^{48}Ti(n,γ),(pol n,γ) E=th 1992Ku17,1983Ru08,2003ChXS

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	T. W. Burrows[a]	NDS 109, 1879 (2008)	14-Jul-2008

1969TrZX: measured γ′s; crystal diffraction spectrometer, Ge(Li). Natural target.
1983Ru08: measured γ′s, Ge(Li) (60 keV<Eγ<2.5 MeV) and pair spectrometer (Ge(Li), NaI. Eγ=2.0-6.8 MeV) and circular polarization (18 primary γ′s), permendur cylinders.
1988Bo34, 1992Ku17: measured Doppler broadening of γ′s; flat crystal spectrometer. Deduced $T_{1/2}$′s; molecular dynamics simulation.
2003ChZS: measured γ′s; HPGe; natural target. Obtained Prompt Gamma-Ray Activation datasets for Ca using their data, ENSDF (1995Bu23), and 1981Lo16.
Others: 2001Ac04 and 2002Re13. See also 1995Bu23.

^{49}Ti Levels

See 1995Bu23 for levels proposed by 1969TrZX that have not been ADOPTED.

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	E(level)[†]	Jπ[‡]	$T_{1/2}$[#]
0.0	7/2−[@]		3618.49 *13*	5/2−[@]	
1381.770 *5*	3/2−	0.97[&] ps *+83−35*	3787.67 *6*	3/2−	
1585.967 *6*	3/2−	1.3[&] ps *+13−3*	3854.97 *7*	3/2[d]	
1622.54? *16*	(5/2)−[@]		4074.17 *22*	5/2−,7/2−[@]	
1723.478 *6*	1/2−		4221.800 *23*	1/2−	
1762.010 *7*	5/2−[@]	20.1[a] fs *14*	4433.26 *4*	3/2−	
2260.96 *14*	(5/2)−[@]		4588.24 *4*	3/2−	
2504.36 *4*	1/2+		4666.665 *21*	1/2−	
2513.44 *15*	[b]		4811.02 *10*		
2664.36 *4*	3/2+[c]		4910.92 *5*	1/2−	
2721.30 *6*			5115.561 *21*	1/2−	
3038.68 *9*	(≤5/2−)[@]		5151.12 *10*	3/2[d]	
3175.283 *9*	1/2−	54.8[a] fs *28*	5412.03 *9*	1/2+[@]	
3260.702 *7*	3/2−	11.2[a] fs *5*	5795.48 *15*	(3/2−,1/2−)[@]	
3428.25 *3*	3/2−		(8142.39[e] *3*)	1/2+[f]	4.4[g] eV *10*
3469.03 *3*	1/2−				

[†] From least-squares fit to Eγ′s.
[‡] From L(d,p) and the γ-CP and γ strengths of 1983Ru08, except As noted.
[#] From Doppler broadening of deexciting transitions (1988Bo34, 1992Ku17) except for Γ_γ(capture state). Data from 1988Bo34 are considered preliminary and have not been included In the Adopted Levels.
[@] From the Adopted Levels.
[&] From 1988Bo34.
[a] From 1992Ku17.
[b] See discussion In the Adopted Levels.
[c] L(d,p)=2; primary γ too strong to Be E2.
[d] ≠ 1/2 since circular polarization coefficient R=1.00 excluded. ≠ 5/2 since the primary γ′s too strong to Be E2 or M2 In nature.
[e] From 2003Au03. Held fixed In least-squares fit.
[f] Thermal capture on an even-even nucleus.
[g] Γ_γ for 17.6 keV, 1/2+ resonance from 2006MuZX. The ^{48}Ti scattering cross section At keV energies and its large thermal cross section (7.84 b *25*) May Be explained satisfactorily by this 1/2+ resonance (2006MuZX) and, therefore, 1983Ru08 employed this Γ_γ along with the primary γ-ray branchings to estimate of the primary γ-ray strengths. Γ_γ(17.6 keV)=4.4 eV *10* and σ_0=8.32 b *16* (2006MuZX).

^{48}Ti(n,γ),(pol n,γ) E=th 1992Ku17,1983Ru08,2003ChXS (continued)

$\gamma(^{49}Ti)$

Systematic uncertainty=5%.

The precision of the energy and intensity measurements by 1983Ru08 are one order of magnitude better than those of 1969Fe08 while the energies agree within uncertainties, the absolute intensities given by 1969Fe08 are≈30% smaller than those of 1983Ru08.

The precision of the energy measurements of 1983Ru08 are usually better than those of 2003ChZS. The energies generally agree within uncertainties. The absolute intensities could not Be compared.

1983Ru08 noted that the 361γ, 740γ, and 2005γ observed by 1969Fe08 were double-escape peaks while the 874γ and 3633γ were identified As contaminants. The 1846.7γ observed by 1969Fe08 appears to Be an unresolved doublet consisting of the 1842.41γ and 1853.7γ.

The following criteria were used by 1983Ru08 to place the gammas: 1. Placement is within 3σ unambiguous. Both levels concerned are excited or deexcited by At least three transitions for which this condition holds. 2. Placement is within 3σ unambiguous. Only one of the levels concerned is excited or deexcited by At least three transitions for which this condition holds. 3. Placement based on $\gamma\gamma$-coincidences (1968Ca01,NaI). 1983Ru08 note how each γ was placed.

See 1995Bu23 for γ's assigned by 1969TrZX that have not been ADOPTED.

E_γ[†]	I_γ[‡q]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ	α(exp)[&]	σ_γ^Z(b)[#]
137.42[a] *7*	0.54 *3*	1723.478	1/2$^-$	1585.967	3/2$^-$				0.0542 *9*
149.56 *15*	0.041 *6*	3618.49	5/2$^-$	3469.03	1/2$^-$				
341.706[b] *4*	24.80 *21*	1723.478	1/2$^-$	1381.770	3/2$^-$	M1+E2[c]	+0.1[c]	0.00095 *14*	1.843 *21*
434.09 *16*	0.033 *5*	4221.800	1/2$^-$	3787.67	3/2$^-$				0.00102 *19*
[x]460.2[r] *3*	0.018 *5*								
605.2 *3*	0.030 *6*	4074.17	5/2$^-$,7/2$^-$	3469.03	1/2$^-$				
638.41[d] *7*	[e]	2260.96	(5/2)$^-$	1622.54?	(5/2)$^-$				0.0035 *3*
[x]703.5 *2*	0.027 *6*								
879.16[d] *17*	0.05[f]	2260.96	(5/2)$^-$	1381.770	3/2$^-$				0.0023 *5*
902.38[g] *5*	0.127 *6*	2664.36	3/2$^+$	1762.010	5/2$^-$				0.0073 *6*
[x]986.74 *11*	0.027 *6*								
1077.0 *3*	0.042 *8*	5151.12	3/2	4074.17	5/2$^-$,7/2$^-$				
1122.69[a] *8*	0.72 *3*	2504.36	1/2$^+$	1381.770	3/2$^-$				0.0475 *12*
1135.35 *6*	0.212 *10*	2721.30		1585.967	3/2$^-$				0.0119 *8*
[x]1243.31 *17*	0.053 *6*								
1315.6 *3*	0.034 *6*	3038.68	(≤5/2$^-$)	1723.478	1/2$^-$				
1327.74[hr] *8*	0.254 *10*	4588.24	3/2$^-$	3260.702	3/2$^-$				0.0168 *11*
1350.46 *14*	0.063 *6*	3854.97	3/2	2504.36	1/2$^+$				
1381.745[b] *5*	85.5 *21*	1381.770	3/2$^-$	0.0	7/2$^-$				5.18 *12*
1406.36 *16*	0.055 *5*	4666.665	1/2$^-$	3260.702	3/2$^-$				
1451.79 *4*	0.242 *8*	3175.283	1/2$^-$	1723.478	1/2$^-$				0.0143 *7*
1498.662[b] *7*	4.89 *13*	3260.702	3/2$^-$	1762.010	5/2$^-$				0.297 *5*
1532.79 *21*	0.053 *6*	5151.12	3/2	3618.49	5/2$^-$				
1549.56[g] *8*	0.115 *6*	4588.24	3/2$^-$	3038.68	(≤5/2$^-$)				0.0081 *7*

From ENSDF

^{48}Ti(n,γ),(pol n,γ) E=th 1992Ku17,1983Ru08,2003ChXS (continued)

$\gamma(^{49}Ti)$ (continued)

E_γ [†]	I_γ [‡ q]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [@]	σ_γ^Z(b) [#]
1585.942 [b] 6	10.2 3	1585.967	3/2$^-$	0.0	7/2$^-$		0.624 8
1589.27 [i] 8	1.01 [j] 3	3175.283	1/2$^-$	1585.967	3/2$^-$		0.0524 [j] 16
1622.84 [dr] 16	[e]	1622.54?	(5/2)$^-$	0.0	7/2$^-$		0.0042 9
1646.46 21	0.046 5	5115.561	1/2$^-$	3469.03	1/2$^-$		0.0041 10
1665.96 17	0.048 [j] 5	3428.25	3/2$^-$	1762.010	5/2$^-$		0.0041 [j] 6
1674.734 [b] 22	0.397 12	3260.702	3/2$^-$	1585.967	3/2$^-$		0.0262 10
1761.971 [b] 8	5.35 16	1762.010	5/2$^-$	0.0	7/2$^-$		0.331 4
1793.478 [b] 8	2.57 8	3175.283	1/2$^-$	1381.770	3/2$^-$		0.1533 24
1842.24 [d] 4	0.31 4	3428.25	3/2$^-$	1585.967	3/2$^-$		0.0436 13
1853.7 [i] 5	0.066 20	5115.561	1/2$^-$	3260.702	3/2$^-$		0.0022 5
1878.891 [d] 10	≈0.5 [f]	3260.702	3/2$^-$	1381.770	3/2$^-$		0.0039 6
1883.06 [d] 4	0.32 4	3469.03	1/2$^-$	1585.967	3/2$^-$		0.0403 12
1940.33 [dhr] 6	0.18 3	5115.561	1/2$^-$	3175.283	1/2$^-$		0.0114 5
[x]1973.0 4	0.032 6						
[x]2003.51 20	0.34 8						
2046.44 [d] 5	0.260 [j] 25	3428.25	3/2$^-$	1381.770	3/2$^-$		0.0266 [j] 11
2132.0 [d] 3	0.031 15	3854.97	3/2	1723.478	1/2$^-$		0.0027 5
2307.3 4	0.043 7	4811.02		2504.36	1/2$^+$		
2346.79 20	0.097 12	(8142.39)	1/2$^+$	5795.48	(3/2$^-$,1/2$^-$)	D,E2 [k]	0.0078 9
2405.76 [d] 8	0.211 16	3787.67	3/2$^-$	1381.770	3/2$^-$		0.0177 10
2430.9 4	0.035 9	5151.12	3/2	2721.30			
2473.03 [d] 14	0.073 10	3854.97	3/2	1381.770	3/2$^-$		0.0043 5
2498.24 7	0.299 17	4221.800	1/2$^-$	1723.478	1/2$^-$		
2513.30 15	0.219 18	2513.44		0.0	7/2$^-$		
[x]2529.1 5	0.032 8						
[x]2548.8 4	0.040 8						
[x]2591.1 5	0.028 8						
2600.9 6	0.027 8	5115.561	1/2$^-$	2513.44			
2611.04 8	0.250 14	5115.561	1/2$^-$	2504.36	1/2$^+$		0.0188 12
2635.5 3	0.123 21	4221.800	1/2$^-$	1585.967	3/2$^-$		
[x]2686.66 5	0.336 15						
2709.63 [g] 12	0.127 11	4433.26	3/2$^-$	1723.478	1/2$^-$		0.0096 10
2730.27 [g] 10	0.147 11	(8142.39)	1/2$^+$	5412.03	1/2$^+$	D,E2 [k]	0.0109 10
2839.88 4	0.630 23	4221.800	1/2$^-$	1381.770	3/2$^-$		0.0437 16
2847.39 15	0.105 [j] 8	4433.26	3/2$^-$	1585.967	3/2$^-$		0.0066 [j] 9
2943.00 3	0.94 3	4666.665	1/2$^-$	1723.478	1/2$^-$		0.0614 18
2991.17 [a] 15	0.185 12	(8142.39)	1/2$^+$	5151.12	3/2	D [l]	0.0134 13
3002.11 9	0.239 12	4588.24	3/2$^-$	1585.967	3/2$^-$		0.0150 14
[x]3013.2 3	0.052 8						

From ENSDF

$^{49}_{22}Ti_{27}$-3

^{48}Ti(n,γ),(pol n,γ) E=th 1992Ku17,1983Ru08,2003ChXS (continued)

$\gamma(^{49}Ti)$ (continued)

E_γ[†]	I_γ[‡q]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	σ_γ^Z(b)[#]
3026.68[m] 3	2.07 6	(8142.39)	1/2$^+$	5115.561	1/2$^-$	D,E2[k]	0.145 3
[x]3051.25[n] 11							0.167 15
3187.19[i] 28	0.141 8	4910.92	1/2$^-$	1723.478	1/2$^-$		0.0099 11
3205.96 17	0.086 7	4588.24	3/2$^-$	1381.770	3/2$^-$		0.0053 9
3224.89 11	0.152 9	4811.02		1585.967	3/2$^-$		0.0117 11
3231.36 5	0.403 14	(8142.39)	1/2$^+$	4910.92	1/2$^-$	D,E2[k]	0.0259 14
3284.85 13	0.111 7	4666.665	1/2$^-$	1381.770	3/2$^-$		
3325.10 25	0.065 7	4910.92	1/2$^-$	1585.967	3/2$^-$		0.0037 9
3331.3 3	0.054 7	(8142.39)	1/2$^+$	4811.02		D,E2[k]	
3388.0 7	0.020 6	5151.12	3/2	1762.010	5/2$^-$		
3427.7[hr] 5	0.035 7	5151.12	3/2	1723.478	1/2$^-$		
3475.52[m] 3	1.57 4	(8142.39)	1/2$^+$	4666.665	1/2$^-$	D,E2	0.1016 25
3529.31[hr] 10	0.168 8	5115.561	1/2$^-$	1585.967	3/2$^-$		0.0105 10
3534.37[d] 17	0.062 7	5795.48	(3/2$^-$,1/2$^-$)	2260.96	(5/2)$^-$		
3553.99[m] 4	0.684 17	(8142.39)	1/2$^+$	4588.24	3/2$^-$	D,E2[k]	0.0460 17
3564.71 17	0.079 7	5151.12	3/2	1585.967	3/2$^-$		0.0038 8
3708.98[m] 4	0.585 15	(8142.39)	1/2$^+$	4433.26	3/2$^-$	D,E2[k]	0.0369 17
3733.61 3	1.31 3	5115.561	1/2$^-$	1381.770	3/2$^-$		0.0873 25
3920.38[m] 3	1.289 22	(8142.39)	1/2$^+$	4221.800	1/2$^-$	D,E2[k]	0.0839 23
4030.06[m] 16	0.062 5	5412.03	1/2$^+$	1381.770	3/2$^-$		
4071.7 4	0.032 5	5795.48	(3/2$^-$,1/2$^-$)	1723.478	1/2$^-$		0.0028 8
[x]4150.4 3	0.045 6						
[x]4200.5 6	0.020 5						
[x]4240.4 6	0.020 5						
4287.18[m] 8	0.136 5	(8142.39)	1/2$^+$	3854.97	3/2	D[l]	0.0088 9
4354.44[a] 8	0.355 8	(8142.39)	1/2$^+$	3787.67	3/2$^-$	D,E2[k]	0.0242 18
4673.16[m] 4	0.560 10	(8142.39)	1/2$^+$	3469.03	1/2$^-$	D,E2[k]	0.0376 18
4713.75[i] 12	0.956 14	(8142.39)	1/2$^+$	3428.25	3/2$^-$	D,E2[k]	0.0661 21
4881.384[m] 26	4.51 5	(8142.39)	1/2$^+$	3260.702	3/2$^-$	D,E2[k]	0.308 7
4966.85[i] 7	2.89 3	(8142.39)	1/2$^+$	3175.283	1/2$^-$	D,E2[k]	0.196 5
[x]5204.37 14	0.074 4						
[x]5291.8 5	0.020 4						
5477.77[m] 6	0.206 5	(8142.39)	1/2$^+$	2664.36	3/2$^+$	M1[o]	0.0135 13
[x]5543.4 4	0.023 4						
5637.74[a] 4	0.428 7	(8142.39)	1/2$^+$	2504.36	1/2$^+$	D,E2[k]	0.0256 16
[x]6195.1 9	0.022 7						
6418.53[a] 6	30.5 3	(8142.39)	1/2$^+$	1723.478	1/2$^-$	D,E2[kp]	1.96 6
6555.99[a] 4	5.09 5	(8142.39)	1/2$^+$	1585.967	3/2$^-$	D,E2[k]	0.334 8
6760.12[a] 4	46.3 4	(8142.39)	1/2$^+$	1381.770	3/2$^-$	D,E2[k]	2.97 9

From ENSDF

$^{49}_{22}Ti_{27}$-4

$\gamma(^{49}Ti)$ (continued)

† From 1983Ru08. Converted to γ energies from Eγ+E(recoil) by the evaluator. Statistical uncertainty given. Calibration for high-energy γ's were based on the ^{2}H and ^{15}N neutron binding energies; if Sn(^{15}N)=10833.230 (2003Au03), these energies May need to Be reduced by up to 7 ppm.

‡ Absolute intensity per 100 N-captures. See 1983Ru08 for branching ratios. Statistical uncertainty given.

From 2003ChZS. Elemental σ_{γ}^{Z} assuming abundance=73.72% 3 (2005TuZX).

@ The upper limit for E2 radiation proposed by J. Kopecky (E.C.N. Report, ECN-99 (1981)) and RUL(M2) (1979En04) were assumed by 1983Ru08 to estimate the maximum δ(E2,M2) In the circular polarization analysis.

& From 1968Tr08 (ce/pe. Mag spect,scin).

a Weighted averages (external) of 137.48 *3* (1983Ru08) and 137.35 *3* (2003ChZS), 1122.63 *3* (2003ChZS) and 1122.79 *4* (1983Ru08), 2991.01 *13* (2003ChZS) and 2991.31 *12* (1983Ru08), 4354.25 *10* (2003ChZS) and 4354.47 *4* [syst. $\Delta E(\gamma)=2.6\times10^{-4}\%$] (1983Ru08), 5637.55 *14* (2003ChZS) and 5637.74 *4* [syst. $\Delta E(\gamma)=2.6\times10^{-4}\%$] (1983Ru08), 6418.35 *8* (2003ChZS) and 6418.551 *19* [syst. $\Delta E(\gamma)=2.6\times10^{-4}\%$] (1983Ru08), 6555.87 *9* (2003ChZS) and 6556.003 *21* [syst. $\Delta E(\gamma)=2.6\times10^{-4}\%$] (1983Ru08), and 6760.01 *9* (2003ChZS) and 6760.133 *20* [syst. $\Delta E(\gamma)=2.6\times10^{-4}\%$] (1983Ru08).

b Systematic $\Delta E(\gamma)=2.6\times10^{-4}\%$.

c From 1959Kn53 (NaI). Alternative δ excluded by α(exp) and $\gamma\gamma(\theta)$ (1968Ho08). Phase difference between E2 and M1 components is 180.5° *4*, consistent with time-reversal invariance (1978Sh07. (pol n,γ), cold 4 angstrom neutron source. 342-1381$\gamma\gamma(\theta)$; NaI with filter and shielding).

d From 2003ChZS. 637.8 *5*, 878.5 *5*, 1618 *3*, and 1881 *1* γ's reported by 1969TrZX; not observed by 1983Ru08. 3534.4γ unplaced by 1983Ru08.

e Weak (1969TrZX).

f From 1969TrZX. Iγ renormalized by evaluator to Iγ(6419γ)=30.5 from Iγ(6419γ)=29.

g Weighted averages (internal) of 902.35 *6* (1983Ru08) and 902.42 *8* (2003ChZS), 1549.56 *8* (1983Ru08) and 1549.67 *11* (2003ChZS), 2709.58 *17* (1983Ru08) and 2709.68 *16* (2003ChZS), and 2730.18 *13* (1983Ru08) and 2730.39 *15* (2003ChZS).

h Placed because intensity imbalance is improved appreciably.

i Unweighted averages of 1589.19 *5* (2003ChZS) and 1589.348 *19* (1983Ru08), 1853.7 *5* (1983Ru08) and 1855.22 *23* (2003ChZS), 3186.91 *10* (1983Ru08) and 3187.46 *14* (2003ChZS), 4713.63 *7* (2003ChZS) and 4713.86 *3* (1983Ru08), and 4966.68 *6* (2003ChZS) and 4966.877 *23* (1983Ru08).

j Branching ratios from 1983Ru08 and 2003ChZS are discrepant.

k From comparison to RUL (evaluator).

l J(5151,3855) ≠ 1/2 since R=1.00 excluded; primary γ's too strong to Be M2 or E2 In nature.

m Systematic $\Delta E(\gamma)=3.2\times10^{-4}\%$.

n 2003ChZS assign this γ As deexciting a 5312 level and adopt $J^{\pi}=1/2^{+}$. The evaluator has found No other evidence for this state.

o L(d,p)=2 for 2664; primary γ too strong to Be E2.

p Circular polarization coefficient R=+1.00 assumed As an internal calibration standard.

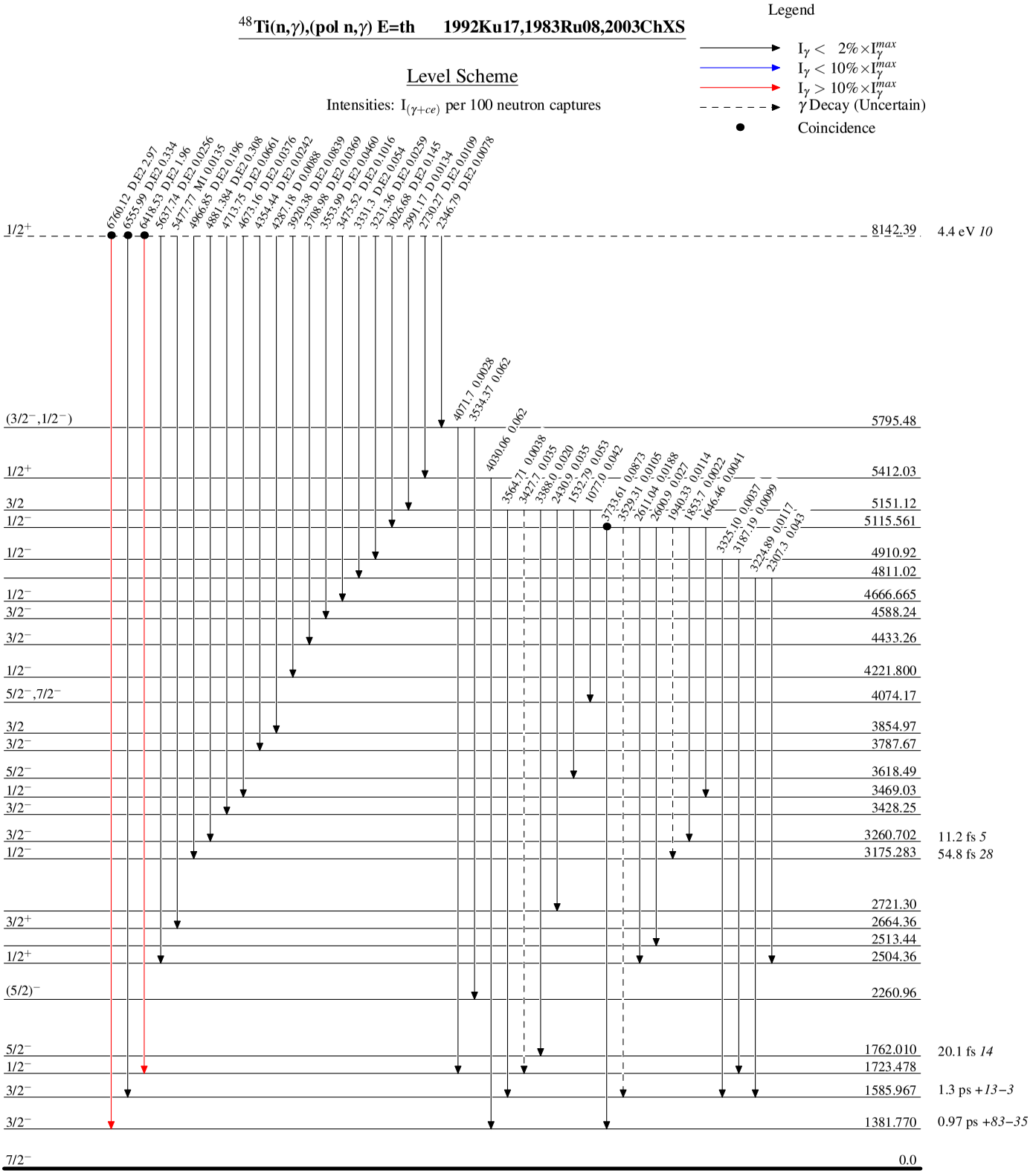
q For intensity per 100 neutron captures, multiply by 1.00 *5*.

r Placement of transition in the level scheme is uncertain.

x γ ray not placed in level scheme.

From ENSDF

$^{49}_{22}Ti_{27}$-5

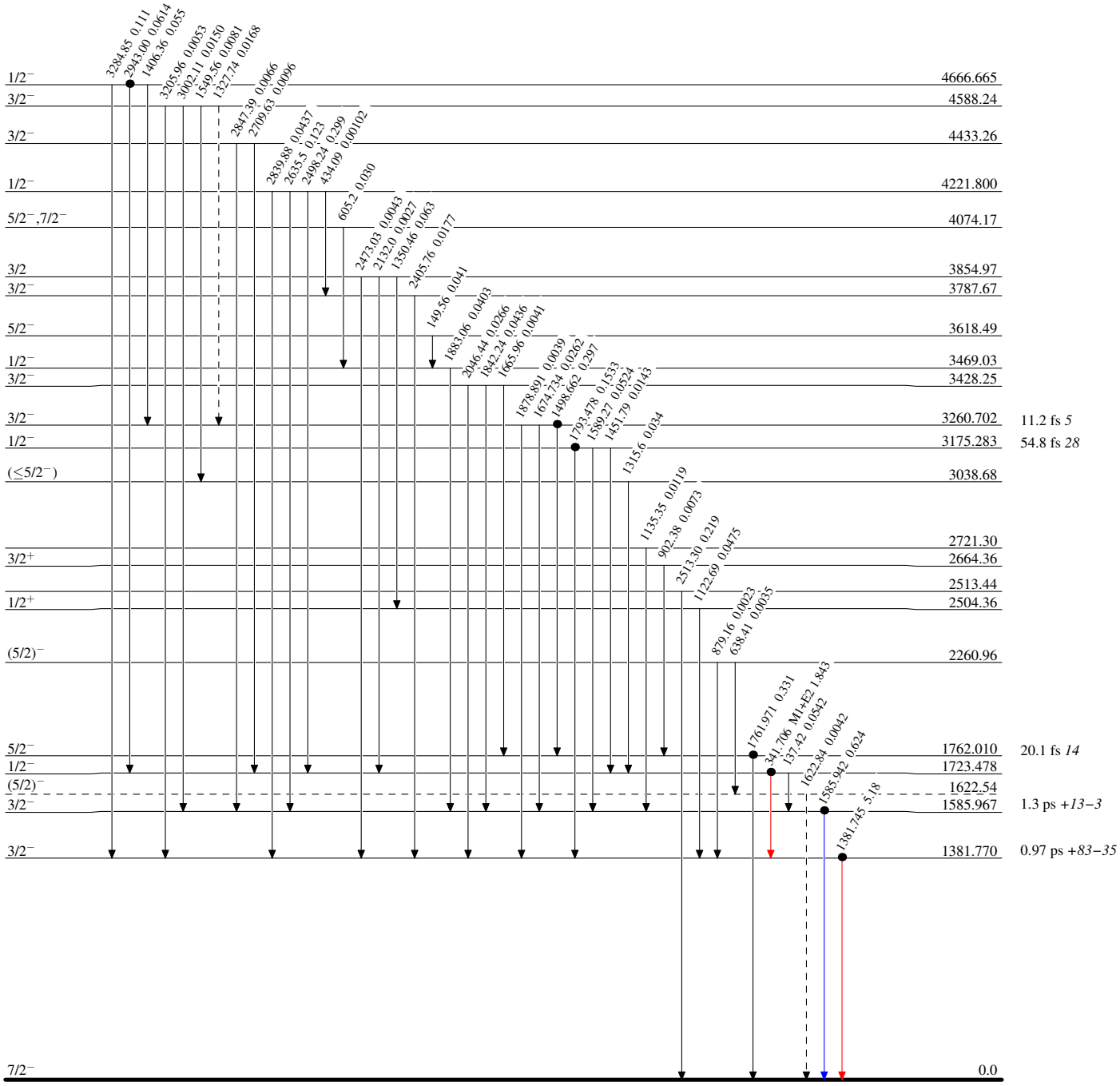

^{48}Ti(n,γ),(pol n,γ) E=th 1992Ku17,1983Ru08,2003ChXS
Level Scheme
Intensities: I(γ+ce) per 100 neutron captures
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
γ Decay (Uncertain)
Coincidence
1/2+ 8142.39 4.4 eV 10
(3/2−,1/2−) 5795.48
1/2+ 5412.03
3/2 5151.12
1/2− 5115.561
1/2− 4910.92
4811.02
1/2− 4666.665
3/2− 4588.24
3/2− 4433.26
1/2− 4221.800
5/2−,7/2− 4074.17
3/2 3854.97
3/2− 3787.67
5/2− 3618.49
1/2− 3469.03
3/2− 3428.25
3/2− 3260.702 11.2 fs 5
1/2− 3175.283 54.8 fs 28
2721.30
3/2+ 2664.36
2513.44
1/2+ 2504.36
(5/2)− 2260.96
5/2− 1762.010 20.1 fs 14
1/2− 1723.478
3/2− 1585.967 1.3 ps +13−3
3/2− 1381.770 0.97 ps +83−35
7/2− 0.0
$^{49}_{22}Ti_{27}$

^{48}Ti(n,γ),(pol n,γ) E=th 1992Ku17,1983Ru08,2003ChXS

Level Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 neutron captures

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



$^{49}_{22}Ti_{27}$