^{59}Co(n,n′γ) 1982Ka29,1979Ka34

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 151, 1 (2018)	1-Apr-2018

Others: 1994El04 (supersedes 1984ElZW), 1988KaZQ, 1980Ab06, 1978Le14, 1968Da14, 1966Wi20, 1966Ma10, 1960An14.

1994El04: fast reactor neutrons, measured $T_{1/2}$ by DSAM (14 levels); publication of 1984ElZW.

1982Ka29: E(n)=1-8 MeV, flux ∝ exp(−0.65E_n); measured (but did not quote) Eγ, branching; θ=125°; Compton-suppressed Ge(Li). Used data of 1979Ka34 supplemented by their own measurements.

1982KaZL: fast reactor neutrons, θ=50°, 90°, 125°, 145°; measured DSAM (5 levels) and Eγ.

1980Ab06: E(n)=1.3-3.9 MeV; θ=30°−150°, Ge(Li) detector; measured Eγ, σ(E,Eγ,θ), branching.

1979Ka34: reactor fast neutrons; θ=51°, 90°, 145°, Compton suppressed Ge(Li) (FWHM=3.8 keV at Eγ=1330); measured Eγ, Iγ, DSAM.

1978Le14: E(n)=1.1-3.5 MeV from ^{3}H(p,n); measured Eγ, branching, σ(E,Eγ,θ).

^{59}Co Levels

E(level)[†]	Jπ[&]	$T_{1/2}$[a]	Comments
0.0	7/2⁻		
1099.2 *1*	3/2⁻		
1190.7 *1*	9/2⁻	75 fs *17*	
1291.4 *1*	3/2⁻		
1434.0 *1*	1/2⁻		
1459.2 *1*	11/2⁻	0.7 ps *+7−3*	Other $T_{1/2}$: 0.31 ps *19* (1994El04).
1481.6 *2*	5/2⁻	0.18 ps *+10−6*	Other $T_{1/2}$: >0.055 ps (1994El04).
1744.7 *4*	7/2⁻	0.42 ps *+21−17*	Other $T_{1/2}$: >0.10 ps (1994El04).
2061.7 *1*	7/2⁻	0.19 ps *+9−5*	Other $T_{1/2}$: 0.019 ps *3* (1994El04).
2087.0 *2*	5/2⁻	17 fs *+8−6*	Other $T_{1/2}$: 29 fs *3* (1994El04).
2153.8 *3*	(7/2⁻)		Adopted J=(9/2,13/2).
2183.2 *3*	7/2⁻	66 fs *12*	Other $T_{1/2}$: 39 fs *6* (1994El04). Adopted J=(11/2⁻).
2204.8 *2*	5/2⁻	>0.69[c] ps	
2394.6 *2*	9/2⁻	0.13 ps *4*	Other $T_{1/2}$: 41 fs *8* (1994El04).
2478.5 *5*	5/2⁻	30.5 fs *28*	Other $T_{1/2}$: 23 fs *12* (1994El04).
2540.3 *2*	5/2(⁻)	0.15 ps *+5−3*	Other $T_{1/2}$: 46 fs *24* (1994El04).
2586.4 *9*	9/2⁻	69[b] fs *14*	Other $T_{1/2}$: 30 fs *5* (1994El04). Adopted Jπ=7/2⁻.
2713.5 *8*	1/2⁺		
2719.1?[#]			E(level): Level not confirmed in 1982Ka29 − not adoped.
2782.3 *9*	5/2(⁻)	97[b] fs *28*	Other $T_{1/2}$: 36 fs *6* (1994El04).
2816?[‡]			
2826.2 *3*	7/2⁻	83 fs *28*	$T_{1/2}$: Other: 28 fs *5* (1994El04).
2912.0 *7*	3/2⁻	43[c] fs *8*	
2957?	(1/2)		Jπ: (3/2⁻,5/2,7/2⁻) in Adopted Levels.
2966.2 *8*	3/2(⁻)		
3014.9 *8*	7/2⁻	0.23[b] ps *+42−10*	
3062.8 *3*	1/2⁻		
3081.7 *2*	5/2⁻	0.21 ps *4*	Adopted Jπ=(9/2⁻).
3090.4 *6*	7/2⁻	0.21[b] ps *+17−7*	
3120.9[@] *16*			
3140.5[@] *14*	7/2,9/2[@]		
3160.4 *5*	3/2⁺		
3194.2[@] *16*	5/2,7/2[@]		
3218.6 *6*	3/2⁻		Jπ: Placement of 824.0γ yields ΔJ=3.
3277.3 *15*	3/2⁻		

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^{59}Co(n,n′γ) 1982Ka29,1979Ka34 (continued)

^{59}Co Levels (continued)

E(level)[†]	Jπ[&]	$T_{1/2}$[a]	Comments
3324.3 *10*			Jπ: 7/2(−) yields ΔJ=3 for 1892.2γ transition to 1/2−.
3381.9 *5*	7/2−	76 fs *14*	
3413.1 *11*			Jπ: 9/2− assignment yields ΔJ=3 for 2313.9γ transition, not adopted by evaluator.
3427 *1*	7/2(−)	55 fs *+28−21*	
3497 *1*	7/2(−)		
3626 *1*	(5/2)	30 fs *+8−6*	
3668 *1*	5/2		
3944.2 *3*	7/2+	0.55[b] ps *+55−28*	
4508?[d]		[d]	

† From 1982Ka29; based on authors′ unenumerated Eγ data.
‡ Tentative level from 1978Le14; level reported in (p,γ) also.
# Reported in 1979Ka34 but absent in 1982Ka29 and other reactions. Not adopted.
@ From 1980Ab06.
& Based on comparison between observed population of levels and Hauser-Feshbach-Moldauer statistical theory calculations. From 1988KaZQ, except as noted. Inconsistencies with adopted Jπ are noted.
[a] From 1979Ka34, except as noted. Neither 1979Ka34 nor 1994El04 take cascade feeding into account. 1979Ka34 used corrected nuclear stopping powers; 1994El04 did not, and obtain $T_{1/2}$ values which are, typically, a factor of 2 or 3 lower than those in 1979Ka34 or 1982KaZL.
[b] From 1982KaZL.
[c] From 1994El04. Value is probably low by a factor of 2 or 3 (see general comment on $T_{1/2}$).
[d] Evaluator tentatively associates a 2308γ seen only by 1979Ka34 with the 4508 level reported in (p,γ). 1979Ka34 place this γ from a 2308 level which is absent in other (n,n′γ) studies and in other reactions, and deduced $T_{1/2}$=14 fs *8* from DSAM for 2308γ assuming that placement.

γ(^{59}Co)

The 497.2γ placed by 1980Ab06 from the 2586 level has been omitted here because 1982Ka29 attribute that γ to the ^{59}Co(n,γ) reaction.

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Comments
1099.2	3/2−	1099.2	100	0.0	7/2−	
1190.7	9/2−	1190.7	100	0.0	7/2−	
1291.4	3/2−	192.2	7.5 *22*	1099.2	3/2−	
		1291.4	100.0 *22*	0.0	7/2−	
1434.0	1/2−	142.6		1291.4	3/2−	
		334.8	[c]	1099.2	3/2−	
1459.2	11/2−	268.5	9.9 *11*	1190.7	9/2−	
		1459.2	100.0 *11*	0.0	7/2−	
1481.6	5/2−	382.4	32 *4*	1099.2	3/2−	
		1481.6	100.0 *26*	0.0	7/2−	
1744.7	7/2−	263.1	24 *4*	1481.6	5/2−	
		554.0	73 *4*	1190.7	9/2−	Iγ: others: 84 (1980Ab06), 67.6 *14* (1979Ka34), 47 (1982Ka29).
		1744.7	100 *4*	0.0	7/2−	
2061.7	7/2−	580.1	100 *7*	1481.6	5/2−	
		871.0	119 *7*	1190.7	9/2−	
		2061.7	14 *5*	0.0	7/2−	Iγ: others: 37 (1982Ka29), 27 (1980Ab06), 32 *4* (1979Ka34).

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^{59}Co(n,n′γ) 1982Ka29,1979Ka34 (continued)

γ(^{59}Co) (continued)

E_i(level)	J_i^π	E_γ †	I_γ ‡	E_f	J_f^π	Comments
2087.0	5/2⁻	796.6	79 *11*	1291.4	3/2⁻	Doubly-placed γ, intensity suitably divided.
		2087.0	100 *11*	0.0	7/2⁻	
2153.8	(7/2⁻)	694.6	100	1459.2	11/2⁻	Not resolved from 693.5γ arising from scattering of neutrons by ^{72}Ge of detector.
2183.2	7/2⁻	888.2[ae]	16	1291.4	3/2⁻	Placement shown as tentative because γ absent in other (n,n′γ) studies. Eγ=891.8 from level energy difference. Not adopted – transition for ΔJ=4 in Adopted Levels.
		992.5	100 *5*	1190.7	9/2⁻	
		2183.2	14 *5*	0.0	7/2⁻	
2204.8	5/2⁻	723.2	100 *11*	1481.6	5/2⁻	
		913.4	70 *11*	1291.4	3/2⁻	γ placed from 2395 level in 1979Ka34.
		2204.8	19 *11*	0.0	7/2⁻	I_γ: others: 82 (1982Ka29), 47 (1980Ab06), 123 *9* (1979Ka34); inconsistent branching may indicate a complex G.
2394.6	9/2⁻	649.9	100 *7*	1744.7	7/2⁻	
		935.4	41 *7*	1459.2	11/2⁻	
		2394.6	76 *7*	0.0	7/2⁻	
2478.5	5/2⁻	2478.5	100	0.0	7/2⁻	γ reported by 1982Ka29 only.
2540.3	5/2(⁻)	795.6	100 *5*	1744.7	7/2⁻	Doubly-placed γ, intensity suitably divided.
		1350.0[@e] *3*	8.8 *24*	1190.7	9/2⁻	γ placed by 1979Ka34; not confirmed in 1982Ka29, but γ with similar energy is reported from this level in (p,p′γ).
		2540.3	72 *5*	0.0	7/2⁻	I_γ: others: 127 (1982Ka29), 82 (1980Ab06), 24 *2* (1979Ka34).
2586.4	9/2⁻	1395.7[b]	79[b] *14*	1190.7	9/2⁻	
		2586.4	100 *14*	0.0	7/2⁻	
2713.5	1/2⁺	1614.3	100	1099.2	3/2⁻	
2719.1?		2719.1[@e] *8*	100	0.0	7/2⁻	Placement not confirmed in 1982Ka29; not adopted.
2782.3	5/2(⁻)	1683.1	18	1099.2	3/2⁻	E_γ: 1680.82 *7* (1982KaZL), 1681.07 *14* (1979Ka34). I_γ: from 1980Ab06; 133 in 1982Ka29. Could plausibly form a doublet with γ from 3141 level known from (p,γ).
		2782.3	100	0.0	7/2⁻	E_γ: 2782.7 *1* from 1982KaZL.
2816?		2816[#e]	100[#]	0.0	7/2⁻	
2826.2	7/2⁻	1634	10 *3*	1190.7	9/2⁻	E_γ: from 1978Le14.
		1727.0	100 *24*	1099.2	3/2⁻	
		2826.2	51 *24*	0.0	7/2⁻	I_γ: others: 89 (1982Ka29), 181 (1980Ab06), 138 *15* (1979Ka34).
2912.0	3/2⁻	850.3	41	2061.7	7/2⁻	
		2912.0	100	0.0	7/2⁻	
2957?	(1/2)	374.0[&]	66[&]	2586.4	9/2⁻	
		751.7	35[a]	2204.8	5/2⁻	
		1857.3	100[a]	1099.2	3/2⁻	
2966.2	3/2(⁻)	783.0	39	2183.2	7/2⁻	
		1865.6[a]	14	1099.2	3/2⁻	
		2966.2	100	0.0	7/2⁻	
3014.9	7/2⁻	954.4[&]	54[&]	2061.7	7/2⁻	
		1555.7	100	1459.2	11/2⁻	E_γ: 1555.7 *1* from 1982KaZL.
		1723.5	67	1291.4	3/2⁻	
		3013.7[&]	86[&]	0.0	7/2⁻	
3062.8	1/2⁻	522.5	100	2540.3	5/2(⁻)	
3081.7	5/2⁻	1891.0	100	1190.7	9/2⁻	
3090.4	7/2⁻	1003.4	100	2087.0	5/2⁻	E_γ: 1002.85 *7* from 1982KaZL.
		1799.0	54	1291.4	3/2⁻	E_γ: 1798.2 *1* from 1982KaZL.
		1991.2	54	1099.2	3/2⁻	
3120.9		3120.9[&]	100[&]	0.0	7/2⁻	
3140.5	7/2,9/2	1049.5[&]	60[&]	2087.0	5/2⁻	
		1949.9[&]	45[&]	1190.7	9/2⁻	

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^{59}Co(n,n′γ) 1982Ka29,1979Ka34 (continued)

γ(^{59}Co) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Comments
3140.5	7/2,9/2	3140.5[&]	100[&]	0.0	7/2⁻	
3160.4	3/2⁺	3160.4	100	0.0	7/2⁻	
3194.2	5/2,7/2	1041.2[&]	60[&]	2153.8	(7/2⁻)	
		1903.9[&]	22[&]	1291.4	3/2⁻	
		2001.1[&]	19[&]	1190.7	9/2⁻	
		3194.2[&]	100[&]	0.0	7/2⁻	
3218.6	3/2⁻	397.4[&]	89[&]	2826.2	7/2⁻	
		824.0	100	2394.6	9/2⁻	
		3220.4[&]	182[&]	0.0	7/2⁻	
3277.3	3/2⁻	3277.3	100	0.0	7/2⁻	
3324.3		541.2[&]	19[&]	2782.3	5/2(⁻)	
		1170.0	38	2153.8	(7/2⁻)	
		1845.0[&]	15[&]	1481.6	5/2⁻	
		1892.2[&]	85[&]	1434.0	1/2⁻	
		2032.9	51	1291.4	3/2⁻	Other Iγ: 9 (1980Ab06).
		3324.8	100	0.0	7/2⁻	
3381.9	7/2⁻	1637.2	33	1744.7	7/2⁻	
		1922.7	100	1459.2	11/2⁻	
		3381.9	>12	0.0	7/2⁻	
3413.1		1931.5	100	1481.6	5/2⁻	
		2313.9	79	1099.2	3/2⁻	I_γ: 447 in 1980Ab06.
		3413.1	34	0.0	7/2⁻	I_γ: 133 in 1980Ab06.
3427	7/2(⁻)	1968.0	100	1459.2	11/2⁻	
		3427.2	61	0.0	7/2⁻	I_γ: 365 in 1980Ab06.
3497	7/2(⁻)	3497.0	100	0.0	7/2⁻	
3626	(5/2)	2144.6	100	1481.6	5/2⁻	
3668	5/2	2568.4	100	1099.2	3/2⁻	
		3667.6	75	0.0	7/2⁻	
3944.2	7/2⁺	2652.9	100	1291.4	3/2⁻	E_γ: 2652.34 *8* from 1982KaZL.
4508?		2307.8[@ e] *3*		2204.8	5/2⁻	

[†] From level energy differences (1982Ka29), except as noted. Eγ and ΔE(γ) are quoted by 1979Ka34 and 1982KaZL only.

[‡] Relative photon branching. From 1978Le14 if uncertainty is shown; from fig. 1 of 1982Ka29 if uncertainty not quoted, except as noted. See 1979Ka34 for Iγ relative to I(1190γ)=100; however, branching from 1982Ka29 presumably supersedes that implied in 1979Ka34.

[#] Tentative placement from 1978Le14. γ absent in 1980Ab06 and 1982Ka29, but present in (p,γ).

[@] From 1979Ka34.

[&] From 1980Ab06; absent in 1978Le14 and 1982Ka29.

[a] From 1980Ab06.

[b] Eγ=1397.00 *7* (1982KaZL), 1397.19 *8* (1979Ka34). Branching consistent with that from 1980Ab06; not consistent with that from 1982Ka29, where E(n) is adequate to excite the 4141 level known from (p,γ) to be de-excited by a 1397γ. Evaluator presumes that doublet is present in 1982Ka29 and 1979Ka34.

[c] Probable doublet, although not indicated as such by (n,n′γ) reaction authors; Eγ=335 transitions from 1434 and 2395 levels (known from (p,αγ) and (p,p′γ)) would not have been resolved. I(335γ)/I(143γ)=0.27 *1* in ^{59}Fe β^- decay (where 2395 level cannot be excited), whereas values of 0.49 (1982Ka29), 0.59 *6* (1978Le14), 0.92 *8* (1979Ka34) are obtained in (n,n′γ) studies.

[d] Placement from 3427 level in 1979Ka34 not confirmed in 1982Ka29. $T_{1/2}$=55 fs *+29−21* deduced from DSAM for this γ (1979Ka34). γ with similar Eγ placed from 3015 level in (p,p′γ) but 1979Ka34 do not report the other branches associated with that level in (p,p′γ) or in 1982Ka29.

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^{59}Co(n,n′γ) 1982Ka29,1979Ka34 (continued)

$\gamma(^{59}Co)$ (continued)

[e] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

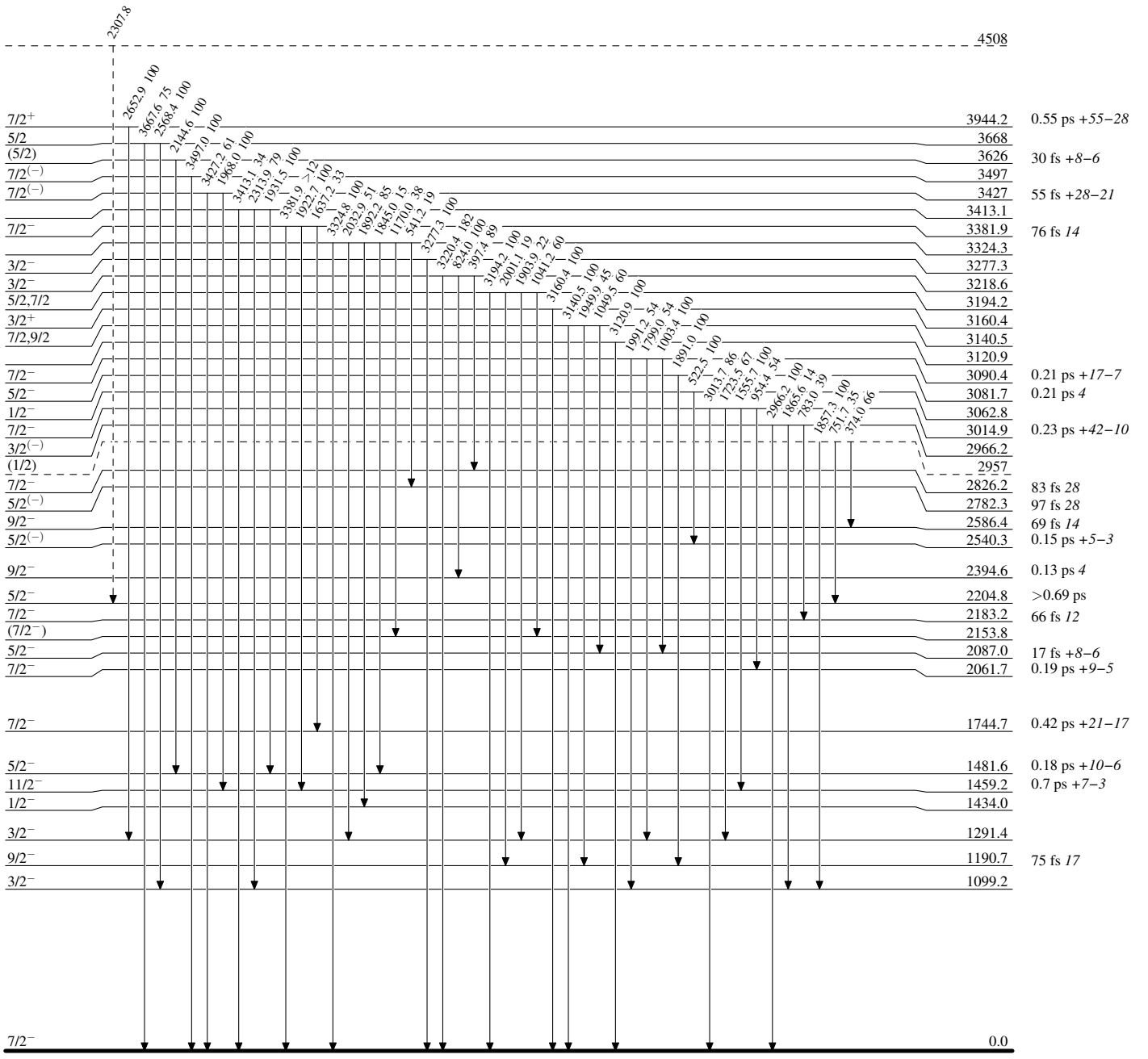
^{59}Co(n,n′γ) 1982Ka29,1979Ka34

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{59}_{27}Co_{32}$

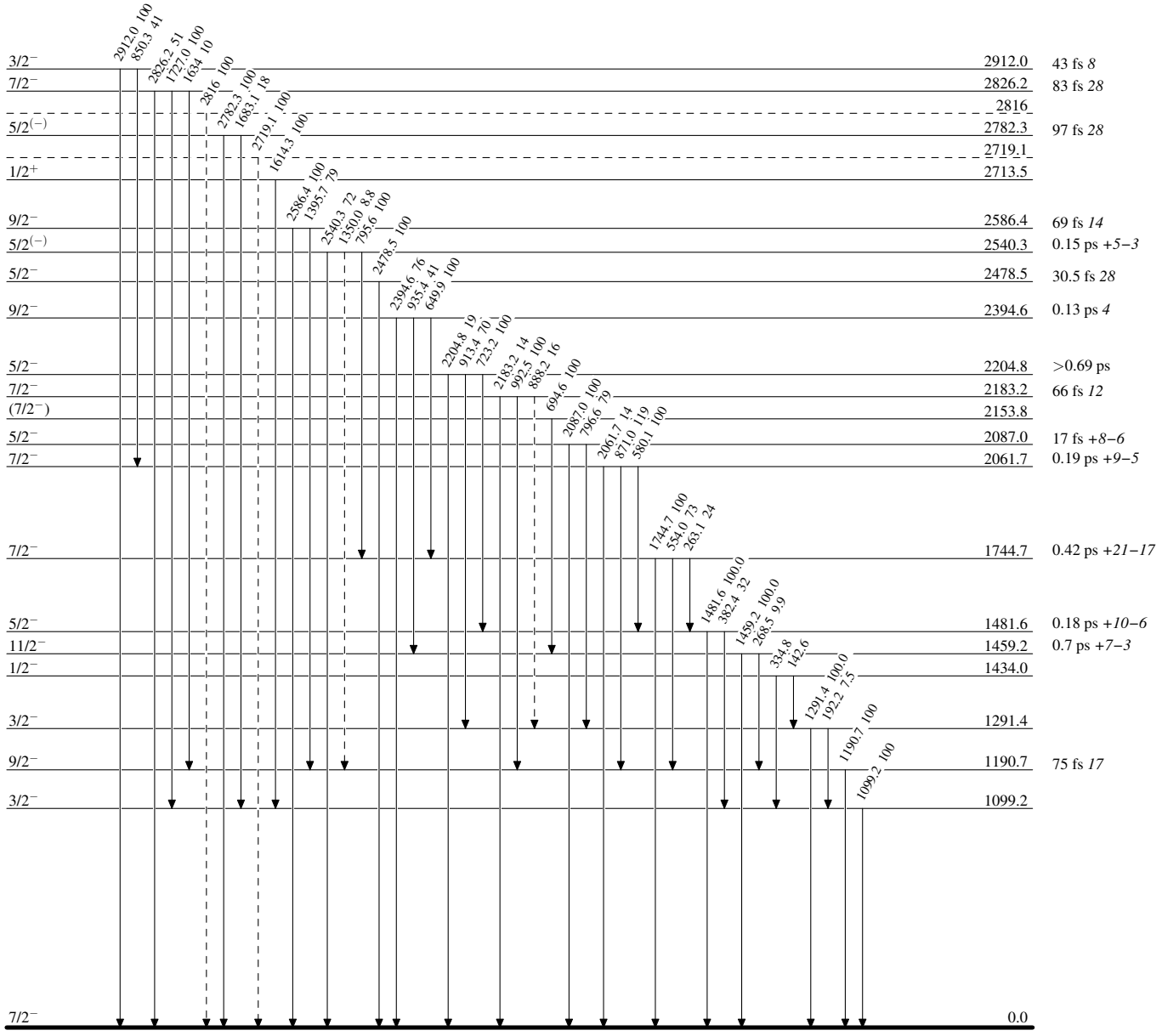
^{59}Co(n,n′γ) 1982Ka29,1979Ka34

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{59}_{27}Co_{32}$