42×10^{-3} *3*	B(E2)(W.u.)=4.3 *+10−7* E_γ: weighted average of 368.80 *10* from (^{19}F,2npγ) and 368.9 *1* from (^{14}N,pnγ). Mult.: Q with ΔJ=2 from $\gamma(\theta)$ in (^{19}F,2npγ) and (^{14}N,pnγ).
8072.0	(1$^-$,2$^+$)	8067	100	0.0	0$^+$			
8320.0		5432	85 *19*	2886.2	2$^+$			
		7235	100 *19*	1083.10	2$^+$			
8382	2$^+$	5499	100 *20*	2886.2	2$^+$			
		7302	40 *20*	1083.10	2$^+$			
		8385	60 *20*	0.0	0$^+$			
8419.0	(0$^+$,1$^-$)	7333	100	1083.10	2$^+$			
8449	2$^+$	5995	27 *13*	2454.32	4$^+$			
		7366	100 *13*	1083.10	2$^+$			
8511	2$^+$	7428	100	1083.10	2$^+$			
8534	(2$^+$,3$^-$)	7451	100	1083.10	2$^+$			
8568	2$^+$	5200	32 *16*	3364.88	4$^+$			
		6034	29 *16*	2530.90	2$^+$			

From ENSDF

$^{44}_{22}Ti_{22}$-15

Adopted Levels, Gammas (continued)

$\gamma(^{44}$Ti) (continued)

E_i(level)	J^π_i	E_γ [†]	I_γ [†]	E_f	J^π_f	Mult. [‡]	δ [‡]	Comments
8568	2^+	7482	100 *16*	1083.10	2^+			
8627	2^+	7544	100	1083.10	2^+			
8639.0	2^+	7556	100 *13*	1083.10	2^+			
		8639	33 *13*	0.0	0^+			
8754	2^+	6223	18	2530.90	2^+			
		7671	64	1083.10	2^+			
		8754	100	0.0	0^+			
8861.9	(10^-)	1452.9 [@]		7409.0	(9^-)			
		1937.3 [@]	100 [&]	6924.2	(8^-)			
8946	(4^+)	6415	82 *13*	2530.90	2^+	[E2]		
		7863	100 *13*	1083.10	2^+	[E2]		
8954	1^-	4727	20 *5*	4227	(3^-)			
		6068	24 *3*	2886.2	2^+			
		7049	100 *5*	1904.4	0^+			
		8954	8 *2*	0.0	0^+			
8962.7	$(3^-,4^+)$	4902	9 *4*	4061.47	(5^-)			
		5020	19 *4*	3942.7	3^-			
		5207	7 *4*	3755.9	2^+			
		5317	100 *4*	3645.89	4^-	D+Q		δ: −0.475 *52* for J(8963)=4 or −0.091 *23* for J(8963)=3 from $\gamma(\theta)$ data (1981Di09).
		5599	12 *2*	3364.88	4^+			
		5787	58 *4*	3176.12	3^-	D+Q		δ: +0.041 *57* for J(8963)=3 or +0.44 *5* for J(8963)=4 from $\gamma(\theta)$ data (1981Di09).
		6509	22 *2*	2454.32	4^+			
8984	(10^+)	2413	100	6572.4	(8^+)			E_γ: from (^{28}Si,2$\alpha\gamma$).
8987	2^+	6456	60 *3*	2530.90	2^+	D+Q		δ: 0.29 *11* or +4.0 *+30−4* from $\gamma(\theta)$ (1971Si13) in (α,γ) E=res.
		6533	<16	2454.32	4^+			
		7904	<16	1083.10	2^+			
		8987	100 *3*	0.0	0^+			
8992	4^+	6461	<9	2530.90	2^+	[E2]		
		6538	100 *6*	2454.32	4^+	D+Q	−0.64 *11*	
		7909	90 *6*	1083.10	2^+	Q(+O)	+0.02 *3*	
		8992 [b]	<9	0.0	0^+			
9140		6609		2530.90	2^+			
		9140		0.0	0^+			
9180		5238		3942.7	3^-			
		5535		3645.89	4^-			
		6005		3176.12	3^-			
		6726		2454.32	4^+			
9215	2^+	5800	54 *7*	3415.3	(3^+)	D+Q		δ: 0.09 *17* for J(3415)=3 (1980Di14) from $\gamma(\theta)$ in (α,γ) E=res.
		6329	28 *5*	2886.2	2^+	D+Q		δ: 0.3 *2* or +3.7 *13* (1980Di14) from $\gamma(\theta)$ in (α,γ) E=res.
		6684	100 *5*	2530.90	2^+	D+Q		δ: 0.07 *8* (1980Di14) from $\gamma(\theta)$ in (α,γ) E=res.
		7311	2.4 *12*	1904.4	0^+			

$\gamma(^{44}Ti)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
9215	2^+	8132	49 *10*	1083.10	2^+	D+Q		δ: 0.84 *25* or 11 *7* (1980Di14) from $\gamma(\theta)$ in (α,γ) E=res.
		9215	31 *7*	0.0	0^+			
9227	2^+	5812	51.1 *13*	3415.3	(3^+)	D+Q		δ: −0.32 *+10−5* when J=2 for 3415 level, −0.09 *7* when J=3 for 3415 level (1971Si13); +0.01 *4* for J(3415)=3 (1980Di14).
		6341	16.8 *7*	2886.2	2^+	D+Q	−0.08	δ: other: 0<δ<+1 (1980Di14).
		6696	100.0 *15*	2530.90	2^+	D+Q	+0.03 *4*	δ: weighted average of +0.02 *4* (1971Si13) and +0.03 *4* (1980Di14).
		7323	<2	1904.4	0^+			
		8144	46.9 *11*	1083.10	2^+	D+Q	+0.06 *5*	
		9227	1.50 *18*	0.0	0^+			
9239	2^+	5824	84 *4*	3415.3	(3^+)	D+Q		δ: 0.11 *7* for J(3415)=3 (1980Di14).
		6353	39 *33*	2886.2	2^+	D+Q	+0.06 *12*	
		6708	100 *6*	2530.90	2^+	D+Q	+0.14 *8*	
		7335	23 *5*	1904.4	0^+			
		8156	90 *7*	1083.10	2^+	D+Q	−0.45 *6*	
		9239	18 *4*	0.0	0^+			
9299	0^+	2082	69 *14*	7216	1^+			
		5542	100 *14*	3755.9	2^+			
9338	0^+	2122	100 *6*	7216	1^+			
		5582	2.5 *6*	3755.9	2^+			
		6452	<0.5	2886.2	2^+			
		6807	<0.5	2530.90	2^+			
		8256	<0.2	1083.10	2^+			
9361	$(2^+,3^-)$	3938	16 *5*	5421	3^-			
		4056	32 *11*	5305				
		4569	63 *11*	4792.2	(2^+)			
		5134	21 *5*	4227	(3^-)			
		5245	21 *5*	4115.3	2^+			
		5381	32 *5*	3980	4^+			
		5418	26 *5*	3942.7	3^-			
		5715	21 *5*	3645.89	4^-			
		5946	11 *5*	3415.3	(3^+)			
		6185	100 *11*	3176.12	3^-			
		6475	21 *5*	2886.2	2^+			
		6830	21 *5*	2530.90	2^+			
		6907	16 *5*	2454.32	4^+			
		8278	95 *11*	1083.10	2^+			
		9361	32 *11*	0.0	0^+			
9503	(10^+)	2932	100	6572.4	(8^+)			
9698	2^+	5582	18 *4*	4115.3	2^+			
		6283	100 *4*	3415.3	(3^+)			
		6522	6 *2*	3176.12	3^-			
		6812	57 *4*	2886.2	2^+			

Adopted Levels, Gammas (continued)

$\gamma(^{44}$Ti) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π
9698	2^+	7167	12 *4*	2530.90	2^+
		7244	6 *2*	2454.32	4^+
		8615	2.7 *6*	1083.10	2^+
		9698	2.7 *6*	0.0	0^+
9713	4^+	4921	26 *7*	4792.2	(2^+)
		5486	7 *2*	4227	(3^-)
		5957	100 *7*	3755.9	2^+
		6298	41 *7*	3415.3	(3^+)
		6827	26 *7*	2886.2	2^+
		8630	17 *4*	1083.10	2^+
9724.2	(11^-)	2054[#]		7670.87	(10^+)
		2315.0[@]	100	7409.0	(9^-)
9908	$(3^-,5^-)$	5847	100 *9*	4061.47	(5^-)
		6152	23 *6*	3755.9	2^+
		6262	66 *6*	3645.89	4^-
		6732	17 *6*	3176.12	3^-
		8825	6 *3*	1083.10	2^+
10386	$(2^+,3^-)$	6159	17 *9*	4227	(3^-)
		6443	87 *13*	3942.7	3^-
		6740	57 *9*	3645.89	4^-
		7210	100 *13*	3176.12	3^-
		7500	70 *9*	2886.2	2^+
		9303	91 *9*	1083.10	2^+
		10386	9 *4*	0.0	0^+
10464.8	(12^-)	1602.6[@]	100[&]	8861.9	(10^-)
		2425.3[@]		8039.70	(12^+)
11087.2		1362.8[@]		9724.2	(11^-)
		3047.5[@]	100[&]	8039.70	(12^+)
11496	(12^+)	2513	100	8984	(10^+)
11537.6	(13^-)	1072.6[@]		10464.8	(12^-)
		3497.8[@]		8039.70	(12^+)
11547.8	(13^-)	1824[@]	100[&]	9724.2	(11^-)
		3507.9[@]	50[&]	8039.70	(12^+)
11835	(12^+)	2852	100	8984	(10^+)
12.20×10^3	(1^-)	11120		1083.10	2^+
		12200		0.0	0^+
13.00×10^3	(1^-)	11900		1083.10	2^+
		13000		0.0	0^+

$^{44}_{22}$Ti$_{22}$-18

$\gamma(^{44}Ti)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Comments
13370.6	(15^-)	1822.8[@]	100[&]	11547.8	(13^-)	
		2906[b]	100[&]	10464.8	(12^-)	E_γ,I_γ: from (^{28}Si,2$\alpha\gamma$). Mult=M3 implied by ΔJ^π makes this transition unlikely in view of competing 1815 (implied mult=E2) transition (evaluators).
13782	(14^-)	3325	100	10464.8	(12^-)	
14.10×10^3	(3^-)	13020		1083.10	2^+	
14.55×10^3	(1^-)	13470		1083.10	2^+	
		14550		0.0	0^+	
15.45×10^3		12960		2454.32	4^+	Final states: 2454+2531.
15.95×10^3	(3^-)	13460		2454.32	4^+	Final states: 2454+2531.
		14870		1083.10	2^+	

† From (α,γ) E=res, unless otherwise noted. For Eγ data from (α,γ) E=res, values with ΔE from 1973Di04 and others from level-energy differences rounded off to nearest keV with E(level) values from 1977Di07 based on their measured Eγ values which however are not listed in 1977Di07.

‡ From $\gamma(\theta)$ in (α,γ) E=res with electric and magnetic natures determined based on recommended upper limit (RUL) of transition strength and measured level $T_{1/2}$ where available, unless otherwise noted. If $T_{1/2}$ is unknown and parity (E or M) is determined not by polarization measurements or ce data, evaluators use D instead of M1 and E1, and Q instead of E2.

Reported in (^{28}Si,2$\alpha\gamma$), but not in (^{24}Mg,2$\alpha\gamma$).

@ From (^{24}Mg,2$\alpha\gamma$).

& From (^{28}Si,2$\alpha\gamma$).

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

b Placement of transition in the level scheme is uncertain.

$^{44}_{22}Ti_{22}$-19

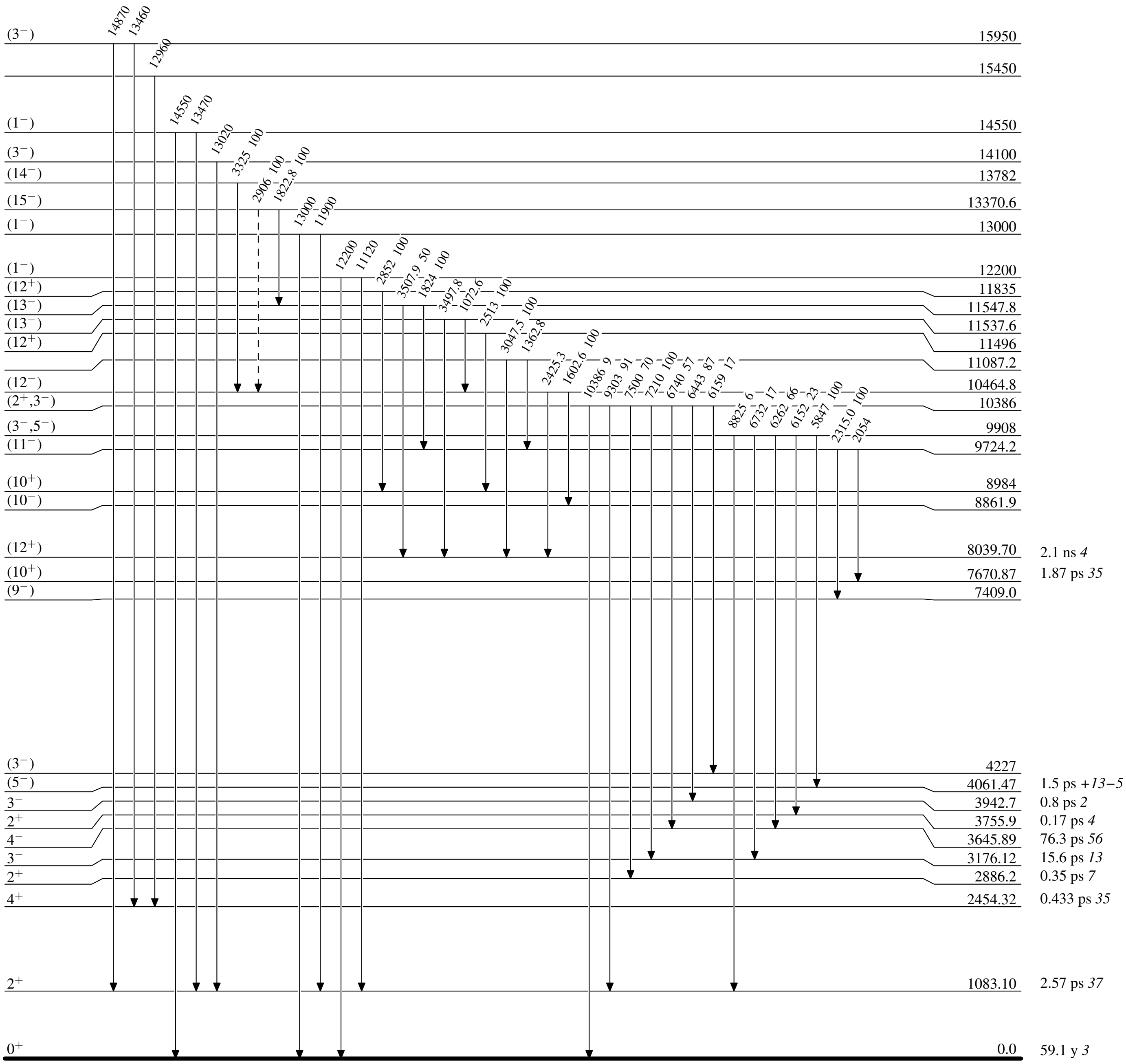
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

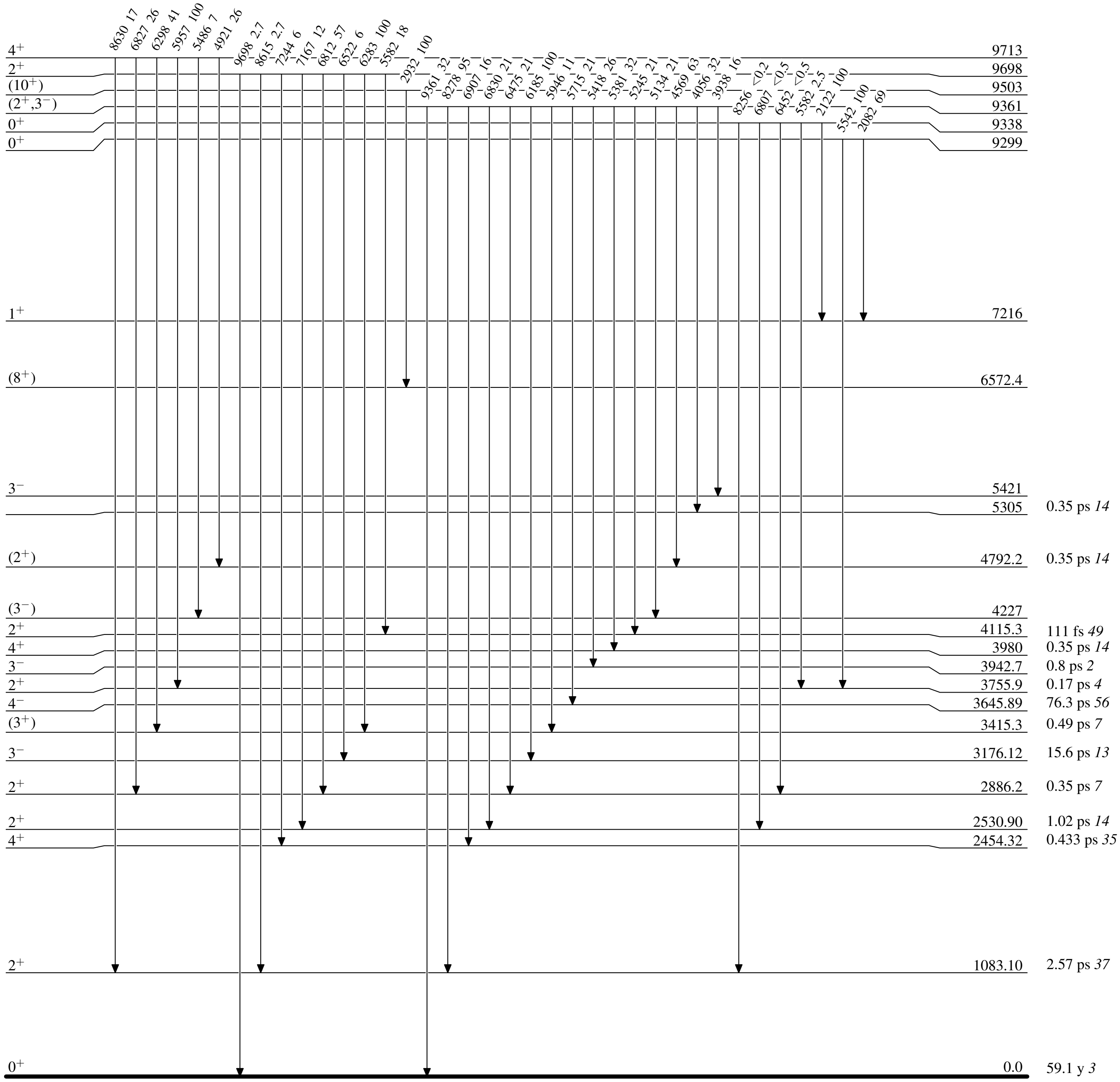


$^{44}_{22}Ti_{22}$

Adopted Levels, Gammas

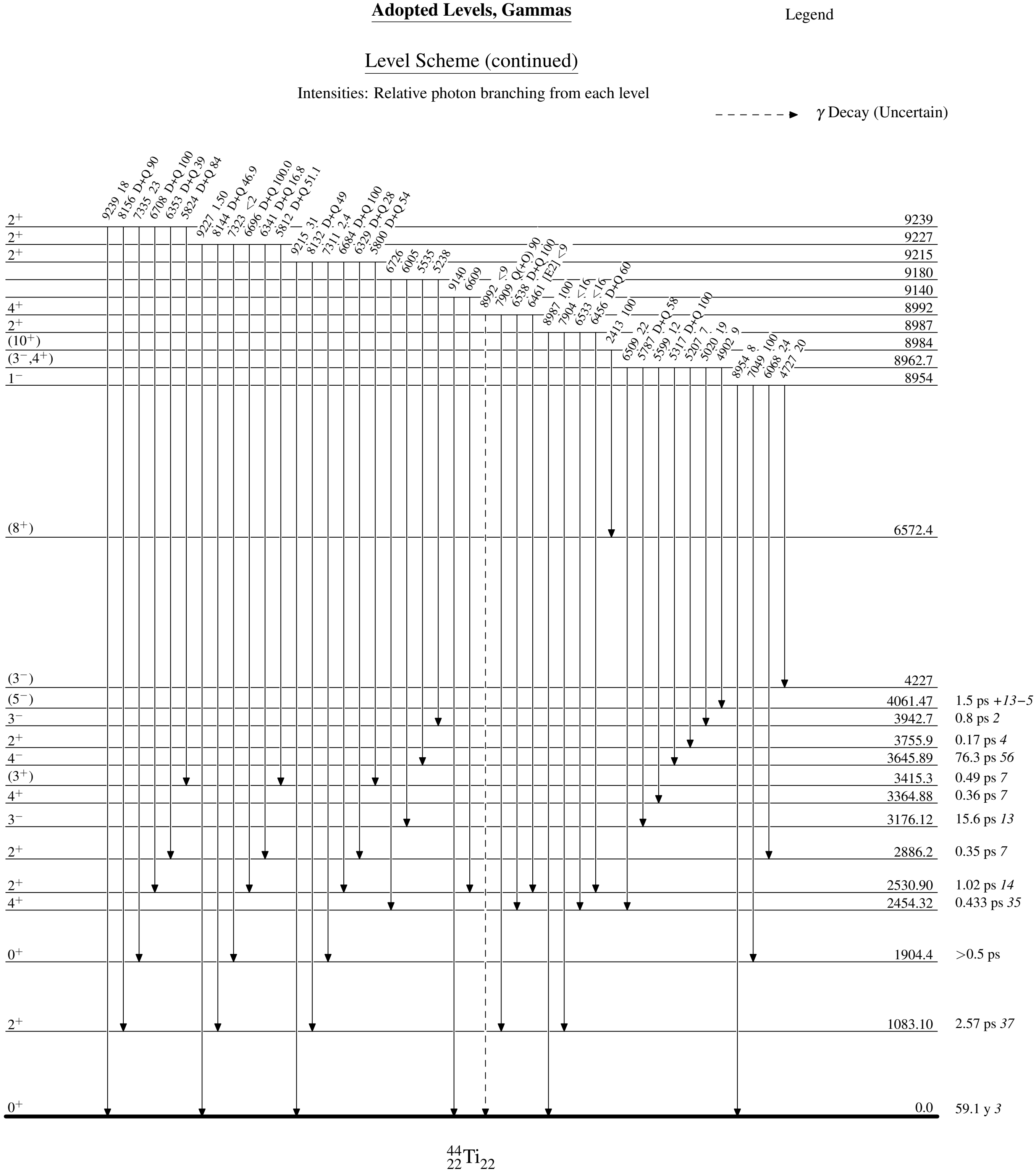
Level Scheme (continued)

Intentities: Relative photon branching from each level



$^{44}_{22}Ti_{22}$

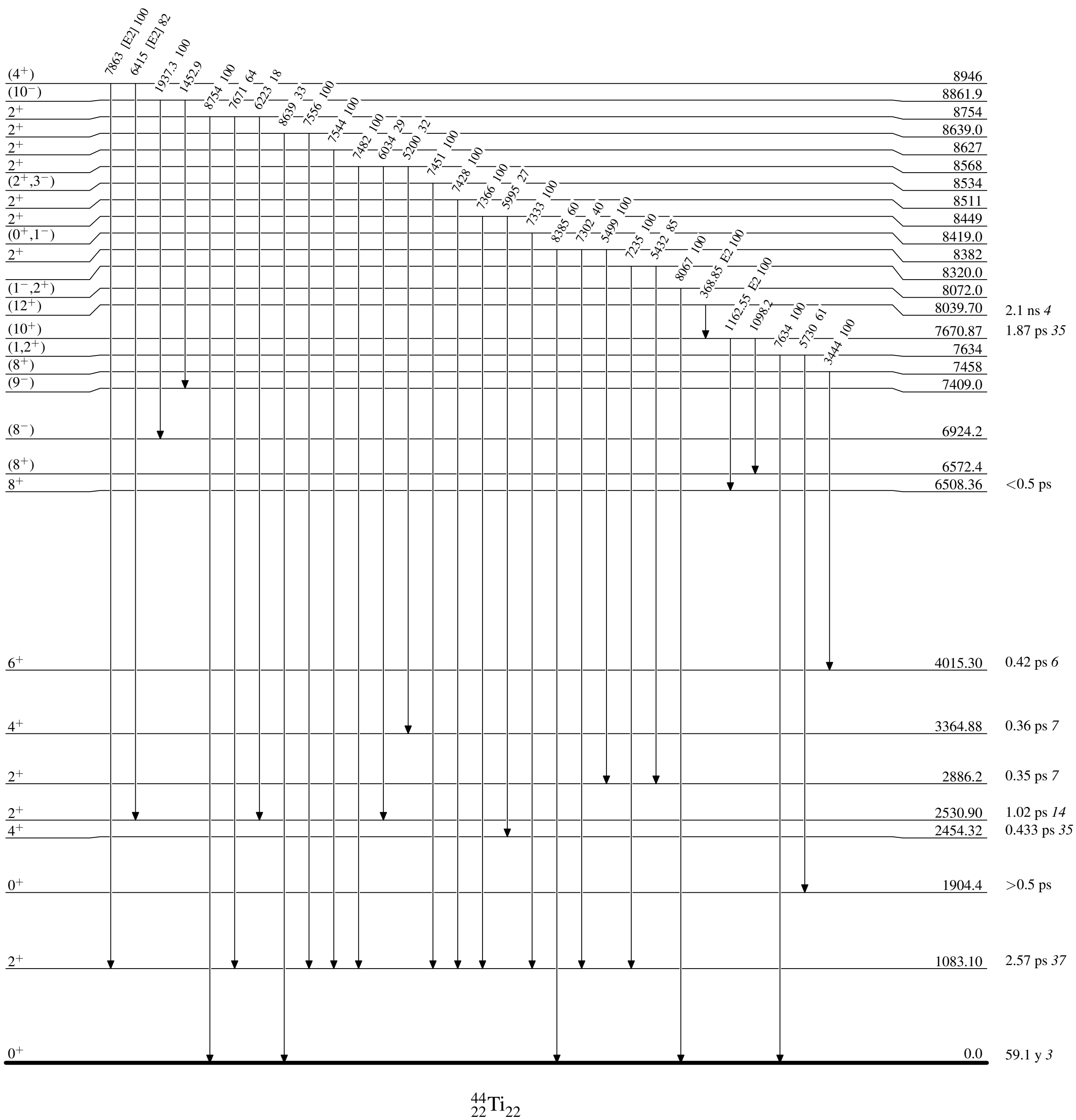
Adopted Levels, Gammas



Adopted Levels, Gammas

Level Scheme (continued)

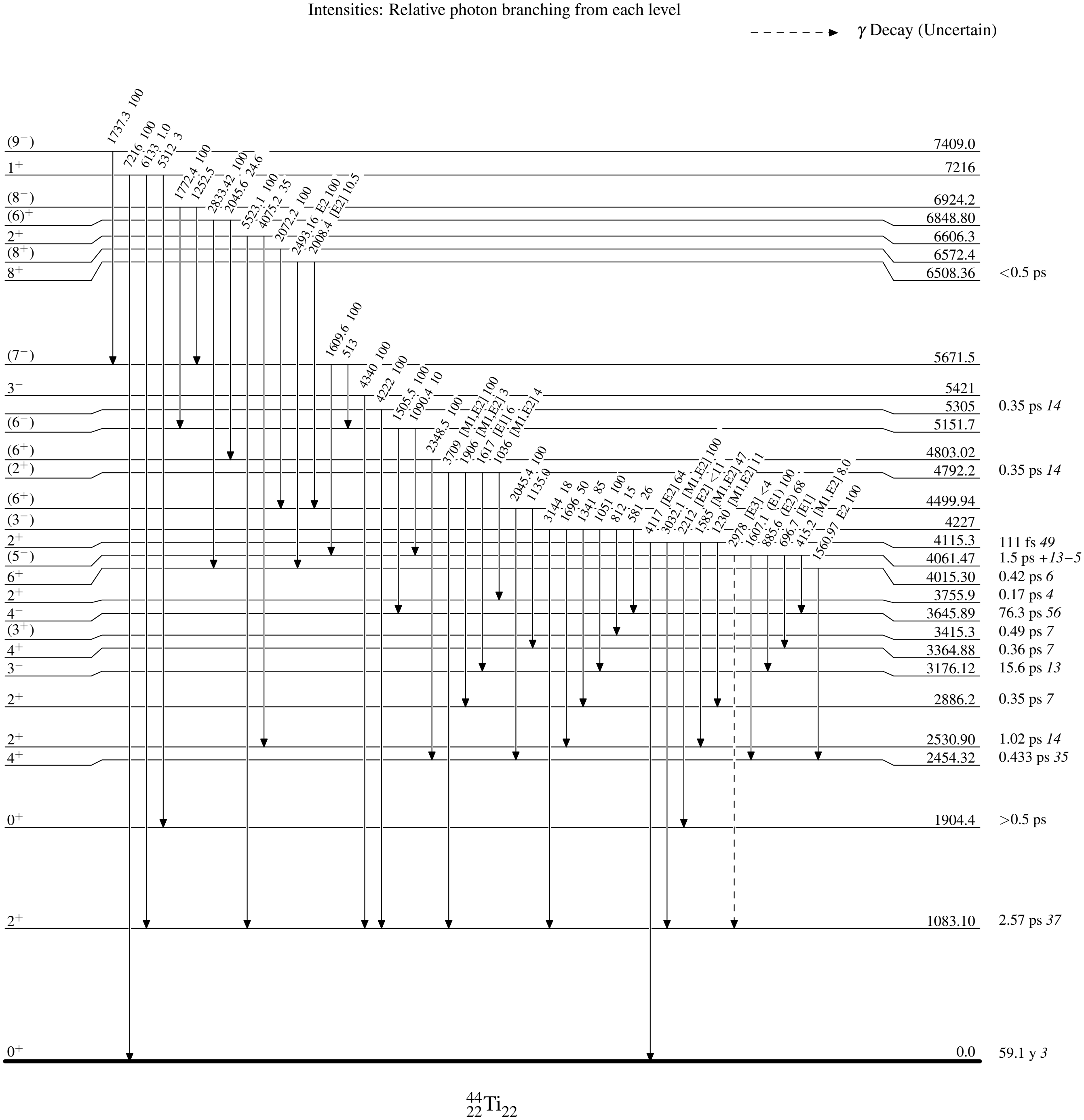
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

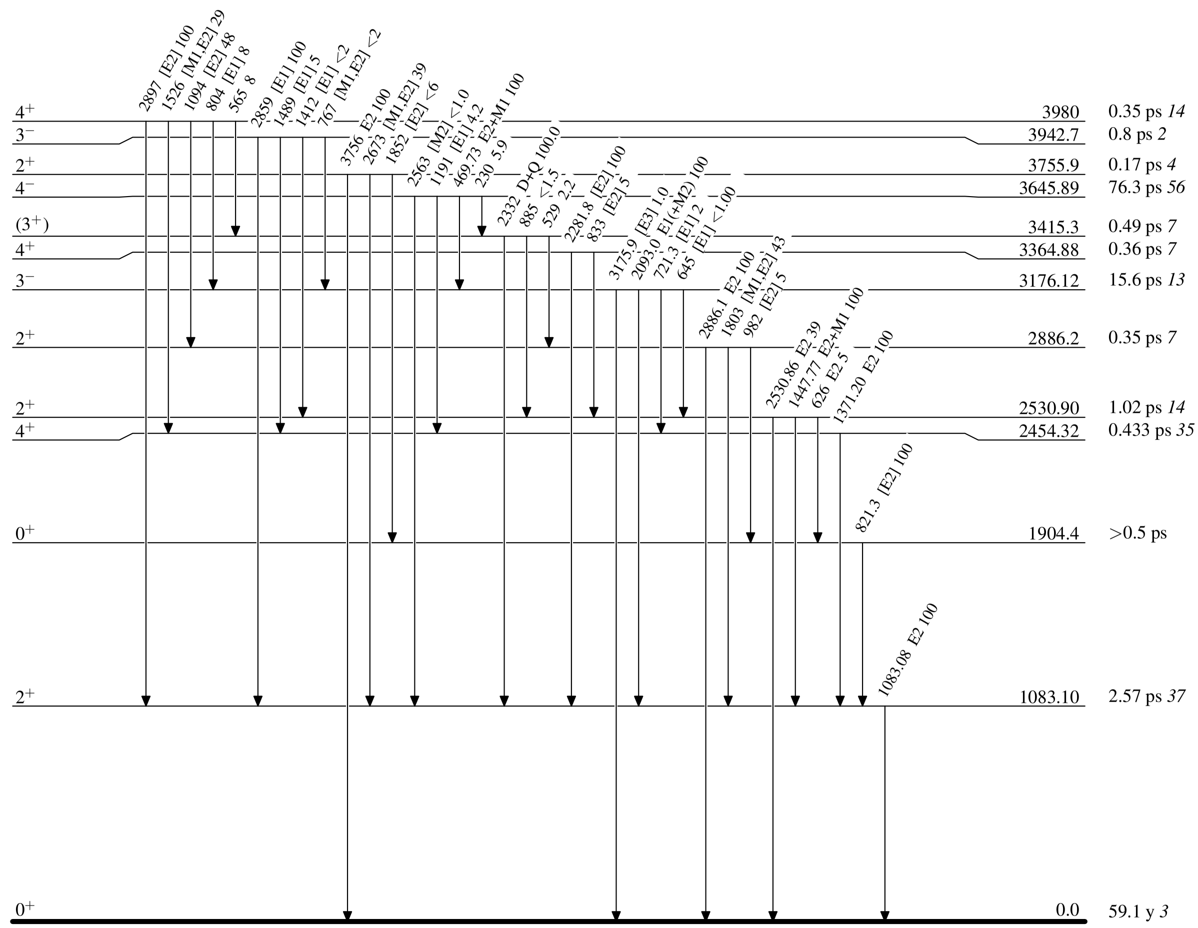
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

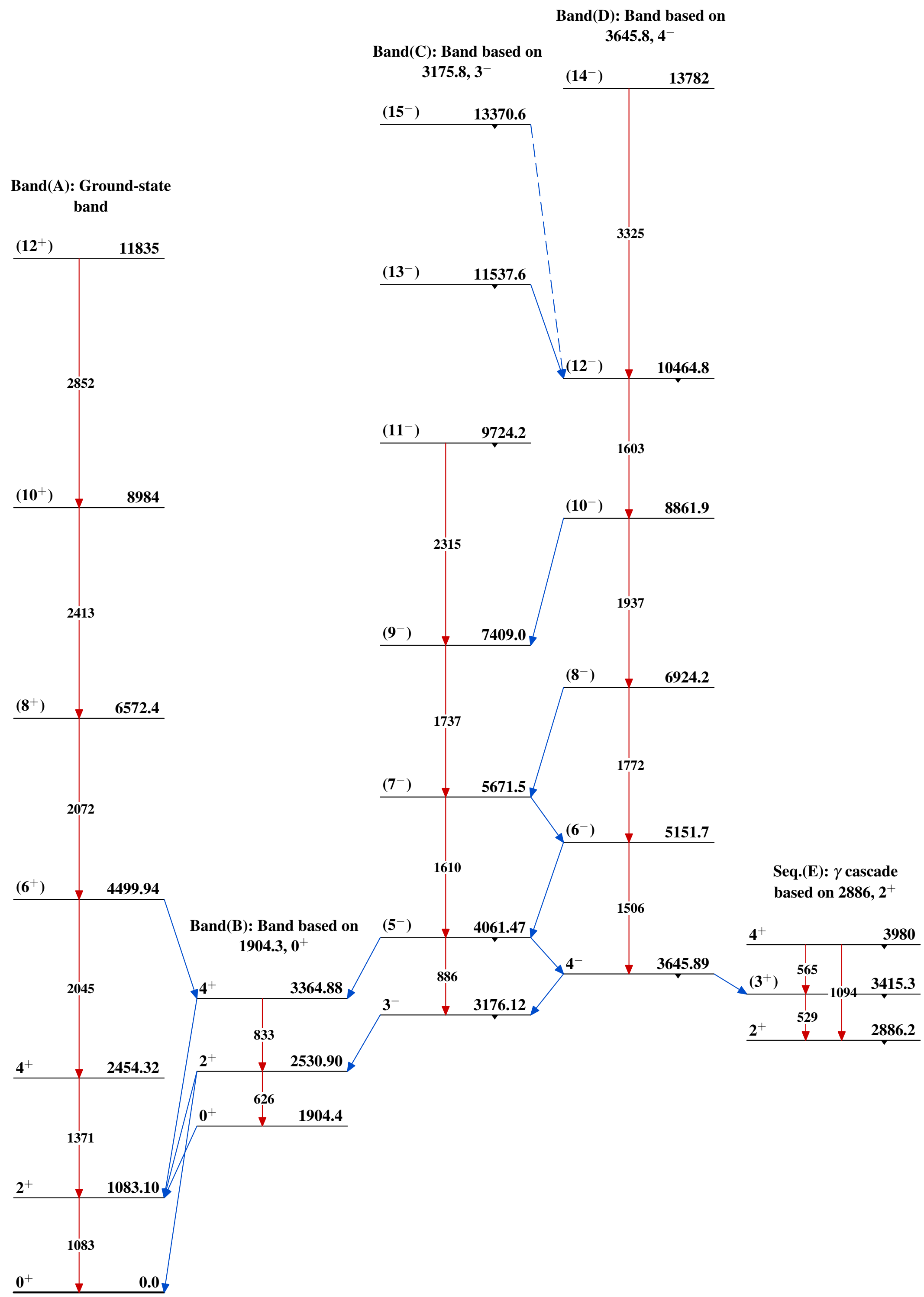
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{44}_{22}Ti_{22}$

Adopted Levels, Gammas



$^{44}_{22}Ti_{22}$