^{57}Co ε decay 1991BaZS,1997HeZZ

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. R. Bhat	NDS 85,415 (1998)	24-Sep-1998

Parent: ^{57}Co: E=0.0; J$^{\pi}$=7/2^{-}; $T_{1/2}$=271.74 d *6*; Q(ε)=836.0 *4*; %ε decay=100

1997Dr06: show the importance of including final state interaction (fsi) in the calculation of double-to-single ratio of K-electron ejection in internal conversion, by leading to a better agreement with experimental data for the 122-keV γ.

1996Me11,1995Me11,1994MeZZ,1993MeZY: measured spectra of ce from Eγ=122 and 136 keV to determine their conversion coefficients.

1995Ch70: review/evaluation of ^{57}Co decay data.

1995Ah04: measured $T_{1/2}$ of 14.4-keV level using electronic timing.

1992ScZZ: measurement of emission probability for 14.4γ.

1991BaZS: evaluation and recommended values by the iaea Coordinated Research Project on x-ray and γ-ray Standards for Detector Calibration. Recommended values from this evaluation are used as indicated.

1990Si03: measured K-capture probability to the 136 level as 0.89 *4*.

1989Ba34: measured internal bremsstrahlung spectrum and compared it with Martin and Glauber theory.

1987Ko38: measured relative intensities and energies of the KLL, KLM, and kmm Auger electrons using an electrostatic spectrometer and observed the intensity ratios: KLL:KLM:km(1-3)M(1-3):K conversion (14 keV)=4.0 *6*:1.0 *1*:0.05 *2*:3.0 *3*. Also KLM:KLL=0.24 *5* and kmm:KLL=0.012 *5*.

1986Ca08,1991CaZZ: I(Kα)/I(Kβ)=0.134 *3* (experiment); 0.1343 (theory).

1994Bu26: I(Kα)/I(Kβ)=0.1210 *24* (experiment); 0.1208 (theory).

1971Ko19: measured Eγ, Iγ, Ge(Li) detector.

Others: 1981VyZZ, 1981KhZY, and 1970Ra51.

^{57}Fe Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
0.0	1/2^{-}		
14.4128 *3*	3/2^{-}	98.3 ns *3*	$T_{1/2}$: unweighted av of $\gamma\gamma$(t), 97.9 ns *2* (1961Cl11,NaI), 98 ns *1* (1965Ki03,NaI), 97.7 ns *2* (1966Ec05,NaI), 97.8 ns *14* (1978AlZX,scin), 99.2 ns *4* (1995Ah04,Ge(Li)), and $\gamma\gamma(\theta$,H,t), 99.3 ns *5* (1969Ho28,NaI). Other: 97 ns *4* (1978AlZX,Xγ(t),scin).
136.4737 *3*	5/2^{-}	9.0 ns *7*	$T_{1/2}$: from 1978AlZX (Xγ(t),scin).
366.89 *13*	3/2^{-}	≤4 ns	$T_{1/2}$: from 1965Ki03 ($\gamma\gamma$(t),NaI).
706.76 *7*	5/2^{-}		

† From a least-squares fit to the Eγ data.

‡ From Adopted Levels. Results deduced from $\gamma(\theta$,H,t), $\gamma\gamma(\theta)$, and α's are consistent.

ε radiations

E(decay)	E(level)	Iε[†‡]	Log *ft*	Comments
(129.2 *11*)	706.76	0.174 *10*	7.70 *3*	εK=0.8791; εL=0.10274 *3*; εM+=0.018148 *6*
(699.5 *11*)	136.4737	99.8 *3*	6.450 *1*	εK=0.8877; εL=0.09557; εM+=0.01672

† From γ-ray intensity balance at each level.

‡ Absolute intensity per 100 decays.

$\gamma(^{57}Fe)$

See 1970Ra51 for summary of conversion-electron ratio measurements (spectrometer, ce) from 1954Al06, 1955Co31, 1957Be45, 1960Ew04, and 1967Ha06. The ratios have also been measured by 1971Po05 (spectrometer, ce). These data were used in the present evaluation as noted below. See 1996Me11 for the ratio of the intensities of conversion electrons for 122 and 136-keV gammas and their conversion coefficients. However, the M,δ of these two gammas derived from the 1996Me11 data are not supported by other measurements. See the comments on M,δ for these two gammas. Other: see 1981HaZY.

14.4γ summary: Eγ: from the difference in energies of the 122γ and 136γ in 1991BaZS which are from the evaluation in 1978He21. See 1967Be65, 1965Be41, 1976Bo16, 1972He42, and 1971Po05 for individual measurements. E(ce): E(ce(K))=7.289 *8* (1967Ha06,spectrometer); 7.300 *6* (1963Th04,pc). E(ce(M1))=14.3134 *2* ("metallic"), 14.3122 *2* ("oxide"); E(ce(N1))=14.4017 *2* ("metallic"), 14.4005 *2* ("oxide") (1971Po05, spectrometer). α: extrapolated from 1976Ba63.

122γ and 136γ summary: δ(122γ): weighted av of $\gamma(\theta$,H,t) (Ge(Li)): +0.120 *2* (1972Fo05), +0.116 *1* (1973Sc15), +0.1195 *10* (1975Co22); and $\gamma\gamma(\theta)$ (Ge(Li)): +0.120 *4* (1972Kr15). Others: 1972Vi09, 1972Ni01. δ(136γ): zero, since it is Q (1969Sp05).

α(exp),α(K)exp(122γ,136γ): from 1967Ha06 (spectrometer, ce/pe). 1967Mu20 has been excluded from consideration since the ce(K) were not completely separated and there appeared to be no separation of the higher shell electrons (1985HaZA). Other: 1981HaZY. K/L+(122γ,136γ): unweighted av of 1954Al06, 1957Be45, 1965Mo22, 1967Ha06.

I(K x ray)/I(14.4γ)=5.58 *30* (scin,pc; x/γ. 1963Mu02) and 5.57 (scin, 1966Su11) are in good agreement with 5.85 *17* from the adopted decay scheme.

Coincidences are from 1965Ki03 (Ge(Li),fast-slow coin).

Additional information 1.

Emission probabilities of x-rays (1991BaZS)

X-ray	E(keV)	I(x-ray)
Fe Kα	6.40	51.0 *7*
Fe Kβ	7.06	6.9 *1*

E$_\gamma$[†]	I$_\gamma$[‡b]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[#]	δ[#]	α[@]	Comments
14.4129 *6*	9.16[a] *15*	14.4128	3/2$^-$	0.0	1/2$^-$	M1+E2	0.00223 *18*	8.56 *26*	α(K)=7.76 *23*; α(L)=0.804 *24* (1976Ba63) α(K)exp=7.35 *19*; α(exp)=8.18 *11* (1985HaZA) L1/(L2+L3)=10.8 *8* (1971Po05) K:L:M+=100:9.59 *13*:1.48 *15* (1971Po05). See summary in comments above.
122.06065[&] *12*	85.60[a] *17*	136.4737	5/2$^-$	14.4128	3/2$^-$	M1+E2	+0.120 *1*	0.0240 *14*	α(K)=0.0214 *12*; α(L)=0.00224 *20*; α(M+..)=0.00037 *5* K/(L+M+N)=8.2 *6*; α(K)exp=0.0214 *12* (1967Ha06)

From ENSDF

$^{57}_{26}Fe_{31}$-2

$\gamma(^{57}$Fe) (continued)

E_γ [†]	I_γ [‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ [#]	α [@]	Comments
									Additional information 2. K:L:M+=100:9.0:1.5 (1955Co31). See summary in comments above. Mult.,δ: 1996Me11 claim that Eγ=122 keV is mostly E2 with a negligible M1 component based on their Ice data; this conclusion is not supported by other data. Their data are: K/L=9.04 *19*; L1/L2=13.1 *3*; L1/L3=8.7 *5*; L1/M=9.7 *10*; α(L1)exp=2.04×10^{-2} *6*; α(L2)exp=1.56×10^{-3} *9*; α(L3)exp=2.34×10^{-3} *21*.
136.47356[&] *29*	10.68[a] *8*	136.4737	5/2$^-$	0.0	1/2$^-$	E2		0.137 *15*	α(K)=0.122 *13*; α(L)+=0.0143 *13* K/(L+M+N)=8.6 *5*; α(K)exp=0.122 *13* (1967Ha06) Additional information 3. α/K=1.118 *5* (1967Ha06). See summary in comments above. Mult.,δ: 1996Me11 claim that the relative weight of the E2 component for the Eγ=136 keV is: 83% *+8−12*; this conclusion is not supported by other data. Their data are: K/L=8.68 *27*; L1/L2=12.2 *16*; L1/L3=9.0 *18*; L1/M=7.9 *22*; α(L1)exp=1.2×10^{-2} *3*; α(L2)exp=1.0×10^{-3} *4*; α(L3)exp=1.4×10^{-3} *6*.
230.4 *4*	4×10^{-4} *4*	366.89	3/2$^-$	136.4737	5/2$^-$	(M1+E2)	+0.02 *8*		Not observed by 1965Ma38 or clearly seen by 1965Sp06. δ: −0.186<δ<−0.072 or −6.99<δ<−2.38 (1975Co22).
339.69 *21*	3.7×10^{-3} *3*	706.76	5/2$^-$	366.89	3/2$^-$	M1+E2	+0.083 *5*		
352.33 *21*	3.0×10^{-3} *3*	366.89	3/2$^-$	14.4128	3/2$^-$	M1+E2	+0.025 *9*		δ: +0.038 *10* or +3.35 *12* (1975Co22).
366.8 *3*	1.2×10^{-3} *3*	366.89	3/2$^-$	0.0	1/2$^-$	M1+E2	−0.45 *5*		δ: −0.047 *25* or −1.56 *9* (1975Co22); not consistent with other results.
570.09 *20*	0.0158 *10*	706.76	5/2$^-$	136.4737	5/2$^-$	M1+E2	+0.097 *8*		
692.41 *7*	0.149 *10*	706.76	5/2$^-$	14.4128	3/2$^-$	M1+E2	−0.465 *8*		
706.54 *22*	5.0×10^{-3} *5*	706.76	5/2$^-$	0.0	1/2$^-$	[E2]			

† Weighted averages of Ge(Li) measurements by 1965Ki03, 1965Sp06, and 1971Ko19, except as noted.

‡ Per 100 parent decays. Iγ are from 1971Ko19 normalized to Iγ(14.4)+Iγ(136)=19.84 *17*, except as stated otherwise.

From adopted gammas.

@ From the evaluation by 1985HaZA, unless indicated otherwise.

& Recommended energies from 1997HeZZ.

a Recommended by 1991BaZS.

b Absolute intensity per 100 decays.

$^{57}_{26}Fe_{31}$-3

^{57}Co ε decay 1991BaZS,1997HeZZ

Decay Scheme