^{126}Te(^{18}O,4nγ) 1987Gu22,2006Pe25,2008Fe02

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 154, 1 (2018)	20-Nov-2018

Dataset includes unevaluated XUNDL file compiled by M. Mitchell, S. Geraedts, and B. Singh (McMaster) from 2006Pe25 and 2008Fe02.
Main reaction: ^{126}Te(^{18}O,4nγ), studied by 1987Gu22, 2006Pe25, and 2008Fe02.
1987Gu22: E=64-76 MeV, measured γ, $\gamma\gamma$, $\gamma(\theta)$ at Wright Nuclear Structure Laboratory (WNSL) at Yale University.
2006Pe25: E=70 MeV. Measured Eγ, Iγ, $\gamma\gamma$, lifetimes using the AFRODITE spectrometer composed of eight 'Clover' Ge detectors with BGO Compton-suppression shields and six segmented LEPS detectors. Search for isomer states through measurement of prompt and delayed γ rays.
2008Fe02: E=75 MeV beam provided by Tandem accelerator at IPN Orsay. Measured γ rays with one clover and three single Ge detectors with BGO Compton suppression. Lifetime of a 20$^+$ isomer measured in this work.
Other reactions:
^{128}Te(^{16}O,4nγ) E=72-76 MeV (1987Gu22); 70 MeV (1981Me09,1980Me11).
^{140}Ce(α,4nγ) E=52-55 MeV (1976Lu05).
Measured:
1987Gu22,1981Me09,1976Lu05: γ, $\gamma\gamma$, $\gamma(\theta)$, yield.
1981Me09: linear pol.
1980Me11,1982KaZO: $\gamma(\theta$,H,T).
1981Me09: γ(t).
All data from 2006Pe25 unless otherwise noted.

^{140}Nd Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	Comments
0.0[b]	0$^+$		
773.85[b] *9*	2$^+$		
1802.66[b] *14*	4$^+$		
2124.4? *8*	(3$^-$)		
2222.12 *14*	7$^-$	0.60 ms *5*	T$_{1/2}$: adopted value.
2276.84 *15*	5$^-$		
2366.93 *15*	6$^+$		
3062.63[c] *15*	7$^-$		
3185.0[@] *8*	8$^+$[&]		
3240.06[c] *16*	8$^-$		
3419.6 *10*	7,8,9$^{(-)}$		
3455.35[c] *16*	9$^-$		
3621.92 *16*	10$^+$	27 ns *5*	g=−0.192 *12* (1980Me11) T$_{1/2}$: measured: 22 ns *1* (1981Me09), 32 ns *1* (1980Me11), 25 ns *8* (1987Gu22), 32.9 ns *18* (2006Pe25). The first value of 1980Me11 (32 ns) was subsequently corrected by 1981Me09 (22 ns) but reproduced by 2006Pe25 (33 ns). Adopted is the average of extreme values. g: Other: −0.164 *22* (1982KaZO).
3668.37 *22*	(10$^-$)[#]		This level was not adopted − γ moved to 5312 level (^{48}Ca,4nγ).
3959.3[@] *4*	9$^-$[&]		
4031.60[c] *17*	10$^-$		
4156.7[@] *13*	10$^+$[&]		
4176.10[@] *21*	10$^-$[&]		
4323.65[c] *17*	11$^-$		
4389.33 *21*	(11$^-$)		
4514.91[c] *17*	12$^-$	0.25[a] ns	
4703.87[c] *18*	13$^-$		

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^{126}Te(^{18}O,4nγ) 1987Gu22,2006Pe25,2008Fe02 (continued)

^{140}Nd Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	Comments
4879.0[@] 4	11^-[&]		
4915.77 24	11^+		
5099.47[@] 23	12^-[&]		
5139.37[@] 22	12^-[&]		
5312.62 18	13^-		
5352.33 23	(13^-)[#]		This level was not adopted – γ moved to 5138 level (^{48}Ca,4nγ).
5432.56[c] 18	14^-		
5527.17 24	(14)[#]		This level was not adopted – γ moved to 5312 level (^{48}Ca,4nγ).
5614.48[c] 19	15^-		
5644.6 3	$15^{(-)}$		
5855.04 19	(16)[#]		This level was not adopted – γ moved to 8190 level (^{48}Ca,4nγ).
5903.2[c] 3	16		
5971.18 25	15^-		
6158.93 21	16^-		
6408.5[c] 3	17		
6411.03 25			
6764.1[@] 6	16^-[&]		
6967.1[@] 3	17^-[&]		
7057.8[@] 4	17^-[&]		
7207.8[@] 4	18^-[&]		
7398.4[@] 3	18^+[&]		
7435.4[@] 4	20^+[&]	1.23 μs 7	$T_{1/2}$: from γ(t), sum of time spectra of 120γ, 182γ, 188γ and 258γ (2008Fe02). Other: >400 ns (from time spectrum of 227.5γ (2006Pe25)). Configuration=$\pi[d_{5/2}g^{-4}_{7/2}\ _{10+}]\otimes\nu[h^{-2}_{11/2}\ _{10+}]$.
7487.8[@] 12	19^-[&]		

† From least-squares fit to Eγ′s (Δ(Eγ)=1 keV assumed when not stated).
‡ Adopted values, except where noted.
# From 1987Gu22.
@ Observed only by 2006Pe25 and 2008Fe02.
& Adopted by 2006Pe25 based on DCO ratio measurements. Some values can differ from those in the Adopted Levels, Gammas dataset.
a From 1981Me09.
b Band(A): g.s. Band.
c Band(B): γ cascade.

γ(^{140}Nd)

The Eγ values from 2006Pe25 are in disagreement with those from other measurements. Of these the more precise Eγ′s of 1987Gu22 and those in the ^{140}Pm ε decay datasets (coming mainly from 2009Wi18 and 1975Ke09) are in good mutual agreement, and systematically higher then the Eγ′s from 2006Pe25. Because of this, differences of several keV appear in between the high end range of level energies, which makes incompatible the data from 1987Gu22 and 2006Pe25, the main contributors in this dataset. The solution adopted by evaluator was to recalibrate the Eγ′s of 2006Pe25 (by a linear regression of Eγ values common to 2006Pe25 on one side, and 1987Gu22 and ^{140}Pm ε decay datasets on the other side). See 2006Pe25 for their original Eγ′s (also its corresponding XUNDL file).

For detailed γγ see also 1976Lu05.

While there is a general good agreement of measured Eγ′s and ΔE(levels)(GTOL), the reduced χ^2=4.8 is greater than the critical

^{126}Te(^{18}O,4nγ) 1987Gu22,2006Pe25,2008Fe02 (continued)

γ(^{140}Nd) (continued)

χ^2=1.6, essentially because of three discrepant Eγ's (see footnote), which differ by 4σ (one γ) and 5σ (two γ's) from ΔE(levels), and contribute about 80% to the reduced χ^2.

DCO ratios are from 2006Pe25 and 2006PeZZ.

Eγ[†‡]	Iγ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[@]	Comments
29.8		5644.6	15$^{(-)}$	5614.48	15$^-$			
36.8[b]		7435.4	20$^+$	7398.4	18$^+$	[E2]		
90.06 *3*		2366.93	6$^+$	2276.84	5$^-$	D		Mult.: A_2=−0.05 *3*, A_4=−0.20 *3* (1987Gu22); A_2=−0.35 *9* (1976Lu05).
^{x}96.4[a]						D[&]		Mult.: A_2=−0.28 *9*.
^{x}108.0								
119.95 *4*	207 *11*	5432.56	14$^-$	5312.62	13$^-$			Mult.: A_2=−0.18 *6*, A_4=−0.06 *7*. Mult.: tentative E1 adopted by 1987Gu22 contradicts spins of initial and final levels in the Adopted Levels, Gammas dataset that indicates an M1(+E2) transition.
^{x}140.0								
144.78 *6*	109 *8*	2366.93	6$^+$	2222.12	7$^-$	D		Mult.: A_2=−0.31 *9*, A_4=+0.01 *11*.
149.6[b] *5*	24	7207.8	18$^-$	7057.8	17$^-$			
166.57 *4*	212 *9*	3621.92	10$^+$	3455.35	9$^-$	E1		Mult.: A_2=−0.05 *4*, A_4=−0.08 *5* (1987Gu22); A_2=−0.25 *2* (1976Lu05).
173.4[b] *2*	11	5312.62	13$^-$	5139.37	12$^-$	M1+E2	−5	DCO=0.56 *2*
174.84 *6*	77 *6*	5527.17	(14)	5352.33	(13$^-$)	M1+E2		γ moved to 5312 level (^{48}Ca,4nγ). Mult.: A_2=−0.26 *8*, A_4=+0.19 *12*. δ: δ=−5.0 *+43−∞*.
177.38 *4*	334 *11*	3240.06	8$^-$	3062.63	7$^-$	M1+(E2)	−0.4 *+4−3*	Mult.: A_2=−0.38 *2*, A_4=−0.01 *3*.
181.91 *4*	327 *11*	5614.48	15$^-$	5432.56	14$^-$	D		Mult.: A_2=−0.24 *2*, A_4=−0.04 *3*.
183.4[b] *5*	2	5099.47	12$^-$	4915.77	11$^+$			DCO=0.53 *2* Mult.: contradictory arguments: M1+E2 in 2006PeZZ (based on DCO), while 12$^-$ to 11$^+$ transition in 2005Pe24 (Fig. 1).
188.95 *4*	452 *15*	4703.87	13$^-$	4514.91	12$^-$	(E2+M1)	−5.0 *15*	Mult.: A_2=−0.25 *2*, A_4=+0.01 *3*.
191.09[c] *4*	542 *16*	4514.91	12$^-$	4323.65	11$^-$	M1+E2		DCO=0.68 *2* Mult.: A_2=−0.09 *2*, A_4=−0.07 *2*.
202.9[b] *5*	24	6967.1	17$^-$	6764.1	16$^-$			
212.3 *5*	250 *50*	5644.6	15$^{(-)}$	5432.56	14$^-$	M1+E2		DCO=0.59 *3* Mult.: A_2=−0.19 *3*, A_4=−0.12 *4*.
212.9[b] *2*	11	5312.62	13$^-$	5099.47	12$^-$			
213.3 *5*	350 *50*	3668.37	(10$^-$)	3455.35	9$^-$			γ moved to 5312 level (^{48}Ca,4nγ). Mult.: A_2=−0.19 *3*, A_4=−0.12 *4* (1987Gu22); A_2=−0.56 *4* (1976Lu05).
215.28 *3*	1072 *26*	3455.35	9$^-$	3240.06	8$^-$	M1+E2	−0.25 *+25−10*	Mult.: A_2=−0.41 *1*, A_4=−0.01 *1*.
216.3[b] *5*	25	4176.10	10$^-$	3959.3	9$^-$			
^{x}218.5								
220.2[b] *5*	3	5099.47	12$^-$	4879.0	11$^-$	M1+E2		DCO=0.56 *3*
222.4[b] *5*	1	5139.37	12$^-$	4915.77	11$^+$			

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^{126}Te(^{18}O,4nγ) 1987Gu22,2006Pe25,2008Fe02 (continued)

γ(^{140}Nd) (continued)

E_γ [†‡]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ [@]	Comments
227.5[b] 2	243	7435.4	20+	7207.8	18−	[M2]		
240.56 5	149 7	5855.04	(16)	5614.48	15−	D		γ placed at 8190 level in Adopted (from (^{48}Ca,4nγ)). Mult.: A_2=−0.35 5, A_4=+0.02 6.
240.6[b] 5	97	7207.8	18−	6967.1	17−	M1+E2		DCO=0.59 1
258.53 4	231 9	5903.2	16	5644.6	15(−)	M1+E2		DCO=0.57 8 Mult.: A_2=−0.26 3, A_4=+0.00 4.
x271.8[a]						D[&]		Mult.: A_2=−0.43 8.
x278.3[a]						D[&]		Mult.: A_2=−0.23 5.
281.0[bd]		7487.8	19−	7207.8	18−			
287.7 5	49	5903.2	16	5614.48	15−			
291.77[c] 5	137 7	4323.65	11−	4031.60	10−	M1+E2		Mult.: A_2=−0.42 5, A_4=+0.02 6. δ: δ=−0.8 +5−∞.
x310.6[a]						D[&]		Mult.: A_2=−0.15 7.
322.0[d]		2124.4?	(3−)	1802.66	4+			
341.1[b] 5	49	7398.4	18+	7057.8	17−			
x380.0[a]						D[&]		Mult.: A_2=−0.11 15.
x391.5								
x401.7								
419.49 5	1994 46	2222.12	7−	1802.66	4+	E3		Mult.: A_2=−0.01 1, A_4=+0.02 1.
431.2[b] 2	243	7398.4	18+	6967.1	17−			
436.2[b] 5	1	5139.37	12−	4703.87	13−			
437.5[b] 2	59	6408.5	17	5971.18	15−			
439.85 6	331 12	6411.03		5971.18	15−	D+Q		Mult.: A_2=−0.59 3, A_4=+0.30 3.
474.01 7	96 6	2276.84	5−	1802.66	4+	E1		Mult.: A_2=−0.14 7, A_4=−0.05 10.
483.86[c] 7	85 6	4514.91	12−	4031.60	10−	E2		DCO=1.03 5 Mult.: A_2=+0.70 9, A_4=−0.25 11.
505.27 8	72 6	6408.5	17	5903.2	16	M1+E2		DCO=0.55 8 Mult.: A_2=−0.29 9, A_4=−0.27 12.
544.44 9	103 6	6158.93	16−	5614.48	15−	M1(+E2)	−0.2 +2−14	DCO=0.46 2 Mult.: A_2=−0.29 8, A_4=+0.04 11. Mult.: M1+E2 In 2006Pe25 based on DCO is E1 In 2013Le22 (^{96}Zr(^{48}Ca,4nγ)).
554.6[b] 5	49	4176.10	10−	3621.92	10+			
564.42 8	109 6	2366.93	6+	1802.66	4+	E2		Mult.: A_2=+0.33 6, A_4=−0.12 8.
576.17 8	200 9	4031.60	10−	3455.35	9−	M1+E2	−1.9 +11−21	Mult.: A_2=−0.80 4, A_4=+0.21 5.
608.6[b] 5	4	5312.62	13−	4703.87	13−	M1+E2		DCO=0.62 7 Mult.: ΔJ=0 transition.
x636.3[a]						D[&]		Mult.: A_2=−0.17 5.
x672.7								
695.51 9	233 10	3062.63	7−	2366.93	6+	(E1)		Mult.: A_2=−0.10 4, A_4=+0.05 4.
702.7[b] 5	24	4879.0	11−	4176.10	10−	M1+E2		DCO=0.33 4
719.1[b] 5	98	3959.3	9−	3240.06	8−			
720.8[b] 2	319	4176.10	10−	3455.35	9−			
720.96 9	350 11	4389.33	(11−)	3668.37	(10−)	E2+M1		γ placed at 4175 level in Adopted (from (^{48}Ca,4nγ)). Mult.: A_2=−0.27 2, A_4=+0.08 2. δ: δ=−4 +1−∞.
728.60 8	414 13	5432.56	14−	4703.87	13−	M1+E2		DCO=0.66 2 Mult.: A_2=−0.25 2, A_4=+0.06 2. δ: δ=−3.0 +16−∞.

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^{126}Te(^{18}O,4nγ) 1987Gu22,2006Pe25,2008Fe02 (continued)

γ(^{140}Nd) (continued)

E_γ [†‡]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ [@]	Comments
773.85 *9*	2456 *56*	773.85	2+	0.0	0+	E2		Mult.: A_2=+0.01 *1*, A_4=+0.02 *1* (1987Gu22); A_2=+0.10 *7* (1976Lu05).
791.8[b] *2*	170	4031.60	10−	3240.06	8−			
797.8 *1*	127 *6*	5312.62	13−	4514.91	12−	M1(+E2)	−0.3 *+3−5*	DCO=0.60 *2* Mult.: A_2=−0.37 *4*, A_4=+0.02 *5*.
798.6[b] *5*	73	7207.8	18−	6408.5	17			
807.6[b] *5*	24	6967.1	17−	6158.93	16−			
818.6[bd]		3185.0	8+	2366.93	6+	E2		Mult.: E2 γ from 2005Pe24 and 2006PeZZ; γ not given by the newer references 2013Le22 and 2013Va10 superseding them (^{96}Zr(^{48}Ca,4nγ) dataset).
840.4 *1*	447 *14*	3062.63	7−	2222.12	7−	M1+(E2)	−0.25 *+25−20*	Mult.: A_2=+0.25 *2*, A_4=−0.02 *2*.
868.4 *1*	954 *24*	4323.65	11−	3455.35	9−	E2		DCO=1.12 *3* Mult.: A_2=+0.18 *1*, A_4=−0.06 *1*.
[x]872.5								
896.3[b] *5*	24	3959.3	9−	3062.63	7−			
923.2[b] *2*	13	5099.47	12−	4176.10	10−	E2		DCO=1.04 *5*
923.3 *1*	263 *9*	5312.62	13−	4389.33	(11−)	E2		Mult.: A_2=+0.30 *3*, A_4=−0.10 *3*.
963.0 *1*	229 *10*	5352.33	(13−)	4389.33	(11−)	E2		γ moved to 5138 level (^{48}Ca,4nγ). Mult.: A_2=+0.17 *4*, A_4=−0.16 *4*.
963.5[b] *2*	5	5139.37	12−	4176.10	10−	E2		DCO=1.04 *12*
963.8[bd]		3185.0	8+	2222.12	7−	(E1)		Mult.: E1 γ in 2005PE24 and 2006PEZZ (no argument given) is missing in 2013Le22 and 2013Va10(^{48}Ca,4nγ).
971.8[bd] *5*		4156.7	10+	3185.0	8+	E2		Mult.: E2 γ from 2005Pe24 and 2006PeZZ; γ not given by the newer references 2013Le22 and 2013Va10 superseding them (^{96}Zr(^{48}Ca,4nγ) dataset).
989.8[b] *2*	194	7398.4	18+	6408.5	17			
1018.2 *1*	1000 *28*	3240.06	8−	2222.12	7−	M1+E2		DCO=0.44 *5* δ: δ=−1.7 *+5−∞*. Mult.: A_2=−0.86 *1*, A_4=+0.19 *1*.
1028.0[b] *5*	315	7435.4	20+	6408.5	17	[E3]		
1028.8 *1*	2425 *56*	1802.66	4+	773.85	2+	E2		Mult.: A_2=+0.01 *1*, A_4=+0.02 *1* (1987Gu22); A_2=+0.04 *2* (1976Lu05).
1048.9[b] *5*	49	7207.8	18−	6158.93	16−	E2		DCO=1.16 *21*
[x]1059.4								
[x]1064.2[a]						&		Mult.: A_2=+0.35 *11*.
1064.9[b] *10*	<24	6967.1	17−	5903.2	16			
1149.2[b] *10*	<24	6764.1	16−	5614.48	15−			
[x]1154.8								
1197.5		3419.6	7,8,9(−)	2222.12	7−			
1233.5 *2*	154 *7*	3455.35	9−	2222.12	7−	E2		DCO=0.96 *19* Mult.: A_2=+0.29 *4*, A_4=−0.06 *5*.
1257.1[b] *10*	24	4879.0	11−	3621.92	10+			
1267.5 *2*	119 *5*	5971.18	15−	4703.87	13−	E2		Mult.: A_2=+0.16 *6*, A_4=−0.06 *8*.

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^{126}Te(^{18}O,4nγ) 1987Gu22,2006Pe25,2008Fe02 (continued)

γ(^{140}Nd) (continued)

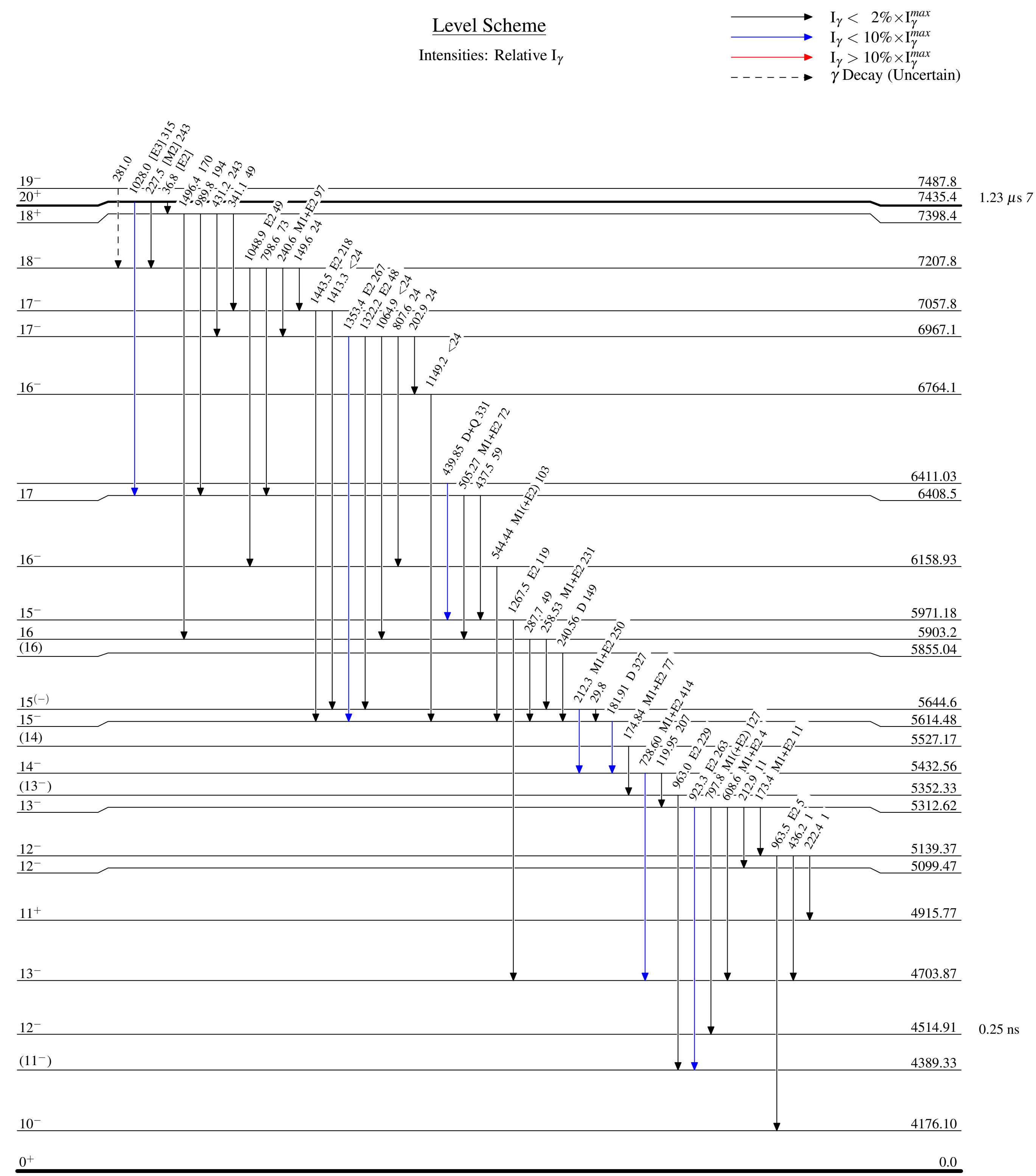
E_γ[†‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[@]	Comments
1293.6 *2*	178 *8*	4915.77	11^+	3621.92	10^+	M1(+E2)	−0.4 *4*	DCO=0.33 *3* Mult.: A_2=−0.70 *4*, A_4=+0.06 *5*.
1322.2[b] *10*	48	6967.1	17^-	5644.6	$15^{(-)}$	E2		DCO=1.0 *3*
1350.3[ad]		2124.4?	(3^-)	773.85	2^+	D[&]		Mult.: A_2=−0.28 *7* (1976Lu05).
1353.4[b] *10*	267	6967.1	17^-	5614.48	15^-	E2		DCO=1.16 *11*
1413.3[b] *10*	<24	7057.8	17^-	5644.6	$15^{(-)}$			
1443.5[b] *10*	218	7057.8	17^-	5614.48	15^-	E2		DCO=1.04 *12*
[x]1488.2								
1496.4[b] *10*	170	7398.4	18^+	5903.2	16			

† Uncertainty for 2005Pe24 is 0.2 keV for Eγ<1000 and Iγ>5, 0.5 keV for Eγ>1000, and Iγ<5, and 1 keV for Eγ>1200 and/or Iγ<1.
‡ From 1987Gu22, except where noted (at E(^{16}O)=76 MeV).
# γ(θ) at E(^{16}O)=76 MeV (1987Gu22, also A_2, A_4 in comments); linear pol (1981Me09) (details are not given); DCO ratio (2006Pe25 and 2006PeZZ, same values as in ^{96}Zr(^{48}Ca,4nγ) dataset).
@ From 1987Gu22.
& A_2 are from (α,4nγ) at E=52 MeV (A_2, if A_4=0) and at E=55 MeV (Iγ) (1976Lu05).
a Observed only in 1976Lu05 in (α,4nγ) at E(α)=52 MeV, 55 MeV (A_2 if A_4=0.0).
b Observed only by 2006Pe25 and 2008Fe02.
c Differs by 4σ or more from ΔE(levels).
d Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

$^{126}Te(^{18}O,4n\gamma)$ **1987Gu22,2006Pe25,2008Fe02**

Level Scheme

Intensities: Relative I_γ



$^{140}_{60}Nd_{80}$

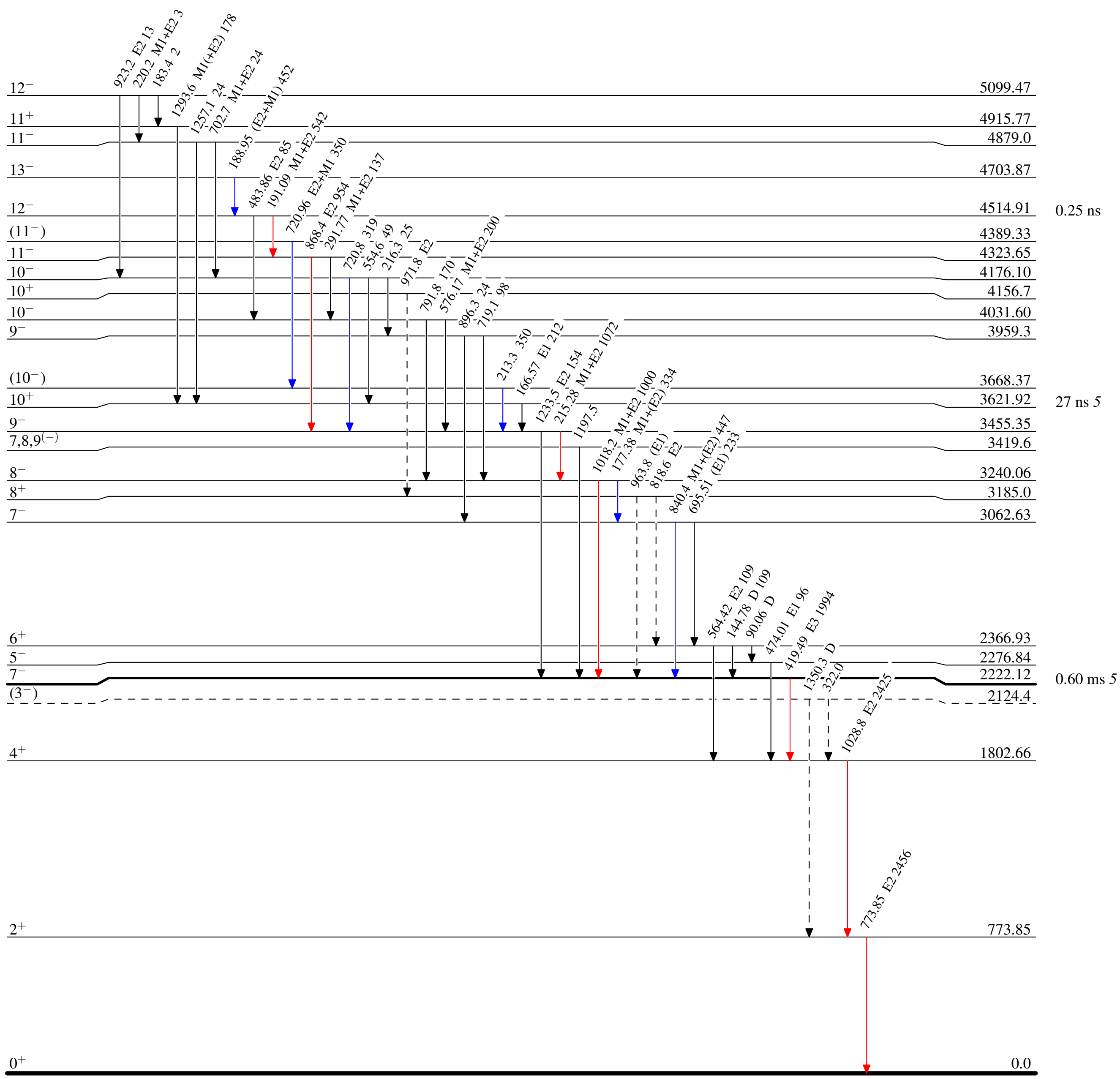
$^{126}Te(^{18}O,4n\gamma)$ 1987Gu22,2006Pe25,2008Fe02

Level Scheme (continued)

Intensities: Relative I_γ

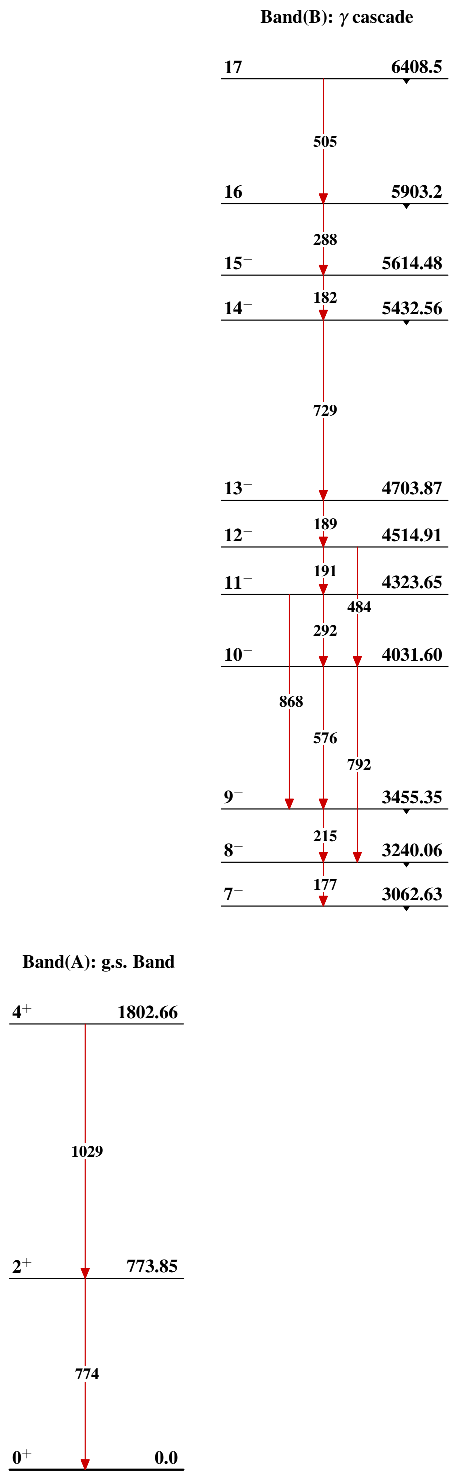
Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)



$^{140}_{60}Nd_{80}$

$^{126}Te(^{18}O,4n\gamma)$ 1987Gu22,2006Pe25,2008Fe02



$^{140}_{60}Nd_{80}$