^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Caroline D. Nesaraja, Scott D. Geraedts and Balraj Singh	NDS 111, 897 (2010)	12-Jan-2010

1969Fa05: measured Eγ, Iγ, $\gamma\gamma$ coincidences and $\gamma\gamma(\theta)$.
1973Ko27: polarized thermal neutron capture; measured Eγ, Iγ, circular polarization (CP) of neutron capture γ's.
Additional information 1.
Other measurements:
1990Kr17: measured lifetimes by DSAM.
1989Co01: measured $\gamma\gamma(\theta)$ for thermal neutron capture γ-rays.
1969Sc24: measured $\gamma\gamma(\theta)$ for thermal neutron capture γ's.
CP=circular polarization.

^{58}Fe Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[a]	Comments
0.0	0$^+$		
810.55 *10*	2$^+$[#]		
1674.30 *16*	2$^+$[#]		
2133.5 *3*	3$^+$		
2257.0 *3*	0$^+$		
2781.77 *18*	1$^+$	62 fs *17*	J=1 or 2 from CP(γ); $\gamma\gamma(\theta)$ excludes J=2 (1969Sc24).
2876.05 *25*	2$^+$	30 fs *+17−8*	
3083.7 *3*	2$^+$[#]	47 fs *9*	
3244.2 *4*	0$^+$	31 fs *+67−14*	
3537.2 *5*	1$^+$	10 fs *3*	J=1 or 2 from CP(γ); $\gamma\gamma(\theta)$ excludes J=2 (1969Sc24).
3630.0 *8*	2$^+$	26 fs *+29−11*	J=1 or 2 from CP(γ).
3879.9 *3*	1$^+$[@]	0.7 fs *7*	
4015.2 *7*	1$^+$[&]		E(level): not proposed by 1969Fa05 or 1969Sc24; seen by 1973Ko27 as populated by a primary γ.
4139.3 *4*	1$^+$[@]	2.8 fs *21*	
4297.6 *5*	2$^+$	2.8 fs *21*	J $\neq$ 0 from CP(γ).
4322.3 *3*	1$^+$[&]	11 fs *7*	
4352.6 *7*	1$^+$[&]		
4444.1 *5*	1$^+$[@]	6 fs *+28−6*	
4550.3 *3*	1$^+$[@]	21 fs *7*	
4832 *3*	1$^+$,2$^+$		
5000.4 *5*	1$^+$[@]	3.0 fs *10*	
5220.8 *5*	1,2	<2.4 fs	J $\neq$ 0 from γ to g.s. (1969Sc24).
5294.6 *6*	(1$^+$,2,3$^+$)	3.5 fs *28*	
5417.5 *6*	(1$^+$,2,3$^-$)	<0.7 fs	
5522.9 *22*	0$^+$		
(10044.20 *23*)	1$^-$		E(level): n capture state. Energy agrees well with S(n)=10044.60 *18* (2009AuZZ). J$^\pi$: for s-wave capture on ^{57}Fe(J$^\pi$=1/2$^-$).

[†] From a least-squares fit to Eγ data with the neutron capture level held fixed.
[‡] Adopted values; supporting arguments from this reaction are indicated in comments.
[#] J=2 from CP(γ).
[@] J=0 or 1 from CP(γ); J=0 can be excluded either because of γ to g.s. or from $\gamma\gamma(\theta)$.
[&] J=1 uniquely from CP(γ).
[a] From DSAM (1990Kr17).

^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27 (continued)

$\gamma(^{58}Fe)$

A_2 and A_4 values are from 1969Sc24 for primary γ rays and from 1969Fa05 (also 1969Sc24,1967FaZZ) for secondary γ rays.

E_γ [†]	I_γ [‡d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ [#]	Comments
[x]233.6 *5*	0.03 *1*							
[x]238.7 *5*	0.07 *1*							
[x]243.1 *5*	0.04 *1*							
[x]252.6 *5*	0.05 *2*							
[x]278.1 *5*	0.14 *1*							
410.9 *5*	0.08 *1*	4550.3	1^+	4139.3	1^+			
459.3 *3*	0.39 *4*	2133.5	3^+	1674.30	2^+			
524.7 *3*	1.20 *6*	2781.77	1^+	2257.0	0^+			
810.48 *10*	66 *3*	810.55	2^+	0.0	0^+			E_γ: from 1962Ma33. Used by 1969Fa05 as a calibration γ.
[x]854.4 *15*	0.10 *5*							E_γ,I_γ: uncertain G.
863.6 *2*	18.1 *10*	1674.30	2^+	810.55	2^+	D+Q	−0.57 *6*	δ: −0.37 *+5−7* (1989Co01). (864γ)(810γ)(θ): A_2=+0.479 *9*, A_4=+0.081 *13*. (864γ)(810γ)(θ): B_2=−0.75 *3*, B_4=−0.08 *2* (1989Co01). E_γ: tentative placement by 1969Fa05 from 5414 to 4550 level is not adopted by the evaluators.
[x]898.2 *4*	0.4 *1*							
1097.4 *3*	0.4 *1*	3879.9	1^+	2781.77	1^+			
1107.3 *2*	3.4 *2*	2781.77	1^+	1674.30	2^+	D+Q	−0.18 *3*	(1107γ)[864γ](810γ)(θ): A_2=+0.02 *3*, A_4=+0.01 *4*. (1107γ)(1674γ)(θ): A_2=−0.04 *4*, A_4=+0.02 *5*.
[x]1164.6 *4*	0.3 *1*							
1238.7 *7*	0.2 *1*	4322.3	1^+	3083.7	2^+			
[x]1250.7 *8*	0.2 *1*							
[x]1260.2 *4*	0.6 *1*							
[x]1266.8 *20*	0.3 *2*							
[x]1269.0 *20*	0.1 *1*							
[x]1292.7 *7*	0.35 *10*							
1306.0 *5*	0.8 *1*	4550.3	1^+	3244.2	0^+			
1322.5 *5*	1.1 *1*	2133.5	3^+	810.55	2^+	D+Q	−0.48 *+12−10*	(1322γ)(810γ)(θ): A_2=−0.40 *5*, A_4=−0.01 *7*.
1446.3[e] *4*	3.5[e] *3*	2257.0	0^+	810.55	2^+	Q		Mult.: from $\gamma\gamma(\theta)$ (1989Co01). (1446γ)(810γ)(θ): A_2=+0.351 *18*, A_4=+1.17 *4*. (1446γ)(810γ)(θ): B_2=−0.58 *12*, B_4=−1.08 *10* (1989Co01).
1446.3[e] *4*	3.5[e] *3*	4322.3	1^+	2876.05	2^+			
[x]1467.7 *5*	0.4 *1*							
[x]1657.2 *15*	0.4 *2*							
1662.5 *6*	0.9 *2*	4444.1	1^+	2781.77	1^+			
1674.2[f] *3*	13.8[f&] *8*	1674.30	2^+	0.0	0^+			I_γ: intensity divided by the evaluators based on branching ratio in adopted gammas. Total Iγ=17.6 *12*.
1674.2[f] *3*	3.8[f&] *14*	4550.3	1^+	2876.05	2^+	D+Q	+0.17 *+10−9*	δ: +0.04 *14* (1989Co01). (1674γ)(2066γ)(θ): A_2=−0.06 *3*, A_4=−0.01 *4*. (1674γ)[2066γ](810γ)(θ): A_2=−0.16 *4*, A_4=−0.02 *5*. Additional information 2.

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^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27 (continued)

γ(^{58}Fe) (continued)

E_γ[†]	I_γ[‡d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[#]	Comments
								(1674γ)[2066γ](810γ)(θ): B_2=+0.49 *24*, B_4=−0.16 *21* (1989Co01).
1862.5 *5*	1.6 *2*	3537.2	1$^+$	1674.30	2$^+$	D+Q	−0.59 *+14−11*	(1862γ)(1674γ)(θ): A_2=+0.35 *6*, A_4=−0.24 *12*.
1971.0 *3*	7.3 *6*	2781.77	1$^+$	810.55	2$^+$	D+Q	−0.17 *4*	δ: −0.16 *+4−5* (1989Co01). (1971γ)(810γ)(θ): A_2=−0.05 *5*, A_4=−0.05 *6*. (1971γ)(810γ)(θ): B_2=+0.10 *8*, B_4=+0.09 *7* (1989Co01).
2065.5 *3*	6.3 *5*	2876.05	2$^+$	810.55	2$^+$	D+Q	−0.33 *+18−11*	δ: −0.22 *+10−13* (1989Co01). (2066γ)(810γ)(θ): A_2=+0.44 *4*, A_4=−0.04 *5*. (2066γ)(810γ)(θ): B_2=+0.65 *9*, B_4=+0.15 *7* (1989Co01). E_γ: tentative placement also suggested by 1969Fa05 from 4322 level but not adopted by the evaluators.
2137.6 *7*	0.7 *2*	5220.8	1,2	3083.7	2$^+$			
2273.3 *3*	13.0 *15*	3083.7	2$^+$	810.55	2$^+$	D+(Q)	−0.05 *2*	(2273γ)(810γ)(θ): A_2=+0.287 *11*, A_4=−0.002 *18*. (2273γ)(810γ)(θ): B_2=−0.44 *8*, B_4=+0.01 *5* (1989Co01). δ: −0.02 *7* (1989Co01).
2433.5 *5*	2.0 *3*	3244.2	0$^+$	810.55	2$^+$			(2433γ)(810γ)(θ): A_2=+0.43 *7*, A_4=+0.9 *3* consistent with 0−>2−>0 cascade with mult=Q for each transition.
[x]2466.9 *15*	0.6 *2*							
[x]2490.6 *15*	0.7 *2*							
2513.5 *10*	1.6 *3*	5294.6	(1$^+$,2,3$^+$)	2781.77	1$^+$			
2726.0 *15*	7.2 *7*	3537.2	1$^+$	810.55	2$^+$	D+Q	−0.57 *+7−5*	δ: −0.42 *7* (1989Co01). (2726γ)(810γ)(θ): A_2=+0.35 *5*, A_4=−0.16 *5*. (2726γ)(810γ)(θ): B_2=−0.35 *11*, B_4=+0.02 *8* (1989Co01).
2781.0 *15*	3.4 *4*	2781.77	1$^+$	0.0	0$^+$			
2820 *3*	1.9 *3*	3630.0	2$^+$	810.55	2$^+$			
2876 *2*	5.7[a] *6*	4550.3	1$^+$	1674.30	2$^+$	D+Q	−0.31 *5*	δ: −0.19 *+24 −27* (1989Co01). (2876γ)[864γ](810γ)(θ): A_2=+0.02 *4*, A_4=+0.01 *5*. (2876γ)(1674γ)(θ): A_2=+0.10 *5*, A_4=−0.06 *6*. (2876γ)[864](810γ)(θ): B_2=+0.05 *46*, B_4=−0.11 *24* (1989Co01).
3071 *2*	1.6 *3*	3879.9	1$^+$	810.55	2$^+$	D+Q	+0.15 *9*	(3071γ)(810γ)(θ): A_2=−0.40 *8*, A_4=−0.03 *11*.
3162 *3*	1.4 *3*	5294.6	(1$^+$,2,3$^+$)	2133.5	3$^+$			
[x]3183 *3*	0.5 *1*							
[x]3205 *3*	0.8 *3*							
3280 *3*	0.3 *2*	5417.5	(1$^+$,2,3$^-$)	2133.5	3$^+$			
3326 *2*	5.7 *5*	5000.4	1$^+$	1674.30	2$^+$	D+(Q)	−0.02 *4*	(3326γ)(864γ)(810γ)(θ): A_2=−0.03 *5*, A_4=+0.01 *6*. (3326γ)(1674γ)(θ): A_2=−0.22 *5*, A_4=−0.05 *6*.
3486 *3*	1.0 *2*	4297.6	2$^+$	810.55	2$^+$			
3540 *3*	1.8 *3*	3537.2	1$^+$	0.0	0$^+$			

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^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27 (continued)

γ(^{58}Fe) (continued)

E_γ[†]	I_γ[‡d]	E_i(level)	J^π_i	E_f	J^π_f	Comments
3740[f] 3	≈0.3[f@]	4550.3	1+	810.55	2+	
3740[f] 3	0.8[f@] 3	5417.5	(1+,2,3−)	1674.30	2+	
3881.7 7	1.4 3	3879.9	1+	0.0	0+	
x3952 4	0.4 2					
x3987 4	0.3 2					
x4006[c] 4	0.4 2					
x4062[b] 4	0.1[b] 1					
x4080 3	0.6 2					
4139.7 7	2.4 3	4139.3	1+	0.0	0+	
x4185 2	0.2 1					
4189 2	0.3 1	5000.4	1+	810.55	2+	
4297.9 6	1.0 2	4297.6	2+	0.0	0+	
4321.9 6	2.1 4	4322.3	1+	0.0	0+	
x4342 3	0.4 1					
x4380 4	0.2 1					
4411 3	0.5 2	5220.8	1,2	810.55	2+	
4443 2	0.7 2	4444.1	1+	0.0	0+	
4483 2	0.5 2	5294.6	(1+,2,3+)	810.55	2+	
x4506 2	0.4 2					
4521 3	0.8 2	(10044.20)	1−	5522.9	0+	
x4592 3	0.3 2					
4626.3 5	3.3 2	(10044.20)	1−	5417.5	(1+,2,3−)	
4712 3	0.6 2	5522.9	0+	810.55	2+	
4749.6 6	3.0 2	(10044.20)	1−	5294.6	(1+,2,3+)	
x4789 3	0.4 2					
4823.7 6	2.4 2	(10044.20)	1−	5220.8	1,2	
x4889 3	0.6 1					
5000.8 7	1.5 2	5000.4	1+	0.0	0+	
5043.8 5	10.7 8	(10044.20)	1−	5000.4	1+	(5044γ)(3326γ)(θ): A_2=+0.05 3, A_4=+0.02 4.
x5092[b] 4	0.2[b] 1					
5212 3	0.6 3	(10044.20)	1−	4832	1+,2+	
5223 3	0.6 3	5220.8	1,2	0.0	0+	
x5241[b] 3	0.4[b] 3					
5493.6 6	10.9 9	(10044.20)	1−	4550.3	1+	(5494γ)(2876γ)(θ): A_2=−0.08 3, A_4=−0.01 4.
5599.9 6	1.1 2	(10044.20)	1−	4444.1	1+	
5691.3 6	2.5 2	(10044.20)	1−	4352.6	1+	
5721.5 6	2.5 2	(10044.20)	1−	4322.3	1+	
5746.7 6	2.4 2	(10044.20)	1−	4297.6	2+	
x5890 4	0.4 2					
5905.3 7	2.5 3	(10044.20)	1−	4139.3	1+	
6028.7 6	1.2 2	(10044.20)	1−	4015.2	1+	
6162.7 6	3.3 3	(10044.20)	1−	3879.9	1+	(6163γ)(3071γ)(θ): A_2=+0.06 5, A_4=−0.02 6.
6413.9 7	1.6 2	(10044.20)	1−	3630.0	2+	
6506.0 7	6.8 8	(10044.20)	1−	3537.2	1+	(6506γ)(1862γ)(θ): A_2=−0.16 3, A_4=+0.02 5. (6506γ)(2726γ)(θ): A_2=−0.16 3, A_4=0.00 3.
x6840[b] 7	0.2[b] 2					
6960.3 7	10.5 10	(10044.20)	1−	3083.7	2+	(6961γ)(2273γ)(θ): A_2=−0.163 18, A_4=−0.005 14.
7163 5	0.6 2	(10044.20)	1−	2876.05	2+	
7261.7 8	11.4 12	(10044.20)	1−	2781.77	1+	(7262γ)[1107γ](1674γ)(θ): A_2=−0.155 25, A_4=−0.01 5. (7262γ)(1107γ)(θ): A_2=−0.048 24, A_4=+0.02 5. (7262γ)(1971γ)(θ): A_2=−0.03 3, A_4=−0.01 3. (7262γ)(2782γ)(θ): A_2=+0.32 10, A_4=+0.01 8.
8369.1 9	11.8 15	(10044.20)	1−	1674.30	2+	(8370γ)(1674γ)(θ): A_2=−0.241 16, A_4=−0.006 20.

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^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27 (continued)

γ(^{58}Fe) (continued)

E_γ[†]	I_γ[‡d]	E_i(level)	J^π_i	E_f	J^π_f	Comments
						(8370γ)[864γ](810γ)(θ): A_2=−0.072 *19*, A_4=+0.005 *6*. (8370γ)(864γ)(θ): A_2=+0.056 *23*, A_4=+0.002 *12*. (8370γ)(864γ+810γ)(θ): A_2=+0.002 *7*, A_4=−0.001 *14*.
9232.9 *10*	2.2 *4*	(10044.20)	1$^-$	810.55	2$^+$	
10043.2 *12*	2.7 *5*	(10044.20)	1$^-$	0.0	0$^+$	

[†] From 1969Fa05, except for γ with E>3800 quoted to tenths of keV which are from 1973Ko27 but decorrected for recoil.
[‡] Photons per 100 neutron capture; values are from 1969Fa05 for for secondary γ's, from 1973Ko27 for primary γ's.
[#] From $\gamma\gamma(\theta)$ (1969Fa05,1969Sc24).
[@] From a comparison of the Doppler shift measurements of the 3740γ and other gammas which deexcite entirely from the 4551 level, 1990Kr17 conclude that most of the Iγ(3740) belongs with the 5414. Intensity of 1.1 *3* divided based on results from (μ^-,nγ) level. This is also confirmed by intensity balance arguments.
[&] From a comparison of the Doppler shift measurements of the 1674γ and other gammas which deexcite entirely from the 4551 level, 1990Kr17 conclude that most of the Iγ(1674) belongs with the 1674 level. This is also confirmed by intensity balance arguments and branching ratios in adopted gammas.
[a] Considerations based on intensity balance by 1990Kr17 indicate that most of the intensity of this transition is due to the 4551 level. Placement from 2876 level is not adopted by the evaluators based on many other experiments where this γ is not seen.
[b] Uncertain G.
[c] Tentatively suggested from a 4008 level by 1969Fa05, but with the current level at 4015.6, this γ does not fit.
[d] Intensity per 100 neutron captures.
[e] Multiply placed with undivided intensity.
[f] Multiply placed with intensity suitably divided.
[x] γ ray not placed in level scheme.

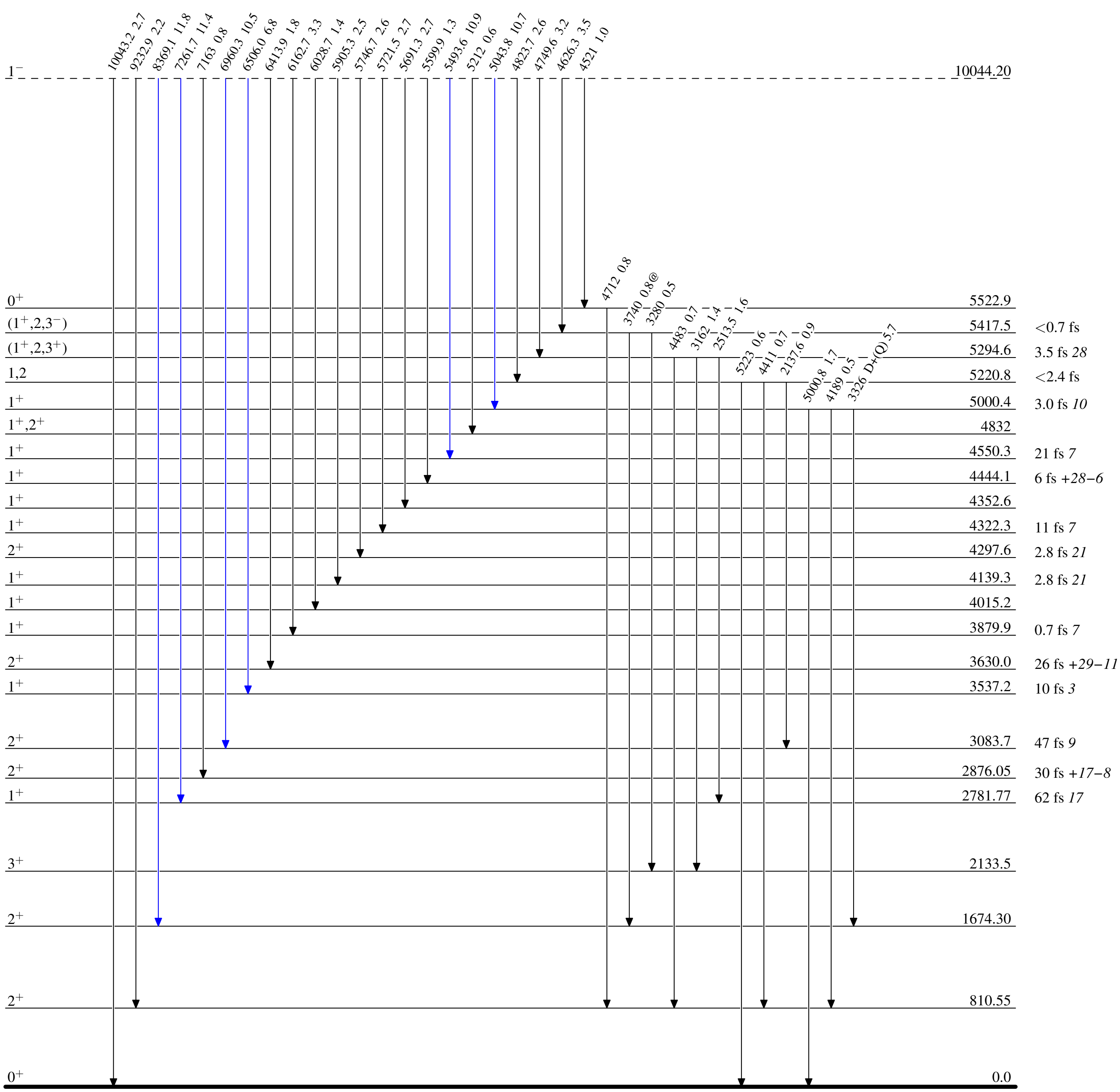
^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27

Level Scheme

Intensities: Photons per 100 neutron captures
@ Multiply placed: intensity suitably divided

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

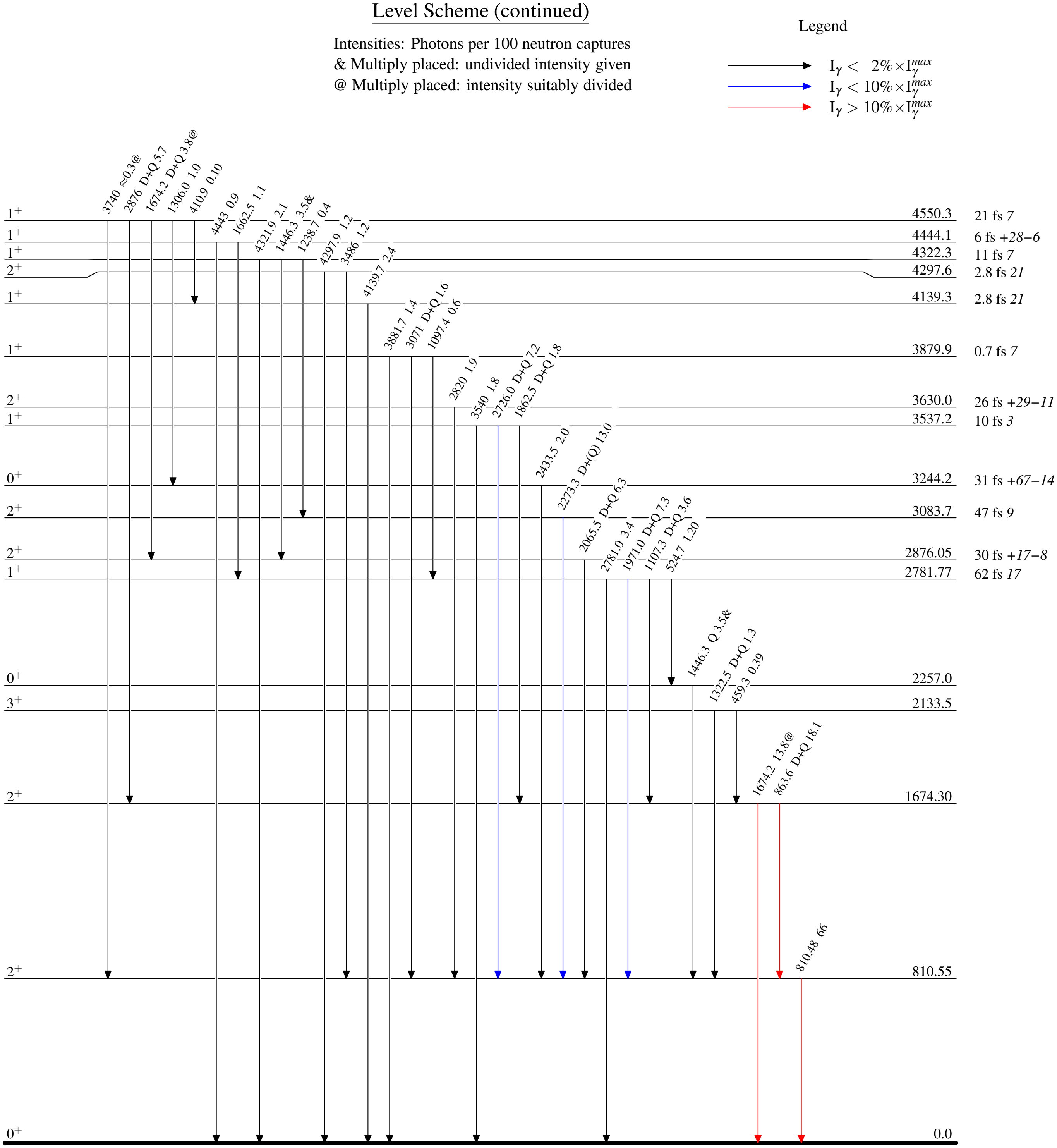


$^{58}_{26}Fe_{32}$

^{57}Fe(n,γ) E=th 1969Fa05,1973Ko27

Level Scheme (continued)

Intensities: Photons per 100 neutron captures
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



$^{58}_{26}Fe_{32}$